The Rational Climate e-Book

1 author:

Patrice Poyet
Independent Researcher

The Freethinkers[1]

The Rational[2] Climate e-Book

Cooler is Riskier

Patrice POYET

https://patricepoyet.org/

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1 Freethinkers hold that knowledge should be grounded in facts, scientific inquiry, and logic, see also (Jacoby, 2005). If you liked this work, in exchange for getting it for free, then please recommend it to ten people. You can also become a member whenever possible or make a donation to support any of those organizations: cato.org cei.org climatecite.com climatedepot.com clintel.org co2coalition.org co2science.org friendsofscience.org geoethic.com heartland.org jennifermarohasy.com notrickszone.com plantsneedco2.org saltbushclub.com scienceandpublicpolicy.org tambonthongchai.com thegwpf.org and for the French speaking readers the association of the climato-realistes.fr does an excellent job.

2 When scientific views come under political attack, so too does independent thinking and good policy-making because all require **rational** thought to be effective, (Legates, 2014).

3 This e-book is under permanent on-going peer-reviewing. It also keeps being extended and improved. So, please refer to this date when communicating with the author so as to identify the version and help improve the document. **Check regularly the website to ensure that you have the latest release**.

To the young generations, with the certainty that the Earth will be worth inheriting and that they will strive to make mankind's adventure even greater and more fulfilling.

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The dystopian vision: "*Indeed, Granpa, tell what life was like before Covid and Climate Policies*".

"*You see my little ones, as Gervais (2018) reminded us in his excellent book, less than three centuries ago we used to travel on foot, on horseback or on a cariole, in a rowing boat or a sailboat. The land was cultivated with a plough pulled by a domestic animal and the goods were transported in galleons or oxcarts. Even the richest castles were loosely heated with wood, and at nightfall, people tried to work in a fleeting and fickle candlelight. Laundry kept the women busy at the wash-house and the economy was largely local and self-sufficient. Energy was provided by wood burning, draught animals, wind and river currents. Then came the industrial revolution, fossil fuels, nuclear power and globalization. Early 2020, before COVID, the world had changed more in 100 years than in 2 million years of human adventure. Then the GRUNZIs[4] imposed a global zero-carbon emissions project, had delusional ideas like a social cost of carbon by demonizing carbon dioxide as a pollutant when it had only advantages and a considerable private benefit of more than $400 per ton (Tol, 2017), and soon enough, due to climate policies and the ecological transition, electricity had started to be in short supply with outages in winter when we needed it the most (Worrall, 2019; Four, 2021), then a massive recession ensued and led to social disorders such that survivors like us of this Malthusian project ended up in the Stone Age. The problem is that as the climate has naturally changed and become colder, most of the few economic survivors have frozen to death, whereas IPCC's RCP 8.5 had forecast a warming of up to 5°C. But we should congratulate ourselves on having a smaller carbon footprint.*" - Grandpa to his seldom grand-children, 2100.

4 The obvious disdain for the fundamental civil rights and freedoms of the citizens, democracy and the parliamentary system expressed by many climate and green activists and alas even a number of climate scientists is also clear in the German "*Changing World, Social Contract for a Great Transformation*" (WBGU, 2011) and thus can be considered as a modern form of "Die Grünen sozialismus", i.e. GRUNZI.

The Sorry State of Climate Science and Policies

Patrice POYET[5]

patrice.poyet.science (at) gmail (dot) com

Foreword

It took a few weeks before the world started to recover its spirits after the COVID-19 blow and wonder whether Neil Ferguson's Imperial College model could be the most devastating software mistake of all time (Richards and Boudnik, 2020). But before this incredible blunder was widely acknowledged, leaders had already announced what would be the next and even more expensive economic nonsense, even more devastating (as it will not be just transient measures), based on the same kind of software lunacies that are also supposed to forecast millions of dead but not because of a virus this time but because of climate change supposedly due to an increase, over two centuries, of 0.007% of the atmospheric share of a totally harmless trace gas and anticipating to lead to all sorts of calamities and devastations which have been foretold for 50 years now (Rasool and Schneider, 1971; Schneider, 1989) and have never happened as reported by Ebell and Milloy (2019) and will never happen.

In the midst of this COVID-19 man-made disaster I started, as a geophysicist, geochemist and computer scientist, to painfully resent the ludicrous harping of ecologists crooks, NGOs and supranational bodies of the UN all well funded with tax-payer monies, and even of talking heads from the showbiz publishing columns in mainstream media to be read by millions of gullible readers to make them feel guilty to just try to make a living for themselves and for their families and to the forthcoming requirement for them to resort to a more frugal way of living «to save the planet» when they themselves have probably not ever experienced what it means to make ends meets. As a geologist it was pretty clear that climate had always changed on all timescales and had not needed mankind to demonstrate its whimsical nature, as a computer scientist I had long known that sophisticated programs can more or less say whatever the software developers have designed them for (plus the garbage in garbage out syndrome with tuned or even forged data) and even in a sometimes poorly reproducible way according to the too often met CACE paradigm (Changing Anything Changes Everything) and finally as a geochemist I had been wary of the supposed evidence (chemical and physical) that were explaining everything based on overly simplistic assumptions (radiative absorption by one scapegoat gas) and furthermore that were not to be discussed as the consensus would not give you a chance to make your job as a scientist, i.e. wonder and assess the soundness of the arguments.

President Obama's advice to this year's graduates «*you can't just accept what the experts and the people in charge tell you*» was spot on and I could not accept to be a silent accomplice of the future destruction of western economies for a witch hunt without going in depth: 1) into the relevance of the brandished scientific « proofs » arising from so many disciplines as climate science is just an illusion but resorts to a bunch of well known disciplines as chemistry, physics, geology, astronomy, biology, to name a few, 2) the relevance of computer models mainly based on fluid mechanics equations which are unable to make a decent fifteen day forecast but will – based on the same physical principles and technology – tell you the average temperature a century away, and 3) the delirious policies that will be implemented to fight the enemy, nothing less than the gas of life, the gas which has enabled in the end all living species on this planet to exist. One should never forget that irreplaceable and widely available fossil energy sources together with nuclear energy have simply enabled mankind to move out of the cave and improve living conditions on earth as never imagined before!

5 https://www.researchgate.net/profile/Patrice_Poyet
https://scholar.google.com/citations?user=UNfcrzYAAAAJ&hl=fr
http://independent.academia.edu/PatricePoyet
https://www.linkedin.com/in/patrice-poyet-247853/

Epistemologists around the end of the XXI century will report that the «Climate Fiasco» was a large scale deception attempt initiated by a U.S. politician twice elected vice-president, who once took a class with an oceanographer and global warming theorist, and decided to embark on a crusade to save the world. Sticking to the wrong causation, namely that CO_2 was responsible for the increase of temperatures, whereas it was the other way round and contrary to all evidence already available at the time, the growing flow of public funds into conforming universities and research laboratories, the threatening and dismissal of opponents, the hijacking of review committees of most prestigious journals, and the use of the powerful bureaucratic machine of the UN, all led to a massive disinformation of the public and a global scare of dissenting scientists. The stifling by all means of other opinions reminded of the worst years of Soviet science under the leadership of Lysenko and enabled the Climate tinkerers to declare victory through «consensus» and «science settled», not even realizing the inanity of their claims as they infringe the very basic historical foundations of science. By the years 2010, their dire predictions of warming and related calamities not happening, they changed the creed from global warming to climate change. Of course, as every scientist knew that climate had always changed and on all timescales, that was a major discovery at little risk of being invalidated or challenged. This could enable them to hasten their agenda by promoting CO_2 not only to the status of a pollutant (which will amaze scientists for the centuries to come) but to declare carbon (the basis of life) the enemy to defeat by all means, including enacting legislation around the 2020 that would promote a zero-carbon economy. These catastrophically ill-founded decisions led to a shift of wealth from Europe and the U.S. to Asian nations, that unwittingly benefited directly of the self-suicide of the West, though certainly not profiting of the global trade reductions that fighting the harmless CO_2 had led to. The Chinese, who had understood the sacred alliance formed by real science and capital as revealed to the world by Adam Smith (1776) observed incredulously the way the western public opinions had been manipulated and deceived and the way these societies were to return to relative poverty. Africa had become the main raw material provider of China and more globally Asia and had done well by changing its customers. On the other hand, and as prophesized by Markovsky (2016), America and the West did not defeat communism, they adopted it, while the former Asian "communist" countries, keeping their development strategies immune to the CO_2 hysteria reached new "standards" of living that had only been known before by the West.

History will tell at the end of the XXI century, that even though at some point of the natural cycle that had started at the end of the Little Ice Age (LIA) temperatures had gone past the medieval optimum, it was already pretty clear that the climate was cooling and that a reversion to the means was to be considered, many being worried again of a return into an ice age. In the meantime, the AGW delirium had come to an end and became known as Al Goreism (like Lysenkoism) a joke with «Algorithms» reminding us that computer programs, based on dubious algorithms, had cost mainly western societies trillions of dollars, wasted in meaningless «research» which confusing cause and effect had misled mankind in extraordinary proportions and generated incredible punitive policies to achieve decarbonization, as if CO_2 were a demon. Unfortunately, real problems had returned and reminded us that one should never take a good life for granted and that it only results of hard work and proper investments, the sacred alliance of science and capitalism, be it for an individual or else at the level of societies. Among other new and real challenges had appeared a whole ensemble of bacteria resistant to any sort of anti-biotherapies, which had made even the simplest surgical operations nearly impossible and had reminded us of the harshness of the fate of Napoleonic era soldiers who could just see their legs and hands chopped away for minor wounds. Earth had taught us the hard way that it has a life of its own and that we had been foolish to believe that our «activities» could thwart in any way the course of such a grand design, the Creation. Mankind was a derisory part of it, competing for a place to keep alive in the grand scheme of things, and the fable about a frog who wanted to become as big as an ox, had been sadly forgotten.

This document tells this bemusing story, of how as early as 2020, an attentive observer could have had all the cards to forecast, not the critical sea-rise levels, the death of the corals, the exponential rise of the temperature that will never happen, but the self-destruction of the western economies and major shift to a new world order dominated by Asian nations for the century to come.

Science has always been in a difficult position «Eritis sicut Deus, **scientes** bonum et malum» as the first biblical mention of science occurs in the story of Eve's temptation by the Serpent and must help separate the Good from the Evil. Succeeding in this endeavor should not be taken for granted. Let's make a try at it.

Moral of the story: given the large databases developed during the XX and XXI centuries nothing will be forgotten and only those who have been genuinely and honestly mistaken will be forgiven.

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6 This table is generated automatically and the 2 of CO_2 is unfortunately not preserved as an index.

1. Introduction

Things seem to be speeding up: in May 2019 the UK Parliament has declared climate emergency, and in June 2019 NYC also declared a climate emergency. New York City Council passed a legislation, calling for an immediate response to the global climate crises; the bill referenced several reports on the state of global warming and its impact, imparting that extreme weather events brought about by rising temperatures demonstrate that the planet is "***too hot to be a safe environment***"! Data from Innovation for Cool Earth Forum (ICEF, 2020) show that more than 670 ruling bodies in 15 countries have declared climate emergencies.

If there is any emergency, it is to debunk this crazy fantasy that climate would have reached a tipping point that would require to destroy our economies to avoid a catastrophe. Understanding how the climate has changed, from the distant glaciations a billion years ago to the most intriguing and mind-boggling «green Sahara» some 6.5k years ago, has always been one of the most challenging and intellectually rewarding endeavor of the geologists. Paleoclimate, coming along with paleogeography, distant plate-tectonics motions and associated orogeneses have always fascinated earth-scientists and I remember as a student reading those reconstructions as fantastic stories that could only be matched by the space-time journey that astronomy offered.

I would never have imagined though, 40 years ago, that by means of a strange hysteria hyper-focusing on just one of the so many parameters driving the climate response (a harmless trace gas, i.e. CO_2, the concentration of which has just increased since the beginning of the industrial revolution by hardly more than 100 ppm, i.e. 0.01% of the atmospheric total composition) and by resorting to mass conditioning of the population thanks to a host of activists relayed by one-sided media, that we would have reached a tipping point; not the supposedly irreversible climate change but one that will inflict incommensurable damage to our economies, industries and standard of living. Our great leaders are going to ruin the prosperity of their own people for a second class theory, which is hardly more than one of the so many possibilities to be considered and that ranks low into the very long list of factors that can and have changed the climate. Furthermore, one should remember that the climate has always changed and quite a lot, on all timescales without any anthropic influence whatsoever. What a disaster looming! There is so much at stake with the planned punitive measures envisaged (i.e. taxes, regulations and more) to enforce a fantasy.

Up until 2007, some sort of opposition still could exist and make itself heard at the time the UN climate conference in Bali met strong opposition from a team of over 100 prominent international scientists, who warned the UN, that attempting to control the Earth's climate was ultimately futile. "*Attempts to prevent global climate change from occurring are ultimately futile, and constitute a tragic misallocation of resources that would be better spent on humanity's real and pressing problems*," the letter signed by the scientists read. U.N. Secretary General Ban Ki Moon did not answer nor met any of those scientists but argued «*that global warming poses as great a threat to the world as modern warfare*», and he vowed to make reduction of greenhouse gases one of his tenure's top priorities. Ban's nickname was jusa (주사), meaning "the administrative clerk" and was probably well deserved as without any scientific training and no desire to listen to another perspective he took sides and he committed himself to making the IPCC's agenda move on. These times when some opposition could be voiced are gone (Morano, 2010), unfortunately, and it has been harder and harder for people dissenting to exist as they have been discredited, threatened, fired or silenced. In any case, do not expect the UN to accept some future responsibility in disastrous climate change policies outcomes; e.g. when a lawsuit challenged UN legal immunity on behalf of Haitian cholera victims (UN peace keepers from Nepal are said to be the source of the 2010–13 Haiti cholera outbreak), Ban declared that the legal immunity of the United Nations before national courts should be upheld.

Does it make sense to write one more paper on the subject in 2020? Probably not! Will it change anything? Certainly not! So what? In the end it will come down to individual responsibility, each scientist will have to chose side and I do not want to share the blame for the self-inflicted damage and impoverishment of the young and future generations by the insane policies that will be enforced. The doom-sayers, the alarmists have to know that beyond the short term glory and comfortable means that their crusade bring them, they might not be alive when they will have to face their horrendous legacy on a longer term, but that they will not be forgotten nor forgiven, except for those who have truly deceived and deluded themselves in trusting their computer models, believing that they had come close to some sort of reality even though they knew that they had had to «reduce» their input data so much in order to try to make their computerized fantasies somehow match in hindsight the observed reality as it keeps unfolding in ways that their dire predictions did not account for.

Albert Camus said in the Plague (1947, p. 151): «*it is not a question of heroism in all this. It is about honesty. It's an idea that can make you laugh, but the only way to fight against the plague is honesty*».

Each one of us who disagrees must voice his / her concerns and not be worried of the disparagements that will inevitably come along, not underestimating the violence of the priests of the new religion. Of course, what I'm going to write has no chance to be published going through a peer-reviewed process and will probably lead to ad-hominem attacks, but until the dreams of the crusaders come true, and they manage to censor the Internet of any dissenting opinion as «fake news», I will make use of the possibility to honestly develop and prop-up my thoughts and make them available to the widest audience possible. I do not claim to detain any certainty but when there remains so many doubts about what influences the climate, when knowledge is still so much in its infancy - and any scientist being honest should and could acknowledge that - it is a mere folly to enforce brutal choices by political means, that will hurt the most and mainly the poor who hardly make ends meet, by increasing the cost of energy.

We need to backtrack a bit as until the beginning of the 20th century, climate was seen as stable over timescales that could be relevant for humans and it was just a matter of making a sufficient number of observations to identify a mean and deviations. Lamb (1959) was probably the first to emphasize that climate was ever changing and that it did not make sense to consider it as stable and already recognized seven distinct climatic changes since the last major ice age. This was a big change of paradigm as it acknowledged that the climate could change and had changed a lot, sometime on short timescales. He described in «Our changing climate, past and present» (Lamb, 1959) the following major episodes:

1. *The last major ice sheet disappeared from Scandinavia, and glaciers from Britain, somewhere about 8000-7000 B.C.*
2. *By 4000-2000 B.C. the post-glacial Climatic Optimum had been reached with world temperature 2-3° higher than now.*
3. *Decline from the Climatic Optimum was at first gradual but became abrupt and accompanied by catastrophe to some of the human civilizations of the time about 500 B.C.*
4. *There was a secondary optimum of climate between 400 and 1200 A.D., the peak probably being 800-1000 A.D. This was on the whole a dry, warm period and apparently remarkably storm free in the Atlantic and in the North Sea.*
5. *Decline set in again. The period 1200-1400 A.D. contained some remarkable climatic instability in western Europe with great floods and droughts, notably severe and notably mild winters.*
6. *The period 1400-1550 was one of partial recovery.*
7. *The period from 1550 to about 1850 has been called the Little Ice Age. The glaciers of Europe reached their most advanced positions since the Ice Age ...and evidence suggests that by 1780-1800 the ice commonly extended more than half way from Greenland to Norway and affected the coasts of Iceland for much of the year*.

And he added: «*Interest in the subject of climatic change was aroused once the considerable warming of our climate in most seasons of the year from the 1890s to the 1930s and '40s became obvious to all. As a matter of fact, I find that this trend was quite clearly recognized in a discussion in the Society as early as 1911*». (Lamb, 1959).

Obviously at that time it was acknowledged that climate had changed a lot over the course of the previous 8000 years, that a significant warming had taken place since the end of the Little Ice Age (LIA), but it did not dawn on anybody mind that mankind could have any responsibility in that matter and it took some more years before some started to wonder whether some of those changes could be related to man-made activities (e.g. land usage, aerosols, pollutants and greenhouse gases), a strange idea to some as Tim Ball.

"*Climate change has happened, is happening and will always happen. Contrary to the message of the last thirty years, current rate of climate change is well within the bounds of natural variability. Thus, a perfectly natural phenomenon became the biggest deception in history*" Tim Ball.

Some other scientists, acknowledged for their immense achievements and vast knowledge in so many fields, just prefer to remain modest: «*The climate of the earth is an immensely complicated system and nobody is close to understanding it.*» Freeman Dyson

Being modest is certainly the right approach to understanding why climate science has become so controversial.

2. Politicized and Controversial Science

«*Thus, a theory can very well be found to be incorrect if there is a logical error in its deduction, or found to be off the mark if a fact is not in consonance with one of its conclusions. But **the truth** of a theory can never be proven. For one never knows if future experience will contradict its conclusion; and furthermore there are always other conceptual systems imaginable which might coordinate the very same facts. When two theories are available and both are compatible with the given arsenal of facts, then there are no other criteria to prefer one over the other besides the intuitive eye of the researcher. In this manner one can understand why sagacious scientists, cognizant of both -theories and facts- can still be passionate adherents of opposing theories.*» (Einstein, 1919).

2.1. Climate Science

«*Climate has always changed. It always has and always will. Sea level has always changed. Ice sheets come and go. Life always changes. Extinctions of life are normal. Planet Earth is dynamic and evolving. Climate changes are cyclical and random. Through the eyes of a geologist, I would be really concerned if there were no change to Earth over time. In the light of large rapid natural climate changes, just how much do humans really change climate?*» Ian Plimer

«*The hypothesis that human activity can create global warming is extraordinary because it is contrary to validated knowledge from solar physics, astronomy, history, archeology and geology*» Ian Plimer cited by Delingpole (2009a).

Climate science is supposed to be a recent discipline which did not really exist when I went to the university. As far as things happen to be organized in France, the keyword "climatology" is one of the 55 which define the field of application of *teaching and research within the framework of section 23* "Physical, human, economic and regional geography" of the National Council of Universities. As much as the universities know how to define and possibly recruit the skills of a mathematician, a physicist, a chemist, a geologist, a geochemist, a biologist, a geographer, climatology appears more mysterious as it was placed together with 54 other specialties under the heading of "Geography". How many authors of the reports of the IPCC justify a thesis in climatology? IPCC writers have generally done their theses in other disciplines and have taken the climate bandwagon, which has become highly politicized, promising credits, budgets, contracts, travel, honors and promotions. Arrhenius, winner of the Nobel Prize in Chemistry in 1903, who is generally and rightfully credited with the authorship of the regrettable atmospheric greenhouse effect idea, was not a "climatologist".

Therefore, most of the prominent scientists in the field have graduated from well established sciences, for example just to name a few in alphabetical order, sorry for the hundreds forgotten, e.g. Vincent Courtillot (geophysicist), James Hansen (Physics and Mathematics / Astronomy / Physics), John T. Houghton (1931-2020) (Atmospheric Physics), Phil Jones (Engineering Hydrology / Hydrology), Richard Lindzen (Physics / Applied Mathematics), Michael Mann (applied mathematics and physics / Geology and Geophysics), Ian Plimer (Geologist), Roger Revelle (1909-1991) (geology / oceanography), Fred Singer (1924-2020) (electrical engineering / physics) and not from «Climate Science». One would argue that they *created* climate science, but in fact it would be more reasonable to think that assessing past, present or future climates requires such a host of expertise in so many fields that no single individual can entirely really master them all.

So many parameters have an influence on the Earth's climate and certainly not being exhaustive, one could mention the cyclical variation of the Earth's orbit (i.e. axis inclination, precession[7], variations of orbital eccentricity), solar cycles and activity, cloud cover and nucleation processes, oceanic oscillations of all sorts, land usage and over longer periods cataclysmic volcanic activity like Deccan traps (eventually on carbonated substrate), clathrate release mechanisms, distribution and drift of continental masses, even the crossing of galactic dust clouds or arms, etc. and I am omitting many, all combining on different timescales, that one can legitimately wonder whether an additional 100 ppm of CO_2 (i.e. 0.01% of the overall atmospheric composition) - generating a supposed +1,6W/m2 overall anthropogenic imbalance (if it really does, in case negative feedbacks have not been underestimated, e.g. Iris effect) - is the driving force of the Earth's climate ?

7 https://en.wikipedia.org/wiki/Precession

«To reduce modern climate change to one variable, CO_2, or a small proportion of one variable - human-induced CO_2 - is not science. To try to predict the future based on just one variable (CO_2) in extraordinarily complex natural systems is folly. Yet when astronomers have the temerity to show that climate is driven by solar activities rather than CO_2 emissions, they are dismissed as dinosaurs undertaking the methods of old-fashioned science». Ian Plimer

Having said that and having further quoted Ian Plimer will undoubtedly lead to a massive flow of critics, including those usually drawn against the signatories of the « Petition Project » (Robinson et al., 2007), summarized as « but most of these people are not climate scientists ». Therefore, I will shortly remind my background and though, not strictly speaking a climate scientist, originally being a geochemist by training, I consider that I do not deserve to be silenced - as is often the case for people expressing divergent opinion - by climate activists having simply no scientific training at all. I graduated with a M.Sc. in 1981 (geology), got a Diplôme d'Etudes Approfondies at the Ecole des Mines de Paris / Nice University (geochemistry and remote sensing) and obtained a State Doctorate Degree, i.e. Doctorat d'Etat ès Sciences (D.Sc.) in 1986 (Poyet, 1986) at INRIA (French National Institute for Research in Computer Science and Control) / Nice University (France). Given the importance taken by climate simulation systems (i.e. software) I will stress that most of my professional career was devoted to Applied Computer Science in various domains like:

- Geochemistry, Hydrogeology, expert-systems in Earth and Planetary Sciences, e.g. (Leymarie and Poyet, 1983; Poyet and Leymarie, 1983; Poyet, 1986; Poyet and Detay, 1988a-b-c; Poyet and Detay, 1989a-b-c, 1990; Detay et al., 1989; Detay and Poyet, 1989; Detay and Poyet, 1990a-b-c-d; Detay et al., 1991; Poyet, 1992; Poyet and Detay, 1992),
- Simulation and Defense Systems, e.g. (Poyet, 1987; Poyet et al., 1987; Poyet, 1988; Poyet and De La Cruz, 1988; Poyet and Haren, 1988; Poyet et al., 1989; Tomasini et al., 1991),
- Applied Artificial Intelligence, e.g. (Poyet and Delcambre, 1989, 1990; Poyet, 1990; Poyet et al., 1990, 1991, 1992; Debras et al., 1991),
- Computer and Software Integration in Construction, Manufacturing and Design, Concurrent Engineering and Virtual Enterprises e.g. (Poyet, 1993; Tolman and Poyet, 1994; Poyet, 1994; Poyet and Dubois, 1995; Poyet et al., 1995, 2002, 2004; Poyet and Monceyron, 1997a-b; Monceyron and Poyet, 1997; Poyet and Zarli, 1997, 1999; Sandakly et al., 2001; Zarli et al., 1997; Zarli and Poyet, 1999a-b, 2017),
- Finance and Trading, e.g. (Poyet and Besse, 2005a-b; Poyet, 2012),
- Astronomy and Planetology, e.g. (Poyet, 1982, 1985, 2014, 2017a-b, 2019; Poyet et al., 2014).

I have been interested in comparative planetology for a very long time (Poyet, 1982, 1985) and since 2015, I have been working on computing double stars' orbits (Poyet, 2017a-b, 2019) but also studying paleo-climates, climate drivers, and natural climate change, and this e-Book represents the compilation of my efforts on this last subject. My friends refer to me as a polymath, my foes as a "touches everything", the truth must be in between. I always try to gather enough knowledge on any given subject I work on as to have a large perspective on it and avoid too narrow of a specialization that would blur the broad picture. That's also why, given the thousands of papers I have read on the climate subject and the past experiences I have in deploying computer systems in so many domains, I dare express my views of what has become a controversial domain, a real mine field if one does not stick to the one-sided dominant thinking. But I consider that I have done more than my homework to be entitled to an opinion and I should not be blamed for doing my best to express it clearly.

The entire climate science rests on the credibility of computer models, and that's a good thing, because beyond my initial training in Earth and Planetary Sciences, that's what I have done my entire life: applied computer science. Be it for the modeling of geochemical or hydro-geochemical anomalies and the spreading of various species and compounds in the aquifers, for the physics of undersea sound propagation used to derive bathymetric models required for submarine simulation warfare, for Kalman filter-based carrier motion simulation to facilitate A.I. assisted aircraft landing, for missile handling and target motion analysis and pursuit, for underground water modeling to ensure village water supply in Africa (e.g. North Cameroon), for data and software integrated models in construction and engineering, for CAD representation and exchange, for computing double stars orbits, etc., computer models are always the same: just models that strive to stick to reality, mimicking somehow some properties of the real world. But the more complex the system modeled is, the less it can pretend to accurately represent the reality.

Earth System Models (ESMs terminology is used here in its most generic sense), are undoubtedly the most complex endeavors one can think of, if not simply the most, and they are well worth it, provided one remembers that they are completely unsuited for making any climate forecasting. Using the same physics, the same numerical methods and technologies, the same ultra-fast parallel computers, one notices that making 15 day meteorological previsions is hard enough facing an extraordinarily complex non-linear and chaotic Earth system. Neither heat-waves e.g. (Nakamura et al., 2005; Weisheimer et al., 2011; Stéfanon, 2012) nor floods (CNRM, 2020a) have successfully been forecast 15 days ahead, and as the climate is the sum over 30 years minimum of such phenomena and many other common events, including a decent account of precipitations also at regional scales (Koutsoyiannis et al., 2008) and obviously monsoons and ENSO-like oscillations (see p. 167), one gets a sense of the gap to face to address climate modeling.

Let's keep our feet on the ground and not delude ourselves believing in models just because they are the result of sophisticated computer runs, let's remember belief is not science, and the results are not more credible because they were produced by a computer any more than an information is more reliable because it was seen on TV! It is also a shame to bet on the public gullibility to sell baseless climate horror stories. Hollywood have excellent science fiction scenarios and do an excellent job, there is no need to add any further to their achievements.

As a summary, my understanding of climate change is driven by my knowledge in geology, geochemistry, remote sensing, data analysis and processing, applied computer science and my experience of the design and implementation of computer models and systems as a professional computer scientist for decades and my very long standing keen interest in astronomy and comparative planetology. I'll try to use my diverse scientific skills and some common sense to ask some good questions. Climate has been warming since the end of the Little Ice Age (LIA). The question is to try to assess whether CO_2 is the only driver of that change, just one of the many reasons of it, or if it even plays a significant role at all… Questioning this statement goes against what is the supposedly well established consensus. What is a consensus?

2.2. The Consensus

Let's start with an anecdote: the consensus was so much prevalent and science settled that the managers of Glacier National Park, a large wilderness area in Montana's Rocky Mountains with glacier-carved peaks and valleys running to the Canadian border, had decided to post signs stating that «*glaciers will be gone by 2020*» as an «inconvenient truth» to be displayed everywhere in the national park to warn the visitors of these dire predictions. Since the early 2000s scientists had analyzed data, stating glaciers would massively recede by 2020. Unfortunately the «inconvenient reality» is that the consensus was horribly wrong and the latest research shows that the glaciers are shrinking (to be checked by how much), but in ways much more complex than what was predicted. Because of this, the park must update now (in early 2020) signs stating all glaciers will be melted by 2020, the indoor and wayside exhibits have also been updated including at the Apgar, Logan Pass and St. Mary visitor centers (Kurzmen, 2020).

The wager made sense as glaciers are demonstrating an extremely rapid response to climate change and since the end of LIA, most of them have been receding, some at an alarming rate as early as the 1855 (Nussbaumer et al., 2011; Fig. 4 and 5), and e.g. Trutat stated in 1876 «*Since I have been exploring the Pyrenees, I see the glaciers melt before my eyes and in the Lys valley and in the area of Oo, they are receding at a frightening speed*» (Trutat, 1876) as reported by (René, 2011). Alpine glaciers, including for example Aletsch[8] and Morteratsch among the largest glaciers in the Alps, but also many others in all locations, e.g. Storbreen in Norway (Jaworowski, 2003), have equally all been receding at the same period indicating that Trutat's observations were not local anomalies (Akasofu, 2011). It is asserted that in some cases the reasons for these extraordinary retreat at the end of LIA might be a decrease of winter precipitations more than a summer months warming (Vincent, 2010). It is noteworthy that glaciers in the Andes have also been receding since the end of LIA as well (Jomelli et al., 2009) demonstrating that this warming has been global and is ongoing. It is noteworthy that all these observations were made long before the industrial age at a period when anthropic CO_2 released so far was negligible. This is confirmed for example, by Ramanathan et al. (1987) «*Furthermore, inferences based on gases trapped in ice cores suggest that the increase in CO_2 and CH_4 is not a recent phenomenon but began before the middle nineteenth century*». Also of interest is the fact that these Alpine glaciers were 3300 years ago even of a more limited extension than today (Holzhauser et *al.*, 2005), e.g. Aletsch being shorter of one km, indicating that the current climate is not exceptional.

The consensus is a mere non-sense in science and resorting to it all the time as an argument of authority to support the AGW theory is in itself an alarming signal. When an hypothesis or a theory can be proved or otherwise invalidated by means of legitimate scientific methods, there is no need to bully or intimidate people with an alleged consensus.

8 Records state that in 1892 the glacier was shrinking by 20 m year^{-1}, a rate similar to that calculated for the past 140 years as reported by Dent (2004).

Aristarchus of Samos (c. 310 – c. 230 BC) was an ancient Greek astronomer and mathematician who presented the first known heliocentric model and Eratosthenes of Cyrene (c. 276 BC – c. 195/194 BC), is best known for being the first person to calculate the circumference of the Earth (Eratosthenes' method to calculate the Earth's circumference has been lost; what has been preserved is the simplified version described by Cleomedes using angular relationships and distances between Alexandria and Syene, modern Assuan) but his calculation was remarkably accurate. He was also the first to calculate the tilt of the Earth's axis, once again with remarkable accuracy. Additionally, he calculated the distance from the Earth to the Sun. This knowledge, the incredible legacy of only two men, represented extraordinary advances for the time, but Plato, Aristotle, and Ptolemy preferred the geocentric model, which was held as true throughout the Middle Ages and represented the consensus for centuries enforced by extreme persecutions by the catholic inquisition, until the heliocentric theory was revived by Copernicus, after which Johannes Kepler described planetary motions with greater accuracy with his three laws which are still used as the basis for computing orbits and double stars' orbits in particular (Poyet, 2017a-b). Climate science has become the religion of our time: The analogy with religion is taken literally; theologians declared that they could not clearly define what is God, but in his name they dictated rules of conduct to men and did not hesitate to burn heretics. Climate Scientists admit they don't know exactly how the entire climate system works nor how reliable their predictions are, but they pretend to decide how human beings shall live.

Interestingly enough, the consensus with climate change, if it makes any sense as previously said, was in favor of cooling in the early 1970s with hundreds of frightening papers and videos[9] (Cordato, 2013) as carefully analyzed by McFarlane (2018). The major risk for mankind is certainly more a global and severe cooling (Roberts, 1975) than a global warming as rightfully Kukla (2000) pointed out as the configuration of the Sun and Earth is fast approaching what it was 116,000 years ago when the last interglacial period ended and while the annual mean temperature on Earth is now rising, polar mean temperatures remain steady and ice fields in the upper elevations of Greenland are actually expanding. Ice ages begin building at the poles thousands of years before their effects are felt elsewhere (Kukla *et al.*, 1997; 2002) as suggested by the study of the Eemian (i.e. 130,000 yr B.P. and end at 116,000 yr B.P.). Thus, the important indicator of impending glaciation may not be global mean temperature so much as the temperature difference between the poles and the equator, the larger the difference the stronger the probable flow of water vapor from the tropics toward the poles, where it would fall as snow to feed the growing ice fields. Even moderate cooling is a much greater risk and direct threat to mankind survival than warming and one should remember Trevelyan (1942, p. 432) saying: «*The last half dozen years of Williams's reign (i.e. the 1690s) had been the 'dear years' of Scottish memory, six consecutive seasons of disastrous weather when the harvest would not ripen. The country had not the means to buy food from abroad, so the people had laid themselves down and died. Many parishes had been reduced to a half or a third of their inhabitants*».

Kukla (1930-2014) is definitely remembered as a «contrarian climate scientist» in fact geologist, but the irony is that coming from behind the curtain wall (Czechoslovakia) and immigrating to the land of the free, Kukla was the very first with his fellow colleague Robley Matthews of Brown University to call on the government for intervention through a letter dated December 3rd, 1972 they sent to President R. Nixon. By February 1973, the State Department had established a Panel on the Present Interglacial, which advised Drs. Kukla and Matthews that it "was seized of the matter" and numerous other government agencies were soon included[10]. Probably, Kukla had not read «Capitalism and Freedom» by Milton Friedman and behaved as a statist, a legacy of his origins, leading to the first grip that politicians and the administrations worldwide would exert over science to bend it to their agenda in controlling minds, fears and voters on that issue of this new «climate science».

The installment of a non scientific international organization, i.e. UN/IPCC as the only supposedly knowledgeable body in that matter proved extremely efficient to later silent all diverging views, moreover leveraging on mainstream media with ad-hominem papers written by journalists with no scientific training at all and having the gall to question the credentials of the most prominent researchers as Richard Lindzen for example (Huet, 2016) or to publish a book to denounce an impostor (Huet, 2010) in the case of Claude Allègre who received the Crafoord prize in 1986 for his exceptional scientific career. Of course, given these exceptional attacks only typical of political feuds, which is not surprising from Huet as he is a well known far-leftist activist journalist, most other dissenting scientists stick to a low profile and apply voluntary self-censorship. At that point, science is dead and only remains politics for the worse, i.e. political constructivism and punitive tax regimes, e.g. carbon tax. The answer to Huet, will be two Lindzen's quotes:

9 https://www.youtube.com/watch?feature=player_embedded&v=1kGB5MMIAVA#!

10 This led to creation and full operation of NOAA's Climate Analysis Center in 1979 (Reeves and Gemmill, 2004).

"*The public discourse on global warming has little in common with the standards of scientific discourse. Rather, it is part of political discourse where comments are made to secure the political base and frighten the opposition rather than to illuminate issues. In political discourse, information is to be 'spun' to reinforce pre-existing beliefs, and to discourage opposition*." Richard Lindzen

"*Scientists who dissent from the alarmism have seen their grant funds disappear, their work derided, and themselves libeled as industry stooges, scientific hacks or worse. Consequently, lies about climate change gain credence even when they fly in the face of the science that supposedly is their basis*." Richard Lindzen

The IPCC was created in 1988 (WMO/UNEP, 1988) by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the objective of the IPCC is "*to provide governments at all levels with scientific information that they can use to develop* ***climate policies***". This further led to the creation of the United Nations Framework Convention on Climate Change (UNFCCC), the key international **treaty**[11] to reduce global warming and cope with the consequences of climate change. The UNFCCC entered into force on 21 March 1994. All that without any scientific proof of any man-made influence on climate. WMO is a fervent supporter of the computerized climatic fantasies (see p 238), which have created a new business for meteorologists who had had to acknowledge their inability to deliver medium term predictions (in fact beyond 15 days) and astutely fell back on developing meaningless "*climate scenarios*". At least WMO achieved an amazing feat: while unable to say anything about the weather more than 15 days in advance they have deluded people to believe that they know what the climate will be in decades or centuries. They have the gall to call that "*sensitivity studies*"! Here again we have a lack of understanding of basic science. If a theory, AGW in this case, is not able to make predictions, it is protected against any attempts at refutation. It is therefore not a scientific theory (Sidiropoulos, 2019a), that's as simple as that. As rightfully pointed out to me by J.-C. Maurin[12] "*the opposition between 'climatologists' and 'climato-skeptics' is in reality an opposition between ignorant people who think they know, i.e. the 'climatologists' and ignorant people who are aware of their ignorance, i.e. the 'climato-skeptics'*". But as I have come to know the 'climatologists' too well for having argued with them so many times over 'Researchgate' forums, they will reply: "*ignorant, us? Talk for yourself!*".

Furthermore, everybody should understand that the excess of CO_2 is certainly not a risk, the real risk is a depletion of CO_2 under say 150 ppm as this would stop photosynthesis and end life and the world as we know it. As CO_2 concentration has had a tendency to decrease steadily through geological times for all the prevalent geochemical processes at work, some have surmised that the release of CO_2 through the industrial age could have earned us some time before the interglacial ends and the natural and ultimate demise of life on this planet happens. If you think that I am overly pessimistic, Moore (2016) is not far from that, stating "*If humans had not begun to use fossil fuels for energy (...) it is reasonable to assume that atmospheric CO_2 concentration would have continued to drop as it has for the past 140 million years*," perhaps to levels so low during the next glaciation period as to cause "*widespread famine and likely the eventual collapse of human civilization. This scenario would not require two million years but possibly only a few thousand*" (Moore, 2016) p. 16-17. Moore (2016) adds "*Human emissions of CO_2 have restored a balance to the global carbon cycle, thereby ensuring the long-term continuation of life on Earth*". But, as I was reminded by Veyres[13], man-made emissions are dwarfed by natural sources (for their formal expression, see Equation 3, p.19), thus Moore's vision is granting again much too large of an importance to our role on this planet, another sort of an anthropomorphic sin opposite to that of the AGW itself.

Not only is science not settled but objecting to the catastrophic narrative promoted by some to fund their research and reused by politicians to threaten our fundamental freedoms is the right of every informed person, including questioning why so many resources are diverted from far more pressing world problems which have been looming for decades such as rampant diseases (e.g. malaria), potable water availability (Poyet and Detay, 1989) and water supply (Poyet and Detay, 1992), (Detay, 1997), sanitation and malnutrition and mull on the legitimate best usage of tax payer monies, as Lomborg did in many of his writings, e.g. (Lomborg, 2007; 2020a-b). This was also very well stated by Crichton (2009) "*In my view, our approach to global warming exemplifies everything that is wrong with our approach to the environment. We are basing our decisions on speculation, not evidence. Societies are morally unjustified in spending vast sums on a speculative issue when people around the world are dying of starvation and disease*". But, it is not just starvation and disease, and as noted by Veyres "*Problems usually come from corrupt governments that keep their subjects in a state of backwardness. The many Asian countries that have gone above 20,000$ GDP per capita thanks to*

11 Climate policies, treaties, etc. All that bears no relationship with science, obviously it all politics.

12 Personal communication on December 10, 2020. See footnote 466.

13 Personal communication on December 8, 2020. I am so much indebted to Camille Veyres, not to mention his careful reading of the manuscript.

industrialization and training have electricity and running water and a medical system that ensures that life expectancy has increased by 5 years for each doubling of the GDP per capita" see note above.

«*I gave a talk recently (on fallacies of global warming) and three members of the Canadian government, the environmental cabinet, came up afterwards and said, 'We agree with you, but it's not worth our jobs to say anything.' So what's being created is a huge industry with billions of dollars of government money and people's jobs dependent on it*», Dr. Tim Ball, Coast-to-Coast, Feb 6, 2007

There is now a powerful and very extensive body of vested interests supporting AGW: governments which intend to use 'global warming' as an excuse for greater taxation, regulation and protectionism; energy companies and investors who stand to make a fortune from scams like carbon trading; charitable bodies like Greenpeace which depend for their funding on public anxiety; environmental correspondents who need constantly to talk up the threat to justify their jobs, research labs and scientists knowing where to side to get fundings, etc. So the consensus is the show must go on! Consensus carries no scientific value. It belongs to politics. Unfortunately as we will detail in the section «deceitful policies» being pursued, the activists' fight to enact a worldwide climate state of emergency reminds us that we're all in it. When the European parliament in Nov. 2019 declared a global "climate and environmental emergency", urging all EU countries to commit to net zero greenhouse gas emissions by 2050, some EU MPs rightfully stated that it reminded them of the Emergency Decree for the Protection of the German People, issued on 28 February 1933, which permitted the suspension of the democratic aspects of the soon-to-disappear Weimar Republic.

As a summary let me quote Frank (1994): "*Also, in scientific discussions sometimes the sentiment of the "generally accepted view of the scientific community" is heard - as if verification or falsification of scientific hypotheses is a matter of majority vote. There are many historic examples when the common belief, the majority of those who knew, hindered true progress. Derogatory statements about a person's scientific reputation are least helpful. Often the less firm arguments are, the more is the interpretation based upon scientific 'authority through majority' ".* The worst about the meaningless "consensus" has probably come recently as Cook[14] et al. (2018) desperately try in a political document to convince people of the importance of it, and of being a "climate scientist", observing that the main author has a PhD in cognitive science, i.e. philosophy, psychology, linguistics, anthropology. A decade ago, Morano (2010) provided a compilation of more than one thousand prominent scientists who dissented with the so-called consensus, see also (Plimer, 2019).

To conclude, as it says everything in one sentence, I will quote Legates et al. (2015) who reporting on intentional agnotology having a deliberate intent to deceive, state "*The 97.1 % consensus claimed by Cook et al. (2013) turns out upon inspection to be not 97.1 % but 0.3 %. Their claim of 97.1 % consensus, therefore, is arguably one of the greatest items of misinformation that has been circulated on either side of the climate debate.*"

"*The work of science has nothing whatever to do with consensus. Consensus is the business of politics. In science consensus is irrelevant. What is relevant is reproducible results. The greatest scientists in history are great precisely because they broke with the consensus. There is no such thing as consensus science. If it's consensus, it isn't science. If it's science, it isn't consensus. Period.* (...) *I would remind you to notice where the claim of consensus is invoked. Consensus is invoked only in situations where the science is not solid enough. Nobody says the consensus of scientists agrees that $E=mc^2$. Nobody says the consensus is that the sun is 93 million miles away. It would never occur to anyone to speak that way.*"- lecture on January 17, 2003 at the California Institute of Technology titled "Aliens Cause Global Warming" by Michael Crichton (2003) also reported in (Perry, 2019b; Youngren, 2019).

"*To me consensus seems to be —the process of abandoning all beliefs, principles, values and policies in search of something in which no-one believes, but to which no-one objects. —the process of avoiding the very issues that have to be solved, merely because you cannot get agreement on the way ahead.*" - Margaret Thatcher (1981)

No doubt that Margaret Thatcher knew what politics is about, thus no wonder she is an expert at defining "consensus".

14 https://ise.gmu.edu/faculty-directory/john-cook/

2.3. Let's get back to some Physics

1) Origin of the Greenhouse effect concept

Strangely enough, Fourier (1824, 1827) is widely recognized as the «father» of the greenhouse effect although he never called it that way and he wisely acknowledged that the actual mechanisms that determine the temperatures of the atmosphere included mainly convection[15]. Based on his work and Tyndal's (1859), Arrhenius (1896) developed what is undoubtedly a close way of thinking to what is unfortunately referred to as the «greenhouse effect» today. « *One may now ask, how much must carbonic acid vary according to our figures, in order that the temperature should attain the same values as in the Tertiary and Ice ages respectively ? A simple calculation shows that the temperature in the arctic regions would rise about 8° to 9°C., if the carbonic acid increased to 2.5 or 3 times its present value. In order to get the temperature of the ice age between the 40th and 50th parallels, the carbonic acid in the air should sink to 0.62-0.55 of its present value (lowering of temperature 4°-5° C.)*». Arrhenius (1896) p. 268.

The ink of the first paper published by Arrhenius was not yet dry that Ångström (1900) disagreed with the computations made by the former, one of the reasons being that Ångström had already noticed that the absorption by carbon dioxide of the infrared radiation increases very little with its concentration and this did not bode well for the new theory (Arrhenius proposed a base-2 logarithmic law to account for the influence of atmospheric CO_2 on Earth's surface temperature). Ångström had published the first modern infrared absorption spectrum of CO_2 with two absorption bands, and published experimental results that showed that absorption of infrared radiation by the gas in the atmosphere was already saturated so that adding more makes no difference, which is still confirmed by all laboratory experiments.

At least Arrhenius recognized that "*By the influence of the increasing percentage of carbonic acid in the atmosphere, we may hope to enjoy ages with more equable and better climates, especially as regards the colder regions of the earth, ages when the earth will bring forth much more abundant crops than at present, for the benefit of rapidly propagating mankind"* which was a much more positive stance with respect to this gas of life than the prevailing posture today.

What's so funny with Arrhenius' paper (1896), and I strongly encourage anyone who has not done so, to read it carefully to the end, is that the very foundation of his carbonic acid centric theory is based on the work of the Italian meteorologist L. De Marchi whose entire set of conclusions have been totally proven wrong by one century of established science.

Let's go back to Arrhenius' paper:

«*Has no one hitherto proposed any acceptable explanation for the occurrence of genial and glacial periods ? Fortunately, during the progress of the foregoing calculations, a memoir was published by the distinguished Italian meteorologist L. De Marchi which relieves me from answering the last question. He examined in detail the different theories hitherto proposed-astronomical, physical, or geographical, and of these I here give a short résumé. These theories assert that the occurrence of genial or glacial epochs should depend on one or other change in the following circumstances:-*

15 see page 586 of this 1824 memorandum: de Saussure's (1779-1796) apparatus known as the Héliothermomètre (1767, 1774) described by Sigrist (1993) p.37-38 and p. 59-76 (even though the explanation p.76 is very misleading), is a distant forerunner of the modern solar flux measuring devices which were born with the pyrheliometer of Pouillet (1838), see Snow (2015); Fourier clearly indicates (p. 586) that it is the movement of air (we would say convection) which is prevented by the glass; p. 587 he states "*la température est augmentée par l'interposition de l'atmosphère parce que la chaleur trouve moins d'obstacle pour pénétrer l'air à l'état de lumière qu'elle n'en trouve pour repasser dans l'air lorsqu'elle est convertie en chaleur obscure*" "[the temperature is increased by the interposition of the atmosphere because the heat finds less obstacle to penetrate the air in the light state than it finds in the air when it is converted into dark heat]" gives an account of the absence of clear concepts on the electromagnetic waves discovered forty years later and the hypothesis, still accepted by Arrhenius, of a solid ether where light propagates, with a conduction of heat as in a solid. This thermal conductivity of solid bodies is included in the Fourier heat equation. For Fourier, it is the contact between two bodies (solids or similar) that allows heat transmission. Fresnel's memoirs rejecting the corpuscular theory in favor of the wave theory and introducing the polarization of light date from 1815 -1822 but the nature of dark heat was probably not yet understood.

(1) The temperature of the earth's place in space.
(2) The sun's radiation to the earth (solar constant).
(3) The obliquity of the earth's axis to the ecliptic.
(4) The position of the poles on the earth's surface.
(5) The form of the earth's orbit, especially its eccentricity (Croll).
(6) The shape and extension of continents and oceans.
(7) The covering of the earth's surface (vegetation).
(7) The direction of the oceanic and aérial currents.
(9) The position of the equinoxes.
De Marchi arrives at the conclusion that all these hypotheses must be rejected (p. 207).» Arrhenius (1896).

So based on the inexact statements made by an Italian meteorologist of all what we know today as having a major impact on the Earth's climate on various timescales, and just to quote a few (Milankovitch, 1949; Hays et al., 1976; Laskar, 1990; Laskar and Robutel, 1993; Dansgaard et al., 1993; Maslin et al., 2001; Marchitto et al., 2010; Mysak, 2010; Scafetta, 2010; Feynman and Ruzmaikin, 2011; 2014), Arrhenius established his carbonic acid centric theory on completely flawed assumptions. «*I trust that after what has been said the theory proposed in the foregoing pages will prove useful in explaining some points in geological climatology which have hitherto proved most difficult to interpret*». Arrhenius (1896).

In the end, Arrhenius who is a chemist, is being challenged in his very domain of competence by Ångström (1900) in his paper «*About the importance of water vapor and carbonic acid in the absorption of the earth's atmosphere*» who stresses the importance of water vapor and refutes the role granted by Arrhenius to the CO_2 as the absorption bands of this molecule are totally saturated and any CO_2 increase will not even produce the logarithmic response envisaged by Arrhenius, i.e. value of the absorption is given by Arrhenius p. 238 as:

$$\log a = b\left(\frac{1}{\lambda}\right) + c\left(\frac{1}{\lambda}\right)^3 \qquad (1)$$

with b=-0.0463 and c=-0.008204 determined by least squares where *a* represents the strength of a ray of the wave-length λ expressed in μ after it has entered with the strength 1 and passed through the air-mass 1, Arrhenius formula trying to match Langley's measurements (1884)[16]). Furthermore, when Arrhenius ventures in other domains of competences than his, what he does best is to quote Högbom's work on carbon cycles in nature (1894) whom has a truly impressive understanding of those processes for the time. But Arrhenius completely fails, in what he calls in his conclusion, to deliver a solution nor even a reasonable perspective to «*geological climatology*» by basing all the arguments supporting his «carbonic acid centric theory» on the rantings of the Italian meteorologist Luigi De Marchi - (De Marchi, 1895) Le cause dell'era glaciale - who clearly ventures himself into «terre incognita» and peremptorily denies without the slightest intuition everything that will be later demonstrated by the most prominent scientists of the XX century as we've seen above.

As a side note, one should notice that Arrhenius' calculations are for a glass suspended in a vacuum with terms for non-radiative exchanges. The wavelength calibration of thermal infrared gas transmission measurements was based on the deflection by a NaCl prism whose index was, in 1886, measured up to 2.3 µm; the linear extrapolation made by Arrhenius (1896) of the wavelength as a function of the deviation between 2.3 and 16 µm is erroneous and correct values can be found here[17] and furthermore its CO_2 and water vapor absorption profiles are completely false. The correct formula is:

$$n = \sqrt{5.174714 + \frac{0.0183744}{(\lambda^2 - 0.015841)} - \frac{8949.52}{(3145.695 - \lambda^2)}} \qquad (2)$$

16 Erren, H., 2003. The key paper on global warming written by Svante Arrhenius in 1896 relies on the infrared observations of the moon as published by Langley (1890). The paper of Langley contains errors that were corrected in by Langley (1900) and Abbot but this was after Arrhenius published his theory. Erren (2003a), re-calibrates Langley's original data with modern observations and standard atmospheric models using modtran3 on-line radiation code.

17 http://www.crystran.co.uk/optical-materials/sodium-chloride-nacl

Linear extrapolation of the index beyond 5 µm using 1.5191 -0.00312 (λ - 5) gives very different values around 10 and 15 µm. The use of the Arrhenius formula ("with one glass") with modern spectra of absorption of water vapor and CO_2 would reduce the heating "for a doubling of the ppm" at +0.22°C see note[18]. As stated by Dufresne[19] (2009) p. 27 "*the atmospheric absorption data used by Arrhenius do not contain the 15 µm band, which is the main absorption band for CO_2, the separation into the contribution of CO_2 and H_2O is very imperfect, and the absorption by CO_2 is notably very overestimated, the model used gives a temperature increase of almost zero for a doubling of CO_2 if realistic CO_2 absorption values are used. This model is fundamentally unsuitable for estimating the temperature increase in response to an increase in CO_2*". The values given by Arrhenius of +5.5°C for a doubling of the ppm are therefore fortuitous which does not prevent them from being said by many as "still relevant" !, e.g. (Ramanathan and Vogelmann, 1997) or that elementary radiative models derived from them be used for software simulators, e.g. (Anderson et al., 2016).

One will further notice that the analogy made with the "green-house" was already refuted as early as 1909 by Wood (1909), see footnote 81, p. 70, but is still re-used "ad nauseam" by almost every 'climatologist' even though they hopefully, most of the time know, that it is grossly irrelevant.

Whatever the reasons that made the climate cool from the warm medieval optimum to delve into one of the coldest period of the Holocene, the Little Ice Age and reversely whatever the reasons why the climate has had to warm up from this minimum to the very favorable conditions we have now[20] (and that we should cherish instead of being worried about), has nothing to do with our CO_2 anthropogenic emissions as there were simply none at the time! When an idea is called into question from the start and does not rest on solid physical and chemical bases, as immediately pointed it out by Ångström and when this theory fails miserably to explain the two last noticeable climatic changes that we observed and that are well documented, it must be recognized that it is simply a baseless guess. If it weren't for the modern frenzy of the doom-sayers who started a prosperous business to scare the public and so many other vested interests, the idea of Arrhenius would have remained for what it is, an old shibboleth as it was for more than 75 years…

18 See (among other sources) Erren (2003b), Arrhenius was wrong. Using Arrhenius with modern day spectra used by Erren (2003b), $T^4 = K/(1 + \nu\ \varepsilon)$ where ν=1-albedo=0.61 and ε emissivity, follows K= 9540491123 for T=288.15 K (15°C), Thus $[CO_2]$ppm=370, ε=0.6293, T°C=15 and for a **doubling [CO2]ppm=740**, ε =0.6223, T°C=15.22270447, i.e. **+ 0.22°C**.

19 Translated from French with www.DeepL.com/Translator (free version), to provide as neutral a translation as possible.

20 A decent attempt to provide such an explanation is given by Pangburn (2018, 2020).

2) Anthropic CO_2 is 6% of tropospheric [CO_2]

One of the key arguments wielded by the alarmists is that the bulk of CO_2 emitted by fossil fuel usage has remained in the atmosphere, will keep doing so for more than a century and that its ominous effect will be deferred and felt by the future generations, therefore trying to put the blame on us right now so that immediate action be taken in order to curb emissions ASAP, whatever the dire economic consequences might be. This does not resist even a quick fact checking.

In fact, the flux out-gassed by warm oceans between the tropics and by the soils where organic matter decomposes is of the same order of magnitude as the flux absorbed by cold oceans at high latitudes and by vegetation, but never quite equal because these absorbed and degassed fluxes depend on temperatures, precipitation and winds in the corresponding zones, and on the volume of vegetation which increases as per the carbon dioxide content of the air. The ratio (annual stock / flux) of the atmospheric carbon stock (in the CO_2 of the air) to the flux absorbed each year by the vegetation and by the oceans at high latitudes is in the range of four to five, hence an average lifespan of a molecule of CO_2 in the air from 4 to 5 years. One fifth of the CO_2 in the air is absorbed every year, roughly half by vegetation and the other half by cold oceans at high latitudes on their surface; almost as much is degassed by the soils where the vegetation decomposes and by the warm oceans on their surface. It appears that fossil fuels make up only 6% of the CO_2 in the air (compared to 2% in 1958), the other 94% come from natural out-gassing of the oceans and soil, in billions of tonnes of carbon, Gt-C or gigatons of carbon: 10 Gt-C / year "fossils" against some 170 Gt-C / year "natural degassing" (Moranne, 2000).

As one fifth of the CO_2 content of the air is absorbed every year, the carbon content of the air y(t) is a solution of the differential equation (Veyres, 2018): dy/dt = f(t) – y(t)/5 or y(t) = 5 f(t) – 5 dy/dt, with f(t) input:

$$y(t) = y(t_0)\mathrm{e}^{\frac{-(t-t0)}{5}} + \int_{t=0}^{t} e^{\frac{-(t-t')}{5}} f(t')dt' \qquad (3)$$

This applies to both components, i.e. the natural and the anthropogenic (f(t) = 10 Gt-C/yr) parts of the carbon of the air as the atmospheric processes do not make any difference between the two, how would they? The anthropogenic component of the air is 5 yr x 10 Gt-C/yr – 5 yr 0,4 Gt-C/yr = 48 Gt-C = 23 ppm or 6%; the component from natural out-gassing is 94%. Furthermore, Veyres (2018) adds «*the natural out-gassing, since 1958, went up from 62 ppm/yr to almost 80 ppm/yr, while anthropogenic emissions went from 1 ppm/yr to 4.5 ppm/yr. Natural climate cycles drive the temperature that drive the natural out-gassing, that provides today's 94% of the CO_2 of the air, and the total CO_2 of the air drives the absorption, always (1/5) of it*».

The oceans contain the bulk of the circulating carbon, 38,000 Gt-C, 90% in the form of bicarbonate ions (above the Carbonate Compensation Depth (CCD), see footnote p. 131) then vegetation (500-800) and soil (1500) represent 2,500 Gt-C, finally the atmosphere 870 Gt-C (for 410 ppm). The cumulative carbon of fossil fuels used since 1750 makes 1%, just one percent, of the carbon circulating in these three reservoirs. Furthermore, since 1900, net primary productivity of vegetation has increased by a third and continues to increase roughly as the CO_2 content of air (Goklany, 2015). Absorption by the surface of cold oceans has increased by a third in proportion to the (increase of) partial pressure of CO_2 in the air. There is therefore in the air, at most, only the equivalent of five years of "anthropogenic" emissions, in 2014, five times 10 Gt-C = 50 Gt-C or 24 ppm, which makes only 6% of the carbon in the air (currently 400 ppm or 850 Gt-C), against 5 times 2.3 Gt-C in 1958 or 11.5 Gt-C or 5 ppm over 315 ppm (Veyres and Maurin, 2020). One will take note that the CO_2 contents of the air noted [CO_2] are expressed in ppm or number of CO_2 molecules per million air molecules or parts per million, with 1 ppm = 2.1 Gt-C or billion tonnes of carbon contained in carbon dioxide molecules.

If we make use of IPCC data for the fluxes absorbed by vegetation and the oceans, we will take the two following reports. The IPCC AR4 (figure 7-3 page 515) gives for vegetation 120 Gt-C (pre-industrial) + 3 Gt-C = 123 Gt-C and for the oceans 70 Gt-C (pre-industrial) +22 Gt-C = 92 Gt-C therefore 190 Gt-C in pre-industrial and 215 Gt-C now (which is +13%). The following report IPCC AR 5 (figure 6-1, page 471) gives for vegetation 109 Gt-C (pre-industrial) +14 Gt-C = 123 Gt-C and for the oceans 60 Gt-C (pre-industrial) +20 Gt-C = 80 Gt-C; therefore 169 Gt-C in pre-industrial and 203 Gt-C now, (which is +20%); and while the air content in CO_2 would have increased by about 37% (from 285 ppm to 390 ppm since this AR5 report refers to 2011), which makes the residence time (or average life-time τ) of the molecules computed as stock/absorbed_flux of 3.5 years in pre-industrial and 4.1 years now (note that the reference to pre-industrial CO_2 emissions ought to be taken with caution as all these values are estimates without known accuracy and precision).

Critics and alarmists will claim that this reasoning based on the ratio (stock/flux) does not stand because it is the very 4 to 5 Gt-C accumulated yearly in the atmosphere that make the system break a supposedly previous equilibrium and that the residence time of CO_2 must also involve exchanges between superficial and deep ocean leading to much longer "residence time" of over a century.

Though one would hardly see why any pre-established equilibrium would have more existed before than now, let's see whether we can find other confirmations of the residence time that comes from the ratio (stock/flux), i.e. 4 to 5 years (Segalstad, 1998; Berry, 2019).

We're going to see that carbon isotopes are going help us. $\delta^{13}C$ is a linear function of the ratio of the number of carbon 13 (7 neutrons and 6 protons) to the number of atoms of carbon 12, expressed in parts per thousand (per mil, ‰, pm):

$$\delta^{13}C = \left(\frac{\left(\frac{^{13}C}{^{12}C} sample\right)}{\left(\frac{^{13}C}{^{12}C} standard\right)} - 1 \right) x\, 1000\,‰ \qquad (4)$$

The standard in Equation 4, was established thanks to the Pee Dee Belemnite (PDB) and was based on a Cretaceous marine fossil, Belemnitella americana (d'Orbigny, 1840), which was from the Pee Dee Formation in South Carolina. This material had an anomalously high $^{13}C/^{12}C$ ratio (0.0112372), and was established as δ13C value of zero. Since the original PDB specimen is no longer available, its $^{13}C/^{12}C$ ratio can be back-calculated from a widely measured carbonate standard NBS-19, which has (Friedman et al., 1982) a $\delta^{13}C$ value of +1.95‰. The $\delta^{13}C$ of a mixture is the sum of the $\delta^{13}C$ of the components of the mixture weighted by their quantities and this signature is expressed as indicated above in parts per thousand (per mil, ‰, pm). The signature of the anthropic emissions varies with the proportion of the various fossil fuels used, i.e. with coal (-24 pm), oil (-28 pm) and gas (-45pm) averaging to around -28pm to -29pm these last years.

If we were to follow the IPCC (Summary for Policymakers SPC, 2013, page 10 § B.5 3rd paragraph): «*Among these cumulative anthropogenic CO_2 emissions [since 1750], 240 [230 to 250] Gt-C have accumulated in the atmosphere*» (corresponding to the Bern formula) this would lead to: 28% (-28 pm) + 72% (-7 pm)= -12.9 pm which does not match at all the observations. Rubino et al. (2013) propose a revised version of early $\delta^{13}C$ measurements covering the last 1000 years (Law Dome, Antarctica), with a mean preindustrial level of -6.50 pm, which matches well the -7 pm used here.

This is also the conclusion drawn by Harde (2019) who states: «*Also the widely spread but wrong declaration that "about half of the emissions remained in the atmosphere since 1750" and "the removal of all the human-emitted CO_2 from the atmosphere by natural processes will take a few hundred thousand years (high confidence)" (see AR5 [1], Chap. 6-Summary and Box 6.1) can be simply refuted by the isotope measurements at Mauna Loa. If the 113 ppm CO_2 increase since 1750 (28.8% of the present concentration of 393 ppm - average between 2007 and 2016) would only result from human impacts and would have cumulated in the atmosphere, the actual ($\delta^{13}C$)atm value should have dropped by Δ = ($\delta^{13}C$)fuel-atm×28.8% = -18‰×28.8% = -5.2‰ to ($\delta^{13}C$)atm ≈ -7‰ -5.2‰ = -12.2‰, which by far is not observed. ($\delta^{13}C$)atm in 1750 was assumed to have been -7‰*».

Therefore the reasoning based on the ratio (stock/flux) is corroborated by the observed isotopic concentrations and leads to a residence time of 4-6 years in the atmosphere for any CO_2 molecule. As a summary, τ the lifespan of a molecule of CO_2 in the air is around 5 years because each year a fifth of the molecules in the air are absorbed by vegetation or by the oceans (high latitudes) and about as many are degassed by the oceans (inter-tropical) and by the grounds. In fact 850 / (90 + 80) = 5 years. 90 Gt-C would be absorbed by the oceans at high latitudes and as much degassed in the inter-tropical zone, where water from high latitudes returns about 30 years later after circulation on the isopycnic surfaces of equal density which surface at high latitudes and later feed the inter-tropical upwelling. 80 Gt-C would be absorbed by vegetation and as much degassed by soils. Therefore the residence time in the atmosphere is 4 to 5 years and the corresponding proportion of anthropogenic CO_2 in the air is 6% which this time matches well the $\delta^{13}C$ observations: 6% (-28 pm) + 94% (-7.2 pm)= - 8.35 pm (see Fig. 2 b).

A simple calculation with the probability of survival in exp(-t/τ) where τ is the lifetime also shows that the share of anthropogenic emissions is 5 years x (annual emissions of 8 to 10 Gt-C) = 40 to 50 Gt-C, which is 5% to 6% of the 840 Gt-

C carbon in the air. For m molecules in a container (or beads in a bag of beads), the probability of survival of a given molecule after drawing and replacing a molecule is (1- 1/m) and after drawing and replacing the molecules p times in a raw: $(1- 1/m)^{m\ (p/m)}$ or exp(-p/m); indeed $\ln[(1-1/m)^m]$ = m ln(1-1/m) ≃ m(-1/m) which converges to -1 for m large; if the anthropogenic emissions noted E increase exponentially in E (t) = $E_0\ (1+a)^t$ in the year t, what remains in the air is:

$$\int_0^t (1+a)^u e^{\frac{-(t-u)}{\tau}} du = \frac{\left((1+a)^t - e^{\left(\frac{-t}{\tau}\right)}\right)\tau}{1+\tau\ln(1+a)} \qquad (5)$$

Which according to Veyres (2014) gives the total anthropogenic contribution remaining in the air, which is for a=2%, τ=5, i.e. (1.02^t – exp(-t/5)) = 4.55 times the annual anthropic emissions, or for a=1%, τ=5 we have 4.76 times the annual anthropic emissions, and finally for a=1%, τ=5.5 we get 5.21 times the annual anthropic emissions.

Thus, the above expression using the term “exp (-t/5.5)” is very different from the Bern formula used by the IPCC -2007 (page 213 note a of table 2-14) which claims that the fraction remaining in the air after t years is:
(21.7+ 25.9 exp (-t / 172.9) + 33.8 exp (-t / 18.51) + 18.6 exp (-t / 1.186))% which gives 36.4% remaining in the air after 100 years! And very close to another Bern formula previously used:
(18 + 14 exp (-t / 420) + 18 exp (-t / 70) + 24 exp (-t / 21) + 26 exp (-t / 3.4))% which gives 33.5% remaining in the air after 100 years! The absurdity of such a model is well visible when comparing it with the natural ^{14}C removal in the atmosphere as depicted by Fig. 5, p. 142 in Harde (2019) or Maurin (2019b).

The conclusion is straightforward: the IPCC's assertion (SPM, 2013) on the accumulation in the air of anthropogenic emissions is very inaccurate. The "Bern formulas" (IPCC-IPCC 2007) supposed to say what is the fraction remaining in the air of the "anthropogenic" emissions is a deception. It is obviously deliberate as this long term residency argument is leveraged by many, e.g. James Hansen noted that «*in determining responsibility for climate change, the effect of greenhouse gas emissions on climate is determined not by current emissions, but by accumulated emissions over the lifetime of greenhouse gases in the atmosphere*». That kind of reasoning leads to assert that « *by this measure, the U.K. is still the largest single cause of climate change, followed by the U.S. and Germany, even though its current emissions are surpassed by the People's Republic of China*».

We have left science and jumped into a different register, once having distorted the facts to fit an objective where the subject becomes who is to blame for that situation, then the next step will be who is to pay for it and that is politics.

Is it possible to have further confirmation of the amount of anthropic CO_2 left in the atmosphere? It is indeed, but let's first remind some notions relating to what is called the “Carbon Cycle” CC. At any given point in time, the atmospheric CO_2 exchanges throughout various geochemical and biological processes that make use of seven different reservoirs including the atmosphere, hydrosphere, biosphere, pedosphere (i.e. the soils), and lithosphere (i.e. rocks) and two additional isolated reservoirs, i.e. deep Earth (the mantle mainly out-gas through volcanism) and outer space, this equilibrium can be called the steady state and over short periods of time the temperature is the parameter that can change the faster and the more easily and lead to a new equilibrium, a new steady state. The largest circulating reservoir and by very far are the oceans which represent nearly 39,000 Gt-C (Zeebe and Wolf-Gladrow, 2001) that can be further subdivided into Dissolved Inorganic Carbon (DIC) 38,000 Gt-C, Dissolved Organic Carbon (DOC) 700 Gt-C, colloids 100 Gt-C, Particulate Organic Carbon (POC) 30 Gt-C, phytoplankton 3 Gt-C, zooplankton 0.1 Gt-C, bacterial 0.2 Gt-C. The atmosphere, as of 2018, is a reservoir of 869 Gt-C which therefore represents a mere 2.25% of the oceanic sink. What characterizes these different reservoir are their storage capacity (stock) and the speed at which they can exchange together (fluxes).

The atmosphere, the oceans, soils and vegetation exchange very large fluxes over short period of time whereas the lithosphere is by far the largest sink over geological timescales (i.e. > 66,000,000 Gt-C and possibly up to 100,000,000 Gt-C) but it has a very slow response. The organic matter contained in the soils is in the range [1,500-2,400 Gt-C], terrestrial plants and vegetation is in the range [500-650 Gt-C], and the permafrost stores around 1,700 Gt-C, the remaining is in the fossil fuels for which reserves are known only to a certain approximation. Within the oceans, the marine biota have a very fast turnover rate and even though they are just representing hardly slightly more than 3 Gt-C they extract net 13 Gt-C from the surface ocean that they redistribute for 11 Gt-C into the Intermediate and Deep-Sea Ocean (IDSO) and for 2 Gt-C as DOC. The surface ocean (SO) with a carbon stock of some 900 Gt-C exchanges twice 275Gt-C/year, an up-flux between the tropics and down-flux at mid latitudes with the IDSO (Levy et al., 2013) and some uncertain amount drops onto the ocean floor to join the sediments which stock above the Calcite Compensation Depth (CCD) or Aragonite Compensation Depth (ACD) is estimated to more than 1,750 Gt-C.

Having stated the global picture, one can focus onto the exchange between the atmosphere and the fast sinks to determine the fate of the anthropogenic CO_2. In order to do that, a reconstruction since 1900 and up to 2018 has been made of the various stocks and fluxes between the several reservoirs involved. Main data sources used for compiling CO_2 emissions were for the the ppm values (Scripps, 2020) and (Keeling et al., 2005), for man-made emission for 1971-2016 (worldometers, 2020) and for man-made emission for 1958-2070 (Hausfather, 2018). We need to define τ as the average lifetime or residence time, corresponding to a decrease of any emission to 1/e=0,3679 of its initial value, after an e-folding time and we further define T, i.e. the half-life, given by T=0.693 τ.

Then let's consider the following reasoning: on year 1 we have the emission em_1, on year 2 we have the emissions em_2 plus what remains of year 1, i.e. $(1-1/\tau)\ em_1$, on year 3 we have the emissions em_3 plus what remains of year 2, i.e. $(1-1/\tau)\ em_2$ plus what remains of year 1, i.e. $(1-1/\tau)^2\ em_1$, on year 4 we have the emissions em_4 plus what remains of year 3, i.e. $(1-1/\tau)\ em_3$ plus what remains of year 2, i.e. $(1-1/\tau)^2\ em_2$, plus what remains of year 1, i.e. $(1-1/\tau)^3\ em_1$, etc.

Therefore we have the following expression for the Anthropogenic CO_2 emissions left after n years, Aem_n:
$Aem_n = em_n + (1-1/\tau)\ em_{n-1} + (1-1/\tau)^2\ em_{n-2} + (1-1/\tau)^3\ em_{n-3} + \ldots + (1-1/\tau)^{n-1}\ em_1$

$$Aem_n = em_n + \sum_{i=1}^{n-1} \left(1-\frac{1}{\tau}\right)^i em_{n-i} \qquad (6)$$

Equation 6, is a very straightforward way of computing what anthropogenic CO_2 is left after n years for the summation over the entire time series available which converges easily with even less than 20 terms. All yearly emissions since 1959 are individually available, and for (1-1/τ)=0.82 (18% of any emission is absorbed at the end of the year it is emitted), we have an e-folding time (or average life) of 5.05 yr as $(0.82)^{5.05}=0.367$, and τ=5.05 years matches well the ratios Fluxes/Stocks and the isotopic spread between species. This corresponds to an absorption efficiency α of (1/τ)=0.198, and one gets 52.15 Gt-C left in 2018 which represents 6% of the 869.27 Gt-C of the 2018 atmosphere (408.63 ppm).

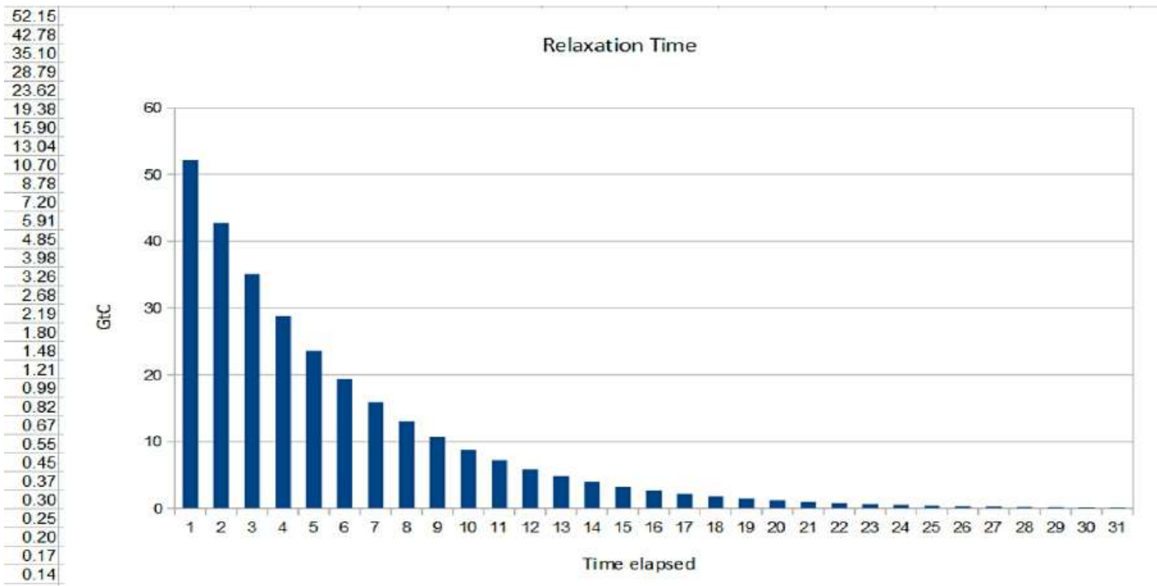

Figure 1. Estimating the relaxation time for a given emission (here the 52.15 Gt-C of anthropogenic origin left today in the atmosphere) with a function $e^{-\lambda t}$ with λ=(1/τ)=0.198 and τ=1/λ =5.05yr over a 30 years time-scale.

Would one wish to know what will remain of these 52.15 Gt-C left in the atmosphere in the future, for example making the assumption that emissions would stop and that one would try to assess a relaxation time or adjustment time, an estimation can be done by an exponential function that is calibrated so as to match the properties of the above series. This will be done by an exponential decrease of type $em_t = e^{-\lambda t}$ with λ=1/τ=0.198 and τ=1/λ =5.05yr, and T the half-life (as for a radioactive decay) is 3.5yr. The function $em_t = e^{-\lambda t}$ gives what remains of any emission em after t years and for T=3.5, λ T = 0.639 = Ln(2) and $e^{0.639}=0.5$ thus the half-life, half of the emission has been exchanged with another reservoir. Searching for the half-life n=T of the term of the series $(1-1/\tau)^n = 0.5$, with τ=5.05yr, thus α of (1/τ)=0.198 and computing n= Ln (0.5) / Ln (1-1/τ) would have also given n=3.5=T. To give an idea, using the exponential approximation, after 10yr there remains 13.81% of the original emission, after 20yr only 0.99% and after 30 yr a mere 0.14%.

Figure 1 is very close in its overall shape (exponential removal) to the curves for the datasets for $\Delta^{14}C$ in CO_2 produced by Graven et al., (2017) which show in Figure 2 a) how this isotope produced by numerous nuclear aerial tests bombs in the late 1950s early 1960s has been naturally removed from the atmosphere and the removal process does not make a major distinction between the different isotopes as there is just a 5% maximum mass difference between the three molecules based on the three C isotopes and it is pretty clear that the relaxation or adjustment time, whatever you call it, cannot be in centuries or millenniums. The e-time is 3 times longer for $\Delta^{14}C$ than ^{12}C but remains very short, i.e. 16.5 years, as stated by Berry (2019) "*The Physics Model accurately replicates the $^{14}CO_2$ data from 1970 to 2014 with e-time set to 16.5 years, balance level set to zero, and starting level set to the $D^{14}C$ level in 1970. (...) Isotopes undergo the same chemical reactions but the rates that isotopes react can differ. Lighter isotopes form weaker chemical bonds and react faster than heavier isotopes*". Another complementary explanation is provided by Veyres (footnote p. 14) "*what is important is the number of ^{14}C molecules in the air constantly renewed by cosmic rays and by the emptying of the stratosphere into the troposphere, which seems to have come to an end since 2010; it is therefore the excess compared to the natural production that counts in atoms or moles of ^{14}C (…) Fluctuations in the production of ^{14}C in the polar zones depend on the magnetic field of the sun, which has probably caused a slight decrease in the natural production also identified by ^{10}Be*". Another major reason for this longer relaxation time for $\Delta^{14}C$ than ^{12}C stems from the very process that led to the massive injection of the ^{14}C in the atmosphere in the first place, the aerial nuclear bomb tests, that propelled very high into the stratosphere massive amounts of that radioactive species.

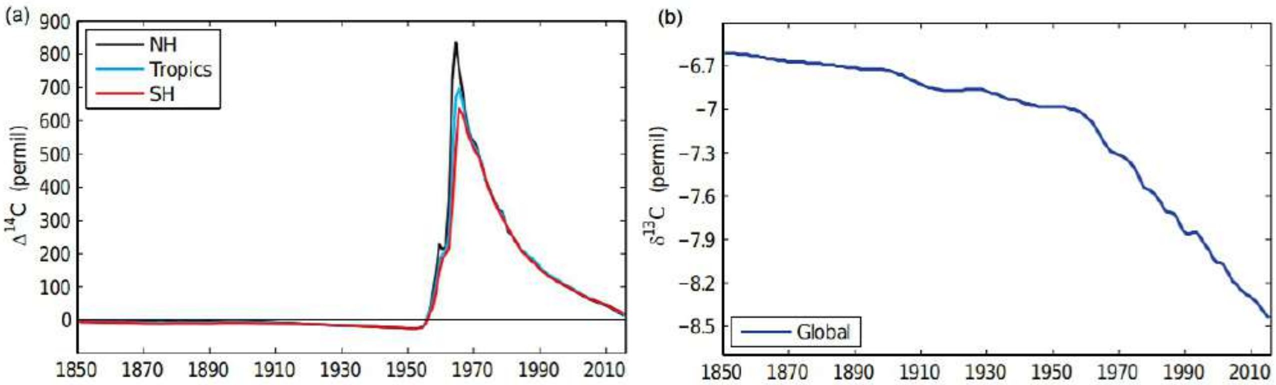

Figure 2. Measured time series for atmospheric $\Delta^{14}C$ in CO_2 (a) (compare to the observed decrease past the emission peak to Figure1) and $\delta^{13}C$ in CO_2 (b). Annual mean values of $\Delta^{14}C$ are provided for three zonal bands representing the Northern Hemisphere (30–90° N), the tropics (30°S–30°N) and the Southern Hemisphere (30–90° S). Annual mean, global mean values are provided for $\delta^{13}C$. Source Graven et al. (2017).

The carbon 14 emitted by atmospheric nuclear testing has been added to the carbon 14 naturally produced in the upper atmosphere. **Its content almost doubled between 1955 and 1965** at the height of the fallout from the nuclear tests. The head of the nuclear cloud enters the stratosphere when the power of the explosions exceeds 20 kt. It becomes essentially stratospheric from 150 kt and reaches an impressive height of 25 km above 1 Mt. The ^{14}C, which represents a minuscule part of total stock on Earth of the the 3 isotopes, is radioactive with a period of 5,730 years. It is formed permanently in the atmosphere by the action of cosmic rays on the nitrogen in the air, at a rate of about $1.54.10^{15}$ Bq/year[21]. Its production evolves permanently with the variation of the energy emitted by the Sun and with that of the Earth's magnetic field. In addition to this natural radiocarbon, about 213.10^{15} Bq have been emitted during atmospheric nuclear tests (Renaud, 2012). This is a massive disturbance of the natural equilibrium as this amount represents 138 times the normal annual production of this isotope by natural processes, leading to a doubling of its concentration at the end of the aerial tests by the three nuclear powers: USA-URSS-GB. The slow flushing of the stratospheric ^{14}C into the troposphere results from gravitational forces and has kept on-going with times much longer than the normal cycle of ^{12}C, thus setting an absolute maximum boundary to the normal half-life of CO_2 in the atmosphere. In that respect, the Fig. 2 a) is very telling and confirms that the $\Delta^{14}C$ measured e-time of 16.5 years (Berry, 2019) within the context of the aerial nuclear tests represents an impassable upper limit for the normal CO_2 circulation processes. Nevertheless, this maximum duration represents a small fraction, i.e. just 1/6 of the erroneous values given by the "Bern formulas" predicting that 36.4% of the emissions remain in the air after 100 years!

The Fig. 2 b) also shows how by a slow mixing with the anthropogenic carbon leads to a slow decrease of the $\delta^{13}C$ with a current value of -8.5 pm.

21 The becquerel (Bq) is the SI unit of radioactivity. One becquerel is defined as the activity of a quantity of radioactive material in which one nucleus decays per second.

Let's be back to IPCC inspired models: Köhler et al. (2018) state that "*If one adds a certain amount of anthropogenic CO_2 to the atmosphere at time t_0, the concentration will increase suddenly and then fall off following a complicated function that depends on the response of the various active carbon reservoirs (…) The function how CO_2 relaxes after such an initial perturbation can be approximated by the sum of a few exponential functions with different characteristic timescales*". In fact, it is worth noticing that the complicated function aforementioned by Köhler et al. (2018) is an artifact of the a priori and completely absurd hypothesis of compartments in static equilibrium (a steady state) without taking into account the degassed and absorbed flows which are 20 times higher than anthropogenic emissions! It is posed a priori by the definition of the transfer function (i.e. Impulse Response Function, IRF) as a solution of a system of differential equations via the Laplace transforms which give the a_i exp($-t/b_i$), where the a_i equals the weight on each exponential (unitless) with $\Sigma a_i = 1$ and the b_i represent the decrease times of each exponential (yr) (Aamaas et al., 2012; Archer and Brovkin, 2008; Archer et al., 2009; Maier-Reimer and Hasselmann, 1987; Maier-Reimer, 1996; Prather, 2007).

The so-called Bern (Siegenthaler and Joos, 1992) and airborne fraction Impulse Response Functions (IRF) assume, **a priori**, a static equilibrium between the three main compartments: oceans, atmosphere and vegetation and soils; this assumption makes the important flows disappear: the huge flows of carbon in the inter-tropical upwelling from deep ocean to surface ocean (275 Gt-C/year), from surface ocean to air (100 Gt-C/year), from air to vegetation and soils (72 Gt-C/year) are completely ignored . Proving that those impulse responses are nonsense is easy:

- The impulse responses apply only to fossil fuel emissions and not to natural out-gassing; how do surface ocean and vegetation sort the molecules of CO_2 according to their origin ?
- The absorption in dy(t)/dt = degaz(t) + emiss(t) – absorb(t) is assumed almost constant since the preindustrial times : this is nonsense as the Global Gross Primary Productivity (GGPP) of the vegetation has according to many authors (Pretzsch et al., 2014; Goklany, 2015; Campbell et al., 2017; Haverd et al., 2020) increased by more than 36% since 1900!

More precisely (with n = the number of exponentials used) the IRF looks like:

$$absorb(t) = absorb(1750) + \sum_{i=1}^{n} e^{\frac{a_i}{b_i}} \int_{1750}^{t} e^{\left(\frac{-t}{b_i}\right)} em(t')\,dt' \tag{7}$$

with absorb(t) = absorb(0) + dy(t)/dt = absorb(0) + (1 - AF(t)) em(t) for the Airborne Fraction (AF), and amazingly absorption depends upon em(t) and not upon y(t) !

The atmospheric C increase, with $y_1(t)$ the mass of C in the atmosphere at time t, is given by the convolution of the Impulse Response Function IRF(t) with the emissions(t), i.e. noted em(t), by the following equation:

$$y_1(t) - y_1(0) = \int_0^t IRF(t-t')\,em(t')\,dt' \tag{8}$$

and the 6 or 8 arbitrary coefficients (a_i, b_i), corresponding to the number n of exponentials used, are adjusted so that the result vaguely resembles the Mauna Loa Observations (MLO) ppm series! It is physically impossible that absorb(t) be a function of anything else than y(t), where y(t) is the mass of C contained in each compartment, another nonsense is a relaxation time b of about 50 years: absorb(0) = y(0)/5 years in preindustrial times and suddenly in 1751 it becomes y(0)/5 + y(t)/50 or y(0)/5 + (y(t) – y(0))/50 instead of y(t)/5.

All these "miracles" and some others are discussed in Harde (2017a-b; 2019). The unfortunate outcome of this 'mathematical engineering' based on IRFs is to dismiss, or if intentional to conceal, the real geochemical processes at play and most importantly hide the dependence of the natural emissions on the temperature as expressed by Equation 179, p. 221. The Earth system is never in a steady state, it keeps adapting to a non-linear chain of sometimes conflicting triggers of very different nature as the Holocene, the Quaternary, and more generally the entire Earth history show (see Past Climates p. 93). Since the end of the LIA (i.e. 1850), the temperature has naturally gone up and the oceans have continuously out-gassed, and just since 1900 they have released as per my Carbon Budget (CB) 403 Gt-C (see p. 89). The mistaken IRF formulation leads to wrongly build erroneous CBs, e.g. IPCC's Le Quéré et al. (2016, 2018), where fraudulently mankind appears as the sole responsible of the emissions, but how could it be otherwise as IPCC is a one-sided thought only organization? It also leads to the flawed and disingenuous conclusion that Humanity would be to blame for having broken a previous steady state, whereas the truth is that there is no and has never ever been any steady state in an ever changing Earth. It also aims to dissimulate the fact that natural emissions are huge and driven by the temperature, the fluxes exchanged between the C-holding reservoirs are massive and what remains of anthropogenic emissions is small as 89% of them have been removed and captured by sinks (i.e. mainly soils and vegetation but also phytoplankton) over the period 1900-2018 (i.e. remains 52 Gt-C of the cumulated 458 Gt-C man-made emissions). This is what sciences teaches us, what this e-book will demonstrate, but it does not fit the agenda of the dominants.

Using the kind of miracle exponential fitting described above, Joos et al. (2013), in a multimodel analysis of a range of models of different complexities including comprehensive Earth system models, Earth system models of intermediate complexity (EMICs), and boxtype models, fit a sum of three exponentials over the first 1000 years, detecting relaxation timescales of 4.3, 36.5, and 394.4 years (Table 5., p. 2803). So, at least the $\tau 3$ (4.3 yr) reported by Joos et al. (2013) is close to the values computed here by a simple but rational analysis, i.e. 5.05 yr. Furthermore, Maurin (2019c) demonstrates that insofar as $^{12}CO_2$ and $^{14}CO_2$ have similar behaviors, the "bomb effect" observations show that the theoretical models selected by the IPCC use **reservoirs** that are **too small** and that they **exchange too slowly** with the atmosphere. Maurin (2019c) shows that taking into account the Suess effect of 1950 (Maurin, 2019a) as well as the $\delta^{13}C$ (Maurin, 2018) and $\Delta^{14}C$ decrease (Maurin, 2019b) has also for consequence to 'de facto' lead to the abandonment of an exclusively anthropogenic origin for the observed growth of atmospheric CO_2. That's of course also in agreement with the Carbon Budget presented in this e-book p. 89.

Some authors have also addressed the dynamics of much slower processes, such as the uptake of atmospheric CO_2 by silicate weathering (see further section CO_2 removal from the atmosphere p. 50) and Colbourn et al. (2015) used the fitting of different numbers of exponentials for an hypothetic 1000 Gt-C instantaneous emission and concluded that an equation consisting of the sum of six exponentials, which differ in their turn-over timescale, provided the optimum fit, capturing the timescales of shorter-term oceanic processes as well as the long-term processes. These are interesting modeling efforts and Colbourn et al. (2015) state that "*By fitting model output to a series of exponentials we determined the e-folding time scale for atmospheric CO_2 drawdown by silicate weathering to be ~240 kyr (range 170–380 kyr), significantly less than existing quantifications*", as they better assess the very long response time of geochemical processes for extremely large hypothetical events but It does not change the clear and straightforward understanding that a simple and rational approach, based on the probability of survival of each molecule, the ratios of fluxes over stock, the spread of the isotopes based on the $\delta^{13}C$ values past and observed, the modeling by series based on reconstructed emissions since 1900 that was presented, and the simple exponential fit of a corresponding decrease function to the previous series all lead to a residence time of 5.05 yr and a relaxation time in decades at most.

Other authors also study the long term geochemical response to extremely large pulse emissions (1,000-20,000 Gt-C) using the fitting of multi-exponential function by means of the Matlab package and other techniques, e.g. "*Convolution Analysis of Atmospheric CO_2 Decay*[22]" of Lord et al. (2016), $3.3 p.10, but these efforts provide complementary angles to what was explained, addressing huge hypothetical pulse emissions and long-term geochemical removal, so there is no contradiction with what has been presented here for the simple reason that over these time-scales mankind faces so many other greater potential threats, bouts of paroxysmal volcanism, super-volcanoes such as the Yellowstone displaying a superficial magmatic chamber of 46,000 km3 with a melt fraction of ~2% (e.g. Huang et al., 2015) with an eruption overdue by geological standards, Large Igneous Provinces (LIP) that baffle imagination and that mankind not only has never witnessed nor known but can even hardly comprehend or fathom (Coffin and Eldholm, 1994) and last but worst an impact with a Near Earth Object (NEO) (e.g. Apophis, see Figure 49, p. 136) as there are unfortunately so many of them dangerously roaming (Morbidelli et al., 2002; Perna et al., 2013; NSTC, 2018; Wheeler and Mathias, 2019), most remaining unknown until very late and that would require so much more attention that CO_2... which is not even a tail risk at timescales of up to more than 250 ky as modeled by Lord et al. (2016).

In the end, Veyres[23] reminds me that one can always 'best fit' an Impulsion Response (IR) to the MLO measurements (or else), but that is no proof of the soundness of the approach and does not ensure that instead of accounting for the real geochemical processes at play one rather does not only perform some 'mathematical engineering'. He also reminds that the derivative of the C-stocks y(t) must be computed, this is a mandatory requirement, before calculating any correlation with the MLO stationary time-series, and by using two complementary means: 1) an autoregressive integrated moving average, or ARIMA[24] (a statistical analysis model that uses time series data to either better understand the data set or to predict future trends) or 2) the monthly ppm increments given by 1.8 (TA[25](t) + 0.8) / 12 that continue to accumulate as long as the DIC (Dissolved Inorganic Carbon) of the ocean does not decrease a little or the temperature anomaly does not reach -0.8°C, he concludes that a decent forecast for 2100 is 540 ppm, which leads

22 Lord et al. (2016) use the term decay that has been avoided in this document to prevent confusion with radioactive processes.

23 Personal communication on December 10th, while peer-reviewing the manuscript.

24 ARIMAProcess[0.121065,{0.951, -0.32 ,-0.33, -0.018, 0.22, -0.387}, 1 , {-0.49} ,0.36]

25 TA is the Temperature Anomaly, e.g. as displayed in Figure 8, p. 37.

using IPCC formula 83 p. 71, to estimate a maximum temperature increase of 1.2°C (which would be good news as explained in section Why a Warmer World is a Better Place to Live, p. 366), or more realistically and unfortunately ≈0° as the Earth is a self-adaptive system based on thermodynamical processes relying on the hydrological cycle.

Now one may question why IPCC keep sticking to indefensible long residence times. The answer is written in plain clear English in IPPC (2018c), p. 38 "*The latter –* ***the atmospheric residence time of the greenhouse gas – is a highly policy relevant characteristic****. Namely, emissions of a greenhouse gas that has a long atmospheric residence time is a quasi-****irreversible commitment*** *to sustained radiative forcing over decades, centuries, or millennia, before natural processes can remove the quantities emitted*". There is simply no science behind such a statement, just a means to drive policies.

Thus, most of the argumentation of the IPCC relies on an extravagant residence time or other similar concepts like the "adjustment time" of the CO_2 in the Earth's atmosphere. By stating that it would stay literally 100s of years, this deception enables to make unfounded and extraordinary claims that pretend to establish and support various scare tactics: CO_2 would be very dangerous because it would stay very long in the atmosphere and thus our responsibility extends long after those who have emitted it as it would impact future generations and that would require extraordinary policies. It is sad to acknowledge how well this brainwashing has operated, as I have even seen people asserting, completely convinced of it, that CO_2 is a waste (!) that must be removed at all cost from the atmosphere. They did not even realize that they could put something in their plate and eat everyday thanks to it. All that started with Revelle (1965) name calling CO_2 a pollutant and the first so called "Bern" model years ago (Siegenthaler and Joos, 1992). IPCC have certainly been aware for a long time, not even of the weaknesses, but of the indefensible nature of their statements. The evidence is given, e.g. Table 1, p. 38 of IPCC(2018c) that gives the following implausible atmospheric lifetime of 5 to 200 years, adding with footnote (c) "*No single lifetime can be defined for CO_2 because of the different rates of uptake by different removal processes*". That level of uncertainty and deliberate confusion would perfectly fit in the further section to come "IPCC and Their Unlikely Physics of Climate Change ", p. 337.

Beyond the excellent rebuttals by Berry (2019) or Essenhigh[26] (2009) of the so called Bern formulae (there are several variants), let's start with the $\delta^{13}C$ mismatch that these approaches lead to and then address other deficiencies that lead to strong incompatibilities with observations. The Bern formula (Siegenthaler and Joos,1992) or Hamburg pretend to give the fraction remaining in the air after n years (like 37% after 100 years). These "Bern" and analogous formulae are supposed to reflect the very slow migration of "anthropogenic" carbon to the ocean floor[27]; in reality they are numerical approximations with six or eight adjustable parameters of the IRF that convert the series of fossil fuel emissions from economic statistics since 1750 to a rough approximation of the series of CO_2 contents observed[28] at Mauna Loa since 1958; they make the conjecture (IPCC AR4 2007 report) that the CO_2 content of the air in 1750 was "*277 ppm to plus or minus 1.2 ppm*", as if they had the slightest idea of that!

As a general observation made by Veyres (2020e) and Veyres and Maurin (2020) "*these formulas (airborne fraction or Bern) used by IPCC want to ignore a) that degassing and absorption depend on water temperatures and soil moisture b) that absorption by vegetation increases as the amount of plant matter or leaf area is roughly proportional to the carbon dioxide content of the air*". The IPCC (Summary for Policy Makers, 2013, page 10 § B.5 third paragraph) says: "*Among these accumulated anthropogenic emissions of CO_2 [since 1750], 240 [230 to 250] Gt-C have accumulated in the atmosphere*" which would therefore make (240/850) = 28% anthropogenic carbon and a $\delta^{13}C$ of 28% (-28 pm) + 72% (-7 pm) = -12.9 pm, a value very different from the observations. This mismatch is a 1st obvious refutation of this "Bern" model.

The application of the Bern formula (IPCC, 2007) to the series of "fossil" carbon emissions since 1750 with the estimate of the $\delta^{13}C$ resulting from the variable proportion of coal-oil and gas in the economic statistics series leads to the curve in blue in the Figure 3, while measurements at MLO are in red. The blue $\delta^{13}C$ curve of the air has been calculated according to the IPCC's Bern formula supposed to give the fractions of anthropogenic emissions remaining in the air t years after the emission, starting from -6.5 pm and 277 ppm in "pre-industrial" and in red have been plotted the observations (Mauna Loa). One can easily see from that sole Figure that the refutation is obvious. It simply does not fit the observations again. This is a clear 2nd refutation of the "Bern" models.

26 Notice that the refutation by (Cawley, 2011), also published in Energy & Fuels, that aims to restore the glory of "Bern" & like models", does not stand scrutiny and is full of arbitrary and unsubstantiated assumptions and mistakes.

27 there is not one ocean in equilibrium with the atmosphere, but there are absorption and degassing zones and a deep water circulation (a few hundred meters away) on surfaces of equal density of seawater determined by temperature and salinity.

28 by applying some dubious smoothing on a moving average over several years to hide the interesting information which is the ppm increments over 12 months.

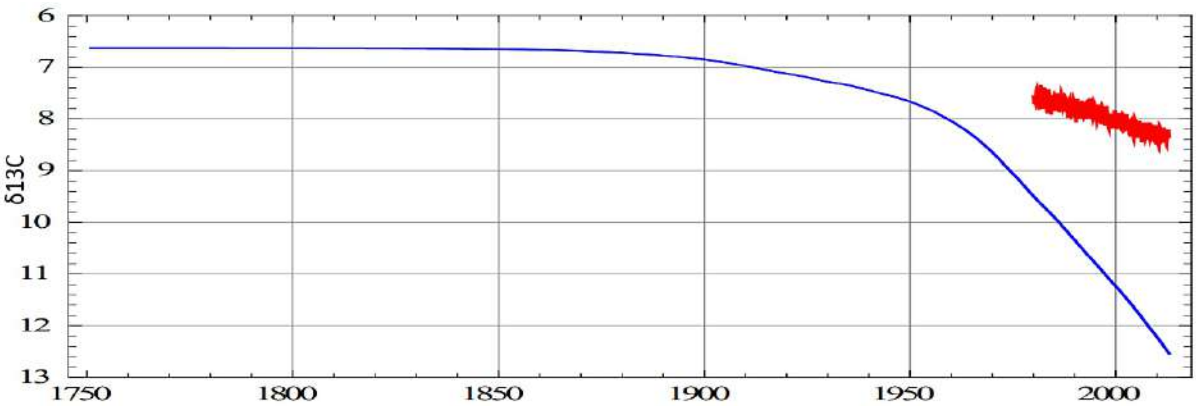

Figure 3. $\delta^{13}C$ mismatch between the “Bern” model (blue line) and the measurements at MLO (in red). Source Veyres (2020e).

Finally the Bern and similar deceptions rely on fabricated IRFs F(t) (IPCC AR1, 1990, Figure 1-2, p. 9): it is assumed a priori that the CO_2 from natural degassing and that from fossil fuels have different destinies, that only the CO_2 from fossil fuel emissions can remain in the air, whereas that arising from natural degassing, thirty or twenty times greater, is absorbed without delay! This artifice is integrated into the equations of the compartments where only the flow of fossil fuel emissions appears and not the total flow of "natural degassing plus fossil fuel". The impulse responses therefore do not apply to natural degassing but only to fossil fuels! Conventional and typical F(t) IRFs are shown in the next Figure 4 (decay time):

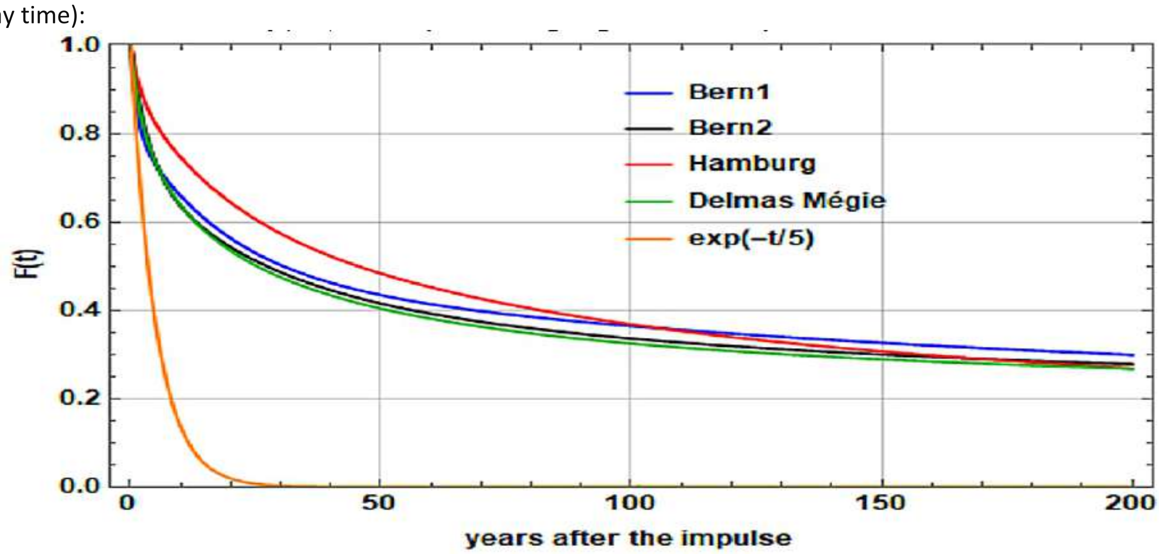

Figure 4. Comparison of various deceitful IRFs (including Delmas et al., 2005) with that in orange that is given as per Equation (3) in exp(-t/5) which is valid both for natural degassing and for "fossil" emissions (of course). Source Veyres and Maurin (2020).

$Bern_1(t)$ = 0.217 + 0.259 exp(-t/172.9) + 0.338 exp(-t/18.51) + 0.186 exp(-t/1.186) as per Siegenthaler and Joos (1992) and still mentioned in AR5 WG3 (2013) and gives a lifetime or residence time of 51 years!
Hamburg(t) = 0.131 + 0.201 exp(-t/363) + 0.321 exp(-t/74) + 0.249 exp(-t/17) + 0.098 exp(-t/1.9), and gives a lifetime or residence time of 101 years as per the Hamburg carbon cycle model of Maier-Reimer and Hasselmann (1987)!
$Bern_2(t)$ = 0.18 + 0.14 exp(-t/420) + 0.18 exp(-t/70) + 0.24 exp(-t/21) + 0.26 exp(-t/3.4) as per Joos et al. (2001) and a rational approximation of Bern2(t) with:
$Bern_2(t)$ $(b0 + b1\ t + b2\ t^2) / (b0 + b3\ t + b4\ t^2 + b5\ t^3)$ with {b0, b1, b2, b3, b4, b5}={279400, 72240, 730.4, 107000, 3367, 1}.

These different Impulse Responses Functions (IRF) are fabricated to match long enough CO_2 withdrawal rates to justify "ad-hoc" policies as stated in IPPC (2018c), p. 38 (thus, taxes and increased control over the economy) and the IRF of the 3-dimensional ocean-circulation model of Maier-Reimer and Hasselmann (1987) of the AR1 (or IPCC FAR, 1990) are visibly adjusted so that F(100) = 1/e (hence a lifetime or "adjustment time" of one hundred years) and a half-life of about 30 years with F(30) = 50%. Fitting IRFs to objectives decided a priori is so obvious that it shames science and provides a 3rd refutation of these fabricated models.

2018	458.09	52.15
2017	447.96	51.37
2016	438	50.65
2015	428.24	50.02
2014	418.52	49.29
2013	408.78	48.36
2012	399.12	47.33
2011	389.63	46.28
2010	380.19	45.07
2009	371.02	43.92
2008	362.35	43.12
2007	353.56	42.03
2006	344.87	40.77
2005	336.48	39.62
2004	328.36	38.64
2003	320.52	37.98
2002	313.01	36.77
2001	305.62	36.18
2000	298.76	35.62
1999	291.78	35.04
1998	285.03	34.62
1997	278.33	34.17
1996	271.67	33.67
1995	265.1	33.17
1994	258.65	32.72
1993	252.4	32.39
1992	246.22	32.06
1991	240.08	31.71
1990	233.92	31.24
1989	227.79	30.71
1988	221.69	30.11
1987	215.7	29.51
1986	209.92	29.00
1985	204.32	28.60
1984	198.81	28.22
1983	193.38	27.85
1982	188.11	27.59
1981	182.87	27.32
1980	177.57	26.90
1979	172.17	26.27
1978	166.7	25.42
1977	161.38	24.56
1976	156.23	23.66
1975	151.23	22.75
1974	146.5	21.87
1973	141.75	20.72
1972	136.99	19.46
1971	132.5	18.25
1970	128.22	17.04
1969	124.14	
1968	120.36	
1967	116.79	
1966	113.4	
1965	110.11	
1964	106.98	
1963	103.98	
1962	101.18	
1961	98.48	
1960	95.9	
1959	93.33	

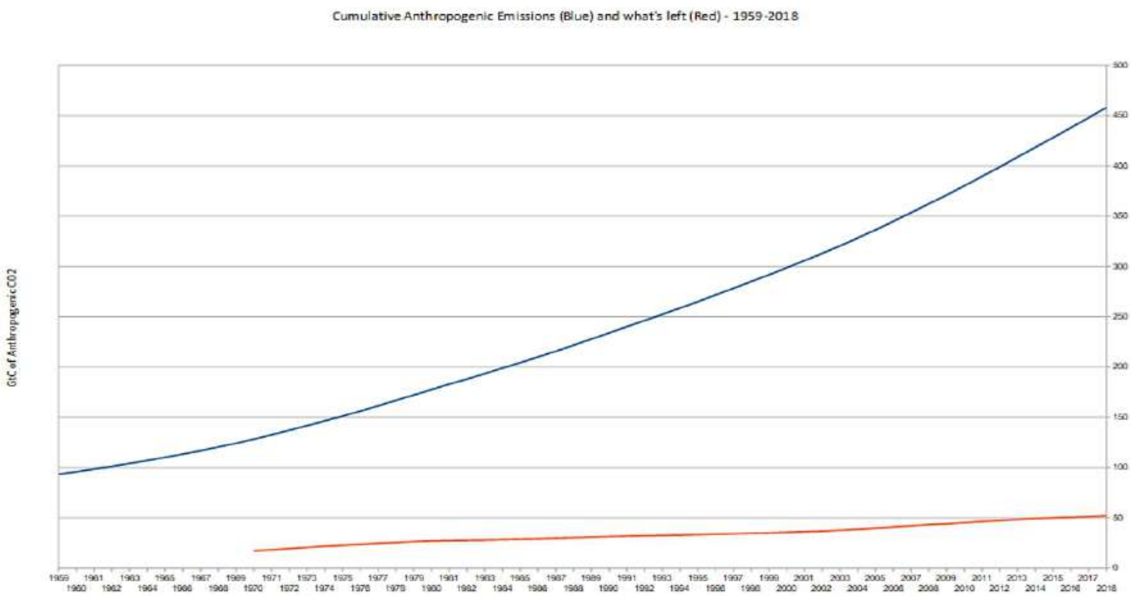

Figure 5. Cumulative anthropogenic CO_2 emissions over 1900-2018 (blue curve) and what's left of them (1970-2018) (red curve) as computed by developing the series of emissions-absorptions according to Equation 6.

Let's go back to the contemporary era: one thing is for sure, over the period 1900-2018 458.08 Gt-C[29] of anthropic CO_2 were emitted and there only remains 52.15 Gt-C in the atmosphere, which means that 405.93 Gt-C of anthropic CO_2 have been removed, representing 88.62% of the total emissions and thus only 11.38% is left behind. The Figure 5 reconstructs all cumulative yearly emissions over the period 1959-2018 (middle column and blue curve) and for each year, and according to the previous formula, calculates how much anthropogenic CO_2 remained in the atmosphere (right column and red curve). In the meantime, the CO_2 bulk has increased from 310ppm (659.45 Gt-C) in 1900 to 408.63ppm (869.27 Gt-C) in 2018 representing an increase of 209.82 Gt-C. But, since the end of the Little Ice Age, the temperature has kept naturally increasing, leading to a different steady state between the massive oceanic sink and the atmosphere, the oceans out-gassing as the temperature increases.

Can we assess how much out-gassing one can expect?

This is an important question as it leads to two very different interpretations of the situation: either we assume that the oceans and other sinks were already quasi saturated in 1900 and therefore there has been a partial uptake of the anthropic CO_2 in the fast exchange but most of it has been replaced by non-anthropogenic[30] (as the oceans could not take more though some was captured by phytoplankton and sank to the bottom in a form of long term storage) leading to the 210 Gt-C increase, or rather one can consider that the total anthropogenic emissions of 458Gt-C just represent a mere 1.08% of the total circulating Carbon stock of 42,370 Gt-C, i.e. oceans, soils, plants, atmosphere and therefore it has been removed at 88.62% into the first 3 reservoirs and the increase is essentially the result of a new steady state involving other sinks as the soils and vegetation where mainly the oceans adapt to a slight increase of the temperature by an incremental out-gassing. To get an idea of what this means, if due to Henry's law the CO_2 solubility in the ocean would just decrease 2.5% (say from 40 to 39 milligram-atoms / liter of carbon, see Figure 6 and 7), the oceans would out-gas 950 Gt-C (2.5% of 38,000 Gt-C) which is more than the current total CO_2 2018 atmospheric content (all in Gt-C units). What one must understand is that due to the very large size of the circulating reservoirs, especially the DIC, a slight change of temperature producing a small decrease of solubility creates a massive change into the atmospheric reservoir as it is very small compared to the other reservoirs (e.g. less than 2.5% of the oceans).

29 The 2 decimals precision is illusory as measurements at Mauna Loa, Samoa, South Pole , Point Barrow (Peterson et al., 1982) are not even at ±2ppm. But they correspond to the spreadsheet data computed and used to produce the graphs for the Carbon Budget presented p. 89. The decimals will be dropped later in the text, not to be misleading with respect to the real accuracy to be expected.

30 The finding presented in this e-book and the CB explained p. 89 are in stark contradiction with IPCC's Ciais et al. (2013), p. 467 Col. 1, statement "*With a very high level of confidence, the increase in CO_2 emissions from fossil fuel burning and those arising from land use change are the dominant cause of the observed increase in atmospheric CO_2 concentration.* ***About half of the emissions remained in the atmosphere (240 ± 10 Gt-C) (113 ppm) since 1750***." This is an unsupported claim that is presented as having a "*very high level of confidence*"!

The total atmospheric CO_2 increase (in Gt-C) since 1900 and up to 2018, whatever its origin, can be estimated at 210Gt-C, corresponding to 99 ppm (310ppm-409ppm). This is an upward limit as evidence from direct measurements of CO_2 in atmospheric air indicates that the 19th century average concentration was 335 ppmv (Slocum, 1955), but still, let's be conservative and keep for reasoning 99 ppm and 210 Gt-C (not 74 ppm and 157 Gt-C). In any case, this will not change much to the observation that follows, as be it 210 Gt-C or 157 Gt-C it corresponds to a new steady state based on a mere decrease of solubility over 120 years of 0.552% first case or of 0.412% second case on the circulating oceanic DIC stock of 38,000 Gt-C. So, very small changes of solubility of the surface oceans connected to a massive oceanic DIC stock can lead to significant atmospheric variations, easily comparable or even well above the anthropogenic emissions (see Figure 6 and 7). As an indication, a 1°C increase of the average global oceanic temperature leads to a mean solubility decrease of 1% (e.g. 10°C to 11°C -1.028% and 15°C to 16°C -1.022%) and a release of ~380 Gt-C over several decades for a fast circulating stock of 38,000 Gt-C, even though that reservoir is spread across the surface and the IDSO layers. Major differences of behaviors can be seen between the cold Arctic and Antarctic oceans and the warm tropical waters, see Figures 90 p.221, and following 91, 92, 93. In the end the solution is obvious as the Primary Productivity (PP) of the autotrophs[31] has increased since 1900 by 30%, e.g. (Pretzsch et al., 2014; Goklany, 2015; Campbell et al., 2017; Haverd et al., 2020) and therefore the organic matter contained in the soils and vegetation has increased by at least 600 Gt-C (1900 to 2500 Gt-C) since 1900, i.e. SV_increase. Thus we are left with a very simple equation:

$$\text{Oceans-net-degassing} = \text{net\_Atm\_Increase} + \text{SV\_increase} - \sum \text{Anthropogenic\_emissions} \qquad (9)$$

which gives a rough estimation for the Oceans-net-degassing = 210 + 600 – 458 = 352 Gt-C (since 1900). This is not a surprising figure as the oceans act as a fast circulating and exchange medium as reminded by Levy et al. (2013) "*climatological physical fluxes of dissolved inorganic carbon (DIC) are two orders of magnitude larger than the other carbon fluxes … At temperate latitudes, the subduction of DIC and to a much lesser extent (<10%) the sinking of particles maintain CO_2 undersaturation, whereas DIC is obducted back to the surface in the tropical band (75%) and Southern Ocean (25%). At the global scale, these two large counter-balancing fluxes of DIC amount to +275.5 Gt-C /yr for the supply by obduction and –264.5 Gt-C/ yr for the removal by subduction which is 3 to 5 times larger than previous estimates*", but as the temperature has increased since the end of the Little Ice Age (LIA), they have adjusted by a net degassing of more than 350 Gt-C since 1900.

It is interesting, in order to provide a better perspective, to backtrack a little to early papers published during the prehistory of the global warming at a time of nonsensical CO_2 computations. Despite their many false assumptions and dubious computations the papers of Callendar (1938, 1940, 1949), Plass (1956) and Revelle and Suess (1957) are still quoted as an early proof that the fossil fuel emissions contribute to the increase of the CO_2 in the air; for instance Table-I of Revelle and Suess (1957) compares cumulative total fossil fuels emissions quoted as 0.2759 10^{18} grams CO_2 or 76 Gt-C over 1860-1949 to the total atmospheric CO_2 (2.35 10^{18} g CO_2 or 651 Gt-C or 307 ppm), as if the emissions were to remain in the air! Using this nonsense, Revelle and Suess (1957) elaborate: "*Thus humans are now carrying out a large scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future. Within a few centuries we are returning to the atmosphere and oceans the concentrated organic carbon stored in sedimentary rocks over hundreds of millions of years*". Table 2 of Revelle and Suess (1957) assumes that the photosynthesis on land is only 3.12% of the CO_2 in the air while the Net Primary Production (NPP) is about 8.6% (Haverd et al, 2020); Table 3 says living matter on land is 12% of the atmospheric carbon and dead organic matter on land 110% while recent estimates are 500/875 = 57% and 2000/875 = 229%; this undervaluation is to support the amazing statement: "*considering the combined marine and atmospheric reservoir as a closed system in equilibrium… τ(sea) / τ(atmosphere) = (carbon in the sea) / (carbon in the atmosphere) = 59.4. A ^{14}C based guess of 400 years for τ(sea) gives 400/59.4 = 6.7 years for the exchange time τ of the atmosphere (…) we conclude that the time it takes on the average CO_2 molecule as a member of the atmospheric carbon reservoir to be absorbed by the sea is of the order of magnitude of 10 years*". Modern estimate are indeed 11% per year for the ocean but with a NPP of vegetation of say 144/2 = 72 Gt-C/year or 8.2% per year the life time is about 5 years as $1/\tau = 0.11 + 0.082 = 0.192$.

Back to the residence time, one should notice though, that by using different methods than those aforementioned but based on isotopic ratios, Revelle and Suess (1957) already concluded a long time ago that the CO_2 residence time was just slightly longer than what has been assessed above: «*From a comparison of C^{14}/C^{12} and C^{13}/C^{12} ratios in wood and in marine material and from a slight decrease of the C^{14} concentration in terrestrial plants over the past 50 years it can be*

31 An autotroph or primary producer is an organism that produces complex organic compounds using carbon from simple substances such as carbon dioxide, generally using energy from light or inorganic chemical reactions.

concluded that the average lifetime of a CO_2 molecule in the atmosphere before it is dissolved into the sea is of the order of 10 years. This means that most of the CO_2 released by artificial fuel combustion since the beginning of the industrial revolution must have been absorbed by the oceans» (Revelle and Suess, 1957). Revelle and Suess (1957) were wise in challenging the **belief** of Callendar (1938, 1940, 1949), of Chamberlin (1899) and Arrhenius (1903) that "*nearly all the carbon dioxide produces by fossil fuel combustion has remained in the atmosphere*".

It should also be noted that, just to mention one, the paper from Callendar (1938) met polite but strong opposition and the discussion which goes with the paper showed that nearly all scientists of the time were doubtful that the temperature variations could be due to radiative effects and stressed the importance of many other factors, including convection and adiabatic air movements «*that it was impossible to solve the problem of the temperature distribution in the atmosphere by working out radiation. The atmosphere was not in a state of radiative equilibrium, and it also received heat by transfer from one part to another. In the second place, one had to remember that the temperature distribution in the atmosphere was determined almost entirely by the movement of the air up and down*» (G. C. Simpson), others mentioned «*that it was not clear how the calculations regarding the gradual diffusion of CO_2 into the sea were carried out*» (J. W. Whipple), or stressed «*that the effect of an increase in the absorbing power of the atmosphere would not be a simple change of temperature, but would modify the general circulation, and so yield a very complicated series of changes in conditions*» (D. Brunt), others objected «*that the rise of temperature was about ten times as great in the arctic regions as in middle and low latitudes, and he did not think a change in the amount of carbon dioxide could cause such a differential effect*» (Brooks C. E. P.).

Therefore, even though the tune of the exchange was certainly way more courteous than the one used by activists ecologists and scientists now days, nobody will miss to notice that disagreement was strong and that Callendar (1938) hypothesis was not considered convincing at the time.

Let's see what are the basic equations if we try to provide an analytical model for the determination of the residence time of CO_2 we can assert that from a physical point of view, anthropogenic releases only add to the other sources. As stated by Beslu (2018), the problem roughly corresponds to a situation with a bathtub with several taps and drains, or more precisely with a tank in which several taps bring a fluid with slightly different characteristics and several outlets open to the outside or to a recirculation loop evacuate the fluid from the large tank (via or without retention tanks). Circuit a bit complicated certainly but the equations that govern it are relatively simple and do not require large calculation software. We have before the industrial era:

$$\frac{dm}{dt}=R_0+R_v-\lambda m=R_0+R_v-\frac{m}{\tau} \tag{10}$$

with m mass of Carbon C in the atmosphere, R_0 emission of C of oceanic origin, R_v emission of C by vegetation, constant λ of disappearance or inverse of the average residence time τ of CO_2 in the atmosphere. By setting $R = R_0 + R_v$ natural emission sources of C, it comes to equilibrium, i.e. when all emissions to the atmosphere are exactly equal to the absorptions by the ocean and vegetation:

$$m=\frac{R}{\lambda}=R\tau \tag{11}$$

the complete equation being given by:

$$m=\frac{R}{\lambda}\left(1-e^{(-\lambda t)}\right)+m_0.\,e^{(-\lambda t)} \tag{12}$$

or with the average lifetime $\tau = 1/\lambda$

$$m=R\tau\left(1-e^{(-t/\tau)}\right)+m_0.\,e^{(-t/\tau)} \tag{13}$$

After the start of the industrial era, the equation becomes:

$$\frac{dm}{dt}=R+r'-\lambda m \tag{14}$$

where r 'is the anthropogenic emission. Beslu (2018) then writes that we have:

$$m=\frac{(R+r')}{\lambda}\left(1-e^{(-\lambda t)}\right)+m_0.e^{(-\lambda t)} \tag{15}$$

or with $\tau = 1/\lambda$:

$$m=(R+r')\tau\left(1-e^{(-t/\tau)}\right)+m_0.\,e^{(-t/\tau)} \tag{16}$$

which after a sufficient time (new equilibrium) will be reduced to (R + r') τ. But we have seen r' is not constant, so Beslu (2018) approximated it by a succession of r'_i periods during which the anthropogenic emission remains constant, rectangular functions of emissions in a way. R is also considered to increase with time according to a linear law (at) which is in agreement with the equation deduced from the observations since 1958 which he has assumed to be true since 1850. For i=i+1 we then have:

$$m_{i+1}=(R(t)+r'_{i+1})\tau(1-e^{(-t/\tau)})+m_i.e^{(-t/\tau)} \quad (17)$$

This analytical model by Beslu (2018) leads to an evolution of the CO_2 concentration in the air close to that observed. Note, however, that the most uncertain variable is that corresponding to the natural out-gassing R(t) = R_0 + at. Such a model is way more satisfactory than contorted reasonings based on some sort «impulsions based» processes that would lead to a different status for natural CO_2 and anthropic CO_2 as is strangely claimed by some «climatologists» and it strengthens the other approaches based on (stock / absorbed_flux) and $\delta^{13}C$.

It is not realistic to think that natural CO_2 emissions remain constant whatever the climatic conditions, the growth of carbon dioxide contents [CO_2] depends on the temperature (Allègre and Michard, 1973; 1974) according to a law of the type (e.g. with a=1.8 and T_0=-0.8°C):

$$\frac{d[CO2]}{dt}=a(T(t)-T_0) \quad (18)$$

while anthropogenic rejection is independent of the temperature. It follows that this growth of [CO_2] comes largely from the natural effect of the degassing of soils and oceans. However, whether by the IPCC or the other authors defending the same line of thought, it is simply affirmed that anthropogenic release is the sole and unique cause of the increase in the concentration of CO_2. This is just plain wrong and has important consequences on the General Circulation Models, i.e. GCMs. To be more accurate, it is obvious that if pCO_2 increases in the atmosphere then the out-gassing of the oceans will slightly reduce. Let's note ΔpCO_2 the increase in pCO_2 in the atmosphere since t=0, thus we can rewrite the previous equation:

$$\frac{d[CO2]}{dt}=a(T(t)-T_0)-\Delta pCO_2 \quad (19)$$

and as ΔpCO_2 increases over time, d[CO_2] /dt reduces theoretically to ultimately zero when: ΔpCO_2 = a (T(t) -T_0), but that's obviously just a limit case mentioned for completeness and correctness.

But in fact, ocean absorption depends on the temperature ratio between mid latitudes and high extra-tropical latitudes (Veyres, 2020a). A rough division of the surface ocean into five geographic zones, the inter-tropical which degases, two intermediate zones in equilibrium with the air and, finally, two zones closer to the poles which pump CO_2 from the air shows that absorption is not very sensitive to climatic cycles because it depends above all on the temperature ratio of the last two zones: if $CO_{2\ seawater}$ = $pCO_{2\ air}$ at 35°N (which determines a DIC), when this surface water without the gyre arrives at lower temperatures the difference ($pCO_{2\ air}$ - $pCO_{2\ seawater}$) of partial pressures at 55°N will be following the relationship: $pCO_{2\ air}$ (1- $(T_{45°N}/T_{35°N})^{12.5}$) and depends only on $pCO_{2\ air}$, see note[32] and Equations 179 p. 221 and 180 p. 221. An increase of 1°C in the average temperature of the globe (air temperature close to the surface) would translate, according to the curve of Budyko-Izrael (Hoffert and Covey, 1992), figure 8 of (Lindzen, 1997) as a function of the sine of latitude, by + 0.8°C at 35°N and +1.6°C at 55 N, because as reminded by Lindzen (1997) *«Thus, climate changes involving primarily changes in the equator-to-pole temperature difference will inevitably scale approximately with the mean temperature, since changes in the mean temperature are simply a residual of the changes in the equator-to-pole temperature when equatorial temperatures are approximately fixed»*.

Therefore, as computed by Veyres (2020) the difference (pCO_{2air} - $pCO_{2\ seawater}$) would go to 55°N from:
p_{air} (1- $((273.15 + 5) / (273.15 + 20))^{12.5}$) = 0.481 p_{air} to
p_{air} (1- $((273.15 + 5 + 1.6) / (273.15 + 20 + 0.8))^{12.5}$) = 0.461 p_{air},

which is not in itself a major change, but the surface of the free ice floe will increase a little and the absorption would in the end be little changed.

32 The flow of CO_2 between the atmosphere and the ocean is proportional to the difference between the partial pressure in the air and the partial pressure of CO_2 in the surface sea water which varies as the power 12.5 of the absolute temperature T of this water, as the power 10 of the water content of carbon denoted DIC (Dissolved Inorganic Carbon) and as the power 10 of Talk (Total Alkalinity) : pCO_2 seawater (µatm) = 400 $(T / 296.42)^{12.5}$ $(DIC / 2000)^{10}$ $(2300 / TAlk)^{10}$. This partial pressure in seawater is almost four times greater in the inter-tropical degassing zone than in the cold zones where absorption takes place (Veyres, 2020a).

3) Wrong Causation, [CO_2] follows T

Questioned by Ball (2014) Is climate change going to be less extreme than you previously thought? "*The Revenge of Gaia was over the top, but we were all so taken in by the perfect correlation between temperature and CO_2 in the ice-core analyses. You could draw a straight line relating temperature and CO_2, and it was such a temptation for everyone to say, "Well, with CO_2 rising we can say in such and such a year it will be this hot.* ***It was a mistake we all made***." James Lovelock

We all know that correlation is not causation[33] and we need to define and test a mechanism of causation to prove cause. No study about climate change has been specifically designed to study cause, rather the contrary if you consider the IPCC mission. Cause is always assumed, expected to be obvious, never tested and if you wonder, then you are a denier! It awfully looks like religious belief and blaspheme crime. And that is very very poor science. In fact, it's not science at all. If we just assumed cause, what if it's wrong? Then we spent billions of dollars for doing research to try to solve the wrong problem. We achieved nothing. We should begin to force attention and apply the real scientific method to the search for causes of climate change. It seems climate change believers think that the only proven fact, namely that carbon dioxide absorbs infrared radiations (IRR)[34], is enough to prove that what they call "greenhouse effect" will irreversibly change climate. But CO_2 is a rather marginal component (0.04%) of a set of various Infrared Absorption Gases (IRAGs), H_2O being by far a more important one and furthermore radiative exchanges being just one rather minor of the many physical phenomenons acting on temperature and just to name some, e.g. atmospheric pressure, convection, advection, evaporation, condensation, cloud formation, oceanic currents, winds and global circulation and so many more! If pressed about the causal mechanism you may hear hand-waving with references to Fourier, Arrhenius, Tyndall, et al., and the fact that "everybody knows that" carbon dioxide absorbs IRR and that a glass panel will let visible light in but not IRR out (see footnote 399, p. 342). So the IRR absorbed by carbon dioxide supposedly gets "stuck" in atmosphere, staying there until doomsday making atmosphere hotter than it should be. Even though there's no glass panels in the sky letting visible light in but not letting IRR out and that the atmosphere has nothing to do with a «greenhouse» nor any of the physical mechanisms at play have because it is by blocking convection that the greenhouse heats. And that, somehow, will make earth's surface hotter, even though nobody can come up with the mechanism of heat transfer from atmosphere to earth's surface that would make earth's surface hotter than it should be. It is however unfortunate for the AGW supporters that the physics of heat transfer that we will revisit later does not support this at all.

Let's put it that way: it is not because the temperature of the thermometer rose that the patient is ill, but because the patient is ill that the temperature rose. In that case the dilatation of mercury is the underlying physical phenomenon. It is not because CO_2 increased that the temperature rose, but because the temperature rose that CO_2 increased. In that case the increased degassing of the oceans and soils due to lesser solubility of CO_2 in warmer waters is the underlying physical phenomenon. This can be anticipated from the temperature dependency of Henry's law (1803) and was already reported by Takahashi (1961). Henry's law shows that the partial pressure in the liquid (in a bottle for instance where the partial pressure in the air is at equilibrium equal to the in the liquid) is heavily temperature dependent as seen above, for sea water it is like $T^{12.5}$ or according to Takahashi (1961) or Takahashi et al. (2009) like exp(-0.0433 T). When the temperature of a system changes, the Henry constant also changes. The temperature dependence of equilibrium constants can generally be described with the van't Hoff equation (van't Hoff, 1884), which also applies to Henry's law constants:

$$\frac{d \ln H}{d\left(\frac{1}{T}\right)} = \frac{(-\Delta_{sol} H_{\sigma,s})}{R} \tag{20}$$

where $\Delta_{sol} H_{\sigma,s}$ is the enthalpy of dissolution. Note that the letter $H_{\sigma,s}$ in $\Delta_{sol} H_{\sigma,s}$ refers to enthalpy of dissolution of the solute σ in the solvent s at temperature T and is not related to the letter H for Henry's law constants H=1/k_H. Integrating

33 http://www.tylervigen.com/spurious-correlations

34 The correct statement should be: carbon dioxide **absorbs only over some limited part of the thermal infrared spectrum** near 15µm and 4.3 µm. As the blackbody radiation at terrestrial temperatures is negligible at 4.3 µm we are left with the small CO_2 band 18 THz to 22.5 THz (or 16.6 µm to 13.3 µm) while the effective thermal infrared band is 1 THz to 65 THz all of which is made extremely opaque by the water vapor (except between 22 and 35 THz).

the above equation and creating an expression based on H° at the reference temperature T° = 298.15 K yields the following equation $H(T) = H° \exp[(-\Delta_{sol} H_{\sigma,s} / R)((1/T)-(1/T°))]$:

$$H(T)=H^{\circ} e^{((\frac{-\Delta_{sol} H_{\sigma,s}}{R})(\frac{1}{T}-\frac{1}{T^{\circ}}))} \tag{21}$$

A reminder along the same line of reasoning is also given by Latour (2014): «*Air is well mixed with only minor variation in CO_2 content with latitude. Ocean is saturated with CO_2 in contact with CO_2 in air. Ocean water circulates up and down, north and south, east and west, all around*[35]. *As warm water flows north and cools by convective and radiant heat transfer, it absorbs CO_2 from air. As cold water flows south and warms by convective and radiant heat transfer, it releases, out-gases, CO_2 to air. If global average Tw increases, water out-gases and CO_2 in air increases. If global average Tw decreases, water absorbs and CO_2 in air decreases. Oceans are a CO_2 reservoir, a sink and source, depending on T changes, average about 14.9°C and solar incidence absorbed/emitted changes, average about 161 w/m2 of surface*». It should also be noted that Henry's law is established for a single solute dissolved in a single solvent. If the solvent is not pure but contains other components, in particular other solutes, the Henry's constant is modified and depends on the composition.

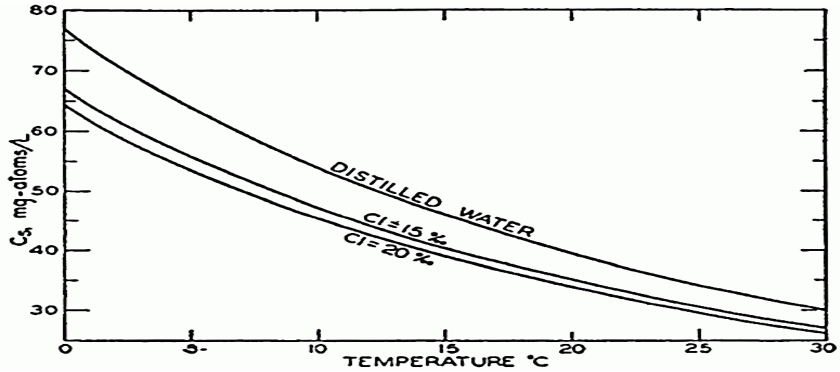

Figure 6. Here are shown curves for Carbon species in solution C_s in mg.atoms/L at different temperatures and chlorinities in sea-water. They represent the amount of H_2CO_3, in milligram atoms of carbon per liter of sea water, in solution under the designated conditions when the partial pressure of CO_2 is 1 physical atmosphere. At 20°C and 19 ‰ Cl, C_s is 34.2. That is, a partial pressure of one atmosphere of CO_2 would be in equilibrium with a solution containing 34.2 milligram-atoms of carbon as free $CO_2 + H_2CO_3$. Source Sverdrup et al. (1942), fig 41, p. 202.

Figure 6 shows that the solubility of permanent gases usually decreases with increasing temperature and CO_2 solubility is thirty times that of oxygen (Marinov and Sarmiento, 2004). Given Henry's law $P_\sigma = x^l_\sigma k_{H,\sigma,S}$ (where x^l_σ is the molar fraction of the solute σ in the liquid mixture) at partial pressure P_σ of solute constant, if $k_{H,\sigma,S}$ increases then the molar fraction in liquid phase x^l_σ can only decrease: **therefore for most gases the solubility decreases when the temperature** increases (Figure 6). The average curve for 19 ‰ Cl of Figure 6, can be reasonably approximated using Θ as the temperature by the following equation 22 and is showed in Figure 7.

$$C_s = 40\left(\frac{1}{0.1\,\Theta+1}\right) - 0.2\,\Theta + 25 \tag{22}$$

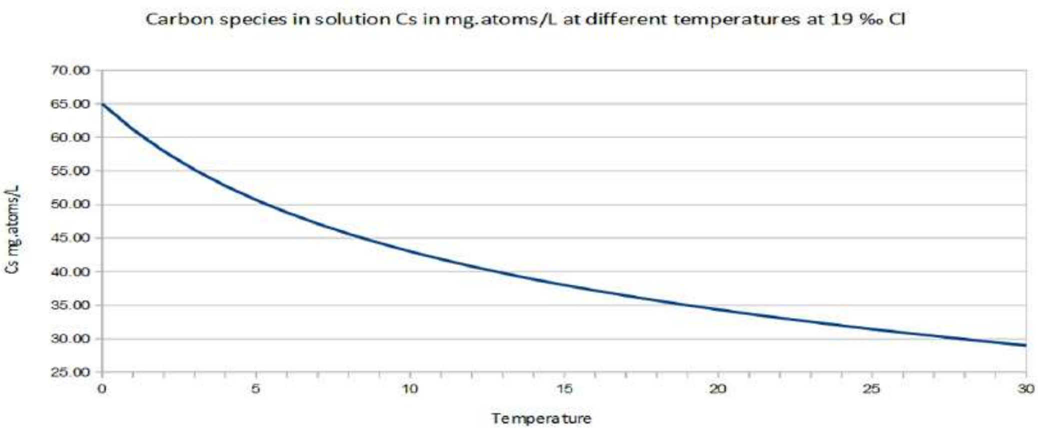

Figure 7. Approximation of the decrease of the solubility as a function of the temperature Cs=f(Θ) according to the equation proposed.

35 It is the upwelling with the layer with DIC = 2250 µmole/kg at 100 m below the surface which brings the 275 Gt-C on the surface between the Tropics, 110 of which are degassed.

Thus the solubility of a gas in sea water is lower than that in fresh water due to the competition between the dissolved gas and the dissolved salts. Carbon dioxide (CO_2) partially forms, by reaction with water, carbonic acid (H_2CO_3), which itself, depending on the pH of water forms the hydrogen carbonate (HCO_3^-) and carbonate (CO_3^{2-}) ions. As a result, the more basic the pH of the water, the more carbon dioxide can be dissolved in the water. We can write these 3 reactions and their corresponding Henry's law equilibrium constants as (a more complete presentation of these reactions is available in section "The Myth of the Acidification of the Oceans" p.206):

a) $CO_2 + H_2O <=> H_2CO_3$ (reaction 169, p.209) and
b) $H_2CO_3 <=> HCO_3^- + H^+$ (reaction 164, p.207) and
c) $HCO_3^- <=> CO_3^{2-} + H^+$ (reaction 165, p.207)

The first chemical equation a) represents the equilibrium of CO_2 in the atmosphere with dissolved CO_2 in the water. The equilibrium constant, Henry's Law, for this reaction is: $K_{CO2} = [H_2CO_3] / P_{CO2} = 10^{-1.47}$ and the equilibrium constant for the two others b) and c) are: $K_1 = [H^+] [HCO_3^-] / [H_2CO_3] = 10^{-6.35}$ and $K_2 = [H^+] [CO_3^{2-}] / [HCO_3^-] = 10^{-10.33}$

Furthermore, Latour (2014) reminds us that: «*Engineers know the rate of mass transfer of any component, x, across any gas-liquid interface is proportional to the difference between partial pressure of x in liquid and its partial pressure in vapor. Partial pressure = mol fraction* total pressure = x*Pt.*
*PPa = Partial pressure CO_2 in air is 400 ppmv * 1 atm = 0.0004 atm*
*PPw = Partial pressure CO_2 in liquid = f*X*Tw, where f = fugacity, X = CO_2 concentration in water and Tw = water Temperature. When Tw increases, solubility decreases and PPw increases.*
*Transfer rate of CO_2 from air to water is: TR = r*A*(PPa – PPw) > 0, where r is the interfacial film coefficient (i.e. a mass transfer rate constant), and A = interface surface area of transfer. If TR < 0, transfer is in other direction, from water to air. TR (in mol/hr) = r*A(x*Pa – f*X*Tw) = r*A*(0.0004 – f*X*Tw).*
This quantifies the rate of CO_2 from air to water increases with its 400 ppmv content in air, a stabilizing effect, and also when Tw decreases (i.e. ocean is a sink in cold waters). As Tw increases, absorption rate decreases and can turn to out-gassing»

This brief reminder of physical chemistry will now enable us to consider how CO_2 lags the temperature (and therefore does not cause its change), for both the immediate measurements that are available over the last decades and for the ice cores were the "névé" behaves like a temporal low pass filter.

(Humlum *et al*., 2013) use data series on atmospheric carbon dioxide and global temperatures and investigate the phase relation (leads/lags) between these for the period January 1980 to December 2011 and conclude: «*Thus, the simplest explanation of observed changes in DIFF12 for atmospheric CO_2 is that they are induced by changes in temperature, as illustrated by Figs. 2–10. Consequently, a substantial part of the atmospheric increase of CO_2 since January 1980 can be explained by associated changes in temperature, and presumably especially changes in ocean temperatures (Toggweiler, 1999; Monnin et al., 2001; Goldberg, 2008), as this is where we find both the strongest correlation to changes in CO_2 (Figs. 4, 6 and 8), and the longest time lag*»

There cannot be a more unambiguous statement than: «*Summing up, monthly data since January 1980 on atmospheric CO_2 and sea and air temperatures unambiguously demonstrate the overall global temperature change sequence of events to be 1) ocean surface, 2) surface air, 3) lower troposphere, and with changes in atmospheric CO_2 always lagging behind changes in any of these different temperature records*» (Humlum *et al*., 2013). The logical inference is: «*A main control on atmospheric CO_2 appears to be the ocean surface temperature, and it remains a possibility that a significant part of the overall increase of atmospheric CO_2 since at least 1958 (start of Mauna Loa observations) simply reflects the gradual warming of the oceans*[36]*, as a result of the prolonged period of high solar activity since 1920 (Solanki et al., 2004). Based on the GISP2 ice core proxy record from Greenland it has previously been pointed out that the present period of warming since 1850 to a high degree may be explained by a natural c. 1100 yr periodic temperature variation*» (Humlum *et al.*, 2013).

Of course, Humlum *et al.* (2013) conclusions have not triggered a lot of enthusiasm in the 'CO_2 greenhouse effect explains all' community and Kern and Leuenberger (2013) argued «*1) what could be the sink for fossil fuel CO_2 emissions, if neither the atmosphere nor the ocean - as suggested by the authors - plays a role? 2) What is the*

36 See for example:
https://woodfortrees.org/plot/esrl-co2/from:1995/derivative/mean:12/scale:2/mean:6/plot/hadsst3gl/from:1995/to/mean:6

alternative explanation for ocean acidification if the ocean is a net source of CO_2 to the atmosphere? Probably the most provocative point of the commented study is that anthropogenic emissions have little influence on atmCO_2 concentrations. The authors have obviously ignored the reconstructed and directly measured carbon isotopic trends of atmCO_2 (both δ13C, and radiocarbon dilution) and the declining O_2/N_2 ratio, although these parameters provide solid evidence that fossil fuel combustion is the major source of atmCO_2 increase throughout the Industrial Era ». Everyone will make his / her own judgment, but it appears that as will be developed later and summarized in Figure 27 p.89, the cumulated uptake by land and forests based on a non linear model, where all processes are dependent on the temperature, leads to a major sink and as developed in the "Anthropic CO_2 is 6% of tropospheric [CO_2]" section p. 19 of this paper the δ^{13}C measures prove the opposite of what Kern and Leuenberger (2013) state, know that the current anthropic concentration is only 6% of the total [CO_2].

For the contents of ice cores at geological times, the mechanism of absorption of CO_2 in the "névé" over a hundred meters (this neve is light snow at the top and compact ice at the bottom) makes it a temporal low-pass filter which eliminates variations happening faster than the accumulation time of 100 m of "névé", i.e. a millennium at a rate of 100 mm / year, which is an order of magnitude of precipitation in the middle of Antarctica; the observations are there: CO_2 is 800 years behind the temperatures determined by isotopic means (deuterium or oxygen 18) and lags temperature (Uemura et al., 2018).

Analysis of the Vostok ice-cores shows that it is the rise in temperatures which increases the CO_2 in the atmosphere (by degassing) and not the reverse. This process still applies today and again, even for small temperature variations, the delay of CO_2 is of a few months (Humlum *et al.*, 2013). For ice cores from the Antarctic, many authors have, since 1999 (Fisher *et al.*, 1999; Monnin et al., 2001[37]; Caillon et al., 2003; Quinn, 2010; Bereiter et al., 2012; Uemura et al., 2018) shown that changes in the CO_2 content of Antarctic ice cores follow temperature changes from 400 years to 800 years (or more), and therefore cannot be the cause, but are the consequence. «*High-resolution records from Antarctic ice cores show that carbon dioxide concentrations increased by 80 to 100 parts per million by volume 600 ± 400 years after the warming of the last three deglaciations*» (Fisher et al., 1999).

Even the third author of (Caillon *et al.*, 2003), i.e. Severinghaus (2004) had to acknowledge that **CO_2 cannot be the driver** of climate change at a glaciation termination «*From studying all the available data (not just ice cores), the probable sequence of events at a termination goes something like this. Some (currently unknown) process causes Antarctica and the surrounding ocean to warm. This process also causes CO_2 to start rising, about 800 years later… In other words, CO_2 does not initiate the warming, but acts as an amplifier once they are underway*». Then as a denier of his own major discovery, a typical example of cognitive dissonance (a psychological defense mechanisms that will be elaborated further on later, i.e. p.293), Severinghaus (2004) adds «*So, in summary, the lag of CO_2 behind temperature doesn't tell us much about global warming*». This is a truly amazing example of a confirmation bias, i.e. the tendency to search for, interpret, favor, and recall information that confirms or support one's prior personal beliefs or values. It is an important type of cognitive bias that has a significant effect on the proper functioning of society by distorting evidence-based decision-making.

The next step in that flawed logic is to elaborate physical notions like «forcings» (Myhre et al., 2013), «feedbacks» and the like which are unknown to Physics as reminded to us by Gerlich and Tscheuschner (2009) «*The main strategy of the defenders of CO_2 - greenhouse effect seems to hide behind more and more pseudo-explanations taking advantage of points which are not usually taught in physics. An example is the radiative transfer calculations that probably few know. Another example is that of feedbacks used to amplify an effect that is not even marginal because it does not exist at all. Obviously the defenders of the thesis of "CO_2-greenhouse effect" refuse to accept reproducible calculations for explanation and have recourse to non-reproducible calculations*».

Severinghaus (2004) is no exception to the rule by declaring «*This process also causes CO_2 to start rising, about 800 years later. Then CO_2 further warms the whole planet, because of its heat-trapping properties. This leads to even further CO_2 release. So CO_2 during ice ages should be thought of as a "feedback", much like the feedback that results from putting a microphone too near to a loudspeaker*». So, the third author of a major article in the leading peer-reviewed journal, i.e. «Science» honestly and almost candidly states one year after its publication that they have no idea what starts to warm up our world from an ice age but that they know with certainty what has caused the warming of the last three decades, invoking pseudo-physics of «feedbacks». It's not a geochemical discussion any longer here that prevails,

37 "*We found that the start of the CO_2 increase thus lagged the start of the δD increase by 800 ± 600 years, taking the uncertainties of the gas-ice age difference and the determination of the increases into account*" In: Monnin et al. (2001) p. 113.

it's the realm of cognitive psychology filled with cognitive dissonances and confirmation bias that prevent even clever people to depart from dogmatic self-assurance and self-reassuring beliefs. We will be back on the Caillon et al., (2003) paper in the section dealing with cognitive dissonances.

As far as ice-cores are concerned, similar results are presented by Indermühle et al. (2000) dealing with the ice core of Taylor Dome, Antarctica and similar time lag between CO_2 and temperature are reported, the maximum correlation R being obtained between CO_2 and T by «*Shifting the time scale of the CO_2 record in steps of 100 yr yields a maximum value of R = 0.83 at a time lag of CO_2 of 900 yrs*». Furthermore, in order to evaluate the sensitivity of the lag, the authors add «*In order to test the sensitivity of this lag to the uncertainty of the control points and of Δage of the Vostok ice core (1000 yr), (Petit et al., 1999), we performed a Monte Carlo simulation (2000 runs) where the ages of the control points have been varied randomly within estimated uncertainties. The simulation yields a lag of (1200 ± 700) yr. This value is roughly in agreement with findings by Fischer et al. (1999) who reported a time lag of CO_2 to the Vostok temperature of (600±400) yrs during early deglacial changes in the last 3 transitions glacial–interglacial*». Results obtained from the EPICA Dome C are also consistent with what has been presented before for a different termination. Landais *et al*. (2013) report «*Here we present high-resolution records of atmospheric CO_2 concentrations and isotopic composition of N2 -an atmospheric temperature proxy - from air bubbles in the EPICA Dome C ice core that span Termination II. We find that atmospheric CO_2 concentrations and Antarctic temperature started increasing in phase around 136 ka, but in a second phase of Termination II, from 130.5 to 129 ka, the rise in atmospheric CO_2 concentrations lagged that of Antarctic temperature unequivocally*» and conclude that they «*investigate the processes that may explain the slowdown of the atmospheric CO_2 concentration when Antarctic temperature is rising, during phase II-b*». Same for Roe (2006) "*Furthermore,variations in atmospheric CO_2 appear to lag the rate of change of global ice volume. This implies only a secondary role for CO_2*". Got it ?

But Humlum *et al*. (2013) conclusions should not have come as a surprise as these results could have been anticipated from the work done by Kuo *et al*. (1990) more than a decade before, these Bell Labs researchers use "telecom" techniques for processing the two temperature and CO_2 time series in the frequency domain to establish that CO_2 concentrations follow the temperatures: «*The hypothesis that the increase in atmospheric carbon dioxide is related to observable changes in the climate is tested using modern methods of time-series analysis. The results confirm that average global temperature is increasing, and that temperature and atmospheric carbon dioxide are significantly correlated over the past thirty years. Changes in carbon dioxide content lag those in temperature by five months*». (Kuo *et al.*, 1990). Similar results are obtained using different methods by Koutsoyiannis and Kundzewicz (2020).

Park (2009), a geology professor at Yale, employs techniques in the frequency domain to establish that the $[CO_2]$ contents follow the temperatures according to the formula: $d[CO_2]/dt = k(T(t)-T_0)$ that will be used thereof in this paper. Finally, before concluding this section, it is worthwhile to draw the reader's attention to the work of Beenstock *et al*., (2012), this article by two economist professors in Tel Aviv and a meteorologist demonstrates through the statistical tests of co-integration of time series developed in econometrics since the years 1985-1995 that to avoid unfounded correlations, there can only be correlation between $d[CO_2]/dt$ and T (t) and that it is necessary to differentiate once the time series of the CO_2 concentrations before looking for correlations with the series of temperatures.

The conclusion of all what has been presented is pretty straightforward and unequivocal: **CO_2 is just a lagging proxy on the temperature** and the natural and regulating source is dominantly the oceans. Another formulation for these 94% coming from natural sources (mainly the oceans and the soils and vegetation) is $d[CO_2](t)/dt = a\,T(t) + b$. Hence Equation 23 by Veyres (2018) :

$$CO_2(t) = \int_{t=t_0}^{t_f} (a\,T(t)+b)\,dt + CO_2(t_0) \tag{23}$$

The grey curve of the next Figure 8 is $dy_1(t)/dt$ for dt = 12 months; $y_1(t) = y(t) - y_2(t)$ is calculated by removing from y(t) observed at the Mauna Loa Observatory (MLO) (or elsewhere) the small quantity $y_2(t)$ calculated from economic statistics[38]. The derivative $dy_1(t)/dt$ is correlated to the yellow-green curve $1.7\,(T(t) - T_0)$ or 1.7 (TA (t) - (-0.8 ° C)). T (t) is the monthly mean of the temperatures of the inter-tropical lower troposphere and AT (t) is the quantity, called anomaly, obtained by taking the difference of T (t) and the average of T (t) over the same months from 1981 to 2010. The El Niño events, when they occur, modulate both the inter-tropical temperatures T (t) and the degassing. This

38 $y_2(t)$ or CO_2 of fossil fuels "left in the atmosphere" in ppm, calculated by weighting by exp (-t / 5) the historical consumption of fossil fuels.

relationship between inter-tropical temperatures and the time derivative dy (t) / dt of the y (t) series of monthly ppm averages at Mauna Loa has been published several times, e.g. see (Beenstock et al., 2012).

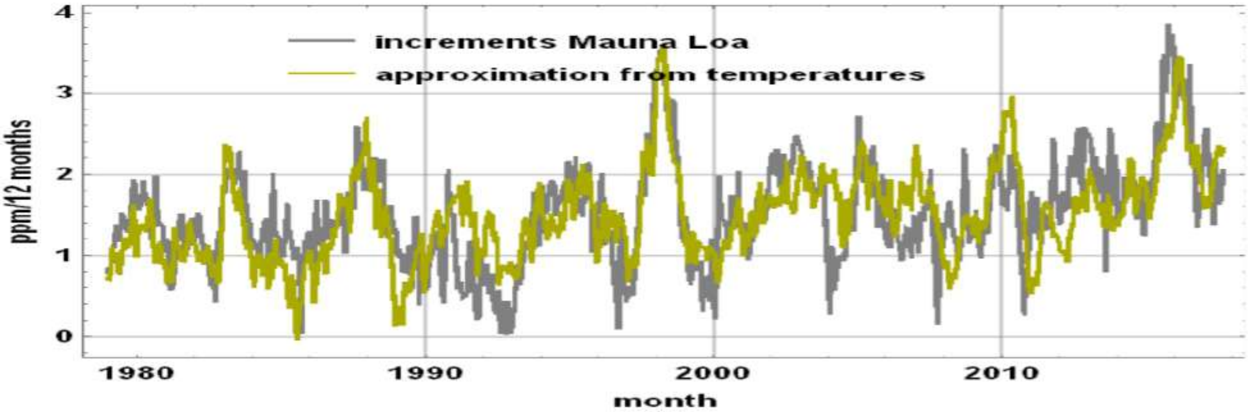

Figure 8. The CO_2 content of the air is a consequence of past inter-tropical temperatures, in fact their time-integral: in grey the time derivative of the ppm, in yellow-green a linear function of the inter-tropical UAH-MSU temperature anomaly[39] TA(t), (Veyres, 2018). This also shows the extraordinary variability of the annual increments in ppm, from less than 0.5 in 1993 or even close to zero in 1959 (off the graph), to more than 3ppm in 2016 (El Niño), thus with inter-annual variations of more than 500% over the period, whereas man-made emission are regular and steadily increasing. Therefore, just from this simple observation, **man-made emissions cannot explain the annual increments measured**. Data from Spencer et al. (2015).

One shall notice that unit root tests on time-series made popular by David Dickey and Wayne Fuller (Maddala and In-Moo Kim, 1998) or KPSS (Shin and Schmidt, 1992) require the ppm curve to be derived once w.r.t. time before attempting a correlation with the temperatures. The correlation between dy (t) / dt and AT (t) is also verified by Wang (2013), and Wang (2014) and by the appearance of the autocorrelation functions of the time series; that of fossil fuel emissions is very different from that of the 12-month increments of the Mauna Loa Observatory (MLO) series and that of the inter-tropical temperatures. It is therefore a deception to say that increases in ppm observed at MLO are correlated with CO_2 emissions from fossil fuels. Non-stationary series may suggest false correlations; the existence of a possible correlation must be studied after having subtracted from each of the two time series its own linear trend. As stated by Munshi (2015; 2016b) «*A statistically significant correlation between annual anthropogenic CO_2 emissions and the annual rate of accumulation of CO_2 in the atmosphere over a 53-year sample period from 1959-2011 is likely to be spurious because it vanishes when the two series are detrended. The results do not indicate a measurable year to year effect of annual anthropogenic emissions on the annual rate of CO_2 accumulation in the atmosphere*». See also Munshi (2016a) for spurious correlations.

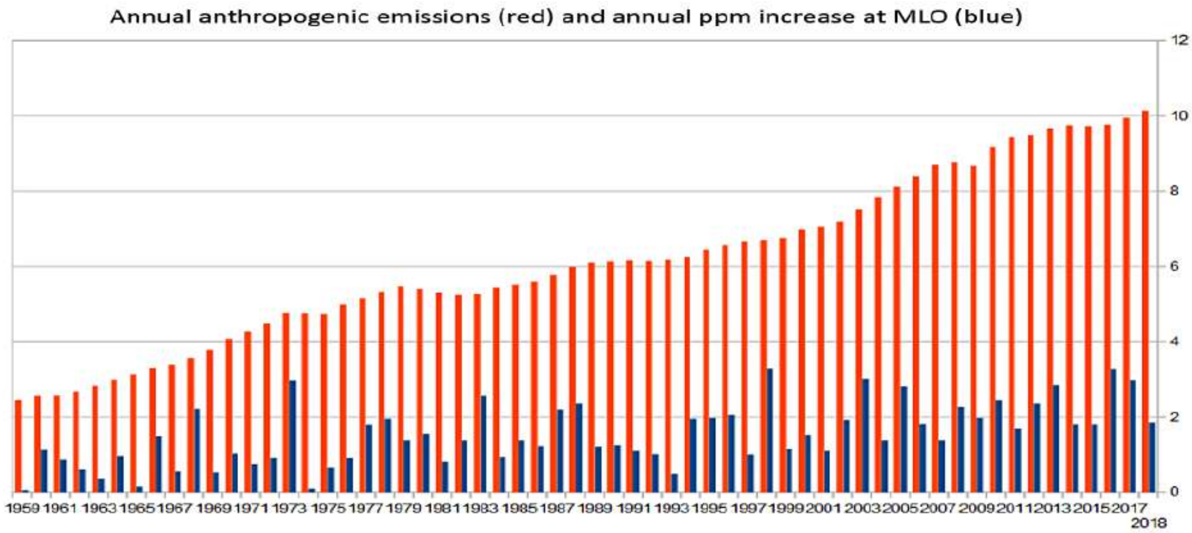

Figure 9. Annual anthropogenic emissions in Gt-C per year (1959-2018) (red) compared to the yearly annual [CO_2] increment in ppm (blue) as measured at the MLO station show no relationship. Inter-annual ppm increases may vary enormously, e.g. 1973 (2.97), 1974 (0.09), 1997 (1.0), 1998 (3.28), 1999 (1.16) whereas emissions are regular with a steady progression. Nature drives the annual increase. Data from: https://www.worldometers.info/co2-emissions/co2-emissions-by-year/.

39 http://apdrc.soest.hawaii.edu/datadoc/msu_uah_anom.php

It doesn't take a remarkable analytical mind to realize that there is simply no relationship between anthropogenic emissions, which have been steadily increasing, and the annual ppm increments as measured at the MLO, which are erratic and dependent as we have seen on Figure 8, on the inter-tropical ocean temperatures. This is simply obvious as displayed on Figure 9, where the anthropogenic emissions are visible in red, and appear as a regular and steadily increasing series progressing from 2.45 Gt-C in 1959 to 10.14 Gt-C in 2018 whereas the annual ppm increase measured at MLO, displayed in blue, is erratic, unrelated to the former and depends on of the inter-tropical UAH-MSU temperature anomaly as explained before. Years with very small ppm increases are cold years, e.g. 1959 (0.06), 1965 (0.15), 1974 (0.09), 1993 (0.5), whereas years with significant increases are typically warm or El Niño years such as 1973 (2.97), 1983 (2.57), 1998 (3.28) or 2016 (3.27). Nature drives the process and inter-annual variability can be enormous and a lot more than 500%.

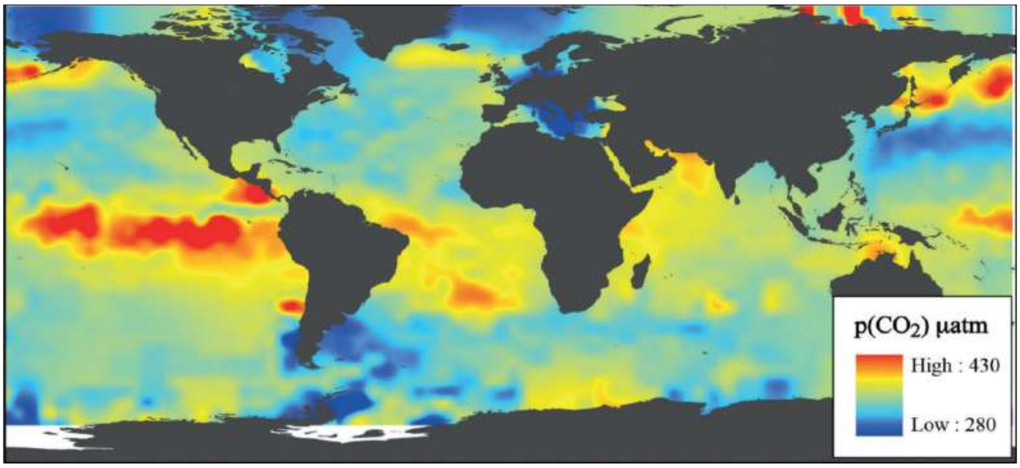

Figure 10. Carbon dioxide concentrations over the ocean, i.e. surface p(CO_2) (µatm) essentially shows the outgassing from the warm intertropical oceans. Source: Barry et al. (2010) and data from Takahashi et al. (2009).

Thus, as Veyres (2018) concludes «*Hence the ppm are the integral over time of the temperature anomaly of the inter-tropical zone where out-gassing takes place, a consequence of past temperatures; CO_2 ppm cannot control the temperature*», and as visible on Figure 10 and further explained by Barry et al. (2010) "*Unlike atmospheric p(CO_2), which is relatively homogeneous over the Earth, aqueous p(CO_2) and other ocean carbonate system parameters can vary greatly over space and time. Water temperature and salinity influence the solubility of carbon dioxide in seawater, widening the range of variability in the carbonate chemistry of the oceans, particularly with latitude*".

The flow of carbon dioxide between the surface ocean and the air follows from the difference in partial pressures *(Wanninkhof, 1999; 2009; 2013) "and is worth* $k \times K0 \times (p_{CO2eau} - p_{CO2air})$ *with* $k = 0.251\ (Sc / 660)^{-0.5}$ *<U2[40]>; it is weakly dependent on salinity. Sc (t) is the Schmidt number,* $Sc(t) = 2073.1 - 125.62\, t + 3.6276\, t^2 - .043219\, t^3$ *where t is the temperature in °C of seawater. The factor* $(Sc / 660)^{-0.5}$ *increases from 0.54 to 1 and to 1.37 when t goes from -1.5°C to + 20°C and to +32°C, which amplifies the degassed flow.* <U2> is the second order moment of wind speed; according to Figure 5 of (Wanninkhof, 2013) it ranges from 30 m^2/s^2 near the equator to 100 m^2/s^2 at 50°N and perhaps 120 m^2/s^2 or even 150m^2/s^2 at 50°S, as explained by Veyres and Maurin (2020).

CO_2 concentration has mainly increased since the end of the Little Ice Age and since the end of the last glacial period because the oceans are warming and as was demonstrated, anthropic CO_2 does not represent more than 6% of the overall [CO_2] and the average residence time of any CO_2 molecule (be it anthropic or not) is less than 6 years. CO_2 plays a rather insignificant role in the "grand climate scheme" at work and its IR absorption and contribution to the Earth's temperature are totally minor effects in the overall phenomenons at play. Therefore the following sentence is an absolute deception "*The removal of all the human-emitted CO from the atmosphere by natural processes will take a few hundred thousand years (high confidence) … we assessed that about 15 to 40% of CO_2 emitted until 2100 will remain in the atmosphere longer than 1000 years*" (IPCC, 2013) AR5 WG1, p. 472, which lies at the core of the IPCC dogma and trickery.

Not even considering the physical mechanisms that would be underlying the relationship between CO_2 and T, Klyashtorin and Lyubushin (2003) first tried to verify if there was a statistical correlation (rigorous, i.e. in the

40 U2 is the second order moment of the wind speed (Wanninkhof, 1999; 2009; 2013)

mathematical sense of the term) between the consumption of fuels on the planet (including coal, gas and fuels) and the temperature variations recorded on the planet from 1861 to 2000. That is to say since the beginning of the industrial era. It should be noted that, in doing so, they are freeing themselves from contentious arguments concerning the exact proportion of CO_2 released by man and stagnating in the atmosphere. It's quite simple: these two researchers want to know if there is a real correlation between the consumption of fuels made by industrial and other activities and the temperature of the planet, without worrying about the physical cause. It is a pure statistical correlation analysis. If there is none, one hardly see why there would be a need to limit such a consumption.

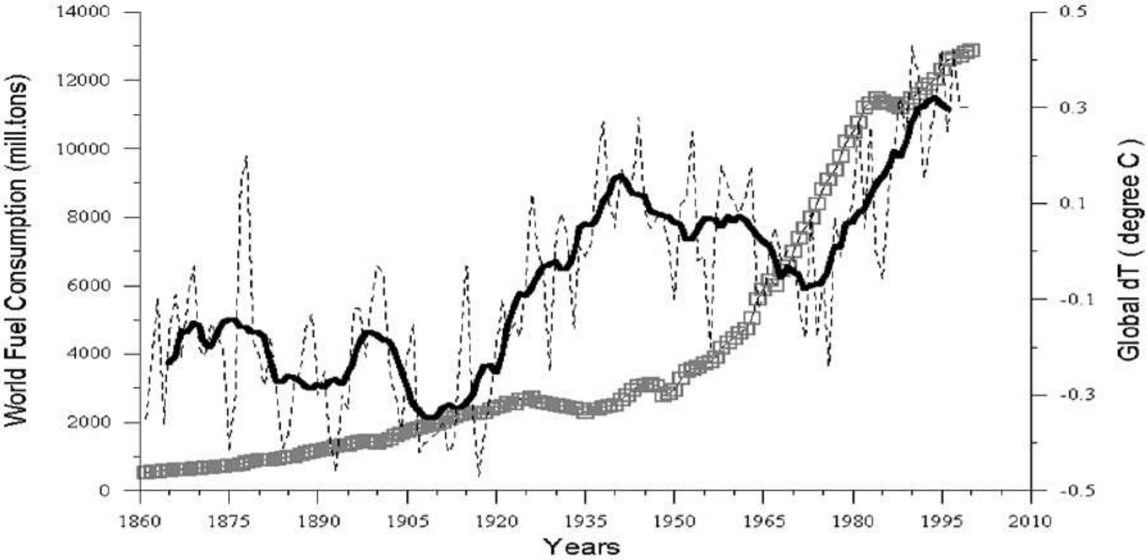

Figure 11. Comparative dynamics of the World Fuel Consumption (WFC) and Global Temperature Anomaly (dT) 1861–2000 (checked against O^{18} ice-core content in Greenland). Thin line shows the annual dT; Bold line is a 13-years moving average; The thick gray line made of squares is the WFC (million tons of nominal fuel). From Klyashtorin and Lyubushin (2003).

Basically what does Figure 11 from Klyashtorin and Lyubushin (2003) show? There are as many periods of negative correlations as of positive and it also identifies clearly two periods during which the temperature decreased whatever the fraudulent actions of William Connolley[41] (a Cambridge-based software engineer and Green Party activist co-founder along with Michael Mann and Gavin Schmidt of the deceptive realclimate.com blog) who removed the highly inconvenient references to the global cooling scare of the 1970s from Wikipedia, the world’s most influential and accessed informational source, by tampering 5428 articles and by obstructing other authors who dissented. All those misconducts that are well documented by Delingpole (2009b), will permanently taint the scientific reputation of the two other co-founders and will definitely tarnish their scientific legacy and standing. This is not only childish or bordering on mental illness as at an age of digitization of all sources and information, there will be no means to wipe off the records neither the 1970 cooling scare not the long periods during which the temperature simply decreased during the XX century, as there are not only plain visible on 11, but also archived in more than 285 papers listed, e.g. by Richard (2016). There is no need to be a member of the Russian Academy of Science like the two authors to see what is visible in plain sight, there are five main periods alternating ascending and descending temperature anomalies (correlations between WFC and dT given in parenthesis): ascending 1861-1875 (+0.92), descending 1875-1910 (-0.71), ascending 1910-1940 (+0.28), descending 1940-1975 (-0.88), ascending 1975-2000 (+0.94). Tampering the data as explained and shown in Figure 105 and 106 p. 275, will not change Nature nor the scientific truth and not only the 1940-1975 cooling was acknowledged by Hansen (1981) who stated “*The major difficulty in accepting this theory has been the absence of observed warming coincident with the historic CO_2 increase. In fact, the temperature in the Northern Hemisphere decreased by about 0.5°C between 1940 and 1970 (9), a time of rapid CO_2 buildup*", but the continuous adjustment of the tampered time-series is becoming so obvious that it is just plain ridiculous. On the very Fig. 3 of Hansen (1981), the difference between the decades [1880-1890] and [1970-1980] stands at 0.35 °C, while latest GISS “adjusted” series show now an unjustified additional increase of +0.55 °C. Unjustified of course, as by any reasonable account the spread across two decades separated by 90 years of past temperature anomalies remain what they were. This “adjustment” is of the same order of magnitude as the 60 year oscillation that was identified by Klyashtorin and Lyubushin (2003) who conclude “*Unlike the monotonously and exponentially increasing of WFC, the dynamics of global dT against the background of an age-long linear trend, undergo quasi-cyclic fluctuations with a*

41 The inability of Wikipedia “arb commission” in dealing with Connolley's misbehaviors is revealed in Forte and Bruckman (2008).

period about 60 years. ***No true linear correlation exists between the Global dT and WFC dynamics for the last 140 years***". This is what science shows by providing irrefutable evidences and the Paris Accord does enforce just the opposite on the false claims that there does exist a positive correlation between WFC and the temperatures. A shame, indeed, when politics corrupt science.

Recently, some authors seem to discover that "*Terrestrial ecosystems play a significant role in the global carbon cycle and offset a large fraction of anthropogenic CO_2 emissions. The terrestrial carbon sink is increasing...*" (Keenan et al., 2016). As Javier (2018d) realistically states "*So, we were unable to predict a few decades ago that over 50% of our fast-growing emissions would disappear from the atmosphere without any time delay, or that the fraction removed could actually increase despite exponentially increasing emissions, yet we have high confidence that 15-40% will remain in the atmosphere 1000 years from now. Clearly, we hugely underestimated the carbon sinks capacity to deal with our emissions, so we cannot have high confidence in distant future predictions*".

Furthermore, if we just consider radiative effects which are not the most important and by far, H_2O vapor is a much more important gas than CO_2 both given its absorption spectrum and its concentration at always more than 1% average (except at the poles) but up to 5% of the atmosphere - not a mere 0.04%. Its short residence time does not change anything to its permanent presence in the atmosphere, and to its overriding radiative role with respect to CO_2. But, radiative processes are the least important phenomenons to consider and we will address the next major one, the atmospheric pressure which determines the temperature on the ground. Then we will see how the atmosphere is opaque to IR radiations and how so many other processes account for heat transfers and contribute to the Earth's temperature.

4) Temperature results from the Gravitational Lapse Rate

In the early seventies I stumbled into my father's library on a book that amazed me as a youngster, i.e. « Planets and Life» (Sneath, 1970), actually the French version of it translated by François de Closets. At the time, before the exploration of the solar system by spacecrafts, most of the information obtained on the atmosphere of the planets and on the nature of their soils had been gathered by telescopic observations (actually mainly refractors then) by spectroscopic and polarimetric studies. It is amazing that as early as the 1920s, the surface temperature and pressure of Mars were reasonably known. Pettit and Nicholson (1924) report observations of the radiation from Mars made with the vacuum thermocouple attached to the 100-inch telescope at the Mount Wilson Observatory on eleven days since November, 1923. «*From these results we may conclude that the radiation temperature of the center of the illuminated hemisphere of Mars is a little above freezing, and that the mean temperature of the pole cap is about -70° centigrade. The measures on the limb give the mean value over a region extending inwards to about one-fourth of the radius towards the center, and this is about -13°C.*».

During the 1920s, Lyot (1929) used a polarimeter to study the surface properties of the Moon and planets and he noted that based on the amount of sunlight scattered by the Martian atmosphere, he could set an upper limit of 1/15 the thickness of the Earth's atmosphere. This restricted the surface pressure to no greater than 2.4 kPa (24 mbar[42]). These polarimetric studies were extended by Dollfus (1957) and Dollfus *et al.*, (1969) and lead to the characterization of the nature of the ground. Furthermore, as early as in 1947, Kuiper (1947) while working at Yerkes Observatory in Wisconsin and using infrared spectrometry, finds that the thin atmosphere of Mars consists mainly of CO_2. NASA's Mariner 4[43] and Mariner 9[44] delivered in 1965 and 1971 the first images of the red planet.

Similar efforts were conducted for Venus with the discovery of CO_2 in its atmosphere by infrared spectrometry with the 100-inch Hooker telescope by Adams and Dunham (1932) and temperature were measured (though the top of the clouds) by Pettit and Nicholson (1955) «*These means temperatures, -37°C and -42°C for the dark and the bright sides, respectively, refer to the top of the high cloud-cover of Venus*». NASA's Mariner 2 made radiometer measurements of the temperature while becoming the first spacecraft to fly past another planet then, passing within 35,000 km of Venus on 14th Dec 1962. In 1967, Venera 4[45] confirmed that the atmosphere consisted primarily of carbon dioxide, providing the first chemical analysis of the Venusian atmosphere, showing it to be primarily carbon dioxide with a few percents of nitrogen and below one percent of oxygen and water vapor. While entering the atmosphere it became the first spacecraft to survive entry into another planet's atmosphere. The first successful landing are made by Venera 7 (broadcast data for only 23mn) in 1970 and Venera 8 in 1972 which revealed the extreme surface temperature of 455-475°C. Venera 9 landed on the 22nd of Oct. 1975 and beamed back the first pictures of the surface of Venus with a surprisingly good visibility; the lander was the first to return images from the surface of another planet.

Thus, after reading Sneath (1970) in the mid-seventies, I was already amazed at the time to fathom that the atmosphere of Venus was mainly made of carbon dioxide (96.5%) and that the ground pressure was 93 bar whereas the tenuous atmosphere of Mars was also mainly made of carbon dioxide (95.3%) but with a ground pressure of only 0,006 bar. Of course the difference of the ground temperature are striking: Mars' surface temperatures may reach a high of about 20 °C (293 K; 68 °F) at noon, at the equator, and a low of about −153°C (120K; −243°F) at the poles whereas Venus is by far the hottest planet in the Solar System, with a mean surface temperature of 735 K (462°C; 863°F). Then it dawned on me rapidly, observing that the temperature on Earth drops when you go up in the mountains, that there was a direct relationship with the atmospheric pressure and that the composition of the atmosphere itself did not seem to play a major role.

Of course, this was well established long before by the kinetic theory of gases which states that the average molecular kinetic energy is proportional to the ideal gas law's absolute temperature and Maxwell (1873) gave the first mechanical

42 The Martian surface pressure varies through the year, but it averages 6 to 7 millibars.

43 Mariner 4 spacecraft performs the first successful flyby of Mars passing within 9846 km of the surface. It takes 21 images of the Southern hemisphere of an area billions of years old, heavily cratered.

44 Mariner 9 is the first spacecraft to orbit another planet. It finds huge dormant volcanoes, a giant system of canyons and signs of erosion by fluids and reveals that the Southern hemisphere is more cratered than the younger Northern hemisphere.

45 Soviet Venera 3 is the first spacecraft to reach another planet, crashing onto Venus on 1st of March 1966.

argument that molecular collisions entail an equalization of temperatures and hence a tendency towards equilibrium. Consider a gas of N molecules, each of mass m, one gets - knowing that:

$$P\,V = \frac{(N\,m\,v^2)}{3} \tag{24}$$

and combining it with the ideal gas law:

$$P\,V = N\,k_B T \tag{25}$$

(where k_B is the Boltzmann constant and T the absolute temperature defined by the ideal gas law), the temperature is given by equation (26):

$$T = \frac{m\,v^2}{3\,k_B} \tag{26}$$

As we see, the kinetic theory of gases enables to link the temperature T and the pressure P (Equation 25). In terms of the kinetic energy of the gas K, we have:

$$P\,V = \frac{2}{3}K \tag{27}$$

thus, the product of pressure and volume per mole is proportional to the average (translational) molecular kinetic energy. The kinetic energy of the system is N times that of a molecule, namely:

$$K = \frac{1}{2}(N\,m\,v^2) \tag{28}$$

And with Equation (26) we derive:

$$T = \frac{2}{3}\left(\frac{K}{N\,k_B}\right) \tag{29}$$

The average kinetic energy of the molecules depends on the temperature:

$$\frac{1}{2}(m\,v^2) = \frac{3}{2}k_b T \tag{30}$$

where k_b is the Boltzmann constant (with $k_b = 1.38\ 10^{-23}$ J.K^{-1}), named after its 19th century Austrian discoverer, Ludwig Boltzmann. It is a physical constant that relates the average relative kinetic energy of particles in a gas with the temperature of the gas. Thus the mean square velocity of molecules in the atmosphere is:

$$v = \sqrt{\frac{3\,k_b T}{m}} \tag{31}$$

The calculation of the adiabatic lapse rate for a dry atmosphere can be performed by considering the adiabatic expansion of a perfect gas (density ρ, molar mass M) which is governed by the law:

$$P^{1-\gamma}T^{\gamma} = cte \tag{32}$$

or Laplace's law (compression and adiabatic relaxation):

$$P\,V^{\gamma} = Cte \tag{33}$$

See Moranne (2020):

$$V^{\gamma}dP + \gamma\,P\,V^{\gamma-1}dV = 0 \tag{34}$$

Thus:

$$V\,dP = -\gamma\,P\,dV \tag{35}$$

where γ denotes the adiabatic index of the gas, equal to:

$$\gamma = \frac{C_p}{C_v} \tag{36}$$

with for air :
C_p = Specific heat at constant pressure 1005 J/kg/K for air,
C_v = Specific heat at constant volume 717 J/kg/K for air.

The ideal gas law is:

$$PV = RT \tag{37}$$

with R= C_p-C_v

thus: $$P\,dV + V\,dP = R\,dT = (C_p - C_v)dT \tag{38}$$

Using Equation (35) for the value of V dP (i.e. - γ P dV) and replacing above in Equation (38):

$$P\,dV-\gamma\,P\,dV=R\,dT=(C_p-C_v)\,dT \tag{39}$$

Thus:

$$(1-\gamma)\,P\,dV=(C_p-C_v)\,dT \tag{40}$$

And:

$$(1-(C_p-C_v))\,P\,dV=(C_p-C_v)\,dT \tag{41}$$

Therefore:

$$C_v\,dT=-P\,dV \tag{42}$$

In adiabatic compression, the variation of the internal energy U is equal to the work received:

$$dW=C_v\,dT=-P\,dV \tag{43}$$

for a mass m of air (using a volume V):

$$\gamma\,P\,dV=\left(\frac{C_p}{C_v}\right)P\,dV=-m\,C_p\,dT \tag{44}$$

Using (35) again

$$replacing:-\gamma\,P\,dV\;by\;m\,C_p\,dT \tag{45}$$

one gets:

$$V\,dP=m\,C_p\,dT \tag{46}$$

And in addition, depending on the altitude : dP = - ρ g dz (Kumar, 1976 p. 54) with density ρ = m/V ; thus:

$$V\,dP=-m\,g\,dz \tag{47}$$

Therefore:

$$\frac{dT}{dz}=-\left(\frac{g}{C_p}\right)=-9.8\,°C/km \tag{48}$$

In a dry atmosphere, the temperature decreases by 9.8°C for every km of altitude.

Thus, as the altitude increases by dz, the pressure decreases by:

$$dP=-\rho\,g\,dz \tag{49}$$

and the temperature by dT such that:

$$(1-\gamma)\frac{dP}{P}+\gamma\frac{dT}{T}=0 \tag{50}$$

By combining these two equations (49) and (50) with the equation of perfect gases:

$$P=\rho\frac{RT}{M} \tag{51}$$

Where M is molar weight of the gas, one also obtains:

$$\frac{dT}{dz}=\frac{-g}{C_p} \tag{52}$$

In reality, due to the condensation of humid air, on the one hand, which gradually releases latent heat of condensation at altitude, and on the other hand, to the heating of the atmosphere due to the absorption of solar radiation by the water vapor it contains, and by the clouds, the denominator is corrected by a (negative) value C_h, and the formula becomes:

$$\frac{dT}{dz}=\frac{-g}{(C_p-C_h)}=-6.5\,°C/km \tag{53}$$

With C_h = - 509 J/kg/K

Therefore, it is not surprising that the polytropic[46] relationship $T(P)/T_0 = (P/P_0)^{R/(Cp\ -\ Ch)}$ between temperature and pressure given by equation (54):

46 A polytropic equation represents a thermodynamic process where the pressure and volume of a system are related by the equation PV^k= C. Where P represents the pressure, V represents the volume, k represents the polytropic index, and C is a constant. Here, the air is assimilated to a perfect gas, of molar mass M. In the atmosphere, we give ourselves a relation between pressure p(z) and density ρ(z) of air at altitude z, called polytropic law of index k: $p(z)/[\rho(z)]^k$ = cte

$$\frac{T(P)}{T_0} = (\frac{P}{P_0})^{R/(C_p - C_h)} = (\frac{P}{P_0})^{0.19} \quad (54)$$

is strictly equivalent on Earth to the decrease in temperature with altitude given by Equation (53), $dT/dz = -g/(C_p-C_h)$ that civil aviation has standardized at - 6.5 °C/km, with g acceleration of gravity (9.8m/s²), C_p= 1005 J/kg/K (specific heat capacity at constant pressure) and $|C_h|$ = 509 J/kg/K as we've seen that it represents the heating at altitude coming from the absorption by water vapor of part of the solar infrared and almost all of it by clouds, and from heating due to the condensation of water vapor, each contributing about 1 K/day. R, the gas constant is equivalent to the Boltzmann constant, but expressed in units of energy per temperature increment per mole, R = 8.31 J K^{-1} mol^{-1}.

{T_0, P_0} represent the temperature and pressure of the layer which, at the Top Of the Air (TOA), effectively loses heat by radiation towards the cosmos, i.e. starting at {255 K, 530 mbar} up to 300 mbar[47]. (T_0, P_0) are controlled by water vapor and clouds. The short cycle of water vapor (11 days between evaporation and precipitation[48]) means that a "radiative imbalance" between the heat coming from the Sun and absorbed by the surface, by humid air and clouds and evacuated by thermal infrared radiation of the globe cannot last, it is **self-stabilizing**. This also matches Miskolczi's greenhouse theory findings (Miskolczi and Mlynczak, 2004; Miskolczi, 2007, 2010, 2014) based on his previous experience in developing HARTCODE (Miskolczi, 1989), i.e. a line-by-line computer program that can translate atmospheric profiles to IR heat fluxes in W/m², and thus that can convert p, T, rH profiles into IR spectra and vice versa, that computes the integrated optical depth, transmittance or radiance spectrum of a layered atmosphere for any viewing geometry with the desired resolution using the line-by-line integration method (it produces graphs such as the simplified one Figure 18). From thereof, Miskolczi asserts that the Earth is a **self-regulating** system and that the atmosphere maintains a stable global average gray-body optical thickness[49], where the maximum heat transfer to space takes place, the value of which is 1.86[50], see Miskolczi and Mlynczak (2004) p. 237. Among the various mechanisms involved, some will be presented later, starting in p. 65.

The demonstration of the previous equations is given by Veyres (2020b-e), the change in Enthalpy H is :

$$dH = T\,dS + V\,dP = C_p\,dT \quad (55)$$

with S the Entropy and from

$$T\,dS = d'Q = C_h\,dT = C_p\,dT - RT\frac{dP}{P} \quad (56)$$

with Q the net heat transfer and from dP = - ρ g dz (ρ = local density, g acceleration of gravity) and P = ρ R T_v with T_v the virtual temperature[51] later used in Equation (58) and defined hereafter:

$$T_v = \frac{T}{1-(\frac{e}{p})(1-\varepsilon)} \quad (57)$$

with T: actual temperature; p: actual (total) pressure = p_d + e; p_d: partial pressure exerted by dry air; e: partial pressure exerted by water vapor; ε = R_d/R_v = 0.622, comes:

$$\frac{dP}{P} = \frac{-g}{(R\,T_v)}dz \quad (58)$$

47 Also take notice that the tropopause is located at about 150 millibars in the tropics and 300 mbar at high latitudes.

48 With an atmospheric stock of ≈17000 km3 and daily rainfall ≈ 1300 km3 we have a residence time of about 11 days.

49 Veyres (footnote 23) states that "*Miskolczi's observations summarized by a constant ratio between S_U and S_T is not, contrary to Miskolczi's presentations, a radiative phenomenon; that Miskolczi's mean S_T is too strong or underestimates the clouds and that the regulation of the OLR is not done via τ_A; it is simply the consequence that if it is hotter on the surface, S_U increases, and as the amount of water vapor at 9 km decreases, E_U increases. On the other hand that E_D / S_U is more or less constant (between 103/165 and 429/521) is simply a consequence of the water vapor absorption spectrum. Stabilization comes from water vapor, not optical thickness "stories" that mix what happens inside the window and what happens outside the window where the air is totally opaque*". Though, the end-result is to lead to the observation of a **self-stabilizing** Earth system.

50 this value correspond to a vertical optical thickness of about τ=1.23 and is obtained by means of computer calculations using the Thermodynamic Initial Guess Retrieval (TIGR) radiosonde empirical measurements or the TOVS Initial Guess Retrieval, i.e. (TIGR2), database which consists of 1761 weather balloon observations (Miskolczi, 2010).

51 Moist air has a lower apparent molecular weight than dry air, therefore the gas constant for 1 kg of moist air is larger than that for 1 kg of dry air. But the exact value of the gas constant of moist air would depend on the amount of water vapor contained in the air, thus it is more convenient to retain the gas constant of dry air and use a fictitious temperature in the ideal gas equation. This fictitious temperature is called "virtual temperature". This is the temperature that dry air must have in order to have the same density as the moist air at the same pressure. Since moist air is less dense that dry air, the virtual temperature is always greater than the actual temperature.

Thus:

$$\frac{dP}{P}=\frac{R}{(Cp-Ch)}\frac{dT}{T} \quad (59)$$

and by integration one obtains Equation (54): $T(P)/T_0 = (P/P_0)^{R/(Cp - Ch)}$
and the lapse rate in the troposphere is Equation (53): $dT/dz = -g/(C_p-C_h)$.

With more water vapor in the air, $|C_h|$ increases, the lapse rate goes from for example 6.5°C/km to 6°C/km, which reduces the surface temperature and surface evaporation. Solar heat absorbed by the oceans and soils or vegetation is converted to latent heat by evaporation and evapo-transpiration and to sensible heat by convection. The radiative heat transfer from the surface to the air is almost zero, in net balance, and the radiative cooling of the surface by this infrared radiation, which reaches the cosmos after having escaped absorption by the water vapor and the clouds, is only 22 W/m^2 (Costa and Shine, 2012), that is to say some 5% to 6% of the "average" radiation of the surface (and mainly happens over dry deserts such as Saudi Arabia, Sahara, Atacama etc...).

Therefore, that the surface is warmer than the top of the air is the effect of gravitation and the weight of the atmosphere according to a relationship between temperature and pressure:

where: the universal constant R = 8.314462 = J mol^{-1} K^{-1} and the specific constant for the air is given by $R_{s,air}$ = 8.314/μ = 287 J kg^{-1} K^{-1} and μ= molar mass of the air (28.97 g/mol or 0,02897 kg/mol) and ~ means proportional to.

$$T(P)\sim P^{(R/\mu/(Cp-Ch))} \; or \; T(P)\sim P^{(8,314/[\mu(Cp-Ch)])} \quad (60)$$

The relation (60) $T(P) \sim P^{8,314/[\mu (Cp - Ch)]}$ fixes the temperature if one gives a couple {T, P} which is in practice that of the top of the water vapor which radiates towards the cosmos, i.e. starting at {255 K, 530 mbar} on Earth (up to 300 mbar, i.e. ≈9 km of altitude) and on Venus {T, P} {230 K, 100 mbar} corresponds to the top of the dust layer (dust and aerosols around 40 to 60 km have the same role as water vapor on Earth).

On Earth starting from the high troposphere {223 K, 263 mbar}:
Ground temperature = 288K (14.85°C) = 223K + 10 km x 6.5 K/km = 223 K $(1\ atm/0.26\ atm)^{0.19}$
g = 9.8 m/s^2, C_p=1005 J/kg/K et C_h = -509 J/kg/K.

On Venus starting from the tropopause around 0.1 atm and 230 K {230 K, 100 mbar} :
Ground temperature =735 K (461°C) = 230 K + 65 km x 7.7 K/km = 735 K = 230 K $(92\ atm/0.1\ atm)^{0.17}$
On Venus, the bulk of the air is carbon dioxide with a molar mass of 44 grams and g = 8.87 m/s^2
C_p = 850 J/kg for CO_2 (highly variable with temperature), R= 8.314/0.042 = 197
The lapse rate is then given by: 8.87/(850+309) = 0.00765 K/m and
the exponent $R/(C_p - C_h)$ is worth 197/(850+309) = 0.17

As I had guessed since I was a youngster and read Sneath (1970) it is well established that the **surface temperature does not result from radiative phenomena in thermal infrared but quite simply from atmospheric pressure on Earth as on Venus** (Sorokhtin *et al*., 2011).

As we have seen, on Earth the temperature at pressure P in the troposphere is:

$$T(P)=T_{reference}\left(\frac{P}{P_{reference}}\right)^a \; with \; a=\frac{R}{(Cp-Ch)}=0.1905 \quad (61)$$

Conversely, if one wishes to know what the pressure P will be at an altitude z expressed in meters, using the classical relationship PV = nRT and ρ = m/V => P m/ρ =nRT => ρ = Pm / n RT = PM / RT with M = m/n the molar mass of the air and assuming a constant temperature (sic), one gets the barometric textbook formula (Délèze, 2020; Stallinga, 2020):

$$P(z)=P_0 e^{-\left(\frac{Mg}{RT}\right)z} \quad (62)$$

As I had long wondered what would be the temperature on Earth **replacing the air with 100% CO_2** (without modifying the water vapor profile), it is easy to notice that this would replace a C_p of 1005 J/kg/K by a C_p of around 850 J/kg/K, and a lapse rate of -6.5 K/km by a lapse rate of -7.2 K/km, which **would decrease** the surface temperature **by around 7°C**! This is also the conclusion reached by Chilingar *et al.* (2008a) «*The writers investigated the effect of CO_2 emission on the temperature of atmosphere. Computations based on the adiabatic theory of greenhouse effect show that increasing CO_2 concentration in the atmosphere results in cooling rather than warming of the Earth's atmosphere*». In fact, they are not alone as Ellsaesser (1984) concluded that "*a doubling of carbon dioxide would have little or no effect on the temperature at the surface and, if anything, might cause the surface to cool*".

Should we then be worried by 100 ppm more of CO_2? Come on, it does not seem serious.

We can also easily simulate what would be the surface temperature with a higher pressure as has been the case in the distant past on Earth, and for example assess with 2 bars 3 billions years ago with:
$223\ K\ (2\ atm\ /0.26\ atm)^{0.19} = 328K = 55.44°C$

This understanding is in accordance with Sorokhtin et al. (2007a) «*The denser the atmosphere (i.e., the higher the atmospheric pressure), the warmer the climate. Thus, the high surface temperature at the ocean level during the Archean time, at a low Sun's luminosity, may only be a result of higher atmospheric pressure. The gradual decrease in the oceanic water temperature with a smooth increase of Sun's luminosity may only be a result of a gradual decrease in the atmospheric pressure. As shown later, the temperature will continue to drop in the future*».

Temperature on the ground is mainly a function of the thickness of the atmosphere and not essentially of the composition of the atmosphere (Jacob, 1999). Therefore one can only be amazed by the following statements by Hansen (2004): «*This has relevance to the Earth's climate. If we compare Venus, Earth and Mars, we find the Goldilocks situation. One is much too hot, one is much too cold, and one is just right. The reason Mars is cold is that it has only a thin atmosphere of CO_2, which warms it by only a few degrees above the temperature that it would otherwise have*[52]*, given the amount of sunlight that it absorbs. Venus has a thick atmosphere that warms it by a few hundred degrees. The Earth has enough greenhouse gases to warm it by a few tens of degrees, enough to make it a nice place to live. The way this works is: greenhouse gases are transparent to sunlight, which passes through the atmosphere and heats the planet's surface, but the gases partially block heat radiation*[53]*, making it more difficult for heat to escape. Like a blanket, they keep the surface warm*». Hansen's reasoning (2004) is completely flawed and one must find other explanations than ignorance of physics as he clearly deliberately forgets the importance of the relationship between the pressure and the temperature and rather focuses exclusively on radiative processes of minor importance. Perhaps as Freeman Dyson puts it «*Hansen has turned his science into ideology*» (Dawidoff, 2009) as it cannot be ignorance given his credentials. The ground temperature is the result of gravitation and of the weight of the atmosphere and certainly not just the result of radiative effects of GHGs. Strangely enough, Hansen (2004) notes that « *Venus has a thick atmosphere that warms it by a few hundred degrees*» but does not wonder whether its «thickness» is not a more important factor in determining its temperature than its «composition» and whether its composition has in fact some relevance at all to the temperature itself. The 93 bar pressure on the ground determines the temperature whatever the composition of this atmosphere be!

As a summary, the ground temperature on Earth depends mainly on the atmospheric pressure, insolation (less aerosols and it is the global brightening which replaces the global dimming of the years 1950-1980), air movements (convection / advection) and related transfers of water vapor (evaporation / condensation), ocean motion and currents, and aerosol and nucleation processes having a direct impact on the cloud cover and albedo. The absorption of the thermal infrared radiation by water vapor and carbon dioxide gases only represents a minor effect, and limited to the contribution made by CO_2 is just a marginal phenomenon.

Thus, the relation (61) $T(P)= T_{référence}\ (P/P_{référence})^{0.1905}$ on Earth and a similar formula for Venus giving the **ground temperature as a function of the pressure**, are accurate to within 1% and are deduced from the elementary thermodynamics of ideal gases in a gravitational field with solar heating at high altitude and not at all from a mysterious "greenhouse effect theory".

Strangely enough, even the strongest proponents of the AGW theory accept that «*Thermodynamics makes it possible to calculate the temperature decrease with altitude, which is called the adiabatic lapse rate. To simplify, we will take the following vertical lapse rate of temperature in the constant atmosphere.* ***The essential point is that it is independent of radiative exchanges and independent of the CO_2 concentration***» (Dufresne and Treiner, 2011) in French, p. 37. Legras, who is also a strong defender of the AGW theory states in Legras (2017) that « *The temperature profile in the troposphere is not determined by the radiative exchanges. It is fixed by mixing by meteorological*

52 Notice Hansen's double standard reasoning as there is 185 kg/m² of CO_2 on Mars (Mars' atmosphere contains 95% by volume of carbon dioxide) whereas just 6,3 kg/m² on Earth !

53 Radiation blockage does not prevent evaporative and convective cooling, which are the natural methods of cooling!

disturbances and cloudy convection" and "***The real atmosphere is not in radiative equilibrium below the tropopause. The rising flow of energy is ensured in the lower layers by convective transport (mainly latent heat)***» (Legras, 2017) in French, p. 42. The next step for the supporters of the AGW theory will just be to accept that if thermodynamics makes it possible to calculate the temperature decrease with altitude and if the main determining factor of the Earth's climate and of the surface temperature is the Earth's atmosphere pressure and composition, i.e. N_2/O_2 (CO_2 being a trace gas of little importance, be it 0.03 or 0.04% and H_2O the major GHG and heat transfer molecule), then no other subterfuge based on gibberish like «CO_2 forcing» is needed, and the denser the atmosphere (i.e., the higher the atmospheric pressure), the warmer the climate - this is sometimes referred to as the adiabatic theory of greenhouse effect (Sorokhtin *et al*., 2011).

Finally, the Gravitational Thermal Lapse Rate determines the temperature in a differential way, and not in an absolute manner: it does not set the temperature on the ground or at the tropopause, rather it fixes one according to the other, without it being possible to say which comes first, it is the chicken and egg classical paradox, see also (Holmes, 2017; Wilde and Mulholland, 2020). To give an example of this close relationship, let's consider these two situations:

In inter-tropical areas, on average : Tropopause : -80°C at 16 km altitude => Surface T: - 80 + 6.5 x 16 = 24°C
In temperate zones, on average : Tropopause : -63°C at 12 km altitude (on average) => Surface T: - 63°C + 6.5°C/km x 12km = 15°C

As N_2 represents 78.09% of the air composition and therefore contributes to the temperature far more than any other gas and especially CO_2, one may wonder where does N_2 come from and why so little was found in Mars's (2.6%) or Venus's (3.5%) atmospheres. A recent study by Mikhail and Sverjensky (2014) has finally brought some interesting perspective on this longstanding question: «*Here we present thermodynamic calculations that establish the speciation of nitrogen in aqueous fluids under upper mantle conditions. We find that, under the relatively oxidized conditions of Earth's mantle wedges at convergent plate margins, nitrogen is expected to exist predominantly as* N_2 *in fluids and, therefore, be degassed easily. In contrast, under more reducing conditions elsewhere in the Earth's upper mantle and in the mantles of Venus and Mars, nitrogen is expected predominantly in the form of ammonium* (NH_4^+) *in aqueous fluids. Ammonium is moderately compatible in upper mantle minerals and unconducive to nitrogen degassing. We conclude that Earth's oxidized mantle wedge conditions—a result of subduction and hence plate tectonics—favor the development of a nitrogen-enriched atmosphere, relative to the primordial noble gases, whereas the atmospheres of Venus and Mars have less nitrogen because they lack plate tectonics*».

Beyond contributing to the unique Earth's atmosphere composition and N_2 content, plate tectonics is also a unique geological feature of planet Earth[54], an affirmation one can make in 2020 after that most if not all significant telluric bodies of the solar system have been explored by spacecrafts thanks to a unique period in mankind history and unprecedented accumulation of knowledge (instead of claiming that her childhood has been stolen, Greta should go to school and later to the University and learn more about the conquest of this ultimate frontier). Thus, plate tectonics contributes to many exceptional characteristics of the Earth, including one remarkable, i.e. the production of calc-alcaline rocks (above subduction zones) characterized by a lighter density than basaltic ocean floor and mafic crust leading over geological times to the creation of cratons and later emerged continents «floating» by isostasy above the mantle and therefore making possible aerial life.

Recently, Johnson and Goldblatt (2018) have endeavored to analyze the Earth system nitrogen cycle over geologic history, which is of the utmost importance to those wishing to develop a global understanding of what the Earth's climate might have been over long geological timescales, once it is well understood that the pressure creates the temperature. These authors have constructed a new nitrogen cycle model, called EarthN, and Johnson and Goldblatt (2018) report that «*This model is driven by mantle cooling, links biologic nitrogen cycling to phosphate and oxygen, and*

54 NASA's Magellan orbits Venus on 10th of August 1990 and using radar maps 98% of the surface. After completing this mission it plunges into Venus's atmosphere in 1994. Further to that, it appears that Earth is the only telluric planet to have active plate tectonics, probably as it requires liquid water to make subduction zones operate as we know and to produce calc-alkaline series of rocks. The calc-alkaline magma series is one of two main subdivisions of the subalkaline magma series, the other subalkaline magma series being the tholeiitic series. A magma series is a series of compositions that describes the evolution of a mafic magma, which is high in magnesium and iron and produces basalt or gabbro, as it fractionally crystallizes to become a felsic magma, which is low in magnesium and iron and produces rhyolite or granite. **Calc-alkaline rocks** are rich in alkaline earths (magnesia and calcium oxide) and alkali metals and **make up a major part of the crust of the continents**. The diverse rock types in the calc-alkaline series include volcanic types such as basalt, andesite, dacite, rhyolite, and also their coarser-grained intrusive equivalents (gabbro, diorite, granodiorite, and granite). They do not include silica-undersaturated, alkalic, or peralkaline rocks.

incorporates geologic and biologic fluxes. Model output is consistent with large (2-4x) changes in atmospheric mass over time, typically indicating atmospheric drawdown and nitrogen sequestration into the mantle and continental crust». What is so important here, is that it introduces the notion that the Earth's atmosphere must have varied a lot throughout geological times, both in composition and overall pressure, and that we cannot just analyze the geological proxies that we are given with our current knowledge of the actual atmosphere.

This is also what Sorokhtin et al. (2007a) explain «*the partial pressure of carbon dioxide reached 3 to 4 atm in the Archean time. During Proterozoic and Phanerozoic time, almost the entire carbon dioxide degassed from the mantle was tied in carbonates (C_{carb}) or biogenic matter (C_{org}). As a result of nitrogen degassing from the mantle, the partial pressure of nitrogen increased substantially during the Late Archean time. The atmospheric pressure (and hence temperature) decline during the Proterozoic and Phanerozoic time could have occurred only due to a decrease in nitrogen partial pressure. There are few bacteria that can assimilate and bind the atmospheric nitrogen into organic matter*».

To elaborate on how much N_2 was removed from the Earth's atmosphere, Sorokhtin et al. (2007a) continue "*The writers assumed an intermediate value of that ratio: C_{org} / N_{org} ~ 1 / 0.08. Ronov and Yaroshevsky (1978) stated that presently 3.9*10^{21} g of C_{org} are present in the oceanic deposits of pelagic zone and shelves plus (9.02 to 8.09) * 10^{21} g, in the continental deposits. Thus, the amount of N_{org} in the present-day oceanic deposits is about 3.12 * 10^{20} g, whereas in the continental deposits it is about 5.0*10^{20} g*" then "*over the entire period of Earth's geologic evolution (i.e., the recent 4 BY), 4.4*10^{21} g of nitrogen were removed from the atmosphere due to bonding of nitrogen by bacteria in the oceanic biota. In addition, about 5.0*10^{20} g of nitrogen was preserved in continental deposits over the recent 400 MMY. Thus, approximately 4.9*10^{21} g of nitrogen was removed from the atmosphere over the entire period of Earth's evolution. As a result, the atmospheric pressure declined by 960 mbar (the present-day partial pressure of nitrogen is 760 mbar)… Without these bacteria, the current atmospheric pressure would be close to 2 atm and the average near-surface temperature would be nearly 50◦C (rather than 15°C) and even over 70°C at the equator*".

One should finally note the essential characteristic of the carbon cycle: two reservoirs clearly dominate the others: carbonate rocks (50 millions of Gt) and fossil organic matter (13 millions of Gt) for just 875 Gt-C in the atmosphere. The latter of course include coals and oils, but also the disseminated organic matter which is contained in all sedimentary rocks. Even if the biomass and the ocean are the reservoirs that play a big role in the short-term carbon cycle (on a human scale), on a geological scale, their mass of carbon is low. Though, the majority of carbon on Earth is not on the surface, but in the depths. The Earth's mantle is a significant reservoir of carbon. The mantle contains more carbon than the crust, oceans, biosphere, and atmosphere put together, thus most of Earth's C is still in the mantle. The figure is estimated to be very roughly 10^{22} kg. Carbon concentration in the mantle is very variable, varying by more than a factor of 100 between different parts.

Today, the atmosphere is made up of 80% N_2 and 20% O_2. These proportions are proportions by volume, but knowing that these gases can be considered as ideal gases, they are also proportions by number of moles. As the molar mass of oxygen and nitrogen are close (32 and 28 respectively), these are also proportions by mass. The mass of the atmosphere is one millionth of the mass of the Earth, or 5.10^{21}g. There is therefore today 0.8 x 5.10^{21} g (4.10^{21} g) of N_2 and 10^{21} g of oxygen O_2. In mole, this corresponds to $0.14.10^{21}$ moles of N_2 and $0.03.10^{21}$ moles of O_2. The dissolution of all the limestones would release 5.10^{21} moles of C, and therefore the proportion of CO_2 in the atmosphere would be:

$$\frac{5\,.\,10^{21}}{\left(5.\,10^{21}+0.14\,.\,10^{21}+0.03\,.\,10^{21}\right)} \tag{63}$$

therefore 97%, against 0.0370% today (Gaillardet, 2000). This calculation could also give an idea of the composition of the atmosphere in the early days of Earth's history, when limestones did not exist. Oxygen (which did not exist either) and carbon now stored in fossil organic matter should be removed from the calculation. The estimate of 97% is therefore a minimum value for the original terrestrial atmosphere. This 97% figure is remarkably close to the CO_2 content of the atmosphere of Venus. The Earth has therefore put in place mechanisms for sequestering atmospheric carbon, degassed from inside the Earth. This mechanism is undoubtedly the chemical alteration of silicates followed by the precipitation of limestone (as long as they remain atop the carbonate compensation depth). Let's see now how that works in the next section.

Therefore **99.9618% of the CO_2 ever present in the atmosphere has been removed by natural processes** over geological times and stored in one form or another, the major storage being limestones and carbonated rocks more generally, see e.g. for a discussion of Urey's reaction (Kellogg et al., 2019). What's remarkable is that enough CO_2 is just left in the atmosphere so that photosynthesis would keep working (must be > 150 ppm), knowing that plants have significantly improved since 1850 their development rate with the recent increase of 100 ppm, i.e. a mere 0.01% of the overall atmospheric composition (Zhu et al. 2016; Idso, 2019). Thanks to solar energy and water, the reaction of photosynthesis in its simplest form is:

$$6CO_2 + 6H_2O => C_6H_{12}O_6 + 6O_2 \qquad (64)$$

and produces glucose, a sugar that is both an energy carrier and a source of carbon for plant growth and the economic benefits for mankind are estimated to more than three thousands billions Euros since 1961 (Idso, 2013; Gervais, 2016b). We should rejoice ourselves everyday that temperature have naturally gone up since the end of LIA and that food security of mankind has thereof been improved!

The subject of paleo-barometry is highly speculative, unfortunately, and very few authors have ventured into this area and must be commended for at least trying and showing how little is known so far, especially as we venture far into a distant past. In fact, limited progress has been made since the early work of Sagan and Mullen (1972). It is generally accepted that the Earth received less energy from the Sun in the Archean and Proterozoic eras (solar evolution models predict an effective temperature of 5,714 K at 2.5 Gyr ago), thus the energy received then represented (5714/5800)^4 = 94.1% of the present value 2.5 billion years (Gyr) ago, but the solar luminosity $L_\odot$ 2.5 Gyr ago is evaluated for the standard solar model given by Bahcall et al. (2001) at at 0.85 $L_\odot$. Despite this lower insolation, our planet was not subject to the permanent extreme glaciation that would have probably occurred if early Earth had its current atmosphere (Sagan and Mullen, 1972). This contradiction is referred to in the literature as "the faint young Sun paradox". Proponents of the AGW theory tend to over-emphasize this phenomenon by exaggerating the deficit of insolation, pretending that at 2.5 Ga we would have had just 80% or less of the current radiation and an effective temperature of just 5,274 K, that would thus justify the alleged role of GHGs and of CO_2 in particular, which is purportedly presented as decisive. This is of course a deception.

Goldblatt et al. (2009) use a radiative–convective climate model "*to show that more N_2 in the atmosphere would have increased the warming effect of existing greenhouse gases by broadening their absorption lines*". Here again, the authors seem to overly focus on the IR absorption properties of GHGs and not enough on the gravitational lapse rate outcome induced by a doubling of the Present Atmospheric Nitrogen (PAN) level which they model. The impact of the «*lapse rate feedbacks*» as they refer to it is somehow considered, as equations of the pseudo-adiabatic (moist adiabatic) lapse rate are given in the annex of the paper, but its effect is not separately explained nor quantified. The Radiative Convective Model (RCM) that Goldblatt et al. (2009) use provides for the global annual mean vertical structure of the atmosphere, and «*convective adjustment in the model is to the pseudo-adiabatic (moist) lapse rate»,* but how is not reported and **the RCM unfortunately does not account for such an important climate component as the clouds**, the justification being «*following the convention in RCMs used for palaeoclimate, we do not explicitly include clouds but use a high surface albedo to represent the net effect of clouds on the surface energy budget. This simplifies the consideration of cloud feedbacks, which are highly uncertain, and facilitates direct comparison with other recent models*». In the end, the paper is not conclusive but opens the reasoning as to what might have caused a warmer Earth than otherwise expected given the energy received from the Sun 2.5 Gyr ago, a thicker atmosphere than today as envisaged by Sorokhtin et al. (2007a) and not the result of a more important greenhouse effect.

Unfortunately, Archaean air pressure seems now constrained by independent methods to ≤ 2 bar (Som et al., 2012) by using raindrop imprints in tuffs of the Ventersdorp Supergroup (South Africa); the assumption is that «*if Archean raindrops reached the modern maximum measured size, air density must have been less than 2.3 kg m^{-3}, compared to today's 1.2 kg m^{-3}*». More recently, by applying a new proxy to the Archean eon, i.e. the size distribution of gas bubbles (vesicles) in basaltic lava flows erupted at sea level, Som et al. (2016) concluded that «*our data indicate a surprisingly low surface atmospheric pressure of P_{atm} =0.23±0.23 (2σ) bar, and combined with previous studies suggest~0.5 bar as an upper limit to late Archean Patm».* These results are in strong disagreement with all models of the early Earth atmosphere, which often propose $P_{atm}CO_2$ of 10 bars or more, and seem logical.

What is interesting in this discussion is to acknowledge how little we know of the distant Earth's atmosphere and paleo-bathymetry and that it is very unfortunate as one must recognize the major impact P_{atm} has on the surface temperature, thanks to the gravitational lapse rate as here explained.

5) CO_2 removal from the Atmosphere

The most interesting part of Arrhenius (1896) p. 271, is when Arrhenius quotes Högbom (1894) «*... as it proves that the most important of all the processes by means of which carbonic acid has been removed from the atmosphere in all times, namely the chemical weathering of siliceous minerals, is of the same order of magnitude as a process of contrary effect, which is caused by the industrial development of our time, and which must be conceived of as being of a temporary nature.*» who develops his views in «Högbom's klassiska arbete om kolsyrans kretslopp i naturen (1894)», i.e. The classic works of A. G. Högbom on carbon cycles in nature (1894).

Högbom further states «*In comparison with the quantity of carbonic acid which is fixed in limestone (and other carbonates), the carbonic acid of the air vanishes. With regard to the thickness of sedimentary formations and the great part of them that is formed by limestone and other carbonates, it seems not improbable that the total quantity of carbonates would cover the whole earth's surface to a height of hundreds of meters. If we assume 100 meters,-a number that may be inexact in a high degree, but probably is underestimated,- we find that about 25,000 times as much carbonic acid is fixed to lime in the sedimentary formations as exists free in the air. Every molecule of carbonic acid in this mass of limestone has, however, existed in and passed through the atmosphere in the course of time* .» again quote by Arrhenius (1896).

Högbom (1894) concludes that because the weathering processes might have had very different intensities at different geological times and because it has consumed quantities of CO_2 many thousand times greater than the amount now disposable in the air, the probability of important variations of CO_2 seems large, especially as the supply is related to volcanic exhalations and other intermittent phenomenons that do not necessarily remain balanced over geological times with other mechanisms withdrawing CO_2 from the air. This is summarized by «*If we pass the above-mentioned processes for consuming and producing carbonic acid under review, we find that they evidently do not stand in such a relation to or dependence on one another that any probability exists for the permanence of an equilibrium of the carbonic acid in the atmosphere*». Furthermore Högbom (1894) does not underestimate "*the consumption of carbonic acid by vegetative processes. The ocean, too, plays an important rôle as a regulator of the quantity of carbonic acid in the air by means of the absorptive power of its water, which gives off carbonic acid as its temperature rises and absorbs it a it cools*"

In the end, the most interesting part of Arrhenius' paper (1896) are the quotes from Högbom (1894) who clearly shows a deep understanding of the carbon cycle and of the relative importance of the several processes involved and who acknowledges that the atmospheric content of CO_2 might have changed significantly, but who as a good geologist refrains himself from establishing any causal relationship with the temperature that may have been observed at the corresponding geological times.

As Galvez and Gaillardet (2012) reminds us, by 1845 Jacques-Joseph Ébelmen (1845; 1847) had brilliantly contributed to the emerging question of atmospheric composition by proposing that the alteration of silicates on continents and the precipitation of carbonates in the ocean should be considered as a sink of atmospheric CO_2. As reminded by Berner (2012) «*The fundamental principles of the factors affecting the global carbon cycle, the global sulfur cycle and the levels of atmospheric CO_2 and O_2 over long-term (multi-million year) time scales were first elucidated by Jacques-Joseph Ébelmen in 1845. He covered all major processes in such a correct manner that no appreciable changes in them have been elucidated since then. Unfortunately, his ideas were forgotten and were independently deduced by others only 100 to 150 years later*». From what we have seen above, and the quotes of Högbom (1894) in Arrhenius' paper (1896) it could be that Ébelmen had left a legacy at least in Högbom's thinking.

From thereof, one should note that the weathering of carbonates has surprisingly attracted little attention in the geochemical community both in terms of its mechanisms and global budget, to the notable exception of Walker et al. (1981). This lack of interest most likely relates to the widely accepted idea that, over long periods of time (0.5 to 1 Myr timescale), carbonate weathering is not a significant contributor to changes in the amount of atmospheric CO_2 (Berner and Berner, 2012). This understanding is based on the following reaction showing that the weathering of carbonate on land is exactly compensated by the opposite precipitation reaction in the ocean[55]:

55 The origin of the protons can be traced back to the following reactions $CO_2 + H_2O \Leftrightarrow H_2CO_3$ and $H_2CO_3 \Leftrightarrow H^+ + HCO_3^-$

$$\text{(Calcite)} \quad CaCO_3 + H_2O + CO_2 <=> Ca^{2+} + 2\,HCO_3^- \qquad (65)$$

and

$$\text{(Forstérite)} \quad Mg_2SiO_4 + 4\,H_2O + 4\,CO_2 <=> 2\,Mg^{2+} + H_4SiO_4 + 4\,HCO_3^- \qquad (66)$$

On the left side of the equation the carbonate rock is weathered and once ions reach the oceans they precipitate mainly thanks to the biota, i.e. corals, shell animals and in the pelagic environment thanks to plankton species.
More generally, the reversible equation can be written as:

$$Ca_x, Mg_{1-x}CO_3 + CO_2 + H_2O <=> x\,Ca^{2+} + (1-x)\,Mg^{2+} + 2\,HCO_3^- \qquad (67)$$

But, as suggested by Gaillardet et al. (2018) there could be some reasons why carbonate weathering may be important for the Earth's surface regulation as the fast kinetics of carbonate weathering allows it to respond to changes at human timescales making it consequently one of the components of climate equilibrium. Nevertheless, the focus will be given here on the weathering of silicates (e.g.Anorthite, Albite)[56]:

$$\text{(Anorthite)} \quad CaAl_2Si_2O_8 + 2\,CO_2 + 3\,H_2O \Rightarrow Ca^{2+} + 2\,HCO_3^- + Al_2Si_2O_5(OH)_4 \quad \text{(Kaolinite)} \qquad (68)$$

In this mono-directional reaction we use 2 moles of CO_2 whereas the precipitation of calcite (using Ca^{2+} + 2 HCO_3^-) will just liberate one (therefore the ocean operate as a CO_2 sink);

and:

$$\text{(Albite)} \quad 2\,NaAlSi_3O_8 + 11\,CO_2 + 2\,H_2O \Rightarrow 2\,Na^{2+} + 2\,HCO_3^- + 4\,H_4SiO_4 + Al_2Si_2O_5(OH)_4 \quad \text{(Kaolinite)} \qquad (69)$$

So, we're going to try to put figures on the processes aforementioned and to give an indication to the reader of how much CO_2 can be trapped in calcareous rocks and limestones by the weathering of silicates. The weathering of silicate minerals makes a big difference to atmospheric CO_2, by-products of hydrolysis reactions affecting silicate minerals are bicarbonates (i.e. HCO_3^-) anions and calcium cations, further metabolized by marine plankton in the oceans and converted to calcium carbonate. The calcite skeletal remains of the marine organisms are deposited as deep-sea sediments (as long as they do not deposit below the carbonate compensation depth) and are subtracted definitely from the biogeochemical cycle until they are recycled into subduction zones and produce calc-alcaline series and associated volcanism.

We forget temporary reversible reactions and just focus on one, irreversible, the alteration of rocks containing calcium silicates (e.g. basalts, andesites, granites, etc.):

Calcium_silicates + CO_2 + H_2O -> Clays + Limestones

Calcium silicates (e.g. plagioclases, pyroxenes, amphiboles) are a good source from which to originate the weathering, and if we take a calcium plagioclase we get:

$$2\,CaAl_2Si_2O_8 + 2\,CO_2 + 4\,H_2O \Rightarrow 2\,CaCO_3 + Si_4O_{10}Al_4(OH)_8 \quad \text{i.e. Kaolinite} \qquad (70)$$

Simplified we retain:

$$CO_2 + CaSiO_3 \Rightarrow SiO_2 + CaCO_3 \quad \text{(Urey, 1952 p. 354[57], 1956)} \qquad (71)$$

So now, let's make some simple calculation, since the 20 Myr that Himalaya has surged, it has been eroded and the sediments (e.g. clays, sandstones, etc.) have deposited in the Gange and Indus deltas. As a first conservative estimate, 2.10^6 km^3 of rocks have been eroded, with an average density of 2.7 g/cm^3, one gets an estimate of $5.4.10^{18}$ Kg of rocks

56 Most of the common minerals found in igneous rocks are solid-solution phases. These include olivine, pyroxene, amphibole, biotite, and plagioclase feldspars. Such a crystallization behavior is often illustrated by using the $NaAlSi_3O_8$ (albite or Ab) - $CaAl_2Si_2O_8$ (anorthite or An) plagioclase system.

57 Urey (1952) states "*Of course the silicates may have been a variety of minerals but the pressure of CO_2 was always kept at a low level by this reaction or similar reactions just as it is now. Plutonic activities reverse the reaction from time to time, but on the average the reaction probably proceeds to the right as carbon compounds come from the earth's interior, and in fact no evidence for the deposition of calcium silicate in sediments seems to exist*", therefore unless metamorphism occurs, the reaction is mainly to the right, see also (Duff and Morel, 1980).

which have produced $1.62.10^{17}$ kg of altered calcium silicates. Knowing that N $CaSiO_3$ have a mass of 116g and N CO_2 a mass of 44g (N Avogadro), 1kg of altered calcium silicate rocks **absorbs** (definitely) 0.38Kg of CO_2.

So far, we can easily compute that the erosion of Himalaya removed over 20 Myr $6.2.10^{16}$ Kg of CO_2, i.e. $6.2.10^{13}$ tonnes of CO_2 or $6.2.10^4$ GT of CO_2 (Giga Tons). If we consider that we have 407.4 ppm of [CO_2] by volume in 2018, then the concentration by weight is: 0.04074*(44.0095/28.97)=0.06189% of weight with CO_2 molar mass=44.0095 g/mole and molar mass of air=28.97 g/mole, knowing that the total mean mass of the atmosphere is 5.148 10^{15} tonnes we get the total weight of CO_2 = 0.06189 % x 5.1480 x 10^{15} tonnes=3.186 10^{12} tonnes or $3.186.10^3$ GT of CO_2 (1 GT=10^9 tonnes). As one knows that the entire atmosphere has $3,186.10^3$ GT of CO_2, one can conclude that the **erosion of Himalaya** has **removed** from the atmosphere (62/3.186)=19.46, i.e. nearly **20 times the total actual atmospheric CO_2**. One can easily understand that if [CO_2] atmospheric concentrations react fast to changes of temperature adjusting to the solubility changes as per Henry's law (see p.32), **a longer term steady state between all carbonate reservoirs depends on many more parameters**, the weathering rate being just one of them, which itself depends on extremely intricate factors such as the distribution of mountain belts, of plates, of the atmospheric circulation, etc.

As a side note, whatever the cause of their formation, the reliefs immediately formed are prey to erosion which destroys them at the rate of a few millimeters or even centimeters per century. The crust thus thins by superficial ablation. But the erosion of a 1km thick of mountain does not lower the relief as much. According to the principle of isostasis this slice of density 2.8 is necessarily replaced in depth by a slice of mantle terrain (d=3.3) of equivalent mass, ie of thickness 2.8 / 3.3 * 1 = 0.85km. A large part of the destroyed relief is therefore reconstituted by a regional uprising (the altitude has only dropped by 150m in the previous example) and by the migration of the Moho (i.e. Mohorovičić discontinuity) upwards. In fact, zero altitude is only reached when the continental crust has regained its thickness of 30km[58]. Thus, the complete erosion of a mountain range lead to far more CO_2, removed than what could be evaluated from the simple height of the chain.

In summary, the alteration of a calcium silicate (e.g. the alteration reaction of Kaolinite or Anorthite) consumes 2 moles of CO_2 on the continent, but only one is released by the precipitation of calcite in the ocean (notice that this CO_2 is immediately converted back into carbonate and bicarbonate ions and does not remain as CO_2). The alteration of Ca silicates (and also of Mg, because magnesium limestones are precipitated) is therefore a mechanism capable in the long term of efficiently pumping atmospheric CO_2.

Let's remember that the CO_2 cycle is fueled by carbon dioxide of mantle origin which leaves at the level of volcanoes. The surface C reservoir seems to keep a constant mass because what happens in the system through volcanism is equal to what plunges back into the mantle in subduction. The fluxes involved in the geological carbon cycle are very low compared to the carbon exchange fluxes between the atmosphere and the biomass on the one hand and the atmosphere and the ocean on the other hand (1000 times larger). However, even if these enormous fluxes play a large role on a small time scale on the regulation of atmospheric CO_2, they cannot play an influence on the geological scale. Indeed, the flux of photosynthesis is almost instantaneously compensated by the flow of respiration[59] and the atmosphere and the ocean are in dynamic equilibrium on a geological scale.

The carbonate reservoir (limestones and sediments) is the largest carbon reservoir at the surface of the Earth along with the fossil organic carbon reservoir. Accumulating during the Earth's geological history (essentially during the Proterozoic era), its size is estimated as > 50,000 000 Gt-C (carbonate), in the range [66,000,000 Gt-C – 100,000,000 Gt-C] and the fossil organic is > 13,000,000 Gt-C[60] (kerogen) (Berner and Berner, 2012). The amounts of C stored in the atmosphere and in the ocean are dwarfed in comparison at respectively 875 Gt-C (2019) and [36,000-38,000] Gt-C. As a consequence, any imbalance, even small, in the carbonate reservoir between the two processes, carbonate precipitation by oceanic organisms on the one hand and chemical weathering and metamorphism on the other hand could have important transient consequences on the atmospheric CO_2 level.

In response to global change, carbonate weathering is an interesting atmospheric CO_2 sink and a source of alkalinity to the ocean that is able to play a key role at the 100 years to 10,000 years timescales (Beaulieu et al., 2012). Chemical

58 This leads to the denudation of very deep areas at the base of mountain ranges and gives geologists access to petrological facies of very high pressures / temperatures.

59 Cellular respiration is the biochemical process in which the cells of an organism (e.g. bacteria) obtain energy, i.e. Adenosine 5'-triphosphate or ATP by breaking down Glucose into carbon dioxide and water using using oxygen in aerobic cellular respiration, and other molecules such as nitrate (NO_3) in anaerobic cellular respiration.

60 Note that 1 petagrams of carbon equals 1 Giga tonnes (1 PgC = 1 Gt-C).

weathering of continental surfaces consumes 0.3 Gt yr^{-1} of atmospheric carbon. This flux is of the same importance as the net uptake of CO_2 by the terrestrial biosphere in LIA-type conditions (0.4 Gt C yr^{-1}). The 0.3 Gt C yr^{-1} weathering flux encompasses the dissolution of the outcropping silicate and carbonate minerals under the corrosive action of dissolved atmospheric or biologically respired CO_2 in continental waters. Both processes can be summarized by two generic equations :

$CaSiO_3$ (silicate mineral) + 2 CO_2 (atmosphere) + H_2O → Ca^{2+} (river) + $2HCO_3^-$ (river) + SiO_2

$CaCO_3$ (carbonate mineral) + CO_2 (atmosphere) + H_2O → Ca^{2+} (river) + $2HCO_3^-$ (river)

In both cases, atmospheric carbon is captured in rivers and transferred to the ocean. This atmospheric CO_2 consumption is balanced at the million-year timescale by the supply of volcanic CO_2 and at the millennial (or much less) timescale (ocean mixing time) by the release of one mole of CO_2 to the atmosphere for each mole of carbonate deposited on the sea floor (the reverse of the second reaction) as reminded by Beaulieu et al. (2012).

6) Atmospheric Sensitivity to CO_2

Climate sensitivity refers to the amount of global surface warming that will occur in response to a doubling of atmospheric CO_2 concentrations. There are three main measures of climate sensitivity. The first is Equilibrium Climate Sensitivity (ECS) which makes the assumption that Earth's climate takes time to adjust to changes in CO_2 concentration and estimates the amount of warming that will occur once all processes have reached equilibrium. The second is Transient Climate Response (TCR). This is the amount of warming that might occur at the time when CO_2 doubles, having increased gradually by 1% each year. TCR more closely matches the way the CO_2 concentration has changed in the past and does not necessarily consider that the distribution of heat between the atmosphere and oceans have reached equilibrium. A third way of looking at climate sensitivity, Earth System Sensitivity (ESS), includes very long-term Earth system «feedbacks», such as changes in ice sheets or changes in the distribution of vegetative cover (note that such a forecast is totally out of reach, and will probably remain so). TCR tends to be notably lower than ECS. The Intergovernmental Panel on Climate Change (IPCC) fifth assessment report, completed in 2014, gave a likely ECS range of 1.5°C to 4.5°C of warming for a doubling of atmospheric CO_2 concentrations, but a likely TCR of only 1°C to 2.5°C. Therefore ECS represents the equilibrium change in surface temperature to a doubling of atmospheric CO_2 concentration and TCR a shorter-term measure over 70 years, represents warming at the time CO_2 concentration has doubled when it is increased by 1% yr^{-1}. For many years, IPCC estimates have put climate sensitivity somewhere between 1.5°C and 4.5°C of warming for a doubling of pre-industrial CO_2 levels. This range has remained stubbornly wide, despite many individual studies claiming to narrow it and in that respect we would put confidence in recent estimates by Lewis and Curry (2018) whereby based on (IPCC,2013) AR5 "forcings" medians are derived: "*for ECS of 1.50 K (5%–95% range: 1.05–2.45 K) and for TCR of 1.20 K (5%–95% range: 0.9–1.7 K)*".

The wide range of estimates of climate sensitivity reflects the high level of uncertainties in current «climate science», including how water vapor, clouds, surface reflectivity and many other factors may change as the Earth warms (as nobody disagrees with the fact, that so far, it has warmed since the end of the Little Ice Age but we strongly disagree with the fact that CO_2 has played a major role in this warming or even any role at all). Climate programmes may amplify («positive feedbacks») or diminish («negative feedbacks») through parametrization (i.e. hundreds of «tuning scroll wheels») the very small effect of warming from increased CO_2 concentrations depending on the way they «model» nature response to this doubling. It is generally agreed that the doubling of CO_2 concentrations will have a very small effect due to a logarithmic response to the increase, but that «feedbacks», i.e. induced effects, will lead for example to an increase in water vapor – itself a more powerful greenhouse gas than CO_2 – which will in turn warm the atmosphere and create a vicious circle (this positive feedback is a hypothesis retained by the IPCC but never demonstrated).

We're going to approach this topic following two slightly different perspectives, first it will be assessed what a doubling of the [CO_2] and its outcome on the climate system could be according to Sorokhtin et al. (2007b) and the use of the polytropic set of equations described by Veyres (2020); this will demonstrate that replacing O_2 with a doubling of CO_2 will not even lead to an increase in temperature at all, then we will briefly address the issue of the «feedbacks». Second, we will follow Moranne (2020) and will see that by evaluating each of the contributions of the gas involved and of the parts of the atmosphere concerned, a maximum of 0.5°C will be deemed reasonable. The temperature at the altitude where the Thin Layer (TL) at the high Troposphere up To the Tropopause (TTT), say between 300-100 mbar emits towards the cosmos, referred to as T_{TL_TTT}, is following Veyres (2020c), given by the parameters of the relation $T_{TL\_TTT}\ (p_{surface}\ /p_{TL\_TTT})^{8,314/\ (Cp\ -\ Ch)/\mu}$ and varies only slightly for a doubling of the content of trace gases (with μ= molar mass of the air (28.97 g/mol), C_p is the specific heat at constant pressure 1005 J/kg/K of the air). For an increase of 400ppm to 800 ppm of carbon dioxide with a corresponding withdrawal an equal quantity of oxygen[61], we have:
$d\mu = 4\ 10^{-4}\ (44\text{-}32)= 4.8\ 10^{-3}$; $dC_p= 4\ 10^{-4}\ (850 - 919) = -0.0276$; $dR/\ R= - d\mu/\mu = -166\ 10^{-6}$
$dC_p\ /\ (C_p\text{-}C_h) = -0.0276\ /\ 1509 = - 18.3\ 10^{-6}$;

T_{TL_TTT} is determined by the albedo and astronomical parameters and is given by:

$$\frac{dT_{TL\_TTT}}{T_{TL\_TTT}} = \frac{-\delta(albedo)}{4(1-albedo)} = -0{,}357\,\delta(albedo) \qquad (72)$$

The relationship expressing $dT_{surface}\ /\ T_{surface}$ is given by equation (73):

61 admitting the very false IPCC assertion that all growth in air content comes from the combustion of coal, oil and gas

$$\frac{dT_{surface}}{T_{surface}}=\frac{dT_{TL\_TTT}}{T_{TL\_TTT}}+\frac{R}{(C_p-C_h)}(\frac{dp_{surface}}{p_{surface}}-\frac{dp_{TL\_TTT}}{p_{TL\_TTT}})+\frac{R}{(C_p-C_h)}(2\frac{dR}{R}-\frac{dC_p}{(C_p-C_h)})\ln(\frac{p_{surface}}{p_{TL\_TTT}}) \quad (73)$$

Therefore:

$$\frac{dT_{surface}}{288}=\frac{dT_{TL\_TTT}}{T_{TL\_TTT}}+0.19(\frac{d\mu}{\mu}-\frac{dp_{TL\_TTT}}{53398})+0.19(-2\frac{d\mu}{\mu}-\frac{dC_p}{(C_p-C_h)})0.64 \quad (74)$$

Which gives (75):

$$\frac{dT_{surface}}{288}=-0.357\,\delta(albedo)+(0.19)(166\,10^{-6})+0.19(-332\,10^{-6}+18.3\,10^{-6})0.64-0.19\frac{dp_{TL\_TTT}}{53398} \quad (75)$$

Thus:

$$dT_{surface}(°C)=-0.002(°C)-0.001\,dp_{TL\_TTT}(Pa)-102\,\delta(albedo) \quad (76)$$

Changing the surface temperature by one degree using Equation (76) supposes a dp_{TL_TOA} = 1000 Pa or 10 hPa or 10mbar, which is improbable[62] because the temperature at the TL_TTT is essentially fixed by water vapor which represents 87% of the OLR radiation and that the essential of the rest is the radiation of stratospheric CO_2 and ozone. Increasing the albedo by 0.01 (for example from 0.3 to 0.31) decreases the surface temperature by 1°C[63] (Farmer and Cook, 2013). At constant albedo and constant TL_TTT pressure a **doubling of CO_2** would lead to a **decrease of the surface temperature by 2 thousandths of a** degree (Veyres, 2020c).

Let's remember that the increase in CO_2, for example since the end of the Little Ice Age, comes from the increase in temperature as we have demonstrated before, not the other way round. It is obviously the increase in natural degassing, which for oceanic degassing is controlled by the temperature of seawater where the partial pressure of CO_2 varies in $T^{12.5}$, (T absolute temperature = 273.15 + temperature in °C) which explains the growth of ppm:

- that the cumulative emissions is unrelated to the "anthropogenic" ppm in the air which are roughly five times the annual emissions averaged over the last few years ;
- that the CO_2 content of the air is essentially (95%) a consequence of the temperatures which control the inter-tropical natural degassing ;
- that the surface temperature depends on the gravitational lapse rate, the insolation of the surface (clouds play a major role by adjusting the albedo) the convection and the advection of latent and sensible heat;
- that the stories of "*radiative forcing by greenhouse gases*" are nonsense and that it is the water vapor content of the upper troposphere and not a warming of this upper troposphere that determines and regulates the thermal infrared flux emitted by the globe to the cosmos (i.e. the Outgoing Long-wave Radiation, OLR). Let us remember once again that it is the quantity of water vapor around 9 km which ensures in a few hours and a few days the regulation of the radiation from the globe to the cosmos (where water vapor radiates 200 W/m² towards the cosmos), and that it is absurd and contrary to observations to posit a priori that it is increasing.

Let's follow now Moranne (2020) to assess the atmospheric sensitivity to CO_2. One must first evaluate the restitution of the radiative energy received by the Earth. To balance its energy (without which it would warm up indefinitely), the Earth must return the energy it has received, namely : 156 W/m² at ground level, to prevent the ground from warming indefinitely, and 240 W/m² at the Top Of the Atmosphere (TOA), that is the solar flux absorbed by the Earth (say 340W/m² * (1-albedo)), to prevent the atmosphere from warming indefinitely, which would have the indirect effect of warming the ground (via the Lapse Rate starting from a warmer tropopause). The Earth's surface, which is on average at 15°C (288K), therefore radiates (on average) at this temperature, according to the red curve 288K on the next Figure 12 and the Sun radiates at 5777K[64] while the visible set of wavelenghts are displayed by the rainbow colors. As most authors do, whenever "terrestrial" thermal infra-red is concerned (i.e. temperatures below 288K), we will reason in frequencies (or wave-numbers), and no longer in wavelengths. Thus, a wavenumber of 1000 cm^{-1} (or frequency ν_s=30 THz) corresponds to a wavelength of 10 µm. Remember that $\nu_s = c / \lambda$ with λ=wavelength (usually in 10^{-9} m), c=2.99792458 10^{10}cm s^{-1} (speed of light) and ν_s frequency in Hz where frequency is a measurement of the number of wave cycles per second (i.e. s^{-1}). Wavenumber ũ = 1 / λ = ν_s / c is the reciprocal of the wavelength and ũ is defined as the number of wavelengths per unit distance, typically centimeters (wavenumber is measured in cm^1).

62 Unlikely for the "global average" value of the temperature of TL_TOA, but observed daily with the passage of anticyclones (first drier kilometers, colder surface in winter) and depressions (first kilometers wetter and warmer surface)

63 A small change in albedo, say from 30 to 31% due to a marginal cloud cover increase, has a radiative effect of 3.4 W/m² (thus reduces the energy received by 3.4 W/m²).

64 Only 5767 K if we want to reach 1360 W/m² with 5.68 x 57.67^4 (.696 / 149.5979)^2 =1360.

As an example, The wavelength λ of the red line in the Hydrogen spectrum is approximately 656.5 nm. This corresponds to 656.5 x 10^{-9} m or 656.5 x 10^{-7}cm or ũ=1.523x10^{4} cm^{-1}. We can convert this to Hz by multiplying by the speed of light which is 2.99792458 x 10^{10} cm s^{-1} resulting in 4.566 x 10^{14} Hz.

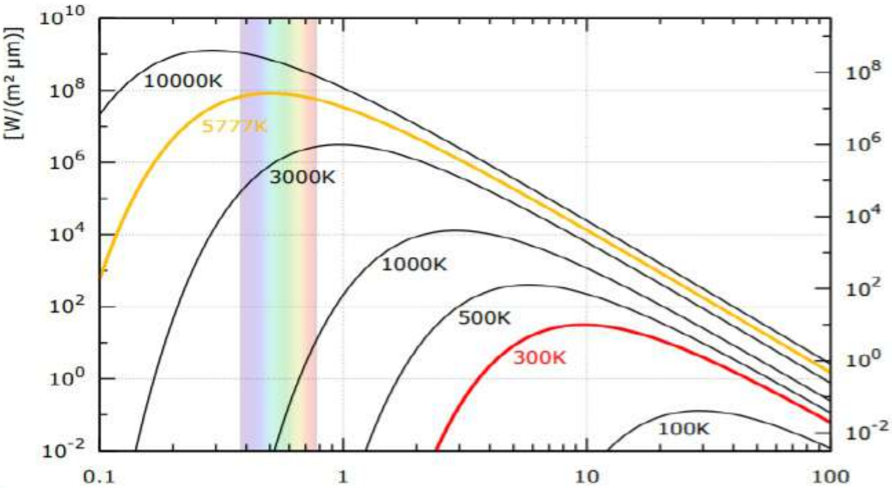

Figure 12. Planck radiation spectra for different temperatures in K (equal to T in °C +273 (thus, 288K=15°C; 0K= -273°C), in log-log representation. Abscissa= Wavelength in µm (left scale= Spectral Specific Radiation right scale=Spectral Radiation).

The surface of the Earth, which is on average at 15°C (288K), therefore radiates (on average) at this temperature, according to the red curve 288K (i.e. 300K) above. Figure 13 shows the opacity of water vapor, of optical thickness or depth[65] greater than a few units over almost the entire spectrum of thermal infrared, from radio frequencies, to a few cm^{-1}, up to at the optical frequency of 2220 cm^{-1}, except over the wide interval of 350 cm^{-1} called "water vapor window" from 770 cm^{-1} to 1180 cm^{-1}. The CO_2 is only significantly active and opaque from 600 cm^{-1} to 750 cm^{-1}, i.e. a band of 150 cm^{-1} (17-24THz Figure 13), against 1870 cm^{-1} for water vapor. The 4.3 µm CO_2 strip (≈2300 cm^{-1}/73THz) absorbs a few W/m² of solar radiation but is negligible at air temperatures.

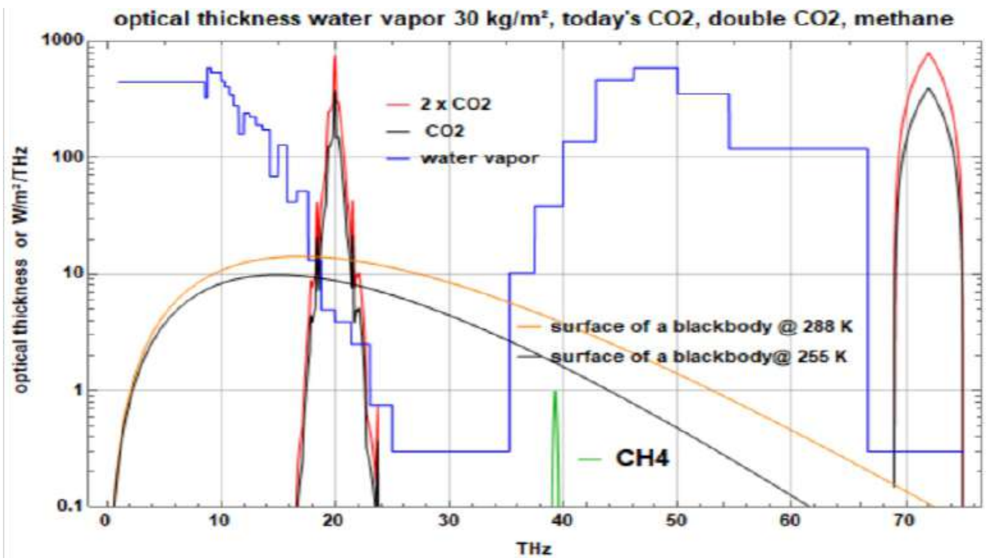

Figure 13. Optical thickness τ at infrared frequencies of water vapor (in blue), and CO_2 in black (and methane in green) for an average value of 30 kg/m² of water vapor and 6 kg/m² of carbon dioxide and after doubling of ppm (in red), thermal infrared frequencies in THz. The orange and black curves are the radiation of a black body surface (π times the Planck function) as a function of the frequency, spectral density given in W/m²/THz (SI units), after Moranne (2020).

65 The optical thickness or depth τ, is the natural logarithm of the ratio of incident to transmitted radiant power through a material, here the air, is also given by τ = - ln T where T is the transmittance of the material. For diffuse radiation, the transmission is a function of the optical thickness τ, and is given by 2 $E_3(\tau)$ where $E_3(\tau)$ is a special function, i.e. an exponential integral of degree 3 https://en.wikipedia.org/wiki/Exponential_integral ; 2 $E_3(\tau)$ can be approximated by exp (-τ) / (1 + 0.676 $\tau^{0.886}$) - this approximation is within 2 thousandths in relative on $0<\tau<4$ - and is worth 20% for τ = 1.07, 5% for τ = 2.15 and 1% for τ = 3.5, and just 0.0016% for τ=4.3, and for τ=10 transmission is negligible, i.e. 7.10^{-6}. The optical thickness τ of the gas varies according to the optical frequency as the lines of absorption of vibrations-rotations and rotations of the molecules which modulate the electric dipole of the molecule which interacts with infrared radiation.

As visible on the previous Figure 13, there exist a transparency band (between 23 THz and 36 THz or between 750 and 1,170 cm^{-1} or between 8.5µm and 13.3µm) which is called the "atmospheric window" or "water vapor window" of an optical thickness of approximately 0.5 (that optical thickness absorbs 44% of the impinging radiation); that window is nevertheless "closed" by clouds more than half of the time as a few microns or few tens of microns of liquid water absorbs all of the thermal infrared: it is the only frequency band in which the Earth's surface can radiate directly towards the cosmos; elsewhere, the atmosphere, totally opaque, blocks and absorbs all direct radiation from the ground to the cosmos. Thus, CO_2 molecules at high altitudes do not receive the IR radiation emitted by the Earth. Everything has been absorbed in a layer of air at a lower altitude that is opaque to radiation at the vibration frequencies of the CO_2 molecule. Moreover, the relaxation time required for the absorbed energy to be radiated is too long in view of the probability of collisions (Witteman, 2020a-b). In 10^{-10} seconds, the molecule does not have the time to radiate that the heat has already been transmitted to its neighbors during mutual shocks (kinetic theory of gases). Aware of this problem, and of the IR opacity of the two absorption bands at the lowest altitudes, Manabe in a series of papers (Manabe and Möller, 1961; Manabe and Wetherald, 1967; Manabe and Strickler, 1964) proposed that the heat absorbed and then dissipated by collisions to neighboring molecules be transported by convection to the TOA. Thus, as collisions become rarer with altitude, all the emissions participating in the radiative balance take part at the TOA level. Furthermore, for over almost the entire CO_2 spectrum, water vapor acts first and superimposes its effect on CO_2, this up to 750 cm^{-1} or 22.5 THz.

Water vapor, the content of which decreases very quickly with temperature, is concentrated in the lower layers (80% below 700 mbar around 3 km) while the CO_2 is rather uniformly distributed over the entire height of the air. This is why CO_2 contributes only for a few percent to the absorption of radiation from the surface by the air while water vapor provides 98% of this absorption: the bulk of CO_2, at altitude, sees only the little amount that has escaped absorption by the water vapor of the lower layers and by the low clouds. A layer of τ = 1.07 absorbs 80% of the incident photons and, in an environment where the temperatures do not vary too quickly, is the source of 80% of the photons coming out from above the upper layer and 80% of the photons coming out through below the lower layer (at the contact with the ground). The radiation of the air, below towards the surface or above towards the cosmos, therefore essentially comes from a layer of optical thickness τ = 1. The lower slice of air is just tens or hundreds of meters thick (depending on the frequency).

Let's evaluate the thickness of this layer of atmosphere that will stop (close to the surface) or produce (TOA) 80% of the radiative emission (optical thickness τ of 1.07). It will represent a small slice of the atmosphere above the ground and a small slice at the TOA. For 30 kg/m² of water vapor at frequencies where the optical thickness τ is 1.07, this will be a layer of roughly 300 grams[66] of water vapor which, at the top or at the bottom of the troposphere, produces the bulk (80%) of radiation towards the cosmos or towards the surface. Moving upwards from the surface (the ground), as the amount of water vapor varies considerably depending on the latitude, an assessment will be made for both the tropical and the temperate areas (in winter).

On the surface, one tonne of air occupies approximately 100 mbar since there are 10.3 tonnes of air for an average atmospheric pressure of 1013 millibar, thus, 300 grams fit in:
(0.3 kg / 16 kg / ton of air) x 100 mbar / ton = 1.9 mbar in tropical
(0.3 kg / 1 kg / ton of air) x 100 mbar / ton = 30 mbar in winter at high latitudes.

Let's now convert these in altitude atop the ground to calculate how much air thickness it takes to absorb 80% of the IR radiation; one needs a polytropic equation that will give a dz in altitude z given a dp in pressure p, here of 1.9 mbar and 30 mbar, knowing p_0=1013 mbar at z_0=0:

$$p=p_0\left(1-\frac{\gamma}{T_0}(z-z_0)\right)^{\left(\frac{MG}{R\gamma}\right)} => \frac{p}{p_0}=\left(1-\frac{\gamma}{T_0}(z-z_0)\right)^{\left(\frac{MG}{R\gamma}\right)} \quad (77)$$

thus

$$\left(\frac{p}{p_0}\right)^{\left(\frac{MG}{R\gamma}\right)}=1-\frac{\gamma}{T_0}(z-z_0) => \frac{\gamma}{T_0}(z-z_0)=1-\left(\frac{p}{p_0}\right)^{\left(\frac{MG}{R\gamma}\right)} \quad (78)$$

then:

$$z-z_0=\frac{T_0}{\gamma}\left(1-\left(\frac{p}{p_0}\right)^{\left(\frac{MG}{R\gamma}\right)}\right) => z-z_0=\frac{T_0}{\gamma}\left(1-\left(\frac{p}{p_0}\right)^{(0.19)}\right) \quad (79)$$

66 For an optical thickness τ = 100, and 30 kg/m² of water vapor **over the entire air column**, the air-to-surface or air-to-cosmos thermal radiation comes mainly, i.e. at 80% from a "skin" of (1.07/100) * 30 kg/m² = 321 grams of water vapor per m².

using the following polytropic relation (79) $z(P) = T_0 /\gamma\ (1-(P/P_0)^{0,19})$ with γ=0.0065 one gets:

Temperature	T_0 /γ	P/P_0	$(P/P_0)^{0.19}$	$1-(P/P_0)^{0.19}$	Altitude (meters)
300	46154	=(1013-1.9)/1013	=0.999643	=0.000357	=16.46
270	41538	=(1013-30)/1013	=0.994304	=0.005696	=236.58

Therefore:
$300\ K / 6.5\ 10^{-3}\ K/m\ (1- ((1013\ 10^{-3} - 1.9\ 10^{-3}) / 1013\ 10^{-3})^{0.19}) =$ **17 meters** in tropical for 1.9 mbar,
$270\ K / 6.5\ 10^{-3}\ K/m\ (1- ((1013\ 10^{-3} - 30\ 10^{-3}) / 1013\ 10^{-3})^{0.19}) =$ **240 meters** for T_0 = 270 K and 30 mbar in winter at high latitudes.

These are remarkable numbers providing reliable orders of magnitude showing that just **17 meters of air in tropical** zone or **240 meters in temperate** zone during winter (lower content of H_20 vapor) are the thickness of the slice of atmosphere that will **stop 80% of the radiative emissions** originating from the ground (optical thickness τ of 1.07)[67].

At the TOA level, the pressure corresponding to the optical thickness τ of 1.07 lies somewhere around 290-310 mbar for [2-12]THz and [40-65]THz (Figure 17 is later provided and shows the height of the level is highly variable depending on the frequencies and the gas, i.e. H_20 or CO_2) and we will be back on that later, as the slight drifting lower of the altitude of this layer explains the thermal regulation of the atmosphere. **The thickness of the layer emitting 80% or the radiations towards the cosmos is a slice of approximately 2 km (and more) and lies around 9 km for about 0.3 atm where we have 250 g to 300 g H_2O / tonne of air**. Within this "atmospheric window", between 23 and 35 THz or 750 and 1170 cm^{-1}, if we reason statistically (dry or humid area, clear or overcast sky, ...), it is generally accepted that the Earth's surface would radiate (at 15°C or 288K) around 110 W/m^2 towards the cosmos (at 0K), by clear sky (optical thickness = 0), if there were not this continuum of water vapor or the clouds. But in this continuum, water vapor, with an average optical thickness of 0.5, blocks most of it at low altitude and on what crosses water vapor, the clouds block (statistically) 60% (depending on whether they are present or not), at an altitude of approximately 2 or 3 km (i.e. 13 to 20°C less than the ground surface, i.e. approximately 20 W/m^2 of heat transfer from the ground to the atmosphere).

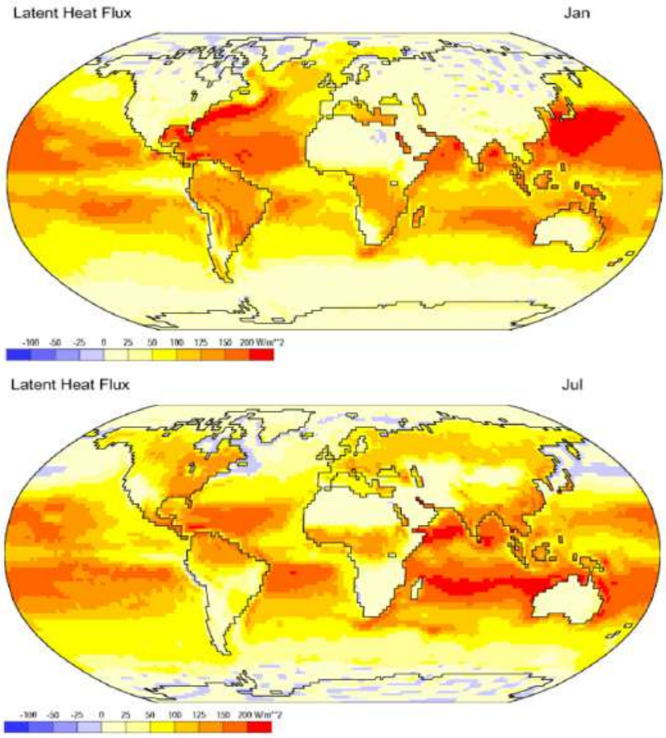

Figure 14. Shows the net absorption and release of latent heat energy for the Earth's surface for January and July, respectively. The highest values of flux or flow occur near the subtropical oceans where high temperatures and a plentiful supply of water encourage the evaporation of water. Negative values of latent heat flux indicate a net release of latent energy back into the environment because of the condensation or freezing of water. From Climate Lab Section, University of Oregon.

67 A slightly different but complementary approach by Nahle (2011) computes that the Quantum/wave stream mean free path length leaving the surface of the Earth to the outer space before it has collided with molecules of carbon dioxide is about 33 meters. Geuskens (2019) then addresses the deactivation mechanisms of the CO_2 molecules after such an encounter.

On average and depending on the clouds (the average optical thickness is taken = 1; τ = 0.5 for clear sky), and the Earth's surface at 15°C, therefore radiates directly 22 W/m^2 towards the cosmos (thus accounts for only 6% of the total outgoing radiation). But outside this "atmospheric window", the **Earth**, at ground level, **cannot dissipate its heat by radiation**, since the **atmosphere is** completely **opaque** (optical thickness greater than 5), therefore the very opaque lower troposphere is at the same temperature as the Earth's surface and there is **no heat transfer by radiation** between the two. And yet, it has to evacuate this energy, otherwise, it would heat up indefinitely, thus it has two other means than radiation to do it: by evaporation and by convection.

The oceans are at the heart of the system; indeed, they receive, like the rest of the earth's surface, 156 W/m^2 (actually a little more, because of their low albedo), and absorb almost all of them on the surface over a few decimeters of thickness but they cannot re-emit this energy by radiation, because the air above them is saturated with water vapor and is therefore almost completely opaque in the thermal infrared range (except in the atmospheric window) and they cannot cool by mixing with the deeper layers, because, heated from above, they are in temperature inversion. The oceans (and wet soils and vegetation) then use a completely different strategy to stabilize their temperature: evaporation. Changes in physical state (melting ⇔ solidification or vaporization ⇔ condensation) involve the state change *latent heat*[68], defined (in Joules) as the energy required to change the state of one kg of water. Considering the abundance of water on the Earth's surface (the oceans occupy 71% of it) and in the atmosphere (there is on average 25 to 30 kg/m^2), this process is very significant : water consumes 590 times more energy to vaporize (or evaporate) than to rise by 1°C. And all this energy is released when it condenses into clouds, then into rain, at altitude. In addition, the warmer the weather, the more water evaporates, at a rate of +7% per °C under average terrestrial conditions (Dalton's Law of Evaporation) and **thus playing a major regulating role**.

Depending on the sources used, evaporation from the earth's surface is estimated at 502,800 km^3 of water/year[69] (oceans) or at 495,000 km^3/year[70] + 74,200 km^3/year (for land surfaces such as lakes, forests, plants, etc.), for a total of 576,000 km^3/year, or 18.25 x 10^9 kg/s. Therefore, as calculated by Moranne (2000) « *The latent heat of water vaporization (energy required) at 15°C is 2.470 x 10^6 J/kg. So this evaporation consumes 2.470 x 18.25 x 10^{15} = 45 10^{15} W; the Earth's surface area is 510,000,000,000 km^2, or 510 x 10^{12} m^2; thus,* ***evaporation*** *at the Earth's surface* ***consumes*** *an average of 45,000 / 510 =* ***88.4 W/m^2****, which corresponds to an average of about 1.13 m of rain per year*[71] ». After recent upward revision Moranne (2020) states « *In total, we can therefore consider that it is about 96 W/m^2 that bypasses the opacity of the lower atmosphere*[72]*, and are directly transferred by convection (like a kind of heat pipe), at an altitude where this vapor condenses into clouds releasing the latent heat it contains. We will see further on that this energy is then radiated into the cosmos at an altitude where water vapor is no longer an obstacle to its own radiation* ». This corresponds to the TOA level of approximately 290 mbars (under which 80% of the IR emission is blocked anyway, i.e. τ = 1.07).

Heat is also transferred by convection and Moranne (2020) adds « *The surface of the warm ground also transfers some of its heat to the air that sweeps it : this lighter air rises and heats the troposphere. This transfer is estimated at about 38 W/m2 (order of magnitude in the absence of precise measurement). This is another "heat pipe", parallel to the previous one, which also crosses the opaque atmosphere to the top of the troposphere* ».

Therefore, from what has been described above, one can propose an overall balance at the level of the ground as follows: as it has been assumed, the ground surface receives an incoming energy of about 156 W/m^2 from the sun and to balance its temperature at the surface, the Earth releases:

- a part by direct radiation through the "atmospheric window", but partially blocked by the "continuum" of water vapor (average optical thickness taken = 1; τ = 0.5 for clear sky and 60% of clouds), i.e. 22 W/m$^{2;}$
- a part by latent heat transfer from ocean evaporation and plant evapo-transpiration, i.e. computed at 88.4W/m^2 and revised upwards at about 96 W/m^2;
- finally, a part by convection of heated air on the ground surface, i.e. approximately 38 W/m^2.

68 Latent heat is energy released or absorbed, by a body or a thermodynamic system, during a constant-temperature process — usually a first-order phase transition. The term was introduced around 1762 by British chemist Joseph Black. It is derived from the Latin latere (to lie hidden) https://en.wikipedia.org/wiki/Latent_heat

69 according to http://www.planetoscope.com/atmosphere/117-evaporation-de-l-eau-des-oceans-dans-l-atmosphere.html

70 according to http ://earthobservatory.nasa.gov/Features/Water/page2.php

71 These figures have recently been revised upwards (almost 10%), particularly in the oceans (satellite observations and increased evaporation due to temperature rise : 7% per °C).

72 Of course, this is an average : overall, depending on the latitude, this consumption is distributed between 0 and 250W/m^2

Even though all these figures can be debated (they are all averages), we focus on an order of magnitude and corresponding balance between the fluxes received and emitted, i.e. 156 = 22 + 96 + 38.
On the Top Of the Atmosphere the incident flux is evaluated at 240 W/m^2 and the following figure gives the pressure at which, for each of the two gases considered, namely H_2O and CO_2, and at their respective frequencies (20-75 THz), the optical thickness is evaluated at τ = 1.07, and therefore 80% of the radiative emission coming from atop has been absorbed, and reversely it is the altitude at which the atmosphere begins to radiate towards the cosmos (below, it can be considered totally opaque).

The Earth's Outgoing Long-wave Radiation (OLR spectrum) shows the Earth's radiance, seen from the cosmos, as a function of the radiation frequency, i.e. in the different emission bands : the energy dissipated is proportional to the area under the curve (i.e. the integral of the curve), the total area being 240 W/m^2. The balance for these 240 W/m^2 is established by Moranne (2020) as follows: « *17 W/m^2 from the stratosphere (O_3 band) as the stratosphere has its own balance and restores what it has absorbed, the 22 W/m^2 radiated directly from the ground to the cosmos (i.e. atmospheric window), 190 W/m^2 from atmospheric water vapor with a part in the band of the atmospheric window (between 800 and 1200 cm^{-1}), coming from a relatively low altitude (top of the continuum) to a high temperature and a part, outside this band, at the top of the water vapor, therefore higher, therefore colder between 500 millibar and the tropopause ; finally 10 to 12 W/m^2 by the top of the tropospheric CO_2 (in the band 610-7350 cm^{-1}, or 18 to 22 THz)*».

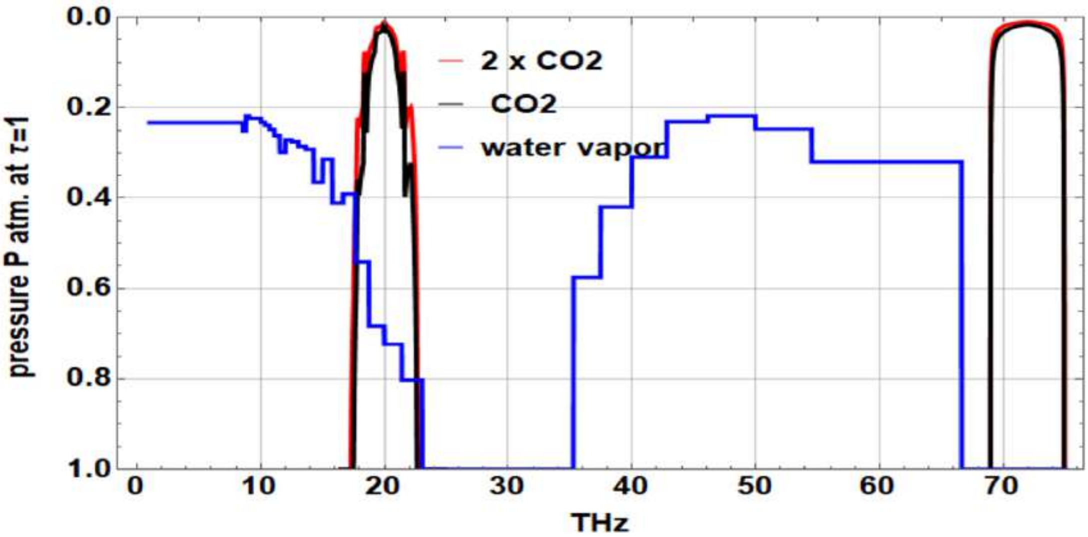

Figure 15. The position (altitude expressed in pressure) of the bottom of the layer that makes 80% of the radiation from the air to the cosmos (TOA) at the different frequencies of the thermal infrared. The "Higher-Colder" for a doubling of the ppm of CO_2 around 18 THz and 22 THz is the difference between the black and red curves!, visible between 0.4 atm and 0.2 atm; in blue the water vapor – layer at τ =1.07 for both CO_2 and H_2O (30 Kg/m^2). For the record, 0.2 atm corresponds to an altitude of 12 km: it is also the altitude of the tropopause in temperate zones, at an average temperature of -60°C or 213K, after Moranne (2020).

If CO_2 plays some role at the level of the stratosphere, one should notice that it blocks very little of the earth's radiation towards the cosmos : 11 W/m^2, or barely 5% of the OLR and appears to have a completely marginal role. To compute the atmospheric sensitivity to CO_2, Moranne (2020) retains the following figures, «*To balance a doubling of CO_2 as the only incident factor, the surface will have to evacuate an additional : 1.1 W/m^2 (IR radiation from CO_2 to the ground) plus **0.3W/m^2** (partial closure of the atmospheric window), minus - 0.4 W/m^2 (solar radiation absorbed by stratospheric CO_2 that the ground will be deprived of), thus a total of 1 W/m^2 and the (upper) troposphere will have to evacuate an additional : 2.1 W/m^2 (decrease in IR radiation at the top of the CO_2 to the cosmos effect) plus the 1 W/m^2 (evacuated from the ground and recovered by the troposphere, provided the ground can balance them), thus a total of 3.1 W/m^2*».
As we have seen before that the evaporation is a very effective mechanism to evacuate heat, each additional degree leads to an increased evaporation of 7%, it is easy to compute that to offset these additional 3.1 W/m^2 one will need an increase of temperature of (3.1/ (96 * 0.07))=0.46°C.

But, AGW supporters will claim that this increased evaporation will lead to an increase content of water vapor, that will increase the optical thickness in the continuum as well and therefore the atmospheric windows undergoes a double shrinkage due to the ***0.3 W/m^2*** seen before that reduce the emission to 21.7 instead of 22 W/m^2 and a new shrinkage due to the increase of water vapor. The increase of 0.46°C, i.e. of 3.22% (0.46/7%) of the evaporation will lead to an increase of the τ from 0.5 to 0.5*3,22%=0.516 and therefore from τ = 1.0 to τ = 1.016 (clouds remaining unchanged).

Thus:

$$\frac{M}{M_0}=e^{-\tau}=>dM=-\tau M_0 e^{-\tau} d\tau=-(\frac{M_0}{e})d\tau \quad = (21.7 / 2,71828) * 0.016 = 0.13 \text{ W/m}^2 \tag{80}$$

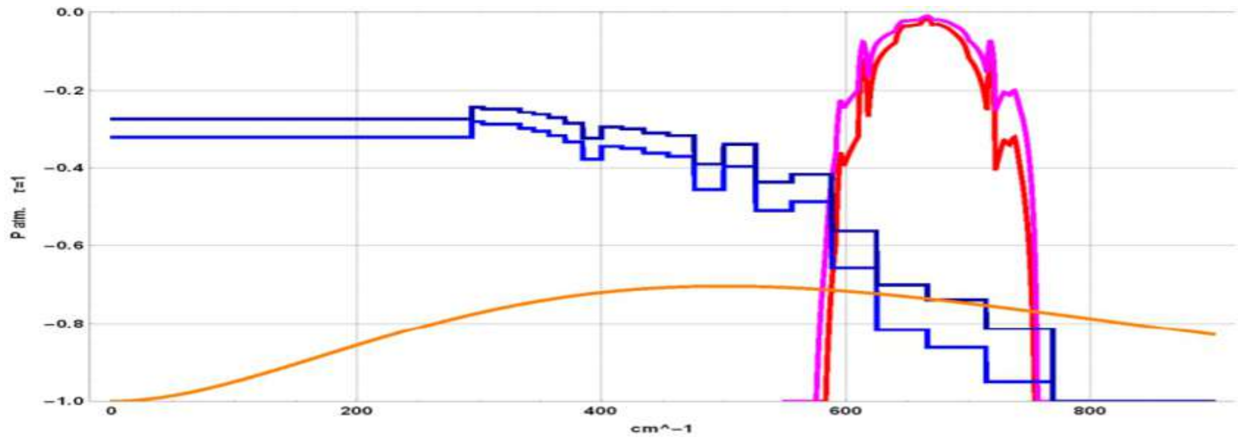

Figure 16. *Pressure (in atm) of the level above which 80% of the photons radiated by the air and reaching the cosmos are produced. Location of the τ =1.07 layer from the top of the air for CO_2, 2*CO_2, and water w=25kg/m² & w=50kg/m². Solutions of τ_{H2Omax} $P^{4.5}$ = 1.07 and of τ_{CO2max} $P^{1.45}$ = 1.07 and 2* τ_{CO2max} $P^{1.45}$ = 1.07. In orange the Planck function for a black body at 255K (Veyres, 2020).*

So, instead of having to evacuate an additional 3.1 W/m² it will be necessary to evacuate (3.1 + 0.13)=3.23 W/m². Then evaporation does not increase of 3.22% but of 3.22*(3.23/3.1)=3.22*(1+0.04) an so on, with an increase of 4% each time and the series converges towards 1.04, thus we finally have to evacuate 3.23 W/m² which leads to:

(3,23/ (96*0.07))=**0.48°C** (81)

The level $P_{1.07}$ of the optical thickness τ =1.07 from the top of the air, is the lower limit of the layer sourcing 80% of the photons lost to the cosmos; this level is the solution of $1 = \tau_{max\ H2O}\ P_{1.07\ H2O}^{\ 4.5}$ or $1= \tau_{max\ CO2}\ P_{1.07\ CO2}^{\ 1.45}$. Doubling $\tau_{max\ CO2}$ uppers the CO_2 level from $P_{1.07\ CO2}$ to P"= 0.62 $P_{1.07\ CO2}$ as shown on the previous Figure 16. There are about 40 cm^{-1} near 610 cm^{-1} and near 730 cm^{-1} where CO_2 would radiate from a cooler and higher layer after an instantaneous CO_2 doubling with all temperature and humidity of the troposphere kept **fixed**, hypothesis which does not make sense!

Let's note first that this CO_2 doubling is not going to happen overnight but, at +2 ppm/year, would take about 200 years; hence there is plenty of time for convection and water vapor to restore the emission of heat energy to space as this happens every day and night. Second this small temperature increase (i.e. 0.48°C) is in fact swiftly compensated by an adaptive phenomenon involving water vapor: if CO_2 radiates from higher and cooler (in the troposphere only !) there will be more cooling of the 250 mbar layer (near 610 cm^{-1} and near 730 cm^{-1}) and less cooling at 350 mbar (this is likely to be erased by convection) and the water vapor content of upper layer of the air (in blue) will change by about 12%/K near the tropopause and is **reduced** by the enhanced cooling of the 250 mbar layer; hence the water vapor radiation will be from a lower and warmer level (e.g. Ellsaesser, 1991), with a very significant spectral leverage of a factor of ten (400 cm^{-1} for the water vapor as compared to 40 cm^{-1} for the CO_2).

Furthermore, the water vapor content of the air near 300 mbar (i.e. ≈ 9 km of altitude) is dynamic, extremely variable and regulates the Outgoing Longwave Radiation of the globe (OLR); the relative humidity is there from 20% to 50%. It wipes out in hours or days any tropospheric effect of more CO_2 in the air. The lower limit of the radiating layer or skin is pictured in blue for water vapor, red for today's CO_2 ppm, magenta for doubled CO_2 (Figure 16). CO_2 radiates from the stratosphere except near 18.4 THz and near 21.6 THz. Doubling the CO_2 content of the air pushes the radiating skin upward around those two absorption lines from 350 mbar to say 250 mbar, from red to magenta, hence a "higher and cooler" effect in the troposphere[73], that reduces the OLR by some 1.6W/m² (effect at the top of the atmosphere), less than one percent of the water vapor tropospheric OLR.

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73 This is an elementary consequence of the ideal gas relationship, because a warmer surface and lower troposphere correspond to a higher tropopause and a colder lower stratosphere and vice versa. So if there is a warming of the lower troposphere, which is observed since the end of the LIA, the relationship between surface temperature and upper troposphere temperature means that the tropopause is higher. However, in cold polar regions there is a temperature inversion (air at 500 m or 1 km is warmer than the surface) and thus more CO_2 would actually decrease the radiation from the air to the surface, as this radiation would come on average from lower and colder (Schmithüsen, H., et al., 2015).

As far as the energy retained at the level of the ground due to a doubling of CO_2, the calculation done by Moranne (2020) of 1.0 W/m^2 is certainly conservative, i.e. «*1.1 W/m^2 (IR radiation from CO_2 to the ground) plus 0.3 W/m^2 (partial closure of the atmospheric window), minus - 0.4 W/m^2 (solar radiation absorbed by stratospheric CO_2 that the ground will be deprived of), thus a total of 1.0 W/m^2*» and Hansen et al. (1984) consider that a doubling of CO_2 would rather lead to an increase of 0.8 W/m² per clear sky. Figure 16 shows that doubling the carbon dioxide content of the air (the red curve replaces the black curve on Figure 13) very slightly closes the window of water vapor around 26 THz and therefore reduces the radiation which, not trapped by the clouds and water vapor, passes directly from the surface to the cosmos; as said this effect is on the order of 0.8 W/m² for a clear sky.

But, the surface radiation reaching the cosmos is on average 22 W/m² including the effect of the clouds and say 50 W/m² through the atmospheric window for clear cloudless sky. Therefore, the 0.8 W/m² need to be corrected by the ratio (22/50) * 0.8 W/m² = 0.35 W/m² to get an effective value of what does not reach any longer the cosmos and was initially radiated by the surface. These 0.35W/m² will go through the cycle of evaporation, advection (or displacement of air), condensation, and radiation at altitude towards the cosmos.

Again, the evaporation is a very effective mechanism to evacuate heat, as seen each additional degree leads to an increased evaporation of 7%, it is easy to compute that to offset these additional 0.35 W/m^2 one will need an increase of temperature of (0.35/(96*0.07))=0.052°C. This additional absorption arising from a doubling of CO_2 traps 0.35 W/m^2 and is therefore negligible compared to the average evaporation of 96W/m², double or triple in tropical areas (Figure 14). Now let's consider what happens at the Top Of the Air and remind first that the radiation from the TOA to the cosmos is supplied roughly half by the solar irradiance absorbed by water vapor and half by condensation and a little by convection; **it is not supplied by radiation from the surface since the net radiative balance between the surface and the air is almost zero**.

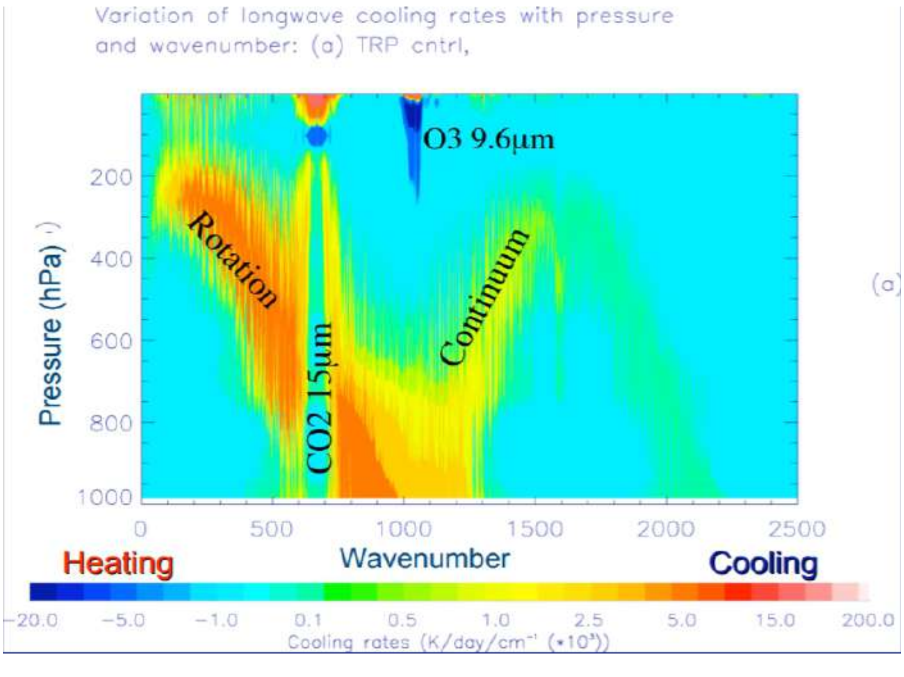

Figure 17. Cooling of cloudless air by radiation for a tropical troposphere: O_3 around 960 cm^{-1}, CO_2 around 666 cm^{-1} and water vapor across the spectrum. The considered spectral range is from 0 to 2500 cm^{-1}. From (Brindley and Harries, 1998). The low areas in pale blue do not cool because the medium is opaque, the high areas in light blue do not cool because there is hardly any trace gas left (no water vapor capable of radiating).

Let us now see the top of the air which radiates towards the cosmos: this radiation takes place in the layers around τ=1, τ optical thickness counted from the top of the air, and therefore at a pressure, in atmosphere, of $(1 / \tau_{max\ H2O})^{(1/4.5)}$ for water vapor and $(1 / \tau_{max\ CO2})^{(1/1.45)}$ for CO_2, see (Veyres, 2020b)[74] p. 9-10. A calculation, made absorption line by absorption line (Figure 17) shows where these layers are. The higher the altitudes at the which they cool (pressures the lower), the bigger the optical thickness τ of the air (Figure 15).

74 See Figure entitled: Approximation of saturated water vapor and real water vapor as a function of P (atm) assuming a change in relative humidity in 80% P$^{0.75}$ and corresponding abacuses.

The heating of the tropopause by CO_2 (and ozone) which absorbs the radiation coming from the warmer zones above and below is evacuated by the radiation of water vapor towards the cosmos, on this same layer between 100 cm^{-1} and 400 cm^{-1}. Figure 17, shows that CO_2 essentially radiates from the stratosphere towards 225K above the tropopause and the O_3 radiates towards the cosmos from the top of the stratosphere at more than 250K and essentially more than 275K; the peaks of optical thickness of CO_2 around 614 cm^{-1} and 718 cm^{-1} (i.e. the two pins or the «horns» Figure 16) are not very clearly visible here and rest a little below the tropopause (towards $\tau = 4$).

For an instant doubling of [CO_2] content of the atmosphere (what a strange first assumption), with unchanged[75] temperature and water vapor profiles (what a strange second assumption), the radiation of tropospheric CO_2 towards the cosmos would decrease by 1.5 to 2.0 W/m². Even if you believe that making such assumptions makes sense (I do not) it is a ludicrous figure for such a convoluted reasoning. The representations for water vapor in Figure 16 assume that the relative humidity remains constant. However, water has the property of condensing (clouds, rain). As Veyres (2020) reminds «*the 1% (or 4%) of the total water vapor which is above 360 mbar (or 500 mbar) provides the bulk of the radiation towards the cosmos (below 600cm^{-1}) and regulates it finely and quickly. The compensation of a lesser radiation towards the cosmos of tropospheric CO_2 on 40 cm^{-1} (passage from the red curve to the magenta curve of Figure 8) is done by a slight decrease in the water vapor content of the upper layers, with an effect on more than 400 cm^{-1}: the water vapor then radiates lower and warmer*», this is based on observations, e.g. as reported Figure 19 and Figure 20.

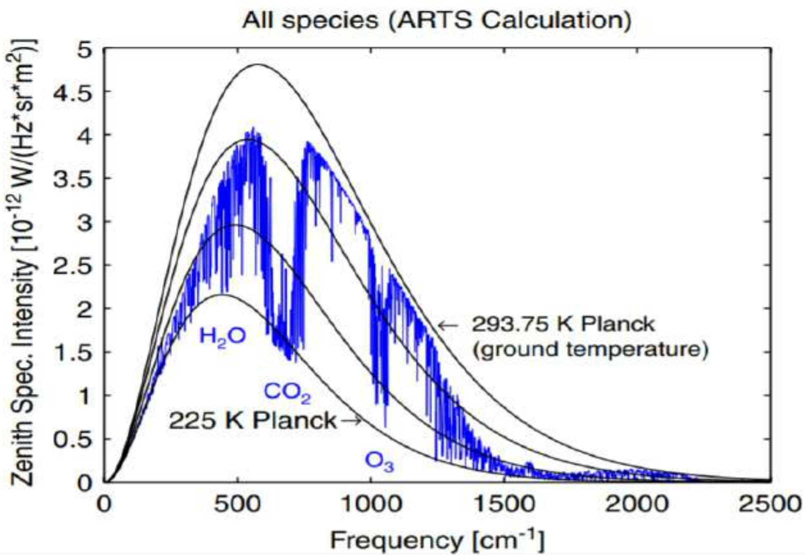

Figure 18. A radiative transfer model simulation of the TOA zenith monochromatic radiance for a mid-latitude summer atmosphere. Smooth solid lines indicate Planck curves for different temperatures: 225, 250, 275, and 293.75 K. The latter was the assumed surface temperature. The calculated quantity has to be integrated over frequency and direction to obtain total OLR (Buehler et al, 2006). Similar OLR spectrum can be measured by Michelson spectrometers at the nadir of satellites.

As explained by Buehler et al (2006) and taken into account by their model "*the sensitivity of OLR to changes in humidity, carbon dioxide concentration, and temperature were investigated for different cloud-free atmospheric scenarios. It was found that for the tropical scenario a 20% change in humidity has a larger impact than a doubling of the carbon dioxide concentration. The sensitive altitude region for temperature and humidity changes is the entire free troposphere, including the upper troposphere where humidity data quality is poor. The considered spectral range is from 0 to 2500 cm^{-1}, the most important radiatively active species in this spectral region are water vapor, carbon dioxide, methane, nitrous oxide, and ozone, with **water vapor being by far the most important one**… Only the clear-sky case was considered. **Clouds** are known to **have a very important impact** on both the SW (i.e. Short Wave, Solar) and the LW (i.e. Long Wave, IR) radiation, but, as stated above, are not the subject of this study… The mean value of clear-sky OLR most strongly depends on the mean temperature and humidity profile*".

75 As reminded by Veyres (2020) the notion of radiative forcing, variation of the net radiative flux rising at the tropopause with temperature and humidity profiles kept fixed, is only a calculation trick used to compare calculation programs with each others. Contrary to the assertions of the IPCC, this «notion» has no physical reality: in 200 years, the time necessary to double the ppm at the current rate of + 2ppm / year, the temperature and humidity profiles have the time to adjust, as they do every day in a few hours, by convection and by condensation.

Even with the limitations of this study, it is visible that doubling CO_2 is not a big deal, but that water vapor, humidity content and temperature profile up to the tropopause, **plus the clouds which have not even be taken into account**, play much bigger roles. The radiation of the stratosphere is hardly changed by a change in CO_2 contents: each layer will always radiate as much as it receives from solar UV absorbed by oxygen and ozone, but at optical frequencies offset by a few cm^{-1}. The notch at 666 cm^{-1} is higher (and "warmer") at an altitude of more than 11 km and corresponds to the maximum of the optical thickness of CO_2, while the spike at the middle of the notch goes a lot higher up to 35 km.

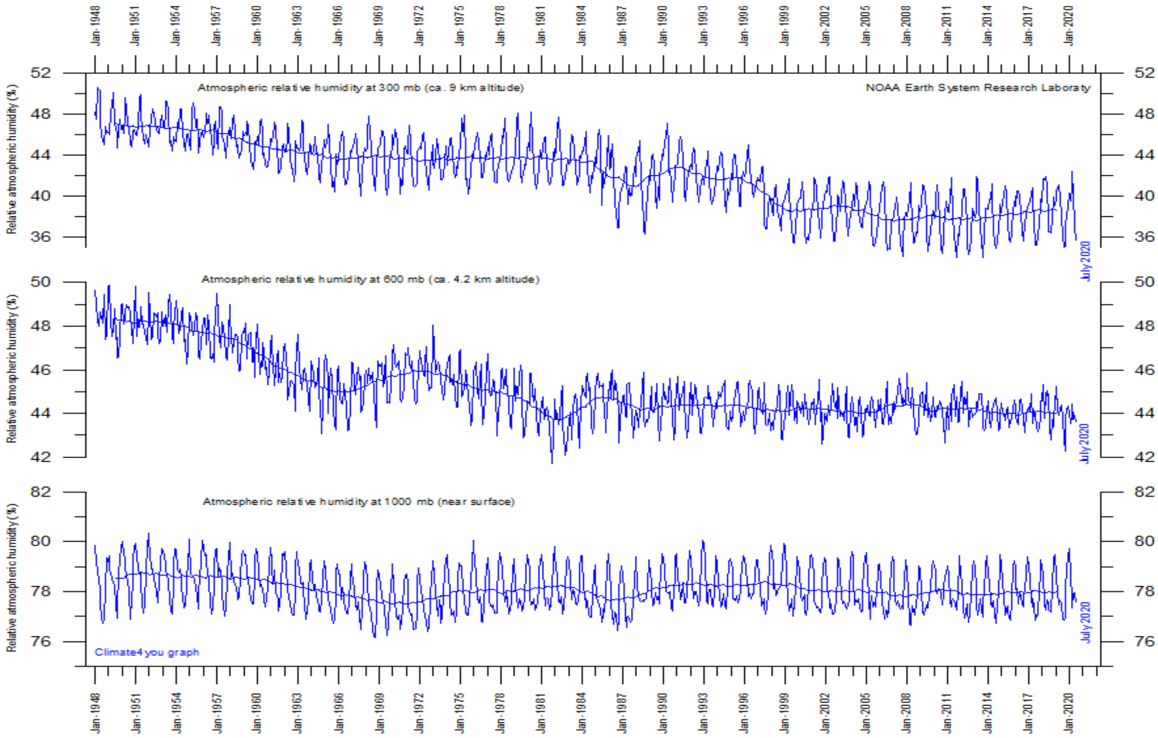

Figure 19. Atmospheric specific humidity at 300 mb (ca. 9 km altitude), 600 mb (ca. 4.2 km altitude), 1000 mb (near surface) over the period 1948-2016. Data from NOAA Earth System Research Laboratory, chart from https://www.climate4you.com/ClimateAndClouds.htm

The polytropic gravitational lapse rate, $g/(C_p+|C_h|)$ seen in one of the previous sections explains the tropospheric temperature profile, and determines the surface temperature attached by the polytropic relation $T/T_0 = (1/P_0)^{R/\mu/(Cp+|Ch|)}$ to a layer $\{P_0, T_0\}$ which radiates towards the cosmos: this layer is, because of the shape of the Planck function (depending on the optical frequency), driven by the water vapor below 600 cm^{-1} and by the clouds (present 2/3 of the time and places), which replace the surface in the 350 cm^{-1} window of water vapor. Figures 13 and 16 correspond to the less frequent case of clear skies.

The reader might probably start sensing that I feel like we have spoken way too much of CO_2 so far and that it will be soon time to move on to more important factors really playing a role on climate, leaving behind us the fantasy land of climate science.

So, it is time to draw some conclusions. **CO_2 plays a very minor role** already at the level of the physics of the atmosphere and we have not considered yet all other factors having an impact such as : variation of the orbital characteristics of the Earth (i.e. obliquity, precession, eccentricity, nutation), variable activity of the sun and the mechanisms by which they can impact clouds formation and therefore the albedo, heat storage and distribution by means of the oceans, the currents and the global atmospheric circulation, etc.

Gregory (2013) also provides a graph of the global average annual Relative Humidity (RH) from 300 mb to 700 mb, shown in next Figure 20. The specific humidity in g/kg of moist air at 400 mb (8 km) is displayed in Figure 21. It shows that specific humidity has declined by 14% since 1948 using the best fit line.

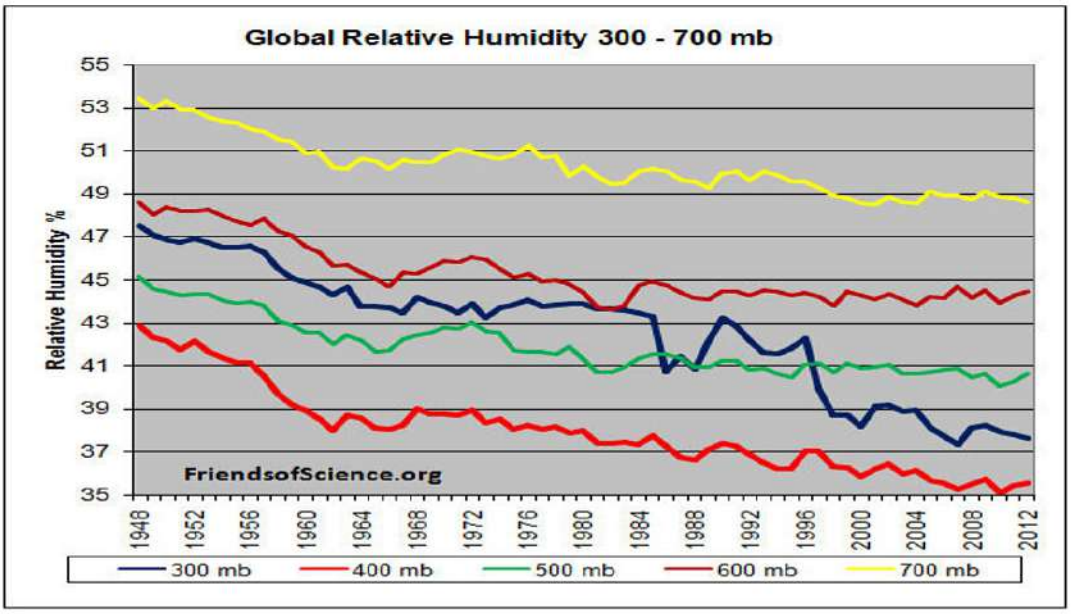

Figure *20*. *Global relative humidity, middle and upper atmosphere, from radiosonde data, NOAA Earth System Research Laboratory. These radiosonde measurements of relative humidity in the upper troposphere (1948-2012) show that increased temperature and CO_2 did not increase humidity there - the opposite of the assumptions of both General Climate Models and the IPCC. Source: Gregory (2013).*

Gregory (2013) states "*In contrast, climate models all show RH staying constant, implying that specific humidity is forecast to increase with warming. So climate models show positive feedback and rising specific humidity with warming in the upper troposphere,* ***but the data shows falling specific humidity and negative feedback***", see Figure 21. This also matches Miskolczi's (2010) findings, who reported based on the NOAA 61 year global average database that the atmosphere's moisture content during 61 years from 1948 to 2008, in global average, decreased by about 1%.

This amount was the climate process's automatic dynamic response and was enough to counter the impact of any CO_2 and methane increase. Furthermore, the Earth climate system has several other ways to self-regulate the impact of CO_2 other than humidity decrease. The possibilities involve modifications in the vertical distribution of water vapor, meridional (latitudinal) distribution of water vapor, meridional distribution of temperature, cloud reaction (e.g. average cloud cover, cloud height, cloud type, cloud thickness, etc.) making it such that "*the total long-wave feedback, including cirrus cloud variations, may even be negative*" (Lindzen, 2019).

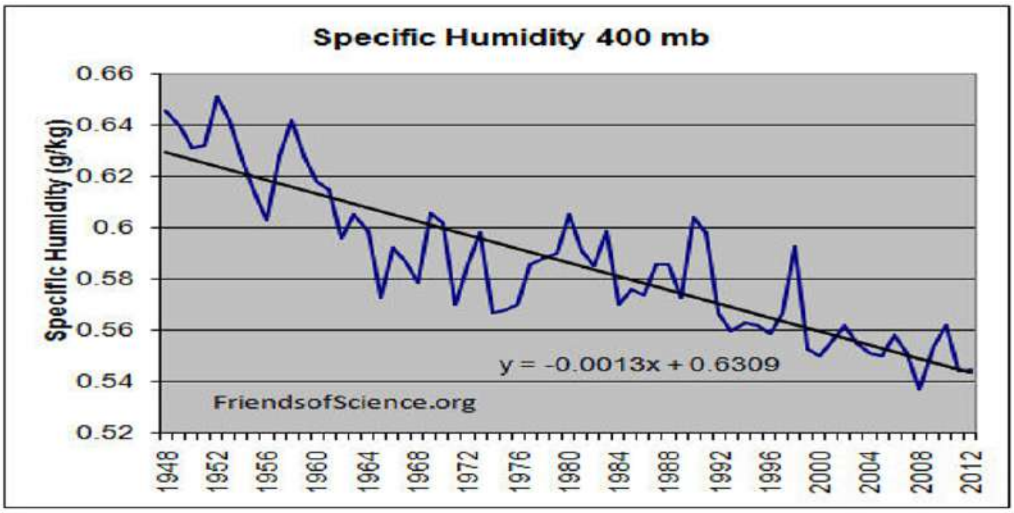

Figure *21*. Specific humidity at 400 mb pressure level. *Source: Gregory (2013).*

As far as the physics of the atmosphere is concerned, one can identify the following three major factors, dealing with the automatic adjustment of the layer of the tropopause where the water vapor radiates towards the universe, the increase of the OLR, and the albedo change:

- 1) The content of air in water vapor is roughly constant (over time) but it tends to decrease in the upper troposphere, as anticipated by Lindzen (1990) p. 296-297, and Ellsaesser (1991) and reported by Paltridge et al. (2009) in their paper "*Trends in middle- and upper-level tropospheric humidity from NCEP reanalysis data*", and displayed on Figure 20 from Gregory (2013), while the IPCC had predicted the opposite (i.e. imaginary positive feedback supposed to happen when the [CO_2] increases[76]). It is the air vapor content of water around 9 km which decreases slightly, hence a warmer and lower (altitude) radiation on 40 THz (Ellsaesser, 1991). That slight decrease in humidity around 300 mbar (i.e. ≈ 9 km of altitude) explains why the bottom of the layer of optical thickness 1.07 has come down, say, from p=300 mbar to p=311 mbar. These pressures correspond, for 288K at the surface, according to the relationship $T \sim P^{0.19}$, to temperatures of 229.1K and 230.7K. Veyres (2020) states that «*the quantity of water vapor above 500 mbar is dynamic (the relative humidity is extremely variable and unstable between 400 mbar and 200 mbar), and regulates the infrared thermal flux emitted by the globe towards the cosmos; as the caloric content of the oceans changes very little from one year to the next, by about a thousandth of the solar flux absorbed by the globe, this demonstrates the efficiency of regulation by the quantity of water vapor between 100 mbar and 400 mbar, and by the clouds. As, at these temperatures, $4\,\sigma\,T^3$ is 2.75 (W/m²) / K, we would have, in black body, a variation of the flux $4\,\sigma\,T^3\,dT$ = 2.75 (230.7K - 229.1K) = + 4.3 W/m²*».

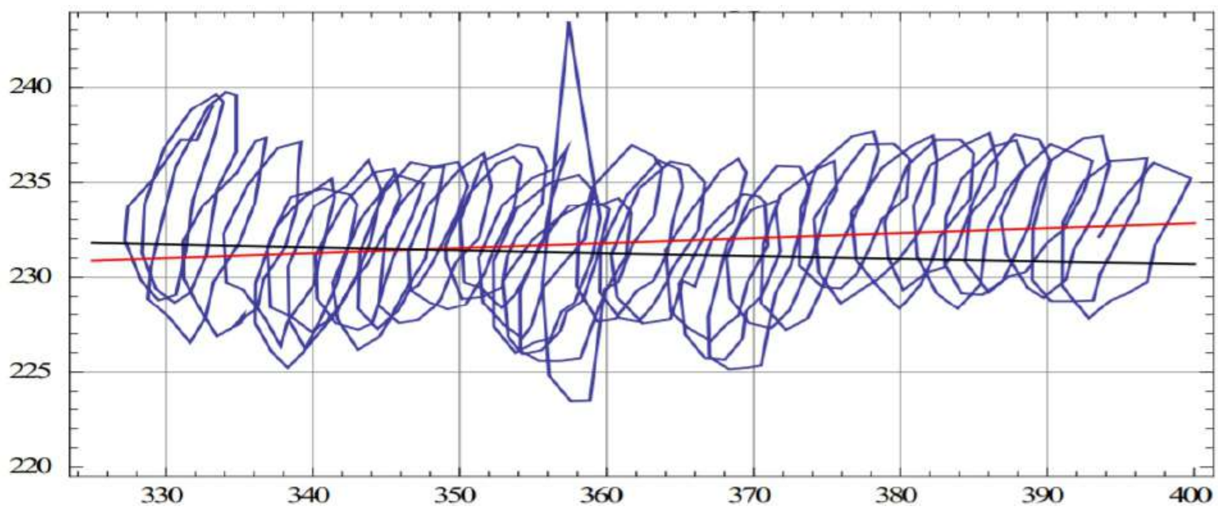

Figure 22. Average total radiation of the globe in thermal infrared (in W/m²) represented as a function of the carbon dioxide content of the air in ppm (Mauna Loa series)[77]. Note the seasonal cycles due to vegetation. Forty years of observations (1974-2014) show a slight growth (trend in red) and certainly not the trapping (or decrease in OLR) of 1 W/m² claimed to come from the greenhouse effect according to the decrease known as by the IPCC Myhre (1998) formula (black line).

The blue curve Figure 13 shows that between 200 mbar and 400 mbar water vapor radiates over about 40THz, almost 40 times the band of tropospheric CO_2 at the same altitude. Figure 15 shows that water vapor at these pressures only emits over part of the thermal infrared spectrum, around 50 THz of the 75 THz. Below 600 mbar the surface temperature determines the water vapor content of the air, but only has a radiative effect in the water vapor window: regulation is done by (low) clouds which reduce the amount of sunshine, absorb the flux radiated by the surface and radiate towards the cosmos, through their upper surface, at their own temperature. Between 400 mbar and 200 mbar the movement of air determines the amount of water vapor which observations show to provide remarkable regulation of the radiation from the air to the cosmos. **None**

76 https://climateaudit.org/2009/03/04/a-peek-behind-the-curtain/ any paper such as Paltridge et al. (2009) reporting "illegal" and "IPCC-unfriendly" results are rejected by the climate obfuscators as a capital offense, the reviewer of "*Journal of Climate*" stating "*the only object I can see for this paper is for the authors to get something in the peer-reviewed literature which the ignorant can cite as supporting lower climate sensitivity than the standard IPCC range*". Is that Science? They hide cowardly behind the anonymity of the so called peer-reviewing process to execute their dirty stint. Who are they peer of ? Not of me, Shame on them!

77 http://www.climate4you.com/GlobalTemperatures.htm#Outgoing

of these phenomenons, which have a major impact on the stabilization of the climate are properly taken into consideration by the computer climate models that, instead, focus on the sole impact of CO_2, i.e. you can't see the forest for the trees. The actual feedback of the water vapor, following a temperature rise, is therefore negative, i.e. stabilizing, which should not surprise the reader nor anyone as it if it had been otherwise the Earth climate would have experienced a runaway million(s) or hundred of millions of years ago when the [CO_2] was a lot higher (10 times).

- 2) The infrared thermal radiation from the globe to the cosmos, the OLR is approximately 240 ±3 W/m² (240 W/m² for Moranne (2020)[78]) sum of 20 W/m² coming from the surface (Costa and Shine, 2012), 20W/m² due to the emission of stratospheric ozone and CO_2 and 193 W/m² (190 W/m² for Moranne (2020)) emitted by **water vapor** which therefore **provides** roughly **83% of the OLR**. As seen before, this radiation comes from the highest layer of optical thickness 1.07 source of 80% of the photons that reach the cosmos. It is stressed by Veyres (2020) that «*the water vapor content of the lower layers (say 80% below 700 mbar) follows surface temperatures, at all time scales, but what matters for the radiation of air to the cosmos is the water vapor content of the upper layers*».

  The surface contributes very little to the OLR, e.g. Costa and Shine (2012) consider «*this indicates that less than one-tenth of the OLR originates directly from the surface*» which matches well with the previous Figure 22. Humlum[79] has drawn up estimates of the water vapor content: from 0.28 kg to 0.24 kg for a layer of 100 mbar (one tonne of air) around 300 mbar in January 1948 to June 2014 (Figure 19). We see (Figure 22) that despite an increase of 21% in the [CO_2] content, the radiation from the globe to the cosmos, i.e. the OLR, has not decreased since 1974 but to the contrary it shows a slight increase (red line Figure 22). Clouds and vapor therefore provide effective regulation. The **OLR** observed from satellites **increased** since 1974 by 1.1 W/m²/decade (Dutch Royal Meteorological Office KNMI[80]) and the ocean Heat Content increases by some 0.25 W/m² since the 1970s.

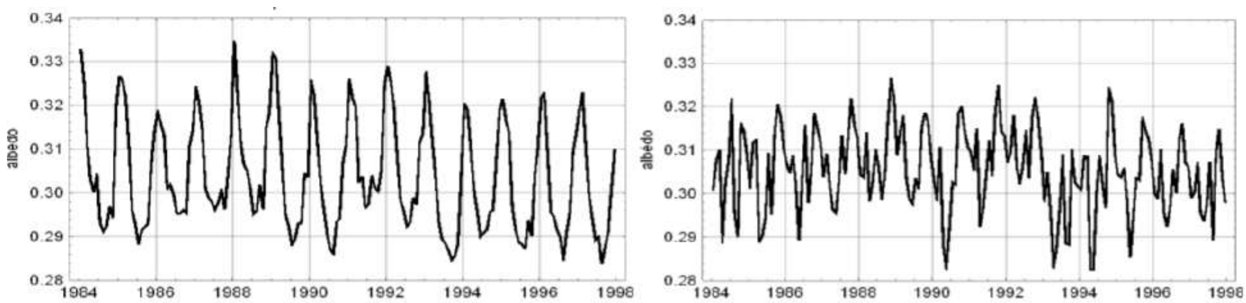

Figure 23. Albedo of the northern (left) and southern (right) hemispheres from January 1984 to December 1997. Data from Hatzianastassiou et al. (2005) plotted by Veyres (2019) suggest that the maximum albedo in the northern hemisphere comes from the cloud cover and incidentally from the snow cover in winter of the mid and high latitudes of the northern hemisphere; the maximum of cloudiness in the southern hemisphere is in southern summer (displacement towards the south of the vertical meteorological equator) and in southern winter (clouding and extension of the Antarctic pack ice). They also clearly show a decrease of the Northern Hemisphere Albedo (left) over the 1984-1998 period.

- 3) The reason why the OLR has slightly increased and the specific humidity decreased at 300 mbar - operating as a negative regulating mechanisms (and not as a positive feedback as all the IPCC AGW theory is based on) - is to be searched in an albedo change; for the record, 1% less albedo (from 31% to 30% for example) i.e. a small 3% change, and it is 3.4W/m^2 more energy received at the ground level (Hatzianastassiou et al., 2005), thus of the same order as a doubling of CO_2 would lead to. They are many reasons why the albedo may change, e.g. (Ramanathan and Collins, 1991) but has most probably a relationship to Svensmark's hypothesis of the influence of cosmic ray fluxes on the global cloud coverage (Svensmark and Friis-Christensen, 1997),

78 Raschke (1968) stated 238 W/m² a long time ago, i.e. 0.341 Cal cm^{-2} min^{-1} (Table 1, p. 10) – use to convert https://www.gordonengland.co.uk/conversion/xindex.htm, but Maurin observes that 240 W/m² is an average and that this average is illusory because the real world values are either far above or far below 240 W/m². It would be preferable to indicate a total power of 122 PW±1.5 PW. This power of 122 PW is also very unevenly emitted according to the geographical area (emitted especially in tropical areas). 1 PW = 10^{15} W.

79 www.climate4you.com

80 http://climexp.knmi.nl/data/inoaa_olr_0-360E_-90-90N_n.dat

(Svensmark, 1998), for which he coined the new term of cosmoclimatology (Svensmark, 2007; Hecht, 2007) and studied the experimental evidence for the role of ions in particle nucleation under atmospheric conditions (Svensmark et al., 2007) and demonstrated that cosmic ray decreases affect atmospheric aerosols and clouds (Svensmark et al., 2009). He also studied the response of cloud condensation nuclei (> 50 nm) to changes in ion-nucleation under atmospheric conditions (Svensmark et al., 2013), observed that increased ionization supports growth of aerosols into cloud condensation nuclei (Svensmark et al., 2017), and finally summed up his work in a very easy to read and intelligible manner into «The Sun's Role in Climate Change» (Svensmark, 2019) where it is emphasized that it is not the change of solar irradiance that generates Sun-driven climate changes, but that the Sun is really the elephant in the room that few wanted to see to its right role and that it acts via other mechanisms than a simple change of radiations as received per the Earth. Many studies confirm the link between GCR and climate series, such as (Gray et al. 2005; Perry, 2007; Laken et al. 2010; Maliniemi 2016; Maliniemi et al., 2017; Asikainen et al., 2017), some focusing specifically on the link between GCR and the albedo, what they refer to as the "umbrella effect" as Kitaba et al. (2017).

Debates concerning the link between geomagnetism and climate have been heated since Courtillot's et al. (2007) paper exploring possible connections between the Earth's magnetic field and climate. Bard and Delaygue (2008) attempted a refutation, which beyond the controversy over the role of GCRs had the merit to once again establish a clear relationship between solar activity and climate asserting "*Indeed, Holocene paleoclimatic records suggest that solar changes have contributed to relatively small climate oscillations occurring on time scales of a few centuries (Bard and Frank (2006) and references therein), similar in type to the fluctuations classically described for the last millennium: the so-called Medieval Warm Period (900–1400 A.D.) followed by the Little Ice Age (1500–1800 A.D.)*". The tentative demonstration by Bard and Delaygue (2008) to attribute the most recent warming to man-made GHGs appears particularly unconvincing as only based on modeling studies by Stott et al. (2000) and Meehl et al. (2004), i.e. virtual computer climate artifacts, they claim "*These modelling studies also suggest that the observed acceleration of the temperature rise since ~ 30 years probably exceeds the natural variability*". This is all the more surprising as one of the sources cited seems much more circumspect as Stott el al. (2000) state "*80% of observed multidecadal-scale global mean temperature variations (...) are due to changes in external forcings*" read natural phenomena and the other resorts to "ensemble simulations" the weaknesses and instability of which "butterfly effect" is well known and discussed in the section presenting Figure 100, p. 248. Thus, such a critical attribution relies on very weak evidences such as "*This recent warming phase cannot be explained by natural changes in the Sun's output, which are well constrained over the last three decades*" pretending to ignore that there is a multi-decadal hysteresis between the Sun forcing, the oceans energy storage capacity and the delayed climate response in a very complex non-linear coupled system. Furthermore, the MSU UAH Global Temperature series It not show any exceptional warming (Spencer, 2021). It seems that Bard and Delaygue (2008) want to jump to a foregone conclusion and this attempt is all the less convincing as they attribute the variations since 1850 to 1980 to the natural variability, which is obvious and very significant. The awkward shift in their argumentation for the last ~30 years, i.e. 1978-2008, based on models looks very similar to what IPCC has done since AR4 and AR5, by waiving the requirement to provide direct empirical evidences. Let's not jump to foregone inferences not properly substantiated. Exploring other mechanisms seems a much more promising route as done by Campuzano et al., (2018) who demonstrate other forms of clear relationship between geomagnetism and climate based on information theory principles and techniques. Finally, one should notice that Courtillot et al. (2008) brought a response where they state "*In any case, the relationship between climate, the Sun and the geomagnetic field could be more complex than previously imagined*" which is probably the best possible conclusion, especially as these authors envisage that to account for their observations, the geomagnetic field geometry could not have been axial and dipolar during archeomagnetic jerks that lead to a cooling climate and thus proposed a mechanism of dipole tilt or non dipole geometry. The response made by Courtillot et al. (2008) is in agreement with what is developed by Campuzano et al., (2018).

One thing known for sure since the work of Osprey et al. (2009) is the almost perfect correlation between the detected cosmic rays and the stratospheric temperature, which is understandable as follows : cosmic rays, also called muons, result from the spontaneous degradation of other cosmic rays, known as mesons. The increase in the temperature of the atmosphere results in an expansion of the atmosphere in such a way that fewer mesons are destroyed by impact on air molecules (O_2, N_2 etc...), leaving a greater number of the latter, which have escaped the impacts, to undergo the natural degradation into muons. Thus, if the temperature of the atmosphere increases, more muons are expected to be observed. But what surprised the researchers was the sudden and intermittent increase in the number of muons observed during the winter months. They verified that these more or less localized puffs of muons correspond to sudden increases in stratospheric temperature of some 40°C. Osprey et al. (2009) state "*These events are known as Sudden Stratospheric Warmings(SSW) and appear as a displacement or splitting of a large persistent low pressure* *system which resides over the pole, known as the wintertime stratospheric polar vortex*". This is an important discovery establishing the relationship of stratospheric temperature with GRCs. As will be seen later, changes in stratospheric temperatures and winds due to changes in GCRs, UV irradiance and ozone production (e.g. and associated planetary waves), have an influence on the underlying troposphere and the surface climate involves complex stratosphere-troposphere-ocean coupling chemistry-processes. The importance of such phenomena is often denied by IPCC-alarmists seeking for sole explanation the radiative role of CO_2.

So, let's give the conclusion of this section to Gregory (2013) "*Climate models predict upper atmosphere moistening which triples the greenhouse effect from man-made carbon dioxide emissions. The new satellite data from the NASA water vapor project shows declining upper atmosphere water vapor during the period 1988 to 2001. It is the best available data for water vapor because it has global coverage. Calculations by a line-by-line radiative code show that upper atmosphere water vapor changes at 500 mb to 300 mb have 29 times greater effect on OLR and temperatures than the same change near the surface.* ***The cooling effect of the water vapor changes on OLR is 16 times greater than the warming effect of CO_2 during the 1990 to 2001 period***".

Radiosonde and satellite data both show that upper atmosphere water vapor declines with warming, thus increasing the OLR which is just the opposite of what IPCC has been conjecturing. The IPCC dismisses the radiosonde data as the decline is inconsistent with theory. During the 1990 to 2001 period, upper atmosphere water vapor from satellite data declines more than that from radiosonde data, so there is no reason to dismiss the radiosonde data. Changes in water vapor are linked to temperature trends in the upper atmosphere.

Gregory (2013) also comes back on the well known "Tropical Hot Spot" issue that was expected and anticipated by IPCC models, but both satellite data and radiosonde data confirm the absence of any tropical upper atmosphere temperature amplification, contrary to IPCC theory. Gregory (2013) concludes "***Four independent data sets demonstrate that the IPCC theory is wrong. CO_2 does not cause significant global warming***". And we more than agree!

Svensmark summarizes his thoughts in this simple way "*By regulating the Earth's cloud cover, the Sun can turn the temperature up and down. High solar activity means fewer clouds and and a warmer world. Low solar activity and poorer shielding against cosmic rays result in increased cloud cover and hence a cooling. As the Sun's magnetism doubled in strength during the 20th century, this natural mechanism may be responsible for a large part of global warming seen then.*"

When one combines the Galactic Cosmic Rays (GCR) effect on the modulated cloud cover linked to solar activity (not just TSI, that is Total Solar Irradiance received at the top of the atmosphere) and changing terrestrial magnetic field, with the orbitally induced effects of the variations of the three primary factors (i.e. tilt over the ecliptic, precession(s) and eccentricity) (see section "Solar and Orbital Variations" p.141) modulated by the ever changing position of the continental masses and mountain-belts affecting the atmospheric circulation and precipitations, plus over long geological time scales the effect of the crossing of the galactic plane by the solar system (increasing GCRs), one gets a sense of what drives the climate on Earth, certainly not CO_2 concentrations, neither on decades, centuries, millenniums, or short geological nor longer time-scales.

But before jumping to conclusions, let's have a look at the "Greenhouse Mess" that unfolds before us!

7) The Greenhouse Mess

"*We shouldn't have forgotten that the system has a lot of inertia and we're not going to shift it very quickly. The thing we've all forgotten is the heat storage of the ocean — it's a thousand times greater than the atmosphere and the surface. You can't change that very rapidly* " James Lovelock (2014)

"*99.9 percent of the Earth's surface heat capacity is in the oceans and less than 0.1 percent is in the atmosphere. Further, CO_2 is only 0.04 percent of the atmosphere. It beggars belief that a trace gas (CO_2), in an atmosphere that itself contains only a trace amount of the total thermal energy on the surface of the Earth, can control the climate of the Earth. This is not the tail wagging the dog, this is a flea on the tail of the dog wagging the dog.*" Andy May (2018)

The «greenhouse» concept is probably the only one in physics for which we have several different definitions, none of them matching the others! It ranges from stories of window or of stack of windows[81] (forgetting the role of the convection in the analogy), to the idea that infra Red Absoption Gases (IRAGs) would absorb and further re-emit e.g. IPCC-GIEC AR3 (2001), to computations of the difference of what is emitted by the surface minus what is emitted by the TOA towards the cosmos, i.e. OLR as per Ramanathan et al. (1987) or others, to a radiative flux from the air that would warm the surface which does not make a lot of sense[82], to models and computations based on Stefan-Boltzmann Law (SBL) (in σT^4) [83] to obtain a (pre)determined value (e.g. 3,7 W/m^2) or mimic the radiative processes of the solar photosphere! (whereby the nuclear fusion creates the energy that radiates outwards - see p. 143, whereas the Earth atmosphere receives its SW energy from outwards), to that of an Earth without an atmosphere that would have a temperature of -18°C (justifying the «greenhouse effect») – what a strange hypothesis! Shall we remove the oceans and not the atmosphere? Or just one and not the other? Or both and reduce the size of the Earth to enable the escape of water into the interplanetary space, reduce down to what?, the Moon? So let's measure the temperature of the Moon and forget the Earth, at least this has been done properly. In fact, this confusing set of definitions and conflicting concepts is well underlined by Gerlich and Tscheuschner (2009).

So, not delving into this mess, let's remind some physics principles that everybody agrees on. All gases which are transparent to visible radiation and which partially absorb telluric infrared radiation participate in shaping the OLR spectrum presented in Figure 18 of the atmosphere. The absorption of infrared radiation depends on the structure of the molecule. Bi-atomic and symmetrical molecules (O_2, N_2, H_2 ...) are very little absorbent in the far infrared range (4 to 40 µm, range of the terrestrial IR spectrum). Triatomic or non-symmetrical molecules (H_2O, CO_2, CH4, CO ...) are much more absorbent. For a gas to play a role, it must have absorption (and therefore re-emission) properties in the thermal infrared emission domain between 4 µm and 40 µm which corresponds to the emission spectrum of a blackbody around 260 to 280K, to which the Earth is roughly assimilated. Within this spectral range some molecules absorb infrared photons in their ground states, which cause the individual atoms to vibrate with respect to each other, sometimes in a variety of different modes. Diatomic molecules like N_2 and O_2 do not have this vibration capacity and therefore do not absorb radiation in the infrared wavelength range. A responsive molecule to IR radiations has discrete or quantified energy levels which are associated with states of molecular movement: state of vibration, rotation or electronic configuration corresponding respectively to increasing energy levels. In the infrared wavelength range, the

81 Analogy already refuted by Wood (1909), «*It appeared much more probable that the part played by the glass was the prevention of the escape of the warm air heated by the ground within the enclosure*» also see (Miatello, 2012). Consider also (Lee, 1973), comment by Berry (1974) and response by Lee (1974).

82 A radiative heat transfer between two bodies A and B is the net balance of what is emitted by A and absorbed by B minus what is emitted by B and absorbed by A; indeed any body which absorbs radiation radiates at its own temperature. Trace gases absorb radiation from the surface and radiate at their temperature which, at altitude, is usually lower than that of the earth's surface; they can in no way "warm" the surface: see the second principle of thermodynamics, which prohibits the spontaneous transfer of heat from a colder to a warmer body.

83 Veyres (2020) reminds that SBL does not apply to gases which are not black bodies and that the correct calculation of the fluxes of thermal infrared radiation amounts to summing over the entire height of the air a function k (ν, P, T) π B (ν, T) weighted by a function exponential-integral 2 E_2 (τ) where τ is the optical thickness between the source and the observation point. The radiation of a uniform temperature trace gas can be estimated by an expression in $\varepsilon \sigma T^4$ with a "blackness coefficient" denoted epsilon (ε) for which Hoyt C. Hottel gave convenient abacuses, but these methods are not valid if the gas (i.e. air) is at a variable temperature for example with altitude.

absorption of radiation is much less energetic than in the visible or the ultraviolet and the energy transitions are made between the fundamental level and the vibrational levels of the molecules (rotation around imaginary axes).[84]

As we have seen Figure 13, except in the «atmospheric window» where the optical thickness is around 0.5, the atmosphere is almost completely opaque to infrared radiations, thanks to existing triatomic trace gases, H_2O and CO_2 accounting for more than 99% of the spectral response. The main active trace gas in thermal infrared is water vapor which provides 90% of the radiation from the air to the cosmos and 99% or 98% of the absorption by the air of the radiation from the surface. Carbon dioxide makes ninety thousandths of the molecules in the air, or 2% of the number of water vapor molecules which make up about 2% of the molecules in the air (highly variable from the equator to the poles). The atmospheric response to an increase of these trace gas has been approximated by many by a logarithmic expression.

Myhre et al. (1998) used three radiative transfer schemes to compute the increase in IR heat flux density (Long-wave Radiation), ΔF (in Watts/m2) which they call the "*radiative forcing*[85]", when CO_2 concentration increases from C_0 to C in ppm and obtained the following relation: $\Delta F = 5.35 \ln (C/C_0)$ in W m^{-2} (Myhre et al. (1998); Table 3, p. 2718) which shows the natural logarithmic response to an increase of the trace gas CO_2. One should notice that this evaluation was already a downwards revision «*Three radiative transfer models are used. The radiative forcing due to CO_2, including shortwave absorption, is 15% lower than the previous IPCC estimate*» (Myhre et al., 1998). But most importantly, all relationships and values for the coefficients are based on models, computer calculations «*This work presents new calculations of radiative forcing due to the most important WMGG*[86]*, using a consistent set of models and assumptions. Three radiative transfer schemes are used, a line-by-line (LBL) model, a narrow-band model (NBM) and a broad band model (BBM)*». Surprisingly enough, 19 occurrences of the word CO_2 is found, whereas none for H_2O, water vapor must not exists or must have no impact in the modeling performed by Myhre et al. (1998)! Furthermore, humidity (profiles?) (if) used in the models is (are) unknown (no occurrence of the word) and «clouds» are mentioned 3 times «*For CH4, N20, CFC-11, and CFC-12 clouds reduce the forcing by 5-7% more in the BBM than in the NBM. The high clouds in the BBM are more black than those in the NBM and therefore have a greater effect on the forcing. CO_2 is less affected by clouds than the other WMGG [Myhre and Stordal, 1997]*» and lead to «adjustments» in the Tables «*Global-Mean Adjusted Cloudy Sky Radiative Forcing*», when nothing is known of the modeling of the clouds and of how they are taken into consideration and of how the adjustments are made. Such a «model» already shows significant uncertainties and it hardly seems reasonable to use it in order to decide major disruptive economic policies, that would designate CO_2 as the enemy.

It is also the comparison of these 3 radiative transfer models that allowed Myhre et al. (1998) to propose an expression of the radiative forcing ΔF in 5.35 (W/m²) ln (C/C_0) where C is the partial pressure of «greenhouse gas» after anthropogenic disturbance in ppm and C_0 the pre-industrial value, see e.g. Ellis (2013) for how to obtain these equations:

$$\Delta F = 5.35 \ln\left(\frac{C}{C_0}\right) \tag{82}$$

The induced warming is:

$$\Delta T = 1.66 \ln\left(\frac{C}{C_0}\right) = 0.31\, \Delta F \tag{83}$$

Most IPCC authors use these formula to calculate what they consider would be the response of the Earth system to a instantaneous doubling of [CO_2], which is very straightforward though highly irrelevant (as will be detailed later) and using (91) they have ΔT = 1.66 ln (2) = 1.66 * 0.693 = 1.15 °C and ΔF = 3.71 W/m². As this does not sound very impressive, they immediately invoke the Clausius-Clapeyron Equation to evaluate what they call "the water vapor positive feedback", following somehow a similar logic as what lead to Equation (89). To better understand how these equations are obtained, e.g. Ellis (2013), let's detail how they are derived from Stefan-Boltzmann law, then will be listed some problems that arise and why their usage is inappropriate or worse even meaningless.

84 Even though the focus is on IR, one should not forget is that it is stratospheric O_3 which protects us from the incident and dangerous UV, that O_3 is naturally generated by the exposition of O_2 to UVs in the, and that with just 10^{-1}% of the atmosphere made of O_3, Earth gets a very decent protection (even down to 10^{-2}%). It has been demonstrated that with atm=1b and just 2% O_2, and even down to a tenth of that) conditions would be OK with respect to UV exposition as enough O_3 would be produced.

85 defined by IPCC as a change in net (down minus up) radiant-energy flux at the tropopause in response to a perturbation.

86 WMGG, i.e. Well Mixed Greenhouse Gases for Myhre et al. (1998)

The effective emission temperature is calculated by assuming that the rate of the Earth's energy absorption equals the rate of emission, (with the solar constant, S = 1366 W/m^2 and the planetary albedo, α_p = 0.3244) thus:

$$S\pi r^2(1-\alpha_p)=4\pi r^2\sigma T_e^4 \tag{84}$$

Stefan-Boltzmann law for the Earth as a black body[87] gives:

$$F=\sigma T^4 \tag{85}$$

Where: F is the flux density emitted in W/m^2, σ is the Stefan-Boltzmann constant, and T is the absolute temperature. Then a strange notion is defined, the effective emission temperature (T_e), which is the temperature the Earth would have without an atmosphere just taking into account its reflectivity and its distance from the sun, thus:

$$F_e=\sigma T_e^4 \tag{86}$$

As from (84) we get:

$$\sigma T_e^4=\frac{S\pi r^2(1-\alpha_p)}{4\pi r^2}=\frac{S(1-\alpha_p)}{4} \tag{87}$$

Now they define T_s, the surface air temperature and $F_{g\text{->}a}$ (ground to atmosphere) is the upward flux density (heat) radiated from the surface σT_s^4 then they calculate the vertical opacity (optical thickness) of the atmosphere τ_g using a relation derived from the general heat transfer equation and given by (Chamberlain, 1978) p. 11:

$$T_S^4=T_e^4(1+\frac{3}{4}\tau_g) \tag{88}$$

Using (86) to replace T_e^4 one gets:

$$T_S^4=\frac{F_e}{\sigma}(1+\frac{3}{4}\tau_g) \tag{89}$$

Replacing F_e by its value obtained in (87) :

$$T_S^4=\frac{S(1-\alpha_p)}{4\sigma}(1+\frac{3}{4}\tau_g) \tag{90}$$

Calculating F_s the flux from the ground to the air $F_{g\text{->}a}$:

$$F_S=\sigma T_s^4=\frac{S(1-\alpha_p)}{4}(1+\frac{3}{4}\tau_g) \tag{91}$$

We now differentiate F with respect to τ :

$$\frac{dF}{\tau}=\frac{S(1-\alpha_p)}{4}x\,\frac{3}{4}=>\Delta F=\frac{3S(1-\alpha_p)}{16}\Delta\tau \tag{92}$$

The formula given by Lenton (2000) p. 1169, Eq. (13) is used to compute Δτ :

$$\tau_{CO2}=0.457(CO_2)^{0.263} \quad \text{where } CO_2 \text{ is in ppmv} \tag{93}$$

Equation (93) is of the form:

$$\tau=aC^b \quad \text{where a and b are constants and C the } [CO_2] \tag{94}$$

The initial conditions are given by:

$$\tau_0=aC_0^b \tag{95}$$

Observing that Δτ = τ - τ_0 therefore τ = Δτ - τ_0 and dividing (94) by (95) and taking the natural logarithm of both sides one gets:

$$\ln(\frac{\Delta\tau-\tau_0}{\tau_0})=\ln C^b-\ln C_0^b=b\ln C-b\ln C_0=b(\ln C-\ln C_0)=b\ln\frac{C}{C_0} \tag{96}$$

now taking the exponential:

$$\frac{\Delta\tau-\tau_0}{\tau_0}=e^{b\ln(\frac{C}{C_0})} \tag{97}$$

Thus:

$$\Delta\tau-\tau_0=\tau_0 e^{b\ln(\frac{C}{C_0})} \tag{98}$$

87 The Earth as an IR source can be considered as a "Black Body", certainly not the atmosphere where the temperature changes as per the gravitional lapse rate. Many problems will arise from this wrong assumption used for the atmosphere.

And finally:

$$\Delta\tau = \tau_0 (e^{b \ln(\frac{C}{C_0})} - 1) \quad \text{where b=0.263} \tag{99}$$

Therefore as :

$$\Delta F = \frac{3S(1-\alpha_p)}{16} \Delta\tau = \frac{3S(1-\alpha_p)}{16} \tau_0 (e^{b \ln(\frac{C}{C_0})} - 1) = \frac{3S(1-\alpha_p)}{16} \tau_0 (e^{0.263 \ln(\frac{C}{C_0})} - 1) \tag{100}$$

with:

$$\Delta F = \Delta F_{a\text{->}g} = f_a \, x \, \Delta F_{g\text{->}a} \tag{101}$$

where

$$f_a = \frac{1}{A} \; and \; A = 1 + \frac{3}{4} \tau_g \tag{102}$$

therefore with $f_a = 0.6$:

$$\Delta F = f_a \frac{3S(1-\alpha_p)}{16} \tau_0 (e^{0.263 \ln(\frac{C}{C_0})} - 1) \tag{103}$$

As the identity applies $e^x \approx 1 + x$ for $x < 1$ thus with

$$x = 0.263 \ln(\frac{C}{C_0}) \tag{104}$$

Then:

$$e^{0.263 \ln(\frac{C}{C_0})} - 1 \approx 0.263 \ln(\frac{C}{C_0}) \tag{105}$$

As:

$$0.263 \ln(\frac{C}{C_0}) < 1 \; for \; C_0 = 300 \; ppm \; and \; 300 \leq C \leq 1000 \; ppm \tag{106}$$

Then:

$$\Delta F = 0.6 \, x \, 173.0 \, x \, 0.201 \ln(\frac{C}{C_0}) = 5.487 \ln(\frac{C}{C_0}) \tag{107}$$

Furthermore, as indicated by Ellis (2013) "*due to a small correction that reduces ΔF by 0.06 w m^{-2} (absorption of high frequency solar radiation)*" one gets Myhre et al. (1998) relation (82) :

$$\Delta F = 5.40 \ln(\frac{C}{C_0}) \tag{108}$$

Let's now see how Equation (83) can be established. The following hypotheses are made by the AGW supporters: they assume that the atmosphere behaves as a Grey body (but using SBL they also assume they can perform computations only applying for a Black body). The "Grey atmosphere" assumption entails that it is transparent to visible radiation and heating only occurs at the Earth's surface (but as 19% of the incident sunlight is already absorbed by the atmosphere and the clouds, we start with bold assumptions). Furthermore, they consider that there is no convection (!), that scattering can be neglected (!), that the atmosphere is in a radiative and thermodynamic equilibrium (!) and that in a localized atmospheric volume below 40 km it is considered to be isotropic (emission is non-directional) with a uniform temperature (!), and as if not enough with unrealistic hypotheses, state that the emissivity equals absorptivity, probably to make Kirchhoff's Law[88] applicable. The Grey atmosphere is also based on the simplification that the absorption coefficient α_v of matter within the atmosphere is constant for all frequencies of incident radiation and therefore has no dependence on frequency (obviously false). Not sure that it makes sense after all these non satisfied assumptions[89] to

88 Kirchhoff's law of thermal radiation states that any material body capable of absorbing a radiation is, itself, a radiation emitter, at the same wavelengths, but requires that the material body be in thermodynamic equilibrium, including radiative exchange equilibrium. Kirchhoff's law states that: for a body of any arbitrary material emitting and absorbing thermal electromagnetic radiation at every wavelength in thermodynamic equilibrium, the ratio of its emissive power to its dimensionless coefficient of absorption is equal to a universal function only of radiative wavelength and temperature. That universal function describes the perfect black-body emissive power.

89 Considering the lifetime of the excited states of CO_2, and for the lower part of the atmosphere, Geuskens (2019) explains "*the deactivation of CO_2 molecules will not be done with emission of radiation. The reason is that at pressures close to an atmosphere, fluorescence could compete with collision deactivation only for very short-lived excited states (10-9 to 10-7 s) which could*

go any further, but for sake of completeness and not conviction it will be shown how (83) is obtained. We will restart from Equations (86) and (87). The Earth surface as a black body radiates upwards and the fraction of that upward flux of IR radiation (heat) that is captured by the atmosphere, will be referred to as φ_u (simplified to φ in the coming equations) and applying Kirchhoff's law will be equal to the flux emitted by the atmosphere (the coefficient used in the literature will often be ϵ – sort of a flux-weighted "emissivity"[90]).

So, of the upward flux emitted by the surface (86) the atmosphere absorbs F_{abs}:

$$F_{abs}=\varphi_u \sigma T_s^4 \tag{109}$$

The radiation absorbed in the upper atmosphere at temperature T_a is re-emitted equally in all directions, half upward and half downward (the flux density at the TOA is given Equation (124)). Hence

$$\varphi \sigma T_s^4=2\varphi \sigma T_a^4 \, and \, T_a^4=\frac{T_s^4}{2} \tag{110}$$

As we wish to create a relation that will link ΔT to ΔF we will establish a relation between Ts and F by means of:

$$\frac{dT_s}{dF}=\frac{dT_s}{d\tau}\frac{d\tau}{d\varphi}\frac{d\varphi}{dF} \, with \, \varphi=\left(1-\frac{1}{A}\right) with \, A=1+\frac{3}{4}\tau_g \tag{111}$$

Now we will calculate each of the terms dTs / dτ; dτ / dφ and dφ / dF, let's start from Equation (88) and derive:

$$T_s=\left(T_e^4+T_e^4\frac{3}{4}\tau_g\right)^{1/4} \tag{112}$$

Taking the derivative of (112) with respect to τ_g, one gets:

$$\frac{dT_s}{d\tau}=\frac{1}{4}\left(T_e^4+T_e^4\frac{3}{4}\tau_g\right)^{\left(\frac{-3}{4}\right)}.\frac{3}{4}T_e^4 \tag{113}$$

Thus:

$$\frac{dT_s}{d\tau}=\frac{3}{16}\frac{T_e^4}{\left(T_e^4+T_e^4\frac{3}{4}\tau_g\right)^{\left(\frac{3}{4}\right)}}=\frac{3}{16}\frac{T_e^4}{\left(T_e^4\left(1+\frac{3}{4}\tau_g\right)\right)^{\left(\frac{3}{4}\right)}}=\frac{dT_s}{d\tau}=\frac{3}{16}\frac{T_e^4}{T_e^3\left(1+\frac{3}{4}\tau_g\right)^{\left(\frac{3}{4}\right)}} \tag{114}$$

Then:

$$\frac{dT_s}{d\tau}=\frac{3}{16}\frac{T_e}{\left(1+\frac{3}{4}\tau_g\right)^{\left(\frac{3}{4}\right)}} \tag{115}$$

Inverting (88) one gets:

$$T_e^4=\frac{T_s^4}{\left(1+\frac{3}{4}\tau_g\right)} \tag{116}$$

Which gives:

$$T_e=\left(\frac{T_s^4}{1+\frac{3}{4}\tau_g}\right)^{1/4}=\frac{T_s}{\left(1+\frac{3}{4}\tau_g\right)^{1/4}} \tag{117}$$

Now replacing T_e given by (117) in Equation (115) one gets:

$$\frac{dT_s}{d\tau}=\frac{3}{16}\frac{T_s}{\left(1+\frac{3}{4}\tau_g\right)^{\left(\frac{3}{4}\right)}\left(1+\frac{3}{4}\tau_g\right)^{\left(\frac{1}{4}\right)}}=\frac{3}{16}\frac{T_s}{\left(1+\frac{3}{4}\tau_g\right)} \tag{118}$$

Finally with A defined Equation (102) :

deactivate by fluorescence before a sufficient number of collisions with the surrounding molecules occur. However, the lifetime of the lowest excited state of CO_2 being 0.64 s, millions of collisions will occur before the emission of radiation can take place. The hypothesis of ***the greenhouse effect is therefore without theoretical foundation***".

90 One should notice that the thermal emission that arises from the solar corona, certainly comes from gases but looks nothing like blackbody radiation. Therefore, ϵ is basically a fudge factor that means the total power emitted is corrected for the fact your gas is not a blackbody. But ϵ is not an intrinsic property of the gas - it depends on composition, pressure, density and geometry. In such cases, it is also not at all a given that ϵ is temperature independent(!) because the amount of emission from a gas does not necessarily depend on T^4.

$$\frac{dT_s}{d\tau}=\frac{3T_s}{16A} \tag{119}$$

Let's now calculate dτ / dφ starting with:

$$\varphi=2(1-\frac{1}{1+\frac{3}{4}\tau_g}) \tag{120}$$

Thus:

$$\frac{d\varphi}{d\tau}=\frac{d(2-\frac{2}{1+\frac{3}{4}\tau_g})}{d\tau}=\frac{d(-2(1+\frac{3}{4}\tau_g)^{-1})}{d\tau}=2(1+\frac{3}{4}\tau_g)^{-2}\frac{3}{4}=\frac{3}{2}\frac{1}{(1+\frac{3}{4}\tau_g)^2} \tag{121}$$

Then finally dτ / dφ:

$$\frac{d\tau}{d\varphi}=\frac{2}{3}A^2 \tag{122}$$

We now need dφ / dF. The AGW theory makes the highly debatable hypothesis that the radiation absorbed in the upper atmosphere at temperature Ta is re-emitted equally in all directions, half upward and half downward. Hence:

$$\varphi\sigma T_s^4=2\varphi\sigma T_a^4 \text{ and } T_a^4=\frac{T_s^4}{2} \text{ with } T_s\approx 288\,°K \text{ and } T_a\approx 242\,°K \tag{123}$$

The flux density out of the top of the atmosphere (TOA), (sum of the part absorbed and re-emitted half upward and half downward $\varphi \sigma T_a^4$ and of the part emitted by the surface and not absorbed $(1-\varphi) \sigma T_s^4$) is given by:

$$F_{TOA}=\varphi\sigma T_a^4+(1-\varphi)\sigma T_s^4 \text{ thus } dF_{TOA}=d\varphi(\sigma T_a^4-\sigma T_s^4)=d\varphi\sigma\frac{T_s^4}{2} \tag{124}$$

From (124) we can deduce what we need, i.e. dφ / dF:

$$dF=d\varphi\sigma\frac{T_s^4}{2} => \frac{2\mathrm{dF}}{\sigma T_s^4}=d\varphi => \frac{d\varphi}{dF}=\frac{2}{\sigma T_s^4} \tag{125}$$

We now have all we need to compute Equation (111).

$$\frac{dT_s}{dF}=\frac{3T_s}{16\mathrm{A}}.\frac{2}{3}A^2.\frac{2}{\sigma T_s^4}=\frac{A}{4\sigma T_s^3} \tag{126}$$

From Equation (90) we derive that:

$$\sigma T_S^4=\frac{S(1-\alpha_p)A}{4} => \sigma T_S^3 T_s=A(1-\alpha_p)S => \frac{A(1-\alpha_p)S}{T_s}=4\sigma T_S^3 => \frac{(1-\alpha_p)S}{T_s}=\frac{4\sigma T_S^3}{A} \tag{127}$$

We finally get what we need for Equation (126):

$$\frac{A}{4\sigma T_S^3}=\frac{T_s}{(1-\alpha_p)S} \text{ Thus } \Delta T_s=\frac{T_s}{(1-\alpha_p)S}\Delta F=\frac{T_s}{928.88}\Delta F=0.31\,\Delta F \tag{128}$$

Therefore we have established Equation (83) ΔT = 0.31 ΔF and by substituting ΔF by its value given by Equation (82):

$$\Delta T_s=\frac{T_s}{(1-\alpha_p)S}.5.35\ln\frac{C}{C_0}=\frac{T_s}{173.62}\ln\frac{C}{C_0} \text{ with } T_s=288.15\,°K => \Delta T=1.66\ln\frac{C}{C_0} \tag{129}$$

Thus (129) also gives ΔT= 1.66 ln (C/C_0) as per Equation (83).

So now that we have established the basic equations of the AGW theory (most of them completely unrealistic as related to a Black body and Grey atmosphere that do not exist), let's see how after calculating the T increase due to a fantasy immediate doubling we are now going to quadruple down with the invoked “positive feedback” of water vapor. The increased surface temperature from the instant doubling of CO_2 content (!) allows an increased water vapor content by maintaining a constant relative humidity and increases the optical thickness, this additional opacity increases the overall absorption by water vapor itself raising the surface temperature further, this is referred to here as the disingenuous scenario. The opacity of water vapor is a function of the water vapor partial pressure (P) and is given by Lenton (2000) as $\tau = 0.0126\ P^{0.503}$.

Elementary derivation of $(u^n)'=n\ u^{n-1}\ u'$ gives by differentiation:

$$\Delta\tau = 0.00634\frac{\Delta P}{P_0^{0.497}} \tag{130}$$

The water vapor partial pressure is a function of temperature and relative humidity and the formula given by Lenton (2000) p. 1169, Eq. (13) already mentioned is reproduced (though I do not see the need of the external parenthesis?) :

$$P = H\left(P_0 e^{-\left(\frac{L}{RT}\right)}\right) \tag{131}$$

Where: R = 8.3145 $Jmol\text{-}1K^{-1}$, molar gas constant ;
L = 43655 $Jmol^{-1}$, latent heat per mole of water ;
P_0 = 1.4 x 1011 Pa, water vapor saturation constant ;
H = 0.77, global average relative humidity.

Using Equation (131) and T = 288.15°K we obtain P_0 = 1315.86 Pa. The extra water vapor contained by the warmer atmosphere raises the partial pressure. If P1 and P2 are the partial pressures at two temperatures T1 and T2 respectively, Equation (131) takes the form:

$$P_2 = P_1 e^{-\left(\frac{L}{R}\right)\left(\frac{1}{T_2}-\frac{1}{T_1}\right)} \tag{132}$$

Using Equation (132) let's calculate the increase in partial pressure when the temperature increases from 288.15°K to 289.35°K, we get: P_2 = 1419.15 Pa and for P_1 = 1315.86 Pa , we get a ΔP = 103.30 Pa. Using Equation (130) one gets: Δτ=0.01844. From Equations (91) and (119) and after having calculated A=1.6837 and τg = 0.9116 one gets:
ΔT = 32.09 Δτ = 0.5917°C. This further increase in surface temperature will cause another cycle of water vapor feedback and so on and Ellis (2013) states "*temperature converges to 290.54°K after 12 cycles of the water vapor feedback loop*".

This is how the disaster fable is constructed, piling up mistaken physics based on unrealistic assumptions and inexistent "Grey atmosphere", doubling down on an immediate massive increase of CO_2 leading overnight to 800 ppm (!) for a mere 1.2°C and quadrupling down with instantaneous "positive feedback" that hardly nudge up the figure by 2.39°C, all together leading to a frightening 3.59°C, that... will never happen. Let's come to our senses now and let's see why we have played the game of the flawed exercise of the college Physics course.

Retrieving these equations is important as they are constantly reminded by the AGW supporters as the basis of the theory. The problem with them is that they do not even make a decent exercise for a physics textbook for college students. They are built on flawed assumptions, absurd limit conditions and completely neglect all biological, geochemical and geophysical phenomenons at play. Normally, a college exercise is a simplification of a complex problem such that it can be understood and calculated in a rather straightforward manner without distorting the very essence of the subject and would in the end contribute to enlighten the student to the complexity of the matter. None of these requirements are met as the atmosphere does not satisfy the black body assumption (above all, the atmosphere is not homogeneous, especially for water!) on which most of the reasoning depends and that would enable the use of Stefan-Boltzmann law, it does not satisfy none of the "Grey atmosphere" criterion either, the overnight doubling is preposterous and does not correspond to any logical physical processes and does not permit any useful simplification that would enable to better approach the problem, and the immediate response to a doubling by the "*positive-feedback*" of water vapor following Clausius-Clapeyron law quadruples down on stupid assumptions, that will never be met and does not present even educative virtues. It is a castle of cards built on a set of small equations supposed to strengthen the confidence of naive readers in badly modeled and absurdly represented real phenomenons. The AGW proponents will tell you that this sand castle should not be discussed, that science is settled and that the "greenhouse effect" is well understood. Once you carefully vet how these equations are established, the only thing which appears clearly is that they bear no resemblance to reality for many reasons:

- The first spurious choice is to derive these equations from the Stefan-Boltzmann's formula in σT^4, as it is only valid for a black body and certainly not for a gas, so only a small part of the reasoning developed to obtain the classical relationships by Myhre et al. (1998) holds, and e.g. Equation (82) makes more sense than (83) for the simple reason that the derivation of the first is mostly based on the radiation emitted by the surface which behaves somehow as a blackbody (even though 101 is debatable) whereas the second resorts to modeling the emission of the gas at various heights as if a blackbody relationship in σT^4 would hold in that case which is not true. The absorption spectrum of the gas, as shown in Figures 13, 15, 16, must be taken into account: for example, at Earth's air temperatures, CO_2 only radiates significantly between the optical frequencies 595 cm^{-1}

and 740 cm^{-1}, where its optical thickness is at least 2, and not over the entire useful spectrum at the temperatures in question (100 cm^{-1} to 2500 cm^{-1}). Figures 13, 15, 16, show that CO_2 is superimposed on water vapor acting first over almost the entire spectrum up to around 770 cm^{-1}. Water vapor, whose content decreases very rapidly with temperature, is concentrated in the lower layers (80% below 700 mbar at about 3 km), whereas CO_2 is in uniform proportion over the entire height of the air (70% above 700 mbar). This is why CO_2 contributes only 1% to 2% to the absorption of radiation from the surface by the air, whereas water vapor provides 98% or 99% of this absorption: the bulk of the CO_2 at altitude only sees the little that has escaped absorption by water vapor from the lower layers and by low clouds[91];

- The second major problem is to postulate that it would make sense to compute the reaction of the atmosphere to an instantaneous doubling of the CO_2 concentration as if we were in a laboratory experiment - some authors even go as far as running computer models for an abrupt quadrupling as Block and Mauritsen (2013) ! These are preposterous limit conditions, as not only a doubling might never happen at all, but what is currently observed is an increase of sort of 2 ppm per year which furthermore does not show any clear relationship with the anthropogenic emissions[92] (see Figure 24) - the only statistical meaningful correlation that can be demonstrated is with the tropical oceanic temperature which drives the degassing (see Figure 8) - and at this rate would take hundred of years for a doubling. To make things worse, after a clueless doubling the water vapor is supposed to derail the climate by quadrupling down on nonsensical hypotheses by having also an immediate and massive response. This is how from a first foolish hypothesis delivering a mere 1.2°C temperature rise (Equation 83) not frightening enough the minds, scare mongers quadruple down on stupidity with the immediate "positive feedback" to nudge things up to a bit more than 3°C. Playing the game of stupid assumptions, i.e. an instantaneous doubling of [CO_2] and immediate water vapor feedback, the maximum that can be reasonably calculated is an increase of 0.48°C as obtained by the reasoning leading to Equation (81) p.61. So not only the doubling is supposed to happen overnight overpowered by the immediate feedback, but the Earth system is not supposed to budge one iota to adapt to any change, nothing is possible and none of the three major factors that have been listed at the end of the previous section can apply in this disingenuous scenario. In fact and as reported there exists an automatic and continuous adjustment of the layer of the tropopause where the water vapor radiates towards the universe (TOA), an increase of the OLR entails, and the modeling of an albedo change as clouds adjust their response to the climate system should be understood and taken into account. So far the only honest acknowledgment made is that clouds are not at all properly taken into account, e.g. Ramanathan et al. (1989) state: "*The study of climate and climate change is hindered by a lack of information on the effect of clouds on the radiation balance of the earth, referred to as the cloud-radiative forcing. The size of the observed net cloud forcing is about four times as large as the expected value of radiative forcing from a doubling of CO_2. The shortwave and long-wave components of cloud forcing are about ten times as large as those for a CO_2 doubling. Hence, small changes in the cloud-radiative forcing fields can play a significant role as a climate feedback mechanism.*", and one should remember that as per Ramanathan et al. (1989), **clouds (forcing) have effects ten times larger than a doubling of [CO_2]** !;

- The third condition taken for granted in Equation (82) and (83) is that there is only one reservoir, i.e. the atmosphere, and that not only it does not exchange with the others but it is supposed to remain the only one to store the man-made emissions. This is plain wrong, not only there is a fast circulation of any CO_2 molecule, the residence time being of five years, but many reservoirs are involved at any time, the oceans, the soils, the vegetation[93] (in all forests, tropical, temperate and boreal together, approximately 31 percent of the carbon is stored in the biomass and 69 percent in the soil). Furthermore, the amount of Dissolved Organic Carbon (DOC)

91 Furthermore, atmospheric pressure greatly affects the absorption spectra of CO_2. This observation poses a major problem in calculating the transfer of infrared radiation through the atmosphere with variations in pressure, temperature and gas abundance. At high altitudes and low pressures the absorption bands are very narrow and very intense while at high pressures and low altitudes the bands are wider and less intense. But the thermal radiation from the edges of the CO_2 absorption bands then reaches Space directly without re-absorption by other molecules at high altitude and low pressure.

92 Since 1880, the only period of covariation between the Global Mean Temperature (GMT) and CO_2 content was 1978-1997. From 1910 to 1940, GMT increased at the same rate as 1978-1997 when emissions were insignificant. From 1950 to 1978, when CO_2 emissions were soaring, the GMT decreased.

93 "*Photosynthesis increases with increasing CO2 following a Michaelis−Menton curve, and this effect grows stronger at higher temperatures, implying, all else being equal, larger effects in warmer climates (9–11), especially in the tropics. Theory and experiments agree in suggesting a CO_2driven net sink that should be roughly proportional to overall productivity (13) leading to a large sink in the tropics, a prediction that should be testable with global observations. The CO_2 effect likely acts as a significant negative feedback in today's global carbon cycle, absorbing up to 30% of fossil fuel CO_2 emissions*" (Schimel et al., 2015)

and Particulate Organic Compounds (POC) in the oceans that precipitate and the speed at which the process happens is highly unconstrained and could reach several Gt-Cs and the amount of inorganic carbon that also precipitate above the Carbonate Compensation Depths (CCD) is also rather unknown. All these uncertainties are well reflected by the missing C of the IPCC carbon budget where the pundits keep wondering where their CO_2 has gone as they cannot even count their eggs.

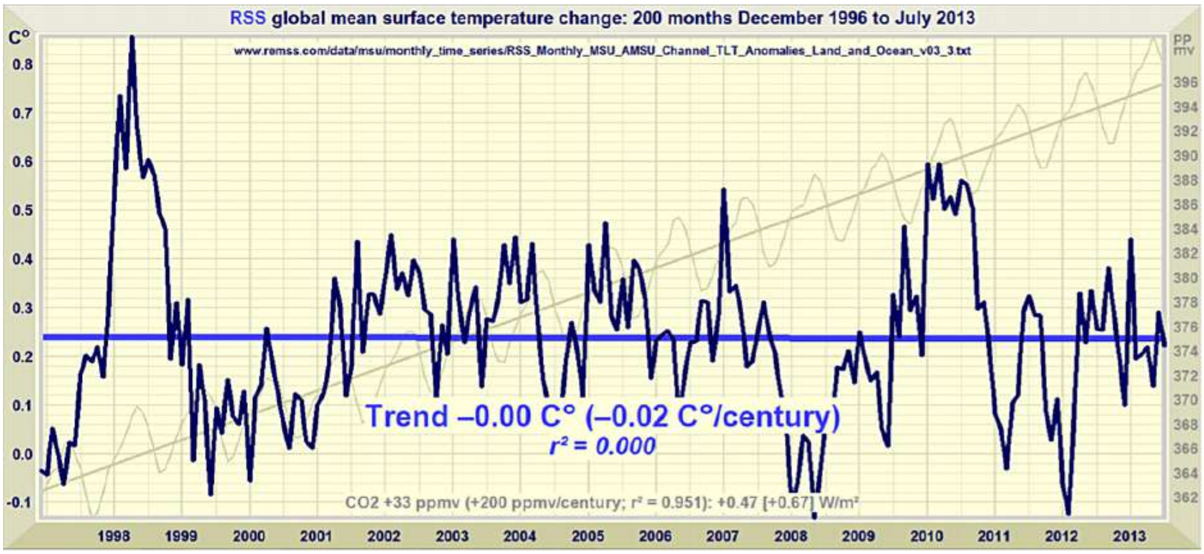

Figure 24. Monthly global mean surface air temperature anomalies, December 1996 to July 2013 (Remote Sensing Systems, Inc.)[94], showing **no trend** over 16 years and 8 months (200 months), **notwithstanding a rising trend in carbon dioxide** concentrations (grey line and curve) from 362 to 398 ppm at a rate equivalent to 200 μatm century^{-1} (NOAA, 2013), implying a radiative forcing of 0.47 W m^{-2} from carbon dioxide alone. From Legates et al. (2015). Another example is over the period 1950-1970 temperature anomalies (HadCRUT4.4) **fell** while [CO_2] steadily **increased**, this is referred to as the "Big hiatus" (Fyfe et al., 2016).

So we have a fantasy tale, where physics laws are used in an inappropriate manner, with limit conditions that are not probable but simply impossible and a perimeter of definition of the physical system studied that is absurd. This is where we stand with respect to this well known green-house effect that does not require any further discussion as it is supposed to be settled science. As said their calculations would not even make a decent college exercise as they totally distort the reality of the phenomenons and do not contribute nor help to grasp the reality of the complex climate drivers studied. The worse is that it is as good as it gets, given that when you consider the IPCC documents (IPCC, 2013) it simply becomes even worse and appalling as explained in the relevant section "IPCC and its Unlikely Physics of Climate Change" p.337.

When qualms were raised by Bardinet and the climato-realists[95] stressing the improper usage of SBL for example, they got from Bréon[96] the following answer "*It is not the IPCC that applies it to gases; it is the entire scientific community that is somewhat competent on these subjects and has been for several decades. The IPCC is merely a transcription of what is found in the scientific literature. Stefan-Boltzmann's law applies to any body that absorbs electromagnetic radiation and therefore to absorbent gases*". What an incredible admission, and what a strange "*scientific community*" that ignores elementary physics and shamelessly proclaims such nonsense. If you are a physicist and cannot believe it, read it again!

The herd mentality as a justification for an improper usage of physics' laws seems rooted in some human behavior as reminded to us by Freeman Dyson «*When I was in high-school in England in the 1930s, we learned that continents had been drifting according to the evidence collected by Wegener. It was a great mystery to understand how this happened,*

94 Temperature data (T) on this graph have seemingly been revised by Mears and Wentz (2017) due to various corrections applied since the graph was created by Legates et al. (2015). But, whatever the corrections be, there is simply no match between T and the ever increasing emissions. Temperatures have gone up since the end of LIA, long before the emissions became significant, in a rather chaotic manner (e.g. with the "big hiatus" 1950-1976 with no increase at all) whereas emissions have followed the - exponential - population increase ! See Fig 1. of Hansen et al. (2013b) or Fig 1. of Hansen et al. (2014) for the period [1880-2014].

95 https://www.climato-realistes.fr/

96 https://www.researchgate.net/profile/Francois-Marie_Breon

but not much doubt that it happened. So it came as a surprise to me later to learn that there had been a consensus against Wegener. If there was a consensus, it was among a small group of experts rather than among the broader public. I think that the situation today with global warming is similar. Among my friends, I do not find much of a consensus. Most of us are skeptical and do not pretend to be experts. My impression is that the experts are deluded because they have been studying the details of climate models for 30 years and they come to believe the models are real. ***After 30 years they lose the ability to think outside the models****.* ***And it is normal for experts in a narrow area to think alike and develop a settled dogma****. The dogma is sometimes right and sometimes wrong. In astronomy this happens all the time, and it is great fun to see new observations that prove the old dogmas wrong*».

As reminded by Veyres (2020) «*Since radiative forcing is, by definition, neither observable nor measurable, people rely on computer simulations and take the average of the results of different computer programs, obviously all questionable. Radiative forcing is a calculation made in a virtual world, so virtual that it was arbitrarily increased by 50% by the IPCC between the 2007 report and the 2013 report without anything having changed much in six years».* You feel reassured?

Veyres (2020c) gives details of the more accurate calculation of radiative fluxes and radiative cooling of air in diffuse radiation than was improperly obtained by the inappropriate usage of Stefan-Boltzmann law "*The descending radiative flux from the top of the air (optical thickness τ=0) to the altitude point y where the optical thickness counted from the top of the air is τ(ν, y) and the ascending flux from the surface where τ(ν, 0)= τ_{max}(ν) are, if there are no clouds or diffusing aerosols, expressed by simple formulae with respect to the optical thickness variable τ : these formulae express the sum over all the layers of the air of the radiation of a layer multiplied by the attenuation between this layer and the observation point here noted y*". The optical thickness also referred to as the optical depth of the atmosphere is the correct parameter upon which should depend all calculations of diffuse radiative fluxes in an absorbent and scattering medium like the air (Chandrasekhar, 1947, 1948a-b, 1950; Chandrasekhar and Breen, 1948; King, 1956; Goody, 1964; Kondratyev, 1969; Goody and Yung, 1995; Harries et al., 2008).

Any body that absorbs radiation at a frequency radiates at that frequency but at its own temperature, so does a gas. The descending flux is the sum of the downward flow from the top of the air (τ=0) to the observation point τ(ν,y) and is given by $\varphi_{descending}$:

$$\varphi_{descending}(\nu, y)=\pi \int_{0}^{\tau(\nu, y)} B(\nu, T(\tau))\, 2 E_2(\tau(y)-\tau)\, d\tau \qquad (133)$$

And the ascending flux (see also Wijngaarden van and Happer (2020) Eq. 31 p. 10), sum of the upward flow as of the surface, where τ(ν, 0)= τ_{max}(ν), is given by $\varphi_{ascending}$:

$$\varphi_{ascending}(\nu, y)=\pi \int_{\tau(\nu, y)}^{\tau_{max}} B(\nu, T(\tau))\, 2 E_2(\tau-\tau(y))\, d\tau \qquad (134)$$

And the flux emitted by the surface[97] $\varphi_{surface}$:

$$\varphi_{surface}(\nu, y)=\pi\, B(\nu, T_{surface})\, 2 E_3(\tau_{max}-\tau(y)) \qquad (135)$$

and again the ascending flux by:

$$\varphi_{ascending}(\nu, y)=\pi \int_{0}^{\tau_{max}-\tau(\nu, y)} B(\nu, T(\tau'+\tau(\nu, y)))\, 2 E_2(\tau')\, d\tau' \qquad (136)$$

where E_2 and E_3 are special functions called exponential integral[98] e.g. (Goody and Yung, 1995, Appendix 6, p. 475; Tjemkes, 1988), and B(ν, T) the function of Planck at the optical frequency ν and temperature T, e.g. (Goody and Yung, 1995; Appendix 5, p.472). It remains to set T(τ) and therefore τ as a function of pressure or altitude, with the previously described polytropic expressions (e.g. Equations 77, 78, 79) giving e.g. T, P, ρ, V as a function of T and P.

97 A more complete form of (135) is given by Goody and Yung (1995) Equation (2.107) p. 50

98 For diffuse radiation coming from all directions, the transmission is 2 $E_3(\tau)$ where $E_3(\tau)$ is a special function called exponential-integral of index three. 2 $E_3(\tau)$ is approximated by $E_3 \approx \exp(-\tau) / (1 + 0.676\, \tau^{0.886})$. The absorption 1-2 $E_3(\tau)$ is 50%, 80%, 94% and 98.2% respectively for τ=0.42, 1.07, 2 and 3. The optical thickness τ depends of course on the optical frequency ν (or wavelength) and will be noted τ(ν). E_2 is given by $E_2 \approx \exp(-\tau) / (1 + 1.65\, \tau^{0.85})$. Note that for a pencil of radiation of frequency between ν and ν+dν at altitude z, where the pencil makes an angle θ to the vertical with ς = sec θ, then $E_n(\tau) = \int_1^{\infty} d\varsigma\, \varsigma^{-n} e^{-\varsigma\tau}$ (Wijngaarden van and Happer, 2020) Eq. 32 p. 10.

If the air were isothermal (which is impossible in a gravitational field, but close enough where the air is quite opaque) it would thus absorb the quantity (1 - 2 $E_3(\tau_{max})$) π B($T_{surface}$) from the radiation of the surface and, at each optical frequency, would radiate towards the surface exactly the same:

$$\varphi_{descending}=\pi\int_0^{\tau_{max}} 2E_2(\tau')B(T(\tau))d\tau'=(1-2E_3(\tau_{max}))\pi B(T_{surface}) \tag{137}$$

since by hypothesis T(τ)= $T_{surface}$.

$$\varphi_{surface}(\nu, y)=\pi B(\nu, T_{surface})2E_3(\tau_{max}-\tau(y)) \tag{138}$$

Let's note by convention the two quantities Q and U, with τ_{trace} the optical thickness for a trace gas:

$$Q=\varphi_{ascending}+\varphi_{descending}-2\pi B(\nu, T) \text{ and } U=\frac{d\tau_{trace}}{dP} \tag{139}$$

Then the absorption coefficient is for a trace gas:

$$k_{trace}(\nu, T, P)\rho_{trace}=\frac{d\tau_{trace}}{dz}=\frac{d\tau_{trace}(g\rho_{air})}{p_0 dP} \tag{140}$$

Hence:

$$\frac{k_{trace}(\nu, T, P)\rho_{trace}}{\rho_{air}}=\left(\frac{g}{p_0}\right)\left(\frac{d\tau_{trace}}{dP}\right)=\left(\frac{g}{p_0}\right)U \tag{141}$$

The radiative air heating for a layer of thickness dz is:

$$\frac{dT}{d(time)}=\frac{(k_{trace}(\nu, T, P)\rho_{trace}Q\,dz)}{(C_p\rho_{air}dz)} \tag{142}$$

or expressed in K/ (24 hours)/cm^{-1}:

$$\frac{dT}{d(time)}=\left(\frac{86400\,Q}{1005}\right)\left(\frac{k_{trace}(\nu, T, P)\rho_{trace}}{\rho_{air}}\right)=\left(\frac{86400\,Q\,g}{1005\,p_0}\right)U=0.0083\,Q\,U \tag{143}$$

Veyres (2020c) states that "*these formulas are calculated explicitly following Chandrasekhar, by some very simple expressions, variants of the Gauss formula for the numerical calculation of integrals*":

$$2\int_0^{\tau} f(x)E_2(\tau-x)dx=a_1 f(\tau_1)+a_2 f(\tau_2) \tag{144}$$

with division points t_i and Christoffel[99] numbers a_i expressed as a function of the total optical thickness τ by:

$$\tau_1(\tau)=-0.00347143+0.00304764\,e^{\tau}+0.216921\,\tau+0.0547904\,\tau^2 \tag{145}$$

$$\tau_2(\tau)=0.0117561-0.0133285\,e^{\tau}+0.821142\,\tau+0.0493289\,\tau^2 \tag{146}$$

$$a_1(\tau)=0.722428-0.206974\,\tau+0.0231897\,\tau^2-\frac{0.373212}{(1+\tau)^2}-\frac{0.346229}{(1+\tau)} \tag{147}$$

$$a_2(\tau)=-0.577111+0.583819\,e^{\tau}+0.297942\,\tau-0.893233\,\tau^2+0.195098\,\tau^3-0.101563\,\tau^4 \tag{148}$$

This manner of computing the radiative fluxes as described by Veyres (2020c) is certainly a lot more accurate than what was seen before by using SBL, though one will note that one of the remaining assumptions was "*if there are no clouds or diffusing aerosols*". This of course reminds that this more rigorous calculation only applies to clear skies and that just a few tens of microns of water, be it in clouds or scattered in the atmosphere, will completely stop the radiative transfer process, reaching optical depths far greater than one. **One may conclude that a complete formal representation of Mother Nature remains somehow beyond our limited formalization and calculation means if all**

99 https://en.wikipedia.org/wiki/Christoffel_symbols

phenomenons at all scales (spatial) and timespan have to be taken into account. The atmosphere is not a homogeneous medium, especially for H_2O (neither in time nor in space)! Maurin[100] states "*Between the air column above the Atacama and the air column above the island of Java it is unrealistic to take an average for the average H_2O content. We can, indeed, always approximate by a calculation with an average optical thickness, for an average H_2O content, but in my opinion, the problem of the real atmosphere remains inextricable*".

In the reference book "Atmospheric radiation: Theoretical basis", Goody and Yung (1989) p. 52 state " *The intricacies of atmospheric radiation calculations, taken together with the ready availability of large digital computers, have led to an emphasis upon the development of numerical radiation algorithms. These algorithms can be coupled to algorithms for hydrodynamic processes and interactions may be handled by iteration. If the end result is to couple algorithms for scattering and radiative heating with algorithms for atmospheric and ocean dynamics, serious questions may arise as to the significance of the results.* ***Recent history has demonstrated that such complex numerical calculations may be flawed****; they may yield unphysical results and* ***equally competent investigators can disagree****.* ***An outsider can make no judgment****. Even if complete documentation were available, it would be* ***impractical to check on the results****, and documentation is often missing*". Politicians are deluded by the "experts" that ensure them that they can trust their computer models and on the basis of such systems commit to enforce legislation that will damage economies and the standard of living of hundred of millions if not billions of individuals. These "experts" ignore the fact that most judicial systems condemn such behaviors, i.e. intentional deception, as criminal offenses on the basis of at least two fundamental principles: "fraus omnia corrumpit" see e.g. Lenaerts (2013) and "nemo auditur propriam suam turpitudinem allegans".

When you ask supporters of the AGW theory how the arbitrary respective contributions of the various «GHGs» are determined in their papers, e.g. 60% H_2O, 25% CO_2 as in Dufresne and Treiner (2011), you get an (courteous) answer like[101] "*The greenhouse effect is quantified by the difference between the flux emitted by the surface and the flow which escapes at the top of the atmosphere towards space. Currently these two quantities are well measured by radiometers and well calculated by radiative models. To estimate the contribution of the different gases to the greenhouse effect, we redo these flow calculations by removing one by one the different gases that make up the atmosphere. The difference between the greenhouse effect that is obtained when this gas is present and when this gas is absent makes it possible to estimate the contribution of this gas to the greenhouse effect"*. One can wonder from this answer, how supposedly well measured quantities (by radiometers) are mixed-up with computer simulations (i.e. programs that mainly remain black boxes) in order to «*redo*» the world by «removing» one or the other of the gases to finally deliver the guesstimate numbers proposed.

Water vapor is by far the main Infra-Red Absorbing gas (IRAG), we will not talk often of «Green House Gases» in this document (unless proper reference to an author requires it) given the confusing nature of the «concept» as seen in the section above. But it seems that for most AGW authors it is not important nor sometimes even worth mentioning it, i.e. 0 – zero – occurrence of for the words H_2O, water vapor, or humidity in (Myhre et al., 1998). However **water vapor ensures 90% of the absorption by the air of the radiation of the surface and more than 85% of the radiation of the air towards the cosmos**; "climatic" changes are first of all changes in the vertical and spatial distribution of water vapor which is the main engine and regulator of the weather. It is water vapor which transfers heat from the tropics to high latitudes; its evaporation increases strongly with temperature (at + 7% /°C or +6 to +12 W/m^2/°C depending on whether the evaporation is 100 W/m^2 or 200 W/m^2 and so thermostats the surfaces of seas or areas of tropical vegetation. Veyres (2020) adds "*Its condensation gives off heat and feeds the radiation from the globe (from the "top" of water vapor) to the cosmos in particular at high and medium latitudes: for example in Paris in January the globe receives on average 110 W/m^2 from the sun (before effect of clouds and albedo and 45 W/m^2 on the surface but radiates 220 W/m^2 towards the cosmos: the difference is mainly made by water vapor"*.

Furthermore, current changes arising from the measurements are small and for example Hansen and Lebedeff (1987) analyze surface air temperature data from available meteorological stations with principal focus on the period 1880-1985. The results indicate a global warming of about [0.5°-0.7°C] in the past century, with warming of similar magnitude in both hemisphere. A strong warming trend between 1965 and 1980 raised the global mean temperature in 1980 and 1981 to the highest level in the period of instrumental records. The warm period in recent years differs qualitatively from the earlier warm period centered about 1940; the earlier warming was focused at high northern latitudes, while the recent warming is more global. There is absolutely no reason why such very small changes may not be the result of

100 Personal communication December 10, 2020.

101 Personal email communication from Dufresne, May 19 2020.

natural processes (Luterbacher et al., 2002a), nature has demonstrated that it can trigger big changes, like the the «green Sahara» and many other major climate change over short periods of time without requiring any help from mankind. The only thing that studies like Marvel (2016) demonstrate is that they are just computer models delivering TCR and ECS values that may change chiefly depending on the way the programs operate and values they use and that "*many observational data sets have been used to constrain these values, including temperature trends over the recent past, inferences from palaeoclimate and process-based constraints from the modern satellite era. However, as the IPCC recently reported, different classes of observational constraints produce somewhat incongruent ranges"*.

One should note that lower values of the climate sensitivity are provided, e.g. by Lewis, and Curry (2018), but also by the following authors for values under 0.6°C (Abbot and Marohasy, 2017; Harde, 2014, 2017a; Kissin, 2015; Lindzen and Choi, 2009, 2010; Ollila, 2017b), but even for values lower than 0.4°C by (Soon et al., 2015; Smirnov, 2018). Of course, using lower climate sensitivity such as 0.6°C by the authors above, Equation 83 changes (Gervais, 2018 p. 111) and delivers smaller values of ΔT:

$$\Delta T = 0.9 \ln\left(\frac{C}{C_0}\right) \tag{149}$$

And thus Equation 82, in that case becomes:

$$\Delta F = 3.12 \ln\left(\frac{C}{C_0}\right) \tag{150}$$

And for a doubling of CO_2:

$$\Delta F = 3.12 \ln(2) = 2.2\, W/m^2 \tag{151}$$

Two questions often asked can now be addressed, 1) how much warming can be anticipated if the current 2ppm yearly increase is observed until 2100 and 2) how much of the current warming since 1900 can be attributed to the increase of the [CO_2]. By differentiating the SBL given by Equation 85, one immediately gets :

$$\Delta T = \frac{T}{4} x \frac{\Delta F}{F} \tag{152}$$

Using Equation 152, is an easy way to make simple projections based on rough elementary calculations for various climate sensitivities, using different ΔF values, given for example by Equation 82, or for a lower climate sensitivity by Equation 150. As we have seen in p. 71, for the high sensitivity of Myhre et al. (1998) one gets for a doubling ΔF = 3.71 W/m^2, thus ΔT = 1.66 ln (2) = 1.66 * 0.693 = 1.15 °C.

This can of course be computed as well using Equation 152, and we have: ΔT = 288/4 x 3.71 / 240 = 1.11 °C (with the OLR=240 W/m^2). Therefore, the answer to question 1) is computed for a sensitivity given by Equation 150, in the following way: ΔT = 288/4 x ln ((410 ppm + 80 x 2 ppm) / 410 ppm) x 3.12 / 240) = 0.308 °C. This supposes that the average yearly increase in ppm remains approximately 2ppm for the next 80 year. Furthermore, this increase is largely natural as shown in Figure 8, as the yearly increase in ppm can be six times as high the warm El Niño years, e.g. 1998, 2016, than during cold years, e.g. (1992, Pinatubo's aerosols; 2011, La Niña), this without any relationship with the man-made emissions, which only vary slightly from one year to the next with a small increment. Furthermore these ppm increases follow the temperature with a 6 to 11 months lag indicating that bursts of up to more than 3ppm come from the degassing of the tropical oceans during warm years[102]. Without any other consideration that could provide for negative feedbacks (e.g. solar activity could decrease, bouts of volcanism could happen, albedo could increase due to the geomagnetic response to solar cycles, etc.), the temperature increase up to 2100 would not even be 0.31°C. This does not look as a threatening urgency.

Assessing how much of the observed warming since 1900 can be attributed to the CO_2 increase can be done in a similar way. Let's assume that [CO_2] in 1900 was 310 ppm and 410 ppm in 2020, so we have as per Equation 82 according to Myhre et al. (1998), a +1.53 W/m^2 radiative imbalance which using the same climate sensitivity would represent +0.475°C. But if we were to use lower climate sensitivities, say 0.6°C as per the average of Lindzen and Choi (2009; 2010) and Soon et al. (2015) we would have significantly lower values, i.e. 0.26°C. Even using the IPCC low value (of

102 To hide this lagging relationship, where CO_2 follows T and that is very visible on yearly graphs, the IPCC AR5 report has chosen to average over 5 years the representation despite the insistent recommendation of an "expert reviewer" to do otherwise.

their range) of 1°C would lower the result to 0.42°C. So that rather gives a range of values [0.26°C - 0.475°C] which we may indicate as better representing the attribution made to CO_2 of the warming observed since 1900

This change is over a total radiative budget at the Top of the Atmosphere of approximately 240 W/m^2, so depending on whether one keeps a high sensitivity that delivers +1.53 W/m^2 or a more reasonable one that gives 0.872 W/m^2 the supposed imbalance is within the range [0.36% - 0.64%]. The budget at TOA is not known to that accuracy and can change for natural reasons of much more than that, changes of cloud cover and types, variation of the altitude at which the water vapor radiates towards space, of the relative humidity of that 300 mbar layer, etc. Furthermore, the radiative budget just represents less than 15% of the total heat transfers, as being conservative more than 85% are of a thermodynamic nature, i.e. (evaporation, condensation, precipitation, advection, etc.).

Actually, CO_2 is not more than 12.5% of the radiative budget, the rest being mainly water vapor and clouds. Furthermore, the climate had been warming long before 1900 and the glaciers were melting at a frightening speed starting in 1850. So, we cannot consider that the trend observed since 1900 at 0.006°C/year could not be mainly attributed to the natural variability. In any case less than 30% of the warming, and more probably a lot less than that, is due to the increase of CO_2, but having said that, one must add that most of that increase of CO_2 came from the natural out-gassing of the oceans occurring in a warmer environment and that a milder climate must be appreciated for a boon as colder climates have always led to misery, starvation and sometimes the collapse of entire societies.

Once these numbers have been recalled to the reader, and the climate emergency is shown for what it is, a decoy to pursue policies seeking an electoral advantage in the conquest of the green vote, developing computer programs to perform **climate simulations**, refining them together with their underlying models (e.g. those modeling clouds the best are not the same as those that are good at reproducing temperature variability) can still be legitimate as long as one remembers that they **are not the reality.** They are simply an attempt to represent a far more complex system than what they can achieve, in fact an intricate and still poorly known and under-measured Earth system. Coercive economic policies having far reaching consequences for the well being and prosperity for the average citizen should not be based on CACE computer programs (Changing Anything Changes Everything) which can be tuned at will to mimic some reality but are in no way representative of THE reality.

Finally, some authors, are extremely severe with this greenhouse mess and conclude like Kramm and Dlugi (2011) "*Based on our findings, we conclude that 1) the so called atmospheric greenhouse effect cannot be proven by the statistical description of fortuitous weather events that took place in past climate periods, 2) the description by AMS and WMO*[103] *has to be discarded because of physical reasons, 3) energy-flux budgets for the Earth atmosphere system do not provide tangible evidence that the atmospheric greenhouse effect does exist. Because of this lack of tangible evidence it is time to acknowledge that the atmospheric greenhouse effect and especially its climatic impact are based on meritless conjectures*".

Stallinga (2020) also provides a very comprehensive analytical study of the greenhouse effect, not resorting to any numerical simulation nor finite-element calculations. His conclusions are extremely clear and completely prohibitive "*Continuing with the reasoning, we find that the alleged greenhouse effect cannot explain the empirical data—orders of magnitude are missing. There where Henry's Law—outgassing of oceans—easily can explain all observed phenomena. Moreover, the greenhouse hypothesis—as presented here—cannot explain the atmosphere on Mars, nor can it explain the geological data, where no correlation between [CO_2] and temperature is observed. Nor can it explain why a different correlation is observed in contemporary data of the last 60 years compared to historical data (600 thousand years). We thus reject the anthropogenic global warming (AGW) hypothesis, both on basis of empirical grounds as well as a theoretical analysis*". Stallinga's (2020) paper is well worth it and highly recommended to any curious reader.

Another paper recommended to the reader is the last one written so far by Ferenc Miskolczi (2014), who earned an M.Sc. degree in nuclear physics (1971), a Ph.D. degree in astrophysics (1975) and another Ph.D. in Earth Sciences (1981) at the Hungarian Academy of Sciences and also holds a diploma in high-level computer programming. He specialized in the experimental and theoretical aspects of infrared atmospheric radiative transfer for his entire carrier and in 2006 he resigned from NASA in protest due to unresolved publication issues related to his AGW related results. Miskolczi (2014) abstract reads as follows "*This paper presents observed atmospheric thermal and humidity structures and global scale simulations of the infrared absorption properties of the Earth's atmosphere. These data show that the global average clear sky greenhouse effect has remained unchanged with time. (...) The stability and natural fluctuations of the global*

103 American Meteorological Society (AMS) and the World Meteorological Organization (WMO)

average surface temperature of the heterogeneous system are ultimately determined by the phase changes of water. Many authors have proposed a greenhouse effect due to anthropogenic carbon dioxide emissions. The present analysis shows that such an effect is impossible". A brief introduction to Miskolczi's theory is provided by Zágoni (2008).

As we are going to see now, water in all its forms is the main player and concur with Miskolczi that the global average surface temperature of the Earth system is ultimately determined by the phase changes of water.

8) Water is the main player

Water, in its various forms (including ice during cooling episodes leading to glaciations), is the main surface and troposphere player of the Earth's climate, the oceans ensuring the medium term storage and restitution of the energy accumulated and water vapor taking care of the everyday immediate balancing. As the air is opaque in thermal infrared, because of water vapor and as an opaque body does not transport heat by radiation, the surface cools by evaporation of water (latent heat), as 71% of the surface of the globe are oceans, and 15% or more of the land with strong evapo-transpiration by vegetation, some convection and advection (sensible heat); what radiates towards the cosmos after having escaped absorption by the air or by the clouds makes, on average, only 20W/m² or 5% of the radiation of the surface (we've seen that when discussing the OLR). The water vapor absorbs almost all the radiation from the surface, the **CO_2 absorbs only 2%** because 80% of the water vapor and the bulk of the low clouds, are located in the first 300 mbar, i.e. below 3 km (see note[22]) and they make a very opaque screen, while the CO_2 is distributed almost uniformly over the entire height of the air and its role is therefore superseded in every respect by water vapor which makes a much better screen to the infrared radiations (i.e. owing to its more efficient and much broader absorption spectrum and because of the uneven distribution and low lying position of water vapor in the atmosphere).

The radiation from the air to the cosmos at the TOA makes 90% or more of the radiation from the globe (220 W/m² on 240 W/m²); 90% of the radiation from the air to the cosmos comes from water vapor (200 W/m² on 220 W/m²), the stratospheric CO_2 and ozone radiate the rest. The radiation towards the cosmos comes from the last 300 grams of water vapor under the tropopause[104] where the temperature of the air is linked to that of the surface by the temperature pressure relationship that was explained in a section before. As reminded by Veyres (2020) "*The position (altitude or pressure) of the layer which radiates towards the cosmos is regulated by the water vapor content of the top of the air ("lower-warmer" effect leading to more radiation towards the cosmos); the regulation of the insolation is done by the clouds, in a few hours. The fables of radiative forcing and of the greenhouse effect suppose by their very definition a virtual world, without surface evaporation, where the regulating effects of water vapor (evaporation, advection, condensation) and convection are by definition same "disengaged" or do not exist (radiative models of Manabe et al. (1964; 1967).*"

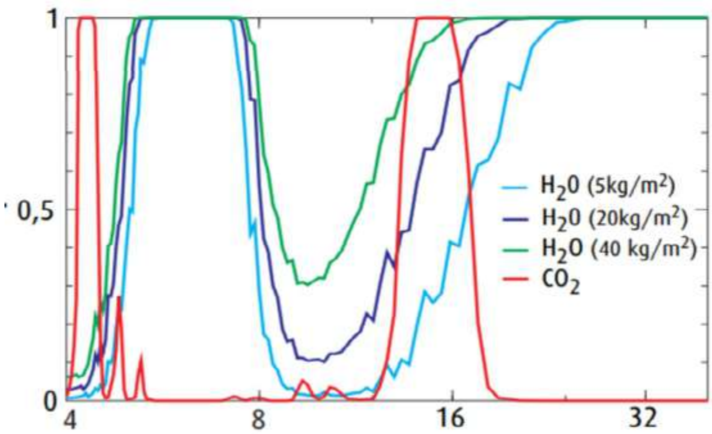

Figure 25. *Spectral dependence of the absorbency for three values of the water vapor content of the atmosphere, here expressed in kg/m². The carbon dioxide curve is reproduced for comparison. The wavelength is in microns in abscissa X and the absorption in Y. Since the concentration of water vapor varies greatly with altitude, we consider the integral of the mass of water vapor on a vertical. The variation with latitude is also large: from 4 kg/m² at high latitudes to 45 kg/m² near the equator. The concentration of CO_2 is on the contrary very little variable for altitudes below 50 km, and therefore the integral of its mass along the vertical is directly proportional to its average concentration, quantity used here. Adapted from Dufresne and Treiner (2011).*

The variations of the cloud cover are in the inter-tropical zone a consequence of the variations of the surface temperature (i.e. a higher temperature of the surface of the sea implies more convection and more clouds), but in the

104 These H_2O molecules were carried up there by thermodynamical processes, e.g. convection, advection, etc., which explains the apparent contradiction that the atmosphere be both globally opaque to IR radiation and that at the same time the emissions balancing the radiative budget take place at the TOA by molecules that have found their way up to the 300 mbar level (9km).

extratropical zone, on the continents, the clouds cool the surface by absorbing the solar infrared and backscattering part of the visible (more clouds, lower surface temperature); there indeed it is the progressive condensation of the water vapor of the air which feeds the standardization of the radiation from the globe to the cosmos. Furthermore, as a confirmation of what was explained above, as reminded by Dufresne and Treiner (2011) "*detailed calculations of the radiative exchanges show that the absorption by carbon dioxide of the infrared radiation emitted by the Earth increases very little with its concentration (absorption of infrared radiation by carbon dioxide is almost at its maximum and depends very weakly on CO_2 concentration). It is said to be saturated. From the experimental point of view, this "saturation" effect of its spectral absorption had already been observed by Ångström (1900), which had led him, as we have seen above, to question the first calculation on the role of the CO_2 greenhouse effect published by Arrhenius (1896) a few years earlier*". This is in fact very well visible on Figure 25.

One could even say that climate is made by the amount of rain received, month after month, by any region on Earth and neither the AGW theory nor the associated Global Circulation Models (GCMs) are any good at making forecasts in that respect (Koutsoyiannis, 2008). The spatial and temporal regime of precipitation is a consequence of the organization of atmospheric circulation, the "purpose" of which is the transfer of water vapor from tropical areas to the high latitudes where it condenses and feeds the radiation of the air to the cosmos in thermal infrared (OLR, Outgoing Long-wave Radiation), so as to compensate exactly, "on average" over the whole globe and over a few weeks, the solar flux absorbed by the globe. The water vapor, which precipitates in rain or snow, often does not come from the place where it rains; it comes from the sweeping by the trade winds of thousands of kilometers to the north and to the south: these trade winds converge in the "equatorial chimney"; for the showers of the cold fronts of our latitudes, the water vapor comes from thousands of kilometers to the southwest and it is transferred towards the northeast in the low pressure corridor which precedes the Mobile Polar Anticyclones[105] (MPAs) which move, them, towards the southeast.

Veyres (2020) concludes "*that the stories of "radiative forcing by greenhouse gases" are nonsense and that it is the water vapor content of the upper troposphere and not a warming of this upper troposphere that determines and regulates the infrared thermal flux emitted by the globe to the cosmos. Let us remember once again that it is the quantity of water vapor around 9 km which ensures in a few hours and a few days the regulation of the radiation from the globe to the cosmos*". Furthermore, the regulating effect of water vapor has not been correctly estimated by any of the models. Most of its effects arise because of its opacity in the long-wave spectral regions. The relative contributions of H_2O, CO_2, and O_3 to reducing the outgoing long-wave flux are very different, and the long-wave effect of H_2O is so significantly larger than the effects of CO_2 and O_3 that it gives no chance to other gas to play a real role. Water vapor leaves no chance to CO_2 to play a significant role on a radiative perspective, but as it was mentioned the major impact of water and water vapor on the climate are through sensible and latent heat transport. It is worthwhile in that respect to recall the orders of magnitude of the stocks and fluxes to better grasp the situation. All data are expressed in Giga tons of Carbon or of H_2O (2018):

Giga tons of Carbon or H_2O	Oceans	Soils and Vegetation	Atmosphere
Stock H_2O	$1.335 . 10^9$		12500-12900 GtH_2O[106]
Flux yr^{-1} / evaporation	-430000	-60000	
Flux yr^{-1} / precipitations	380000	110000	
Stock C	39000	2500	870
Flux yr^{-1} / degassing	-90	-80	170 + Anthropogenic (10)
Flux yr^{-1} / absorption	80	95	175

Comparing the fluxes for H_2O and CO_2, are very telling and confirm that even without going into the details as was done here to quantify the various physical and chemical phenomenons at play, there is simply no doubt as to which fluid is mastering the distribution of heat on the planet and in charge of the climate. With a bit of humor and as climate is first and foremost made of precipitations (Köppen, W., 1884a-b; Kottek et al., 2006), one should notice that it has never rained CO_2 when it falls 380,000 $GtH_2O\ yr^{-1}$. The Earth thermodynamical machine is sat on the water and water vapor cycle which dwarfs in all aspects (not even in the radiative domain does it leave any chance to CO_2 to play any meaningful role) all other circulating components. Let's provide a synthesis on a sketchy synthetic diagram.

105 Or Mobile Polar High (MPH) see (Leroux, 1993).

106 As per Trenberth and Guillemot (1994)

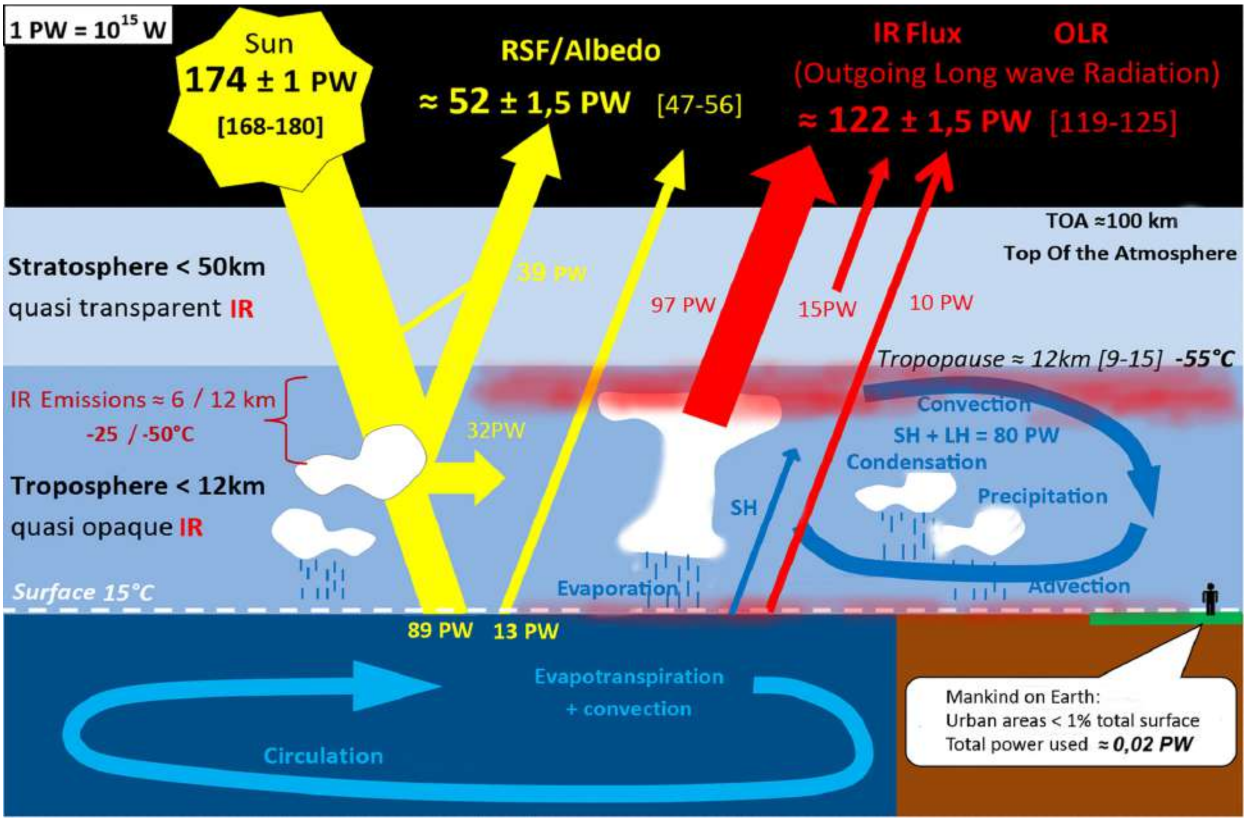

Figure 26. A sketchy global annual mean Earth's energy budget expressed in PetaWatts (10^{15} Watts). SW radiations are represented in yellow ($\lambda < 4$ µm), LW radiations are in Red ($\lambda > 4$ µm) and energy transported by thermodynamical processes is in Blue (Sh= Sensible Heat, LH=Latent Heat). IR emissions toward space taking place at TL_TTT are figured in vaporous red. As explained p. 58 the very thin red vaporous layer atop the ground shows that just 17 meters of air in tropical zone or 240 meters in temperate zone during winter (lower content of H_20 vapor) are the thickness of the slice of atmosphere that will stop 80% of the radiative emissions originating from the ground. After an exchange with J.-C. Maurin (2021).

Depending on the time of the year and the 11-year solar cycle, the actual power received from the Sun at TOA is between 168 PW[107] and 180 PW, an average of 174 PW is displayed on Figure 26. Of these, 52 PW are Reflected Solar Fluxes (RSF), by the atmosphere (39 PW) and the ground (13 PW) and provide a mean albedo of 0.3. 89 PW (51%) are absorbed by the Earth and 32 PW (19%) are scattered into the atmosphere (Oklahoma Climatological Survey, 2005). The atmosphere being extremely opaque to the IR radiation, just 10 PW of IR can directly pass trough the atmospheric window (8% of TOA emissions), and it has been known since Manabe in a series of papers (Manabe and Möller, 1961; Manabe and Wetherald, 1967; Manabe and Strickler, 1964) that the heat absorbed by CO_2 molecules and then dissipated by collisions to neighboring molecules (de-activation process from rovibrational[108] states) is transported by convection to the TOA. Thus the Earth operates essentially as a thermodynamic machine, by means of evaporation, condensation and precipitation (Latent Heat), and convection and advection (Sensible Heat, SH) for a total of 80 PW. These 80 PW plus the 32 PW of scattered energy represent 112 PW that will be radiated to space as IR (97 PW + 15 PW), and adding the 10 PW of IR that go directly from the ground to the TOA through the atmospheric windows, this completes the budget to 122 PW.

IR is mainly emitted toward space from the Thin Layer (TL) at the high Troposphere up To the Tropopause (TTT), see p. 54, i.e. the TL_TTT 300-100 mbar level, and water vapor and clouds represent at least 97 PW of the emissions (> 80%), while CO_2 and stratospheric O_3 represent a maximum of 15 PW (< 12.5%). Overall, the 97PW from water vapor and clouds, plus 15 PW from CO_2 and O_3, plus 10 PW escaping from the ground through the atmospheric window represent overall 122 PW. Added to the 52 PW of the RSF one gets the 174 PW that balance the incoming solar flux. Worth noticing in this Figure 26, is the place of mankind with urban areas using less than 1% of the total surface of the planet and even more importantly with a total power produced and used of less than 0.02 PW!

107One PetaWatts = 10^{15} Watts

108https://en.wikipedia.org/wiki/Rotational%E2%80%93vibrational_spectroscopy

Once again, humanity keeps thinking that we have a major impact on the Earth system and such insane ideas as the Anthropocene have been floated around, when all the energy we produce and use is less than 1/10,000th of the energy received from the Sun, i.e. 0.02PW!

Noteworthy to remind the reader though, that Figure 26 provides a very simplified global representation, knowing that the mean net TOA radiation balance shows a surplus of up to 12 PW between 37S and 37N (50% of the earth's surface is located between 30S-30N and this half is three-quarters oceanic), and is strongly negative beyond 37S and 37N with a deficit of -6PW on each side towards the poles. But as sketched by Figure 26 and as explained by Wilde and Mulholland (2020) "*the opacity of the atmosphere fundamentally controls the height of the radiant emission surface that vents energy to space*" that was referred to as the TL_TTT in p. 54, and furthermore these authors demonstrate that there is no need for dubious atmospheric energy amplifier via radiative feed-back as conjectured by Trenberth et al. (2009) Fig. 1 p. 4, for which massive "backradiations" of 333 W/m^2 are hypothesized that correspond to no empirical evidence and no experimental measurements.

As reminded to me by Mulholland[109] "*In climate science, planetary cloud albedo is the primary control on the intensity of insolation that enters into the atmospheric system. Clouds are the consequence of the presence of a condensing volatile within the planetary atmosphere. Condensation of a volatile is due to the cooling of the air as it rises in a gravity field by convection, and loses kinetic energy by its conversion to potential energy during the process of adiabatic expansion. On continuing to rise due to the release of latent heat of condensation, the convection cloud will ultimately reach the tropopause, the coldest level of the troposphere. In the upper troposphere it is the temperature of the tropopause that determines the place where the process of freezing finally occurs, and where the relevant condensing volatile completely freezes into particulate crystals. Once in solid form the condensing volatile changes to become an efficient upper atmosphere particulate thermal radiator*". This sentence should be understood in terms of IR emissions toward space, this is what is meant by "radiator". It is the temperature of the tropopause that governs the process of volatile condensation or freezing. As we have seen in section "Temperature results from the Gravitational Lapse Rate" p. 41, it is the planetary lapse rate, a function of gravity and specific heat, that mainly determines the level of this point above the ground in the atmosphere. It is the mass and gravity induced pressure reduction at the TL_TTT and above (i.e. at higher altitudes below 100 hPa of pressure) that determines where the mean free path to space for thermal radiation through the overlying atmosphere is no longer blocked. The conclusion from Mulholland is surprising "*In short, atmospheric albedo is a consequence and not a cause of planetary climate*". This appears as one more simple yet powerful self-adaptive mechanism that may explain why the OLR has slightly increased and the specific humidity decreased at 300 mbar - operating as a negative regulating mechanisms (and not as a positive feedback as all the IPCC AGW theory is based on). Adding the GCR effect and considering the global albedo, which changes from the glacial-interglacial cycles from a 38% high to a 30% low due to the expansion or withdrawal of extensive ice-caps, one gets a very complex and inter-dependent system where the role of CO_2 appears very muted with respect to all other parameters.

109 Personal communication on the 3rd of March, 2021.

9) A new Carbon Budget at a Glance

«*The carbon dioxide in the atmosphere is strongly coupled with other carbon reservoirs in the biosphere, vegetation and top-soil, which are as large or larger. It is misleading to consider only the atmosphere and ocean, as the climate models do, and ignore the other reservoirs. Fifth, the biological effects of CO_2 in the atmosphere are beneficial, both to food crops and to natural vegetation. The biological effects are better known and probably more important than the climatic effects.*» Freeman Dyson

From all what has been seen in this first Chapter, a very different Carbon Budget from what is proposed by IPCC can be suggested, where the various notions seen can be put together. The amount of carbon dioxide in the air is a consequence of the surface temperatures of the inter-tropical zone where most of the ocean degassing takes place (Figure 10). 94% of the carbon dioxide in the air comes from the natural degassing of the oceans (Levy et al., 2013) and is the time integral of past temperatures (Figure 8, Equation 23), a consequence of these temperatures (Equations 18 and 19), and therefore cannot be the cause. Only 6% of the CO_2 in the air is what remains from fossil fuels after that a fast circulation with the oceans happens (Equations 6 and 16). A simple polytropic relationship between temperature and pressure describes the air and surface temperatures (Equations 60 and 61). Water vapor makes the Earth's atmosphere extremely opaque over the bulk of the thermal infrared spectrum (Figures 13, 15, 16), Table p. 57 after Equation 68, and Equations 69, 70: the atmosphere cannot, at these frequencies, transport heat by radiative mechanisms; the surface loses the heat received from the sun mainly by evaporation and convection. The thermal infrared radiation of the troposphere, 80% of that of the globe, is regulated and controlled by the water vapor content of the air around 300 millibar (9 km) (Figures 19, 20, 21); changes in the carbon dioxide content of the air cannot have an effect because the water vapor content of the upper troposphere is extremely dynamic and quickly adjusts the thermal infrared radiation to the solar heat absorbed under the tropopause.

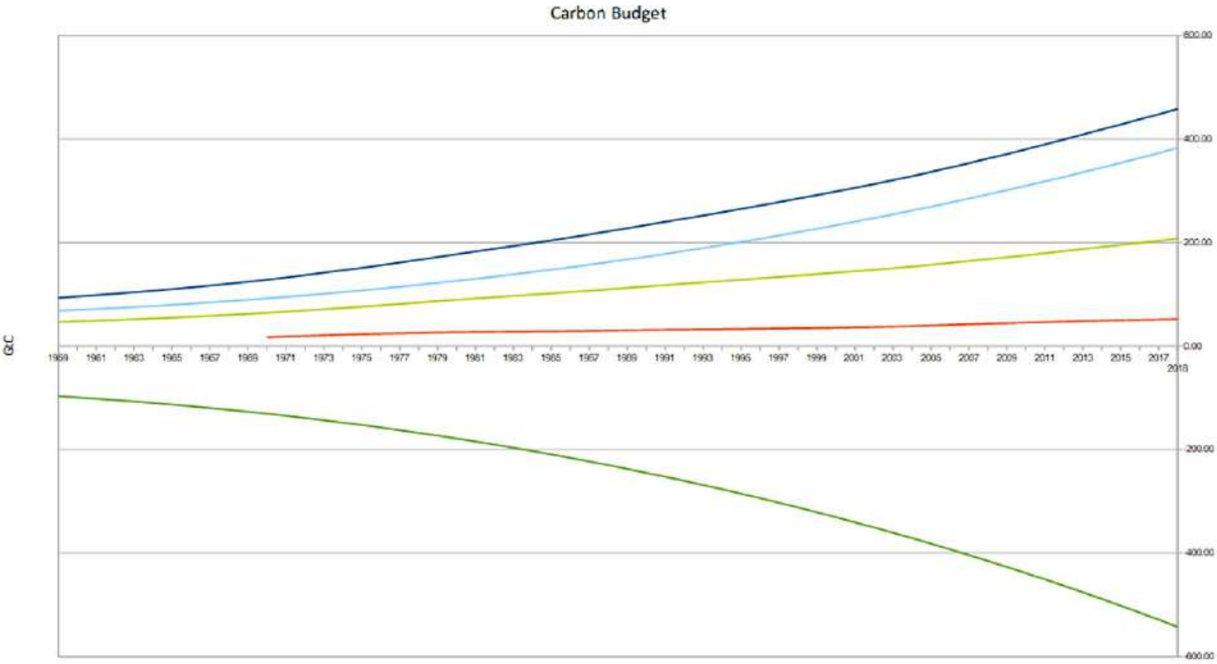

Figure 27. *Carbon Budget at a glance over the period 1900-2018 displayed on the graph over 1959-2018. Dark Blue = Cumulated man-made emissions Gt-C (same as Figure 5), Light Blue= Cumulated Degassing by the Oceans yr^{-1} of Total Gt-C in Atmosphere, Light Green = Cumulated Gt-C Budget (overall ppm atmospheric increase), Red = Anthropic Gt-C CO_2 remaining (same as Figure 5), Green = Cumulated uptake by Land, Forest, and Biological Punp yr^{-1} of total Gt-C in Atmosphere. Based on a non linear model where all processes are dependent on the Temperature.*

The Carbon budget (CB) proposed (1900-2018) illustrated by Figure 27, takes into consideration what has just been reminded here. Let's see how it has been computed starting from the bottom of the graph, the green curve, soils and vegetation to which can be added the Biological Pump (BP) mainly relying on the marine autotrophs (Burd et al., 2010; Passow and Carlson, 2012; Herndl and Reinthaler, 2013; Le Moigne, 2019). Notice though that the amount accounted for by the meso and bathypelagic biological pump activity remains conjectural. This series, the uptake by the soils and vegetation (Usv+), is obviously proportional to the total amount in Gt-C of CO_2 in the atmosphere which as explained above is dependent on the temperature and results from it. In fact, the reason is that the Primary Productivity (PP) of the autotrophs depends on both. The coefficient α_{sv} (-0.017) will characterize the uptake by the soils and vegetation (negative as it corresponds to an uptake) and the β_i will be an arithmetic progression of common difference of 0.013 to model the progressive increase of the uptake as the temperature progresses and the total atmospheric [CO_2] in ppm does the same. The initial β_0 equals 0.2. This model as represented by Equation 153, leads to an uptake by soils and vegetation of 571,52 Gt-C over the period (1900-2018) and the increased primary production of the autotrophs is what has driven the uptake and growth of that sink from 1900 to 2500 Gt-C (Campbell et al., 2017; Haverd et al., 2020), somehow 600 Gt-C.

$$Usv_n = \beta_0 \alpha_{sv} Usv_0 + \sum_{i=1}^{n} \beta_i \alpha_{sv} Usv_i \; with \; \beta_0 = 0.2 \; ; \; \beta_i = \beta_{i-1} + 0.013 \; ; \; \alpha_{sv} = -0.017 \quad (153)$$

The second time series in Red is what is left of the anthropogenic emissions after n=118 years, i.e. 52.15 Gt-C as resulting from Equation (6).

The light-green curve corresponds to the CB itself, the cumulated sum of the yearly anthropogenic emissions, minus the fraction removed, minus the uptake by soils and vegetation, plus the degassing from the oceans. As an indication, for 2018, man-made emissions (+10.15 Gt-C), minus fraction removed (-1.82 Gt-C), minus net uptake by soils and vegetation (-14.48 Gt-C), plus net degassing by the oceans (+10.22 Gt-C), leads to an overall Gt-C Budget (+4.05 Gt-C). This positive number should be reduced by increased DOC and POC due to the increased primary productivity of the oceans, but are hard to assess accurately, e.g. Toggweiler (1990) p. 122 states "*Druffel and Williams*[110] *now add new evidence that supports the dissolved organic pathway. They have measured the degree to which the* ^{14}C *produced by nuclear weapons testing has contaminated the particulate organic carbon (POC) pools, both sinking and suspended, in the North Pacific. At present, inorganic* CO_2 *in the water below the upper kilometre of the ocean is uncontaminated with respect to bomb* ^{14}C*. This is not true, however, with respect to the organic carbon in particles. Large settling particles can sink to the bottom in less than a year*". So, this number is a "worst case" figure. The light-green curve is the total cumulated CB over the period 1900-2018.

The light-blue curve represents the total cumulative degassing of the oceans over the period 1900-2018. It is computed according to the same logic as the uptake by soils and vegetation except that we consider a positive contribution to the CB as the degassing (Docean) is dependent on the temperature, which as it progresses leads to more out-gassing. The same approach as for Equation (153) is used, except that the α_{ocean} (+0.012) is positive (net contributor to the CB). Overall, the process is calculated in the following way:

$$Docean_n = \beta_0 \alpha_{ocean} Docean_0 + \sum_{i=1}^{n} \beta_i \alpha_{ocean} Docean_i \; with \; \beta_0 = 0.2 \; ; \; \beta_i = \beta_{i-1} + 0.013 \; ; \; \alpha_{ocean} = +0.012 \quad (154)$$

During the same period, also driven by the temperatures, the oceans have net out-gassed in this model 403 Gt-C, given the fact that the solubility of CO_2 in seawater has globally slightly decreased as per Henry's law. Overall, in the picture presented, the atmosphere has had an increase of approximately 200 Gt-C as the net result of all these processes.

The dark blue curve represents the cumulated man-made emissions in Gt-C over 1900-2018 and amount to 458 Gt-C.

The way the land, forests and vegetation and BP uptake and the oceans net degassing have been represented rely on a non-linear model (β_i times α_{sv} or times α_{ocean}) that depends on the temperature and which progressively increases the net degassing by the oceans and the uptake by soils and vegetation as T goes up (and reversely goes down) according to a simple "peg" to the total atmospheric [CO_2] in Gt-C and an arithmetic progression. All processes end up with a consistent overall atmospheric CO_2 ppm increase of approximately 200 Gt-C which matches well what was observed of 209.80 Gt-C.

One should not be mistaken by the appearance of high accuracy of the numbers given above. They are just reasonable gross estimates that demonstrate that a CB can be balanced on completely different hypothesis than those adopted by IPCC e.g. (Le Quéré et al., 2016, 2018); but obviously nobody knows whether over the timescales 1900-2018 the

110(Druffel et al., 1992)

vegetation has had an uptake of -600 Gt-C or as calculated here of -571.52 Gt-C or whether the oceans have degassed +403.42 or simply +352 Gt-C as evaluated by means of Equation (9) p.29, etc. What should be remembered is that fundamental physical and chemical processes are operating before us and that first and foremost these should be accounted for: the soils and vegetation act as a sink, the oceans ensure a fast circulation with a large reservoir leading to a short residence time for any CO_2 molecule in the atmosphere of less than five years and even though they ensure the removal of some DIC, DOC and POC by deep precipitation, they globally degas as the temperature has increased since the end of LIA and that should be reflected in any decent CB.

What remains of the 458 Gt-C of total anthropogenic emissions is a small fraction of just 52.15 Gt-C and the overall 210 Gt-C increase of the CO_2 atmospheric stock has a complex explanation (balancing all sources and sinks) and does not mainly result of the man-made emissions[111], a preposterous hypothesis made by IPCC authors. Schimel et al. (2015) rightfully reminds that "*Feedbacks from terrestrial ecosystems to atmospheric CO_2 concentrations contribute the second-largest uncertainty to projections of future climate. These feedbacks, acting over huge regions and long periods of time, are extraordinarily difficult to observe and quantify directly.*"

The CB presented here that focuses on natural phenomenons, which are by far of a greater order of magnitude than the total of the man-made contributions, and most probably underestimates the role of the oceans into sequestering part of the organic carbon that it contains, especially given the fact that the increased oceanic productivity which goes along with an increase of the temperature and of the availability of CO_2 lead to more organic sequestration. As Steele (2020) summarizes "*Productivity increased after the last glacial maximum ended, and increasing organic sediments on the sea floor suggest increased carbon sequestration*". So even though the oceans are net degassing for obvious physico-chemical reasons, their uptake of organic and particulate organic matter are underestimated in the afore-presented Carbon Budget, but one can hardly assess objectively to how much these additional sinks amount by now.

In fact, the IPCC Carbon Budget does not stand the quickest scrutiny. As per IPCC, CO_2 emitted by fossil fuel consumption can only find its way into three different sinks: accumulate in the atmosphere, be dissolved and removed by the oceans or finally be absorbed by the vegetation or the phyto-plankton that it feeds. This is represented graphically by the Figure 6.8, p. 487 of IPCC (2013) and shows large yearly variations from -0.5 to +4 Gt-C. It is worth noticing that only the atmospheric part of such a budget is measured, by means of IR spectrometry, whereas the other components are either the result of a model (ocean uptake) or of a simple subtraction from the two previous numbers. As such, by way of just obtaining the land uptake by that subtraction, this value appears as the simple "negative" of the annual atmospheric variations.

As per the IPCC CB, the uptake by the vegetation would have been minimum, in fact even negative, the warm El Niño years like 1983 (2.57 ppm increase) with -0.3Gt-C and 1998 (3.28 ppm increase) -0.5 Gt-C, whereas the uptake by vegetation would have been maximum with values of 4Gt-C in 1992-93 (ppm increase of [1.01-0.5]), much colder years, by around 1°C, than 1998. Thus, as per IPCC carbon budget, during warm years the vegetation would appear unable to capture any CO_2 at all, with even negative numbers, letting the emissions accumulate as per their model in the air and the oceans, whereas the maximum uptake would happen during cold years. Such a curious model is defeated by the obvious observation of the Keeling curve that shows that the seasonal variations of the [CO_2] is mainly due to its consumption by the vegetation. It shows that there does not exists the kind of difference that appears in the IPCC budget [-0.5-4]Gt-C, the curve being very repetitive from one year to the next, displaying comparable patterns of seasonal variations and showing for the years 1992-1993 or 1998 comparable vegetation consumption during spring and summer of 17 Gt-C. One immediately sees the absurdity of such IPCC CB model as if the vegetation was unable to provide for any uptake the warm years, why the UN would undertake massive tree planting operations, that despoil peasants in countries like Uganda and Cameroon? The conclusion is that the IPCC carbon budget shows an entirely

111 This is of course a very different approach to that of the Le Quéré et al. (2016) paper which necessitated 68 authors (argument of authority ?) to come up with an IPCC compliant CB which leaves no place to Nature. These Le Quéré et al. (2016, 2018) CBs are based on the combination of a range of data, algorithms, statistics, and model estimates and their arbitrary interpretation by a broad and partisan community tainted by major conflicts of interest because their economic and social survival depends on continued state funding based on the erroneous assumption that CO_2 only results from anthropogenic emissions. The global carbon budget of all these researchers, ensconced in the comfort of their laboratories, asserts that averaged over the decade (2006–2015), 91% of the total emissions were caused by fossil fuels and industry, and 9% by land-use change. **Nothing from Nature;** this is meaningless. So many authors were required to impress the reader, make him/her believe that Nature has no role to play and come up with sort of a dogma based on a dubious interpretation of data and on gimmicked models; what an outlandish and ludicrous claim to think that these arbitrary guesstimates bear any resemblance to reality and would justify coercive economic policies to be based on them.

erroneous behavior for the land and vegetation sink as a result of considering it as a simple subtraction of the two other sinks.

The approach and the model presented here is certainly not settled, nothing is never, and will be improved and refined as our understanding progresses but it has the merit of giving reasonable and rational orders of magnitude for the physical, chemical and biological processes that any objective observer and scientist must first and foremost account for; e.g. Henry's law and the degassing of the oceans cannot be ignored and is obviously one of the main players of the CB budget. Never ever any honest scientist should start from foregone conclusions and try to thwart the reality in so far as to make it match the flawed assumptions (i.e. man-made emissions are 100% responsible of the CO_2 increase and for sure, Nature does not play any role), only pseudoscience does that. Science works the other way round, but IPCC has corrupted it by supporting and funding only the dogma that man-made emissions were responsible of everything, nothing to argue about, science is settled ; this will prove ultimately extremely detrimental to the confidence that the public will place in science in the future when the dogma will unravel as a card castle facing the climate reality, that will not conform to the AGW lunacies and forecasts.

As a brief summary, not only does CO_2 have a very little effect as the atmosphere is very opaque to IR radiations (e.g. Equation 79 and corresponding Table), but its radiative contribution is very small even considering the water vapor feedback (Equations 80, 81)[112], and in the end most of the heat distribution which makes the climate is related to other processes such as transport by latent heat (i.e. evaporation – condensation – precipitation), sensible heat (i.e. convection – advection), etc., or radiation by the TOA where the regulation by water vapor is far more important than any role that CO_2 could play, **but furthermore one must acknowledge that most of its increase (210 Gt-C) since 1900 is not even of anthropogenic origin!**

112 Even as per the flawed IPCC model based on SBL, CO_2 delivers a muted log-response (Equations 82, 83) which had to be reinforced arbitrarily by a number of nonsensical hypothesis in order to make it have some climatic impact!

2.4. *Let's get back to some Geology, Astronomy, etc.*

1) Past Climates

Going through past climates is like exploring a process represented in a log-scale. The further away you go the rougher the knowledge and the granularity of the information you can have access to. The first 2,000 years are full of information and data that can be cross-checked to verify your reconstructions. The next 12,000 years ago are still providing plentiful of evidences, that are honestly bewildering for any curious mind given that we observe massive changes, e.g. the green Sahara somewhere around -6.5 kyr, as it is still extraordinarily close to us, and then somewhere around -12,000 years we move back to a glaciation period, reminding us of the extreme advantage of benefiting from a warmer climate. Exploring the previous 2 Myr, just yesterday in geological terms, gives a perspective on this long alternate cycles of glaciation with ice sheets advancing and retreating on 40,000- and 100,000-year time scales called glacial periods, and interglacial periods. This quaternary glaciation is the last known of 4 others distant events namely: *Huronian* (-2470 to -2210 Myr), the *Cryogenian* (-720 Myr to -630 Myr), the so-called *Andean-Saharan* glaciation (-460 to -420 Myr), then the *Late Paleozoic* (-360 to -260 Myr).

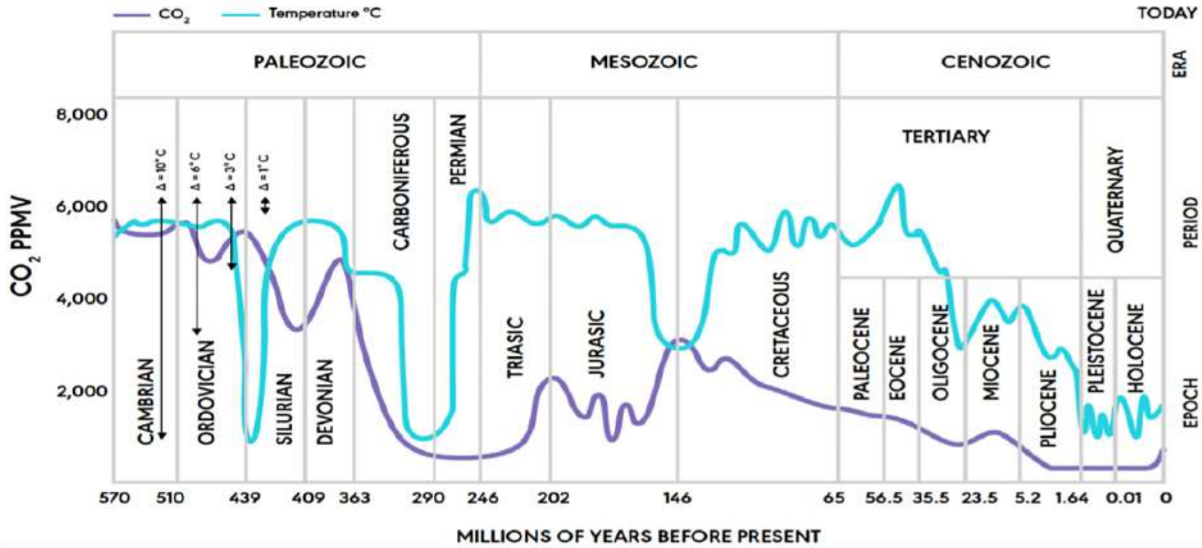

Figure 28. Global temperature and atmospheric CO_2 concentration over the past 570 million years. Purple line is CO_2 concentration (ppm); blue line is change in temperature (Δ°C). **Horizontal scale is not in constant units**. CO_2 scale derived from ratios to levels at around 1911 (300 ppm) calculated by Berner and Kothavala (2001). Source Idso et al. (2019) adapted from Nahle (2007), referencing Ruddiman (2001), Scotese (2003), Pagani et al. (2005).

The most important information conveyed by Figure 28 is that **over geological times there is** simply **no relationship between CO_2 concentration** levels (violet curve), i.e. [CO_2] **and the temperature** T (blue curve). The *Andean-Saharan* glaciation at the end of the Ordovician (-460 to -420 Myr) happened within the context of increasing and extremely high [CO_2] of up to nearly 6,000 ppm (12 to 15x times actual concentrations), while the next glaciation referred to as the *Late Paleozoic* or *Karoo* ice-age (-360 to -260 Myr), at the end of the carboniferous era for its second Pennsylvanian sub-period (318–299 Myr), happened at the Pennsylvanian-Permian boundary, a glaciation that became bipolar at its maximum extension (Fielding et al., 2008) when [CO_2] were low. During the Permian, T recovered to very high levels and remained there until the end of the Jurassic while [CO_2] remained somewhat depressed and at around -146 Myr the [CO_2] increased significantly to more than 3,000 ppm, while T dipped significantly going anti-phase. Subsequently [CO_2] has decreased almost monotonically (except for the very short lived volcanic Paleocene-Eocene Thermal Maximum (PETM) pulse and the limited blip at the Miocene) while T reached a maximum during the PETM. Very low CO_2 concentrations followed the mid-Pliocene period with alternating of stadials and interstadials. At any given time over the geological records, CO_2 concentration is in an equilibrium with the overall geochemical processes at work and geophysical conditions (e.g. distribution of tectonic plates, ratio continents/oceans, atmospheric composition, atmospheric and oceanic circulation, etc.) and the solar system variables (e.g. orbital parameters, Total Solar Irradiance, etc.). In no way does CO_2 concentrations have any impact on the climate at these geological timescales and trying desperately to find a relationship is futile. So the question one might ask is: why do we observe such a good correlation between [CO_2] and T as displayed e.g. Figure 42. The explanation is in fact very simple: once a geochemical and geophysical steady state is reached that corresponds a given CO_2 concentration, then changes of T lead to changes of [CO_2] and not the other way round. Correlation is not causation. In fact we do not have one but two physical rules (one law and one principle) that apply here: Henry and Le Chatelier (equilibrium law). As explained above whenever T increases the solubility of CO_2 decreases and therefore the oceans out-gas (Henry), but as the out-gassing leads to an increase of pCO_2 this tends to oppose the effect of the T increase (Le Chatelier) acting as a negative feedback. The two phenomena are decoupled as they do not happen on the same timescales or at the same place. The tropical oceans massively out-gas (with little counter effect due to the small increase of pCO_2) while the polar seas and oceans act as strong CO_2 sinks (with little help due to the small increase of pCO_2). **CO_2 has a much more potent effect than controlling the temperature** (which it does not do in any way), **it controls life on Earth!** Whenever CO_2 concentration becomes too low, plants and ecosystems generally suffer. Phytoplankton productivity decreases because photosynthesis is made harder at lower concentrations. Whilst plants have adapted themselves to overcome this major hurdle, there is a lower limit. Concentrations below 280 ppm lead to plants starvation (Ward et al., 2005).

So let's rewind the tape, starting from the Holocene which goes back to 11,700 BP (0.01 Myr) detailed in Figure 34, followed by the Pleistocene which goes back to 1.64 Myr, and together with the Holocene make the Quaternary epoch, and only 23 kyr ago, was the Last Glacial Maximum. The previous interglacial optimum known as the Eemian shows that it was warmer than now, following a succession of alternating glacial and interglacial cycles over one million years. The initial period was about 41,000 years (-2.58 Myr to -0.74 Myr), but following the Mid-Pleistocene Transition (MPT) the planet became so cold that it has slowed on average to about 100,000 years. Over the past 740,000 years there have been eight glacial cycles (Augustin et al. 2004). In fact, the entire Quaternary Period, starting 2.58 million years BP, is referred to as an ice age because at least one permanent large ice sheet, i.e. the Antarctic ice sheet, has existed continuously. There is uncertainty over how much of Greenland was covered by ice during each interglacial. Then temperature slowly moves back up to the beginning of the Pliocene at 5.333 Myr BP (period which ends at 2.58 Myr BP). As far as hominids are concerned, the beginning of the Stone Age and therefore the oldest evidence of use of tools known to date seem to relate to Kenyanthropus platyops (a 3.2 to 3.5-million-year-old Pliocene hominid fossil discovered in Lake Turkana, Kenya in 1999). So as can roughly be seen, apart from various optima that will be addressed later, hominids have had to cope with mainly colder conditions than those that mankind has been benefiting from since the end of the Little Ice Age (LIA). In fact, mankind has lived through the last glaciation, i.e. Quaternary and has experienced first-hand the tough times, alternating between extremely cold periods, i.e. stadials and interstadials where climate improved somehow. Each Quaternary climate phase is associated with a Marine Isotope Stage (MIS)[113] number, which describes alternation between warmer and cooler temperatures as measured by oxygen isotope data. Stadials have even MIS numbers and interstadials odd MIS numbers. The current Holocene interstadial is MIS 1 and the last glacial maximum stadial is MIS 2.

Moving backward, from the end of the Miocene to the beginning of Paleocene (66 Myr ago), is definitely the realm of geology, as most major recent orogenies took place during that time-frame (Alpine orogeny, Himalayan orogeny) to give Earth its familiar aspect. Basically, the climate was much warmer with differences in atmospheric circulation, ocean currents and circulation, impact of mountain ranges on the climate, etc. The early Eocene is notable as it appears perhaps to be the warmest period of these last 540 Myr. This is why authors such as Klages et al. (2020) who use CO_2 concentrations to explain what they observe are deluded. For example at the Turonian–Santonian stage (93–83 Myr), when there is no correlation. CO_2 concentration is not helpful to explain any of the previous changes that were observed in the cretaceous period, on any timescale, but these authors stick to their obsession of trying to find explanations based on GHGs. The actual explanations to situations are world apart (Jolivet et al., 2016). Tectonic plates drifted and made the worlds of the past unrecognizable compared to the present day (Hay, 1996; Fluteau, 2003; DeConto, 2008). It is also worth noticing that during the period going from mid-Jurassic to the PETM (-175 to -55 Myr) CO_2 concentration and T have had **negative** correlations, the reverse of behavior corresponding to the AGW theory: CO_2 concentration increased (-175 to -145 Myr) while T decreased and from (-145 to -55 Myr) T increased while CO_2 concentration decreased, how annoying! This matches Davis' (2017) findings who analyzed the relationship between temperature and atmospheric CO_2 with the most comprehensive assemblage of empirical databases of these two variables available for the entire Phanerozoic period (522 Myr) and concludes "*Temperature and atmospheric CO_2 concentration proxies plotted in the same time series panel (Figure 5) show an apparent dissociation and even an antiphasic relationship. (…) Correlation does not imply causality, but the absence of correlation proves conclusively the absence of causality*".

So let's set out to see how much climate has changed without mankind having a say in it!

113 https://en.wikipedia.org/wiki/Marine_isotope_stage

The last 2,000 years

In: Observed Climate Variations and Change, IPCC WG1, Chapter 7; p. 199 Executive Summary, "*A global warming of larger size has almost certainly occurred at least once since the end of the last glaciation without any appreciable increase in greenhouse gases. Because we do not understand the reasons for these past warming events it is not yet possible to attribute a specific proportion of the recent, smaller, warming to an increase of greenhouse gases*". Folland et al. (1990).

Detailed written archives for the last 500 to 1000 years enable to perform some **historical climate reconstructions** for periods were we lack instrumental measures. Historians have detailed documents that give indications of the weather at a particular time: descriptions of harsh winters, rotten or too dry summers, dates of the first snows, of the setting of rivers by ice, dates of harvests, grape harvests, sometimes even flowering, direct or indirect estimates of cereal yields from tithes, the advance or retreat of glaciers attested by texts, the disappearance of hamlets, iconographic or cartographic documents (Le Roy Ladurie, 1967, 2004, 2006, 2009, 2017; Le Roy Ladurie et al., 2009, 2011, 2017). These elements taken individually do not allow firm conclusions to be drawn, as poor wheat yields can result from a rotten summer or a too dry spring, just as glacial advance can result from snowier winters or cooler summers that limit the ablation of ice. But the long series of French and German wine harvest dates and quality reports indicate that early harvests resulted from warm springs and summers characterized by anticyclonic conditions and the late ones from cold springs and summers with cool and cloudy conditions. Of course, the dates of the harvest used without discernment do not mean much since a late harvest can be the result of a very cool summer as well as the result of a change in viticulture techniques used, for example to obtain a higher alcohol content. An early harvest can also be explained, independently of the climate, by an increased need to supply the market with wine (Nichols, 1972).

But all the elements juxtaposed and analyzed together undoubtedly make it possible to trace the climate history from an historical perspective over the last millennium. Le Roy Ladurie (1967) describes the Little Ice Age in Chapter IV of the book in the most detailed way. The author studies with extreme attention the Alpine glaciers and the maximums of 1600, 1820 and 1850 and the glacial flood which also affects Scandinavia and Iceland. Chamonix hamlets are destroyed in 1601 (the year is specified thanks to the tithes counts) whereas they had been established in the Middle Ages during the climatic optimum.

Then winters became less mild, frosts more frequent, snows more abundant during the second half of the 16th century and summers became cooler. The peat bog at Fernau (Tyrol), known thanks to studies of the so called Bunte Moor swamp stratigraphy (Mayer, 1964 ; Chernykh et al., 2013), records peat beds (the thickness of which indicates how long the glacier retreated) and moraine sand beds (which record the advances). Thus, thrusts appear between -1400 and -1300 (the strongest), -900 and -300, between 400 and 750, between 1150 and 1200 and 1300-1350 then 1550-1850. These archives are extremely rich and document with irrefutable evidences the harsh swings experienced over the last millennium (though more accurately for the last 500 years) with extremely cold or mild winters and rotten rainy and cool summers or to the contrary very dry and scorching summer with heatwave and none of these climatic disasters can be attributed to CO_2 or industrial and transportation emissions, simply as they were none! The work done by Le Roy Ladurie and his co-workers through the painstaking analysis from European temperature proxies then available are imaginative, evocative, and persuasive, it definitely makes mockery of global warming or cooling or climate change, it's gone on for centuries, millennial, instead millions of years.

As reminded to us by Le Roy Ladurie and Rousseau (2009) there has been no shortage of climate catastrophes in the well documented French and European history. In 1168, the Sarthe river dried up. During the summer of 1351 the price of wheat was multiplied by three because of its rarity, as a result of "scalding"[114], which led to very early harvests. There are also a series of consecutive scorching summers, climatic micro eras: 1331-1334, four summers in a row, 1383-1385, three summers. Year 1420 is marked by a very severe drought (Le Roy Ladurie et al., 2017). The first half of the 16th century is particularly mild, where we can speak of a small age of warming, during summer the glaciers retreat a lot and the snow melts very high and in, e.g. 1540, many witnesses living in the Alps noted this.

But from 1560 onwards, we enter the LIA, and hot summers become rarer and climate deteriorates significantly. In any case, excess of rain is enemy number one, more so than anything else: rotten summer is more feared than hot summer.

114 Grain Growth Accident caused by excessive heat when the grain has not yet matured

On the other hand, mortality rises in hot summers due to dysentery. The level of rivers and streams drops, the water drawn for living and drinking is muddy, infected, polluted, and the mortality is spectacular. 500,000 deaths during the summer of 1636 or 1705, 700,000 during the hot summers of 1718-1719, with even the appearance of swarms of locusts and a form of Saharan climate in the "*Ile-de-France*" region. These deaths were mainly babies and young of the year.

Of the so many events that make the historical recounting of climate a long list of catastrophes, one can mention at least the following:

- The famine of 1693: is essentially a famine pushed to the extreme, due to the rain (1692-1693) and the cold, with a little scalding (1693) to complete the disaster. It is within the framework of the Maunder Minimum (1645-1715), and more specifically the Late Maunder Minimum or LMM (1675-1715). The number of additional deaths in 1693 and 1694 is an astounding 1,300,000 people, i.e. 5.8% of the French population. This is by far the greatest demographic catastrophe that France has experienced since the 1680s to the present day; a France, let us remember, which had at the time 20 to 22 million inhabitants.

- The great winter of 1708-1709: The icy and deadly winter of 1708-1709 was perhaps prepared by four volcanic eruptions, Vesuvius and Santorini in the nearby (Mediterranean) area; Fujiyama, in Japan, and Piton de la Fournaise, in Reunion Island. Seven winter cold spells were counted and on January 20, 1709, the temperature plunged to -20.5°C in Paris (-23.1°C according to Fuster (1845) p. 300). The demographic deficit calculated using the same methods as in 1693 is 600,000 people who died in addition to the normal. During the hot summers of the 18th century, the losses can be estimated at about 200,000 people in three years (1705, 1706 and 1707). This excess of deaths is the result of deadly epidemics, some of which (dysentery in 1706 and 1707 in particular) were probably favored by episodes of very severe drought and summer heat, by the infection of rivers and water tables that had become too low and too sensitive to the invasion of pathogenic germs.

- Summers of the two years 1718-1719: The hot and dry summers led to early harvests, the earliest in duo (since the quartet of 1683-1686), with African locusts as far as Languedoc. In 1719, this same torrid summer caused the pollution of waters that had become too scarce and all the dirtier. It leads to an outburst of a terrible epidemic of dysentery which contributes to the enormous mortality of the time, more than 400 000 additional deaths in the year 1719 alone. There was another considerable, albeit less marked and less deadly, but not insignificant heatwave in 1747, with a fatal surplus of about 200,000 people. After two years of heat, notably in the summer and autumn of 1778 and 1779, epidemics of dysentery broke out in early September 1779, a date which was recorded in the north of France; the number of deaths was around 200,000 people above the normal average annual death figures for the decade 1770-1779. Would the 18th century thus be essentially a heatwave? In fact, there are also large mortalities due to wheat crop failure (1693-1694) because of excess rainfall as recorded in 1692-1693. There have been classical type famines since the Middle Ages and since the "modern" era, famines of 1315-1317 and 1661-1662, which were extremely aggressive. In 1740 (great winter plus subsequent rains) and in 1770 (heavy rainfall), there was a real rainy assault on wheat production with fairly significant lethal consequences, even though there were no more than a million deaths in the years 1693-1694. Messier (1793) reported 40°C in Paris (France) on July 8th, 1793 and the thermometer had marked 40° at half past three on August 17th, 1701! Since, Paris-Montsouris has a record high temperature of 42.6°C on July 25th, 2019, the second hottest heat was recorded at 40.4°C on July 28th, 1947 but these record-high only apply to the instrumental period and not to all the centuries before which might have registered higher values.

Overall, based on the work of Fuster (1845), an historical climate reconstruction of a long list of very hot and dry summers with associated drought can be made:

- I century: 70 ("*Tacitus reports the unheard-of drought of the 70's : water was scarce in northern Gaul, and the Rhine was barely navigable and it was possible to ford the River*");
- IV century: 357 ("*The drought of summer 357 made it possible to ford the Rhine River*");
- VIe century : 580, 582 ("*The heat made the trees bloom in January*"), 584 ("*We got roses in January, the trees produced a new harvest in September; some of them blossomed again in December, and the vines produced well-formed bunches of grapes at the same time*"), 586 ("*The trees blossomed again in September 586, and many of them, which had already borne fruit, bore fruit a second time until Christmas*"), 587, 589, 591;

- VIIe century : 675 ("*In 675 there was no rain for three months, and there was a great drought, and the wells were dry in Chalons, in the Austrie region*"), 700;
- VIIIe century : 783;
- IXe century : 872 ("*The extreme drought of summer 872 destroyed almost all the fruit*") 874 ("*The drought of the long summer caused hay and wheat to run out*"), 892;
- Xe century : 921 (same as 874), 987, 994;
- XIe century : 1078, 1094 ("*Extraordinary drought*");
- XIIe century : 1137 ("*Drought started in March until Sept. also drying up wells, fountains and rivers*"), 1183 ("*Heatwave that dried rivers, fountains and wells in several places*"), 1188 (*same*);
- XIIIe century : 1204, 1212, 1226 ("*The extreme drought led to the ruin of almost all the summer harvests*"), 1287 ("*It did not rain all summer long; the wells and fountains dried up*"), 1294 "*The drought dried up all the wells and springs of Provence. The Huveaune dried up there and the Rhone diminished to such an extent that it was no longer navigable, even at its mouth*";
- XIVe century : 1305, 1306, 1325 ("*Barely the value of two rainy days in the course of four lunar months...*"), 1331 ("*Such a great drought that the earth could not be plowed because of its hardness*"), 1334, 1361, 1384 ("*The springs dried up during the summer due to the lack of rain and the unbearable drought*"), 1392 ("*The stubborn drought dried up the springs and prevented the largest rivers in France from being navigable*");
- XVe century : 1473;
- XVIe century : 1536 ("*drought dried up all the springs of Provence again*"), 1540, 1553;
- XVIIe century : 1632, 1639 ("*In 1639, hardly any snow fell on the Alps, nor rain in Provence the Durance and the other rivers dried up, the waters of the Rhone descended very low*"), 1674, 1684[115] (ranked by the astronomer J.-D. Cassini as one of the hottest), 1694;
- XVIIIe century[116] : 1701, 1712 ("*The drought and heat of 1712 dried up the springs and destroyed the crops*"), 1718 ("*The extreme lowering of the waters of the Seine at the Tournelle bridge, gave the zero of the measurements for the variable heights of this river*"), 1719 ("*In Marseille, on December 18th, fully ripe cherries and apples are picked*"), 1726, 1727, 1767, 1778 ("*Recounted by Messier as one of the most severe*"), 1793 ("*People and animals died from asphyxiation, vegetables and fruits were roasted or eaten by caterpillars...*");
- XIXe century : 1800 ("*Most of the ponds dried up, the springs dried up and many plants died. On August 20, the Seine was 176 mill. lower than the zero of the 1719* scale"), 1803 ("*The wells and fountains dried up. In Paris, the small arm of the Seine remained almost dry, and the level of the river indicated, on November 21st and 27th, 24 centimeters below zero. In some departments there was a complete lack of water; people went to fetch water three or four leagues away, and it cost thirty cents to water a horse*"), 1811 ("*In the south as in the north, the heat and the drought exhausted most of the springs, dried out the streams and rivers, precipitated the ripening of fruits, consumed the forage plants* "), 1817, 1825, 1842 ("*In the Meuse, the barrel of water sold in August for up to three francs. In Paris, transport by the Seine were interrupted for four months in a row*"), 1858, 1875, 1893.

Same can be read about floods and excessive rainfalls, a very long list of devastating events, starting p. 337 in Fuster (1845). During the early and mid-XX century many newspapers used to mention them (HA, 1952) and GHG were not the scapegoat as man-made emissions could not – obviously - have played a role as they were none! Recent milder and nicer climate and technological progress have made times much better than before and one can put in perspective the death tolls of the past (climate and epidemics) with current events. Therefore, the last 2000 years offer all sorts of proxies and even plentiful of human archives to reconstruct the temperature, rainfall or droughts.

The cycle of 1000 years is very well visible on the next Figure 29 from Christiansen and Ljungqvist (2012). The medieval optimum or Medieval Warm Period (MWP) around year 1000 which was obliterated by (Mann et al., 1998, 1999; Marcott et al., 2013) corresponds to the warmest ocean surface conditions of the SE Greenland shelf over the late Holocene and Miettinen et al. (2015) add "*It was characterized by abrupt, decadal to multidecadal changes, such as an abrupt warming of ~2.4°C in 55 years around 1000 CE. Temperature changes of these magnitudes are rare on the North*

115 Reported by Foster (1845) p. 322 as the first year were thermometric measurements were made. It is also reported by May (2020) that "*The winter of 1683-84 was one of the coldest in English history, the Thames River was frozen down to London Bridge by the second of January and stayed frozen for months. The canals of Venice froze so solidly in 1684 and 1709 that heavy goods could be transported on the ice without breaking through*".

116 Daniel Gabriel Fahrenheit, the originator of the era of precision thermometry invented the mercury-in-glass thermometer in 1714 and Fahrenheit scale in 1724. Since then accurate meteorological records can be made.

Atlantic proxy data" and enabled the colonization of Greenland by the Vikings[117]. The MWP was warmer than today and corresponds to the total withdrawal of the Aletsch Glacier (Figure 30, p.99).

One should notice that the study of Huang et al. (2008), based on hundreds of boreholes from all continents (except Antarctica) which are among the most reliable means of establishing reconstructed paleo-temperatures, is in good accordance with Christiansen and Ljungqvist (2012) and gives strong evidence for a temperature difference of 1.0-1.5 K between the Medieval Warm Period (MWP) and the Little Ice Age (LIA), also as per Mayewski et al. (1993). This has been a contentious subject since the flawed "Hockey Stick" reconstruction and massive deceptive usage made of it by IPCC for years long. Furthermore, the LIA as demonstrated by deMenocal et al. (2000b) is not a regional event limited to the Northern Hemisphere as "*subtropical SSTs were reduced by 3° to 4°C. These events were synchronous with Holocene changes in subpolar North Atlantic SSTs, documenting a strong, in-phase link between millennial-scale variations in high- and low-latitude climate during the Holocene*".

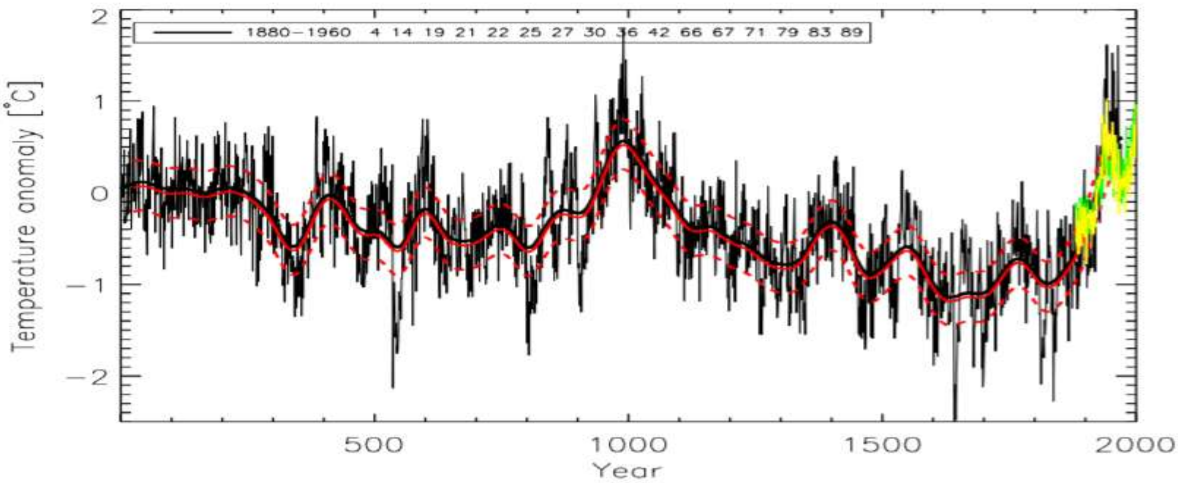

Figure 29. Reconstruction of extra-tropical temperatures of the northern hemisphere in °C, deviating from the average for the period 1880-1960. The thin curves are the annual values, and the smoothed curve (in red) an average over 50 years, with dashed quantiles at 2.5% probability. The green curve shows the observed extra-tropical (>30° N) annual mean temperature. The yellow curve show the temperature average over grid-cells with accepted proxies. Both curves have been centered to zero in 1880–1960 AD. Source: Christiansen and Ljungqvist (2012). Other similar reconstructions by Moberg et al. (2005).

The LIA is also very well visible with a minimum around 1650-1850 (Desprat et al., 2003). As already mentioned, Trutat (1876) reported the frightening receding of the glacier in the Pyrenees and the same happened in the Alps (Nussbaumer et al., 2011; Fig. 4 and 5) and lead Painter et al. (2013) to conjecture that it could have been forced by black industrial carbon. This anthropogenic hypothesis (one more) was refuted by Sigl et al. (2018) who asserted that the 19th century glacier retreat in the Alps preceded the emergence of industrial black carbon deposition on alpine high altitude glaciers «*Our study reveals that in AD 1875, the time when rBC (i.e. refractory Black Carbon; using soot photometry) ice-core concentrations started to significantly increase, the majority of Alpine glaciers had already experienced more than 80 % of their total 19th century length reduction, casting doubt on a leading role for soot in terminating of the Little Ice Age*» (Sigl et al., 2018).

During the Holocene, there are at least 4 such LIA-type events and they are related to very low solar activity as recorded in cosmogenic records. The way these depressed solar levels can propagate to the climate system is suggested by Moreno-Chamarro et al. (2017) "*Here we demonstrate that such exceptional wintertime conditions arose from sea ice expansion and reduced ocean heat losses in the Nordic and Barents seas, driven by a multi-centennial reduction in the northward heat transport by the SubPolar Gyre (SPG)*". A reversal of these very depressed levels of solar activity naturally lead to a reversal of the climatic conditions. Nothing related to CO_2 or industrial soot.

LIA-type events are progressive and one cannot pick exact dates on a continuous process, but 1260 can be chosen as a start date, with a very visible drop on Figure 3 of Hegerl et al. (2007), just after the Samalas eruption as the resulting cooling marked the end of the Medieval Warm Period and was followed by the terrible events of the 14th century, the

117 The Icelandic sagas say that 25 ships left Iceland with Erik the Red in 985, and that only 14 of them arrived safely in Greenland. The Norse established settlements along Greenland's fjords, the larger Eastern Settlement and the smaller Western Settlement.

1315-1317 great famine[118] (occasionally dated 1315-1322 due to the lasting and deleterious effects on the European populations), and the Black Plague. For the end date one can choose 1840, after a bout of volcanic activity from 1790 to 1835 that coincided with the Dalton period of low solar activity, causing a relapse to colder temperatures that had been increasing since around 1700. To try quantify the impact of volcanic activity, one should know that it is the amount of sulfur injected into the stratosphere that matters and the location of the eruption, see (Sigl et al., 2015) for the eruptions that mattered over the last 2500 years (note that 1257 and 1815 figure prominently). For solar activity, reconstructions from cosmogenic isotopes give a better picture than sunspots and extend over a much longer period (Muscheler et al., 2007).

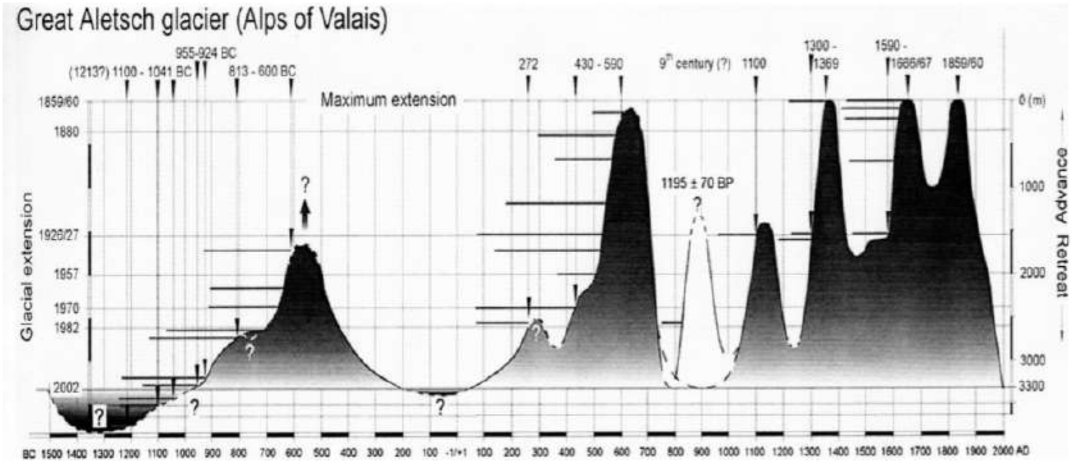

Figure 30. The Little Ice Age (LIA), "cold" period from 1300 to 1860, ended, according to the glacier moraines, around 1860; observations on the great Aletsch glacier (Switzerland) also strongly suggest cycles of around 1000 years; before our era, around the Iron/Roman Age Optimum (I/RAO) (aka the Roman Warm Period) between 250 BC and 400 AD the glacier was somehow shorter than today, and around 1350 BC – 1200 BC i.e. Late Bronze Age Optimum (BAO) the glacier was 1000m shorter than today as per Schafer (2018), graph after Holzhauser et al. (2005).

Christiansen and Ljungqvist (2012) conclude that their reconstructions indicate that «*the first millennium AD was generally significantly warmer than the second millennium AD. The 17th century was the coldest century during the last two millennia and most of the LIA seems to have been colder than during the Dark Age Cold Period ca. 300–800 AD. The level of warmth during the peak of the MWP in the second half of the 10th century, equaling or slightly exceeding the mid-20th century warming, is in agreement with the results from other more recent large-scale multi-proxy temperature reconstructions…*». One should notice though, that reconstructions from (Mann et al., 1998, 1999; Marcott et al., 2013) fail to account for the fact that LIA was 1.5° cooler than the MWP and present, as demonstrated by Huang et al. (2008) based on hundreds of boreholes or based on the study of Length of Day (LOD) and NAO by Mazzarella and Scafetta (2018) which demonstrate that LIA "*was 1.0–1.5 °C cooler than current warm period*" or even from accurate global reconstructions like provided by May (2017) for the Antarctic, Southern Hemisphere mid-latitudes, the tropics, the Northern Hemisphere mid-latitudes, and the Arctic, all combined into a simple global temperature reconstruction.

Considered over such a short timescale as 2000 years (for paleo-climate analysis but an eternity for climate software modeling), the current warming does not appear exceptional as it compares with the Roman Warm Period (RWP) and barely surpasses the Medieval Warm Period (MWP), especially as we recover from a remarkably cold period when temperatures in the 17th century reached values as cold as −1.0 °C below the 1880–1960 AD level. The Roman Climatic

118 "**Cooling not warming is riskier**": the Great Famine started with bad weather in spring 1315 (Baek et al., 2020). Crop failures lasted through 1316 until the summer harvest in 1317, and Europe did not fully recover until 1322. Crop failures were not the only problem; cattle murrains caused sheep and cattle numbers to fall as much as 80%. Throughout the spring of 1315 and the summer, it continued to rain heavily, and the temperature remained cool. Under such conditions, grain could not ripen, leading to widespread crop failures. Grain was brought indoors in urns and pots to keep dry. The straw and hay for the animals could not be picked up, so there was no fodder for the livestock. Salt, the only way to preserve meat, was difficult to obtain because brine could not be evaporated in wet weather. In the spring of 1316, it continued to rain on a European population deprived of energy and reserves to sustain itself. Extreme measures were taken, the future was mortgaged by slaughtering the draft animals, eating the seed grain, abandoning children to fend for themselves , old people voluntarily refusing food for the younger generation to survive. This rural and societal disaster has been attributed to the major volcanic eruptions of 1314 (± 12 years) A.D. Okataina (Tarawera), North Island, New Zealand (Nairn et al., 2004; Hodgson and Nairn, 2005) and 1257 A.D. Samalas, Indonesia, see section "Volcanoes, Tectonics and Climate", p. 223

Optimum (RCO) or RWP is a period of warm climate, at least in Europe and the North Atlantic, which runs from around 250 BC to 400 AD, e.g. (Bianchi and Mccave, 1999) p. 516, (Desprat et al., 2003). Theophrastus (371 B.C.-287 B.C.) wrote that date palms could grow in Greece if they were planted, but that they could not bear fruit. This is the case today, suggesting that average summer temperatures in the southern Aegean in the 4th and 5th centuries BC were at least at a comparable level to those of today. This, together with other literary indications of the time, confirm that the Greek climate was then basically the same or warmer as it is today. Dendrochronological evidence, found in the Parthenon, shows a climate variability in the 5th century BC that resembles the modern pattern of variation (Wang et al., 2013). Growth rings of trees from Italy in the 2nd century BC indicate "mild" climatic conditions at the time when Hannibal crossed the Alps with his elephants (218 BC).

Recent study by Margaritelli et al. (2020) based on SST reconstruction from the Sicily Channel based in Mg/Ca ratios measured on the planktonic foraminifer "*Globigerinoides ruber*" shows in the Mediterranean area "*persistent regional occurrence of a distinct warm phase during the Roman Period. This record comparison consistently shows the Roman as the warmest period of the last 2 kyr, about 2°C warmer than average values for the late centuries for the Sicily and Western Mediterranean regions*". Providing a good illustration of the principle "**Cooling not warming is riskier**", see footnote p. 99, Margaritelli et al. (2020) conclude "*We hypothesis the potential link between this Roman Climatic Optimum and the expansion and subsequent decline of the Roman Empire*".

Tree-ring chronologies from the Russian Altai and Austrian Alps used to reconstruct summer temperatures over the past two millennia show that in both regions, conditions during recent times are comparable to the Roman optimum and slightly warmer than throughout the medieval period (Büntgen et al., 2016). Shi et al. (2013) present comparable results. Then, the study of the Aletsch glacier by Holzhauser et al. (2005), provides data in good agreement with the findings of Christiansen and Ljungqvist (2012), and by extending backwards 1500 years further also shows a probable complete disappearance of the glacier(s) around -1000BC as presented by Nussbaumer et al. (2011), Fig. 7(b). We are definitely not in unchartered territory, even limiting ourselves to such a short period, well documented through human archives (e.g. Hannibal's crossing of the Alps during the Second Punic War, 218BC).

One will remember that for having published the paper of Soon and Baliunas (2003) where they stated that "*Furthermore, the individual proxies can be used to address the question of whether the 20th century is the warmest of the 2nd millennium locally. Across the world, many records reveal that the 20th century is probably not the warmest nor a uniquely extreme climatic period of the last millennium*", the six editors of the journal *Climate Research* who dared to publish the paper were fired by the publisher[119] (Jaworowski, 2007). But, this is just what Luterbacher et al (2016) also state "*reconstructions indicate that the mean 20th century European summer temperature was not significantly different from some earlier centuries, including the 1st, 2nd, 8th and 10th centuries CE. The 1st century (in BHM also the 10th century) may even have been slightly warmer than the 20th century*". Don't shoot the messenger, it will change nothing to the facts. Another very comprehensive companion paper of Soon and Baliunas (2003) is Soon et al. (2003).

Broadening the time window, to prepare the transition to the next section and the Holocene, it should be noticed that the Atlantic optimum happened just before the neo-glacial started (figure 34), and is known from forests reconstructions and palynological studies (Kalis et al., 2003; Marquer et al., 2014, 2017; Roberts et al., 2018; Zanon et al., 2018). It dates back to the 4th millennium B.C. and shows that a mixed forest of oak, hazelnut, alder and linden trees covered the whole of northwestern Europe at that time. Although it is not easy to determine by how much the average temperature of that time could exceed the present one (after LIA), one thing is certain, the characteristic plant associations of that period could never reappear again. Comparing, over the entire Holocene, forests extension and the observed associations of vegetation gives a reasonable clue to whether the Holocene Climatic Optimum (HCO) was higher than now and by how much. With respect to vegetation and forest extension, Marquer et al. (2017) state that "*The overall results indicate that climate is the major driver of vegetation when the Holocene is considered as a whole and at the sub-continental scale, although land use is important regionally*". Then Kalis et al. (2003) Fig. 12 p. 14-15, can be used to see how the forests extension has kept decreasing since the HCO. We are nowadays very far from the optimum of the HCO either in terms of extension or in terms in associations (species / groups not found any longer as requiring a warmer environment). Of course the very final decrease in extension is linked to anthropogenic deforestation but the trend started 6000 years ago and the message given by association changes is unequivocal. Current modern warming is colder than the HCO by far, this is going to be addressed in detail in the next section, see also section "Why a Warmer World is a Better Place to Live" p. 366.

119 https://en.wikipedia.org/wiki/Soon_and_Baliunas_controversy

The last 12,000 years, brief overview of the Holocene

When one extends the horizon back to 12,000 years, really nothing in geological terms, remarkable surprises already await the reader. The bigger picture is that the 100,000 year glacial and 12,000 year interglacial cycles have alternated for over 600,000 years. This is what leads Nicholson et al. (2006) to state "*A fundamental goal of Earth science is to understand the remarkable instability of late Quaternary global climate prior to the beginning of the Holocene, about 11,000 years ago. This unusual climate behavior was characterized by millennial-scale climate oscillations on suborbital timescales, and a distinctive `Sawtooth' pattern of very abrupt glacial and stadial terminations (within decades) followed by more gradual global cooling (Dansgaard et al., 1993). The fact that both major (glacial) and minor (stadial) cooling periods in Earth's climate were terminated by similar abrupt warming episodes suggests a common mechanism driving such rapid changes in global climate*".

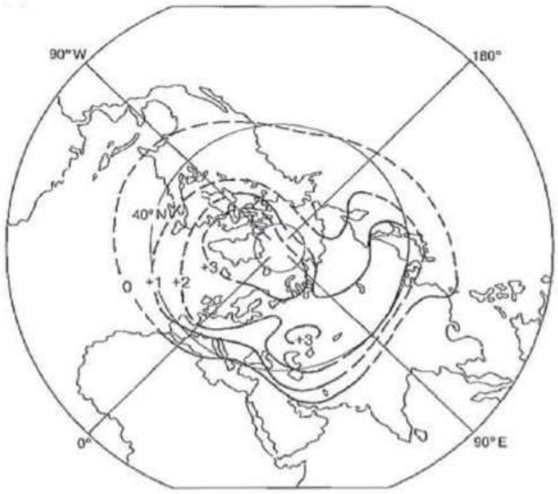

Figure 31. Departure of summer temperature (°C) from modern values for the Holocene climatic optimum optimum (5000 to 6000 years BP) as per Borzenkova and Zubakov (1984), (Budyko and Izrael, 1987) after Folland et al. (1990).

The beginning of the Holocene is by convention fixed at 11,700 BP (Before Present, that is before 1950) or 9,750 BC: it is also the beginning of the current interglacial. Temperatures during the Holocene Climatic Optimum (HCO) between 8,000 years and 6,000 years before the present were up to 3°-5°C higher than now (Borzenkova and Zubakov, 1984; Ramos-Román et al., 2018) as well visible on the Figure 31.

Around 6000 BCE the summer insolation at 65 ° N was say 40 W/m² stronger than the current one but the average annual insolation (at the top of the atmosphere) not much different. Arctic summer temperatures a few degrees higher[120] reduced the contrast with the tropical zone; the high subtropical pressures which translate this contrast and limit the extension of the monsoon towards the north were much less, from where, in the north of the current African Sahel, precipitations of 300 mm higher than the current ones and a Sahara covered with lakes with crocodiles and hippos, this is the "Green Sahara" episode. But before addressing this extraordinary change, there is an even more recent and dramatic event that lead to the fall of an empire, i.e. the Akkadian Empire in Mesopotamia.

The story of the synchronous collapse of the Akkadian Empire in Mesopotamia, the Old Kingdom in Egypt and Early Bronze Age settlements in Anatolia, the Aegean and the Levant tells us that climate change keeps happening and does not need mankind to show how whimsical climatic conditions can be (Weiss, 2016; 2017a-b). Weiss has directed the Yale University Tell Leilan[121] Project's excavations and surveys in northeastern Syria since 1978. His most recent contributions demonstrates that abrupt, century-scale, climate changes altered the fate of prehistoric and ancient West Asian societies, such as the abrupt climate change 4,200 years before present referred to as «4.2 ka BP mega-drought» that reduced agricultural production in northern Mesopotamia, forced regional abandonment, disrupted Akkadian imperial revenues, and thereby lead to the political collapse in southern Mesopotamia.

120 Summer insolation at 65 ° N of a few tens of W / m² higher than the current were due to the fact that the perihelion was then in July and not in January.

121 https://leilan.yale.edu/publications/all

Weiss and his colleagues discovered evidence in northern Syria that this once prosperous region was suddenly abandoned around 4,200 years ago, as indicated by a lack of pottery and other archaeological remains. Instead, the rich soils of earlier periods were replaced by large amounts of wind-blown dust and sand, suggesting the onset of drought conditions. Weiss (2016) explains that «*Decadal to century-scale mega-droughts are a recently discovered but now well-documented feature of the Holocene. A major and much-discussed example is the abrupt global megadrought and cooling at ca. 4.2-3.9 ka BP (2200-1900 BC)*».

This hypothesis is now confirmed by a study by Carolin et al. (2019) and reported by Ersek (2020) after an analysis of the stalagmites and stalactites found in the Gol-e-Zard Cave (Iran). The cave lies in the shadow of Mount Damavand, which at more than 5,000 meters dominates the landscape of northern Iran. In this cave, stalagmites and stalactites are growing slowly over millennia and preserve in them clues about past climate events. Changes in stalagmite chemistry from this cave have now linked the collapse of the Akkadian Empire to the «4.2 ka BP mega-drought» event described by Weiss. In fact, the Gol-e-Zard stalagmites can be used as an indicator of dustiness at the surface, with higher magnesium concentrations indicating dustier periods, and by extension drier conditions. Ersek (2020) reports that «*The stalagmites have the additional advantage that they can be dated very precisely using uranium-thorium chronology. Combining these methods, our new study provides a detailed history of dustiness in the area, and identifies two major drought periods which started 4,510 and 4,260 years ago, and lasted 110 and 290 years respectively. The latter event occurs precisely at the time of the Akkadian Empire's collapse and provides a strong argument that climate change was at least in part responsible*». The collapse of the Akkadian Empire in Mesopotamia was followed by mass migration from north to south which was met with resistance by the local populations. A 180km wall known as the "Repeller of the Amorites" was even built between the Tigris and Euphrates in an effort to control immigration.

The origin of the 4.2 kyr event is clearly not related in any manner to changes in the composition of the atmosphere and some researchers simply honestly state that it remains poorly understood (Javier, 2017f; Geirsdóttir et al., 2019). Probable causes have been searched and volcanism was proposed by Antoniades et al. (2018) - though there is some mismatch in the concordance with the Deception Island's caldera collapse that occurred at 3980±125 yrs - or a link with the millennial scale variability in the Atlantic Meridional Overturning Circulation[122] (AMOC) and / or the sub-polar gyre, e.g. (Risebrobakken et al., 2011) may provide for a better explanation as it accounts for the similarity in the timing of other cool events at higher latitudes in the Northern Hemisphere. Risebrobakken et al. (2011) state "*The maximum in oceanic heat transport at 10 ka BP occurred due to a major reorganization of the Atlantic Ocean circulation, entailing strong and deep rejuvenation of the Atlantic Meridional Overturning Circulation, combined with changes in the North Atlantic gyre dynamic causing enhanced transport of heat and salt into the Nordic Seas*". Courty et al. (2008) state another hypothesis "*The detailed study of soils and archaeological records provided evidence to re-interpret the 4 kyr BP dust event linked rather to the fall-back of an impact-ejecta, but not climate change*", though as from our viewpoint, it is just another form of... climate change!

Just before the fall of the Akkadian Empire happened, probably the most intriguing climatic change over the last 12,000 years is the «Green Sahara» (deMenocal and Tierney, 2012), (deMenocal, 2015). Of course, one must be struck by the fact that this a massive change occurring over a short period of time and recently enough in mankind history to enable transmission through oral tradition and later by Herodotus in 440 BC (often referred to as "The Father of History," a title first conferred on him by the first-century BC Roman orator Cicero) and Strabon in 23 AD who discussed the existence of a greener Sahara, although their reports were at first questioned owing to their anecdotal nature. This should remind us that climate changes, has always done so, on short timescales and also over geological times. Humankind has had no influence on that matter of fact and the best we can do is to adapt ourselves, as a species, to these changes. Thinking that CO_2 controls the climate is more than questionable its is simply dubious, that one 100 ppm increase of that trace gas is a game changer is devoid of scientific substance and furthermore a sin of egocentricity, of bloated pride.

«*The humid period began about 14,600–14,500 years ago at the end of Heinrich*[123] *event 1, simultaneously to the Bølling-Allerød warming. Rivers and lakes such as Lake Chad formed or expanded, glaciers grew on Mount Kilimanjaro and the Sahara retreated. Two major dry fluctuations occurred; during the Younger Dryas and the short 8.2 kilo-year event. The African humid period ended 6,000–5,000 years ago during the Piora Oscillation cold period. While some*

122 https://en.wikipedia.org/wiki/Atlantic_meridional_overturning_circulation

123 A Heinrich event happens when large groups of icebergs break off from glaciers and traverse the North Atlantic. They occurred during five of the last seven glacial periods over the past 640,000 years. https://en.wikipedia.org/wiki/Heinrich_event

evidence points to an end 5,500 years ago, in the Sahel, Arabia and East Africa the period appears to have taken place in several steps»[124]

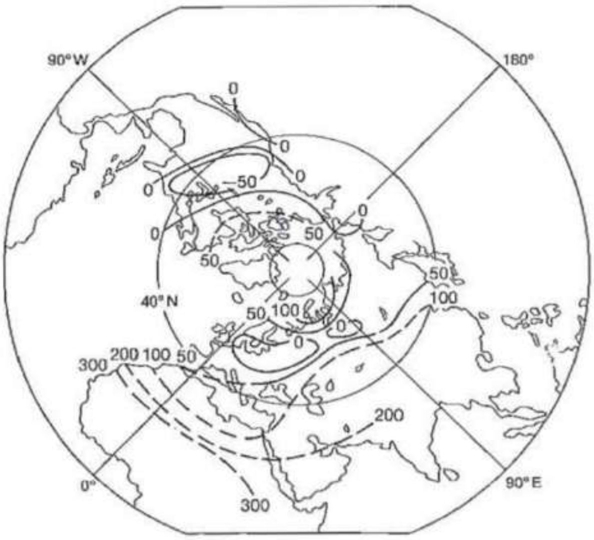

Figure 32. Departure of annual precipitations from modern values for the Holocene climatic optimum optimum (5000 to 6000 years BP) as per Borzenkova and Zubakov (1984), (Budyko and Izrael, 1987) after Folland et al. (1990).

The African humid period has been explained by increased insolation during Northern Hemisphere summer, as detailed by Shanahan et al. (2015) «*During the African Humid Period about 14,800 to 5,500 years ago, changes in incoming solar radiation during Northern Hemisphere summers led to the large-scale expansion and subsequent collapse of the African monsoon*».

Due to precession, the season at which Earth passes closest to the Sun on its elliptical orbit (i.e. the perihelion) changes, with maximum summer insolation occurring when this happens during Northern Hemisphere summer, this was described by deMenocal et al. (2000a) «*Orbital variations cause changes in the seasonal distribution of incident solar radiation, and resulting changes in summer season insolation affect the strength of the summer monsoon*» and later revisited by Liu and Shi (2009) who established that «*Since the early 1980s, more and more observed evidence and simulated results, especially the absolute-dated stalagmite records and orbital-scale transient model runs in the last few years, have indicated that the quasi-20ka period in the Quaternary monsoon climate change is caused by precession*».

Between 11,000 and 10,000 years ago, Earth passed through the perihelion at the time of summer solstice increasing the amount of solar radiation by about 8% as deMenocal et al (2000a) acknowledge that «*The early Holocene greening of North Africa has been linked to an intensification of the African monsoon due to earth orbital changes which increased summer season insolation forcing of the African monsoon. By 10-11 cal. ka BP, summer insolation in the Northern Hemisphere had risen to peak levels approximately 8% greater than today due to earth's orbital precession which gradually aligned the boreal summer solstice with perihelion (Berger and Loutre, 1991)*». Take notice that the original paper from Berger and Loutre, with all calculations was as early as 1991.

This increase of the solar radiation by up to 8% results in the African monsoon becoming both stronger and reaching farther North (deMenocal, 2015), see Figure 33. Summer insolation was at least 4% higher than today between 15,000 and 5,000 years ago (McGee and deMenocal, 2017). Veyres (2020d) estimates that «*the average temperature should, from 9000 years to 5500 years before the present (that is to say -7050 to -3550) be at least 2°C higher than the current one: it was the time of the wet Sahara strewn until in the Tropic of large lakes with crocodiles and hippos. There was then no arid zone outside southern Tunisia and Sinai; the current deserts were game eaters steppes as shown by the rock images of Tassili; pharaohs would have hunted the hippopotamus in Syria still around -1200 (3150 BP). Arctic temperatures a few degrees higher in summer reduced the contrast with the tropical zone; the high subtropical pressures which limit the extension of the monsoon towards the north, and which are the expression of this contrast, were much less, p. 38*».

Can we have a more mind boggling climate change example that this Green Sahara story?

124 Excerpt from https://en.wikipedia.org/wiki/African_humid_period

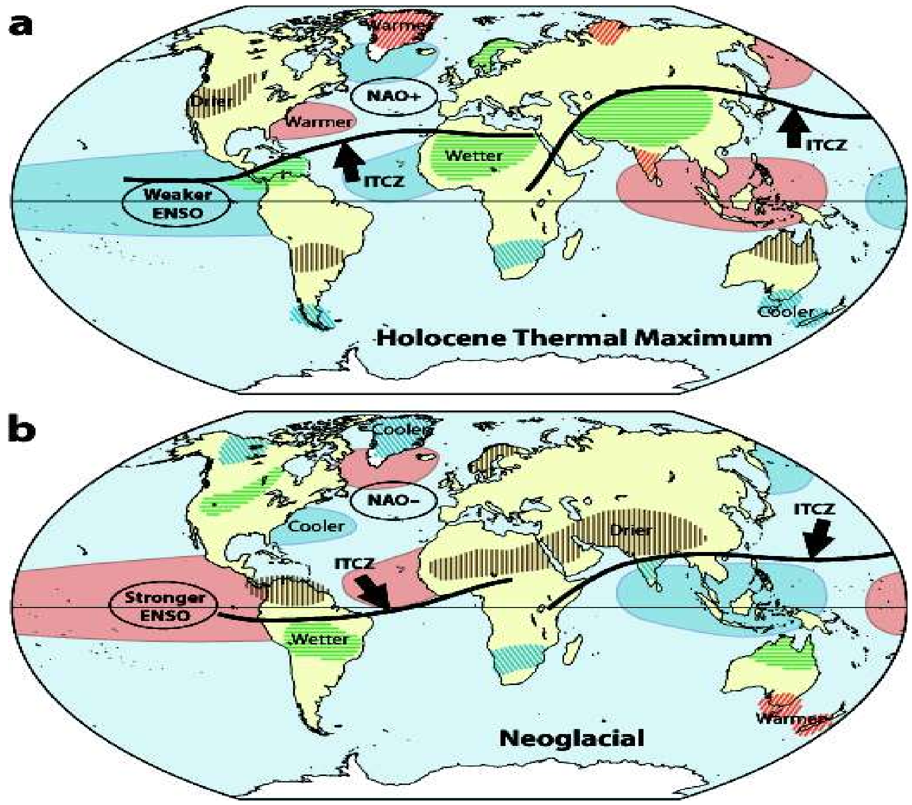

Figure 33. Based on multiple climate proxy time series, the transition from a) Holocene Climatic Optimum to b) Neoglaciation. The climate patterns changed at the Mid-Holocene Transition (see Figure 34) due to orbitally-driven changes in insolation and a shift from solar to atmospheric-oceanic frequencies leading to the shift of the Inter-Tropical Convergence Zone (ITCZ) and led to the end of the Green-Sahara period, after Wanner and Brönnimann (2012). Source: Javier Vinós[125].

This shift of the ITCZ also explains the collapse of the mangrove ecosystems along the coastline of Oman (Decker et al., 2020). Confirming results have also been obtained by studying the $\delta^{18}O$ variations of a stalagmite in the Dongge Cave, located in southern China which reflect the changes of the in-situ precipitations and therefore of the strength of the Asian Monsoon. The conclusions by Wang, Y., et al. (2005) are that "*the broad decline in AM intensity through the latter part of the Holocene correlates well with other northern low-latitude records and results directly from the orbitally induced lowering of summer insolation affecting ITCZ position and low-latitude precipitation patterns. Thus, changes in the Holocene AM result from a number of factors, including orbitally induced insolation changes, changes in solar output, and changes in oceanic and atmospheric circulation*". This is in fact a good summary of what has made the climate over the last 11,700 BP, the natural variability of which during the Holocene has by far exceeded the modern observations.

Taking a broader picture and backtracking to the beginning of the Holocene, we can find a number of events of the LIA-type (Figure 30). The LIA is not a special period, but part of a recurring phenomenon that due to the progressive neoglacial cooling of the planet just happened to be the last and more remarkable cooling period. Every one of those Holocene cooling events (Andersen et al., 2004) are reflected in Bond Ice-Rafting Debris[126] (IRD) records (Bond et al., 1992; 2001), associated with a strong minimum in solar activity (Haigh, 2001), and have had a recovery period characterized by warming and a reversion of changes over a period of 2-3 centuries. Essentially, Holocene LIA-type of events terminate because the causes that originated them end. And the main coincidence factor for most of these type of events is prolonged low solar activity manifested in the presence of a large minimum or of a cluster of grand solar minima. Even though changes in Total Solar Irradiation (TSI) are small and have led to dismiss or minimize the role played by the Sun we have a strong correlation and clearly solar variability affects climate through non-linear responses

125 https://figshare.com/authors/Javier_Vin_s/6370913 Javier Vinós's public data

126 These IRDs consist of glass particles which originate from volcanic eruptions in Iceland. They are accumulated by glaciers moving towards the coast where they break up into icebergs drifting southwards carrying the particles. During the melting of the iceberg, the particles are released, sink to the bottom, and are incorporated into the sediment. The distance an iceberg can drift south before melting depends on the prevailing climate conditions. Therefore, the cooling episodes precede the main phase of ice-rafted detritus deposition.

to be better determined (Soon et al., 2015). The LIA is well represented in hundreds of proxies of very different nature and more importantly is not a unique event, it is part of an Holocene collection of cold events that are well registered in North Atlantic ice-rafted petrological detritus, i.e. Bond events (Bond et al., 1992). LIA is just the latest and the coldest of them, well visible for example on Figure 3 of the temperature reconstruction provided by Hegerl et al. (2007). In a comment made about an article written by Andrews (2018), Javier provided an extended explanation with respect to the factors that make LIA-type events come to an end. "*These LIA type of events, like the 2.7, 5.2, 9.3, or 10.2 kyr events, are generally associated to low solar activity reflected in cosmogenic records. When solar activity declines, there is a change in winter circulation in both hemispheres due to changes in stratospheric temperature and pressure gradients between the equator and the poles in the dark hemisphere*". During low-solar-activity winters atmospheric circulation changes due to a stronger activation of the meridional circulation. The change in Atmospheric Angular Momentum (AAM) associated to low solar activity is reflected in the small acceleration in the Earth's rotation speed that takes place (Lambeck and Cazenave, 1976). This atmospheric circulation change produces a disorganization of the polar vortex and a more meandering jet stream. The Arctic climate and Greenland in particular become warmer thanks to an an easterly zonal wind anomaly (Roy, 2018a), while high latitudes in the Northern Hemisphere become colder and there is more frequent winter blocking conditions. The Arctic Oscillation and the North Atlantic Oscillation become predominantly negative. Under these atmospheric conditions more heat is transported to the poles and radiated to space so the planet cools. But at certain times solar activity becomes so low that it enters a different state and gets stuck in a low mode that is known as a solar grand minimum. For years and decades every winter has low solar activity.

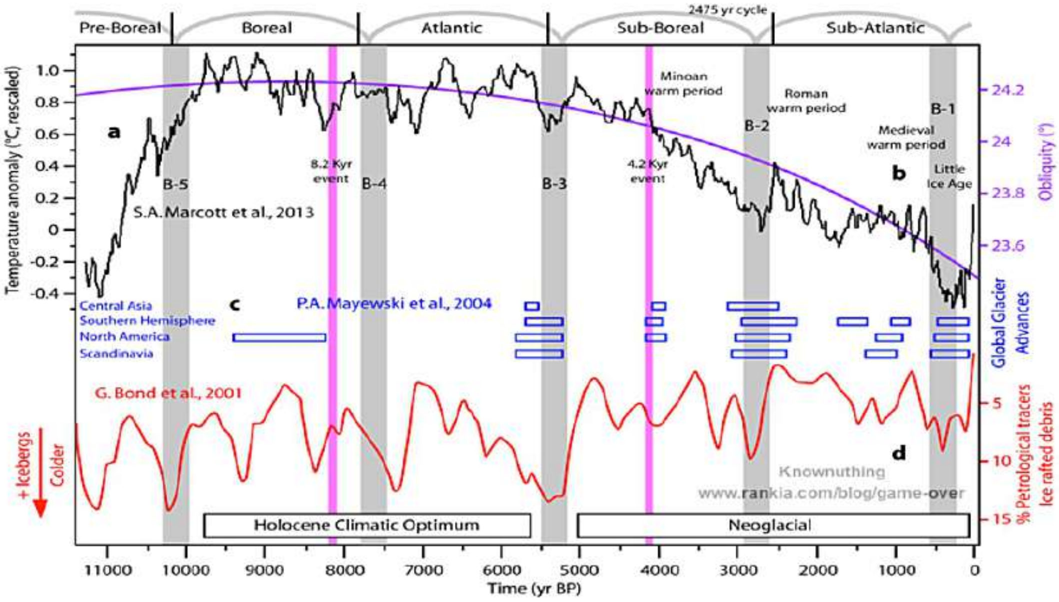

Figure 34. Holocene climate reconstruction from Javier (2017c) "Major palinological subdivisions of the Holocene (names on top) match a 2450-yr regular spacing (grey arches on top). (a) The global temperature reconstruction has been rescaled resulting in the Holocene Climate Optimum being about 1.2°K warmer than LIA (b) The general temperature trend of the Holocene follows the Earth's axis obliquity (purple), and significant downside deviations generally match the lows of the ≈2400-year Bray cycle of solar activity (grey bands labeled B-1 to B-5). (c) Significant negative climate deviations manifest also in global glacier advances - blue bars, Mayewski et al. (2004) and (d) strong increases in iceberg detrital discharges (red curve, inverted) Bond et al. (1992; 2001) that generally agree well with the lows in the ≈2400-year Bray cycle and ≈1000-year Eddy cycle (not shown) of solar activity", Source: Javier (2017c).

Over time the polar cell expands, while the Hadley cell contracts, and overall wind circulation strengthens with associated increase in storminess and decrease in sea surface temperatures due to more active vertical mixing. At the same time zonal wind circulation becomes weaker. Javier adds "*The Westerlies become weaker so there is less contribution from the Sub-polar Gyre*[127] *current to the North Atlantic Current branch of the Atlantic Meridional Overturning Circulation. The North Atlantic Current becomes warmer due to less contribution from polar waters and brings more humidity to Scandinavia increasing winter snow precipitation and causing glacier growth. The European*

127 In oceanography, a gyre is any large system of circulating ocean currents, particularly those involved with large wind movements. Gyres are caused by the Coriolis effect; planetary vorticity, horizontal friction and vertical friction determine the circulatory patterns from the wind stress curl (torque). A subpolar gyre, is an area of cyclonic ocean circulation that sits beneath a persistent region of low atmospheric pressure. In contrast to subtropical gyres, the movement of ocean water within the Ekman layer of sub-polar gyres forces upwelling and surface water divergence.

storm track takes a more southerly path due to weaker Westerlies and North and Central Europe become drier and colder, while Southern Europe remains warm and becomes wetter".

Glaciers in the Alps grow due to an increase in winter precipitation. Due to the asymmetry in continental mass distribution, the Northern Hemisphere wind regime is more sensitive to low solar activity than the Southern Hemisphere. This is reflected in the semi-annual component of the changes in length-of-day (Earth rotation speed measurement) that shows a much stronger winter peak for the Southern Hemisphere (Le Mouël et al., 2010). The result is that the climatic effects of low solar activity are stronger in the Northern Hemisphere, and the LIA was more prominent in that hemisphere. Alpine glaciers decreased rapidly after solar activity increased because winter storms took a more northerly path and it snowed less in the winter. The LIA ended because solar activity recovered and volcanic activity decreased. Atmospheric circulation has been slowly returning to a high solar activity state for the last 200 years. Hadley cell has been expanding (tropics expand), and Polar cell has been contracting. But reference is made to the effect on climate of direct solar variability, not necessarily of cosmic rays.

The Laschamps event[128] about 41,400±2000 years ago was a geomagnetic event (Bonhommet and Zähringer, 1969), (Nowaczyk et al., 2012), that resulted in a huge amount of cosmic rays arriving to the Earth over several hundred years, but was for long only considered as associated to a weak climate response until a recent study by Cooper et al. (2021) demonstrated that it triggered substantial changes in atmospheric ozone concentration and circulation and that this explains synchronous global climate and environmental changes (AAAS, 2021). This proves that geomagnetic field fluctuations can affect atmospheric temperature and circulation on a global scale. In fact, this should not come as a surprise as it was already easily visible in Kaiser et al. (2005) reconstructions for example (Figure 3) with a visible drop of Sea Surface Temperatures (SSTs) at 41 kyr. Furthermore, the interplay of geomagnetism and solar wind (Badruddin and Aslam, 2013) is probably considerably under-evaluated as a powerful climate driver as is the Sun's variability which went during this 42 kyr event through several Maunder type grand solar minima, the solar activity not only being much lower but also more unstable (Fogwill et al., 2021). Who believes in the "solar constant" being constant? Discovering the natural factors which have driven climate-change over all time-scales is key to understanding the Earth system and a preliminary requirement to any claim of foolish man-made attribution of the observed phenomena.

The five following main periods can be identified on Figure 34:

- Pre-Boreal: 11,500 – 10,500 yr BP. Cool and sub-arctic;
- Boreal: 10,500 – 7,800 yr BP. Warm and dry;
- Atlantic: 7,800 – 5,700 yr BP. Warmest and wet;
- Sub-Boreal: 5,700 – 2,600 yr BP. Warm and dry;
- Sub-Atlantic: 2,600 – 0 yr BP. Cool and wet.

The transition from Sub-Boreal to Sub-Atlantic took place at the end of the Bronze Age. Rutger Sernander[129] proposed that this climatic change was abrupt, even a catastrophe that he identified with the Fimbulwinter of the Sagas. As summarized by Javier (2017b; 2017c) "*Holocene climate is characterized by two initial millennia of fast warming followed by four millennia of higher temperatures and humidity, and a progressively accelerating cooling and drying for the past six millennia. These changes are driven by variations in the obliquity of the Earth's axis. The four millennia of warmer temperatures are called the Holocene Climatic Optimum which was 1-2°C warmer than the Little Ice Age. This climatic optimum was when global glaciers reached their minimum extent. The Mid-Holocene Transition, caused by orbital variations, brought a change in climatic mode, from solar to oceanic dominated forcing. This transition displaced the climatic equator, ended the African Humid Period and increased El Niño activity.*"

As far as glacier are concerned, there are evidences that at the Holocene Climatic Optimum[130] (HCO) glaciers were globally more reduced than now and there was much less sea ice in the Arctic (Porter et al., 2019). Joerin et al. (2006)

128 https://en.wikipedia.org/wiki/Laschamp_event a short reversal of the Earth's magnetic field; the period of reversed magnetic field was approximately 440 years, the transition from the normal field lasting approximately 250 years. The reversed field was 75% weaker, whereas the strength dropped to only 5% of the current strength during the transition. This reduction in geomagnetic field strength resulted in more cosmic rays reaching the Earth, causing greater production of the cosmogenic isotopes beryllium 10 and carbon 14. As reported by Nowaczyk et al. (2012) "*The central, fully reversed phase of the Laschamp excursion is bracketed by virtual geomagnetic pole (VGP) excursions to the Sargasso Sea (41.9 ka) and to the Labrador Sea (39.6ka)*"

129 https://en.wikipedia.org/wiki/Rutger_Sernander Swedish botanist, geologist and archaeologist. He was one of the founders of the study of palynology which would later be developed by Lennart von Post.

130 HCO was a warm period during roughly the interval 9,000 to 5,000 years BP, with a thermal maximum around 8000 years BP.

suggest that in the time of the Roman Empire, they were smaller than today and 7,000 years ago they probably weren't around at all. Joerin and a colleague are standing in front of the Tschierva Glacier in Engadin, Switzerland at 2,200 meters (7,217 feet) "*A few thousand years ago, there were no glaciers here at all*" he says. "*Back then we would have been standing in the middle of a forest.*" He digs into the ground with his mountain boot until something dark appears: an old tree trunk, covered in ice, polished by water and almost black with humidity. "*And here is the proof*" says Joerin. As explained in Joerin et al. (2006) "*A comparison with other archives and dated glacier advances suggests 12 major recession periods occurring at 9850-9600, 9300-8650, 8550-8050, 7700-7550, 7450-6550, 6150-5950, 5700-5500, 5200-4400, 4300-3400, 2800-2700, 2150-1850, 1400-1200 cal. yr BP.*" and "*The radiocarbon ages of tree fragments and peat discs found on proglacial fore-fields indicate 12 phases of glacier recessions during the Holocene. Locations and type of occurrence of the dated samples show that trees and mires grew where glaciers exist at present and, therefore, glaciers were smaller at that time*". Finally, Joerin et al. (2006) conclude "*As a result, it is suggested that major glacier fluctuations occurred on a multi-centennial scale and that their pattern changed from long recessions (>500 yr) interrupted by short advances (<200 yr) during the early Holocene to the opposite pattern with relatively short recessions and prolonged advances during the late Holocene (after 3.3 cal. kyr BP)*". These patterns match very well with the two distinct Holocene periods identified by Javier (2017b; 2017c), six millennia of warm and humid weather followed six millenia of accelerating cooling and drying. According to Holzhauser et al. (2005), the Aletsch Glacier was one kilometer shorter than it is today between 3300 and 3200 years BP (Minoan warm period).

Yes, climate change happens naturally and can have very adverse effect on societies and mankind, but it does not need any help from us to show its rather unpredictable and freakish temperament. Sometimes, change can happen extremely rapidly as it did for the '8.2 ka Cold Event' (Alley et al., 1997). The '8.2 ka cold event' visible on Figure 34 is remarkable because of it brutality and was first identified from changes in oxygen isotope composition in ice cores from the Summit site in Greenland[131]. The decrease in air temperature during this event has been estimated at -6 ± 2 °C in central Greenland (Allen et al. 2007). The duration of the entire cold event was about 160.5 ± 5.5 years, the coldest phase occurring at 69 ± 2 years (Thomas et al. 2007). A drop in air temperature of -3 ± 1.1°C occurred within less than 20 years. "*Most studies relate this cooling and other cooling events in the past 13,000 years to changes in the circulation of surface and deep water in the North Atlantic Ocean driven by melt water from the continental ice sheets*" (Borzenkova et al., 2015).

Clark et al. (2001; 2002) assumed that freshening of the sea surface layer of the North Atlantic Ocean not only disturbed the circulation in the surface layer but also hindered the formation of deep water, thus affecting the intensity and position of the Atlantic 'conveyor belt' itself, i.e. the general thermo-haline circulation[132]. "*A leading hypothesis about the origin of the large and abrupt fluctuations in high-latitude climate on millennial time scales invokes changes in the rate of formation of North Atlantic Deep Water (NADW) and their attendant effect on oceanic heat transport. Numerous modeling studies demonstrate that the Atlantic thermohaline circulation (THC) is sensitive to the freshwater budget at the sites of deepwater formation: Increased freshwater flux to the North Atlantic decreases the formation of deep water, thereby reducing meridional heat transport, which causes cooling of the high latitudes*" (Clark et al., 2001).

It is further elaborated by Clark et al. (2002) that "*abrupt climate change during the last glaciation originated through changes in the Atlantic thermohaline circulation in response to small changes in the hydrological cycle*". This increase in freshwater supply in the North Atlantic is most commonly, but not only, attributed to the final stages of the deglaciation of the Laurentide and Scandinavian ice sheets (Borzenkova et al., 2015). One can further notice, that atmospheric and oceanic responses following these hydrological changes were then transmitted globally and led to abrupt climate changes with no relationship whatsoever with GHGs concentrations. As Bond et al. (2001) observed, solar influence on the Holocene was a major factor explaining climate variability and should be further explored "*Surface winds and surface ocean hydrography in the sub-polar North Atlantic appear to have been influenced by variations in solar output through the entire Holocene. The evidence comes from a close correlation between inferred changes in production rates of the cosmogenic nucleides carbon-14 and beryllium-10 and centennial to millennial time scale changes in proxies of drift ice measured in deep-sea sediment cores. A solar forcing mechanisms therefore may underlie at least the Holocene segment of the North Atlantic's "1500-year" cycle*". Furthermore, it should be noted that the observed climate variation on century-to-millennia timescales during the Holocene is not reflected in atmospheric

131 Notice that Stomata are small orifices that allow gas exchanges for plants. Their number and size are an indicator of the CO_2 level. The values delivered by the ice archives are smoothed by a low-pass filter (due to the firnification process, see the explanation starting at the bottom of p. 184) and are much lower (260 ppm) than the values deduced from the stomata (330ppm) and given, e.g. by Wagner et al. (2002). Non only using the ice-core archives leads to systematically underestimate the CO_2 but it also erases peaks and troughs. This should be kept in mind when only dealing with ice-core records.

132 https://en.wikipedia.org/wiki/Thermohaline_circulation

carbon dioxide levels as reported by Svensmark (2020) : "*according to ice-core data, these have been relatively constant (Indermühle et al., 1999). It is therefore unlikely that variations in carbon dioxide concentration have had any influence on the climate variability on these timescales*". By means of the micro-paleontological study of coccoliths (which are individual plates of calcium carbonate formed by coccolithophores), Giraudeau et al. (2000) could retrace the changes in properties of surface waters south of Iceland during the entirety of the Holocene, and monitored long-term reorganizations of the surface hydrology and interpreted them "*as the response of the North Atlantic to the combined force of the solar insolation and the waning Laurentide ice sheet*". Slightly deviating from other circulation patterns and temperature records for reasons they consider, Giraudeau et al. (2000) observe that the "*period of culminating warming over the Gardar drift is dated from our record at 6.5 ka. This episode is marked by maximum surface salinity of the IC[133] west and south of Iceland and by SST 2-3°C warmer than present within the main flow of the NAD[134] [48] as well as throughout the high latitude North Atlantic*".

So the question one can raise now is where do we stand with respect to the current interglacial, the Holocene. To try to answer that question, one must observe that the majority of interglacials of the past 800 kyr are the product of very similar orbital and ice-volume conditions and present a common pattern with respect to their position in the obliquity cycle which is the leading influential parameter as represented on Figure 35 and explained by Huybers and Wunsch (2005) and Huybers (2011). The Holocene interglacial is the result of similar conditions, and belongs to this group. Nearly all exceptions can be explained in terms of particular orbital and ice volume conditions that do not apply to the Holocene. When northern insolation is declining at its fastest pace, the interglacial enters a phase of slowly declining temperature (≈-0.2°C/millennium) and the Holocene has been clearly at this stage since ≈ 5000 BP and this condition, termed Neoglaciation, is well visible and identified as such on Figure 34. When northern summer insolation becomes low, and obliquity is at its fastest rate of decline, the interglacial reaches glacial inception. This tipping point appears to take place during solar minimum paced by a Bray cycle leading to a cold period when due to the start of ice-sheet build up, sea-level starts dropping. The intensification of ice-albedo and vegetation feedbacks result in a point of no return. As rightfully stressed by Javier (2018d) "*During the past 2.3 million years no interglacial has been able to continue from one obliquity oscillation to the next. Low obliquity conditions have always led to the end of the interglacial*". In fact, the situation is even worse as the Earth as been cold enough no to enable to an interglacial to happen for each favorable period of the obliquity cycle, far from it, most of the time skipping one opportunity, but sometimes skipping even two!

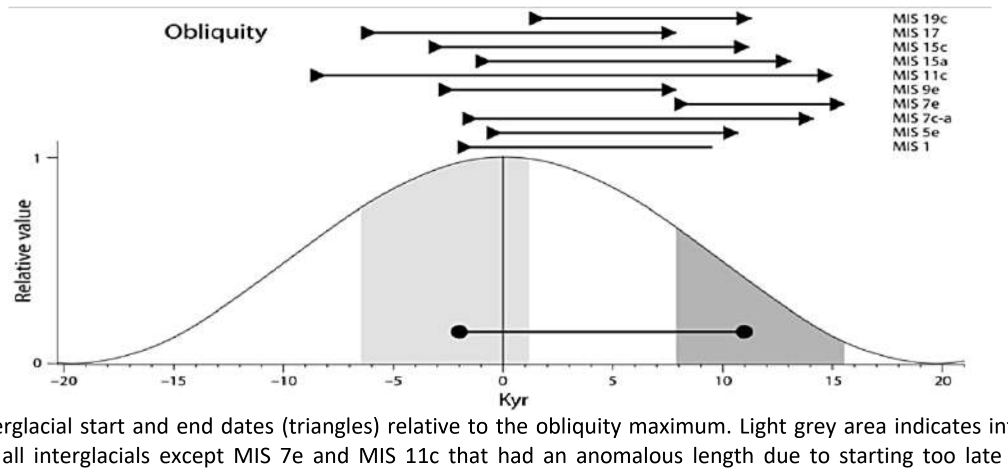

Figure 35. Interglacial start and end dates (triangles) relative to the obliquity maximum. Light grey area indicates interglacial start for all interglacials except MIS 7e and MIS 11c that had an anomalous length due to starting too late and too early respectively in the obliquity cycle. Dark grey area indicates interglacial end for all interglacials. Circles indicate start and end of a typical interglacial with average 13.8 kyr length. Interglacials start when obliquity is high and end when obliquity is low. Source: Javier (2018d).

Glaciation and deglaciation seem to be rather asymmetrical processes, the first appears to be a slow and degenerative process where conditions progressively worsen and that takes almost 15,000 years, whereas the deglaciation appears as a response to a trigger whereby a climatic impulsion produces a faster change of state and does not extend over 5,000 years "*Ice sheets tend to collapse in response to unusually large maxima in insolation forcing that result from the coincidence of high obliquity and alignment of perihelion with Northern Hemisphere summer solstice*" (Huybers, 2011). More precisely, details in the timing may vary slightly but obliquity remains the trigger "*Here I show that both obliquity and precession pace late Pleistocene glacial cycles. Therefore, precession will tend to influence the precise timing of a*

133 Irminger Current
134 North Atlantic Drift

deglaciation within an obliquity cycle, but obliquity will more fundamentally govern the interval between deglaciations" (Huybers, 2011). While Lewis & Curry (2018) consider that with an estimated ECS of 1.5°C, CO_2 contribution to the glacial-interglacial temperature change would be relatively minor (~ 15%) we rather consider that CO_2 plays almost no role whatsoever and its concentration just fluctuates as a lag to the temperature like a retarded thermometer.

The prevalent view is according to Berger and Loutre (2002) that the Holocene has a long way to run and that CO_2 levels are too high to enable a glacial inception (IPCC, AR5, 5.8.3, 2013) and I would confess that I am surprised to notice that astronomers in the particular case mentioned have given more credence to the "magic" properties of a trace gas than to the long history of proven orbitally-driven glacial-interglacial cycles observed. This relies on several assumptions that have led to propose models that rest on several weak assumptions: the first is that climate has a high sensitivity to CO_2 levels, which is pure conjecture (such models produce an average of 3°C per a doubling of CO_2), and the second supposes that CO_2 levels remain elevated for tens of thousands of years after the anthropogenic pulse, which based on what we saw is just plain wrong for it is already now erroneous because the anthropogenic [CO_2] is just 6% of the total [CO_2] as we have easily demonstrated before and the residence time of any CO_2 molecule is less than 6 years (most probably 5). If, as we anticipate, climate has a low sensitivity to CO_2, and the estimate by Lewis & Curry (2018) appears to be a maximum (~1.5°C per doubling of CO_2), and if [CO_2] just follows the descent of the Neoglacial temperature as per Henry's law and quickly reverse to pre-glacial values or simply to LIA values, the obliquity will resume its rights with a vengeance, as summer energy will quickly decline below threshold values (Figure 36).

As displayed in Figure 35, a typical interglacial starts 2000 years before obliquity maximum, and 1000 years before insolation maximum, and lasts 13,000 years, all on average. As reminded by Javier (2018d) "*So far, the Holocene is extraordinarily close to a typical interglacial in astronomical terms and length. Orbital configuration alone can explain when interglacials start and end, while changes in CO_2 levels cannot. Eemian glacial inception and the next 5000 years of cooling took place under stable 270 ppm CO_2 levels, indicating that glacial inception is responding to orbital changes, not CO_2 changes*". Climate shows some hysteresis to the astronomical signal and it is generally considered that the response to the no-return obliquity trigger is ≈ 6000 years (Huybers, 2009; Donders et al., 2018) and therefore the irreversible orbital decision is taken long before that the glacial stage settles in. The process is at first gradual, as the temperature starts to decline, this is the Neoglacial in which the Holocene has already been for a long time (Sharapova et al., 2008), and then one can identify a crossing point, beyond which there is no return back point. Therefore, as explained by Javier (2018d) "*Analysis of the orbital conditions that produce a glacial inception requires examining them 6000 years before the inflection point in the cooling rate at the end of the interglacial. Glacial inception does not take place at 65°N, but at 70°N, where ice sheets start to grow (Birch et al., 2017ab). Examination of 70°N summer energy (at 250 W/m² threshold) 6000 years before glacial inception reveals a threshold at 4.96 GJ/m² when the glacial inception orbital "decision" has already been taken for all previous interglacials*".

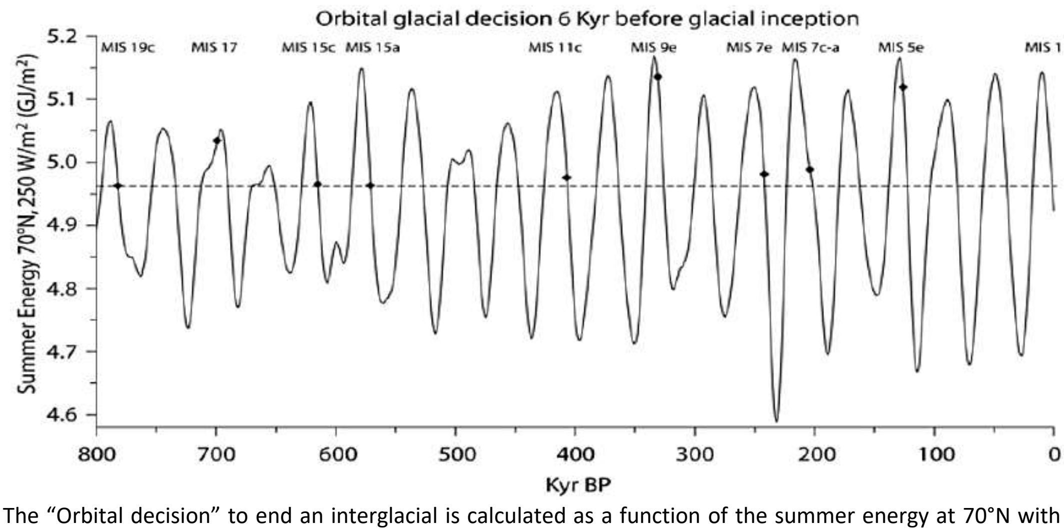

Figure 36. The "Orbital decision" to end an interglacial is calculated as a function of the summer energy at 70°N with a 250 W/m² threshold for the past 800 kyr. Diamonds mark the position 6 kyr before glacial inception as observed in the EPICA Dome C temperature proxy record for each interglacial except MIS 13. Dashed line marks the lowest value observed (4.96 GJ/m²). Six interglacials were very close to this value 6 kyr prior to glacial inception. The Holocene (MIS 1) is already below that value. Source: Javier (2018d).

And here we go, the 4.96 GJ/m^2 limit was crossed by the Holocene some 1500 years ago as displayed on Figure 36, and one must acknowledge that whatever the CO_2 levels that one may speculate on to avoid the return of a glacial the orbital decision to end the Holocene has already been taken. By orbital considerations alone the Holocene doesn't have more than 4500 years left maximum before glacial inception, e.g. if it were to last as long as MIS 11c, but it could have as little as 1,500 years left if it just runs as per the average interglacial of a 13.8 kyr average length. Javier (2018d) adds "*Between 1500-2500 years from now, there should be a period where two consecutive lows in the Eddy solar cycle separated by a low in the Bray solar cycle are expected, defining a period similar to 8.4-7.1 kyr BP when eight solar grand minima took place in rapid succession. 1500-2500 years from now looks like an excellent time for the next glacial inception*".

If Berger and Loutre (2002), Archer and Ganopolski (2005) and IPCC mainstream authors are correct, which is extremely doubtful as they all bet on the previous highly speculative assumptions, then the higher atmospheric CO_2 content than at previous glacial inceptions will allow for the first time in two million years the survival of an interglacial through an obliquity minimum; in that case the Holocene should last for at least 50 kyr more. Not only will that be against all odds, but supposes to defeat the obvious scenario Nature had planned to unfold. It will also be a landmark in a 800 kyr cycle where obliquity had not been any longer powerful enough to enable an exit of the glacial era at each opportunity and where most of the time Earth had to wait for one or two more opportunities before being given a chance to return to livable conditions, i.e. interglacial, for a short while as reminds Huybers (2011) "*Combined orbital pacing is also consistent with earlier findings that the intervals between successive deglaciations cluster into 80-kyr or 120-kyr periods, indicative of two or three obliquity cycles*", e.g. the Holocene MIS 1 (-11,700 years) was separated by 119.7 kyr from previous glacial and had to skip two cycles before making it for good, MIS 5 (-131,400 years) 83.3 kyr from previous, MIS 7c (-214,700 years) had to skip one cycle to succeed exiting the glacial lock-down.

Hard to know whether it is sad or funny to see the illuminated doom-sayers telling us that the world will stop turning if we do not destroy our economies and industries by stopping the emissions of the satanic gas before 10 years latest and to observe at the same time how benighted they are with respect to the unprecedented risk that the inception of the next glaciation in 1,500-2,000 years will represent. Mankind survived the previous ones, with small nomadic tribes able to easily relocate and search for milder tropical or equatorial conditions. But next time tens of billions of humans will depend on a highly sophisticated and technological society that will be totally disrupted by an Ice Age, and that may well in fact be totally wiped out.

As Hoyle and Wickramasinghe (2000) reminded us "*Despite the great cost and effort that has gone into modelling the terrestrial climate system our understanding of glacial cycles and their forcing mechanisms remains rudimentary to say the least*". Let's give here the final word to Javier (2018d) "*For the past 2 million years, when obliquity declined enough a glacial period always followed. Obliquity is declining fast, and we should not have too much confidence on computer models that tell us this time will be different*". The Holocene demonstrated that the climate over 12,000 years has been changing considerably (Sarnthein et al., 1995; Giraudeau et al., 2000; Alley et al., 2003; Debret, 2008; Borzenkova et al., 2015), mankind has gone through a roller-coaster of variable conditions just speaking of the last interglacial to which we have had to adapt constantly to the best we could, climate changes which happened of course without any alleged man-made responsibility. Shouldn't we be more reasonable and just try to monitor and adapt to changes?

It does not seem to be what everybody thinks and some are ready to go as far as mad geo-engineering projects to "mitigate" climate change. The Stratospheric Particle Injection for Climate Change[135] (SPICE) in the UK involves pumping water nearly one kilometer up into the atmosphere (thanks to stadium-size hydrogen balloon), or sulfates, to mimic the atmosphere-cooling effects of volcanic eruptions, such as the Mount Pinatubo (1991) which sent 20 million tons of sulfate particles into the air, cooling Earth by 0.5°C for 18 months ! Along the same line of thought and not envying anything to the most demiurgic projects, those worried to the bones by 70 ppm of CO_2 (6% of it being of anthropogenic origin), are ready to envisage the alteration of cirrus clouds without frowning a second.

As it is generally accepted that cirrus clouds have a very little warming effect on the climate on balance as the reflected sunlight should be slightly more than compensated by the absorption long-wave radiation, some authors have seriously envisaged that cirrus cloud thinning, i.e. changing the radiative properties of cirrus clouds by reducing their lifetime and the altitude at which they form, could present a geo-engineering possibility to thwart the minuscule positive radiative effect of CO_2. Nevertheless, frightened by their own boldness and using a lot of conditional tense, Lohmann and

135 http://www.spice.ac.uk/ and https://en.wikipedia.org/wiki/Stratospheric_Particle_Injection_for_Climate_Engineering

Gasparini (2017) assert "*Unintended cirrus formation is especially pronounced if the seeded INPs*[136] *start to nucleate ice at very low relative humidities (2). Because of the competition of these various factors, the radiative forcing of cirrus cloud seeding varies between –1.8 and +2.1 W* m^{-2}*. Thus, if cirrus seeding is not done carefully,* ***the effect could be additional warming rather than the intended cooling****. The results from model studies of cirrus thinning* ***suggest*** *that the perfect seeding INPs* ***should*** *be large and that seeding* ***could*** *be geographically or temporally limited. Bismuth triiodide (*BiI_3*) has been* ***suggested*** *as a nontoxic and affordable substance for cirrus seeding (6); other substances such as mineral dust* ***should*** *work as well.*"

Is all that a wise way of spending hard earned tax-payer monies? Isn't it time to take a break of this climate change hysteria and rethink it all?

136Ice Nucleating Particles (INPs)

The last 130,000 years, the Phlegraean Fields & the Toba

During this period there are many major natural climate change events happening that are worth considering and we cannot cover them all. Nevertheless, Figure 37 gives a snapshot of how leaving the Holocene (11,700 BP) we move very quickly into the extremely cold Younger Dryas (Sarnthein et al., 1995), followed by the warm Bølling–Allerød event[137] which offered temperatures close to the Holocene, and further past we enter the sequence of Dansgaard / Oeschger events (Dansgaard *et al.*, 1993) and Heinrich events (Heinrich, 1988) which have shaped this glacial period. The DO events have a solar origin, and Braun et al. (2005) demonstrated that "*an intermediate-complexity climate model with glacial climate conditions simulates rapid climate shifts similar to the Dansgaard–Oeschger events with a spacing of 1,470 years when forced by periodic freshwater input into the North Atlantic Ocean in cycles of ~87 and ~210 years*".

Two major volcanic eruptions happened during this period. These will be addressed, one 39,300 yrs ago in the Northern Hemisphere (NH) and another super-eruption of ~75,000 yrs ago in the Southern Hemisphere (SH). The Younger Dryas[138], around 12,900 to 11,700 years BP (Rasmussen et al., 2006) just before the Holocene started, was a return to glacial conditions after the warm Bølling–Allerød DO1 event, which temporarily reversed the gradual climatic warming after the Last Glacial Maximum (LGM) started receding around 20,000 BP. It is named after the alpine-tundra wildflower Dryas octopetala, as its leaves are occasionally abundant in late glacial sediments, such as the lake sediments of Scandinavia. In Greenland, during the last glacial stage, the rapid oscillations of the climate, lasting between a decade and the millennium, are memorized both in ice cores (Dansgaard et al, 1993), as in sea sediments carrots (Heinrich, 1988).

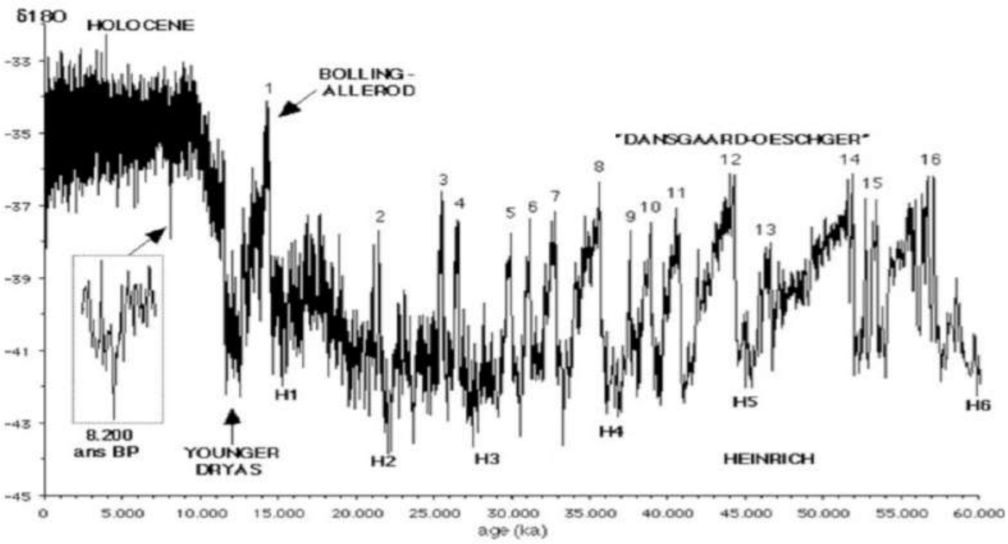

Figure 37. Succession of the Dansgaard / Oeschger events (numbers atop) in the Greenland glacial archives and the Heinrich events (Hx below) in the marine sediments of the North Atlantic. The Bølling–Allerød event (DO 1) is well visible and followed by the Younger Dryas - more details provided in Stuiver et al. (1995), Fig. 11, p. 348. The 8200 years event is recorded in Greenland ice-cores and zoomed (left). The DO 19 ca. mentioned before at 70-71,000 BP is further right, out of scale of x-axis (age); y-axis is $\delta^{18}O$[139] a proxy for the temperature, from Debret (2008).

137 The Bølling–Allerød interstadial was an abrupt warm and moist interstadial period that ran from 14,690 to 12,890 years BP and ended abruptly with the onset of the Younger Dryas, a cold period that reduced temperatures back to near-glacial levels within a decade. https://en.wikipedia.org/wiki/Bølling-Allerød_warming

138 https://en.wikipedia.org/wiki/Younger_Dryas – With a brutal +10±4°C warming to end the cold episode (Grachev and Severinghaus, 2005)

139 In geochemistry, paleoclimatology and paleoceanography $\delta^{18}O$ data from corals, foraminifera and ice cores have been used, since Urey et al. (1951) as a proxy for temperature "*Since the abundance of the O^{18} isotope in calcium carbonate varies with the temperature at which it is deposited from water, the variation in abundance can be used as a thermometer*": see for an introduction https://en.wikipedia.org/wiki/Δ18O and https://en.wikipedia.org/wiki/Oxygen_isotope_ratio_cycle. Precursors pioneering the use of isotopic compositions were Dansgaard (1964) and also Epstein and Sharp (1967) who analyzed oxygen and hydrogen isotope variations in a firn core in Western Antarctica.

These are called Dansgaard-Oeschger[140] (DO) cycles and Heinrich events. Heinrich's events are the most imposing cold events, occurring every 7,000 to 8,000 years. These events identified in the North Atlantic (between 40 and 60°N) result in sudden and massive arrivals of coarse sand and debris transported by icebergs, i.e. Ice-Rafted Debris[141] (IRD). These glacial cold events are induced by the response of the Atlantic Meridional Overturning Circulation (AMOC) to such massive freshwater inputs coming from major ice sheet collapse events (IRD) and produce a southward displacement of the Inter-Tropical Convergence Zone (ITCZ) during stadials (Guillevic et al., 2014). Furthermore, Stríkis et al. (2018) demonstrate "*that iceberg discharge in the western subtropical North Atlantic led to an abrupt increase in monsoon precipitation over eastern South America and an increase in atmospheric methane concentrations during Heinrich Stadials*"[142]. During a typical DO event, the Greenland ice cores revealed rapid cooling (5-10 °C in a few centuries) followed by very rapid warming (a few decades). These anomalies would have occurred approximately every 1500 years. They have also been observed in oceanic sediments. In Antarctica, at the same time, instead of cold episodes, we find hot events called the Antarctic Isotope Maximum (AIM) events. The European EPICA consortium, using an ice core covering the last ice cycle, linked the magnitude of the Antarctic isotopic maxima to the duration of the Greenland episodes. A slowdown in thermohaline circulation affecting the Atlantic would appear to be the cause of this blockage of heat in the Southern Hemisphere. This demonstrate the global and contra-cyclic nature (between NH and SH) of these events.

The ice cores from the Greenland Ice-core Project (GRIP) and Greenland Ice Sheet Project II (GISP2) from central Greenland show that the end of the Younger Dryas interval involved a 5-10°C warming and a doubling of snow accumulation in central Greenland; a large drop in wind-blown materials, indicating reduced wind speed and other changes in distant source regions attested by a large increase in methane, indicating expansion of global wetlands, probably including those of the tropics. Most of these changes occurred very rapidly, in less than a few decades. "*A simple picture emerging from these and other data is that the normal climate experienced by agricultural and industrial humans has been more stable in many or most regions than is typical of the climate system. Large, rapid, widespread changes were common in the pre-agricultural past, especially in regions near the North Atlantic, but apparently also in monsoonal regions affected by the North Atlantic, and likely elsewhere or even globally*". (Alley, 2000)

The Bølling–Allerød interstadial (Hartz and Milthers, 1901) was an abrupt warm and moist interstadial period that ran from 14,690 to 12,890 years BP (Rasmussen et al., 2006) and ended abruptly with the onset of the Younger Dryas, a cold period that reduced temperatures back to near-glacial levels within a decade. The Melt-water pulse 1A[143] event coincides with or closely follows the abrupt onset of the Bølling–Allerød (BA), when global sea level rose ~16 m during this event at rates of 26-53 mm/yr (Gornitz, 2012). In that respect, it is simply funny to see how Gornitz (2012) tries unconvincingly to relate these fast and major natural changes, which occurred without any man-made influence, to the alleged sea-rise disasters that the proponents of the AGW theory keep forecasting. In fact, the longest series of monthly averages, the leader in the collection of the permanent sea level observation service (www.psmsl.org), that of Brest (France), shows an increase of +200mm in 207 years (less than 1 mm/yr) and +150mm over 1910-2015 (see more in the related section later p. 157).

Records obtained from the Gulf of Alaska show abrupt sea-surface warming of about 3°C (in less than 90 years), matching ice-core records that register this transition as occurring within decades. In recent years research tied the Bølling–Allerød warming to the release of heat from warm waters originating from the deep North Atlantic Ocean, possibly triggered by a strengthening of the Atlantic meridional overturning circulation (AMOC) at the time (Thiagarajan et al., 2014; Lohmann et al., 2016). Study results which would help to explain the abruptness of the Bølling–Allerød warming, based on observations and simulations, found that 3°–5 °C Ocean warming occurred at intermediate depths

140 Dansgaard-Oeschger events are rapid climate fluctuations that occurred 25 times during the last glacial period, i.e. dramatic but fleeting global climatic swings characterized by a period of abrupt warming followed by a period of slow cooling that occurred during the last ice age.

141 Dansgaard-Oechsger events and Bond events are of very different nature. DO events are characterized by sudden warming centered in the North Atlantic-Nordic Seas area and require glacial conditions (low sea level and extensive sea ice cover). Water stratification along salinity and temperature clines appears to be the critical factor behind DO events. By contrast, Bond events are of opposite nature. They reflect abrupt cooling, not warming, could be heterogeneous in nature as not all events appear to have the same cause, but are well reflected from North Atlantic ice-rafted debris (IRD) to China's Dongge cave speleothem records of the South Asian Monsoon (Cheng et al., 2016).

142 The detailed atmospheric methane record defined new modes of variability, including sharp increases during some of the cold Greenland "Heinrich" stadials. This led to a hypothesis that extreme southward migration of the Intertropical Convergence Zone during the Greenland stadials activated Southern Hemisphere methane sources (Rhodes et al., 2015). During Heinrich Stadial 1, this possible Southern Hemisphere source of methane is directly associated with an abrupt rise in atmospheric carbon dioxide

143 https://en.wikipedia.org/wiki/Meltwater_pulse_1A

in the North Atlantic over several millennia during Heinrich stadial 1 (H1). The authors postulated that this warm salty water (WSW) layer, situated beneath the colder surface freshwater in the North Atlantic, generated ocean convective available potential energy (OCAPE) over decades at the end of H1. "*According to fluid modeling, at one point the accumulation of OCAPE was released abruptly (~1 month) into kinetic energy of thermobaric cabbeling convection (TCC), resulting in the warmer salty waters getting to the surface and subsequently warming of ca. 2°C sea surface warming*" (Su et al., 2016).

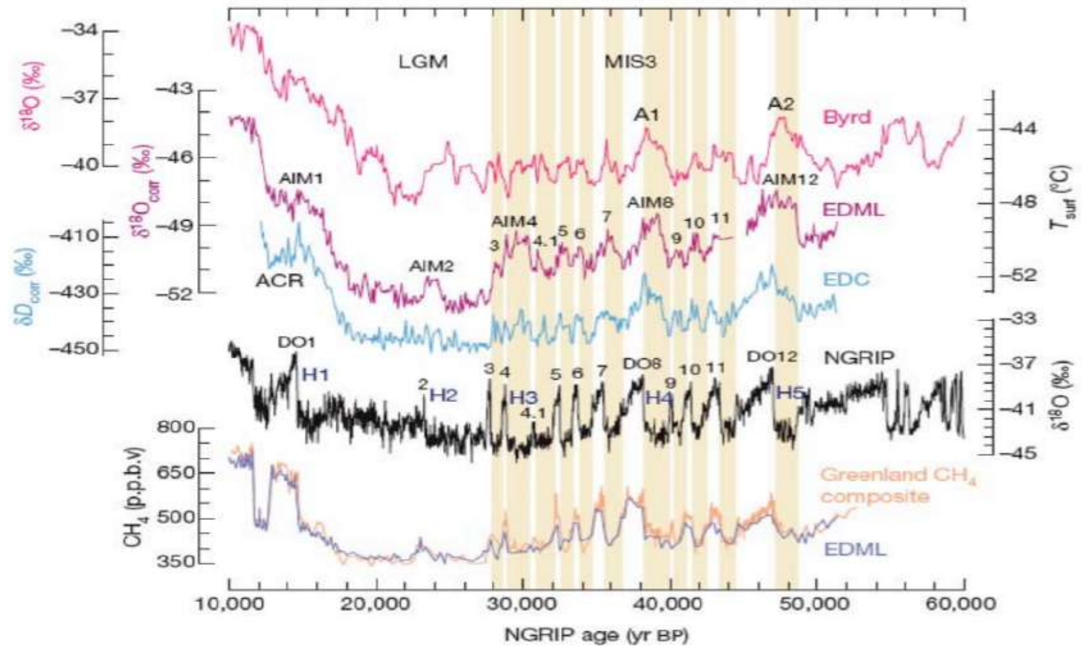

Figure 38. Displayed are ice records from Antarctic and Arctic: (1) the EPICA project has provided two records in East Antarctica, one at Dome C (EDC, EPICA community members, 2004), and one in the Dronning Maud Land area (EDML, EPICA community members), (2) Byrd Station, West Antarctica (80°01'S, 119°31'W; 1530m elevation), (3) the NGRIP Northern Greenland Ice-core Project site. The synchronization between the two hemispheres reveals a coupling between the amplitude of hot Antarctic events and the duration of the equivalent stadial in Greenland. Note: Last Glacial Maximum (LGM), Antarctic Cold Reversal[144] (ACR), Antarctic Isotope Maximum (AIM) warm events, Marine Isotope Stage 3 (MIS3), Antarctic warming A1, A2, adapted from Parrenin et al. (2007) and Debret (2008).

Now, it is simply delusional to read how Köhler et al. (2011) state with respect to this Bølling–Allerød event that "*Estimates of CO_2 rise are 20–35 ppmv within 200 years, a rate less than 29–50% compared to the anthropogenic global warming signal from the past 50 years, and with a radiative forcing of 0.59–0.75 W m^{-2}*" as if Köhler et al. (2011) were disappointed that the far greater increase in [CO_2] since the industrial revolution had not produced any of their flawed forecasts and will force them to invoke even more obscure pseudo-physics, e.g. "feedbacks", unseen "forcings", etc. to justify for what is not observed. In fact, [CO_2] concentrations have as always, just followed the temperature increase of the Bølling–Allerød warming that produced more out-gassing from the oceans according to Henry's law, and CO_2 played no role, as always, in the abrupt climate changes of the past, as it will play no role in the future either. Fortunately, more lucid authors, such as Borzenkova et al. (2015) assert "*However, this small trend in rising Holocene CO_2 levels could only have had a very small effect on climate, if any at all*".

A longer picture, up to 60,000 years is given in the Figure 38. Observe how the warming from the last glacial to the Holocene is interrupted by a cold event in Greenland as well as in Antarctica, even though it is more visible there on CH_4 records than on $\delta^{18}O$. The ACR in the Byrd and Vostok cores (West and East Antarctica) clearly precedes the YD event and furthermore the Antarctic warming A1 and A2 are slightly out of phase with the DO events (8 and 12). More importantly, A1 and A2 are characterized by a gradual increase and decrease whereas DO events show a brutal increase and slow decrease. The next reconstruction from Kaiser et al. (2005), Figure 39 , provides SST reconstruction based on Alkenones[145] and go back to 70 kyr, showing A1 to A5. The Last Glacial Maximum (LGM) and sea-level minimum

144 https://en.wikipedia.org/wiki/Antarctic_Cold_Reversal

145 Alkenones are long-chain unsaturated methyl and ethyl n-ketones produced by a few phytoplankton species (microscopic algae) of the class Prymnesiophyceae. The earliest known occurrence of alkenones is during the Aptian 120 million years ago. They are used in organic geochemistry as a proxy for past sea surface temperature (using $\delta^{13}C$ values), see also Wang et al. (2021). https://en.wikipedia.org/wiki/Alkenone .

occurred ca. 21,000 years before present (BP). Antarctic ice cores show gradual warming beginning 3000 years later. At about 14,700 BP, there was a large pulse of melt-water, identified as Melt-water pulse 1A, probably from either the Antarctic ice sheet or the Laurentide Ice Sheet. Melt-water pulse 1A produced a marine transgression that raised global sea level about 20 meters in two to five centuries and is thought to have influenced the start of the Bølling/Allerød interstadial, the major break with glacial cold in the Northern Hemisphere. Melt-water pulse 1A was followed in Antarctica and the Southern Hemisphere by a renewed cooling, the Antarctic Cold Reversal (ACR), in ca. 14,500 BP which lasted for two millennia. The ACR brought an average cooling of perhaps 3°C. The Younger Dryas cooling, in the Northern Hemisphere, began while the Antarctic Cold Reversal was still ongoing, and the ACR ended in the midst of the Younger Dryas. This pattern of climate decoupling between the Northern and Southern Hemispheres and of "southern lead, northern lag" would manifest in subsequent climate events.

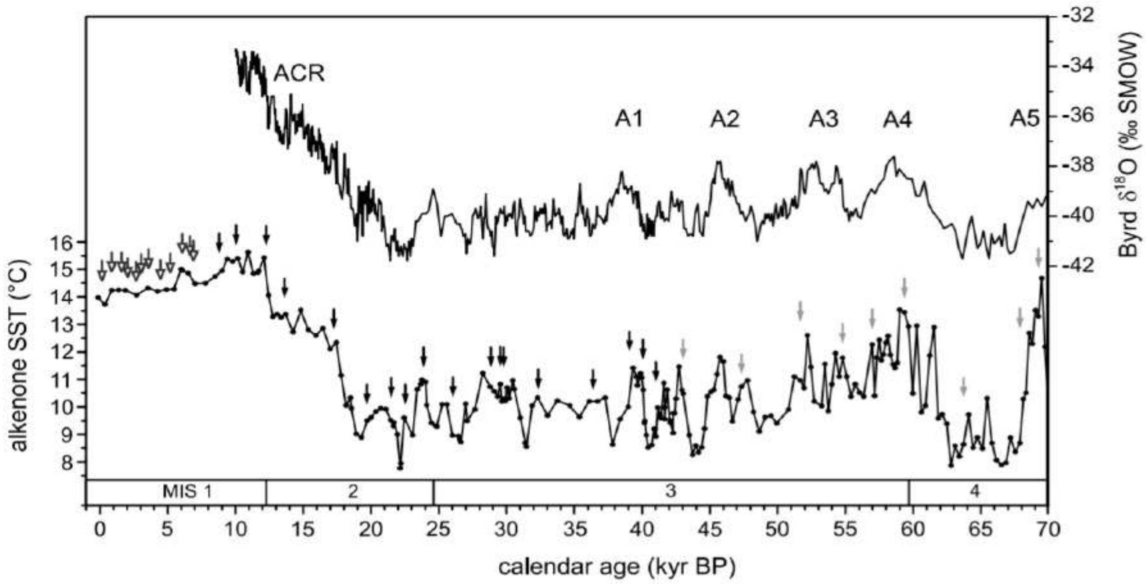

Figure 39. Age model of Ocean Drilling Programme (ODP) Site 1233. Alkenone-based SST reconstruction at Site 1233 compared to the Byrd $\delta^{18}O$ record over the last 70 kyr. The open arrows represent the correlation points to the core GeoB3313-1, the black arrows represent the ^{14}C-AMS[146] datings and gray arrows show the tuning points to the oxygen isotope record of the Byrd ice core. A1 to A5 are Antarctic warm events after Blunier and Brook (2001), MIS is marine isotope stages 1 to 4, from Kaiser et al. (2005).

In the midst of this 70 kyr period, a major volcanic eruption happened 39,300 years ago in southern Italy, near the current city of Naples. This was simply the largest volcanic eruption on the Northern hemisphere in the past 130,000 years, namely the eruption of a super volcano, in the area of today's Phlegraean Fields[147] near Naples[148], Italy, is also recorded through the study of sediments as far as the Black Sea (Nowaczyk et al., 2012) or of a trachytic volcanic ash layer in Russia (Pyle et al., 2006) or ice records in Greenland. The ashes of this eruption (Volcanic Explosivity Index, VEI=7), during which about 350 cubic kilometers of rock and lava were ejected, were distributed over the entire eastern Mediterranean and up to central Russia. The Campanian Ignimbrite (CI) erupted from the modern Campi Flegrei, Italy, at 39.28 ±0.11 ka BP - $^{40}Ar/^{39}Ar$ dating according to De Vivo et al. (2001) - and have been reported as far as the southeastern Black Sea sediment cores studied by Nowaczyk et al. (2012), and also in Russia where "*a trachytic volcanic ash layer is widely distributed across south-western Russia, where it is found both in well-characterised archaeological contexts close to the Don River, i.e. the Paleolithic sites of Kostenki-Borschevo (51.41N, 39.01E). Chemical analysis confirms that this ash layer is a distal equivalent of the deposits of the ca 39.3 ka Campanian Ignimbrite eruption of the Phlegrean Fields, Italy, and correlates with the widely recognized Y5 ash layer in marine cores in the south-eastern Mediterranean. This work shows that ash particles can be dispersed over considerable distances (>2500 km) and areas (>1.5–3 10^6 km^2) during large magnitude explosive eruptions*" (Pyle et al., 2006). It is considered that this major eruption, the largest in the Greater Mediterranean area over the past 200,000 yrs (Barberi et al., 1978) possibly led to the Middle to Upper Paleolithic cultural transition and the replacement of Neanderthal populations by anatomically modern Homo sapiens (Fedele et al., 2002), this period corresponding to one of the most conspicuous cultural

146 Accelerator Mass Spectrometry (AMS) accelerates ions to extraordinarily high kinetic energies before mass analysis to separate a rare isotope from an abundant neighboring mass isotope. https://en.wikipedia.org/wiki/Accelerator_mass_spectrometry

147 https://en.wikipedia.org/wiki/Phlegraean_Fields

148 https://en.wikipedia.org/wiki/Eruption_of_Mount_Vesuvius_in_79_AD . Naples, beyond its famous pizza(s) is well known for the Vesuvius eruption in 79 Anno Domini (AD) with a VEI=5.

modifications in Old World prehistory, termed the European Late Pleistocene shift (ELPS). Three periods of volcanic activities are acknowledged and a large molten magma chamber lies today under the remains of the blown off caldera. The area is still active, bradyseismic phenomena are recorded and inflation around Pozzuoli continues at steady rates with a maximum average of 0.7 cm per month since July 2017.

The plains of southwestern Russia extend from Ukraine to the Caucasus mountains, and contain well documented archaeological evidence for human occupation over the past 30-60,000yrs. One cluster of Palaeolithic sites is at Kostenki, Voronezh (51.391N, 39.041E) and evidences of the tephra layer have been found here but also as far south as Rostov on Don (47.11N 39.51E) and as far north as Tambov (52.51N, 41.51E). In the site Kostenki 14 (Markina Gora) the Upper Paleolithic man from Markina Gora was studied by Moiseev et al. (2017) and the tephra layer forms a remarkable stratigraphic horizon where it lies above a palaeosol (Velichko et al., 2009), which contains evidence for the Laschamp magnetic excursion! (Pyle et al., 2006). The study of the paleoclimate at Kostenki 14 (Markina Gora) by Velichko et al. (2009) is also amazing as it reveals that the conditions have been changing enormously over quite short periods of time "*The early stage of the site's existence (second half of the Middle Valdai megainterstadial*[149]*) was marked by a mild climate, causing the spread of coniferous and broadleaved forests. Layer IVa (ca 33 ka BP) can be correlated with the beginning of cooling, when spruce forests still existed. At the end of the megainterstadial, the landscapes around the site varied from periglacial to tundra and forest-tundra. Layer I (ca 22 ka BP) correlates with the most severe cryoarid conditions of the pleniglacial*". So basically, over a 20,000 years period, humans in this area have had to accustom themselves to a changing climate that has evolved from a mild environment that changed to severe cryoarid conditions!

One can easily imagine the importance of the 39 kyr event and the atmospheric consequences of such an explosion that human populations of the time have had to go through at a regional or even more global scale. As postulated by Fedele et al. (2002) "*An eruption of the CI magnitude can thus have disrupted ecosystems on a fairly large scale and well beyond the direct impact zone, human systems included. Such events typically exert short-term alteration of global climate, with stronger effects at higher latitudes in the Northern Hemisphere; where positive feedbacks between climate and volcanism occur, large eruptions can even affect the climate on century to millennial timescales*". There is no doubt the large eruptions (e.g. VEI>7) can even affect the climate on century to millennial timescales (Rampino and Self, 1992, 1993; Zielinski et al., 1996b; Robock, 2000; Huang et al., 2001).

The Toba super-eruption of ~75,000 yr ago, is admittedly a much larger event than the CI in terms of Dense Rock Equivalent (DRE) with a factor-of-20 difference (Ambrose, 1998; Rampino and Ambrose, 2000). Mount Toba, is an ancient volcano located in the Barisan Mountains, north-central Sumatra, Indonesia. A massive eruption 75,000 ±900 years BP ago[150], of an estimated Volcanic Explosivity Index (i.e. VEI) of 8, expelled an estimated 2,800 km^3 of ash and lava (DRE) and Rampino and Ambrose (2000) consider that "*several lines of evidence suggest that Toba produced an estimated* 10^{15}–10^{16} *g of stratospheric dust and* H_2SO_4 *aerosols*". That event is considered by many volcanologists to be the largest volcanic eruption in all of human history (Detay, 2017), and it sent the planet into a volcanic winter lasting six to ten years (i.e. residence time of the dust and aerosols) and a severe cooling for up to one thousand years that nearly caused the extinction of modern humans. Ice-core evidence suggests that average air temperatures worldwide plunged by 3–5°C (5.4–9.0°F) for years after the eruption. The Toba eruption coincided with a 200-yr period of sharp cooling that initiated a ca. 1,000-yr stadial event and is evidenced by ice-core analysis from Greenland. Some model simulations estimate that this temperature decline may have been as much as 10°C (18°F) in the Northern Hemisphere in the first year after the event. A study of the remains of a human settlement located in southern Africa and dated to the time of the eruption suggests that some areas of Earth with sufficient food supply may have served as refuges for human beings in the years following the eruption (Smith et al., 2018) but also in other places (Greshko, 2018), (Clarkson et al., 2020), (Hruska, 2020). The remnants of the volcano's caldera contain present-day Lake Toba.

In 1993, science journalist Ann Gibbons posited that a population bottleneck occurred in human evolution about 70,000 years ago, and she suggested that this was caused by the eruption of the Toba; this theory was supported by Rampino and Self (1993a-b) in '*Bottleneck in human evolution and the Toba eruption*', Ambrose (1998) who studied the "*Late Pleistocene Human Population Bottlenecks, Volcanic Winter, and Differentiation of Modern Humans*", and later by Rampino and Ambrose (2000) in the "Volcanic winter in the Garden of Eden: The Toba super-eruption and the late

149 Lasting from about 55 to 25 ka, the Middle Valdai Megainterstadial separates the early (Kalinin) and late Valdai (Ostashkov) glacial stages. Cultural layer IVb goes down to 46.9 ±3.9 kyr.

150 The Toba ignimbrite deposits have been dated by the K/Ar method at 73,500 ±3,500 B.P., and $^{40}Ar/^{39}Ar$ age determinations give 73,000 ±4,000 B.P. (Chesner et al., 1991).

Pleistocene human population crash" and by Williams et al. (2009) who studied the "*Environmental Impact of the 73ka Toba super eruption in South Asia*". The consequences of the explosion were a whopping global ecological disaster and as reminded by Rampino and Ambrose (2000) "*Genetic studies indicate that sometime prior to ca. 60,000 yr ago humans suffered a severe population bottleneck (possibly only 3,000–10,000 individuals), followed eventually by rapid population increase, technological innovations, and migrations*". What supports the global ecological disaster hypothesis is that other animal species have been equally impacted by the event. For example, this is revealed by the analysis of mtDNA (i.e. mitochondrial DNA) of the Eastern Chimpanzee. Furthermore, as the climate was already cooling and as other events, e.g. Dansgaard-Oeschger (DO) Event 19 - ca. 70-71,000 BP and Isotope Stage 4 - ca. 60-68,000 BP, superimpose their effect on the Toba disaster, thus the probability of lasting unfavorable conditions is high, challenging humans' survival.

Even before the Toba event was considered as the possible reason of the "throttling", researchers had ventured through the bottleneck hypothesis and Harpending et al. (1993) had proposed the "weak Garden of Eden" version of the replacement model where "*modern humans appeared in a subpopulation and spread slowly over several tens of thousands of years, then later expanded from separated daughter populations bearing modern technologies such as those of the African Late Stone Age or the European Upper Paleolithic*", in which modern humans dispersed from Africa ca. 100,000 yr ago and then went through a population bottleneck ca. 50,000 ± 20,000 yr ago, followed by a dramatic population increase. Harpending et al. (1993) estimate "*the bottleneck reduced the human population to ~500 breeding females, or a total population as small as 4,000 for ca. 20,000 yr, or as small as 40 individuals for two centuries*". Of course, the Toba event matches well with the supposed bottleneck period. Recently, other research has cast doubt on a direct relationship between the Toba ignimbrite explosion and a human genetic bottleneck. For example, ancient stone tools in southern India were found above and below a thick layer of ash from the Youngest Toba eruption and were very similar across these layers, suggesting that the dust clouds from the eruption did not wipe out this local population (Clarkson et al., 2020).

But for the Indian study, Smith et al. (2018) say "*the reported evidence did not include piece-plots of the archaeological finds, and the resolution of the dating and age model for those finds was insufficient to resolve occupation continuity*", therefore the proofs given were considered inconclusive by some. The same authors also report that "*for two archaeological sites on the south coast of South Africa, humans in this region thrived through the Toba event and the ensuing full glacial, perhaps as a combined result of this region's uniquely rich resource base and a fully evolved modern human adaptation*". The fact that some humans have managed to make it through the Toba event and subsequent last glaciation should not surprise us, as we are here to discuss it, but at the same time we probably should not underestimate the challenges that were overcome by these populations. Cooler is much riskier than warmer!

Toba's possible effects on climate and biological systems have undoubtedly been considerable. Locally, direct-impact effects and long-term ecological damage must have caused an environmental disaster with ensuing depopulation. Do you still think that a 0.007% increase of the gas of life, i.e. CO_2, 75% of which increase is natural and just 6% of the 0.04% are of anthropic origin (i.e. a mere 0.0024% of the volume of the overall atmosphere) is THE major problem mankind is going or will have to face? No, whatever consequences the explosions of the Toba or of the trachytic Phlegraean Fields have had, it reminds us of our place on Earth, we are passengers and not drivers of the planet and we should not overrate our impact and do not believe that we have changed our place in the grand scheme of things. Even our highly technological civilization remains extremely vulnerable to a whimsical nature and we'd better seek adaptation to various scenarios (Lomborg, 2020a-b) rather than destroy our economies and sacrifice our adaptation capabilities for decarbonation lunacies. One should just remember of the air travel disruptions[151] that the (small) eruption of the Eyjafjallajökull created in 2010, or the vulnerability of our communications systems to solar bursts (Mekhaldi et al., 2015), etc.

Over this 130,000 years period that we consider in this section, the next major event back in the past is the Eemian interglacial optimum, known as Marine Isotope Stage 5e (MIS-5e) or Late Pleistocene Eemian Stage, situated 131–114kyr ago, is the Last Interglacial Stage (LIS) before the Holocene. Although global annual average temperatures were approximately 1 to 2˚C warmer than preindustrial levels, high latitude regions were several degrees warmer still, up to +8˚C as displayed Figure 40, as it was a time when climate was significantly warmer than now, whatever the CO_2 atmospheric content was. This meant ice caps melted, Greenland's ice sheet was reduced and the West Antarctic ice sheet may have collapsed. The sea level was at least 6m higher than today as evaluated by Kopp et al. (2009) "*We find a 95% probability that global sea level peaked at least 6.6 m higher than today during the last interglacial; it is likely*

151 https://en.wikipedia.org/wiki/Air_travel_disruption_after_the_2010_Eyjafjallaj%C3%B6kull_eruption

(67% probability) to have exceeded 8.0 m but is unlikely (33% probability) to have exceeded 9.4 m. When global sea level was close to its current level ($210 m), the millennial average rate of global sea level rise is very likely to have exceeded 5.6 m kyr^{-1} *but is unlikely to have exceeded 9.2 m* kyr^{-1}". During the LIG, the authors take notice that greenhouse gas concentrations were comparable to pre-industrial Holocene levels (Petit et al., 1999) (Saltzman et al, 1999), but Earth's orbital eccentricity was more than twice the modern value (Berger and Loutre, 1991). In fact the article from Berger and Loutre (1991) says more "*Analysis of the insolation values obtained from BER90 brings some general conclusions: insolation is dominated by precession mainly in the equatorial regions, but the obliquity signal is reinforced at the solstices and at high latitudes. The role of eccentricity in modulating the precessional component in the variation of insolation is very visible through the 400,000 year cycle. the most significant deviations of the 65°N July mid-month insolation from the 1950.0 AD value (427* W/m^2*) are found to be located around... 114 ka BP (-35* W/m^2*)...126 ka BP (60* W/m^2*)*" and demonstrate clearly that the maximum insolation value at 126 kyr corresponds exactly with the maximum of the temperature as measured from the Vostok ice core station[152]. **No need to search for a dubious involvement of the GHGs**.

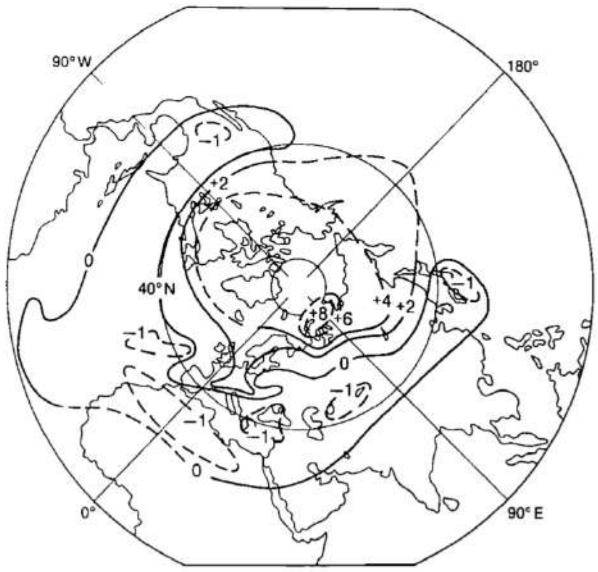

Figure 40. Departures of (a) summer air temperature (°C) from modern values for the Eemian interglacial from Folland et al. (1990) and after Velichko et al. (1982, 1983, 1984).

One should further notice that the conclusion of the Berger and Loutre's (1991) paper states that "*up to 1Ma results are very solid, between 1 and 1.5 Ma some differences arise*"but the horizon of validity is somewhere in between 5 to 10 myrs ago most probably not for periods earlier than 10 Myrs "*as this seems to be the limit of validity of the astronomical solution. Indeed, before 10 Ma, the orbits of the inner planets look chaotic, any two orbits with nearby initial solutions diverge (Laskar, 1989, 1990)*". Back to the Eemian interglacial optimum, across Asia and North America forests extended much further north than today and straight-tusked elephants (now extinct) and hippopotamuses were reported living as far north as the British Isles.

So far, we've gone through:

- The LIA (1650-1850) corresponding to the solar Spörer[153] Minimum (1450-1550), Maunder Minimum (1645-1715) and Dalton Minimum (1790-1820), whereby the TSI of the late 17th century was 3-4 W/m^{-2} lower than at present (Haigh, 2003);
- The great famine (1315-1317), everybody starved, most died, it simply just rained too much and the weather was cool;
- The MWP around year 1000 and the Vikings' settlements in Greenland (i.e. the Green Land!);
- Hannibal's crossing of the Alps with his elephants during the Second Punic War, 218 BC;

152 https://en.wikipedia.org/wiki/Quaternary_glaciation

153 The evidence suggests that the ^{10}Be enhancements in 1459 may be the result of a gamma ray pulse from Vela Junior as the increase in ^{10}Be production in the Southern hemisphere was three times that in the Northern which is consistent with the declination of -46,5° of the Vela Junior SN remnant (distance of 650-700 light-years away is a 1/10th of the distance to the closest of the other nine SN that have occurred in the past 2000 yrs). But the solar origin cannot be excluded either as 1459 falls in the middle of the Spörer solar minimum (Zharkova et al., 2019).

- The synchronous collapse of the Akkadian Empire in Mesopotamia, the Old Kingdom in Egypt and Early Bronze Age settlements in Anatolia, the Aegean and the Levant due the «4.2 ka BP megadrought»;
- The green Sahara 6500 BP with solar radiation up 8% as compared to present that resulted in the African monsoon becoming both stronger and reaching farther north;
- The complete disappearance of the glacier in the Alps and elsewhere around 7000 BP;
- The "8.2 ka cold event" due to the fast drainage of the huge pro-glacial lake[154] Agassiz resulting from the melting of the Laurentide and Scandinavian ice sheets;
- The cold Younger Dryas with extreme and brutal temperature change of +10±4°C to end the cold episode (Grachev and Severinghaus, 2005), the warm Bølling–Allerød event (DO 1);
- The LGM, 25 Dansgaard / Oeschger events, tens of Heinrich stadials and AIM events over more than 70 kyr;
- The bonus are two major super-volcanoes' explosions, one in each hemisphere (-39 kyr and -73 kyr), the Toba nearly managing to wipe out hominids from the planet;
- and the previous Eemian interglacial optimum with hippopotamuses in the British Isles due to variations of insolation resulting from the regular change of the Earth's orbital parameters;

Do you still need the AGW shibboleth and the CO_2 fable ?

154 https://en.wikipedia.org/wiki/Proglacial_lake and https://en.wikipedia.org/wiki/Lake_Agassiz

The last 3.5 M years and the Glaciations

The entire Quaternary Period, starting at -2.58 Ma, is referred to as an ice age because at least one permanent large ice sheet, i.e. the Antarctic ice sheet has existed continuously, but this section will extend the presentation slightly beyond, i.e. to -3.5 Myrs because the climate only reverted to a more normal pattern beyond then. Generally speaking and not strictly limited to the Quaternary, Ice Ages in general are rightfully attributed to several causes[155], including but not limited to changes in Earth's atmosphere (probably the least important factor), position of the continents, fluctuations in ocean currents, uplift of various major mountain ranges (e.g. the Tibetan plateau), variations in Earth's orbit, variations in the Sun's energy output, and volcanism.

Initially the fluctuation period between two successive glacial episodes was about 41,000 years, but following the Mid-Pleistocene Transition it has slowed to about 100,000 years, as evidenced most clearly by ice cores for the past 800,000 years and marine sediment cores for the earlier period. Over the past 740,000 years there have been eight glacial cycles, i.e. MIS 1 (-11,700) separated by 119.7 kyr (average) from previous glacial, MIS 5 (-131,400) 83.3 kyr from previous, MIS 7c (-214,700) 29.1 kyr from previous, MIS 7e (-243,800) 91.7 kyr from previous, MIS 9 (-335,500) 89.3 kyr from previous, MIS 11 (-424,800) 74.2 kyr from previous, MIS 13 (-499,000) 80.6 kyr from previous, MIS 15a (-579,600) 44.8 kyr from previous, MIS 15c (-624,400) 82.6 kyr from previous, MIS 17 (-707,000) 80 kyr from previous, and finally MIS 19 (-787,000) 77 kyr from previous glacial, they are all well visible on Figure 41.

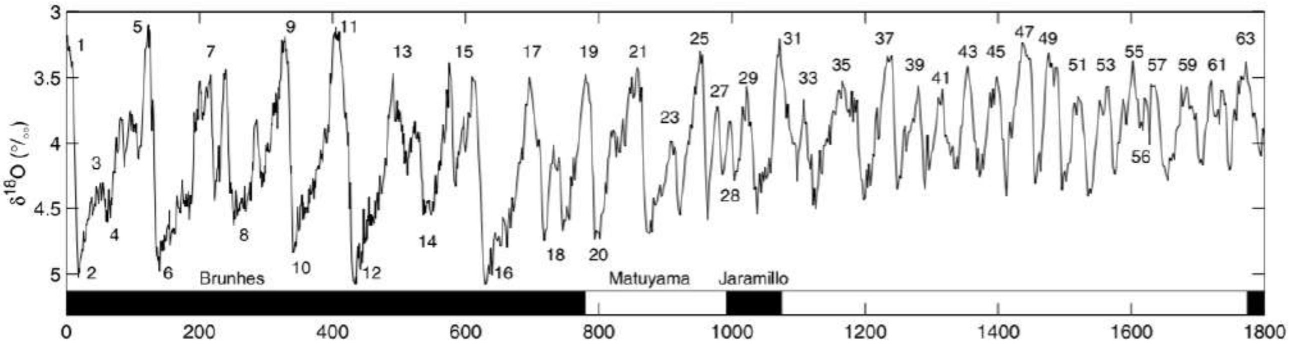

Figure 41. $\delta^{18}O$ isotopic record from LR04 stack of 53 benthic cores from all over the world shows that from about 1.8 million years ago some interglacials continued reaching the previous average temperature, while others show a decreasing trend in interglacial average temperature, and are not considered interglacials. Periods of higher temperature more recent than MIS 23 that did not reach interglacial levels are usually not assigned an MIS number (asterisks). Source: Lisiecky and Raymo (2005).

The origin of the glacial and inter-glacial cycles is obviously not to be searched into major atmospheric composition changes, that did not occur. CO_2 just followed the temperature as rightfully explained by Henry's law and just represented a lagging proxy on the temperature changes (Caillon et al., 2003). For anyone, not even needing a magnifying glass but just a bit of honesty, it is clear that the CO_2 curve follows the Temperature curve and that shifting the first by some hundred years improves considerably the already high correlation between the two of them (see Figure 42). So, the explanation of such a large and repeated climate change must be found somewhere else.

These and other benthic $\delta^{18}O$ time-series show that climate varies in a quasi-periodic fashion during all intervals characterized by glaciation, regardless of the location and extent of ice-sheets. In terms of frequency, much of the power in the climate spectrum since the early Oligocene appears to be concentrated in the obliquity band (approx 40kyr). Zachos et al. (2001) continue "*Additional power resides in the eccentricity bands, although the signal strength is more variable. For example, $\delta^{18}O$ variance in the 100-ky frequency band is exceptionally pronounced over the last 800 to 900 ky following a mid-Pleistocene shift, but weaker through the early Pleistocene and Pliocene when the signal was dominated by variance in the 41-ky band. Similar secular shifts in the power of the 100-ky cycle occurred in the late Oligocene and early Miocene. Power in the 400-ky band is exceptionally pronounced in the early Miocene, whereas it is relatively weak in the Pleistocene, and early Oligocene*"

155 https://en.wikipedia.org/wiki/Ice_age

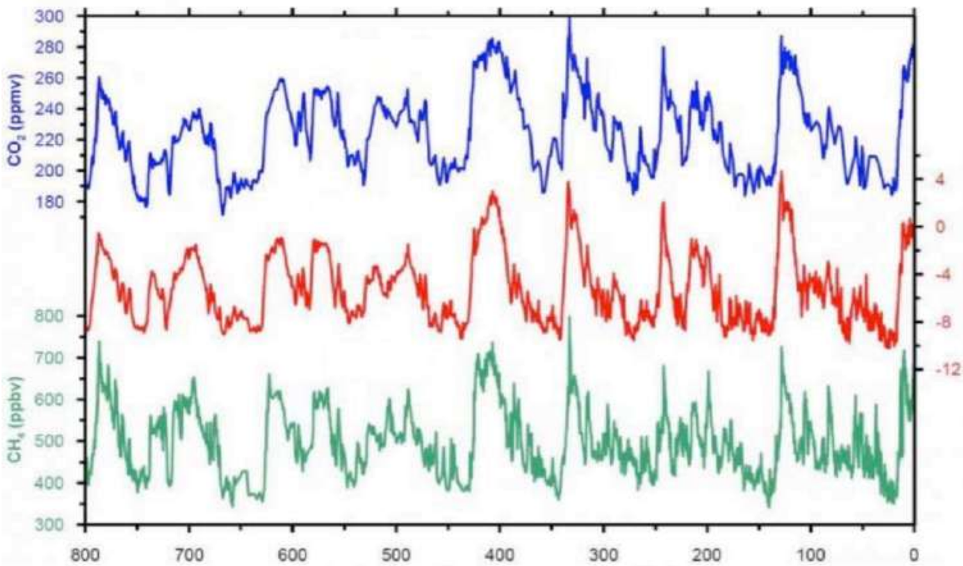

Figure 42. Temperature Anomaly in Antarctica over 800 kyr is displayed in Red, CO_2 in Blue, CH4 in Green. No need for magnifying glasses to see that CO_2 lags the temperature (e.g. at 650kyr, 430kyr, 240kyr, 130kyr)!

As noted earlier, until about 1 Myr ago glaciations were taking place at 41 kyr intervals, pointing to obliquity as the main factor among others such as eccentricity and precession. For a perfect presentation for the layman, a good summary is given by Javier (2016a). For an introduction into computing orbits for double stars, see Poyet (2017a-b-c). For a detailed description of sophisticated methods for a n-bodies problem with ephemeris spanning as far as 20 Myr in the future and 10 Myr back in the past, see Berger and Loutre (1991). As extraordinary as it is , and computing ephemeris as far in the future (20 Myr) and into the past (10 Myr) with decent accuracy is a great achievement, it only gives the position of the planets with an acceptable confidence (4.5 Myr) for just 0.001% of the Earth's existence (4.5 Byr). Beyond that one thousandth we are in “terra incognita”. Since about 1 Myr ago, glaciations have taken place at an average 100 kyr intervals[156], as it seems that the Earth has gone cooling too far to exit the stadial at each potential occasion given by its orbits' parameters. When this was discovered the problem was that the Milankovitch theory did not reserve any special place for the eccentricity cycle, since its effect is minimal.

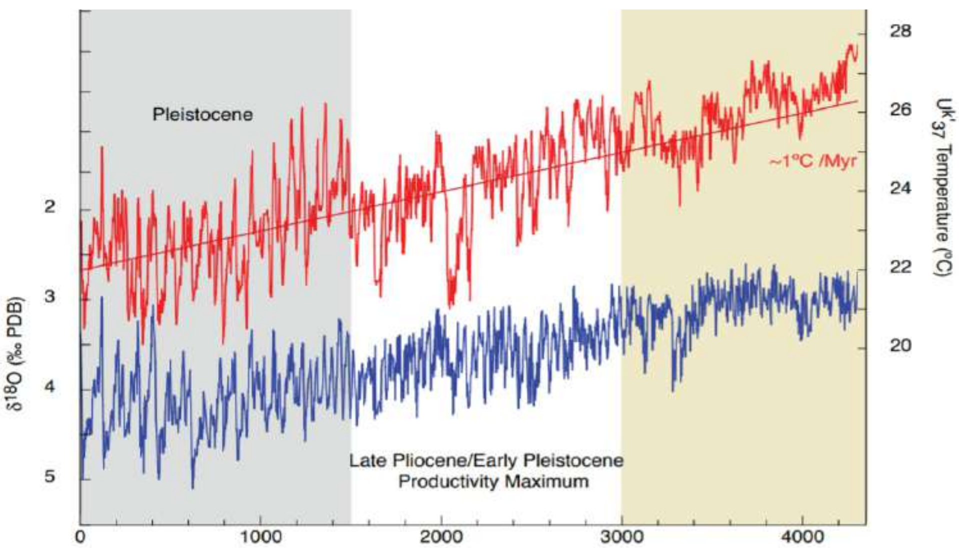

Figure 43. Two different paleoclimatic proxies from ODP Site 846 for temperature, the alkenone $U^{K'}_{37}$ in marine sediments (red), and $\delta^{18}O$ isotope in benthic cores (blue), show the progressive cooling of the Earth through the Pliocene. At the early-Pleistocene, glaciations start to take place at 41 kyr intervals. As the cooling progresses, this interval lengthens to 100kyr in what is called the Mid-Pleistocene Transition. All data are correlated to the LR04 Stack, the early Pliocene is shaded yellow, a white background defines the interval of maximum Eastern Equatorial Pacific (EEP) plankton productivity, and the portion of the Pleistocene after the productivity maximum is shaded gray, after Lawrence et al. (2006).

156https://en.wikipedia.org/wiki/Geologic_temperature_record and (Javier, 2018d)

As pointed out by Javier (2018b) "*So Hays, Imbrie, and Shackleton in their 1976 article proposed that the eccentricity was playing its role in a non-linear way. The problem is compounded because the main cycle of eccentricity is 413 kyr and that cycle is even less apparent in the record so we are left with the conclusion that eccentricity produces a multiplicative effect during its minor cycles, yet no important effect in its major cycle*". Maslin and Ridgwell (2005) call it "the eccentricity myth". In addition, the change from early-Pleistocene 41 kyr glaciations to late-Pleistocene 100 kyr glaciations was achieved without any change in insolation, so Milankovitch theory is at odds to explain it.

It is worth noticing that probably the first to acknowledge by direct field observations that regular climate modifications could be explained by orbital changes is Gilbert (1895) p. 124, while studying sedimentary sequences and more precisely the marine limestone-shale bedding rhythms of the late Cretaceous of Colorado; he asserted that they were of precessional origin and also listed many scholars having already surmised that orbital cycles had an impact on the Earth's climate before him, including Joseph Adhémar[157] and James Croll, see Raymo and Huybers (2008) for a more comprehensive historical perspective. But it was the serbian genius Milutin Milanković (Milankovitch, 1949) who was the first to bring the calculus to the point of a making a theory, refined later (Hays et al., 1976; Laskar, 1990; Laskar and Robutel, 1993) and led further to very sophisticated solutions providing ephemeris and accurate insolation reconstructions, e.g. "*A characteristic feature of the insolation around 4.4 Ma is the small value of the eccentricity at that time (e is almost 0 at 4.38 Ma BP) and to the small changes in precession and obliquity*" (Berger and Loutre, 1991).

Before that a 0.007% increase of CO_2 had blurred the mind and emptied the brain of so many bringing back the spirits of religious wars, i.e. you endorse my beliefs or else you are excommunicated and later worse, extraordinary geologists had found in the past records of the Earth's legacy what really could have had an impact on the climate. Studying a carboniferous limestone-shale sequence and using methods of mathematical geology, i.e. statistical time-series analysis, Schwarzacher (1964) found that a persistent oscillation and a high-order of auto-correlation was present in the sequence of data he had analyzed and asserted that periodic variations in the earth's orbit could be suggested as the ultimate cause of the oscillation. Schwarzacher (1993) also recognized that the Alpine Jurassic carbonate cycles attributed to -20 kyr precession were bundling into -100 kyr eccentricity cycles (Olsen and Whiteside, 2008). Field geologists are remarkable and prime observers of natural cyclical changes and according to Weedon (2003), the European Tethysian marine sequences are dominated by obliquity-forced cycles in the Hettangian and Sinemurian age parts of the sections, precession in the Pliensbachian, and a mixture of precession and obliquity in the Kimmerigian, see Hinnov and Goldhammer (1991), Hinnov and Park (1998), Hinnov (2005) for more references. In fact, from thereof a new discipline, called cyclostratigraphy emerged and started looking for cycles in the geological records with the objective to match them to known phenomenons, orbital variations being obvious potential causes (Pretro et al., 2004; Strasser et al., 2006; Vaughan et al., 2011; Kemp, 2016). Whatever the legitimate interrogations raised by Wunsch (2000, 2003, 2004), the geological records show that the climate has kept changing a lot naturally and most notably following cycles, though orbital factors might not explain the totally of the variance.

Of course, as for any theory, a lot of discussions arose as to which of the orbital parameters identified by Milanković are the more important and as to how they combine to exert an influence on the Earth's climate, see for example Maslin and Ridgwell (2005) for the role of the eccentricity or more generally for the nature and causes of rapid climate transitions during the quaternary (Maslin et al., 2001). It is surprising though, to observe that these authors are perfectly aware of the many dramatic climate changes that have happened over short periods of time, without any man-made influence as they mention for example, Maslin et al. (2001) "*the global collapse of the urban civilizations coincided with the deterioration of climate around 4,300 BP*" but they draw from there the conclusion that "*These sudden stepwise climate transitions are also a disturbing scenario to be borne in mind when considering the effects that humans might have on the present climate system through the rapid generation of greenhouse gases*" (Maslin et al., 2001). So, instead of accepting that climate changes a lot without any man-made interventions, the authors focus on the supposed effect humans "*might have*" through "*greenhouse gases*". That's flabbergasting! There is not the slightest indubitable proof that our emissions of GHGs have any impact on the climate, there are tons of evidences that the climate can change abruptly and over short periods of time without notice on its own, but our GHGs emissions are for sure the cause of the next disaster. That kind of logic escapes me.

The *Quaternary Glaciation* Ice Age started about 2.58 million years ago at the beginning of the Quaternary Period when the spread of ice sheets in the Northern Hemisphere began. Since then, as described, the world has seen cycles of glaciation with ice sheets advancing and retreating on 41,000 and 100,000 year time scales called glacial periods, and interglacial periods. The earth is currently in an interglacial, i.e. the Holocene, and instead of felicitating ourselves to

157 https://en.wikipedia.org/wiki/Joseph_Adhémar and https://en.wikipedia.org/wiki/James_Croll

benefit of some respite in what became an ever cooler and cooler environment (it was certainly not easy to survive during the LGM -20,000 years ago), we should worry that GHGs might avoid the next glaciation? GHGs emitted will not avoid anything but if it were we should rejoice ourselves instead of bemoaning. In fact, anything that allows interglacial to take place during this very cold period of the planet should be welcomed, as otherwise for the last 1.5 million years the planet would have been locked in a permanent glacial period only interrupted by interglacial every 400 kyr, at the peak of eccentricity. It is possible that there wouldn't be humans in that planet as conditions are already too close to CO_2 starvation for plants during glacial maximums (Ward et al., 2005). Only the arrival of the occasional interglacial prevents further cooling.

In that respect, reading Claerbout (2020) summarizing Moore's (2015) conference was illuminating and gave me a glimmer of hope, not everything was lost "*The amount of CO_2 in the atmosphere was reduced by about 90% during the last 150 million years. If this trend continues CO_2 will inevitably fall to levels that threaten the survival of plants, which require a minimum of 150 ppm to survive. If plants die all the animals, insects, and other invertebrates that depend on plants for their survival will also die. How long will it be at the present level of CO_2 depletion until most or all of life on Earth is threatened with extinction by lack of CO_2 in the atmosphere? If humans had not begun to unlock some of the carbon stored as fossil fuels, less than 2 million years from today! Human emissions of carbon dioxide have saved life on Earth from inevitable starvation and extinction due to lack of CO_2. Let us have no hominem arguments about "deniers". I submit that much of society has been collectively misled into believing that global CO_2 and temperature are too high when the opposite is true for both. Even when the fossil fuels have become scarce, we have the quadrillion tons of carbon in carbonaceous rocks, which we can transform into lime and CO_2 for the manufacture of cement using solar energy or nuclear energy. The human species has made it possible to prolong the survival of life on Earth for more than 100 million years. We are not the enemy of nature but its salvation!*". Finally a little common sense.

The benefits of current higher [CO_2] levels for the development of vegetation is also exposed by Zhu et al (2016). But during this quaternary ice age, plant starvation due to lack of CO_2 has had very significant implications for the biosphere and the reading of the paper of Cerling et al. (1998) is suggested and uplifting. Glacial lows for [CO_2] have been ranging between 175 and 225 ppmv for the last 700,000 years and if this gas has a very subdued impact on the climate (if any discernible) it is the gas of life and is necessary to the very existence of plants and therefore of all living forms on Earth. One should understand, that all vegetation dies when [CO_2] passes under 150 ppmv, it is not any longer a matter of adaptation as happened before, it is a lethal disruption. As will be described in the next section, the decline of atmospheric CO_2 had started long ago, i.e. 65 Myr, and many adaptations have occurred as a response to this, notably the widespread distribution of C4 plants, which are less sensitive to CO_2 levels than are C3 plants. But there exists a threshold under which, the Earth dies and becomes just another telluric planet as all the other unfortunate ones in the solar system, devoid of life and this is the fateful 150 ppmv [CO_2] level. Beyond the scientific insanity of declaring CO_2 an enemy, what an ingratitude, it is also completely missing the point of what makes life possible on this planet and sawing off the branch on which mankind is sitting on. To get a glimpse on a CO_2 starved future, just consider the mammalian evolution and extinction in the late Neogene related to the CO_2 starvation of C3 ecosystems. Biting the hand that feeds us will have a price, that of stupidity. If Arrhenius could see where his paper has led us, he would not believe it!

Morel (2013) was correct stating "*Paleo-climatologists like paleontologists have the advantage of talking about concrete phenomena or spectacular creatures. In addition, they do not fear the contradiction of first-hand witnesses, and for good reason! On the other hand, it is certain that paleoclimatic discoveries are the basis of our conception of the magnitude of possible variations over time, the essential source of information on the natural variability of the climate system. From this point of view, prehistoric reconstructions are an invaluable source of inspiration. However, no paleo-climatological reconstruction quantitatively defines all of the boundary conditions and internal parameters that come into play in the dynamics of the climate. By simplifying a little, historical or prehistoric climatology poses fascinating questions but does not answer any. We cannot rely directly on paleo-climatological work to advance our ability to predict or at least frame the field of future climate change*". For the same reasons that led Geller et al. (1997) to correctly state that earthquakes cannot be predicted (they have not been refuted so far), one should accept that we probably have, for the same reasons (chaotic system), no ability to predict future climate change as well. Nevertheless, knowing the long history of natural climate changes and being aware of the vast range of possibilities one can await, help put in perspective our place on Earth and enable us to consider the course of the most probable events.

Having said that, what can we expect for the continuation of the Holocene?

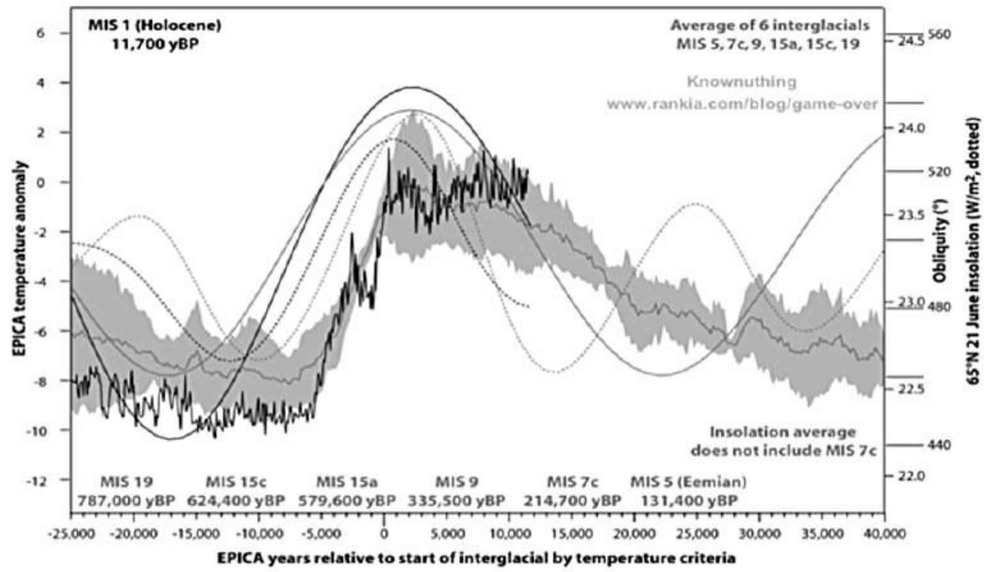

Figure 44. The average interglacial (grey curve and 1σ grey bands) and the average obliquity (grey sinusoid continuous line) and insolation at 65°N on 21 June (grey dotted line) are compared to Holocene temperature (smoothed, black curve), obliquity (black sinusoid continuous line), and insolation (black dotted line), Source: Javier (2018b).

The conclusions drawn by comparing the Holocene to the average interglacial (see Figure 44) are the same as those obtained by comparing it to its closest astronomical analog, MIS 19 (Pol et al., 2010; Tzedakis et al., 2012). Pol et al. (2010) assert that "*This comparison shows the lack of a perfect orbital analogue but highlights that the orbital context of MIS 19 is closer to the present one than during MIS 5e or 11*" and therefore MIS 19, 787 kyr ago, was an interglacial in the same Milankovitch configuration as our current Holocene interglacial as reminded by Pol et al. (2010) "*By aligning the respective early interglacial maxima of MIS 1 (~11 ky BP) and MIS 19 (~787 ky BP), enables a more detailed comparison of orbital contexts over a 50 ky interval. This alignment shows that the interglacial optima occur during eccentricity maxima, and with exactly comparable values of the precession parameter*".

Therefore MIS 19 has an almost identical astronomical signature, with the same low eccentricity and the same coincident peaks of precession and obliquity. The comparison suggests that the descent into **the next glacial should start in about 1,500 years** (Tzedakis et al., 2012) notwithstanding a restriction placed by the authors[158] on the [CO_2] that can be dismissed given what we developed in the previous section "atmospheric sensitivity to CO_2". Other authors disagree but their conjecture is based on [CO_2] assumptions which have departed them from their sound celestial mechanics background (Berger and Loutre, 2002). Finally, Javier (2016a) adds "*Once the present short warming interval ends, the Holocene should continue its temperature descent and an increase in northern summer insolation in the next several thousands of years should not significantly alter this decline as it has not done so in the past. To my knowledge no decaying interglacial has been revived this late in the obliquity cycle regardless of the amount of northern summer insolation. Therefore, there is no astronomical reason to expect that the Holocene should be a long interglacial, and humankind must wait for another obliquity cycle, probably the one after next, in 70,000 years, to have another chance at being scared by global warming*". In any case, one must know that the Earth has spent 90% of its time during the past million years in the coldest 1% of the temperatures seen in the past 500 million years...

Interestingly, as it concerns the kind of large observed multidecadal to multi-centennial variability that was presented in the section that dealt with the climate over the last 2000 years, Pol et al. (2010) acknowledge "*Based on the entire power spectrum of Holocene and on the sub-millennial deuterium variability observed during previous interglacials (MIS 5.5, 9 and 11 data offering centennial resolution), our working hypothesis is that multidecadal to multi-centennial variability must indeed be a common feature of all interglacials*". As man-made GHGs emissions are not responsible of observed multidecadal to multi-centennial variability of MIS 5.5, 9 and 11 nor even the Holocene of course, it would be just reasonable to search for another kind of explanation than the convenient scapegoat, i.e. CO_2!

Furthermore, just as the best celestial mechanics shows its limits and are acknowledged by astronomers and astrometrists who do not pretend to compute ephemeris or orbits for tens of millions of years in the future or the past, one can start to sense some honesty in the limits of using ice cores to explore past climate as was long claimed by

158 Condition added "if atmospheric CO2 concentrations did not exceed 240 ± 5 ppmv"

Jaworowski (1994, 2004). In fact, many problems arise the deeper the ice core as many physicochemical phenomenons take place and erase high frequency climate variability. Pol et al. (2010) state "*no new information on MIS 19 climate variability has been revealed, because of a strong smoothing of the deuterium signal. This smoothing, highlighted by a loss of spectral amplitude below a periodicity of ~1600 y, contrasts with the sub-millennial variability preserved for Holocene at comparable resolution and in MIS 19 high resolution calcium data*". In fact, and rightfully pointed out by Jaworowski (1994, 2004), as some water-veins at the grain junctions can be observed under some circumstances, as continuous liquid water network is expected to strongly enhance isotopic diffusion, and as the time period spent by the MIS 19 old ice at temperatures warmer than the critical value of −10 °C which is expected to be a threshold for migration–recrystallization processes, all that leads to a loss or distortion of information.

From this very brief overview of the last 3.5Myr one can easily see that contrary to the rantings and posturing of the New York City officials who declared a climate emergency in an effort to mobilize local and national responses to stall global warming. «*The New York City Council passed the legislation Wednesday, calling for an immediate response to the global climate crises. The bill referenced several reports on the state of global warming and its impact, imparting that extreme weather events brought about by rising temperatures demonstrates that the planet is "too hot to be a safe environment*» (Andrew and Ahmed, 2019) one should now easily sense that **the planet has just temporarily recovered from the last 3.5Myr of a too cold to be a safe environment** and that the Holocene is now ending its course, just round the next corner in 1,500 years to experience the start of the next stadial, a glacial period that will last at least 80 kyr as given the orbital configuration, obliquity will not save us in 41 kyr. So instead of fighting an imaginary AGW we'd better work as hard as we can to master all new forms of technologies that would give us an hedge to have cheap energy at will (e.g. new generation of nuclear plants, nuclear fusion, etc.) to support the billions of us that will face that future.

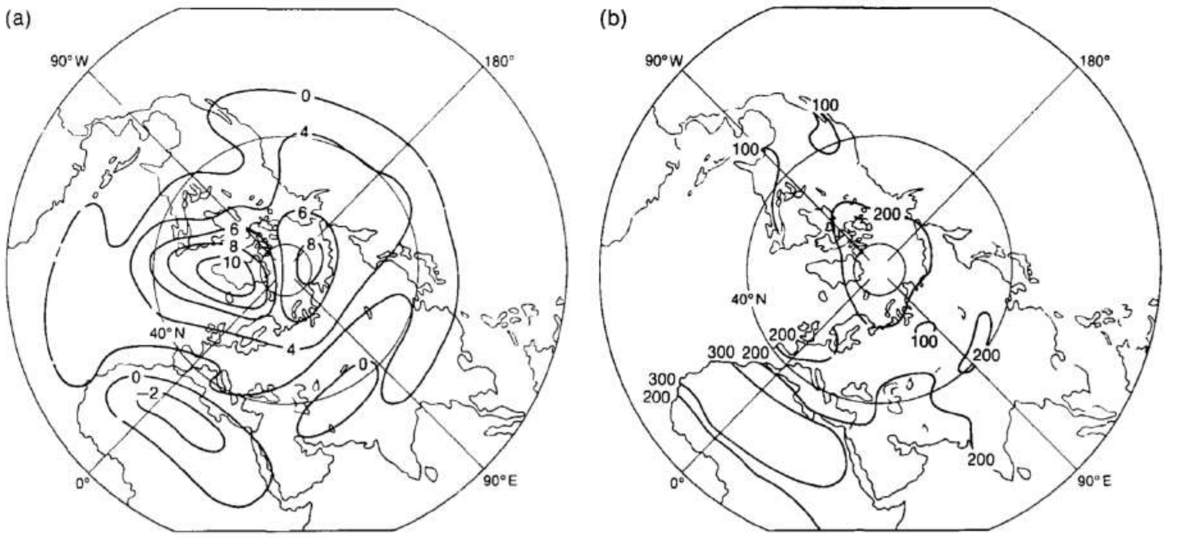

Figure 45. Departures of (a) summer air temperature (°C) and (b) Departures of annual precipitation (mm) from modern values for the Pliocene climatic optimum (4.3 to 3.1 million years BP) from Budyko and Izrael (1987) after Folland et al. (1990).

The transition from the Pliocene climatic optimum (Figure 45) into the Pleistocene Ice Ages is of course of great interest as it ends the good ol' times when temperature was warm to slowly but steadily delve into the quaternary ice ages. As was underlined before, ice cores do not provide appropriate sampling means for horizons spanning that far in the past, i.e. here up to 4 Myr. But fortunately, there exists a meteorite impact in Russia, located 100 km north of the Arctic Circle in Chukotka (67°30'N, 172°05'E), the $^{40}Ar/^{39}Ar$ dating of which thanks to impact glasses yielded 3.58 ± 0.04 Myr (Layer, 2000). The impact origin is well established (Gurov et al., 2007) and (Layer, 2000) and the formation well preserved from glacial erosion contains Lake El'gygytgyn which delivers a continuous sediment sequence recording a complete lacustrine record of the Late Cenozoic climate history on centennial to millennial time scales, a gift. The study of this stratigraphic sequence shows that 3.6 to 3.4 million years ago, summer temperatures in Arctic Russia, were ~8°C warmer than today as displayed on the Figure 45. As reported by Brigham-Grette et al. (2013) "*At the time of the El ´gygytgyn impact 3.6 Ma, the North American Arctic had a more continental geography, forests reached the Arctic Ocean coast, Greenland was mostly ice-free, and permafrost was not widespread*". So the middle Pliocene climate, between 3.6 to 3.4 Ma, was much warmer than that of today. The mean temperature of the warmest month of the year reached +15-16°C (+8°C today) while rainfall, indicated by the influx rates of sediment, was also substantially greater in the past at 600mm/year compared to the 200m/yr average of today.

The pollen-based reconstructions from Lake El'gygytgyn show that the largest cooling event of the mid to late Pliocene occurred between 3.31 and 3.28 Myr, when steppe-like habitats developed around the lake. This event, a punctuation mark in the overall warm theme, is thought to have been related to a period in which the influence of the North Atlantic Current declined significantly. However, from 3.26 to 2.6 Myr, warm and moist conditions prevailed, with warmest month temperatures 3-6°C greater than those of today. Finally, as reported by Brigham-Grette et al. (2013) "*At Lake El'gygytgyn, the first cold "glacial" sediment, Facies A, occurs at ~2.6 Ma; this facies, indicative of perennial summer lake-ice cover and MAT at least 4° ±0.5°C colder than today, becomes common after 2.3 Ma during cooler summer orbits, after an increase in low latitudinal temperature gradients in the Pacific*". Lake El'gygytgyn also records the fact that during the Pleistocene there occurred a number of 'super-interglacials', e.g. Marine Isotope Stage (MIS) 31, at about 1.07 Ma and which displays temperatures some 4-5°C warmer than present.

From the lacustrine records provided by Lake El'gygytgyn one can understand that CO_2 or not, anthropic emissions or not, the climate has widely fluctuated from the Pliocene optimum to the later quaternary ice ages, overall following a general cooling trend. Among the major parameters that drove this permanent climate change scheme but not limited to, have been: the evolution and intertwining of the Earth's orbital characteristics and their consequences on insolation at various latitudes, the establishment of lasting high/low pressures schemes and associated currents (both atmospheric and oceanic) and winds, the modulation of the solar activity and its effect on albedo (i.e. clouds and ice sheets) through yet to be precisely determined mechanisms by far exceeding the sole Total Solar Irradiance TSI (e.g. involving other and more powerful spectral bands as UVs), the establishment of meridional / latitudinal gradients, the impact of geographical changes such as the closure of the Panama isthmus, all the previous factors having a direct impact on humidity and precipitations as recorded by the lacustrine sediments and therefore the distribution (in 3D) of the major GHG contained by the atmosphere, i.e. water vapor, including at high latitudes where normally its role is reduced.

In short, we have a very complex climate system but be reassured the same hoary explanation will be ever proposed, as cannot resist Brigham-Grette et al. (2013) "*Elevated warmth across cold and warm orbital cycles during the "41,000-year obliquity-dominated world" of the Pliocene and early Pleistocene is consistent with pCO_2 estimates of 280 to 400 ppm, but evidence of extreme polar amplification exceeds that simulated by many climate models. Mechanistic explanations for observed trends in temperature and precipitation have yet to be determined, but imply high sensitivity to CO_2 forcing*". Take it or leave it, but it means: the models fail to represent the observed climate changes and 400 ppm are completely unable to account for the observations (given the log response), so there must be some "*high sensitivity to CO_2 forcing*" hiding somewhere! Perhaps we could (ex)change the respective CO_2/H_2O absorption spectrums and atmospheric concentrations to match your desired needs?, or invent some obscure "retro-forcing" on something? No, the climate changed a lot, CO_2 just followed the temperatures according to Henry's law and the adjustment of the out-gassing of the oceans at tropical latitudes, and a lot of work remains to be done to come up with better explanations than the worn out "CO_2 tinker knob". Jiménez-Moreno et al. (2019) rightfully stated that "*The Pliocene is a key period in Earth's climate evolution, as it records the transition from warm and stable conditions to the colder and more variable glaciated climate of the Pleistocene. Simultaneously, climate became more seasonal in the Mediterranean area, and Mediterranean-type seasonal precipitation rhythm with summer drought established*". The previous study was conducted in the western sector of the Guadalquivir Basin in SW Spain, but Pliocene deposits are very typical of some Mediterranean landscapes, including deposits in the Côte d'Azur area (France) where large transgressions took place and deposited the well known "Pliocene pudding" with layers of up to more than 100 meters. The change in the seasonal precipitation rhythm must have had a much larger impact on climate than whatever CO_2 changes.

The last 66M years and the Paleocene-Eocene Maximum

Here we go, now we enter the realm of geology with a time window expanding back to 65 Myrs. For the geologist it is just normalcy and not that impressive as, for example, most of the stratigraphic trips I made in the Alps used to focus more onto the Triassic (251.9 Myrs ago) serving as decollement surfaces, a typical tectonic feature of regions of thrust faulting such as the Alps, the Jurassic (-201.3 Myrs) or the Cretaceous (-145 Myrs) deposits and their further restructuring into the massive Alpine orogenesis. Tertiary deposits appeared rather recent in comparison and deposited in molasse basins[159], when the orogenesis had already advanced enough to produce the first erosion detritals removed from the emergence of the future belt of mountains.

But thinking of how much the climate has changed over the last 3.5 Myrs that we have just covered, makes you dizzy about speaking about events spanning over tens of millions of years. In fact, the very reason to embark on that trip is to show how much different the world was from now, major mountain belts like the Alps or the Himalayans not having formed yet, epicontinentals seas were covering wide parts of the current continents and oceans or seas promised to a fatal destiny as the Thetys[160] were still major parts of that past geography, see Figure 46.

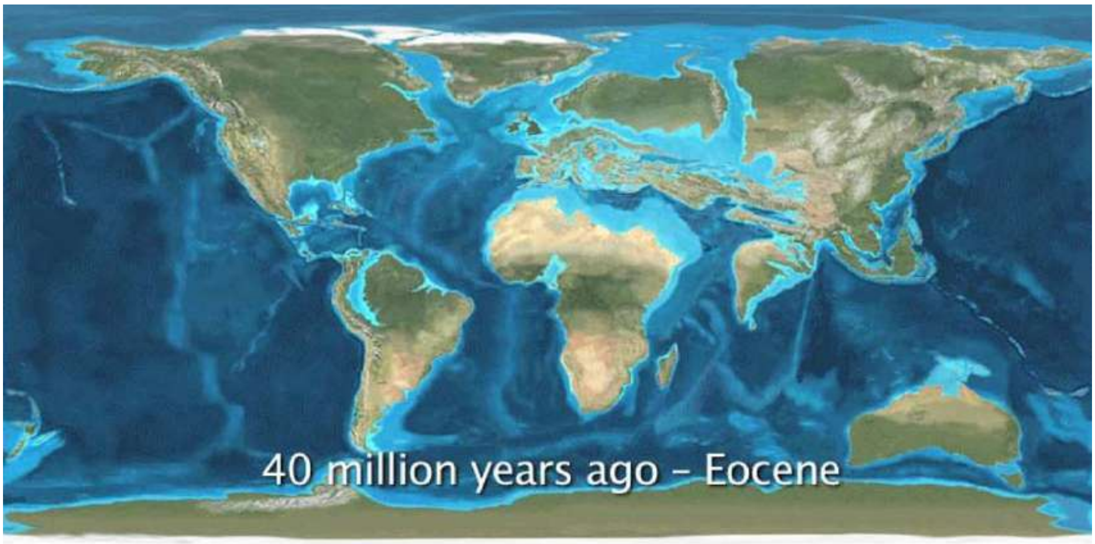

Figure 46. 40 Myrs ago, the Alps, the Himalayan mountain belts did not exist, the Tethys ocean was to disappear (except a remnant in the Eastern Mediterranean), India will collide with Eurasia, the northern motion of the African plate will entirely reshape the Mediterranean area, but some authors are obsessed by CO_2 levels of the time!, map after "The Burgess Shale[161]", see also Scotese (2001, 2003), Boucot et al. (2013), Scotese and Wright (2018).

The northern migration of the African plate led to the connection between the Atlantic and Indian Oceans across the Tethys being closed off (Bialik et al., 2019) in what is now the Middle East during the Miocene. During the Oligocene (33.9 to 23 Myrs), large parts of central and eastern Europe were covered by a northern branch of the Tethys Ocean, called the Paratethys which was an epicontinental sea (like the Northern Sea today). The Paratethys was separated from the Tethys with the formation of the Alps, Carpathians, Dinarides, Taurus, and Elburz mountains during the Alpine orogeny. The Tethys was a deep ocean and contained pelagic species (Dommergues and Guiomar, 2011) and its remains, located East of Malta (Bialik et al., 2019) and making the East Mediterranean, will disappear in the future as the African plate keeps moving north.

This world is hardly recognizable and the atmospheric circulation, the monsoons (were there any?), the hydrographic patterns, the precipitation regimes, the oceanic currents operating into these disappeared seas and oceans, the weathering processes, etc., everything was entirely different and had necessarily an impact on the climate of that not

159 https://en.wikipedia.org/wiki/Molasse_basin and https://en.wikipedia.org/wiki/Molasse
160 https://en.wikipedia.org/wiki/Tethys_Ocean
161 https://burgess-shale.rom.on.ca/en/transcripts/slideshow_plate_tectonics.html

so distant (in geological terms) past. But what is amazing is that you still have well conditioned authors, who activate their Pavlovian behaviors, and immediately jump back on what? Guess it, the [CO_2] levels as if this had any major importance into understanding what could have been those climates of the past! Well, they were six times higher than now (i.e. 1700 ppm during the late Cretaceous Period). So what? Given the logarithmic radiative response to an increase of this trace gas and its narrow absorption lines and limited parts not yet overridden by water vapor (see Chapter "Let's get back to some Physics"), this is certainly not even the beginning of an explanation to how far the Paleocene climate was from what we observe today.

We need more imagination to come up with some decent framework, a little bit like when Wegener and Alexander du Toit (1937) had to fight to impose their plate tectonics framework to the defenders of the geosynclinal theory (Knopf, 1948, 1960), created by U.S. geologists Hall (1859, 1882) and refined by Dana (1863). Suess (1875) was a strong opponent of the geosyncline theory as reminded by Brückl and Hammerl (2014) and is known for conceptualizing the super-continent Gondwana (proposed in 1861) and the Tethys Ocean, but it took a long time before Wegener ideas, the originator of the theory of continental drift by hypothesizing in 1912 that the continents are slowly drifting around the Earth (German: Kontinentalverschiebung) were accepted. His hypothesis was controversial and widely rejected by mainstream geology until the 1950s and many universities in the eighties were still making references to the geosyncline framework. This gives us an idea of how long it can take to get rid of bad theories, but Arrhenius conjecture has now lasted long enough. The $\delta^{18}O$ stable isotope ratio was the first paleo-thermometer, proposed by Urey (1947) and developed especially by Emiliani (1955)[162].

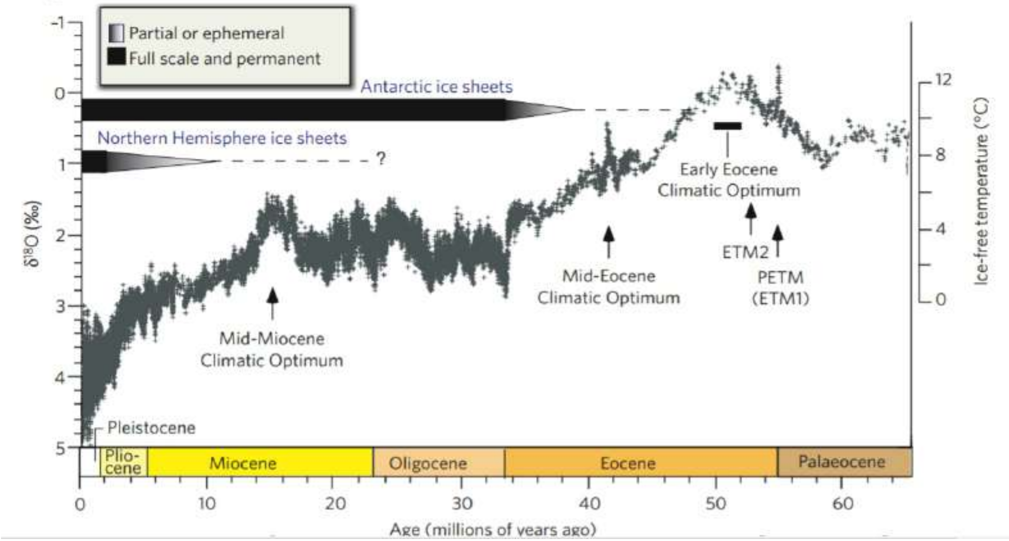

Figure 47. Evolution of the Climate over 65 Myears from Zachos et al. (2008). Global deep ocean $\delta^{18}O$. The climate curve is a stacked deep-sea benthic foraminiferal oxygen-isotope curve based on records from Deep Sea Drilling Project and Ocean Drilling Program (Zachos et al., 2001). As stated by Zachos et al. (2008) "The raw data were smoothed by using a five-point running mean. The $\delta^{18}O$ temperature scale, on the right axis, was computed on the assumption of an ice-free ocean; it therefore applies only to the time preceding the onset of large-scale glaciation on Antarctica (about 35 million years ago). The figure clearly shows the 2-million-year-long Early Eocene Climatic Optimum and the more transient Mid-Eocene Climatic Optimum, and the very short-lived early Eocene hyperthermals such as the PETM (also known as Eocene Thermal Maximum 1, ETM1) and Eocene Thermal Maximum 2 (ETM2; also known as ELMO). ‰, parts per thousand".

There are now several alternative proxy measures of ancient climate change, but the $\delta^{18}O$ data of Zachos et al. (2008), based on a conglomerate of global ocean sediment cores, is well-suited for reconstruction purpose as it covers the Cenozoic era with good temporal resolution. There are large, even dominant, non-climatic causes of $\delta^{18}O$ changes over hundreds of millions of years (Jaffrés et al., 2007), but non-climatic change may be small in the past few hundred million years (Wallman, 2001) and is generally neglected in Cenozoic climate studies. The principal data set used is the temporal variation of the oxygen isotope ratio ($\delta^{18}O$ relative to $\delta^{16}O$) in the shells of deep-ocean-dwelling microscopic shelled animals (foraminifera) in a near-global compilation of ocean sediment cores.

162 "Pleistocene temperatures" presented for the first time (1) variations in the composition of oxygen isotope ratios in carbonate tests of marine planktonic foraminifera, sampled in 11-deep-sea sediment cores from the Pacific and Atlantic; (2) temperature change of ocean surface water during the last 280 000 years; (3) an oscillation of warm stages (uneven stage numbers) and cold stages (even stage numbers), i.e. the oxygen isotope stratigraphy; (4) ocean temperature cooling in association with glaciations on the continents; and (5) the application of Milankovitch's orbital theory to determine the ice ages.

The fact that the Earth's climate has been dramatically cooling since the Early Eocene Climatic Optimum (EECM) is well displayed by Figure 47 and striking to any observer and has led many authors to promote conjectures to try to explain it. The importance of weathering mechanisms were addressed in the section "CO_2 removal from the Atmosphere" p. 50 and the processes by which huge quantities of CO_2 have been removed from the atmosphere by the alteration of silicates were described. This was a boon that led some authors like Raymo et al. (1988) to assert "*The cooling of global climate over the past few million years may be linked to a decrease in atmospheric CO_2 driven by enhanced continental weathering in these tectonically active regions*", i.e. Himalayan and Andean mountain ranges and the Tibetan Plateau in the referenced paper.

There is no doubt that weathering regulates largely the CO_2 atmospheric content, but that [CO_2] changes have had a major impact on the climate is something that was dismissed easily, e.g. in the section dealing with the atmospheric sensitivity to CO_2.. When Raymo and Ruddiman (1992) say 4 years later "*We propose that over the past 40 Myr, uplift of the Tibetan plateau has resulted in stronger deflections of the atmospheric jet stream, more intense monsoonal circulation, increased rainfall on the front slopes of Himalaya, greater rates of chemical weathering and, ultimately, lower atmospheric CO_2 concentrations*" they are on a better track to solving the climate puzzle, they notice and understand that these orogenesis have had a major impact on the atmospheric circulation including jet streams and monsoons but they end up concluding that [CO_2] are the explanation to the observed climate changes!

That kind of shortcut as well as in Klages et al. (2020) looks like an Obsessive Compulsive Disorder (OCD) whereby the observer is confronted to a very complex system and finding a quick fix solution will make it, sooth anxieties, like claiming that increasing or reducing the [CO_2] content (i.e. the magic knob) will be good enough to explain it all.

Furthermore, it becomes clearer and clearer that the climate has a chaotic dimension, making its prevision a high risk exercise and in that respect, let's quote Zachos et al. (2001) "*Perhaps the most interesting and unexpected discoveries of the last decade are the aberrations. These are loosely defined as brief (~10^3 to 10^5 y) anomalies that stand out well above "normal" background variability in terms of rate and/or amplitude, and are usually accompanied by a major perturbation in the global carbon cycle as inferred from carbon isotope data. The three largest occurred at ~55, ~34,and ~23 Ma, all near or at epoch boundaries. This last distinction is significant in that it implies that each of these climate events may have also had widespread and long-lasting impacts on the biosphere*". Examples of such aberrations and brutal climate change for the late Cretaceous and Paleogene can be found in Bralower et al. (2002).

Fortunately, some authors start considering that pCO_2 played only a marginal role, if any, in the factors that may explain the major climate change of the past, like the termination of the Oligocene glaciation, and did even notice that in this particular case the termination of the glacial episode (stadial) was accompanied by a decreasing pCO_2 (which shows how little influence pCO_2 has on climate change as its move was just opposite of what would have been expected). Actually a study by O'Brien et al. (2020) of the Oligocene climate, Global Mean Surface Temperature GMSTs and pCO_2 shows that not only there is no relationship between the two latter but that a continuous decline from pCO_2 > 1000 ppm for the mid Eocene down to 200-400 ppm (given the incertitude range of their Fig. 3) for late Oligocene corresponded to a situation where "***Oligocene GMSTs** were ~22 to 24 °C (Fig. 3A), thus not significantly different from those of the late Eocene, 23 °C, and **>8 °C higher than modern** rather than ~5 °C*". Can the reader figure that out? Late Oligocene shows pCO_2 that are comparable or lower than current values and the GMST are >8°C to current temperatures. Amazingly enough, instead of drawing the only reasonable conclusion from these evidences, i.e. that pCO_2 and GMST have little relationship if any at all, O'Brien et al. (2020) amazingly state "*This significant upward revision of GMSTs requires a reevaluation of estimates of climate sensitivity*". In fact, these low levels pCO_2 also went along with the "Antarctic Thawing" as indicated in the next Figure 48, p. 130.

Zachos (2001) rightfully identifies many other factors having a much more important role on climate than pCO_2 and lists some of those that he considers major determinants of climate status "*A case in point is the transition into and out of the long-term Oligocene glaciation. Thermal isolation of Antarctica by widening oceanic passages may explain the initial appearance of Antarctic ice-sheets, but fails to explain the subsequent termination. New reconstructions of Cenozoic pCO_2 have added another dimension to this argument, indicating that this termination occurred at a time when greenhouse gas levels were declining or already relatively low. This reinforces the notion that moisture supply was the critical element in maintaining large polar ice-sheets, at least during the middle Cenozoic. Although globally averaged precipitation should covary with pCO_2, on regional scales other parameters such as circulation patterns need to be considered as well. Future efforts to model the onset of Oligocene glaciation should investigate the role of the hydrological cycle in maintaining large ice-sheets on an otherwise warmer than present Antarctic continent. Similarly,* *with low pCO_2 over the last 25 My, tectonic events such as mountain building or oceanic gateway reconfigurations, which can alter ocean/atmosphere circulation and heat and vapor transport, may have had a dominant role in triggering large-scale shifts in climate*" (Zachos et al., 2001).

One could add to this list: orbital parameters and astronomical configuration determining insolation, solar activity, albedo changes and cloud nucleation processes responding to variable triggering processes (e.g. Jiménez-Moreno et al., 2019), weathering depending on the configuration of the major mountain belts undergoing erosion, volcanism and its variable activity, biosphere status including its distribution and activity (Villa, et al., 2013), plate motions with changes in ocean(s) / continent distribution (Hay, 1996; Fluteau, 2003; DeConto, 2008), e.g. opening of the Drake Passage around 30 Myr (Lyle et al., 2008), the Tethys Seaway closure which was not a gateway per se but rather a sea in its own right and its subsequent closing during the Oligocene (~35 Myrs ago, i.e. late Eocene) had significant impact on both ocean circulation and climate (von der Heydt and Dijkstra, 2006; 2008) and this constriction of the Tethys Gateway, which previously linked the Indian and Atlantic oceans caused large-scale circulation changes that promoted global cooling and the Oi-1 (marine oxygen isotope record) glaciation ~33.8–33.6 Myr ago (Francis et al., 2009), (Allen and Armstrong, 2008), (Tripati and Darby, 2018).

The further closure of the Thetys is also documented by the study of benthic foraminifera and recorded in the next stadial the Oi-2b global glaciation as documented by Fenero et al. (2013) "*The data from micropalaeontological study (foraminifera and calcareous nannofossils) are helpful for the further development of the sequence stratigraphic analysis and for the understanding of the causes of an interpreted relative sea-level change of the global climatic event (Oi-2b) in the western Tethys for the first time. Thus, the exhaustive analysis of Zarabanda section suggests that this event indicates a sea level fall, which can be correlated to the major expansion of the Antarctic Ice Sheet that occurred at approximately 26.7 Ma, e.g. the Oi-2b global glaciation event*".

Therefore, even though this period is significantly warmer than the conditions that will be met later during the quaternary ice ages, and the early Eocene even appears as an optimum that could be close to what Earth has known as the more favorable climatic conditions ever (Figure 48), it is well documented that for various reasons having little or nothing to do with the [CO_2], and some were aforementioned, the climate embarked on a significant roller coaster with two noticeable glaciations that we mentioned, i.e. Oi-1 glaciation (~33.8–33.6 Myr ago) and Oi-2b global glaciation event (26.7 Myr ago) and the Early Oligocene glacial maximum was accompanied by intensification of atmospheric and deep ocean circulation and elevated $\delta^{13}C$ and productivity (Zachos et al., 1993; Salamy and Zachos, 1999).

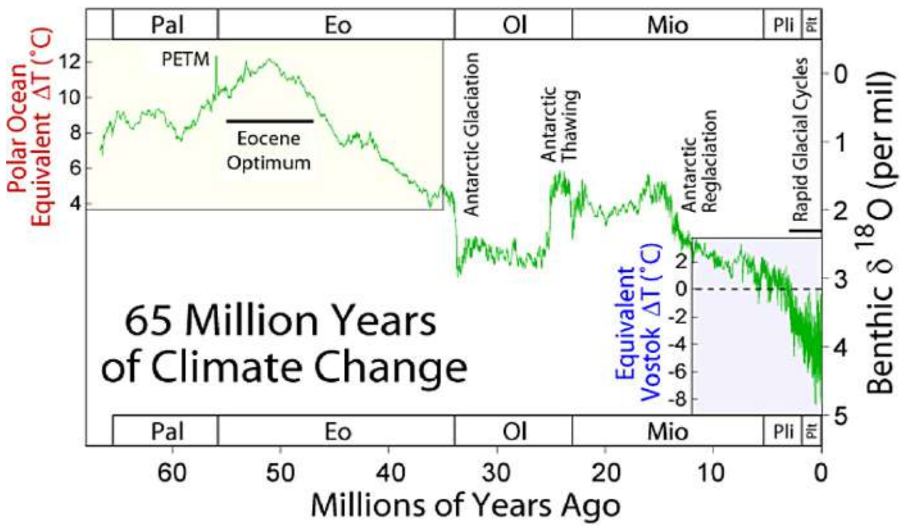

Figure 48. 65 millions of Climate Change with Antarctic glaciations and thawing: Source Wikipedia

What one must understand is that the carbon dissolved in the oceans is, in mass, fifty times the carbon contained in the air; Henry's law of degassing in exp(2400/T) says that the amount of dissolved carbon in the oceans decreases by 3% when the water temperature increases by 1°C. Therefore as explained by Veyres (2020a) "*during some geological epochs, e.g. including the "maximum" of the Paleocene Eocene transition some 56 million years ago, excursions of a few degrees are reported, involving degassing of the order of at least 5°C x 3% x 50 = 7.5 times the current quantity in the air and roughly 7.5 x 400 ppm = 3000 ppm out-gassed by the tropical oceans in the air*". So, given the high temperature of the early Eocene it is no wonder that one might expect to find elevated levels of pCO_2, as it is just the consequence of a very basic physical law. But in fantasy land and sticking to Arrhenius flawed conjecture as one could have stuck to geosynclines of Hall and Dana, Pearson and Palmer (2000) assert that "*Some authors have stressed the importance of changing inputs to the atmosphere such as volcanic and hydrothermal outgassing or metamorphic decarbonation reactions, while others have focused on outputs such as the weathering of silicate minerals and limestone formation or organic carbon burial*". So basically, it could be anything[163] but the obvious, i.e. the oceans adjusting their [CO_2] to the current ambient temperature, as this would endanger the very axioms of the dogma. This is amazing because the [CO_2] these authors report, have indeed, nothing surprising given the new equilibrium reached by the oceans as was indicated before "*We estimate CO_2 concentrations of more than 2,000 p.p.m. for the late Palaeocene and earliest Eocene periods (from about 60 to 52 Myr ago), and find an erratic decline between 55 and 40 Myr ago that may have been caused by reduced CO_2 outgassing from ocean ridges, volcanoes and metamorphic belts and increased carbon burial*" (Pearson and Palmer, 2000).

Around the Paleocene-Eocene Thermal Maximum (PETM) transition, one needs more than just CO_2 to account for the climatic changes observed and therefore the most awkward conjectures flourish such as what is reported by Royer et al. (2001) "*A period of rapid climatic warming (~2°C global mean rise within 10^4 years that lasted 10^5 years) near the Paleocene / Eocene boundary has been extensively documented. Although the leading hypothesis for the cause of most of this warming is the rapid release of methane from marine gas hydrates and its subsequent oxidation to CO_2 in the atmosphere and ocean, all previous attempts to resolve this possible atmospheric CO_2 spike have failed*", but unfortunately, all attempts have failed, simply because they failed to consider the obvious, i.e. that [CO_2] just follows T, not the other way round, and has no impact on the climate or so limited that it is hardly noticeable. Finally, as one does not shrink from any sacrifice of an unbridled imagination, Speelman et al. (2009) will come to the rescue of science fiction with the Azolla bloom to opportunistically regulate the pCO_2 knob at will to force T to follow pCO_2 as all other "models" failed. There is nothing wrong with studying the Azolla bloom or clathrate hydrates of CH_4 or CO_2 or any other gas and their transition phases, of course, but it seems preposterous to desperately try by all means to relate the temperature and climate to [CO_2] or other GHGs supposedly coming to the rescue when the former is not enough by all "forcing" mechanisms to account for the observations, as if no other factors were far more important.

The specific case of the PETM is interesting and following the way a story is built is telling. For example, Renssen et al. (2004) do not hesitate to state that "*The Paleocene/Eocene thermal maximum (PETM, ~55.5 Million years ago) is a well-known example from the past of a period with drastic climate change due to massive releases of methane from hydrates*" giving as references for such an evidence two papers from Dickens et al. (1995; 1997). But when considering these papers, one reads "*Cause of rapid warming during the LPTM[164] remains **unclear** but probably involves changes in tectonism, thermohaline circulation, and atmospheric pCO_2*". Reading more carefully is even more telling as Dickens et al. (1997) say "*Evidence for rapid >4 °C warming at high latitudes during the LPTM is abundant. Although it is **unclear** how much of this warming can be attributed to changes in thermohaline circulation, massive input of carbon, and other mechanisms (there are probably important feedbacks between various mechanisms), stratigraphic relationships between oxygen and carbon isotopes of benthic foraminifera suggest that **warming preceded** (in part) massive input of carbon during the LPTM (Thomas and Shackleton, 1996; Thomas, 1996). Thus, **addition of carbon cannot explain** all of the inferred warming...*" Bold added.

So from two papers where an hypothesis is conjectured, somehow even negated, a lot of unknowns listed and some simulations made (including a convenient upward move of the lysocline[165] contributing much to the modeled CO_2

163 Among many other conjectures, Kellogg et al. (2019) attributes to the flood basalt volcanism resulting from the opening of the north Atlantic (Storey et al., 2007), earliest at 56.1 ± 0.5 Myr, a GHG pulse that drove temperatures up 4-5°C, and estimate that the subsequent decay lasted some 120–220 kyr, with a relaxation time to be about 50 kyr. It is funny to see how the AGW community dismisses volcanism as a significant contributor to the CO_2 overall emissions and current budget and is quick to resort to it when it could help them explain major natural paleo-climate changes.

164 LPTM, i.e. Latest Paleocene Thermal Maximum, it was characterized by reduced oceanic turnover and decreases in global $\delta^{13}C$ $\delta^{13}C$ and in marine productivity Zachos et al. (1993).

165 The lysocline is the depth in the ocean usually around 3.5km, below which the rate of dissolution of calcite increases dramatically because of a pressure effect and lies atop the CCD, i.e. Carbonate (or Calcite) Compensation Depth or Aragonite Compensation Depth (ACD). It was reported by Li et al. (1969), Allègre and Michard (1973; 1974) that with respect to a) calcite the Atlantic becomes under-saturated below a depth of 4000-5000 meters, and the Pacific below a depth of 1500-3000 meters whereas b) to aragonite the Atlantic becomes under-saturated below a depth of about 2300 meters, and the Pacific below about 300 meters. "*Since the distribution of temperature, salinity, and pressure are similar in the deep waters of both oceans, the difference in the water depths at which the water becomes undersaturated with respect to calcite in the two oceans is due mainly to the difference in the CO_2 contents. This difference in the CO_2 content is controlled by the pattern of deep circulation in the ocean*" (Li et al., 1969). Furthermore, the CDs levels are driven by the production of CO_2 from the organic carbon in the water(s) and as the Pacific

release by changing the CCD), the next scientific evidence is to jump to Renssen et al. (2004) "*Catastrophic releases of methane gas from hydrates (clathrates) have the potential to cause rapid climate changes*". Not only does such a claim appears completely unsubstantiated based on the references given, but the conclusion from Dickens et al. (1997) is even more cautious "*The LPTM hydrate dissociation hypothesis invokes three fundamental assumptions (Dickens et al., 1995): the estimated mass of the present day oceanic hydrate reservoir (11 × 10^{18} g of C) is the correct order of magnitude; processes controlling hydrate formation and distribution were the same in the Paleocene and present day; and carbon transfer can occur between oceanic hydrates and the ocean-atmosphere inorganic carbon reservoir during deep sea warming.* ***None of these assumptions can be rigorously evaluated with current information***". Therefore from two papers, the latest concluding that the hypothesis made is all but proven and that none of the assumptions it rests on can be evaluated, the way the scientific story telling is now constructed jumps on asserting in the most affirmative way that "*This massive methane release had a profound effect on climate*" (Renssen et al., 2004). Of course, to move from weak science to pure science fiction one just needs one more step, and hereinafter it is "*In addition, there is growing concern that the expected future global warming may lead to hydrate instability and thus to an enhanced emission of methane, imposing a strong positive feedback that amplifies anthropogenic warming. It is thus very important to quantify the impact of such a methane hydrate scenario on the climate system*" (Renssen et al., 2004).

Summary of the narrative: a weak hypothesis is made for a distant paleogeography, 55 Myrs ago, sharing little to nothing with the current world and some simulations are run, leading to a lukewarm conclusion where the authors honestly admit that nothing can be rigorously asserted, but from thereon other authors consider proof established by means of a complete misrepresentation of the work of their colleagues, and go on to affirm further that anthropogenic warming, in itself a fantasy lacking of the first embryo of irrefutable proof, will amplify the former effect, i.e. the previous weak conjecture taken for granted as supposedly demonstrated. There is something wrong with the realm of science. Is that on that kind of science that politicians and rulers feel confident for imposing the most coercive and unfounded measures that they envisage?

The PETM and later transition to the Oligocene show a myriad of other explanations possible, including orbital factors in ice creation which can be seen with 100,000-year and 400,000-year fluctuations in benthic oxygen isotope records, the creation of the Antarctic circumpolar current which isolated the cold water around the Antarctic and would reduce heat transport to the Antarctic along with ocean gyres that result in the upwelling of colder bottom waters, or more simply and realistically a reduced level in cloud condensation nuclei (CCN) and a change of the microphysical properties of liquid water clouds (Kiehl and Shields, 2013), etc., basically as was indicated before, the recognition of a world apart from the current distribution of plates, continents, mountain belts, oceans, currents, etc. with massive volcanic eruptions in between like La Garita[166], all that far better explain than the poor CO_2 that climate has kept changing (as ever). The passage towards -55 Ma from 1375 ppm to 2250 ppm of CO_2 means that during the PETM we can legitimately presume a 64% growth of the net primary productivity of the vegetation reinforced by the growth of rainfall (Carmichael et al., 2017). The high temperatures of the ocean bottom (+8°C to +10°C compared to the current one) are sufficient to explain the duration of the PETM, see Kiehl and Shields (2013) Fig. 2 p. 7. Though this PETM episode has been recently attributed to massive volcanic emissions, more specifically the North Atlantic Igneous Province (Gutjahr et al., 2017), with a massive pulse > 10,000 Gt-C over less than 5000 years (Turner et al., 2017), characterized by a strong carbon isotope excursion, this event needs more critical analysis and bears no similarity with size and rate of the current pace of change.

For any geophysical and geochemical regime, it is the surface temperatures that determine the atmospheric content of trace gases, water vapor or CO_2 and not the other way around. Veyres (see footnote 13, p. 14) adds "*at 0.01°C/year (0.3 W/m²) losing 20°C takes 2000 years on the first 300 m of seawater and 20,000 years on the "average" 3800 m*". Boulila (2019) explores the connection between cyclic and acyclic processes, as triggers or feedbacks, for these major climate excursions, but they remain somehow enigmatic and help put in perspective the major climate variability experienced by the Earth system, and this relegates to the background any anthropogenic disturbance. Beyond the reasons aforementioned, the slow but steady decline in temperature from the Eocene optimum to the Pleistocene can be also related to additional factors such a changes in albedo resulting from different circulation patterns or CCN

has a higher organic C content than the Atlantic, the ACD is much lower for the former (Allègre and Michard, 1973; 1974), p. 90. and Sabine et al. (2004), Millero (2007) Fig. 25.

166 La Garita volcanism was the second greatest of the Cenozoic Era. The resulting Fish Canyon Tuff has a volume of approximately 1,200 cubic miles (5,000 km³), giving it a Volcanic Explosivity Index rating of 8. The Fish Canyon eruption was the most energetic event to have occurred on Earth since the Cretaceous–Paleogene extinction event 66 million years ago. The asteroid impact responsible for the K-T mass-extinction, equivalent to 240 teratons of TNT was approximately one thousand times more powerful than the Fish Canyon eruption.

formation mechanisms, variations in the relative humidity of the TOA radiating towards the cosmos (a decrease leads to water vapor emitting from lower therefore stronger) increasing the OLR, or even minor variations of the P_{atm} which could have slightly decreased reducing the effect of the gravitational lapse rate. In an Earth system where everything has evolved over the last 65 Myr and had an impact on the climate how could it be that just the minuscule player CO_2 would be responsible for 100% of the climate changes observed? Does that make sense to marginalize all changes that happened, tectonic organization, plate distribution, atmospheric and oceanic circulations, atmosphere's properties (albedo, OLR, etc.), volcanic bursts, solar activity (who can affirm that Sun's TSI was constant over 65 Myr) to focus on the variations of just one tiny trace gas as the only regulating mechanism? How could it be? What logic would that imply?

One should notice that this warm Cenozoic environment which presented as high as eight time the present-day [CO_2] did not create disturbing conditions for coral fauna, at least in the Eastern Pacific where the study from López-Pérez (2017) showed that the highest numbers of genera (>11) and species (>12) correspond with the middle Eocene to early Miocene epochs. But, the only thing for sure that observed [CO_2] decrease has led to, since the early Eocene, is a transformation of the vegetation and of the biosphere depending on it. Plants had first to adapt to implement more efficient means of using carbon dioxide available and this became more and more of a survival requirement as the concentrations went down to critical level when the ice-ages replaced the previous warm and favorable climate. "*The decline of atmospheric CO_2 over the last 65 million years (Ma) resulted in the `CO_2-starvation' of terrestrial ecosystems and led to the widespread distribution of C4 plants, which are less sensitive to CO_2 levels than are C3 plants. Global expansion of C4 biomass is recorded in the diets of mammals from Asia, Africa, North America, and South America during the interval from about 8 to 5 Ma. This was accompanied by the most significant Cenozoic faunal turnover on each of these continents, indicating that ecological changes at this time were an important factor in mammalian extinction. Mammalian evolution in the late Neogene, then, may be related to the CO_2 starvation of C3 ecosystems*" (Cerling et al., 1998).

The transition Eocene-Oligocene is characterized by extinctions that were attributed by Shoemaker and Shoemaker (1990) to a mild comet shower. In fact, there were several successive crisis that led to a progressive but steady overturn of the species. Prothero (2003) asserts that these extinctions "t*ook place over about 10 million years, starting with a major extinction in tropical organisms at the end of the middle Eocene, and followed by a significant global cooling event and a lesser extinction event in the earliest Oligocene. In spite of the evidence of four impacts around 35-36 Ma, no short-term extraterrestrial events or volcanic eruption is sufficient to explain this pattern of extinction. The overwhelming evidence for global cooling and oceanic circulation changes argue that these must have been the proximal cause of extinction. The likely triggers of this cooling were the development of the circum-Antarctic current and the opening of the Norwegian-Greenland Sea*". This is indeed very interesting as it shows that many factors can lead to major transformations of the habitats on Earth, be they cataclysmic like the encounter with another celestial body or simply due to natural but sustained climate change, until either transformation by adaptation of straight replacement would have happened. Undoubtedly some progressively declining global atmospheric carbon-cycle equilibrium took place and must be related to many natural phenomenons, the slow decrease of the temperature being the most important and leading to a better dissolution by the oceans of CO_2 and some other factors such as those mentioned by various authors, including silicate weathering due to the uplift of the Himalayas (Raymo and Ruddiman, 1992).

As studied by Barry et al. (2002) and reported by other authors (e.g. Cerling et al., 1998), a remarkable aspect of the change in the fauna of the Pakistan Siwalik sequence is that the mammalian herbivore assemblage evolves from a C3-dominated to a C4-dominated diet, apparently reflecting total replacement of the prevailing vegetation, the evidence pointing to global ecological change in the late Miocene, driven by gradual CO_2 starvation of C3 plants and their replacement by C4 plants (Barry et al., 2002). Again these significant changes in the biosphere, happening at 7.8 Myr and 7.3 Myr during the late Miocene which were announcing the future ice-ages to come were driven by natural factors and as stated by Barry et al. (2002) "*The close correlation of latest Miocene species turnover and ecological change to expansion of C4 plants on the floodplain, in association with oxygen isotopic and sedimentological evidence for increasingly drier and more seasonal climates, causes us to favor explanations based on climatic change for both latest Miocene pulses*". Finally, Cerling et al. (1998) go as far as considering that "*In North America the great extinction affecting large mammals (including Equus, Mammut, Mammuthus) at the end of the Pleistocene has been variously attributed to human overkill or increased seasonality. The vegetation changes observed during the Pleistocene and discussed elsewhere in this paper raise the possibility of a different mechanism: ecological change due to CO_2 stress*".

This reminds us that CO_2 is the gas of life and that it is its rarefaction and not a hypothetical excess that threatens the biosphere on Earth.

Finally, the bigger picture is that for a given geochemical and biological steady state, the temperature is the parameter that determines how much CO_2 is found in the atmosphere as a result of Henry's law. For the current global mean oceanic temperature, let's assume that we have 15°C and 19 ‰ Cl, therefore we dissolve around 40 milligram-atoms / liter of carbon as free CO_2 + H_2CO_3 and have a global stock as previously seen of 38,000 Gt-C of DIC. Would the global mean oceanic temperature be raised up to say approximately 22-23°C, as during the Paleocene-Eocene Thermal Maximum (PETM), the oceans would only store 32 milligram-atoms / liter of carbon (see Figure 6) and thus only 30,400 Gt-C would remain in the oceans as DIC and 7,600 Gt-C would have to find their way into the atmosphere, increasing to more than 8,470 Gt-C the overall content, which is 3982 ppm, just around what the maximum 4,000 ppm of the PETM are expected to have been. So there is no wonder to find 4,000 ppm of CO_2 during the PETM, it is just the logical equilibrium determined by Henry's law between the vast DIC oceanic reservoir and the atmosphere. CO_2 has just adjusted itself to the various reservoirs according to the temperature and has in no way been responsible for the PETM temperature change.

«*What historians will definitely wonder about in future centuries is how deeply flawed logic, obscured by shrewd and unrelenting propaganda, actually enabled a coalition of powerful special interests to convince nearly everyone in the world that CO_2 from human industry was a dangerous, planet-destroying toxin. It will be remembered as the greatest mass delusion in the history of the world - that CO_2, the life of plants, was considered for a time to be a deadly poison*».
Richard Lindzen

The last 540M years, mass extinctions and beyond

The 66 Myr that have been quickly addressed, corresponding to the Cenozoic, represent an amazing length of time for any human being, but still is just 1,46% of the Earth existence. This puts into a better perspective the geological records to which geologists are used to and gives a better idea of the geochemical and geophysical processes at work. Astronomers are even used to more daunting figures, both in time duration and space. And one should not forget that the Earth is also, first and foremost, an astronomical object, orbiting around a G0 star somewhere in the Orion–Cygnus Arm of an unremarkable spiral galaxy, the Milky Way, except that it is ours. The Orion Arm is a minor spiral arm of the Milky Way Galaxy that is 3,500 light-years (1,100 parsecs) across and approximately 10,000 light-years (3,100 parsecs) in length, and this Local Arm is between the Carina–Sagittarius Arm (toward the Galactic Center) and the Perseus Arm (main outer-most arm and one of two major arms of the galaxy).

The distance to which astronomers have been able to compute double stars orbits and therefore access to the real, physical mass of some stars is roughly 1000 light-years, therefore not even the thickness of the local Arm, this is our immediate astronomical neighborhood. The solar system is located at 10,000 pc (or 10k pc) from the center of the galaxy which would look like a pancake with a radius of 30k pc and 5k pc thick in its center. On geological time scales, cold periods, with supposed cooling of several degrees including glaciations or at least widely expanding glaciers return every 130 to 150 (say 138 million years), and could correspond to the passage of the solar system in the one of the arms of the galaxy (Shaviv, 2002, 2003), arm where the flux of cosmic rays is stronger than between the arms (Shaviv and Veizer, 2003), (Veizer, 2005), and also at the passage of the solar system in the plane of the galaxy, or even to "near" supernova explosions. The Milky Way having a somehow an irregular shape, these mechanisms do not operate with a perfect return-time, but give a general idea of the periodicity. Therefore, the climate over hundred of million of years cannot be dissociated from the trajectory of our spatial galactic vessel, i.e. the Earth, into its galactic environment, following the Sun in its course.

The limit between the Cenozoic (-66 Mys) and the Mesozoic (-252 to -66 Mys), is characterized by a catastrophic event, the Cretaceous–Paleogene (K–Pg) extinction, also known as the Cretaceous–Tertiary (K–T) extinction, which led to the disappearance of more than three-quarters of the plant and animal species on Earth. The reasons have been widely debated, and two concurrent hypothesis were proposed. The impact of a 10-15km large asteroid is now considered the most probable reason, since the discovery of the Chicxulub crater in the Gulf of Mexico's Yucatán Peninsula. It is also reported that other crater-like features have also been proposed as collateral impact craters formed in connection with the K-T extinction and suggests the possibility of near-simultaneous multiple impacts, perhaps from a fragmented asteroidal object similar to the Shoemaker–Levy 9 comet and subsequent impact with Jupiter (Poyet, 2014).

The recent paper from Henehan et al. (2019) would let one believe that the alternative volcanic hypothesis (Courtillot et al., 1988, 1996), (Keller et al., 2009), i.e. the Deccan Traps, is unfavored by now. Its title is curious as it shows more how any research has to try to conform to the fashionable thesis of the AGW theory, here a flash acidification of the oceans, than presenting a more balanced view on this remarkable event. As a major object like the one involved in the K-T extinction hits the Earth, one can expect a fantastic disruption of the Earth ecosystem, and the enormous quantities of atmospheric nitrogen that would be burnt by the impact fireball would create acid nitric rain that would anyway increase the acidity of soils, lake and shallow waters of the oceans. The paper itself is way more nuanced than its title would hint to "*However, the mechanism (or mechanisms) by which impact drove global-scale ecosystem turnover and mass extinction is less certain. Among the most prominent hypotheses are global darkness and associated primary productivity loss leading to food chain collapse, acid rain, impact winter, and flash ocean acidification. Some of these mechanisms are supported by modeling work but, critically, they generally lack empirical validation. Furthermore, the issue is complicated by the possibility of contributing effects from ongoing or intensified Deccan flood basalt volcanism...*" (Henehan et al., 2019).

From the current astronomical inventory, over the past several hundred million years several comet nuclei > 10 km have collided with the Earth (mean impact velocity is 3.3. times higher for comets than asteroids but their density is less well known) and by virtue of the ratio of the surface occupied by the oceans and the continents, the odds are that 70% of these collisions happened in the sea or the oceans creating massive tsunamis. It was estimated by Shoemaker and Shoemaker (1990) that comet nuclei having a diameter of 2.5km should collide with Earth about once every 10 million years, on average and that five Earth-crossing asteroids, in the range [0.9-1.7km], would collide with Earth every million year or so. Hoyle and Wickramasinghe (2001) went as far as thinking that regular comets impacts in the ocean, in the range of 10^{15} to 10^{16}g, could release enough water vapor to trigger an interglacial, though as we have seen Figures 35 and 44, these interstadials "*are necessarily short-lived, eventually drifting back to glacial conditions on timescales of ~10 kyr*". Furthermore, the Earth resides in an asteroid swarm of more than a thousand of such magnitude 18 objects [0.9-1.7km]. Some authors suggest, in order to combine the two hypothesis, that the Chicxulub impact could have triggered some of the largest Deccan eruptions[167], as well as eruptions at other active volcanoes. Therefore, the only thing for sure is that, be it an asteroid, a comet or the massive release of lavas by vast volcanic provinces, or both, the Earth ecosystem was nearly entirely destroyed during the K-T event, and that reminds us that the Earth has its own life and that mankind is just one passenger among others of an astronomical body.

On a philosophical standpoint, thinking of limiting our emissions as if they were the cause of the current warming (which started long before the industrial era at the end of LIA) in order to "freeze" the natural on-going climate variations is both naive and childish, kind of an immature desire to make last longer the "good times". But they were no better times before, just an ever changing world to which mankind must adapt, warming, cooling, corona-virus(es) hitting, Near-Earth Objects[168] (NEO) by the thousands, some approaching undesirably (e.g. 99942 Apophis, near-Earth asteroid with a diameter of 370 meters, see Figure 49) "*Of the over 18,000 NEOs known today (June 2018), there are nearly 2,000 objects classified as potentially hazardous objects (PHOs)*" (UN-OOSA, 2018), or else.

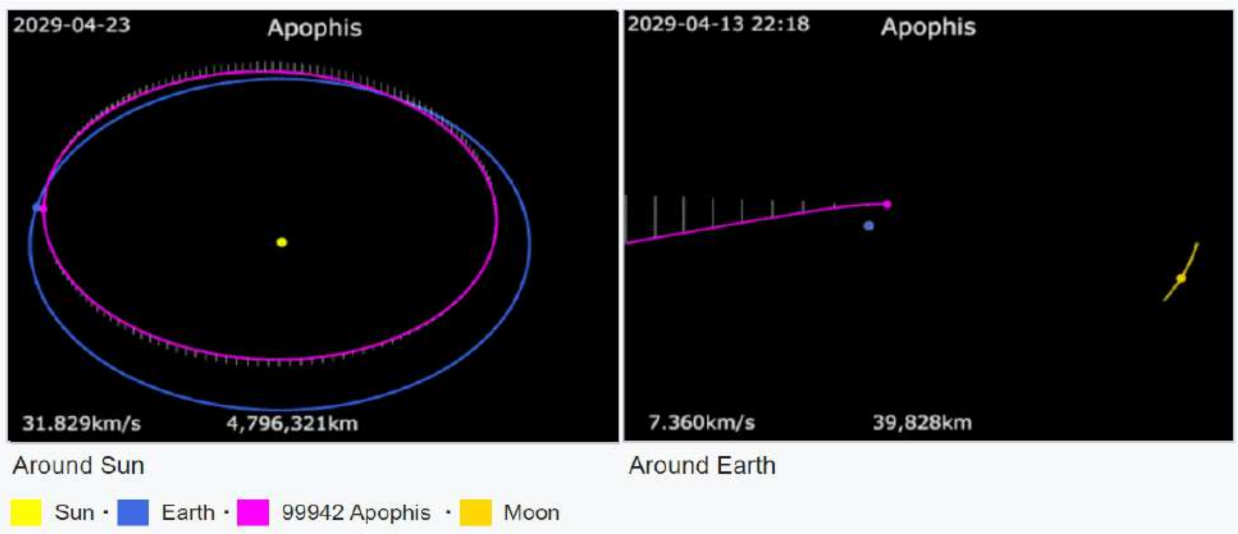

Figure 49. Animation of 99942 Apophis's orbit – Close approach on April 13, 2029. Source: Wikipedia[169]. Apophis is displayed on the left on April 23rd, 10 days after closest encounter, and visible on the right on April, 13th slightly past closest encounter at 39,828 km! (in fact will come no closer than 31,200 km), i.e. 1/10th of the distance between the Earth and the Moon, and will nearly also collide with the Moon, visible on the right, a few hours later on April 14th, 2029 around 17:00 UT.

Past this K-T boundary, this document is not the place to explore the geological records all through the Phanerozoic (Mesozoic and Paleozoic representing 541 Myr down to the beginning of the Cambrian) or even why not all through the Proterozoic down to the Archean (-2.5 Gyr) or more, one will simply notice that, while the AGW supporter have scared the masses with the possibility of a transgression, the famous Sea Level Rise, the end of the mesozoic, i.e. the late Cretaceous, just before the K-T event, is characterized by one of the most notable regression of the geological times, the Maastrichtian regression, a drop in sea level for which there is no direct known cause, one hypothesis being that the mid-ocean ridges became less active and sank under their own weight.

Natural climate change kept happening as this regression would disrupt winds and ocean currents and logically reduce the Earth's albedo (cloud formation would be limited by reduced sea/ocean extension) and increasing global temperatures, which anyway were considered to be during the Cretaceous 10°C more than during Cenozoic. This regression, by reducing continental shelf area, was certainly not of the taste of all living species and Marshall and Ward (1996) report that the "*analysis of latest Cretaceous outer-shelf macrofossils from western European Tethys reveals either a faunal abundance change or an extinction of up to nine ammonite species associated with a regression event*

167 https://en.wikipedia.org/wiki/Cretaceous-Paleogene_extinction_event
168 https://cneos.jpl.nasa.gov/ https://en.wikipedia.org/wiki/List_of_Earth-crossing_minor_planets
169 https://en.wikipedia.org/wiki/99942_Apophis

shortly before the boundary, gradual extinction of most inoceramid bivalves well before the K-T boundary, and background extinction of approximately six ammonites throughout the latest Cretaceous".

This K-T extinction is unfortunately not the only one in the geological records. In fact, and from our precarious situation in the cosmos one will not be surprised to learn that five major such extinctions[170] have been acknowledged during the Phanerozoic eon (Raup and Sepkoski, 1982), but it is a rather arbitrary count and depending on the way one assesses the impact of the event(s) on the biota, others could be added to the list. It will not be appropriate to go into the details of these extinctions, but the reader should sense that over the last 10% of the Earth existence or so, all forms of life have been threatened in their very existence more than five times on this planet. A short list of the damages is given here:

- at the Ordovician–Silurian transition (450–440 Myr ago), two events occurred that killed off 27% of all families, 57% of all genera and 60% to 70% of all species;
- near the Devonian–Carboniferous transition (375–360 Myr ago), in the later Devonian Period, a prolonged series of extinctions eliminated about 19% of all families, 50% of all genera and at least 70% of all species;
- at the Permian–Triassic transition (252 Myr ago), Earth's largest known extinction killed 57% of all families, 83% of all genera and 90% to 96% of all species! (53% of marine families, 84% of marine genera, about 96% of all marine species) and an estimated 70% of land species including insects and the recovery of vertebrates took 30 million years!
- at the Triassic–Jurassic transition (201.3 Myr ago), about 23% of all families, 48% of all genera (20% of marine families and 55% of marine genera) and 70% to 75% of all species became extinct;
- finally, at the Cretaceous–Paleogene (or K–Pg), extinction event that was mentioned before, about 17% of all families, 50% of all genera and 75% of all species became extinct.

Though the idea proposed by Raup and Sepkoski (1982) that "*Background extinction rates appear to have declined since Cambrian time*" is disputed, it would seem just reasonable that the rate of encounter with other bodies has just kept subsiding from very high distant rates (3.5 Gyr ago) when the solar system was much more crowded. The blossoming of new species or the opposite mass extinctions were driven by transgressions, regressions, plate motions with subduction, collision, obduction, or simple subsidence, flood basalt events, current atmospheric or oceanic patterns changes, modifications in the oceanic overturn, anoxic events, geomagnetic reversal, orogenesis of all sorts, a collision with an extra-terrestrial body from time to time to remind us our place, continuous variations of the Earth's orbital parameters and gravitational interaction with our neighbors, a bit of solar variability (most stars are variable stars anyway), a short list which is a good recipe for natural climate change, don't you think ? Of course, climate is a combination of all these factors, and many more, and not the result of the increase of 0.007% of the concentration of a trace gas.

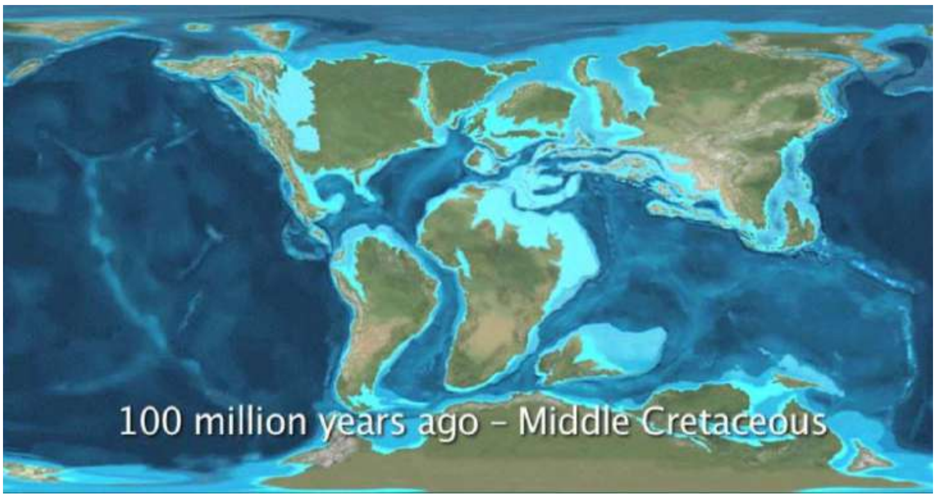

Figure 50. 100 Myrs ago, the Alps and all the mountain belts eastward to the Himalayan did not exist, the huge Tethys ocean was to disappear, Middle East and Arabian plate did not exist, the Indian plate had just started it motion N, Africa and S. America were separating, and much more!, but if there is a problem with what you observe as a geologist, invoke CO_2 !. See also Scotese (2001, 2003), Boucot et al. (2013), Scotese and Wright (2018).

170 https://en.wikipedia.org/wiki/Extinction_event is a very well documented paper

This is why, in the middle of this late Cretaceous warmth, it becomes funny to read Klages et al. (2020) who make the demonstration of a perfect example of a CO_2 OCD trouble when they report the existence of temperate rain-forests near the South Pole during peak Cretaceous warmth.

From the very short presentation made before, one can imagine how far this world could have been from ours, but still Klages et al. (2020) will explain everything by the convenient molecule, the famous CO_2 scapegoat: "*The mid-Cretaceous was one of the warmest intervals of the past 140 million years (Myr) driven by atmospheric CO_2 levels around 1000 ppmv. In the near absence of proximal geological records from south of the Antarctic Circle, it remains disputed whether polar ice could exist under such environmental conditions. Here we present results from a unique sedimentary sequence recovered from the West Antarctic shelf. This by far southernmost Cretaceous record contains an intact ~3 m-long network of in-situ fossil roots. The roots are embedded in a mud-stone matrix bearing diverse pollen and spores, indicative of a temperate lowland rain-forest environment at a palaeolatitude of ~82°S during the Turonian–Santonian (93–83 Myr). A climate model simulation shows that the reconstructed temperate climate at this high latitude requires a combination of both atmospheric CO_2 contents of 1120–1680 ppmv and a vegetated land surface without major Antarctic glaciation, highlighting the important cooling effect exerted by ice albedo in high-CO_2 climate worlds*". (Klages et al., 2020). One will notice the precision, as these authors have nudged up the number in a couple of sentences from around 1000 pppv to up to nearly 1700!

No, the temperatures were not "*driven*" by 1000 ppmv, or 5000 pppv or even ten times more, they were just the result of a completely different world, see Figure 50. What Klages et al. (2020) report is what makes Geology amazing, but their total lack of imagination prevent them from just lifting the corner of the veil on this distant past. I will add that the 50,000 to 500,000 ppm [CO_2] estimated by Kasting (1993) did not prevent the Huronian glaciation more than 2 Gyr ago. Climate is the result of the combination of so many factors, a little bit the synthesis of all the knowledge gathered in all the disciplines involved to be able to sketch and make alive again in our imaginations these far-off worlds, so the plus or less of 0,0X% of the atmospheric content of a trace gas is anecdotal, please give us a break with that; one will furthermore notice that its concentration has varied a lot through geological times as shown on the Figure 51 below.

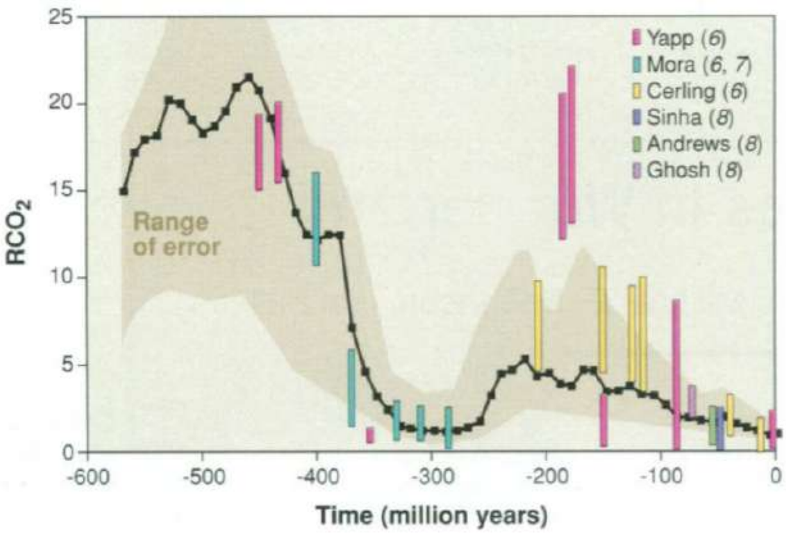

Figure 51. The parameter RCO_2 is defined as the ratio of the mass of CO_2 in the atmosphere at some time in the past to that at present (with a pre-industrial value of 300 parts per million) Berner (1997), see also Berner and Kothavala (2001) Fig. 6, p. 195, Berner (2006) Fig. 18, p. 5662.

As reminded by Happer (2003) «*For example, as documented by the work of Berner (1997) atmospheric carbon dioxide concentrations were some five times higher than those now from about 300 million years to 30 million years ago, a geological period of flourishing life on earth. For most of the time since the first fossils of advanced forms of life appeared in the Cambrian era, some 600 million years ago, the earth's climate has been somewhat warmer than at present, and the poles have had little or no ice cover. The exceptions were two ice ages, similar to the present one, the Gondwanian, about 280 million years ago, and the Ordovician, about 430 million years ago. Both ice ages coincided with unusually low levels of carbon dioxide in the atmosphere, much as we have experienced at present. It is hard to understand hysteria over manmade increases in carbon dioxide levels that will not even bring atmospheric carbon dioxide levels up to their norm for most of geological history, and which will probably help to prevent the next advance of ice sheets. So we should be very careful about taking actions that will certainly cause great economic harm*», for daring to think along these lines, Happer (2003) was fired from his position! Happer was the Director of Energy Research of the Department of Energy in the early 1990s. However, after a few months following the election of Bill Clinton and Al Gore in the fall of 1992, Secretary O'Leary called him to say that he was unacceptable to Al Gore and his environmental advisers, and that he had to be replaced.

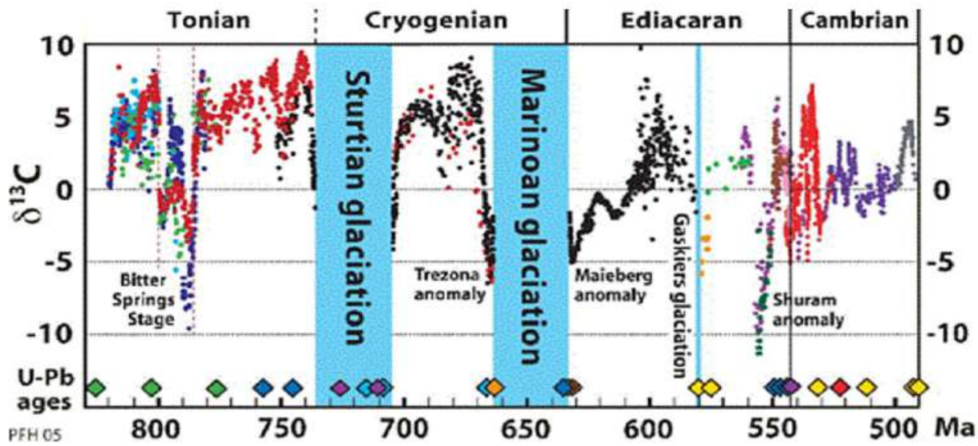

Figure 52. The cryogenian is considered as probably the most severe episode of global glaciation, with two successive episodes: the Sturtian and Marinoan glaciations, thought to be global in extent, shown up clearly in this graph of carbon-13 (thought to be an indicator of biological productivity). The glaciations are at 710 and 650 Myr. A later glaciation at 580 Myr is also indicated, i.e. (Varanger or Gaskiers), although its nature remains elusive. The mantle value for δ13C is believed to be -5 to -6 ppm. When this actually was the sediment value, photosynthesis had nearly ceased. After Banik (2016).

We have knowledge of the existence of distant glaciations:

- in the very distant *Huronian* -2470 to -2210 Myr;
- then at the end of the Precambrian during the *Cryogenian*, i.e. between -720 to -630 Myr probably the most severe of all which may have produced a Snowball Earth in which glacial ice sheets reached the equator with two episodes (Banik, 2016), i.e. Marinoan (ca. 645-635 Myr) and Sturtian (ca. 717-659), see Figure 52, according to Stern and Miller (2019). Hoffman et al. (2017) state that geochemical data evidence that CO_2 was 10^2 Present Atmospheric Level (PAL) which obviously did not prevent the extremely severe glaciation, though the global character of the event is somehow refuted by Etienne et al. (2007) on stratigraphical grounds;
- then during the late Ordovician and Silurian, the so-called *Andean-Saharan* glaciation occurred from -460 to -420 Myr ago for which an extra-terrestrial trigger has recently been conjectured (Schmitz et al., 2019);
- then with the Karoo glaciation, named after the glacial tillites found in the Karoo region of South Africa, referred to as *Late Paleozoic* there were extensive polar ice caps at intervals from -360 to -260 Myr ago in South Africa during the Carboniferous and early Permian Periods. Correlatives are known from Argentina, also in the center of the ancient super-continent Gondwana.

Beyond classical Milankovitch (1949) factors, based on Earth's orbital parameters, one should not eventually underestimate how continents distribution, reliefs and high plateau may modify the global atmospheric circulation and lead to glaciations. This is the hypothesis of Raymo and Ruddiman (1992), «*An important implication of the plateau uplift hypothesis is that even steady-state plate motions can lead to non-steady-state effects on climate and, hence, possibly global relief. Continent-continent collisions which result in plateaux of the magnitude of Tibet are infrequent and episodic. Consequently, the accompanying effects of uplift (perturbation of atmospheric flow, large monsoons, and intense erosion and weathering), should be comparably infrequent. Over the past 700 Mys, only two other time periods were characterized by Tibetan-size plateaux, the late Precambrian and the late Palaeozoic; these were also intervals of widespread continental glaciation*».

The irregular growth over time of the cratons and of their assembling is also well addressed by Des Marais (1992) focusing on Proterozoic orogenies. "*Commencing at 2.2-2.1 Gyr, the large continental plates that had assembled for the first time in the late Archean to early Proterozoic underwent rifting and, later, orogeny on a globale scale, as evidenced by massive basic and ultra-basic dyke swarms and Andean-type orogenic belts. Post-Archean tectonic styles display an increasing prominent early rift stage and a well developed terminal stage of orogeny. The earliest-known glaciations occured during this interval...*" Des Marais (1992). Declining atmospheric CO_2 concentrations over the past

2.5 Ga are, however, qualitatively consistent with the observed increase in the $^{13}C/^{12}C$ ratio of marine kerogens. (Des Marais, 1992), though they might have remained very high as a study by Kaufman and Xiao (2003) of carbon isotopes in individual organic-walled microfossils extracted from a Proterozoic shale in North China dated -1.4 Gyr, where they report "*calculated magnitudes of the carbon isotope fractionation in these large, morphologically complex microfossils suggest elevated levels of carbon dioxide in the ancient atmosphere—between 10 and 200 times the present atmospheric level*". More speculatively, but interesting is the simulation by Walker (1985) of an Archean Earth devoid of continents with an early ocean rich in carbonic acid with a lower pH, and a total mass of carbon in the ocean and the atmosphere combined of up to 10^{22} gr, which would have yielded a carbon dioxide partial pressure close to 10 bars, and Kasting's computational methods used for the circumstance, i.e. (Kasting and Ackerman, 1986), show that while this much carbon dioxide leads to a hot Earth, it is not so hot as to cause a runaway greenhouse effect which would only happen with a $p_{atm}CO_2$ of more than 100 bars. Kasting (1987) even concluded that "*the critical solar flux at which a runaway greenhouse occurs, that is, the oceans evaporate entirely, is found to be 1.4 times the present flux at Earth's orbit (So). This value is close to the flux expected at Venus' orbit early in solar system history. It is nearly independent of the amount of CO_2 present in the atmosphere, but is sensitive to the H_20 absorption coefficient in the 8- to 12-µm window region*".

Right now a paper from Arnscheidt and Rothman (2020) analyses the routes to global glaciation, especially low-latitude glaciation most prominently observed towards the end of the Neoproterozoic Era (1000–542 Myr ago), and conjecture that glaciations could be initiated when incoming radiative fluxes exceed a critical rate of change, putting more an emphasis on the time derivative of the processes and state "radiative flux perturbations can initiate transient glaciations quite far from the instability boundary" and furthermore "*Because rate-induced glaciation can be initiated via one-way movement between two long-term stable states, the co-occurrence of transient glaciations with periods of major biogeochemical transition in Earth's geologic past could reflect a fundamental characteristic of the Earth system rather than a mere coincidence. Intriguingly, transient catastrophic climate disruptions may be a general feature of Earth-like planets that move between different stable states too quickly*". One should notice that, rightfully, for Arnscheidt and Rothman (2020) a climatic catastrophe is a glaciation and certainly not a transient warming that benefits all.

No need to go any further into the geological records, it should be clear from now on, why even a limited knowledge in physics, historical geology, stratigraphy, paleontology, tectonics, astronomy, etc. should make anyone extremely cautious with overly simple(istic) explanations, i.e. the convenient "CO_2 climate control button". In fact, studies of the potential relationship between the global temperature and CO_2 concentration show that there is no correlation at all, e.g. Davis (2017) concludes that his analysis "*demonstrates that changes in atmospheric CO_2 concentration did not cause temperature change in the ancient climate*," which findings, he adds, "*corroborate the earlier conclusion based on study of the Paleozoic climate that global climate may be independent of variations in atmospheric carbon dioxide concentration*" (Came et al., 2007).

Life is made of carbon and 500 million years of historical geology have taught us that life strives with warmth and moisture and fortunately they most often come together, dry and hot deserts remain geographical anomalies. CO_2 is of course the primary source of carbon and therefore supports every form of life on this planet. Glaciations meant death on wide scales, e.g. including the disappearance of 80% of the temperate forests and of so many species needing them for their habitat and an 80% reduction of the extension of coral reefs and of the marine ecosystems that go along; cold has always spread death and desolation, strongly reducing all forms of living productivity (Jaccard et al., 2005).

The Earth has never been so cold over its entire geological history and the last 0.2% of its existence (900 kyr) has seen the most catastrophic succession of glaciations, such that hominids could only survive by mainly being a tropical species and finding refuge essentially in Africa living between the tropics. The end of the inter-glacial will alas come sooner than later, and mankind should work to be better prepared for the challenge, mastering vast sources of nuclear energy to help grow plants in green-houses to feed billions when agricultural productivity will fall because of cooling.

The fight against CO_2, led by a suicide squad who got a Nobel price for it, is the most stupid and nonsensical idea devised ever.

It is a crime against Life.

2) Solar and Orbital Variations

William Herschel theoretical and observational work provided the foundation for modern binary star astronomy; he was the first to recognize the orbital relationship that may physically link together double stars (Poyet, 2017a-b) and not consider them to be just fortuitous alignments «*I may therefore immediately go to the second, which treats of binary sidereal systems, or real double stars*» (Herschel, 1803). He is also the discoverer in 1800 of infra-red radiations (IR), that characterize the absorption spectrum of trace gas that we have studied in this work, water vapor first, though it is unclear whether this discovery happened while testing solar filters to observe solar spots or rather pioneering the use of astronomical spectrophotometry, using prisms and temperature measuring equipment to record the wavelength distribution of stellar spectra.

But the reason to mention Herschel's work here, is that he ventured into the speculation that there would exist a link between solar irradiance and climate. This was based on an apparent correlation he had found between sunspot numbers and the price of wheat, and Herschel (1801) reported «*The result of this review of the foregoing five periods is, that, from the price of wheat, it seems probable that some temporary scarcity or defect of vegetation has generally taken place, when the sun has been without those appearances which we surmise to be symptoms of a copious emission of light and heat*» p. 316. The hypothesis that there would exist such a relationship did not bring him fame, as this had already happened thanks to his discovery of Uranus on March 13, 1781 but rather mockery and elicited guffaws (from Lord Brougham among others). It took some time before this relationship would be further investigated and confirmed by two researchers in Israel who have found a statistical link between the activity of the Sun and the price of wheat in seventeenth-century England, confirming that "*at the point in the solar cycle when sunspots were least likely, wheat prices tended to be high*" (Pustilnik and Yom Din, 2004).

This is well summed up by Pustilnik and Yom Din (2004) «*The results of our study show: a) The coincidence between the statistical properties of the distributions of intervals between wheat price bursts in medieval England (1259-1702) and intervals between minimums of solar cycles (1700-2000); b) The existence of 100% sign correlation between high wheat prices and states of minimal solar activity established on the basis of 10Be data for Greenland ice measurements for the period 1600-1700. These results imply a causal connection between solar activity and wheat prices in medieval England. This conclusion is consistent with our conceptual model of the causal chain, consisting of "solar activity – cosmic ray intensity – terrestrial weather – wheat production – wheat price" that presented in this work*». They add that for all ten solar cycles between 1600 and 1700, high wheat prices coincided with low activity, and vice versa and that «*the probability of this happening by chance is less than 1 in 500*».

Therefore, changes in solar activity alter the strength of the solar wind, i.e. the stream of charged particles that flows from the Sun throughout the solar system (Parker, 1958[171]). When the solar wind is strong, it is more difficult for charged particles from deep space to penetrate Earth's atmosphere. Once in the atmosphere, these cosmic rays collide with molecules in the air to produce ions, which help cloud droplets to form. So in periods of high solar activity the skies are less cloudy. Over the past few years, satellite observations have confirmed this link as well as results from the Earthshine project which studies the modulation of the albedo (Pallé et al., 2004a). One should remember that a change of albedo of a tiny 3% (say from 31% down to 30%) is equivalent to the warming anticipated by a doubling of [CO_2]. The tidal forcing of the planets on the solar surface and solar wind has been explored by Poulos (2016; 2020).

In fact this line of reasoning has been explored probably first by Denton and Karlén (1973) using C^{14} variations measured from tree rings "*Short-term atmospheric C^{14} variations measured from tree rings correlate closely with Holocene glacier and tree-line fluctuations during the last 7000 yr. Such a correspondence, firstly, suggests that the record of short-term C^{14} variations may be an empirical indicator of paleoclimates and, secondly, points to a possible cause of Holocene climatic variations. The most prominent explanation of short-term C^{14} variations involves modulation of the galactic cosmic-ray flux by varying solar corpuscular activity*", then Tinsley and Deen (1991) and later by Svensmark and Friis-Christensen (1997) and Marsh and Svensmark (2000), Carslaw et al. (2002), Kirkby (2007) as reminded by Veizer (2005) "*In this alternative, an increase in TSI results not only in an enhanced thermal energy flux, but also in more intense solar*

171 When Eugene Parker submitted a paper on his discovery of solar wind in 1957, two eminent reviewers rejected the paper. However, since Chandrasekhar was editor of the Astrophysical Journal and could not find any mathematical flaws in Parker's work, he went ahead and published the paper in 1958.

wind that attenuates the CRF[172] *reaching the Earth. This, the so-called heliomagnetic modulation effect reflects the fact that the solar magnetic field is proportional to TSI and it is this magnetic field that acts as a shield against cosmic rays. The terrestrial magnetic field acts as a complementary shield, and its impact on CRF is referred to as geomagnetic modulation" (Beer et al., 2002).* As Carslaw et al. (2020) sum it up "*It has been proposed that Earth's climate could be affected by changes in cloudiness caused by variations in the intensity of galactic cosmic rays in the atmosphere. This proposal stems from an observed correlation between cosmic ray intensity and Earth's average cloud cover … the observation has raised the intriguing possibility that a cosmic ray–cloud interaction may help explain how a relatively small change in solar output can produce much larger changes in Earth's climate"*.

To summarize, what could be classified under "astronomical influences" on the climate may be decomposed under:

- either direct solar influences (Le Mouël et al., 2008), e.g. variations in TSI due to changes in solar activity (Hoyt and Schatten, 1993, 1997; Shapiro et al., 2011; Soon et al., 2015) which could be as high as ± 4.5 W/m^2 since 1750 (Judge et al., 2020) as compared to IPCC estimate for 2XCO_2 anthropogenic forcing of 2.2 ± 1.1 W/m^2 or of just 1.3 W/m^2 for Smirnov (2020), or indirectly through modifications of the cloud formation processes due to changes in the CFR received, or through other amplification mechanisms (Shaviv, 2008);
- or indirectly through orbital variations (Javier, 2016a), i.e. eccentricity (as the Earth is subject to the influence of the other planets, especially the closest giants Jupiter and Saturn, the Earth's orbit eccentricity changes with a major beat of 413,000 years and two minor beats of 95,000 and 125,000 years, the two precession movements (axial of 26,000 years and the slow rotation of the elliptical orbit around the focus of the ellipse closest to the Sun in a period of 113,000 years), obliquity[173] (variations of the inclination of the rotation axis over the ecliptic where the axial tilt varies between 22.1° and 24.3° over the course of a cycle that takes 41,000 years, the last maximum having been about 10000 years ago), and finally the small nutation (period of 18.6 years, the same as that of the precession of the Moon's orbital nodes), all which lead to changes of the TSI received by the Earth. Into this latter effect, one could also add longer term variations linked to the travel of the solar system into the inter-stellar environment or even into the galactic space.

Because of the earth's elliptical orbit the natural variation of incoming solar irradiance at TOA (i.e. 100 km per NASA) fluctuates 90 W/m^2 from perihelion (1,413 W/m^2) to aphelion (1,323 W/m^2) and because of the earth's tilted axis the total solar insolation on a horizontal surface at the top of the atmosphere and 40 N latitude fluctuates 638 W/m^2 between winter and summer[174]. One should further notice that eccentricity is the only factor that changes the amount of energy received by the Earth. However, as the Earth's orbit has currently an eccentricity of 0.016 and is thus quite circular (eccentricity varies from 0.005 to 0.06), the change in insolation between Perihelion (closest to the Sun) and Aphelion (farthest to the Sun) respectively now at January and July, is always small, currently about 6.4%. The other changes entail variations in the distribution of the energy over the various areas, i.e. NH and SH, and respectively continents and oceans (and cloud systems) as they are not evenly distributed in between the two hemispheres. Therefore remains two major sources of astronomical influences on climate change, one that will deal directly with the Sun and its activity and the other that will be referred to in generic terms as Milankovitch theory (Levrard, 2005) even though strictly speaking Milankovitch (1949) asserted that the main determinant of a glacial period termination is high 65° N summer insolation, and a 100 kyr cycle in eccentricity which induces a non-linear response that determines the pacing of interglacials, whereas modern calculation means available today show that a more complex combination of orbital parameters determines a signature which triggers the start or enable the end of a glacial period.

It is noteworthy that even users of climate models (models that we dismiss because they fail to represent observations and are highly parametrized to reflect great and inappropriate sensitivity to CO_2) do conclude that orbital parameters are more important than GHGs, as Vettoretti and Peltier (2011) who use the ocean-atmosphere version of the Community Climate Model to compare the effects of decreasing CO_2 concentrations with those of the orbital influence on snow accumulation and the abyssal circulation in the Atlantic. They come to a somewhat challenging conclusion for the Early Anthropogenic Hypothesis postulated by (Ruddiman, 2007), that is, astronomical trigger is a more important driver of ice accumulation than CO_2., i.e. "*Results from this set of multi-century sensitivity experiments demonstrate the relative importance of forcings due to insolation and atmospheric greenhouse gases at the millennial scale, and of*

172 CRF, i.e. Cosmic Ray Flux

173 Earth changes of obliquity are stabilized by its large satellite , the Moon, whereas Mars for example undergoes wild and chaotic changes of obliquity that would make the existence of life difficult anyway (Touma and Wisdom, 1993; Laskar and Robutel, 1993)

174 According to IPCC AR5 the heat added to the atmosphere by the increased CO_2 over the 261 years from 1750 to 2011 is 2 W/m^2. IPCC AR5's worst, worst, worst, worst case modeled scenario is Representative Concentration Pathway (RCP) 8.5 W/m^2.

Atlantic ocean overturning strength (AMOC) at the century scale. We find that while areas of perennial snow cover are sensitive to GHG concentrations, they are much more sensitive to the contemporaneous insolation regime", and they further add "*Our analyses demonstrate that while cool NH summers are a prerequisite for glacial inception, a low value of obliquity is most important in determining the strength of the inception process, followed in order of importance by the magnitude of the eccentricity-precession forcing, which dictates the timing and magnitude of the NH summer cooling through geologic time. The minimum and maximum values of carbon dioxide concentrations inferred from ice core records characteristic of the late Pleistocene glacial inception periods also influence the strength of the inception phenomenon, in fact to the same degree as the eccentricity-precession forcing*" (Vettoretti and Peltier, 2011).

The incident solar flux on the globe, of power (on an annual average) 173 PetaWatt (173 10^{15} W) is ten thousand times the power corresponding to the consumption of primary energy (13,865 Mtoe / year in 2018) by all humanity. The part of the incident solar absorbed by the globe, about two thirds, is compensated, over the year, but fairly exactly, to the nearest thousandth, by the thermal infrared radiation from the globe to the cosmos of the order of 120 PW in January and 125 PW in July. This infrared thermal radiation from the globe to the cosmos, subsequently designated by the Outgoing Long-wave Radiation (OLR), averaged over the globe, varies between 234 W/m² in January and 244 W/m² in June-July while the sunshine, on average over 24 hours, at the top of the air varies between 353 W/m² in January and 331 W/m² in June (Earth at aphelion).

The Sun represents 99% of the mass of the solar system and it is at first hard to imagine how the planets would influence it and create some variability. But one must remember that all stars are sort of self-regulating systems that obey to an hydrostatic equilibrium. Energy is generated in the star's hot core, then carried outward to the cooler surface, this is the outward force of pressure which is balanced by the inward force of gravity (Djorgovski, 2004; Malherbe, 2010). If we consider a small cylindrical element between radius r and radius r + dr in the star of surface area = dS to which is applied the inward pressure P (r+dr) and outward pressure P(r) for a mass = Δm with the mass of gas in the star at smaller radii = m = m(r) then the inward force applying on the small element is the gravity given by:
$F_g = -(Gm\,\Delta m) / r^2$ then the Pressure (net force due to difference in pressure between upper and lower faces) is:
$F_p = P(r)dS - P(r + dr)dS = P(r)dS - [\,P(r) + (dP/dr)\,dr]\,dS = -(dP/dr)\,dr\,dS$ and as $\Delta m = \rho\,dr\,dS$ applying Newton's second law $\Sigma F = m\,\Upsilon$ leads as the star is in static equilibrium and acceleration=0 to: $-(Gm\,\Delta m) / r^2 - (dP/dr)\,dr\,dS = 0$ substituting for Δm one obtains: $-(Gm\,\rho\,dr\,dS) / r^2 - (dP/dr)\,dr\,dS = 0$ and therefore:

$$\frac{dP}{dr} = -\left(\frac{G\,m}{r^2}\right)\rho \qquad (155)$$

stellar structure equation stating hydrostatic equilibrium.

Stating the conservation of mass, let r be the distance from the center and Density as function of radius is ρ(r), let m be the mass interior to r, then conservation of mass implies that: $dm = 4\pi r^2\ \rho\ dr$ which leads to:

$$\frac{dm}{dr} = 4\pi\, r^2\, \rho \qquad (156)$$

stellar structure equation stating the conservation of mass.

we can combine these two equations $(dP / dm) = (dP / dr) \times (dr / dm) = -(Gm / r^2)\ \rho \times (1 / 4\pi r^2\ \rho)$ and thus:

$$\frac{dP}{dm} = -\left(\frac{G\,m}{4\pi\, r^4}\right) \qquad (157)$$

The interior of a star contains a mixture of ions, electrons, and radiation (photons). For most stars the ions and electrons can be treated as an ideal gas and quantum effects can be neglected, thus the total Pressure:
$\Sigma P = P_i + P_e + P_r = P_{gas} + P_r$

where P_i is the pressure of the ions, P_e is the electron pressure, P_r is the radiation pressure.

The gas pressure P_{gas} is given by the equation of state for an ideal gas: $P_{gas} = nkT$ where n is the number of particles per unit volume; $n = n_i + n_e$, where n_i and n_e are the number densities of ions and electrons and in terms of the mass density: $P_{gas} = (\rho / \mu\, m_H)\, kT$ where where m_H is the mass of hydrogen and μ is the average mass of particles in units of m_H. Therefore, the ideal gas constant is given by: $R = k / m_H$ ($R = 8.3\ 10^7$ erg g^{-1} K^{-1}) thus:

$$P_{gas} = \left(\frac{R}{\mu}\right)\rho\, T \qquad (158)$$

The radiation Pressure for a Black Body will be given by:

$$P_r = \frac{a\,T^4}{3} \qquad (159)$$

where a = 7.565 10^{-16} J m^{-3} K^{-4} is the radiation constant. Not going any further into details, one should know that "Gas pressure" is most important in low mass stars while "Radiation pressure" is most important in high mass stars.

The reason why this short presentation was developed is that one needs to understand that a star like the Sun (and all others neither collapsing or exploding while they remain on the main sequence for billions of years) is in a relative equilibrium between inward gravitational forces and outward pressure forces, therefore even though all the planets of the solar system just represent 1% of the mass of the entire system, it is not unconceivable that their motion around the Sun may create some solar variability, by creating small disturbances to the equilibrium of forces the Sun depends on. What would at first look like a form of "astrology" gets physical sense once this notion of disturbance to a precarious equilibrium is better understood. Of course, the planetary beat is not going to lead to a great imbalance in between the internal solar gravitational forces and outward pressure forces but slight changes due to planetary triggers can entail a new equilibrium leading to some form of solar variability.

This possibility of an extreme importance for our subject has been explored by Abreu et al. (2012) and leads to key conclusions "*The excellent spectral agreement between the planetary tidal effects acting on the tachocline and the solar magnetic activity is surprising, because until now the tidal coupling has been considered to be negligible. We therefore suggest that a planetary modulation of the solar activity does take place on multidecadal to centennial time scales*". The tachocline, invented by Spiegel and Zahn[175] (1992) is the transition region of stars of more than 0.3 solar masses, between the radiative interior and the differentially rotating outer convective zone. This concept resulted of the work performed for years by Zahn on tidal friction in close binary stars (1977) and models of circulation and turbulence in rotating stars (1992) and Zahn also worked on understanding tidal effects produced by solar and extra-solar planets. It should be noted here that the superadiabaticity δ, is a dimensionless measure of the stratification of the specific entropy in a medium, and enables to separate a radiative zone $\delta < 0$ (stable stratification) from a convection zone $\delta > 0$ (unstable stratification). Somewhere at the level of the tachocline, characterized by a very large shear, the bottom of the convection zone δ changes sign. δ becomes negative and very small in what is referred to as the "overshoot layer", where it is believed that strong toroidal flux tubes (~10^5 G[176]) are stored prior to the eruption of the sunspots[177].

How a tiny modification (1 part in 10^4 or 10^5) of the entropy stratification is produced by the tidal forces remains unknown. But Abreu et al. (2012) state "*we can think of a resonance effect mediated by gravity waves. Since this coupling takes place in the tachocline, the tidally excited gravity waves (Goldreich & Nicholson 1989a,b; Goodman and Dickson 1998; Barker & Ogilvie 2010) may be modified by the shear of the environment*". But the conclusion of Abreu et al. (2012) is of great relevance "*Here we suggest that a full understanding of the long-term solar magnetic activity can only be achieved by considering the influence of the planets on the Sun and allowing for internal amplification mechanisms. As a first step in this process we have proposed a simple model describing planetary torques acting on a non-spherical solar tachocline*". Now it must be stated that the solar modulation potential ϕ[178], which can be derived from either the ^{10}Be (polar ice-cores) or the ^{14}C (tree-rings) production rates[179], best represents the role of the solar magnetic field in deflecting cosmic rays and observing Fig. 1 and Fig. 5 of Abreu et al. (2012) is very telling for two reasons:

1. the solar modulation potential ϕ as never been higher than now for the last 9,000 years, thus confirming the exceptional level of solar activity as displayed in Figure 54, p. 147;
2. the comparison between solar activity and planetary torque in the frequency domain shows well known peaks such as the 88 yr Gleissberg and the 208 yr de Vries cycles, but also periodicities around 104yr, 150yr, and 506yr. Of major importance to our subject is the extraordinarily well visible 506yr frequency displayed by the Fourier spectrum of the annually averaged torque modulus Fig. 5b of Abreu et al. (2012).

175 https://fr.wikipedia.org/wiki/Jean-Paul_Zahn supported Paul Couteau at the Nice Observatory for whom I worked and where I was lucky to participate in visual double stars measurements, see Poyet (2017a; 2017b).

176 https://en.wikipedia.org/wiki/Gauss_(unit)

177 Sunspots are the surface manifestation of a strong internal toroidal magnetic field leading to the observed spectral Zeeman effect; see Hale (1908) and Hale et al. (1919).

178 ϕ varies in- (anti-) phase with the sunspot number during strong (weak) cycles, in agreement with ϕ estimates from ice core records of ^{10}Be concentration, which are in-phase during most of the last 300 years, but anti-phase during the Maunder Minimum (Owens et al., 2012), see Czechowski et al. (2010) for the definition of the Heliospheric Current Sheet (HCS) tilt angle.

179 One should note that ^{14}C and ^{10}Be are both produced by cosmic rays in the atmosphere, but have completely different geochemical properties, because whereas ^{14}C enters the carbon cycle by forming CO_2, ^{10}Be becomes attached to aerosols and is removed from the atmosphere mainly by wet deposition.

Thus, the strongest periodicity displayed by the Fourier spectrum of the annually averaged torque modulus, i.e. 506 yr ±6.0, is the average period separating the Roman optimum from the misery of the collapse of the Roman empire, and from thereof from the next medieval optimum, and from this optimum to the next misery of the LIA, and from then to the current modern optimum. Abreu et al. (2012) conclude "*Here we suggest that a full understanding of the long-term solar magnetic activity can only be achieved by considering the influence of the planets on the Sun and allowing for internal amplification mechanisms. As a first step in this process we have proposed a simple model describing planetary torques acting on a non-spherical solar tachocline*". The statistical significance of the results obtained is also addressed in Appendix A and Abreu et al. (2012) state "*We observe that five of the strongest spectral lines in all three records agree very well. Finally, we determine the probability that these five lines agree by chance using a Monte Carlo technique. We conclude that the chance of a random coincidence is about* 5×10^{-7}".

Along the same line of reasoning, this is what led Mörner et al. (2013) in "*Pattern in solar variability, their planetary origin and terrestrial Impact*" to address the question of the possible planetary modulation of solar variability, "*The Sun's activity constantly varies in characteristic cyclic patterns. With new material and new analyses, we reinforce the old proposal that the driving forces are to be found in the planetary beat on the Sun and the Sun's motions around the center of mass..." the authors of the special issue "conclude that the driving factor of solar variability must emerge from gravitational and inertial effects on the Sun from the planets and their satellites*".

Therefore, throughout the Holocene it has been possible to identify numerous solar activity cycles which are preserved within various records and known in the literature as the cycles of:

- Bray-Hallstatt[180] (2,310 yr ±300) displayed on top of Figure 34, discovered by Bray (1968) and confirmed since many times, e.g. (Hood and Jirikowic, 1990; Damon and Sonett, 1991; van Geel, 1998; Vasiliev and Dergachev, 2002; Charvátová and Hejda, 2014; Javier, 2017g; May and Javier, 2017), see Figure 55 ;
- Eddy (976 yr ±53) (Eddy, 1976; Javier, 2017g, Lüdecke and Weiss, 2017), the list of Solar Grand Minimum (SGM) potentially related with the Eddy cycle lows, according to Usoskin (2017) and using his dates (adding E for Eddy and B for Bray) is : Maunder (B1-E1-270 BP), Roman (E2-1,260 BP), Greek (E3-2,310 BP), No name (E4-3,335 BP), No name (E5-4,400 BP), Sumerian (B3/E6-5,275 BP), No name (E7-6170 BP), No name (E7-6,265 BP), Jericho (E8-7,145 BP), Jericho (E8-7,250 BP), Sahelian (E9-8,335 BP), Boreal 2 (E10-9,255 BP), Boreal 1 (B5/E11-9,465 BP), Preboreal (E12-11,115 BP);
- Abreu (506 yr ±6.0), the most prominent of all in the study by Abreu et al. (2012) and the most relevant to the periodicities that correspond to the last known and documented climatic optima, i.e. the Roman, Medieval and Modern;
- Suess-de Vries[181] (208 yr ±2.4), e.g. (Damon and Sonett, 1991; Stuiver et al., 1995; Bond et al., 2001; Wagner et al., 2001; Rombaut, 2010; Liu, Y, et al., 2011; Lüdecke et al., 2015; Javier, 2017g);
- Jose (155-185 yr) "*The motion of the sun about the center of mass of the solar system has periodicity of 178.7 yr. The sunspot cycle is found to have the same period*" (Jose, 1965; Charvátová and Hejda, 2014);
- Gleissberg (88 yr ±13), e.g. (Damon and Sonett, 1991; Peristykh and Damon, 2003), reported by Stuiver and Braziunas (1993) as "*The 210 and 88 yr* ^{14}C *periodicities relate rather unequivocally to solar forcing (...) The 88 yr* ^{14}C *periodicity has only a minor* ^{18}O *companion*" dismissed by Javier (2017g), but reported as very prominent by Knudsen et al. (2011) between 4,000 and 6,250 years BP and later became remarkably vague from ~3,500 years BP onwards;
- the 55-65 yr cluster (Javier, 2017g) or ~60 yr oceanic oscillation (Jevrejeva et al., 2008; Scafetta, 2010) or evidenced by Klyashtorin and Lyubushin (2003) using spectral analysis over 1,000 years, which could be explained by the ~60-year oscillation in the barycentric movement of the Sun due to its ~60-year tri-synodic period produced by the Jupiter–Saturn system[182] (Mazzarella and Scafetta, 2011; Gervais, 2016a);
- and the 11 years Schwabe / Wolf cycle of course, which is known to have among others effects, a direct impact on Arctic weather as reported by Roy (2018a) "*when the winter solar sunspot number (SSN) falls below 1.35*

180 Named after a cool and wet period in Europe when glaciers advanced, the Hallstatt culture was the predominant Western and Central European culture of Late Bronze Age (Hallstatt A, Hallstatt B) from the 12th to 8th centuries BC and Early Iron Age Europe (Hallstatt C, Hallstatt D) from the 8th to 6th centuries BC

181 Named after Hans Eduard Suess and Hessel De Vries respectively

182 A full cycle of Jupiter and Saturn around the sun (J/S Tri-Synodic Cycle) takes 59.6 years, therefore every ~60-years the Earth, Jupiter and Saturn reach the same relative alignment around the Sun. One can easily dismiss these harmonics, but before doing so, one shall remember first that, for example, the Moon is synchronized with the Earth and it always presents us the same face for very good reasons, and there exists many other resonances, e.g. Mercury is locked to its own orbit around the Sun in a 3:2 resonance. It happens that more 60 satellites do the same with respect to their planets in the solar system and tidal locking is a very well known phenomenon https://en.wikipedia.org/wiki/Tidal_locking

standard deviations (or mean value), the Arctic warming extends from the lower troposphere to high up in the upper stratosphere and vice versa when SSN is above". This 11 years Schwabe cycle also has a very strong influence on NAO and North Atlantic has shown by Roy (2020) since 1977.

The 11 year cycle was discovered by Christian Horrebow in 1775, later formalized as a periodic variation in 1843 by Samuel Heinrich Schwabe and later organized and numbered by Rudolf Wolf, going back to 1745. This cycle has been known for the longest and thereafter has of course been the most studied and demonstrates at least two important things: 1) how the various components of the terrestrial atmosphere are tightly coupled and interact together and 2) how the cycle originates far from the Sun in tidal forces exerted by several planets on our star. This is remarkable as it shows the complexity of the Earth-Solar-Planetary system which cannot be reduced to a trace gas. Labitzke and Van Loon (1991) report "*We describe a 10-12-year oscillation (TTO) in the upper troposphere and lower stratosphere of the Northern Hemisphere in summer... The TTO is in phase with the 11-year solar cycle...The analyses show that the large amplitude of the TTO in the geopotential heights of the lower stratosphere is associated with temperature variations of the same time scale in the upper troposphere*", showing the influence of the 11-year solar cycle on the stratosphere and demonstrating how it impact the troposphere. Stefani et al. (2019) present the 11-year cycle as the result of planetary tidal forces "*We discuss a solar dynamo model of Tayler-Spruit type whose Ω-effect is conventionally produced by a solar-like differential rotation but whose α-effect is assumed to be periodically modulated by planetary tidal forcing. Specifically, we focus on the 11.07 years alignment periodicity of the tidally dominant planets Venus, Earth, and Jupiter, whose persistent synchronization with the solar dynamo is briefly touched upon*". Other evidences are provided, such as (Zhai, 2016) or Misios et al. (2018) "*Influences of the 11-y solar cycle (SC) on climate have been speculated, but here we provide robust evidence that the SC affects decadal variability in the tropical Pacific. By analyzing independent observations, we demonstrate a slowdown of the Pacific Walker Circulation (PWC) at SC maximum*". This is a perfect illustration, at the shortest and most reproducible frequency possible, i.e. 11 years, of the planetary influence on solar activity and of its further action on our atmosphere and climate.

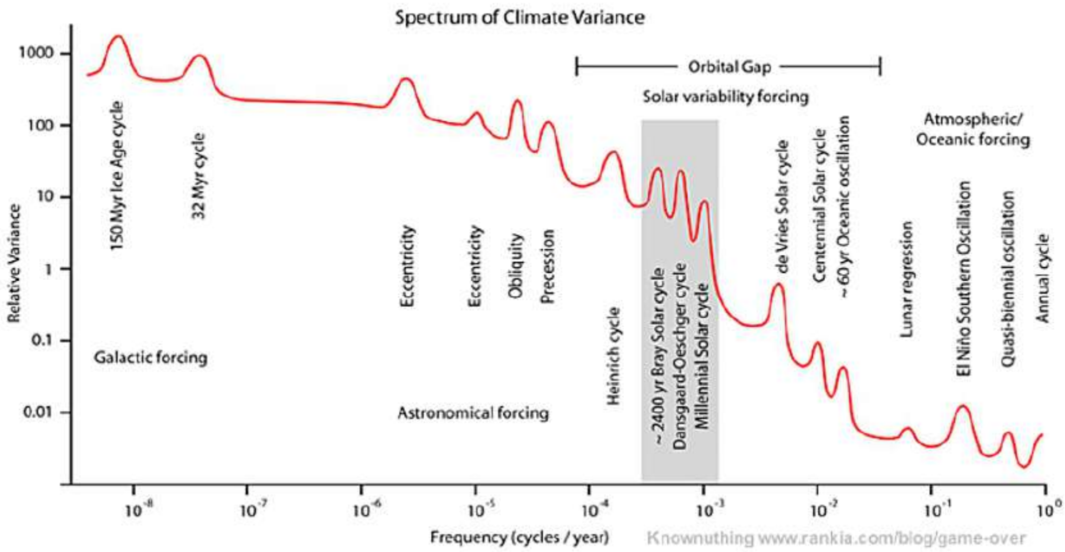

Figure 53. A periodogram[183] shows how periodicities (either of orbital or solar origin) dominate climate change at all temporal scales. The 150 Myr Ice Age cycle has produced four Ice Ages in the last 450 million years. It is proposed to be caused by the crossing of the galactic arms by the Solar system (Veizer, 2005). The 32 Myr cycle has produced two cycles during the Cenozoic era, the first ending in the glaciation of Antarctica and the second in the current Quaternary Ice Age. It is proposed to be caused by the vertical displacement of the Solar system with respect to the galactic plane[184]. The orbital cycles are well visible (eccentricity, obliquity, precession). The millennial climate cycles (grey band) regroup most of the known solar cycles aforementioned. Short term climate variability is dominated by the El Niño-Southern Oscillation. Adapted by Javier (2017c) from Maslin et al. (2001).

183 In signal processing, a periodogram is an estimate of the spectral density of a signal. The term was coined by Arthur Schuster in 1898

184 Rampino and Caldeirac (2020) have detected a 32-million year cycle in sea-level fluctuations over the last 545 Myr. They consider various tectonic mechanisms to explain the sea level variations, including a variation of the ocean-floor spreading rates but do not dismiss the astronomical origin to which this 32 Myrs cycle has been attributed here.

Because chronological uncertainties of paleoclimate time series are of an order of magnitude of 1%-2% of the absolute age, for example, between 100 and 200 years for a 10,000 year old sample, this typically leads to make it difficult to try to identify short cycles (e.g. Gleissberg, de Vries) beyond the Holocene. Furthermore, as a general rule, the longer the cycle, the more significant the impact is on the climate (see Figure 53), e.g. the Bray-Hallstatt 2475 yr cycle is very well visible on top of Figure 34 and more significant than shorter cycles. Some high-energy cosmic rays entering Earth's atmosphere collide hard enough with molecular atmospheric constituents that they occasionally cause nuclear spallation reactions. Fission products include radionuclides such as ^{14}C and ^{10}Be that later settle on the Earth's surface.

Therefore, ^{14}C and ^{10}Be cosmogenic isotope records are considered direct proxies for solar activity, and are extracted from trees, sediments, ice cores (e.g.: McCracken et al., 2001; Muscheler et al., 2020; Neff et al., 2001; Ogurtsov et al., 2002; Steinhilber et al., 2012; Vasiliev and Dergachev, 2002), in long sunspot sequences (Ogurtsov et al., 2002), in aurora records (Scafetta and Willson, 2013) and others (e.g. Hoyt and Schatten, 1997). Interestingly, similar solar cycles are also found on a Late Miocene lake system revealed by biotic and abiotic proxies, i.e. by the off-shore sedimentation rates of the Tortonian Vienna Basin which revealed patterns resembling well Holocene solar-cycle-records (Kern et al., 2012) and therefore indicate that they operate not on thousands or tens of thousands of years (e.g. Holocene) but over millions or tens of millions of years (i.e. Cenozoic). These solar cycles are of great relevance as variations of the TSI are considered marginal by IPCC and therefore too small to be responsible of climate change, but in fact as reported by Safetta (2019) "*the total solar irradiance forcing is still highly debated because some records show a secular variability as low as 0.6 W/m² since 1700 to present (Wang et alii, 2005) while others show a very large secular variability up to 6 W/m² during the same period (Egorova et alii, 2018a); 2) there are several indications that the sun induce climatic changes through a cosmic ray forcing that could directly modulate the cloud system (Kirkby, 2007; Svensmark et alii, 2017). This would be a different kind of solar related forcing that is completely missing in the GCMs*". Of course, depending on whether one uses the values of Wang et al. (2005) or those resulting from the model of Egorova et al. (2018a) the changes of TSI are so important that the Sun passes from a backseat in the climate change distribution role to the forefront.

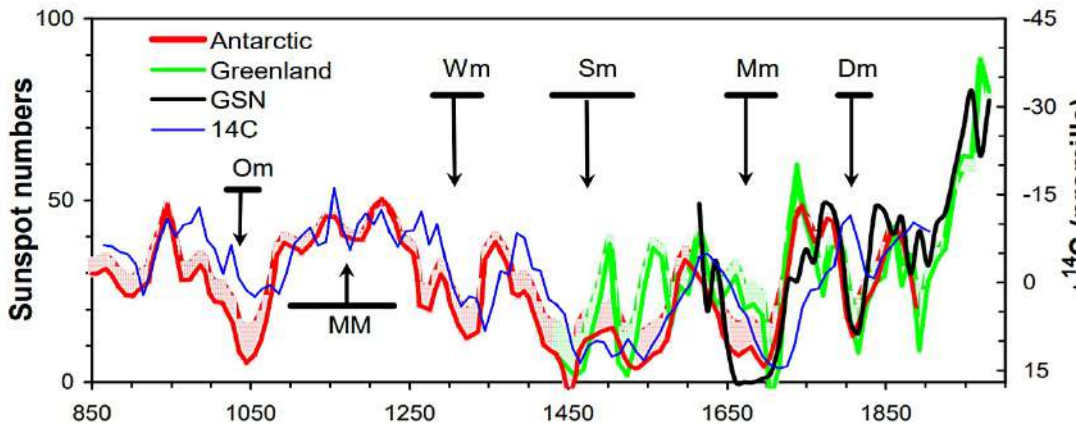

Figure 54. Time series of the sunspot number as reconstructed from ^{10}Be concentrations in ice cores from Antarctica (red) and Greenland (green). The thick black curve shows the observed group sunspot number since 1610 and the thin blue curve gives the (scaled) 14C concentration in tree rings, corrected for the variation of the geomagnetic field. The horizontal bars with attached arrows indicate the times of Great Minima and Maxima: Dalton minimum (Dm), Maunder minimum (Mm), Spörer minimum (Sm), Wolf minimum (Wm), Oort minimum (Om), and Medieval Maximum (MM). From Usoskin et al. (2018).

One should observe at least two things here, first and again we mainly deal with models due to the lack of direct measurements of solar radiation on climatological time scale[185], second that depending on how the quiet Sun is reconstructed and other parameters, the TSI can vary a lot, e.g. > 4 W/m² over the 1600-2000 period (Haigh, 2003), in which case there is an easy and strong case supporting the observations made, which attest the close link between solar variability and climate change, including the precipitations and monsoons, e.g. as mentioned by Neff at al., 2001 "*The excellent correlation between the two records (i.e. $\delta^{18}O$ et $\Delta^{14}C$) suggests that one of the primary controls on*

185 TSI measurements have been made from satellites since 1979 but each individual instrument records only last for a number of years and each sensor suffers degradation in orbit. Thus, the construction of a composite series (or best estimate) of TSI from overlapping records from several successive satellites becomes a complex task and many corrections are necessary to compensate for problems of sometimes unexplained drift and uncalibrated degradation in the time-series (Haigh, 2003, 2007). The Active Cavity Radiometer Irradiance Monitor (ACRIM) TSI composite is such an example, see Scafetta and Willson (2014). For the controversy ACRIM-PMOD see Scafetta et al. (2019).

centennial to decadal scale changes in tropical rainfall and monsoon intensity during this time are variations in solar radiation". But more importantly, the level of solar activity beginning in the 1940s is exceptional, the last period of similar magnitude occurred around 9,000 years ago, i.e. during the warm Boreal period, e.g. (Solanki, et al., 2004; Usoskin, et al., 2007; Usoskin et al., 2018). This is also confirmed by Lean (2018) who reports "*The new estimates suggest that total solar irradiance increased 0.036 ± 0.009% from the Maunder Minimum (1645–1715) to the Medieval Maximum (1100 to 1250), compared with 0.068% from the Maunder Minimum to the Modern Maximum (1950–2009)*", i.e. 1.88 times more for the modern maximum than for the MWP from the maunder minimum used as a reference. This is very well visible on the sunspot reconstruction from Usoskin et al. (2018) reproduced in previous Figure 54.

The Sun was at a similarly high level of magnetic activity for only ~10% of the past 11,400 years. Almost all earlier high-activity periods were shorter than the present episode. Reconstructions of solar activity levels into the distant past (Solanki et al., 2004) indicate that the overall level of solar activity since the middle of the twentieth century stands amongst the highest of the past 10,000 years, e.g. "*the modern Grand maximum (which occurred during solar cycles 19–23, i.e., 1950-2009) was a rare or even unique event, in both magnitude and duration, in the past three millennia*" (Usoskin al., 2014). Solar cycles and variations of the Earth's orbital parameters determine the climate and this is well summed up by Scafetta et al. (2017a) "*In fact, the magnetic activity of the sun and, probably, also the planetary motions modulate both the solar wind and the flux of the cosmic rays and interstellar dust on the earth with the result of a modulation of the clouds coverage*". This is why the explanation of the transmission of the variations of solar activity to the Earth climate cannot be limited to changes in TSI, even though there is still a lot to argue about the "Solar Constant" (Eddy, 1977), which does seem to only have its name constant!

Astronomers are far more cautious than "climatologists" with respect to the supposed stability of the Solar Constant and therefore the TSI, e.g. Lockwood et al. (1992; 1997) stated "*This suggests that the Sun is in an unusually steady phase compared to similar stars, which means that reconstructing the past historical brightness record, for example from sunspot records, may be more risky than has been generally thought*". Two years earlier, Lockwood and Skiff (1990) reported after a large scale survey of the variability of stars comparable to the Sun "*Nearly 200 years of daily sunspot records teach us that the most visible manifestation of solar activity vary unpredictably. Every 11-year cycle is unique. The variation of the total solar output, measured only for slightly less than one ll-year solar cycle,leads us to think that long-term variations are quite small--only 0.1% or so. But to contain this minuscule variation requires the delicate and continual balancing between larger competing effects, the flux deficits associated with sunspots and the flux excesses associated with faculae Stellar photometry offers little assurance that the solar variability actually measured thus far provides an accurate long term prognosis. Indeed, many stars quite similar to the Sun demonstrably vary by amounts much larger than the Sun has over the last decade. Thus we conclude, considering the Sun among the stars, that* ***the present short record of solar variability is remarkable only in its present restraint***".

With regards to other similar stars (spectrum, luminosity, temperature, etc.) the expected TSI variability over longer periods must be far greater than that the IPCC use (0.1%). One can plot the stellar total irradiance measured at 1 astronomical unit versus the color temperature of the stellar photosphere in degrees Kelvin in sort of a Hertzsprung-Russell Diagram. Most main-sequence stars fall along a curved line going from the upper left corner to the lower right corner. The Sun is a main-sequence star (G0) with a color temperature of 5880 °K and an irradiance of 1367 W/m^2, i.e. the mean value of the so-called Solar Constant (SC). Hoyt and Schatten (1997) remind that "*Five billion years ago, the sun began as a late G-class star, perhaps G7 to G9, with an initial irradiance at 1 astronomical unit of about 1000 W/m^2 and a color temperature of approximately 5400 K. Since then it has steadily warmed up, with a 30% increase in luminosity, and its color has changed from reddish to yellow*" and is known as the faint Sun paradox[186].

But more importantly, Hoyt and Schatten (1997) are extremely cautious with respect of the supposed stability of the TSI as measured over the short period where we have instrumental records. Hoyt and Schatten (1997) assert "*The results of the Hipparchus satellite experiment that detected variations in light output of numerous stars. The main sequence reveals that stars both brighter and dimmer than the sun display more variability than the sun itself. Even though the sun varies, it is one of the more stable stars. The sun's level of activity is about average, but its variations in brightness are well below average.* ***This suggests that in the last two solar cycles, we have only seen a small portion of the brightness variations we would see if we observed many solar cycles***" - bold added.

This is a clear message, that "climatologists" should better listen to, the TSI as measured is not representative of the Sun's longer term variations. In that respect, both Lockwood and Skiff (1990) and Baliunas and Vaughan (1985) found

186 https://en.wikipedia.org/wiki/Faint_young_Sun_paradox

that the variations in the total radiative output from solar-type stars exceeded the currently observed solar-constant variations (from spacecraft over the last decade) by nearly a factor of 4.

It would be preposterous to think that our instrumental records are telling us anything valuable of the long term, not even speaking of geological times but simply of thousands or tens of thousands of years. From thereon, Hoyt and Schatten (1997) make the 3 following assumptions "*Excluding remote alternatives, this suggested the following: 1.) The sun may undergo irradiance variations several times larger than any we have seen during the past decade. 2.) Compared with other solar-analog stars our sun is highly unusual because it has especially quiescent radiative output. 3.) Our terrestrial position in the heliosphere (the Earth always lies close to the sun's equator, since the tilt of the sun's rotation axis, BO, relative to the ecliptic plane is a small angle, 7.25°) provides a special vantage point that reduces the observed solar-irradiance variations*".

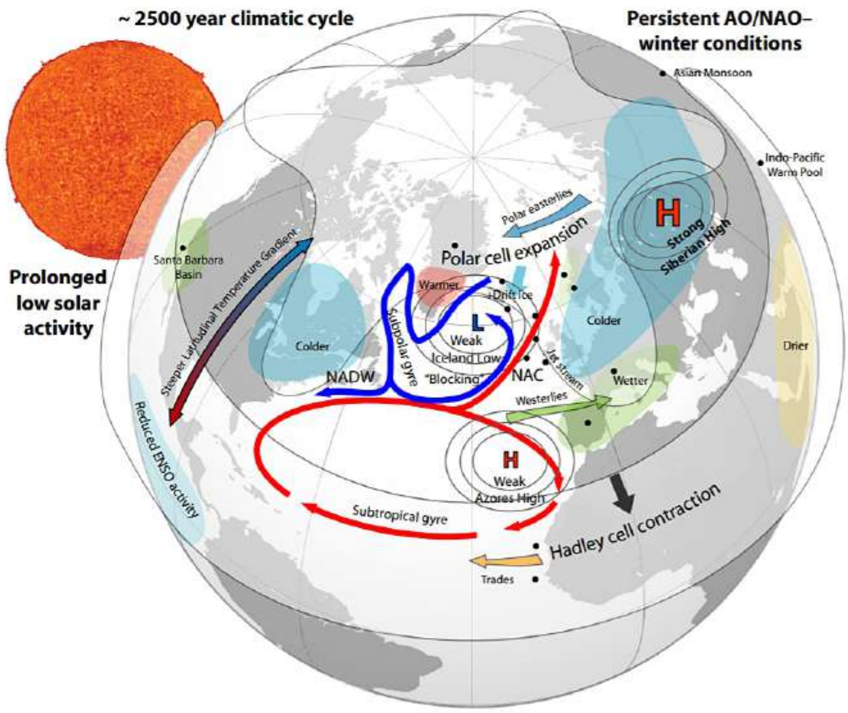

Figure 55. Effect of the ~2500-year Bray(Hallstatt) solar cycle on the climate organization, Source: Javier Vinós public data.

In fact, the three hypothesis have been listed not to be suspected of dishonesty but the third does not appeal to me for a number of reasons, to say the least. As the probability of 2) is very low, indeed, only remains 1) and one must consider that variations of the TSI of up to 4 times what has been measured so far are the most probable alternative. Furthermore, Beer et al. (2002, 2006) mention that even small changes of the TSI are accompanied by far greater changes in the UV part of the solar spectrum (Pagaran et al., 2011; Ermolli et al., 2013), modifying the stratosphere response which is further coupled down to the troposphere (Haigh and Blackburn, 2006). For example, values derived by Lean (2018) show of a factor of 5.66 in between the UV and visible Solar and Spectral Irradiance (SSI) changes respectively.

In a series of papers dealing with the climate during the Holocene, that will certainly prove seminal in the future, Javier (Vinós) addressed many aspects of how the Earth evolved from the time it exited from the LGM and entered the Holocene up to the current modern global warming, and specifically addressed the Bray solar cycle in two articles (Javier, 2017d-e) and one with May and Javier (2017). The last occurrence of the Bray cycle, identified as B2 on Figure 34 and which corresponds to the transition from Sub-Boreal to Sub-Atlantic had already been identified by van Geel et al. (1998) as a major disruption between the Bronze-Age to Iron-Age transition in NW Europe, period during which an abrupt climate change around 850 BC was testified by the sharp rise of the ^{14}C content of the upper atmosphere which was caused by a weakening in solar activity, leading to an increase of the cosmic ray flux and a decrease of the temperature through various mechanisms, including but not limited to a reduction or change of distribution of the ozone layer (including variation at the tropopause and stratosphere), planetary waves, increased cloudiness and precipitations, among others.

This cooler and wetter climate on middle and high latitudes on both hemispheres came together with a change to a dryer climate in tropical regions due to a weakening of the monsoonal regimes. This resulted of a change of the latitudinal extension of the Hadley Cell circulation and an expansion of the Polar Cells and a change of trajectory of the main depression systems at mid-latitudes in a more equatorward regime. Javier (2017d-e) adds "*El Niño is less frequent altering global precipitation patterns. The North Atlantic displays more AO / NAO winter negative conditions shifting the winter European storm track southwards. Weaker westerlies reduce the Sub-Polar Gyre contribution to the North Atlantic current, increasing winter precipitation over Scandinavia and promoting glacier growth. A stronger Siberian High activates polar circulation and southward drift-ice, cooling northern Eurasia. Greenland undergoes a temperature inversion. Black dots represent proxy locations displaying a prominent 2500-year periodicity*" and all these effects are well represented and summarized on Figure 55. In fact, around 2,760 ±35 yr BP and 2,620 ±20 yr BP, over a very short period of time of sort of 60 years, houses that were built on artificial mounds could not be used any longer and the area could not be farmed and inhabited as the fresh water table rose everywhere in the northern Netherlands and correspond to an increase of $\Delta^{14}C$. van Geel et al. (1998) remind that "*The isotope 14C is produced in the upper atmosphere under the influence of cosmic rays... The most energetic cosmic rays are of galactic origin. The fluctuations of in the cosmic ray flux on Earth are mainly caused by changes in the solar wind, which is a low density gas ejected from the Sun, which strongly influences the magnetic field strength around the Earth*". van Geel et al. (1998) have no doubt that the climate change they report came from solar irradiance variations and it seems that apart from "climatologists" all other scientists studying the climate over longer periods have no doubts about the role of the Sun as a major player in the Earth climate regulation.

At that point in the development of our thoughts it is now possible to start putting forward what represents the essence of out understanding, what will be referred to as from now on as the **Energetic Balance of Climate**. Climate is the response or the Earth system, in physical terms, to energetic stimulations. These stimulations have several origins: the solar flux whatever form it takes, the orbital configuration which determines how much of the former is received by the Earth, the Earth's own energy which is released through geological manifestations (e.g. mainly volcanism but also some other geothermal sources), plus external, occasional and very unwelcome energy supply like the impact with another celestial body (e.g. asteroid, comet, else) and finally the tiny fraction of the energy stored over geological time (e.g. fossil fuels) that is released by anthropogenic processes. The response of the Earth climate system is proportionate to the energy stimulation received and given the fact that all the power consumption by humankind is less than one ten thousandth of the solar energy received, it gives the size of the maximum possible anthropogenic disruption that mankind is able to produce on the Earth system.

Because the response of the Earth climate system is commensurate to the stimulus, one can easily sense that whatever fake arguments used, the anthropogenic perturbation is minuscule compared to the energies at plays. The physical mechanisms invoked to justify the AGW theory are totally unable to generate the level of disruption claimed by its proponents and therefore they keep resorting to strange notions to the physicists, like "forcing" (Myhre et al., 2013) to justify that if CO_2 in its own is unable to generate any significant change to the energy budget, which they know, it will still manage to do so by contorted arguments such as "positive or negative feedbacks" etc. This simply does not make sense and the very illustration of the fact that their theory is completely flawed is that their computer models which implement their physical rantings are completely unable to reproduce accurately even the last 200 years, say since LIA. Warming started long before that the anthropogenic emissions have any significance and warming has been very irregularly distributed over the corresponding period. For instance, the globe warmed in an equal way during the 1922-1941 and 1980-1999 periods whereas models based on [CO_2] to explain the temperature profile accelerate the warming a lot for the second period versus the first to reflect the increase [CO_2] content. And they keep doing so for the period 2000-2016 when there has been nearly no warming at all. (this is the "pause"). So on the one hand there is the reality with warming very unevenly distributed over the reference period and on the other hand there are computerized fantasies which keep forecasting an ever accelerating warming to reflect their dogma into the naive relationship equating more [CO_2] with an increase in temperature.

One thing is for sure, not only the level of solar activity is unusually high but it has also lasted unusually long as stated by Solanki et al. (2004) "*According to our reconstruction, the level of solar activity during the past 70 years is exceptional, and the previous period of equally high activity occurred more than 8,000 years ago. We find that during the past 11,400 years the Sun spent only of the order of 10% of the time at a similarly high level of magnetic activity and almost all of the earlier high-activity periods were shorter than the present episode*", though to be honest the same authors dismiss the Sun as the sole explanation "the Sun cannot have contributed more than 30% to the steep temperature increase [since 1970]" (Solanki and Krivova, 2003) though they admit serious simplifying assumptions such as "*the connection between the relevant solar and terrestrial quantities is linear*", among others. The reason why

Solanki and Krivova (2003) are in trouble trying to explain the solar influence on climate is probably because they focus to much on TSI and on the sole troposphere response.

As soon as one checks the correspondence between cloud cover and solar cycles, not saying anything about how one may correlate to the other, but just checking the relationship, the result is statistically significant and positive as reported by Udelhofen and Cess (2001) "*Results of spectral analyses reveal a statistically significant cloud cover signal at the period of 11 years; the coherence between cloud cover and solar variability proxy is 0.7 and statistically significant with 95% confidence*" who also notice that the cloud cover variations are not in phase with changes of the Galactic Cosmic Rays (GCR). At that point, one must admit that solar influence drives the cloud formation mechanisms at the 11 years cycle level, though the mechanisms by which this is achieved is unknown. Udelhofen and Cess (2001) mention that "*cloud variabilities may be affected by a modulation of the atmospheric circulation resulting from variations of the solar-UV-ozone-induced heating of the atmosphere*". The reference to this "solar-UV-ozone-induced" heating is odd as it is asserted as if it were a well known mechanism but apart from their paper no other reference is found to the concept. In fact, one must move up into the atmosphere, to the stratosphere to start gathering some clues as to which mechanisms may be at play and in that respect the paper from Marchand et al. (2012) is telling as they assert "*Variations in both ozone and temperature in the stratosphere have been linked successfully to solar cycles using observations and model simulations (Gray et al., 2010)*" and confirmed by the reference to Gray et al. (2010) "*Perhaps the first place to look for solar impact on the Earth's climate is in the upper atmosphere because it inter-acts most directly with the radiation, particles, and magnetic fields emitted by the Sun. Solar signals in the stratosphere are relatively large and well documented during the past few11 year SCs since satellite observations became widespread*" where SC stands for Solar Cycles.

Therefore, assessing the solar influence on the climate, which is obvious at all timescales considered, is made difficult by the need to not only address changes in the TSI and the way physical phenomenons at the particular scale take place (e.g. atmospheric response to the interaction with GCR, charged particle effects, etc.) but also to need address how the different levels of the atmosphere interact with the solar input and how they convey these signals from one level to the next, e.g. the change in stratospheric temperatures and winds due to changes in UV irradiance and ozone production (e.g. and associated planetary waves), have an influence on the underlying troposphere and the surface climate involves stratosphere-troposphere-ocean coupling chemistry-processes which are far beyond the capabilities of the best GCM software simulation systems available. Is there a need for an strong anthropogenic influence to account for the temperature increase in the models (and off we go, we're done) or is there a need to better understand the extraordinary complexity of the Earth system and accept that the "models" so far need to better account for the natural variability of the climate response to the various triggers it is subject to, I let the reader decide.

While governments and the UN have funneled billions of dollars to computer modelers to create various CO_2 – driven (and other GHGs) climate simulators since the 1970s, far too little attention has been given to the effect of our Sun on Earth climate. From what was seen, the frequency and intensity of sunspot activity has proven profound influence on Earth weather expressing the influence of solar activity on the climate system. It is also notable that the UN/IPCC dismisses quite completely such solar influence as not significant. That is a huge mistake by all serious evidence. IPCC only acknowledge reluctantly that : «*However, there is evidence for a detectable volcanic influence on climate. The available evidence also suggests a solar influence in proxy records of the last few hundred years and also in the instrumental record of the early 20th century*» (IPCC, 2018a) TAR-12 p. 697. Could they do less ?

The Earth's magnetic field, also known as the geomagnetic field, is the magnetic field that extends from the Earth's interior out into space, i.e. a dipole with magnetic field lines, and interacts with the solar wind, a stream of charged particles emanating from the Sun. The Sun does not only radiate in the visible part of the spectrum and beyond (where the energy varies much more, e.g. UV) but also produces a flux of charged particles, i.e. the solar wind, released from the upper atmosphere of the Sun, called the corona. This plasma mostly consists of electrons, protons and alpha particles with kinetic energy between 0.5 and 10 keV. Therefore, the Sun's light is only a part of the global energy emitted, the other parts correspond to solar particles and fields which interact in a more subtle way with the Terrestrial Environment (TE), i.e. the Earth, its atmosphere (and certainly not only the troposphere) but also the Earth's magnetosphere.

This is the sum of all these forms of energy originating from the Sun and interacting with the TE, that have made the climate on Earth for hundred of millions of year, plus exceptional contributions from massive volcanic manifestations or from the collision with another celestial body (the bigger the less frequent), often acting as disruptions of various scales, some being so brutal (impactor > 10km) that they lead to a reset of all forms of life on Earth that can take tens of millions of years and redistributes species and habitats. Therefore, even though the variations of the TSI and of the solar constant should be an on-going debate and certainly not considered as settled (there are no long-term instrumental records of the TSI), one should not circumvent the investigation of the mechanisms by which the Sun drives the climate on Earth to the TSI / Troposphere relationship (Maliniemi, 2016; Asikainen et al., 2017; Maliniemi et al., 2019). One can easily sense that very complex interactions take place between all the component displayed on next Figure 56, and that even some stratospheric chemical changes have their origins in the solar–terrestrial coupling. All these phenomenons will have a direct impact on a number of natural oscillations that we will address in a further section - i.e. Natural Oscillations: QBO, ENSO (El Niño - La Niña), AMO, NAO, PDO.

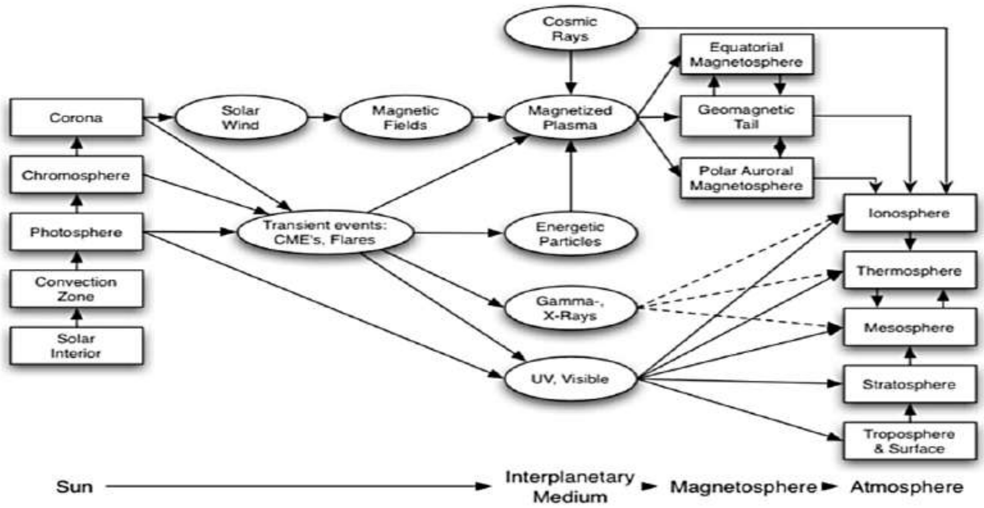

Figure 56. The flow of mass, momentum, and energy from the Sun's interior through the interplanetary space into the Terrestrial Environment (TE) after (Baker, 2000). Some of the effects of this flow within the coupled system reveal the effect of solar variability on the atmosphere (i.e. Down from the Ionosphere to the Surface), Both normal solar wind flows and transient events are indicated. Source: Javier (2018a).

Solar disturbances are observed to have significant effects in near-Earth space and of among the most remarkable are the high-speed solar wind streams and fast Coronal Mass Ejections (CMEs) often generating strong interplanetary shock waves and are in the geologic records identified and known as Forbush Decreases (FD), i.e. a rapid decrease in the observed galactic cosmic ray intensity following a CME. It occurs due to the magnetic field of the plasma solar wind sweeping some of the galactic cosmic rays away from Earth (Dragić et al., 2011). Svensmark (2019) reminds that it has been for some time (Harrison and Stephenson, 2006; Laken et al., 2010) and demonstrated experimentally "*that cosmic rays help the initial formation ('nucleation') of small aerosols (1–2 nm), and it was found that by increasing the ionization, the number density of nucleated aerosols increased as well. These results were later confirmed by the CLOUD collaboration experiment at CERN in Geneva*" and also state that FD are ideal to test the link between cosmic rays and clouds. In fact, this is what Dragić et al. (2011) did by using the Diurnal Temperature Range (DTR) as an indicator of cloud cover (logically negatively correlated with cloudiness) and demonstrated that the effect of FD on DTR is statistically significant for high amplitude FDs and led to an estimated effect on DTR to be of the order of (0.38±0.06)°C.

These results suggest that this particular chain of related events, from solar activity to cosmic rays, to aerosols (CCN), to clouds is active in the Earth's atmosphere and plays a role in modulating the cloud cover and therefore the very important albedo, Laken et al. (2010) providing a compelling evidence of a GCR-climate relationship. Other telltales are provided by the cloud-retrievals from the ISCCP satellite program[187] which show a strong correlation between low liquid water clouds with galactic cosmic rays from July 1983 to September 1994 and furthermore Gray et al. (2005) state that "*Cosmic rays and Total Solar Irradiance variations are often closely correlated*". One should notice that this is just one chain of actions but that as displayed on Figure 56, many others exist and also have an effect on the complex interaction at play between the Sun and the TE and thus on the climate and make it therefore spurious to focus only on the TSI / Troposphere radiative balance (not knowing what the TSI has been over long paleoclimatic record) to conclude that the obvious and essential role played by the Sun on the climate cannot be at the origin of climate change, which is just to the contrary of common sense and of all observations.

187 International Satellite Cloud Climatology Project (ISCCP), https://isccp.giss.nasa.gov/

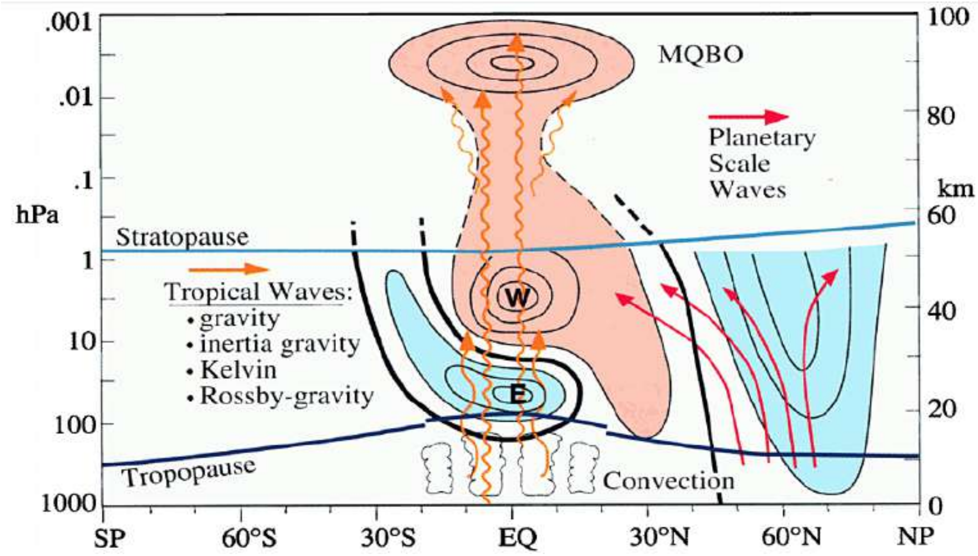

Figure 57. Dynamical overview of the QBO during northern winter. The propagation of various tropical waves is depicted by orange arrows (in the middle), with the QBO driven by upward propagating gravity, inertia-gravity, Kelvin, and Rossby-gravity waves. The propagation of planetary-scale waves (red arrows) is shown at middle to high latitudes. Black contours indicate the difference in zonal-mean zonal winds between easterly and westerly phases of the QBO, where the QBO phase is defined by the 40- hPa equatorial wind. Easterly anomalies are light blue, and westerly anomalies are pink. The Mesospheric QBO (MQBO) is shown above ~80 km. Source: Baldwin et al. (2001).

Svensmark (2019) says that "*Temperature variations of the order of 1.0–1.5 K between periods of high and low solar activity, as seen repeatedly over the Holocene period, seem much more likely than the limited changes suggested in those studies [e.g. MBH98, MB99 or Marcott et al., 2013]*". Finally, as pointed out to me by Alain Robichaud (personal communication), *"celestial driver of cosmic rays producing cloud condensation nuclei might seem attractive but there are much better explanation for missing source of CCN and ice nuclei in the troposphere".* The atmosphere is part of the biosphere as stated by J. Lovelock[188] (Ball, 2014), and ignoring the biological contribution is ignoring the complex relationship that the biosphere maintains with the rest of the Earth's system. Biological particles neglected by physicists might explain a significant part of uncertainties related to clouds in climate models.

Alain Robichaud[189] adds *"Bacteria (the best ice nuclei on earth. e.g. Pseudomans syringae), fungal spores and pollen (e.g. birch pollen) are better ice nuclei than mineral dust, seas salt usually considered in climate models. Research effort should be directed towards better monitoring and modelling of bioaerosols because they have an impact not only on climate (radiative transfer, cloud processes, etc.), meteorology (bioprecipitation) but also on public health (allergies, respiratory infections) and on agriculture (fungal spores, molds)".* In that respect, the paper from Després et al. (2012) is a good starting point and provides a comprehensive overview of bio-aerosols together with (Bianchi et al., 2016), though it does not permit yet to quantify how much those processes contribute to the overall cloud nucleation processes, but they do as confirmed by Tröstl et al. (2016) "*Using data from the same set of experiments, it has been shown that organic vapours alone can drive nucleation*" or Kirkby, et al. (2016) "*Some laboratory studies, however, have reported organic particle formation without the intentional addition of sulfuric acid, although contamination could not be excluded. Here we present evidence for the formation of aerosol particles from highly oxidized biogenic vapours in the absence of sulfuric acid in a large chamber under atmospheric conditions*" a summary is provided by Castelvecchi (2016).

One should remember at that point, that the modeling of the clouds with the GCMs is very weak, their nucleations processes are very complex and their impact on the albedo is immediate and that just a change of a tiny 3% (say from 30 to 31%) represents 3,7 W/m^2 (of energy reflected back to space), i.e. as much as what a doubling of CO_2 is generally considered to produce. Now, it is worthwhile now to display in a less diagrammatic form than Figure 57, and therefore in a more phenomenological representation the various interactions happening at the different levels of the atmosphere up to the mesosphere, and it will be exposed after, how these phenomenons, especially the Quasi-Biennial

188https://en.wikipedia.org/wiki/James_Lovelock
189https://www.researchgate.net/profile/Alain_Robichaud

Oscillation (QBO) and the planetary *waves*[190] have been associated to solar cyclicity and solar wind by demonstrating the existing correlation between weather and sunspot numbers in a series of seminal articles by Labitzke and Van Loon (1988, 1989, 1991) and Van Loon and Labitzke (1988, 1990). Roy (2014) also studies the inter-relations between the Solar Cycle, and the QBO and ENSO in an atmosphere and ocean (only Pacific) coupling and demonstrates the crucial role played by the Sun in the natural variability observed. In an important paper delivering a key finding on natural variability, Roy and Haigh (2011) also demonstrate "*that solar variability, modulated by the phase of QBO, influences zonal mean temperatures at high latitudes in the lower stratosphere, in the mid-latitude troposphere and sea level pressure near the poles*". See also Roy and Haigh (2012) for the detection of a strong positive solar signal on the Aleutian low.

Figure 57 from Baldwin et al. (2001) spans the troposphere, stratosphere, and mesosphere from pole to pole and shows schematically the differences in zonal wind between the 40-hPa easterly and westerly phases of the QBO. Convection in the tropical troposphere produces a broad spectrum of upward waves (orange wavy arrows) which propagate into the stratosphere, transporting easterly and westerly zonal momentum.

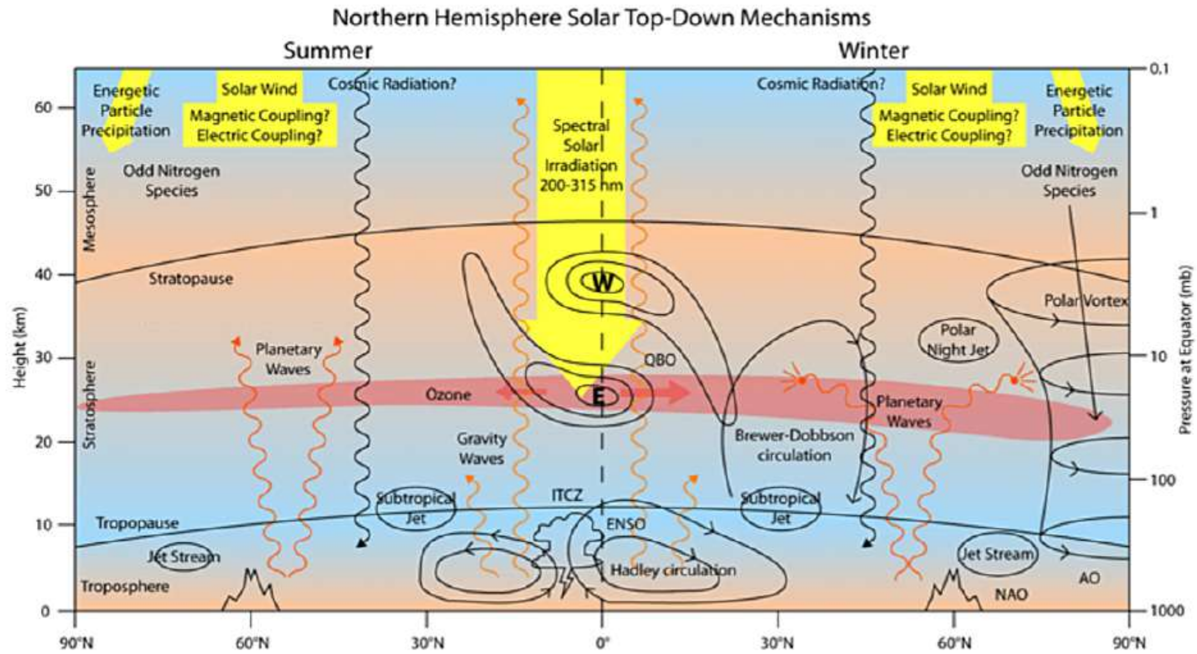

Figure 58. Summary of proposed top-down solar variability effects on climate. Only the Northern Hemisphere is represented, with the left and right halves showing the differences between summer and winter. The ITCZ, the Inter-Tropical Convergence Zone, is the climatic equator, ENSO, El Niño Southern Oscillation. Source: Javier (2018a).

Baldwin et al. (2001) explain "*Most of this zonal momentum is deposited at stratospheric levels, driving the zonal wind anomalies of the QBO. Some gravity waves propagate through the entire stratosphere and produce a QBO near the mesopause known as the mesospheric QBO, or MQBO*". In the tropical lower stratosphere are represented the actual winds during the easterly phase of the QBO (In blue with symbol E) whereas at high latitudes, there is a pronounced annual cycle, with strong westerly winds during the winter season. During the easterly phase of the QBO the polar vortex north of ~45°N shows weaker westerly winds and the high-latitude wind anomalies penetrate the troposphere and provide a mechanism for the QBO to influence the tropospheric weather patterns and therefore as explained by Javier (2018a) "*One of the most puzzling aspects of the QBO is that it also modulates the Northern Hemisphere Polar Vortex, a persistent, large-scale, midtroposphere to stratosphere, low pressure winter zone that when strong contains a large mass of very cold, dense Arctic air, and when weak and disorganized allows masses of cold Arctic air to push equatorward, causing sudden temperature drops in ample regions of the Northern Hemisphere*". Therefore, as visible on Figure 57 and 58, the QBO is originally a tropical phenomenon that by means of upward waves affects in the end the global stratosphere through the modulation of winds, temperatures, extra-tropical waves, meridional wind circulation, the transport of chemical constituents, and the repartition of ozone.

190 https://en.wikipedia.org/wiki/Rossby_wave - Carl-Gustaf Arvid Rossby first identified such waves in the Earth's atmosphere in 1939 and went on to explain their motion.

Labitzke and Van Loon (1988, 1989, 1991) and Van Loon and Labitzke (1988, 1990) had the idea to separate the data on stratospheric temperatures at the different latitudes according to the QBO phase (Kerr, 1987) and managed in that way to identify an obvious correlation with the solar cycles "*Linear correlations between the three solar cycles in the period 1956–1987 and high-latitude stratospheric temperatures and geopotential heights show no associations. However, when the data are stratified according to the east or west phase of the Quasi-Biennial Oscillation (QBO) in the equatorial stratosphere significant correlations result: when the QBO was in its west phase the polar data were positively correlated with the solar cycle while those in middle and low latitudes were negatively correlated. The converse holds for the east phase of the QBO. Marked relationships existed throughout the troposphere too*". (Labitzke and Van Loon, 1988).

Not going to far, one can easily sense from what has been exposed now, that it is not trustworthy to claim on the basis of the sole short time-series of instrumental measures of the TSI that solar variations and cycles have to be dismissed as a major explanation of climate change. For example Labitzke () states "*But there is general agreement that the direct influence of the changes in the UV part of the solar spectrum (6 to 8% between solar maxima and minima) leads to more ozone and warming in the upper stratosphere (around 50 km) in solar maxima. This leads to changes in the vertical gradients and thus in the wind systems, which in turn lead to changes in the vertical propagation of the planetary waves that drive the global circulation. Therefore, the relatively weak, direct radiative forcing of the solar cycle in the stratosphere can lead to a large indirect dynamical response in the lower atmosphere.*" This, it just demonstrates a will to jump to a foregone conclusion, which in the end is not too surprising given the one-sided mission of IPCC, demonstrate that climate-change is man(n)-made.

In a remarkable series of paper published on J. Curry "Climate Etc" website, Javier (2016a-b, 2017a-b-c-d-e-f-g, 2018a-b-c-d) has covered most of the aspect of the climate over the Holocene. The above Figure 58 is from Javier (2018a) and summarizes the components we have briefly discussed and which play a role in responding to the solar action.

One will notice that the effects of solar wind or induced magnetic and/or electric coupling and the effects of cosmic rays are considered by Javier (2018a) as still quite unknown and they have been left out of Figure 58. This is a very cautionary stance as we have seen that more and more research work has proven the interactions happening between the solar wind, the magnetosphere and thereon from the stratosphere down to the troposphere, in the end impacting the Earth's cloud cover and thereof its albedo (e.g. Asikainen et al., 2017; Svensmark et al., 2016, 2017; Maliniemi 2016; Maliniemi et al., 2017). Depending on the phase of the solar cycle, electrons from tens to hundreds of keV, precipitate down to the mesosphere and upper stratosphere, where they can create nitrogen and hydrogen oxides which during winter time survive longer and can descend down to the mid-stratosphere and destroy ozone (Kilifarska and Haigh, 2003), which leads to cooling of the high-latitude stratosphere. This enhances the meridional temperature gradient and westerly winds, thus accelerating the polar vortex and leading to an anomalously positive Northern Annular Mode (NAM) which encloses the cold arctic air into the polar region and enhances the westerly winds at mid-latitudes[191] and Asikainen et al. (2017) assert "*These results give additional evidence that not only solar electromagnetic radiation but also the solar wind can affect the climate*".

Javier (2018a) summarizes all the phenomenons displayed on Figure 58 "*Energetic particle precipitation at the pole produces odd Nitrogen and Hydrogen species in the upper atmosphere, that are more efficiently transported downward by the winter stratospheric vortex, reducing polar ozone levels. UV solar irradiation, variable with the solar cycle, is responsible for the ozone layer and its temperature gradients. Different types of tropical waves (orange) originating from convection, are responsible for the creation and maintenance of the Quasi-Biennial Oscillation (QBO), that together with the Brewer-Dobson circulation[192] is responsible for the poleward transport of ozone. The position of the Tropical Jet Stream is determined by the Hadley circulation, while the strength and position of the Jet Stream and the Polar Night Jet depend on the strength of the Polar Vortex. Depending on stratospheric conditions, planetary-scale Rossby waves (red) can be deflected during the winter, causing stratospheric warming and a weakening of the Polar Vortex. The Polar Vortex determines the winter state of the Arctic Oscillation (AO), which strongly influences the North Atlantic Oscillation (NAO).* ***Solar activity level, through its effect on stratospheric conditions, influences Northern Hemisphere winter weather far more than its small change in irradiation suggests***", (bold added).

191 Enhancement of westerlies brings warm and moist air from Atlantic to the Northern Eurasia causing positive temperature anomalies and at the same time negative temperature anomalies are observed in the Northern Canada and Greenland.

192 Proposed by Alan Brewer in 1949 and Gordon Dobson in 1956, explains why tropical air has less ozone than polar air, even though the tropical stratosphere is where most atmospheric ozone is produced. It posits the existence of a slow current in the winter hemisphere which redistributes air from the tropics to the extra-tropics. The Brewer–Dobson circulation is driven by atmospheric waves.

These planetary waves are well known by the meteorologists as they lead to strong temperature anomalies and major weather patterns, e.g. (Mann, 2019). How could climate, which is the sum (i.e. integral) over time of the weather, not be influenced by these complex relationships happening between the magnetosphere, the stratosphere, and the troposphere, not be influenced by them? Numerous physiochemical interactions happen in the stratosphere, some originating as high as the mesosphere and move down as waves impacting the tropopause and further propagate into the troposphere. These mechanisms were already envisaged by Stott et al. (2003) though more focused in that respect in their paper on UV interaction "*Potentially the largest amplification of solar forcing could result from modulation of stratospheric ozone by variations in solar ultraviolet, which could influence the troposphere via modulation of planetary waves (Shindell et al. 1999) or modulation of the Hadley circulation (Haigh 1996)*".

These authors also remind us that the interplanetary magnetic field increased during the twentieth century and led to a decline of the intensity of CRF which contributed to increasing the solar effects on climate. Similar conclusions are drawn by Haigh and Blackburn (2006) "*We conclude that solar heating of the stratosphere may produce changes in the circulation of the troposphere even without any direct forcing below the tropopause. We suggest that the impact of the stratospheric changes on wave propagation is key to the mechanisms involved*". GCM models have been pretty unable, even over extremely short-time scales (e.g. 11-year solar cycle) to render this troposphere-stratosphere coupling and especially to account for the the secondary maximum in temperature in the lower stratosphere. As pointed out by Gray et al. (2005) "*This secondary maximum is likely to be an important part of the mechanism that transfers the solar signal from the lower stratosphere to the troposphere underestimate the ozone signal in the upper stratosphere / lower mesosphere*". One must acknowledge that we have very complex non-linear coupled-systems, e.g. (Simpson et al., 2009), and that the weather is clearly originating far from us as gravitational interactions modulate the Sun activity and cycles, the solar wind and charged particles play their role and one cannot just measure TSI variations over short instrumental periods to grasp how the Sun influences the weather and therefore over time the climate system.

Finally, Scafetta (2014) gives the big picture "*It seems simply unlikely that in a solar system where everything appears more or less synchronized with everything else, only the Sun should not be synchronized in some complex way with planetary motion. Thus, the Earth's climate could be modulated by a complex harmonic forcing consisting of (1) lunar tidal oscillations acting mostly in the ocean; (2) planetary-induced solar luminosity and electromagnetic oscillations modulating mostly the cloud cover, and therefore the Earth's albedo; and (3) a gravitational synchronization with the Moon and other planets of the solar system modulating, for example, the Earth's orbital trajectory and its length of day (cf. Mörner, 2013).*"

As a side note, one should consider that even though the Earth's climate has changed a lot on all timescales for various reasons that we have addressed, the strange couple that the Earth and the Moon form, the latter being abnormally large of a satellite with respect to Earth's size, has lead to stabilizing the inclination of the Earth's rotation axis on the ecliptic (tilt of the earth's axis relative to its orbit around the sun). This is a unique case in the solar system and very fortunate, as Mars for example which present a comparable inclination today to that of the Earth has seen its value change a lot over time (Touma and Wisdom, 1993). This has resulted in a much more stable climate on Earth than it would have been if the Moon hadn't teamed up with us (Ward and Brownlee, 2000).

3) Sea Level Changes

"*The slow emergence of fossil fuel emissions prior to 1950 did not contribute significantly to 19th and early 20th century sea level rise. Identifying a potential human fingerprint on recent sea level rise is confounded by the large magnitude of natural internal variability associated with ocean circulation patterns. There is not yet any convincing evidence of such a fingerprint on sea level rise associated with human-caused global warming.*" (Curry, 2018)

Rasool and Schneider (1971) had forecast that the increased rate of injection of man-made particulate matter in the atmosphere would return us in the next 50 years into an ice age. In the same paper, they noted though that « *Even for an increase in CO_2 by a factor of 10, the temperature increase does not exceed 2.5 °K. Therefore, the runaway greenhouse effect does not occur because the 15-µm CO_2 band, which is the main source of absorption, "saturates," and the addition of more CO_2 does not substantially increase the infrared opacity of the atmosphere*». Both assertions were correct, though the ineluctable return to an ice age will not happen on short notice and not for the reasons given. They probably quickly sensed that their career needed a U turn to take some momentum and they converted to the rising tide of climate global warming alarmists. As soon as the late seventies, Schneider in the "The Palm Beach Post" edition of the 8th of January 1979, while working for the National Center for Atmospheric Research at Boulder (Colorado) predicted that «*man-caused global warming would thus melt polar ice and raise sea levels by many feet*". Schneider predicted this as a possibility to happen before the end of this century (understand before 1999) and teamed up with Robert Chen of MIT to add «*sea-level rise of 15 to 25-foot. The nation's coastline would change markedly*».

Fifty years after these predictions failed miserably, it is therefore simply amazing to see the same scare tactics used again and again. Prophets of doom keep popping all over the place and litter the greatest universities worldwide and are ready to embark us on an economic Armageddon on baseless fears. Consider this example, of which we just pick-up one amazing sentence, as it cannot be further away from any decent scientific approach «*One issue that concerns many scientists is that many of global warming's impacts have unfolded significantly faster than expected. For example, in 2007 the IPCC projected that global average sea levels would rise 0.6 meters (2 feet) by 2100, but in 2013 the prediction was revised to as much as 0.98 meters (3.2 feet), and then in 2016 revised again up to 2 meters (6.6 feet)*» (Henderson *et al.*, 2017). This is typical of the way people confuse astrological predictions through a crystal ball and how science should be made. So far, nothing has unfolded at all, the only thing that has happened is that changing the crystal ball they use, those charlatans have increased their «forecasts», but why not increase them to more than 20 meters, or even more to engineer a good epicontinental transgression? This analysis reported by Henderson *et al.* (2017) is based on a journalist paper (Jones, 2013).

In fact the conclusion of Jones's (2013) paper is just hilarious; she quotes Don Chambers (sea level researcher at the University of Texas), who declares "*I always tell people if they live under 3 feet above sea level, they should be worried about the next 100 years*", do you really think that these people will not have anything else to worry about for their next 100 years! Those academics simply live on another planet than the average Joe and do not even know it. The Henderson *et al.* (2017) paper continue «*At the highest level, several studies suggest that the cost of mitigating the effects of climate change are likely to be much lower than the costs of leaving it unchecked. For example, the IPCC estimated that... leaving global warming unchecked might cost 23% to 74% of* ***global per capita GDP*** *by 2100…*» What an accurate forecast that we must trust, between 23% to 74% of global per capita GDP, it is an amazing number and a dazing uncertainty, it is not even an astrological forecast any longer now but plain delirium. Then the ranting goes on by attempting to calculate «*the social cost of carbon" (SCC), a measure designed to capture the economic damages caused by carbon emission...*».

It is plain madness, there is no costs but only benefits to making use of carbon-based energies, they will strengthen the growth of plants and vegetables and they will enable us to keep achieving what humankind has made it possible to happen, a better life for everybody, as since the year 1500 human population has increased 14-fold, production 240-fold and energy consumption 115-fold. It is because we have access to fossil and nuclear energy that we have increased production 240-fold. Academic staff from Harvard Business School are not just mistaken in their strange reasoning, they have gone straight into the ditch of non-sense. It is also amazing to see how lightly business academics can take numbers which are no better than what a roll of dice would give and claim « *global warming's impacts have unfolded significantly faster than expected*»!

Had they done their homework, not science as its not their job, they would have found that it takes 360 Gt of water to raise the sea level by 1 mm. Floating sea ice does not contribute to a Sea Level Rise (SLR). Tide gauges spread over the globe say that we have had a rise of around 1.3 mm/year (Wöppelmann et al., 2007) after GPS correction of the subsidence or the emergence of the basement carrying the tide gauge; a part (half?) of this 1.3 mm/year is attributed to a pumping of groundwater greater than their filling (local subsidence) and perhaps and for at most 0.5 mm - and for the last decade only - to a decrease of altitude glaciers outside Antarctica and Greenland. Altimeter observations (Zwally et al., 2012; 2015) suggest an Antarctic mass gain of 43 to 49 Gt-water/year revised upward in 2015 for 1992 to 2008 to +200 Gt-water / year on the eastern part and - 65 Gt-water/year on the western part and the Antarctic Peninsula, that is, net, 135 Gt-C / year sequestered.

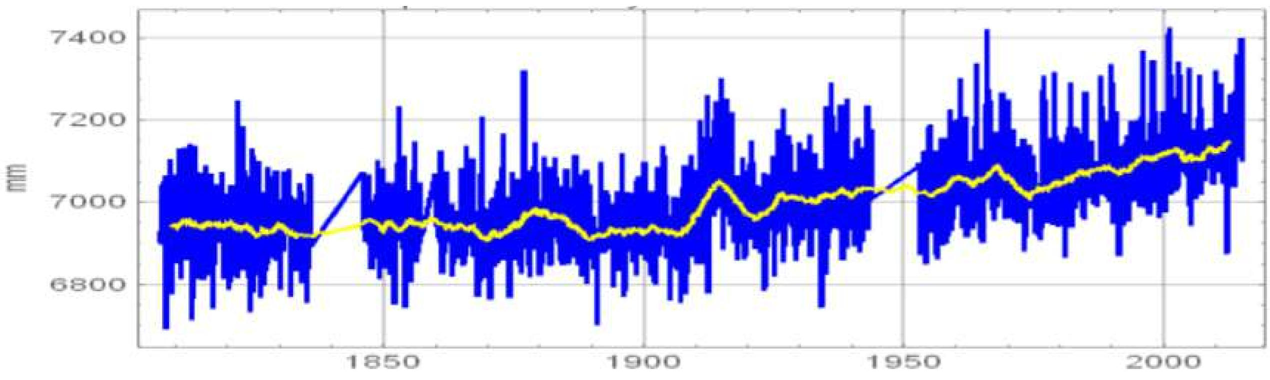

Figure 59. Average monthly levels in Brest since 1807: the big maximums are in Dec. 1821 (7225 mm), Nov. 1852 (7233 mm), Dec. 1876 (7322 mm), Feb. 1966 (7422 mm) and Dec. 2000 (7426 mm). The 18.6-year lunar cycle is visible on the annual averages while the monthly values mainly show the effect of winter storms. In yellow moving average over 5 years. http://www.psmsl.org/data/obtaining/rlr.monthly.data/1.rlrdata

Veyres (2020) reminds us that the longest series of monthly averages, the number 1 in the collection of the permanent sea level observation service (www.psmsl.org), that of Brest (France), Figure 59, shows an increase of +200mm in 207 years and +150mm over 1910-2015. So, none can say «*the global warming's impacts have unfolded significantly faster than expected*» as Henderson *et al.* (2017) claim, forecasts announcing a sea level rise of 2 meters by 2100 are just ridiculous, and observations show that so far over 207 years we have observed +200 mm, e.g. Church and White (2006) report 195 mm from January 1870 to December 2004, a tenth of what the doom-sayers claim over a much longer period than the 80 years to go until 2100! Furthermore, the Antarctic Peninsula, is sequestering net, 135 Gt-C/year and contribute to a **decrease** of the sea level of 0.375mm/year (Zwally et al., 2012; 2015). One of the objections some people have aired with our reasoning has been why don't you use more global satellite data? The reason why we have been cautious with satellite data is that are constantly being reprocessed, adjusted, forged?, as it has been too often the case for other global observation data, for which obtaining «raw data» is always a challenge as these are too often locked down by the institutions managing them. This cast a doubt on their validity and makes their integrity questionable and this is unfortunate because this was not the case in the 1980s when the remote-sensing laboratory[193] I used to work for made a daily usage of them in trust, before the climate fiasco and related hysteria.

This is not the case with sea gauges and whatever the world area where we get their data from, they show a coherent (across series) and consistent (over time and for Brest, long periods of time) picture : the sea level rise is minimum and there is no measurable significant acceleration: "*It is evident that the installation of GPS equipment in 2000 has had an influence on stabilizing the SEAFRAME gauges. Since that date, there has been little evidence that the sea level is changing in the 12 Pacific islands*" (Gray, 2010)[194] or consider the report by Mitchell et al. (2012), i.e. South Pacific Sea Level and Climate Monitoring Project: Sea Level Data Summary Report, July 2010 to June 2011, and go to Fig. 10. Monthly mean sea levels 1991 to June 2011, p. 22, and you will see no sea-level rise for entire pacific area considered, flat curves (except perhaps the Federated States of Micronesia which has shorter time-serie and may be victim to subsidence). Furthermore, superimposed on the long-term searched-for eventual acceleration are quasi periodic fluctuations with a period of about 60 years (Figure 53) and the decadal variations of sea level dominate the estimate of acceleration for records shorter than about 75 years (Douglas, 1992; Jevrejeva et al., 2008).

193 Centre de Télédétection et d'Analyse des Milieux Naturels (CTAMN) à Sophia Antipolis. http://www.oie.mines-paristech.fr/Accueil/Historique/

194 In memoriam of the fight for honesty https://en.wikipedia.org/wiki/Vincent_R._Gray

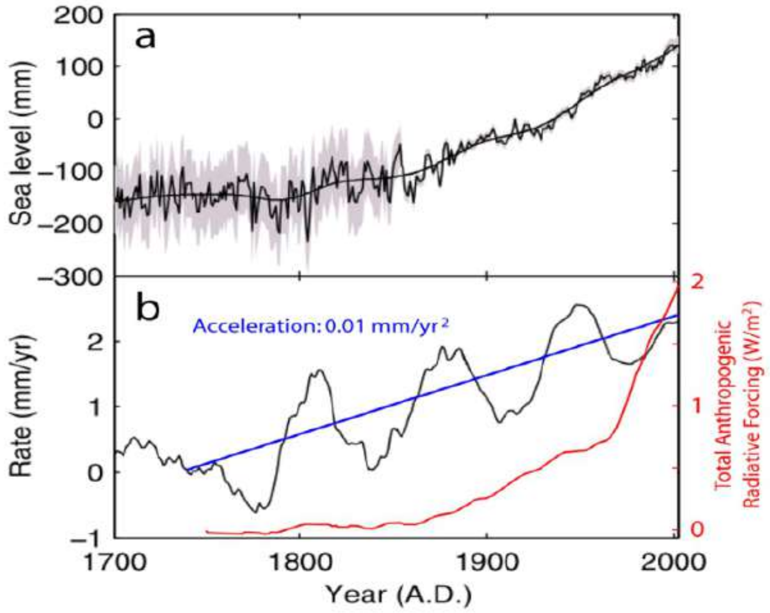

Figure 60. a) Time series of yearly global sea level calculated from 1023 tide gauge records corrected for local datum changes and glacial isostatic adjustment. Time variable trend detected by Monte-Carlo-Singular Spectrum Analysis with 30-year windows. Grey shading represents the standard errors. b) The evolution of the rate of the trend (black line) showing multidecadal variability. Blue line corresponds to the linear background sea level acceleration that corresponds to a sea level acceleration of 0.01 mm/yr2. Red line, IPCC calculated total anthropogenic radiative forcing. Source: Jevrejeva et al. (2008).

As reported by Douglas (1992) the acceleration can even be a deceleration as "*for the 80-year period 1905–1985, 23 essentially complete tide gauge records in 10 geographic groups are available for analysis. These yielded the apparent global acceleration −0.011 (±0.012) mm/yr^2*". As displayed on the previous Figure 60 from Jevrejeva et al. (2008), SLR started more than 200 years ago, when anthropic emission were ridiculously small as displayed by the red curve in b). The central estimate on 20th-century average SLR is ~ 1.6 mm/yr (1.2-1.9 mm/yr range), and the acceleration d(SLR)/dt is usually estimated as small as ~0.01 mm/yr^2 ! "*A reconstruction of global sea level since 1700 has been made. Results from the analysis of a 300 year long global sea level using two different methods provide evidence that global sea level acceleration up to the present has been about 0.01 mm/yr^2 and appears to have started at the end of the 18th century*" (Jevrejeva et al. 2008).

SLR displays a 60-year oscillation, like many other climatic manifestations. The recent period of satellite altimetry (1993-2017) coincides with the crest of the oscillation, and thus shows a higher rate of SLR, ~ 3.0 mm/yr, but no acceleration, to the surprise of some authors: "*Global mean sea level rise estimated from satellite altimetry provides a strong constraint on climate variability and change and is expected to accelerate as the rates of both ocean warming and cryospheric mass loss increase over time. In stark contrast to this expectation however, current altimeter products show the rate of sea level rise to have decreased from the first to second decades of the altimeter era*" (Fasullo et al., 2016). The conclusion here is given by Javier (2018) "*If the 60-year oscillation continues affecting SLR, over the next couple of decades we should expect a deceleration of SLR rates towards ~2 mm/yr*".

As was the case with temperature, SLR precedes the big increase in emissions, and does not respond perceptibly to the anthropogenic contribution. The b) graph of the previous Figure 60 displays the linearly adjusted trend in long term average SLR acceleration as a blue line, and the increase in anthropogenic "forcing" (IPCC-AR5, 2013) with a red line. The evidence shows that the big increase in anthropogenic contribution, has not provoked any perceptible effect on SLR acceleration. "*The belief that a decrease in our emissions should affect the rate of SLR has no basis in the evidence*" (Javier, 2018b). The observed SLR is the result of the cryosphere response to the warming that started since the end of LIA and no proof can be given that a significant acceleration (so far observed at ~0.01 mm/yr^2) is to be expected.

This had to be acknowledged by Fasullo et al., (2016) who expected that satellite altimetry would save their day. When an acceleration is shown it is mostly caused by selective trend calculation (i.e. cherry-picking). For example, by using a start year of 1993, at the bottom of a dip in the trend, a spurious calculation of 3.1 mm/yr is obtained instead of 1.6 mm/yr. In reality the recent data is in line with the long-term trend and the "acceleration" is artificial. Sea level reconstructions over longer terms, such as those performed by Grinsted et al. (2009) show that thermo-steric expansion (Domingues et al., 2008), (Purkey et al., 2014), (Madec et al., 2015) explains a part of variations observed "*Over the last 2000 years minimum sea level (-19 to -26 cm) occurred around 1730 AD, maximum sea level (12 to 21 cm) around 1150 AD*", therefore the high corresponds to the MWP and the low to the LIA and gives a clear idea of the amplitude of the variations that one can expect from the current on-going natural warming that took place since the end of the LIA. It also clearly shows the correspondence with MWP and LIA which were removed of climate reconstructions by Mann and IPCC.

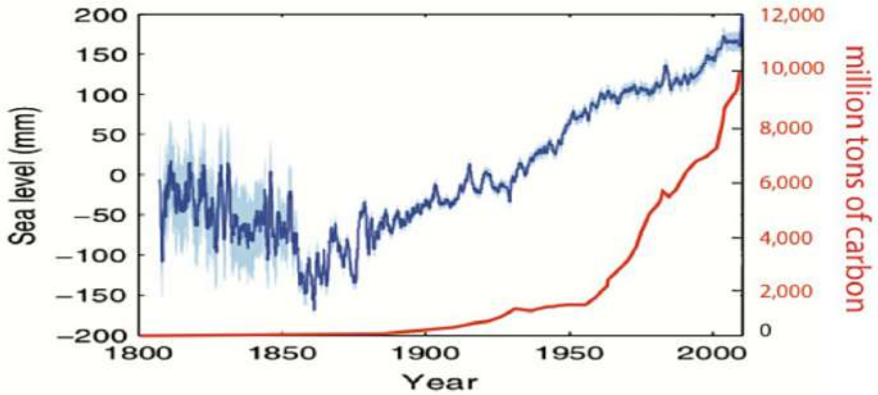

Figure 61. Time series of sea level anomalies (blue) Jevrejeva et al. (2014). Million tons of carbon emitted from burning fossil fuels (red) from the Carbon Dioxide Information Analysis Center (CDIAC 2014). Source: (Curry, 2018). As one can see there is simply no relationship, SLR (blue) started long before significant anthropogenic emissions and did not accelerate with the massive increase of emissions since the late 1950s. Another culprit will have to be found.

These facts are highlighted by Curry (2018) "*At least in some regions, sea level was higher than present around 5000 to 7000 years ago. After several centuries of sea level decline following the Medieval Warm Period, sea levels began to rise in the mid 19th century. Rates of global mean sea level rise between 1920 and 1950 were comparable to recent rates. It is concluded that recent change is within the range of natural sea level variability over the past several thousand years*".

Furthermore, recent studies show (Fudge et al., 2016) that there is no straightforward and durable relationship between the temperature and the ice accumulation rate at the poles and that, of course, prevents from making any decent forecast to an SLR contribution. In fact, The Antarctic and or Arctic contribution to sea level is a balance between ice loss along the margin and accumulation in the interior. But in Antarctic, at least as far as the WAIS Divide (WDC) site is concerned, and over the 31 kyr studied with high resolution recently, results show considerable variability through time with high correlation and high sensitivity (between temperature and accumulation) for the 0–8 kyr period but no correlation for the 8–15 kyr period and then Fudge et al. (2016) report: "*Accumulation records for the past few decades are noisy and show inconsistent relationships with temperature. These results suggest that variations in atmospheric circulation are an important driver of Antarctic accumulation but they are not adequately captured in model simulations. Model-based projections of future Antarctic accumulation, and its impact on sea level, should be treated with caution*".

Basically, the General Circulation Models are simply unable to account for the 15 most recent kyr and corresponding estimates of SLR contribution are fictions as there does not even exist a stable relationship between the temperature and ice accumulation rates. If Antarctic is in no way significantly a contributor to any SLR, one can reliably assess that Arctic has been a net contributor since the switch of its the decadal mass balance which occurred in between 1972–1980 when showed a mass gain of +47 ± 21 Gt/y and tilted to a loss of 51 ± 17 Gt/y in 1980–1990 (Mouginot et al., 2019). Cumulated since 1972, these authors report that Arctic has been the main contributor to SLR, i.e. "*the largest contributions to global sea level rise are from northwest (4.4 ± 0.2 mm), southeast (3.0 ± 0.3 mm), and central west (2.0 ± 0.2 mm) Greenland, with a total 13.7 ± 1.1 mm for the ice sheet. The mass loss is controlled at 66 ± 8% by glacier dynamics (9.1 mm) and 34 ± 8% by SMB[195] (4.6 mm)*", but will see in the section dealing with the Arctic that it is in no way outside of normal natural variability.

Then people can run computer models or throw the dice to try to scare the public, the result is not very different. In that respect, Storch et al. (2008) considered as experts in that domain have studied the relationship between global mean sea-level and global mean temperature in a climate simulation of the past millennium and are honest when they

195 SMB = Surface Mass Balance

report that «*it has been found that the best statistical model of the four explored here is the one that uses the ocean heat-flux as predictor. Unfortunately, the ocean heat-flux is a variable that is difficult to estimate in the real world, and of which long time series simply do not exist. Therefore, this close relationship is not useful to estimate empirically future sea-level changes. The linear link between global mean temperature and the rate of change of global mean sea level (model Eq. 1) has turned out to be not reliable over the full time period in the context of this climate simulation; instead, for some periods, even inverse relationships were found to describe the simulated data best. The second predictor "rate of change of temperature", used in model Eq. 4, analyzed here in more detail, did not show markedly better results. For both predictors, there exist periods in the simulation where the prediction errors are very large*». Basically, running sophisticated computer models, in that case four different, has not delivered any reliable estimate of what the sea level rise could be, instead sometimes providing even inverse relationships!

Furthermore, trying to attribute to anthropogenic CO_2 emissions SLR will be made extremely difficult by the natural, internal climate variability associated with ocean circulations, i.e. currents and winds. These introduce strong changes in regional sea level on timescales from years to decades (and even longer). As reported by Curry (2018) "*For example, sea level variability in the Pacific Ocean related to El Niño Southern Oscillation (ENSO) and to the Pacific Decadal Oscillation (PDO) is of the order of ±10–20 cm, which masks any sea level changes due to increasing CO_2*".

Finally all geologists know that a level is highly variable as the land used as a reference can instead experience subsidence or rise for various geodynamic reasons, one of the most frequent being just an isostatic adjustment, example taken by Legates in his testimony "*Sea level, while important to areas in southeastern Pennsylvania along the Delaware River, has risen steadily over the past 120 years but shows no correlation with increasing carbon dioxide concentrations. At the US Coast Guard Station in Philadelphia, sea level is likely to rise another 9½ inches by 2100, but half of that rise in sea level is due to coastal subsidence due to Glacial Isostatic Adjustment from the unloading of glacial ice since the last Ice Age some 22,000 years ago*" (Legates, 2019).

The main cause of U.S. East Coast subsidence is natural and is due to the melting of the ice-sheet that covered northern America during the LGM. The land beneath it has been springing back up by isostatic adjustment and like a see-saw, that's causing areas south of the former ice sheet to sink back down, including Maryland, Virginia and North Carolina. Other areas have experienced strong subsidence mechanisms leading to an apparent sea level rise, and e.g., Nienhuis et al. (2017) report "*Coastal Louisiana has experienced catastrophic rates of wetland loss over the past century, equivalent in area to the state of Delaware. Land subsidence in the absence of rapid accretion is one of the key drivers of wetland loss*".

What is serious, is that Harvard Business School academics should not jump start on the first scare and realize that major economic disruptions will happen if people keep going along IPCC's line of thoughts without doing their own homework and cross-checking of data and results. So, nobody can claim that he knows where the sea level will be in 2100, not the IPCC better than others as they have consistently been wrong with all their predictions, but what I am sure about is that given the complexity of the subject, the fuzziness of the forecasts and the limited understanding we have of the situation, we are going to face many other problems, more worrying, before that one might happen in 2100, if it will, especially if we destroy our economies for such kind of non-sense and disrupt our industries and create massive poverty and unemployment. I would suggest that business schools focus on improving businesses, productivity and wealth creation and not worry about where the sea level will be in 2100 and do not take whimsical predictions for granted.

"*In many of the most vulnerable coastal locations, the dominant causes of local sea level rise problems are natural oceanic and geologic processes and land use practices. Land use and coastal engineering in the major coastal cities have brought on many of the worst local problems, notably landfilling in coastal wetland areas and groundwater extraction*" (Curry, 2018)

It is not possible to close this short section on "sea level rise" without mentioning the work of Nils-Axel Mörner who passed away on Oct 16, 2020. As summarized by Monckton of Brenchley (2020c) "*he knew more about sea level than did Poseidon himself. Professor Mörner was a hands-on scientist. He did not enjoy squatting in his ivory tower. He liked to travel the world investigating sea level by the novel method of actually going to the coastline and having a look*". Mörner wrote many papers on the subject with the rigor of a great scientist, a great geologist who always put more credence on the facts observed in situ than on any other remote measurements, such as data acquired by satellites. This sounds like the basics of natural sciences, go into the field, observe things as they are, not running sea-level change models on computers and dismissing what's visible in plain sight! By doing so, he was involved in many projects with a host of scientists who welcomed him in distant parts of the world, such as the in the Maldives Project (2000-2005) , in the Qatar Project (2006), in the Bangladesh Project (2009), in the Goa Project (2013), and in the Fiji Project (2017). In Mörner (2017) he observes that because the satellite altimetry data have been "corrected" to give a rise in the order of 3.0 mm/yr the value of the observations in the field is paramount. Mörner (2017) notes "*This 'correction' may, of course, be classified as a "manipulation" of facts, like the manipulation temperature measurements recently revealed*" making reference to the tortuous issue raised by Rose (2017a-b). He concludes "*In this situation, there are all reasons to return to solid observational facts. Those facts are controllable, and this is a key criterion in science. The global perspective is general stability to a minor rise with variations between ±0.0 and +1.0 mm/yr. This poses no problem for coastal protection*". Other studies worth reading are (Mörner, 2010-2011, 2012).

His studies in all the places he visited confirm the very slow SLR that have been reported here, that occur since the end of LIA, and show no acceleration whatsoever as visible on Figure 61, whereas the emissions have kept growing at an accelerated rate. He even reported in some places as in Bangladesh that the sea level was actually falling and that when locally some anomalies occurred, they were related to completely different reasons, e.g. local prawn farmers had grubbed up the mangroves whose roots had previously kept the coastline stable. As reported by Monckton of Brenchley (2020c) in Mörner's eulogy "*On another occasion Professor Mörner was visiting the Maldives when he noticed a small tree, 40 years old, right on the beach, in leaf but lying on its side. The fact that the tree was still there, feet from the ocean and inches above sea level, after 40 years told him that there had been no sea-level rise since the tree had first begun to grow, or it would have been drowned. He enquired locally about whether there had been an exceptional spring tide caused by global warming and sea-level rise that had overthrown the tree. He discovered, however, that a group of Australian environmental extremists had visited the beach shortly before him. They had realized that the presence of the tree showed that the official sea-level record showing a sharp rise over the past half-century must be incorrect, and had uprooted the tree. Professor Mörner stood it back up again and photographed it.*"

Figure 62. Left: The V atop an horizontal bar Ɣ[196] visible inside the ellipse (near center-left) which stands a bit less than one meter above the water is a mark 50 cm across (tidal range is less than a meter) that was etched by Capt. Sir James Clark Ross in 1841 to indicate the mean sea level and is still perfectly visible in this picture made by Daly in 2004 at the Isle of the Dead (Tasmania) showing that no significant SLR has occurred since 1841, < 0.8±0.2 mm/yr as per Hunter et al. (2003), Fig. 1 and 2, p.54-2 and 54-3, for the complete story refuting the SLR altogether, see Daly (2003a-b-c). Right: the Mörner Tree of the Knowledge of Good and Evil shows that no SLR occurred either in the Maldives, from Monckton of Brenchley (2020c).

Exactly as the picture taken by John L. Daly in 2004 (low tide on 20 Jan.) of the 1841 sea level benchmark (inside the ellipse) on the `Isle of the Dead'[197], Tasmania, remains and reminds where was, according to Antarctic explorer Capt. Sir James Clark Ross, **the mean sea level in 1841** (Ross, 1847), the Mörner Tree of the Knowledge of Good and Evil[198] should lead to the expulsion of all the cheaters, the manipulators, the unworthy ones from the realm of science. These are facts rooted in the field observations, not on 'corrected', i.e. fudged? satellite data and fantasy computer models.

196 Go to http://www.john-daly.com/photomrk.htm for a larger picture.
197 https://en.wikipedia.org/wiki/Isle_of_the_Dead_(Tasmania)
198 https://en.wikipedia.org/wiki/Tree_of_the_knowledge_of_good_and_evil

They are also completely at odds with statements in the press made by Mann and Hansen (Wallace-Wells, 2017), who appear more as climate activists and alarmists than as scientists in such operations of intentional deception (see p. 317).

Figure 63. Zoom on the etched benchmark displayed in the ellipse (near center-left) of Figure 62, that was engraved under the order of Capt. Sir James Clark Ross in 1841 to indicate the mean sea level at the Isle of the Dead (Tasmania). After Hunter et al. (2003).

The mark carved by Lempriere under the instructions of Ross (Figure 63) has led to a dispute between Daly (2003a-b-c) and Hunter et al. (2003) who write "*From the position of the benchmark relative to mean sea level as estimated in 1875– 1905, 1888 and 1972, and from our modern records (Figure 2), we believe that it is **inconceivable** that the benchmark **could have been at mean sea level in 1841***". It can be inconceivable for them, but it is what Ross (1847) stated in several occasions and wrote in his book "*The fixing of solid and well secured marks for the purpose of showing **the mean level of the ocean** at a given epoch, was suggested by Baron von Humboldt, in a letter to Lord Minto, subsequent to the sailing of the expedition, and of which I did not receive any account until our return from the Antarctic seas, which is the reason of my not having established a similar mark on the rocks of Kerguelen Island, or some part of the shores of Victoria Land. ...*". From thereof is rooted the origin of the disagreement with Daly (2003a-b-c) the importance of which is further minimized by Hunter et al. (2003) stating that this single point would not alter significantly the global picture and the results of surveys based, e.g. on say 24 other stations (Douglas, 1997). This is of course true and incorrect at the same time: arithmetically true if one considers that Port Arthur, Tasmania, is just one observation point of a series of a well established theory this being the position of Hunter et al. (2003) and incorrect if one considers that one observation is more than enough to refute a theory as long as it is certain, which is Daly's (2003a-b-c) stance. The latter is especially true given the uniqueness of the engraving at the Isle of the Dead, delivering the oldest physical reference that provides for the longest direct observation of the sea-level. The situation is further complicated by the fact that the 1880s tremors may have changed the geographical setting at Port Arthur, Tasmania (and thus corresponding levels up or down, in fact as in many other places[199] for various geodynamical reasons such as tectonic or isostatic natural adjustments). These earthquakes were well documented by Shortt (1885) and reported on a map where appears the likely epicenter of a series of earth tremors (also listed in a comprehensive table) that occurred in Tasmania between 1883 and 1885, and which continued into 1886 after he published his paper. They were unprecedented in both scale and frequency either before or since.

The Isle of the Dead in Tasmania is certainly not the only place where the battle rages. The Maldive archipelago is also regularly used by the scare mongers to let people think of a supposedly urgency to take drastic measures to circumvent the alleged catastrophic SLR that should submerge the low lying islands worldwide. The only problem is that their apocalyptic vision does not match with the facts, the mere reality, when observed in a non-partisan way. This is just what Duvat (2020) did in her recent paper where it appears that since 2005, 110 (59.1%) of the 186 islands in the Maldives studied grew by ≥3%. Of those 110 expanding islands, 57 grew by ≥10% and 19 grew by ≥50%, that's just in the last decade. Of the islands that didn't expand in size, 38.2% (71 islands) were classified as stable (defined as neither growing or contracting by more than 3%). This leaves only 5 islands out of 186 (2.7%) that decreased in size since the 1980s. Put another way, 97.3% of Maldives islands have been either stable or growing since 2005, all while Climate Alarmists have exploited the Maldives as a poster child of ''sinking islands" to recruit gullible children into their cult. This situation is despite the fact that the Maldives islands are objectively a region characterized as one of the most vulnerable to sea level rise perturbation, as about 80% of the islands are less than 1 meter (m) above sea level.

199 Recent vertical motions can be assessed using the following site: https://www.sonel.org/-GPS-.html CGPS indicates rising land motion for many places, e.g. Oslo, Norway and Vaasa, Finland, 5.33 +/- 1.12 mm/yr at Oslo and 7.88 +/- 1.14 mm/yr at Vaasa leading to sea-level drops!

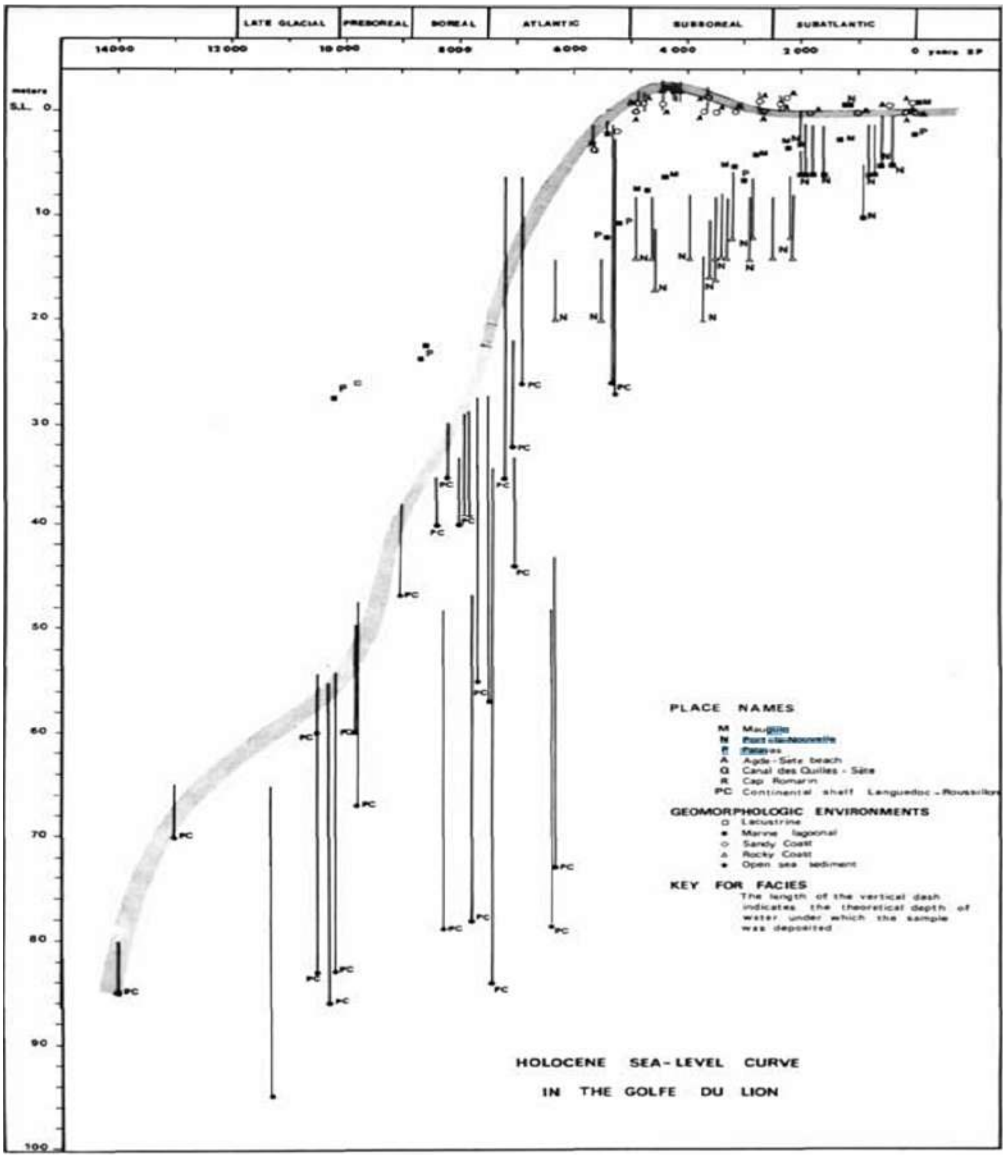

Figure 64. Sea-level change over the last 14.000 years (Holocene) in the "Golfe du Lion" as per Aloïsi et al. (1978) showing a constant SLR of +1mm/year over 8000 years, stopping at -4,500 years ago. This reconstruction matches that of Lambeck and Bard (2000), Fig. 3. Since the top observed at -4,000 the sea level has been pretty stable as reported by Morhange et al. (2001). After Aloïsi et al. (1978). See also O'Brien et al. (1995), Fig. 2 (center-down), p. 1963.

Considering that the Maldives population (>400,000) has been doubling every 25 years since the 1960s and nearly 1.3 million tourists visit many of the 188 inhabited islands every year, the Maldives islands are especially vulnerable and represent a landmark in the critical assessment of the effects of sea level change. The situation shows that if a small SLR has occurred, has it really?, it has been defeated by human ingenuity, adaptation to changing conditions being the best response as always, and engineering feats such as island raising, artificially expanding island areas, and "armoring" shorelines, have lead to an expansion of most of the Maldives in recent decades. Rightfully making a difference between the islands where man intervention and engineering led to human adaptation and "natural" islands, Duvat (2020) states "*As a result of widespread human intervention, these islands behave very differently from both the documented Pacific islands and the Maldivian islands of Gaafu-Alifu Dhaalu Atoll (most of which are 'natural'), 15.5 % and 19.5 % of which underwent expansion over the past decades, respectively*". The later islands, referred to as the Huvadhu atoll, is a large atoll that contains 255 extremely low lying islands, the most in the Maldives and is further divided in between the Northern Huvadhu Atoll (Gaafu Alifu), and Southern Huvadhu Atoll (Gaafu Dhaalu). So even in that extremely unfavorable case, nearly 20% of the islands managed to show some natural expansion which is, in itself, a bewildering observation. But in fact what Duvat and Magnan (2019) report is that it is the anthropogenic change brought to these islands to accommodate population expansion or economic development that is the main factor behind island evolution and not any related climate-change problem and of course this drives what the adaptation strategies to any possible future climate-change should be as they differ for rather unadulterated ecosystems (Type 1 and 2 islands) and other islands' types. In any case, so far, it is certainly not the supposedly devastating AGW-related SLR that is driving the future of these atolls. Furthermore in a previous study, Duvat (2018) published a global assessment of how the Earth's islands and atolls are faring against the ongoing challenge of sea level rise since satellite monitoring began in the 1980s. She reported "*no widespread sign of physical destabilization in the face of sea-level rise.*" In fact, a) none of the 30 atolls analyzed lost land area, b) 88.6% of the 709 islands studied were either stable or increased in area, c) no island larger than 10 hectare (ha) decreased in size, and d) only 4 of 334 islands (1.2%) larger than 5 ha had decreased in size. The rapidly increasing population ever drawing more of the local resources of these small low lying islands is creating a challenge to nature conservation and preservation, and is not related to supposedly AGW-induced climate change.

To better put this section in perspective, one should notice that transgressions and regressions are the very basics of a scientific discipline, i.e. stratigraphy and that they have happened constantly over millions or rather hundreds of million of years and are well documented by geologists. They have been constantly happening over the recent late Pliocene-Pleistocene and have been extensively studied, e.g. (Brigham-Grette and Carter, 1992; Bromley and D'Alessandro, 1987; Malatesta and Zarlenga, 1988; Migoń and Goudie, 2012; Naish and Kamp, 1995; Yi, et al., 2016). During the Eemian the Mediterranean sea was up to 6 meters higher than now (Gilli, 2018). Just considering the very recent record, i.e. since the end of the LGM, 30,000 years ago, e.g. as per Lambeck and Bard (2000) or more accurately for the last 14,000 years as studied by Aloïsi et al. (1978), a marine transgression has been observed worldwide and many papers documented correctly what was in the geological record. The previous Figure 64 is from Aloïsi et al. (1978) and shows a 80 meters increase of the sea-level over the period -12.5ky to -4.5ky and a quasi stagnation since -4.5ky as can be attested by observations, e.g. in the Cosquer Cave[200] (Collina-Girard, 2014). Basically a 10mm/year increase over 8,000 years corresponding to the end of the stadial (glacial stage). It is also known that during the MIS 5a the sea level was higher than that observed now and the timing of this ~84- to 80-kyr maximum closely matches the June 60°N insolation peak at ~84 kyr, see Dorale et al. (2010) Fig. 2. It also appears that the ice-sheets built up during the cold MIS 5b completely and very rapidly melted or so and that MIS 5a was thus warmer and more ice-free than now, while MIS 5a also nearly matches MIS 5e-1 (~117 kyr). These observations provide evidences of the strong natural variability over the last ~100 kyr, whereas changes of the atmospheric composition certainly did not drive it.

We have evidenced from Figure 59, that direct measurements since 1821 show that since the end of LIA (and with no relationship to man-made emissions) we have had a return to a transient regime of SLR. The end of the interglacial is in sight, in less than 1,000-1,500 years and things will naturally strongly reverse (marine regression). Don't we have more urgent problems to solve over the next millennium than a potential but absolutely uncertain 1 to 1.5 meter maximum sea-level rise before returning to an ice-age? Can't we adapt to that over a millennium? In many places in southern Italy, because of natural changes and tectonic adjustments many antic harbors (dating back to -2.000 years) are kilometers inside the lands or inversely submerged by natural subsidence. Did mankind stay there, people twiddling their thumbs waiting for catastrophic sea-level changes, either up or down ? In any case fossil fuels will have been exhausted centuries before then.

My understanding is that we argue again about measures which are unable to deliver a clear anthropogenic signal that would be undeniably different from the natural variability and as summarized by Figures 59, 60 and 61, there has been since the end of LIA a slow and rather steady SLR that did not show any meaningful acceleration whereas the CO_2 emissions have been skyrocketing since 1950 (to properly assess their effects one should of course take their logarithm, but nonetheless) and in any case adaptation and remediation would be better policies to cope with a phenomenon that started hundreds years ago from natural variations than to enact radical measures that most probably will have no effect on the natural order of the things and will harm severely the prosperity of humanity by restricting access to cheap and easily available energy sources, see e.g. (Lomborg, 2020a-b).

Finally as the melting of the poles cannot account for any significant SLR, the AGW-proponents have tried to find a solution into the thermo steric (see foot-note 453) expansion of the oceans. This required a new conjecture, that of the heat hidden in the oceans, which is one more lasting deception. Argo is an international program that uses a fleet of more than 4,000 profiling floats to observe temperature, salinity, currents, and, recently, bio-optical properties in the Earth's oceans; it has been operational since the early 2000s and is mainly used to monitor the Ocean Heat Content (OHC). Heat is an energy measured in Joules and it flows only from the warmer to the colder as Rudolf Clausius stated it in 1850 with the second principle of thermodynamics. One should observe here that if the IR properties of the water

200https://en.wikipedia.org/wiki/Cosquer_Cave by 43° 12′ 10″ N, 5° 26′ 57″ E molecule explain why some heat re-emitted by the Earth is absorbed in the IR by water and water vapor in the atmosphere (the so called GH effect), it also explains why no IR radiation can penetrate the oceans for the simple reason that a few microns of water stop them due to the vibrations of the water molecule. By using data delivered by such a massive fleet of "Argo floats" Wunsch and Heimbach (2014) have analyzed the oceans down to the abyss and report an increase of $4\ 10^{22}$ Joules over a 19 years period, this apparently very large energy contributing to the radiative forcing of a tiny 0.2 W/m^2, this value has steadily decreased over the years, from a max given by Hansen et al. (2005) of 0.8 W/m^2, Lyman et al. (2010) of [0.53-0.75 W/m^2], von Schuckmann et al. (2011) of 0.54±0.1 W/m^2, down to 0.2 W/m^2 by Wunsch and Heimbach (2014). Given the volume of the oceans of $1{,}3\ 10^{18}$ m3, thus a mass of $1{,}3\ 10^{18}$ tons, Wunsch and Heimbach (2014) have deduced a calorific capacity of $5.4\ 10^{24}$ Joules per degree °K.

As the mean temperature of the oceans is 15° ±13°C, i.e. 288 ±13°K, the thermal energy contained in the oceans is around $5.4\ 10^{24}$ x 288 = $1.5\ 10^{27}$ Joules and thus over 19 years the energy accumulated in the oceans is 19 x $1.5\ 10^{27}$ Joules. Thus, the annual increase can be computed as ($4\ 10^{22}$) / (19 x $1.5\ 10^{27}$) = 0.00014%, and an annual warming of a very small amount: ($4\ 10^{22}$) / (19 x $5.4\ 10^{24}$) = 0.0004°C/yr as detailed by Gervais (2018).

Such a ridiculously small number is beyond even ARGO system's measurements capabilities and is furthermore, if real, very heterogeneously distributed across the various oceanic basins. Again, these values when compared to the natural variability appear insignificant.

In the end, can we get a better proof to show that the subject is a propaganda issue, not a scientific one, than the fact that people like Al Gore and Susan Solomon (Co-Chair for Working Group I for the IPCC's Fourth Assessment Report) have invested heavily in beach-front properties, so worried they are of the threatening sea level rise to come.

4) Oscillations & Circulation : ENSO, PDO, NAO, AMO, A(A)O, QBO, AMOC

The climate is not driven by the short-term SW or LW absorption within the atmosphere's relatively trivial mass, as its heat capacity is only the equivalent of a 2.5 m layer of seawater, but rather by the long-term 'storage function' of the memory of the accumulated radiative equilibrium that resides in the ocean (Ellsaesser, 1984). In the intermediate term, the atmosphere is driven by variations in ocean dynamics in accordance with the various oscillations that we are dealing with in this section, the El Niño phenomenon being probably one of the most conspicuous. In the longer term, it is driven by variations in solar irradiance associated with variations in the Earth's orbital motion about the Sun and the variations in the solar activity (and cycles) and how they might influence cloudiness and thus the albedo.

Most of the natural oscillations discussed in this section, if limited to their atmospheric component, could be considered as such short-term changes that would have a more direct relationship to meteorology than to climate-change strictly speaking, though climate as already said is just the sum over time (the integral) of the weather, thus their indissociable connection. Most of these oscillations concern the oceans to the notable exception of the mainly atmospheric QBO (Quasi-Biennial Oscillation) and some are mixed (e.g. ENSO), thus showing the complex intricacies happening in this highly coupled-system ocean-troposphere-stratosphere not to mention the role played by the topography (and of course the major mountain-belt systems) which should also be integrated as they deviate or orient in some way the atmospheric circulation. ENSO (El Niño Southern Oscillation, alternatively El Niño - La Niña), AMO (Atlantic Multidecadal Oscillation), NAO (North Atlantic Oscillation), PDO (Pacific Decadal Oscillation), AO (Arctic Oscillation), AAO (AntArctic Oscillation), and QBO will be briefly reviewed. Even though these oscillations take place on short-term scales (as far as the climate is concerned) they can be traced back for the entire Holocene and so belong to the climate and furthermore contribute to physical phenomenons having an impact on longer term mechanisms, e.g. the importance at all time-scales of the role of the oceans in regulating the CO_2 atmospheric content as per Henry's law "*We used space-based CO_2 observations to confirm that the tropical Pacific Ocean does play an early and important role in modulating the changes in atmospheric CO_2 concentrations during El Niño events*" (Chatterjee et al., 2017). AMOC will be considered last and AMO in more details in another section with the Arctic.

ENSO is the first global system of climate variability, in fact the largest perturbation to the climate system on an inter-annual time scale with a period of 2 to 7 years. The Southern Oscillation is an associated (atmospheric) pressure oscillation between northern Australia and the central Pacific. The warm phase is designated El Ninõ (El Niño de Navidad), it is the term used by Peruvian fishermen who named the weather phenomenon after the newborn Christ, as they mainly noticed it after Christmas. It is an intensive warming of the ocean in the Eastern Pacific at the level of the tropics for about 5 months. The opposite cold phase is called La Ninã and the system oscillates between warm and cold conditions over a return period of about 4 years, on average with large deviations (e.g. no ENSO occurred in between 1927 to 1940). The climatic impact of ENSO is spatially and temporally complex and involves time delays and each El Ninõ event is distinct from another one in terms of precipitation, temperature, etc. (Jacobs et al., 1994). There exists a negative correlation between the indexes of these oscillations, i.e. the sea surface temperatures (SST) averaged over the tropical east-central Pacific on the one hand and the Southern Oscillation Index (SOI), i.e. the normalized pressure difference between Tahiti, in the mid-Pacific, and Darwin, Australia on the other hand. The SOI measures the pressure gradient across the tropical Pacific, an indicator of equatorial wind variations. When the SOI index reaches low negative values, a strong El Niño is in progress with air pressure low in the eastern Pacific and high in the western Pacific. Reversely when the SOI index goes highly positive, this indicates a La Niña episode, with air pressure high in the eastern Pacific and low in the western Pacific, corresponding to a strengthening of the Walker circulation and to the upwelling of cold deep sea water which cools the sea surface to below average temperatures. Initially, it was thought that the ENSO variability affected only the Pacific ocean, but the severe ENSO event of 1982/1983, when the sea surface off Peru warmed by more than 7° C, demonstrated that there are strong links to weather in other regions , e.g. floods in California, intensified drought in Africa, etc. but it was further discovered that the effects were even much broader and that planetary-scale oceanic waves crossed the Pacific and that effects of El Nino events can be extremely long-lived (Jacobs et al., 1994). The observation of this global connection implied that the oceanic and atmospheric anomalies of the equatorial Pacific might be the key to accurate seasonal weather forecasts in other regions. ENSO has major regional impacts, but the most obvious is that the displacement of warm water from the west Pacific and the Indian Ocean to the east Pacific takes the rain with it, causing extensive drought in the western Pacific and rainfall in the normally dry eastern Pacific and for example, Singapore experienced the driest February in 2014 since records began in 1869, with only 6.3 mm of rain falling in the month and temperatures hitting as high as 35 °C on 26 February. There are extensive regional impacts over northern and southern Americas, and all over the western Pacific to the least, but they will not be addressed here.

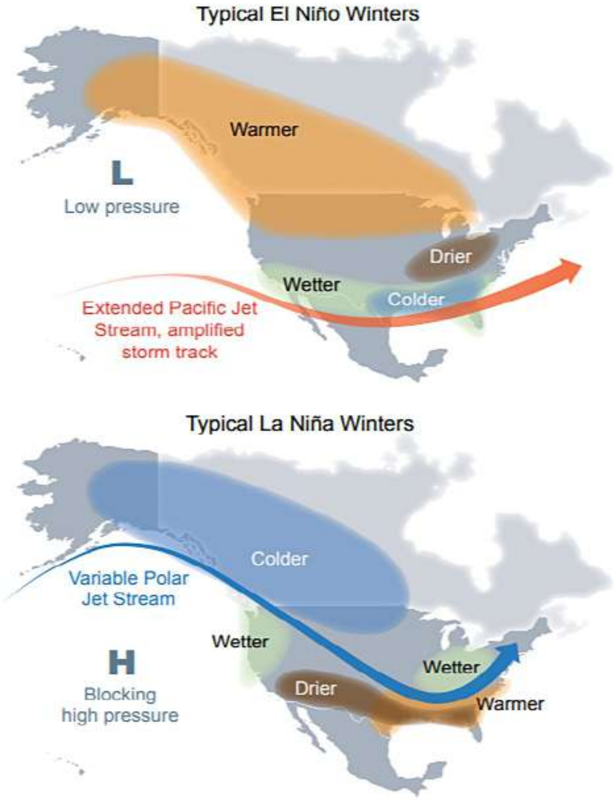

Figure 65. The typical January–March weather anomalies and atmospheric circulation during moderate to strong (top) El Niño and (bottom) La Niña natural variability patterns. These influences over the United States often occur most strongly during the cold season. From (USGCRP, 2017)

Nevertheless, it will be stressed that it was recently discovered that the impact of ENSO goes beyond the previously known regional influence and that it has a global reach by means of "teleconnections" acting on the stratosphere as it affects "*the strength and variability of the stratospheric polar vortex in the high latitudes of both hemispheres, as well as the composition and circulation of the tropical stratosphere*" (Domeisen et al., 2018) or through the northern winter PDO modulation when it is in phase with ENSO (Rao et al., 2019).

ENSO can influence the global circulation pattern thousands of kilometers away and during El Nino events, deep convection and heat transfer to the troposphere is enhanced over the anomalously warm sea surface temperature generating Rossby waves. These planetary waves form at preferred locations both in the North and South Pacific Ocean, and the teleconnection pattern is further established within 2–6 weeks. ENSO driven patterns modify surface temperature, humidity, wind, and the distribution of clouds over the North Pacific that alter surface heat, freshwater fluxes and thus induce sea surface temperature, salinity, and other anomalies. In fact what ENSO shows is that if the atmospheric response seems short-term, short-lived and somewhat chaotic from one episode to the next, the oceans are the major sinks (providing for long term storage of heat, of CO_2, etc.) and they organize the world wide circulation and hysteresis with teleconnections to distant parts of the planet. The extraordinary complexity of these oscillations that may further be intertwined and their impact on the weather over durable periods and distant locations are one more telltale of the set and variety of the phenomenons acting and once again completely marginalize the expected additional 2.6 W/m^2 due to the increase of the infamous trace gas.

The lasting existence and patterns of ENSO throughout the Holocene have been fiercely debated. Sandweiss et al. (2020) report that by using multi-proxy evidence from the Peruvian coast and elsewhere they found "*that EN frequency varied over the Holocene: 1) present in the Early Holocene; 2) absent or very low frequency during the Middle Holocene (~9 to 6 ka); 3) low after ~6 ka; and 4) rapidly increasing frequency after 3 ka*". This is somehow concordant with what Carré et al. (2014) state when they report that "*ENSO variance was close to the modern level in the early Holocene and severely damped ~4–5 ka. In addition, ENSO variability was skewed toward cold events along coastal Peru 6.7–7.5 ka owing to a shift of warm anomalies toward the Central Pacific. The modern ENSO regime was established ~3–4.5 ka*".

This is in accordance with Zhang et al. (2014) "*In agreement with other proxy evidence from the tropical Pacific, the mid-Holocene (5600–3500 yr BP) was a time of consistently weak El Niño activity*". Moving away to subtropical Australia, even if the various stages aforementioned could not all be identified, it is worthwhile to notice that the current ENSO regime is also established as dating back to ~3.2 kyr as stated by Barr et al. (2019) "*We find a generally wet (more La Niña like) mid-Holocene that shifted towards drier and more variable climates after 3200cal. yr BP, primarily driven by increasing frequency and strength of the El Niño phase*". In the end, the attribution exercise seems compromised for those who would like to see any anthropogenic print on the oscillation as natural fluctuations are large and ENSO has been responding to natural triggers for more than 10 kyr so far and Cobb et al. (2013) report "*Our results suggest that forced changes in ENSO, whether natural or anthropogenic, may be difficult to detect against a background of large internal variability*". The high natural internal variability is well attested by Corrège et al. (2000). Carré et al. (2014) also report "*that record clearly shows the occurrence of eight large flood events before 8 ka and 14 after 4 ka (Fig. 3B), which is also consistent with earlier studies of flood-related debris flow deposits in Peru. We conclude that ENSO was sensitive to changes in climate boundary conditions during the Holocene, including but not limited to insolation*".

From the studies aforementioned, one can infer that during the warmest part of the Holocene, El Niño's patterns were fewer and weaker than currently as displayed on Figure 33, and this is related to the northern displacement of the ITCZ due to an increased insolation at the time resulting from the axial precession maximum (26,000 years for a complete cycle, remember the Green Sahara), thus the increased frequencies and stronger ENSO oscillations are a testimony to a cooling world moving into the Neoglacial stage of the interglacial, creating strong natural climatic hazards, such as floods (Carré et al., 2014). During the Holocene Climatic Optimum there were a lot less El Niño, and Sandweiss et al. (2020) considered ENSO quasi absent during the interval spanning 9-6 kyr. Therefore, ENSO has been more or less active for the entirety, at least, of the interglacial and the Holocene has demonstrated strong climate adjustments to solar and orbital triggers with ENSO and other oscillation(s) responding to these natural solicitations without any anthropogenic need or contribution whatsoever. These are typical significant climate change drivers, with solar connections known for at least the short-term Wolf cycle, e.g. (Zhai, 2016 ; Misios et al., 2019), that let imagine how such oscillations may leverage stronger modulations driven by more powerful solar cycles or orbital variations, like the Bray cycle or yet unknown but highly probable stronger solar variability as Lockwood and Skiff (1990) concluded their study of similar stars to the Sun by stating "*the present short record of solar variability is remarkable only in its present restraint*". It would certainly be highly presumptuous or simply preposterous to conclude from sketchy TSI measures since 1979[201], i.e. 41 years and reconstructed TSI records for a bit longer, that solar variability is a settled subject and that one can bank on a solar constant to ensure a stable climate. Changing modes of ENSO activity at millennial and multi-centennial timescales are therefore induced by variations in the solar radiation budget associated with changes in solar activity and orbital oscillations and especially the precession of the equinoxes (mainly axial but also apsidal). This is what natural climate change has always been and mankind must adapt and stop thinking that we've taken the driver's wheel, we are just passengers of this nice planet that we all want to take care of. As far the modeling of ENSO is concerned, we will see that even the latest Complex coupled Global Circulation Models (CGCMs) fail at predicting with a reliable accuracy even if one should expect a El Niño or a La Ninã on short time scales (Collins et al., 2010), e.g. the next to be event with certainty and when to expect it, and some projecting more El Niño and others suggesting a tendency towards greater La Niña-like conditions (Steig, et al., 2013), therefore one can easily imagine how speculative it is to imagine modeling and reproducing the climate back just to LIA or even more, only to the two previous millenniums, and puts in perspective the fancy claims asserted by IPCC and Lloyd (2012) p. 395.

The far-reaching effects of El Niño have just been briefly described but this is not the only Pacific-wide inter-annual anomaly which has been recognized and at least another inter-decadal oscillation is well known, with strong influences upon weather patterns over North America, i.e. named North Pacific Oscillation (NPO) when it was first recognized by Walker and Bliss (1932) p. 57, and currently referred to as the Pacific Decadal Oscillation[202] (PDO). As early as 1976, the development of stochastic climate models led Hasselmann (1976) to propose an approach where "*the coupled ocean-atmosphere-cryosphere-land system is divided into a rapidly varying "weather" system (essentially the atmosphere) and a slowly responding "climate" system (the ocean, cryosphere, land vegetation, etc.)*", the climate system, acting as an integrator of the short-period random weather excitation and displaying a "red" noise feature (i.e. higher variance at lower frequencies or very long periods) and Hasselmann (1976) observes that "*although GCM's provide important*

201 Ensuring the integrity of time-series of measurements coming from different sensors (with their own internal deterioration over time) embarked with various satellites and their grouping as a coherent set of measures is a challenge in itself.

202 The Pacific Decadal Oscillation (PDO) is a pattern of Pacific climate variability similar to ENSO in character, but which varies over a much longer time scale. The PDO can remain in the same phase for 20 to 30 years, while ENSO cycles typically only last 6 to 18 months.

information for climate studies, they are not suitable for the simulation of climate variability as such". This work is extended by Frankignoul and Hasselmann (1977) who study Sea Surface Temperature and thermocline variability and demonstrate that "*long-time SST anomalies may be explained naturally as the response of the oceanic surface layers to short-time-scale atmospheric forcing*", here the word forcing means excitation (Markov process). Frankignoul and Hasselmann (1977) are the first to study the correlation functions and power spectra of spatially averaged SST anomalies and atmospheric pressure anomalies for the North Pacific (North of 20°N), where the SST anomalies were correlated with atmospheric surface pressure anomalies and conclude that "*the principal statistical properties of SST anomalies can be explained by a simple model in which the atmosphere acts as a white-noise generator and the ocean as a first-order Markov integrator of the atmospheric input. According to this picture,* ***the evolution of SST anomalies is unpredictable****, except that, once generated, they tend to decay with an e-folding time of the order of 1/2 year*" reminding us the chaotic nature of weather, the excitation being represented by the passage of storms that alter the ocean mixed layer temperature via surface energy fluxes and Ekman currents. The response of the system is damped due to the enhanced (reduced) heat loss to the atmosphere over the anomalously warm (cold) SST via turbulent energy and longwave radiative fluxes and its further impact on climate. These chaotic triggers and the oceanic responses through oscillations support the following quote by Roy Spencer "*The case for natural climate change I also present an analysis of the Pacific Decadal Oscillation which shows that most climate change might well be the result of….the climate system itself! Because small, chaotic fluctuations in atmospheric and oceanic circulation systems can cause small changes in global average cloudiness, this is all that is necessary to cause climate change*". The PDO is a long lasting oceanic feature, though displaying strong variability as studied by Biondi et al. (2001).

Another major weather pattern with climate implications as it can also be traced back throughout the Holocene is the North Atlantic Oscillation, NAO (Wanner, 2001; Luo and Cha, 2012). Throughout the North Atlantic basin there is a pressure field characterized by a region of low pressure centered on Iceland and a region of high pressure centered on the Azores. In general, a lower than normal pressure in Iceland corresponds to a higher than normal pressure in the Azores and vice versa. This oscillation of pressure modes is a characteristic of the North Atlantic disturbance regime, referred to as the NAO. If the pressure difference is enhanced, then stronger than average westerlies occur across the Atlantic, cold winters are experienced over the northwest Atlantic, winters are warm over Europe, Siberia, and East Asia, and conditions are wetter than average in Scandinavia and drier in the Mediterranean.

To simply characterize these opposing barometric situations over the Northern Hemisphere, climatologists have established an index dating back to 1864 and NAO reconstructions have been made up to 1,500 (Luterbacher et al., 2002b). This index is defined and measured as the difference in mean daily pressure (normalized by the standard deviation over the measurement period, which has the dimension of a force per a surface), between two fixed weather stations (Uppenbrink, 1999). It is interesting to notice that this NAO oscillation and the associated Atlantic Multi-decadal Oscillation (AMO) can both be retrieved over longer time periods, i.e. quite all throughout the Holocene, e.g. Husum and Hald, 2004, in their benthic foraminifera assemblages and their corresponding $\delta^{18}0$ reconstruction of the Malangen fjord in northern Norway, recognize a pattern similar to the NAO during the middle and recent Holocene as did Knudsen et al. (2011) who identified over the past 8,000 years typical AMO-type ~55- to 70-year variations, linked to internal ocean-atmosphere variability and established that "*the coupling from the AMO to regional climate conditions was modulated by orbitally induced shifts in largescale ocean-atmosphere circulation*".

Therefore these weather patterns have extended long enough to be considered as climate features even if they have been of highly variable intensity, both in time and space. They appear under control of solar variability or / and of orbitally induced shifts in large scale ocean-atmosphere circulation. One will take due notice that over the Holocene, changes of [CO_2] played no role into these natural climate changes that demonstrated a variability superior to what we have experienced during the modern time, i.e. since the end of LIA and for example, Luterbacher et al (2002b) conclude "*The late twentieth century NAO extremes are within the range of variability during earlier centuries*". Finally, Mazzarella et al. (2011) define a time-Integrated NAO, i.e. INAO with the formula $INAO(t)=INAO(t-1)+NAO(t)$ for each year "t" (INAO has the dimension of a mass per a length per a time) and using this time series, establish 1) a correlation with historical European aurora records since 1700, e.g. (Stothers, 1979; Křivský and Pejml, 1988; NOAA ftp[203]), which suggests that this ~60-year dominant climatic cycle has a solar–astronomical origin and 2) that INAO correlates very well with the variations of the Length of the Day (LOD, i.e. The Earth's rotation speed in millisecond[204]) and the Met Office Hadley Centre Sea Surface Temperature dataset HadSST3 (Mazzarella, 2013). Mazzarella et al. (2011) states that "*LOD is a good proxy for climatic changes under the assumption that it is the integral of the different circulations that*

203ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/AURORAE/
204https://hpiers.obspm.fr/eop-pc/earthor/ut1lod/UT1.html

occur within the ocean–atmosphere system both along latitude (zonal circulation) and longitude (meridional circulation)*". It is also worth noticing that the Medieval Warm Period known also as Medieval Climate Optimum was caused by a persistent and large positive NAO (that corresponds to high values of INAO) whereas the LIA was characterized by a weaker NAO, as stated by Trouet et al. (2009) "*We present here a 947-year-long multidecadal North Atlantic Oscillation (NAO) reconstruction and find a persistent positive NAO during the MCA. Supplementary reconstructions based on climate model results and proxy data indicate a clear shift to weaker NAO conditions into the Little Ice Age (LIA)*".

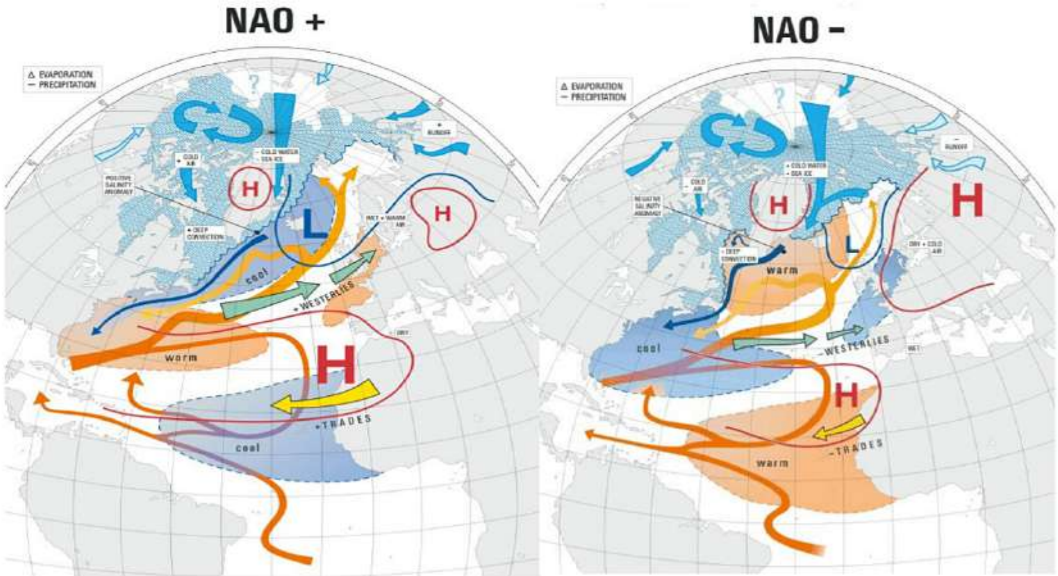

Figure 66. Temperature, pressure, wind, sea ice, ocean current and precipitation changes related to a positive and negative NAO phase (KLIMET, Grüppe fur Klimatologie/Meteorologie, Geography, University of Bern, Switzerland). Source: Rombaut (2010).

Over short time-scales, Roy (2018b) also explores how explosive volcanism during later two decades of the last century (1976–1996), i.e. El Chichón (1982) and Pinatubo (1991) can have had amplifying effects on the positive NAO phase. This in turn leads to a cascade of inter-relations via extra-tropical Atmospheric Rossby waves, thus impacting the Aleutian Low and which acting throughout an oceanic and atmospheric bridge has a modulating effect on central pacific ENSO. Roy (2018b) also shows how the Indian Summer Monsoon may have also been disrupted by these events.

Interestingly, until the discoveries of Bond et al. (2001) it was assumed that the Sun was responsible for the oscillations observed in the North Atlantic "*Surface winds and surface ocean hydrography in the subpolar North Atlantic appear to have been influence by variations in solar output through the entire Holocene*" as evidenced by the correlation between cosmogenic isotopes and IRDs. The work by Debret et al. (2007) is a breakthrough as they manage to show that the 1,500 year cycle (i.e. Bond) has an oceanic origin, while the others, i.e. 1,000 (Eddy) and 2,500 (Bray-Hallstatt) have a solar origin. As stated by Debret et al. (2007) "*Here we show by the use of wavelets analysis that it is possible to distinguish solar forcing of 1000- and 2500- year oscillations from oceanic forcing of 1500-year cycles. Using this method, the relative contribution of solar-related and ocean related climate influences can be distinguished throughout the 10 000 yr Holocene intervals since the last ice age*". The two major drivers of the climate throughout the entire Holocene are therefore well identified, i.e. the Sun and the oceanic circulation, here the NAO in this North Atlantic region, the NAO being related to the THC and therefore to the Sun output as well in a coupled-system. Furthermore, as demonstrated by Andersen et al. (2004), the Holocene showed a very unstable climate, its internal variability was superior to modern time (2,000 BC up to now) and no relationship can be established with GHG changes.

Several authors, e.g. (Andersen et al., 2004; Giraudeau et al., 2000) confirm the presence of a climate oscillation throughout the Holocene that could be associated with the North Atlantic Oscillation and others like Cronin et al. (2005) in the Eastern U.S. or Rimbu et al. (2004) through a study of surface temperatures in tropical regions and the North Atlantic by alkenones, coupled with an Ocean-Atmosphere model, recognized the signature of the Arctic Oscillation/North Atlantic Oscillation variability at the millennium scale. They assume that AO/NAO oscillation plays a role in generating not only a trend but above all a millennial variability during the Holocene with a return period of 2500 years (Bray-Hallstatt solar cycle), period also met in various other parts of the world (Debret, 2008).

It has been found that a positive index of the NAO (i.e. above-normal pressures in the Azores and below-normal pressures towards Iceland) is associated with drier conditions over central and southern Europe, and wetter and milder conditions over the northwest Atlantic (Scandinavia, Iceland...). On the other hand, a negative index leads to weakened oceanic westerly currents and thus rather dry and anticyclonic conditions over northern Europe, while southern Europe is then wetter (Figure 66). For example, when glacier budgets are above average in the Alps, they tend to be lower than normal in Scandinavia, and conversely, when glaciers advance in Scandinavia, they retreat in the Alps (Six et al., 2001; Guyard et al., 2013). In fact, Scandinavian glaciers are sensitive to precipitation inputs, while temperatures appear to be predominant for the annual balance of Alpine glaciers (Six et al., 2001). Other responses to changes in the NAO include variations in the distribution, intensity and prevalence of storms, ice volume and Iceberg fluxes. Multivariate linear regression was used by Hurrell (1996) to show that "*nearly all of the cooling in the northwest Atlantic and the warming across Europe and downstream over Eurasia since the mid-1970s results from the changes in the NAO, and the NAO accounts for 31% of the hemispheric inter-annual variance over the past 60 winters*".

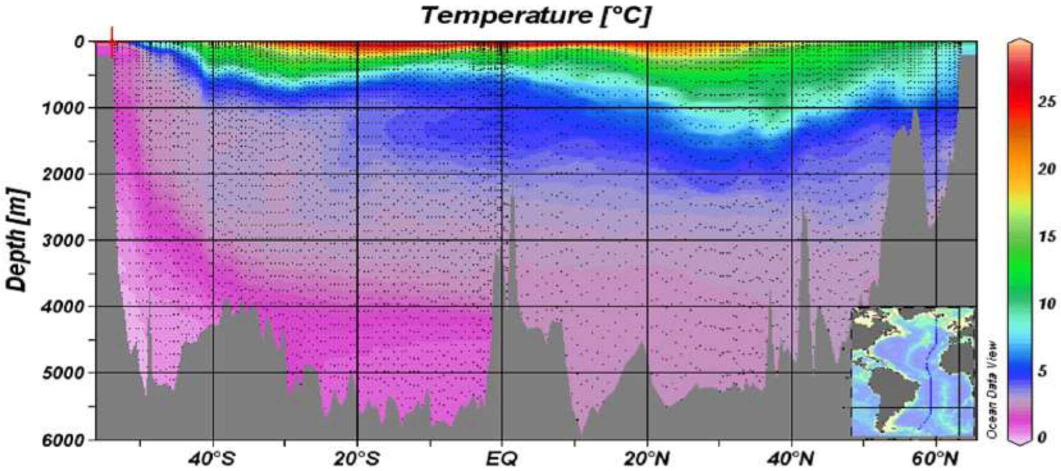

Figure 67. North–south vertical cross section of ocean temperature with depth in the Atlantic Ocean, showing its huge heat storage capacity given the very high specific heat capacity of water[205] and that most of the ocean (95%) is below 5°C. Source: Spencer (2016).

Furthermore, Rohling et al. (2002) demonstrate that the AO / NAO effect is felt far away from where it originates and record its imprint down into the Aegean Sea, through the SST in the area "*A direct atmospheric link is revealed between Aegean sea surface temperature (SST) and high-latitude climate. The major Holocene events in our proxies of Aegean SST and winter/spring intensity of the Siberian High (GISP2 K^+ record) follow an ~2300 year spacing, recognized also in the $\Delta^{14}C$ record and in worldwide Holocene glacier advance phases, suggesting a solar modulation of climate. We argue that the primary atmospheric response involved decadal-centennial fluctuations in the meridional pressure gradient, driving Aegean SST events via changes in the strength, duration, and/or frequency of northerly polar/continental air outbreaks over the basin*".

The oceans are in inverted thermal situations, with the warm water lying at the surface (Figure 67) and therefore hardly mixing naturally with the cold deep waters. But, as we have just seen, e.g. with ENSO and NOA, by means of these oscillations vertical mixing still occurs and enables to cool the surface and warm the deep ocean. Given the overall low temperature of the oceans, their huge volume and the high specific heat capacity of water, they simply represent the main bulk of storage of energy over long time-scales. Therefore, the oceans are a direct source of strong natural climate change, and as the rate of mixing keeps changing in a rather chaotic manner due to the stochastic nature of the ocean-atmosphere interactions as hinted to before (Frankignoul and Hasselmann, 1977), any change in the rate of exchange between warm surface waters and cold deep waters can cause global warming or cooling as planetary waves will create teleconnections propagating the changes far from where they originated. These changes can occur over a period of decades of centuries (i.e. multi-decadal oscillations like AMO), so any small changes in the rate of overturning can cause the climate to change over long periods of time.

Ellsaesser (1984) was very conscious of the essential role played by the oceans when he stated long ago " *current eager acceptance of oceanic thermal lag as the "explanation" as to why CO_2 warming remains undetected, reemphasizes that the atmosphere cannot warm until the oceans do. The logical implication follows that most current climate models are*

205 Water has the highest specific heat capacity of any liquid and has to absorb 4,184 Joules of heat (i.e. energy) for the temperature of one kilogram of water to increase 1°C

lacking in relevance; they have not been constructed with ocean surface temperature as the fundamental variable. When the problem is attacked from this view, sensitivity to CO_2 is significantly reduced; a position also strongly supported by the available palaeoclimatic data". It is unfortunate that the objective followed by many seems to be providing a biased support to the high sensitivity promoted by IPCC and not to account for what Mother Nature does, e.g. negative feedback at the TOA resulting from the drying of the high troposphere but leading to a stronger radiative emission at a lower (altimetric level) of water vapor finely tuning the Earth's OLR, or better accounting for the massive hysteresis provided by the oceans and their circulation, etc.

Therefore, summing it up, exactly as the ENSO had a major regional impact with teleconnections way beyond the Pacific area, and the PDO led to clear weather patterns over north America (down to Mexico and up to Canada), AO and NAO / AMO served as a structuring circulation mechanism in the Atlantic and beyond and influenced major climate patterns and changes that all paleo-climate specialists and reference papers trace back throughout the entire Holocene to solar variability and specially the 976 yr ±53 Eddy cycle but even more importantly the 2,310 yr ±300 Bray-Hallstatt cycle in a coupled ocean-atmosphere system. Holocene climate variability was way beyond what has been observed during the modern period, and had no relationship whatsoever to any GHGs changes and particularly not to CO_2 concentrations[206]. But this was before it became beyond any understandable reason apparently necessary to have recourse to a "0.007% deus ex machina" useless invention, to account for what had been perfectly explained so far during 11,700 years by whimsical Nature and its tricks. Climate (activism) has its political reasons and benefits that must go well beyond the simple search of the scientific truth, but this will be addressed into the "rogue and dystopian policies" section later.

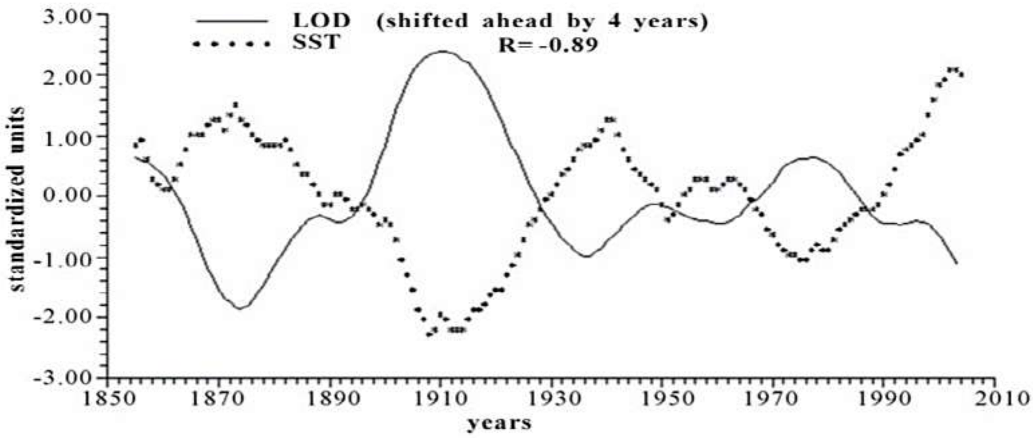

Figure 68. Earth rotation and sea surface temperature anticorrelation. Continuous line, detrended yearly values of ΔLOD with a 5-year running mean smoothing, shifted ahead 4 years. Dotted line, detrended yearly values of Northern Hemisphere SST, from HadSST3 with a 5-year running mean smoothing. Source: Mazzarella (2013).

The quasi-biennial oscillation (QBO) is a most remarkable atmospheric phenomenon and a major determinant, with ENSO and other oceanic circulation features (e.g. THC) of seasonal and inter-annual weather variability.

"*In the equatorial stratosphere, strong zonal winds circle the Earth. They originate at an altitude of 10 hPa (~ 35 km) and migrate downward at ~ 1 km/month until they dissipate at the base of the stratosphere at 80 hPa (~ 20 km). As the new zonal wind belt originates to replace the downward migrating previous one, it moves in an opposite direction, alternating easterly and westerly winds (Baldwin et al., 2001; figure 95). The QBO is usually defined at 30 hPa, where winds in one direction will start and increase in strength, and then decline and be replaced by winds moving in the opposite direction. The easterly and westerly phases of the QBO alternate every 22-34 months with an average of 28 months, but the periodicity is tuned to the yearly cycle, so the phase reversal occurs preferentially during the Northern Hemisphere late spring. The signature of the QBO in angular momentum, rather than having only a single spectral frequency peak at ~ 28 months, includes two additional spectral peaks at the annual frequency plus or minus the QBO frequency. In a breakthrough at the time, Lindzen and Holton (1968) proposed, and it was later demonstrated, that convection-originated vertically-propagated gravity waves provided the necessary wave forcing (momentum) for the QBO generation and maintenance (figure 95)*" in: Climate change mechanisms, (Javier, 2018a).

206 https://en.wikipedia.org/wiki/Abrupt_climate_change

The quasi-biennial oscillation leads to the reversal of the zonal winds in the tropical stratosphere, while the 3-4-year component matches the ENSO signal and during periods of El Niño, the tropospheric zonal winds have westerly anomalies. "*At the peak of the westerly anomaly period, the globally integrated AAM is notably strong, driving a slowing of the Earth's rotation. During the 2015-16 winter season, El Niño produced a LOD excursion reaching 0.81 ms in January 2016*" (Javier, 2018a).

Lambeck and Cazenave (1976, 1977) reported on the similarity between the trends of numerous climate indexes for the past two centuries and changes in ΔLOD, in particular surface temperature and pressure, were related to wind strength. They concluded that periods of increasing zonal winds and global-surface warming correlate with an acceleration of the Earth which is quite normal given the orientation of the geostrophic circulation while periods of decreasing zonal circulation correlate with a deceleration of the Earth. They found a lag of 5-10 years in the climatic indexes. Their result has been reproduced multiple times, and an example is shown with SST and ΔLOD (Figure 68; Mazzarella, 2013) as per Javier (2018a).

The close correlation between SST and the Atmospheric Angular Momentum (AAM) and LOD has been known for a long time. The correlation is explained as due to ocean-atmospheric coupling where upwelling and down-welling depend on wind strength, and atmospheric pressure correlates with SST. Salstein (2015), one of the foremost experts in AAM, explains that the atmosphere has been simulated by a large number of models that are driven solely by the temperature of the underlying ocean surface. Based on these models, AAM has been calculated since the late 19th century from available SST data, and checked against LOD estimations based on lunar occultation measurements.

Probably the first great presentation of the large scale oceanic circulation was provided by Broecker (1991) under the term of "**The Great Ocean Conveyor**". This naming was progressively replaced by the Thermohaline circulation[207] (THC) or by the Meridional Overturning Circulation (MOC) or AMOC when referring specifically to the Atlantic. The term MOC is more accurate as it does not separate the part of the circulation driven by temperature and salinity alone from other factors such as the wind and tidal forces and refers to the large-scale ocean circulation that is driven by global density gradients created by surface heat and freshwater fluxes, given that in the deep ocean, the predominant driving force is differences in density, caused by salinity and temperature variations (e.g. increasing salinity and lowering the temperature of a fluid both increase its density). A more recent presentation is provided by Rahmstorf (2006). It has long been surmised that oceanic circulation was one of the major drivers of climate, assessing the residence time of the water to determine the overturning rate and the density drivers such as temperature and salinity changes have been major challenges for a long time.

Knowing the residence time can be done either by deriving it from a combination of current-meter measurements and geostrophic flow calculations as physical oceanographers do, or by resorting to the decay of some radionuclide, e.g. radiocarbon measurements on samples of deep water. The mean residence time can be obtained by dividing the volume of water contained in the deep Atlantic by the radio-carbon-based estimate of the flux for the North Atlantic Deep Water (NADW) into the deep Atlantic, further corrected for the impact of temporal changes in the $^{14}C/^{12}C$ ratio for atmospheric CO_2, and of the contribution of the Antarctic Bottom Water (AABW) the only competitor to NADW for space in the deep Atlantic.

Broecker (1991) stated "*The major obstacle to calculation from radiocarbon measurements of residence times for water in the deep Atlantic is the determination of the initial $^{14}C/^{12}C$ ratio for each parcel. The reason is that all waters in the deep Atlantic are mixtures of northern component water with a comparatively high $^{14}C/^{12}C$ ratio ($\Delta^{14}C$ = -68‰) and of southern component water with a comparatively low $^{14}C/^{12}C$ ratio ($\Delta^{14}C$= -158‰). Because of the large difference in the $\Delta^{14}C$ values for these end members, much of the variation in $^{14}C/^{12}C$ ratio within the deep Atlantic is created by differences in the end-member blend*".

Given this blend between end-members of the **deep Atlantic waters**, one can deduce from the radiocarbon deficiency for the entire deep Atlantic which averages ~22‰ that it corresponds to a **residence time of about 180 years**. As the volume of the deep Atlantic reservoir is estimated to 1.55×10^{17} m^3 (i.e., 2,500 m mean thickness with an area of 6.2×10^{13} m^2), to achieve this residence time requires a ventilation flux of 8.6×10^{14} m^3/y or 27 Sv (with 1 Sverdrup = 10^6 m^3/sec) and as the flux of AABW is ~4 Sv, the flux of NADW is estimated to be 23 Sv (Broecker, 1991). These are huge values, indeed.

207 https://en.wikipedia.org/wiki/Thermohaline_circulation provides a quick introduction.

In the 1990s authors like Broecker (1991) were very conscious of the major role played by the oceanic circulation but were also aware that is was just one important component of the Earth's climatic system which also involved obviously the atmospheric circulation with Hadley cells having an influence on cloudiness and atmospheric water-vapor content. They knew that some other mechanisms had to be involved to explain for a transition out of an ice age, and this will be addressed in the next section dealing with “Antarctica and Arctic”.

Figure 69 give a schematic description of the THC circulation: the red curves in the Atlantic indicate the northward flow of water in the upper layers, in this process heat is released to the atmosphere. The filled orange circles in the Nordic and Labrador Seas indicate regions where near-surface water cools and becomes denser, causing the water to sink to deeper layers of the Atlantic, this process is referred to as “deep water formation.”. The light blue curve denotes the southward flow of cold water at depth. At the southern end of the Atlantic, the AMOC connects with the Antarctic Circumpolar Current (ACC). Deep water formation sites in the high latitudes of the Southern Ocean are also indicated with filled orange circles. These contribute to the production of Antarctic Bottom Water (AABW), which flows northward near the bottom of the Atlantic (indicated by dark blue lines in the Atlantic). The circles with interior dots indicate regions where water up-wells from deeper layers to the upper ocean, after: (Kuhlbrodt et al., 2007).

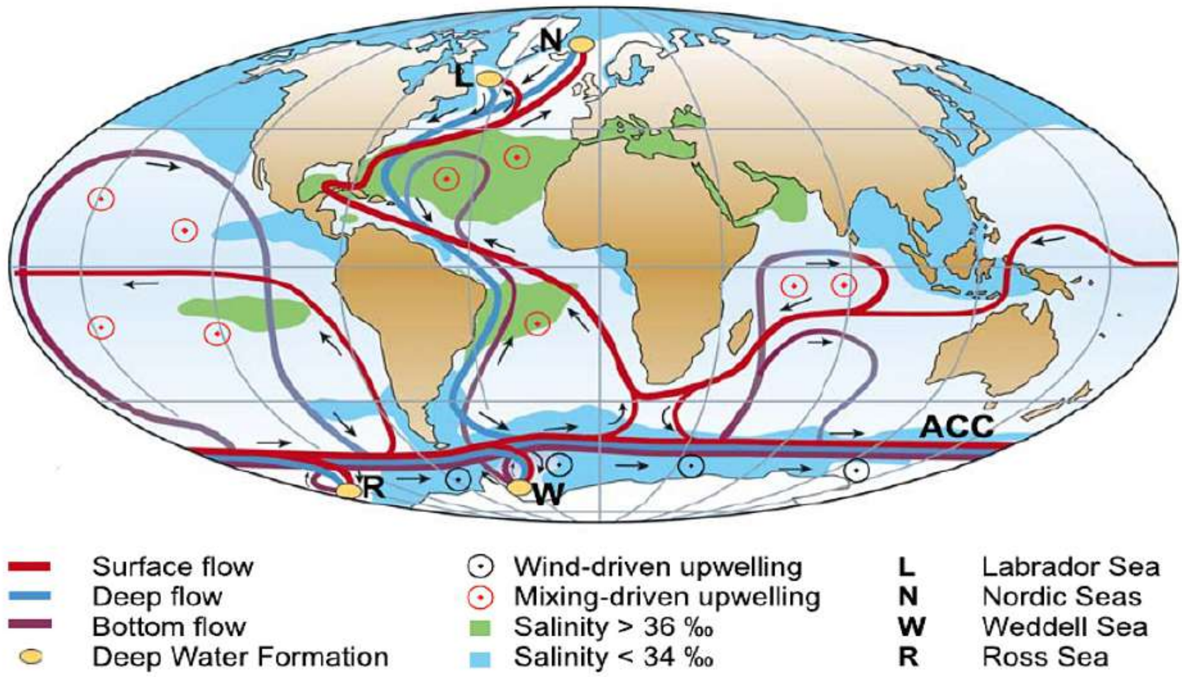

Figure 69. Schematic of the ocean circulation associated with the global Meridional Overturning Circulation (MOC), with special focus on the Atlantic section of the flow (AMOC), in the Atlantic, warm and saline waters flow northward all the way from the Southern Ocean into the Labrador and Nordic Seas. By contrast, there is no deep-water formation in the North Pacific, and its surface waters are fresher. Deep waters formed in the Southern Ocean become denser and thus spread in deeper levels than those from the North Atlantic. Note the small, localized deep-water formation areas in comparison with the widespread zones of mixing-driven upwelling. Wind-driven upwelling occurs along the Antarctic Circumpolar Current (ACC). After Kuhlbrodt et al. (2007).

What has been noticeable is that studies by Broecker (1991) and many subsequent authors have overlooked the fundamental role played by the southern oceans, probably given the NH focus of the researchers due to their own geographical location, e.g. Broecker worked for the Geological Observatory of Columbia University (NY), but more recently new studies have shown the central role played by the southern oceans into the circulation and heat distribution across the planet by focusing onto the return path from the cold waters up to the surface, largely driven by winds. The distribution of the oceans is very uneven across the globe and the southern hemisphere is displaying a much broader ensemble of oceans, all interacting and control a large part of the circulation of these immense reservoirs and the way they communicate with the surface, including the heat release and degassing. Furthermore, in contrast to the northern Atlantic where wind driven upwelling is confined to the upper ocean, surface winds in the Southern Ocean drive upwelling of deep water and a special sub-marine topography, devoid of meridional topographic barriers down to a depth of about 2,500 m, enable the routing of currents along an oceanic band that circles the Earth without encountering any obstacle (Kuhlbrodt et al., 2007).

Given the immensity of the oceanic volumes and the enormity of the heat storage capacity, the oceans also representing the major reservoir of mobile CO_2, one can easily understand that the oceanic circulation associated to the previous oscillations (e.g. ENSO, PDO, NAO, etc.) that were described represent a major component of the Earth climatic system, and its study has led to numerous speculations.

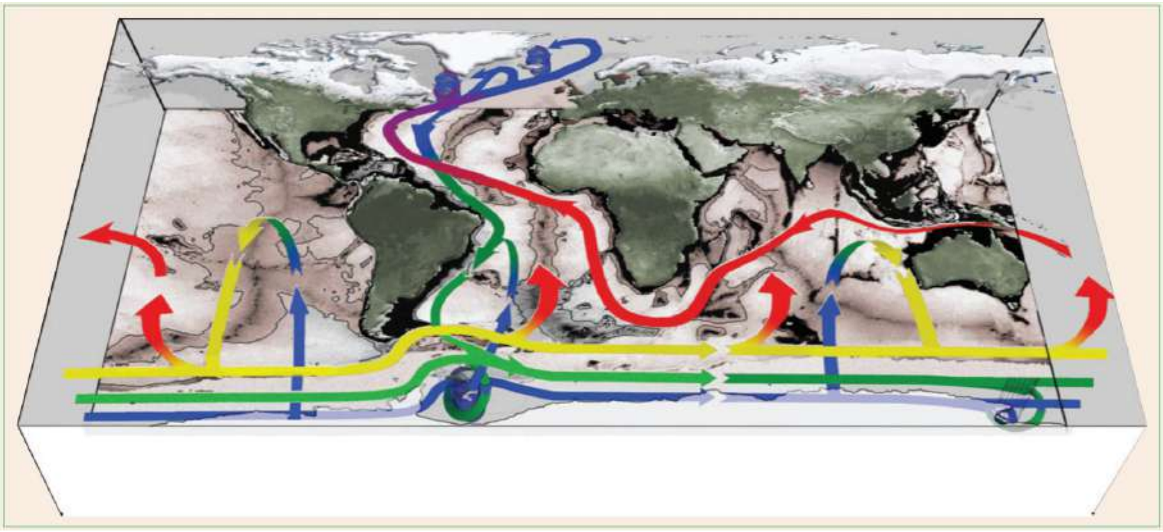

Figure 70. Large surfaces of equal density represented by rising yellow–red arrows widely circulate over the main ocean basins and the upwelling around Antarctica is mainly due to the action of wind and eddy processes. In the northern Atlantic basin, warm water initially traveling broadly towards the East is cooled in the subpolar gyre and eventually becomes dense enough to sink under the thermocline in the polar seas and Labrador Sea convection regions, with blue arrows representing the down-welling of dense water flowing southwards in the deep branch of the South Atlantic current (green arrow), before joining the ACC system. After Marshall and Speer (2012).

It is especially noteworthy that many authors have conjectured the response of such a vast thermodynamical system to minor disturbances such as for example, increasing CO_2 scenarios., and have projected a weakening, at least of the northern branch of the AMOC, by means, again, of simulations resorting to general circulation models of the coupled ocean–atmosphere system. The significance of such a possibility should certainly not be too much overrated as Clark et al. (2002) report "*But it remains difficult to assess the likelihood of future changes in the thermohaline circulation, mainly owing to poorly constrained model parameterizations and uncertainties in the response of the climate system to greenhouse warming*", and Rahmstorf (2006) adds "*Model simulations – even those that lead to a complete shutdown in future – find that the **influence of anthropogenic warming** on the THC until today should be **smaller than the natural variability**. Therefore, any variations observed to this date are likely related to natural oscillations*". This is common sense given the minuscule energetic contribution that an increase of CO_2 can provide as compared to the enormous amount of heat carried over by the oceanic circulation, an active and highly nonlinear component of the climatic system which furthermore shows an hysteresis of sort of 200 years, given the residence time unveiled by Broecker (1991).

Furthermore, most if not all authors have acknowledged that previous massive climate change which occurred in the not to distant past, say back to the Eemian, originated in circulation changes and Rahmstorf (2002) states "*Increasingly clear evidence implicates ocean circulation in abrupt and dramatic climate shifts, such as sudden temperature changes in Greenland on the order of 5–10 °C and massive surges of icebergs into the North Atlantic Ocean — events that have occurred repeatedly during the last glacial cycle*". In fact, Arctic has always appeared more sensitive to warming than Antarctica and the influx of freshwater from the melting of the Greenland ice-sheets, including changes in the hydrological cycle, have contributed to modifying the THC, and for example to the advent of Heinrich events (Figure 37) over the last 70,000 years of the order of ~0.1 Sv [Sverdrup (Sv):1 Sv approx $10^6 m^3 s^{-1}$], this is what a continuous melting of the Greenland ice-sheets for 1,000 would lead to. This also shows, that even though Arctic has seen its ice sheet receding, the situation is far from exceeding normal climate variability as demonstrated by the abrupt changes that occurred naturally, e.g. since the Eemian.

The melting of the Greenland ice-sheets, which is in no way certain though it could happen for perfectly natural reasons as we've seen it happen many times in the past, and exaggerated outcomes going as far as a radical southward shift of the Inter-Tropical Convergence Zone (ITCZ) and a disruption to the monsoons are regularly waged by scare mongers, and in that vein a study by Zickfeld et al. (2007) presented the results from detailed interviews with 12 leading climate scientists about the possible effects of global climate change on the Atlantic Meridional Overturning Circulation (AMOC), though the authors in a bout of honesty stated that "*Many processes and factors deemed important are assessed as poorly known and insufficiently represented in state-of-the-art climate models*". But did not deprive the so-called experts to forecast that "*Elicited consequences of AMOC reduction include strong changes in temperature, precipitation distribution and sea level in the North Atlantic area*". One will tend to think that if all experts agree, the opposite has a strong chance to happen as Tetlock (2017) wrote an excellent book about why experts in various domains are so often consistently wrong at making forecasts.

But, if experts somehow agree to some degree about the fateful consequences of a supposedly reduction of the AMOC, the reader will feel reassured that the models disagree between each others, as the degree of weakening varies considerably among them. For example, Cheng et al. (2013) report "*Under the Representative Concentration Pathway 4.5 (RCP4.5) scenario, the weakening by year 2100 is 5%–40% of the individual model's historical mean state; under RCP8.5, the weakening increases to 15%–60% over the same period*", and one will wonder what a (15%-60%) range of estimate can entail in terms of reliability; might be very little indeed.

One positive thing though, it seems that the "models", here ten of the Coupled Model Inter-comparison Project (CMIP5), have finally come to terms that the Sun could play a role, well a major one, and they finally display a 60 yr cycle, which they call that a multidecadal variability, and that this would even be related to net surface shortwave radiative flux, i.e. solar irradiance. Cheng et al. (2013) say "*Additionally, the multimodel ensemble-mean AMOC exhibits multidecadal variability with a ~60-yr periodicity and ... this multidecadal variability is significantly correlated with similar variations in the net surface shortwave radiative flux in the North Atlantic and with surface freshwater flux variations in the subpolar latitudes*". So the good news is that the "models" start to integrate something else than the naive equation "a bit more CO_2 = A LOT warmer".

Would the reader want to know how much the models diverge, Jungclaus et al. (2006) will be a good start, and show that as a reaction to a freshwater addition of 0.1 Sv, models led to an AMOC reduction by 10% to 60% (Stouffer et al., 2006), appreciate the small error interval, while in a transient global warming experiment, Fichefet et al. (2003) found a strong and abrupt weakening of the AMOC at the end of the 21st century and whereas in stark contrast, Ridley et al. (2005) analyzed a climate with four times the pre-industrial CO_2 level and found relatively minor changes in the THC. Furthermore, as not all of the models include the possible negative consequences of melt water induced AMOC weakening and North Atlantic cooling which would reduce Greenland melting and contribute to stopping the production of freshwater, the projections can only be extremely speculative, perhaps only guesstimates. Certainly more realistically, Jungclaus et al. (2006) do not anticipate any major trouble would the influx of freshwater from Greenland accelerate and state "*The impact of the additional fresh water is limited to further enhancing the static stability in the Irminger and Labrador Seas, whereas the backbone of the overturning is maintained by the overflows across the Greenland-Scotland Ridge. Our results suggest that abrupt climate change initiated by GIS melting is not a realistic scenario for the 21st century*".

In terms of assessing the natural variability that can be expected from changes occurring to the oceanic circulation, the analysis of sediment cores and corals provides a wealth of information on past ocean circulation and shows that it has undergone major changes during the past 120,000 years (Rahmstorf, 2002) and states "*Increasingly clear evidence implicates ocean circulation in abrupt and dramatic climate shifts, such as sudden temperature changes in Greenland on the order of 5–10 °C and massive surges of icebergs into the North Atlantic Ocean — events that have occurred repeatedly during the last glacial cycle*". In that respect, Sarnthein et al. (1994) have showed that over time and during the alternation of glacial and inter-glacial eras, in the Atlantic, three distinct circulation modes have existed, they have been labeled the stadial mode, interstadial mode, and Heinrich mode. In the interstadial mode, North Atlantic Deep Water formed in the Nordic Seas, in the stadial mode it formed in the subpolar open North Atlantic (i.e., south of Iceland) and finally in the Heinrich mode, NADW formation all but ceased, and waters of Antarctic origin filled the deep Atlantic basin.

None of these changes required anything else to happen than the normal natural variability resulting on the one hand from cyclical and regular phenomenons that can be well assessed (orbitally-driven changes) or much less known and anticipated as solar variability and on the other of the rather chaotic response of a highly complex and non linear climatic system to these initial triggers.

Where is CO_2? Cannot see it!

5) Glaciers, Ice-Cores, Arctic and Antarctic

"*Temperature measurements in the arctic suggest that it was just as warm there in the 1930's...before most greenhouse gas emissions. Don't you ever wonder whether sea ice concentrations back then were low, too?*" Roy Spencer

As was detailed in the "Past Climates" section of this document and the corresponding sub-sections "The last 2,000 years" and "The last 12,000 years, brief overview of the Holocene", glaciers offer a fast response to any climate change. Trutat's (1876) striking observations, made long before man-made emissions, were reported several times and they were not isolated (Nussbaumer et al., 2011; Fig. 4 and 5), this is why glaciers have often been an easy prey to the scare mongering tactics of climate fabricators, as they have been generally receding since the end of the LIA (Akasofu, 2011). In fact, one can regularly see such reports in mass media come to the cover or front-page of newspapers or magazines to create sort of a Pavlovian response of the conditioned masses, where the gullible and easy to influence people, because they lack the time, will or the wherewithals to reach an informed opinion, get an imprint in their mind that there is no arguing, worse no denying (with an implicit creepy hidden allusion to the holocaust), things are written, the mass is said, man-made global warming is irrefutable, glaciers will disappear.

The inconvenient reality is that even this easy gamble, yes they melt, has often been lost by the manipulators. It was already reported how the managers of Glacier National Park, a large wilderness area in Montana's Rocky Mountains, have had to remove signs stating that «*glaciers will be gone by 2020*» as nature did not want to cooperate with their dire predictions. This was not the first time that glaciers had been devious and contradicted lightly formulated forecasts. The leak of the Climatic Research Unit's (CRU) "Climategate[208]" emails from the University of East Anglia (UEA), as if not embarrassing enough, coincided with the exposure of some blatant errors in the IPCC AR4 report (IPCC, 2007a), most notably a claim that Himalayan glaciers would disappear by 2035, an affirmation that turned out to completely lack of any scientific basis, e.g. (Bagla, 2009), (Cogley, 2011) and led to a contorted apology of the Chair and Vice-Chairs of the IPCC, and the Co-Chairs of the IPCC Working Groups (IPCC, 2010). Senior glaciologist Vijay Kumar Raina, formerly of the Geological Survey of India, had to deny the unsubstantiated claims by IPCC by dismissing that measurements made of a handful of glaciers would be representative of the fate of India's 10,000 or so Himalayan glaciers and that they would be shrinking rapidly in response to climate change (Raina, 2009). The document, i.e. a "Discussion Paper, Ministry of Environment and Forests" is not available any longer on its original web site (electronic form of book burning?) but the Heartland Institute archives it. In it, Raina (2009) states "*Glaciers in the Himalayas, over a period of the last 100 years, behave in contrasting ways...* ***It is premature to make a statement that glaciers in the Himalayas are retreating abnormally because of the global warming****. A glacier is affected by a range of physical features and a complex interplay of climatic factors. It is therefore unlikely that the snout movement of any glacier can be claimed to be a result of periodic climate variation until many centuries of observations become available. While glacier movements are primarily due to climate and snowfall, snout movements appear to be peculiar to each particular glacier*" and in fact they "cooperate" so little that "*one side of a glacier tongue may be advancing while the other is stagnant or even retreating*" Raina (2009). Vijay Kumar Raina's is now former or ex- of all the positions he occupied and is identified as the author[209] of a controversial discussion paper and tagged by desmog as a member of climate resistance[210], an honor; imagine he had the gall to state "*Climate changes naturally all the time, sometimes dramatically. The hypothesis that our emissions of CO_2 have caused, or will cause, dangerous warming is not supported by the evidence*". Well, getting rid of him will not make Himalayan glacier melt faster, but many will probably have rejoiced of that nice catch.

IPCC acknowledged of the mistake in a statement dated 20th Jan 2010 where they stated "*It has, however, recently come to our attention that a paragraph in the 938-page Working Group II contribution to the underlying assessment refers to poorly substantiated estimates of rate of recession and date for the disappearance of Himalayan glaciers*" (IPCC, 2010). it's so awkward on the part of the IPCC to make use of an unsubstantiated WWF interview when then keep claiming that they only resort to peer-reviewed literature, which is no wonder as they control throughout their vast network of lead authors and affiliated scientists all the gates of official publications in their related domain, which is in itself a problem often stressed by dissident scientists who have been marginalized for not conforming with the dogma.

208 https://www.conservapedia.com/index.php?title=Climategate
209 https://en.wikipedia.org/wiki/Vijay_Kumar_Raina
210 https://www.desmogblog.com/vijay-kumar-raina

In fact Raina (2013), given his extensive knowledge over decades of Himalayan glaciers, is even more cautious than the position that we could have defended. He does not even observe a rapid response of glacier to changing climate and says "*So far as observation of the glaciers, for more than five decades now, allows a judgment, I have no hesitation in making a statement that a glacier does not necessarily respond to the immediate climatic changes. Data presented reveals the fact that the glacier snout fluctuation is not influenced by one single parameter but by a combination of parameters. Physiographic character of the accumulation zone and valley slope probably has more dominant role than the annual precipitation and the atmospheric temperature per se*" (Raina, 2013).

Denying the evidence that glaciers had been melting long before any anthropogenic emission since the end of LIA, will not help either hiding that Hannibal's crossing with his elephants of the Alps during the Second Punic War, 218 BC was only possible because there was no glacier on his path nor of ice at the time, at the end of October. Controversy over the alpine route taken by the Hannibal's Army from the Rhône Basin into Italy in 218 BC (2,170 cal BP) has raged for over two millennia, but recently Mahaney et al. (2018) brought it to an end by confirming what Polybius[211] wrote, i.e. that Hannibal had crossed the highest of the Alpine passes: Col de la Traversette (2,947 meters!) between the upper Guil valley and the upper Po river is indeed the highest pass. It was the end of October, troops had been marching for over five months, when Hannibal ordered the descent to Italy and snowy weather was to welcome them. Furthermore, "*Hannibal's Numidian cavalry carried on working on the road, taking three more days to fix it sufficiently to allow the elephants to cross to the plain"* and three days later, the elephants – not exactly a high mountain animal – had managed in 218 BC to cross in autumn the highest pass of the Alps. This is of course a testimony of how much warmer conditions in 218 BC were than those encountered now-days even after two centuries of natural warming following the end of LIA, but it is probably far from the very warm conditions met there 7,000 BP as Joerin et al. (2006), standing in front of the Tschierva Glacier in Engadin, Switzerland at 2,200 meters (7,217 feet) reminds that 7,000 years ago they were no glacier at all "*Back then we would have been standing in the middle of a forest*".

The climate has kept changing a lot, with or without our ridiculous anthropogenic emissions, and for the time being, even the easiest wager of the climate fabricators is regularly lost. Even the Alaskan glaciers do not cooperate as expected and as reported by Berthier et al. (2010) previous studies have largely overestimated mass loss from Alaskan glaciers over the past 40-plus years. As reminded by Spencer (2007) glacier obviously do react to temperature changes but more importantly to precipitation changes "*Similar points can be made about receding glaciers. Glaciers respond to a variety of influences, especially precipitation. Only a handful of the thousands of the world's glaciers have been measured for decades, let alone for centuries. Some of the glaciers that are receding are uncovering tree stumps, indicating previous times when natural climate fluctuations were responsible for a restricted extent of the ice fields*", and as an anecdotal evidence, the reader will remember the trunks revealed by the receding Tschierva Glacier in Engadin by Joerin et al. (2006).

An emblematic example of a glacier receding due to various factors, especially a loss of precipitation, and certainly not because of the nefarious action of CO_2 is the case of the Kilimanjaro (Tanzania). As reported by Hardy (2011), the first report by a European of the existence of an ice cap atop Kilimanjaro was made by Johannes Rebmann in 1848 and was dismissed for more than a decade and it took the ascension of Hans Meyer who climbed nearly to the crater rim in 1887, and managed to reach the summit 2 years later on 6 October 1889 (Meyer, 1891) to definitely confirm the curiosity which has kept drawing scientific attention ever since, e.g. (Young and Hastenrath, 1987). But, Kilimanjaro was unwillingly quickly employed to symbolize the impacts of global warming, and Greenpeace (2001) never missing an occasion to resort to the scare tactic issued a press release forecasting that the Furtwängler glacier atop Kilimanjaro would be gone by 2015 and Joris Thijssen, the great specialist not of the physics of the atmosphere or other scientific discipline but organized deception and climate scare, stated lambasting evil nations protecting their greenhouse gas polluting industries while negotiating the Kyoto protocol "*But this is the price we pay if climate change is allowed to go unchecked – here in Africa we will not only lose glaciers, but will face more extreme droughts and floods, widespread agriculture loses, and increased infectious diseases, all of which are felt hardest by people in developing nations*". Same hogwash repeated at nauseam, blame the rich nations that will make suffer the poor with their feckless emissions, and they will have to face the creepy outcomes of their misdeeds, even including the spread of infectious diseases! To make the story whole, Joris Thijssen added "*Businesses and governments must realise that unless coal, oil and gas, which produce the bulk of global greenhouse emissions, are rapidly phased out and replaced with renewable energy sources, we are going to see more and more devastation, and face higher and higher costs of attempting to keep up with an unpredictably changing world*", so mankind need to reverse centuries of progress made by hardworking engineers,

211 https://en.wikipedia.org/wiki/Polybius

scientists and people who supported them in their findings and developments to return to the cave for the lunacies of some illuminated eco-crooks.

Of course, we are in 2020, the glacier is still atop Kilimanjaro though melting as it has ever been doing since the end of LIA and its discovery in 1848, as by the time the 19th century explorers reached Kilimanjaro's summit, vertical walls had already developed, setting in motion the loss processes that have continued to this day. But the Greenpeace (2001) press release has since disappeared from their website, in testimony to their enlightened forecast and honesty. In the meantime, scientists have acknowledged that Kilimanjaro's summit climate has been impacted by large scale atmospheric circulation changes, with strong evidence that there is an association between the Indian ocean surface temperatures and the atmospheric circulation and precipitation patterns that either feed or starve the ice of Kilimanjaro and that "*... loss of ice on Mount Kilimanjaro cannot be used as proof of global warming*" (Mote and Kaser, 2007), p. 325, who have probably been berated for such boldness and for adding "*The observations described above point to a combination of factors other than warming air—chiefly a drying of the surrounding air that reduced accumulation and increased ablation—as responsible for the decline of the ice on Kilimanjaro since the first observations in the 1880s. The mass balance is dominated by sublimation, which requires much more energy per unit mass than melting; this energy is supplied by solar radiation.* ***These processes are fairly insensitive to temperature and hence to global warming***" (Mote and Kaser, 2007), p. 325.

Kilimanjaro's glacier will very probably disappear but so far it does not want to cooperate much with the CO_2 hogwash story, because as soon as the atmospheric circulation changes (westerlies, from 270° ±30°, represent only ~5% of hourly means), it snows a lot and Hardy (2018) reported the greatest snowfall on Kilimanjaro glaciers in years (Figure 71).

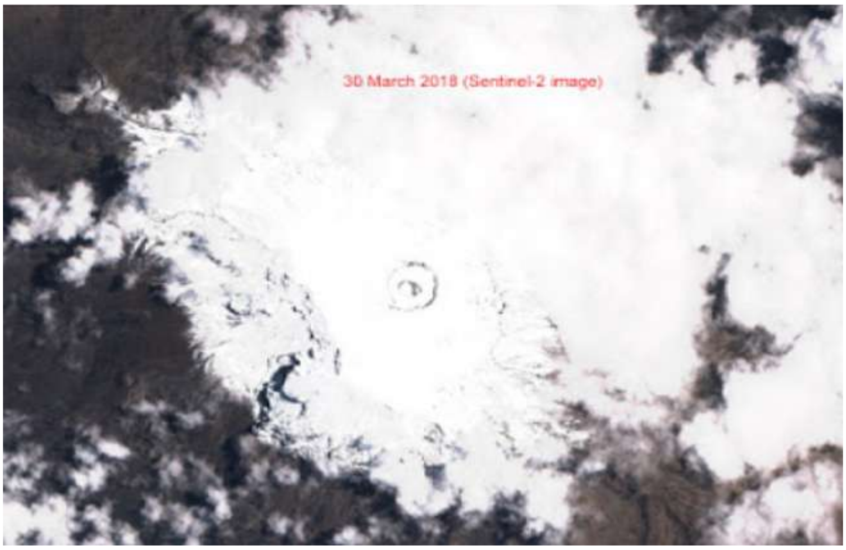

Figure 71. The Kilimanjaro on March 30, 2018 does not want to cooperate with the anthropic global warming narrative and due to some atmospheric circulation change (westerlies) benefit of the greatest snowfall in years. This anecdotal glacier will keep receding as it has done since its discovery in 1848 and will probably disappear but for other reasons than evil man-made emissions. Source: (Hardy, 2018).

Hogwash I said, in fact not just as we also see deception and scare tactics in action or dumbness and ideology, who knows? Perhaps both!

Before we continue our journey to the Arctic and Antarctica it is worthwhile to spend some time on the way ice-cores are being collected and extracted. In that respect, Jaworowski until his death has been claiming that the way the ice-core were interpreted raised a number of questions (Jaworowski et al, 1992a-b; Jaworowski, 1994, 2003, 2007, 2009). It seems that these questions could have been addressed and a common understanding could perhaps have been reached and progress made. But, instead of that and it is sad, leading researchers like Stefan Rahmstorf (2004) in a Munich Re funded paper, had nothing to oppose the perfectly valid reservations issued by Jaworowski (2003) than the ad-hominem attack that he was a self-appointed climate researcher (he knew far more about ice-core than Rahmstorf will ever[212]), that his paper was for the laypersons[213] and that the journal in which the paper was published belonged to the organization of an American multimillionaire and conspiracy theorist Lyndon LaRouche. What a shame, if I were to dismiss the scientific opinion of Stefan Rahmstorf, and that would be a pleasure doing so, given the weakness of the argumentation he puts forward into his laypersons flyer ordered by a large insurance group, full of affirmations and devoid of proofs, I would not mention first (though I must do it now) that in 1999, he received from an organization representing the legacy of an American multimillionaire industrialist a US$-1m fellowship award from the James S. McDonnell Foundation https://www.jsmf.org/ (isn't there kind of a mental conflict in accepting such a grant when one wants to de-industrialize and decabonize the planet?). One could expect from these system-appointed climate researchers that they would address the problems faced, for example by the ice-core methodologies used and the distortions they induce, which have been courageously and repeatedly underlined by Jarowosky (Jaworowski et al, 1992a-b; Jaworowski, 1994, 2003, 2007, 2009) instead of using ad-hominem attacks, disparagement, ending arguing about the data on a graphic presenting a relationship between cloudiness and cosmic-rays that seems to bring him much frustration. Rahmstorf (2004) rejoices that "*Given that the warming is now evident even to laypeople, the trend sceptics are a gradually vanishing breed*" forgetting two important things: 1) that neither the UAH data nor the NOAA STT show any warming going further than the natural variability observed throughout the Holocene (appreciate the recourse to the laypersons when supposedly useful whereas he was full of contempt when Jaworowski wrote seemingly for them) and 2) that even though all skeptics might disappear, this is not what will ultimately prove him right and make his scientific legacy destined for a better fate than the dust bin, if he happens to be wrong, what I am sure of. It is unfortunate that Rahmstorf's work did not convince him of how much more the oceans drive the climate, he is a recognized international expert in the domain, than the 0.007% increase of the devil trace gas. Furthermore, Rahmstorf makes as if he would ignore the fact that the reason why the skeptics are disappearing is because of the massive brainwashing and subliminal harassment made by the media and governments, the same that publish and pay him and not because of his overwhelming science. You will notice that I have the highest consideration and respect for Zbigniew Jaworowski[214], who had - as a self-appointed multi-disciplinary expert - a very wide knowledge and understanding of all what contributes to making the climate of this planet what it is, whereas I am very wary of narrow views by those appointed to know better than everybody what's good for mankind and each of us.

How funny to read Wikipedia "*However, Jaworowski's views are rejected by the scientific community [**citation needed**]*" whereas the "scientific community" is embarrassed enough by Jaworowski's criticisms to have preferred to ignore him and wait for his death, so obviously on July 2020 the citation is more than needed as there are none available. Jaworowski commands the greatest admiration for having written clear and challenging papers until his death in 2011 at 84 years old. Then we can read that "*Increases in CO_2 and CH_4 concentrations in the Vostok core are similar for the last two glacial-interglacial transitions, even though only the most recent transition is located in the brittle zone. Such evidence argues that the atmospheric trace-gas signal is not strongly affected by the presence of the brittle zone.[4]*". The Wikipedia team of authors claim that Jaworowski's concerns would deal with a so-called "brittle zone" and that Jaworowski's arguments could be dismissed on the basis that the consistent GHG records would appear for the Eemian and the Holocene and quote to support their claims .[4] the referenced paper being that of (Raynaud et al., 1994). One will observe that referring to comparisons with the Eemian is highly speculative as, for example, the stratigraphic part of the West Antarctic Ice Sheet Divide Ice CoreCore[215] (WAISDIC, 2020) stopped at 31 kyr (the part which is not based on a model, whatever it is, but on the physical counting of layers), therefore far from the Eemian and the brittle zone problems are well acknowledged and documented by Souney et al. (2014), p. 20. Therefore, dismissing Jaworowski's claims by asserting that "*the atmospheric trace-gas signal is not strongly affected by the presence of the brittle zone*" is simply a deception and one does not need to go further than the extreme precautions taken by the WAISDIC team (Souney, et al., 2014) to handle the ice cores as of the entire 3,405 meters long of the drill, non-brittle ice was just met from 120 to 520 m and from 1,340 to 2,564 m, the rest having to winter-over at WAIS Divide to give the ice more time to relax before shipment to the analysis facilities at the US National Ice Core Laboratory (NICL)!

To the contrary of what is asserted and to the support of Jaworowski's claims exist several articles, that mention that many problems arise going deeper extracting the ice cores as many physico-chemical phenomenons take place and

212 In the 1990s Jaworoswski was already working for the Norwegian Polar Research Institute in Oslo, and for the Japanese National Institute of Polar Research in Tokyo. In this period he already studied the effects of climatic change on polar regions, and the reliability of glacier studies for estimation of CO_2 concentration in the ancient atmosphere.

213 What a contempt! Jaworowski's papers are all well written, well documented and always reference relevant work, and they are certainly not only informative for the laypersons, though the term in my writing has certainly no pejorative insinuation, but to everybody, including the scientists of the establishment who should have made the effort to answer his valid questions.

214 https://en.wikipedia.org/wiki/Zbigniew_Jaworowski

215 https://en.wikipedia.org/wiki/WAIS_Divide and http://waisdivide.unh.edu/about/index.shtml

erase high frequency climate variability, e.g. Pol et al. (2010) state "*no new information on MIS 19 climate variability has been revealed, because of a strong smoothing of the deuterium signal. This smoothing, highlighted by a loss of spectral amplitude below a periodicity of ~1600 y, contrasts with the sub-millennial variability preserved for Holocene at comparable resolution and in MIS 19 high resolution calcium data*". In fact, and rightfully pointed out by Jaworowski (1994, 2004), as some water-veins at the grain junctions can be observed under some circumstances, as continuous liquid water network is expected to strongly enhance isotopic diffusion, and as the time period spent by the MIS 19 old ice at temperatures warmer than the critical value of −10 °C which is expected to be a threshold for migration–recrystallization processes could have been too long, all that leads to a loss or distortion of information. This is further obvious when Haan and Raynaud (2002) report dealing just with the last 2,000 years of reconstruction of [CO] "*In order to study in detail the pre-industrial CO level during the last two millennia and its temporal variations, several ice cores from Greenland and Antarctica were analysed. Our Antarctic CO results remain very close to those observed previously for the last 150 years and suggest that carbon monoxide concentration did not change greatly over Antarctica during the last two millennia. Between 1600 and 1800 AD, CO concentrations obtained in the Greenland ice are also very close to those already reported for the 1800–1850 AD period.* ***In contrast, the oldest part of the Greenland CO profile exhibits high CO levels (100–180 ppbv) characterised by a strong variability. This part of the Greenland record likely does not reflect the true atmospheric CO concentrations***. ***We discuss the possible processes which could have altered the atmospheric CO signal either before or after its trapping in the ice***. ***The oxidation of organic material in the oldest part of the investigated Greenland ice appears as the most likely explanation. Because there are strong similarities between the Greenland CO and CO_2 concentration profiles for the 1000–1600 AD period, mechanisms involved in both cases could be at least partly the same. Therefore, oxidation of organic materials is a serious candidate for in-situ CO_2 production in the Greenland ice***. *Due to the fact that the Antarctic ice contains much less impurities and show no peculiar variability in CO concentrations, we are more confident about the atmospheric significance of our Antarctic CO concentration profile*". In the end, these honest authors state the ice-core records might not reflect the true CO concentrations (not the CO_2 ones either) that they have more confidence into their Antarctica reconstructions than into the Arctic ones, all that over a very short period of time, 2,000 years. We're not going to show more confidence in their own results than them, and it will obviously be very low. Then the papers from Rubino et al. (2013; 2019) show how much processing and corrections these ice-records require, and indicate that "*Additionally, the records have been revised with new, rule-based selection criteria and updated corrections for biases associated with the extraction procedure and the effects of gravity and diffusion in the firn*", confirming what Jaworowski has been saying all along, that there are major side-effects, one of them being the isotopic diffusion due to the increased pressure resulting from the mass of the huge stack of glass accumulated. Finally, Wikipedia writes "*Similarly Hans Oeschger[5] states that "...Some of (Jaworowski's) statements are drastically wrong from the physical point of view*", quoting (Oeschger, 1995).

So let's analyze the answer brought by Oeschger and see whether it brings any convincing perspective, the sentences in italic are excerpts from Oeschger's (1995) response paper:

- "*JAWOROWSKI has induced considerable confusion regarding the reconstruction of ancient atmospheric compositions by the analysis of air occluded in polar ice of known age.*" The reader does not learn whether Oeschger thinks Jaworowski's claims are valid of not, he is dubbed a confuser.
- "*Although we knew since the nineteen fifties that human activities might change the climate of the Earth, it was not until the mid-seventies we realised that mankind was faced with a serious problem.*" Value judgment, unsubstantiated assertion, deception.
- "*The US-CO_2 programme was planned at an ERDA meeting in Miami in the late seventies. At that time we proposed a reconstruction of the CO_2 history by measuring the gases trapped in polar ice. This idea was met with great deal of scepticism and we were aware that the changes (sic!) for success were limited because of a wide spectrum of problems, including those which JAWOROWSKI describes in his paper.*" So Jaworowski's claims were legitimate and there were not some but a wide range of other problems. The reader will not be entitled to know more, let's continue...
- "*Some of* ***his statements are drastically wrong from the physical point of view****, e.g; the statement that CO_2 at 70m depth in the ice* ***begins*** *to change into solid clathrates*". This is the major and in fact sole argument, used by Oeschger to discredit Jaworowski and put forward by Wikipedia, and after verification, Oeschger does not look correct in his affirmation. Let's consider the Phase Diagram P/T, Figure 72, at ~6.4 bars given the ice density of 0.91 and temperatures of the range [-15°C, -40°C] we do not only begin to have hydrates but we are getting straight in the middle of the V-I-H zone. The dark gray region (V-I-H) represents the conditions at which CO_2 hydrate is stable together with gaseous CO_2 and water ice (below 273.15 K). The pressure is displayed on the left with a logarithmic-scale representation, while temperatures in °C (up) and K (down) are normal scales. Unless one would be unable to find an (X,Y) on a graph, it appears that for ~6.4 bars (~70 meters) and a range

of temperature [-10, -40°C] one falls straight in the dark gray region (V-I-H) where the CO_2 clathrate (H) resides and the more P increases the better sits in the dark gray area. So, unless proven otherwise, Oeschger looks mistaken and **Jaworowski correct**. Would Oeschger talk of air hydrate, of course they are met much deeper as they are made of 78% N_2 and 21% O_2 (very different P/T diagram) and therefore reported at respectively 1,092m, 1,099m at Dye-3 Camp Century and 727 m at Byrd Station (Shoji. and Langway, 1987), but Jaworowski mentioned CO_2. Furthermore, and unless Jaworowski (1994) would specifically have written it otherwise, Jaworowski (1997) states Fig.2 "***Greenhouse** gas clathrates begin to form at 80 to 160 m*" which gives a pressure range of [~7.3 bars - ~14.5 bars] which is even more in the V-I-H co-existence zone or even beyond into the hydrate stability area. At a mean temperature of -24°C or less, e.g. (Raynaud and Barnola, 1985), one can see that we exit the V-I-H co-existence zone to reach the hydrate stability-only zone at P> ~11.0 bars. So I hardly see how Jaworowski could be wrong and claiming as Oeschger did, on that sole basis, that "***his statements are drastically wrong from the physical point of view"***.

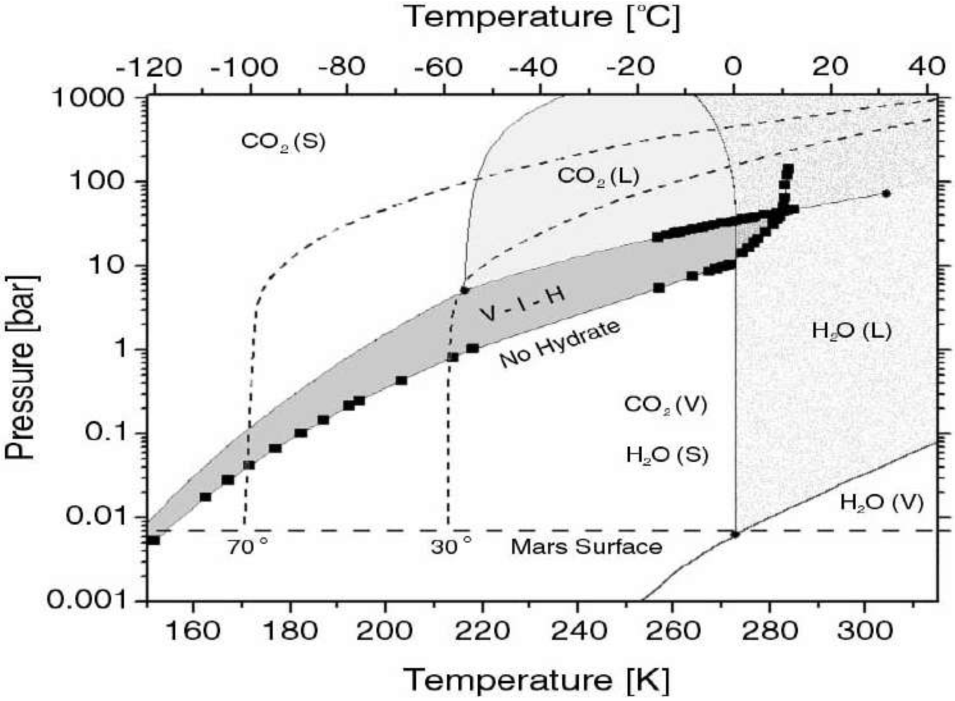

Figure 72. CO_2 hydrate phase diagram from Genov (2005), Fig.I.8 p. I-8. The black squares show experimental data (Sloan, 1998). The lines of the CO_2 phase boundaries are calculated according to the International thermodynamical tables (1976). The H_2O phase boundaries are only "guides to the eye". The abbreviations are as follows: L - liquid, V - vapor, S - solid, I - water ice, H – hydrate.

- "*The teams of researchers involved in ice core studies have a high standing within the scientific community.*" What an impressive argument of authority, should such arguments be even taken into account? History of science proves rather the contrary.
- "*The early increases of the greenhause (sic!) gases are used to initiative (sic!) the models simulating climatic change... The low glacial greenhouse concentrations are an essential boundary condition for climate modelling experiments of the Earth during a glacial period.*" So, as the models are initialized with controversial data there is no asking question!
- "*The papers by JAWOROWSKI, and the one by HEYKE quoted in this paper, are not taken seriously by the science community.*" Again a useless and empty argument of authority. They could add, we've been well paid by IPCC for all that deception and Jaworowski was dumb enough to work hard, be right and not make a penny with it!
- => then some rantings about the dire consequences of inaction... classical scare mongering tactics, normally used by Greenpeace and the like, but one can also be a reputed professor of Physics at the famous University of Bern and do the same....
- "*Based on my experience during decades of involvement in this field, I consider the changes (sic!) as very small that the major findings from greenhouse gas studies on ice core are fundamentally wrong; and I find the publications of JAWOROWSKI not only to be incorrect, but irresponsible*" If I understand well: Oeschger has been unable to answer one single question asked by Jaworowski, but he states that he cannot be wrong because

he's been involved for so long that he cannot be mistaken, and finally the cherry on the cake, the argument of morality, Jaworowski is irresponsible because he dares ask questions.

Honestly, I had no opinion before reading the exchange and the response by Oeschger, but if the latter has convinced me of anything, it is to read very carefully what Jaworowski has to say, and to make a head-start on the first and most remarkable statement from him, is "*No study has yet demonstrated that the content of greenhouse trace gases in old ice, or even in the interstitial air from recent snow, represents the atmospheric composition*" Jaworowski (1997) and it is simply correct. Shouldn't it have started there?

The validity of current reconstructions of pre-industrial and ancient atmospheres, based on CO_2 analyses in polar ice requires that the ice cores fulfill the essential closed system criteria, which basically rests on three fundamental premises Jaworowski et al. (1992a) : "

1. *that the age of the gases in the air bubbles is much lower than the age of the ice in which they are entrapped (e.g. Oeschger et al., 1985)* ;
2. *that 'the entrapment of air in ice is essentially a mechanical process of collection of air samples, which occurs with no differentiation of gas components' Oeschger et al., 1985)*; and
3. *that the original air composition in the gas inclusions is preserved indefinitely*".

Falsifying just one of these assumptions is more than enough to challenge the entire theory of man-made climate change as it rests largely on the reconstructed atmospheres by means of ice cores. None of them will survive an honest analysis and confrontation with the basic facts. The main argument in support of the last two premises is another assumption that no liquid phase occurs in the polar ice at a mean annual temperature of -24°C or less (Berner et al, 1977; Raynaud and Barnola, 1985) but one will observe that this might not be correct because of the existence of a simple thermal gradient as reported, e.g. by Shoji and Langway (1983) "*The average bore hole temperature was -20°C from the near the surface to approximately the 900m depth and progressively increased to -12°C at the bottom*", makes it such that we are far from a required homogeneous -24°C. Jaworowski died at the end of 2011, and it is very unfortunate that this deprived him from first hand confirmation of his reservations, as in July 2012, an exceptional heat wave struck Greenland, creating a melt zone, where summer warmth turned snow and ice into slush and melt ponds of meltwater, and extended to 97 percent of the ice cover (Witze, 2012; Dahl-Jensen et al., 2013). Do not invoke AGW here to explain that it is exceptional and that it did not occur before, because ice cores show that events such as this occur approximately every 150 years on average. The last time a melt this large happened was in 1889. When the meltwater seeps down through cracks in the sheet, it accelerates the melting and, in some areas, allows the ice to slide more easily over the bedrock below, speeding its movement to the sea. During this unusual heat over Greenland in July 2012 melt layers formed at North Greenland Eemian Ice Drilling (NEEM) site as reported by Dahl-Jensen et al. (2013). As the reader can see, the requirement that no liquid phase occurs in the polar ice, so that premises 2) and 3) be reasonable is simply already falsified and much more can be reported.

The first and most obvious evidence that there are a host of physico-chemical processes happening in the ice, is that if the ice was just gently piling up with no physico-chemical transformation happening over the years, the scale of all ice-core diagram (CO_2 versus depth/age) would be very different, and the age would simply more or less linearly follow the depths (to the variations of the atmospheric supply), whereas it is obvious that the deeper one goes the more condensed the age scale, but with the unfortunate characteristic of neither being a nice log-scale (or else corresponding to a simple physical phenomenon that would let itself easily characterize[216]) nor even displaying an homogeneous response across the various sites, e.g. Figure 74 shows well the complete heterogeneity (of the age-scale properties) between the Camp Century core; b, the Byrd core.

In order to help the reader follow a clear logic, the presentation will simply follow the order of the physico-chemical processes leading to the final ice-core in the laboratory. Therefore, the entrapment process will be described first, then the accumulation phase where the ice core progressively is buried deeper under an ever increasing ice load and more numerous ice-layers, like "the P-38 Glacier Girl", then the drilling process and relaxation that occurs when the sample is extracted, a little bit like when a diver goes back up to the surface.

216 It is often assumed that the plastic deformation of ice is generally expressed by a power law in terms of strain rate, $\acute{\varepsilon}$, and stress σ where A is a constant by: $\acute{\varepsilon} = (\sigma / A)^n$ (Shoji and Langway, 1983), or by similar expressions but no less empirical, e.g. defined by (Barnes et al., 1971) as $\acute{\varepsilon} = A (\sin\ h\, \alpha\, \sigma)^n \exp(-Q/RT)$ where σ is the applied stress, Q an activation energy and A, α and n are suitable constants. The work of (Barnes et al., 1971) deals both with uniaxial compression and basal sheer on rocks (e.g. glacier).

1. When snow is transformed into ice (firnification process) by sedimentation near the surface of an ice sheet, some of the atmospheric air is trapped in the inter-grain spaces which are progressively isolated from the surrounding atmosphere and the resulting material is an “air-tight” bubbly glacial ice, but this progressive transformation does happen over months, years or sometimes decades or more and permits many physico-chemical mechanisms to happen (questioning the closed system requirement, i.e. the air trapped must have stayed intact). Therefore, this interaction between the firn and the above atmosphere makes it such that the age of the air in the inclusions may be slightly younger than that of the ice, but one immediately see that this is a process that will show an extreme variance depending on the climatic conditions at the sampling site. This has led to many arbitrary adjustments by those authors wishing to claim that the air is much younger than the ice so that they could also claim that higher CO_2 concentrations (inconveniently measured) were related to younger air bubbles than they are in reality. How convenient, isn't it ? If your old reference has too much CO_2, rejuvenate it by claiming that it interacted longer with the surface and here it goes! Doing so, arbitrarily, infringes the 3rd principle enunciated by Jaworowski (2004). Therefore the relative age of the air bubbles with respect to the enclosing ice, i.e. their dating with respect to the age of ice where trapped in leads to interpretations and adjustments. The consolidation of snow to ice necessary to trap the air takes place at a certain depth (the ‘trapping depth’) once the pressure of overlying snow is great enough. Since air can freely diffuse from the overlying atmosphere throughout the upper unconsolidated layer (the ‘firn’), trapped air is younger than the ice surrounding it. But, trapping depth varies with climatic conditions, so the air-ice age difference could vary greatly between a few decades and 6000 years;

2. While the future ice-sample keeps getting older and therefore going deeper, it feels the effect of an increasing pressure. As the phase diagrams for the various gas making up the atmosphere differ significantly, they will also react differently to the pressure increase. In the highly compressed deep ice all air bubbles disappear, as under the influence of pressure the gases change into solid clathrates, which are tiny crystals formed by interaction of gas with water molecules (see Figure 73). The problem is that there always remain some liquid water in ice, which contributes to change the chemical composition the air bubbles trapped between the ice crystals and the more water percolates throughout the cracks during episodic warm summer events, the more disturbances one can fear. In that respect, one should notice that the three main components of the atmosphere have very different basic physico-chemical properties, e.g. carbon dioxide is seventy (70) times more soluble than nitrogen and thirty (30) times more soluble than oxygen. This means that, whenever an air bubble trapped in ice enters in contact with liquid water, not only does the liquid percolating the ice continues to absorb gases, but it does so selectively, favoring carbon dioxide, by a huge margin, over the other common gases in the air bubble and even the coldest Antarctic ice (down to –73°C) contains liquid water as reported by Mulvaney et al. (1988) studying the existence of liquid veins at grain boundaries state “*Calculations show that between 40 and 100% of the sulphuric acid present in this ice was found at the triple-junctions, and would have been liquid at ice-sheet temperatures. This finding, if general, has considerable implications for many of the physical properties of polar ice*”. This leads Jaworowski et al. (1992a) to conclude “*More than 20 physico-chemical processes, mostly related to the presence of liquid water, contribute to the alteration of the original chemical composition of the air inclusions in polar ice*”. Of course, every molecule of carbon dioxide that passes into a solution is removed from the air within the air bubble. All these processes necessarily lead to various forms of fractionation, simply because the various gases have different P/T phase diagrams. Fractionation is a direct result of the different reaction of the gases that compose the atmosphere to the increase of pressure as predicted by their different phase diagram P/T. This infringes the first principle listed by Jaworowski (2004) "*the entrapment of air (in the ice) is essentially a mechanical process of collection of air samples, which occurs with no fractionation of gas components*". At the ice temperature of -15°C dissociation pressure for N_2 is about 100 bars, for O_2 75 bars, and for CO_2 5 bars. “*Formation of CO_2 clathrates starts in the ice sheets at about 200 meter depth, and that of O2 and N_2 at 600 to 1000 meters*”. This leads to depletion of CO_2 in the gas trapped in the ice sheets. This is why the records of CO_2 concentration in the gas inclusions from deep polar ice show the values lower than in the contemporary atmosphere, even for the epochs when the global surface temperature was higher than now.

3. Now, third stage, while drilling and extracting the core, when lifting up the column will let the gas reform from the clathrate and escape the sample throughout the cracks (this is somewhat following similar physical-processes to what happens when oil and gas are extracted by fracking). Furthermore various pollutions, contamination and corruption of the T preservation are unavoidable during the drilling, conditioning and transportation processes. While lifting up the ice core the same mechanisms that led to fractionation when the ice accumulated over time are also at play but in a reverse manner as the gases will transit from their hydrate

form to gas again at different P/T (according to the phase diagram) and therefore at different moment and depths thwarting the records in the bubbles. Drilling decompresses cores excavated from deep ice, and contaminates them with the drilling fluid filling the bore-hole. Decompression leads to dense horizontal cracking of cores, by a well known sheeting process. After decompression of the ice cores, the solid clathrates decompose into a gas form, exploding in the process as if they were microscopic grenades. In the bubble-free ice the explosions form a new gas cavities and new cracks as reported by Shoji and Langway (1983) for a 2,037m long ice-core "*Deep-ice cores drilled from the Greenland and Antarctic ice sheets undergo volume relaxation due to the expansion of air bubbles with time after core recovery*". These authors also report, and it gives an idea of the stress of the recovered sample, "*decreasing rate of hydrostatic pressure of about 5.4bar.min^{-1} for each core length recovered of approx 1.9m*". Through these cracks, and cracks formed by sheeting, a part of gas escapes first into the drilling liquid which fills the bore-hole, and then at the surface to the atmospheric air. Particular gases, CO_2, O_2 and N_2 trapped in the deep cold ice start to form clathrates, and leave the air bubbles, at different pressures and depth.

Obviously, the assumption that the original air composition in the gas inclusions is preserved indefinitely seems violated all along and confirms the qualms expressed by Jaworowski (2004) "*that the original chemical and isotopic composition of atmospheric air trapped in the ice is permanently preserved in the ice sheets and in the decompressed ice cores; this means that the ice should remain a closed system in the ice sheet, in the ice cores during drilling, during decompression from several hundred bar down to one bar, and during transport to laboratory and storage, with no chemical reactions, diffusion through micro-cracks, and gas-liquid-solid phase changes occurring*". As a summary, all these problems arise simply because the ice cores do not fulfill the essential closed system criteria.

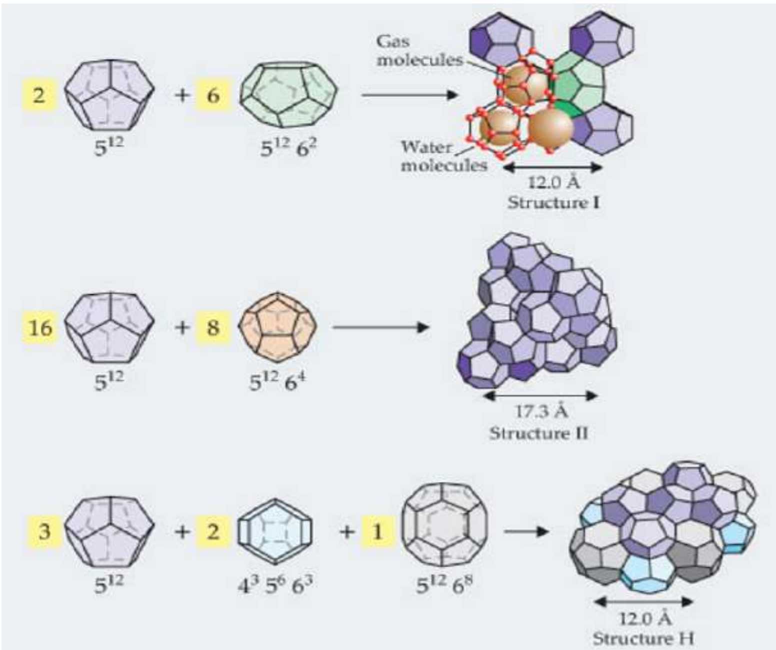

Figure 73. Clathrate hydrates are inclusion compounds in which a hydrogen-bonded water framework—the host lattice—traps "guest" molecules (typically gases) within ice cages. The gas and water don't chemically bond, but interact through weak van der Waals forces, with each gas molecule—or cluster of molecules in some cases—confined to a single cage. Clathrates typically crystallize into one of the three main structures illustrated here. As an example, structure I is composed of two types of cages: dodecahedra, 20 water molecules arranged to form 12 pentagonal faces (designated 5^{12}), and tetrakaidecahedra, 24 water molecules that form 12 pentagonal faces and two hexagonal ones ($5^{12}6^2$). Two 5^{12} cages and six $5^{12}6^2$ cages combine to form the unit cell. The pictured structure I illustrates the water framework and trapped gas molecules (from Mao et al., 2007), see also (Brook et al., 2008) and (Everett, 2013).

Let's come back a bit on the lag between the age of the ice and that of the air trapped in it. Berner et al. (1980) considered that atmospheric air can freely circulate in the firn down to the depth at which it finally changes into ice. But at the same time Berner et al. (1980) acknowledge that "*Air can circulate in the firn. Measurements on firn samples indicate **a loss of CO_2 during the sintering process** probably due to diffusion of CO_2 out of the grains. The transition from firn to ice in Greenland takes place at typical depths of around 70m*", and how that loss is accounted for is not reported. Furthermore, Berner et al. (1980) state "*The age of the occluded air is, therefore, younger than that of the ice matrix.*

For Greenland, the typical age difference is 200 years. Measurements on samples of young ice from different cold accumulation regions show that the amount of CO_2 in the ice lattice is about equal to that in the bubbles". But the paper is followed by a discussion where Begemann has some questions:

Begemann: "*Why is a different CO_2 content of the atmosphere not reflected by the CO_2 in the ice lattice?*"

Oeschger: "*We also looked at this question. If Henry's law would hold for the CO_2 fraction in the ice, the varying CO_2 content of the atmosphere* ***should be reflected****. But the CO_2 in the ice lattice may be due to* ***decomposition of organic debris and/or CO_2 trapped in refrozen melt layers****, ie, phenomena not directly related to the atmospheric CO_2 content*".

One should notice that there is a mismatch between the CO_2 trapped in the bubbles and that in the ice-lattice. What Bernerd et al. (1980) state is that "***Enrichment or depletion of CO_2 in the bubbles by exchange with the ice is difficult to estimate***". Furthermore, the relationship between the 70 meters depth and the age, i.e. 200 years is based on a rheological model described by Hammer et al. (1978) and supposed to be better than a 3% error, but one will observe that it does not match with the "P-38 Glacier Girl" burial rate which is perfectly known. Not going to much into the details, in the summer of 1942, the United States started building up troops in the United Kingdom, using Narsarssuak Air Base in Greenland as a stop en route. Among them, bound for the UK, was a flight of six P-38 Lightning fighters and two B-17 Flying Fortress bombers that set out from Greenland on July 15, flying across the North Atlantic to keep their route short but had due to heavy weather in the Denmark straight to return to their base and end up making a forced landing at approximately 150 km west of Angmagssalik near the coast and at less than 200 km away from the future Dye 3 ice core drilling research camp. This is the first time, when the P-38 Echo of Lt. Col. Wilson's was retrieved in Sept 1989, that one could measure exactly how much ice had accumulated over a given period of time, herein 47 years. The aircraft was buried under 78 meters of snow, firn and ice, which was a lot more than the 12 meters that glaciologists had anticipated and led to reconsider the way the layers were counted and dated (Heinsohn, 1994). The question of why "Glacier Girl" was not more squashed by its long stay under 78 meters of ice and snow is relevant and looking closer at the remains shows that the plexiglass windscreen had exploded and that the aircraft was in fact totally "filled" with snow and ice and where it had not, it had indeed been crushed by the ~5 to 6 bars of pressure (depending on the relative proportions of snow, firn and ice).

So far, we have a rheological model better to 3% accuracy which does not match the observations as the "Glacier Girl" was buried under 78 meters of ice in 47 years (and not 200 years for 70 meters) and two CO_2 fractions, i.e. one in the bubbles and one in the lattice, which do not match either. Oeschger finally asserts "*The following studies should give information on the origin of the ice lattice fraction: CO_2 measurements on snow and firn combined with chemical analyses, measurements of the isotopic composition of the extracted CO_2, laboratory measurements on artificially produced snow and ice samples, etc.*". So, here was the footings on which the AGW story started, not sound as you will agree, but to add a bit to where we stand now, further to the 2012 heat wave Dahl-Jensen et al. (2013) reported that "*We reconstructed the Eemian record from folded ice using globally homogeneous parameters known from dated Greenland and Antarctic ice-core records. On the basis of water stable isotopes, NEEM surface temperatures* ***after the onset of the Eemian (126,000 years ago) peaked at 8 ± 4 degrees Celsius above the mean of the past millennium****, followed by a gradual cooling that was probably driven by the decreasing summer insolation. . Extensive surface melt occurred at the NEEM site during the Eemian, a phenomenon witnessed when melt layers formed again at NEEM during the exceptional heat of July 2012*".

So far, we know 1) that the previous inter-glacial, the Eemian was much warmer than current conditions and therefore emphasizes that natural variability lead to a far greater variance than observed and that current climate and conditions atop the Arctic are within natural range 2) that melt water percolate throughout the ice sheet and demonstrate that Jaworowski is right in claiming that, necessarily over long periods, say centuries, water drains across the ice sheets and modifies the records, invalidating all the fragile foundations of the AGW theory as no reliable estimates of pre-industrial CO_2 atmospheric content can be asserted with reasonable confidence. The depletion in CO_2 matches the increase of pressure and reflects a simple fractionation process as the deeper we go into the ice-sheets the more depressed the CO_2 content of the core.

Jaworowski (2004) sums everything up "*The problem with Siple data (and with other shallow cores) is that the CO_2 concentration found in pre-industrial ice from a depth of 68 meters (i.e. above the depth of clathrate formation) was "too high". This ice was deposited in 1890 AD, and the CO_2 concentration was 328 ppmv, not about 290 ppmv, as needed by man-made warming hypothesis. The CO_2 atmospheric concentration of about 328 ppmv was measured at Mauna Loa, Hawaii as later as in 1973, i.e. 83 years after the ice was deposited at Siple. An ad hoc assumption, not* *supported by any factual evidence, solved the problem: the average age of air was arbitrary decreed to be exactly 83 years younger than the ice in which it was trapped. The "corrected" ice data were then smoothly aligned with the Mauna Loa record (Figure 1 B) , and reproduced in countless publications as a famous "Siple curve"* . Furthermore, the evidence from direct measurements of CO_2 in atmospheric air indicates that the 19th century average concentration was 335 ppmv (Slocum, 1955) and more than 90,000 direct chemical measurements in the atmosphere at 43 Northern Hemisphere stations, between 1812 and 2004 have shown that CO_2 varied very significantly [290-440ppm] over that period (Beck, 2007, 2008)[217]. Finally, and very importantly, a study of stomatal frequency in fossil leaves from Holocene lake deposits in Denmark, showing that 9,400 years ago CO_2 atmospheric level was 333 ppmv, and 9,600 years ago 348ppmv, finishes to falsify the concept of low and stable CO_2 air concentration previous the advent of the industrial revolution.

Wagner et al. (1999) state "*The inverse relation between atmospheric carbon dioxide concentration and stomatal frequency in tree leaves provides an accurate method for detecting and quantifying century-scale carbon dioxide fluctuations. In contrast to conventional ice core estimates of 270 to 280 parts per million by volume (ppmv), the stomatal frequency signal suggests that early Holocene carbon dioxide concentrations were well above 300 ppmv*". In this important paper, Wagner et al. (1999) report accurate CO_2 concentrations and variations for the **pre-Boreal Holocene period which were as high as 348 ppmv** and state "*In the Friesland phase, inferred CO_2 concentrations of 265 ± 21 and 260 ± 25 parts per million by volume (ppmv) are followed by a rapid rise to 327 ± 10 ppmv and a more gradual increase to a maximum of 336 ± 8 ppmv in the early part of the Late Preboreal. Then, there is a continuous CO_2 decline to a minimum of 301 ± 21 ppmv, followed by a sharp increase to 348 ± 14 ppmv. In the uppermost part of the studied interval, CO_2 concentrations stabilize again to values between 333 ± 8 and 347 ± 11 ppmv*". On the other hand, the ice core data from the Taylor Dome, Antarctica, which are used to reconstruct the IPCC's official historical record, feature a much more flattish time trend and range, i.e. 285 to 245 ppmv (Indermühle, et al. 1999). This difference strongly imply that ice cores are not a proper matrix for reconstruction of the chemical composition of the ancient atmosphere.

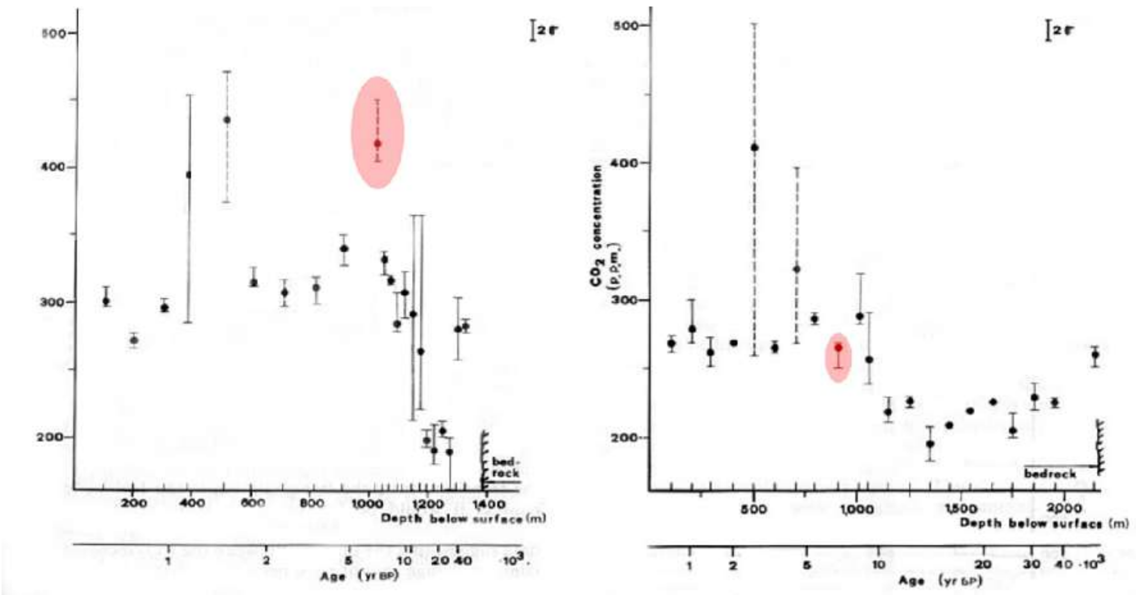

Figure 74. *CO_2 concentrations in the bubbles and total carbonate content of: a, the Camp Century core; b, the Byrd core. The CO_2 concentrations are presented with the lowest, highest and median values for each depth. The dashed lines indicate depths were drill fluid was observed in the large sample. Maximum CO_2 values of 500 ppm at 500m (~300 years) for the Byrd Core. Modified after: Fig.1 in (Neftel, 1982) with anomalies as pink ellipses ~7,000-year BP added.*

217"*Meanwhile, more than 90,000 direct measurements of CO_2 in the atmosphere, carried out in America, Asia, and Europe between 1812 and 1961, with excellent chemical methods (accuracy better than 3%), were arbitrarily rejected. These measurements had been published in 175 technical papers. For the past three decades, these well-known direct CO_2 measurements, recently compiled and analyzed by Ernst-Georg Beck (Beck 2006a, Beck 2006b, Beck 2007), were completely ignored by climatologists—and not because they were wrong. Indeed, these measurements were made by several Nobel Prize winners, using the techniques that are standard textbook procedures in chemistry, biochemistry, botany, hygiene, medicine, nutrition, and ecology. The only reason for rejection was that these measurements did not fit the hypothesis of anthropogenic climatic warming. I regard this as perhaps the greatest scientific scandal of our time.*" (Jaworowski , 2007)

Furthermore, Jaworowski (1997) claims that many discrepancies affect the ice cores and that (Oeschger et al., 1985) made an ad hoc attempt to explain some of these anomalies without success and further adds a very specific claim "*In about ~6,000-year-old ice from Camp Century, Greenland, the CO_2 concentration in air bubbles was 420 ppmv, but it was 270 ppmv in similarly old ice from Byrd, Antarctica*". Though, he does not provide the source of this, it is not difficult to find Fig.1 in (Neftel, 1982) to display exactly that sort of anomaly, though the age is mor e ~7,000-year-old corresponding to 1010 meters at Camp Century, Greenland and 900 meters at Byrd, Antarctica, see for yourself next Figure 74.

So we are left with inaccurate and dubious ice core results as the three fundamental premises are violated because the closed system criteria cannot be met, and which lead the entire AGW edifice to crumble. Pre-industrial CO_2 air concentration of at least 335 ppmv (Slocum, 1955) and pre-Boreal Holocene concentrations of up to 348 ppmv totally invalidate the low and arbitrary cherry picking of Callendar (1938) of 292 ppmv[218] which appears more as pathological science (Langmuir, 1989) than anything else. "*Callendar was prejudice in selecting from all his data roughly 30%, which showed concentration around 290 ppm, leaving the remaining 70% which showed concentrations over 300 ppm*" (Foscolos, 2010) and he made a disservice to science. This practice of arbitrary selection of data sets matching prerequisites is also prejudicial to science and denounced by Jaworowski (1997) for Neftel at al.; Pearman et al.; Leuenberger and Siegenthaler; Etheridge et al.; Zardini et al.; among others.

Let's give the final point here to Jaworowski (2004), «*the basis of most of the IPCC conclusions on anthropogenic causes and on projections of climatic change is the assumption of low level of CO_2 in the pre-industrial atmosphere. This assumption, based on glaciological studies, is false.* ***Therefore IPCC projections should not be used for national and global economic planning***».

Time now to move on to Antarctica and Arctic. The first will be a rather quick trip as the reader will see that there is not much to say in terms of warming, as it is in fact rather cooling, albeit slowly. Arctic will be more of a challenging place to investigate as it shows some warming and the question will be to try to know what it can be related to. As CO_2 is a Well Mixed Gas (WMG), as recalled by Neftel et al. (1982) "*Due to atmospheric mixing, the CO_2 concentration in the Northern and Southern Hemispheres should not differ by more than a few p.p.m.*", one must conclude that any explanation based on GHG warming that would apply only to Arctic and not to Antarctica does not hold.

The West Antarctic Ice Sheet Divide Ice Core, a leading hedge project (WAISDIC, 2020), was completed by the United States Antarctic Program (USAP) and ran under the auspices of the WAIS Divide Ice Core Science Coordination Office (Desert Research Institute and University of New Hampshire) and reports on operations supported by the National Science Foundation under various awards to the Desert Research Institute, Nevada System of Higher Education, and to the University of New Hampshire. They provide a host of information and enable to get a sense of how progress is being made. The site is located at 79°28'03"S 112°05'11"W and is at a linear boundary that separates the region where the ice flows to the Ross Sea, from the region where the ice flows to the Weddell Sea. It is similar to a continental hydrographic divide and was designed so to represent a Southern Hemisphere equivalent to the deep Greenland ice cores. Surprisingly enough, it was asserted that a site in Antarctica was needed because Greenland ice contains enough dust that post-depositional chemical reactions compromise the record of atmospheric carbon dioxide, thus casting a serious doubt on all Arctic records. WAISD drilling was halted 50 meters above the bedrock at a depth of 3405 meters to leave an environmental barrier between the drilling fluid and the pristine basal aqueous environment and intended to provide for a high accuracy of dating of the ice stratigraphy of the most recent 31 kyr based on continuously counting annual layers observed in several indicators, including multi-parameter aerosols (e.g. dust), in the chemical and trace elements, and in records of electrical conductivity, etc. (Sigl, et al. 2016) and led to very accurate dating of key pre-Holocene events, e.g. "*Younger Dryas–Preboreal transition (11.595 ka) and the Bølling–Allerød Warming (14.621 ka)*".

The site was chosen according to a specific criterion. The divide permits to limit the amount of horizontal ice flow drift (<10 meter-year^{-1} at the basement), thus leading to a better integrity of the ice record (limiting different ice deposition locations for ice at different depths), high annual ice accumulation and thick ice was needed to provide a high time resolution record and led to prefer West Antarctica which has higher ice accumulation rates than East Antarctica, and simple basal topography. The first observation is that the relationship between temperature and accumulation is not as simple as it may appear, and as stated by Fudge et al. (2016a) "*the relationship shows considerable variability through*

218 To reach the low 19th century CO_2 concentration, the cornerstone of his hypothesis, Callendar (1938, 1940, 1949) used a biased selection method. From a set of 26 19th century averages, Callendar rejected 16 that were higher than his assumed low global average, and 2 that were lower, see Fig.1 in (Jaworowski, 2007)

time with high correlation and high sensitivity for the 0–8 ka period but no correlation for the 8–15 ka period. This contrasts with a general circulation model simulation which shows homogeneous sensitivities between temperature and accumulation across the entire time period. These results suggest that variations in atmospheric circulation are an important driver of Antarctic accumulation but they are not adequately captured in model simulations. Model-based projections of future Antarctic accumulation, and its impact on sea level, should be treated with caution". Here we have a first red flag that clearly identifies that ice stratification and accumulation is certainly not a linear process over time, that it depends on the actual circulation over the site over long periods of time and that just over a 15 kyr timescale, for at the WAISD site, the situation changed from a good to no correlation, whereas the westerlies should have ensured some regularities to the precipitations and accumulation.

When it comes to the identification of the strata, optical stratigraphy or imaging is often performed, but only as long as the contrasts are satisfactory, which was not the case for the entire WAISD ice core. Therefore, a two-dimensional electrical conductivity stratigraphy was performed for the deepest 40% of the WAIS Divide ice core (1,956 m to 3,405m, 11.5 kyr to 68 kyr) as explained by Fudge et al. (2016b) "*The electrical stratigraphy showed clear banding driven primarily by annual variations. Centimeter-scale pinched layers and other irregularities were concentrated between 2700 m and 2900 m (27 ka to 33 ka); below 2900 m, decreasing amplitude of conductance variations likely due to diffusion prevented confident interpretation of both annual and irregular layering*".

So, beyond 33 kyr and using the best techniques, the records get fuzzy displaying irregular layering which arises from variations in the deformation of ice due to strain and sheer even in a limited flow conformation due to the divide between the Ross Sea and the Weddell Sea and Fudge et al. (2016b) report "*below 2900 m, decreasing amplitude of conductance variations likely due to diffusion prevented confident interpretation of both annual and irregular layering. The effective diffusivity at −30°C is* $2.2 \times 10^{-8}\ m^2\ yr^{-1}$*, approximately 5 times greater than for self-diffusion of water molecules, implying diffusion at grain boundaries... the irregular layering likely arises from variations in the deformation of ice*". So, here one starts seeing the processes described by (Jaworowski, 1997), stress, cracks, strain, sheer, diffusion, which for the WAISD ice core represented 1,780 m (0 to 120m, 520 to 1,340m and 2,565 to 3,405m) over the entire 3,405 m, i.e. nearly 53% of the entire total of the ice core and I will add gas fractionation which is not visible but inevitable and intimately linked to the increase of pressure as we talk at the bottom of the drill of kind of three hundreds (300) bars, and finally decompression and selective degassing when the sample is extracted.

Despite the fact that glacial stratigraphy is always complex as it has just been noted, if only because it provides intertwined levels, with deposition processes leading to layers displaying unconformity and nonconformity due to climatic hazards, etc. the simple ice flow and the annual numbering of the ice strata **resulted at WAISD in the first record of ice stratigraphy** and accumulation rate back to the Antarctic Isotope Maximum 4 (AIM) warm event **that is independent of** an assumed relationship to **water stable isotopes**. Alas, the ice accumulation rate did not consistently correlate with water isotopes, particularly at times of abrupt climate change in the Northern Hemisphere (Fudge et al., 2016a, 2016b). "***This calls into question the common practice of using water isotopes as a surrogate for the ice accumulation rate***" (West Antarctic Ice Sheet (WAIS) Divide Project Members, 2013; Buizert et al., 2015).

Be it for previous studies, e.g. (Neftel, 1982; Neftel et al., 1988) where the bedrock was met before 60 kyr, be it at Camp Century (Arctic) or Byrd (Antarctic), the WAISDIC results confirm that even 20 years later the first studies and with significant instrumentation progress, the bedrock remains where it is and that 31 kyr of real chrono-stratigraphy is a great achievement and 68 kyr is the limit which is reached only at the cost of widely increased uncertainties. The chronology for the deeper part of the core (67.8–31.2 kyr BP), was reportedly based on stratigraphic matching to annual-layer-counted Greenland ice cores using globally well-mixed atmospheric methane. Buizert et al. (2015) report "*We calculate the WD gas age–ice age difference (Δage) using a combination of firn densification modeling, ice-flow modeling, and a data set of* $\delta^{15}N$-N_2*, a proxy for past firn column thickness. The largest Δage at WD occurs during the Last Glacial Maximum, and is 525 ± 120 years*".

One will immediately notice that the techniques used have drastically changed and that using a combination of models and proxies for the firn column thickness, a Δage is then assessed and Buizert et al. (2015) add "*Internally* ***consistent solutions can be found only*** *when* ***assuming little to no influence of impurity content*** *on densification rates, contrary to a recently proposed hypothesis. We* ***synchronize*** *the WD chronology to a linearly scaled version of the layer-counted Greenland Ice Core Chronology (GICC05), which brings the age of Dansgaard–Oeschger (DO) events into agreement with the U/Th absolutely dated Hulu Cave speleothem record*". That's a lot of geo-engineering to make things match and show somehow some coherence down to the 68 kyr limit. In any case, the site does not provide information on the status of WAIS during MIS-5e because basal melting would have melted any ice from that time.

Therefore, one will wonder how much 800 kyr reconstructions can be trusted and with which confidence and reliability the results should be considered as it takes us more than 10 times further back than what appeared already as a technological prowess with the wherewithals of a unique and recent project (2006-2013), such surprisingly distant reconstructions are provided by e.g. (Jouzel et al. 2007; Bereiter et al., 2015) and one must notice that they do not rest on any real stratigraphic counting, just on modeling (firn densification, water isotopes, etc.). The European Project for Ice Coring in Antarctica (EPICA) has provided two deep ice cores in East Antarctica and the drilling at Dome C, was stopped at a depth of 3260 m, about 15 m above the bedrock. As stated by Jouzel et al. (2007) "*A preliminary low-resolution δD*[219] *record was previously obtained from the surface down to 3139 m with an estimated age at this depth of 740,000 years before the present (740 ky B.P.), corresponding to marine isotope stage (MIS) 18.2 (1)... We completed the deuterium measurements,* δD_{ice}*, at detailed resolution from the surface down to 3259.7 m. This new data set benefits from a more accurate dating and temperature calibration of isotopic changes based on a series of recent simulations performed with an up-todate isotopic model*".

One will notice that it is not mentioned any longer the existence of any stratigraphic ice age records that would serve as a validating reference to the far extending δD_{ice}, but of simulations based on ad-hoc isotopic model. The accuracy envisaged by the authors, and one will hardly understand how it can remain constant and stable over the entire 740 kyr given what was seen over the 15 kyr period at the WAISD site with accurate records, is mentioned as "*EDC3 has a precision of ±5 ky on absolute ages and of ±20% for the duration of event*".

Furthermore, one will also notice that the only validation of the entire results reported depends on another piece of software, i.e. a GCM as stated by Jouzel et al. (2007) "*Results derived from a series of experiments performed with the European Centre/Hamburg Model General Circulation Model implemented with water isotopes (9) for different climate stages (SOM text) allowed us to assess the validity of the conventional interpretation of ice core isotope profiles (δD or* $\delta^{18}O$*) from inland Antarctica, in terms of surface temperature shifts*". So, we have simulations performed according to an ad-hoc isotopic model which are validated by another piece of obscure software which is a general circulation model, and this is how the temperatures are known, all that is truly impressive but one remains cautious, aren't you ?

One thing for sure, with Jouzel et al. (2007) one is more into the response of a modeling system than into the stratigraphic counting of the ice layers, which even when done with the greatest care starting from ad-hoc drilling procedures, e.g. (Shturmakov, 2007)[220] and (Souney et al., 2014) show that beyond tens of kyr problems start piling up, not even considering all reservations brought up by (Jaworowski et al, 1992a-b; Jaworowski, 1994, 2003, 2007, 2009).

As one can always find positive information, and provided that the results can be trusted notwithstanding all observations made, one will notice that the climate changes mentioned over the 740 kyr record show a natural variability which far exceed the current changes observed throughout the last two millenniums and Jouzel et al. (2007) state "*We inferred that the change in surface temperature (ΔTs) range, based on 100-year mean values, was ~15°C over the past 800 ky, from -10.3°C for the coldest 100-year interval of MIS 2 to +4.5°C for the warmest of MIS 5.5*" which means huge natural amplitudes and a Δts of up to 15°C! Of course without any man-made emission...

At that time, i.e. 2007, the authors were of the opinion that "*peak temperatures in the warm interglacials of the later part of the record (MIS 5.5, 7.5, 9.3, and 11.3) were* ***2° to 4.5°C higher than the last millennium***" and considered that "*the interplay between obliquity and precession accounts for the variable intensity of interglacial periods in ice core records*". It seems that some CO_2 mind-blurring has happened in the meantime and they are looking now with the IPCCC for another explanation were sort of +1.6 W/m^2 (maximum but probably much less in the order of +1.0 W/m^2) of CO_2 IR absorption (for a doubling) would produce stronger effects than just the variation of the obliquity (notwithstanding all other factors) that they reported by then as representing ten times more at +14 W/m^2, Jouzel et al. (2007) "*With respect to the strong linear relationship between δD and obliquity, the link may be local insolation changes, which at 75°S vary by ~8% up to 14 W/m*^{2}*.*"

219 D stands of course for Deuterium.

220 e.g. the drill fluid is a mixture of HCFC 141b (densifier) and Isopar K (base solvent).

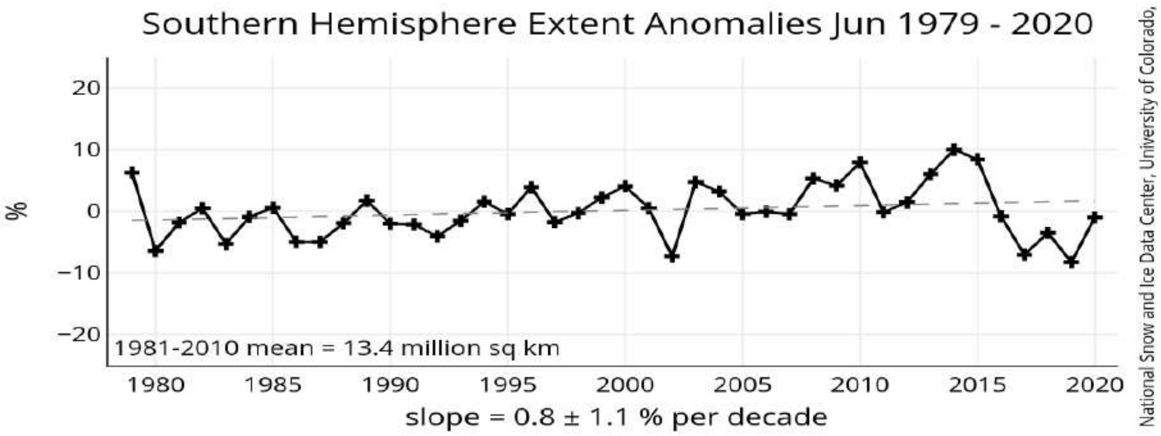

Figure 75. *Antarctica monthly sea ice extent anomaly as per* https://nsidc.org/data/seaice_index *shows a +0.8 ± 1.1%* ***increase*** *per decade. Methodology described at* https://nsidc.org/sites/nsidc.org/files/G02135-V3.0_0.pdf

So now the good news, which is that whatever the IPCC speculations and the arguing about the next Armageddon if all the emissions are not cut drastically, the Antarctica has kept growing, yes growing albeit at a small pace, i.e. +0.8 ± 1.1% per decade, and the graph Figure 75 (National Snow & Ice Data Center - University of Colorado, Boulder) is quite clear.

And as a picture is worth a thousand words, let's see the geographical extent of the sea ice and compare it to its median ice edge (1981-2010):

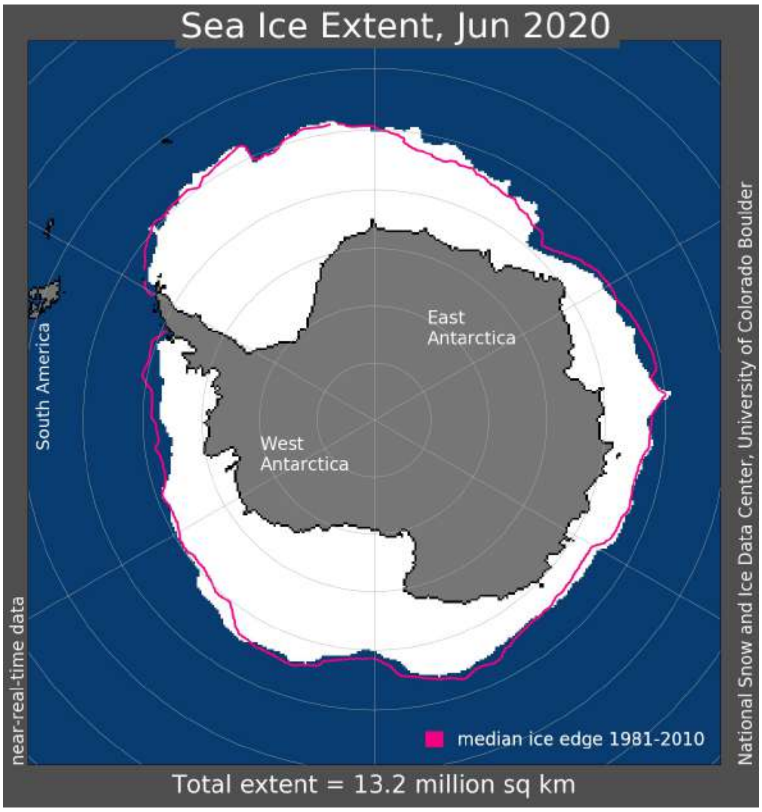

Figure 76. *The monthly Sea Ice Index provides a quick look at Antarctic-wide changes in sea ice. It is a source for consistently processed ice extent and concentration images and data values since 1979. Monthly images show sea ice extent with an outline of the 30-year (1981-2010) median extent for that month (magenta line), as per* https://nsidc.org/data/seaice_index*. Source: National Snow & Ice Data Center - University of Colorado, Boulder.*

Finally, the following graphic depicts the temperature in Antarctic with the Ln(CO_2) and shows that despite the massive increase in [CO_2] there is simply no temperature response for the simple reason, that the climate has a very low sensitivity to CO_2 as we have amply demonstrated up to now.

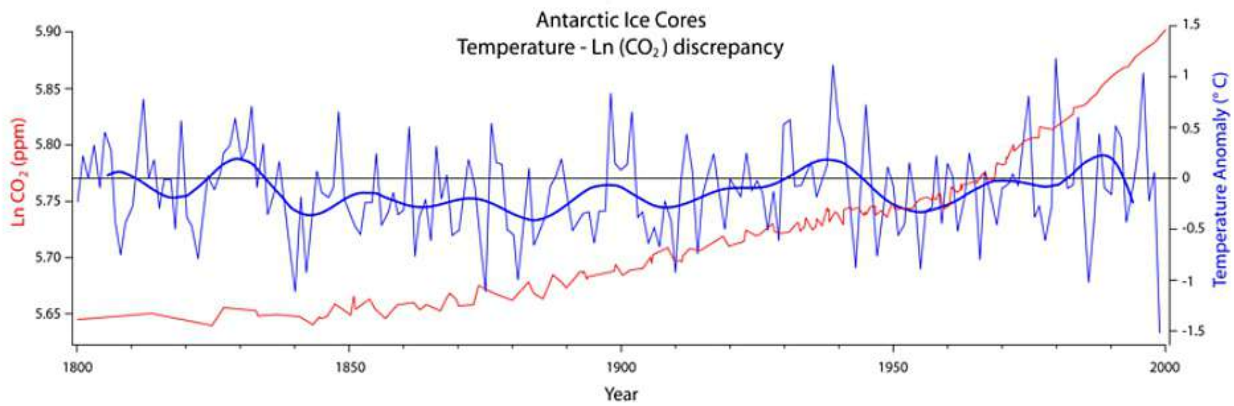

Figure 77. *CO_2 curve (red) from Antarctic Ice Cores Revised 800 kyr CO_2 Data (to 2001). Source: NOAA, contributed by Bereiter et al., (2015); and from NOAA annual mean CO_2 data (2002–2017). Due to the logarithmic effect of CO_2 on temperatures, the comparison is more appropriately done with the Ln(CO_2). Temperature curve (blue) for the past 200 years from 5 high resolution Antarctic ice cores. Source: Schneider et al. (2006).* ***No temperature change*** *is observed in response to the massive increase in CO_2, over the period 1800-2000 (despite the conclusion from Schneider et al. (2006), who by cherry-picking the data, says slightly otherwise). Source: Javier (2018b).*

Surprisingly, Antarctica shows absolutely no warming for the past 200 years as displayed on Figures 75, 76 and 77. The only place where one can measure both past temperatures and past CO_2 levels with some confidence for 31 kyr shows no temperature response to the huge increase in CO_2 over the last two centuries and at least for the last 7 decades as evidenced by a thorough analysis by Singh and Polvani (2020). This evidence supports that CO_2 has very little effect over Antarctic temperatures, if any, and it cannot be responsible for the observed correlation over the past 800,000 years, and again appears just as a lagging proxy on the temperature. "*It also raises doubts over the proposed role of CO_2 over glacial terminations and during Modern Global Warming (MGW)*" (Javier, 2018b).

Measurements are directly available and can be checked for a host of different stations. A very limited excerpt of some stations is listed hereafter and show no warming over the period 1950-2020 :

Station Data: Halley (75.45S, 26.217W):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=AYM00089022&ds=14&dt=1
Station Data: Mawson (67.6S, 62.8670E):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=AYM00089564&ds=14&dt=1
Station Data: Vernadsky (65.25S, 64.267W):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=AYM00089063&ds=14&dt=1
Station Data: Dumont D'Urville (66.667S, 140.0170E):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=AYM00089642&ds=14&dt=1
Station Data: Jan Mayen (70.9331N, 8.6667W):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=NOE00105477&ds=14&dt=1
Station Data: Bjoernoeya (74.5167N, 19.0167E):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=NO000099710&ds=14&dt=1
Station Data: Nikolskoye Beringa Ostrov (55.2000N, 165.9800E):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=RSM00032618&ds=14&dt=1
Station Data: Barrow Post Rogers Ap (71.2833N, 156.7814W):
https://data.giss.nasa.gov/cgi-bin/gistemp/stdata_show_v4.cgi?id=USW00027502&ds=14&dt=1

Complete access is provided here, selecting stations at will on the sensitive globe display: https://data.giss.nasa.gov/gistemp/station_data_v4_globe/

It has long been considered by most authors that the change of CO_2 levels between glacial and interglacial periods, of only 70–90ppmv, is too small to drive the glacial cycle, and even if Shakun et al. (2012) state that "*Our global temperature stack and transient modelling point to CO_2 as a key mechanism of global warming during the last deglaciation*" not only does their excellent paper totally invalidates that assertion but also provides for a clear sequence of event of how a deglaciation happens and of how little the CO_2 plays a role. We now have seen all the required concepts to describe the full scenario of how the Earth exists a glacial era, let's see how that works.

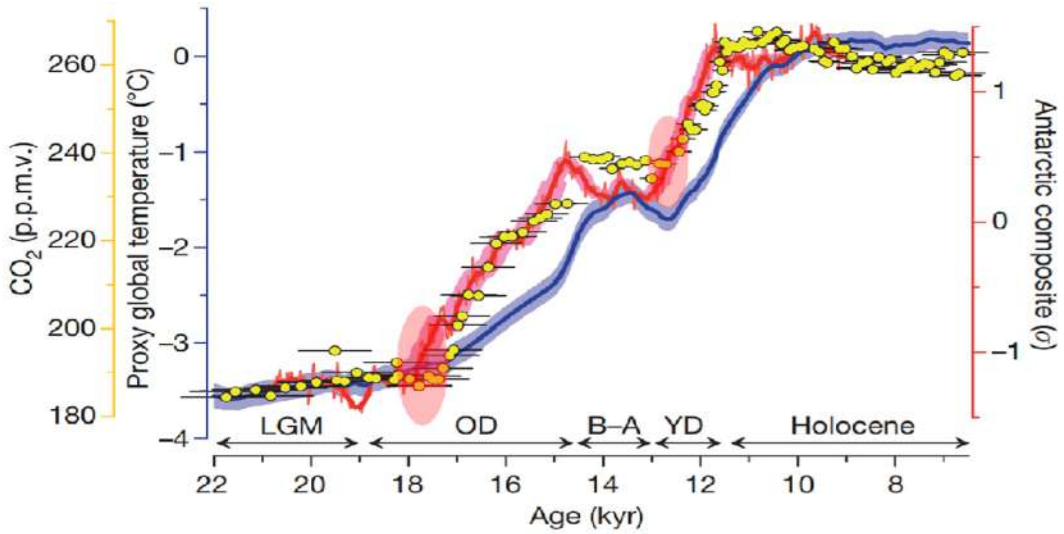

Figure 78. Temperature(s) T and CO_2 concentration: The graph displays the global proxy temperature stack (blue) T_G as deviations from the early Holocene (11.5–6.5 kyr ago) mean, an Antarctic ice-core composite temperature record (red) T_A, and atmospheric CO_2 concentration (EPICA Dome C ice core). The pink ellipses show clearly where T_A starts rising before CO_2 which keeps lagging all along except for the degassing hysteresis oceanic effect when T stabilizes (between -15 and -13kyr). The Holocene, Younger Dryas (YD), Bølling–Allerød (B–A), Oldest Dryas (OD) and Last Glacial Maximum (LGM) intervals are indicated. Modified after: Shakun et al. (2012).

1) As with seen Figure 35, the sinusoidal change of obliquity, with the help of precession, leads to an increase in insolation at 65N at around -19 kyr. This does not succeed to produce the initial trigger the exit of the glacial era each time, i.e. every 41 kyr, as the Earth as gotten cooler and cooler, and since the previous inter-stadial, i.e. the Eemian, two unsuccessful attempts failed until the Holocene turned out to be the right one. It is remarkable that it was not until Roe (2006) that it was recognized that during the alternation of deglaciations and glaciations, the insolations at 65°N from Milankovitch's calculations are not correlated with the ice volume V(t), deduced from the sea level found by various geological markers, but with the time rate of change of global ice volume, i.e. the derivative dV/dt of this volume with respect to time! It is however obvious that temperature determines the melting of the ice dV/dt, and not its volume V(t), and thus that there exists a relationship of the kind: $dV/dt = a\,(T(t) - T_0)^b$. By doing so, Roe (2006) reports that "*the available records support a direct, zero-lag, antiphased relationship between the rate of change of global ice volume and summertime insolation in the northern high latitudes. Furthermore, variations in atmospheric CO_2 appear to lag the rate of change of global ice volume. This implies only a secondary role for CO_2 – variations in which produce a weaker radiative forcing than the orbitally-induced changes in summertime insolation – in driving changes in global ice volume*". Then, and this is very important, Shakun et al. (2012) state "*Substantial temperature change at all latitudes, as well as a net global warming of about 0.3°C, precedes the initial increase in CO_2 concentration at 17.5 kyr ago, suggesting that **CO_2 did not initiate deglacial warming***". Not only did CO_2 not initiate the deglacial warming, but contrary to what Shakun et al. (2012) try to demonstrate by using monte-carlo simulations, CO_2 did not play any role at all, just lagged the temperature and especially those in Antarctica (as they concede anyway) where the degassing of the southern oceans produced the increase in the gas of life, this being very well visible on Figures 70 and 78, e.g. (Martínez-Botí et al. 2015). Each of the pink ellipses show that the Antarctica temperature broke out of a consolidation phase first (at 12.5 and 17.8 kyr) and second CO_2 followed, and that when the temperature stabilized horizontally, CO_2 slightly overshot due to the hysteresis effect of the warmer ocean which kept degassing, given the long residency time of the AMOC, and finally started to subside.

2) This warming of the Northern mid to high latitudes, due to the orbital trigger, were the first to warm after the LGM leads to the observed retreat of Northern Hemisphere ice sheets and the increase in sea level commencing 19 kyr ago, with an **increase of freshwater** that produces a **weakening of the AMOC**. In response to 1.0-Sv freshwater input, the THC switches off rapidly in all model simulations. A large cooling occurs over the North Atlantic. The annual mean Atlantic ITCZ moves into the Southern Hemisphere (Stouffer et al., 2006) ;

3) At that point there occurs a a pronounced **inter-hemispheric seesaw** event around -13.5 kyr, as seen in the Pa/Th (protactinium/thorium ratio) record and Shakun et al. (2012) state "*We find that ΔT decreases during*

the Oldest Dryas and Younger Dryas intervals, when the Pa/Th record suggests that the AMOC is weak and heat transfer between the hemispheres is reduced, and that ΔT increases during the LGM, the Bølling–Allerød and the Holocene, when the AMOC is stronger and transports heat from the south to the north". There results a cooling of Arctic between 13.8 kyr to -12.5 kyr, but the tropical and Southern Hemisphere warming seem to completely offset northern extra-tropical cooling. A near-synchronous seesaw response is seen from warming of the mid southern latitudes to the cooling of the high northern latitudes, and strong Antarctic warming is observed and **the increase in CO_2 concentration obviously lags the temperature and the AMOC change**, as it is the very change in the AMOC circulation which leads to an increase in the degassing of the southern oceans. There exists a correlation between times of minima in the AMOC and maxima in CO_2 release, for the simple reason that to a minimal northern AMOC corresponds warmer southern oceans and more degassing. Anderson et al. (2009) observe "*In the record with the greatest temporal resolution, we find evidence for two intervals of enhanced upwelling concurrent with the two intervals of rising atmospheric CO_2 during deglaciation. These results directly link increased ventilation of deep water to the deglacial rise in atmospheric CO_2*".

4) The entire Bølling-Allerød period -12.7 to -14.7 kyr was a climatically unstable period in the northern high latitudes and this instability is linked to alternating modes of the Arctic sea ice cover between periods with and without perennial sea ice cover. Then the AMOC resumes around -12.5 kyr and the northern hemisphere and the Arctic warm again to reach a high level at the beginning of the Holocene, at the end of the Younger Dryas, at -11.7 kyr, but the Holocene Climatic Optimum will only be reached slightly later, during the Boreal at around -9.7 kyr (Figure 34).

As was clearly explained above, CO_2 has been accompanying the events, nothing more and acted as a ex-post thermometer just recording the increase in temperatures through the simple effect of Henry's law and the obsessional focus on it to try to explain a much more complex sequence of event is surprising. Thus the final statement by Shakun et al. (2012) "*Our global temperature stack and transient modelling point to CO_2 as a key mechanism of global warming during the last deglaciation*" seems to simply go against all evidences brought by the paper and contradicts the very title of the article.

Over the last 200 years CO_2 levels have increased by 78 ppm (335 ppmv before the industrial age and 413 ppmv as of July 2020), an increase comparable to that of a glacial termination in terms of additional CO_2. But, Antarctica shows absolutely no warming for the past 200 years and this evidence supports that CO_2 has very little effect over Antarctic temperatures, if any, confirms the very low atmospheric sensitivity to CO_2 and it cannot be responsible neither for the termination of the glacial cycle, as Shakun et al. (2012) have rightfully acknowledged, nor of the modern warming which started at the end of LIA. As far as very recent times are concerned, since 1958, Curry (2018) reports "*Temperature reconstructions for Antarctic show little change in East Antarctic surface air temperatures, but warming since 1958 over West Antarctic and the Antarctic Peninsula (Nicolas and Bromwich, 2014). Since the late 1990s, the Antarctic Peninsula has cooled, decadal temperature changes for West Antarctic and the Antarctic Peninsula are within the large natural climate variability (Turner et al., 2016; Smith and Polvani, 2017)*" (Curry, 2018). In fact, a recent paper rather shows that East Antarctica has been rapidly cooling in recent decades, with magnitudes reaching -0.7°C to -2.0°C per decade since the mid-1980s (Obryk et al., 2020). How unfortunate, it seems that the whimsical climate does what it wants and does not stick to AGW climate-illusionists injunctions.

It does not look like the house is on fire, doesn't it?

Actually, the Arctic displays some kind of unusual response since the mid of the 1980s, though it is not the first time as the north polar cap shows a much greater sensitivity to weather and climate changes than the other pole; in that respect the free e-book from Longhurst (2015) addresses very well this topic through its section 8.1-8.4 and its reading is highly recommended. Let's start with a question: do you remember the settlement of the Vikings on the "Green Land" with Erik the Red in 985, who was the first permanent European settler, during the Medieval Warm Period?. The Icelanders established two colonies just after sailing past Cape Farewell, a headland on the southern shore of Egger Island, Nunap Isua Archipelago at the southern extremity of Greenland, one on the extreme southwest coast known as the the Eastern Settlement[221] or Eystribyggð (which was in fact just close to the extreme South), now Qaqortoq, and the Western Settlement, close to present-day Nuuk. The Norse settled at the head of long fjords and grew up to 4,000 inhabitants, with more than 500 groups of ruins of Norse farms known and a diet which consisted initially of 80% of agricultural products and 20% marine food (Arneborg et al., 1999).

221 https://en.wikipedia.org/wiki/Eastern_Settlement

This says a lot about the climate as it must have enabled at that time the growth of enough hay meadows during summertime to feed livestock, and undoubtedly, around year 1000, Greenland was warmer and nearly devoid of ice a significant part of the year, at least in most of the surroundings of southern fjords where the Eastern Settlement was. From the 14th century on the Greenland Norsemen had 50–80% of their diet from the sea and had undergone an adaptation process to climate change, but as stated by Dugmore et al. (2010) it is estimated "*that the Norse had achieved a locally successful adaptation to new Greenlandic resources but that their very success may have reduced the long term resilience of the small community when confronted by a conjuncture of culture contact, climate change, and new patterns of international trade*". In any case, a wedding solemnized in 1408, is the last recorded contact with the colony, placing it about 50–100 years later than the end of the more northern Western Settlement, the Norse are considered to have deserted around 1,450 whereas the the Thule Inuit survived through the period of Norse extinction. The more than 400 years of settlement ended by an abrupt collapse, due as always to cooling conditions and certainly not warming, as the entire history of mankind tells us, and that we should remember if History is any guide. Today, farming is still the main occupation in Qassiarsuk and the local sheep farmers in the area cultivate the same fields and graze their animals on the same hillsides that the Norsemen used more than a thousand years ago, and they certainly welcome the milder climate than that of the LIA.

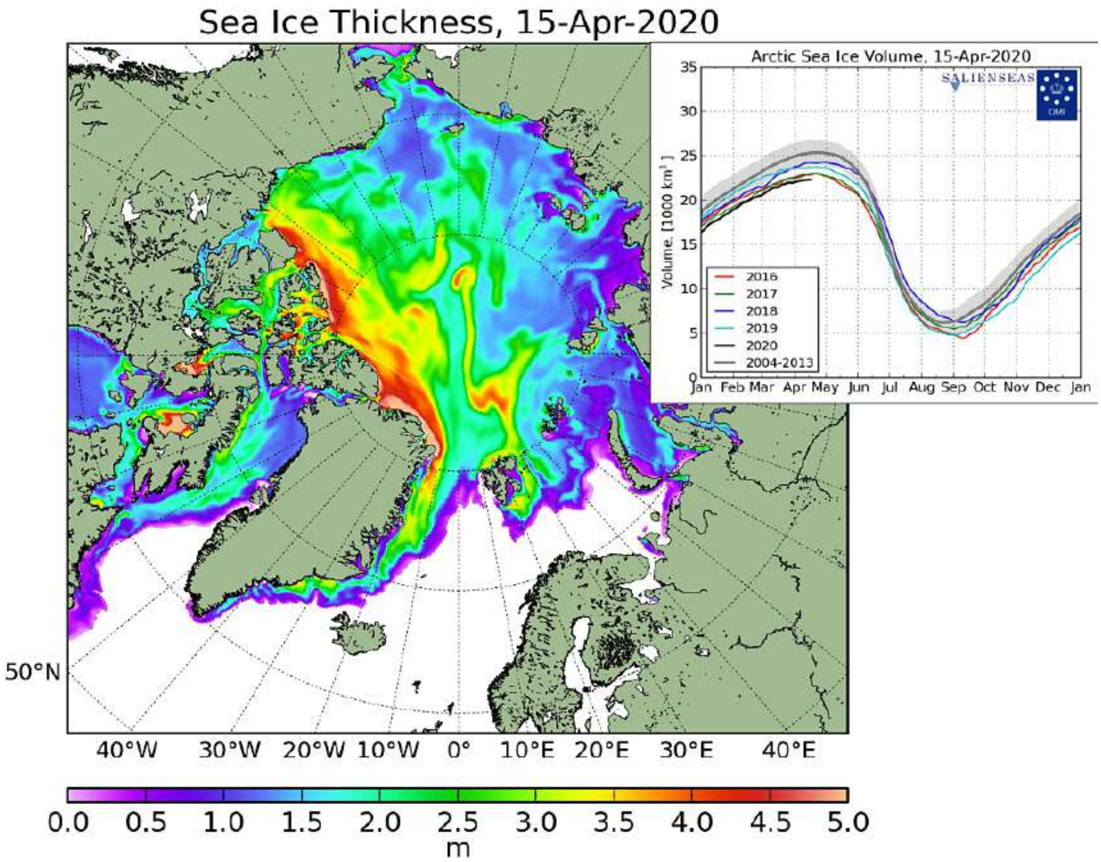

Figure 79. *The Sea Ice Thickness and extent provides a quick look at Arctic-wide changes in sea ice, here for April 15, 2020, somewhere around its maximum yearly extension as displayed in the superimposed sinusoid. Source: from the Danish Meteorological Institute (DMI), as per* http://ocean.dmi.dk/arctic/icethickness/images/.

As reminded by Longhurst (2015) "*The entire record - in which 20th century temperature are rather similar to those of the Mediaeval Warm Period - is marked by multi-decadal oscillations over 2-3°C so that, consequently, the observed recent changes are not unusual either in scale or duration: the ice-core record of temperature thus confirms historical evidence (Kobashi et al., 2010)*" and Kobashi et al. (2011) assert "*Therefore, we conclude that the current decadal mean temperature in Greenland has not exceeded the envelope of natural variability over the past 4000 years*". Furthermore, as explained by Longhurst (2015) "*But the present glacier retreat is not a uniform phenomenon, as it is usually portrayed. On Bylot Island, across Baffin Bay from the Greenland coast at about 73°N, a party of Canadian geologists in summer 2009 found that almost all of the glaciers were at their terminal moraines, implying a regional lack of glacier retreat*". Checking the details of this information in Wielens et al. (2009) p. 25, one will be surprised to read "*The glaciers on Bylot Island are striking. Virtually* ***all are at their end moraines****, the ground-up* ***rocks deposited farthest out by the snout of the glacier****, and crevasses are present only over 'steps' in the underlying bedrock*". Obtaining striking images of glaciers calving massive discharges of ice in the sea is better for publishing a successful paper in the news-press, and a well known site to obtain such pictures is the Ilulissat glacier (also known as Jakobshavn Glacier[222]) which calves abundant icebergs into Disko Bay and did so throughout the XXth century, the Titanic iceberg is thought to have come from it in 1912. Thus the behavior of the glacier is very differential and the AGW meme puts the emphasis on the glaciers that recede, as the Wikipedia paper does, forgetting all the others. But as will be next explained, the behavior of the regional glaciers and of the Arctic more generally coincides with the influence of Atlantic waters through the various oscillations known as the AMO e.g. (Chylek et al., 2011) or e.g. a negative phase of the NAO, i.e. anti-correlation of (r=–0.84 to–0.93) with the Greenland temperatures (Chylek et al., 2004), etc. and not with any radiative imbalance.

Having reminded of the natural variability through historical and regional records, which is always a good start to make an informed reasoning, clearly, since the mid-1980s, the mass balance has switched in Arctic, in fact the Decadal Mass Balance (DMB) of the entire Greenland ice sheet tilted from a mass gain of +47 ± 21 Gt/y in 1972–1980 to a loss of -51± 17 Gt/y in 1980–1990 but showed that the ice sheet as a whole was near balance over the time period 1972–1990 (Mouginot, et al., 2018). Of course, to make such an assertion, a lot of modeling has to take place as the only way to access with some reliability the evolution of the Total Mass Balance (TMB) is through the Mass Budget Method (MBM) that provides information about the physical processes controlling the mass loss made 1) through the Surface Mass Balance (SMB) processes made of accumulation minus runoff and other forms of ablation and 2) glacier dynamics (basal ice mass flux into the ocean). Knowing precisely the TMB requires to assess the precise glacier fluxes into the ocean and reconstruction of SMB over the ice sheet. The major change leading to a negative DMB is an increase of the basal ice discharge under the influence of tidewater glaciers responding to the Atlantic Multidecadal Oscillation[223] (AMO). The oceanic influence is always from where the triggers come and the action of the AMO in Arctic is mirrored somehow by what is also happening in Western Antarctica where the tips of glaciers under the influence of oceanic tides also show some increased discharge (whereas TMB is positive). As was said, the computation of TMB requires a lot of modeling to determine on the one hand the accumulation of snowfall (from regional atmospheric climate models) and on the other the mass loss based on Digital Elevation Model DEMs (using among other sources of information radar surveys and airborne laser altimetry) which yields a time series of glacier thickness to calculate glacier fluxes with precision in Greenland since 1972, i.e. the start of the Landsat historical archive. Provided that one trusts the models, the discharge has increased since the 1980s and especially the mid-1980s, but this comes as no surprise as when one looks at the Arctic ice volume in the upper corner of Figure 79, one can visibly see that 2020 is at the bottom of the short-term variability, but 2018 just 2 years ago was within the gray envelope representing the mean for the decade 2004-2013.

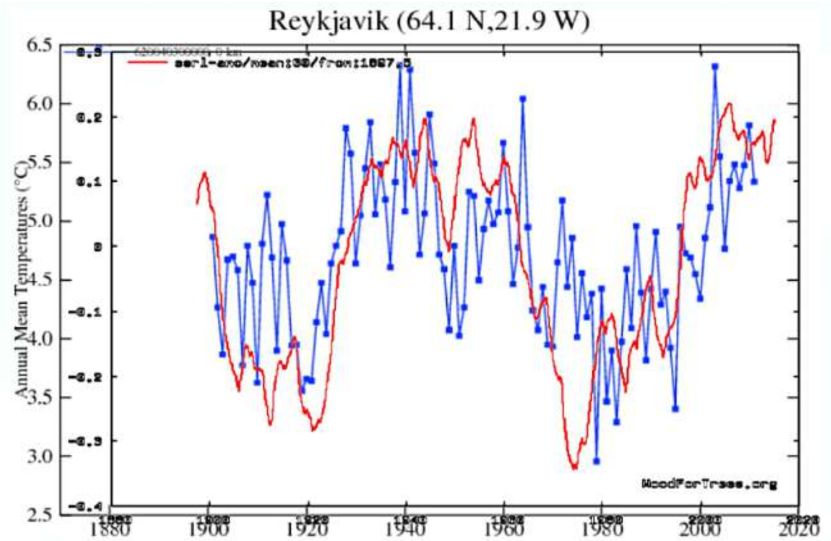

Figure 80. *GISS Surface Temperature Analysis (in Blue), Station Data: Reykjavik (64.1 N, 21.9 W)[224] Iceland and Atlantic Multidecadal Oscillation (AMO) (in Red) "ESRL AMO index[225]" superimposed. Eastern Arctic temperatures closely track the Atlantic Multidecadal Oscillation, and show no correlation with atmospheric CO_2. Source: https://realclimatescience.com/arctic-sea-ice-unchanged-from-60-years-ago/.*

222 https://en.wikipedia.org/wiki/Jakobshavn_Glacier

223 https://en.wikipedia.org/wiki/Atlantic_multidecadal_oscillation is a climate cycle that affects the sea surface temperature (SST) of the North Atlantic Ocean .

224 https://data.giss.nasa.gov/cgi-bin/gistemp/show_station.cgi?id=620040300000&dt=1&ds=1 Directly from NASA web page where one can get any data for any station wished.

225 https://woodfortrees.org/plot/esrl-amo/mean:60/from:1897.5

Let's remind first that CO_2 is a Well Mixed gas (WMGG), e.g. "*Due to atmospheric mixing, the CO_2 concentration in the Northern and Southern Hemispheres should not differ by more than a few p.p.m.*" (Neftel et al., 1982) and "*Air is well mixed with only minor variation in CO_2 content with latitude*" (Latour, 2014). Thus, any explanation based on GHG warming applying only to Arctic and not to Antarctica does not hold, **the limited warming in Arctic is not the consequence of the observed increase of CO_2**. This is anyway what was stated by Chylek et al. (2006) in the clearest way "*To summarize, we find no direct evidence to support the claims that the Greenland ice sheet is melting due to increased temperature caused by increased atmospheric concentration of carbon dioxide*". As was presented while addressing the oscillations and the oceanic currents and the scenario that enabled the Earth to exit the last glacial era to enter the milder Holocene, Arctic has proved very sensitive to the influence of the THC and of the Atlantic Multidecadal Oscillation (AMO) in particular, to which it responds with the regularity of a metronome.

From the previous Figure 80, one can see multiple important patterns, first Eastern Arctic temperatures and temperatures in Iceland show no alarming sign of warming (not above the 1930-1940 period representing a comparable very short term variability, see also Mikkelsen et al. (2018) Fig.2 p. 6), and second and more importantly, they closely follow the AMO with great regularity. Let's remind ourselves again that the AMO is an oscillation that affects the sea surface temperature (SST) of the North Atlantic Ocean on multidecadal timescales and ocean circulation drives the phase changes of the AMO by controlling ocean heat content and exchange. McCarthy et al. (2015) remind that "*Positive (negative) phases of the AMO coincide with warmer (colder) North Atlantic sea surface temperatures. The AMO is linked with decadal climate fluctuations, such as Indian and Sahel rainfall, European summer precipitation, Atlantic hurricanes and variations in global temperatures*". Furthermore, ocean circulation appears to result from atmospheric triggers, refer to the NAO described before, through circulation changes between the sub-tropical and sub-polar gyres, i.e. the inter-gyre region.

Studying the AMO variability over some decades, Ting et al. (2008) observe "*However, the earlier warming trend in the 1930s and the cooling trend in the 1970s were connected mainly to internal variability*". They also report that beyond the Atlantic surrounding which is under direct influence of the AMO, its effects are felt much further and the largest impact is over the Sahel region, where the warming trend of the AMO is associated with increased precipitation and reversely the epoch of the Sahel drought of the 1970s and 1980s is associated with a cooling trend in the AMO and opposite for the Yucatan peninsula (Knudsen et al., 2011), Fig.2. All that reminds us that the climate is first and foremost made of precipitations and natural variations (Koutsoyiannis, 2008), that it has always been the case and not of a minuscule increase of CO_2 concentration.

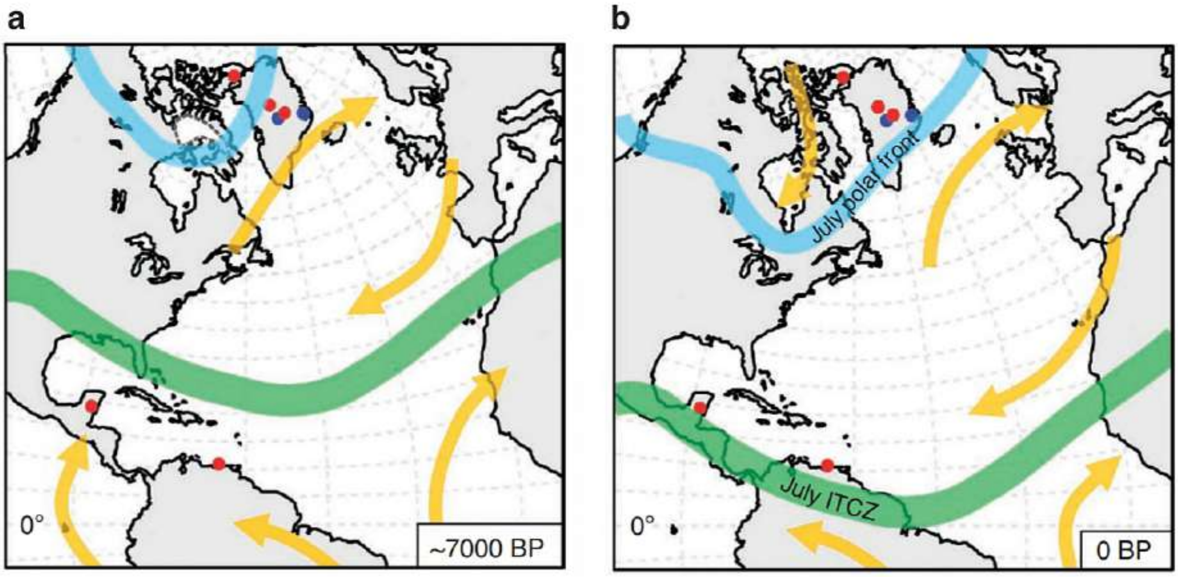

Figure 81. a) ~-7,000 years with significantly higher NH summer insolation than today, whereas it was lower in the SH (opposite in winter) led to a shift of the ITCZ, located north of its present position, with the PF also displaced well to the north in the North Atlantic sector. These conditions may be representative for the average conditions between -6,000 and -8,000. b) Modern atmospheric systems of the North Atlantic region (may also represent average conditions for the period 0–3,000 years BP, where an overall 'neo-glacial' regime with more frequent meridional atmospheric circulation patterns. PF, atmospheric Polar Front; ITCZ, Inter-Tropical Convergence Zone. The yellow arrows indicate the dominant wind directions and explain why it rained 7,000 years in the Green Sahara, whereas dry Trade winds prevail today. After Ting et al. (2008).

Ting et al. (2008) have shown, based on spectral analyses of high-resolution climate proxy records from the region bounding the North Atlantic, that distinct ~55 to 70-year oscillations characterized the North Atlantic ocean-atmosphere variability over the past 8,000 years and that AMO and NAO adapted to the shifts of the ITCZ and PF (Figure 81). These authors also add "*The AMO is also believed to influence regional to hemispheric-scale climate trends as far away as the Tibetan Plateau and India , possibly through changes in the interhemispheric redistribution of heat*". The southward migration of the ITCZ and of the PF entailed a general change in the atmospheric circulation, including a southward shift of the jet stream and Icelandic Low as well as a major change in the AMO circulation, leading to its attenuation in the Arctic from a maximum during the HCO, and an increasing influence in the tropics.

Back to Greenland, Hofer et al. (2017) found that the important reduction in Greenland's mass balance since 1995 is caused by decreasing summer cloud cover having a warming effect from increased solar radiation with an enhanced effect on the low albedo ablation zone, and that summer melt increases by 27 ± 13 gigatons[226] (Gt) per percent reduction in summer cloud cover. More importantly, the observed reduction in cloud cover is strongly correlated with a state shift in the North Atlantic Oscillation (NAO), promoting high-pressure conditions in summer that inhibits cloud formation and also reduces precipitation. Thus, Hofer et al. (2017) conclude "*that the enhanced surface mass loss from the Greenland Ice Sheet is driven by synoptic-scale changes in Arctic-wide atmospheric circulation*". As Arctic climate is decidedly not the result of simply more CO_2, Wang et al. (2018) have shown that Cloud Radiative Effects (CRE) offer sort of a regulating mechanism that balances the radiative energy budgets between the relatively cold and warm regions in Greenland and they report that "*in the accumulation zone that currently occupies most of Greenland, clouds warm the cold and bright surface to enhance snow metamorphism and snow melt, which tends to reduce albedo. In an expanding ablation zone with warming climate, CRE becomes increasingly negative as albedo decreases. This stabilizing mechanism might also occur in the Arctic ocean and other ablation zones, where surface and cloud conditions are similar to those in Greenland's ablation zone, helping decelerate surface melt in the dimmer Arctic*". These stabilizing feedback mechanisms involving clouds, snow-melt, snow metamorphism and surface albedo are also relevant as they are not limited to Greenland but also influence the entire Arctic ocean.

As if the oceanic currents, the atmospheric circulation changes and the variable cloud cover feedback mechanisms were not enough to bury CO_2 at the bottom of the pile of the worries, precisely at the bottom lies another trouble maker, some unexpected geothermal flux of an average intensity in the order of $93 \pm 21 mWm^{-2}$, which in fact is seldom directly measured but shows a high variability with reported values ranging from 20 to $40mWm^{-2}$ in the south and up to $140mWm^{-2}$ in the central northern Greenland. In fact, this may explain the discrepancies between the observed and simulated (again!) ice flows and this may be due to a host of reasons to be first searched into the models, e.g. inaccurate parameterization of basal motion, or of sub-glacial hydrology, but also of neglected heat sources that could play a role from beneath the ice sheets. Local high melt rates and strong basal flows indicate geothermal gradients of 15 to 30 times higher than continental background values, and one should notice that East Greenland constitutes a volcanic rifted margin that forms part of the Tertiary North Atlantic Igneous Province and that many hot geothermal springs [55-62°C] are spread north and south of Scoresby Sund (Kangertittivaq). This high geothermal signature corresponds exactly to what Rysgaard et al. (2018) report by presenting the first direct measurements of the Geothermal Flux (GF) from beneath the deepest basin of the Young Sound-Tyrolerford system in Northeast Greenland (74°N), asserting that "*A compilation of heat flux recordings from Greenland show the existence of geothermal heat sources beneath GIS and could explain high glacial ice speed areas such as the Northeast Greenland ice stream*".

As if that was not enough, a study by Rogozhina et al. (2016) unveils the particular geotectonic context that underlies Greenland and prove that there exists a large geothermal anomaly, 1,200-km-long and 400-km-wide, that spreads across the continental mass and confirms the high GF observed in the Sound-Tyrolerford, but more importantly that this anomaly was formed by Greenland's passage over the Iceland mantle plume between roughly 80 and 35 million years ago according to paleo-reconstructions of the plate motion. Rogozhina et al. (2016) observe that "*the complexity of the present-day subglacial hydrology and dynamic features of the north-central Greenland ice sheet originated in tectonic events that pre-date the onset of glaciation in Greenland by many tens of millions of years*".

The question of whether this warming, at least until 2005 was exceptional was addressed by Chylek et al. (2006) and they concluded that "*Although there has been a considerable temperature increase during the last decade (1995 to 2005) a* ***similar increase and at a faster rate occurred during the early part of the 20th century*** *(1920 to 1930) when carbon dioxide or other greenhouse gases could not be a cause. The Greenland warming of 1920 to 1930* ***demonstrates that a high concentration of carbon dioxide and other greenhouse gases is not a necessary condition*** *for period of*

[226] 1Gt = 1 Billion of tons

warming to arise. The observed 1995 – 2005 temperature increase seems to be within a natural variability of Greenland climate". Thus, what should be reminded is that current Arctic ice retreat is largely within normal short (Mörner et al., 2020) and longer term variability, if only for the Holocene when a much lower Arctic sea ice extent existed between 9,000 and 4,000 BP; many studies establish with confidence this evidence, with observations all around the Arctic ocean.

In the Canadian Arctic Archipelago a -7.0 kyr spring sea ice record for Victoria Strait and Dease Strait was determined by quantification of the sea ice diatom-derived biomarker IP_{25} (Belt and Müller, 2013) and indicates lower spring sea ice occurrences during the early part of the record between -7.0 to -3.0 kyr and for parts of the late Holocene -1.5 to -0.8kyr (Belt et al., 2010). The Arctic Palaeoclimate and its EXtremes (APEX) program has conducted studies in 18 different locations around the North pole and the Arctic ocean and the results are reported by Jakobsson et al. (2010) who state "*The combined sea ice data suggest that the seasonal Arctic sea ice cover was strongly reduced during most of the early Holocene and there appear to have been periods of ice free summers in the central Arctic Ocean*". Stranne et al. (2014) focus on paleo-reconstructions during the Holocene and even though these authors acknowledge the difficulty to determine the paleo sea-ice extent they concur to recognize that parts of the Holocene were characterized by less sea ice than now over large areas and potentially even sea ice free summers. They assert that between -10.0 to -6.0 kyr the sea ice extent was reduced and they attribute it to Early Holocene Insolation Maximum (EHIM) associated with Earth's orbital cycles as per Berger and Loutre (1991) calculations, around -9.2 kyr. Studying the Chukchi and East Siberian Seas with biomarker proxy records, Stein et al. (2017) show that the early Holocene displayed a minimal sea extent, some high-variability in sea ice extent during the mid-Holocene and a steady increase during the last 4.5 kyr and attribute these changes to "*changes in surface water and heat flow from the Pacific into the Arctic Ocean as well as the long-term decrease in summer insolation*", thus showing the importance of SST contributions to the Arctic climatic state. In fact, the simple truth is that **the current total Arctic sea and continental ice volume** (measured in m of SLE) has simply been steadily increasing for the last 5 kyr and notwithstanding minor recent variations (over 1 kyr) **has never been that big** as reported by Mikkelsen (2017) and as very well visible on Fig. 1 in Mikkelsen et al. (2018), supplement material p. 5.

Finally, if one wants to know where the Arctic sea ice will be and its extent, it seems that it is not towards the computer models that one must turn himself or herself as they are well known to overestimate Arctic warming (Huang et al., 2019). Figure 82, taken from Eisenman et al. (2011) shows the IPCC model forecasts for the summer minimum in Arctic sea ice in the year 2100 relative to the period 1980–2000. As we can see, there is a model and a result that can satisfy everyone. Lindzen says "*It is a little like the formula for being an expert marksman: shoot first and declare whatever you hit to be the target*". Decidedly, reading in the digital coffee grounds will be a tough endeavor, as in that case the result delivers everything in between [1%-88%] !. With that kind of "*settled science*" there is an obvious need to prosecute the "*deniers*" as explained in section "Thought Police and the Fledgling of Eco-Dictatorship", p 359.

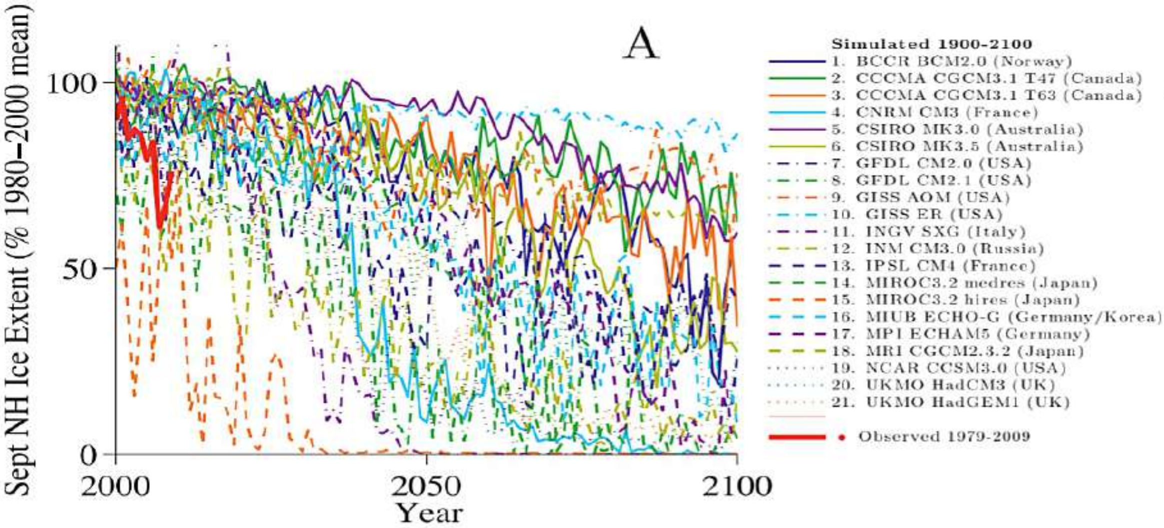

Figure 82. *Differences among the GCM projections of the rate of Arctic sea ice loss. Timeline toward seasonally ice-free Arctic Ocean conditions indicated by Northern Hemisphere September sea ice extent during the twenty-first century scaled by the 1980–2000 mean September value for each model. From Eisenman et al. (2011).*

As all geo-scientists have been knowing for a very long time, the Earth is a unique and extraordinarily complex system and Mother Nature is not impressed by a +0.007% (max) CO_2 increase of its overall atmospheric composition (70 ppm) and has many tricks in her sleeves. We have just seen here how changes in oceanic currents (THC / AMOC), sea surface temperature cyclical variations (AMO), atmospheric oscillations (NAO), cloud cover modulation and albedo variations, geothermal gradient and even a particular geodynamic context all contribute to the Arctic climate far more than a tiny increase in a trace gas. Most geologists with an experience on the field know that and Dr. Donald Eschman will have the final word: "*Before I retired from my position as a geology prof I often took my students on field trips out to the glacial deposits exposed in gravel pits west of Ann Arbor. In one very large pit (Killins gravel on Scio Church Road) the pit had a two layered aspect. At the bottom was the well washed sand and gravel that was deposited as the Erie Lobe of the Wisconsinian ice sheet had retreated and the meltwater pouring off the front of the ice laid down thick and economically valuable outwash material. Must have been a time of ice retreat and presumably warmer climate. At a later time the ice readvanced over the outwash gravel and laid down a thinner but very obvious layer of clayey glacial till. The climate must have cooled to get the ice to re-advance and then the climate changed or stalled and the melting ice lobe dropped it's load of till (everything from fine clay to crystalline Canadian boulders as big as a car) on top of the outwash deposits.* ***It's situations like this that always made me dubious of the notion that the climate could only change for the worse because of man's actions. What could be more natural than climate change***". Dr. Donald Eschman

6) Extreme Events

"*As a climatologist who has studied the Earth's climate for nearly forty years, I have learned that carbon dioxide is not a climate control knob; it is merely a minor player in climate change. Water vapor is the most important greenhouse gas and it accounts for nearly 90% of the net warming of the planet due to the radiative impact of the Earth's atmosphere.*" David R. Legates (2019).

"*It is well known that strong to violent tornado activity in the US has decreased markedly since statistics began in the 1950s, which has also been a period of average warming. So, if anything, global warming causes FEWER tornado outbreaks...not more. In other words, more violent tornadoes would, if anything, be a sign of 'global cooling,' not 'global warming.*" Roy Spencer

As Pielke (2017) said in his address and testimony to the Committee on Science, Space and Technology of the U.S. House of Representatives "*Scientific evidence in support of the conclusions I presented to this committee in 2013 is even stronger today. **There is little scientific basis in support of claims that extreme weather events – specifically, hurricanes, floods, drought, tornadoes – and their economic damage have increased in recent decades due to the emission of greenhouse gases**. In fact, since 2013 the world and the United States have had a remarkable stretch of good fortune with respect to extreme weather, as compared to the past*".

He then added "*The lack of evidence to support claims of increasing frequency or intensity of hurricanes, floods, drought or tornadoes on climate timescales is also supported by the most recent assessments of the IPCC and the broader peer reviewed literature on which the IPCC is based*" (Pielke, 2017).

In fact, browsing through (IPCC, 2012) and (IPCC, 2013) one can only concur with Pielke (2017) and be surprised of the harassment he reports having been victim of, for his honest stance and his unbiased report of the facts.

"*There is low confidence in any observed long-term (i.e., 40 years or more) increases in tropical cyclone activity (i.e., intensity, frequency, duration), after accounting for past changes in observing capabilities*". SREX, p.8, (IPCC, 2012)

The better are the observations and the more accurate are the records, the less confidence IPCC have in an increase in tropical cyclone activity.

"*There is medium confidence that some regions of the world have experienced more intense and longer droughts, in particular in southern Europe and West Africa, but in some regions droughts have become less frequent, less intense, or shorter, for example, in central North America and northwestern Australia* " SREX, p.8, (IPCC, 2012)

So, there is no global drought trend but only regional phenomenons, some more some less intense or frequent.

"*The uncertainties in the historical tropical cyclone records, the incomplete understanding of the physical mechanisms linking tropical cyclone metrics to climate change, and the degree of tropical cyclone variability provide only low confidence for the attribution of any detectable changes in tropical cyclone activity to anthropogenic influences. Attribution of single extreme events to anthropogenic climate change is challenging*". SREX, p.9, (IPCC, 2012)

If it is challenging for IPCC and SREX authors to attribute any change in tropical cyclone activity to anthropogenic influences, one can hardly imagine who will succeed!

"*Projected changes in climate extremes under different emissions scenarios generally do not strongly diverge in the coming two to three decades, but these signals are relatively small compared to natural climate variability over this time frame. **Even the sign** of projected changes in some climate extremes over this time frame **is uncertain***". SREX, p.11, (IPCC, 2012)

The IPCC tells us that the natural variability is way bigger than the "signals" coming from their anthropogenic influence scenarios and that in the end that they do not even know the sign (!), i.e. which is whether these climate extremes will increase or decrease!

"*It is likely that the global frequency of tropical cyclones will either decrease or remain essentially unchanged. There is medium confidence that there will be a reduction in the number of extra-tropical cyclones averaged over each hemisphere*" SREX, p.13, (IPCC, 2012)

The first good news, tropical cyclones are now forecast to decrease !

"*There is low confidence in projections of changes in large-scale patterns of natural climate variability. Confidence is low in projections of changes in monsoons (rainfall, circulation) because there is* ***little consensus in climate models regarding the sign of future change*** *in the monsoons. Model projections of changes in El Niño–Southern Oscillation variability and the frequency of El Niño episodes are not consistent, and so there is low confidence in projections of changes in this phenomenon*". SREX, p.16, (IPCC, 2012)

As seen before, large-scale patterns of natural climate variability are the most important part of these extreme events, but it is unfortunate that even the sign of future change is beyond climate models. Well, the good news is that for once, it is clearly stated that one just deal with models, software, simulations, i.e. nothing real.

"*In some aspects of the climate system, including changes in drought, changes in tropical cyclone activity, Antarctic warming, Antarctic sea ice extent, and Antarctic mass balance, confidence in attribution to human influence remains* ***low*** *due to modeling uncertainties and low agreement between scientific studies*" (IPCC, 2013) p. 115

One must congratulate here IPCC for their honesty, they know nothing. In fact this above statement could even make them sympathetic for the first time as it would place them in the real of science for once, as per reminded by Harari (2015) "*Modern science is based on the Latin injunction ignoramus – we do not know. It assumes that we don't know everything. Even more critically, it accepts that the things that we think we know could be proven wrong as we gain more knowledge. No concept, idea or theory is sacred and beyond challenge*". Given what was stated before and how uncertain things are, one should not be surprised that the AGW theory is no immune to critics.

"*Based on model results there is limited confidence in the predictability of yearly to decadal averages of temperature both for the global average and for some geographical regions. Multi-model results for precipitation indicate a generally* ***low predictability****. Short-term climate projection is also limited by the uncertainty in projections of natural forcing*" (IPCC, 2013) p. 115

IPCC acknowledge that they have very limited capabilities to forecast future Global Annual Mean Temperature (GAMT) be they global or regional, that precipitations are beyond scope and that as they do not even master the most important "natural forcing" call it natural climate variability, short-term projection is also beyond their means.

"*There is generally low confidence in basin-scale projections of significant trends in tropical cyclone frequency and intensity in the 21st century*" (IPCC, 2013) p. 115

So, tropical cyclones are supposed to be less frequent, but IPCC does not know where at the basin-scale level.

"*There is low confidence on magnitude of carbon losses through CO_2 or CH_4 emissions to the atmosphere from thawing permafrost. There is low confidence in projected future CH_4 emissions from natural sources due to changes in wetlands and gas hydrate release from the sea floor*" (IPCC, 2013) p. 115

At least one more scare that has low confidence. That one should be removed from the list of apocalyptic warnings one is threatened with.

Another classical scare, the hydrological cycle and the droughts is dealt with (IPCC, 2013), p. 44 "*The most recent and most comprehensive analyses of river runoff do not support the IPCC Fourth Assessment Report (AR4) conclusion that global runoff has increased during the 20th century. New results also indicate that the AR4 conclusions regarding global increasing trends in droughts since the 1970s are no longer supported*." dismissing previous AR4 conclusions.

Finally, reading this Unlikely Physics of Climate Change (IPCC, 2013) had some merits, beyond the astonishing 1,732 occurrences (!) of the word or sub-word "likely" and the 190 occurrences of the word "unlikely", which means that 190 times in this document were discussed unlikely or even more than unlikely conjectures, one knows now that IPCC does not know much and that the worse of the apocalyptic forecast of the doomsday sayers are not even endorsed nor supported by IPCC who remain extremely cautious with respect to their ability to forecast or anticipate anything!

In fact, apart from those who make their bred and butter pushing the scare button, serious authors are extremely cautious with any kind of human-related causation and, for example, as far as the North Atlantic Ocean is concerned Villarini et al. (2011) "*By using statistical methods combined with the current understanding of the physical processes, we are unable to find support for the hypothesis that the century-scale record of short-lived tropical cyclones in the Atlantic contains a detectable real climate signal. Therefore, we interpret the long-term secular increase in short-duration North Atlantic tropical storms as likely to be substantially inflated by observing system changes over time*".

The testimony of David R. Legates, on 28th October 2019, before the House Environmental Resources & Energy Committee is replete with highly relevant data and information relating to extreme meteorological events and Legates explain why, for obvious reasons, warmer climate is not only better for general plant productivity and food sustainability but also decreases extreme meteorological events contrary to what the scare mongers pretend. Legates (2019) states "*Warmer conditions, such as what we currently are experiencing, exhibit less climate variability than colder conditions. The Equator-to-Pole temperature gradient drives the poleward transport of energy in the climate system. Under a warmer world, the Tropics warm but the Poles warm even more. Consequently, the Equator-to-Pole temperature gradient lessens and the outbreak of much severe weather – driven by the interaction of cold polar air with warm tropical air – diminishes. Hurricane landfalls, for example, were much more frequent in South Carolina, New England, and China during colder periods*". Legates' statement is further supported by an extensive study by Liu et al. (2001) considering a 1,000-Year History of Typhoon Landfalls in Guangdong, Southern China, where they state "*this article, we produce a 1,000-year time series of typhoon landfalls for the Guangdong Province in southern China, based on Chinese historical documentary records.* ***Remarkably, the two periods of most frequent typhoon strikes in Guangdong*** *(AD 1660–1680, 1850–1880)* ***coincide with two of the coldest and driest periods in northern and central China during the Little Ice Age***"

Then rightfully, Legates (2019) stresses that Mean Global Air Temperature(s) (MGAT) is not that which is important and it should even be said that they contribute to the deception scheme that has been put in place, especially when trying to present smoothed data over various time-periods in terms of "anomalies" with respect to the MGAT. In fact, this is just meaningless and what people are interested in, are brutal daily or short-term shifts and dangerous weather events that create the most damage and cause the most deaths, not arguing about whether some adjusted measurements (e.g. Tropical atmosphere) show that MGAT has increased by less or more than +0.1°C/decade (e.g. satellites +0.095°C/decade, Balloons +0.073 °C/decade) when models, having lost any credibility, forecast three times more. Therefore and rightfully, Legates (2019) states "*So, let us look at the data...Next, consider hurricanes. The global number of tropical storms and hurricanes shows no net change since the satellite era began in the early 1970s. Neither is there a significant change in the number of major hurricanes (Category 3-5) or in the number of hurricanes making landfall. Consider also tornadoes. The annual number of tornadoes since the advent of the Next Generation of NOAA weather radars has not changed and, in fact, the number of strong tornadoes in the United States has actually decreased over the past fifty years. In addition, the length of time between the strongest tornadoes, F5/EF5, has steadily increased over the same time period. Again, much of this can be explained by the reduction of the Equator-to-Pole temperature gradient and the reduced contrast between warm, moist Tropical air and cold, dry Polar air that feeds tornadic activity*".

Finally, on a more conjectural note following the dire events that occurred in early October 2020 in the South-East of France, Météo France[227] indicates "*in the current state of analysis of the observations, there is no marked trend towards an increase in the number of episodes of heavy rainfall in the South-East of France since it has been possible to record them accurately (since 1958)*". Within the frame of the HyMeX project (Ducrocq et al., 2014), the National Center for Meteorological Research observes that the Mediterranean region is subject to a wide range of natural risks, including heavy rainfall and flash floods in autumn (Beaulant et al., 2009), intense cyclogenesis associated with strong winds and swells in winter and heat waves and droughts accompanied by forest fires in summer. These phenomena involve complex non-linear interactions between processes covering a wide range of scales (from a few hours to a century) and different compartments of the Earth system (sea, air and continental surfaces) (CNRM, 2020a) and states "*The evolution of the occurrence and severity of High Precipitation Events in the frame of climate change remains an open question*" (CNRM, 2020b). So, there is no need to jump to a foregone conclusion, even though this is what most of the mainstream media have done, blaming the global warming for these.

227 Météo France is the official government sponsored meteorological organization who fully supports the AGW thesis.

So, it is not difficult to summarize where we stand: those who make baseless claims that extreme weather events will increase due to a very minor increase of the Mean Global Air Temperature are just dead wrong and are most probably performing an intentional deception as it cannot be supposed that they are so incompetent that they cannot come up straight with the facts. The simple truth is that the facts do not support their narrative and that they cannot care less as they are used to thwarting them and to mislead people and to go always further... Since 2003 and the curious paper by Allen (2003) the outlandish idea of finding a culprit, even if there is none, for any flood or any adverse climate event has grown and the community of Extreme Event Attribution (EEA) has been reported as taking some importance by Jézéquel et al. (2018).

In fact, even though Stott et al. (2016) acknowledge from the beginning that "*The evidence for human influence on the probability of extreme precipitation events, droughts, and storms is more mixed*" these authors endorse the idea that some attribution could be made on an ad-hoc basis for such extreme events as if many extreme weather and climate events had never occurred before. This approach is an extension of some flawed reasoning coming from their baseless statement "*Societies around the world are faced with increasing climate change risks*" and shows how much our modern societies have become unable to accept natural risks as an intricate and con-substantial part of life and how people are self-deceiving themselves with the anthropic sin, always thinking that man is at the core to all processes, all events, etc., be they good or bad. In a perfect example of circular reasoning, the Coupled general circulation models (GCMs) which appear completely useless to forecast these events would be good enough for their attribution, you are flummoxed, aren't you, so are we ! This is the sorry state of climate science and policies.

A very clear and not passionated truth about such extreme weather events can be assessed by observing the deaths caused by climate disasters, it is very factual. In the 1920s, the number of deaths from climate disasters averaged 485,000 per year. In the last full decade, 2010-2019, there were an average of 18,357 per year, or 96% less. In the first year of the new decade (2020), the initial estimated number of deaths from natural (climate) disasters was even lower at 8,086, i.e. 98% lower than the 1920s average of the 20th century. But of course, these numbers must be put in perspective of the fact that since the 1920s, the world's population has quadrupled. With these data, one can easily estimate the global risk of "death in a climate catastrophe" (in one year):

- In the 1920s it was 0.000243 (reference point);
- In 2010, 0.0000025 (down 99%);
- In 2020, 0.000001 (down 99.6%).

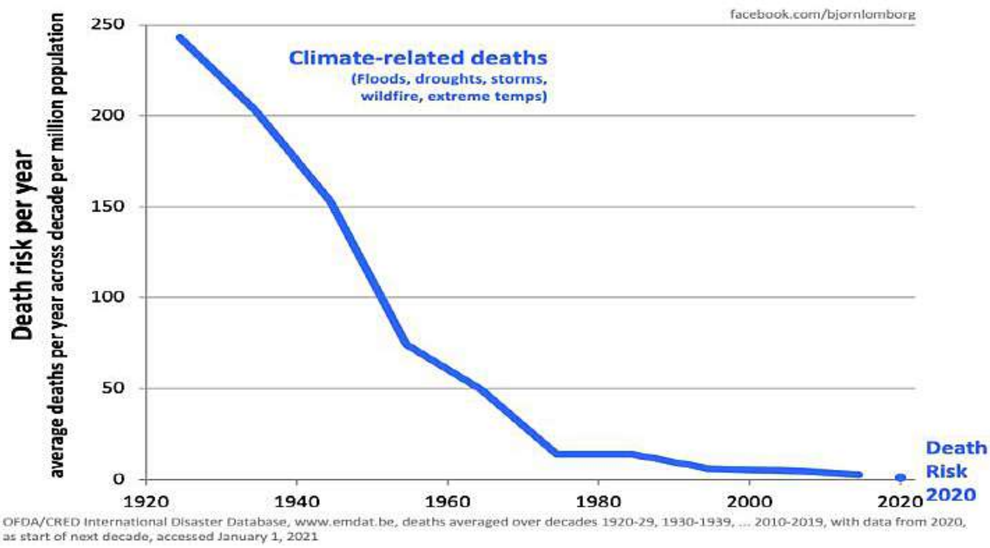

Figure 83. *Climate-related death risk has decreased 99.6% since the 1920s. From Lomborg (2020b).*

"*Interestingly, basic meteorological theory tells us that extremes depend significantly on the temperature difference between the tropics and the poles – something that is expected to diminish in a warmer world*". Richard Lindzen (2016)

7) The Myth of the Acidification of the Oceans

Claude Allègre is a well known French scholar (and politician), a geochemist who wrote hundreds of scientific papers and a textbook that every student has read, i.e. (Allègre and Michard, 1973; 1974). Allègre was one of the two laureates in 1986 of the Crafoord Prize[228] awarded by the Royal Swedish Academy of Sciences for is work on "Isotope geochemical relations". Doubtful that the anthropogenic emissions of CO_2 could have a great impact on the Earth's climate he wrote a book "*L'imposture climatique ou la fausse écologie*" or "*The climate imposture or false ecology*" (Allègre, 2010). Of course, the book was not at all well received to say the least and a journalist with no scientific training replied with another book "the impostor is him" (Huet, 2010). As if that was not enough, the same clueless person durst write, among so many similar insightful papers, an article in a mainstream media wondering "*Climate and scientific debate: Is Richard Lindzen credible?*" (Huet, 2016). Would the reader need to check, which is doubtful, the answer is here[229]. The explanation to such situations is in fact given by Michel Audiard, a prominent figure on the French cultural scene of the 1970s (screenwriter and film director), who coined the following saying "*Les cons ça ose tout. C'est même à ça qu'on les reconnaît*" that DeepL translates as "*Idiots dare everything. That's even how you can recognize them...*". Of course, the unrivaled clout of the science of these self-proclaimed defenders of the Earth, which can be summed up in less than half a sentence "a CO_2 increase of +0.007% of the overall atmospheric composition (70 ppm) will destroy the climate and everything", is beyond reach of the dumb skeptics and they feel so well supported by the medias, the NGO, the UN/IPCC and the political powers that their contempt and arrogance is beyond limits.

Having reminded that, the reason why it is worth being back to Allègre's book, is that even though the author is a perfectly knowledgeable geochemist, he mentions that fossil fuels should be spared because our children will also need them (fine, always good to spare resources) but also says six times that he is worried of the acidification of the oceans. Normally, I would used a quote of Monckton of Brenchley (2013) which seems to sum things up quite quickly and nicely "*Since the oceans already contain 70 times as much CO_2 as the air, it would be impossible appreciably to acidify them even if all the CO_2 in the air found its way into the sea. Besides, the oceans are buffered by the rock basins in which they move, and the buffering is homoeostatic, maintaining the present pronouncedly alkaline acid-base balance. So even the fall-back position that the profiteers of doom have adopted when faced with the failure of their global-warming predictions – ocean "acidification" – has no rational scientific basis*". But one cannot dismiss Allègre's statement with such flippancy and there is a need to go further to try to understand where his qualms could come from and also gives an opportunity to address an interesting subject, which should never be missed.

Seawater can be considered as the result of the neutralization of acids emitted from volcanoes (volcanoes release large quantities of HCl, H_2SO_4, CO_2) by bases coming from meteoric weathering (Sillen, 1961, 1967), with the addition of salts dissolved from the ocean floor, especially near plate-spreading boundaries. The meteoric weathering is the result of the freshwater discharge into the oceans. The total global freshwater discharge, excluding that from Antarctica, is about 37,288 ± 662 $km^3\ yr^{-1}$ representing ~7.6% of global precipitation or ~35% of terrestrial precipitation (excluding Antarctica and Greenland) according to Dai and Trenberth (2002). As freshwaters have a significantly different geochemical signature, it is worthwhile to restart from the beginning and first address the chemistry of freshwaters and then see the chemistry of the oceans and finally the interactions between both, especially given the importance of the action of the biosphere at the interface.

There exists of course a difference between homogeneous chemical reactions in solution and reactions where there is an interaction between the solution and a gaseous or a solid phase, for the geochemist these will correspond to reactions involving the lithosphere and the hydrosphere or between the hydrosphere and the atmosphere. So, let's make a start:
If the ions A and B react to give an insoluble compound AB, the law of mass action relating to reaction is written:
$AB\searrow \Leftrightarrow A + B$ and the solubility product[230] is $(A) . (B) = K_s$ and this relationship holds only if the solution is in presence of the solid AB, otherwise this equation becomes: $(A) . (B) < K_s$.

228 According to the the Royal Swedish Academy of Sciences the eligible disciplines for the Crafoord Prize are chosen so as to complement those for which the Nobel Prizes are awarded.

229 http://www-eaps.mit.edu/faculty/lindzen/PublicationsRSL.html

230 Both ionic product and solubility product represent the product of the concentrations of the ions in the solution but the term solubility product is applied only to a saturated solution in which there exists a dynamic equilibrium between the undissolved salt and the ions present in solution. Parentheses ( ) refer to the activities and [ ] to the concentrations.

Reactions within an homogeneous phase can be considered as an exchange of a particles (p) between two couples of giver and taker (or donor and acceptor), (A_1, D_1 and A_2, D_2): $A_1 + D_2 \Leftrightarrow A_2 + D_1$ with $D_1 \Leftrightarrow A_1 + p$ and $D_2 \Leftrightarrow A_2 + p$
If the particle exchanged is a proton H+ we're talking about an acid-base reaction, the giver is an acid while the receiver a base and if the particle exchanged is an electron e^- this is a Redox (reduction–oxidation) reaction where the giver (the reducing agent) undergoing oxidation by losing electrons and the taker (the oxidizing agent) undergoes reduction by gaining electrons. The general case will be referred to as reactions of formation of compounds[231] (or complexes), of compound and of ionic compound (complexes). Each of the couples of giver-taker (donor and acceptor) is characterized by an equilibrium constant given by equation 160:

$$\frac{(A_1)(p)}{D_1} = K_1 \tag{160}$$

whenever the particle p exists in solution (acid-base reaction or of compounding or complexation) or by an electrical data, i.e. the normal redox potential E_0. Whenever a redox reaction is met, the chemical species from which the electron is removed is said to have been oxidized, while the chemical species to which the electron is added is said to have been reduced.
Water is involved into acid-base reactions (autoprotolysis of water) as it behaves either as an acid (reaction 161):

$$H_2O \Leftrightarrow OH^- + H^+ \;(\; 2H_2O \Leftrightarrow OH^- + H_3O^+ \;) \tag{161}$$

Or as a base (reaction 162):

$$H_3O^+ \left(i.e.\ H^+\ hydrated\ or\ Hydronium\right) \Leftrightarrow H_2O + H^+ \quad ^{232} \tag{162}$$

Acids such as $AH + H_2O \rightarrow A^- + H_3O^+$ or $AH \rightarrow A^- + H^+$ are totally dissociated in the water, they are called strong acids and the corresponding bases A^- have lost their basic properties. Bases stronger than OH^- cannot exist in the water and the corresponding acids do not show any acid properties any longer, they are said inactive. The acid dissociation equilibrium constant or acidity constant is noted Ka and is written: $Ka = ([A^-][H^+])/[AH]$. From Ka we define the pKa which is written $pKa = -\log_{10} Ka$. Pka is usually used instead of Ka to determine the strength of an acid. We notice that the stronger the acid, the smaller the pKa. Indeed, if the acid is strongly dissociated, the concentration [AH] becomes low.
In the same way, water is both an oxidizing agent $H_2O + e^- \Leftrightarrow ½\, H_2 + OH^-$ and a reducing agent $2H_2O = ½\, O_2 + 2H^+ + 2e^-$
Thus, reducers stronger than hydrogen cannot exist in water (e.g. Na), therefore the corresponding oxidized form is inactive in water (e.g. Na^+) and oxidizers stronger than oxygen (e.g. F_2) also do not exist in aqueous solution and the corresponding reduced forms (e.g. F^-) are inactive in water. For a solution where take place acid-base reactions or compounding (complexation) reactions, activities of ions H^+ hydrated and of the compounding ions species enable to characterize the state of the solution and the state of dissociation of all the corresponding giver-taker systems. A logarithmic scale has been defined as for the pKa and we have: $[H^+] = 10^{-pH}$ thus:
$pH = -\log_{10} [H^+]$ and the same is true replacing H by C the compounding particle. The pH and the pKa are are then related by the following relation: $pH = pKa + \log_{10}([A^-]/[AH])$

In a similar but less direct way the redox state of a solution measured as its redox potential Eh, is measured by the difference of potential between a platinum Pt electrode and a standard hydrogen electrode immersed in the solution. This potential is linked to the concentrations of the redox systems in the solution by the Nernst equation 163:

$$E_h = E_0 + \frac{RT}{nF} \ln \frac{(Oxidizing)}{(Reducing)} \tag{163}$$

As a reminder, in pure water the law of mass action gives $[H^+] \,.\, [OH^-] \,/\, [H_2O]$ = constant, but as the dissociation of reactions 161 is very small, we obtain $[H^+] \,.\, [OH^-] = K_w$ which varies between 10^{-15} at 0° to 10^{-14} at 20°C. The two following reactions are also of interest, i.e. a dissolved carbonic acid molecule can dissociate into a bicarbonate ion and a free proton:

$$H_2CO_3 \Leftrightarrow HCO_3^{\ -} + H^+ \tag{164}$$

with $[H^+] \,.\, [HCO_3^-] \,/\, [H_2CO_3] = 4.15\ 10^{-7} = K_1 = 10^{-6.38}$
and a bicarbonate ion can dissociate to a positive hydrogen ion and a carbonate ion:

$$HCO_3^- \Leftrightarrow CO_3^{2-} + H^+ \tag{165}$$

with $[H^+] \,.\, [CO_3^{2-}] \,/\, [HCO_3^-] = 4.2\ 10^{-11} = K_2 = 10^{-10.38}$

231 The difference is that a complex is a structure consisting of a central atom or molecule weakly connected to surrounding atoms or molecules while compound is a substance formed by chemical union of two or more ingredients in definite proportions by weight.

232 Protonation of water, i.e. addition of a proton to a molecule of water.

To give a hint to the variety of natural pH, on average pH is 4-4.5 in peat bogs, 6-7 in rivers, 7.2 to 8.2 in rivers crossing areas with limited vegetation, 8-8.4 in alkaline waters, 7.9-8.25 in seas (Doney, 2006 p. 62; Hofmann et al., 2011), and 8.6-10 in supersaturated basins. Among the ions present in significant quantities in natural waters, the only ones with acid-base properties are carbonates, borates and silica. The high pK values of boric and silicic acids and their relatively low concentration mean that they generally play only a secondary role. Therefore, the main acid-base system in natural waters is H_2CO_3, HCO_3^- and CO_3^{2-}. So the pH prediction comes down to computing the pH of a solution of weak acids and strong bases (carbonates and bicarbonates) partially buffered. The electro-neutrality of the solution will involve all other ions:

$[Na^+] + [K^+] + 2[Ca^{2+}] + 2[Mg^{2+}] + [H^+] + \ldots = [Cl^-] + 2[SO4^{2-}] + [HCO_3^-] + 2[CO_3^{2-}] + [OH^-] + \ldots$

And we ca group together all the terms corresponding to ions without acid-base properties and write:

$[Na^+] + [K^+] + 2[Ca^{2+}] + 2[Mg^{2+}] + \ldots - [Cl^-] - 2[SO4^{2-}] \ldots = [HCO_3^-] + 2[CO_3^{2-}] + [OH^-] - [H^+] \ldots$

the ions of the first member of the equation are involved only through their overall charge, which is referred to as the alkali reserve or Alkalinity, i.e. R_B, unit of which is in Faraday per kilogram of $\mathscr{F}$/kg.

The cations (e.g. Na^+, K^+, Ca^{2+}, Mg^{2+})come from two major origins, the hydrolysis of the silicates by weathering (partially counter-balanced by aggradation reactions), e.g. :

(Anorthite) $CaAl_2Si_2O_8 + 2\, CO_2 + 3\, H_2O \rightarrow Ca^{2+} + 2\, HCO_3^- + Al_2Si_2O_5(OH)_4$ (Kaolinite) see Equation (68), p. 51

(Albite) $2NaAlSi_3O_8 + 11\, CO_2 + 2\, H_2O \rightarrow 2\, Na^{2+} + 2\, HCO_3^- + 4H_4SiO_4 + Al_2Si_2O_5(OH)_4$ (Kaolinite) see Equation (69), p.51

and for the potassium feldspar:

$$\text{(Orthoclase)}\quad 2\,KAlSi_3O_8 + 2\,H^+ + H_2O \Rightarrow 2\,K^+ + 4\,SiO_2^- + Al_2Si_2O_5(OH)_4 \quad \text{(Kaolinite)} \tag{166}$$

and from strong bases, e.g. : NaOH, and potassium hydroxide, i.e. KOH (lye) and much less soluble magnesium hydroxide, i.e. Mg(OH)2 and calcium hydroxide Ca(OH)2 (slaked lime).

The anions, e.g. Cl^-, $SO4^{2-}$ can be thought of as coming from the strong acids, hydrochloric acid, HCl and sulfuric acid, H_2SO_4.

Rainwater loaded with soluble compounds such as SO_2, CO_2 and highly hydrolysable heavy metal chlorides has a negative alkaline reserve (Alkalinity) and its CO_2 pressure is close to that of the atmosphere, resulting in a pH between 4 and 5. Waters from river runoff in areas with little vegetation (mountains) have an alkaline reserve of 10^{-4} to 10^{-3} $\mathscr{F}$/kg, is in equilibrium with atmospheric CO_2 and has a pH between 7.2 and 8.2. The alkaline reserve of sea water is relatively high, i.e. R_B = [Alk] ≈ 2.34 × 10^{-3} $\mathscr{F}$/kg or M[233] for a chlorinity of 19‰ and a typical salinity of 35 g kg^{-1} (grams of salt per kg of water). Given the high ionic strength of the solution, the dissociation constants of H_2CO_3 and HCO_3^- are higher. The pH varies very little around 8.1.

Na^+, K^+, Ca^{2+}, Mg^{2+} and Cl^-, $SO4^{2-}$ can be considered as pH-independent ions and their concentration is unaffected by normal changes in the pH of the ocean water; more on ocean pH can be found in Tans (2009). Using $[OH^-] = K_w / [H^+]$ and the charge neutrality relationship 167:

$$[\,OH^-\,] = [\,Alk\,] + [\,H^+\,] \tag{167}$$

one gets: $[H^+]^2 + [Alk][H^+] - Kw = 0$

This quadratic equation has one real solution:

$$[\,H^+\,] = \frac{1}{2}\left(\sqrt{4K_w + [\,Alk\,]^2} - [\,Alk\,]\right) \quad = 4.35\ 10^{-12}\ \mathscr{F}/\text{kg (or M)} \tag{168}$$

using pH = - $\log_{10}$ $[H^+]$ one gets with the above value pH=11.4!

As was indicated, a typical pH for the ocean is around 8.1 and the difference comes from the buffering of the weak acids, notably carbonic acid H_2CO_3, boric acid $B(OH)_3$ and silicic acid $Si(OH)_4$, and of these only the first plays an important role. Now, as explained by Cohen and Happer (2015) we imagine that we start buffering the highly alkaline ocean (11.4) by dissolving CO_2 while maintaining a $P_{atm}CO_2$ constant, and therefore replacing in the atmosphere all the molecules dissolved in the ocean. Some of the CO_2 molecules dissolved in the ocean will react to give carbonic acid[234]:

233 For ocean chemistry the unit of alkalinity M (or equivalent) is usually taken to be one mole of elementary charge (one Faraday) per kg of water.

234 The hydration equilibrium constant at 25 °C is called Kh, which in the case of carbonic acid is $[H_2CO_3]/[CO_2] \approx 1.2\times10^{-3}$ in seawater. Hence, the majority of the carbon dioxide is not converted into carbonic acid, remaining as CO_2 molecules. See https://en.wikipedia.org/wiki/Carbonic_acid

$$CO_2 + H_2O \Leftrightarrow H_2CO_3 \tag{169}$$

and the ratio of the concentrations of the two uncharged species of dissolved inorganic carbon will be independent of pH, but will depend on temperature. For simplicity, we will let the symbol ∑CO_2 describe the total concentration of uncharged, inorganic carbon molecules in solution, therefore ∑unchargedCO_2 = [CO_{2aq}] + [H_2CO_3].

The concentration of uncharged dissolved inorganic carbon molecules ∑unchargedCO_2 in the surface water will be proportional to the partial pressure P_{CO2} (in atmospheres) of the CO_2 molecules in the gas phase:
∑unchargedCO_2 = α P_{CO2}, where α = 2.84 × 10^{-2} M atm^{-1}. The numerical value of the coefficient α for Henry's law is from the work of Weiss (1974) for a temperature of 20°C (close values were proposed by Buch, then Lymann, i.e. α = 2.84 × 10^{-2}) see also Sander (2015).

Starting from the dissociation of a carbonic acid molecule into a bicarbonate ion and a free proton (reaction 164):
H_2CO_3 <=> HCO_3^- + H^+, we can write the equilibrium concentrations of ∑unchargedCO_2 species associated with the previous reaction as with [H^+] . [HCO_3^-] = K'_1 ∑unchargedCO_2 where K'_1 = 10.00 10^{-7} 𝒯/kg (or M) with value of K'_1 at 20°C from Mehrbach et al. (1973). Replacing ∑unchargedCO_2 by α P_{CO2}, in the previous equation gives:

$$[\ HCO_3^-\ ] = (\frac{K_1^{'}}{[\ H^+\ ]})\,\alpha P_{CO2} \tag{170}$$

A bicarbonate ion can dissociate to a positive hydrogen ion and a carbonate ion: HCO_3^- <=> CO_3^{2-} + H^+ and with mass action law for the sea-water:

$$[\ H+\ ].\,[\ CO_3^{2-}\ ] = K_2^{'}[\ HCO_3^-\ ] \quad \text{where } K'_2 = 7.69\ 10^{-10} \tag{171}$$

Using equations (170) and (171) one easily gets:

$$[\ CO_3^{2-}\ ] = (\frac{K_1^{'}.\,K_2^{'}}{[\ H^+\ ]^2})\,\alpha P_{CO2} \tag{172}$$

Taking into account all chemical species in presence, the equation of neutrality (167) must be re-written:

$$[\ Alk\ ] + [\ H^+\ ] = [\ OH^-\ ] + [\ HCO_3^-\ ] + 2[\ CO_3^{2-}\ ] \tag{173}$$

thus substituting (172) and (170) into (173) one gets the following equation:

$$[\ H^+\ ]^3 + [\ Alk\ ]\,[\ H^+\ ]^2 - (K_w + K_1^{'}\alpha P_{CO2})[\ H^+\ ] - 2K_2^{'}.\,K_1^{'}\alpha P_{CO2} = 0 \tag{174}$$

For positive alkalinity [Alk] > 0 and partial pressure P_{CO2} > 0, the cubic equation (174) for [H^+] has three solutions, two non-physical solutions where [H^+] is either a negative real number or has an imaginary part, and one where [H^+] is a positive real number.

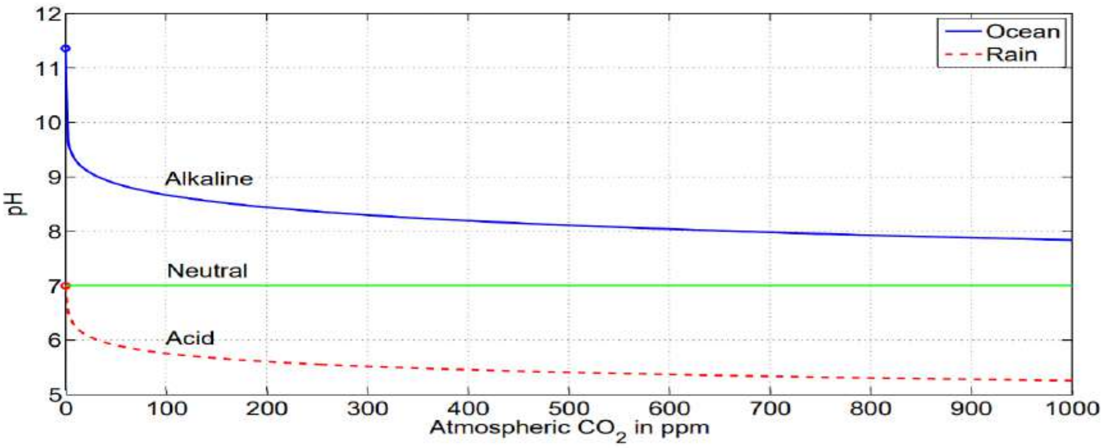

Figure 84. *pH of ocean water and rain water versus concentration of CO_2 in the atmosphere. Calculated with (7f) ; Ocean alkalinity [Alk] = 2.3 × 10^{-3} M. Rain alkalinity [Alk] = 0. Temperature T = 25°C. After Cohen and Happer (2015).*

Figure 84, calculated with equation (174) shows that for a doubling a CO_2 to 800 ppmv, the pH will only marginally change, if the doubling happened at T constant. We will see that this is not the case, as T has slightly increased [235], but

235To set ideas, if at 15°C the pH is of 8.21, it is of 8.13 at 20°C and goes down at 8.05 at 25°C. pH decreases with increase in temperature. But this does not mean that water becomes more acidic at higher temperatures, because the neutral point also depends on the temperature. One can use the following tool: https://pubs.usgs.gov/of/2010/1280/ (Robbins et al., 2010).

the impact on pH remains extremely small. As a result, between summer and fall, the pH of a given location can vary from 0.16.

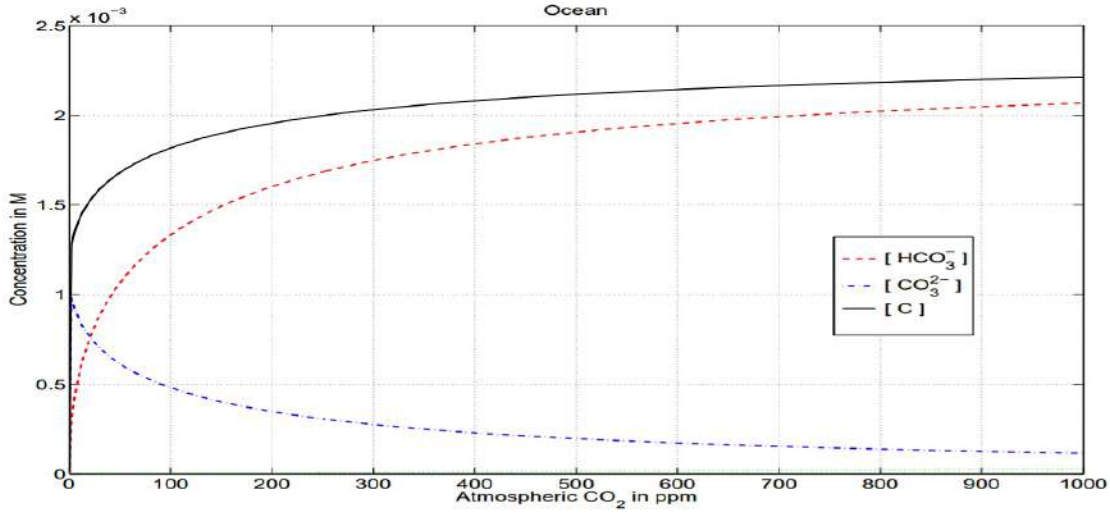

Figure 85. *Inorganic carbon in ocean water: bicarbonate [HCO_3^-], carbonate [CO_3^{2-}] and total [C]= Total Dissolved Inorganic Carbon= ∑unchargedCO$_2$ + [HCO_3^-] + [CO_3^{2-}] versus concentration of CO_2 in the atmosphere. Calculated with (7f), (7d), (7b) and ∑CO_2 = α P_{CO2}, under the assumption of complete chemical equilibrium. The ocean alkalinity is [Alk] = 2.3 × 10^{-3} $\mathscr{T}$/kg (or M) and the temperature is T = 25°C. After Cohen and Happer (2015).*

The partitioning of dissolved inorganic carbon in the ocean between uncharged species, bicarbonate and carbonate ions is shown in Figure 85, which was calculated with equations (173), (172), (170) and ∑unchargedCO$_2$ = α P_{CO2}. At current atmospheric levels of CO_2, about 400 ppm, most of the dissolved inorganic carbon consists of bicarbonate ions. Would atmospheric CO_2 levels increase (and pH slightly decrease), the concentration of bicarbonate ions will also slowly increase, and the concentration of carbonate ions will slowly decrease. The buffering of ocean alkalinity is mainly due to dissolved CO_2, other weak acids make a minor contribution, the next most important buffering specie in the ocean after dissolved CO_2 is boric acid, $B(OH)_3$, for more see Zeebe et al. (2001). But to be clear, the graph displaying the ocean buffering with only CO_2 or with CO_2 + boric acid as displayed by Cohen and Happer (2015) Fig. 5, is so similar that it shows how little impact boron has, given that the two curves are hardly discernible.

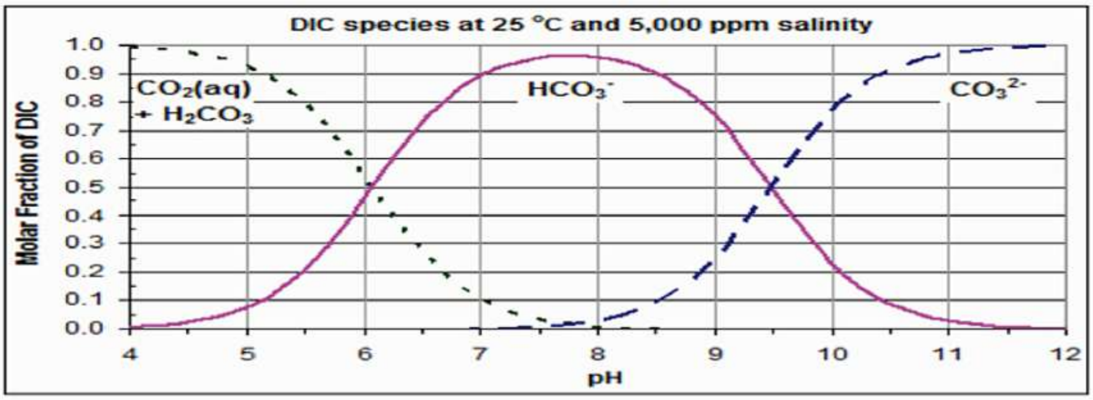

Figure 86. *Bjerrum plot of inorganic carbon in ocean water: DIC species met at 25°C and constant salinity as a function of pH with uncharged species [$CO_{2(aq)}$] + [H_2CO_3] , bicarbonate [HCO_3^-], carbonate [CO_3^{2-}]. Source Wikipedia[236].*

This brief study of the variations of the speciations depending on an increase of pCO_2 as displayed Figure 85 is conducted for a constant temperature and shows that while the ocean pH is very insensitive to CO_2 atmospheric variations, species concentrations will also change very slightly in such a scenario: for a small pH decrease due to a doubling of pCO_2, [CO_3^{2-}] (already very low) will decrease further while [HCO_3^-] will increase until pH=7.6. Figure 86 covers a much wider range of pH [4-12] and shows the four DIC species met and their proportions in molar fraction of DIC. But of course, the very reason why one wonders how the chemistry of the oceans will react is because of a rise of the temperature, i.e. SST, which of course will reduce the solubility of the gas dissolved (Copin-Montegut, 1988), CO_2

236https://en.wikipedia.org/wiki/Bjerrum_plot first and foremost and therefore this will counter-balance the very small decrease of pH that was calculated and displayed on Figure 84.

This is exactly what is reported by Jiang et al. (2019) as they observe that "*When water temperature increases, the extra H^+ from the dissociation of HCO_3^- and H_2O will react with the most abundant carbonic species in the ocean, HCO_3^-, driving it to build up excess aqueous CO_2 (CO_2*). In the above example, when temperature increases from 20 to 25 °C, [CO_2*] increases by 0.82 µmolkg^{-1}, which would translate to an fCO_2 increase of ~25 µatm if CO_2 solubility (K_0) were not to change. In reality,* ***K_0 decreases with increasing temperature****, and the change of K_0 alone would cause fCO_2 to increase by an additional ~53 µatm, twice as much as that from the change of [CO_2*]. In summary,* ***when temperature increases****, the changes of both [CO_2*] and solubility (K_0) work together to create a tendency for* ***seawater to degas CO_2 to the atmosphere****, lowering the DIC/TA ratio,* ***thus raising*** *both* ***pH*** *and aragonite saturation state*". One can sum up stating that there are 4 measurable parameters of the carbonic acid system in seawater: pH, Dissolved Inorganic Carbon (DIC)[237], Total Alkalinity (TAlk)[238], and CO_2 partial pressure (pCO_2)[239]. Dore et al. (2009) state that "*any pair of these can be used to describe the entire system; however, such calculations rely on empirically derived apparent dissociation ''constants,'' which are themselves functions of temperature and salinity*".

As anticipated, the effect of a change of solubility with an increase of temperature, which is the direct consequence of Henry's law, is to create an out-gassing of the ocean which more than offsets the increased effect of a rise in $p_{atm}CO_2$. Let's remind that pCO_2 = K_0 [CO_2 (aq)], where pCO_2 is the partial pressure of CO_2 in the gas phase, K_0 is a solubility coefficient, and CO_2 (aq) is the concentration of CO_2 dissolved in the water. The solubility of CO_2 in water is a function of both the temperature and the salinity of the water, with one relationship from Weiss (1974):

$$\ln (K_O) = -60.2409+93.4517(100/T) + 23.3585 \ln (T/100) + S(0.023517-0.023656(T/100)+0.0047036(T/100)^2)$$

where the solubility coefficient (K_O) has the units of mol kg^{-1} atm^{-1}, temperature (T) is Kelvin, and salinity (S) is in parts per thousand. Note that for non-saline waters, the second term of the equation becomes zero. Furthermore, the two temperature dependent processes, i.e. chemical speciation vs. gas exchange tend to cancel each others and as a result, surface ocean pH shows very little latitudinal variation, pH only varies from 8.09 to 8.11, i.e. hardly anything. Upwelling equatorial and tropical waters, with lower pH, tend to degas substantially more than polar or temperate waters and even though they show the lower pH they also tend to react less to variations of $p_{atm}CO_2$. The spatial variation of surface ocean pH is finally mainly attributable to air-sea CO_2 disequilibriums driven by temperature changes and upwelling on regional scales and not on global changes in $p_{atm}CO_2$, and Dore et al. (2009) can be quoted in that respect "*Air-sea CO_2 fluxes, while variable, did not appear to exert an influence on surface pH variability*".

Jiang et al. (2019) conclude stating "*From 1770 to 2000, the global average surface ocean pHT decreased by ~0.11±0.03 (spatial variability) units*". Not only does that change appear to be very small, but it should be considered not forgetting that seawater pH measurements date back to the beginning of the 20th century (so in order to make reconstructions back to 1770 there is a need for some model or else but no reliable measured data are available before 1924). Furthermore, very few historical pH data are adequate for studying the global pH distribution (Dore et al., 2009) and prior to 1989, seawater pH was typically measured using glass electrodes with uncertainties as much as 0.1 units (Dickson, 1993), therefore measurement uncertainties represent as much as the supposedly "true signal" that is reported by Jiang et al. (2019). It simply seems unrealistic to have an estimate of the average pH for the world ocean, at the surface, with the precision indicated using proxies.

Once again we are faced with historical errors in the data series being as big, if not larger for most of the period covered, to the results, and one will hardly sense an urgent and critical problem, given the fact that much larger pH changes are due to the biological pump, diurnal cycles and specific regional conditions, e.g. estuaries, coasts, etc. (Duarte et al., 2013). Again, natural processes such as SST changes and oceanic currents appear largely responsible for the pH variations observed as reported by Wu et al. (2018) "*High-amplitude oceanic pH changes, likely related to atmospheric CO_2 uptake and seawater dissolved inorganic carbon fluctuations, reveal a coupled relationship to sea surface temperature variations and highlight the marked influence of El Niño/Southern Oscillation and Interdecadal*

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237 DIC = [CO_2] + [HCO_3^-] + [CO_3^{2-}] which is 90% in the form of bicarbonate ion HCO_3^-, 9% in carbonate ion CO_3^{2-} and 1% in carbonic acid H_2CO_3 or CO_2

238 Talk: Total Alkalinity, i.e. [HCO_3^-] + 2[CO_3^{2-}] + [$B(OH)_4^-$] + [OH^-] + [HPO_4^{2-}] + 2[PO_4^{3-}] + [$H_3SiO_4^-$] + 2[$H_2SiO_4^{2-}$] + [HS^-] + 2[S^-]+ [NH_3^+]+ [Org^-] − [H^+] − [H_3PO_4] where Org− represents a collective term for organic acids. TAlk = [C-Alk]+ [NC-Alk]+ [OH^-] − [H^+] where C-Alk is the sum of carbonate and bicarbonate, and NC-Alk is the net contribution of non-carbonate species to alkalinity (Millero, 2007)

239 https://biocycle.atmos.colostate.edu/shiny/carbonate/ shows how the pH changes when the 3 other parameters are modified.

Pacific Oscillation. We suggest changing surface winds strength and zonal advection processes as the main drivers responsible for regional pH variability".

To give some perspective to the changes previously reported, i.e. ~0.11±0.03 over 230 years (when we do not even have one century of measures), it is worthwhile to mention that, e.g. in the Monterey Aquarium (CA) the pH varies between 7.65 and 8.2 depending on the season and the year without any apparent effect on the animals and plants presented. Variations in alkalinity and salinity greatly influence pH and determine it far more than anything else. This sham of ocean acidification was apparently fabricated in the early 2000s by Ken Caldeira (from the Carnegie Institution for Science) who is known to have coined the term[240], with a horrific film financed by the lobby group or "NGO" NRDC, Natural Resources Defense Council.

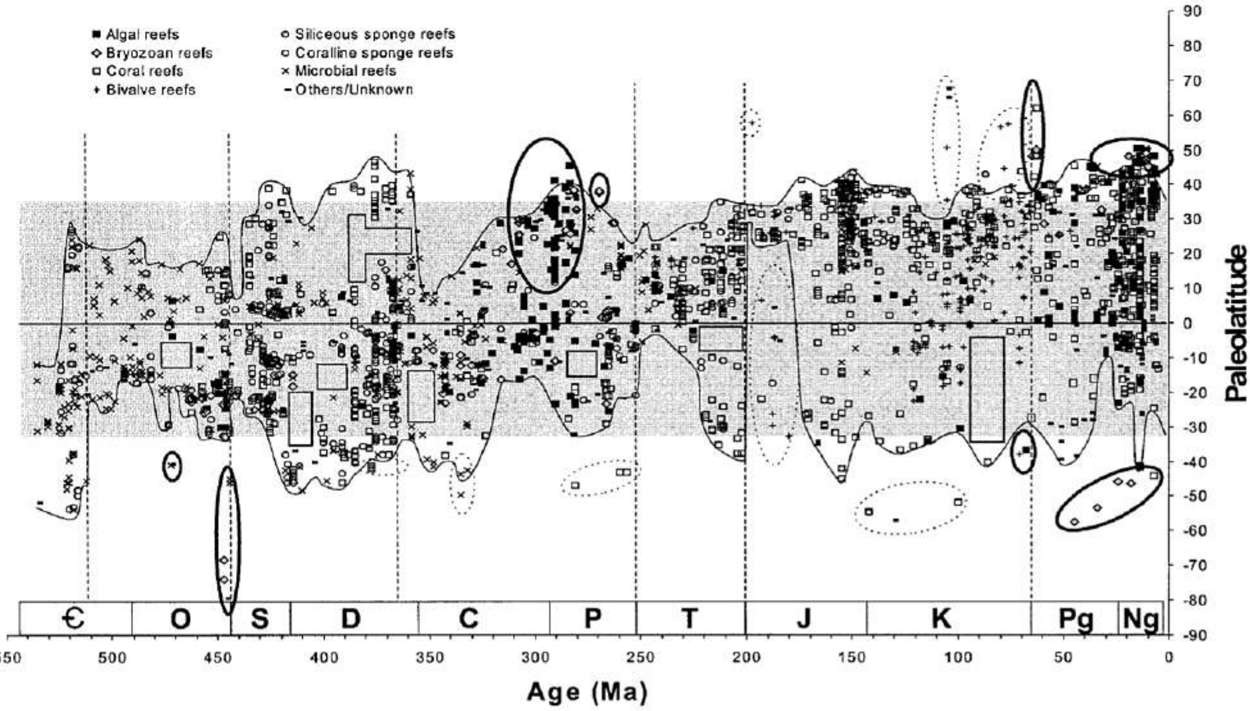

Figure 87. 550 Myr of Paleolatitudinal distribution of 2910 reef sites through pre-Quaternary Phanerozoic time. Shaded area indicates modern reef zone, and enveloping pair of lines demarcates inferred width of ancient tropical reef zone. Thick-line ellipses indicate distinct high-latitude reef provinces, dashed-line ellipses refer to isolated reefs of problematic affinity, and angular blocks indicate significant reef gaps in low latitudes. Straight dashed lines demarcate major mass-extinction events. Note that, compared to today, the ancient reef zone was often more confined. After Kiessling (2001).

Caldeira, already some time ago run the scare tactics full speed in a paper entitled "*Coral reefs may start dissolving when atmospheric CO_2 doubles*" and with his co-authors Silverman et al. (2009) state "*Finally, we are aware that coral reefs were exposed throughout their geological history to higher temperatures and CO_2 levels than at present and yet have persisted. The geological record however reveals that coral reefs have undergone many cycles of expansion and decline that lasted several millions of years*". Surprisingly, what they do not say is that coral reef faced nearly extinction, not during warmer time with a lot more CO_2, but during glaciations when a lot more CO_2 was dissolved in the oceans, i.e. up to 850 billion tons more (Anderson et al., 2019) and reduced upwelling (Anderson et al., 2019), and a lot less remained in the atmosphere, because of lower SST and because of Sea Level Fall (SLF) that left them emerged as more water was trapped in the polar ice sheets and as their ecosystems were destroyed (Kleypas, 1997).

Generally speaking and as visible on the Figure 87, what corals seem to dislike the most are ice-ages during which coral reef extent was reduced by 80% and carbonate production was reduced by 73% relative to today (Kleypas, 1997), and their latitudinal extension recedes the most during the Marinoan glaciation (ca. 645-635 Myr), the Andean-Saharan glaciation (ca -460 to -420 Myr), the Karoo glaciation, (ca -360 to -260 Myr) and even more recently and in an obvious way on Figure 87 during the Oi-1 glaciation (~33.8–33.6 Myr ago) and Oi-2b global glaciation event (26.7 Myr ago), or Mi-1 (23.8 Myr) with a coral extinction according to Zachos et al. (2001), Fig. 2. One should also remember that life is on

240 Kolbert (2016) "*Caldeira told me that he had chosen the term "ocean acidification" quite deliberately, for its shock value. Seawater is naturally alkaline, with a pH ranging from 7.8 to 8.5—a pH of 7 is neutral— which means that, for now, at least, the oceans are still a long way from actually turning acidic*". In doing so Caldeira does politics and seeks to influence public opinion.

a continuous evolving track, always adapting to new conditions and various authors studying the evolution of marine life, e.g. (Di Martino et al, 2018) or specifically coral reefs over time, e.g. Budd (2000) or López-Pérez (2017) revisiting the Cenozoic History and the Origin of the Eastern Pacific Coral Fauna observed striking natural changes over short geological periods, e.g. "*The highest numbers of genera (>11) and species (>12) correspond with the middle Eocene to early Miocene of Central Chiapas, and the late Eocene of Panama; Based on coral occurrences, species richness increased during the Late Eocene/Early Oligocene (55 species), decreased during the early and middle Pleistocene (5 species), rose again during the late Pleistocene (13 species) and finally peaked again during Recent times (46 species). Quantitative analysis of presence/absence coral data suggests that during the last six million years, Gulf coral communities and reefs experienced dramatic turnover, in particular (a) the extinction of Caribbean-related regional endemics, and (b) since the middle Pleistocene, the steady arrival of Info-Pacific taxa likely via the North Equatorial Counter Current.*". Everybody knows that life is and has always been evolution and adaptation.

Furthermore, though the reconstructions from Pearson and Palmer (2000) based on the usage of Boron isotopes[241], could trigger a lot of discussions as knowledge of the relationship between $\delta^{11}B$ and pH remains incomplete for many taxa, see Guillermic et al. (2020), one will just remember that they asserted that pH during the Paleocene and early Eocene were probably as low as 7.4 and this did not lead the coral reefs to disappear either. **One should be extremely cautious with these pH reconstructions** as potential secular variation of the seawater boron isotope composition may occur. Furthermore, the limitations of the analytical precision, the temporal resolution and/or location of the sediments analyzed for $\delta^{11}B$ have generally not brought a clear evidence of the tight coupling between atmospheric pCO_2 and surface seawater pH. Other limitations arise from isotopic offsets between foraminifera species, shell size and dissolution effects (Hönish and Hemming., 2005). Furthermore, 57% of the variance in alkalinity is defined by salinity and [Alk] is directly involved in pH calculations, see (7f). One can surmise that pH changed significantly but bringing conclusive evidences is rather difficult to provide.

We're full in the anthropocentric sin. Corals belong to extremely various types with very diversified biological organizations and they have thrived throughout all changes during the last 550 Myr as displayed Figure 87! Including impacts from asteroids, massive volcanic eruptions, ice-ages, up to 20 times more CO_2 than now (see Figure 51) and what else, but an increase of 0.007% will dissolve them into oblivion as if they had gone from the surface to under the ACD[242] overnight! Of course, as the scare tactics do not dissolve the reefs nor turn fantasies into reality and coral reefs are flourishing and not graveyards as pretended by McCarthy (2019), the only remaining possibility is to fire the trouble-makers, those who say that there is no urgent problem. This is what happened to Pr. Peter Ridd who had been working for 28 years for James Cook University (JCU); he was sacked and JCU spent more than 640k$ in legal advice and support to get rid and silence the opponent[243]. As Jennifer Marohasy summarizes "*It is not Peter Ridd's personal opinion that the corals are alive, and the Great Barrier Reef resilient to climate change. It is fact. I've seen the coral reefs whose health is contested with my own eyes: they are very much alive.* ***What is dead is academic freedom in Australia***".

What needs to be addressed is that the system considered demonstrates a double level of homeostasis, first strictly speaking on the physico-chemical level the pH changes are small with respect to the pCO_2 variations and increasing CO_2 concentrations have an increasingly smaller effect on ocean pH (Figure 84) and second life plays a major role in buffering the reactions observed as conjectured early by Ericksson and Welande (1956) and rightly formulated in what is now know as the the Gaia theory by Lovelock (1972) and Lovelock and Margulis (1974) "*if life has merely a passive role in cycling the gases of the air then the concentrations will be set by equilibrium chemistry; in fact they most certainly are not. If life actively cycles the gases then we ask how could such a system be stable in the long run without homeostasis?*". The atmosphere is of course not alone to be concerned by the Gaia theory, the oceans also show this strong interaction between the physico-chemical environment and the biota it hosts, this interaction determining at the end the conditions observed; all living species inhabiting the ocean have contributed to adapt to their needs for a better survival. This is why, pH does not mainly react to simple physico-chemical equilibriums but is set by many other

241 The boron-isotope ($\delta^{11}B$) approach to pCO_2 estimation relies on the fact that a rise in the atmospheric concentration will mean that more CO_2 is dissolved in the surface ocean, causing a reduction in its pH. Thus the pH of ancient sea water can be estimated by measuring the boron-isotope composition of calcium carbonate ($\delta^{11}B_{cc}$) precipitated from it. This is because boron in aqueous solution occurs as two species, $B(OH)_3$ and $B(OH)_4^-$, between which the equilibrium is strongly pH-dependent over the natural acidity range of sea water. Furthermore, there is a pronounced isotopic fractionation between the species of approximately -19.5‰, so that the $\delta^{11}B$ of each species is highly dependent on pH. Because boron incorporation into marine carbonates is predominantly from $B(OH)_4^-$, $\delta^{11}B_{cc}$ is a sensitive pH indicator. For the usage of foraminifera see (Foster and Rae, 2016) and for diatom opal (Donald et al., 2020).

242 Coral reefs are mainly made of aragonite, thereof the reference to ACD and not CCD.

243 https://jennifermarohasy.com/2020/07/university-appeal-upheld-peter-ridd-loses-we-all-lose/

phenomenons where the biosphere plays a major role, this is referred to in this case as the Biological Carbon Pump (BCP), and neither the biological pump nor the ocean circulation are in a steady state as, e.g. oscillations like El Niño - La Niña, NAO, PDO, etc. all affect upwelling which has a far greater effect on pH by bringing back to the surface CO_2 enriched waters with a lower pH than direct exchange of atmospheric CO_2 with surface waters (deep waters have a lower temperature and a lower pH as DIC increases, e.g. see the profiles from Ben-Yaakov and Kaplan (1968)).

Furthermore, as explained by Steele (2016, 2020) "*far from being catastrophic, not only is a pH range between 8.4 and 7.7 experienced daily in thriving coral reefs, that range appears to be an optimal balance that supports both photosynthesis and calcification!*". The reason is that through the effects of photosynthesis, respiration and calcification[244], coral reefs can experience a pH hovering around 8.5 or higher during the day followed by a low pH of 7.8 or lower at night[245] and careful surveys of the reefs led, e.g. Kline et al. (2015) to state "*As with many other reefs, the nighttime pH minima on the reef flat were far lower than pH values predicted for the open ocean by 2100*". The two essential reactions are:

1) Photosynthesis (simple Equation is 64, p.49) but observe how protons are used in a more complete formulation:

$$106\,CO_2 + 16\,NO_3^- + HPO_4^{2-} + 78\,H_2O + 18\,H^+ <=> C_{106}H_{175}O_{42}N_{16}P + 150\,O_2 \tag{175}$$

and

2) Calcification / dissolution

$$Ca^{2+} + 2\,HCO_3^- <=> CaCO_3 + CO_2 + H_2O \tag{176}$$

These three essential activities photosynthesis, respiration and calcification together with winds, tides and oceanic currents drive the pH and not the dissolution of CO_2 at the interface between surface waters and the atmosphere, which only has a marginal influence, **wrong causation again**. As far as photosynthesis is concerned, generally and not only limited to coral reefs species, Mackey et al. (2015) discuss the impact of Ocean Acidification (OA) and state "*we discuss the current state of knowledge about the effects of increased CO_2 on photosynthesis across marine photosynthetic taxa from cyanobacteria and single-celled eukaryotes to marine macrophytes. The analysis shows that photosynthetic responses to OA are relatively small for most investigated species and highly variable throughout taxa*".

Shallow-water reef-building corals are able to thrive in low-nutrient tropical waters via their symbiosis with a dinoflagellate algae commonly referred to as zooxanthellae. In order to sustain photosynthesis, corals actively pump hydrogen ions (H+) into the vesicles encapsulating their algal symbionts. This lowers its internal pH to truly acidic levels between pH 4 and 5 and Barott et al. (2015) explain "*that coral host cells acidify the microenvironment where the symbiotic algae reside using a proton pump, the V-type H+ATPase (VHA), which is present in the host membrane surrounding the algae*". This increases H+ concentrations up to 10,000 times greater than any theoretical contributions to surface waters by atmospheric CO_2. If coral do not acidify their symbionts' surroundings, the limiting supply of CO_2 would dramatically decrease the rate of photosynthesis (Steele, 2016). Furthermore, coral growth and calcification is supported by the translocation of fixed organic carbon by the same algal symbionts of the genus Symbiodinium and Barott et al. (2015) add "*In addition to providing corals with a source of metabolic energy, symbiont photosynthesis is hypothesized to promote coral calcification by supplying precursors for the skeletal organic matrix and by buffering the protons produced during precipitation of the coral's calcium carbonate skeleton*". Definitely, the pH of the surface water of the open ocean does not tell much of the complex story happening in the symbiotic organisms partnering[246] to ensure optimal execution of the three essential vital functions of the organisms of the reef: photosynthesis, respiration and calcification.

Furthermore oceanic oscillations on decadal or multi-decadal scales have an impact on the reef equilibrium either through trends in wind or currents strength and can further magnify biological effects causing pH to trend independently of atmospheric CO_2. As explained by Steele (2016) "*CO_2 generated by calcification does not completely outgas and thus changes in the rate at which reefs are flushed with open ocean water will modulate how calcification*

244 Photosynthesis makes the glucose that is used in cellular respiration to produce the Adenosine TriPhosphate (ATP), that provides energy to drive many processes in living cells, e.g. muscle contraction, nerve impulse propagation, condensate dissolution, and chemical synthesis. The rate of photosynthesis (happening only during sunlight) is usually faster than respiration (which happens all the time), so plants or phytoplankton produce more oxygen than they need for themselves. Cellular respiration is the biochemical process in which the cells of an organism (e.g. bacteria) obtain energy (ATP) by breaking down Glucose into carbon dioxide and water using using oxygen (aerobic).

245 A pH of 7.8 is already reached at a depth of 100 meters, yet many organisms live in this area and are not affected!

246 The "upwellings", depending on the winds, will bring acidic water to the surface, and locally modify the pH of the sea water. They will also cause many modifications in the structure of the phyto- and zooplanktonic communities, (the upwelling bring nutrients).

affects surface pH. In contrast to Caldeira's "lifeless" pH models that suggest pH has dropped from 8.2 to 8.1 since preindustrial times, a study of pH since 1700 AD on Flinder's Reef in the Great Barrier Reef concluded pH has oscillated between 8.15 and 7.9 every 50 years. During a positive Pacific Decadal Oscillation and El Nino years, trade winds slowed and reduced the flushing rate of the reef. As a result there was a build up of CO_2 released from calcification and average pH dropped pH to 7.9. When winds increased during a negative PDO and more La Ninas, the reef was flushed and pH rose to 8.15. Several studies have linked changes in pH driven with multidecadal oscillations".

Caldera's reef model does not describe the complex interactions of symbiotic species living in ever changing conditions with oceanic and atmospheric cycles and oscillations but resemble a pack of aragonite crystals that are immersed in a solution in a laboratory where one would increase the atmospheric pCO_2 as it it were the only parameter having an impact on so complex biological environments. As seen before, when more CO_2 dissolves into seawater, and by decreasing the carbonate ion concentration (Figure 85 and 86) it lowers the pH and shifts the equilibrium of the carbonate system. This lowers a chemical property of seawater known as the calcium carbonate saturation state or Ω given by equation 177. Seawater Ω is a function of $[CO_3^{2-}]$ and of the concentration of the ion calcium $[Ca^{2+}]$ as follows:

$$\Omega = \frac{[Ca^{2+}][CO_3^{2-}]}{K_{sp}} \qquad (177)$$

where K_{sp} is the solubility product of a specific $CaCO_3$ mineral polymorph, (e.g. aragonite belongs to the orthorhombic, crystal system, calcite is trigonal and vaterite is hexagonal like crystals of ice and is seldom met as less stable than the two other forms and more soluble) at a specified temperature, salinity, and pressure. Starting from the thermodynamics of inorganic $CaCO_3$, precipitation and dissolution can largely be described by seawater Ω, with precipitation occurring at $\Omega > 1$ and dissolution at $\Omega < 1$ and people investigated the calcification rates of organisms such as corals in seawater of varying Ω by manipulating bulk seawater content, $[CO_3^{2-}]$ and $[Ca^{2+}]$ (e.g. Gattuso et al., 1998) and have drawn hasty conclusions thereof. However biologically controlled calcification bears no relationship to the simple metrics of chemical equilibriums and saturation points. Several researchers since have now published evidence demonstrating the "**Omega Myth**", by evidencing how much more complex are biologically driven processes, e.g. Cyronak et al. (2016) say "*gross calcification is under biological control and mediated by organic tissue that separates the calcifying surface from overlying seawater. Therefore calcification occurs in a media (i.e. the calcifying fluid) that has significantly different $[CO_3^{2-}]$ than the bulk seawater. However, despite the complexities inherent to biological mediated calcification, much of the current OA literature presents the problem of reduced calcification under OA scenarios as an issue of simple CO_3^{2-} substrate availability*".

For example, even if mollusc's shells consist of 95–99% calcium carbonate by weight, an organic component makes up the remaining 1–5% and the resulting composite has a fracture toughness ≈3000 times greater than that of the crystals themselves! In the biomineralization process, specialized proteins are responsible for directing crystal nucleation, phase, morphology, and growths dynamics and ultimately give the shell its remarkable mechanical strength and the organic components are diverse, i.e. proteins, sugars and lipids. The most common polymorphs in biomineralization are aragonite (e.g. corals) and calcite (e.g. foraminifera, coccolithophores[247]) and coccolithophores have been extremely successful at achieving their coccolithogenesis for hundreds of millions of years, since the mid-Triassic whatever the SSTs or the pH of the oceans, e.g. forming the cliffs of Dover (UK), and the genesis of calcite starts in their Golgi apparatus where protein templates nucleate the formation of $CaCO_3$ crystals and complex acidic polysaccharides control the shape and growth of these crystals. That's not exactly like dripping a crystal of calcite or aragonite in a test tube like a sugar in your coffee in the morning and checking if it dissolves when Ω changes, its the beauty of life and its mystery. The first evidence of biomineralization dates to some 750 million years ago and sponge-grade organisms may have formed calcite skeletons 630 million years ago, but in most lineages, biomineralization first occurred in the Cambrian or Ordovician periods. Do you really think that the SST and oceans pH have remained stable all along? The reactions and metabolisms taking charge of the bio-mineralization processes are sophisticated and resort to signaling transmitters, inhibitors, and transcription factors and many elements of these controlling processes are shared between diverse phyla. Even though most marine creatures resort to $CaCO_3$, including e.g. foraminifera, coccolithophores, calcareous sponge spicules, corals, Archaeocyatha, bryozoans, brachiopod and mollusk shells, Echinoderms, Serpulidae others use silica like radiolarians, diatoms, most sponge spicules. A telling example of bio-adaptation to a fast hyper-thermal episode like the PETM is given by Gibbs et al. (2006) and they report "*Yet major perturbation of the surface-water saturation state across the PETM was not detrimental to the survival of most calcareous nannoplankton taxa and did not impart a calcification or ecological bias to the pattern of evolutionary turnover*". This PETM episode is attributed to massive volcanic emissions, more specifically the North Atlantic Igneous

247 https://en.wikipedia.org/wiki/Coccolithophore

Province (Gutjahr et al., 2017), > 10,000 Gt-C over less than 5000 years (Turner et al., 2017), which bears no similarity with size and rate of the current pace of change, characterized by a strong carbon isotope excursion, but as extraordinary as the event was, a recent study of the rich molluscan fossil record of the U.S. Gulf Coastal Plain (GCP) explores whether the PETM had a significant lasting effect on the richness, turnover, or ecological structure of shelf faunas or the body size, growth rate, or life span of component taxa. And the conclusion by Ivany et al. (2018) is very clear "*Taken as a whole, our results indicate that the long-term impact of the PETM on these shallow-water benthic communities was unremarkable. Unlike the deep-sea benthos (22), molluscan shelf associations on the GCP suffered little in the way of lasting biodiversity loss, taxonomic turnover, or persistent ecological restructuring relative to changes at earlier or later formation boundaries*".

Once it is better understood that we deal with living species, though not as sophisticated as vertebrates, still which are far from responding to elementary physico-chemical processes like simple dissolution in an under-saturated fluid, one is on a better track to understand what follows. And being back to the coccolithophores, it simply appears that they cannot care less than the level of saturation of $CaCO_3$ in the water, they have been *designed by evolutionary forces* to overcome this difficulty! This is what was reported by Marañón et al. (2016) who state "*We found a significant relationship between primary production and calcification, such that the calcification to primary production (CP/PP) ratio was relatively invariant among ocean basins. Both the CP/PP ratio and* ***cell specific calcification were largely constant across a wide range of calcite saturation state*** *(1.5–6.5), [HCO_3^-] / [H^+] (0.08–0.24; mol: µmol),* ***and pH*** *(7.6–8.1), which indicates that* ***calcification by natural coccolithophore assemblages was independent of carbonate chemistry****. Our results suggest that coccolithophore calcification, at least in tropical regions, may not be decreasing in the currently acidifying ocean*".

Those who speculated that 95% of the coral will be lost by 2050 (Hoegh-Guldberg, 2014), and argue that our current high levels of CO_2 are creating conditions coral have not experienced for millions of years. They have to resort to contorted calculations and outright lies and deceptions to assert their claims. In order to "*prove"* that reef-building corals have responded to climate changes over geological times through evolutionary adaptation, changes to community structure, and migration of species and ecosystems because climate changes of the past would have been much slower than now. Hoegh-Guldberg (2012) state that "*slow rate of environmental change over most of this time (e.g. the past 420,000 years, 0.01±0.017°C per century, 99% confidence interval, Hoegh-Guldberg et al. (2007) is a key characteristic of why these responses were possible without any apparent loss of coral reef abundance*". This is a very bold assertion made using Petit et al. (2005) δD_{ice} data (just a proxy of local temperature change) which itself follows a model of ice accumulation and is not a stratigraphical ice record as, e.g. only the first 31 kyr of the West Antarctic Ice Sheet Divide Ice CoreCore (WAISDIC, 2020) are (Sigl et al., 2016). Then, based on a proxy that is adjusted to a model, and using some unstated and most probably heterogeneous sampling due to the existence of brittle ice, rates were "*calculated for each successive pair of points in the Vostok Ice Core record*[248] *by dividing the difference between two sequential values (ppm or °C) by the time interval between them*", see Table 1 of Hoegh-Guldberg (2007). This does not stand examination but has good explanation in activism and vested conflicts of interests as reported by Laframboise (2011)[249].

What the Figure 88 shows is that the natural (how could it be otherwise) SSTA observed over the 47 years period in the mid-Holocene by Corrège et al. (2000), which exceed 2°C between the min-max (4166yr-4157yr), were far superior to those registered over the contemporaneous period of 159 years by Huang et al. (2017) which are of ~1.2°C between the min-max (1910yr-2017yr) and their rate is of 4°C / century, in the middle of the Holocene recent past, and certainly not of the kind of 0.01 °C / century which can only be a delusion or a deception. One will also remember the statement by Alley et al. (2003) "*Many paleoclimatic records,... show... regional climate changes of as much as 8° to 16° occurred repeatedly in as little as a decade or less... effects were clearly hemispheric to global...*", who can believe the "*0.01±0.017°C per century for the past 420,000 years*" fantasy?

248 Note that 2 Vostok samples are separated on average by 1,500 years as we have 283 samples over 400 kyr! ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/vostok/deutnat.txt

249 "*Australian marine biologist Ove Hoegh-Guldberg is often described as a "world renowned reef expert." Nine chapters of the 2007 [IPCC] Climate Bible base their conclusions partly on his work. He was a contributing author to that report and has been appointed a coordinating lead author for the upcoming edition. The problem is that Hoegh-Guldberg has had close ties to activist organizations for the past 17 years. Between 1994 and 2000 he wrote four reports about coral reefs and climate change that were funded, vetted, and published by Greenpeace. Since then he has written two more for the World Wildlife Fund (WWF). Someone who has spent 17 years working closely with activist groups is thoroughly tainted. By no stretch of the imagination can he be considered a disinterested party who will carefully weigh the pros and cons and then write a scrupulously objective account of the situation*" (Laframboise, 2011)

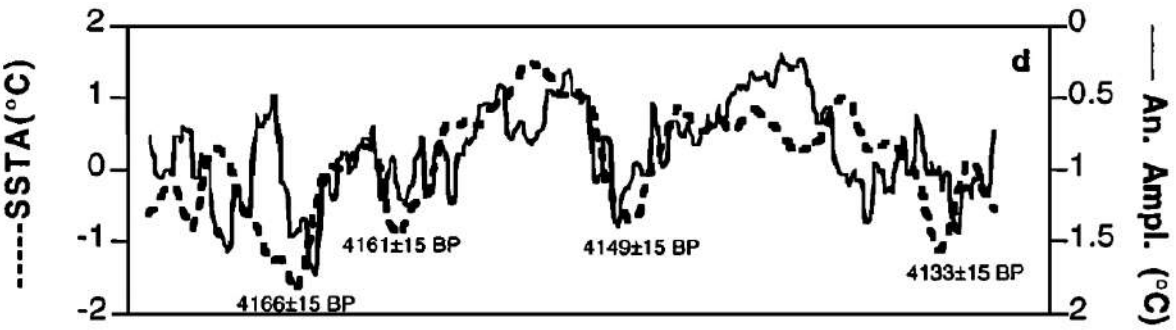

Figure 88. *Monthly SSTA (dashed line) with respect to a 47-year-long record of sea surface temperature (SST) derived from Sr/Ca and U/Ca analysis of a massive Porites coral which grew at ~-4150 B.P. in Vanuatu (southwest tropical Pacific Ocean) and 24-month running annual amplitude (solid line) according to (Corrège et al., 2000).*

Either Hoegh-Guldberg et al. (2007) ignore the existence of rapid and so much more severe natural climate changes of the past than even those observed and measured during the Holocene (e.g. Figure 88) which are already far off their 0.01°C/century rate, like, e.g. the cold Younger Dryas with extreme and brutal temperature change of +10±4°C at the termination of the cold episode (Grachev and Severinghaus, 2005), the Bølling–Allerød episode, 25 Dansgaard / Oeschger events, tens of Heinrich stadials and AIM events, etc., and at least four glacial cycles (i.e. MIS 2, MIS 6, MIS 8, MIS 10) as the reader can visualize, e.g. on Figures 37 and 41, during which reef extent was reduced up to 80% (Kleypas, 1997), and their credibility is extremely low even if they publish in the peer-reviewed "*Science*" journal, or they intentionally use deceptions to sustain false statements and their credibility is even lower. **Corals will not be gone by 2050, they are not threatened by the elusive acidification of the oceans** and whenever problems arise they come of pollution, over exploitation or other forms of physical degradations (e.g. crown of thorns starfishes). Misleading people for political reasons does not help address the real issues.

Finally, it seems that the oceans are sequestering up to twice as much carbon dioxide as previously thought, according to Buesseler et al. (2020). The Biological Carbon Pump (BCP) refers to the large-scale process by which CO_2 is absorbed by the phytoplankton in the oceans. The mechanism is as follows: with the help of solar energy, the phytoplankton absorbs CO_2 and releases oxygen. It is in turn absorbed by animal zoo-plankton and other marine species that carry it further down to the bottom of the oceans. When these latter species die, they become carbon-rich debris that falls to the ocean floor. This process enables the oceans to sequester carbon; the concentration of carbon dioxide in the atmosphere would be much higher if this BCP did not exist. The balance between 1) atmospheric carbon sequestration and 2) oceanic upwelling and export by the BCP is also the key factor determining the pH level in ocean surface waters.

Small changes in the efficiency of the biological pump can significantly alter ocean carbon sequestration and hence atmospheric CO_2 and ecosystem functioning in intermediate waters. The area where phytoplankton live is called the euphotic zone (EZ). The ability of phytoplankton to absorb CO_2 depends largely on the amount of light that penetrates the upper layers of the oceans. The study by Buesseler et al. (2020) shows that this EZ zone is larger than expected and absorbs up to twice as much CO_2 as previously estimated. This adjustment changes regional assessments of the efficiency of the carbon pump as well as global carbon budgets and shifts the emphasis on the BCP and not just the elementary physico-chemical reactions. As Steele (2020) summarizes "*If ocean photosynthesis and marine productivity improves, and all the added CO_2 entering the ocean is sequestered into organic matter, there would be no change in ocean pH. And indeed, marine productivity has increased as the earth warmed. Productivity increased after the last glacial maximum ended, and increasing organic sediments on the sea floor suggest increased carbon sequestration*".

Generally speaking marine life, and all photosynthesizing organisms (e.g. phytoplankton, corals, etc.) lack CO_2 as it has become scarcer and scarcer over geological times and they have devised various mechanisms to counter its starvation and its natural disappearance into the oceanic inorganic pathway which tends to quickly dissociate CO_2 into bicarbonate ions HCO_3^- and H^+, i.e. reactions (169) and (164). To that aim planktons use an enzyme, the carbonic anhydrase to recombine HCO_3^- and H^+ into H_2CO_3 following reaction (165) then use reaction (169) reversely to transform H_2CO_3 into H_2O and CO_2, and corals further concentrate H^+ ions in their vesicles where photosynthesis occurs, causing their internal pH to fall to very acidic levels, i.e. 4.5 in order to efficiently gather H^+ ions from the surrounding waters to regenerate as much CO_2 as possible for photosynthesis which causes the pH in the corals' surrounding waters to rise to 8.5 or more during the day! Many other organisms as bacteria and algae have also devised mechanisms to further concentrate CO_2 to sustain their photosynthesis, life does its best to keep going on with less CO_2. During night time, photosynthesis stops of course and respiration and calcification mainly for the coral reefs organisms become the driver of the pH, releasing

CO_2 and lowering the pH down to as low as 7.7 during winter, **a daily swing of 0.8 which by far exceeds any forecast that one could make for the surface water of the open ocean**, even pushing up [CO_2] to ten times its actual concentration, i.e. 4,000 ppm.

Current models based on saturation and calling disaster if $\Omega < 1$, and IPCC models which do not take into consideration the ocean productivity (IPCC, 2013)[250] are just representative of a dead ocean, whereas just the opposite occurred and for example, between 1998 and 2012 the productivity of the Arctic ocean increased by 30% ! So, not only cannot pH calculations be correct nor carbon budgets either, especially as due to increased productivity some organic matter can sink quickly enough to be buried into the sediments at depths were the carbon they contain will be sequestered for millions of years and not decay and therefore not participate into respiration, literally pumping the carbon to depths.

The reason why the pH decreases with depth is not only due to the fact the water getting colder with depth it dissolves and holds more C, though the pH / T relationship is obvious on Fig. 1 of Ben-Yaakov and Kaplan (1968), but also the result of the biological pump as organic matter can be exported downwards much faster than any inorganic components. Steele (2020) reminds that "*It is best to differentiate the biological pump into at least three different dynamics: 1) a passive gravity-driven pump causing organic matter to sink, 2) an active pump driven by vertical migrations of living organisms that actively carry carbon from the surface to depth, and 3) a calcium carbonate pump in which inorganic calcium carbonate shells sink, carrying DIC in the form of carbonate ions to depth*". Organic carbon sinking also feeds creatures of the meso-pelagic zone, an area spanning between 200 (limit of EZ) and 1,000 meters that was long underestimated, life forms that also perform daily vertical migrations to feed at night and avoid predators and the existence and abundance of this meso-pelagic life requires a far higher surface productivity than estimated before.

Not only OA scare mongers and IPCC have dead oceans but they address laboratory mineral chemistry and not a living Earth where the metabolisms of organisms show complex bio-chemical processes where the shells are protected by 5% of organic compounds making ad-hoc tissues that isolate them from the changes of ocean chemistry (i.e. periostracum[251]). Finally, shell builders do not directly resort to CO_3^{2-} but rather use HCO_3^- into shell building compartments, then H^+ ions are pumped out, i.e. reaction (165) to provide for the needed CO_3^{2-}. And as Figure 86 shows a lower pH means more HCO_3^-, what marine shell builders use.

As we have seen Figure 87, surface corals are found at various latitudes within waters ranging between 18°C and 34°C and even almost 40°C in the Arabian Sea; they've been around for 550 million years and there are multiple species, well documented over the last 60 million years, including those of coral reef builders which form colonies and have a dual feeding strategy with polyps to catch zoo-plankton, particles and even small fishes, and symbiotic algae (known as zooxanthellae or symbiodinium, up to 10^4 /cm^3) which ensure chlorophyll photosynthesis and provide sugars to the coral which in exchange protects them in a pocket where it ensures an acid pH (pH around 4 to 5) by pumping H^+ ions into it in order to maximize the presence of dissolved CO_2.

The aragonite skeleton is made under the calicoblastic ectoderm: the coral removes H^+ ions by pumping them out and injects (thanks to Ca2+-ATPase, a trans-membrane protein found in most eukaryotic cell membranes) Ca^{2+} ions that react with bicarbonate ions: $HCO_3^- + Ca^{2+} \leftrightarrow CaCO_3 + H^+$

The vertical extension of the calcareous skeleton occurs at night and, for example, every 30 days the tissues move upwards for a reef growth of 10 mm/year, or 4kg/m²/year of limestone, and a net organic production of 3g/m²/day of carbon, all highly variable figures (Allemand, 2004; Le Goff, 2016). According to Montaggioni (2009), over the temperature range of 23°C to 29°C, **coral calcification** in kg/m²/year is 3.33 $t_{surface}$(°C) - 70.7 and **increases with temperature** from 5.8 kg/m²/year to 25.9 kg/m²/year while **coral size growth** (mm/year) is 3.11 $t_{surface}$(°C) - 68.96 and **increases with temperature** from 2.6 mm/year to 21 mm/year.

Contrary to all stories told by scare mongers and alarmists of all sorts, the reefs are not threatened buy Ocean Acidification or by an increase of temperature, but face very real dangers as they are grazed by crown of thorns starfish, sensitive to storms, and sometimes ravaged by bacterial infections; they cannot tolerate being out of the water for

250 IPCC (2013). p 292. "*Ocean carbon uptake and storage is inferred from changes in the inventory of anthropogenic carbon... Changes due to variability in ocean productivity (Chavez et al., 2011) are not considered*."

251 This is a thin organic coating or "skin" which is the outermost layer of the shell of many shelled animals, including mollusks and brachiopods. Among mollusks it is primarily seen in snails and clams, i.e. in gastropods and bivalves, but it is also found in cephalopods (literally they walk on their heads) such as ammonites (extinct) or nautilus species.

more than a few hours, resulting in bleaching of the corals closest to the surface when large El Niño(s), combined with high tides, lower the sea level by a few decimeters.

As shown by Mellin et al. (2019) crown of thorns starfish outbreaks are responsible of 42% of the loss observed for the Great Barrier Reef which are then left in such a damaged condition that they are later further easily destroyed by storms and cyclones (48% of the observed loss) and bleaching does only represent a bleak 10%. All these organisms enjoyed Cretaceous times with its 2,000-1,000 ppm of CO_2 and left behind huge sedimentary accumulations, testimony of their success, so would some challenges be around, CO_2 is the wrong enemy and fighting an incorrect foe leads to lost battles. Marine life generally speaking will be perfectly fine, and won't care of the OA myth, corals face some specific threats that well deserve close attention and scrutiny. But if mankind continues indiscriminate over-fishing and exploitation, habitat destruction (Hendriks et al., 2010), then the backlash is bound to happen. But it has nothing to do with man-made CO_2 emissions, does it ?

Let's summarize: Søren Peter Lauritz Sørensen was famous for the introduction of the concept of pH, and the first measures of seawater pH are supposed to having been reported in a paper of Sørensen and Palitzsch (1910) though it does not appear possible to get this original article, but a paper by Palitzsch (1911) with the same title is on the other hand readily available. Color indicators were first used for pH measurements in seawater (Palitzsch, 1911) and early color measurements were carried out visually for qualitative measurements, or colorimetrically. Later, oceanic pH measurements have usually been made using a potentiometric technique using the hydrogen ion sensitivity of the glass electrode as the basis for the measurement and is considered by Dickson (1993) as "*beset with a variety of experimental problems such as electrode drift, susceptibility to electromagnetic interference, and problems with reference electrodes. It is this catalogue of potential problems that is in part responsible for the poor opinion many chemical oceanographers have of pH measurements*".

In order to measure expected changes that would be due to ocean acidification one needs to monitor very small pH changes in the global oceans, typically a pH decrease of approximately 0.1, over the past 100 years and measuring such small changes requires very sensitive and reliable observations (PMEL, 2015). **The data collected prior to 1989 are typically not well documented and such data are of unknown and probably variable quality and uncertainties of these older pH measurements could easily be as large as 0.2 in pH and thus not at all well-suited to showing a change of 0.1 in pH over the last 100 years**. Furthermore, recent measures show strong regional or even larger scale variations as Rérolle et al. (2016) for instance report that "*Finally, the investigation yielded a reliable high resolution pH dataset in surface waters along a transect from the Pacific to the Arctic Ocean.* ***Large pH variations were observed*** *in the ice-free Arctic surface waters,* ***with pH ranging between 7.98 and 8.49***".

Therefore one has to acknowledge that:

- **there does not exist a long term accurate time series of seawater pH** as measurements **to better than 0.1** are recent and proxies dubious and therefore trends in oceans pH cannot be assessed;
- **there are significant regional variations of measured pH** (Rérolle et al., 2016) and in that respect, Jiang et al. (2019) show that "*air-sea CO_2 disequilibrium is the dominant mode of spatial variability for surface pH, and discuss why pH and calcium carbonate mineral saturation states show contrasting spatial variability*";
- the **biosphere** locally strongly **affects measured pH values** depending on biological cycles and activities (e.g. very variable pH observed over coral reefs depending on whether the reef performs photosynthesis or rather calcification and respiration).

This creates a situation in which **the natural variations** observed **are several orders of magnitude larger than** the changes searched for within the frame of **the supposed Ocean Acidification** (OA) response. Some authors, e.g. Wu et al. (2018) try to convince their reader that OA is obvious from their work and to that aim present 323 years of annually resolved $\delta^{18}O$, $\delta^{13}C$ and $\delta^{11}B$ results from a modern slow-growing massive scleractinian coral, Diploastrea heliopora, collected from the open-ocean island of New Caledonia in the South Pacific Ocean (22.21°S, 166.15°E). Beyond the intricate complexities of their reconstructions that should somehow reflect the pH of open-waters, if one can observe a very small trend for $\delta^{18}O$ and one slightly more visible for $\delta^{13}C$, the only thing obvious is that there is no trend at all on the reconstructed pH as shown on Figure 89:

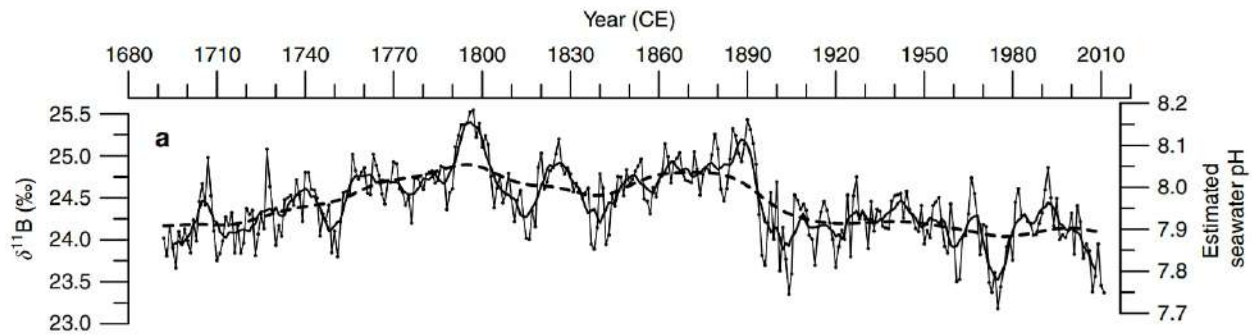

Figure 89. *No trend for more then 330 years of pH reconstructions based on Diploastrea heliopora coral proxy records (δ^{11}B-pH reconstruction). New Caledonia D. heliopora annually resolved records over the period 1689–2011 CE from precisely dated ^{230}Th/U-age. a Coral δ^{11}B signature (left y axis) with estimated seawater pH (pH_{SW}) on the right y axis using the $\delta^{11}B_{SW}$ = 39.61‰ and isotopic fractionation factor (α[B3-B4]) of 1.0272. After Wu et al. (2018).*

What can be inferred is that beyond instantaneous large pH **spatial variability** as recorded by (Rérolle et al., 2016) there exists also a large **temporal variability** which was already expressed long before any anthropogenic emission became significant, see the swings around 1800 and around 1890. Wu et al. (2018) give an explanation which is much better than their anthropogenic scapegoat, which is "*the timing of reconstructed pH variability in the South Pacific is coupled to prominent sea surface temperature variations modulated by the phases of ENSO and IPO. We suggest changing surface wind strengths and zonal advection processes across the Pacific Ocean as the main drivers responsible for South Pacific pH variability*". Furthermore, the Revelle Factor (Revelle and Suess, 1957) which is, alas, a well known measure used to assess the ocean's "buffer capacity" for the carbonate system in seawater, and defined as the ratio between the fractional change in pCO_2 to the fractional change in dissolved inorganic carbon (DIC[252]) at constant temperature, salinity and Total Alkalinity (TA):

$$Revelle_{factor} = \frac{\left(\frac{\Delta pCO_2}{pCO_2}\right)}{\left(\frac{\Delta DIC}{DIC}\right)} \tag{178}$$

The Revelle_factor = ($\Delta pCO_2/pCO_2$)/($\Delta DIC/DIC$) supposes that the $p_{atm}CO_2$ and the $p_{ocean\_surf}CO_2$ of the ocean be in equilibrium, **which is not the case**, see e.g. Jiang et al. (2019).

But the totally unrealistic part of the *Revelle_factor* is that it **is** supposed to be **defined** at **constant temperature**, **salinity** and **Total Alkalinity** but as T changes for example, its average value of 11.5 varies a lot and ranges from 8 for warm waters to up to 14 for cold waters. The objective of Revelle and Suess (1957) was to claim that a very slight increase in DIC in the surface ocean of, for example, 8.7% is sufficient to compensate for a doubling of CO_2 in the air, as +8.7% x 11. 5 = +100%, and that consequently the surface ocean, allegedly claimed to be almost in equilibrium with the air, and without exchange of carbon with the deep ocean will absorb almost nothing of the "fossil" CO_2 emitted in the air, which will be divided about half and half between the other two reservoirs, the vegetation (without the soil!) and the atmosphere, supposedly both of comparable masses. Revelle (1965), p. 118, states "*Perhaps the most striking result is that the ocean takes up a relatively small fraction of the total added CO_2 probably about 15%.....*" while the oceans have been supposed by many authors to have absorbed a significant part of the cumulative emissions since 1900[253], where the biological pump also acted as a significant sink (they were modeled as net degassing in Equation 154).

The approximately 100 Gt-C/year drawn from the air by the surface oceans at mid and high latitudes are carried away by the 275 Gt-C/year that descend from the cold surface ocean to the deep ocean. The 275 Gt-C/year that inter-tropically up-wells from the deep ocean degas about 100 Gt-C/year. But the main deception of this Revelle_factor is that it also aims to hide the major impact of the temperature as the partial pressure of CO_2 in seawater and pH are given by the the following expressions (Copin-Montegut, 1988; Veyres, 2020) for a salinity S=34.78:

252 Dissolved Inorganic Carbon DIC = $[CO_2] + [HCO_3^-] + [CO_3^{2-}]$. DIC is 90% in the form of bicarbonate ion HCO_3^-, 9% in carbonate ion CO_3^{2-} and 1% in carbonic acid or CO_2; the rebalancing between these different forms is done in a few minutes when the parameters temperature, DIC or TAlk change.

253 McKinley et al. (2017) consider rather more than 41% but add "*This sink is expected to grow and to substantially mitigate atmospheric carbon accumulation over the next several centuries (Randerson et al., 2015)*"

$$pCO_2 = 400\,(T/296.42)^{12.5}\,(DIC/2000)^{10}\,(2300/TAlk)^{10} \quad (179)$$

with T in K, DIC and TAlk[254] (Total Alkalinity) in µmole/kg

and the pH is given to better than 0.05 by the relation:

$$pH\,(T, DIC, TAlk) = -7.85 + 0.0164\,(T(K) - 296.42) + 0.00181\,(DIC - 2100) - 0.00168\,(TAlk - 2300) \quad (180)$$

With DIC and Talk expressed in µmole/kg as for Equation (179).

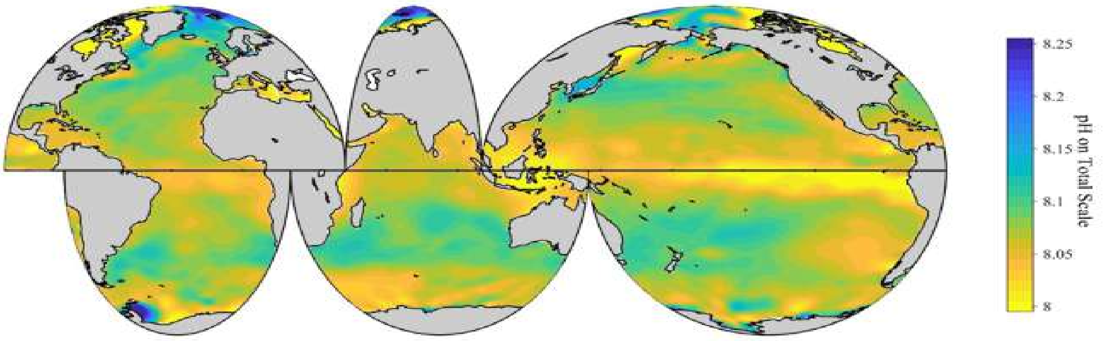

Figure 90. *Global surface ocean pH on the total hydrogen scale (pHT) at in-situ temperature, shows the Hot zones with a pH < 8 and Cold zones with a pH > 8.25 as explained, based on the 6th version of the Surface Ocean CO_2 Atlas (SOCATv6, ~23 million observations). After Jiang et al. (2019).*

Hot zones (27°C) and high DIC (2200 µmole/kg), **degas** ($p_{water}CO_2$ = 706 µatm for TAlk = 2320 µmole/kg) and are towards pH = 7.8. Here $p_{air}CO_2$ limits the degassed flow but contributes neither to DIC nor to pH because the CO_2 flow is from surface water to air.

Cold zones (0°C) with low DIC (1950 µmole/kg) **absorb** ($p_{water}CO_2$ = 97 µatm for TAlk = 2320 µmole/kg) and are at more basic pH = 8.55. There, the excess CO_2 from the air will anyway be carried away by the carbon flux of 275 Gt-C/year which goes down to the depths.

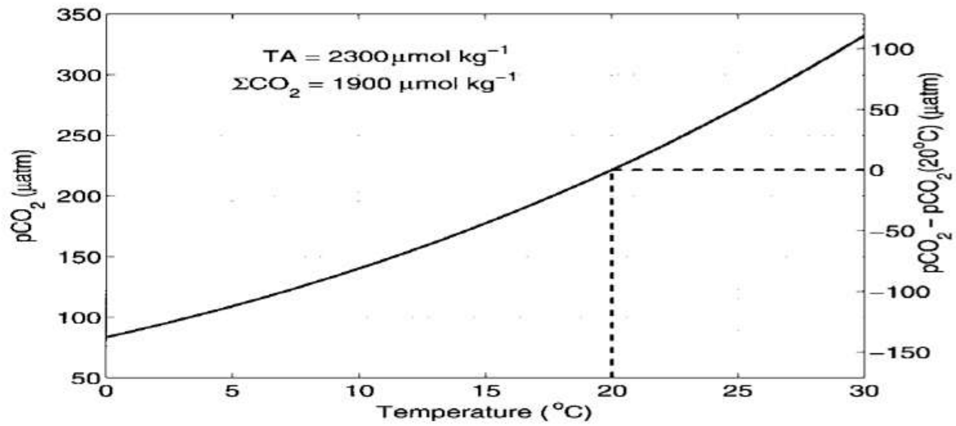

Figure 91. *Seawater pCO_2 as a function of temperature (T). Source: Zeebe and Wolf-Gladrow (2003), Fig. 1.4.18, p. 64.*

When one considers carefully the Figure 91 from Zeebe and Wolf-Gladrow (2003) showing well, for very low DIC values, the effect of temperature on the partial pressure of CO_2 in seawater, it is striking that a factor of 4 exists between 0°C and 30°C (i.e. between the Arctic or Antarctic oceans and the tropical waters), between 80µatm and 320 µatm. The degassing of CO_2 is proportional to the difference between the partial pressures in water and air and to the average of the square of the wind speed, which makes all estimates, e.g. Takahashi et al. (2009), of the quantities exchanged very questionable. There is **no static equilibrium** of the partial pressures of CO_2 between the oceans and the air, but a flow of CO_2 continuously degassed by the inter-tropical ocean (78 Gt-C as per IPCC but rather 90 Gt-C) and absorbed by the ocean at mid and high latitudes (80 Gt-C). This transfer of carbon from the ocean to the air and to vegetation (and soils) accounts for one-third of the growth in net productivity of the observed vegetation (Pretzsch et al., 2014; Goklany, 2015; Campbell et al., 2017).

254 See section Glossary, Acronyms and Abbreviations for a complete definition

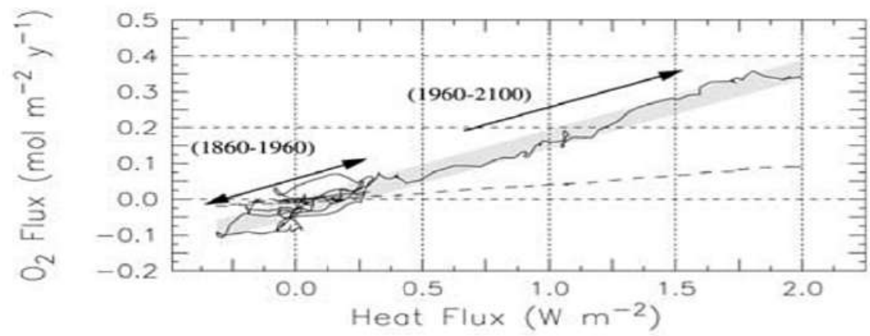

Figure 92. *Total heat flux (dashed) versus total O_2 flux from Bopp et al (2002) model (solid line). Inter-annual variations of total O_2 flux and total heat flux are smoothed with a 10-year running mean. The two variables are linearly correlated (R2 = 0.95), with an out-gassing of 0.195 mole O_2 m^{-2} yr^{-1}, for a warming of 1 W m^{-2}. This slope is similar for 1860 – 1960 (0.192 with R2 = 0.56) and for 1960 – 2100 including model projections (0.204 with R2 = 0.97). Adapted from Bopp et al (2002).*

Since the year 1900, vegetation being fertilized by more CO_2 in the air, as a consequence of temperatures slightly milder since the end of the LIA which favors the net degassing of the ocean. The upwelling of carbon from the deep ocean to the surface ocean in the inter tropical zone is of the order of 270 Gt-C/year, of which almost one third passes through the air; at high latitudes the partial pressure is much lower (by a factor of 3.5 to 4) and it is the air that releases CO_2 to the surface ocean that sends this carbon into the ocean deep (265 Gt-C/year) (Levy et al., 2013).
Logically and as per Henry's law (see Equations 20, 21 p. 33 and Figure 6), CO_2 is not alone to be out-gassed as the temperature increases since the end of LIA and O_2 does the same as it reacts to the overall warming and Bopp (2020) states "*The global oceanic O_2 and heat fluxes are strongly correlated for both the decadal variations and the climate trend*", see Figure 92.

Finally the next Figure 93, shows the wide area where the warm oceans out-gas, located between the bold lines 0 and broadly covering the surface spanning from one tropic to the other, whereas the high latitudes NH and SH beyond the isoline 0 represent natural sinks where cold waters absorb CO_2.

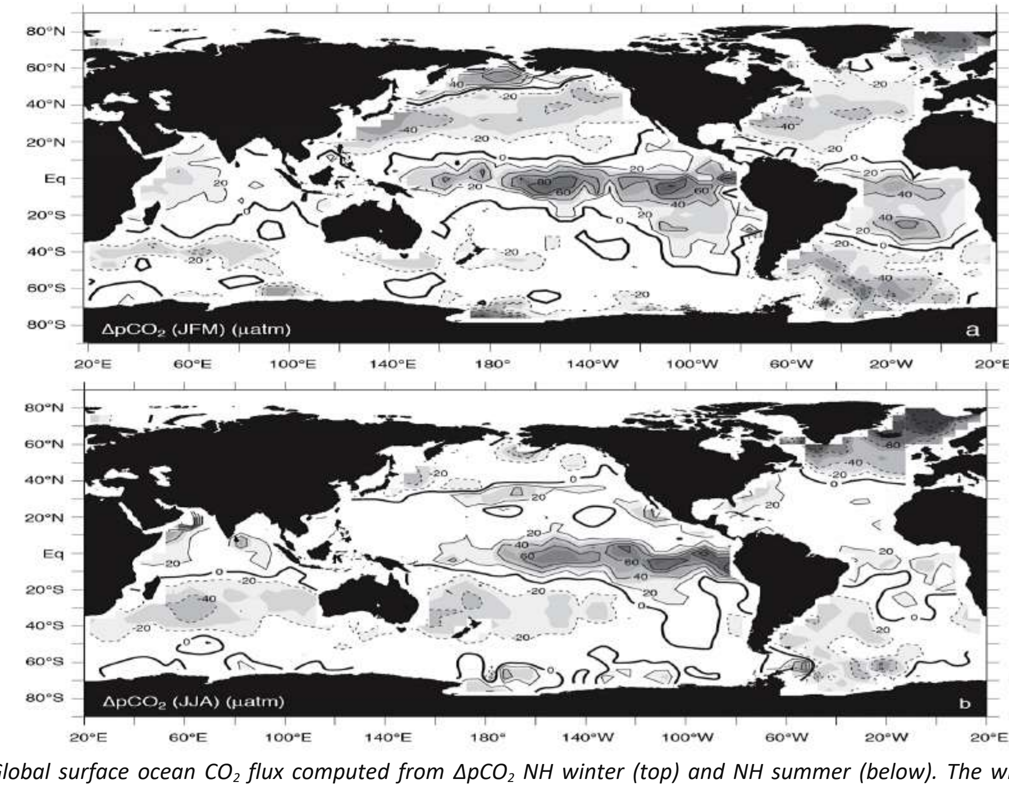

Figure 93. *Global surface ocean CO_2 flux computed from ΔpCO_2 NH winter (top) and NH summer (below). The wide area located between the bold lines 0 and broadly covering the surface spanning from one tropic to the other represent where the warm oceans out-gas whereas the high latitudes NH and SH beyond the isoline 0 represent natural sinks where cold waters absorb CO_2. After Bopp and Le Quéré (2009).*

8) Volcanoes, Tectonics and Climate

In this section the relationships between some aspects of tectonophysics and climate are going to be briefly reviewed. Tectonophysics is concerned with movements in the Earth's crust, examples of such processes include the formation of sedimentary basins, postglacial rebound of regions such as Fennoscandia, earthquakes, plate tectonics, mountain building (i.e. orogenesis), volcanoes and volcanic events. Of these various phenomenons, some can have a short-term and a long-term effect on climate while others have only an impact on longer time-scales, though a very significant one. Volcanoes and volcanic phenomenons are remarkable as they have both a short-term and long-term impact depending on the type of events considered. Plate tectonics, and orogeneses have major long-term impacts as they change all circulations on Earth, be they atmospheric or oceanic and as these circulations regulate largely the distribution of energy and heat on the planet (and not only on a meridional scale), they set the patterns that define the global and regional climate(s). The erosion and alteration rates of silicate rocks depend on the latitudinal position and organization of the continents and of the climate observed where they are situated and therefore plate tectonics and orogeneses contribute to influence marginally the composition of the atmosphere by a variable withdrawal rate of CO_2. A lot of emphasis has been placed on these issues as a result of the excessive focus of the early XXI century research on the supposedly warming effect of CO_2. The position of the plates, their organization and therefore their impact on the oceanic circulation, the obstacles and incidences that mountain belts have on the atmospheric circulation, all have a far greater impact on the climate than whether more of less CO_2 is withdrawn by erosional and alteration processes that were described in the section "CO_2 removal from the atmosphere", starting page 50. Trying to explain the Cenozoic or worse, e.g. the Cretaceous climate up to 145 million years ago by whatever changes of CO_2, be they of the order of ±1,000 or even ±2,000 ppm, are not relevant as was stressed in the "Past Climate" sections pages 127 and 135. One should remember the paper of Zachos et al., (2003) stating "*Thus, these findings reinforce the hypothesized greenhouse gas forcing for the PETM. Whether the primary radiative forcing was supplied directly by CH_4 and / or CO_2 is still unknown. The carbon isotope excursion has been attributed to the expulsion… of CH_4 from gas hydrates... assuming that the CH_4 was converted to CO_2, numerical models indicate a modest rise in atmospheric p CO_2 (100 ppmv), an amount far below that required to drive the observed warming... This suggests either that the CH_4... escaped immediate oxidation in the ocean and accumulated in the atmosphere, that the mass of CH_4 released was substantially greater (> 4 x 10^3 Gt) than estimated, and/or that additional greenhouse gas (CO_2) was supplied by another source*". When one needs a combination of three "Deus ex machina" to fit the bill when numbers cannot add up, it means that one is looking under the GHG lamppost, because this is where the light is supposed to be, but that no solution will be found there. One needs more imagination to fathom what these distant worlds could have been and tectonophysics is the discipline that helps build mental representations and frames that organize thought in that respect. Of all the relevant phenomenons, this section will only briefly deal first with volcanism and volcanic events and then with how plate tectonics might have impacted by their relative positioning and ordering the circulations and climate patterns.

Apart from geologists and planetologists who do not need it, volcanoes with the earthquakes are the two manifestations having an internal origin that remind our contemporaries that the Earth is an active body (Zobin, 2018). In fact, hot springs also tell the same story and could serve as a reminder. Volcanoes are a source of awe and fear and history of mankind has always showed a conflicting stance as fertile terrains have always attracted men for good agricultural reasons while at the same time leading them to being too close of dangerous and massive objects. From time to time, alas, one of these monsters erupts and as was previously mentioned, Naples, beyond its famous pizza(s) is well known for the ominous and dreadful Vesuvius eruption in 79 Anno Domini (AD) with a VEI=5. I personally live in Malta, located just 70 km away from Mount Etna, the highest active volcano in Europe outside the Caucasus, a stratovolcano of 3,326 m (10,912 ft), being about two and a half times the height of the next largest, Mount Vesuvius. On clear days, one can see the top of the volcano stand out well above the blue horizon of the Mediterranean sea.

Etna occupies a very special geodynamical position, it lies above the convergent plate margin between the African Plate and the Eurasian Plate and volcanic activity started about 500,000 years ago, and about 300,000 years ago, volcanism began occurring to the southwest of the current summit, then activity moved towards the present center 170,000 years ago. Eruptions at this time built up the first major volcanic edifice, forming a strato-volcano in alternating explosive and effusive eruptions leading to the collapse of the summit to form calderas. From about 35,000 to 15,000 years ago, Etna experienced some highly explosive eruptions, generating large pyroclastic flows, which left extensive ignimbrite deposits (i.e. a hardened tuff, a pyroclastic rock of dacitic or rhyolitic composition). Ash from these eruptions has been found as far away as south of Rome's border, 800 km (497 mi) to the north. Thousands of years ago, the eastern flank of the mountain experienced a catastrophic collapse, generating an enormous landslide in an event similar to that seen in the 1980 eruption of Mount St. Helens. The landslide left a large depression in the side of the volcano, known as 'Valle del Bove' (Valley of the Ox). Research published in 2006 suggested this occurred around 8,000 years ago, and caused a huge tsunami, which left its mark in several places in the eastern Mediterranean. Etna is also well known for the 44 B.C. eruption, that will be mentioned later.

Volcanic eruptions inject ash consisting of frozen magma shards and fragments, pulverized rock fragments and crystals and gases into the atmosphere dominated by water vapor (~80%), and carbon dioxide (~10%), and the rest is made up of N_2, SO_2, H_2S, CO, H_2, HCl, and HBr. It is volcanic aerosols, formed by sulfur species injected into the tropopause and the stratosphere, rather than the ash which is quickly washed away, that are the main reasons of climate effects. Sulfur-bearing gases, i.e. SO_2, H_2S, and COS (Carbonyl sulfide) have a direct impact on the atmosphere and climate, as their oxidation in the atmosphere to SO_3 and H_2SO_4 forms sulfate aerosols that disturb the radiative balance of the atmosphere and sulfate particles also act as cloud condensation nuclei and therefore may contribute to albedo changes. One should notice that even though today the contribution of volcanoes and eruptive events to water and carbon dioxide is negligible in terms of flux with respect to the existing stock, they have been nonetheless the only source of these two molecules over the geological ages.

Large pyroclastic eruptions having a Volcanic Explosivity Index (VEI) ≥ 4 are the most studied in terms of climate impact because they release huge amounts of sulfur (e.g., 20 Mt for the Mount Pinatubo eruption in 1991 and 7 Mt for the 1982 El Chichon eruption) into the stratosphere, where they stay for about a year or more (Robock, 2000), instead of a week in the troposphere, where the hydrological cycle washes them down and these eruptions leave major signatures in particular in ice-cores records. Sometimes, the eruptive column does not reach the stratosphere or even the tropopause region (VEI < 4), but these volcanic eruptions still affect the atmospheric radiation balance but on regional scales (e.g., the Laki lava eruption in 1783–1784). An easy distinction of stratospheric and tropospheric eruptions is given Fig. 1 of Gautier et al. (2019) over the last 2,600 years.

Of course, large eruptions are far less frequent than moderate ones are, but more modest eruptions remain the greatest natural sources of atmospheric S-bearing gas. On average, tropospheric eruptions release about 10–20 Mt of SO_2 per year, which is twice as much as stratospheric eruptions that result in the release of very large amounts of SO_2 into the stratosphere but are much less frequent (<0.2 Mt of SO_2 per year while annualized). The volcanic aerosol cloud forms in several weeks by the conversion of sulfur dioxide (SO_2) to sulfate aerosol with a residence time of a couple of years and has important impacts on both shortwave and long-wave radiation budgets. Of course, the higher the plume in the atmosphere, i.e. the stratosphere, and the bigger the sulfuric emissions the stronger and the more lasting the impact on climate. Several smaller eruptions in a row can also have by adding up their effect a significant impact as well and Miller et al. (2012) state "*Decadally paced eruptions may produce greater cooling than a single large eruption if the recurrence interval is shorter than the upper ocean temperature relaxation time of decades*". Furthermore, no two eruptions can be considered similar as so many parameters influence the results, the VEI being just an indicator; the amount of sulfuric gases emitted and the altitude reached by the emissions is probably the single most relevant factor.

Nature of the phenomenon – Action mode	**Starts**	**Lasts**
Reduction of diurnal cycle by the blockage of SW and emission of LW radiation	Imm.	1-5 days
Summer cooling of NH tropics, subtropics by blockage of SW radiation	Imm.	1-2 years
Reduced tropical precipitation by blockage of SW, reduced evaporation	Imm.	~1 year
Ozone depletion, enhanced UV	1 day	1-2 years
Global cooling (if multiple eruptions lasts much longer)	Imm.	1-3 years up to 10-100 years
Stratospheric warming by blockage of SW radiation	Imm.	1-2 years
Winter warming of NH continents, Stratospheric absorption of SW and LW radiation	½-1½ years	1 or 2 winters

Broadly speaking, large tropical eruptions lead to winter warming and summer cooling. Summer Indian monsoon failures generally follow large high latitude eruptions. The largest summer temperature anomalies occur on average 1-3 year(s) after the volcanic eruption when a large-scale decrease by more than 6°K with peak values of 12°K can be observed over the Northern Hemisphere. Multiple eruptions can lead to a much more lasting impact of no less than 10-100 years. Over the tropical ocean, the cooling is generally less severe and depends on the local SST at the time of the eruption. In the tropical Pacific Ocean the natural temperature variability is particularly strong due to ENSO. Positive temperature anomalies over the Northern part of Eurasia can be found during winter. In this region, advection of mild humid air coming from the Atlantic overrides the effect of radiation-induced cooling. This fact was also observed after most historic volcano eruptions (Timmreck, 2011). The previous table summarizes the phenomenons and the mode of action they present, when they start following the eruption and how long they last.

A non-exhaustive list of some significant eruptions known over the last 2,500 years gives a perspective on the historical records of volcanology, but of course extremely large events happen at less frequent periodicities having more of an impact on climate. The Toba, already mentioned in the "Past Climate" section of this document, will be addressed in a separate list.

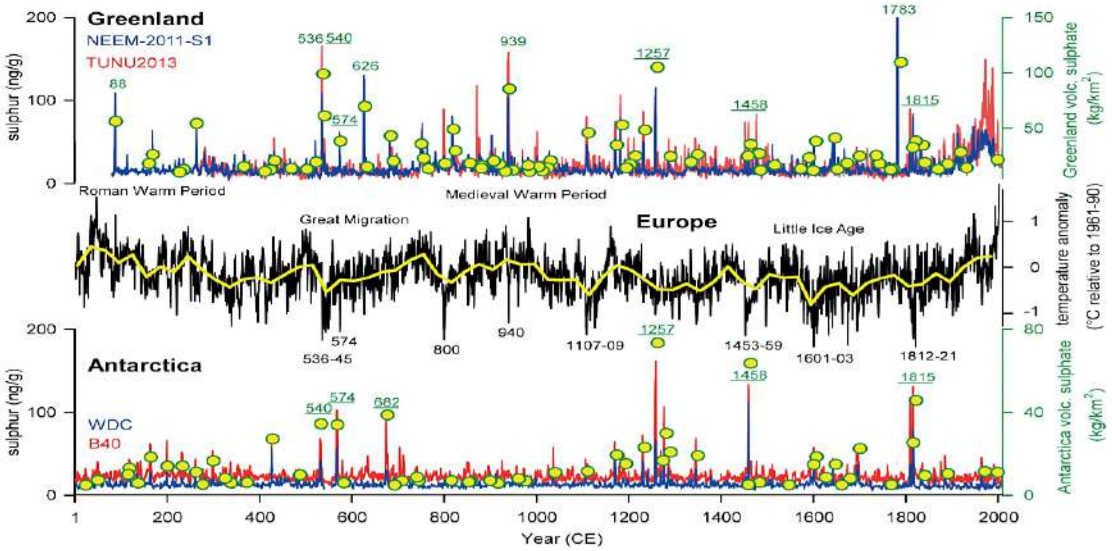

Figure 94. *Ice-core records of sulfur to infer atmospheric deposition (yellow circles) from two ice cores in Greenland and two ice cores in Antarctica. More than 100 individual eruptions are reconstructed based on the timing of sulfate deposition over the ice-sheets. Notice the Temperature anomaly and the Roman Warm Period (RWP) which compares with modern temperatures and and the MWP. After Sigl et al. (2015b).*

Here follows a non-exhaustive list of eruptions[255] known from historical records or from ice-cores or other records that have had a discernible impact on climate:

- 1991 A.D. Pinatubo, Luzon, Philippines (15°08'30"N 120°21'00"E): it belongs to a chain of subduction volcanoes, and originated 1.1 M yrs ago with andesite and dacite products whose eruptive activity was much less explosive than modern Pinatubo which dates back to 33,000 B.C., the last eruption before June 15[th] 1991 was the 1500 A.D. Buag Eruptive Period. This is a typical **VEI-6** event, with ejecta > 11 km^3 of tephra, more than 20 millions tons of SO_2, referred to as Plinian / Ultra-Plinian and described as colossal, with a plume rising to a height > 30 km, frequency > 100 yrs. cloud circled the globe in three weeks (Douglass and Knox, 2005). Over the following months, the aerosols formed a global layer of sulfuric acid haze. Global temperatures dropped by about 0.5 °C in the years 1991–93 and ozone depletion temporarily saw a substantial increase (Douglass and Knox, 2005) ;

- 1982 A.D. El Chichón, Chiapas, Mexico (17°21'36"N 93°13'40"W): The volcano had been dormant for 600 years before this **VEI-5** eruption injecting 7 million tonnes of sulfur dioxide and 20 million tonnes total of particulate material into the atmosphere. As a result of the simultaneous eruption and a fledgling El Niño, the climate felt the impacts of both, making it difficult to separate their effects. A stratospheric warming by blockage of SW radiation was felt during the winter in the NH in 1982 and 1983, with temperatures increasing over North America, Europe, and Siberia but during the same winter, Alaska, Greenland, the Middle East, and China witnessed colder temperatures than normal resulting from a differential impact of volcanic aerosols on the atmospheric wind patterns, including the Arctic Oscillation. The cloud from the eruption circled the globe in

255 https://en.wikipedia.org/wiki/List_of_Quaternary_volcanic_eruptions provides a tentative list of all quaternary eruptions

three weeks. Although El Chichon (17°N) and Mt. Pinatubo (15°N) are separated by only 2° of latitude, their clouds, after only one circuit of the globe, ended up separated by 15° of latitude, indicating that the spread of the cloud strongly depends on the atmospheric circulation of the time and that paleo-reconstructions cannot rely on the latitude;

- 1980 A.D. Mt St Helens, Washington, US (46°11'28"N 122°11'40"W), is a young stratovolcano that formed only within the past 40,000 years. St. Helens started its growth in the Pleistocene 37,600 years ago, during the Ape Canyon stage, with andesite and dacite eruptions of hot pumice and ash. Since, it has undergone various eruptive stages and the modern period started some 2,500 years ago and volcanic products emitted have changed from a characteristic mixture of andesite and dacite (subduction calc-alcaline lavas), to modern lava which is very diverse (ranging from olivine basalt to andesite and dacite, therefore slightly more mafic). The May 18, eruption is a typical **VEI-5** event, ejecta > 1 km^3, referred to as "Plinian" and described as paroxysmal, with a plume rising to a height > 20 km, frequency > 10 yrs;

- 1963 A.D. Agung, Bali, Indonesia (8°20'27"S 115°30'12"E), the **VEI-5** eruption started on March 17, and produced massive pyroclastic flows, though the products were mainly andesites and mafic enough to even be classified as basaltic andesite. Lahars formed due to the heavy rainfall caused by coincidental cyclonic activity. The stratovolcano has been active again since Sept 2017. The dip that the 1963 explosion created in the surface temperature anomalies is very well visible. The Agung eruption decreased the amount of solar energy reaching Earth by about -0.81 W/m^2 (Zanchettin et al., 2013);

- 1912 A.D. Novarupta (Katmai), Alaska, US (58°16'0"N 155°9'24"W), the June 60-hour-long ultra-plinian eruption of **VEI-6** expelled 13 to 15 km^3 of ash. The erupted magma of andesite, dacite and rhyolite (increasing the silica content) resulted in more than 17 km^3 of air fall tuff and approximately 11 km^3 of pyroclastic ash-flow tuff. The eruption ended with the extrusion of a lava dome of rhyolite, the more acidic (i.e. silica rich) form of all the products emitted that plugged the vent;

- 1907 A.D. Ksudach, Kamchatka, Russia (51.80°N 157.53°E), is a stratovolcano atop a subduction zone which erupted on March 28, with a **VEI-5** and ejected 2.4 km^3 of material. A complete review of the Kamchatka volcanic province and of the Holocene key-marker tephra layers can be found in Braitseva et al. (1997) the corresponding tephra layer is $KSht_3$ from Shtyubel cone in Ksudach volcanic massif. Ksudach previously erupted in 240 A.D.;

- 1902 A.D. Santa Maria, Guatemala (14°45'20"N 91°33'06"W), before 1902 the stratovolcano had been dormant for at least 500 years and possibly several thousand years, but its awakening was indicated by a seismic swarm starting in January 1902 and a major earthquake in April 1902. The eruption began on October 24, and the largest explosions ejected 8 km^3 of magma. The eruption was one of the largest of the 20th century, only slightly less in magnitude to that of Mount Pinatubo in 1991 and had fateful regional consequences, all the West zone agricultural harvest was ruined, and famine was due to food shortages; likewise, cattle were dying and there were meat shortages as well. The eruption was **VEI-6**, thus being colossal. The dip created by the 1902 eruption in the surface temperature anomalies is very well visible. The current lava dome complex, which is now named Santiaguito, is still active today with over 1 km^3 of lava erupted so far. The lava dome complex has four main domes: El Caliente, La Mitad, El Monje and El Brujo. The currently active vent is El Caliente. The Santa Maria eruption decreased the amount of solar energy reaching Earth by about -1.06 W/m^2 (Zanchettin et al., 2013) ;

- 1886 A.D. Okataina (Tarawera / Taupo), North Island, New Zealand (38°13'00"S 176°31'00"E), the eruption started on June 10, all settlements around and many Māori villages were buried by the eruption, it is estimated that tephras of up to 2.0 km^3 were ejected. The amount of sulfur gas emitted remains unknown. The eruption, to the difference of that of 1314 A.D. that was made of a series of rhyolitic lava domes, seems to be basaltic (Lowe and Pittari, 2014);

- 1883 A.D. Krakatau (Krakatoa), Indonesia (6°06'07"S 105°25'23"E): The Ultra-Plinian eruption happened on August, 26-27, when over 70% of the island of Krakatoa and its surrounding archipelago were destroyed as it collapsed into a caldera. At least 36,417 deaths are attributed to the eruption and the tsunamis it created. 20 million tons of sulfur were released which led to a global increase in sulfuric acid concentration in high-level cirrus clouds. The resulting increase in cloud reflectivity (or albedo) reflected more incoming light from the sun than usual, and cooled the entire planet until the sulfur fell to the ground as acid precipitation, leading to a five-year drop of temperature of 1.2 °C. Observations after the eruption showed that the aerosol cloud circled the globe in two weeks. The plume is estimated to have reached 80 km. This is a **VEI-6** event (as Pinatubo). The Krakatau eruption decreased the amount of solar energy reaching Earth by about -2.22 W/m^2 (Zanchettin et al., 2013);

- 1875 A.D. Askja, Iceland (65°01′48″N 16°45′00″W), the eruption started on March, 29. Minor precursory activity took place at Askja in early January 1875 included the eruption of a basaltic tephra with composition similar to that of two phreatomagmatic tuff cone sequences in the Askja caldera. The precursory eruptions were followed by an explosive, rhyolitic, phreatoplinian to Plinian eruption on 28–29 March 1875 that generated 0.321 km^3 DRE in three units (Lupi et al., 2010) of rhyolitic tephra and initiated the collapse of the Öskjuvatn caldera. The observation of the various volcanic products and their emission mechanisms led Hartley and Thordarson (2013) to state that "*particular geochemical signatures are not necessarily confined to the tectonic or structural surface expression of single volcanic systems*". It is an estimated **VEI-5** event ;

- 1835 A.D. Cosigüina, Nicaragua (12°59′N 87°34′W) is a stratovolcano and ash from the Jan 20, 1835 eruption has been found in Mexico, Costa Rica, and Jamaica. The minimum estimate of the total bulk volume of eruptive products emitted in 1835 is composed of 0.5 km^3 of pyroclastic-flow deposits, 0.2 $km^{3\ of}$ fine-grained proximal ash-fall deposits, 2 km^3 of scoria-fall deposit, plus an estimate of 1.5 km^3 of distal ash-fall deposit, for a total of roughly 3 km^3. Distal ash could add one to 1.5 km^3 for an overall total of 4.5 to 6 km^3 (Scott et al., 2006; Longpré et al., 2014). The 1902 eruption of Santa María in Guatemala was probably the only eruption in Central America during the past few centuries that produced a greater volume of ejecta—about 7.8 km^3; VEI unknown but most probably a minimum of 5. New petrologic analyses of the Cosigüina deposits by Longpré et al. (2014) reveal that the eruption released enough sulfur to explain a prominent circa A.D. 1835 sulfate anomaly in ice cores from both the Arctic and Antarctic and 2-3 years global cooling of 0.5°C. The authors state "*A compilation of temperature-sensitive tree ring chronologies indicates appreciable cooling of the Earth's surface in response to the eruption, consistent with instrumental temperature records. We conclude that this eruption represents one of the most important sulfur-producing events of the last few centuries and had a sizable climate impact rivaling that of the 1991 eruption of Mount Pinatubo*". A tropical sea surface temperature reconstruction , based on coral, tree ring, and ice core proxies, documents a -0.60°C anomaly for 1837 (the 25th most negative value over the past 400 years), suggesting that post-Cosigüina cooling extended to low latitudes (D'Arrigo et al., 2009). The Cosigüina eruption decreased the amount of solar energy reaching Earth by about -1.84 W/m^2 (Zanchettin et al., 2013) ;

- 1815 A.D. Tambora, Sumbawa, Indonesia (8°15′S 118°0′E), is a stratovolcano lying above an active subduction zone and had been dormant for centuries before activity started on April 5. An estimated 100 km^3 of pyroclastic trachyandesite was ejected, weighing approximately 1.4 10^{14} kg and the plume penetrated the stratosphere up to more than 43 km. The DRE volume for the ash is estimated at 23 ± 3 km^3 and the DRE for the pyroclastic flows is estimated at 18 ± 6 km^3 while the stratospheric SO_2 injection has been estimated by Toohey et al. (2016) to approximately 50 Tg. After the eruption of Tambora in 1815, the year 1816 is known as the year without summer in most parts of the world (Cole-Dai et al., 2009). The meteorological tables of Paris Observatory report 25 days of overcast or very cloudy sky for only 5 days of good weather in June, 10 days of rain, 18 days of overcast or very cloudy sky and 3 days of good weather in July, 6 days of rain, 20 days of overcast or very cloudy sky and 5 days of good weather in August. The NH summer anomalies are > 0.5°C. Poor harvests caused severe shortages in many places of the world. This is a **VEI-7** event, referred to as "Ultra-Plinian", described as super-clossal, fatalities went up to more than 70,000 persons, frequency > 1,000 yrs. The Tambora eruption decreased the amount of solar energy reaching Earth by about -4.06 W/m^2 (Zanchettin et al., 2013) ;

- 1808 A.D. (1809) unknown volcano late November or early December 1808 (4 December 1808 ± 7 days) location still unknown. This eruption has been identified for some time but the originator remains unknown. Guevara-Murua et al. (2014) provides convincing evidence that it was only one source and that the source was tropical given the way the clouds dispersed and the eruption left its imprint in the ice-core records in Arctic and Antarctic. Guevara-Murua et al. (2014) date the eruption on the basis of the reports made by two credible observers: Francisco José de Caldas, who describes a stratospheric aerosol haze that was visible over the city of

Bogotá, Colombia, from 11 December 1808 to at least mid-February 1809; the second, made by physician José Hipólito Unanue in Lima, Peru, describes sunset after-glows (akin to well-documented examples known to be caused by stratospheric volcanic aerosols) from mid-December 1808 to February 1809. This eruption, followed by the 1815 A.D. Tambora will lead to high levels of Aerosol Optical Depth (AOD), not far from the record 536–545 decadal AOD which appears just 1.5 times larger than the combined impact of the unknown eruption of 1809 and Tambora in 1815. The early XIX century is therefore notable for the clustering of this unknown 1808 with the Tambora (1815) eruption, which coupled with a period of low solar activity (the "Dalton minimum"), led to making the 1810s the coldest decade and longest sustained period of below average hemispheric and tropical temperatures in the last 500 years (Cole-Dai, 2010). This is at least a VEI-6, with a stratospheric sulphuric acid loading of 34–68 × 1012 g. According to Guevara-Murua et al. (2014) "*this makes the 1808 unknown eruption one of the most SO_2-rich stratospheric tropical eruptions in the last 500 years: it contributed half the sulphate of the Tambora eruption, two or three times that of the Krakatau eruption (VEI 6, 1883), and more than three times those of the eruptions of El Chichón (VEI 5, 1982) and Mt Pinatubo (VEI 6, 1991)*". Caldas reported unusual cold temperatures leading to increased incidence and severity of frosts, which is consistent with the strong negative tropical sea surface temperature anomalies observed during 1809 from proxy sources (D'Arrigo et al., 2009) and marine and land temperature observations which found a pronounced cooling of −0.84°C in annually averaged data from 20°N–20°S in 1809 (Guevara-Murua et al., 2014) ;

- 1783 A.D. through 1784 A.D., Grímsvötn (Laki or Lakagigar), Iceland (64°03′53″N 18°13′34″W), the Laki[256] lava flood (NH) is an **effusive** eruption, 14.7 km^3 of basaltic lava that came out of 140 vents along a 23-km-long set of fissures and cones. Reports were made by Benjamin Franklin in a 1784 lecture and a clear relationship with events in Iceland and the climate disruption was made. An estimated 120 10^6 tons of SO_2 was emitted which led to a tropospheric "dry fog" (Stothers, 2002). Iceland was of course hit the most with 20–25% of the population that died in the famine and fluoride poisoning after the fissure eruptions ensued and 80% of sheep, 50% of cattle and 50% of horses died because of dental and skeletal fluorosis from the 8 million tons of hydrogen fluoride (HF) that were released. Contamination extended over Europe and 23,000 British people died from the poisoning. The Laki eruption weakened African and Indian monsoon circulations, leading to reduced precipitations over the Sahel of Africa. The low flow in the River Nile and failed crops resulted in a famine that afflicted Egypt in 1784 and cost it roughly one-sixth of its population. The winter of 1783–1784 was very severe in Europe with 8,000 additional deaths in the UK. During the spring thaw, Germany and Central Europe reported severe flood damage. The meteorological impact of Laki continued, contributing significantly to several years of extreme weather in Europe. In France, "*The irregularities of 1784 and 1785 were similar until they became confused. Immoderate cold and snow. The two winters were also characterized by abundant rainfall; a persistent drought, common to both springs, caused the fodder to perish; the two summers were alternately hot and cold, wet and dry. Premature cold weather similarly invaded the two autumns*" (Fuster, 1845), these events contributed significantly to an increase in poverty and famine that may have contributed to the French Revolution in 1789. In North America, the winter of 1784 was the longest and one of the coldest on record, a huge snowstorm hit the South; the Mississippi River froze at New Orleans and there were reports of ice floes in the Gulf of Mexico ;

- 1694-1696 Serua/Banda Api, Indonesia (4°31′30″S 129°52′17″E). The Serua/Banda Api eruption decreased the amount of solar energy reaching Earth by about -2.39 W/m^2 (Zanchettin et al., 2013) ;

- 1674 A.D. Mount Gamkonora is a stratovolcano on Halmahera island, Indonesia (1°22′42″N 127°32′03″E) is a stratovolcano with 12 historic eruption between 1564 and 1987, and bulk rock analyses indicate a basaltic andesite to andesite source beneath Gamkonora (Saing et al., 2020). The Gamkonora (and not Gamokara as referenced by Zanchettin et al. (2013)) eruption in 1673 was a VEI-5 event and decreased the amount on solar energy reaching Earth by about -1.86 W/m^2 ;

- 1641 A.D. Parker, locally known as Mélébingóy, is a stratovolcano located on Mindanao island in the Philippines (6°06′48″N 124°53′30″E). Delfin et al. (1997) report that this andesitic-dacitic stratovolcano had four major eruptions of silicic magmas that can be dated back to -23-27 kyr, -3.8 kyr, -600 yr, -300 yr and all events involved dacitic pyroclastic flows. The last Parker eruption, on January 4, 1641 which corresponds to -300 yr dating, decreased the amount of solar energy reaching Earth by about -2.11 W/m^2 (Zanchettin et al., 2013) ;

256 https://en.wikipedia.org/wiki/Laki

- 1600 A.D. Huaynaputina is a stratovolcano in southern Peru located above the subduction zone of the Nazca tectonic plate (16.608°S 70.85°W) and erupted on February 19, and went through 3 stages: first Plinian stage, second pyroclastic stage, third Vulcanian stage, with a **VEI-6**. The eruption had significant effects on global climate with decreasing temperatures in the Northern Hemisphere, causing floods, famines and cold waves in numerous places, and depositing several million tons of acid. The climate disruption caused social upheaval in many countries such as Russia and may have played a role in the onset of the Little Ice Age. The Huaynaputina eruption decreased the amount on solar energy reaching Earth by about -1.94 W/m^2 (Zanchettin et al., 2013). The summer of 1601 was among the coldest in the northern hemisphere during the last six centuries and this event is very well visible in Briffa et al. (1998), Fig.1 p. 451, which leads to think that the Huaynaputina event has thus been underestimated ;

- 1458 A.D. (Sigl et al., 2015a) or 1452-1453 Kuwae[257] (Gao et al., 2006), Vanuatu, (16°49′45″S 168°32′10″E), around 32–39km³ of magma was erupted, making the Kuwae eruption one of the largest in the last 10,000 years and a **VEI-6** event. The Kuwae eruption has been linked with the second pulse of the Little Ice Age, with the end of MWP which had started two centuries earlier with a series of four unidentified eruptions. In many places, records exists of the nefarious outcome of the event, including In Sweden where grain tithes fell to zero as the crops failed, Mexican codices describe autumn frosts in 1453 that affected agriculture throughout central Mexico, the history of the Ming Dynasty in China report that in the spring of 1453, "*Nonstop snow damaged wheat crops*" and that after that year, as the dust obscured the sunlight, "*Several feet of snow fell in six provinces; tens of thousands of people froze to death*" and early in 1454, "*it snowed for 40 days south of the Yangtze River and countless died of cold and famine*". Lakes and rivers were frozen, and the Yellow Sea was icebound out to 20 km from shore. The event is also recorded by the Western US bristle-cone pines which show frost damage in 1453 and the reduced growth of European and Chinese trees in 1453–57. Again cooler is riskier...

- 1314 (± 12 years) A.D. Okataina (Tarawera / Taupo), North Island, New Zealand (38°13′00″S 176°31′00″E). (Nairn et al., 2004; Hodgson and Nairn, 2005; Lowe and Pittari, 2014) is a high **VEI-5** or perhaps even **VEI-6**, that some surmise to be responsible for the great famine in Europe. The volcanic setting consists of a series of rhyolitic lava domes (i.e. Ruawahia, Tarawera and Wahanga) that were fissured down the middle by an explosive basaltic eruption later in 1886. This Kaharoa eruption lasted 5 years and emitted up to 5 km³ (DRE), therefore a lot more of tephras and ash, and displayed two main high-silica rhyolite compositions; T1 erupted early (as plinian pyroclastics), and T2 erupted late (mostly as lavas). A small volume of rhyodacite pyroclastics, mingled with injected basalt, was also erupted. Nairn, et al. (2004) studied the Kaharoa eruptive types and eruption sequences to reconstruct the magmatic chamber and the T1 series overlying the T2, while a third rhyolite magma (T3) is recognized as the silicic end-member that was modified by basalt to form the rhyodacite eruptives. This eruption, following the VEI-7 1257 A.D. Samalas, in Indonesia was considered by Cantor (2001) p. 74, as the trigger of the great famine in Europe "*Climatic cycling continued to drive social and economic change. Around 1280 the warming trend began to run down. A new weather cycle unevenly but visibly intruded into rural England. Summers became cooler and shorter, the long autumns ideal for bringing the lush crops truncated. Winters became longer and more harsh. The cooler period was to last until the late fifteenth century, when it would be followed by another warm century and then the "little ice age" of the seventeenth century, when people actually skated on the frozen Thames - not something you would want to try today. On the summers of 1316 and 1317 rural disaster struck. The sun did not shine. There were widespread crop failures. There was famine and death from hunger. These terrible years had a special cause. Huge volcanic eruptions in Indonesia threw continent-sized clouds of ashes into the atmosphere and by 1316 this cloud of unbeing had reached England*";

- 1257 A.D. Samalas, Lombok, Indonesia (8°24′36″S 116°24′30″E), the signal in the ice cores is one of the strongest of the last 2,500 years as displayed in Figures 94 and 95 and the amount of sulfur dioxide released by the eruption has been estimated to be 158 ± 12 million tonnes (Vidal et al., 2016). It is reported by Hernández-Almeida et al. (2015) who studied Chrysophyte (freshwater algae) cysts that "*during medieval times (AD 1180 – 1440) winters were generally shorter (warmer)* [in Poland]*, except for a decade with very long and severe winters around AD 1260 – 1270, following the AD 1257 volcanic eruption*". The same authors also observe that "*Striking correspondence between the combined volcanic and solar forcing and the DB4°C reconstruction prior*

257https://en.wikipedia.org/wiki/Kuwae

to the 20th century suggests that winter climate in Poland responds mostly to natural forced variability (volcanic and solar)". The plume went up into the stratosphere at more than 40 km. Decreased tree growth were observed in Mongolia between 1258–1262 based on tree ring data, light tree rings and frost rings (tree rings damaged by frost during the growth season) in Canada and northwestern Siberia from 1258 and 1259, thin tree rings in the Sierra Nevada, California, plus a very wet monsoon in Vietnam and to the contrary droughts in many places in the Northern Hemisphere. This is a **VEI-7** event ;

- 946 A.D. Paektu Mountain in Korea and China (42°00′20″N 128°03′19″E), also known as the Millennium Eruption or Tianchi eruption, was one of the most powerful volcanic eruptions in recorded history and is a **VEI-7** event and the total bulk ejecta of 120 km^3 was derived from bulk volumes of pumice[258] fall of 83 km^3 and ignimbrite of 37.5 km^3. But often a the total bulk volume of 161.6 ± 7.8 km^3 is reported. The ignimbrite-forming eruption may have lasted one and a half to four days (35–104 hours), while the Plinian eruption may have lasted three to nine and a half days (77–230 hours). The total duration of the eruption may have been four and a half to fourteen days. The Millennium eruption was estimated to have emitted an enormous mass of volatiles into the stratosphere, potentially resulting in a major climatic impact ;

- 939-940 A.D. The Eldgjá eruption. Oppenheimer et al. (2018) use "*high temporal resolution glaciochemical records from Greenland to show that the eruption began in spring 939 CE and continued, at least episodically, until at least autumn 940 CE. Contemporary chronicles identify the spread of a remarkable haze in 939 CE, and tree ring-based reconstructions reveal pronounced northern hemisphere summer cooling in 940 CE, consistent with the eruption's high yield of sulphur to the atmosphere*". Beyond the DRE of 19.6 km^3 of lava it is estimated that 70-219 million tons of sulfur dioxide were emitted, this effusive event is recorded as **VEI-4**. In 940 CE, cooling is most pronounced in Central Europe, Scandinavia, the Canadian Rockies, Alaska and Central Asia and reaches -2°C ;

- 683 AD ± 2 years eruption of the Rabaul Volcano. This is a large arc / belt volcano on the tip of the Gazelle Peninsula in East New Britain, Papua New Guinea (4°16′16″S 152°12′11″E). There was a **VEI-6** eruption in 683 that was dated by corrected radio-carbon records.

- 535-542 A.D. is widely recognized in ice-cores as a major event or rather sequence of events as it seems that several eruptions took place in different locations and left successive imprints into the geological records, see Figures 94 and 95. The extreme weather events of 535–536 were the most severe and protracted short-term episodes of cooling in the Northern Hemisphere, crops failed in Ireland, Scandinavia, Mesopotamia, and China and the Irish chronicles record "*a failure of bread from the years 536–539*". Tree ring analysis show little growth in Irish oak in 536 and another sharp drop in 542 and summer temperatures in 536 CE dropped 1.6–2.5°C relative to the previous 30-year average (Sigl et al., 2015a). The 536 eruption is most probably a NH event as explained by Toohey et al. (2016) "*The resulting Greenland-to-Antarctic sulfate flux ratio of more than 10:1 can be safely assumed to be representative of a mid or high latitude NH eruption*" and could have occurred in Iceland according to ice-core data from the Colle Gnifetti drill site in the Swiss Alps (Büntgen et al., 2016; Licciulli et al., 2019). The second eruption around 540 created an extensive atmospheric dust veil, possibly resulting from a large volcanic eruption in the tropics (with a 2:1 Greenland-to-Antarctic sulfate flux ratio), and could be the Krakatau with a major caldera collapse c.a. 535 A.D. or more probably the Ilopango (or both). The global stratospheric SO_2 injections have been estimated by Toohey et al. (2016) to approximately 30 Tg and 50 Tg for the 536 and 540 CE events respectively and their injection heights of up to 24 km (30 hPa). A major eruption of the Ilopango volcano, El Salvador (13.67°N 89.05°W) occurred in the first half of the 6th century and was identified by Dull et al. (2019) as the originator. The eruption size is estimated at a DRE of 43.6 km^3 with 84 km^3 of tephra fall and a **VEI-7** event. The Ilopango's latitude (13.7° N), squarely frame the Tierra Blanca Joven (TBJ) eruption in Mesoamerica as the major climate-forcing eruption of 539 or 540 CE identified in bipolar ice cores and sourced to the tropics, causing regional abandonment of an area covering more than 20,000 km^2 and having a major impact on the Maya of Central America, including estimated 100,000 + fatalities. The effects were widespread, causing unseasonable weather, crop failures, and famines worldwide. These two successive events lead to the Late Antique Little Ice Age (LALIA, 536 to ~660 CE)

258 Pumice is composed of highly microvesicular glass pyroclastic with very thin, translucent bubble walls of extrusive igneous rock. It is commonly but not exclusively of silicic or felsic to intermediate in composition (e.g., rhyolitic, dacitic, andesite, pantellerite, phonolite, trachyte), but basaltic and other compositions are known.

characterized by decadal-scale anomalies of Arctic sea ice and mean temperature anomalies reaching more than −2°C ;

- 240 A.D. Ksudach, Kamchatka, Russia (51.80°N 157.53°E), is a stratovolcano atop a subduction zone which ejected 18-19 km^3 (8 km^3 DRE), including 15 km^3 of tephra fall and 3-4 km^3 of pyroclastic flows in a large Plinian eruption. The estimated height of eruptive column is 22-30 km. A collapse caldera resulting from this eruption was 4 X 6.5 km in size with a cavity volume of 6.5-7 km^3. It is estimated as a **VEI-6** event. The corresponding tephra layer is KS_1, Braitseva et al. (1996) report "*The eruption was initially phreatomagmatic and then became rhythmic, with each pulse evolving from pumice falls to pyroclastic flows*". The major component of KS_1 tephra is volcanic glass and dominates in lapilli and bombs (97%) and in fine ash (93%). In coarse ash the volcanic glass content decreases to 80-85% because of increasing crystal content. Bombs and lapilli near the vent are low-potassium rhyodacites which are quite classical products given the geodynamic context. The GISP2 ice core data suggest that of the five eligible peaks in SO_4^{2-} concentration either the A.D. 264 or the A.D. 267 peak was caused by the KS_1 eruption as they are closer to average age A.D. 236. See also Grishin et al. (1996) ;

- ~232 AD ± 15 (Tarawera / Taupo), North Island, New Zealand (38°49'S 175°55'E), date of the eruption according to Sparks et al. (2016). The Hatepe eruption, named for the Hatepe Plinian pumice tephra layer, was Taupo Volcano's most recent major eruption. It is considered New Zealand's largest eruption during the last 20,000 years. The eruption ejected some 120 km^3 of material, and the tephra or pumice fall from the eruption was far greater than previously thought, approximately 150km^3. The eruption went through several stages, with six distinct marker horizons identified. Despite the uniform composition of the erupted magma (i.e. The Waimihia and Hatepe plinian deposits consist predominantly of rhyolitic pumice with a low density and a low phenocryst content), a wide variety of eruptive styles were displayed, including weak phreatomagmatism, Plinian eruptions, and a huge pyroclastic flow (Walker, 1981). Rhyolitic lava domes were extruded some years or decades later. It is a **VEI-7** event;

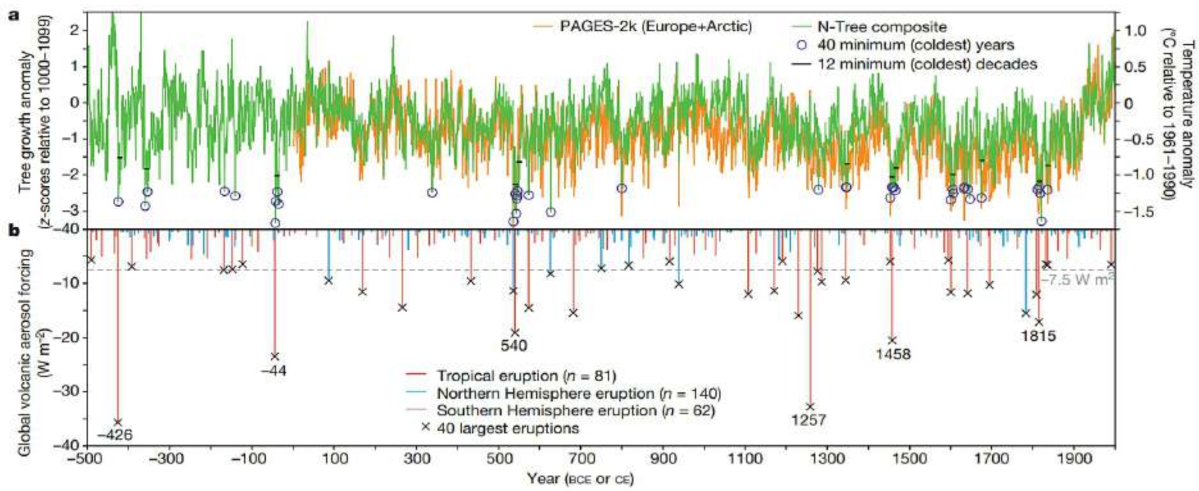

Figure 95. Global volcanic aerosol forcing and Northern Hemisphere temperature variations for the past 2,500 years. a) Tree-growth anomalies and reconstructed summer temperature anomalies for Europe and the Arctic with the 40 coldest single years and the 12 coldest decades. b) Reconstructed global volcanic aerosol impact from bipolar (NH/SH) sulfate composite records from tropical (bipolar), Northern Hemisphere, and Southern Hemisphere eruptions. The 40 largest volcanic signals are indicated, with ages for events stronger than the Tambora 1815 eruption. After Sigl et al. (2015b).

- 79 A.D. Mount Vesuvius in Italy, Campania, Italy (40°49'N 14°26'E), this is of course the same volcanic field as the Phlegraean Fields which ~-39,300 B.CE. led to a much bigger VEI-7 event (see hereafter). The 79 A.D. is probably one of the most famous if not the most famous eruption in mankind history for the simple reason that it happened in the middle of the civilized world of the time. The main harbor of the Roman Empire was exactly in Naples and casualties of 20,000 given the population 2,000 years ago was a massive toll by any account, wiping out the map four cities: Pompei, Herculaneum, Oplonti and Stabiae (Giacomelli et al., 2003). Recent evidences point to the 24th Oct as the date of the disaster (BBC, 2018), a **VEI-5** event. The Plinian eruption was phreatomagmatic and resulted of the contact of seawater seeping into the deep-seated faults of the region with hot magma and led to an explosion which resulted in a column of volcanic debris and hot gases ejected between 15 km and 30 km high into the stratosphere, and produced a fall of pumice and ashes. But the real brunt came with the Pelean eruption phase, where two pyroclastic surges at least, of molten rock and hot gases, flowed over the ground, burning and asphyxiating any living beings who had remained behind. Today more than 3 million people live around the same active volcanic field (Petrone, 2019). Impact on climate is rather unknown;

A short list of massive eruptions before our era, i.e. B.C., with significant climate and ecological impacts follows:

- -44 B.CE. Etna eruption (Forsyth, 1988), Sicily, Italy, (37°45.3'N 14°59.7'E), Plutarch (Life of Julius Caesar 69.3-4) provides a good account of the sun appearance following the eruption who speaks of the rays of the sun being veiled, leaving the face of the sun pale and without radiance and thus furnishing so little heat that fruits never fully ripened, but shriveled instead (Forsyth, 1988). Other ancient sources confirm the 44 B.C. date of this event, as do all modern dating methods such as sulfate concentrations and acidity levels in ice cores from Greenland and frost damage to the growth rings of very long-lived trees. This potentially a **VEI-6** volcano ;

- -426 B.CE. This tropical eruption which gives a major signal for Sigl et al. (2015b) and well visible on their Figure 95, is unknown so far and no candidate originator could even be found ;

- ~-1627-1600 B.CE. Kolumbo, Agean Sea (36°31'00"N 25°29'30"E). The Minoan eruption was a major catastrophic volcanic eruption that devastated the Aegean island of Thera (now called Santorini) with a Dense-Rock Equivalent (DRE) in excess of 60 km^3 and the volume of ejecta was recently revised upwards at > 100 km^3. The eruption is characterized by a **VEI-7** and ejecta were up to four times as much as the well-recorded eruption by Krakatoa in 1883. The eruption also generated 35 to 150 m high tsunamis that devastated the northern coastline of Crete, 110 km away. Around the time of the radiocarbon-indicated date of the eruption, there is evidence for a significant climatic event in the Northern Hemisphere, including failure of crops in China and evidence from tree rings, including bristlecone pines of California, bog oaks of Ireland, England, and Germany; and other trees in Sweden. The tree rings date the event to 1628 (±65 years) BCE. A volcanic winter from an eruption in the late 17th century BCE has been claimed to correlate with the collapse of the semi-legendary Xia dynasty in China and the rise of the Shang dynasty. This was approximately dated to 1618 BCE and were accompanied by "*yellow fog, a dim sun, then three suns, frost in July, famine, and the withering of all five cereals*" ;

- -2030 ±125 B.CE. (3980 B.P.) Deception Island, Antarctica, (62°58'37"S 60°39'00"W). Antoniades et al. (2018) have firmly established this **VEI-6** explosion, where a volume of 30–60 km^3 of volcanic products erupted, as the largest eruption documented in Antarctica during the Holocene.

- ~-39,300 B.CE. Phlegraean Fields, Naples, Italy, (40.827°N 14.139°E). The campanian ignimbrite (CI) erupted from the modern Campi Flegrei, in southern Italy, near the current city of Naples. This was simply the largest volcanic eruption on the Northern hemisphere in the past 130,000 years, namely the eruption of a super volcano. The ashes of this eruption (**VEI-7**), during which about 350 km^3 of rock and lava were ejected reached Russia. This is referred to as an ultra-plinian eruption described as super-colossal with a plume rising to a height > 40 km, frequency > 1,000 yrs;

- ~-74,000 B.CE. Toba, Sumatra, Indonesia (2.6845°N 98.8756°E). The Toba super-eruption[259] is admittedly a much larger event than the CI in terms of Dense Rock Equivalent (DRE) with a factor of 20 difference (Ambrose, 1998; Rampino and Ambrose, 2000). Mount Toba, is an ancient volcano located in the Barisan Mountains, north-central Sumatra, Indonesia. A massive eruption of an estimated **VEI-8**, expelled an estimated 2,800 km^3 of ash and lava (DRE) and Rampino and Ambrose (2000) consider that "*several lines of evidence suggest that Toba produced an estimated* 10^{15}*–*10^{16} *g of stratospheric dust and* H_2SO_4 *aerosols*". That event is considered by many volcanologists to be the largest volcanic eruption in all of human history (Detay, 2017), and it sent the planet into a volcanic winter lasting six to ten years (i.e. residence time of the dust and aerosols) and a severe cooling for up to one thousand years that nearly caused the extinction of modern humans. Ice-core evidence suggests that average air temperatures worldwide plunged by 3–5°C (5.4–9.0°F) for years after the eruption. The Toba eruption coincided with a 200-yr period of sharp cooling that initiated a ca.

259A tentative list of the largest eruptions (explosive or effusive) and of Large Igneous Provinces (LIP) is available here: https://en.wikipedia.org/wiki/List_of_largest_volcanic_eruptions

1,000-yr stadial event and is evidenced by ice-core analysis from Greenland. Some model simulations estimate that this temperature decline may have been as much as 10°C (18°F) in the Northern Hemisphere in the first year after the event. This is a super-eruption described as mega-colossal, with a plume rising to a height > 50 km, frequency > 10,000 yrs.

There is no doubt the large eruptions (e.g. VEI>=7) can even affect the climate on century to millennial timescales (Stothers, 1988; Rampino and Self, 1992, 1993ab; Zielinski et al., 1996b; Rampino and Ambrose, 2000; Huang et al., 2001). The work performed to achieve a stratigraphical dating of the most recent 31 kyr of the WAISD ice core, with a continuously counting of annual layers (identified in records of electrical conductivity, multi-parameter aerosols, and trace elements (Sigl et al., 2016) was a major advance for Antarctic ice cores, enabling synchronization of ice cores from Greenland and Antarctica and led to clarify the influence of volcanic eruptions on climate, societal disruptions, famines, and pandemics during the last 2500 years (Sigl et al., 2014, 2015) and **demonstrated that cooling from volcanic sulfate aerosols is the primary driver of short-term climate variability** (Sigl et al., 2013, 2014, 2015) and a direct relationship exists between the stratospheric Aerosol Optical Depth (AOD) and satellite-based estimates (MSU[260] / NOAA) of both lower troposphere temperature and short-wave fluxes at the top of the atmosphere (Santer et al., 2014).

Episodes of anomalously cold summers are attributed to some combination of reductions in solar irradiance, (e.g. the LIA Maunder sunspot minimum), explosive volcanism with high plumes and sulfur gases injected high and in great quantities into the stratosphere, and changes in the internal modes of variability in the ocean–atmosphere system, e.g. NAO (Wanner et al., 2011; Miller, et al., 2012). The growth of sea ice in response to these triggers is the main factor that characterizes Arctic climate sensitivity (Serreze and Francis, 2006). Exceptional VEI-7 or VEI-8 events or smaller but repeated VEI-6 to VEI-5 explosive volcanism can lead to a persistent expansion of sea ice (e.g. during the LIA). Sea ice does not form easily around Iceland and only appears when there is a large export of sea ice from the Arctic Ocean. In fact, sea ice was rarely present on the North Iceland shelf from 800 A.D., until the late 13th century, the period during which the Norse settled and thrived in Greenland, period ending when an abrupt rise in sea-ice suggests a rapid increase in Arctic Ocean sea ice export (Miles et al., 2020), followed by another increase ~1450 AD, after which sea ice was continuously present until the 20th century and the advent of the modern warming (Massé et al., 2008). Throughout the Holocene, Earth's orbital configuration resulted in lower summer insolation across the NH since the inversion of the obliquity cycle some 9 kyr ago (Figure 35) and acted as a climate trigger that led to the initiation of the neo-glacial which started at the end of the "Atlantic" period some -5,000 yr ago (Figure 34), allowing Arctic Ocean sea ice to expand during "B2" and "B1" vertical gray band stages. Repeated explosive volcanism can lead in these conditions to an increased sea ice export thanks to a self-sustaining sea-ice / ocean retro-action mode in the North Atlantic region that can foster suppressed summer air temperatures for centuries after volcanic aerosols were removed from the atmosphere. Wanner et al. (2011) generalize what was said for the entire Holocene stating "*spatiotemporal variability of temperature and humidity / precipitation during the six specific cold events (8200, 6300, 4700, 2700, 1550 and 550 years BP) was very high. Different dynamical processes such as meltwater flux into the North Atlantic, low solar activity, explosive volcanic eruptions, and fluctuations of the thermohaline circulation likely played a major role. In addition, internal dynamics in the North Atlantic and Pacific area (including their complex interaction) were likely involved*". Many authors concur to recognize the major impact of explosive volcanism on the climate coupled to other relevant phenomenons already described, e.g. Schurer et al. (2013) stating "*it can be shown that explosive volcanism and changes in solar output combined are the dominant drivers of forced variability over the second half of the last millennium*", especially as the sulfur budget is revised upwards "*The long-term annual mean volcanic stratospheric sulfur injection (VSSI) from major volcanic eruptions is estimated to be ~0.5 Tg[261][S] yr^{-1}, ~50% greater than a prior reconstruction due to the identification of more events and an increase in the magnitude of many intermediate events*" (Toohey and Sigl, 2017)

Both the location and season of an eruption will affect the climatic impacts. Extra-tropical and tropical source lead to very different outcomes because the latitude determines the geographic distribution of both atmospheric response and climatic effects. If a strong eruption (VEI 5 or greater) is located within the tropics, the stratospheric aerosol layer rapidly spreads zonally (> 20 m s^{-1}) around the equator. Aerosol transport toward the poles follows with preference towards the winter hemisphere, as a strengthened meridional temperature gradient leads to increased planetary wave propagation into the stratosphere (Holton et al., 1995). Sulphate aerosols from tropical volcanic eruptions form a stratospheric layer across the entire globe with an e-folding residence time of 1-2 year[262] (Robock, 2000). In contrast,

260 Microwave Sounding Units (MSU).

261 1 Tg = 10^{12} grammes.

262 Therefore there remains $1/e \approx 0.37$, i.e. 37% after a year and $1/e^2 \approx 0.14$, i.e. 14% after 2 years, etc.

strong high-latitude volcanic eruptions produce stratospheric aerosols that seldom reach the tropics, due to rapid removal through both strong subsidence in the polar vortex and mid-latitude tropospheric folding (Hamill et al., 1997). Hence, the effects of high-latitude stratospheric eruptions are mainly restricted to the extra-tropics, and to the hemisphere in which the eruption occurred which is the good reason these different types of eruptions are separated in Figure 95. The season is critical because it controls the hemispheric distribution of radiative impacts, atmospheric responses and therefore climatic perturbations (Robock, 2000). Associated temperature anomalies are predominantly determined by the amount of shortwave radiation that arrives at the Earth's surface (or which is prevented from doing so by the sulfuric aerosol) and, therefore, impacts are more noticeable between the tropics and the summer hemisphere (Guevara-Murua et al., 2014). The tropical ocean–atmosphere system is extremely responsive to changes in radiative forcing caused by stratospheric aerosols (D'Arrigo et al., 2009).

It can be summarized that the effect of volcanic eruptions on global climate is due to the absorption and scattering of radiation by sulfate aerosols produced by the vast amounts of sulfur species (especially SO_2) injected into the stratosphere during catastrophic volcanic eruptions. While they can sometimes have a high latitude surface warming effect in the NH winter by warming the stratosphere and disrupting its circulation through enhanced zonal wind (Robock and Mao, 1992), they have a stronger surface cooling effect in the lower latitudes and tropics during spring and summer, that can last for a few years due to the scattering effect of the sulfuric aerosol in the stratosphere and subsequent blocking of incoming sunlight (Robock, 2000). Robock and Mao (1992) state "*An examination of the Northern Hemisphere winter surface temperature patterns after the 12 largest volcanic eruptions from 1883–1992 shows warming over Eurasia and North America and cooling over the Middle East which are significant at the 95% level. An enhanced zonal wind driven by heating of the tropical stratosphere by the volcanic aerosols is responsible for the regions of warming, while the cooling is caused by blocking of incoming sunlight*". Javier (2018a) adds "*Surface cooling is because the sulfate aerosols are more efficient at scattering incoming solar radiation than absorbing Earth's surface radiation. The aerosols participate in the destruction of ozone through their interaction with anthropogenic chlorine, and in the reduction of atmospheric water vapor (Soden et al., 2002). There is also speculation that volcanic eruptions might trigger or imitate El Niño conditions through their effect on trade winds, partially ameliorating the cooling effect*".

Whenever no significant volcanic activity takes place in particular in the tropics, McLean et al. (2009) have demonstrated that ENSO (Southern Oscillation) has a dominant and consistent influence on mean global temperature and that shifts in temperature correspond to shifts in the ENSO regime that occurred about 7 months earlier. They also observe that "*The relationship weakens or breaks down at times of volcanic eruption in the tropics*" which again emphasizes the importance of volcanism in the global steady-state climate regime and they also note that "*Since the mid-1990s, little volcanic activity has been observed in the tropics and global average temperatures have risen and fallen in close accord with the SOI of 7 months earlier*". GCM of any sort cannot pretend to model meaningfully existing climate (not past or future) without succeeding to account for and to forecast ENSO regime, keeping in mind that volcanism will be a much bigger deal as it remains chaotic and nondeterministic by nature.

As no significant eruption happened since the Pinatubo (VEI=6), kind of more than 30 years ago, and no major one since the Tambora (VEI-7) nearly 200 years ago, it appears that a cleaner atmosphere with much below normal aerosol levels - 25% less VSSI[263] than the reference period 500 BCE to 1900 CE as per Toohey and Sigl (2017) - allows more solar radiation to reach the earth's surface. This, together with the warm multi-decadal modes in both Atlantic and Pacific and a very active Sun over the last decades are driving the current continued modern warming. The impact of volcanoes and volcanic emissions on the climate should certainly not be assessed on the basis of the yearly average emissions of CO_2. This would simply be a severe misunderstanding of the chaotic occurrence and catastrophic nature of these events and of their mechanisms of action mainly through stratospheric scattering of incident solar light by sulfate aerosols.

The European history provides well kept archives of how the climate was shaped over 2,000 years by a combination of large volcanic eruptions and solar activity combined to produce effects on the NH sea-ice extent and entailed corresponding changes in the oceanic and atmospheric circulations and oscillations. CO_2 played no role whatsoever in this suite of climate changes[264], most of them being of a very adverse nature which lead to the rise and fall of civilizations, no less. Extreme hardships have been endured by the populations when a long-lasting cooling following a cluster of large volcanic eruptions in 536-540 CE was reinforced by ocean cooling, thermohaline circulation weakening and NH sea-ice extension, superimposed on a solar minimum. This lead to the Late Antique Little Ice Age (LALIA, 536 to

263 Volcanic Stratospheric Sulfur Injection.

264 It was funny to read recent studies that express surprise at the small decrease of CO_2 during the LIA. Of course, [CO_2] slightly decreased because as per Henry's law the oceans were colder and their uptake was stronger. What a surprise! Isn't it?

~660 CE) and contributed to the outbreak of the the Plague of Justinian (541–549 AD) through the import of grain in Constantinople (carried to the city by infected rats on grain ships arriving from Egypt), the weakening of the eastern Roman Empire and collapse of the Sasanian Empire (pre-islamic Persia), movements out of the Asian steppe and Arabian Peninsula, spread of Slavic-speaking people, and upheavals in China (Büntgen et al., 2016). The 1314 A.D. Okataina eruption in New Zealand that followed the VEI-7 1257 A.D. Samalas in Indonesia was the straw that broke the camel back. Around 1280 the warming trend had already begun to run down but the 1314 eruption was the trigger of the 1316 and 1317 rural disaster and the trigger of the great famine in Europe. The LIA was again a long period of hardship and the 1783 A.D. through 1784 A.D.extremely large Grímsvötn (Laki) effusive eruption (Iceland) was again the straw that broke the camel's back for some impoverished European societies and the extremely unsettled weather that prevailed during the years 1884-1785, with failed crops and fodder which perished, lead to social upheavals that favored the French revolution.

Even more abrupt changes such as the Younger Dryas have been recently tentatively attributed to volcanism, and Sun et al. (2020), by studying Highly Siderophile Element (HSE) and ratios of stable isotopes of osmium $^{187}Os/^{188}Os$ in a well-dated sediment section at Hall's Cave, TX, USA, have concluded that "*The HSE abundances indicate that these layers contain volcanic gas aerosols and not extraterrestrial materials*" and therefore could be related to a volcanic origin. The Younger Dryas (YD) event occurred from 12.9 kyr to 11.7 kyr ago with an abrupt cooling over a time interval of decades with temperatures possibly abruptly falling 15°C colder than present. The mega-eruption (VEI-6) of the Laacher See caldera volcano in Germany (50°25′N 7°16′E) ejected 6.3 km^3 of DRE of a sulfur-rich low-silica phonolite magma (a fine-grained equivalent of a nepheline syenite volcanic rock that results of partial melting, are silica-under-saturated, and have feldspathoids in their normative mineralogy). The eruption produced 16 km^3 of tephra with a plume reaching far into the stratosphere at a height of 35 km at the time of the onset of the YD event. Laacher See released potentially up to 150 Mt of S and is considered as having possibly triggered the sudden lowering of temperature coincident with YD.

Certainly more frightening than less than a hundred ppm or so of CO_2 is what is reported by Hensch et al. (2019) "*The observed deep low-frequency (DLF) earthquake activity and continuous volcanic gas emissions around the Laacher See Volcano (LSV) indicate an active magmatic system, possibly connected with an upper mantle melt zone*". This is straight in the middle of Europe, the magmatic chamber is active and recharging from the upper mantle melt zone and during the last eruption 12,900 years ago (yesterday, even in mankind history) the pyroclastic fallout has been identified in an area of more than 300,000 km^2, stretching from central France to northern Italy, and from southern Sweden to Poland. Are you still frightened by 70 ppm or so of CO_2, I'm not indeed. But I quite dislike the geodynamical context of the East Eifel volcanic field (Vulkan Eifel), see Figure 96, which covers more than 2000 km² of nice green landscapes and pasture, in fact thick pumice and basalt layers and 70 maars with more than 20 volcanoes[265], each of them with the potential to become a new Laacher See... as they appear just dormant (Lorenz and Zimanowski, 2008). After the last explosion, the Federmesser culture (the name is derived from the small backed flint blades, in German termed Federmesser "quill knife") which subsisted by foraging and hunting, using both spears and bows and arrows did not survive and was succeeded by the less advanced Ahrensburg culture after 12,800 B.P.

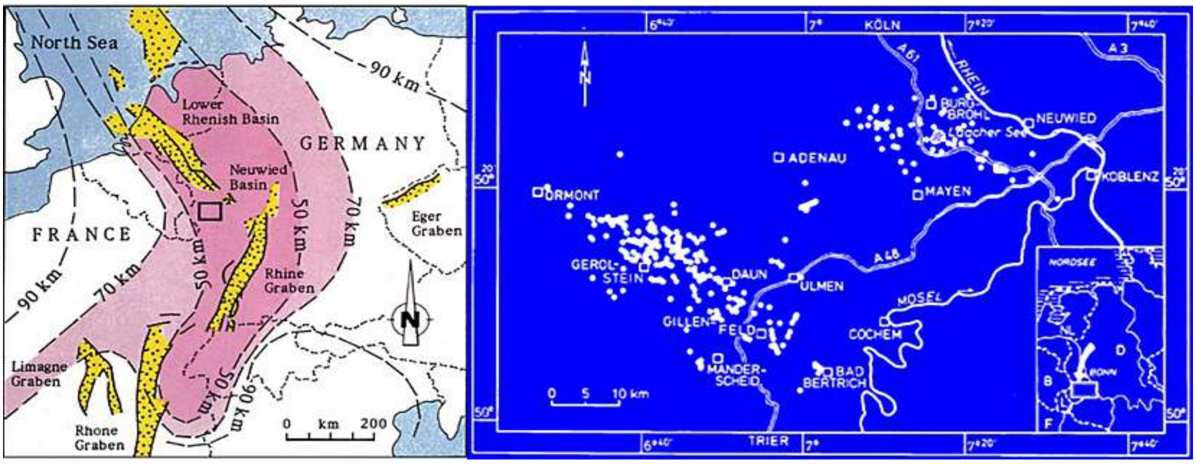

Figure 96. a) left: The West European Rift Zone with its Tertiary grabens and the thickness of the lithosphere. Square: West Eifel volcanoe field. b) right: The West and East Eifel volcanic field. The NW-SE trends of both field and the tectonic structures

265 https://en.wikipedia.org/wiki/Volcanic_Eifel

underlying the Middle Rhine River follow the maximum compressive component of the present day stress field. Laacher See is just left (West) of Neuwied, upper-right corner. After Lorenz and Zimanowski (2008).

The Laacher See catastrophic eruption took place just before the last eruption happened in the French Volcanic province of “Massif Central” where Miallier et al. (2010) report that the ultimate Pelean eruption of Puy de Dôme volcano, Chaine des Puys, French Massif Central (45°46’19”N 02°57’45”E) happened about 10,700 years ago after a significant resting period which enabled vegetation to re-establish itself on its slopes; the entire volcanic province, as for the Eifel field, is is far from the edge of any tectonic plate and represents sort of geodynamic enigma, a type of aborted intra-plate rifting. If the tertiary and quaternary volcanic episodes in France leave behind two very large stratovolcanoes (i.e. Cantal and Mont Dore) which can be considered extinct, the latest manifestations at “puy de la Vache” and “puy de Lassolasalso” are just 8,600 years old (Miallier et al., 2012) and as per the USGS criterion must be considered dormant.

These two strombolian monogenetic basaltic volcanoes are surrounded by more than 80 dormant volcanoes which surged in the middle of an old tectonic plate in a intriguing geodynamic context. The system Montchal-Pavin would have erupted trachy-basalts 3,500-2,000 years ago and the meromictic lake Pavin[266] (45°29’45”N, 2°53’18”E) which formed by phreatomagmatism 6,900 years ago in a very violent explosion (Leyrit et al., 2016), would according to Thierry del Rosso and Pierre Lavina be active as gas would still be emitted. This was confirmed by François Le Guern [267] (deceased in 2011) who visited Pavin in 2009 and concluded that the site is active. The “scientific community” disagrees but archives are there “*… sur icelle montaigne y a un grand gouffre duquel il sort ordinairement une grande fouldre de gresle et de tonnerre, qui gatste les bledz des vallées*[268]” wrote Abel Jouan, chronicler of King Charles IX, during his visit to Auvergne in 1566. This reminds of Lake Nyos[269] and the massive 1986 degassing of CO_2 that killed 1746 people and 3,500 livestock during a limnic eruption (Freeth et al., 1990; Le Guern et al., 1992; Freeth, 1994; Kusakabe et al., 2008; Kusakabe, 2015, 2017). Would del Rosso, Lavina and Le Guern be correct (contrary to the consensus!), magmatic CO_2 is continuously discharged from depth, and is trapped and accumulated in deep waters of the lake meaning that the French volcanic province would somehow still be active. This was in fact confirmed by Aeschbach-Hertig et al. (1999) who proposed that a flux of magmatic gases into the monimolimnion (i.e. the deep water lying below the chemocline under 60-70m), and a weak diffusive coupling between the monimolimnion and the overlying mixolimnion leads to a long deep-water residence time (~70 yr) and after reassessing the carbon budget of the lake concluded that the major part of the accumulated CO_2 in the monimolimnion is of magmatic origin. Aeschbach-Hertig et al. (1999) state “*The flux of magmatic CO_2 is estimated as (1.2 ±0.4) 10^{-7} mol m^{-2} s^{-1}, which is also comparatively low. The monimolimnion appears to be in steady state with respect to these fluxes, therefore no further, potentially hazardous, accumulation of CO_2 takes place*”. The study of these authors is based on the $^3He/^4He$ isotope ratio which presents a very distinctive isotopic signature for the various geochemical reservoirs Helium may come from. In the lake Pavin case, it clearly indicates a flux of mantle-derived magmatic gases into the monimolimnion and therefore, it seems that Thierry del Rosso and Pierre Lavina are correct and that Abel Jouan, chronicler of King Charles IX, was an attentive observer well versed in his duties. To be more precise, in the atmosphere, the ratio $^3He/^4He$ is $1.384 \cdot 10^{-6}$ which is defined as R_a, and the He isotopic signatures of volcanic lakes is found to range from 5.4 R_a in Laacher See to 7.5 R_a in lake Nemrut, i.e. a caldera in eastern Turkey (38°38’16”N 42°14’19”E). Aeschbach-Hertig et al. (1999) report for the lake Pavin a value of “*6.57 ±0.01 R_a*” which is a typical value for a magmatic origin.

Thus, meromictic lakes in disequilibrium would be one of the rare occasions when CO_2 would appear dangerous when released in such massive quantities that it suffocates people.

To sum things up, the CO_2 hysteria results of a total lack of historical perspective on climate and severe misunderstanding of the climate risks and more generally of other natural risks. Whatever the results of the computations made in the Section “Atmospheric Sensitivity to CO_2” starting p. 54, following Moranne (2020) or Veyres (2020) or even IPCC (2013) the additional effect on the global temperature is not only very small (< 0.4°C) but would not be able to thwart the adverse effects of major volcanic eruptions, or of a decrease of solar activity or worse of such events happening synchronously. We should rejoice ourselves everyday of having had a mild climate for most of these

266 The name comes from the Latin pavens (an adjectival participle of paveo meaning "to be struck with horror") and if it behaves like Lake Nyos and Monoun the name is well chosen.

267 https://www.researchgate.net/scientific-contributions/77294762-F-Le-Guern

268 Written in old French, means “on this mountain there is a great abyss from which usually comes out a great lightning of hail and thunder, which devastates the wheat of the valleys.”

269 Nyos in Cameroon is one of only three known exploding lakes to be saturated with carbon dioxide in this way, the others being Lake Monoun, also in Cameroon, and Lake Kivu in the Democratic Republic of Congo and Rwanda.

last 2 centuries without sustained volcanic activity and a distant last VEI-7 event occurring more than 200 years ago, i.e. 1815 A.D. Tambora, and we should appreciate the marginal benefits that the small increase of anthropogenic CO_2 may have contributed to this modern optimum. Since the end of the LIA, mankind has been spoiled by Nature and the mild climate conditions, unable to see the chance we have had and have.

Not speaking of those living close or above dormant volcanoes, waiting for their magma chambers to be refilled...

The impact of volcanoes on the climate has been briefly addressed in this section so far and one can sense that a strong connection does exist by means of rather complex mechanisms happening through the injection of aerosols in the stratosphere which can be further reinforced by effects producing significant disturbances on the atmospheric and oceanic circulations (Driscoll et al., 2012), e.g. leading to changes to the NH sea-ice extent or triggering oscillation responses like a “la Niña-event” in the third SH summer post-eruption (Maher et al., 2015). These mechanisms operate on durations of years or decades and mankind has been regularly affected by the catastrophic regional outcome and global reach of major eruptions (VEI-7 or more) or by a series of smaller but significant (VEI-5 or more) events strengthening their cumulative effects. Exceptional VEI-8 events, are fortunately rare but have an impact lasting for centuries or millenniums and can stage a glacial era if they are coincidental with other parameters, e.g. such as an orbitally-driven reduction of northern hemisphere summer insolation.

Super-volcanoes like the Yellowstone (Huang et al., 2015) or Large Igneous Provinces (LIP) as coined by Coffin and Eldholm (1994) represent phenomenons of a different order of magnitude than what has been presented up to now (even VEI-8) (Bryan and Ferrari, 2013), and it is hard to fathom what their implications could entail. LIP are characterized by sustained pulses of magmatic emissions forming “trapps” of up to 20,000 km^3 over only a few years and these can last several million years. Mankind has obviously no means of even mitigating the consequences of such massive eruptions. They are only superseded in their dire perspectives by the impact of a NEO of substantial size, 10 km being more than enough. For instance the originator of the Chicxulub[270] liberated sort of 4.67 10^{23} J which dwarfs in comparison the eruption of La Garita (Fish Canyon Tuff) of 5000 km^3 (28 million years ago) by being ~465 times more powerful! (Detay, 2017). Durand-Manterola and Cordero (2014) even estimated “*that the kinetic energy of the impactor is in the range from 1.3x10^{24} J to 5.8x10^{25} J. The mass is in the range of 1.0x10^{15} kg to 4.6x10^{17} kg. Finally, the diameter of the object is in the range of 10.6 km to 80.9 km*” and concluded that the impactor was most probably a comet.

We live in a dangerous environment, even though the long history of the solar system has cleaned up much of the hazards over time, billions of years helping, but decidedly CO_2 appears as a joke for those who want to play scare each other with not a lot of stuff...

Climate urgency, climate crisis, climate breakdown,... climate hogwash!

The title of this section promised to study the impact of tectonics, tectonophysics and Earth dynamics on climate change as these are very significant, but they are only on geological timescales, and thus help understanding the climates of the past. Therefore their study will be kept for an extended version of this document and in the meantime it is suggested that the reader refer to the works of, e.g. Hay (1996), Ramstein et al. (1997), Ruddiman (2001) Chapter 4, Fluteau (2003), or Zhang et al. (2006) among others, as it is time to move on to the next subject, the computer models that pretend to forecast the climate of the future...

270https://en.wikipedia.org/wiki/Chicxulub_crater

3. Deceitful and Questionable Computer Models

"*In brief, we have the new paradigm where simulation and programs have replaced theory and observation, where government largely determines the nature of scientific activity, and where the primary role of professional societies is the lobbying of the government for special advantage*." Richard Lindzen

«*The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future climate states is not possible*», IPCC – 2001 – TAR-14 – «Advancing Our Understanding», p. 771

«*When I was in high-school in England in the 1930s, we learned that continents had been drifting according to the evidence collected by Wegener. It was a great mystery to understand how this happened, but not much doubt that it happened. So it came as a surprise to me later to learn that there had been a consensus against Wegener. If there was a consensus, it was among a small group of experts rather than among the broader public. I think that the situation today with global warming is similar. Among my friends, I do not find much of a consensus. Most of us are skeptical and do not pretend to be experts.* ***My impression is that the experts are deluded because they have been studying the details of climate models for 30 years and they come to believe the models are real. After 30 years they lose the ability to think outside the models****. And it is normal for experts in a narrow area to think alike and develop a settled dogma. The dogma is sometimes right and sometimes wrong. In astronomy this happens all the time, and it is great fun to see new observations that prove the old dogmas wrong*» Freeman Dyson

3.1. What Can be Expected?

I'd like to start this Chapter by my experience of computer models. I have always been fascinated by computer models and software systems. By the time I was a research-student at Ecole des Mines de Paris in 1980-1982 the best computers we had at the «Centre de Télédétection et d'Analyse des Milieux Naturels», i.e. the Remote Sensing Laboratory, lead at the time by J.-M. Monget, were HP-1000[271] with 35kbytes of RAM and 2,5Mbytes of removable disks! Some talented people like Albuisson, Cano, Wald[272] and a few others had managed to write drivers for specialized peripherals and dedicated software that already enabled more than 35 years ago to devise new methods, for example for the determination of the global solar radiation from meteorological satellite data (Cano et al., 1986). Under the supervision of Pierre Leymarie, who since the early 70s had sensed the revolution that computers would lead to in the areas of geological, geochemical and geophysical data processing (Leymarie, 1969, 1970, 1983; Leymarie et al., 1975, 1980, 1981; Leymarie and Frossard, 1983), I was involved into writing FORTRAN code to perform statistical processing of geochemical data by means of factor analysis, principal component analysis, etc (Poyet, 1985), which led to my D.Sc work (Poyet, 1986), (Poyet, 1992). Later, at INRIA a research group led by Pierre Haren was involved into developing multi-expert systems, with applications in engineering and special emphasis on port engineering. I first started to create in Le_LISP the interface of the expert-system generator, i.e. the shell, then was in charge of developing for the French Navy a tactical warfare system with special emphasis on strategic nuclear submarines (Poyet and Haren, 1988) and developed an Expert Simulator Prototype for Submarine Command Aid (Poyet, 1988).

I was thrilled by the possibility to develop software that would not only perform calculations like bathymetric models, submarine motion and simulation, target acquisition (Tomasini et al., 1991) but that would also rely on simulated reasoning, e.g. based on rules and constraints, a new field at the time of a recent discipline referred to as Artificial Intelligence (AI). Computers could be used in the late 1980s not only to perform calculations but also to simulate human reasoning, and it was a challenge for example to create compact expert-systems in logic programming[273] (i.e. PROLOG[274]) (Kowalski, 1988; Colmerauer and Roussel, P., 1993; Stéphan, 2018) running on PCs to be used on the field for water resources assessment and village water supply in Africa (Poyet and Detay, 1989a; 1989b; 1992) and aquifer

271 https://www.computerhistory.org/collections/catalog/102682887

272 https://www.researchgate.net/profile/Lucien_Wald

273 Logic programming is a programming paradigm which is largely based on formal logic and the demonstration of Horn clauses. Any program written in a logic programming language is a set of sentences in logical form, expressing facts and rules about some problem domain.

274 https://en.wikipedia.org/wiki/Prolog

modeling (Detay et al., 1989). Designing complete software architectures was a challenge of the early 1990s to ensure an integrated access to information systems (Poyet, 1990), (Poyet et al., 1990) but work extended for 25 years (Zarli and Poyet, 2017). I was also involved in developing complex systems in finance and trading (Poyet and Besse, 2005a-b) and software to compute double stars orbits (Poyet, 2017a; 2017b). Though my detractors will claim that I never developed an atmospheric circulation model, which is true, they will have a hard time explaining that I have no knowledge of what a software system is or can do and of what you can expect, or not, of large computer programs after that I gathered decades of professional experience in this area in so many application domains. The only certainty I have is this: don't take your computer program for reality. This applies to "climate science" as well.

There are fields other than "climate science", where if it were enough to have good mathematicians, physicists and economists and access to powerful computers to model in a perfect way the reality, this would have far reaching consequences. The stock market is the first one we can think of and if it were, the total wealth listed would quickly be drained into the hands of the wizards who would have achieved such a prowess. The truth is that more often than wished, these sophisticated programs will also have the potential to generate losses and that nobody would endorse a program result as a certainty or else take the risk of being severely disappointed. Traders know that and have sophisticated strategies to hedge their risks (i.e. unforeseen outcomes), whereas climate scientists too confident in their forecasts, lead us to dramatic economic consequences once the corresponding policies will have been enforced, whereas these researchers, all civil servants with no taking any risk of their own resources, will transfer the astronomical cost of their blunders onto our citizens to ultimately bear the bill. Climate sorcerers should take a break from their ideology and realize that their software have just been trained to confuse cause and effect and surf the increase in temperature that has happened regardless the cause since the end of Little Ice Age. A 10 years old child with a ruler and a pen would more often than not draw an intuitive regression line in a plot of temperature measurements that would fit the bill better than most «sophisticated» computer creations.

Morel (2013) physicist by training (theoretical physicist, quantum statistical mechanics) and former director of the world observation program of the WMO (World Meteorological Organization) said «*We also read in the technical documents of international bodies that the models of the climate derive from the laws of physics. This statement is illusory since these models are in fact decoupled from the fundamental physical principles defined on the microscopic scale by a hiatus constituted by the meteorological processes of medium and small scales which are not represented by their physical reality. For this reason the climatic predictions are not very credible with regard to intense phenomena (cumulonimbus, tornadoes and hurricanes, blizzards etc.), the rain regime, hydrological phenomena or the regional consequences of future global changes. These phenomena are only taken into account on average by means of empirical formulas, called parametric, which are not logically the consequences of laws of physics. However theorists [understand the authors and operators of "models"] like to believe that their models are based on fundamental laws because this belief exempts them from validating each of the formulas they use in their models*». Here we are.

As everything related to water vapor – the critical component of the atmosphere reaction and stabilization - is, in these so-called "climate models" tinkered (they say "parametrized"), announcements of future disasters are devoid of any credibility. The "models" are variants of the calculation programs used for weather forecasting, which we know to be highly unstable in relation to the initial conditions, which prevents correct forecasts beyond a few days. In fact, multi-decadal climate predictions are claimed to be different types of prediction (i.e. called "boundary forced" as distinct from "initial value" problems), but, of course, they are also initial value predictions, as discussed in Pielke Sr. (1998) and Pielke Sr. et al. (1999). These "climate models" have often discretization meshes as large as 100 km instead of a few km for weather forecasting. To mask the exponential divergence of the "models" compared to the initial conditions one takes averages on the results of five or ten calculations by pretending that each set of a model is of the form "tendency plus noise" and that the average will be less noisy; this conjecture has no basis in numerical analysis and even less the assertion of the IPCC that we would better identify the "trend" by averaging over several "models" manufactured by different laboratories.

In a paper frequently cited, Ramanathan et al. (1987) make an honest statement «*A basic theme that emerges from the discussions presented in this paper is that the observed increases in these gases and their potential climatic effects are largely determined by the interactions between radiation, dynamics, chemistry, and the natural as well as anthropogenic sources and sinks of these gases. Recent research on the trace gas problem has significantly improved our understanding of the nature of the interactions. But we are still far from unraveling many of the complexities of these interactions, and as a result, even the most comprehensive climate model results are subject to large uncertainties*». In the same paper, Ramanathan et al. (1987) add «*Thus for the 180-year period from 1850 to 2030, our assessment suggests a trace gas-induced cumulative equilibrium surface warming in the range of 1.5 to 6.1 K*». Given the enormous range reported, it is reasonable to call that a guesstimate at best. And finally, this sentence puts the final nail in the coffin of the climate model «*The response of clouds to climate change is one of the major sources of uncertainty in the greenhouse theory of climate change. This cloud-climate feedback can influence not only the equilibrium climate sensitivity but also the transient response of the climate system to time-varying trace gas concentrations*».

Since Ramanathan et al. (1987) one could argue that significant progresses have been made tackling these problems, e.g. (Muench and Lohmann, 2020), especially with respect to the representation of water and its three phases, as the absorption and / or release of energy associated with these phase changes is one of the most important factors that drive the climate system. Unfortunately, among the many recent papers providing evidence of the contrary, one of the most salient is probably Nakamura (2018) "*Since water and ice can be removed from the atmosphere by precipitation, accurately simulating atmospheric motions that bring these phase changes is a prerequisite for reasonably accurate simulation of climate, not to mention prediction of climate variations and changes. (…) Needless to say, reasonably accurate computation of the vertical motions and effects of the vertical motions on water vapor is absolutely essential if one hopes to calculate the atmospheric water vapor distribution with reasonable accuracy. Here is an important fact:* ***climate simulation models cannot calculate the vertical motions*** *and only diagnose a minuscule portion of the vertical motions from changes in the large-scale state of the atmosphere which is calculated by the models*". To expect the models to succeed calculating the vertical motions, the hydrostatic approximation should be overcome, not supposing any longer that the atmosphere is in hydrostatic equilibrium nor that the vertical pressure gradient may be given as the product of density times the gravitational acceleration, but this would require an extraordinary enhancement in the computational power. Thus, the approach used by the GCMs as reminded by Nakamura (2018) is to resort to parametric representations that "*employ procedures that adjust the atmospheric water vapor content in a vertical column by using as references certain smooth profiles derived from averaging relative humidity profiles over the globe or over very large areas and over very long periods of time, and have nothing to do with instantaneous physical processes (…) these parametric representations are ad hoc and rely on major simplifying assumptions that are not justifiable when scrutinized against the reality*". After discussing the strength of Pr. Kerry Emanuel's[275] (MIT) physics-based parametrization scheme as compared to other techniques, Nakamura (2018) nevertheless concludes that "*reproducing the observed vertical profiles of the atmospheric water vapor reasonably realistically is an* ***insurmountable task for all climate models****, which is to say that the* ***models are not capable of simulating the vertical radiative forcing profiles with reasonable accuracy***". Unfortunately, the horizontal distribution of water vapor is also affected by sub-grid motions that cannot be explicitly calculated by the models as they are too small.

These difficulties are mentioned by Vallis (2020) in a very recent paper and show that the situation has not dramatically improved since Ramanathan's et al. (1987) paper. It is acknowledged that essential real world phenomenons such as clouds or rainfall are still not properly addressed by complicated numerical models. Vallis (2020) reminds that "*Those models often rely on parameterizations of unresolved processes, parameterizations that may work very well but that often have a semiempirical basis*". The sub-grid representation and motions limitations are again recalled by Vallis (2020) who states "*the distribution (i.e., the PDF[276]) of water vapor may not be well simulated in global models, with the problems stemming from finite resolution and the treatment of diffusion, which must be unrealistically large in a GCM*" and who acknowledges that "*Such models necessarily involve the use of ad hoc parameters, and not surprisingly the predictions of condensation and cloud cover (and how it will vary in the future) vary considerably across models. Since c****louds are widely regarded as the greatest single uncertainty in global warming calculations****, this is an important thing to get righ*t". Nakamura (2018) adds "*Ad hoc representations of clouds in climate models may be the greatest source of uncertainty in climate prediction. A profound fact is that only a very small change, (…) in the global cloud characteristics can completely offset the warming effect of the doubled atmospheric carbon dioxide. Two easy examples of such a change is an increase in the area covered by clouds and a decrease in the average size of cloud particles with a concomitant increase in the number of cloud particles, which can occur when the number of cloud condensation nuclei increases. (…)* ***Accurate simulation of cloud is simply impossible in climate models****, since it requires calculations of processes at scales smaller than 1 mm. So, clouds are represented with parametric methods in climate models.* ***Are those methods reasonably accurate? No***".

The only problem is that getting the representation of clouds "right" as Vallis said resorts more to wishful thinking than practical software systems implementation possibilities and given what has just been reported, it is certainly not reasonable to have exaggerated expectations with respect to GCMs.

275 https://www.researchgate.net/profile/Kerry_Emanuel

276 i.e. the Probability Distribution Functions

3.2. Brief Typology of Simulation & Modeling Systems

"*I wanted to explain why observing the ocean was so difficult, and why it is so tricky to predict with any degree of confidence such important climate elements as its heat and carbon storage and transports in 10 or 100 years. I am distrustful of prediction scenarios for details of the ocean circulation that rely on extremely complicated coupled models that run out for decades to thousands of years. The science is not sufficiently mature to say which of the many complex elements of such forecasts are skillful*" Carl Wunsh[277]

We're going to try to provide some schematics to the situations one may encounter saying that there exists formal, convergent, divergent and totally chaotic systems. In fact with the same underlying theory (e.g. Kepler's laws) you can sometimes face one or the other of these situations. For example, you can compute the orbit of a double star (i.e. a solution to the differential equation the system obeys to) and have a quick convergent way to compute the orbit, say some tens or hundreds of iterations like in the spreadsheet provided here (Poyet, 2017c) and given the trigonometric parallax, one can immediately compute the sum of the masses for the binary system by using the third Kepler's law (the square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit). Then you can miss one important parameter (e.g. the trigonometric parallax) but overcome the situation by means of an approximate relation, e.g. between the mass and luminosity (MLR) of main-sequence stars, which was predicted by Eddington (1924) and leads to the calculation of dynamic parallaxes (Russell, 1928), (Kuiper, 1938), (Baize, 1943), (Baize and Romani, 1946), (Baize, 1947), (Couteau, 1971), enabling the knowledge of each individual mass of the binary system. Using this method and coupling it to simple iterative calculations in a spreadsheet enables to derive in less than ten iterations stable absolute bolometric magnitudes for each star A and B, individual masses for A and B, the dynamic parallax and the sum of masses to serve as a crosscheck.

Thus, one has both a formal and convergent means to compute the values he / she is interested in, this is the best situation. But at the same time, when one faces a n-body problem (e.g. solar system), the same theory does not provide any longer for a formal solution and by numerical integration, with billions of small steps (i.e. iterations) you know that the system will unfortunately be divergent over the very long run. This situation still enables to make very reliable solar system ephemeris over decades but totally prevent from knowing where the planets will be, say in 100 million years "*The motion of the Solar System is thus shown to be chaotic, not quasi-periodic. In particular, predictability of the orbits of the inner planets, including the Earth, is lost within a few tens of millions of years*" (Laskar, 1990). This hints to the limits of the theory and of the knowledge available (as you miss of a formal solution to a n-body problem) as well as of the frontier introduced by the technology used, as billions of small increments required over a 100 million years simulation will erase any reliable accuracy due to minimal rounding over such a very long term.

Then you have chaotic systems, like in meteorology or worse climate (the same but over longer timescales) and the situation gets a lot more desperate, this is the Lorentz effect and designates the instability of the solutions of certain systems of equations (non-linear) compared to the initial conditions; it can mean that the system that the equations want to describe is actually "chaotic" or that the equations used do not correctly describe the system. This instability of the discretization programs of the fluid equations limits to a few days the quality of the forecasts of meteorology… which are inapplicable in climatology. As reported by Snider (2016) «*It's the proverbial butterfly effect said Clara Deser, a senior climate scientist at the National Center for Atmospheric Research (NCAR). Could a butterfly flapping its wings in Mexico set off these little motions in the atmosphere that cascade into large-scale changes to atmospheric circulation?*».

It is also the CACE syndrome, Change Anything Changes Everything. Believing that by averaging n runs, here n=30, provides for a « mean » having some significance is total delusion, it is like thinking that by throwing 30 times 2 (or more) dices and by averaging the results of the draws would give any insight into what will come out next ! Here we have left science and delved into beliefs, illusions when one think that because the map was calculated by a supercomputer it bears some meaning, it contains information. When one faces the wall of reality, like with meteorological forecasts, scientists know that they deal with a totally chaotic system that gives them no chance to make any meaningful prevision beyond 2 weeks, but when they are climate tinkerers they delude themselves thinking that extending the timescales to decades and furthermore adding complexity, would enable them to produce some reliable result, by wizardry. As reminded by Hansen (2016), «*Averaging 30 results produced by the mathematical*

277 http://www.realclimate.org/index.php/archives/2007/03/swindled-carl-wunsch-responds/

chaotic behavior of any dynamical system model does not average out the natural variability in the system modeled. It does not do anything even resembling averaging out natural variability. Averaging 30 chaotic results produces only the average of those particular 30 chaotic results».

Think of it, just make 30 meteorological forecasts at six months letting the (super)computer run, average these and see whether it makes any sense to claim that the fantasy maps you have colored represent any reality from which you are going to subtract the observed weather to assert that the natural variability can be assessed in this way. The situation is crystal clear, the six months fantasy colored maps bear no information, has no relationship to any reality, has no intellectual nor economic value and claiming otherwise is at best self-delusional and at worst an intentional cheating.

But the amazing thing is that IPCC goes into a circular deception in his main reports. First, Randall et al. (2007) states "*Note that the limitations in climate models' ability to forecast weather beyond a few days do not limit their ability to predict long-term climate changes, as these are very different types of prediction*". They are not different types of predictions, the climate is the integral over time of the weather and when one is unable to make forecasts beyond 15 days, because we deal with a chaotic system, he deludes himself and deceit others when he claims that he can "model" the climate thousands or tens of thousands years ago or in the future. The very definition of the climate is "the composite or generally prevailing weather conditions of a region, as temperature, air pressure, humidity, precipitation, sunshine, cloudiness, and winds, throughout the year, averaged over a series of years. a region or area characterized by a given climate"[278].

Then Randall et al. (2007) p. 601, when addressing the question "How Reliable Are the Models Used to Make Projections of Future Climate Change?" affirms an incredible thing "*A third source of confidence comes from the ability of models to reproduce features of past climates and climate changes. Models have been used to simulate ancient climates, such as the warm mid-Holocene of 6,000 years ago or the last glacial maximum of 21,000 years ago (**see Chapter 6**)*" and does not provide one single reference to some published work that would have claimed and proved to do so and demonstrated how. When one goes to Chapter 6, which is the only reference provided, i.e. (Jansen et al., 2007) p. 440, instead of finding references to recognized work you get a circular reference to Chapter 8 ! and the following "*In principle the same climate models that are used to simulate present-day climate, or scenarios for the future, are also used to simulate episodes of past climate, using differences in prescribed forcing and (for the deep past) in configuration of oceans and continents. The full spectrum of models (**see Chapter 8**) is used (Claussen et al., 2002), ranging from simple conceptual models, through Earth System Models of Intermediate Complexity (EMICs) and coupled General Circulation Models (GCMs)*".

So, in order to demonstrate that climate "models", "simulations" - call them the way you like – have been able to render the climate back to the LGM long before the Holocene, the trick is the circular reference: Chapter 8 says GO TO Chapter 6 which says GO TO Chapter 8 ! The only reference given, i.e. Claussen et al. (2002) starts by reminding the evidence, that there is a close link between the weather and climate "*Following the traditional concept of von Hann (1908), climate has been considered as the sum of all meteorological phenomena which characterize the mean state of the atmosphere at any point on Earth's surface*", so one can hardly see how one could make decent climatic forecasts made of the sum of unreliable forecasts beyond 15 days; then the authors address the typology of climate systems and the place of Earth system Models of Intermediate Complexity (EMICs) and certainly do not provide any proof that anyone has ever managed to reproduce the climate all back throughout the Holocene or even further. If one were to do so, and cheating, the system would simply operate as a best fit to pre-recorded data and regurgitate the tape. In fact, this might not even be possible as from the study of Hessler et al. (2014) it is stated that "*We present and examine a multi-sensor global compilation of mid-Holocene (MH) sea surface temperatures (SST), based on Mg / Ca and alkenone palaeothermometry and reconstructions obtained using planktonic foraminifera and organic-walled dinoflagellate cyst census counts. Overall, the uncertainties associated with the SST reconstructions are generally larger than the MH anomalies. Thus, the **SST data currently available cannot serve as a target for benchmarking model simulations***", thus it will not even be possible to "read" and "regurgitate" the tape, as there is no such reliable tape.

What is extremely annoying to say the least, is that once unproven statements have been written in the IPCC report, it is like "seen at the TV", people copy word for word not even checking the plausibility of what was asserted as a proof and which is not even a deception but a mere lie and regurgitate the sentences not even putting quotes around, this is what happened with Llyod (2012) p. 395. One reminds of the high impact of the various oscillations (e.g. ENSO, PDO, NAO, etc.), really driving the weather as a response to the insolation triggers and to the long term heat storage capacity

278 https://www.dictionary.com/browse/climate

of the oceans, and one also remembers the trouble for even the latest generation Complex coupled Global Circulation Models (CGCMs) to tackle the issue on a semi-meteorological timescale, i.e. just accurately forecasting what the next event will be. Actually, CGCMs fail at predicting with certainty if one should expect a El Niño or a La Ninã next, when and with which intensity and also fail by contradicting each others on longer timescales, some forecasting more El Niño and others suggesting a tendency towards greater La Niña-like conditions (Steig, et al., 2013).

So, let's not speak of decades, millennial timescales or the Holocene or more, let's be reasonable, science would benefit of honest reports of where we stand. CGCMs are remarkable pieces of software, but nobody should deceit the public and others by making fanciful assertions with respect to their capabilities as IPCC and Lloyd (2012) p. 395, did. In fact, as stated by Collins et al. (2010) many reasons simply make CGCMs unable to just project ENSO events decades in the future such as "*because of limitations in: (1) computer resources, which typically restrict climate model resolutions to fewer grid cells than are needed to adequately resolve relevant small-scale physical processes; (2) our ability to create parameterization schemes or include some relevant physical and biological processes that are not explicitly resolved by climate models; (3) the availability of relevant high-quality observational data; and (4) our theoretical understanding of ENSO, which evolves constantly*", all these limitations make assertions that CGCMs or any other software system would reproduce climate back to the LGM fantasies that would make blush any science-fiction novelist.

In the end, not only Chapter 6, i.e. (Jansen et al., 2007) p. 481, does not provide any hints as to how models would magically reproduce the climate back to the Holocene and further, but more realistically and modestly state "*It is difficult to constrain the climate sensitivity from the proxy records of the* ***last millennium*** *(see Chapter 9). As noted above, the evidence for hemispheric temperature change as interpreted from the different proxy records, and for atmospheric trace greenhouse gases, inferred solar forcing and reconstructed volcanic forcing, is to varying degrees uncertain*", and furthermore, p. 483, concludes "*Even though a great deal is known about glacial-interglacial variations in climate and greenhouse gases, a comprehensive mechanistic explanation of these variations remains to be articulated. Similarly, the* ***mechanisms of abrupt climate change*** *(for example, in ocean circulation and drought frequency)* ***are not well enough understood****, nor are the key climate thresholds that, when crossed, could trigger an acceleration in sea level rise or regional climate change. Furthermore,* ***the ability of climate models to simulate realistic abrupt change in ocean circulation, drought frequency, flood frequency, ENSO behaviour and monsoon strength is uncertain****. Neither the rates nor the processes by which ice sheets grew and disintegrated in the past are known well enough*".

So, how could computerized simulations, which are as per Jansen et al. (2007) unable to render any abrupt climate change in any area of interest, be it oceanic circulation or else, be capable how accounting for the climate changes that naturally happened all throughout the Holocene and further to the LGM ? Explain me! Show me! Prove me!

Well what it seems is that the best of these GCMs are not only not covering the Holocene or properly backtracking to the LGM, but actually and more realistically they are just still **unable to make any valuable forecast for the next season to come**, summer or winter as you wish. What is next comes from a report to the Australian House of Representatives, with respect to future collaboration between the Aussie BoM and CSIRO and the United Kingdom Meteorological Office's (UKMO). Let's observe that there are two main approaches to seasonal climate forecasting: 1) statistical methods using statistical relationships between atmospheric or oceanic indicators and seasonal climate variables such as rainfall or temperature, and 2) dynamical methods using global atmospheric and oceanic circulation models. It is then reported that the direction being taken by most weather forecasting groups internationally, as in Australia, is to replace existing empirically based statistical schemes with systems based on dynamic models, when the dynamic systems have comparable or better skill than the existing statistical systems. Thus, it is in that context that a collaboration with the the UKMO is presented to the MPs. The UKMO Unified Model is a high-powered computer-based climate and weather prediction program considered the best in the world (2009), a sophisticated coupled GCM, released by the Hadley Centre. Let's see how well it fares with respect to six months forecasts, as stated in (HRC, 2009), not the Holocene! Here you go "*The Committee heard evidence that the UK model* ***has not had a high success rate with long term weather forecasts****. John McLean, an information technology specialist who has applied his skills in analysis to various issues relating to climate change, provided written evidence of the lack of success of the model from 2007 until 2009. He told the Committee: … in the UK the Met Office has been using modelling for seasonal forecasts over the last few years.* ***2007 was one of the wettest summers since, I think, 1913 and they had predicted a very hot summer****. They tried again the next year and it was, again, a very wet summer.* ***Last winter they predicted quite a mild and dry winter, and they had very heavy snow. They ran out of salt and grit for the roads***".

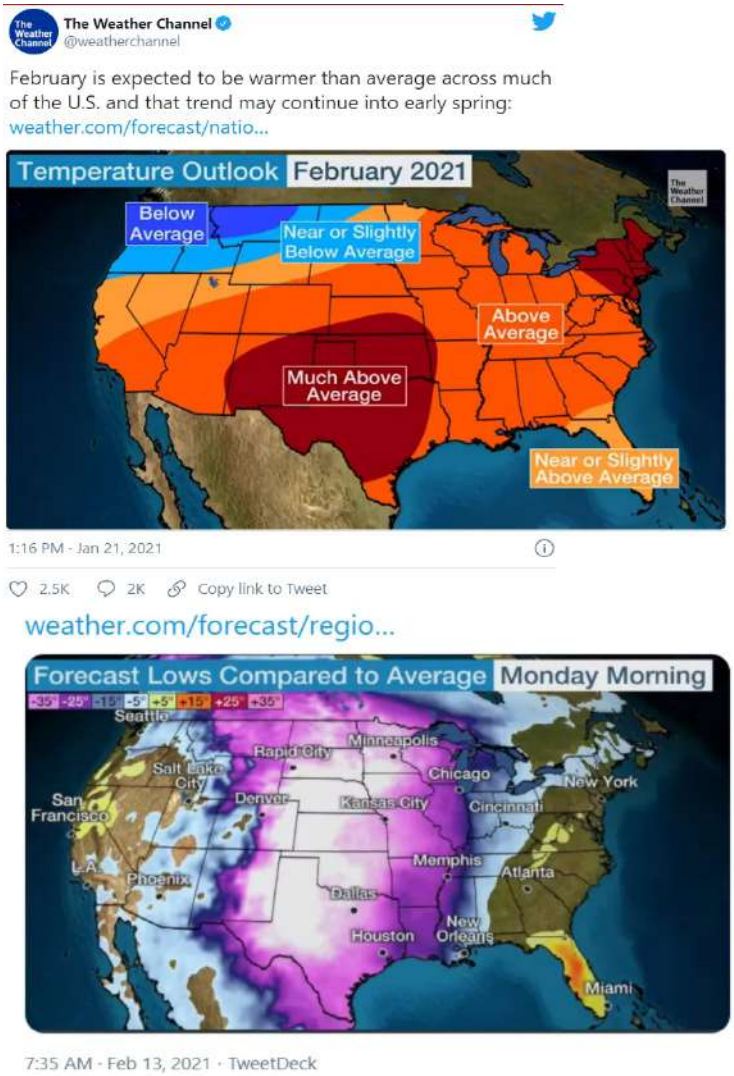

Figure 97. The dramatic cold spell that left dozens of people dead in Texas alone, show the abysmal failure of “seasonal forecast” (top figure) made on Jan 21, 2021 @ 1:16 PM as compared to real “temperature map only” observed on Feb 13, 2021 @7:35 AM.

So, instead of making climate-change forecasts that would span decades or centuries in the realm of fantasy land based on computerized over-gifted soothsayers and dare pretend that they account for the Holocene, that they go back to the LGM and why not more, the Eemian? Why not the entire Quaternary? They just ran out of salt and grit for the roads for the next winter in the UK. But, things went even worse in the US, because as the winters were supposed to get warmer due to global warming, the electricity production systems had been shifted to renewable. Texas instead of a mild weather as anticipated by the “seasonal forecast” faced record-low temperatures this February 2021 and snow and ice made roads impassable, the state’s electric grid collapsed, leaving millions without access to electricity. As the blackouts extended from hours to days, people died in the dozens and weeks will be required to make a complete assessment of the final death toll. Before thinking to making climate so-called scenarios for 2100, it would be good enough not to have fantasy seasonal forecasts as displayed in Figure 97, where the temperature outlook for February 2021 was announced on Jan 21, 2021 @ 1:16 PM as expected to be “much above average” whereas the reality that struck the Texans is displayed by the real temperature map displayed on Feb 13, 2021 @7:35 AM.

When climate-illusionists claim that weather and climate predictions are unrelated and that they can fail abysmally on 20 days “seasonal forecast” and dare pretend that they know what the the climate will be in 30 years or in 2100 is not only an ugly deception but an outright fraud. Turning the CO_2 knob and adjusting a so called “climate sensitivity” is no recipe for any credible climate scenario. That's totally delusional. Indeed, would you place any credence in such dismal systems? That does not bode well for the future climate-policies based on these lunacies.

I must commend Janusz Pudykiewicz[279] for his constructive, wise and lucid comments on that matter made public on "Researchgate" on December 11, 2020: "*The essential task is to predict extremes in the extended range weather prediction (from weeks to a season) as well as in the sub-climatic range of forecast. As soon as we leave the deterministic or quasi-deterministic range of prediction that is of the order of 10 days, we have to develop the methods to deal with randomness. Perhaps the Fokker-Plank equation to describe the evolution of probabilities can supplement the traditional fluid dynamics and thermodynamics equations?* ***We still don't know how to develop better methods****. The projection of the state on a combination of empirical eigenfunctions can be another way of addressing the problem. Based on the observation of trends in science in general, I think that solution will be surprising and ingenious*". Pudykiewicz and Brunet (2008) remind us of the great achievement that 10 days meteorological forecasts have represented and the extraordinary benefits for society that arose from them. Now, the emphasis as underlined above is more on delineating the risks coming with extreme events (Sillmann et al., 2017). **Climate forecasting remains beyond scope** and better, original methods need to be devised.

Hopefully, Janusz Pudykiewicz will be right and climate science will not follow the fate of another yet sadly unresolved issue. Another domain which bears some resemblance with the chaotic features displayed by meteorological models is earthquake predictions, which unfortunately offers dire perspectives since the work of Geller et al. (1997), actually climate tinkering is much worse as it does not attempt to forecast weeks ahead but to tell us what will be the temperature, the pattern of precipitations and where will the sea-level be in 2100! Alas, the central hypothesis contended by Geller et al. (1997) has not been refuted since and states «*Citing recent results from the physics of nonlinear systems "chaos theory," they argue that any small earthquake has some chance of cascading into a large event. According to research cited by the authors, whether or not this happens depends on unmeasurably fine details of conditions in Earth's interior. Earthquakes are therefore inherently unpredictable. Geller et al. suggest that controversy over prediction lingers because prediction claims are not stated as objectively testable scientific hypotheses, and due to overly optimistic reports in the mass media*». We are back to chaotic systems and it would be wise to learn from Geller's savvy recommendation that whenever science is not based on «*objectively testable scientific hypotheses*» one embarks on a futile attempts, such as forecasting long term mean temperatures, sea-levels, rainfalls, droughts, etc. Refuting that CO_2 is the culprit of observed climate changes, based on all scientific evidences, is what has been honestly done here and If it were not for a pure ideological stance which has lasted too long, it should logically lead to trying to assess which are the causes of these climate changes.

Finally, some systems are not chaotic but are not entirely deterministic either as the trading expert-system developed by Poyet and Besse (2005a-b). The software ensures that the best decisions be taken at each stage of the reasoning process according to the situation encountered, here managing portfolios of listed securities on the stock markets. To benchmark and validate how such systems operate, one must make hundreds of «runs» each lasting several hours as the logic of the expert-system is checked against decades of market data. The starting date of each validation run is shifted say of one week and the software creates an initial portfolio which will somehow differ from what would have been done one week after or one week before, because the best in time opportunities might have been slightly different. After years of operations on the market, decisions tend to level out and performances converge towards the efficiency of the trading logics used, still showing some deviations with respect to some mean return. Such systems, are inherently conscious of their limitations (seemingly making them different from climate tinkering) and enforce strong risk mitigation techniques to ensure that unforeseen events will not lead to extremely adverse results. Doing so has consequences on the performances (i.e. the returns) and finding the right balance between risk control and high performances is always a trade-off that can only be decided according to the portfolio's owners.

In fact, TEXSOL (Trading Expert-System On Line) developed by Poyet and Besse (2005a-b) shares some resemblance with the Large Ensemble Techniques (LSE) currently implemented by "climate-groups" but to their difference, where they claim to know what the climate will be decades ahead, will never pretend to know what will be the balance of an account a decade ahead! γνῶθι σεαυτόν[280]

279 https://www.researchgate.net/profile/Janusz_Pudykiewicz
280 https://en.wikipedia.org/wiki/Know_thyself

3.3. Do Climate Models Account for Observations?

«*First, the computer models are very good at solving the equations of fluid dynamics but very bad at describing the real world. The real world is full of things like clouds and vegetation and soil and dust which the models describe very poorly. Second, we do not know whether the recent changes in climate are on balance doing more harm than good. The strongest warming is in cold places like Greenland. More people die from cold in winter than die from heat in summer. Third, there are many other causes of climate change besides human activities, as we know from studying the past. Fourth, the carbon dioxide in the atmosphere is strongly coupled with other carbon reservoirs in the biosphere, vegetation and top-soil, which are as large or larger. It is misleading to consider only the atmosphere and ocean, as the climate models do, and ignore the other reservoirs. Fifth, the biological effects of CO_2 in the atmosphere are beneficial, both to food crops and to natural vegetation. The biological effects are better known and probably more important than the climatic effects.*» Freeman Dyson

As Lindzen stated (1997) «*The more serious question then is do we expect increasing CO_2 to produce sufficiently large changes in climate so as to be clearly discernible and of consequence for the affairs of humans and the ecosystem of which we are part. This is the question I propose to approach in this paper. I will first consider the question of whether current model predictions are likely to be credible. We will see why this is unlikely at best*»

Models must be subordinated to the observations, not the other way round. This is the way science has always proceeded, for example when you compute the orbit of a double star (Poyet, 2017a; 2017b) if it does not match the observations you just try to recompute a better orbit. And every astronomer, given the method you have stated that you use, can have access to the observations, reproduce the work that you have done and check that it was correct. This is the very basics of science, the theory or the model should match the observations and science should be reproducible. As long as the theory or the model is able to make decent forecasts (i.e. an ephemeris in the previous example), it is considered appropriate, as soon as it fails, everything must be reconsidered. It seems that climate tinkerers have completely forgotten the basics and the observations must be wrong as 95% of the models fail to reproduce them, even on extremely short timescales as it is displayed in the next figure 98!

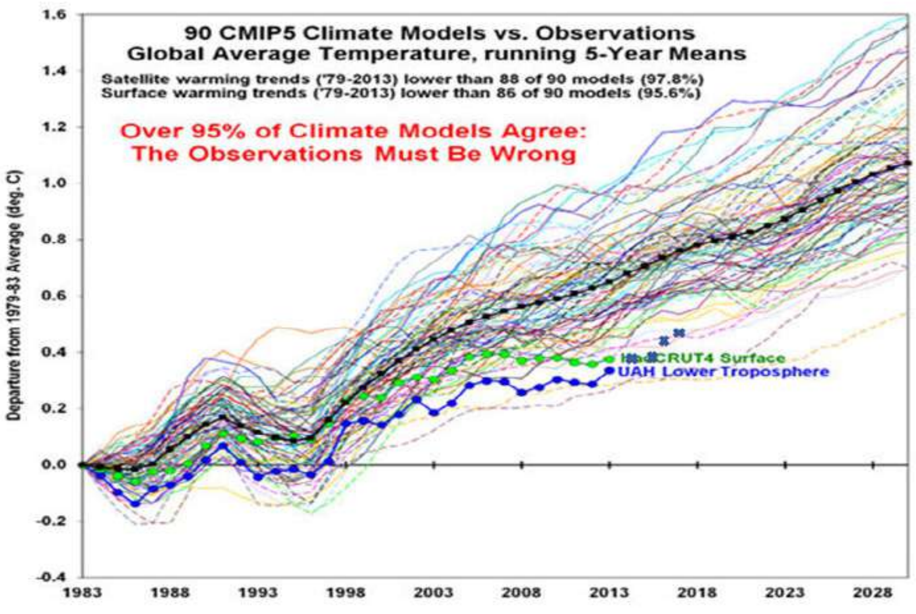

Figure 98. >95% of the models have over-forecast the warming trend since 1979, whether use is made of their own surface temperature dataset, i.e. HadCRUT4 (Morice et al., 2012), or of UAH satellite dataset of lower tropospheric temperatures. After Spencer (2014).

«*Unfortunately, no model can, in the current state of the art, faithfully represent the totality of the physical processes at stake and, consequently, no model is based directly on the basic mechanical, physical or geochemical sciences. On the contrary, these models are fundamentally empirical and necessarily call on arbitrary parameters which must be* *adjusted to best represent the existing climatological data, foremost among which is the annual cycle of the seasons* » (Morel, 2009).[281]

From this benchmarking of the models against reality, Christy (2016) observes «*On average the models warm the global atmosphere at a rate 2.5 times that of the real world. This is not a short-term, specially-selected episode, but represents the past 37 years, over a third of a century*», this is well visible on next Figure 99. See also Gregory (2019).

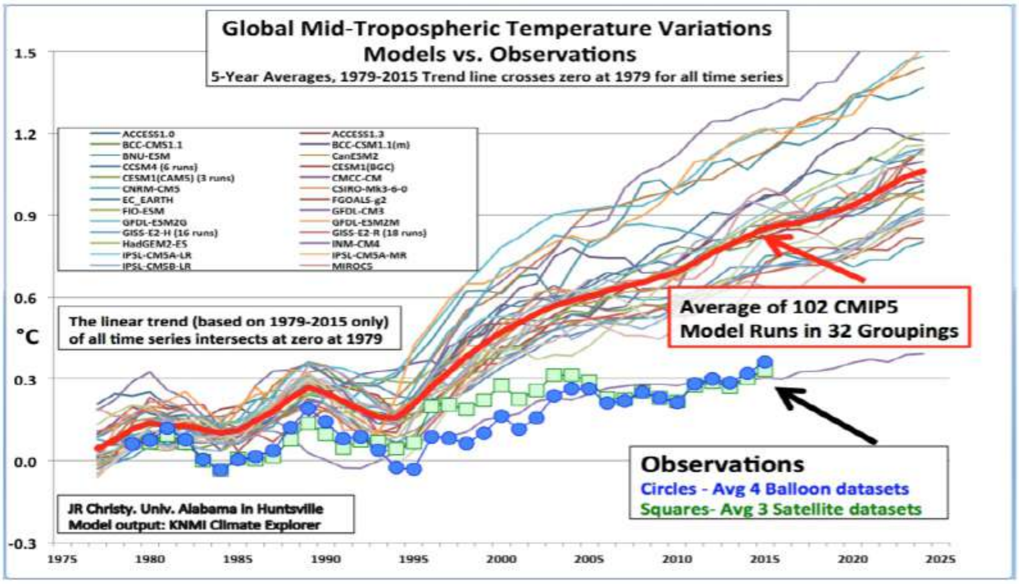

Figure 99. Global average mid-tropospheric temperature variations (5-year averages) for 32 models (lines) representing 102 individual simulations. Circles (balloons) and squares (satellites) depict the observations. The Russian model (INM-CM4) was the only model close to the observations (Christy, 2016).

Thus, as we explained before taking the example of the computation of the orbits of double stars, one will not be surprised by the conclusions logically drawn by Christy (2016) «*Following the scientific method of testing claims against data, we would conclude that the models do not accurately represent at least some of the important processes that impact the climate because they were unable to "predict" what has already occurred. In other words, these models failed at the simple test of telling us "what" has already happened, and thus would not be in a position to give us a confident answer to "what" may happen in the future and "why." As such, they would be of highly questionable value in determining policy that should depend on a very confident understanding of how the climate system works*».

Back to our astrometric comparison, that means that these models, if they were orbits, would not even represent past observations data correctly, i.e. in fact they would be rejected immediately by the astronomer as he would know that no decent ephemeris could be derived of an orbit that does not even account for the past observations. This is the dire situation in which the climate science community stands after having received massive amounts of money with clear instructions while allocating the grants to prove that the temperature had to be explained by changes in [CO_2]. Could be time to revisit all assumptions. In astronomy, when you do not succeed to compute an orbit, there might be a third object, or else more. But at least you know that Kepler's laws will stand, well they have been so far. Here, the Kepler's law of the climate fiasco community, i.e. that everything depends on [CO_2] concentration does not look so good, might be high time to change the gun instead of insisting on disregard for the obvious.

Furthermore, all these computer codes, their documentations and data used should be available in the public domain as they have been funded by tax-payer monies and as their authors cannot claim trade secrets to prevent their public availability. Even though this would be the case, which has not always been to say the least, the use of supercomputers could hamper the reproducibility of these experiments as stated by Laframboise (2016) « *There is no reason to believe that the politically charged arena of climate science is exempt from these problems, or that it doesn't share the alarming rates of irreproducibility observed in medicine, economics, and psychology. Indeed, non-transparency is an*

281 Pierre Morel, Oct. 2009, at «Bureau des longitudes». https://www.canalacademie.com/ida5110-Rechauffement-planetaire-et-science-du-climat.html

acute problem in climate science due to the use of climate modeling via supercomputers that cost tens of millions of dollars and employ millions of lines of code*» and the reproducibility and assessment of the way the computers models operate is also legitimately challenged «*Outsiders – whether they be other scientists, peer reviewers, or journalists – have no access to the specialized software and hardware involved, and it is difficult to imagine how such access might be arranged, never mind the person-years that would be required to fully explore the subtle computational and mathematical issues arising from a careful audit of such a model. Reproducibility is the backbone of sound science. If it is infeasible to independently evaluate the numerous assumptions embedded within climate model software, and if third parties lack comparable computing power, a great deal of climate science would appear to be inherently non-reproducible*» (Laframboise, 2016).

Climate science is also characterized by a disproportionate usage of computer models as compared to other disciplines. In fact, and in some way, the software code has substituted itself to the very object of the study, the climate of planet Earth, and the modelers and software developers have come to believe that their creations are the real system, or so close of an image of it that one should not question the soundness, reliability or forecasting capacity of these systems. As Michaels and Wojick (2016) observe «*in short it looks like less than 4% of the science, the climate change part, is doing about 55% of the modeling done in the whole of science. Again, this is a tremendous concentration, unlike anything else in science*». Climate modeling is not climate science which furthermore does not really exist as we have seen before, inasmuch it is such a collection of disparate knowledge garnered from so many disciplines.

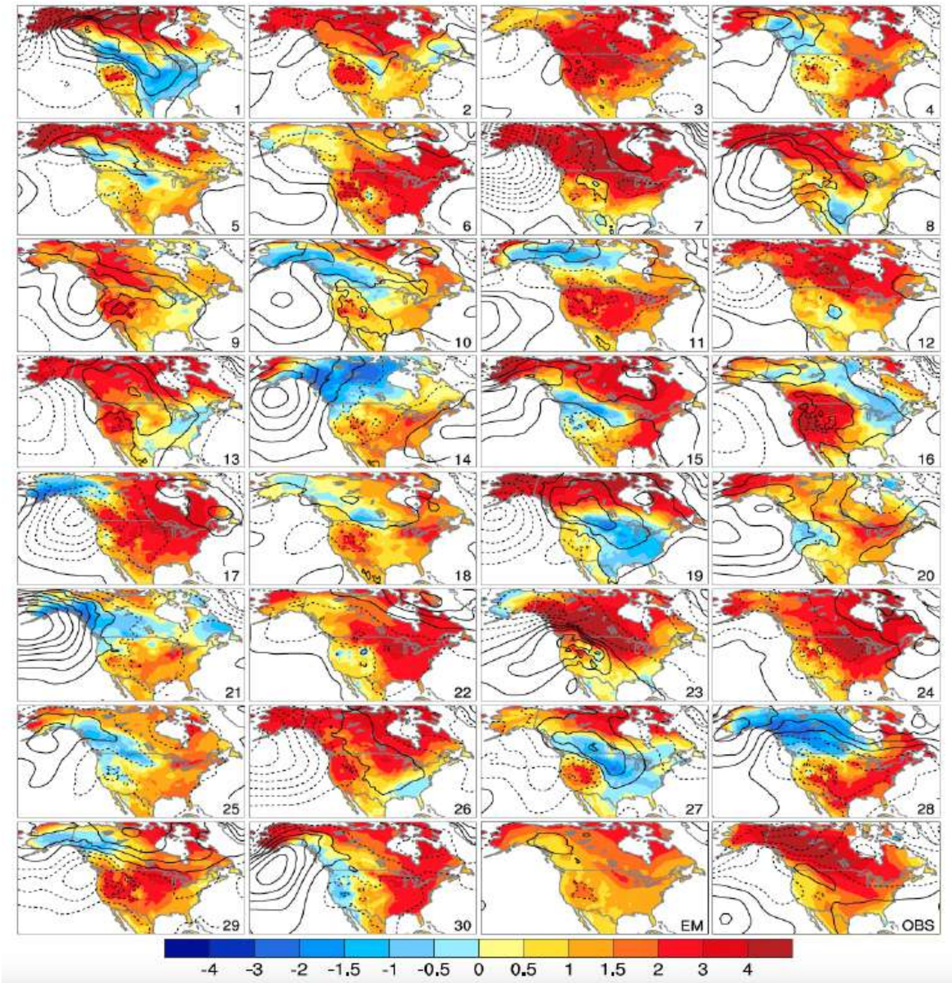

Figure 100. *Computer models and chaotic results: Lorenz effect. 30 results of the same program which ran with initial conditions different from one thousandth of a degree Celsius: the trends over 1963-2013 of the surface temperatures in North America are represented, between -5°C (blue) and + 5°C (red). Down on the right EM (Ensemble Mean is the mean of the 30 runs) OBS is observed conditions. Image from Kay et al. (2015) and Snider (2016).*

Moreover, the climate science research that is done appears to be largely focused on improving the models, i.e. an evasive virtual reality which is not so real unless you trust it! Michaels and Wojick (2016) add « *In doing this it assumes* *that the models are basically correct, that the basic science is settled. This is far from true. The models basically assume the hypothesis of human-caused climate change. Natural variability only comes in as a short term influence that is negligible in the long run. But there is abundant evidence that long term natural variability plays a major role climate change. We seem to recall that we have only very recently emerged from the latest Pleistocene glaciation, around 11,000 years ago. Billions of research dollars are being spent in this single minded process. In the meantime the central scientific question -- the proper attribution of climate change to natural versus human factors -- is largely being ignored*».

The original legend of Fig. 21 by Snider (2016) was «Winter temperature trends (in degrees Celsius) for North America between 1963 and 2012 for each of 30 members of the CESM Large Ensemble. The variations in warming and cooling in the 30 members illustrate the far-reaching effects of natural variability superimposed on human-induced climate change. The ensemble mean (EM; bottom, second image from right) averages out the natural variability, leaving only the warming trend attributed to human-caused climate change. The image at bottom right (OBS) shows actual observations from the same time period. By comparing the ensemble mean to the observations, the science team was able to parse how much of the warming over North America was due to natural variability and how much was due to human-caused climate change. (© 2016 AMS.)».

As reminded by Hansen (2016), «*Averaging 30 results produced by the mathematical chaotic behavior of any dynamical system model does not average out the natural variability in the system modeled. It does not do anything even resembling averaging out natural variability. Averaging 30 chaotic results produces only the average of those particular 30 chaotic results*» and such a legend is just a deception. In the paper that produced this image, the precise claim made was: «The modeling framework consists of 30 simulations with the Community Earth System Model (CESM) at 1° latitude/longitude resolution, each of which is subject to an identical scenario of historical radiative "forcing" but starts from a slightly different atmospheric state. Hence, any spread within the ensemble results from unpredictable internal variability superimposed upon the forced climate change signal» (Kay et al., 2015).

In fact Snider (2016) acknowledges the chaotic nature of the results «*With each simulation, the scientists modified the model's starting conditions ever so slightly by adjusting the global atmospheric temperature by less than one-trillionth of one degree, touching off a unique and chaotic chain of climate events*» that it makes the legend associated to the experience totally unsubstantiated. By adding that «*The result, called the CESM Large Ensemble, is a staggering display of Earth climates that could have been along with a rich look at future climates that could potentially be*» Snider (2016) confesses that throwing dices would have been no different and that the software provides no idea whatsoever as to which final conditions one can actually expect. "*We gave the temperature in the atmosphere the tiniest tickle in the model, you could never measure it, and the resulting diversity of climate projections is astounding*" Deser said, see also (Deser et al., 2012). Deser added "*It's been really eye-opening for people*", yes indeed it is and shows how useless these systems are. At least we can compliment IPCC for one of the rare correct statement they made «*The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future climate states is not possible*», IPCC – 2001 – TAR-14 – «Advancing Our Understanding», p. 771

A classical deception technique is to use models as if they were the observed reality, mixing up past observed data (but often arbitrarily corrected), extrapolated or tampered data and "points" resulting from oriented models in the same graphical representations[282] to confuse people and make them believe that the AGW mass is said and that there is no question to be asked. Most of the time what is presented as an indisputable and irrefutable reality is just an unbelievable tinkering where the impact of so-called "assessed" climate response to natural and human-induced drivers - that nobody knows - is arbitrarily evaluated by means of statistical techniques hiding the tampering done to the data (e.g. through multiple regression) and further subtracted, then what they call the "forcings" which has no definition or reality whatsoever in Physics[283]. It is evaluated by a "simple climate model", i.e. an ad-hoc piece of software that implements a naive thermal response to an arbitrary increase of CO_2 and further retrofitted to the data that they cannot otherwise account for, to finally use hundreds of variations of the so-called "forcings" to, in the end hopefully, reach the desired results!

Llyod's article (2012) boils down to a long plea to desperately try, in the pay of the men of the climate fabricators, to overturn an aphorism that fundamentally defines science, the one placed by Pierre-Augustin Caron de Beaumarchais in

282 https://www.carbonbrief.org/analysis-why-scientists-think-100-of-global-warming-is-due-to-humans

283 Please, find just one Physics Textbook (not a climatologist gibberish) that defines what a "forcing" is! This scam will be addressed hereafter and debunked in detail later.

the mouth of his fictional character, Figaro, in the Marriage of Figaro, a comedy in five acts, written in 1778, who enunciates “Les commentaires sont libres, les faits sont sacrés”, which means "Comments are free, facts are sacred".

The author in Llyod (2012) creates two groups of scientists, one resorting to ‘direct empiricism’ who consider facts sacred and deliver the respected University of Alabama in Huntsville (UAH) measurements based on raw satellite data checked against radiosonde data and “*are treated as windows on the world, as reflections of reality, without any art, theory, or construction interfering with that reflection*” and another group called ‘complex empiricists’ who simply reject the facts they dislike because these disprove their models by stating that all of the datasets, both satellite and radiosonde, were considered as theory-laden or heavily weighted with assumptions which is just ultimate bad faith. Thus, Llyod (2012) states “*they held that understanding the climate system and the temperature trends required a combination of tools, including models, theory, the taking of measurements, and manipulations of raw data*”. It's awesome, it just clearly states black on white that “understanding the climate” requires to make every effort to ensure that nothing contradicts the models, which makes sense as it is their bread and butter! Then Llyod (2012) goes on “*As I will show, the philosophical clash between ‘direct’ and ‘complex’ empirical approaches is one basis of this long disagreement over the status of climate models and the greenhouse effect*”. There is no philosophical clash, we just have on the one side a clever quakery and on the other a legitimate aspiration to keep doing science the way it has always been “facts are sacred" and would the models accommodate the data and as long as they would correctly some value will be placed in them, otherwise just change the models, the theory, everything but make no compromise with the facts. But as the arbitrary CO_2 warming resemble more a religion that the logical outcome of a reasoned calculation as was done in the first part of this document, there is simply no way to discard the dogma, no way to recoup one's mind. Llyod (2012) further goes on asserting that the ‘complex empiricists’ claim that ‘‘*We have used basic physical principles as represented in current climate models, for interpreting and evaluating observational data” (Santer et al., 2005, p.1555)*”. In fact, the paper of Santer et al. (2005) is quite amazing as it simply states that if the data and observations do not match the models of the simulations, then they must be wrong ! “*On multidecadal time scales, tropospheric amplification of surface warming is a robust feature of model simulations, but it occurs in only one observational data set. Other observations show weak, or even negative, amplification. These results suggest either that different physical mechanisms control amplification processes on monthly and decadal time scales, and models fail to capture such behavior; or (more plausibly) that residual errors in several observational data sets used here affect their representation of long-term trends*”.

What an inversion of Science published in Science !

And as if not enough, Lloyd (2012) adds “*Note that this is the opposite of direct empiricism; the data are seen in terms of the theory and its assumptions... The evaluation of datasets is one where raw data are evaluated as plausible or acceptable based on their compatibility with certain theoretical or dynamic processes*”. I remain speechless, flummoxed, cannot type on the keyboard any more! The observations do not fit the models or the simulations, they must be wrong, that was Figure 98 “95% of Climate Models agree: the observations must be wrong”!

Furthermore, one will not forget that the numerical approximation of partial differential equations having no formal solutions since 1822 (it has not yet been even proven whether solutions always exist in three dimensions and, if they do exist, whether they are smooth !) into opaque computer codes with lots of discretizations and parametrizations does not represent a physical phenomenon but somehow and very imperfectly tries to mimic a little what mother Nature performs at a highly different complexity level and has been doing so for billions of years. If these models do not match what Nature does and tells us so by the measurements made, we're not going to change mother Nature by tinkering and tweaking the measurements. It is totally delusional to keep going along with some feckless tampering of the data and hope for understanding and thus forecasting anything meaningful.

Let's come to the “forcings”: these neo-physical notions are totally meaningless concepts. Radiative Forcing (RF) is defined by Myhre et al. (2013), as “*the change in net downward radiative flux at the tropopause after **allowing** for stratospheric temperatures to readjust to radiative equilibrium, while **holding** surface and tropospheric temperatures and state variables such as water vapor and cloud cover fixed at the unperturbed values*” and Effective Radiative Forcing (ERF) “*is the change in net TOA downward radiative flux after **allowing** for atmospheric temperatures, water vapour and clouds to adjust, but with surface temperature or a portion of surface conditions **unchanged***”. Furthermore and very interestingly, one should notice that there are multiple ways to compute these fantasies as Myhre et al. (2013) add “*Although there are multiple methods to calculate ERF, Calculation of ERF requires longer simulations with more complex models than calculation of RF, but the inclusion of the additional rapid adjustments makes ERF a better* *indicator of the eventual global mean temperature response... The general term forcing is used to refer to both RF and ERF*".

This is a truly new way of "doing Physics". Instead of observing the real world, trying to understand how it works and unveil laws that could make sense and check against data and consider the theory only correct as long as not invalidated by the observations, "IPCC neo-Physicists" have decided that they would define physically meaningless notions (e.g. RF, ERF) that would dictate to Mother Nature how she should respond, and for example for RF she will not be allowed to make any change except to the stratospheric temperature, holding all else constant! What a scam, especially as it is by the slight variations of H_2O vapor at the TOA, both in content and altitude, and therefore changing the Outgoing Longwave Radiation (or radiative flux) emitted towards the cosmos that the Earth balances it energy budget. Telling Mother Nature what she is allowed to do, what she must hold constant or unchanged is just amazing. As just seen, in the RF case, the fact that the Earth is just allowed to readjust stratospheric temperature keeping all else fixed is telling a lot about the way these neo-Physicists have "re-invented" science. As Veyres (2020) reminds "*Since radiative forcing is, by definition, neither observable nor measurable, people rely on computer rantings and take the average of the results of different computer programs, obviously all questionable. Radiative forcing is a calculation made in a virtual world, so virtual that it was arbitrarily increased by 50% by the IPCC between the 2007 report and the 2013 report without anything having changed much in six years*". All these stories of "radiative forcing by greenhouse gases" are nonsense and it is mainly the water vapor content of the upper troposphere – which obviously does not remain constant as no IPCC control button can hold it such - that determines and regulates the thermal infrared flux emitted by the globe to the cosmos (i.e. the Outgoing Long-wave Radiation) and not a warming of this upper troposphere. Their "models" which rely on neither observable nor measurable ad-hoc neo-physical quantities (how convenient, isn't it?) have also arbitrarily decided that the 0.007% increase of CO_2 was going to destroy the Earth's atmosphere equilibrium and that there is no need to check whether this has any sense, the simulations are more than enough to tell Mother Nature how she should comply!

What an inversion of Science!

For the readers who want to have a clearer picture of where the models stand after all these years of re-inventing the world, Flato and Marotzke et al. (2013), p. 743, were kind enough to us to tell the truth "*Most simulations of the historical period **do not reproduce the observed reduction in global mean surface warming trend over the last 10 to 15 years**. There is medium confidence that the trend difference between models and observations during 1998–2012 is to a substantial degree caused by internal variability, with possible contributions from **forcing error** and some **models overestimating the response to increasing greenhouse gas (GHG) forcing**. Most, though not all, **models overestimate the observed warming trend in the tropical troposphere** over the last 30 years, and tend to **underestimate the long-term lower stratospheric cooling trend***".

Finally the neo-scientists resort to some hijacking of real science by pretending that their models are based on "sound" physical principles whereas they mistreat or betray them. For example, Randall et al. (2007) state "*Climate models are based on well-established physical principles and have been demonstrated to reproduce observed features of recent climate (see Chapters 8 and 9) and past climate changes (see Chapter 6)*". Clearly, from what Flato and Marotzke et al. (2013), p. 743, reported above just six years later this is not the case. But Randall et al. (2007) p. 600 continue "*One source of confidence in models comes from the fact that model fundamentals are based on established physical laws, such as conservation of mass, energy and momentum*". But every meteorological coupled circulation model does the same, they are very sophisticated pieces of software indeed, but they still cannot make any forecast beyond 15 days, not 15,000 years or 150,000 years! As if that was not enough, Randall et al. (2007) p. 596 resort to Newton to ascertain some legitimacy to their computerized fantasies "*Climate models are derived from fundamental physical laws (such as Newton's laws of motion), which are then subjected to physical **approximations** appropriate for the large-scale climate system, and then further **approximated** through mathematical discretization. Computational constraints restrict the resolution that is possible in the discretized equations, and some representation of the large-scale impacts of **unresolved processes** is required (the **parametrization** problem)*". May I dare to summarize to save the mind of poor Newton, we deal with approximations that are further approximated with unresolved processes that require parametrizations! What a mess! And one should have absolute confidence in that sort of science supposed to represent the sound basis for extraordinarily coercive social policies, preventing you from traveling to save the planet, ruining your most fundamental constitutional liberties, claiming that there is a social cost of carbon[284], the ultimate non-sense, and that you should pay the price to redeem your sins! There are no social costs whatsoever, there are only benefits

284 https://en.wikipedia.org/wiki/Social_cost_of_carbon

and as Idso (2013) states "*For a 300-ppm increase in the air's CO_2 content, for example, herbaceous plant biomass is typically enhanced by 25 to 55%, representing an important positive externality that is absent from today's state-of-the-art social cost of carbon (SCC) calculations. The present study addresses this deficiency by providing a quantitative estimate of the direct monetary benefits conferred by atmospheric CO_2 enrichment on both historic and future global crop production. The results indicate that the annual total monetary value of this benefit grew from $18.5 billion in 1961 to over $140 billion by 2011, amounting to* ***a total sum of $3.2 trillion over the 50-year period 1961-2011****. Projecting the monetary value of this positive externality forward in time reveals it will likely bestow an additional $9.8 trillion on crop production between now and 2050*". We walk on our heads, there are only benefits to have some more CO_2, the gas of life. How could we become so wacky?

Finally and it looks by now more like humor than anything else, as if climate was not made first and foremost of precipitation, Randall et al. (2007) p. 591, 600, 601 tell us "*There is considerable confidence that Atmosphere-Ocean General Circulation Models (AOGCMs) provide credible quantitative estimates of future climate change, particularly at continental and larger scales. Confidence in these estimates is higher for some climate variables (e.g., temperature) than for others (e.g., precipitation)*". Enjoy first the word "confidence" which defines this strange Physics and then take good notice that we do not know where it is going to rain (no wonder, nobodies does beyond two weeks) but we know what the temperature will be as suffice it to claim that more CO_2 (+0.007% of the overall atmospheric composition, i.e. 70 ppm) will equal with A LOT warmer! What an interesting forecast, how much did we have to spend for that one?

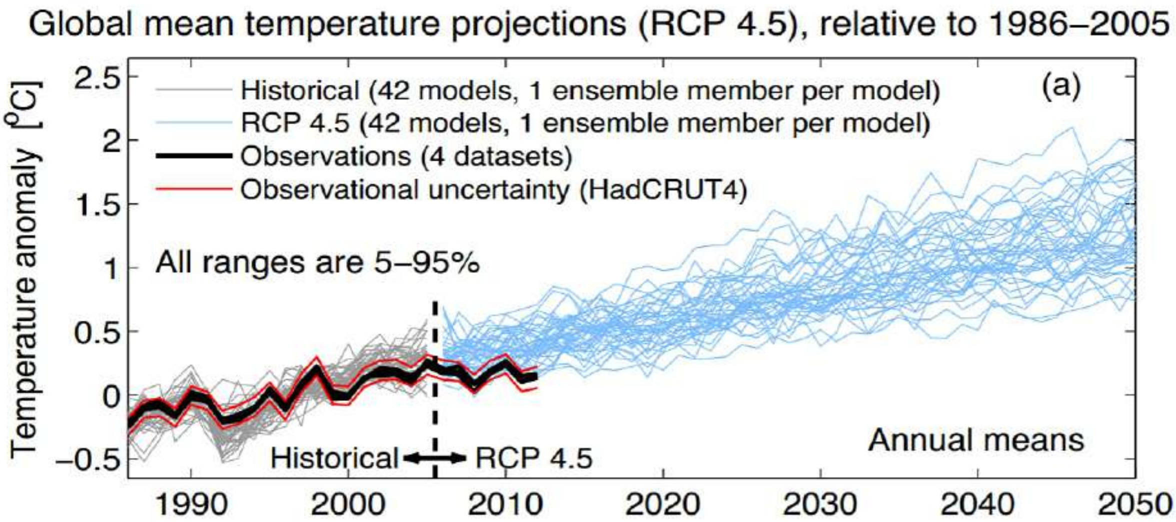

Figure 101. IPCC-AR5 *Figure 11.9 | (a) Projections of global mean, annual mean surface air temperature 1986–2050 (anomalies relative to 1986–2005) under RCP4.5 from CMIP5 models (blue lines, one ensemble member per model), with four observational estimates: Hadley Centre/Climate Research Unit gridded surface temperature data set 3 (HadCRUT3); European Centre for Medium range Weather Forecast (ECMWF) interim reanalysis of the global atmosphere and surface conditions; Goddard Institute of Space Studies Surface Temperature Analysis; National Oceanic and Atmospheric Administration for the period 1986–2011 (black lines). Note that UAH data series are not among the data sets used. Source (IPCC, 2013), p. 981.*

As one can see from the global mean temperature projections provided by (IPCC,2013), i.e. Figure 101, the ensemble model runs appearing here as a set of blue spaghettis are far from the observations that creep at the bottom of the graph, hardly taking off from the 0 (zero) level of the temperature anomalies and it will be explained that the models rendering the best the observations in this set are the various versions of the Institute of Numerical Mathematics of the Russian Academy of Sciences (INM RAS) Climate Model (CM). Before considering why the Russian models appear to perform much better than all the others, let's remind that when Randall et al. (2007) p. 600 state "*One source of confidence in models comes from the fact that model fundamentals are based on established physical laws, such as conservation of mass, energy and momentum*" they implicitly make reference to the Navier-Stokes equations, a set of partial differential equations which describe the motion of viscous fluid substances, and express conservation of momentum, conservation of mass, and conservation of energy. They are usually accompanied by an equation of state relating pressure, temperature and density. The Navier-Stokes equations are usually understood to mean the equations of fluid flow with a particular kind of stress tensor, but the GCMs do not really use Navier-Stokes equations. The base of an atmospheric GCM is a set of equations called the "primitive equations"[285]. These represent conservation of momentum, the continuity equation (conservation of mass), the first law of thermodynamics (conservation of thermal energy) and lastly, an equation of state. If we track water vapor we need another continuity equation. The atmosphere can be assumed to be in hydrostatic equilibrium at the scales modeled, ~10-100 Km, i.e. the pressure-gradient force prevents gravity from collapsing Earth's atmosphere into a thin, dense shell, whereas gravity prevents the pressure gradient force from diffusing the atmosphere into space (hydrostatic balance can be regarded as a particularly simple equilibrium solution of the Navier–Stokes equations) or in quasi-hydrostatic state (models relax the precise balance between gravity and pressure gradient forces by including in a consistent manner cosine-of-latitude Coriolis terms), see Marshall et al. (1997). The ocean part is similar, but continuity amounts to zero divergence, because the ocean is taken to be incompressible. This set of hyperbolic partial differential equations is then discretized and solved by different means (Grossmann and Roos, 2007).

Then come phenomenons that cannot be taken into account at the grid level as they all occur at scales far below the "grid scale", and thus are addressed differently and are often referred to as parametrizations (Hourdin et al., 2017) and include phenomenons such as condensation and precipitations, radiation and the way aerosols are taken into account e.g. Yu et al. (2018) for the NSF/DoE Community Earth System Model (CESM), friction, etc., and this is where the main intractable problems occur as these cannot follow in any respect physical laws, because either these laws are elusive or because we don't know how to model them. Thus, the claim often made that GCMs are based on first-principle physics and primitive equations simply ignores the parameterizations and tuning above mentioned. If the models were truly based on physics, there would be no need for tuning, it would work properly 'right out of the box'. This is why claiming that GCMs rests firmly on well established physical laws to impress the public is either an outright simplification or a more subtle deception.

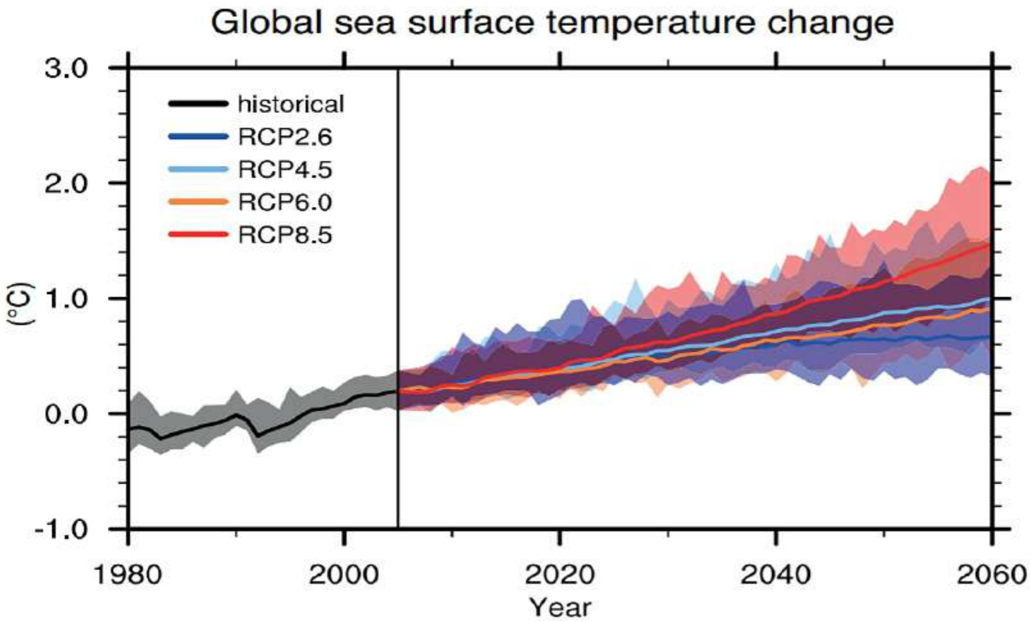

Figure 102. IPCC-AR5 *Figure 11.19 | Projected changes in annual averaged, globally averaged, surface ocean temperature based on 12 Atmosphere–Ocean General Circulation Models (AOGCMs) from the CMIP5 (Meehl et al., 2007b) multi-model ensemble, under 21st century scenarios RCP2.6, RCP4.5, RCP6.0 and RCP8.5. Shading indicates the 90% range of projected annual global mean surface temperature anomalies. Anomalies computed against the 1986–2005 average from the historical simulations of each model. Source (IPCC, 2013), p. 993.*

The excessive warming of the CMIP5 set of slow-cookers software fantasies is even acknowledged by IPCC (2013) "*The discrepancy between simulated and observed GMST trends during 1998–2012 could be explained in part by a tendency for some CMIP5 models to simulate stronger warming in response to increases in greenhouse gas (GHG) concentration than is consistent with observations... Another possible source of model error is the poor representation of water vapour in the upper atmosphere... It has been suggested that a reduction in stratospheric water vapour after 2000 caused a reduction in downward longwave radiation and hence a surface-cooling contribution (Solomon et al., 2010), possibly missed by the models*" Chapter 9, p. 771.

285 The primitive equations are a set of nonlinear differential equations that are used to approximate global atmospheric flow and are used in most atmospheric models., they are atmospheric equations of motion under the additional assumption of hydrostatic equilibrium for large-scale motions. https://en.wikipedia.org/wiki/Primitive_equations for an introduction.

But the graph reproduced Figure 102, of the global sea surface temperature change forecasts does not appear much more convincing given the extremely large dispersion of the possible scenarios, and it will be reported by Frank (2019) that the situation is serious as the absence of a unique solution puts these models outside of the field of empirical science as they are simply not refutable (Popper, 1935, 1959; Sidiropoulos, M., 2019a-b) and as they do not portend any valuable information or forecast if considered how errors can cumulate over simulation cycles when they are correctly propagated and how they lead to unsustainable and extraordinary uncertainty ranges. In fact, the origin of the errors is multiple and Browning has a very long and extensive experience of the sources of error applying to numerical integration of formal set of equations (with special emphasis on symmetric hyperbolic sets of partial differential equations) having an application in meteorological or oceanic representations, e.g. Browning, et al. (1980, 1989), Browning and Kreiss (1986, 1994, 2002) and Browning (2020) using the mathematical Bounded Derivative Theory (BDT). Browning reminds that there are many sources of error in numerically approximating a system of time dependent partial differential equations and then using the numerical model to forecast reality.

He states that the total error E can be considered to be a sum of the following errors $e_{i:}$ $E = \sum e_{i:} = DDE + SD + TD + F + ID$ where:

- DDE, represents the error in the continuum dynamical differential equations versus the system that actually describes the real motion and contains errors from inappropriate descriptions of the dynamics, be they incorrect physical assumptions or too large of dissipative terms ;
- SD, the spatial discretization (truncation) error is linked to the errors due to insufficient spatial resolution ;
- TD, the time discretization (truncation) errors are due to insufficient temporal resolution;
- F, the errors in the "forcing" (parameterizations versus real phenomena), these errors result from incorrect specification of the real forcing ;
- ID, the error in the initial data.

It has been shown that SD and TD are not dominant for second order finite different approximations of the multi-scale system that describes large (1000 km) and mesoscale (100 km) features. Browning states "*We have shown that these scales can be computed without any dissipation and it is known that the dissipation for these scales is negligible. It has been proved mathematically that the multi-scale system accurately describes the commonly used fluid equations of motion for both of these scales. We are left with F and ID and we have shown that F is large, e.g. the boundary layer approximation, and ID is large because of the sparse density of observations even for the large scale (Gravel et al., 2020). Thus there is no need for larger computers until F and ID are not the dominant terms*".

Currently all global climate (and weather) numerical models are numerically approximating the primitive equations (see note above 253), i.e. the atmospheric equations of motion modified by the hydrostatic assumption. But, Browning (2020) asserts that "*It is well known that the primitive equations are ill posed when used in a limited area on the globe (…) this is not the system of equations that satisfies the mathematical estimates required by the BDT for the initial data and subsequent solution in order to evolve as the large scale motions in the atmosphere*", and reminds that the equations of motions for large-scale atmospheric motions are essentially a hyperbolic system, that with appropriate boundary conditions, should lead to a well-posed system in a limited area. The correct dynamical system is presented in the new manuscript of Browning (2020), and introduces a 2D elliptic equation for the pressure and a 3D equation for the vertical component of the velocity and goes into the details of why the primitive equations are not the correct system. Having done that, Browning (2020) can, in two short points, stress why the GCM relying on the wrong set of equations are inappropriate for any forecasting:

- "*Because the primitive equations use discontinuous columnar forcing (parameterizations), excessive energy is injected into the smallest scales of the model. This necessitates the use of unrealistically large dissipation to keep the model from blowing up (…) this substantially reduces the accuracy of the numerical approximation*";
- "*Because the dissipation in climate models is so large, the parameterizations must be tuned in order to try to artificially replicate the atmospheric spectrum. Mathematical theory based on the turbulence equations has shown that the use of the wrong amount or type of dissipation leads to the wrong solution. In the climate model case, this implies that no conclusions can be drawn about climate sensitivity because the numerical solution is not behaving as the real atmosphere*".

Of all the error terms listed above, Frank (2019) studies how just errors on F (and specifically tackling just one), when propagated throughout the simulation cycles of the software systems lead to valueless forecasts given the resulting uncertainty ranges. Frank (2019) starts from the ±4 Wm^{-2} cloud forcing error provided in Lauer and Hamilton (2013). Essentially, it's the average cloud forcing error made by CMIP5-level GCMs, when they were used to hindcast 20 years of satellite observations of global cloud cover (1985-2005). The differences between observed and CMIP5 GCM hindcast global cloud cover were published in Jiang et al. (2012). The difficulty to publish his manuscript has led Patrick Frank to wonder whether climate modelers are scientists. Frank (2015) stated "*Climate modelers are not scientists. Climate modeling is not a branch of physical science. Climate modelers are unequipped to evaluate the physical reliability of their own models*". The analysis of the tentative submission(s) and corresponding review reports shows that it is amazing to observe that beyond confusing accuracy with precision the reviewers also take an uncertainty range (resulting of the normal propagation of errors) for a potential physical temperature (anomaly). This paper has also led to a comprehensive exchange of arguments between Frank and Patrick Brown in Brown (2017). All that demonstrates that the entire climate-illusion beyond sloppy physics and moot modeling as reminded by Browning (2020) rests on GCMs that have no predictive value as explained by Frank (2019).

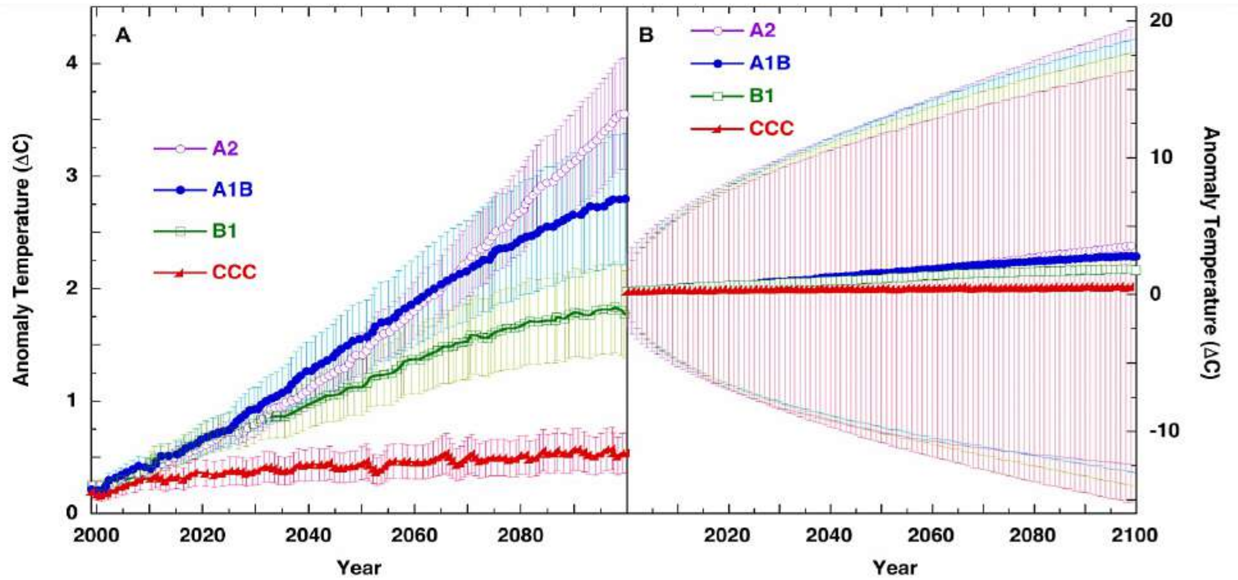

Figure 103. *Panel (A), SRES scenarios from IPCC AR4 WGI Figure SPM.5 (IPCC, 2007) p.14, with uncertainty bars representing, the±1 standard deviation range of individual model annual averages. Panel (B) the identical SRES scenarios showing the ±1σ uncertainty bars due to the annual average ±4 Wm^{-2} CMIP5 TCF long-wave tropospheric thermal flux calibration error propagated in annual steps through the projections. After Frank (2009).*

SRES in (A) refers to the IPCC Special Report on Emission Scenarios (Nakićenović et al., 2000; IPCC, 2000). Approximate carbon dioxide equivalent concentrations corresponding to the computed radiative forcing due to anthropogenic greenhouse gases and aerosols in 2100 (see p. 823 of the TAR) are the following for the various scenarios illustrated here: for the SRES B1 (600ppm), A1B (850ppm), A2 (1250ppm) and CCC corresponds to the case were the concentrations were held constant at year 2000 values. Figure 103 (B) shows the growing uncertainties resulting from the propagation of errors, i.e. the ±4 Wm^{-2} cloud forcing error as per Lauer and Hamilton (2013), due to the iterative process implemented in fact by any GCMs simulation software. This leads Frank (2019) to state "*Uncertainty in simulated tropospheric thermal energy flux imposes uncertainty on projected air temperature*" and conclude "*The ±4 Wm^{-2} year^{-1} annual average LWCF thermal flux error means that the physical theory within climate models incorrectly partitions energy among the internal sub-states of the terrestrial climate. Specifically, GCMs do not capture the physical behavior of terrestrial clouds or, more widely, of the hydrological cycle (Stevens and Bony, 2013)*". As shown on the previous Figure 103, the propagation of the long-wave cloud forcing (LWCF) thermal energy flux error through the IPCC SRES scenarios CCC, B1, A1B, and A2 leads to uncover a massive ±15 C **uncertainty** in air temperature at the end of a centennial-scale projection. An uncertainty should not be understood as a physical temperature range, it is the visible knowledge failure or uncertainty that results from the iterative propagation of just one of the many errors embedded in GCMs. Thus Frank (2019) asserts "*Analogously large but previously unrecognized uncertainties must therefore exist in all the past and present air temperature projections and hindcasts of even advanced climate models. The unavoidable conclusion is that an anthropogenic air temperature signal cannot have been, nor presently can be, evidenced in climate observables*". If the reader believes that this affirmation is made on lightly further to Frank's (2019) paper, one is encouraged to read the extremely detailed answer provided by Frank to Patrick Brown in Brown (2017). More about models deficiencies along the same line of reasoning is presented in Hooper and Henderson (2016) and Henderson and Hooper (2017). A very complete study of the limitations of GCMs is provided by Lupo and Kininmonth (2013).

Of all the simulations performed during the Coupled Model Intercomparison Project Phase 5 (CMIP5) one can easily see from Figures 101 and 102 that models compare badly with observations and that little to no credence can be put into their future predictions. Among them, the INM RAS (Institute of Numerical Mathematics of the Russian Academy of Sciences) Climate Model 4, i.e. INMCM4 is an outliers, as it was certainly the one performing the best, not showing a totally unrealistic global warming as a response to GHG increase, though acknowledging many limitations (Figure 99). It is noticeable to observe the reasons behind this semblance of adherence to the observations:

1. INMCM4 has the lowest "*sensitivity of 4.0 K to a quadrupling of CO_2 concentration*" (Volodin et al., 2013). That is 37% lower than multi-model mean;
2. INMCM4 has by far the highest climate system inertia and deep ocean heat capacity in INMCM4 is set at a value of 317 W yr m^{-2} K^{-1}, which is a value situated at 200% of the multi-model average ;
3. INMCM4 exactly matches observed atmospheric H_2O content in lower troposphere (at 215 hPa), and is biased low above that layer while most others are biased high.

So the model that most closely reproduces the temperature history has high inertia from ocean heat capacities, low forcing from CO_2 and less water for unrealistic positive feedback. The obvious reason why other models are not designed like INMCM4 is that it does not support the man-made catastrophic story telling of IPCC of disastrous climate change resulting from CO_2 increase. What is even more interesting is the appreciation of the authors the INMCM4 model, Volodin and Gritsun (2018) who state "*Numerical experiments with the previous model version (INMCM4) for CMIP5 showed unrealistic gradual warming in 1950–2014*", therefore making it extremely clear, that what could be considered the best of all models, was not still evaluated as realistic by its own authors. The INMCM4 performances were detailed in Volodin et al. (2013). The evolution of INMCM4.0 lead to the INM-CM48 version with two major improvements: a) the use of more advanced parameterizations of clouds and condensation and b) interaction of aerosols with the radiation. Some other adjustment of other parameterizations were also performed. The next stage was to better model the stratosphere dynamics and its influence on the troposphere and was performed with the next generation INM-CM5 (Volodin et al., 2017; 2018; Volodin and Gritsun, 2018). Such model requires several hundred processors for the efficient computation on a supercomputer with distributed memory. Volodin et al. (2017) report "*A higher vertical resolution for the stratosphere is applied in the atmospheric block. Also, we raised the upper boundary of the calculating area, added the aerosol block, modified parameterization of clouds and condensation, and increased the horizontal resolution in the ocean block*" and the authors also focused on reducing systematic errors and phenomenons poorly handled or represented in previous versions.

Beyond the two main parts of such coupled ocean-atmosphere simulation systems, i.e. the general circulation of the atmosphere and of the ocean, the emergence of a generation Earth System Models (ESM) is based on the incorporation of other components of the climate system represented as additional software modules, e.g. models of the land surface (active layer, vegetation, land use), sea ice, atmospheric chemistry, the carbon cycle, etc. Hydrodynamics differential equations in the atmospheric module are solved in the quasi-static approximation with the finite difference method - see e.g. Grossmann and Roos (2007) - which is of second order in space and first order in time, but Volodin et al. (2017) state that "*Formally, there are no exact conservation laws in the finite difference model*". Compared to the INM-CM4 version, all resolutions are improved, the grid is finer and cells are 2° × 1.5° (longitude x latitude) and the vertical modeling contains 73 vertical levels with a vertical resolution in the stratosphere of about 500m, and the upper boundary of the calculating area lies at the altitude of about 60 km, about twice as much as in the previous version, and enables a much improved representation of the dynamics of the stratosphere. Within the cells, at the grid level, phenomenons are represented by parametrizations, i.e. atmospheric radiation, deep and shallow convection, orographic, and non-orographic, gravity-wave drag and processes in the soil, land surface, and vegetation. In the new INM-CM5 version the proportion of the cells occupied by clouds and cloud water content is calculated according to the prognostic scheme of Tiedtke (1993) for stratiform and convective clouds where their formation and evolution is considered in relation with the large-scale ascent diabatic cooling, boundary-layer turbulence, and horizontal transport of cloud water from convective cells and their disappearance is through adiabatic and diabatic heating, turbulent mixing, and depletion of cloud water by precipitation. In the GC ocean module, the hydrodynamics differential equations of the ocean are solved with the finite difference method on a generalized spherical coordinates grid with a resolution of 0.5° × 0.25° (longitude x latitude) and 40 levels vertically, using an explicit scheme for solving the transport equation with an iterative method for solving equations for the sea level and barotropic[286] components of velocity.

286A barotropic fluid is a fluid whose density is a function of pressure only.

Volodin et al. (2017) explain that the explicit scheme was used as it opened possibilities to "*adapt the algorithm of the model to massively parallel computers; The optimal numbers of processor cores for a given spatial resolution, as derived for the Lomonosov supercomputer in Moscow State University and supercomputer of the Joint Supercomputer Center of Russian Academy of Science, are 96 for atmospheric and aerosol blocks and 192 for the ocean block, i.e., 384 cores in total for the whole model. Under these conditions, the count rate is about 6 years of modeled time for one day of computer time*". Running such a system for a simulation spanning say 2,000 years, would take approximately an entire year of computing power of the most powerful Russian super-computers using 384 cores in parallel computing[287]. This is a key information and it puts a lid on all claims made by any other author(s) or any other group(s) – e.g. (Lloyd, 2012) - that would pretend to succeed the modeling of the Holocene or more or would report such achievements! Volodin et al. (2017) have been extremely honest and have disclosed the state of the art of current Earth System Models with appropriate details and this entails much respect. A lot more information are provided by these authors about how they connect supplementary modules dealing with aerosols, ice-sheets, etc. and the frequency with which these modules are solicited by the parametrizations. The reader is encouraged to consider the following references: (Galin et al., 2007; Volodin, 2017; Volodin and Gritsun, 2018; Volodin et al., 2010, 2013, 2017, 2018).

Having been reminded that, Volodin and Gritsun (2018) put their INM-CM5 Earth System Model at work and perform seven historical runs for the 1850–2014, not the Holocene !, and provide a clear, honest and very informative report of where the best model stands so far. Here is what Volodin and Gritsun (2018) report "*All model runs reproduce the stabilization of GMST in 1950–1970, fast warming in 1980–2000, and a second GMST stabilization in 2000–2014. The difference between the two model results could be explained by more accurate modeling of the stratospheric volcanic and tropospheric anthropogenic aerosol radiation effect (stabilization in 1950–1970) due to the new aerosol block in INM-CM5 and more accurate prescription of the TSI scenario (stabilization in 2000–2014)*". The authors also report the limitations encountered as simply no model trajectory reproduces the correct time behavior of the AMO and PDO indexes. From thereof they make very bold statements such as "*the correct prediction of the GMST changes in 1980–2014 and the increase in ocean heat uptake in 1995–2014 does not require correct phases of the AMO and PDO as all model runs have correct values of the GMST, while in at least three model experiments the phases of the AMO and PDO are opposite to the observed ones in that time*".

Failing to account for the correct phases of the AMO and PDO and still getting some decent values for the GMST does not entail that there is no need to correctly model the AMO and PDO to obtain correct GMST. It just means that this very specific system gave the appearance of correctly modeling the temperature even though it was unable to render the state of the oscillations known to have a direct impact on the climate. Volodin and Gritsun (2018) further add "The North Atlantic SST time series produced by the model correlates better with the observations in 1980–2014. Three out of seven trajectories have a strongly positive North Atlantic SST anomaly as in the observations (in the other four cases we see near-to-zero changes for this quantity)". It means that less than 43% of the runs, over just a total of 7, have managed to account for the SST anomalies. The worse deviation is for the the rate of sea ice loss which is underestimated by a factor between 2 and 3 with extreme dispersion as in one extreme case the magnitude of this decrease is as large as in the observations, while in the other the sea ice extent does not change compared to the preindustrial age. From all these runs with what seems the best state of the art system as it reasonably well account for the GMST, the natural strong internal variability of Arctic sea ice and internal variability of the AMO dynamics remain far beyond current science and technology.

Let's compliment Volodin and Gritsun for their achievements and their honest account of the strengths and weaknesses of their latest NM-CM5 Earth System Model. At the same time, failing to account for the major AMO and PDO oscillations does not reinforce credence into the proper representation of the climate system as accounting better for the GMST than others does not ensure that this is not the result of the providence. As reminded by Christy (2016) "*a fundamental aspect of the scientific method is that if we say we understand a system (such as the climate system) then we should be able to predict its behavior. If we are unable to make accurate predictions, then at least some of the factors in the system are not well defined or perhaps even missing. [Note, however, that merely replicating the behavior of the system (i.e. reproducing "what" the climate does) does not guarantee that the fundamental physics are well-known. In other words, it is possible to obtain the right answer for the wrong reasons, i.e. getting the "what" of climate right but missing the "why".]*".

Said just slightly differently, understanding enables forecasting, science has always worked that way. As long as climate story tellers cannot forecast when and where the next drought, the next flood, the next heat-waves, the next El Niño,

287https://www.open-mpi.org/ Open Source High Performance Computing based on a A High Performance Message Passing Library.

etc., will happen, they just show that their understanding of the phenomenons they pretend to master so well that their computerized fantasies would be able to ascertain to a fraction of a degree the global temperature a century from now is just a fake propaganda designed to pursue a social engineering agenda, mind and population control, wealth redistribution, de-industrialization as a means to fight capitalism, etc., and that this has nothing to do with science. If they cannot say anything meaningful about the climate just a month from now, not a year or a decade or a century, no, just ONE month, their models, their computer systems and their gibberish is worthless, they should shut up.

It is interesting to note that scholars who have devoted an entire life to climate models and climate dynamics are starting to be extremely cautious with respect to the kind of expectations that one can have with climate simulation systems. In fact, the more they acknowledge the importance of natural climate variability the more they explain that the best forecasts they can expect of their systems **is no forecast at all**.

This trend started in 2010 with a paper from Deser et al. (2012) where the authors used the National Center for Atmospheric Research (NCAR) Community Climate System Model Version 3 (CCSM3) to evaluate how natural variability, i.e. the real climate, would affect the runs. Deser et al. (2010) assert "*The dominant source of uncertainty in the simulated climate response at middle and high latitudes is internal atmospheric variability associated with the annular modes of circulation variability. Coupled ocean-atmosphere variability plays a dominant role in the tropics, with attendant effects at higher latitudes via atmospheric teleconnections*". Surprisingly enough, it is nearly acknowledged that the climate is not made of more or less of CO_2, but of a vast number of systems interacting, though one can doubt that the simulator does represent them all and them well, and already in 2010, it was further stated that "*the Internal variability is estimated to account for at least half of the inter-model spread in projected climate trends during 2005–2060 in the CMIP3 multi-model ensemble*".

This cautious trend seems to be more and more in fashion as a recent paper by Maher et al. (2020) with Marotzke as co-author and studying the role of internal variability in future expected temperature start by acknowledging that "*On short (15-year) to mid-term (30-year) time-scales how the Earth's surface temperature evolves can be dominated by internal variability as demonstrated by the global-warming pause or 'hiatus'*". Mentioning the 'hiatus' is also saying that the exponential increase of man-made CO_2-emissions has not led to a monotonic or worse accelerated increase of the temperature, there has simply not been any relationship: when emissions where still limited a rapid increase (1922-1941) led to a top in the 40ties, then a stabilization of GMST in 1950–1970, fast warming in 1980–2000, and a second GMST stabilization in 2000–2014 (Akasofu, 2013) when emissions were accelerating fast, all that shows that GMST evolved independently of the rates of the anthropogenic emissions. As if experienced scholars were already doubting that the catastrophic changes or even very noticeable climate changes would over the next 30 years – or ever happen, Maher et al. (2020) state "*We confirm that in the short-term, surface temperature trend projections are dominated by internal variability, with little influence of structural model differences or warming pathway. Finally we show that even out to thirty years large parts of the globe (or most of the globe in MPI-GE and CMIP5) could still experience no-warming due to internal variability*".

Finally, as for Deser et al. (2012) ten years before, the real climate system and its variability is back on stage in the foreground, relegating CO_2 not to the second roles, nor even to the background but to no mention at all, and lately Maher et al. (2020) say "*Additionally we investigate the role of internal variability in mid-term (2019-2049) projections of surface temperature. Even though greenhouse gas emissions have increased compared to the short-term time-scale, we still find that* ***many individual locations could experience cooling or a lack of warming*** *on this mid-term time-scale due to internal variability*". This is worth repeating what they dare say in this paper, that after we've been told by pundits that the tropics will have reached Paris (France) in 30 years, it seems now that some better advised scholars start preparing us to an eventual cooling for the next 30 years should things go astray, just in case natural variability plays a bad trick on them.

This trend continues with an honest paper co-authored by twenty leading scientists developing computer models of the climate where Deser et al. (2020) report of the extraordinary computing resources used for just one Large Ensemble (LE) "*the CESM1-LE used 21 million CPU hours and produced over 600 terabytes of model output*" to obtain modest results where it is stated that "***Internal variability in the climate system confounds assessment of human-induced climate change and imposes irreducible limits on the accuracy of climate change projections****, especially at regional and decadal scales*".

As to the accuracy of the climate models or rather inaccuracies, they certainly diverge from reality when observed data is not assimilated to force them back towards reality, which is not surprising as meteorological forecasting systems do the same when not put back on track every six hours or so. This has led Pielke (1998) to state " *This is one (of a number of reasons) that I have been so critical of multi-decadal climate predictions. They claim that these are different types of prediction (i.e. they call "boundary forced" as distinct from "initial value" problems), but, of course, they are also initial value predictions*". Rial et al. (2004) p. 30, do not appear more optimistic when it comes to climate prediction "*our examples lead to an inevitable conclusion: since the climate system is complex, occasionally chaotic, dominated by abrupt changes and driven by competing feedbacks with largely unknown thresholds, climate prediction is difficult, if not impracticable. Recall for instance the abrupt D/O warming events (Figure 3a) of the last ice age, which indicate regional warming of over 10°C in Greenland (about 4°C at the latitude of Bermuda). These natural warming events were far stronger – and faster – than anything current GCM work predicts for the next few centuries. Thus, a reasonable question to ask is: Could present global warming be just the beginning of one of those natural, abrupt warming episodes,.. ?*".

As we have seen in the sections before, models also have a hard time to cope with the most basic short-term observations in a variety of domains, ranging from the modeling of the Arctic sea ice and its extent, as they are well known to overestimate Arctic warming (Huang et al., 2019) and produce as shown Figure 82 p.200, taken from Eisenman et al. (2011) ludicrous estimates used by the IPCC to forecast the summer minimum in Arctic sea ice in the year 2100 (relative to the period 1980–2000), but also fail among other severe weaknesses to account for the cooling that can be expected of the volcanic aerosols as reported by Chylek et al. (2020) who even state furthermore that solar variability is not even taken care of at all "*The CMIP5 models also greatly underestimate the effect of solar variability on both hemispheres. In fact, in CMIP5 models there is effectively no influence of solar variability on temperature, while the analysis of the observed temperature suggests quite a significant effect, especially on the southern hemisphere, consistent with the global results of Folland et al. (2018)*". In fact, CMIP5 model just considerably overestimate the cooling that can be expected of volcanic aerosol, by 40-50% and Chylek et al. (2020) "*hypothesize that the models' parameterization of aerosol-cloud interactions within ice and mixed phase clouds is a likely source of this discrepancy*". One should notice that by over-tuning in general the aerosol response of the models (thus exacerbating the cooling) and not taking into account the solar variability enables to over-emphasize the impact of CO_2 by exaggerating its warming effect. If one thinks that it happens by a fluke, I do not, and as explained before when so many parameters can be tweaked or tuned, it is no wonder that one finds a means to put CO_2 at its expected place in the model adjusting its contribution and all others in hindcast.

A stunning recent study by Block et al. (2019) even shows, as far as the Arctic is concerned, that "*Climate models disagree on the sign of total radiative feedback in the Arctic*" in fact, models and simulations are split and only half of them show negative Arctic feedbacks which implies that Arctic local feedbacks alone suffice to adjust in a stable way Arctic surface temperatures in response to a radiative perturbation, and Block et al. (2019) claims "*Our results indicate that the large model spread does not only arise from different degrees of simulated Arctic warming and sea ice changes, but also from the dependency of these feedback components to largely different and incoherent representations of* ***initial temperatures and sea ice fractions*** *in the preindustrial control climate which inversely relate to the exhibited model warming.*" This not only does not provide a lot of confidence in the models and their results, but it also delivers a brilliant demonstration of what Peilke Sr. (1998) stated "*In fact, multi-decadal climate predictions are claimed to be different types of prediction (i.e. called "boundary forced" as distinct from "initial value" problems), but, of course, they are also initial value predictions*" and demonstrates the extreme fragility of such systems as large differences in initial sea ice cover and surface temperatures determine the increased spread in estimated warming.

And, if one is using a model that is either missing one or more non-trivial parameters, or if one or more parameters are wrong because of inaccurate measurements (or subsequent 'corrections') and the model is 'tuned' to get historical agreement, then the arbitrary adjustment provides no assurance that the adjustment will work beyond the interval of time used for tuning. That is, it becomes a process of fitting a complicated function to observational data that is only valid for a limited time interval; not unlike fitting a high-order polynomial and naively expecting predictions to be useful.

As the climate is first and foremost characterized by the precipitations as per Köppen-Geiger (Köppen, 1884a-b, 1936), a basic test to evaluate their relevance is to check the models against the precipitation records. This approach is followed by Anagnostopoulos et al. (2010) and also Koutsoyiannis et al. (2008) who propose a study with a special emphasis on the observed precipitations that "*compares observed, long climatic time series with GCM-produced time series in past periods in an attempt to trace elements of falsifiability, which is an important concept in science (according to Popper, 1983, '[a] statement (a theory, a conjecture) has the status of belonging to the empirical sciences if and only if it is falsifiable')*". From thereoff, the authors observe that "*At the annual and the climatic (30-year) scales,* *GCM interpolated series are irrelevant to reality. GCMs do not reproduce natural over-year fluctuations and (…) show that model predictions are much poorer than an elementary prediction based on the time average. This makes future climate projections at the examined locations not credible*".

This strongly refutes the hypothesis that the climate can be deterministically forecast, that climate models could be used to such an endeavor and that this would make any sense to use these GCMs relying on hypothesized anthropogenic climate change to address the availability of freshwater resources and their management, adaptation and vulnerabilities as conjectured, e.g. by Kundzewicz et al. (2007, 2008). If climate models would rest on a comprehensive and satisfactory theory of climate, such a theory would describe exactly how climate responds to the radiative physics of GHGs: how convection reacts, how cloud properties and amounts are affected, how precipitations adjust, and so forth, all which to have been verified by direct comparison to accurate observations. Of course, none of this is available and has been done, and indeed does appear not possible, and none of this physics is known to be properly represented in the models.

Thus, one will not be disappointed by the dismal performance of the GCMs and by their inability to make any reliable forecast, especially with respect to the crucial aspect of precipitations which are at the core of climate. Most of this delusion comes from the fact that even though it is well agreed that the weather is chaotic and can only be forecast for a week or so, meteorological systems being constantly put back on track by means of all sets of observations, climate would be less as it would be more a boundary-forced system than an initial-value dependent problem.

It is interesting to observe how the official IPCC stance on that matter has evolved from 2001 where it was stated with some realism «*The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future climate states is not possible*», IPCC – 2001 – TAR-14 – «Advancing Our Understanding», p. 771., to 2007 when unfortunately, this bout of lucidity has quickly vanished into the wispy streamers of the IPCC illusion machine and Randall et al. (2007) have peremptorily declared "*Note that the limitations in climate models' ability to forecast weather beyond a few days do not limit their ability to predict long-term climate changes, as these are very different types of prediction*", an unsubstantiated claim that would make climate predictable. This could not be further from the truth, and already some time ago Mandelbrot and Wallis (1969) offer investigative observational proof that such a claim is wrong: they looked at the statistics of 9 rainfall series, 12 varve series, 11 river series, 27 tree ring series, 1 earthquake occurrence series, and 3 Paleozoic sediment series and found no evidence for such a claim of distinctions between weather and climate.

Basically, Mandelbrot and Wallis (1969) p. 556-557 stated "*That is, **in order to be considered as really distinct, macro-meteorology and climatology should be shown by experiment to be ruled by clearly separated processes**. In particular, there should exist at least one time span λ, on the order of magnitude of one lifetime, that is both long enough for macro-meteorological fluctuations to be averaged out and short enough to avoid climate fluctuations. (…) It can be shown that, to make these fields distinct, the spectral density of the fluctuations must have a clear-cut "dip" in the region of wavelengths near λ, with large amounts of energy located on both sides. This dip would be the spectral analysis counterpart of the shelf in measurements of coast lengths. But, in fact, **no clear-cut dip is ever observed**. (…) However, even when the R/S pox diagrams are so extended, **they still do not exhibit the kind of breaks that identifies two distinct fields.***"

This means in plain English that if the weather is chaotic, the climate is as well, and we all know the weather is chaotic. Chaotic or not, one thing for sure, GCMs "*predictions*" are so out of sync with the observations that it makes them completely unsuitable for establishing any policies based on their fantasies. It is amazing to observe that in the same document where Randall et al. (2007) tout the ability of GCMs "*to predict long-term climate changes*" they also state that "*Models continue to have significant limitations, such as in their representation of clouds, which lead to uncertainties in the magnitude and timing, as well as regional details, of predicted climate change*" Randall, et al. (2007) p. 601. That deserves an award: how to say one thing and its contrary 170 pages apart in the same document. The "parametrization" of the clouds remains one the absolute weaknesses of the GCMs and this aspect is well covered, e.g. by Pielke, Sr., et al., (2007); Stevens and Bony (2013); Tsushimaa and Manabe (2013). Even though some progresses have been recently reported in that respect one should notice that cloud representation and parametrization remain highly prone to arbitrary adjustments as reported, e.g. by Muench and Lohmann (2020) "*The simulated ice clouds strongly depend on model tuning choices, in particular, the enhancement of the aggregation rate of ice crystals*".

In the end, it is worth noticing that Monckton of Brenchley et al. (2015a-b) propose a much simpler model than the GCMs which does not fare worse than their very sophisticated counterparts, the pieces of software supposed to be the ultimate weapons in climate-story telling. The model of Monckton of Brenchley et al. (2015a-b) is based on simple equations such as 82, and 83 and a low atmospheric sensitivity to CO_2 and though criticized by many stands perfectly the comparison. In some sense, this demonstrates that our imperfect knowledge of the carbon cycle is built into defective Earth Systems Models (ESMs) which produce the atmospheric CO_2 concentrations from different emissions scenarios that General Circulation Models (GCM, or climate models) use as input and Millar et al. (2017) have shown that the ESMs contribute to current models not only running too hot but simply astray.

Along the lines small is beautiful, some simple models succeed very well at reconstructing the Average Global Temperature (AGT), and compare more than favorably with much more sophisticated and opaque pieces of software characterized by their obscure operating intricacies, like CGMs. In that respect, studying the respective influence of Water Vapor (WV) and CO_2, Pangburn (2020) states and demonstrates how "*WV increase has been responsible for the human contribution to Global Warming with no significant net contribution from CO_2*". WV in the aforementioned study is the result of clear sky water vapor measurements over the non-ice-covered oceans in the form of total precipitable water (TPW)[288]. These measurements have been made since 1988 by Remote Sensing Systems (NASA/RSS) and use microwave radiometers to measure columnar (atmospheric total) water vapor, thanks to the properties of the strong water vapor absorption line near 22 GHz (RSS, 2020).

Pangburn (2020) asserts that "*Humanity's contribution to planet warming is from increased atmospheric water vapor resulting nearly all from increased irrigation. The increased CO_2 has negligible effect on warming. Climate Sensitivity, the temperature increase from doubling CO_2, is not significantly different from zero*". Pangburn (2018) studies how well AGT can be reconstructed by means of a simple algorithm employing clear observable variables which increments annually over the period of study. The algorithm uses three factors to explain essentially all of AGT change since before 1900. Pangburn (2018) selects "*ocean cycles, accounted for with an approximation, solar influence quantified by a proxy which is the SSN[289] anomaly and, the gain in atmospheric water vapor measured since Jan, 1988 and extrapolated earlier using measured CO_2 as a proxy*". The approach in the analysis is 'top down' where, instead of trying to account for multiple contributing pieces, the behavior of the system as a whole is examined in response to the selected contributing factors. Using input data through 2018, the results of the analysis in order of importance of the contributing factors and their approximate contributions to the temperature increase 1909 to 2018 are: 1) the (increase in) water vapor TPW, 60% 2) the net of all ocean Sea Surface Temperature (SST) cycles which, for at least a century and a half, has had a period of about 64 years, 22% and 3) the influence of variation of solar output quantified by the SSN proxy, 18%. This simple methodology provides temperature reconstructions which match closely (96+%) the observations. The model could be supplemented with additional observable variables would reliable time-series be available, like the cloud cover, the sensitivity to which is discussed in Pangburn (2015), e.g. "*Sustained increase of only about 1.7% of cloud area would result in an eventual temperature decline of 0.5 °C*".

The conclusion of Pangburn (2018) is well worth it, especially as it could prove correct, "*Humanity has wasted over a trillion dollars in failed attempts using super computers to demonstrate that added atmospheric CO_2 is a primary cause of global warming and in misguided activities to try to do something about it. An unfunded engineer, using only a desk top computer, applying a little science and some engineering, discovered a simple equation that unveils the mystery of global warming and describes what actually drives average global temperature*".

Let's see how Tennekes (2009) after a prolific and remarkably successful career[290] summarizes his position: "*Since heat storage and heat transport in the oceans are crucial to the dynamics of the climate system, yet cannot be properly observed or modeled, one has to admit that claims about the predictive performance of climate models are built on quicksand. Climate modelers claiming predictive skill decades into the future operate in a fantasy world, where they have to fiddle with the numerous knobs of the parameterizations to produce results that have some semblance of veracity.*" and "***Climate models cannot be verified or falsified** (if at all, because they are so complex) until after the fact. Strictly speaking, **they cannot be considered to be legitimate scientific products***".

288 One should notice that there is no contradiction with the decrease of the RH at the TOA developed at point 1) p. 66 as what is considered here is the Total Precipitable Water (TPW) for the entire column of air, which does not prevent variations to occur in the vertical distribution of water vapor in the column – of course, and thus changes of the level at the TOA where water vapor radiates towards the cosmos, which has come down slightly (though total TPW has increased).

289 Sun Spot Numbers as a proxy for the Sun activity, i.e. the time-integral of sunspot number anomalies.

290 https://en.wikipedia.org/wiki/Hendrik_Tennekes

3.4. IPCC own Tinkering & Tweaking Confession

"*The presence of H_2O in the CO_2 band (12-19μ) prevents the increase of temperature due to the saturation of the band, because the combined effect of CO_2 and H_2O yields an absorptivity that approaches unity, as in the black body case....the presence of H_2O in these interval (12-19μ) reduces the effect of CO_2 doubling, because the spectrum of CO_2 plus H_2O gets closer to Planck's curve, and there is* ***no room*** *for larger increases* ***in the spectrum****.* ***This saturation effect limits the temperature increase due to the increase of*** CO_2" Adem and Garduño (1998) in the detailed presentation of the equations ruling their ATM1 computer models.

Going through the section «9.8.3 Implications of Model Evaluation for Model Projection of Future Climate» (Flato and Marotzke et al., 2013) reveals the amazing level of «tinkering» that the authors consider normal in their assessment of the ensemble of models they review. Honestly, for any computer scientist, it is simply flabbergasting. Not only do they confess that it is better if the model(s) are somehow capable of reproducing past variations, amazing as one could have expected that to be the very minimum, but they also naively indicate that when projections of previous IPCC assessments have failed to materialize it is not that serious as «*these projections were not intended to be predictions over the short time scales for which observations are available to date*». So basically, models are unable to make short term predictions (say a few years to one decade) but we must trust them for making good computations for the Average Mean Temperature, decades from now! Well, not that much because «*longer-term climate change projections push models into conditions outside the range observed in the historical period used for evaluation*». As if things were not severe enough, they confess that weighing the models, i.e. just ad-hoc tweaking to make things better match, is a reasonable practice. The tuning will be made by adjustments according to past abilities demonstrated by the models to account for past observations not knowing if this will in any case be related to their future ability to forecast anything meaningful «*In some cases, the spread in climate projections can be reduced by weighting of models according to their ability to reproduce past observed climate*» (Flato and Marotzke et al., 2013) and this goes as far as «*the use of unequally weighted means, with the weights based on the models' performance in simulating past variations in climate, typically using some performance metric or collection of metrics*». The cherry on top of the cake is when it is written plain black on white that «*Another frequently used approach is the re-calibration of model outputs to a given observed value*» which means that making such sort of retro-fitting to anchor off the track computer programmes to some reference data is considered acceptable. What a mess for any computer scientists who has worked in the industry! I just could not believe it.

So models are unreliable, they fail to make any decent projections (at least IPCC honestly acknowledge it) and making weighted averages of them would improve their forecasting ability? Adjusting, tuning, parameterizing the models a posteriori to accommodate ex-post reference data points or observations that could not be properly accounted for in the first place is not a satisfactory practice. This could be somehow acceptable if the underlying physical principles were so sound that such adjustments would have no impact on the basic theories involved, but it is not the case as the computer models are supposed to help validate the AGW theory! Vicious circular reference. Let's make an astrometric analogy: let's compare the situation to an ensemble of incorrect orbits (for the same system), each unable to deliver any reliable ephemeris, and one would think that by making weighted averages of these, one would have any chance of getting an improved orbit ? Astronomers are going to laugh, indeed! This is just a spooky quackery and a feckless tampering of gimmicked models, what an outlandish and ludicrous claim to think that these computerized fantasies bear enough resemblance to reality that coercive policies could be based on them.

One should recall the very basic reasons why Gerlich and Tscheuschner (2009) dismissed climate models "*It cannot be overemphasized that even if these equations[291] are simplified considerably, one cannot determine numerical solutions, even for small space regions and even for small time intervals. This situation will not change in the next 1000 years regardless of the progress made in computer hardware. Therefore, global climatologists may continue to write updated research grant proposals demanding next-generation supercomputers ad infinitum. As the extremely simplified one-fluid equations are unsolvable, the many-fluid equations would be more unsolvable, the equations that include the averaged equations describing the turbulence would be still more unsolvable, if "unsolvable" had a comparative*". Furthermore, these authors elaborate on the issue of boundery conditions and Gerlich and Tscheuschner (2009) state "*There are serious solvability questions in the theory of non-linear partial differential equations and the shortage of numerical recipes leading to sufficient accurate results will remain in the nearer or farer future - for fundamental*

291 MHD-type global climatologic equations

mathematical reasons. The Navier-Stokes equations are something like the holy grail of theoretical physics, and a brute force discretization with the aid of lattices with very wide meshes leads to models, which have nothing to do with the original puzzle and thus have no predictability value. In problems involving partial differential equations <u>*the boundary condition determine the solutions much more than the differential equations themselves*</u>*. The introduction of a discretization is equivalent to an introduction of artificial boundary conditions, a procedure, that is characterized in von Storch's statement "The discretization is the model". Thus there is simply no physical foundation of global climate computer models, for which still the chaos paradigma holds: Even in the case of a well-known deterministic dynamics nothing is predictable [201]. That discretization has neither a physical nor a mathematical basis in non-linear systems is a lesson that has been taught in the discussion of the logistic differential equation, whose continuum solutions differ fundamentally from the discrete ones [202, 203]*"

For these and many more reasons, Gerlich and Tscheuschner (2009) assert "*In conclusion, the derivation of statements on the CO_2 induced anthropogenic* ***global warming*** *out of the computer simulations* ***lies outside any science***".

The conclusion here could be borrowed from Morel (2013) "*We are always making more images or "special effects" more and more disconnected from reality. This is one of the causes of the discredit to which the scientific community has exposed itself. Real scientists, like Professor Bolin, performed the measurements they needed on the ground themselves. Professor Bolin, more than any other, should have felt the danger of substituting for reality observations, numbers debited on demand by computers. He should never have let the IPCC embark on the path of "virtual reality" created by models. Scientific integrity requires that a formal distinction be maintained between the conclusions of objective observations of nature and the hypotheses illustrated by numerical simulations*" (Morel, 2013)

«*In sum, a strategy must recognize what is possible. In climate research and modeling, we should recognize that we are dealing with a coupled non-linear chaotic system, and therefore that the long-term prediction of future climate states is not possible. Rather the focus must be upon the prediction of the probability distribution of the system's future possible states by the generation of ensembles of model solutions. The most we can expect to achieve is the prediction of the probability distribution of the system's future possible states by the generation of ensembles of model solutions.*» p.774. - IPCC – 2001 – TAR-14 – «Advancing Our Understanding».

The models are unreliable, they are in "disagreement" with the observations for more than 15 years, i.e. they fail to model and to predict correctly but IPCC have high confidence in them «*There is hence very high confidence that the CMIP5 models show long-term GMST trends consistent with observations, despite the disagreement over the most recent 15-year period. Due to internal climate variability, in any given 15-year period the observed GMST trend sometimes lies near one end of a model ensemble, an effect that is pronounced in Box TS.3, Figure 1a, b as GMST was influenced by a very strong El Niño event in 1998.*» (IPCC, 2013).

The elementary tuning of or across the models leads to discrepancies that are higher than the major effects searched for, e.g. it is amazing to see that the effect of the differences in CMIP3 PI ensemble inter-model average planetary albedo is greater than the supposedly effect of a doubling of CO_2: "*We have partitioned the earth's planetary albedo into a component due to the reflection of incoming radiation by objects in the atmosphere $\alpha_{P,ATMOS}$ and a component due to reflection at the surface $\alpha_{P,SURF}$. In the global average, the vast majority (88%) of the observed planetary albedo is due to $\alpha_{P,ATMOS}$. The CMIP3 PI ensemble inter-model average planetary albedo is also primarily due to $\alpha_{P,ATMOS}$ (87%). The inter-model spread in global average planetary albedo is large, corresponding to radiative differences at the top of the atmosphere ($2\sigma = 5.5\ W\ m^{-2}$) that exceed the radiative forcing of doubling carbon dioxide*" (Donohoe and Battisti, 2011). The only thing it shows, is that we only deal with models having more than a hundred parameters to tune them to help produce what results are expected and even like that, that they keep changing their "predictions" and that the more they keep changing the less we trust them, even though they are supposed to be improved from one generation to the next!

The study from Zelinka et al. (2020) addresses how climate sensitivity is dealt with across latest CMIP6 models. It seems that the logic followed is sort of a headlong rush, always predicting more warming and trying to ever find new means of doing so. The latest arbitrary choice comes up with the representation of clouds, without any rationale to support their choices, both the water content and the areal coverage of low-level clouds decrease more strongly with greenhouse warming in the latest models, causing enhanced planetary absorption of sunlight, which provides for the long awaited amplifying feedback that ultimately results in more warming! Zelinka et al. (2020) report "*Here we show that the closely related effective climate sensitivity has increased substantially in Coupled Model Inter-comparison Project phase 6 (CMIP6), with values spanning 1.8–5.6 K across 27 GCMs and exceeding 4.5 K in 10 of them. This* *(statistically insignificant) increase is primarily due to stronger positive cloud feedbacks from decreasing extra-tropical low cloud coverage and albedo. Both of these are tied to the physical representation of clouds which in CMIP6 models lead to weaker responses of extra-tropical low cloud cover and water content to unforced variations in surface temperature*". So, does one can have any idea of the way clouds are being represented in these models, and why there should be more or less ? The glimpse of an answer is offered by the worthless notion of parametrized physics as Zelinka et al. (2020) add "*The sensitivities of cloud properties to CCFs*[292] *are typically estimated via multi-linear regression applied to inter-annual covariations of meteorology and clouds in the unperturbed climate. Models exhibit widely varying cloud sensitivities owing to diversity in how clouds, convection, and turbulence are represented via parameterized physics* ". As Gerlich and Tscheuschner (2009) reminded us, later supported by Kramm and Dlugi (2011), this pseudo-physics of parametrized computations and sensitivities estimated by multi-linear regressions applied to whatever covariation are simply meaningless!

The only thing that these studies, investigating "forcing", "feedbacks", and "climate sensitivity" in abrupt "CO_2 quadrupling experiments" conducted in the latest generation of fully coupled GCMs as part of CMIP6 demonstrate, is how the modelers have completely run amok and lost any connection to physics, reality and the way the Earth's climate slowly reacts and adapts to ever changing conditions. Zelinka et al. (2020) end their paper with a glimmer of lucidity "*This raises the possibility that ECS is indeed high in the real world, but it first needs to be established that CMIP6 feedbacks and forcing are in quantitative agreement with these constraints. It is possible, for example, that higher ECS in models from larger extratropical low cloud feedbacks might simply be revealing (as yet unknown) errors in other feedbacks. Such a conclusion would also need to be evaluated in light of other evidence. For example, how well do high ECS models simulate past climates or the historical record? While some high ECS models closely match the observed record (e.g., Gettelman et al., 2019),* ***others do not*** *(e.g., Golaz et al., 2019). Do the former models achieve their results via unreasonably large negative aerosol forcings and/or substantial pattern effects (Kiehl, 2007; Stevens et al., 2016)?"* So most of the latest models are simply unable to account for past climate up to LIA, they keep nudging up fear levels for an overnight quadrupling (!) of [CO_2] (why not more?) by resorting to obscure modeling techniques better called tricks or gibberish, and those that perform somehow better could find means to do so by making an unreasonable usage of aerosol to cool down the past! Science has lost its mind, but as DOE orders and fat grants flow in, one must deliver what he's been paid for. Finally, the only reasonable sentence of this comprehensive appraisal of the the latest generation of models is "*Establishing the plausibility of these higher sensitivity models is imperative given their implied societal ramifications*" (Zelinka et al., 2020). No doubt, politicians are on the right track, let's destroy our economies and our societies, for models that even those at the heart of their development wonder – with some honesty – what is their **plausibility** ! Let's remind what that means, for the Cambridge dictionary "*seeming likely to be true, or able to be believed*". Highly unlikely forecasts delivered by these models must be believed! This is a religion not science any longer.

Some hinsight into the sequence of evolution of these Global Climate Models (GCMs) can be obtained by studying the way a group of authors teamed up under the leadership of Hansen starting with (Hansen et al., 1984) to slowly move the target away from any climate reconstruction objective to software platforms designed to numerically simulate the "forcing" of various components. These GCMs were certainly not able to predict climate in 1997 and at least acknowledged by then the chaotic nature of the phenomenons studied, Hansen (1997) wrote "*Indeed, the climate system exemplifies "complexity," a combination of deterministic behavior and unpredictable variations ("noise" or "chaos"). Interactions connect all parts of the system, giving rise to complex dynamical patterns that never precisely repeat. The slightest alteration of initial or boundary conditions changes the developing patterns, and thus next year's weather is inherently unpredictable. This behavior results from the nonlinear fundamental equations governing the dynamics of such a system (Lorenz, 1963)*".

In the next five years, the authors focused on modeling whatever greenhouse gas catastrophe could be predicted from arbitrary increases of various "forcings", with little regard to the influence of the clouds, the oceans and the Sun and it was pretty clear that these GCMs could not account for even the little ice age, much less the interglacial warming and the Holocene. Hansen (2002) wrote "*The present simulations, carried out on a Silicon Graphics 2000 system, focus on the past 50-year period and include additional forcings and models. Some of the experiments now being carried out for 1951 to present (see Table 3) are using a version of the model reprogrammed, documented, and optimized for parallel computations but nominally with the same physics as in SI2000. The aim is to find a practical path leading to a prompt new round of experiments for longer period, 1850 – 2000, including improvements in the realism of both forcings and models*". So basically, as of 2002, these GCMs were hardly capable of accounting for the last 50 years of observations

292 CCF= Cloud Controlling Factor

and mainly focused as per the authors on the inclusion of "*additional forcings*". The Little Ice Age (LIA), was a remote objective, not even really considered as 1850 was set as tentative and remote mark. As long as any of these models are completely unable to account to what led to the end of the LIA and to a reversal of the conditions, how could they benefit of the slightest credibility?

As noticed by Glassman (2009) "*All by themselves, the titles of the documents are revealing. The domain of the models has been changed from the climate in general to the "inter-annual and decadal climate". In this way Hansen et al. placed the little ice age anomaly outside the domain of their GCMs. Thus the little ice age anomaly was no longer a counterexample, a disproof. The word "forcing" appears in each document title. This is a reference to an external condition Hansen et al. impose on the GCMs, and to which the GCMs must respond. The key forcing is a steadily growing and historically unprecedented increase in atmospheric CO_2. "Efficacy" is a word coined by the authors to indicate how well the GCMs reproduce the greenhouse effect they want.*"

In fact, the change from Global Climate Models to Global Circulation Models, acknowledges the abandonment of these authors of the goal to predict global climate and according to the objectives they set to themselves, "*The accuracy and sensitivity of their models is no longer how well the models fit earth's climate, but how well the dozens of GCM versions track one another to reproduce a certain, preconceived level of Anthropogenic Global Warming*" (Glassman, 2009). It is worth noticing that in these GCMs, no part of the CO_2 concentration is a consequence of other variables (e.g. such as the temperature, accounting for the increased out-gassing of the oceans according to Henry's law) and these GCMs appear to have no provision for the respiration of CO_2 by the oceans. They neither account for the uptake of CO_2 in the cold waters, nor the exhaust of CO_2 from the warmed and CO_2 saturated waters, nor the circulation by which the oceans redistribute through down-welling and later up-welling the CO_2 from the pole to the tropics.

As of 2005, these authors started considering other important factors, such as how loosely modeled the clouds were or how the "forcings" would produce rather regional effect than global ones, Hansen et al (2005) asserting "*global forcing has more relevance to regional climate change than may have been anticipated. Increasing greenhouse gases intensify the Hadley circulation in our model, increasing rainfall in the Inter-tropical Convergence Zone (ITCZ), Eastern United States, and East Asia, while intensifying dry conditions in the subtropics including the Southwest United States, the Mediterranean region, the Middle East, and an expanding Sahel. These features survive in model simulations that use all estimated forcings for the period 1880–2000*". With respect to the influence of the clouds, one will be happy to learn that until 2005 it did not dawn on these authors that they might have an important effect, (i.e. actually a regulating one) and Hansen et al (2005) write "*Clouds affect the amount of sunlight absorbed by the Earth and terrestrial radiation to space. Even small imposed cloud changes can be a large climate forcing. Cloud changes due to human aerosol and gaseous emissions or natural forcings such as volcanic emissions and incoming cosmic rays are difficult to quantify because of the large natural variability of clouds, cloud feedbacks on climate that occur simultaneously with imposed cloud changes, and imprecise knowledge of the driving human and natural climate forcing agents. In the meantime, cloud forcings in climate models are probably best viewed as sensitivity studies. Various observational constraints allow rationalization of the overall magnitude of assumed cloud forcings, but these constraints are imprecise and their interpretations are debatable*". When clouds are so roughly accounted for, does tuning the software to respond mainly to hypothetical CO_2 forcing make sense ?

The answer may be brought by Voosen (2016) "*Climate models render as much as they can by applying the laws of physics to imaginary boxes tens of kilometers a side. But some processes, like cloud formation, are too fine-grained for that, and so modelers use "parameterizations": equations meant to approximate their effects. For years, climate scientists have tuned their parameterizations so that the model overall matches climate records. But fearing criticism by climate skeptics, they have largely kept quiet about how they tune their models, and by how much. That is now changing. By writing up tuning strategies and making them publicly available for the first time, groups hope to learn how to make their predictions more reliable—and more transparent*". The trouble is that the damage is done, the Pandora Box is now open, and one can see in it the can of worms that needs heavy parametrization to achieve what are not lackluster results but truly deceptive predictions. What is unbelievable is that these "climate models" guide regulations like the U.S. Clean Power Plan, and inform U.N. temperature projections and calculations of the social cost of carbon when they are highly unsuitable for any kind of decent prediction nor even proper rendering of past climate observations. This is well acknowledged by the disclosure of the constant tuning required by all modeling teams (Voosen, 2016), but also crystal clear after the analysis made by Curry and Webster (2011) and Curry (2016a-b, 2017). In fact, everybody knows the deception and Indeed, whether climate scientists like to admit it or not, nearly every model has been calibrated precisely to the 20th century climate records—otherwise it would have ended up in the trash. "*It's fair to say all models have tuned it*," says Isaac Held, a scientist at the Geophysical Fluid Dynamics Laboratory, another prominent modeling center, in Princeton, New Jersey. More importantly, claiming that "climate models", i.e. softwares, represent the direct application of the laws of physics is also far fetched for various reasons: the first is that the equations of Henry Navier are of great interest but of little immediate usage without a computer as in most cases they cannot be solved analytically and as it has not yet been even proven whether solutions always exist in three dimensions and, if they do exist, whether they are smooth – i.e. they are infinitely differentiable at all points in the domain, and therefore this situation has led the Clay Mathematics Institute in May 2000 to make this problem one of its seven Millennium Prize problems in mathematics[293]. It offered a US $1,000,000 prize to the first person providing a solution for this specific statement of the problem: In three space dimensions and time, given an initial velocity field, there exists a vector velocity and a scalar pressure field, which are both smooth and globally defined, that solve the Navier–Stokes equations. Despite their relative simplicity of form, Navier-Stokes equations also have this property of generating extremely complex behaviors, apparently random and unpredictable: they indeed have, under certain conditions, explosive amplification properties of very small disturbances or errors ("chaos") which make them unusable directly for simulating or predicting turbulent flows ("butterfly effect") due to the too large number of scales and structures, some instability, too great sensitivity to initial data and boundary conditions, both of the flow and of the equations (DeMoor and André, 2005). Most of the mathematical difficulties linked to Navier-Stokes equations, partial differential equations with respect to time t and to position coordinates x_i, have their origin in the non-linearity (with respect to the speed field) of the term representing the acceleration of the fluid particle: decomposed according to such partial derivatives, it indeed appears as the sum of a linear "trend" $\partial \vec{u} / \partial t$ and a quadratic nonlinear "advection" $(\vec{u} . gradient)\vec{u}$ where $\vec{u}$ is the velocity field.

Therefore, from the "basic" laws of physics as elicited by Henry Navier and George Stokes, i.e. a set of partial differential equations in space and time for a set of state variable, a lot remains to be done to accommodate them to some usage by computer programmes and Müller and von Storch (2008) remind "*This requires first the discretization of the equations, both in space and time. The process of deriving the governing differential equations includes several closures through parametrizations and approximations. These equations are transformed into a discrete, finite form which allows for a digital implementation on a computer*". The closure problem is the consequence of the fact that it is impossible to represent all the processes within the system, to incorporate the surroundings and to resolve all scales; in that respect, "Example 2.1." given by Müller and von Storch (2008) dealing with cloud formation is very revealing and shows the complexity of the issues addressed. One can easily understand that these models, although of a great complexity, have necessarily to simplify a lot the real world to cope with it and also heavily depend on the discretization techniques used. This make them suitable for meteorological forecasts, or for theoretical studies in atmospheric and oceanic sciences, but certainly not as means to make decadal or centennial temperature projections to determine calculations of the social cost of carbon, an heresy in itself. They are and remain just research instruments and were unfortunately purposely diverted from their original mission to serve as a surety means to give credence to the anthropogenic explanation promoted by IPCC (they do not search for any other!). The outcome is that policy makers relying on the information delivered by these ad-hoc models had no idea of the uncertainties embedded in these climate simulations and hence in their conclusions and the implications for their policies. The damage to science will be incommensurable as it will be difficult to explain in layman terms why one can have confidence in astrometric calculations delivering an ephemeris of Apophis for example (Figure 55), but why "climate models" were fantasies and failed to make any decent account of past or future climate states.

"*It's not just the fact that climate simulations are tuned that is problematic. It may well be that it is impossible to make long-term predictions about the climate – it's a chaotic system after all. If that's the case, then we are probably trying to redesign the global economy for nothing*" Judith Curry (2017).

Moving away from strictly radiative (-convective) circulation models, research teams have started to consider that the Earth is a far more complex system than what is portrayed by studies focusing just on an increase in CO_2 and their alleged consequences. In that respect, the approach described by Heavens et al. (2013) is interesting as long as the model and the computer software that goes along is taken for what it is, i.e. a means to study an extremely complex system and not a means to make forecasts on which to base policies. Here is how the authors describe their effort "*Studying how biological processes and climate are related requires a new type of climate model: the Earth system model (ESM). ESMs include physical processes like those in other climate models but they can also simulate the interaction between the physical climate, the biosphere, and the chemical constituents of the atmosphere and ocean. ESMs are chiefly distinguished from climate models by their ability to simulate the carbon cycle. If the sum of all CO_2 emitted into the atmosphere between 1966 and 2008 is compared with the observed level of atmospheric CO_2,*

293 http://www.claymath.org/millennium-problems/navier%E2%80%93stokes-equation

approximately one of out of every two CO_2 molecules appears to be missing (Figure 2). This extra CO_2 has not vanished entirely. It has been incorporated into land and ocean reservoirs, often in carbon fixed by organisms during photosynthesis. Whether all of it will stay there and what proportion of future emissions will remain in the atmosphere are open questions, which have motivated the development of land model components that can predict the spatial distribution of vegetation, how its growth varies through the year, and the exchange of carbon between it and the soil. Similar model components exist to simulate the marine biosphere and chemistry".
One can sense from this excerpt the extraordinary complexity of the system modeled and the fact that whatever the progress we can make and the computing means we can allocate, we can just expect as Gerlich and Tscheuschner (2009) reminded us, well … models and one should be very cautious not taking them for the reality!

Hopefully, the role of the oceans operating as a biological carbon pump is taken now more effectively into account. Buesseler et al. (2020) observe that "*Earth system models, including those used by the UN/IPCC, most often assess POC (particulate organic carbon) flux into the ocean interior at a fixed reference depth*" using an idealized and empirically based flux-vs.-depth relationship, often referred to as the "Martin curve", but observe that "*We find that the fixed-depth approach underestimates BCP efficiencies when the Ez*[294] *is shallow, and vice versa*".

Moving on to a completely different approach, probably much more realistic, is to acknowledge that the Earth Climate System is such a complicated issue with intricate variables and unknown responses that it does not make sense to try to model it the way the GCMs do and to rather follow a technique known as system identification. "*The field of system identification uses statistical methods to build mathematical models of dynamical systems from measured data. A common approach is to start from measurements of the behavior of the system and the external influences (inputs to the system) and try to determine a mathematical relation between them without going into many details of what is actually happening inside the system; this approach is called system identification*"[295]. Classical references are (Ljung and Glad, 1994) or (Isermann and Münchhof, 2011), in French one could mention, e.g. (Bako, 2008) or (Bastin, 2013).

An example of such an approach is Golyandina and Zhigljavsky (2013) where black box models applied to the energy balance of the planet directly give climatic sensitivities to the equilibrium with respect to three inputs: CO_2, solar activity and volcanic dust.

In his book, "Climate Change: Identifications and projections" de Larminat (2014) deals with the issue of climate modeling in a different way: by using proven techniques for identifying black box-type models. "*Taking climate observations from throughout the millennia, the global models obtained are validated statistically and confirmed by the resulting simulations. This book thus brings constructive elements that can be reproduced by anyone adept at numerical simulation, whether an expert climatologist or not. It is accessible to any reader interested in the issues of climate change*". de Larminat (2014; 2016) uses well-known techniques in identifying industrial processes, from several historical reconstructions of temperatures (eg Moberg, Loehle, Ljungqvist, Jones & Mann) and from several series representing solar activity (Usoskin-Lean, Usoskin -timv, Be10-Lean, Be10-timv) of the last millennium and even until the year 843, without a priori assumptions. A very careful analysis of confidence intervals and confidence domains leads to the results summarized as follows:

(1) observations cannot demonstrate the anthropogenic origin of global warming; neither climate sensitivity to CO_2 nor even its sign can be said with confidence;
(2) solar activity is the main factor of climate change and its role (sensitivity in °C / (W/m²)) is underestimated by a factor of 10 to 20 by the IPCC; the IPCC starts from physical considerations on the smallness of the variations of the total solar irradiance (TSI); but the black box model applied to the series of observations gives a much higher sensitivity and the solar activity explains most of the warming since the end of the Little Ice Age.

Therefore, de Larminat (2014) demonstrates very clearly that for such a complex system as the Earth's climate, system identification techniques deliver objective and convincing results such as:

- the warming period which led to the contemporary optimum is essentially due to the combined effect of solar activity and natural variability (which is found in residues, like the 60-year cycles which result from parameters which are not taken into account in this black box model);

294 Ez is the sunlit euphotic zone, the layer closer to the surface that receives enough light for photosynthesis to occur.
295 https://en.wikipedia.org/wiki/System_identification

- the anthropic contribution, if it exists, is not distinguished enough from the preceding effects for one to claim to see it, and certainly not with the high degree of certainty displayed by the IPCC.

The margin of error and uncertainty calculations and the hypothesis tests provide all the necessary validations from a scientific point of view. Furthermore, as reported by Veyres (2020) "*a more visual demonstration of the accuracy of the results found is the agreement between the calculation results and the observations and the predictive capacity of the model; blind simulations without any information on temperatures after the year 2000 show with surprising accuracy the "plateau" observed in global warming since 2000. For these short-term predictions, state estimates by Kalman filters are used, where the state reflects the accumulation of heat in the oceans. In addition to sensitivities, the method provides a rigorous assessment of the probability that a parameter is within a certain interval, without all of these very subjective statements of "confidence" or "likelihood" or "subjective probability" that adorn each paragraph of the IPCC WG1 report and of which Rittaud (2010; 2015) has emphasized the non-scientific nature*".

All models proceed by conventional flux adjustments as explained by Kerr (1994) "*In climate modeling, nearly everybody cheats a little. Although models of how the ocean and the atmosphere interact are meant to forecast the greenhouse warming of the next century, when left to their own devices they can't even get today's climate right. So researchers have tidied them up by "adjusting" the amount of heat and moisture flowing between model's atmosphere and ocean until it yields something like the present climate*". In that respect, Nakamura et al. (1994) introduced deliberately an error and demonstrated that coupled ocean-atmosphere GCMs that require adjustments in the surface fluxes of heat and freshwater to achieve some resemblance to current climate conditions do not account for the real sensitivity of the real climate. This was clearly summarized by Kerr (1994) "*Mototaka Nakamura, Peter Stone, and Jochem Marotzke of the Massachusetts Institute of Technology (MIT) report that they deliberately introduced an error into a climate model, then seemingly adjusted the error away, only to find that it still hampered the model's ability to predict future climate*". Coupling the atmospheric and oceanic components was inevitable as otherwise the atmospheric software component relied totally on getting SSTs and the amount of heat released by the oceans on observation data which prevented the systems from forecasts capacities and Kerr (1994) adds that this coupling "*left the job of calculating the interactions of the ocean and the atmosphere to the less-than-perfect models themselves. If the atmospheric component made more clouds than in the real world, not enough sunlight would get through to warm the ocean; if the ocean currents did not carry enough warm water poleward, high latitudes would be too cold. The result was that even when a coupled model was set up to simulate the existing climate, it would drift away to something quite unreal. In the 1989 version of the NCAR coupled model, for example, winter-time ocean temperature around ice-bound Antarctica were 4°C above zero, while the tropical ocean was as much as 4°C too cold*". It is always reassuring to think that people argue a lot about a supposed 0.6 or 0.4°C warming per century when their models are several degrees apart from basic observations.

The truth is that the best meteorological models and corresponding software simulation systems must be reminded of the reality by plugging them in actual observation data every six hours or so, otherwise they fall into the ditch and ironically during Covid-19, and because the frequency of overseas flights was considerably decreased, observations made by commercial flight were not available any longer as usual and the quality of meteorological forecasts decreased considerably. In fact most models are tweaked with fudged flux-adjustments and this up to the point, that not too far in the past Kerr (1994) stated "*Actually, shove might be a better word than nudge:* ***Adjustments*** *have typically been at least as big as the model-calculated fluxes - in some places* ***five times as large***". Syukuro Manabe admitted though defending the practice that the Geophysical Fluid Dynamics Laboratory (GFDL) in Princeton, also did compensate underlying errors with flux-adjustments, for example as stated by Kerr "*because of computational biais, the GFDL model assumed an unrealistically large amount of precipitation in high latitudes - an error he and his colleagues corrected with a moisture flux adjustment*". Amazingly, Syukuro Manabe stated "*Compensating in kind for a fictitious climate feature is harmless*". I am sure that if the reader had some doubts, he feels much better now. Manabe also claimed that an increase of computer power will reduce flux-adjustments in the future, but as reminded by Browning (2020) "The total error E can be considered to be a sum of the errors: $E = D + S + T + F + I$" and increasing the power of the computer does not solve the issues at stake. In a similar way to the experiment performed by Nakamura et al. (1994), Krasovskiy and Stone (1998) demonstrated that the model representation of THC in the simulators could be seriously deteriorated whenever other errors were corrected by flux-adjustments "*The approximate analytic solutions are in good agreement with Marotzke's exact numerical solutions, but show more generally how the destabilization of the thermohaline circulation depends on the sensitivity of the atmospheric transports to the meridional temperature gradient. The solutions are also used to calculate how the stability of the thermohaline circulation is changed if model errors are ''corrected'' by using conventional flux adjustments*".

Coupling convincingly the Ocean-Atmosphere circulation boxes have been and remain an on-going a challenge, but adding ice-components, land usage, vegetation, freshwater budgets and all geochemical processes requires a lot of faith to think that this will tell anything of how planet Earth will really behave. Moving from the time-scale of prediction of the meteorological systems, basically one week, to just one month or slightly more is demonstrated as a major challenge by the forecast of exceptional events such as heat waves, e.g. (Weisheimer et al., 2011; Stéfanon, 2012). Nakamura (1994) in his D.Sc. thesis studied the influence of planetary-scale flow structure on the evolution of synoptic-scale[296] waves and how these synoptic eddies exhibit complex behavior when strong diffluence[297] in the low-frequency flow (defined as blocking), is observed and displays a strong relationship with high-frequency synoptic scale eddies. This D.Sc. work led naturally to the simulation study of the 2003 heatwave in Europe reported in Nakamura et al. (2005), for which the Atmospheric general circulation model For the Earth Simulator, AFES i.e. a massively-parallel-vector supercomputer (Ohfuchi et al., 2004) was used. Nakamura et al. (2005) explain that because of the seemingly low-frequency nature of the dynamics behind the heatwave of 2003, it serves well as a test case for low-frequency state hind-casting and tried to "*reproduce the heatwave in AFES with the observed daily SST, starting one month before the heatwave. The resolution used for this study was T639L48, truncation wave number of 639 and 48 vertical levels. There are 6 levels in the planetary boundary layer, 28 levels in the troposphere, and 14 levels in the stratosphere*".

Apart from the control run where all observed SSTs were given to the system, the results of the other runs do not appear overly encouraging. Nakamura et al. (2005) conclude that "*a coarse-resolution model (perhaps even T639 used here) is unlikely to simulate the event well even if all the external forcings, including the SST, are given. This is because the model cannot adequately resolve the nonlinear processes involved in the positive feedback of high-frequency waves onto the diffluent low-frequency flow*". Furthermore, making any one month or slightly more previsions, not 2,000 years or the Holocene, supposes that the state of the art would have the "*ability to forecast the SST and land surface temperatures, in addition to its ability to accurately represent the internal dynamics of the atmospheric low-frequency state. This means that such a long-range forecast model must have the atmosphere up to the top of the stratosphere, all oceans, the land surface, and perhaps the ice, interacting dynamically and thermodynamically with each other. Needless to say, the model must be able to accurately represent those second-order variables, such as the cloudiness, precipitation, and soil moisture, that are important for low-frequency forcing. Finally, but never the least, observational network must be improved to provide a reasonable initial condition to the forecast model*". One can sense from this concrete example of the prevision of heat-waves, one month or so ahead of their occurrence, why this represents a major challenge and why running models for hundreds or worse thousands of years into the future (or the past feeding them data and adjusting fluxes) does not appear too realistic nor rational. As just reported, Nakamura is a long standing expert and has always been cautious, especially as adding more and more component does not ensure more reliability, especially if the underlying processes are not well understood and represented. In Nakamura (2013) the sudden change in the reference Greenland Sea surface temperature (GSST) is interpreted as resulting from "*a major change in the near-surface baroclinicity in the region, in addition to a large change in the net surface heat flux at the air–sea boundary over the Greenland Sea*" and related these modifications to changes in the North Atlantic Oscillation (NAO) index. From thereof, it is stressed that without a proper understanding of the various processes in the Arctic and sub-Arctic regions and appropriate representation in climate simulation models no short- to mid-term climate variations, not to mention longer-term climate variations or changes could be considered reliable. Perhaps, the ever more fanciful claims of the IPCC experts stating that the models are ready to reproduce the climate in all details for centuries, milleniums or are even "validated" because they account for climate events over geological times (for sure if they just read the tape backwards) have been the straw that broke the camel's back of this honest scientist when he decided to publish on the sorry state of climate science "Confessions of a climate scientist: the global warming hypothesis is an unproven hypothesis" in Nakamura (2018) with a summary given by Thomas (2019) in "A Climate Modeler Spills the Beans". What Nakamura (2018) says is well worth reading as this is the result of 25 years of academic work beyond his MIT D.Sc. in the domain and does not exactly match the consensus that is sold to us on each and every occasion:

"*The temperature forecasting **models** trying to deal with the intractable complexities of the climate **are no better than toys** or Mickey Mouse **mockeries of the real world***".

"*The **global surface mean temperature-change data** no longer have any scientific value and **are nothing more than a propaganda tool to the public***".

296 The synoptic scale in meteorology (also known as large scale or cyclonic scale) is a horizontal length scale of the order of 1000 kilometers or more. This corresponds to a horizontal scale typical of mid-latitude depressions (e.g., extratropical cyclones)

297 Diffluence in meteorology is a widening of the pressure isolines in the direction of the wind. Diffluence corresponds to a deformation of the pressure field without any associated vertical movement.

"***Climate forecasting is simply impossible***, *if only because future changes in solar energy output are unknowable. As to the impacts of human-caused* CO_2*, they can't be judged with the knowledge and technology we currently possess*".

Mototaka Nakamura

Other gross model ***simplifications*** *include:*

- *Ignorance about large and small-scale ocean dynamics*
- *A complete lack of meaningful representations of aerosol changes that generate clouds.*
- *Lack of understanding of drivers of ice-albedo (reflectivity) feedbacks: "Without a reasonably accurate representation, it is impossible to make any meaningful predictions of climate variations and changes in the middle and high latitudes and thus the entire planet."*
- *Inability to deal with water vapor elements*
- *Arbitrary "tunings" (fudges) of key parameters that are not understood*

Mototaka Nakamura

"*I want to point out a simple fact that it is* ***impossible to correctly predict even the sense or direction of a change*** *of a system* ***when the prediction tool lacks*** *and/or grossly distorts* ***important non-linear processes***, *feedbacks in particular, that are present in the actual system. The real or realistically-simulated climate system is far more complex than an absurdly simple system simulated by the toys that have been used for climate predictions to date, and will be insurmountably difficult for those naïve climate researchers who have zero or very limited understanding of geophysical fluid dynamics. The dynamics of the atmosphere and oceans are absolutely critical facets of the climate system if one hopes to ever make any meaningful prediction of climate variation. Solar input, absurdly, is modelled as a "never changing quantity". It has only been several decades since we acquired an ability to accurately monitor the incoming solar energy. In these several decades only, it has varied by one to two watts per square metre. Is it reasonable to assume that it will not vary any more than that in the next hundred years or longer for forecasting purposes? I would say, No*".

Mototaka Nakamura

"*Good modelling of oceans is crucial, as the slow ocean currents are transporting vast amounts of heat around the globe, making the minor atmospheric heat storage changes almost irrelevant. For example, the Gulf Stream has kept western Eurasia warm for centuries. On time scales of more than a few years, it plays a far more important role on climate than atmospheric changes. It is absolutely vital for any meaningful climate prediction to be made with a reasonably accurate representation of the state and actions of the oceans. In real oceans rather than modelled ones, just like in the atmosphere, the smaller-scale flows often tend to counteract the effects of the larger-scale flows. The* ***models result in a grotesque distortion of the mixing and transport of momentum, heat and salt***, *thereby* ***making*** *the* ***behaviour of the climate simulation*** *models* ***utterly unrealistic***. *Proper ocean modelling would require a tenfold improvement in spatial resolution and a vast increase in computing power, probably requiring quantum computers. If or when quantum computers can reproduce the small-scale interactions, the researchers will remain out of their depth because of their traditional simplifying of conditions*".

Mototaka Nakamura

"*The models are 'tuned' by* ***tinkering*** *around with values of various parameters until the best compromise is obtained. I used to do it myself. It is a necessary and unavoidable procedure and not a problem so long as the user is aware of its ramifications and is honest about it. But* ***it is a serious and fatal flaw if it is used for climate forecasting/prediction purposes***. *One set of* ***fudges*** *involves clouds. Ad hoc representation of* ***clouds may be the greatest source of uncertainty in climate prediction***. *A profound fact is that only a very small change, so small that it cannot be measured accurately… in the global cloud characteristics can completely offset the warming effect of the doubled atmospheric* CO_2*. Two such characteristics are an increase in cloud area and a decrease in the average size of cloud particles*".

Mototaka Nakamura

"*Accurate* ***simulation of cloud is simply impossible in climate models*** *since it requires calculations of processes at scales smaller than 1mm. Instead, the modellers put in their own cloud parameters. Anyone studying real cloud formation and then the treatment in climate models would be* ***flabbergasted by the perfunctory treatment of clouds in the models***. *In tuning some parameters, other aspects of the model have to become extremely distorted. A large part of the forecast global warming is attributed to water vapor changes, not* CO_2 *changes. But the fact is this:* ***all climate simulation models perform poorly in reproducing the atmospheric water vapor and its radiative forcing observed in the current***

climate. *They have only a few parameters that can be used to 'tune' the performance of the models and (are) utterly* ***unrealistic***. ***Positive water vapor feedbacks*** *from CO_2 increases* ***are artificially enforced*** *by the modelers. They neglect other reverse feedbacks in the real world, and hence they exaggerate forecast warming.* ***Modellers are merely trying to construct narratives that justify the use of these models for climate predictions***".

Mototaka Nakamura

"The take-home message is that **all climate simulation models**, even those with the best parametric representation scheme for convective motions and clouds, **suffer from a very large degree of arbitrariness in the representation of processes that determine the atmospheric water vapor and cloud fields**. Since the climate models are tuned arbitrarily …**there is no reason to trust their predictions/forecasts**. With values of parameters that are supposed to represent many complex processes being held constant, **many nonlinear processes** in the real climate system **are absent or grossly distorted in the models**. It is a **delusion** to believe that simulation models that lack important nonlinear processes in the real climate system can predict (even) the sense or direction of the climate change correctly".

Mototaka Nakamura

Having read what one of the most knowledgeable scholar in the field thinks after 25 years of top-level research accomplished after his D.Sc. obtained at MIT in 1994, one may better appreciate the level of politicized science, in fact a mere advertisement for gullible laymen, that is delivered in a well designed, full of nice images prospectus marketed by the Australian Academy of Science stating "*Climate models allow us to understand the causes of past climate changes, and to project climate change into the future. Together with physical principles and knowledge of past variations, models provide compelling evidence that recent changes are due to increased greenhouse gas concentrations in the atmosphere*" (AAS, 2015), p. 4. If you cannot believe it, read it again and remember:

"***If you tell a lie big enough and keep repeating it, people will eventually come to believe it***. *The lie can be maintained only for such time as the State can shield the people from the political, economic and/or military consequences of the lie. It thus becomes vitally important for the State to use all of its powers* ***to repress dissent***, *for* ***the truth is the mortal enemy of the lie***, *and thus by extension,* ***the truth is the greatest enemy of the State***." Joseph Goebbels[298]

Finally, one important point is that the models can only be as good as the data they use.

Pierre Morel is a well known French scholar (retired), a theoretical physicist (Statistical quantum mechanics). He is the founder of the Laboratory of Dynamic Meteorology (LMD) of Paris VI University, ENS, CNRS, in 1968. Among other eminent functions, Pierre Morel was Director General of the French Space Agency in charge of science and technology (1975-1982), then Director of the International Research Program on the Global Climate (1982-1994). This is what he stated (2009) "*Any climatological reconstruction, based on direct or indirect instrumental measurements, is subject to systematic interpretations and corrections of the same order of magnitude as the variations expected for average global quantities. We could not therefore find more fertile ground for controversies and quibbles of all kinds, based on more or less partisan interpretations of quantitative information necessarily crushed by specialists. The evolution of the global climate is simply too small up to now (compared to the random meteorological variations and the uncertainty of the observation data) to allow an assured diagnosis of the long-term changes, even less the identification of putative cause and effect relationships based on correlations between two or more uncertain "climate signals". In terms of interpretation of climatic signals, the intensive (and passionate) examination of global data is similar to the Rorschach test: we find what we want, it is impossible to reach a scientifically indisputable conclusion based on the sole consideration of global average quantities deduced from archived observations (a fortiori from historical or paleoclimatic reconstructions*" (Morel, 2009).

298 https://www.jewishvirtuallibrary.org/joseph-goebbels-on-the-quot-big-lie-quot

3.5. How Reliable are the Data Used?

Models can't be better than the data they are based on. It is of the utmost importance to collect reliable data and to document the more accurately as possible the way they were gathered and not to adjust the data. Making data available to other scientists and letting them reproduce the computations and check the models is and has always been the very basis of science. Tycho Brahe[299] is remembered by Burtt (1924) as "*the first competent mind in modern astronomy to feel ardently the passion for exact empirical facts*" and remains known to each scientist for having been the one who collected the observations that enabled Kepler to formulate his three laws, a decisive step forward in mankind's understanding of the universe. In fact, Tycho had urged Kepler in a letter "*to lay a solid foundation for his view by actual observation, and then by ascending from these to strive to reach the cause of things*".[300]

Without the fastidious and precise observations and further data compiled by Tycho Brahe, Kepler would have been unable to make his heliocentric formulation and as reminded by Burtt (1924) "*It was very fortunate for Kepler that he was just plunging into such profound labours at the time when Tycho Brahe, the greatest giant of observational astronomy since Hipparchus, was completing his life-work of compiling a vastly more extensive and incomparably more precise set of data than had been in the possession of any of his predecessors*". Things should normally not have changed since Tycho Brahe and these ancient times should serve as a guidance, both with respect to scientific rigor but also in terms of moral, honesty, and integrity.

In that respect Wunsch et al. (2013) remind us that "*Predicting climate change is a high priority for society, but such forecasts are notoriously uncertain. Why? Even should climate prove theoretically predictable—by no means certain—the near-absence of adequate observations will preclude its understanding, and hence even the hope of useful predictions As in most scientific problems, no substitute exists for adequate observations. Without sufficient observations, useful prediction will likely never be possible*". Therefore the feckless data obstruction and tampering that we have seen and summarized by "Mike's trick to hide the decline"[301] is not only scientifically mistaken or stupid (McIntyre, 2010), (Muller, 2011) and will in the long term ruin more than the legacy of those who have indulged themselves in that sort of obnoxious practice but will be remembered as futile attempts to deliberately delude people, as the truth always prevails, whatever the time it might take. Because, either these authors did honest science and in the end temperature curves will display a hockey stick print and I will have been dead wrong all along (I would in that case even apologize posthumously), or they would have deliberately forged the data for reasons that epistemiologists will have to clarify (though the conflict of interest is so obvious that there is no need to dwell on it) and I would not rather be in their shoes as to what history will remember of them.

In the meantime, one can only worry and wonder of the recurrent need to adapt ever more the data so that they would better ~~fit the climate affabulators' agenda~~, demonstrate the next to come catastrophic global warming. Christy (2016) came back in his testimony before the U.S. Senate on the huge discrepancies visible on Figure 99, between observations representing the bulk atmospheric temperature of the layer from the surface to 50,000ft and compiled thanks to the average of 3 satellite datasets (green - UAH, RSS, NOAA) and 4 balloon datasets (blue, NOAA, UKMet, RICH, RAOBCORE) and values estimated or projected by models and software simulators. Christy (2016) adds "*The layer shown is known as the mid-troposphere or MT and is used because it overlaps with the region of the tropical atmosphere that has the largest anticipated signature of the greenhouse response by bulk mass – between 20,000 and 50,000 feet*". Christy (2016) continues "*That two very independent types of measuring systems (balloons and satellites) constructed by a variety of institutions (government, university, private) all showing the much slower rate of warming gives high confidence in its result. Thus, the evidence here strongly suggests the theory, as embodied in models, goes much too far in forcing the atmosphere to retain heat when in reality the atmosphere has a means to relinquish that heat and thus warms at a much slower rate*". The reasons why it is so were explained in the discussion accompanying the set of Figures 19, 20, 21, 22, 23, and one of the major reasons has to do with the fact that contrary to what was asserted by IPCC the measurements from weather balloons and satellites show declining water vapor in the upper atmosphere (at the TOA level) and the departure between models and reality is even worse for the tropical Mid-Tropospheric temperatures as depicted in Figure 104.

299 https://en.wikipedia.org/wiki/Tycho_Brahe

300 Sir David Brewster, Memoirs of Sir Isaac Newton, Vol. II, p. 401.

301 https://judithcurry.com/2011/02/22/hiding-the-decline/ and awkward defense by Gavin A. Schmidt's RealClimate blog (Director of NASA Goddard Institute for Space Studies) http://www.realclimate.org/index.php/archives/2009/11/the-cru-hack/

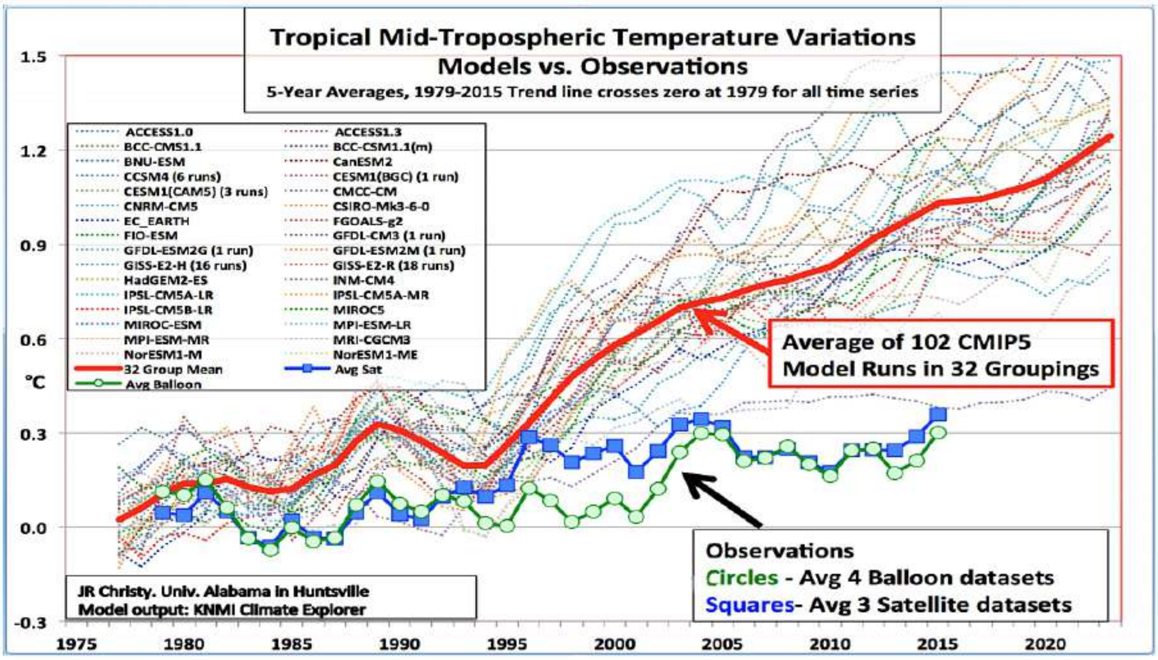

Figure 104.Tropical average mid-tropospheric temperature variations (5-year averages) for 32 models (lines) representing 102 individual simulations. Circles (balloons) and squares (satellites) depict the observations. *Source: Christy (2016).*

Using spurious arguments, Santer had to team up with 10 others authors in a paper, i.e. Santer et al. (2017) not forgetting to thank in the "Acknowledgments" of their paper all the climate establishment that paid very well for that awkward rebuttal attempt mainly based on the assertion that "*Trends in TMT estimated from microwave sounders receive a substantial contribution from the cooling of the lower stratosphere*", to conclude that finally the models would only over-estimate by a factor of 1.7 and not 2.5 the reality. Would they have tried to better prove that Christy was right in dismissing the reliability of the climate models, in challenging their use for establishing carbon policies, Santer et al. (2017) could not have done a better job. In fact, they just strengthen Christy (2016) statement "*I have given evidence that the bulk atmospheric temperature is measured well-enough to demonstrate that our understanding of how greenhouse gases affect the climate is significantly inadequate to explain the climate since 1979*". An indirect answer to Santer et al. (2017) is brought by Christy et al. (2018) where they conclude "*The rate of observed warming since 1979 for the tropical atmospheric TMT layer, which we calculate also as +0.10 ± 0.03°C decade^{-1}, is significantly less than the average of that generated by the IPCC AR5 climate model simulations. Because the model trends are on average highly significantly more positive and with a pattern in which their warmest feature appears in the latent-heat release region of the atmosphere, we would hypothesize that a misrepresentation of the basic model physics of the tropical hydrologic cycle (i.e. water vapour, precipitation physics and cloud feedbacks) is a likely candidate*". This means in simple terms: there is no tropical hot-spot, one of the most emblematic forecast of IPCC climate models and results are not that far from those presented a decade ago in (Christy et al., 2010). In fact, comparisons with radiosonde datasets show that the actual tropical (20°S-20°N) trend is over a factor of two less than the trend projected from the average of the IPCC climate model simulations for this same period (+0.27°C decade^{-1}). Climate models fail to account for the most basic observations, how could they be used to establish policies and lead to enact law with extraordinary coercive outcomes, all to no avail as this will not change the climate of an iota?

Then going back to the surface temperature measurement processes, Christy (2016) also stresses the Urban Heat Island Effect (UHIE) and how it fails to be properly taken into account "*I closely examined individual stations in different regions and have come to the conclusion that the magnitude of the relatively small signal we seek in human-induced climate change is easily convoluted by the growth of infrastructure around the thermometer stations and the variety of changes these stations undergo through time, as well as the variability of the natural ups and downs of climate. It is difficult to adjust for these contaminating factors to extract a pure dataset for greenhouse detection because often the non-climatic influence comes along very gradually just as is expected of the response to the enhanced greenhouse effect*". Trying to detect a signal based on the compilation of numerous stations data which are unevenly affected by various local transformations due to urban sprawling and deriving global mean temperature from which anomalies should be extracted is not a daunting task, it is somehow unrealistic. Better taking into account the UHIE phenomenon could lower by -0.3°C the average mean anomaly (Gregory, 2019; Scafetta, 2021), making the hypothetic anthropic signal even more conjectural as discussed by Frank (2010) in his paper "*Uncertainty in the Global Average Surface Air Temperature Index*". Furthermore, one should understand that the thermometers are actually a measure of the temperature of the thermometer not an absolute ideal surface temperature: such a measurement is influenced by the air temperature (of course), but also the wind speed, whether the enclosure is ventilated, passively ventilated or forced ventilated, whether the enclosure is exposed to sunlight and how much sunlight. Because all of these variables change, what the thermal equilibrium achieved is and how long the thermometer takes to achieve equilibrium constantly changes, in short the instrumental error is inconsistent and unpredictable. Furthermore, air temperature sensors measure the temperature inside their enclosure and the sensor can approach the outside temperature pretty well when the enclosure is well-aspirated whereas without aspiration, significant, non-normal, and variable errors are produced. Patrick Frank stated that "*The entire land-surface historical temperature record up to about year 2000 was obtained using unaspirated sensors. Today, world wide, that's still mostly true. That means the errors are not constant in time or space. They are not mere offsets, they are not removed at all by taking anomalies.*" The only way to deal with persistent and variable systematic errors is to evaluate their average magnitude by a series of calibration experiments, and then report that average as an uncertainty attached to every field measurement. In fact, taking an anomaly by subtracting a measurement contaminated with systematic error u_1, from a mean that also has a systematic error contamination u_2, produces a greater uncertainty in the anomaly, u_3 equals to:

$$u_3 = \sqrt{u_1^2 + u_2^2} \qquad (181)$$

That is, with non-normal and variable systematic errors, taking differences produces an anomaly with increased uncertainty. The impact of systematic error in climate measurements on the surface air temperature record is addressed by Frank (2016a-b) and Limburg (2014).

Ground based stations are unfortunately not the only ones to be subjected to erratic anomalies and Christy (2001) discovered while examining ocean temperatures that the trends of the water temperature at a depth of 1m depth do not match well with those of the air temperature just above the water (3m), even if both were measured on the same buoy over 20 years. From thereof, Christy (2016) asserts "*This is important for the discussion below where NOAA used marine air temperatures to adjust water temperature measurements from ships*". Going from one "adjustment" to the next while measuring very small variations does not provide any confidence in the data sets used, especially as at least the following reasons for deviations are listed by Christy (2016) "*(a) lack of systematic geographical coverage in time, (b) unsystematic measuring methods and instrumentation in time and space, (c) the point measurement represents at best a tiny, local area and (d) is easily impacted by slight changes in the surroundings, which can occur for example when a station moves*".

Furthermore, whatever the automated systems in operation, the gathering and automated integration of data into gridded or other systems requires extraordinary quality control to ensure that data not be vitiated by some undetected outliers. Observing either buoys data reports or simply weather stations showing obviously wrong measurements for sometimes months before they are fixed leads naturally to wonder whether those data are used and spoil the entire time-series they contribute to. Some attentive observers like "oz4caster[302]" have been monitoring some of these automated devices and report clearly dysfunctional systems. For example, during April 2016, it is reported that "*WMO ID 48507[303] frequently showed long stretches of constant temperature with only small variations over time. The last 13 observations available for April 19, 2016 showed a constant -8.46°C spanning a five hour period from 1200 to 1700 UTC. The closest buoy station, WMO ID 48731, showed temperatures ranging from -23.52°C to -21.05°C over this same period and every one of the 20 observations had a slightly different temperature*". Another example is given by the Canadian weather station CWND at Pelly Island (69.63250, -135.44389) which has been reporting for April 19, 2016 "*a high of 29°F or 30°F and low of 29°F every day for the last 30 days. Of course, it seems highly unlikely to be real temperature measurements, especially considering all the nearby stations were around 14°F to 17°F at last report*". Whoever is responsible for data quality control for this weather station is not doing their job to take that data off-line until the problem is fixed. I am certainly not saying that maintaining very large systems with various sensors' types distributed over large areas is an easy task, but the quality control of the data is a key issue when one wishes not to use this information for meteorological purposes but claim to be able to elaborate time-series supposed to be accurate to better than a tenth of a degree globally to pretend that the GMAT is representative of a supposedly Anthropic Global Warming. Adding up all these issues, ranging from measures adjustments to simply bias or even mere unreliable measures as they may happen for any data collecting system lead to a lack of confidence in the integrity of the data for another usage than meteorological forecast, especially as observing the way "the climate data-series" have evolve over the years gives the very uncomfortable feeling that they are always processed in the same way: cooling the past and

302 https://oz4caster.wordpress.com/

303 Data about International Arctic Buoy Programme can be found at https://iabp.apl.uw.edu/maps_daily_table.html

nudging up the recent data so that the trend would appear always steeper and more frightening. The anthropogenic signal searched for to prove a climate deviation from the natural variations is so small compared to the amplitude of the anomalies of the measurement systems themselves that any reasonable observer must remain skeptic.
Here follows three versions of the NASA GISS Land Surface Anomaly, the 2000, 2017 and 2019 versions:

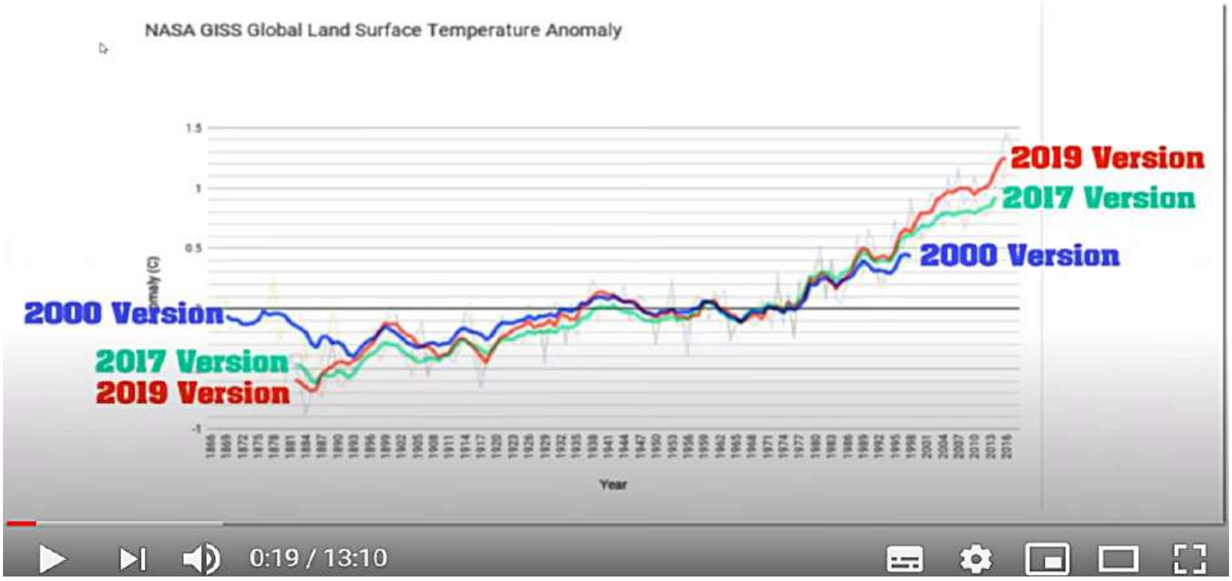

Figure 105. *Data Tampering Past The Climate Tipping Point (Goddard, 2019). Three versions of the NASA GISS Global Land Surface Temperature Anomaly. Source: Goddard (2019)* https://www.youtube.com/watch?v=8tODIRhhV80&feature=youtu.be

The Figure 105 shows three versions of the NASA GISS Global Land Surface Temperature Anomaly released over time. As raw data do not support too well the objective of demonstrating an imminent peril, data are "adjusted" so that they finally cooperate. The 2000 version shows ~0.5°C warming, the 2017 version has nudged up numbers to ~1.5°C warming, and the 2019 version shows that the Climate Fabricators[304] are getting impatient and over just 2 years warmed the climate by ~0.5°C more which is as much as what their 2000 version showed for the entire period spanning (1870-2000) and reach now ~2.0°C warming. Still does not look like a deceitful Hockey Cross, but wait for some years more and they will manage to manufacture it. The distant past data got successively cooler for each new version, the very recent past and present is getting warmer. No Need for satellites, just a Calc spreadsheet and a good deal of data "adjustment" will be more than enough, 80% of the 3X fold warming increase since the 2000 and later 2019 version is just due to data manipulation, euh, sorry, adjustment.

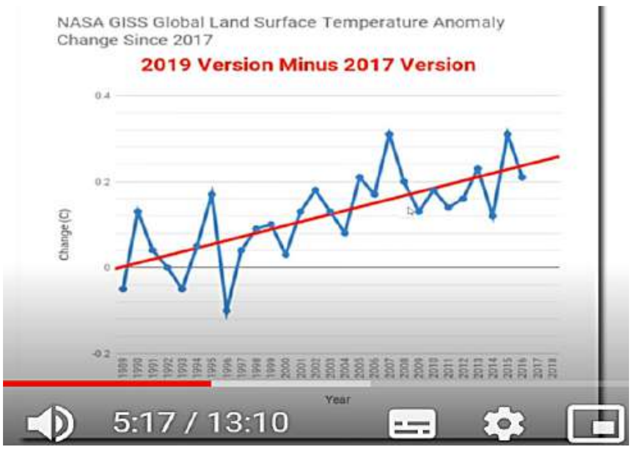

Figure 106. *The derivate of the increase d_{t2019}/d_{t2017} of the NASA GISS Global Land Surface Temperature Anomaly. Source: Goddard (2019)* https://www.youtube.com/watch?v=8tODIRhhV80&feature=youtu.be

304 Climate Fabricators deny that the climate has always changed for natural reasons and pretend that mankind is now the main influence on the course of the climate in the future. They claim an anthropic contribution of 6% of an 0.01% increase of an harmless trace gas is threatening our future on this planet and go as fas as wishing to create an "Anthropocene" forgetting that if mankind were to disappear it would take nature less then 500 years to completely wipe out any trace of our civilizations.

This is what Tony Heller, the blogger behind https://realclimatescience.com/ claims and requires of course some further verifications. Before doing so, one can observe 2019 version of the NASA GISS Global Land Surface Temperature Anomaly minus the 2017 version (just two years separate them) and see how they compare figure 106. Obviously the trend between the two time-series appears extraordinary given that they are only two years apart. This requires some further investigation to try to better understand how these time-series are produced and one cannot take any longer for granted that these dataset properly reflect some physical phenomenon, just because they are produced by supposedly reputable institutions. In fact, one would tend to think that temperatures are just measured, that they have been for a long time and that comparing past and present measurements shows some clear and undeniable trend, and that's it. This is just far from being the case and a bit of investigation will show that not only average mean anomalies do not mean much but that they are far from being as reliable as thought for various reasons, and that even if all procedures leading to the data collection were perfect, which they are far from (McKitrick, 2010), would remain the intrinsic errors as reported by Frank (2010). The first thing to understand, is that there are three main global temperature records: the combined Hadley Centre/Climatic Research Unit Temperature[305] (HADCRUT), the NASA-GISS (GISTEMP) record, and the NOAA record. All three global averages depend on the same underlying land data archive, the Global Historical Climatology Network[306] (GHCN) (Peterson and Vose, 1997; Lawrimore et al., 2011; Menne et al., 2012) maintained by NOAA under the auspices of the (U.S.) National Climate Data Center[307] (NCDC). CRU and GISS supplement it with a small amount of additional data. As explained by McKitrick (2010) "*Because of this reliance on GHCN, its quality deficiencies will constrain the quality of all derived products*".

Now the first thing to understand is that we do not deal with temperatures. As explained by Hausfather (2014) "*the way that NCDC, GISS, Hadley, all calculate so-called temperatures is by taking station data, translating it into anomalies by subtracting the long-term average for each month from each station (e.g. the 1961-1990 mean), assigning each station to a grid cell, averaging the anomalies of all stations in each gridcell for each month, and averaging all gridcells each month weighted by their respective land area*". The details differ a bit between each group, but this is how they produce data, called anomalies and presented as temperatures. Not only does this "Gridded Anomalies" method cools the past and increases the trend, and all honest persons involved in such a process will accept that there is no denying that, but it also leads to questioning the integrity, homogeneity and long term stability of the process as a lot of changes happen over time as will be seen.

Then the trouble is that as stated by McKitrick (2010) "*The number of weather stations providing data to GHCN plunged in 1990 and again in 2005. The sample size has fallen by over 75% from its peak in the early 1970s, and is now smaller than at any time since 1919. The collapse in sample size has not been spatially uniform. It has increased the relative fraction of data coming from airports to about 50 percent (up from about 30 percent in the 1970s). It has also reduced the average latitude of source data and removed relatively more high-altitude monitoring sites. GHCN applies adjustments to try and correct for sampling discontinuities. These have tended to increase the warming trend over the 20th century. After 1990 the magnitude of the adjustments (positive and negative) gets implausibly large*". Even though there is no mischievous intent, who could imagine that?, the changes brought to the GHCN over time and the methodologies used introduce some bias that are only further compounded by the fact that the NCDC global observing network, the heart and soul of surface weather measurement, is facing serious challenges. Urbanization has placed many sites in unsuitable locations, on hot black asphalt, next to trash burn barrels, beside heat exhaust vents, even attached to hot chimneys and above outdoor grills! The data and approach taken by many global warming alarmists is seriously flawed. If the global data were properly adjusted for urbanization and station siting, and land use change issues were addressed, what would emerge is a cyclical pattern of rises and falls with much less of any background trend.

Even though Heller's qualms with respect to irresponsible infilling of missing data with computed or substituted records from other stations were dismissed at the time by Hausfather (2014) mostly on the grounds that "*If Goddard is adverse to anomalies, a simple spatial gridding would eliminate most of the problem (I'm using USHCN's standard of 2.5×3.5 lat/lon grid cells, though the 5×5 that Hadley uses would work as well)*" it does not change anything to the fact that any observer understands that these time series are constructed by some processes – not simply measured - and that they are only as good as the belief one places in them and the processes that have generated them. When the increase of trend over just a two years time is as big as what is shown by Figure 106, the credence is uncomfortably low.

305 https://en.wikipedia.org/wiki/HadCRUT

306 https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/global-historical-climatology-network-ghcn

307 https://www.ncdc.noaa.gov/

McKitrick (2010) summarizes with "*The quality of data over land, namely the raw temperature data in GHCN, depends on the validity of adjustments for known problems due to urbanization and land-use change. The adequacy of these adjustments has been tested in three different ways, with two of the three finding evidence that they do not suffice to remove warming biases.* ***The overall conclusion of this report is that there are serious quality problems in the surface temperature data sets that call into question whether the global temperature history, especially over land, can be considered both continuous and precise****. Users should be aware of these limitations, especially in policy sensitive applications*".

After 1980 the SST products have not trended upwards as much as land air temperature averages and one could imagine that Sea Surface Temperatures (SSTs) would not be prone to such serious drawbacks as much as land records. The annoying truth is that they are subject to other problems that are only going to be very briefly mentioned just so that one can sense that they will not offer a quick solution either. As reminded by Christy (2016) "*the depth of the water temperature measurement is quite varied from 2 ft to 50 ft or so, by methods that range from buckets drawn up on deck into which a thermometer is inserted to engine-intake temperatures much deeper in the water and to buoys, drifting or moored to the bottom. So the fact temperature varies by depth is an issue to tackle before the possibility of constructing a systematic dataset may be attempted. Then too, the measurements are not spatially or temporally consistent with large regions, such as Africa and the southern oceans, unmeasured*".

Over the ocean, the temperature utilized is that of the water itself, not the air above, and sea-surface temperature (SST) anomalies are assumed to be good surrogates for near-surface marine air temperature (MAT) anomalies. Therefore, traditional global surface datasets mixing both sources of data do not measure a homogeneous physical parameter over land versus ocean. Furthermore, exactly as for land networks, e.g. GHCN, measurements at sea have also undergone very significant changes, as for example, in 1980, only about 10 percent of the data reports were from buoys, whereas by 2000 about 90 percent were buoy data and starting as of 1990, NOAA introduced an adjustment applied to buoy data, adding about +0.12°C to the buoy readings while constructing the ERSSTv4 series (Huang et al., 2015, 2017). As reported by Christy (2016) "*Thus, because the influence of the buoy data grew significantly through time, the simple addition of a bias to all the buoys from the beginning created a warmer trend as they became the dominate source of information*". Exactly as for land based networks, changes in the measurement means and methods at sea introduce heterogeneities that require adjustments leading to systematic bias (Matthews, 2013; Matthews and Matthews, 2013).

Furthermore, as pointed out by Christy (2016) "*NOAA used a curious reference variable to calibrate the water temperatures measured from ship intakes – the Night Marine Air Temperature (NMAT). This is curious because there are considerable adjustments required for the NMATs themselves, i.e. corrections for height of ship deck, etc. In any case, from this, the buoy data were then adjusted to match the ship data. It appears, then, that the foundational adjustment process depends on NMATs to adjust the ship data to then adjust the buoy data*". The trouble is that the final product from NOAA mixes all of these together and recent research by Rubino et al (2020) demonstrates that contrary to what was long expected, SST anomalies are not good surrogates for near-surface Marine Air Temperature (MAT) anomalies and they "*show that SST and MAT anomalies differ regarding crucial statistical properties such as multiannual trends and probabilistic distributions of daily and monthly averages*" and therefore sea-surface air temperature (MAT) cannot be so easily derived as thought from SSTs and as global gridded temperature datasets commonly blend SST and near-surface air temperature anomalies to overcome the lack of geographically homogeneous and reliable MAT data one must face the evidence of a lack of interchangeability and its consequences on the reliability of the global datasets.

So, there only remains satellite observations as a reasonably consistent dataset gathered over some decades that would be based on rather homogeneous instruments, even though they also need to be well understood to make the best use of them. In that respect, Spencer et al (2015) and Spencer (2016) reports "*Since 1979, NOAA satellites have been carrying instruments which measure the natural microwave thermal emissions from oxygen in the atmosphere. The intensity of the signals these microwave radiometers measure at different microwave frequencies is directly proportional to the temperature of different, deep layers of the atmosphere. Every month, John Christy and I update global temperature datasets that represent the piecing together of the temperature data from a total of fifteen instruments flying on different satellites over the years*". Therefore, the UAH satellite data appear as the most reliable set of global tropospheric temperature measurements benefiting of rigorous inter-comparisons with other observation means and delivering consistent time-series over several decades. As stated by Christy et al. (1997) and one cannot concur more "'*We believe that lower-tropospheric temperatures measured directly by satellites have excellent long-term accuracy, as seen by comparisons with independent atmospheric measurements from weather balloons*".

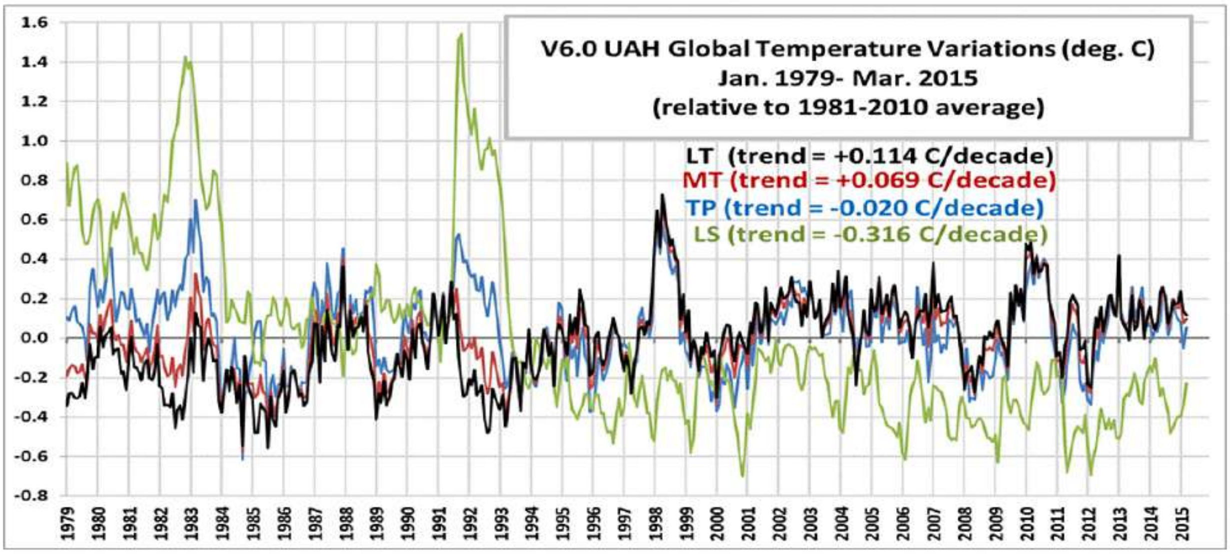

Figure 107. Resulting UAH v6.0 Global Average Temperature time series of LT (lower-troposphere), MT (mid-troposphere, from MSU2/AMSU5), TP (our new "tropopause level" product, from MSU3/AMSU7) and LS (lower stratosphere, from MSU4/AMSU9) from Spencer et al. (2015).

It simply appears that UAH series (see Figure 107) show a lot less warming over the same period (1979-2015) than for example the NASA-GISS (GISTEMP) reconstruction, the HADCRUT reconstruction or even the NOAA ERSSTv4 series (see Figure 108) as per Huang et al. (2017), which are more reasonable than the two previous ones whatever the reservations made, and they also show 2.5 times less warming than the GCMs simulators that have completely failed to simply reproduce observed temperatures as seen before.

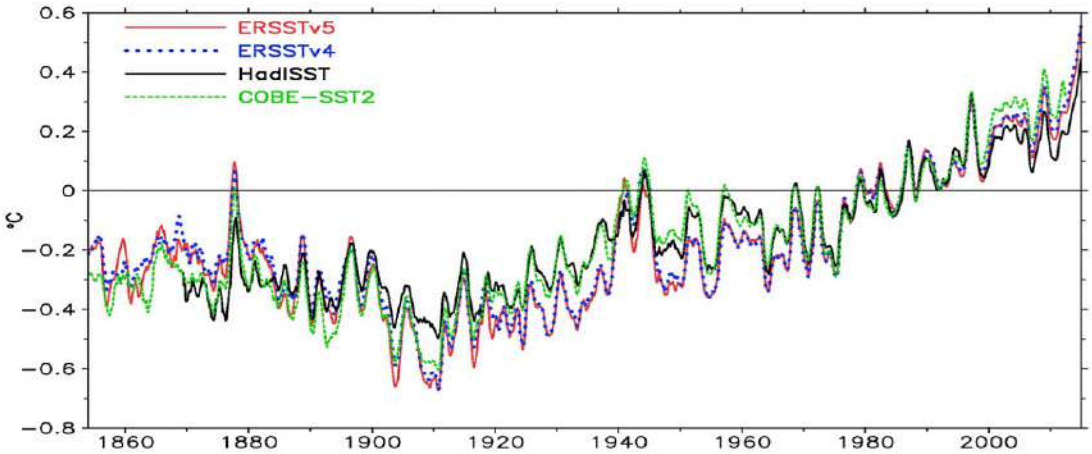

Figure 108. Globally averaged SSTAs from ERSSTv5 (solid red line), ERSSTv4 (dotted blue line), HadISST (solid black line), and COBE-SST2 (dashed green line). For an analysis of the warming spanning 1910-1940 see Egorova et al. (2018b). Source: Huang et al. (2017).

As reminded by Spencer (2016) "*There are three main methods used to monitor global temperatures, all of which have systematic errors that need to be corrected for. We have had thermometer data since the mid-1800s, which are our only reliable way of monitoring near-surface temperatures. Over the oceans, the thermometer measurements have mostly come from buoys and ships. Weather balloons (radiosondes) have made measurements of the lower atmosphere only since the 1950s, and for a greatly reduced number of locations. Finally, satellite measurements of the lower atmosphere are our newest technology (since 1979), which have the unique advantage of global coverage*".

The problem is that with very small trends over short periods as those displayed in Figure 107 and rather chaotic or bumpy rides since 1860 as visible in Figure 108, whereas emissions have exponentially increased all along, and the potential long term lag of the climate system to any stimulation (supposedly man-made or simply natural) as the ocean circulation may always vary and cool the surface by bringing waters from the depths, touting all the time as the media or even supposedly reputable agencies do e.g. (GISS, 2015) "*this is the hottest something*[308] *since blabla or unprecedented or ever*" is simply meaningless given that for all three measurements methods we have, the errors on the measures themselves are significant and furthermore adjustments made to concatenate time series gathered with the same techniques but facing a changing environment (UHIE) or procedures, or resorting to means evolving over time (e.g. drift of the satellites' orbits, different sensors over successive generations), all lead to uncertainties that are as large as the signal that is searched for. As pointed out by Jenkins, Jr. (2017) there is a scheme behind, well thought off one "*U.S. government agencies stopped mentioning uncertainty ranges because they wanted to engender a steady succession of headlines pronouncing the latest year unambiguously the hottest when it wasn't necessarily so*" and furthermore as stressed out in Figures 105 and 106, Jenkins, Jr. (2017) also observes that "*The numbers keep changing. Years 2005 and 2010 were exactly tied in 2010, but now 2010 is slightly warmer, just enough to impart an upward slope to any graph that ignores statistical uncertainty. Government scientists are undoubtedly ready with justifications for each of the countless retroactive adjustments they impose on the data, but are you quite sure they can be trusted?*".

Thus, just compiling the raw data is not advisable, but adjusting the data for known changes in the measurement systems are a requirement, but unfortunately as the sizes of those adjustments are with respect to the measures large and uncertain, and depending on how they are made, some significant differences in calculated global temperature trends can result depending upon who is making the adjustment decisions. Given the very highly politicized context of "climate-science" the constant and numerous adjustments of the ever changing data series have led to legitimate suspicions (see Figures 105 and 106).

Of all the time series available, the longest and unfortunately also the most prone to arbitrary corrections are the simple series coming from thermometers, usually placed to measure air temperature about 2 meters above ground. Beyond changes in the time of day that high and low temperatures for the day are reported, the major problem comes from the UHIE problematic that has already been stressed, which touches, for example, the weather stations of the Global Historical Climatology Network (GHCN). Spencer (2016) calculated the average UHI effect in daily surface weather data that he computed from weather reporting stations all around the world during the year 2000, based upon daily temperature differences between neighboring temperature stations, and from thereof states *"As can be seen, even at population densities as low as 10 persons per square kilometer, there is an average warming of 0.6 C (1 F), which is almost as large as the global warming signal over the last century"* and can go up to 2.2°C for densities of population of up to 7000 per square km^2. Properly correcting for the UHIE is therefore of the utmost importance, and the unfortunate observation is that contrary to all logical requirements, adjustments have been made the other way round by making rural stations match urban stations which generate an artificial "global warming" signal much welcome for the "warmists" (Scafetta, 2021). Furthermore, the basic thermometers of the previous centuries are now long gone and have been replaced with electronic thermistor-type "thermometers" in smaller metal housings. The newer sensors measure electrical resistance which is then related to temperature; this is well and fine for meteorological observations but certainly not for the acquisition of long term series with the intent to draw some climatic conclusions. Spencer (2016) states "*As in the case of the thermometer measurements, these changes have not affected weather forecasting, because they are small (usually a degree or less) compared to the size of day-to-day weather changes. But they are large and detrimental for the purposes of long-term temperature monitoring*". All what has been mentioned, including changes of procedures, changes of instrumentation, changes of the environment with the UIHE phenomenon, all lead to numerous adjustments that can go one way or another depending on whether one searches for the best data or for the data that best fit the objective. Unfortunately, as suggested and visualized by Figures 105 and 106 it seems that the best data are those that best fit the objective and are obtained by cooling the past and warming the present, all with the intent to increase the trend, the budgets and maintain the narrative well and alive, "the hottest month" or "the hottest year", etc.

Satellite data sets are the results of complex measurement systems and sophisticated processing, Spencer et al. (2015) gives a comprehensive explanation of how the latest version V6.0 of the UAH temperature series are obtained. One could think that they would be less prone to "adjustments" than the poor "thermometers" down on Earth, which are facing all sorts of spurious heat influences around them like concrete or asphalt paving, exhaust fans, etc. Alas, even though they fly high in the sky, they are also a battleground for corrections of all sorts with all justifications, some

308 Put whatever you wish, be it day, month, year, or since whenever will manage to impress the reader. Resolution limits and systematic measurement error produced by the instruments used constitute lower limits of uncertainty. The scientists engaged in consensus climatology have neglected both of them. Frank (2016a-b) states "*The uncertainty estimate developed here shows that the rate or magnitude of change in global air temperature since 1850 cannot be known within ±1 C prior to 1980 or within ±0.6 C after 1990, at the 95% confidence interval. The **rate and magnitude of temperature change since 1850 is literally unknowable**. There is **no support at all for any 'unprecedented'** in the surface air temperature record.*"

certainly valuable whereas others are much more dubious and strongly rely on models (e.g. usage of general circulation model output to remove the effects of drifting local measurement time on the measured temperatures) ! For example, temperature data (T) on the graph displayed Figure 24, p. 78, have been revised by Mears and Wentz (2017) following a puzzling number of operations as displayed in Fig. 1, p. 7697 of their paper. After a 30% increase in upwards adjustments, the last paragraph of their paper provides a laundry list of excuses for future upwards adjustments. With each study, the list of excuses for making further upwards adjustments is never ending. And by total coincidence, all adjustments just happen to be upwards. This culminates 10 years of taxpayer funded research which is purely designed to find excuses, that sound legitimate, to make upwards adjustments to the satellite temperature dataset to make them consistent with the theory of human-caused global warming. Honestly, how one can place any confidence in datasets that are kept being corrected all the time, for which the adjustments are large with respect to the measurements accuracy and furthermore rather arbitrary and plentiful, especially when one knows more about RSS.

An algorithm that always works and does not need any arbitrary correction or adjustment is 'follow the money' and it is always instructive. RSS is a company funded in 1974 and since entirely funded by a NASA program: Earth Science Enterprise program. The early presentation of the programme by NASA in 1999 (ESE, 1999) was pretty clear and stated p. 11: "NASA Facts - January 1999" "Is the Earth Experiencing a Warming Trend?" then it reads "*Computer **models** **predict** that it is. Burning coal, oil, and natural gas to heat our homes, power our cars, and illuminate our cities produces carbon dioxide (CO_2) and other greenhouse gases as by-products. (…) Records of past climate going as far back as 160,000 years indicate a close **correlation** (1) between the concentration of greenhouse gases in the atmosphere and global temperatures. Computer **simulations** of the climate indicate that global temperatures **will rise** as atmospheric concentrations of CO_2 increase. An international **panel** of 2,000 of the world's leading climate scientists concluded that Earth has already warmed about l°F over the last century, and that "the **balance of evidence suggests** a discernible human influence on global climate." (…) This international **panel estimates** that global surface air temperature will increase another 2-6°F in the next 100 years. The difference in temperature from the last ice age to now is about 9°F. Their **best guess** is that we will experience warming of about 3.5°F by 2100, which would be a faster rate of climate change than any experienced during the last 10,000 years, the period in which modern civilization developed. (…)*"

It is so funny to notice, though, that their illustration "*Satellite Temperature Record*" "*The Global Lower Tropospheric Temperatures 1979-1997*" used in (ESE, 1999) p.11 to illustrate their above rantings, is... so desperately flat. Summing up, we have people who relied on a massive conflict of interest since 1974, who are funded by an Agency's program which from the start in 1999 was basing all the soundness of their reasoning on everything but science: prediction of models, on the correlation is not causation but still we mislead people as if it were, from simulations we jump to use an affirmative style (will and not would) and claim that a balance of evidence suggests (sic !) that the panel estimates that their best guess (sic!) would be that the rate of change will be unprecedented (sic!). What a demonstration, what a compelling set of evidences, was just missing the "consensus" but the "*international panel of 2,000 of the world's leading climate scientists*" very much looks like resorting to it anyway. So with the argument of authority we have it all.

How seriously can be taken such results? Certainly not that the scientists involved are incompetent but they are simply too dependent on NASA fundings and climate objectives as clearly stated in (ESE, 1999) to revise otherwise than in the direction suggested (or more likely expected?, requested?) by the agency, i.e. upwards and faster as they need a "*faster rate of climate change than any experienced during the last 10,000 years*" and they probably have no time to lose to make such a brilliant demonstration of all their "best guesses" as they clearly stated it black on white. As will be seen later Harari (2015) reminds "*Most scientific studies are funded because somebody believes they can help attain some political, economic or religious goal p.303*" and it seems pretty obvious that what was reported before falls into that category. This method of financing scientific research has unfortunately led to a complete distortion of the scientific method, to such an extent that little confidence, rightfully or not, is now placed in the results, and further damage to the credibility of the studies would have to be expected if things continued to proceed in this way, which not only seems to be the case but in fact seems to be accelerating.

The question of whether one set of Global Mean Surface Temperature Anomalies (GMSTA) is meaningful or not to account for the evolution of the climate of such a complicated system as the Earth is certainly worth being asked, but even before doing so, one should notice that because the evolution of these anomalies over time has been all but smooth and linear but bumpy and chaotic - see Fig. 1 of Hansen et al. (2013b) or Fig. 1 of Hansen et al. (2014), contrary to the emissions which have followed their exponential pattern linked to the population growth, any lasting interruption in the minuscule increase of the GMSTA has led to battlegrounds between those eager to dismiss any 'hiatus' and those simply observing what the data actually show. In that respect, the introduction to the paper of von Känel et al. (2017) is very telling "*Between 1998 and 2012 the rate of increase in global mean surface temperature*

(GMST; 0.15°C/15 years) was only about half of that of the preceding 26 years period [Karl et al., 2015] and much lower than projected by most climate model simulations [Fyfe et al., 2013]. This temporary slowdown in global warming (often called the "global warming hiatus" or "global surface warming slowdown") occurred despite the unabated and anthropogenically driven increase in radiative forcing. This apparent inconsistency between the observed slowdown in global warming and the continued intensification of radiative forcing and the continued simulated global warming in climate models has generated intense scientific, political, and public debates [Boykoff, 2014], primarily because of its implications for the understanding of the human interference with the climate system". Even though there had been a widespread study of the 1998-2013 so called 'hiatus', e.g. (Akasofu, 2013; Macias et al., 2014; Maher et al.; 2020; Ollila, 2020) "*On short (15-year) to mid-term (30-year) time-scales how the Earth's surface temperature evolves can be dominated by internal variability as demonstrated by the global-warming pause or 'hiatus'*" see Maher et al. (2020) the paper by Karl et al. (2015) was opportunistically released or rather as Rose (2017a-b) says "*was rushed through and timed to influence the Paris agreement on climate change*" and aimed at challenging the existence of such a hiatus which was a very bad omen for the Paris meeting and was distributed to all participants so that they would have no doubt left when requested to sign the agreement.

The papers by Rose (2017a-b) were published further to the retirement of John Bates, a climate scientist formerly responsible for NOAA's climate archive who was awarded a U.S. Department of Commerce Gold Medal in 2014 for visionary work in the acquisition, production, and preservation of climate data records (CDRs). Bates, once relieved from NOAA hierarchy wrote the detailed blog article "*Climate scientists versus climate data*". Bates (2017) states "*The most serious example of a climate scientist not archiving or documenting a critical climate dataset was the study of Tom Karl et al. 2015, purporting to show no 'hiatus' in global warming in the 2000s*". In fact, this example piles on another very serious case that will be mentioned later and led to the dismissal of the scientist in charge of the data, though another reason was invoked, is the case of Michael James Salinger who worked for decades for the National Institute of Water and Atmospheric Research (NIWA) and consistently resisted the release of appropriate data as will be seen later.

Back to the Karl et al. (2015) paper, one should notice that even though other scientists came with a host of criticisms and confirmed the hiatus, e.g. Fife et al. (2016) with a paper entitled "*Making sense of the early-2000s warming slowdown*" and von Känel et al. (2017) as quoted before who also confirmed their understanding of the hiatus, a report ordered by NOAA - as far as I understand – i.e. Grasso (2018) exonerated Karl et al. (2015) of any wrong doings. In fact, if the reader wants to think that there was finally no hiatus at all and that all these researchers could not even read a trivial graph one can always find a paper stating so, i.e. Rajaratnam et al. (2015), showing that the only agreement all these AGW scholars have is to disagree. How this can make up the well touted 100% (sorry just 97%) ridiculous consensus (Morano, 2010) is a riddle that will be left to the perspicacity of the reader as it is clearly beyond my intellectual means.

In any case, the special interests have been quick to line up behind Karl et al. (2015) to defend their vision by trying to reduce it to an internecine quarrel between NOAA's scientists, just a personal grudge, and undermining the credibility of Judith Curry's blog by stating that she had just retired and "*walked the line between science and climate contrarians over the past decade*" (Cornwall and Voosen, 2017). This very small quote from this paper in sciencemag.org written by a freelance journalist in Washington State and a staff writer who covers Earth and planetary science tells a lot and has nothing to envy to an excommunication sentence pronounced by a quick inquisition trial , you cross the line doubting – which is a scientist's basic job – and you are relegated out of the scientific realm into the besotted 'contrarians'. For sure, 'contrarians' irk the plans of all these well intentioned data fabricators who want to save the world nudging up a bit here, adjusting there, outright fudging whenever required and not correctly archiving, documenting nor making available the data and the processes that led to the time series they provide as indisputable evidence, as for the New Zealand disputed and incredible case (TNZCSC, 2009; Treadgold, 2010a; Wratt et al., 2020).

The question of the man-made global warming, not with CO_2 emissions, but with data tampering was clearly raised by The New Zealand Climate Science Coalition (TNZCSC) in a paper entitled "*Are we feeling warmer yet?*" (TNZCSC, 2009). New Zealand's National Institute of Water & Atmospheric Research (NIWA) is responsible for New Zealand's National Climate Database. TNZCSC (2009) stated "*This database, available on-line, holds all New Zealand's climate data, including temperature readings, since the 1850s. Anybody can go and get the data for free*". That's what TNZCSC (2009) did, and they produced their own graph. The trouble that arises is that the graph they obtained has nothing to It with the official version, basically theirs shows no warming over the period 1850-2009 whereas the official NIWA's version shows a positive trend of 0.92°C / century (Figure 109).

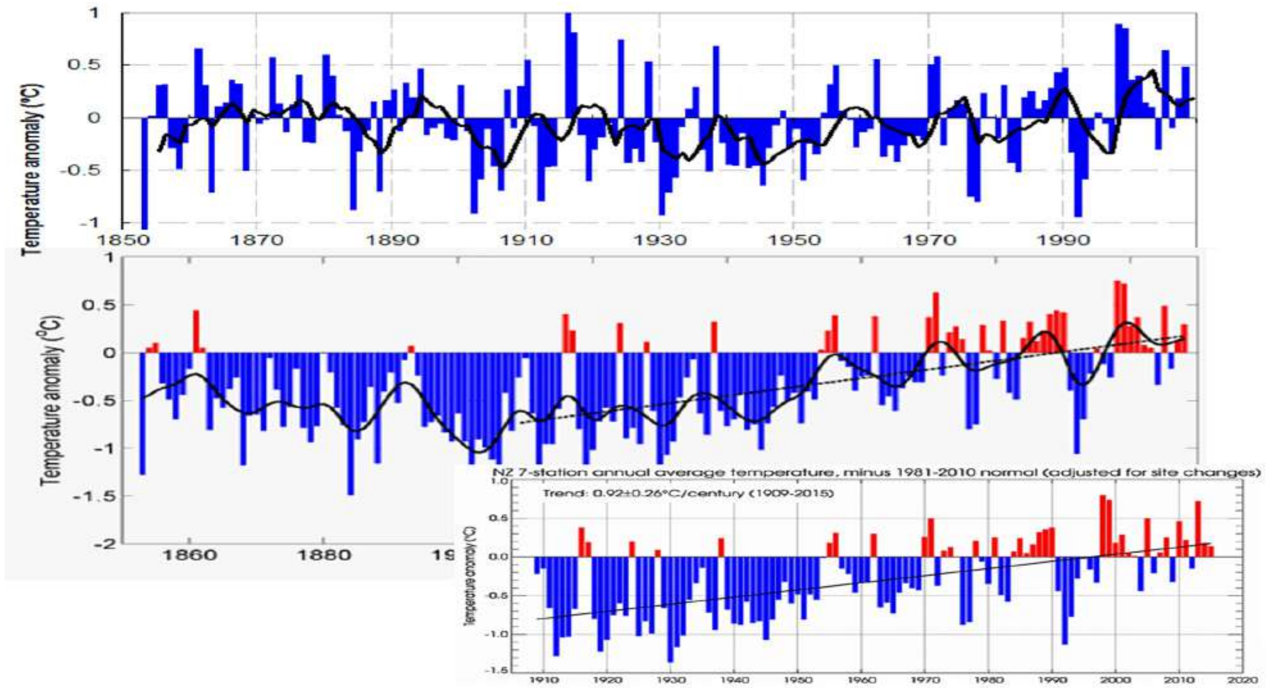

Figure 109. *NZ Temperature anomaly (unadjusted) as per TNZCSC (2009), b) After Salinger's undocumented adjustments: Mean annual temperature over New Zealand, from 1853 to 2008 inclusive, based on between 2 (from 1853) and 7 (from 1908) long-term station records. The blue and red bars show annual differences from the 1971-2000 average, the solid black line is a smoothed time series, and the dotted [straight] line is the linear trend over 1909 to 2008 (0.92°C/100 years) NIWA (2007), c) period 1909-2015 NIWA (2020) as per Wratt et al. (2020).*

As the official graph is the centerpiece of NIWA's temperature claims, contributes to global temperature statistics and the IPCC reports and supports the insistence of the NZ government on introducing an Emission Trading Scheme (ETS) it was legitimate for the TNZCSC to check how the graph is obtained. Dr Jim Salinger who was dismissed by NIWA on 23 April 2009[309], started this time-series in the early 1980s when he was at CRU (Climate Research Unit at the University of East Anglia, UK, 1980-1981). The adjustments made to the data had been asked since the 1980s by the most senior scientists in TNZCSC, including Dr Vincent Gray and Dr Warwick Hughes, and, of course, Dr Jim Salinger was the scientist they asked, since it was he who worked on the time series and adjusted the data.

Treadgold (2010a) reports "*Vincent and Warwick wondered how he had done the work and asked to have a look. Salinger said you can't have the data. For 30 years he said no. Then, about a year ago, he was fired from NIWA. Now perhaps they would not be denied. But there was no longer anyone at NIWA who knew how the Salinger adjustments had been made and it would be embarrassing to admit they didn't even have them*". The very objective of the paper "*Are we feeling warmer yet?*" (TNZCSC, 2009) was to obtain the Schedule of Adjustments (SOA), the precise reasons why adjustments had been made and how. TNZCSC's scientists waited for the SOA but never got them and concluded that "*Of course, they wished to obscure the simple fact that they couldn't say anything about the actual adjustments, because they didn't know what they were. There was no SOA. It was Salinger's secret*". TNZCSC reports that their objective was achieved upon Tim Mahood's (NIWA's General Counsel 2005-2012) admission on 29 January [2010] that "*NIWA does not hold copies of the original worksheets*". Thus, the time-series on which the entire policies of the NZ government is based is an undocumented illusion as downloading the data and plotting a graph delivers a completely different perspective to the alleged warming.

Finally, addressing NIWA's lack of rigor and inability to produce any decent record-keeping of the way the time-series had been altered, Treadgold (2010a) says "*They must also explain why they never questioned the graph, since it was based on a 30-year-old thesis and non-peer-reviewed work. At the very least, they are guilty of confirmation bias, in that they blindly accepted the results because it suited their beliefs. They should also explain to the ministers (Mapp, Hide and Smith) why they presented unverified data to support the ETS legislation, and why they attacked the NZCSC when they raised the issue, instead of admitting they didn't have the SOA. It made them look like activists instead of scientists*" (…) "*They have made mistakes, but still they are part of this country, part of our family. They have only to*

309 Curiously Salinger was not dismissed for having failed to document how the temperature time-series he was in charge of had been collated and how they had been adjusted but for infringing the rules established to communicate with the press!

demonstrate their re-commitment to excellence to secure our whole-hearted support". Do you think this is what happened?

That NIWA would have tried to reconstruct to the best of their ability a decent SOA? No, that's the way things actually unfolded. TNZCSC had to challenge NIWA going to court and then the reader must remember the lesson: "*The Coalition came to prominence in 2010 when it challenged the methodology and accuracy of NIWA's historical temperature records in court. The Coalition lost the case, could not afford to pay costs awarded against it and was forced into liquidation*[310]". The message of the dominants is pretty clear: do not challenge our views and whatever we do or say, justice will be on our side. Unfortunately for them, all these shenanigans and demonstrations of force and power succeed to kill, somehow and for some time, opposing views but will not make in the end the flawed AGW theory correct. Nature will run its course and climate will show, soon reverting to the mean (through a Grand Solar Minimum), that it cannot care less of CO_2 but that mankind should have instead better prepare for adverse possibilities, i.e. cooling, than wasting trillions of hard earned tax-payer monies into unsubstantiated conjectures.

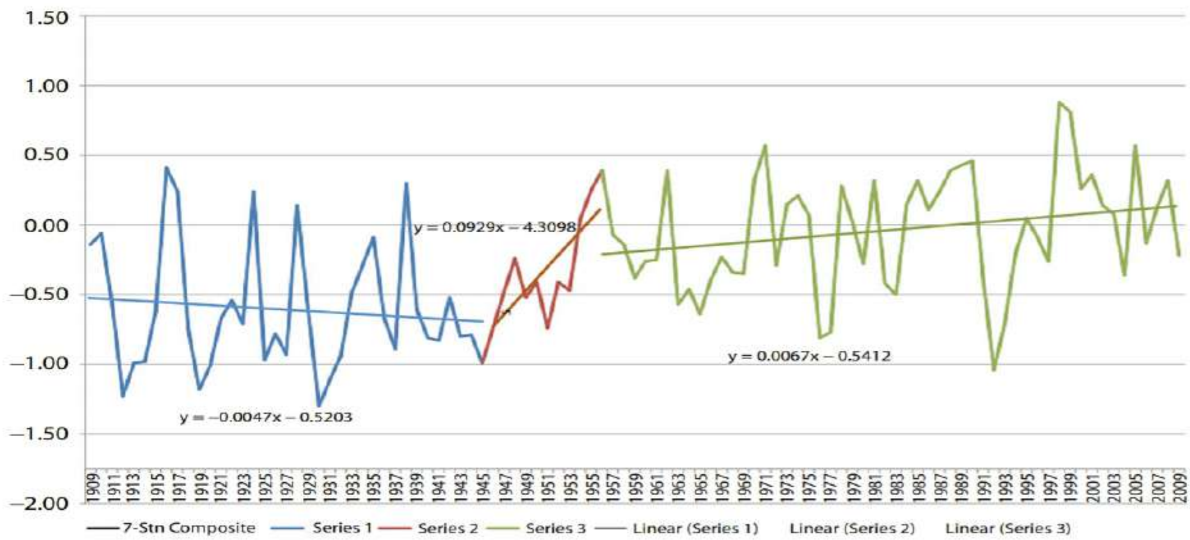

Figure 110. *NZ Temperature anomaly: revised trend analysis (Gray, 2011), showing a very slight downward trend from 1909-1943, a sudden rise from 1945-50 and a slow rise from 1950 to 2010; after a private communication with Leyland, B., 2010.*

Adding insult to injury, the current version of the official NIWA website not only has stuck with Salinger's time-series and its undocumented SOAs supposedly based on Salinger (1981) and later Rhoades and Salinger (1993) but as if not enough to "prove" the warming has decided that it would be better to cut off the disturbing data before 1910 (Fig. 7 [311]) (lower right graph of Figure 109) as they did not help contribute to the "trend" that must be enforced by all means, so as to brilliantly conclude with a 0.92 ± 0.26°C/100 years (Wratt et al., 2020). This time-series was analyzed and corrected of spurious Salinger's adjustments (referred to as 1981 methods) by De Freitas et al. (2014) who concluded for the period 1909-2009 "*Current New Zealand century-long climatology based on 1981 methods produces a trend of 0.91 °C per century. Our analysis, which uses updated measurement techniques and corrects for shelter-contaminated data, produces a trend of 0.28 °C per century*". But as the warmsters never concede wrongdoings, dubious adjustments or questionable processing or defeat and as they fortunately recovered memory of how the adjustments had seemingly been made, Mullan et al. (2018) from NIWA teamed up with refugee Salinger (who is now affiliated at the "Dipartimento di Scienze delle Produzioni Agroalimentari e dell'Ambiente" (DISPAA) under the auspices of Marina Baldi's Italian National Research Council) who after refusing to reveal the SOA for 4 decades has seemingly fortunately recovered the lost excel file and can now argue with Wratt that they disagree with De Freitas et al. (2014).

From the Mullan et al. (2010) report one should notice one of the strong points put forward, i.e. "*The variations in time of New Zealand temperature are consistent with completely independent measurements of regional sea temperatures. There is also a strong correlation between variations in New Zealand temperature and prevailing wind flow, which relates closely to the abrupt warming in the mid 20th century, and the slower rate of warming since about 1960*". From thereof, Gray (2011) concludes referring to the aforementioned report "*They give further details of these explanations*

310 https://en.wikipedia.org/wiki/New_Zealand_Climate_Science_Coalition
311 https://niwa.co.nz/our-science/climate/information-and-resources/clivar/pastclimate

in the text. What they are really saying is the behaviour is best represented by several "trends" referring to the different climate behaviour over the period (…) The implication here is that there is no need to claim that the changes shown can be related to changes in atmospheric concentrations of greenhouse gases". A naked-eye analysis not even requiring a best-fit, regression analysis or else, simply enables to see that the last point on the graph in 2009 is just **below** the first in 1909 and though perfectly conscious of not making hasty and flimsy conclusions, one cannot prevent from thinking that we are dealing with a matter which is not striking by its utmost urgency, as for over a century, quite to nothing happened in terms of irrefutable man-made trend, or even trend whatever it be. I will let the reader decide which time-series he/she wishes to place his/her confidence in, but the 4 decades long NZ cesspool stinks and the stench can be smelt from far away, in fact as far as from Malta on the other side of the planet. Enforcing coercive ETS policies that will harm the well-being and standard of living of NZ citizens for their good after that they have been consistently deceived with frightening warming slogans, when natural variability is the most valuable cause of the changes observed (be they up or down) is placing a grave responsibility on the politicians and the governments. And this responsibility will be, including the handful of NZ scientists who are stakeholders in that conflict of interests as their budgets and salaries depend on kicking the can, a tough legacy because as is going to be explained now, natural variability seems to be back with a vengeance.

Not only TNZCSC is not dead as Wiki and Desmog would be glad to report and the reader can follow them here[312], but it seems that Nature is going its own way as recent research by Mackintosh et al. (2017) invalidates the thesis that Salinger has been defending since his 1975 paper in Nature (Salinger and Gunn, 1975) that started the warming frenzy in NZ. Brill (2019) makes a summary of Salinger's position since 1974 "*James Salinger had a research paper accepted by Nature in which he contended that New Zealand must be warming because its glaciers were retreating. This led on to his doctoral thesis and his eventual apotheosis – the 7-Station Series – and his focus on those glaciers never waned in the following 40 years*". If Salinger's thesis (1981) is hardly available at a period when all such documents have been scanned worldwide (Treadgold, 2010b-c) and is not available on Salinger's RG account for example[313], Mullan et al. (2010) have already defended the 7SS methodology and went further in Mullan et al. (2018), citing Chinn (1996) to justify the alleged warming "*Retreat of NZ Glaciers Chinn [27] reported on a study of 127 Southern Alps glaciers, which indicated an average shortening by 38% and loss of 25% in area in the century up to 1990. He concluded that the upward shift of glacier mean elevation with this century of change is approximately equivalent to a temperature rise of 0.6 °C*". Even though Mackintosh et al. (2017) had to bow before the new AGW cult acknowledging that there exists an "*anthropogenic climate warming*" and the requirement to state that their findings is "*consistent with a climate system that is being modified by humans*" otherwise we would have never discussed their paper as it would have been rejected, the fact is that their work is just a shattering blow to all NIWA biased pseudo-evidences, stating "*The exceptional terminus advance of some glaciers during recent global warming is thought to relate to locally specific climate conditions, such as increased precipitation.* ***In New Zealand, at least 58 glaciers advanced between 1983 and 2008, and Franz Josef and Fox glaciers advanced nearly continuously during this time****. Here we show that the glacier advance phase resulted predominantly from discrete periods of reduced air temperature, rather than increased precipitation. The lower temperatures were associated with anomalous southerly winds and low sea surface temperature in the Tasman Sea region. These conditions result from variability in the structure of the extratropical atmospheric circulation over the South Pacific*".

Thus, in NZ there is a supposedly catastrophic warming that justifies ETS enforcement but in fact, the simple observable truth as reported by Mackintosh et al. (2017) is that sort of half of the NZ glaciers have been advancing contrary to what Salinger and NIWA have been claiming for four decades and not surprisingly "*NZ has been cooling for 26 years*" as per Brill (2019), but of course all that is regional and AGW is well alive.

The problem is that the climate is always regional and the notion of a Global Mean Average Temperature (GMAT) or of anomalies derived from the subtraction of 30 years means from the GMAT does not make any sense. This is what is going to be addressed now. After having spent billions to sent constellations of satellite into orbit to quarrel about tenths of a degree in such a poorly convincing way as illustrated by Figures 109 and 110, the poor average biped is frequently experiencing changes of the overnight temperature of more than 10-15 degrees and tries to adapt himself / herself to cope with his / her reality which is miles away from the well heated offices of the bureaucrats and researchers who pontificate for decades about the tenths of irrelevant degrees for his / her life. With respect to how useful for the billions of us these notions of global averaged anomalies can be, Gerry Denaro says: "*Who decides where thermometers or rain gauges are placed? Should we only measure it where people live and ignore oceans and vastly*

312 https://www.climateconversation.org.nz/ https://www.climatescience.org.nz/
313 https://www.researchgate.net/profile/M_Salinger/publications

under populated regions of which there are many? Depending on latitude and elevation, earth's temperatures vary between -50 and +50°C across the globe. Even if we could make 100 or 1000 accurate in situ measurements and "average" them to 0.1°C, it would be more honest to express the result with a confidence limits or relative error say 25°C + or – 2°C. How can any continent, let alone the whole planet quote an 'average temperature' when there are so many complex, cyclical and unpredictable parameters? ***How relevant or meaningful is average temperature any more than say average ocean depth, land altitude, rainfall or sunny days?*** *In Australia tropical Northern Queensland receives 2 meters or more rain in the wet seasons while other inland areas are lucky to get 2mm? Our temperature ranges from −23.0°C at Charlotte Pass to a high at Oodnadatta, 50.7°C. Many choose to live in warm places like Darwin whose temperature rarely falls under 30°C all year round . At the opposite extreme, Tasmania is cold, all of the time. Collinsvalle has an annual mean temp of 7.5°C.* ***In a country of such extreme climate, an 'average temperature' has no more meaning than average rainfall, altitude or perhaps personal wealth****. On a planet with even more climate diversity and extreme weather events, lets be brutally honest here and admit such values have limited significance overall and to individuals are of no value, except possibly to climate alarmists trying to justify global warming*".

Veyres (2020e) discusses in that respect the temperatures, i.e. the true and the so-called anomalies easily tweaked to tell the expected AGW story, and the presentation is edifying. It starts with the average temperatures for the day on April 1st at Paris-le Bourget (now a well known airport) 1900-2019 series. It ranges between -2°C and +13°C for the same day of the year, and one does not deal with sort of tenths of a degree, nor does see a catastrophic trend over 120 years that is going to roast us.

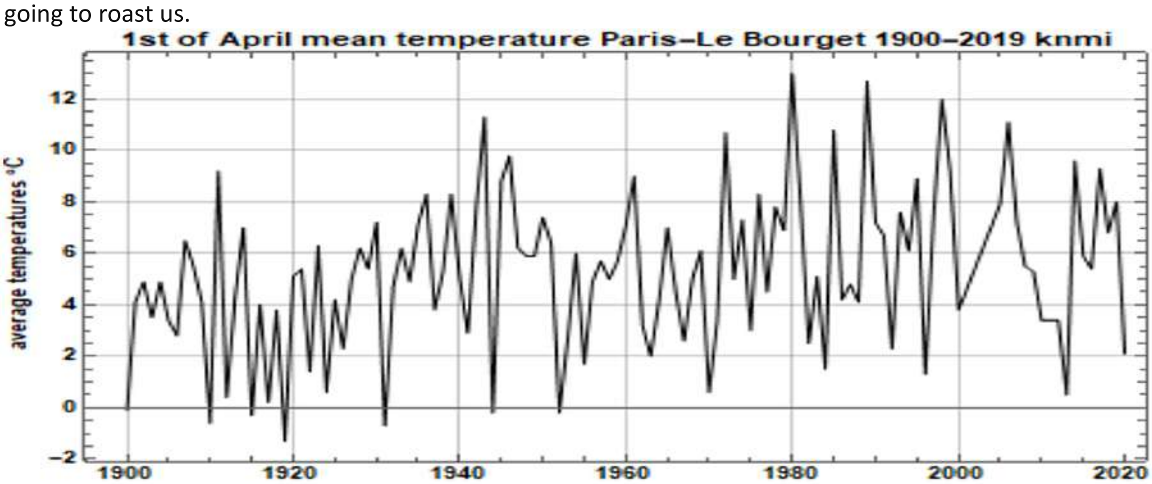

Figure 111. *April 1st at Paris-le Bourget (now a well known airport) 1900-2019 series. It ranges between -2°C and +13°C ; Source knmi-explorer. After Veyres (2020e)*

And as if not varying enough, it is of course necessary to add or subtract a few degrees, from 5 to 10°C, to obtain the minimum at the end of the night and the maximum, generally in the afternoon. These are the temperatures felt by the real people, those who work outside and not in an air-conditioned office, tracking the tenths of the degree on time-series adjusted satellite records.

Next Figure 112 (source: www.infoclimat.fr) shows for Lyon (France), for each of the years 1921-2020, in green vertical lines the average of the 31 days of January for the year on the x-axis (for each year it shows the range between the average of the min and the average of the max), the high (red dot) and low (blue dot) records of January of that year, the averages 6.1°C (dotted red line) and -0.1°C (dotted blue line) taken on the top (Mean Tx) and bottom (Mean TN) of the green lines, thus on all the days of January of these 100 years, and, averages taken over a period of 30 years, here 1981-2010 called by convention "Normal" which are 0.35°C warmer. One will notice the extreme temperatures range for each day of January in Lyon, observed from 1921 to 2020: -23°C on January 23, 1963 and +19.1°C on January 10, 2015 (nearly similar record in 1955); the records are 10°C above the average max (in red) and 15°C or more below the average min (in blue). These are real temperature changes and demonstrate the extreme variability over more than a century, i.e. 120 years. Taking an average over all the days of the month glosses over the "lived" reality of figure 112. The average over 1981-2010 is 0.35°C warmer than the average over the whole century: does it matter? The height of the green vertical lines in figure 112 are 6°C to 8°C!

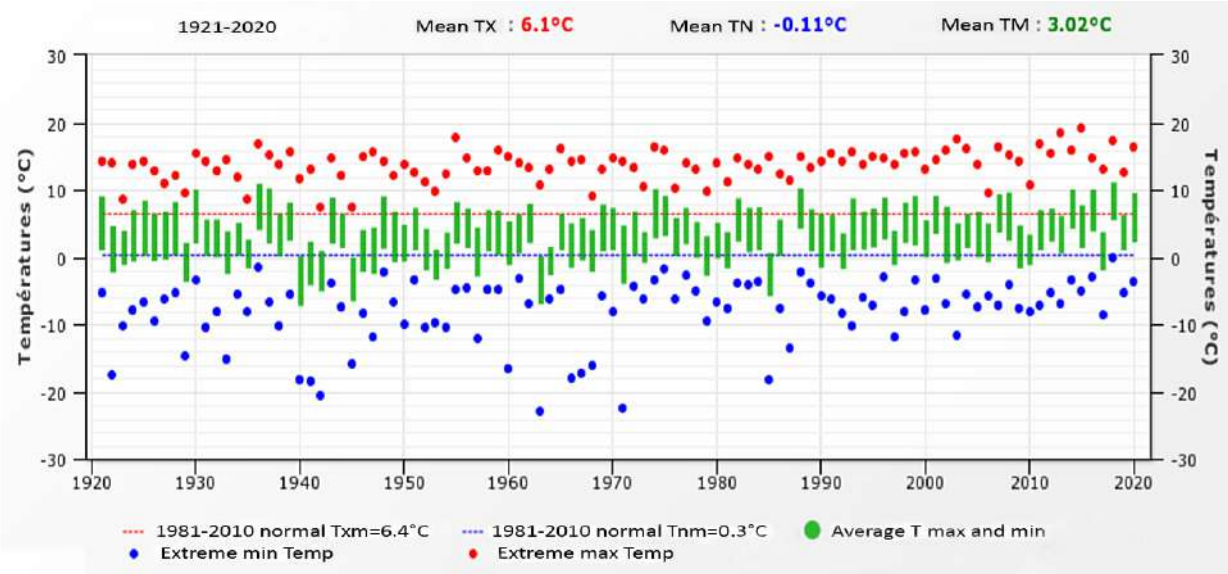

Figure 112. *1920-2020 Time-series of max and min temperatures in January at Lyon (Bron), France, green vertical lines: for each year give the range between the average of the min and the average of the max; blue and red dots extreme temperatures in January of the year considered; source: www.infoclimat.fr, After Veyres (2020e).*

For the July temperatures over the period 1921-2020 in Lyon (France), it should be stressed that the range between extremes is [8°C -40°C], day-night dynamics is of more than 12°C between the average of the minima (15.46°C) and of the maxima (27.01°C); average over all July days over these 100 years is 21.27°C and, over 1981-2010, 22.2°C. Cumulative rainfall over the month ranges from 0 mm or almost 0 mm in 1922 and 2003 to 180 mm in 2008 and 160 mm in 1930.

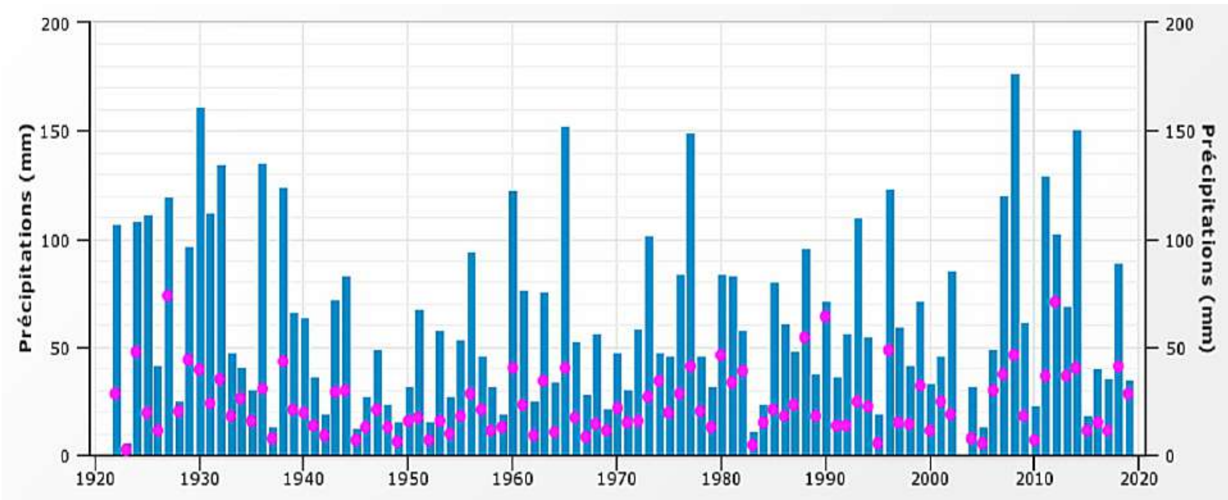

Figure 113. 1921-2019 July precipitations at Lyon (Bron) with a mean of 62.21 mm/month with the monthly precipitations in blue and the max precipitations for one day represented as violet dots. After Veyres (2020e).

As the climate is first and foremost characterized by the precipitations as per Köppen-Geiger (Köppen, 1884a-b, 1936), it is very telling to observe a graph of the precipitations over the same period (1921-2019) and notice the extreme variability of the phenomenon, see Figure 113 and the total absence of a trend. This shows what the climate has been over a century, displaying extreme variability and no meaningful trend whatsoever. Similar graphs could be produced for other places in Europe (Kossobokov et al. 2012; Cornes et al., 2018) or worldwide (Lüdecke et al., 2011) and for example, Veyres (2020e) provides thermometric series for the period 1757-2000 in Paris and 1753-2019 in Geneva, and 1676-2007 for the Paris region based on Rousseau's (2009) work, finally the Central England Temperature (CET) time-series for 1659-2020. They all show similar patterns of quasi trend-less records with high variability, and for the CET example, the trends are 0.5°C/century in January and 0.2°C/century in July observing that random processes represent the observations perfectly well: e.g. in July we have y(t) = 16°C + e(t), with e(t) a white noise centered normal of variance 1.4°C, and in January, we have an autoregressive process defined by: (1 - 0.081 L) y(t) = 3°C + e(t), with e(t) a white noise of normal centered variance of 3.9°C, where L is the Lag operator (one year).

Finally, using Luterbacher et al, (2016), Veyres (2020e) concludes "*These estimates of surface temperatures from 1500 to 2002, averaged over one season, summer or winter, and in Western Europe (5°W to 10°E, 40°N (Madrid) to 50°N (Lille) are presented (...).* ***Neither the temperatures nor the recent rate of change are 'unprecedented'****. The linear trends over the whole series from 1500 to 2002 are +0.02°C/century in summer and +0.1°C/century in winter, with very cold winters less frequent over the period 1965-2002. Veyres (2020e) adds "The linear trend of the summer series over these five centuries is zero; the series can be modeled as a random autoregressive process ARProcess [14.8, {0.096, 0.08}, 0.61] solution of (1 - 0.096 L - 0.08 L^2) y(t) = 14.8°C + e(t) with e(t) normal white noise of variance 0.6 and L delay operator or Lag, $LX_t = X_{t-1}$. (…) The winter series can be modeled as a random process without memory 2.87°C + e(t) with e(t) white noise of variance 1.44°C.*". As noted, similar series can be found worldwide and these random representations are found for example, for a rural station in Nebraska between 1893 and 2019, but with much higher variances indicating a much more continental climate.

One can conclude that computing anomalies and adjusting the data by means of complex processes, sometimes not even correctly documented nor archived as were mentioned before, and furthermore not even taking correctly account of major phenomenons such as the UHIE (Lüdecke et al., 2011) leads to questionable or fictitious time-series with so slightly inclined trend-lines (e.g. Figure 110) that they are meaningless, in particular to how real people experience the climate and seem to just serve the objective of maintaining the delusion that the AGW theory makes sense.

It was stressed already by Essex et al. (2007) that it is impossible to talk about a single temperature for something as complicated as the climate of the planet Earth. Bjarne Andresen, a specialist of thermodynamics who is co-author of the previous paper says "*A temperature can be defined only for a homogeneous system. Furthermore, the climate is not governed by a single temperature. Rather, differences of temperatures drive the processes and create the storms, sea currents, thunder, etc. which make up the climate*". He explains that while it is possible to treat temperature statistically locally, it is meaningless to talk about a a global temperature for Earth. The Globe consists of a huge number of components which one cannot just add up and average. That would correspond to calculating the average phone number in the phone book. That is meaningless. The example given is pretty obvious though a bit simplistic, still it illustrates that "*If temperature decreases at one point and it increases at another, the average will remain the same as before, but it will give rise to an entirely different thermodynamics and thus a different climate. If, e.g. it is 10 degrees at one point and 40 degrees at another, the average is 25 degrees. But if instead there is 25 degrees both places, the average is still 25 degrees. These two cases would give rise to two entirely different types of climate, because in the former case one would have pressure differences and strong winds, while in the latter there would be no wind*".

Beyond the very small trends put in evidence using the anomalies, if any, and beyond their low significance with respect to the real changes of the temperature themselves which, as we have seen, are more than ten orders of magnitude greater, they are very few studies dealing with the accuracy of the measurement systems and fortunately the paper by Frank (2010) fills the gap and shows that "*reviews of surface station data quality and time series adjustments, used to support an estimated uncertainty of about ±0.2 C in a centennial global average surface air temperature anomaly of about +0.7 C, have not properly addressed measurement noise and have never addressed the uncontrolled environmental variables that impact sensor field resolution*".

When doing so, Frank (2010) demonstrates that "*In view of the problematic siting record of USHCN sensors, a globally complete assessment of current air temperature sensor field resolution seems likely to reveal a measurement uncertainty exceeding ±0.46°C by at least a factor of 2*". It also appears that the assumption made of stationary noise variance in temperature time series cannot be justified and the outcome of all the above in plain and simple English means that touting (e.g. as GISS does) an unprecedented warming over a century of less than 1°C is not even a delusion but simply a hoax as there is no reasonable means to assert with any sort of acceptable confidence that one can have knowledge, based on these measurement systems and network of stations, of a differential magnitude of any air temperature be it warmer or cooler than the present, within ±1°C, for any year prior to the satellite era.

But even though there are seldom studies addressing the reliability of Surface Air Temperature SAT series as already mentioned, there is more to it as developed by Pielke Sr., et al. (2007a) who investigate a number of factors contributing to making the reliability of SATs questionable ranging from poor siting of measurement stations to undocumented biases in the regionally and globally averaged time series, etc., and the conclusions from these authors are that "*as a climate metric to diagnose climate system heat changes (i.e., ''global warming''), the surface temperature trend, especially if it includes the trend in nighttime temperature, is not the most suitable climate metric (...) the assessment of climate heat system changes should be performed using the more robust metric of ocean heat content changes rather than surface temperature trends. (…) This paper presents reasons why the surface temperature is* *inadequate to determine changes in the heat content of the Earth's climate system*". Parker et al. (2009) propose some comments about Pielke Sr., et al. (2007a), especially with respect to two of the weak points identified in the SAT time-series, but their argumentation falls short of being convincing, as they even concede "*On smaller scales and during data sparse times, uncertainties in trends need to be narrowed by rescue and incorporation of all existing historical data*" which demonstrates that indeed, some rescue process is needed!

Thus, as the NCDC, GISS and HadCRUT analyses draw from mostly the same raw data and are facing systematic bias and uncertainties that have been documented in the various papers cited above, problems that apply to all of these analyses and corresponding time-series, it is certainly more appropriate to use tropospheric layer averaged temperatures (from satellite and radiosondes) for atmospheric trends of heat changes, the UAH series displayed figure 107, being the best. Of course, this should not make the reader forget of the specific problems that we have reminded when addressing the collation of various generations of satellites' data over time and of the reconciliation of data delivered by several satellites providing measurements with different types of sensors and the inherent difficulty due to the recent availability of such satellite records that prevent, for a long time to go, the analysis of long term series.

One of the more serious consequence is that ocean heat content changes should be used instead of SATs, but one should notice that heat that goes deeper into the ocean is not even sampled by surface temperatures. Undoubtedly, the climate system has warmed in recent decades - but it has done so for natural reasons since the end of LIA and there is this nothing remarkable to such a statement, but the heating is more muted than claimed using the global surface temperature trend (provided there is any irrefutable), not even speaking of the climate models which have consistently failed at predicting anything meaningful. The heating is also quite spatially variable as shown in the ocean heat content data with a significant fraction going into the Southern Oceans.

It is simply surprising that the AGW lobby would expect the scientific community at large to accept these SAT time series as compelling evidence of a global anthropogenic warming, given that they are arbitrarily adjusted and lacking the properly documented SOA and complete archiving, prone to various intrinsic problems and hard to correct from the impact of a changing environment over time such as UIHE, and as the final anthropogenic signal claimed is so small as compared to measurements errors, bias and all other problems which have been listed. Furthermore, even if an indisputable trend were to be acknowledged, its anthropogenic origin would remain highly questionable given that the continuation of the natural warming that has occurred since the end of LIA would be the most probable course of action taken by climate change.

Finally, if one single indicator of the entire Earth's system response were to be used, it should rather be the Global Average Ocean Heat Content (GAOHC). Some time series are provided by Laloyaux et al. (2018) in Fig. 10, p. 1185 and a rather synthetic presentation is offered by Boisséson de (2017)

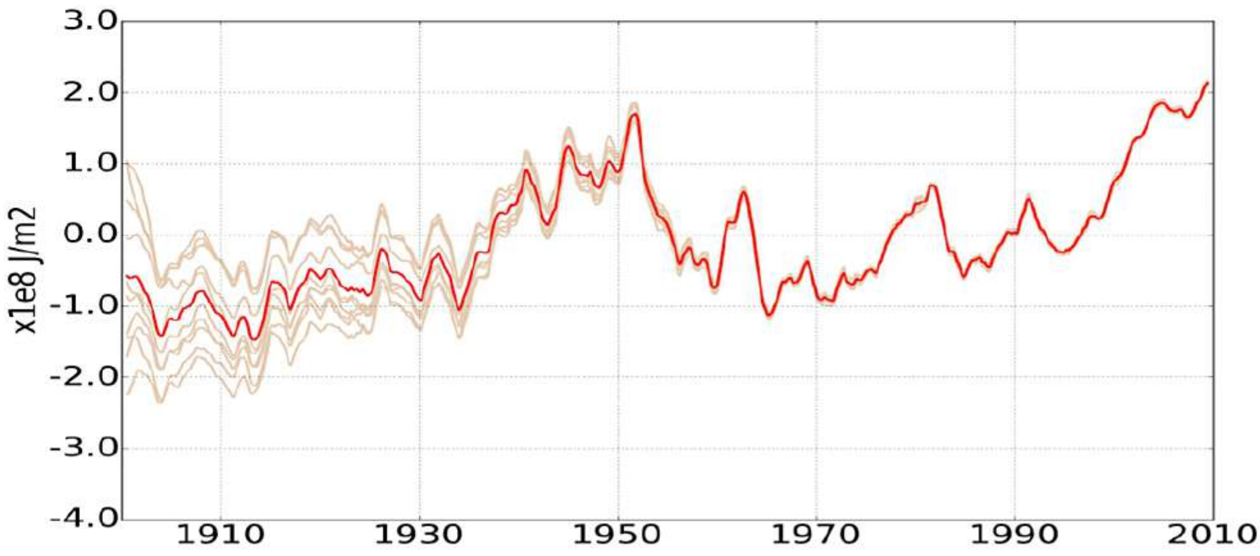

Figure 114. 1900-2010 Ocean Heat Content 0-300m between 60S-60N, in ordinates the unit is 100 10^6 J/m^2 (or 100 MJ/m^2). The two periods of accelerated warming correspond to change of phases of PDO (-) and AMO (+) From Boisséson de (2017).

One can see on Figure 114, that there is absolutely nothing special to the current situation with respect to the global average ocean heat content. The warming of the ocean between 1970 and 2010 is to be compared to that observed between 1910 and 1950, which, according to the IPCC itself, is completely natural! Boisséson de (2017) considers that the two periods of accelerated warming correspond to change of phases of PDO (-) and AMO (+). In ordinates the unit is 100 MJ/m², which is 100 x 361 M km² = 36 10^{21} J = 36 zettajoules or 36 ZJ; the solar flux absorbed (and the thermal IR flux radiated) by the globe is roughly 122 PW x 31.55 M sec/year = 3900 ZJ/year (with one Petawatt = 10^{15} Watt). We observe over 40 years (1970-2010) a change of 3 units, thus we have ((3 * 36 ZJ) / 40) / 3900 ZJ/year = 6.92 10^{-4} = 0.000692 J/m^2 yr^{-1}. For the first 300 meters considered, given the corresponding thermal capacity of the oceans of 4.6 10^{23} J/K, one can compute the temperature change over 40 years, i.e. (3 * 36 ZJ) / 4.6 10^{23} J/K, thus 1.08 10^{23} / 4.6 10^{23} = **0.24K over 40 years**, which is hardly measurable! Many natural phenomenons can produce such a small variation, including a very small change of albedo. Furthermore, the simple observation of the Figure 114, shows that the top made in 1951-52 is hardly surpassed in 2010, one more simple observation contradicting alarmists statements that the current rate of change of climate would have anything special.

"*Data that challenges the [global warming] hypothesis are simply changed. In some instances, data that was thought to support the hypothesis is found not to, and is then changed. The changes are sometimes quite blatant, but more often are somewhat more subtle. The crucial point is that geophysical data is almost always at least somewhat uncertain, and methodological errors are constantly being discovered. Bias can be introduced by simply considering only those errors that change answers in the desired direction. The desired direction in the case of climate is to bring the data into agreement with models, even though the models have displayed minimal skill in explaining or predicting climate. Model projections, it should be recalled, are the basis for our greenhouse concerns. That corrections to climate data should be called for, is not at all surprising, but that such corrections should always be in the 'needed' direction is exceedingly unlikely. Although the situation suggests overt dishonesty, it is entirely possible, in today's scientific environment, that many scientists feel that it is the role of science to vindicate the greenhouse paradigm for climate change as well as the credibility of models.* " Richard Lindzen (2009)

To sum everything up let's quote IPCC (2007a) "*...Nevertheless, models still show significant errors. Although these are generally greater at smaller scales, important large-scale problems also remain. For example, deficiencies remain in the simulation of tropical precipitation, the El Niño Southern Oscillation and the Madden-Julian Oscillation (an observed variation in tropical winds and rainfall with a time scale of 30 to 90 days). The ultimate source of most such errors is that many important small-scale processes cannot be represented explicitly in models, and so must be included in approximate form as they interact with larger-scale features. This is partly due to limitations in computing power, but also results from limitations in scientific understanding or in the availability of detailed observations of some physical processes. Significant uncertainties, in particular, are associated with the representation of clouds, and in the resulting cloud responses to climate change. Consequently, models continue to display a substantial range of global temperature change in response to specified greenhouse gas forcing (see Chapter 10). Despite such uncertainties, however, models are unanimous in their prediction of substantial climate warming under greenhouse gas increases, and this warming is of a magnitude consistent with independent estimates derived from other sources, such as from observed climate changes and past climate reconstructions...*" IPCC Fourth Assessment Report "The Physical Science Basis", 2007, p. 601.

Conclusion: the models are useless but they are "*unanimous in their prediction of substantial climate warming*".

Undoubtedly, IPCC does not bear any relationship with normal science.

Falsehoods, deceptions, lies...

Let's conclude with a quote: "*I am arguing that climate models are not fit for the purpose of detection and attribution of climate change on decadal to multidecadal timescales*". Judith Curry

4. Rogue and Dystopian Policies

"*In my view, climate change is the most severe problem that we are facing today, more serious even than the threat of terrorism*" Sir David King (2004), the UK Tony Blair's Government's chief scientific adviser.

“*Controlling carbon is a bureaucrat's dream. If you control carbon, you control life*.” Richard Lindzen

“*Climate science has been targeted by a major political movement, environmentalism, as the focus of their efforts, wherein the natural disasters of the earth system, have come to be identified with man's activities - engendering fear as well as an agenda for societal reform and control... This greatly facilitates any conscious effort to politicize science via influence in such bodies where a handful of individuals (often not even scientists) speak on behalf of organizations that include thousands of scientists, and even enforce specific scientific positions and agendas*.” Richard Lindzen

4.1. Some Philosophical and Historical Considerations

“*Future generations will wonder in bemused amazement that the early 21st century's developed world went into hysterical panic over a globally averaged temperature increase of a few tenths of a degree, and, on the basis of gross exaggerations of highly uncertain computer projections combined into implausible chains of inference, proceeded to contemplate a roll-back of the industrial age*.” Richard Lindzen

Before delving into how devastating the decarbonization policies will be economically speaking, one must first understand how unfounded they are, not only on a scientific standpoint, what we have tried to demonstrate in the previous chapters, but also on a philosophical and historical perspectives. To help support our reasoning, it is convenient to quote Harari (2011) in its comprehensive analysis of what makes mankind so special. This author refers to us, i.e. Sapiens, as «Ignoramus», the word comes right from the Latin ignoramus, literally "we do not know," which was a legal term in the 16th century that could be used during a trial when the prosecution presented insufficient evidence, but this is not in our case a pejorative reference, quite the contrary in fact. Harari (2015) states that « *Humans have sought to understand the Universe… and put a great deal of time and effort into trying to discover the rules that govern the natural world. But modern science differs from all previous traditions of knowledge in three critical ways* ». The very first and most important difference stressed is « *The willingness to admit ignorance, modern science accepts that the things we think we know could be proven wrong as we gain more knowledge. No concept, idea or theory is sacred and beyond challenge – p.279* ».

Read that again, and think at how aggressive the proponents of the AGW theory are with respect to trying to make everybody, other scientists, politicians, the public at large, accept and endorse the idea that science is settled! This is as reminded by Harari (2015) in total contradiction with what has led us where we are today « *The Scientific Revolution has not been a revolution of knowledge. It has been above all a revolution of ignorance. The great discovery that launched the Scientific Revolution was the discovery that humans do not know the answers to their most important questions* », and furthermore «*Modern-day science is a unique tradition of knowledge, inasmuch as it openly admits collective ignorance regarding the most important questions p. 281* ». This way of reasoning traces back to Michel de Montaigne (1543) who supports Copernic and endorses an attitude of irreducible reserve with regard to what science presents as truth, he considers that science is changing, and that we must draw all the consequences. Montaigne states that the truths established by Aristotelicism hinder the spirit of inquiry and « *the ruin of geocentrism is one of the events that helps combat the illusion that there could be definitive scientific truths* ». What a lesson that should be remembered by the AGW theory community who tries to impose their views lately by having laws enacted and censorship enforced to prevent opponents, not considered skeptical any longer but confusers, to make their voices heard.

The trouble is that admitting that even the scarce knowledge we posses is only tentative has far reaching societal consequences as it also challenges many myths that enable the establishment of a social order and enable millions of strangers to cooperate. As Harari (2015) points it out, in order to stabilize the socio-political order, history teaches us that politicians have had to resort to on either one of two following unscientific methods: « *A) Take a scientific theory, and in opposition to common scientific practices, declare that it is a final and absolute truth. This was the method used* *by the Nazis (who claimed that their racial policies were the corollaries of biological facts) and Communists (who claimed that Marx and Lenin had divined absolute economic truths that could never be refuted). B) Leave science out of it and live in accordance with a non-scientific absolute truth. This has been the strategy of liberal humanism…*».

The behavior of the proponents of the AGW theory is the very negation of any form of scientific approach which should always be based on the doubt and never declare matters settled according to point A) as described above and one will not be surprised that whatever the scientific credentials of the persons involved, e.g. Hansen, there is a strong political bias as well, where we find liberal activists who support the AGW theory to be the most aggressive in their vision and «solutions» as this matches B).

Furthermore, one should observe that those who keep claiming that scientists who do not subscribe to the AGW hypothesis should be suspected of conflicts of interests with for example the the petrol and gas industry are the first to be plagued themselves by a major conflict of interests as they benefit of government funding supporting their universities and laboratories who pay their salaries, their staff and students, their equipments, their travel and all expenditures to help them "prove" what they keep claiming as settled science, which is only settled for their fellow AGW believers. Again, Harari (2015) will not be surprised by such a contradictory stance as he states that « *even science itself has to rely on religious and ideological beliefs to justify and finance its research*».

Where things become clearer is if one puts in perspective what was written by Francis Bacon (1620) in his book Novum Organum, «*Those who have taken it on themselves to lay down the law of nature as something that has already been discovered and understood, whether they have spoken in simple confidence or in a spirit of professional posturing, have done great harm to philosophy and the sciences. As well as succeeding in producing beliefs in people, they have been effective in squashing and stopping inquiry; and the harm they have done by spoiling and putting an end to other men's efforts outweighs any good their own efforts have brought*» a close way of Michel de Montaigne's reasoning. But the explanation of the current situation gets clearer considering that Bacon (1620) also asserted that « *The roads to human power and to human knowledge lie extremely close together and are nearly the same. p.49 Book 2:1-25* » and Harari (2015) reminds us that *«the real test of knowledge is not whether it is true, but whether it empowers us. Consequently truth is a poor test for knowledge. The real test is utility*». In that light, sticking to the classical scientific deontology with respect to «climate change», i.e. considering that undoubtedly the climate has reversed its course since the end of the Little Ice Age (≈1850) but that we do not know exactly why with any kind of certitude and that climate has always changed and that one should be extremely cautious with respect that a 0.007% increase of [CO_2] in the atmospheric composition could have any effect at all for all the reasons developed in the previous chapters, does not empower the proponent of such a thought in any way. To the contrary, claiming that Armageddon is around the next corner and that major changes should be brought to our ways of living before the next «decade» (insert whatever you like to stress more your reader down to «year») or it will be too late, empowers the AGW promoters to all sorts of coercive decisions with supposedly rational reasons, as vague and irrefutable as «saving the planet»!

In that respect, the analysis of the paper by Collomb (2014) "The Ideology of Climate Change Denial in the United States" is simply amazing. Though well written, the author succeeds in the feat of a biased interpretation that leads to cultivating counter-senses from the beginning to the end of his article. The first observation is that science is a foreign notion to these apostles of global warming and so much so, that they keep sticking on the notion of consensus to enforce their vision, missing the simple fact that in science, even though 99.99% would agree, such an argument is not and will not - ever - be a scientific proof of anything[314]. This leads to sentences as "*The effort to undermine the credibility of scientific research on man-made global warming has continued since the early 1990s after the IPCC had started calling the alarm. Nevertheless because of mounting scientific evidence (Oreskes, 2005) it is becoming increasingly untenable to deny reality, which has led conservative and libertarian think tanks to modify their tactics*". The paper referenced as establishing a mounting evidence is written by Oreskes (2005) and is an excerpt of a more detailed presentation given by one member of the "Department of History and Science Studies Program" at the AAAS[315] meeting on 13 February 2004. Oreskes (2005) simply does not succeed to provide the slightest evidence of the existence of an anthropogenic warming and in her defense, she could not and cannot, not only because she is not a scientist but simply because there are none. She is even honest enough to state "*The scientific consensus might, of course, be wrong. If the history of science teaches anything, it is humility, and no one can be faulted for failing to act on what is not known*". Good point. Then she continues "*Many details about climate interactions are not well understood, and there are ample grounds for continued research to provide a better basis for understanding climate dynamics*."

314 "*Even when the experts all agree, they may well be mistaken.*" - Bertrand Russell https://en.wikipedia.org/wiki/Bertrand_Russell
315 American Association for the Advancement of Science

Good point again. Then comes “*The question of what to It about climate change is also still open. But there is a scientific consensus on the reality of anthropogenic climate change. Climate scientists have repeatedly tried to make this clear*”. Bursts of laughter. It would be funny if this oxymoron were a rhetorical figure, but climate scientists making it clear that there is consensus is the perfect demonstration that they are climate pseudo-scientists, and that they share no common values with scientists. Pseudoscience[316] is differentiated from science because - although it claims to be science - pseudoscience does not adhere to accepted scientific standards, such as the scientific method, falsifiability of claims, and Mertonian norms[317] (and especially not disinterestedness given the massive conflict of interest in which is entangled public climate-funded research, and organized skepticism). Claiming a consensus is just the most stupid, obvious and redhibitory stance of a non adherence to the most basic principles in science. Then comes sentences like Collomb (2014) “*Far from being a means to an end and a way to achieve the good society, the conservative movement’s commitment to small government and free markets seems to have become an end in itself and almost a secular religion*” which you can re-write as “Far from being a means to an end and a way to achieve the good society, the obsessive commitment to anthropogenic global warming seems to have become an end in itself and almost a secular religion”, sounds better? The best of the paper, the quote from Charles Krauthammer (2008) “*Just as the ash heap of history beckoned, the intellectual left was handed the ultimate salvation: environmentalism. Now the experts will regulate your life not in the name of the proletariat or Fabian socialism but—even better—in the name of Earth itself.*” Who can falsify this statement? I kept the best for the end, Collomb (2014) states “*Global warming poses a philosophical challenge to libertarians and small-government conservatives: their world view is premised on the idea that government power should always be held in check lest it destroy individual freedom while the world is faced with a crisis of global proportions that could only be averted by a strong and prolonged government action*”. Claiming a crisis of global proportion, when the slight increase in CO_2 has just given a boost to photosynthesis, not created the slightest climatic problem and enabled trillions of $ of crops productivity improvements is a gross manipulation and pretext to effectively attack individual freedom, that's just a matter of fact of their socialist agenda.

Again as Harari (2015) reminds us «*Science is not an enterprise that takes place on some superior moral or spiritual plane above the rest of human activity. Like all other parts of our culture, it is shaped by economic, political and religious interests*» and furthermore «*Most scientific studies are funded because somebody believes they can help attain some political, economic or religious goal p.303*» and that is all too frightening.

François Rabelais[318] said in “*Pantagruel*” (1532), "*Science without a conscience will lead to the destruction of the soul*". Rabelais was a skeptic, the founder of modern skepticism. He criticized those who know neither fear nor human limits. Rabelais is the thinker of a modest human condition, conscious of its finiteness. This philosophy of finitude is quite close to Pascal's (i.e. le roseau pensant: the thinking reed), defending a human nature that is weak, but strong in that it is aware of its weakness, contrary to the forces of physical nature. The sentence is well known though it remains a bit enigmatic and still triggers many analyses. But one can see how this is an extension of the ancient Greek aphorism "know thyself"[319] (Greek: γνῶθι σεαυτόν, transliterated: gnōthi seauton) or Scito te ipsum (“know yourself”) in Latin. The two maxims that followed "know thyself" on the pronaos (forecourt) of the Temple of Apollo at Delphi were "*nothing to excess*" and "*surety brings ruin*". The Suda, a 10th-century encyclopedia of Greek knowledge, states: "*the proverb is applied to those whose boasts exceed what they are*", and that "know thyself" is a warning to pay no attention to the opinion of the multitude.

What a lesson in a couple of sentences for the “knows everything”, “science is settled”, “scientific experts have made all the demonstrations” “listen to no-one else” community. This AGW interest group will certainly succeed to deceive the public but will not convince the scientists at large and apart from those who directly benefit from the public subsidies to make a (very decent) living they will only be left with the pseudo-consensus argument typical of pseudo-science reasoning. This does not come as a surprise as, from where we stand at that point in this e-book, climate science appears to notch all check-boxes of pseudo-science and true politicized dogma.

The climate, on its side, that appears as the result of an unfathomable complex system has more than one trick up its sleeve and will do whatever Nature has decided and will not stick with the dire predictions of the anthropocentric pseudo-science entirely based on a minuscule increment of a trace gas in the overall atmospheric composition. What a prank!

316https://en.wikipedia.org/wiki/Pseudoscience
317https://en.wikipedia.org/wiki/Mertonian_norms
318https://en.wikipedia.org/wiki/François_Rabelais
319https://en.wikipedia.org/wiki/Know_thyself

4.2. Cognitive Dissonances

"*The global warming mantra changes the whole nature of the Scientific Method, which hitherto, has been driven by evidence, evidence backed by data. The whole global warming thing does not even rate as an hypothesis because there is no data, and certainly no evidence that 420 ppm CO_2 (or whatever, pick any number below 6000) drives climate change. It may cause mild warming, which is good, also because it greens the planet. Climate change as presented by the alarmists is a thought bubble, a dogma, which the Scientific Method cannot deal with because there is no data, no evidence. Science will only progress when the veracity of data and evidence can be argued. Instead the alarmists base their whole case on flawed and incomplete computer models around so-called 'climate sensitivity'.*" Aert Driessen, Australia, Bureau of Mineral Resources, Geology and Geophysics.

"*I suspect most of the 97% of scientists privately have grave doubts about how this has panned out, but all of us suffer more from being rejected by our peers than we suffer from being wrong. Strong advocates of the CO_2 dominance of climate change, at an emotional level, fear being proven wrong by the skeptics far more than they fear the impending apocalypse. This is not climate science, it's the irrationality of humans*"[320]. Boxer (remaining anonymous).

The Cognitive Dissonance Theory (CDT) was established by Leon Festinger (1957) and acknowledges the fact that when observations do not match the theory, some people will inevitably resolve the dissonance by blindly believing whatever they wanted to believe. Perfect examples of such situations will be provided later, such as what is illustrated by Figure 116, and AGW believers stating that blizzards killing and freezing populations is exactly what could be expected of Global Warming! As they intimately perceive the non-sense of having explained for years that CO_2 was an IR GHG that would lead to an uncontrolled elevation of the temperatures and of having to stick desperately to their position as confronted to nonconforming observations, they thwart the words in a futile attempt to restore their internal comfort and to reassure themselves that all is fine in the world of ideology and belief by calling their failed AGW theory a climate crisis. Not only the climate does not experience any crisis, but the only crisis visible in plain sight is their distress and the internal stress they feel whenever confronted to observations that do not match their failed theory.

Normally, and it is the beauty of science as reminded by Carl Sagan (1987) "*In science it often happens that scientists say, 'You know that's a really good argument; my position is mistaken,' and then they would actually change their minds and you never hear that old view from them again. They really do it. It doesn't happen as often as it should, because scientists are human and change is sometimes painful. But it happens every day. I cannot recall the last time something like that happened in politics or religion*". In fact, if climate theories had remained a discussion among scientists, much progresses would have been made towards a more sophisticated, a much more subtle analysis of the various factors having an impact on the climate that an ideological and frozen incrimination of CO_2 as a major disruptor that no objective analysis can support. In fact, it has become a politically motivated plea based on non-scientific recursive arguments as the consensus tries desperately to be enforced in the scientific methods, which it has never been and will never be. For many scientists trapped in between what they have to do and say to keep their standings and positions and what they intimately sense of the robustness of their discourse, they experience internal inconsistencies that tend to make them feel psychologically uncomfortable and motivate actions to reduce the cognitive dissonance (Harmon-Jones and Mills, 2019). Without delving into the details of that sophisticated psychological theory, it is accepted that individuals in such situation of dissonance react either by adding new parts to the cognition causing the psychological dissonance (rationalization) or by avoiding circumstances and contradictory information likely to increase the magnitude of the cognitive dissonance (confirmation bias). This is exactly what the AGW believer do, rationalizing by distorting fact so that they would somehow fit in their mental scheme (whatever the intellectual cost, such as claiming that freezing is the result of Global Warming) or by simply discarding whenever possible the facts that would go against their credence and searching for confirmation bias.

In fact, this kind of behavior has been known since a very long time and Bacon (1620) who his one of the founders of the modern scientific method, stated "*Once a human intellect has adopted an opinion (either as something it likes or as something generally accepted), it draws everything else in to confirm and support it. Even if there are more and stronger instances against it ·than there are in its favor·, the intellect either •overlooks these or •treats them as negligible or •does some line-drawing that lets it shift them out of the way and reject them. This involves a great and pernicious prejudgment by means of which the intellect's former conclusions remain inviolate. A man was shown a*

320A comment from "Boxer" on http://donaitkin.com/my-last-climate-change-essay-for-a-while-at-least/

picture, hanging in a temple, of people who had made their vows and escaped shipwreck, and was asked 'Now do you admit the power of the gods?' He answered with a question: 'Where are the pictures of those who made their vows and then drowned?' It was a good answer! That's how it is with all superstition— involving astrology, dreams, omens, divine judgments, and the like, Men get so much pleasure out of such vanities that they notice the confirming events and inattentively pass by the more numerous •disconfirming ones. This mischief insinuates itself more subtly into philosophy and the sciences: there, when a proposition has found favour it colours other propositions and brings them into line with itself, even when they in their undisguised form· are sounder and better than it is." in: The New Organon, BOOK 1: 1–77.

What should be observed is that when the facts do not support the flawed theory, the next step to cognitive dissonance is to manufacture erroneous facts to pretend that they do support the narrative. This is what we see with the latest UN report on climate catastrophes, where the organization does not even embarrass itself with scientists any longer, but resorts to Mami Mizutori[321] (diplomat) and Debarati Guha-Sapir (an Indian epidemiologist) to explain us that the world need to decarbonize asap otherwise the punishments we deserve will come down on us in spite of the clear-sightedness of all these international bureaucrats that take care of us "*Disaster management agencies have succeeded in saving many lives through improved preparedness and the dedication of staff and volunteers. But the odds continue to be stacked against them, in particular by industrial nations that are failing miserably on reducing greenhouse gas emissions,*" said Mami Mizutori (Parry, 2020). The paper is a masterpiece of disinformation, organized by bureaucrats putting pressure on national governments, with baseless claims. This guilty scaremongering tactics is at odds with the available data. For example, the 2019 report of the insurance company AON reports 409 natural disasters in 2019 (including 32 earthquakes) and notes no significant change in the number and severity of extreme weather events over the course of its reports (2016, 2017 and 2018). The UN states, among other things, that tropical storms have been the most frequent disasters over the last two decades. **This is not true**: the ACE index, which measures cyclonic activity over the entire planet, shows no increase since satellite observations began in 1972. Moreover, the number of deaths due to natural disasters is below the long-term average for the ninth consecutive year, with 2019, for example, ranking among the 13 least costly years for human life since 1950. To enforce by all means a flawed theory as the AGW, not only the believers discard all facts that blatantly disprove the assumptions on which it is based but they also manufacture as much fake data they need to support their lies. Notice that nobody will wonder whether Mami Mizutori[322] or Debarati Guha-Sapir[323] have any scientific credential in any related field, e.g. Earth and planetary sciences, they know climate pseudo-science perfectly because they regurgitate the welcome clichés.

You think it cannot get worse? Alas, it can and goes beyond any rational thought (remember the title of this e-Book). A journalist working for a mainstream French newspaper, Mouchon (2019) has met with a "climatologist" (read misfortune teller), David Salas y Melia[324], and from what he was told states "*the increase in global average temperatures reaches 6.5 to 7°C in 2100 in the worst-case scenario considered*". Mouchon (2019) has of course no doubt of what Salas y Melia told him because "*Scientists have succeeded to obtain this catastrophic scenario by using a computer model that simulates the functioning of our planet: the state of the atmosphere, the state of continental surfaces and oceans, the carbon cycle, and so on.*". So as we have seen before, based on sort of software that cannot tell you anything meaningful about the weather beyond 15 days (whereas the climate is the integration of the weather over 30 years minimum) and based on a delirious Representative Concentration Pathway 8.5 (RCP8.5) scenario, the journal spreads massively misinformation or rather lies to the population. Does Salas y Melia believe the RCP8.5 scenario just plausible one second? or rather those scholars ensconced in the comfort of their fantasies and well heated offices are so disconnected from any reality that they don't even see that every winter people die of cold in southern countries like Morocco, and not only high in the mountains were snow can be as thick as 9 meters! but also in areas like Tafraout, Chichaoua, Beni Mellal and Boumia. Don't say that it happens only in the high mountains, it does also in the hinterlands and sometimes even in the precincts of urban areas. This happens despite the efforts made by the authorities and instructions given by the King of Morocco (Hamid, 2018), just because for the reality of these Moroccan people the Anthropic Global Warming is a stupidity of rich countries which can afford to waste time, energy and money on non-existent problems. It is so much disconnected from their lives that the dire truth of what they call the "White Death" (Haddadi, 2015) visit them regularly. In 1980 eighty persons died because of a snap cold and in 2007 tens of persons died in the Khénifra area because of the cold (Bernichi, 2007). Seen from this angle, these AGW delusions are

321 The card castle already starts to unravel and Mizutory as reported by Timmer (2020) seems "*to have been inspired by activist groups like Extinction Rebellion*", and this UN report on - The Human Cost of Disasters - has been described as "*an embarrassment*" and "*a catalogue of errors*" after it emerged its headline claim of a "staggering rise in climate-related disasters" was refuted by its own data. Headlines in the news now refer to the report as "*This is not science, but politics*".

322 https://en.wikipedia.org/wiki/Mami_Mizutori

323 https://en.wikipedia.org/wiki/Debarati_Guha-Sapir

324 https://www.researchgate.net/profile/David_Salas_Y_Melia

indecent. These scholars do not see the harsh reality unfolding before their eyes and they stupidly pontificate about the unpredictable future of a chaotic climate system as if their software had any reliability. Their climate forecasts have miserably failed all along so far and they are victims of cognitive dissonances and cognitive disorders syndromes.

A bunch of feckless bureaucrats supported by a maximum of a couple hundreds scientists worldwide, always the same wallowing in an awful situation of conflict of interest as they are the main beneficiaries of the fears they spread, all unaccountable before the forced taxpayers who fund either their lavish lifestyles or their positions, influenced by NGO populated of ideologists also making a business of these lunacies, pressure the heads of state into insane "climate action" as they pretend to know better than everybody what is good for mankind. The result will be an incredible waste of resources that could have been so much better allocated, a massive and longstanding recession inverting what decades of economic progress had enabled to achieve, i.e. namely a reduction in poverty and the emergence of a middle class in China and India. They will also slow down or hamper the development of Africa as fossil fuel energies are the cheapest and the most convenient for that continent and the people there. This small number of influent people relayed by activists and special climate interest groups, who are full of certitudes, are a plague to mankind's fate and will deserve the strongest blame and shame for their delirious obsessions.

At that point of the craziness of the situation and of the certitude of these "know-nothing" but tell us "what-to-do", I can only think of two Richard P. Feynman quotes:

"*Religion is a culture of faith; science is a culture of doubt.*" Richard P. Feynman

"*Science is the belief in the ignorance of experts.*"[325] Richard P. Feynman

Even though Tetlock (2005) conducts his analyses in a different domain he summarizes well most drawbacks that fail expert reasoning "*A warehouse of experimental evidence now attests to our cognitive shortcomings: our willingness to jump the inferential gun, to be too quick to draw strong conclusions from ambiguous evidence, and to be too slow to change our minds as dis-confirming observations trickle in. A balanced apportionment of blame should acknowledge that learning is hard because even seasoned professionals are ill-equipped to cope with the complexity, ambiguity, and dissonance inherent in assessing causation in history*".

As reminded by Carlson (2017) and based on Tetlock (2005) analysis, one come to the observation that:

- Experts can talk themselves into believing they can do things they cannot. There are diminishing returns to knowledge in the prediction game but overconfidence often trumps this fact;
- Experts are reluctant to admit when they're wrong and change their minds. This is our cognitive dissonance on display;
- Experts fall prey to the hindsight bias. People convince themselves they "knew it all along" even when completely unpredictable events occur (or they just plain missed it);
- Experts fall prey to confirmation bias. Experts have a hard time viewing the other side of an argument;
- We're all patterns seeking creatures. We look for structure or consistency where none often exists in the real world, which is quite random most of the time.

He notes a perversely inverse relationship between the best scientific indicators of good judgment and the qualities that the media most prizes in pundits--the single-minded determination required to prevail in ideological combat.

Tetlock (2005) points out that while we're terrible at predictions, experts fall into two "cognitive styles" when they're making those predictions: foxes and hedgehogs.

Tetlock explores what constitutes good judgment in predicting future events and looks at why experts are often wrong in their forecasts. "*Foxes know many things while hedgehogs know one big thing. Being deeply knowledgeable on one subject narrows one's focus and increases confidence, but it also blurs dissenting views until they are no longer visible, thereby transforming data collection into bias confirmation and morphing self-deception into self-assurance*". Basically, the hedgehogs are very prone to falling into Cognitive Dissonance Disorders (CDD) but they are not alone in that they

325 From address to the National Science Teachers' Association convention (Apr 1966), 'What Is Science?', collected in Richard Phillips Feynman and Jeffrey Robbins (ed.), The Pleasure of Finding Things Out: The Best Short Works of Richard P. Feynman (1999, 2005), 187.

resemble people moved by faith and not by curiosity for whom the outcome is unimportant, only the search for the truth is paramount. One of the reactions is to add new parts to the cognition, often by adding new ad hoc hypothesizing, causing the psychological dissonance less painful, i.e. **rationalization**, to make things match when they do not. For example, when on the 5th Jan 2018, Al Gore tweets "*It's bitter cold in parts of the US, but climate scientist Dr. Michael Mann explains that's exactly what we should expect from the climate crisis.* http://ow.ly/Gdm230hAFv4 (see section 4.6.) he obviously knows that the facts are in stark contradiction with all what he had been preaching for years, namely that temperatures will rise like Hell for the IR properties of one trace GHG, so he needs to find means to rationalize by using a defense mechanism in which contradicting observations leading to controversial feelings are justified and explained in a seemingly rational or logical manner to avoid the true explanation (the AGW theory is flawed), and make them consciously tolerable. The other technique is just to dismiss any observation that just contradicts the theory and which are likely to increase the magnitude of the cognitive dissonance by only focusing on seemingly perfectly matching observations, i.e. **confirmation bias**. Of course, when people are dying frozen by a bitter cold, it is hard not to see the mismatch between observations and the flawed theory, so rationalization is used, whereas when one stresses that the current modern climate optimum started long ago, i.e. at the end of the LIA around 1850, and that glaciers had not waited for modern man-made emissions to melt and shrink (Trutat, 1876; Akasofu, 2011), the technique used by the AGW believers (they follow a faith) is to ignore the observation, using the confirmation bias technique as more convenient, since the fact is not known to all, is more remote and buried in the past and less prone to brutal confrontation with reality. Sometimes, they will not deny the obvious but will claim that "things go faster now then then" twisting facts by adding rationalization. The psychological angle of analysis of the personalities is very important as it explains what could be otherwise messy to figure out. Once you take out those who know very well why they obstinately defend an unsustainable position and the conflict of interest of the public-funded "climate pseudo-science" is so obvious and scandalous that nobody dares even underline it, as if that situation was perfectly normal, and an extremely limited number of individuals who may have been paid by oil and gas companies (though they have figured out much better solutions to get around the problem, including participating into the renewable-energies mess and trading carbon permits) you remain with those who fight a crusade with very similar behaviors as what history taught us of religious and / or political conflicts and those, the only real scientists left, who defend what they consider the most plausible interpretation of all facts and observations without any compromise that would invalidate their line of thought.

I clearly belong to the latter group and if I have had any doubt about what I have written in this e-book, I would have stopped the project or garbaged the file. But the facts are stubborn and the more the AGW believers show their faith, the more I had to delve into the intricacies of their reasoning and pseudo-science, and the more I did it, the more it became clear that the AGW realm is rotten by all means of analysis.

Tetlock (2005) states "*The world is a messy, complex, and contingent place with countless intervening variables and confounding factors, which foxes are comfortable with but hedgehogs are not*". I am clearly a fox in Tetlock's (2005) classification as I am perfectly at ease with the messy, complex and sometimes bewildering behavior of Nature, the reader might be surprised if I say that I take no side and simply adjust to the facts. And the facts that have been reminded all along this e-Book simply do not substantiate the AGW theory, rather to the contrary, all prove that CO_2 is not the explanation to what we observe. I am also perfectly fine with the acceptation that I do not know *all* the reasons that drive the climate over various time-scales (from a few hundred years to several million years) but I appreciate how much progress has been made since when being a young student, when we studied a bit bemused the succession of quaternary glaciations. Nobody in the late 70s had yet a definite explanation, Milankovitch (1949) was enticing, Hays et al. (1976) was so recently published that it had not yet pervaded all university courses and all the others, I.e (Laskar, 1990; Laskar and Robutel, 1993; Dansgaard et al., 1993; Maslin et al., 2001; Marchitto et al., 2010; Mysak, 2010; Scafetta, 2010; Feynman and Ruzmaikin, 2011; 2014) had yet to come! That's what makes science passionating and that explains that I have been dubbed a polymath as I enjoy so much revisiting a subject or another after a decade or more to see how much things have evolved.

Back to Tetlock (2005), it becomes now clear why low scorers were "*thinkers who 'know one big thing,' aggressively extend the explanatory reach of that one big thing into new domains, display bristly impatience with those who 'do not get it,' and express considerable confidence that they are already pretty proficient forecasters.*" By contrast, says high scorers were "*thinkers who know many small things (tricks of their trade), are skeptical of grand schemes, see explanation and prediction not as deductive exercises but rather as exercises in flexible 'ad hocery' that require sticking together diverse sources of information, and are rather diffident about their own forecasting prowess*".

While working on this e-Book project I had many exchanges with Johan K. Fremerey[326], but one still puzzles me. We obviously disagreed on many things to say the least and we tried to keep the exchanges courteous, though uncompromising. At some point, he sent me a paper written by von Zahn (1981), the title of being "*The importance of carbon dioxide for the climate of the planets Earth and Venus*". As was seen before (see Equation 60, p.45), the temperature on Venus results from the gravitational lapse rate. The atmosphere of Venus is mainly made of carbon dioxide (96.5%) and the ground pressure is **93 bars** and Venus is by far the hottest planet in the Solar System, with a mean surface temperature of 735 K (462°C; 863°F). The relation (60) $T(P) \sim P^{8{,}314/[\mu\ (Cp\ -\ Ch)]}$ fixes the temperature if one gives a couple {T, P} which is in practice on Venus {T, P} {230 K, 100 mbar} which corresponds to the top of the dust layer (dust and aerosols around 40 to 60 km have the same role as water vapor on Earth).

On Venus starting from the tropopause around 0.1 atm and 230 K {230 K, 100 mbar} :
Ground temperature =735 K (461°C) = 230 K + 65 km x 7.7 K/km = 735 K = 230 K $(92\ atm/0.1\ atm)^{\mathbf{0.17}}$ the bulk of the air is carbon dioxide with a molar mass of 44 grams and g = 8.87 m/s²
C_p = 850 J/kg for CO_2 (highly variable with temperature), R= 8.314/0.042 = 197
The lapse rate is then given by: 8.87/(860+309) = 0.00765 K/m and
the exponent $R/(C_p - C_h)$ is worth 197/(850+309) = **0.17**

So, one ends up with a very simple polytropic relationship that links the temperature to the pressure, the exponent being only slightly different than on Earth (i.e. 0.19) and therefore it is well established that the surface temperature does not result from radiative phenomena in thermal infrared but quite simply from atmospheric pressure which is enormous on Venus (Sorokhtin et al., 2011), somehow up to half what is inside a divers' cylinder!

Reading the paper of von Zahn (1981) led to an unpleasant exchange, but more than that led me to wonder how some scholars, with well established credentials, actually form their reasoning processes. One always makes the assumption that well trained scientists with many achievements over the years must have a perfectly logic course of action and reasoning and I would have tended to agree with that. Reading von Zahn's (1981) paper was an experience, as if it did not succeed to shake up my ideas with respect to the minuscule radiative role CO_2 plays, it just challenged more badly my assumption about logical reasoning of acknowledged scientists. First, I took notice that von Zahn was convinced of the extremely harmful effect of CO_2 on the terrestrial (eco)-system. So far, even if I disagree, and I would point to the complete lack of convincing proof, everyone is entitled to his/her opinions; I just noticed that according to the author, observing a 70 ppm increase of that trace gas on Earth is a destabilizing factor, thus CO_2 must be very powerful and dangerous. Now, von Zahn moves to Venus where the atmosphere does not contain 0.04% of CO_2 but as reminded above 96.5% and is nearly 100 times thicker than that of the Earth, so we would expect the author to focus on the role of CO_2 which, if it was already a disruptor at 0.04% must be awful at 96.5% and 93 bars, no? In fact no! von Zahn states that on Venus, it is the 0.02% of H_2O that has derailed everything and is required to explain the ground temperature of 735 K (462°C; 863°F) ! (p. 9 of the translated version) "*In addition, there is a small amount of water, which has been positively detected, but is everywhere less than 0.02%. Nevertheless, I must stress that this water is absolutely necessary to explain the high temperatures on Venus*" (von Zahn, 1981). von Zahn[327] was awarded the NASA Exceptional Scientific Achievement Medal in 1997.

Strange reasoning, indeed, but i will not add much as my intent is not and has never been to be unpleasant, but I'll leave the reader to his own thoughts and I'm sure there will be no lack of them. One thing for sure, the ground temperature on Venus does not depend on 0.02% of H_2O (no more than that of the earth depends on 0.04% of CO_2) but on the gravitational lapse rate and the polytropic equation above enables to compute very precisely the temperature not only on the ground but at any height within Venus' atmosphere and matches very well the observed profile. **93 bars** of ground pressure **is** what determines Venus ground temperature. Furthermore, as H_2O became suddenly important, I'll just remind that there is not just 0.02% of water on Earth (hopefully) and that as I stressed in section "Water is the Main Player" p.85, water and water vapor regulate the climate throughout all mechanisms described in this e-Book, both in the atmosphere and the oceans, the most important ones being of a thermodynamical nature (i.e. convection / advection – latent heat / sensible heat). But, even if limited to its radiative contribution, which is the least important aspect of heat transport by H_2O species, it is also by far the most important of all gases, more than 85% at the TOA. The laconic conclusion is therefore that no one can be spared from a thorough analysis of the coherency of his/her reasoning.

326https://www.researchgate.net/profile/Johan_Fremerey
327http://cpr.uni-rostock.de/resolve/id/cpr_person_00001979

We've seen how "rationalization" and "confirmation bias" lead to cognitive dissonances and unfortunately scientific reasoning is not immune to these caveats. "*Irving Langmuir spent many productive years pursuing Noble-caliber research. Over the years, he also explored the subject of what he called "pathological science". Although he never published his investigations in this area, on 18 December 1953 at General Electric's Knolls Atomic Power Laboratory, he gave a colloquium on the subject that will long be remembered by those in his audience. This talk was a colorful account of pitfall into which scientists may stumble*". Introduction by Robert N. Hall in (Langmuir, 1989).

From the studies that Langmuir (1989) performed he came up with two simple alarm bells that should ring loud when we face some sort of strange reasoning, he stresses:

- "*The maximum effect that is observed is produced by a causative agent of barely detectable intensity, and the magnitude of the effect is substantially independent of the intensity of the cause*";
- "*The effect is of a magnitude that remains close to the limit of detectability or, many measurements are necessary because of the very low statistical significance of the results*";

Be it for 0.04% of CO_2 on Earth or 0.02% of H_2O on Venus, we deal with causative agents having a barely detectable intensity and what is claimed by the AGW believers is that the effects will not be commensurate with the intensity of the cause, as a 0.007% increase of CO_2 in the Earth overall atmospheric composition is supposed to derail completely the Earth climate stability. Then, since the amazing Revelle et al. (1965) report stupidly calling CO_2 a pollutant, 55 years have elapsed and the IPCC "attribution exercise" is still as little convincing as ever, so the effects of man-made emissions remain close to the limit of detectability (if any effect at all) and it is not many measurements that have been necessary but billions that have been spent in an inconclusive way. The only spurious argument put forward is to resort always more to the "consensus" that is supposed to increase whereas it is just always more a mockery of the most fundamental scientific principles. So the AGW theory ticks both of aforementioned Langmuir's check-boxes brilliantly!

We have already seen throughout several sections of this e-book various examples of surprising reasoning or of conclusions that do not match the reasoning that have supposedly led to them. One example was the final statement by Shakun et al. (2012) "*Our global temperature stack and transient modelling point to CO_2 as a key mechanism of global warming during the last deglaciation*" which seems to simply go against all evidences brought by the paper and contradicts the very title of the article, as was reported while studying Figure 78, p. 194. Another example is provided by a paper by Young et al. (2010) where the authors study whether changes in atmospheric CO_2 coincide with latest Ordovician glacial-interglacial cycles and state "*The observed change in $\Delta^{13}C$ through the Hirnantian Stage in Estonia and Anticosti Island can be interpreted to reflect atmospheric pCO_2 levels that were relatively low immediately prior to the $\delta^{13}C_{carb}$ excursion and then increased as ice sheets expanded*". So, let's observe first that ice-sheets are expanding while pCO_2 are increasing, interesting as it just does the opposite of what they try to demonstrate. Then, one annoying fact omitted is that at the time considered, i.e. late Ordovician, there was more than 5,500 ppm of CO_2 in the atmosphere and that the Earth was nevertheless heading full speed into a glaciation. Finally, the Fig. 9 of Young et al. (2010) is fantastic as it demonstrates the exact opposite of what the authors claim. Let's see: during stage 1, pCO_2 and $\delta^{13}C$ are stable (dashed and dotted curves) while the sea-level decreases and the ice-volume increases, so pCO_2 cannot be responsible of anything as it is stable, then during stage 2 the glaciation accelerates as the slope of the curves showing the sea-level changes and the ice-volume clearly demonstrate that the glaciation is running fast while the pCO_2 and $\delta^{13}C$ simply go the wrong way (and increase... all that with more than 5,500 ppm and a glaciation biting) and finally when pCO_2 and $\delta^{13}C$ are peaking the glaciation is also peaking at the first unconformity at the end of stage 2. **Basically, they could not provide better evidence that pCO_2 levels and temperature and just during that period negatively correlated![328]** No need to go any further[329]. This looks like one more example of a cognitive dissonance when conclusions are opposite to the facts presented. Intentional and grave deceptions as those orchestrated by authors who speculated that 95% of the coral will be lost by 2050 (Hoegh-Guldberg, 2014), and argue that our current high levels of CO_2 are creating conditions coral have not experienced for millions of years, have to resort to contorted calculations and outright lies and deceptions to assert their claims (see discussion of Figure 88, p. 217). These situations are hopefully less frequent though extremely worrying.

328 Surprisingly! and as per the data they provide. But Henry's Law would normally lead to a positive correlation as we observe for example throughout all quaternary glaciations. Observe though that during the late Ordovician and Silurian, the so-called *Andean-Saharan* glaciation occurred from -460 to -420 Myr ago for which an extra-terrestrial trigger has recently been conjectured (Schmitz et al., 2019); this could explain some of the oddities of this event, but not those of the reasoning of Young et al. (2010)!

329 Take good notice of the reversed scales for pCO_2 and $\delta^{13}C$ increase towards the right of the Fig. 9 in Young et al. (2010) whereas Ice-volume increases towards the left.

If dubious or even twisted reasoning can lead to academic success and visibility in the supposedly best journals, saying the truth has not great success, for example Allègre has been unduly lambasted for having durst put in writing what appears this time as clear scientific reasoning but that does not fit any political correctness and which does not help the laboratories involved in these research to get funded, as well as all NGOs, associations like WWF or else to keep pumping monies into their business, nor help bureaucrats strengthen their grip and power over the world population and put their hands over the precious booty they require, so they say, to avert the crisis and catastrophe they foretell and that will make them indispensable. A massive counter-attack was organized by Valérie Masson-Delmotte[330] against Allègre and Courtillot by means of a petition signed by hundreds of scientists[331] and sent to the ministry of research of the time in 2010 (Bélouve, 2010). As noted by Prud'homme (2010) resorting to a political arbitrage in a scientific debate was very ill-inspired and discredited even more IPCC and the involvement of the signatories in that organization. Basically, the reproach made to Allègre was that they had not succeeded to censor him by means of mate-reviewing and that he should not have brought the debate to the public place. How dubious and sneaky when the AGW-supporters, Al Gore the first, have used the public for the political leverage it provides. Worth noting is the fact, that the laboratory to which belongs the head of the petition is the "Le Laboratoire des Sciences du Climat et de l'Environnement[332]" and is funded by the "Commissariat à l'énergie atomique[333]" that added "et aux énergies alternatives" to its name (CEA). Under the pressure of the green parties, and following Fukushima, Germany has permanently shut down eight of its 17 reactors and pledged to close the rest by the end of 2022. Belgium, Germany, Spain and Switzerland plan nuclear phase-outs by 2030. The French CEA is trying to save the French nuclear industry from dismantling as in the neighboring countries by funding laboratories like LSCE having a clear agenda, i.e. demonizing carbon-dioxide and at the same time emphasizing that nuclear energy is very low carbon. But where things become frightening is when the co-chair of LSCE, François-Marie Bréon[334], explains in an interview in a leading newspaper "Libération" that "*The fight against climate change is incompatible with international tourism and many economic sectors. The measures that should be taken will be difficult to accept. It can be said that the fight against climate change is contrary to individual liberties and therefore undoubtedly to democracy.*[335]" (Coulaud, 2018). The issue is not whether these scientists' credentials are appropriate but rather that they follow two political agendas, saving the French nuclear plants and transforming the society according to the vision of the green parties. This obvious disdain for liberal democracy and the parliamentary system is also clear in the German "*Changing World, Social Contract for a Great Transformation*" (WBGU, 2011) that can be considered as a modern form of "Die Grünen sozialismus", i.e. GRUNZI.

Let's make a quote from Allègre (2010) "*The CO_2 content of the atmosphere has increased over the past 100 years, and in contrast the global temperature has fluctuated over the past 100 years, just as it has fluctuated over the past few millennia, at times when atmospheric CO_2 was out of the question. Surface temperatures fluctuate with oscillations of the order of thirty years, while CO_2 levels have been increasing monotonically since the end of the 20th century, with seasonal variations. The famous equality dear to the proponents of global warming - variation in temperature = variation in atmospheric CO_2 content - is therefore simply false. The famous double hockey stick curve is false. Al Gore's sledgehammer argument that has hit politicians and the media the hardest is false. Al Gore's assertions, which he presented as ... demonstrations, are all false. For all that, this does not mean, you say, that there is no relation between CO_2 content and average temperature of the globe ... Important precision: at the current contents of 380 ppm of CO_2! ... If this relationship exists, it is complex, with phenomena of delay, shift, phase shift. Maybe there is also no relationship! Using a false correlation to promote an idea is a sham. I assume this word because it is an abuse of the public's trust by scientists. Historical data in an attempt to demonstrate the existence of continuous global warming clearly linked to the increase in the CO_2 content of the atmosphere are therefore, as things stand, null and void. I've been arguing this for more than a decade, simply by looking at how these data were obtained and using my expertise in geophysical or geochemical data processing.*" Claude Allègre

Finally, we're going to see how the narrative is written and how this has nothing to do with science. Gérard Mégie was the head of the French National Research Center (CNRS) until his untimely death in 2004 and was very aggressively

330 https://www.researchgate.net/profile/Valerie_Masson-Delmotte2, Co-Chair of the Working Group I - IPCC since 2015.

331 Note as reported by Bélouve (2010) that the scientists who did not want to sign had to find dubious pretext not to be threatened. Does that sound like normal scientific practice?

332 www.lsce.ipsl.fr

333 https://en.wikipedia.org/wiki/French_Alternative_Energies_and_Atomic_Energy_Commission

334 https://www.researchgate.net/profile/Francois-Marie_Breon

335 Automatically translated by https://www.deepl.com/ so that I would not be accused of misrepresentation of the wording.

promoting the AGW theory. Let's remind how Allègre (2010) recalls the way Jouzel received the CNRS Gold Medal[336] in 2002: "*Atmospheric specialist, Gérard Megie became President of the CNRS in 2000. He wants to honor his discipline with the CNRS gold medal, the highest scientific distinction given to a Frenchman. It is humane. He chose Claude Lorius, but the latter is retired. So he appointed Jean Jouzel, who had been working with Lorius for ten years, but who belonged to his own laboratory! But when you give a scientific medal, the habit is to say why. This is called "writing a citation". Gérard Megie, therefore, writes the following quotation: " ...* ***For showing man's influence on the climate****." This award irreversibly associated Jean Jouzel with the "cause" of global warming caused by man via CO_2. Suppose we show that man-made CO_2 has no influence on the climate: this gold medal would be unfairly underestimated. Jouzel therefore believes himself to be linked to the dominant theory, and he will now defend it against all odds. That is to say, even against the evidence. What did Jouzel say then? He signed the paper, adding that the result did not prove that CO_2 had no influence (which is, of course, obvious). He looked for over-exaggerated explanations. And the unfortunate researcher who had made this essential discovery[337] was poured into the corps of research technicians and engineers. Jouzel, for his part, continues to this day, on every television set, to proclaim the coincidence between CO_2 and temperature fluctuations, all presented as proof that CO_2 is indeed the primary cause of climate variation.*" Claude Allègre

In a funny way enough, in the 1970s, Jean Jouzel and Claude Lorius rather thought that the Earth was at the beginning of a new period of glaciation. According to Jouzel, "*The three previous interglacial periods had lasted about 10,000 years, ours was approaching 12,000 years, and since there had been a small decline in the 1960s-1970s, cooling was being considered*". So was Lorius, by the way. At least they will have been correct once, remains to see when. I have my idea and looking at Figures 35 p. 108 and 36 p. 109, the reader will easily sense when. Preferring honors and fame to satisfy the expectations of the dominants, complying with contortions to the one-sided thought is a terrible trade-off as that sacrifices a scientific legacy on the alter of intellectual integrity. It is so typically human to prefer an immediate reward than to get trouble and lasting problems for contradicting the top boss, reminding that no, man's influence on the climate has never been demonstrated and not only that, but the paper from Caillon et al. (2003) that Jouzel signed and was rightfully considered an important discovery, just shows the opposite of the basic postulate of the AGW theory, by demonstrating that CO_2 follows the temperature by approximately 800 years. This fact will certainly not surprise the attentive reader of this e-book; CO_2 always lags the temperature (see Equation 23, p. 36) at all timescales (according to and depending on the available resolutions of observed processes). William Henry[338] will long remain known and remembered for having provided the correct answer in 1803 to this question, while others and their opportunistic stances will vanish in the oblivion of the incongruous ideas which will have triggered at some point the anger of the citizens victims of these stupidities. History might even remember them more for the last reason than any other...

The maximum level of cognitive dissonance is reached when the dominants unveil more completely their thoughts, establishing a link between the COVID-19 and "climate-change" as Gates (2020) does in his blogpost "*COVID-19 is awful. Climate change could be worse*".

The first thing to observe, is that CO_2 will not change more the fate of mankind than COVID-19 has. As cruel as the death of a loved one is in every family, reasoning must distance itself from the emotions. Each year, 60 million people die worldwide (Ritchie, 2019) and would none of the 1.11 million who died of COVID-19 as of late Oct. 2020 have died this year of something else (which is a doubtful hypothesis as most were elderly with medical pre-conditions and previous morbidity), then COVID-19 will account at most in the worse case for just 1,85% of the annual death toll so far and will hardly reach 2% by year end; Furthermore, 1.11 million over 7.8 billion is a tiny 0.0142% of the world population, do you think it is going to change anything to mankind's fate on this planet? Thus, this leaves us with 98% of the deaths to be attributed to another cause.

So when Gates (2020) states "*A global crisis has shocked the world. It is causing a tragic number of deaths, making people afraid to leave home, and leading to economic hardship not seen in many generations. Its effects are rippling across the world*", one will notice that the tragedy and the economic devastation does not result of COVID-19 but of the inappropriate measures taken by most governments and local authorities worldwide, reproved by many health practitioners (UHP, 2020). As Grannis (2020) puts it "*The shutdown of the US economy will prove to be the most expensive self-inflicted injury in the history of mankind*". Sweden and a few other countries have taken another route

336 The CNRS gold medal is the most prestigious French scientific award. It has been awarded by the National Center for Scientific Research (CNRS) every year since its creation in 1954. It "*distinguishes the body of work of a renowned scientific personality*".

337 i.e. Caillon et al. (2003).

338 https://en.wikipedia.org/wiki/William_Henry_(chemist)

and resorted to the responsibility of their citizen by informing them and letting them free of taking what appropriate measures they deemed necessary for their protection and to let the virus propagate until herd immunity would be obtained. Did Sweden fare worse than the others who enforced extraordinarily coercive measures violating the most fundamental human rights? Certainly not! Furthermore, not accounted for by the COVID-19 statistics will be the host of mental illnesses, people committing suicide because they will not longer succeed to feed their families, all deaths that result not of COVID-19 but of the the desire to protect us against our will by enacting at all levels, i.e. governments, local authorities, etc. regulations and decrees that have simply trampled our most basic freedoms, i.e. to go to work, to move around, to freely travel, to meet who we needed or wished when we wanted, etc.

Then comes in Gates' post (2020) a bunch of baseless but fearful expressions such as "*dramatically higher temperatures*", "*climate disaster*", "*eliminate our greenhouse gas emissions*" note that the target is not any longer to reduce but to eliminate and "*the fight against climate change*". Gates does not say if to eliminate emissions, mankind has to stop breathing, because 7.8 billion persons release a lot of CO_2 and we will not know whether his Malthusianism goes as far as Erlichs', one of the apostle of loony and lurid doom-saying (see p. 317) and preacher of population decrease. Gates goes on with "*If you want to understand the kind of damage that climate change will inflict, look at COVID-19 and spread the pain out over a much longer period of time. The loss of life and economic misery caused by this pandemic are on par with what will happen regularly if we do not eliminate the world's carbon emissions*", no doubt that he is right for once, if one wants to get a sense of how far and disruptive to our well-being and standard of living will these rogue policies go for climate-fantasy, just look at what disaster they engineered with COVID-19. Like modern Don Quixotes that would inspire Cervantes Saavedra (de) (1605-1615), they believe that the world must obey their whimsical ideas, that they know better than us what is good for us and that their models tell the future.

Gates (2020) continues "*The economic picture is also stark. The range of likely impacts from climate change and from COVID-19 varies quite a bit, depending on which economic* ***model*** *you use. But the conclusion is* ***unmistakable****: In the next decade or two, the economic damage caused by climate change will likely be as bad as having a COVID-sized pandemic every ten years*". How sad to see a successful entrepreneur thinking that the forecast of his models have no chance to be mistaken, I'm ready to bet that these dire predictions will bear no resemblance to what the world will be in the next decades, as long as these dominants will not manage to scuttle the average person efforts who does his / her best to make things move on and progress. Because contrary to Erlich and consorts' miscues, not only has life expectancy considerably increased, in the US but in most parts of the world, but the conditions of living significantly improved over these last 50 years.

More amazingly, when Gates (2020) states "*So just as we need new tests, treatments, and vaccines for the novel coronavirus, we need new tools for fighting climate change: zero-carbon ways to produce electricity, make things, grow food, keep our buildings cool and warm, and move people and goods around the world*", he does not seem to see that food grows with and thanks to CO_2, that plants are made of Carbon as we are, and that the small 70 ppm increase over a couple hundred years has been a bonanza for mankind, improving agricultural prosperity, Gates has been blinded by propaganda and self confidence in his own mistakes and falsehoods. He should read Goklani (2015) with a prescient foreword by Freeman Dyson, and he will discover that:

"*Both satellite and in situ data show that biological productivity has increased globally for a broad range of managed, lightly managed and also unmanaged ecosystems. Although this increase is not universal, in aggregate increased biological productivity has increased food resources per acre over what they would be otherwise for both human beings and the rest of nature. Consequently, the earth is greener, farms are more productive, and the planet can support both a larger biomass and more human beings*" Goklani (2015)

"*Crop yields have increased (see Figure 3) and global food production, far from declining, has actually increased in recent decades. Between 1990–92 and 2011–13, although global population increased by 31% to 7.1 billion,* ***available food supplies increased by 44%****. Consequently, the* ***population suffering from chronic hunger declined by 173 million*** *despite a population increase of 1.7 billion[339]. This occurred despite the diversion of land and crops from production of food to the production of biofuels. According to one estimate, in 2008 such activities helped push 130–155 million people into absolute poverty, exacerbating hunger in this most marginal of populations. This may in turn have led to 190,000 premature deaths worldwide in 2010 alone. (Goklany, 2011). Thus,* ***ironically, a policy purporting to reduce AGW in order to reduce future poverty and hunger only magnified these problems in the present day***." Goklani (2015)

339. FAO (2013) Food security indicators, http://bit.ly/14FRxGV

"*Despite claims that human wellbeing will suffer, living standards, measured by GDP per capita, have never been higher globally. Consequently,* ***the absolute poverty rate*** *– the share of population living on less than $1.25 per day in 2005 dollars –* ***was more than halved between 1981 and 2010****. As a result,* ***there were more than 723 million fewer people living in absolute poverty in 2010 than in 1981*** *although the developing world's population increased by 2,174 million*[340]*.* ***In low-income countries, life expectancy, probably the single best indicator of human wellbeing, increased from 25–30 years in 1900 to 42 years in 1960 and 62 years today****. (WB, 2014)*". Goklani (2015)

Then Gates (2020) goes on "*More than anywhere else, climate change will dramatically increase death rates in poor countries near or below the Equator, where the weather will get even hotter and more unpredictable. In other words, the effects of climate change will almost certainly be harsher than COVID-19's, and they will be the worst for the people who did the least to cause them*". Like all doom-sayers going, whose forecasts are always contradicted by events, Gates anticipate against all evidences an increase in death rates in the developing world and tries to leverage on a moral and dubious argument that has found some resonance since the emergence of the community of Extreme Event Attribution (EEA) and the bizarre paper by Allen (2003) who developed the outlandish idea of finding a culprit, even if there is none, for any natural event, flood or adverse climate event (Jézéquel et al., 2018). "*The relatively small decline in emissions this year makes one thing clear: We cannot get to zero emissions simply—or even mostly—by flying and driving less*". Gates (2020).

No for sure, preventing us from driving and flying will not be enough, there will be a need for the dominants to senselessly destroy our economies and standards of living; what an outlandish idea! Why should we go to zero emissions? Shall we all stop also breathing? "*Although I am spending most of my time these days on COVID-19, I am still investing in promising new clean energy technologies, building programs that will help innovations scale around the world, and making the case that we need to invest in solutions that will limit the worst impacts of climate change*". Gates (2020). The annoying thing here, is that M. Gates does not act as a capitalist, which I would welcome, investing in solutions he believes in, and letting the Market decides what he likes and requires, but falls into crony-capitalism as he expects the governments to enforce his lunacies as to make them profitable for him as the next quote shows: "*Some* ***governments*** *and private investors are committing the funding and the* ***policies*** *that will help us get to zero emissions, but we need even more to join in. And we need to act with the same sense of* ***urgency*** *that we have for COVID-19.*" Gates (2020); and as he is impatient to making some profits, he wishes the rogue policies to come soon, waving a baseless urgency.

We, the poor wretches, if not ready to live free or die, will wake up ensnared by the dominants, being deprived of all our most fundamental freedoms. Trading some promised and hypothetical security for a great loss of freedom has always been a loosing proposition.

At that point, I will let the reader meditate the following quote:

"*Three things cannot be long hidden: the sun, the moon, and the* ***truth***". Buddha

340 http://iresearch.worldbank.org/PovcalNet/introduction.aspx

4.3. Hidden Agenda

«*No matter if the science (of global warming) is all phony . . . climate change (provides) the greatest opportunity to bring about justice and equality in the world. It's a great way to redistribute wealth*», Christine Stewart, Canadian Minister of the Environment, Calgary Herald, 1998

From what has been explained in the previous section, none should be surprised of the existence of a hidden agenda.

While the global warming alarmists have done a good job of spreading fright, they haven't been so good at hiding their real motivation. We have been told now for almost three decades that man has to change his ways or his fossil-fuel emissions will scorch Earth with catastrophic warming. Scientists, politicians and activists have maintained the narrative that their concern is only about caring for our planet and its inhabitants. But this is simply not true. The narrative is a ruse. They are after something entirely different. If they were honest, the climate alarmists would admit that they are not working feverishly to hold down global temperatures -- they would acknowledge that they are instead consumed with the goal of holding down capitalism and establishing a global welfare state.

«*One has to free oneself from the illusion that international climate policy is environmental policy. This has almost nothing to do with the environmental policy anymore, with problems such as deforestation or the ozone hole. We redistribute de facto the world's wealth by climate policy*» Ottmar Edenhofer[341].

For those who want to believe that maybe Edenhofer just misspoke and did not really mean that, consider that a little more than five years ago he also said that "*the next world climate summit in Cancun is actually an economy summit during which the distribution of the world's resources will be negotiated*." Get it now? If you have still have a doubt listen to what Christiana Figueres[342] said in February 2015 «*This is the first time in the history of mankind that we are setting ourselves the task of intentionally, within a defined period of time, to change the economic development model that has been reigning for at least 150 years, since the Industrial Revolution. This is probably the most difficult task we have ever given ourselves, which is to intentionally transform the economic development model for the first time in human history*». At the same time and not fearing conflict of interests or mental contorsions, Figueres served as Senior Adviser to C-Quest Capital, a carbon finance company focusing on programmatic CDM[343] investments. She was the Principal Climate Change Advisor to ENDESA Latinoamérica, the largest private utility in Latin America with operations in Argentina, Brazil, Chile, Colombia and Peru. She was also Vice Chair of the Rating Committee of the Carbon Rating Agency, the first entity to apply credit rating expertise to carbon assets.

The plan is to allow Third World countries to emit as much carbon dioxide as they wish -- because, as Edenhofer said, "*in order to get rich one has to burn coal, oil or gas*" -- while at the same time restricting emissions in advanced nations. This will, of course, choke economic growth in developed nations, but they deserve that fate as they "*have basically expropriated the atmosphere of the world community*" he said. The fanaticism runs so deep that some have even suggested that we need to plunge ourselves into a depression to fight global warming. The goal of environmental activists is not to save the world from ecological calamity but to destroy capitalism.

Naomi Klein is typical of these authors considered as influential opinion makers who have no training nor experience in the matter they discuss but run a well organized hidden agenda. She hasn't got the slightest scientific background nor does she demonstrate any knowledge of economic science, but as her ideas align with the mainstream nobody dares question her credential or the rationale of her arguments, whereas ad-hominem attacks are immediately directed against those who do not conform (to the consensus). She knows that capitalism will destroy climate and as her communists grand-parents taught her parents who inspired her, she must be a beacon for mankind showing us the way forward into full speed "backwardation" and misery. Klein's third book, «The Shock Doctrine: The Rise of Disaster Capitalism» (2007) argues that the free market policies of Nobel Laureate Milton Friedman and the Chicago School of

341 Ottmar Edenhofer co-chaired the U.N.'s Intergovernmental Panel on Climate Change working group on Mitigation of Climate Change from 2008 to 2015.

342 Christiana Figueres was Executive secretary of U.N.'s Framework Convention on Climate Change (2010-2016) and completed her second term as Executive Secretary of the UNFCCC on 6 July 2016.

343 The Clean Development Mechanism allows the Annex I countries to meet part of their emission reduction commitments under the Kyoto Protocol by buying Certified Emission Reduction units from CDM emission reduction projects in developing countries.

Economics are implemented by taking advantage of certain features of the aftermath of major disasters, be they economic, political, military or natural. The book appears to claim that these shocks are in some cases intentionally encouraged or even manufactured. The book has led The New Yorker to judge her "the most visible and influential figure on the American left like Noam Chomsky was thirty years ago». In Naomi Klein's fourth book,"This Changes Everything: Capitalism vs. the Climate" (2014) Klein argues that the climate crisis cannot be addressed in the current era of neoliberal[344] market fundamentalism, which encourages profligate consumption and has resulted in mega-mergers and trade agreements hostile to the health of the environment. "*What if global warming isn't only a crisis?*" Klein asks in a preview of a documentary inspired by her book. "*What if it's the best chance we're ever going to get to build a better world?*" In her mind, the world has to "change, or be changed" because an "economic system" -- meaning free-market capitalism - has caused environmental wreckage. «This Changes Everything» had become a touchstone of progressive climate activism. "*It's the single strongest statement we have for why carbon-fueled capitalism (or 'extractivism') with its imperative of relentless growth and exploitation, is fundamentally incompatible with ecological sensibility and climate justice*". The book puts forth the argument that the hegemony of neoliberal market fundamentalism is blocking any serious reforms to halt climate change and protect the environment. Questioned about Klein's claim that capitalism and controlling climate change were incompatible, Benoit Blarel, manager of the Environment and Natural Resources global practice at the World Bank, said «*that the write-off of fossil fuels necessary to control climate change will have a huge impact all over*" and that the World Bank was "*starting work on this*". One must remember that the founders of the World Bank were John Maynard Keynes and Harry Dexter White.

This is how the global warming alarmist community thinks. «*It wants to frighten, intimidate and then assume command. It needs a "crisis" to take advantage of, a hobgoblin to menace the people, so that they will beg for protection from the imaginary threat. The alarmists' "better world" is one in which* ***they rule a global welfare state****. They've admitted this themselves*» (Jackson, 2015).

The only economic model in the last 150 years that has ever worked at all is capitalism. The evidence is prima facie: From a feudal order that lasted a thousand years, produced zero growth and kept workdays long and lifespans short, the countries that have embraced free-market capitalism have enjoyed a system in which output has increased 70-fold, work days have been halved and lifespans doubled. Demonstrating an anti-rich and anti-capitalist stance is nothing new as Jesus said «*it is easier for a camel to pass through the eye of a needle than for a rich man to enter the kingdom of God*» (Matthew 19:24). Hopefully, the belief that the economy could be a growing global pie turned out to be revolutionary has it enabled growth based on credit, and the book «The Wealth of Nations» published in 1776 by Adam Smith was probably a strong foundation to this new way of thinking.

The first theme in «The Wealth of Nations» is that regulations on commerce are ill-founded and counter-productive. Another central theme is that this increased productive capacity supporting a positive vision of the future and thereof the rationale for credit rests on the division of labor and the accumulation of capital. This is made possible contrary to Jesus's and all later anti-capitalist's beliefs in general. Smith's third theme is that a country's future income depends upon this capital accumulation[345]. A fourth theme is that this system is automatic and the market is self-regulating. Where things are scarce, people are prepared to pay more for them: there is more profit in supplying them, so producers invest more capital to produce them. But the system is automatic only when there is free trade and competition. A further theme of «The Wealth Of Nations» is that competition and free exchange are under threat from the monopolies, tax preferences, controls, and other privileges that producers extract from the government authorities and in that respect the policies enacted in the wake of the UN/climate change do not escape the criticism. For all these reasons, Smith believes that government itself must be limited. Its core functions are maintaining defense, keeping order, building infrastructure and promoting education. It should keep the market economy open and free, and not act in ways that distort it. At yet, by showing how the freedom and security to work, trade, save and invest promotes our prosperity, without the need for a directing authority, «The Wealth Of Nations» still leaves us with a powerful set of solutions to the worst economic problems that the world can throw at us (Smith, 1776). As Harari (2015) reminds us «*Smith's claim that the selfish human urge to increase private profits is the basis for collective wealth is one of the most revolutionary ideas in human history – revolutionary not just from an economic perspective , but even more so from a*

344 With the meaning used in Europe, of neo-capitalism.

345 Countries fighting capital accumulation with a wealth tax of whatever kind to promote «social justice» will impoverish themselves as evidence has shown, e.g. France (1981-2020) and this is why the Nobel price in economic sciences awarded to Esther Duflo (together with Abhijit Banerjee and Michael Kremer) is unwise; her first public appearance was for a full re-installment of the wealth tax in France. Why, if the measure was efficient, did it not obtain any result fighting poverty over the very long 1981-1986 and 1988-2017 period?

moral and political perspective. What Smith says is that greed is good, and that by becoming richer I benefit everybody, not just myself. Egoism is altruism».

The most economic important resource is trust in the future and this is where science and capitalism have made a sacred union. Science provides the belief that future will be better than the present and has shown its ability to make it such and capitalism provides credit for the entrepreneurs to make it happen, thanks to the fractional-reserve banking system. Banks and governments print money, but entrepreneurs and scientists foot the bill in the end. Of course, liberals and activists of all sorts, including climate activists usually fight both and also oppose the fact that the governments cannot freely print money and must borrow it on the markets (they have simply forgotten the bankruptcy of the Weimar republic, in 1919, one loaf of bread cost 1 mark; by 1923, the same loaf of bread cost 100 billion marks. The value of the Papiermark had declined from 4.2 Marks per U.S. dollar in 1914 to one million per dollar by August 1923).

In today's world, «*If the Chinese are such high performers and so innovative, it is because, like the Indians and the Russians, they have faith in science: they have faith in the ability of science to embellish their future and to create a better world. In Europe, there was a time when we, too, had faith in science; and faith in an evolution of our societies that would rest on science. Today we have not only turned our backs on science, we are choked and infantilized by bureaucrats who suck the living forces of the old continent*» (Markó, 2017) interviewed by (Watts, 2017).

One should remind that climate is, in fact, the consequence of an incredibly complex interaction of massive and diverse forces, from variations in solar radiation intensity, to eccentricities of Earth's orbit, axis precession, and rotation, atmospheric absorption and reflection, convection and advection, to ocean heat absorption, mixing currents, and thermohaline circulation, volcanism and even plate tectonics creating mountain belts influencing the location of monsoons and the global atmospheric circulation and many other massive forces interacting. The agenda by climate alarmists to claim that this entire spectrum of massive forces is somehow insignificant next to a change of a mere 0.007% over 250 years in the concentration of a trace gas in Earth's atmosphere that in total represents just 0.04% of the atmosphere, is prima facie absurd. This gas is essential for life, and has at other stages in Earth's history been as much as ten times more in concentration without any ill effect. In fact, times of higher concentration are times of incredibly lush, vibrant, and diverse plant and animal life whose fossilized carbon remains actually created the vast oil and gas reserves we today depend on to fuel human civilization.

Would the Anthropic Global Warming Theory have remained a discussion among scientists we could and would have had heated exchanges between proponents of various theses, but climate change has long been hijacked by some activists, be they scientists, bureaucrats, NGO leaders or even more seldom politicians who claim knowing better than the remaining of us and know what to decide for the good of mankind. Sometimes, aides and scientific and political advisors bear a heavy responsibility for drafting speeches that commit their leaders, even up to Heads of States, pushing them to venture into scientifically uncharted territories, making spurious statements, for example François Hollande (the former French President) stated (in French) at 70th session of the UN General Assembly in New York, on September 28, 2015 that **tsunamis and earthquakes** will be the result of uncontrolled anthropic global warming (Hollande, 2015b). He was obviously deluded by his own entourage who certainly ensured him that no doubt remained, that science was settled and the alleged urgency would require to further force the line in this presentation to maximize political impact. How could Heads of State know? With their hectic lives, meeting all the time people and traveling around the world, they must trust their advisors and rely on the work prepared by their staff.

This is how, on Thursday 26th of February 2015, for his opening of the COP21 forum in Manila entitled « *Towards COP 21: Civil Society Mobilized for the Climate*» he stated (Hollande, 2015a): «*Yet there are scientific experts who have made all the demonstrations, who have shown all the information, such as Jean Jouzel, the vice-president of the GIEC, who is among us. They do not elaborate on theories or doctrines. They speak of reality. Today, climate change is a scientific fact. And the GIEC has gone very far, indicating that if we do nothing in the next years, it will not be a global warming of 2 degrees that we will see at the end of the century, but of 3, 4 or 5 degrees. And with* ***consequences such as tsunamis, earthquakes****, rising of the sea level, the inexorable loss of biodiversity, and what we know to be the impact of these catastrophes: thousands of deaths, hundreds of thousands of displaced persons, considerable destruction, the impossibility of living by the sea, disappearance of islands, these are what we already know and what is currently taking place.*» Do the advisors and the staff who prepared the speech realize the seriousness of their assertions? Do they imagine, as any reasonable scientist always does, that they could be wrong? But what world leaders should remember is that the aides and advisors will long be gone and have vanished whereas their speeches will remain and be evaluated by History.

Obviously, as long as some special interest groups (including climate-illusionists) will have a direct interest in selling a catastrophic storytelling (to justify their existence) and will keep running the game (and benefiting of taxpayer's monies) science will have to remain in a back seat. More recently, after having ruined their countries for SARS-CoV-2 and imposing lock-down to half the world population bringing economies to a halt and pushing hundreds of millions of people on the verge of bankruptcy, all for a disease showing a very low death rate and a median age of the dead of 83 years, talking heads and influential people encouraged by all climate activists, extremists and lobbies feeling the time has come for action, have started to announce that if nonsensical measures could have been taken for COVID-19 to save lives (this remains to be demonstrated) the same and more could be done for climate change! Everybody should feel the jitters in the spine and be frightened.

Ecrooklogists, opportunistic politicians, bureaucrats, climate-illusionists, anti-capitalists and all ideologists want our modern civilization to go back to the cave and if the public opinion does not rapidly and strongly fight and revolt against these lunacies, sooner than you believe they will enforce by law their (not so hidden) agenda. The outcome will be devastating for our civilization and our children who instead of living in their better world will see their standard of living fall as never in the pursuit of those chimeras.

If we go back to the beginning of the «Climate Xtremism» movement, the man who invented climate change was not a scientist, he was rather a big government ideologue and socialist. The Father of «Climate Change» or as climate has always changed rather «CX» is Maurice Strong, a Canadian multimillionaire passionate not in science but in wealth distribution and who could sense the power that wielding the environment banner and using the United Nations to his own profit could provide him. As a result Strong skillfully taped on weak climate change science, attacking fossil fuels, to form the leverage for a New World Government, or New World Order[346]. Therefore, from the start and continuing today the UN/IPCC supports the pseudo-science of demonizing life giving CO_2, which has "nothing to do with the environment" because this is the road to a new global wealth distribution.

The complete story is reminded to us by Brooker (2015), in 1972 Strong set up a UN Environment Conference in Stockholm, to declare «*that the Earth's resources were the common inheritance of all mankind. They should no longer be exploited for the benefit of only a few countries, at the expense of poorer countries across the globe*». To pursue this, he became founding director of a new agency, the UN Environment Programme (UNEP), and in the eighties he took up the cause of a tiny group of international meteorologists who had come to believe that the world faced catastrophic warming. In 1988, UNEP sponsored this little group into setting up the UN's Intergovernmental Panel on Climate Change (IPCC). In 1992, now allied with the IPCC, Strong managed to set up another new body, the UN Framework Convention on Climate Change (UNFCCC), to stage that colossal "Earth Summit" over which he presided in Rio, arranging for it to be attended not only by 108 world leaders and 100,000 others but also by 20,000 UN-funded "green activists". It is the UNFCCC which in effect has dictated the global climate change agenda ever since. Almost yearly it has staged huge conferences, notably those at Kyoto (1997), Copenhagen (2009) and Paris (United Nations, 2015). And all along it has been Strong's ideology, enshrined at Rio in "Agenda 21", which has continued to shape the entire process, centered on the principle that **the richer developed countries must pay for a problem they created**, to the financial benefit of all those "developing countries" that have been its main victims. In 2005, Strong was caught having been illicitly paid $1 million from the UN's Oil for Food programme, supposedly set up to allow Saddam Hussein to pay in oil to feed starving Iraqis. Strong, a member of the Club of Rome[347] was dismissed from the UN for the Iraqi Oil for Food programme scandal and since had taken refuge in Beijing where he traded in emission rights of Chinese origin according to the Clean Development Mechanisms of the Kyoto treaty, Beijing where he had been close to China's Communist leaders until his death in 2015. The scientists he indirectly enrolled were on a mission and misbehaved by fudging the data to make the climate seem warmer than it was, see the 'Hockey Stick' Global Climate Reconstruction (McIntyre and McKitrick, 2009), (Wegman et al., 2006; 2010) and climategate (Storch von, 2009), (McIntyre, 2010), (Montford, 2010), (Costella, 2010). As soon as the politicians like Al Gore usurped the science they declared a fake consensus demanding public acceptance that the science is settled not open to debate. Close to the end of his life, Strong (2012) did not hide much his longstanding agenda when he stated «*The change of course called for at Rio in 1992 requires radical changes in our current economic system. This will need to be led by those countries, mostly Western, which have dominated the world economy during the period in which our cumulative damage to the Earth's life-support systems, its precious biological resources and its climate, have occurred and have monopolized the*

346 It is funny to see that 2 articles are provided by wikipedia on the subject, one immediately referring to the notion of "Conspiracy Theory" and its links to https://en.wikipedia.org/wiki/Right-wing_populism. So NWG or NWO must be one more taboo. https://en.wikipedia.org/wiki/World_government and https://en.wikipedia.org/wiki/New_World_Order_(conspiracy_theory)

347 https://en.wikipedia.org/wiki/Club_of_Rome

economic benefits of this. I am sure that you will all agree that Rio+20 must support the increase in the status of UNEP to that of a specialized agency. This could lead to the establishment of World Environment Organization as some have proposed. This Symposium will, I trust, provide strong impetus for this».

So the logic is simple and is not new as it reminds the catholic indulgences, you committed a sin and are guilty and the only way to redeem your fault is to accept the unjustifiable penalties that we will impose on you, via the carbon demonization policies, as you have «*damaged the Earth's life-support systems and its climate*» as Strong (2012) put it.

But following the quote heralded on Strong's own website «*Everybody's actions are motivated by their inner life, their moral, spiritual and ethical values. Global agreements will be effective when they are rooted in the individual commitment of people, which arises from their own inner life*» it will be hard to obtain the individual commitment of people once they discover that they are the victims of a scam, rooted in the primary objective which is to use a pretext to transfer wealth from those who created it to their supposedly victims.

But, beware the wreck train is moving fast and unless a necessary awareness of the peoples happens, they will run over us. What will happen if a small group of world leaders establishes that the essential risks for *Creation* are those of the lifestyles of the rich countries and that the only way out for the survival of humanity is the contractual reduction of the burden on the environment and of our standard of living? Will we do it? No rich countries will not want to change their consumption habits! To save the planet anyway, the group of influential figures will decide the complete destruction of industrial civilization. Is it not our responsibility to watch over this destruction? This group of influential figures has agreed to wreck the economy.

You believe I am exaggerating?

This theme of the necessary seizure of power by "climate experts" with a "muscular" world government endowed with dictatorial powers is illustrated by countless texts and by the draft international treaties drawn up by the bureaucracy of the UN. For example the text of 2011 «Gesellschaftsvertrag für eine Große Transformation» or Social contract for a Great Reset (446 pages) of the German WBGU, (WBGU, 2011) is calling for a **state of emergency** and the **suppression of constitutional freedoms** (Vahrenholt Von, 2011). The WBGU (Wissenschaftliche Beirat der Bundesregierung für Globale Umweltveränderungen) was established and is funded by the federal government in 1992 for the United Nations Rio Conference on Environment and Development, as an "independent scientific council". The same ideas were published in "Scientific American" of March 2012: "*Human societies must change their trajectory and move away from the tipping points and runaway of the climate which could bring about rapid and irreversible changes. International institutions towards more effective governance ... This new world government must have transnational powers based on force and the exercise of force ... What institution will be able to bring into mind a mentality of permanent crisis for decades and even centuries ... it is necessary to have recourse to techniques of management of human behavior (i.e. behavioral economics) ...* ".

It is as we sees a totally Orwellian program (Orwell, 1949), with monolithic bureaucracies, armies of civil servants to ensure the power of these bureaucracies and techniques of "mass management" inspired by the communist propaganda of the years 1918-1990 and the Nazi propaganda of the years 1930-1945. These power and money-hungry fanatics, worthy heirs to Maurice Strong, are obviously much more dangerous than their supposed global warming (1975-1997), which has been gone for more than 18 years now.

You think that your constitutional freedoms cannot be taken away easily from you, that a quick vote for a state of emergency cannot achieve that, think twice at what happened to you when you were locked-down during the inflated coronavirus «Covid-19» crisis (Durden, 2020). Do not forget to be grateful to Neil Ferguson and his junk computer programs and do not think that this will remain a lone occurrence of the most devastating software mistake of all time (Richard and Boudnik, 2020). Climate science computer programs will enable decision makers to go far beyond what we have gone through. You can be sure that they will not flatten the «unemployment curve» as they cannot care less about it, they all have secured safe jobs working for universities, research bodies, governmental or better inter-governmental organizations while you will feel very hard the pain of their deranged policies.

4.4. Climate Activists, Environmentalists and Malthusians

Climate activists, even though they have not even been to school as they are too busy teenagers testifying before the U.S. Congress or attending the UN Climate Action Summit, know better than scientists who have studied earth and planetary sciences, computer sciences and much more for their entire life and who dissent the «consensus». As unbelievable as it is, one must listen to Thunberg (2019) chastise world leaders and decide that science has been settled for more than 30 years. What does she know about science? Can someone tell me! Invited by the United Nations, Thunberg, born in 2003, has the gall when she has benefited of the best conditions of living that mankind has ever had these last 2 million years thanks to the hard work and intelligence of so many previous generations, she has the gall to declare to the world: «*How dare you ? You have stolen my dreams and my childhood with your empty words and yet I'm one of the lucky one, people are suffering, people are dying, dying ecosystems are collapsing, we are at the beginning of a mass extinction and all you can talk about is money, the fairy tales of economic growth, how dare you continue to look away ? ... For more than 30 years the Science has been crystal clear, how dare you continue to look away, etc.* » (Thunberg, 2019).

Of course, she understands science better than Einstein (1919) who knew «***the truth** of a theory can never be proven»* and Thunberg has decided that the matter is crystal clear and settled! Who else would dare to oppose such a savvy analysis. What a difference one century can make! It is simply bewildering that so many public organizations, e.g. Swedish Parliament, United Nations, U.S. Congress, etc., demonstrate such a lack of discernment and have extended invitations to a clueless teenager that is to become the world fortune teller and reveal the new gospel as she does in Pearl Jam's song "Retrograde" with a startling vision for an Earth ravaged by climate change (Cohen, 2020). It is simply inappropriate and morally indefensible to make use of a dysfunctional youngster suffering from Asperger syndrome, obsessive–compulsive disorder (OCD), and selective mutism, a teenager who struggled with depression for three or four years before beginning a school strike, to promote the worst and totally baseless climate activist vision and this should be obvious to our leaders and to the media who have organized this saddening circus. This is too much like a set-up to create any public trust in man-made climate change and will probably soon lead to a severe backlash as can be sensed from the comments left by the readers of the papers describing Thunberg achievements. Hopefully, the common sense of the people should not be underestimated.

Mike Hulme has probably been one of the first to have enlightened us about the looming dangers of a future environmentalist push to try to promulgate a climate state of emergency (Hulme, 2018). Unfortunately, it seems that he was overly optimistic at the time, stating that «*Simon's People's Petition to the British Government seems unlikely to go very far. …. But it is the underlying political populist instinct at work here that is concerning. Publicly calling for climate emergencies to be declared on the basis of the fear induced by cliff-edge deadline-ism is not good psychology. Neither is it based on good science and nor does it lead to effective politics*». Unfortunately, since Hulme's warning the Welsh and Scottish governments have both already declared a climate emergency, along with dozens of towns and cities, including Manchester and London. The UK Parliament has also declared climate change emergency in April 2019 and Labour leader Jeremy Corbyn, who tabled the motion, said it was "a huge step forward".

Later on, New York City officials declared a climate emergency in an effort to mobilize local and national responses to stall global warming. «*The New York City Council passed the legislation Wednesday, calling for an immediate response to the global climate crises. The bill referenced several reports on the state of global warming and its impact, imparting that extreme weather events brought about by rising temperatures demonstrates that the planet is "too hot to be a safe environment*» (Andrew and Ahmed, 2019).

The European parliament has followed suit and declared a global "climate and environmental emergency" as it urged all EU countries to commit to net zero greenhouse gas emissions by 2050 (The Irish Times, 2019).

A spreadsheet of more than 670 governments in 15 countries having declared climate emergencies as of May 2020 is available from Innovation for Cool Earth Forum (ICEF, 2020). It is simply frightening as under these state of emergencies, likewise with the Covid-1984, all your most basic constitutional freedoms could be banned at their will. You will become slaves of their lunacies.

«*If you see a disease as a political statement, as an opportunity to pursue your pre-existing misanthropic agendas, there is something very wrong with you. And they latch on to everything from bushfires to floods, from plagues of locusts to melting ice-caps, as signs from nature, lessons from a furious Gaia. When religious crackpots blame floods on gay marriage, claiming God is punishing us for losing the moral plot, we rightly mock them. Yet greens offer merely a secular version of such backward, apocalyptic claptrap*». Joel Kotkin, (Kotkin, 2020)

«*Like the rest of the country, although far less than New York, California is suffering through the Covid-19 crisis. But in California, the pandemic seems likely to give the state's political and corporate elites a new license to increase their dominion while continuing to keep the middle and working classes down. Perhaps nothing spells the triumph of California's progressive oligarchy more than Governor Gavin Newsom's decision to off-load the state's recovery strategy to a task force co-chaired by hedge-fund billionaire Tom Steyer. A recently failed presidential candidate, Steyer stands as a progressive funder. He is as zealous as he is rich. Steyer sometimes even found the policies adopted by climate-obsessed former governor Jerry Brown not extreme enough for his tastes. Steyer's failed, self-funded presidential run was full of extreme notions, such as imposing a "state of emergency" to address climate issues, essentially shutting down fossil fuels; and, as a kind of bonus for those who still can find work, promoting a $22 an hour minimum wage while offering alms for the soon-to-be-eliminated legions of miners and energy workers*». Joel Kotkin, (Kotkin, 2020)

«*This wartime analogy has long lurked on the deep-ecological fringes of the environmentalist movement. It crops up, for instance, in James 2009 broadside, The Vanishing Face of Gaia. He writes that surviving climate change 'may require, as in war, the suspension of democratic government for the duration of the survival emergency (p. 95). Both express the key elements of today's environmentalist script. The shrill tone. The end-is-nigh urgency. The act-now-or-else command. And underwriting this script, as ever, is the core idea of contemporary environmentalism — namely, the climate emergency. This is the idea that so imminent and 'existential' is the threat of climate change that world leaders need to act as if they are at war. They need to declare a state of emergency. There's no time for deliberation or debate anymore, because, well, 'our house is on fire'. In this state of emergency, all civil liberties and democratic freedoms can be suspended. All dissent and debate silenced*». Tim Black, (Black, T., 2020)

«*The Emergency Decree for the Protection of the German People, issued on 28 February 1933, permitted the suspension of the democratic aspects of the soon-to-disappear Weimar Republic, and legally sanctioned the Nazis' suppression and persecution of political opponents. That, after all, is what states of emergency tend to entail: a clampdown on civil and democratic freedom in the interests of preserving the state against a perceived existential threat. And that is what the climate emergency entails, too».* Tim Black, (Black, T., 2020)

Barbara Demeneix, second author of the paper «Let's stop the manipulation of science» (Kortenkamp et al., 2016), is a good example of doing what she claims should not be done. As far as «endocrine disrupting chemicals» are concerned, subject which represents 99% of the content of the paper, I have no informed opinion and I would rather lean on Kortenkamp and Demeneix's side for a host of reasons. But, the manipulation of science goes full steam when the authors proclaim «*The petrochemical industry alone is the source of thousands of toxic chemicals and contributes to the massive increase in atmospheric carbon dioxide that drives climate change. The battle for climate protection entered a new era with the 2015 Paris Agreement, bitterly opposed by skeptics despite widespread consensus among climate scientists committed to working for the public interest*» This is obnoxious and despicable, it instrumentalizes science as if anything had ever been settled, resorts to the notorious infamous consensus and pretends that all those, be scientists or the public at large, who dare not think like them are working against «*the public interest*». Strangely enough, the authors believe that having to their side, just to name three, Paul R. Ehrlich who has always been consistently wrong during his entire career on all subjects, Michael Mann who will have a legacy as a dubious user of principal component analysis (McIntyre, 2006a), tree ring analysis (McIntyre, 2006b) and the strange 'Hockey Stick' Global Climate Reconstruction (McIntyre and McKitrick, 2009; Wegman et al., 2006, 2010) and curious scientific ethic, i.e. climategate (Storch von, 2009; Costella, 2010; McIntyre, 2010; Montford, 2010), and Jean-Pascal van Ypersele who is the author of the infamous sentence «*The balance of evidence suggests that there is a discernible human influence on global climate*» (IPCC, 1996) when nothing such has ever been proven rather the contrary, will reinforce their plea for controlling endocrine disruptor.

Their conclusion to resort to ever more supra-national bodies, led by international civil servants not elected nor controlled by the public «*within the United Nations with the same international standing and charge as the Intergovernmental Panel on Climate Change*» is only to raise the utmost worries of all those who have to pay taxes for these people who are themselves exempt! The reader will not be surprised to see van Ypersele «team up» with Greta Thunberg (also a leading scientist as we've seen before) at the COP24 in Katowice in 2018. As one should never renounce to honors and much more, on 2 April 2019 van Ypersele announced that he would again apply for the IPCC presidency (he failed to be elected during the 42nd IPCC Session, 2015). My friend István Markó who signed a petition with eight Belgian academics and opinion makers opposing van Ypersele candidacy as IPCC chair in 2015 is unfortunately dead[348] and van Ypersele rantings will go full steam «*countries should do everything possible to work towards the report's goal of reining in carbon emissions by 2030, at which point scientists say damage to the climate will be irreversible unless urgent action has been taken. Nobody, even the so-called superpowers, can negotiate with the laws of physics*» with the same and worn out scare techniques. Unfortunately for van Ypersele, the laws of physics do not support at all his claims, nor any other science, e.g. geology, geochemistry, astronomy, etc. and even if van Ypersele will have lived as an important man during his lifetime, István Markó will be right at the end even though Wikipedia refers to him today as a «climate confusers» and mention that he produced a large scientific output in the field of organic chemistry, but not climatology – sure one can listen to Greta she knows better science and climatology than István! Shame on them.

The moral of the fable is that the public who had already learned hard at their expense how distrustful it should be of its great leaders and politicians especially the big government proponents such as communists, socialists and national-socialists over the course of history shall also have to learn to distrust its scientists when they produce a science to order, for politicians, and in collusion with them for their greatest temporal benefits. Science had been my dream as a youngster, a passion as a professional and a nightmare now as I anticipate its demise in the future when the public will become totally mistrustful as a consequence of having been deceived and manipulated by unscrupulous individuals who will have built entire and incredibly successful careers on fables. Shame on them.

Ypersele van (2019) in his latest presentation before the European parliament has made himself a fool and a cartoon of a scientist. Here is how he concludes his speech:
« *Given:*
- *that the planet has a serious fever*
- *that the "planetary plysicians" have diagnosed the cause: fossil fuel addiction*
- *that climate confusion efforts by the fossil fuel and deforestation lobbies contribute to delay the implementation of the needed remedy (fast decarbonization)*
- *that these efforts by climate confusers are similar to those by tobacco lobbyists and anti-vaccination charlatans*
- *the role of social networks in spreading the "fake news" about climate science*

=> ***The European Parliament will consider how to convince social networks*** *of their responsibility in this regard, and how to lead them* ***to stop spreading climate disinformation*** *!*»

It is good then to learn that Yann Arthus-Bertrand and Brice Lalonde are such great scientists that they deserve to "Préface" and "Postface" the latest book of van Ypersele «Une vie au coeur des turbulences climatiques» ! And cherry on top of the cake, the final slide is with the top scientist Greta referred to as "Well-informed young people speaking truth to power" and legend with @GretaThunberg at COP24 !

This presentation is totally miserable, has just a wrong causation (as we've seen before that the increase in CO_2 is the result of the increase in temperature and not the other way round) to put forward to confuse representatives of the European people and tries by all means to deceit the failure of so called "climate science" to prove anything so far after billions of taxpayers monies spent and propose to resort to massive censorship to avoid "climate confuser" disturbing his ranting and doomsday prophecies ! That «climate science» does not exist, let's go back to physics, geology, geochemistry, astronomy, etc and I challenge Mr. Ypersele to try to convince me with scientific arguments - if this still makes sense to him – that he's right. Shame on him to try to silence others not conforming with his apocalyptic and unfounded views. I am not funded by the fossil fuel or deforestation industries and I do not recognize the right to van Ypersele to silence me by force of law. Shame on him. No doubt that van Ypersele would probably be considered a good representative of Hayek's constructivists (Hayek, 1978), (Diamond, 1980), (Williams, 1999), as he knows better than the others what's good for them, for the planet and for the Universe!

Van Ypersele should know that we will all long be dead when the relevance of the work done will be assessed and that he will not get off Scot-free then. In the meantime, if science is so much settled and the consensus so well established and if everybody agrees with the catastrophic and coercive policies that he recommends, why would he need to beg EU

348 István Markó (June 18, 1956 – July 31, 2017). https://uclouvain.be/en/research-institutes/imcn/most/istvan-marko-biography.html see also Gosselin (2017) in French https://fr.wikipedia.org/wiki/István_Markó

representatives to resort to full blown totalitarianism in order to silence other scientists[349]?. Why does he need to insult them by calling them names like «confusers»?. To the contrary, climate realists[350] are not confused as everybody can clearly see how one sided Van Ypersele is, how his career and interests, his contracts and laboratory depend on proving what he has not succeeded to do for decades, i.e. that the warming is man-made, this is the very mission of IPCC.

There cannot be more of a conflict of interest than to only work for an organization that has one and only one objective, proving the unprovable. The confuser is Van Ypersele with is flawed AGW theory[351] trying to deny the vast complexity of the geological, astronomical, physical and chemical problems we face with an ersatz of science (i.e. CO_2 explains all - known as «climate science»), claiming that the 0.007% increase of a harmless trace gas – the gas of life (of which just 6% circulating in the atmosphere is anthropic as seen before) will lead to the demise of mankind. If he were honest he would say that nobody knows for sure what has caused the ongoing warming since the end of the Little Ice Age in the early 1800s, that this warming started long before any significant industrial release of CO_2 in the atmosphere, that all we know is that climate has always been changing on all timescales considered and that physics does not support a major role for CO_2, limited to a marginal radiative role (its spectrum being largely overridden by water vapor) with a logarithmic response to any further increase.

Ypersele should think twice to this statement by Morel[352] (2013) «*Contrary to the approach adopted by certain international bodies or institutions, the researchers' effort must first aim at convincing their peers in the scientific community of the veracity of their conclusions, a necessary step to grab the attention of the general public. Any other political or media shortcut is bound to fail in the face of the skepticism of citizens, skepticism justified by the scale and complexity of the physical phenomena involved as much as by the fragility of the human institutions responsible for remedying them*».

Activists, environmentalists and scientists making their bread and butter of the ever going scare can count on the subservient mainstream media to relay their litany. Countless examples could be taken, but the tone of this article is well representative of so many others: "*As emissions grow, scientists say the world is close to reaching thresholds beyond which the effects on the global climate will be irreversible, such as the melting of polar ice sheets and loss of rain-forests. This is the critical decade. If we don't get the curves turned around this decade we will cross those lines, said Will Steffen, executive director of the Australian National University's climate change institute, speaking at a conference in London. Reuters, Mar 26, 2012*" (Chestney, 2012). Dr. Steffen's mission was terminated in September 2013 by Abbott's government with the dissolution of the corresponding commission and ANU (saving tax-payers monies). As always, sense of urgency to rush political decisions and cause always assumed and never demonstrated (man is responsible) are the tactics of the alarmists "*The climate is warming, and many other changes to the climate system – patterns of precipitation, sea-level rise, melting ice, acidification of the ocean – are also occurring. It is beyond reasonable doubt that the emission of greenhouse gases by human activities, mainly carbon dioxide from the combustion of fossil fuels, is the primary cause for the changes in climate over the past half-century*" (Steffen and Hughes, 2013). Claiming that "*it is beyond reasonable doubt, bla, bla*" does not and will never represent a scientific proof.

The recent tactic of climate activists is to pretend that even if they know nothing about the science that governs these phenomena, by making these issues a political agenda and pointing the finger at designated culprits on moral grounds, it will bring them benefits. For example, the interview with Angelique Pouponneau as reported by McCarthy (2019) is telling: "*It's critically important to make climate change a political issue to the point where candidates are saying where they stand, and the electorate decides to elect a government that acts*" then fortunately for Science and Oceanography Ms. Pouponneau has been scuba-diving for four years and let us know of her observations "*We've seen tremendous bleaching of our coral reefs. The last bleaching event had 90% mortality, and of course that affects biodiversity, I've been snorkeling and diving maybe four years ago, and what was once a rain-forest, is now like a desert*

349 This reminds of lysenkoism (Soyfer, 1994), eugenism and all other «ism» imposing their «science» or vision of society through the most brutal policies suffered in mankind history.

350 https://www.climato-realistes.fr/ we are realists, not funded by any organization and scientists for the sake and beauty of science.

351 Theory not based on classical physics but resorting to all sorts of «new» and magical wording and thinking like «forcing», «feedback», etc. Did anyone read these strange notions in any decent physics book before the invention of «climate science»?

352 Pierre Morel is a theoretical physicist (Statistical quantum mechanics). He is the founder of the Laboratory of Dynamic Meteorology (LMD) of Paris VI, ENS, CNRS, in 1968. Among other eminent functions, Pierre Morel was Director General of the French Space Agency in charge of science and technology (1975-1982), then Director of the International Research Program on the Global Climate (1982-1994).

or a graveyard." So, if things go that fast and "rain-forests" of corals rejoin the netherworld in four years, we should not have to wait for long to see how right she is. The terrible thing for her narrative, but fortunate for the world, is that we've heard this gibberish many times before to no avail. Then slowly comes the moral blackmail, asserting that "*although the Seychelles are severely threatened by climate change as sea levels rise and storms become more extreme, the coastal nation has hardly released any greenhouse gas emissions compared to industrial countries*", which is one more baseless affirmation that leads to the moral indictment of the wealthy WASPs, culprit of the world's curse, as Pouponneau adds "*Slavery built a lot of what exists in a lot of developed nations, then colonization extracted more resources, and that caused climate change, which is now displacing everyone from where they live*". If one did not see clear enough the dire cynicism of these green postures of self-entitled world savers, Pouponneau concludes that the situation "*reflects global imbalances and abuses of power*". All is said.

A puzzling example of the schizophrenia reached by the system is the nomination of Alice Larkin[353] who has been appointed in 2017 Head of the School (now Department) of Mechanical, Aerospace and Civil Engineering (MACE) at the University of Manchester, and in 2019 became Head of the School of Engineering. She is so much entrenched into the GHG ideology that she provided expert-witness (Bows-Larkin, 2016) to the trial of the Heathrow 13 protesters from the Plane Stupid[354] campaign group, who chained themselves to Heathrow Airport's Northern Runway to protest against the impact of climate change. Notice that the Head of the Mechanical, Aerospace and Civil Engineering Department avoids herself flying as she believes "*that climate change experts should act as role models in curbing aviation growth*" and testimonies at the same time to destroy the very industry she is supposed to train students for!

All that would not be so appalling if the arguments she puts forward for the defense of the protesters were not either plain wrong or simply just political, bearing no relationship with science. Bows-Larkin (2016) starts observing that "*The combined effect of these contributions to the amount of warming is uncertain and challenging to ascertain precisely*." which is just an honest acknowledgment of the magnitude of the unknowns that will starkly contrast with the peremptory attitude that will follow all along. For example, the point 4 of section 1.1 "*Sulphur oxides, sulphuric acid and soot lead to an increase in the cirrus cloud cover, again further increasing the climate warming impact of the aircraft*" is just in total contradiction of what is known and observed of the action of volcanic eruptions and their impact on the climate (i.e. cooling) by the release of sulphuric acid in the high troposphere and low stratosphere. But when it becomes a plain deception is when Bows-Larkin (2016) asserts twice in a couple of pages that "*the release of CO_2 with a lifetime of >100 years*", and elaborates "*Whilst recognising that these other emissions are important, it is also worth noting that the long-lived nature of CO_2 means that if aviation growth were curtailed to zero (i.e. no additional flights each year), then the warming impact induced by the CO_2 from the aircraft increases in importance compared with the sum of all the emissions over time. This is because most of the additional emissions will not accumulate as their lifetimes are so short, whereas **CO_2 lasts for >100 years**. **Again to my knowledge this is not contested***". This statement is a shame as contrary to all evidences (see section p. 19), and science is based on evidences, if to Bows-Larkin's knowledge her falsehood is not contested, it is just because she is victim of her own cognitive dissonances, using massively both rationalization and confirmation bias to avoid listening to all the dissenting voices that she has just decided to ignore from an IPCC ivory tower. Then it is interesting to observe how the discourse moves on slowly but steadily to a political structure as the arguments invoked have stopped bearing any relationship with science, i.e. demonstrations, irrefutable evidences, measurements, etc., but resort to opinions, sentiments having no role whatsoever to play in science, such as when she states "*cumulative CO_2 is widely recognised in the scientific community to have a direct relationship with future temperature change (Summary for Policymakers, page 8, IPCC 2014b)*." and quotes the **IPCC summary for policymakers which has never been written by scientists and is a well known piece of deception in itself** having led many scientists to slam the IPCC door as their positions where so much distorted as to make them unrecognizable, that they were not caricatures but had become simply the opposite of what they had said (e.g. acknowledging the influence of man on climate when they had just said the opposite).

Wikipedia states that Bows-Larkin (2017) "*is a theme lead in the EPSRC project Shipping in Changing Climates and develops models to predict climate-change across the world. These models inform how the shipping industry can prepare for the future. She proposed that the shipping industry use sails, biofuel and slow steaming*". These models are again just computer models[355] that do not inform about anything or anyone, except those who have credence in them, and with people like her at the helm of the School of Engineering and Department of Mechanical, Aerospace and Civil Engineering everybody can rest assured that planes will stop flying and being manufactured and the international

353 https://en.wikipedia.org/wiki/Alice_Larkin

354 https://en.wikipedia.org/wiki/Plane_Stupid

355 Do you remember of Neil Ferguson's Imperial College model, one of the most devastating software mistake of all time (Richards and Boudnik, 2020). You want more models, paid for with your taxes, to govern your lives?

maritime trade traffic will have to revert to sail-power and why not to row also to cross the oceans, making a backward move of several centuries. Mankind will have to return into the caves and the population should probably decrease fast under one billion to make all these delirious ideas an enticing future. How can things have turned so badly? All that for a trace gas that has a next to no influence on the climate and when so many other major stakes await to find better solutions, e.g. pollution, over-fishing, sanitation in so many countries, improved health and education, etc. How can baseless ideology derail brilliant minds in such a way as to make them useless for mankind progress? This is a puzzling question and I'll try to address it in the future with the help of friends of mine, proficient in philosophy, psychology, etc., because as one can see in plain light, science is not even any longer discussed, just arguments vaguely resorting to "*widely recognized*" but unfounded and unproven ideas in the "*scientific community*" and understanding better how psychological drivers operate to make these brains operate so wrongly is a truly worthwhile endeavor.

Bringing climate pseudo-science on track will not succeed by just sound scientific reasoning and obvious evidences, it will have either to wait for the climate to snap their face by going the opposite (but be prepared to ear that <u>Cooling</u> happens because they were right with the AG <u>Warming</u> theory and that it matches exactly what they said[356]) or by better understanding how, a massive self-delusion based on attractive immediate rewards and funding, leveraged on mass-conditioning has managed to wipe off any scientific principles of decent reasoning. To conclude, based on broken science and no evidence but strong politically motivated arguments and a mindless Paris agreement engineered by bureaucrats, Bows-Larkin (2016) states "*To conclude, options for expanding the aviation sector are at odds with the Paris Agreement, given that the language of 'well below 2°C' will require net zero CO_2 emissions from around 2050 (this is taken from the Agreement). This is because, without the widespread global adoption of negative emission technologies that are currently unproven at scale, 'well below 2°C'* ***implies a phasing out of fossil fuels as sources of energy by around 2050****.* ***This is largely uncontested***". Notice again the argument of authority, which bears no relation with science; it is just one more proof of Bows-Larkin cognitive disorders and autism.

"*All CO_2 emitting sectors are damaging to human health through contributing to further warming, but particularly concerning are sectors that do not foresee a significant cut in CO_2 going into the future.*" Bows-Larkin (2016). Further warming, if it were to happen due to CO_2 is more than dubious, and if it were to happen due to the continuation of the natural climate evolution occurring since the end of LIA, would be <u>welcome</u>. The only damaging action is that of people like Bows-Larkin who keep spreading fables devoid of the slightest scientific ground and keep misleading the gullible public and bamboozle journalists, judges and more. Their action is now to be considered as severely detrimental to the well being of our modern societies and their pernicious agendas and clueless motivations must be fought by all means if we hope to keep some reason and freedom. Their delirium is comparable to what struck societies with COVID-19 (UHP, 2020) and gives jitters in the back as people with these sort of mental obsessional disorders, i.e. targeting the gas of life as evil whereas it is the benefactor of this planet Earth and labeling it a pollutant, are now occupying major positions in the decision centers of our societies.

"*The vast majority of academics working on climate change mitigation would agree that a rapid and significant reduction in the combustion of fossil fuels is needed in the coming decades…I am unaware of any analysis that can demonstrate how aviation could be an exception to this.*" Bows-Larkin (2016). Since when Science is made by majority? Majority of whom? Of the climate-fantasists afflicted by major conflicts of interest as their salaries and laboratories depend on the continuation of the funding based on the climate scare strategy? Those that should shut up as their partiality is so obvious that it is obscene!

The next objective is just one little more step ahead and perfectly fills the Malthusian agenda: should we stop breathing or even living?

As each and every person on Earth exhales 1.0438 kg of CO_2 per day on average (Palmer, 2009), 7.8 billion people (2020) breathing over a year releases 3.276 billion tons of CO_2, i.e. 8.81% of the total 2018 emissions of 37.15 $GtCO_2$ but Palmer (2009) immediately adds that "*Experts are quick to point out that this figure is meaningless, since human respiration is part of a "closed loop cycle" in which our carbon dioxide output is matched by the carbon dioxide taken in by the wheat, corn, celery, and Ugli fruit that we eat*". As soon as an argument of authority is raised, the reader has now learned that he should raise his/her eyebrows and look twice. And here again, we're going to see that the experts are never thrifty of one more stupidity. First, the basics of a sound reasoning is that we make use of some carbon stored in a sink (be it short term like the wheat or the corn we eat or longer term like fossil fuels), that the carbon we use has always the same origin, i.e. photosynthesis, and that we are going to transform it into another form. If we were to apply

356This was exactly Al Gore's behavior on Jan 4, 2018, see section 4.6."Deceptions, Manipulations and Frauds".

the stupid reasoning of the experts we would say that when we cook or heat our houses burning wood it is matched by the carbon dioxide that was taken by the plants and the trees we have burnt, and that it should not be added to man-made carbon emissions as it is in “closed loop cycle”. How stupid. Second, the carbon we have used is transformed and has three main destinations: our body which is made of organic matter (a small part of our consumptions finally ends there), the excrements that we deject and the CO_2 that we release, by exhaling into the air. These three destinations have different characteristics, obviously and the “closed loop” gibberish appears even more for what it is, a new deception. The only carbon that was released was the CO_2 exhaled, the two other forms will have different life-cycle expectations but have just changed sink. The carbon we deject through excrements was calculated by Muñoz et al. (2010) who add “***Human excretion** contributes significantly to water polluting through providing organic matter and nutrients, such as nitrogen and phosphorus... but that returning these waste waters to the environment is not a bad thing in itself, as they **are nutrients, just like manure is reused as fertilizer in agriculture***”. See also (FECYT, 2010)[357] and effectively, this carbon has just joined another organic reservoir, mainly the soils after their most often transportation by water. The carbon stored in our body will remain there some decade and as observed by Richard Feynman, when a body will be cremated the ashes will show how little of us belongs to the Earth, the rest having vanished in the atmosphere (i.e. mainly CO_2 and H_2O).

The truth is that we are low sequestration carbon organisms and that most of the carbon we eat we excrete it, but to produce the energy we need for our metabolism we breathe consuming O_2 and releasing CO_2, and that produces net 3.276 billion tons of CO_2 per year, i.e. 8.81% of the total 2018 emissions and that wherever the carbon we release came from, had we not been here on Earth, we would have left it into longer forms of sequestration and it would not have returned so quickly to the sewages (where it participate to the stock of organic matter in the soils) or to the atmosphere. Claiming that we operate as a closed loop and therefore that we are irrelevant to the carbon budget is not only a spurious argument, it is as what we can expect from the experts when they have an agenda, plain wrong. Would mankind have disappeared with the Toba eruption ~75,000 years ago, 3.276 billion tons of CO_2 would not be released every year now in the atmosphere and the corresponding carbon would have remained in the sinks where it was originally trapped before we used it for our metabolism, i.e. in the plants (eventually decaying and the organic matter staying much longer into the soils) and in the animals we ate. The 3.276 billion tons of CO_2 we exhale are net man-made emissions that must, of course, be added to other sources. But I have a good news, it does not matter at all, CO_2 is the gas of life and mankind should more than welcome its presence and the recent slight increase instead of bemoaning in a clueless way.

But a broader perspective must be considered and producing food from animals, such as meat and dairy products, e.g. from farms raising cattle, creates the largest impact. Agriculture, livestock, fishing and the food industry are the greatest source of carbon dioxide water pollution, but in both cases the effects of human excretion (through breathing or due to waste water treatment) are next. One must also include the production facilities, i.e. industrial food processing, sale and distribution, preparation and cooking at home, solid waste treatment (food remains and packaging).

Shall we stop everything ? Are we too much on this planet ? Is Mankind adventure not worth it? Maybe the only species that ever managed to go to the Moon, to know its place in the Solar System, in the Galaxy, building the largest telescopes equipped with astonishing CCDs and sending them into orbit, and discovering all other planets over a couple of decades and orbiting or tele-driving rovers over them or plunging into their distant atmospheres, even bringing back rocks from asteroids, to discover the bewildering geological history of the Earth, etc., perhaps Mankind did not deserve it? Would the planet be better off with mountains of dinosaurs breathing and farting in our place?

This leads Malthusians who are congenital pessimists and do not hide to claim it in plain sight, to not only welcome a decrease of the global world population but to target the decrease into the more advanced countries, a perfect recipe for a global crash, and Socolow (2011) states “*An average American emits at least ten times more greenhouse gases per year than an average Indian. So, reduction of population growth, from the perspective of climate change, is especially important in wealthy countries. Right now, women in some wealthy countries---including Japan, Italy, and Russia---are on average having fewer than two children, which over time will lead to falling populations*”. Socolow does not say if he expects the US to keep brain-draining the developing countries of their most brilliant minds for their good so that they keep creating successful startups to pay for his retirement or if he has other plans for that. It is just suicidal at the scale

357 FECYT (2010) adds that “*human excrements have a net null effect on global warming, as they are offset by carbon fixation in photosynthesis. As a result, they do not contribute to increasing the concentration of CO_2 in the atmosphere*” which is correct but this leaves breathing as a separate subject which produces 3.276 billion tons of CO_2

of any society and is also sheer madness, as there is wealth only in Men (and of course women, the saying obviously uses the generic term/meaning), but it has the merit to show where those people want to drive us. Socolow, professor emeritus of Mechanical and Aerospace Engineering at Princeton University, also focuses on global carbon management and is the co-principal investigator of Princeton University's Carbon Mitigation Initiative and it seems that his brilliant intellect just cowered on carbon dioxide. As a typical Malthusian he states "*A global population smaller by the end of the century than today is plausible---and a desirable objective if it can be achieved without coercion, pestilence, or war*". In fact these ideas are not new as in Harte and Socolow (1971) the authors already encouraged various essays in Section III , p.203 – dealing with "*The Equilibrium Society (equilibrium population and Stationary-State Economy)*".

Now to give a feel of how distorted the facts can be, how far falsehoods can go, how deeply ingrained into the brainwashing dominant newspapers the ideology has gone, I am going to unveil how the vast network of media operate as an immediate relay to give massive coverage and visibility to a nonsensical study matching their agenda when searching just a little bit would have enabled to see how flawed and inconsequential the research was. Immediately after Mora et al. (2017) paper was published on-line, i.e. on 19 June 2017[358], titled "Global risk of deadly heat", **several co-ordinated articles** appeared in the mainstream media **on the very same day**, showing an extraordinary alacrity, incredible no?, like the Guardian (Milman, 2017), The Washington Post (Harvey, 2017) and the day after on 20 June 2017 in the U.S. News (Trimble, 2017) and even the French speaking 'Le Figaro' (Cherki, 2017), and certainly so many more in local or regional languages, to launch a campaign of public intoxication aiming at convincing people that they will be in danger to die of future heat-waves.

So what did Mora et al. (2017) came up with so important as to be immediately relayed into the mainstream media? "*We reviewed papers published between 1980 and 2014, and found 783 cases of excess human mortality associated with heat*". Therefore, based on 783 cases, Mora et al (2017) conclude "*Our study underscores the current and increasing threat to human life posed by climate conditions that exceed human thermoregulatory capacity. Lethal heatwaves are often mentioned as a key consequence of ongoing climate change, with reports typically citing past major events such as Chicago in 1995, Paris in 2003, or Moscow in 2010*". The first thing to notice is that these heat-waves have nothing to do with GHG as acknowledged by many authors who studied these meteorological phenomenons and report them as examples of odd meteorological systems and second that they have not even been able to make a decent list of the proper references for a study that is entirely based on a bibliographical study, and the paper from Gasparrini et al., (2015) published just two years before in The Lancet. Based on that lousy research and shoddy bibliographical analysis, limited to 783 cases on 7.8 billion persons, we are told a massive falsehood, i.e. that "*A third of the world now faces deadly heatwave*". How shameful, would they have read the paper from Gasparrini et al., (2015) based on more than 74 million persons, yes 74 225 200, not 783 (sic!), **they would have learned that the cold kills 20 times more than the heat**, and that climate-related deaths are people who died freezing, the excess mortality in winter being even extremely noticeable in rich countries and being aggravated by increasing cost of energy due to rogue energetic (read green) policies. The sad truth as reported by MacRae (2019) is that "*cold, not heat, is by far the greater killer of humanity. Today, cool and cold weather kills about 20 times as many people as warm and hot weather. Excess Winter Deaths, defined as more deaths in the four winter months than equivalent non-winter months,* ***total over two million souls per year****, in both cold and warm climates*". See also D'Aleo and MacRae (2015).

Indoctrinated journalists and partisan mainstream media bear a sinister responsibility in the sting operations of dis-information of the public. They ignore evidence that is provided from a study of 74 million deaths in thirteen cold and warm countries including Thailand and Brazil, and studies of the United Kingdom, Europe, the USA, Australia and Canada and give an immediate, coordinated and disproportionate light on a dubious study based on 783 cases making baseless forecasts for 2100. Contrary to popular belief, Earth is colder than optimum for human survival, we are originally a tropical species with little adaptation to severe cold. A warmer world, such as was experienced during the Roman Warm Period and the Medieval Warm Period, lowers winter deaths and a colder world like the Little Ice Age increases winter mortality. These conclusions have been known for many decades, based on national mortality statistics, but the journalistic waffles end saying the opposite of the most basic truth. Journalism is a noble profession, a beautiful job where, as for scientists, it is a primordial duty to seek the truth, to inform oneself as much as is necessary in order to advance only information in which it is possible to place a high level of trust. What a shame to see what has become of this profession under the thumb of the dominants. This profession is no longer even a shadow of its former self, just a vanishing specter.

358https://www.nature.com/articles/nclimate3322

The special interest groups do not even hide any longer to manipulate and deceive the public with their shenanigans, their collusion is visible in plain sight; as soon as some researchers publish a shoddy "scientific" paper, for example in this case in "nature climate change", they are given direct access and relays to the mainstream media, in the hours following the issuing of their dubious research in partisan scientific journals, beating loud the drum of the climate scare, trying to terrify the average citizen who has no way to separate the wheat from the chaff, tired enough when back home from work of having had to waste so much in taxes in order to support the massive deception scheme that work full time against him or her to run an agenda that will prove vastly detrimental to his own standard of living. This is of course further broadcast asap on all the Communists News Networks (CNN) of the world to ensure that no brain remain immune to the deception.

Know for what you wish, you are close to getting it! A massive economic disaster, a crumbling of the standard of living worldwide, a return of the poverty, a reduction of life expectancy, all that for a delirious whim.

"*When Mother Nature decided in 1980 to change gears from cooler to warmer, a new global warming religion was born, replete with its own church (the UN), a papacy, (the Intergovernmental Panel on Climate Change), and a global warming priesthood masquerading as climate scientists. Selfish humans in rich, polluting countries were blamed for the warming and had to pay for past trespasses by providing material compensation to poor nations as penance. Cutting greenhouse gas emissions became the new holy grail. With a warm wind at their backs, these fundamentalists collected hundreds of billions of dollars from naive governments that adopted their faith on behalf of billions of people. No crusader was ever so effective*." Maurice Newman[359] (2012b).

In the end all hope is not lost as even some well known activists turn their jackets as recently Shellenberger (2020) did with his "*On Behalf Of Environmentalists, I Apologize For The Climate Scare*" and his book "Apocalypse Never: Why Environmental Alarmism Hurts Us All".

359https://en.wikipedia.org/wiki/Maurice_Newman

4.5. *Prophets of Doom and Gloom*

In 1970, quite exactly 50 years ago, the first Earth Day promoted ice age fears, and environmentalist Nigel Calder warned "*The threat of a new ice age must now stand alongside nuclear war as a likely source of wholesale death and misery for mankind*" and C. C. Wallen of the World Meteorological Organization said "*The cooling since 1940 has been large enough and consistent enough that it will not soon be reversed*". On the same first Earth Day Kenneth E. F. Watt "*If present trends continue, the world will be about four degrees colder for the global mean temperature in 1900, but eleven degrees colder by the year 2000... This is about twice what it would take to put us in an ice age*" quotes from (Markovsky, 2016).

In the early seventies, two prominent scientists working for the Institute for Space Studies, Goddard Space Flight Center, National Aeronautics and Space Administration in the USA published in Science that:

«*From our calculation, a doubling of CO_2 produces a tropospheric temperature change of 0.8°K (12). However, as more CO_2 is added to the atmosphere, the rate of temperature increase is proportionally less and less, and the increase eventually levels off. Even for an increase in CO_2 by a factor of 10, the temperature increase does not exceed 2.5 °K. Therefore, the runaway greenhouse effect does not occur because the 15-µm CO_2 band, which is the main source of absorption, "saturates," and the addition of more CO_2 does not substantially increase the infrared opacity of the atmosphere*». (Rasool and Schneider, 1971).

Which is correct and concluded that (which is not so far):

«*However, it is projected that man's potential to pollute will increase six- to eightfold in the next 50 years (24). If this increased rate of injection of particulate matter in the atmosphere should raise the present global background opacity by a factor of 4, our calculations suggest a decrease in global temperature by as much as 3.5°K. Such a large decrease in the average surface temperature of Earth, sustained over a period of few years,* ***is believed to be sufficient to trigger an ice age***». (Rasool and Schneider, 1971).

These dire predictions which have been made over the last five decades have regularly been emphasized by the mass media and for example the previous «ice-age coming» quote aforementioned was relayed by Victor Cohn, Washington Post Staff Writer, in The Washington Post Times Herald (1959-1973); Jul 9, 1971 with the paper « U.S. Scientist Sees New lce Age Coming ».

Then in the late 1980s Schneider's message changed diametrically (Schneider, 1989): «*Results from most recent climatic models suggest that global average surface temperatures will increase by some 2° to 6°C during the next century... Sea level rises of 0.5 to 1.5 meters are typically projected for the next century*» and stressed that policy responses could encompass a "*Law of the Atmosphere*".

Then in a paper in *Detroit News*, dated December 5, 1989, p. 10A, Schneider claimed that a statement that he was "*among those actively warning of a returning ice age*" ... "*is blatantly false*". This is in tune with is advice on scientific honesty "... *we need to get some broad based support, to capture the public imagination. That of course means getting loads of media coverage. So we have to offer up some scary scenarios, male simplified dramatic statements and little mention of any doubts one might have... Each of us has to decide the right balance between being effective and being honest*" (Quoted in Discover Magazine, p. 45–48, October 1989).

As stated by Ebell and Milloy (2019) «*More than merely spotlighting the failed predictions, this collection shows that the makers of failed apocalyptic predictions often are individuals holding respected positions in government and science. While such predictions have been and continue to be enthusiastically reported by a media eager for sensational headlines, the failures are typically not revisited*».

One thing did not change since 1970, the doom-sayers keep running their businesses. As displayed on the Earth Day Website http://www.earthday.org/ «*Scientists warn us that climate change could accelerate beyond our control, threatening our survival and everything we love. We call on you to keep global temperature rise under the unacceptably dangerous level of 2 degrees C, by phasing out carbon* ***pollution*** *to zero. To achieve this, you must urgently forge* *realistic global, national and local agreements, to rapidly shift our societies and economies to 100% clean energy by 2050. Do this fairly, with support to the most vulnerable among us. Our world is worth saving and now is our moment to act. But to change everything, we need everyone. Join us.*»

Those rantings are in fact very positive as none of what these people have ever anticipated has never happened. The other positive is that CO_2 is not a pollution, it is the gas of life, what enables us to live on this planet by benefiting of the growth of the vegetation which enjoys the 0.007% bonus that it was offered.

Think about it, this is what they claimed in 1970 for the first Earth Day:

Harrison Brown, a scientist at the National Academy of Sciences, published a chart in Scientific American that looked at metal reserves and estimated «*the humanity would totally run out of copper shortly after 2000. Lead, zinc, tin, gold, and silver would be gone before 1990*».

Ecologist Kenneth Watt declared, "*By the year 2000, if present trends continue, we will be using up crude oil at such a rate…that there won't be any more crude oil. You'll drive up to the pump and say, `Fill 'er up, buddy,' and he'll say, `I am very sorry, there isn't any'*"

Paul Ehrlich who has consistently been wrong on everything and made a fantastic academic career warned in the May 1970 issue of Audubon that DDT and other chlorinated hydrocarbons "*may have substantially reduced the life expectancy of people born since 1945. Ehrlich warned that Americans born since 1946…now had a life expectancy of only 49 years, and he predicted that if current patterns continued this expectancy would reach 42 years by 1980, when it might level out*», and more "*Population will inevitably and completely outstrip whatever small increases in food supplies we make*" Paul Ehrlich confidently declared in the April 1970 Mademoiselle. "*The death rate will increase until at least 100-200 million people per year will be starving to death during the next ten years*".

Peter Gunter, a North Texas State University professor, wrote in 1970, "*Demographers agree almost unanimously on the following grim timetable: by 1975 widespread famines will begin in India; these will spread by 1990 to include all of India, Pakistan, China and the Near East, Africa. By the year 2000, or conceivably sooner, South and Central America will exist under famine conditions….By the year 2000, thirty years from now, the entire world, with the exception of Western Europe, North America, and Australia, will be in famine*". Take notice of the reference to a «consensus», the specialists «agree almost unanimously».

Among the worse doom-sayers, scare mongers and falsehoods propagators rank the international bureaucrats who keep driving the people's deception with the pedal down to the metal. The reader was already instructed of the amazing story of the latest UN report on climate catastrophes (p. 294), where the organization does not even embarrass itself with scientists nor truths any longer, but resorts to Mami Mizutori (diplomat) and Debarati Guha-Sapir (an Indian epidemiologist) to explain us that the world need to decarbonize asap in their fantasy tale. These delirious reports are in fact nothing new as Legates et al. (2015) report that "*For example, the United Nations Environment Programme issued a statement in 2005*[360] *proclaiming 'fifty million climate refugees by 2010'. Those numbers, of course, never materialized. But in 2011, the UN was back*[361] *with another forecast: '60 million environmental refugees by 2020'. Examples like this are legion, largely because the popular press is overrun by articles which agree with the contrived consensus*". The fortunate but inconvenient truth is that none of these dire scenarios ever materialized and that even including the very special case of the Carteret Islands addressed later p. 322, there are no environmental refugees so far. We are in 2020 and we have **zero environmental refugees**, shame on the climate-bonkers.

More recently one will have to add to the posterity of the deranged forecasters two influential scientists and this is where things become worrying, when those supposed to know and to act responsibly in their communication while shaping the public understanding of these complex question, lose their balance and become prophets of the Apocalypse as a headlong rush into ever more catastrophic forecast which are not supported by the weakest scientific evidence:

- "*That's the big thing – sea-level rise – the planet could become ungovernable*." Dr. James Hansen, former Director, NASA GISS (Wallace-Wells, 2017). For sure, had we a lot of people like him been paid a life-time

360 From Norman Myers, ''Environmental refugees. An emergent security issue''. 13 Economic Forum, Prague, OSCE, May 2005; Millennium Ecosystem Assessment, 2005.

3618 http://phys.org/news/2011-02-million-environmental-refugees-experts.html

180,000$ with tax-payer monies for dubious and inconclusive research as their AGW theory remains controversial and elusive[362] to say the least, already arrested twice as an environmental activist in 2009 and 2010 before being arrested again before the White House with dozens of eco-activists on Aug. 29, 2011 (Fox, 2011), and also now suing the federal government alleging complicity on climate change (which Hansen and his fellow litigants argue is a violation of the equal protection clause), the planet would become certainly very hard to govern, much more than due to the minuscule observed sea-level rise;

- "*We're talking about literally giving up on our coastal cities of the world and moving inland*[363]." Dr. Michael Mann, Penn State University.

Then Mann asserts in the same interview with Science Friday "*There's very little doubt among scientists that climate change has ratcheted up the potential intensity of hurricanes and other large storms*". The fabricators of the IPCC's 2001 (in)famous Hockey Stick graph had already heavily weighted the result by using the widths of annual tree-rings from bristle-cone pines (Pinus longaeva) to reconstruct pre-thermometer temperatures knowing that bristle-cones annual tree-rings widen not only in warmer weather but also when it was wetter and when there was more CO_2 in the air (Lamarche et al., 1984; McIntyre, 2006), they have indulged themselves again into pure deception and this is unforgivable. Let's remind here what IPCC says in their latest SREX report: "*There is low confidence in any observed long-term (i.e., 40 years or more) increases in tropical cyclone activity (i.e., intensity, frequency, duration), after accounting for past changes in observing capabilities*". SREX, p.8, (IPCC, 2012). Therefore, and contrary to what Mann asserts, the better are the observations and the more accurate are the records, the less confidence IPCC have in an increase in tropical cyclone activity. In fact the deception technique reminds of one of the "errors" attributed by Justice Burton with respect to the paragraph 31 of the ruling dealing with - An Inconvenient Truth - "*In scene 12 Hurricane Katrina and the consequent devastation in New Orleans is ascribed to global warming. It is common ground that there is insufficient evidence to show that*" (EWHC 2288, 2007). Even WMO also clarified that "*no individual tropical cyclone can be directly attributed to climate change*" (WMO, 2016).

As Hansen is never thrifty of a bold prevision, I let the reader meditate this last one made in 2008, "*The arctic will be free of summer ice in 5-10 years*" (Borenstein, 2008). We're in 2020, 12 years later, and 'We're NOT toast'. With respect to the ice-free Arctic, I remind you of the travel of the USS Skate (SSN-578), in 1959. "*On 30 July, Skate steamed to the Arctic where she operated under the ice for 10 days. During this time,* ***she surfaced nine times through the ice****, navigated over 2,400 miles (3,900 km) under it, and on 11 August, 9:47 pm EDT (the week after USS Nautilus) became the second sea ship to reach the North Pole*[364]". See captain's Calvert 1960 book, "*Surface at the Pole: The Extraordinary Voyages of the USS Skate*". Given the technologies used to build USS Skate, **she could certainly not have surfaced thick ice** and was not designed either for that.

The Arctic was not ice-free summer time in 1959 as captain's Calvert had searched "*in vain for a suitable opening to surface in*", but Skate did manage to surface and make contact with Drifting Ice Station Alpha at 85ºN, 300 nautical miles away. From the pictures (see Figure 115), summer-ice was not that thick nor covering entirely the pole either as free water is seen around on many pictures. In fact, it is worth remembering, that at the end of LIA, how strange, the Arctic was ice-free in June 1854 at 80-81°N, to the north of the Kane Basin, along the Kennedy Channel that leads north to the Lincoln Sea. This reported by Kane (1856) in "*Arctic Explorations*". "*In the midst of this danger, they had sighted open water and now they saw it plainly. There was no wind stirring and its face was perfectly smooth…Hans could scarcely believe it. But for the birds that were seen in great numbers, Morton says he would not have believed it himself.*" (Kane, 1856).

"*A rather common assumption of recent studies of arctic sea ice cover is that what has been observed in recent decades is a unique event, unlike any previous conditions, although the quotation [at the head of this chapter] before describes open water in June 1854 at 80-81°N, to the north of the Kane Basin, along the Kennedy Channel that leads north to the Lincoln Sea; a sledding party, searching for traces of Franklin's expedition, found open water as far up the channel as they could see from hilltops. But, in summer 1980, our ice-strengthened CSS HUDSON could not penetrate even into the northern bight of Kane Basin, which remained ice-covered in mid-August*". (Longhurst, 2015)

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362 Appointed lead-author of Chapter 8 of the 1995 IPCC Report titled "Detection of Climate Change and Attribution of Causes" Santer determined to prove humans were a factor by altering the meaning of what was agreed by the others at the draft meeting in Madrid (Ball, 2011).

363 https://www.sciencefriday.com/segments/hurricane-harvey-and-the-new-normal/

364 https://www.youtube.com/watch?v=iv9NxOrKDow

Figure 115. USS Skate (SSN-578) was the third nuclear submarine[365] *commissioned, the first to make a completely submerged trans-Atlantic crossing, and the second submarine to reach the North Pole and* ***the first to surface there****.*

Furthermore, even as recently as 1500-1600 (CE), the Wrangel Island which is located in the Arctic's Chukchi Sea and is covered in sea ice for all but a few weeks of the year today was sea ice-free 4-5 months per year, suggesting the Western Arctic is much colder today than it was even during the Little Ice Age (Porter et al., 2019) see Fig. 3 p. 6. Thus, even though Hansen's prediction would become true (for once) and would Arctic be ice-free summer time in the future, this would remain in the range of short-term natural variability and would have nothing exceptional to be attributed to man-made emissions.

Notice though, that Arctic was ice-free during the Holocene optimum and not summer time but quite all year round. That was just 7000-8000 years ago and man-made emissions had nothing to do with that. As noticed by Richard (2020) "*Wild Horses And Mammoths Were Still Eating Grass Year-Round In The Arctic Until 2500-4000 Years Ago. Surface temperatures needed to have been much warmer than today to supply enough grass year-round for horses and mammoths to subsist in the Arctic through the Late Holocene*". If until the 1990s, it was thought the Earth's last woolly mammoths went extinct during the Pleistocene-Holocene transition about 15,000 to 10,000 years ago, the fact is that Arctic's Wrangel Island is home to extensive mammoth remains and radiocarbon dating indicates that the woolly mammoth continued living on this island until 3700 years ago, or until the Arctic climate became too cold to provide enough grass year-round to sustain them (Bryson et al., 2010; Arppe et al., 2019).

According to Bryson et al., 2010, a small mammoth is modeled to have conservatively required 25 kg of grass per day to survive. Richard (2020) states "*mean July temperatures decreased from above 5°C during the Early Holocene to below -2.5°C – the threshold for grass production – by about 4,000 years ago. Consequently, without enough year-round grass to feed on, the woolly mammoth died out*". Even though the study by Graham et al. (2016) points to other factors that could have contributed to the demise of these populations such as a reduction of available freshwater "*Five independent indicators of extinction show that mammoths survived on St. Paul until 5,600 ± 100 y ago. Vegetation composition remained stable during the extinction window, and there is no evidence of human presence on the island before 1787 CE, suggesting that these factors were not extinction drivers. Instead, the extinction coincided with declining freshwater resources and drier climates between 7,850 and 5,600 y ago*" thus all evidences suggest a much warmer climate then today during the HCO and an ice-free Arctic all year round or so.

365 "*The US Navy regards levels of 5000 ppmv on nuclear submarines as safe; ambient levels are currently 400 ppmv*" (Lindzen, 2016); this safety level also corresponds to the OSHA Permissible Exposure Limit (PEL) of 5,000 ppm (ESHG-Health-02.00), this document adds "10,000ppm (1.0%) Typically no effects, possible drowsiness"

That's natural climate variability. No need for dubious IPCC "*attribution*".

But the relentless scare mongers are always back to full steam trying by all means to justify their salaries and the massive budgets of the so many agencies involved, NOAA and 13 more in the last particular case (USGCRP, 2018), that reports after reports they come up with more frightening previsions immediately publicized in the mass media news-press, e.g. (Rice, 2018), that are either baseless affirmations such as the increase of extreme events, which is not even attempted by IPCC, or with exotic and magical forecasts of sea-level rise or else that never happened so far and will not. Of course, all these people do not make science but politics and use the massive financial and human means at their disposal to push harder each time their agendas, adding layers of deceptions over layers of computer models that deliver ever more science-fiction scenarios but nothing very useful for the average citizen who had to fund by the force of the tax system these elucubrations. Report co-author Brenda Ekwurzel of the Union of Concerned Scientists said it "*makes it clear that climate change is not some problem in the distant future. It's happening right now in every part of the country. U.S. residents are now being forced to cope with dangerously high temperatures, rising seas, deadly wildfires, torrential rainfalls and devastating hurricanes,*" she said. Of course, none of these nice meteorological events have ever happened in the past, and claiming that they are worse than before without any evidence of such lies only aims at frightening the populations.

We've eared all these glib, goof-balls and loony predictions for so long now, a masterpiece of quackery, that they are not even distracting anyone any longer. This is not just appalling to observe these visionary leaders or all these scholars being so consistently wrong as reported by Ebell and Milloy, (2019) or Perry (2019a), but leaves aghast to see them now teaming up by the hundreds in IPCC or USGCRP reports to deliver the same lurid forecasts, fortunately always so consistently wrong, that the pattern of intentional deception is now unmissable unless it would simply be mere collective madness, sort of a social schizophrenic. Harping on again and again their dire vision of the future is the strategy followed by these climate-tricksters, they have relentlessly regurgitated their obsessional scenarios of catastrophe in the making for five decades. They populate their jabberwocky climate tales of horror-land with their unfathomable CO_2-fed stupidities and delusions, strangely hoping that some day, by some divine (in)justice, the sins of the mortals consumerists who spoiled the terrestrial Eden would finally be punished by the revenge of Gaia. A plethora of climate-illusionists who read in the digital coffee grains and push the scare in order to keep cashing in their salaries do their best to kick the can of delusion down the road to the detriment of everyone else, and more importantly of the truth. After that "*in 2008 climate genius Al Gore predicts ice-free Arctic by 2013*" (Perry, 2019a), we have New York City's West Side Highway underwater by 2019 according to Hansen (Salon.com, October 23, 2001), and now the last but not least fortune-teller has just pronounced (Cummings, 2019) her sentence "*The world is going to end in 12 years if we don't address climate change*" Ocasio-Cortez says. USA TODAY Dec 14, well as Perry (2019a) says "*if we don't immediately convert to socialism and allow Alexandria Ocasio-Crazy to control and organize our lives, the planet will become uninhabitable*".

This reminds of the great books of Mackay (1841) 'Memoirs of Extraordinary Popular Delusions and the Madness of Crowds'[366] who stated in his preface p. VIII "*Popular delusions began so early, spread so widely, and have lasted so long, that instead of two or three volumes, fifty would scarcely suffice to detail their history. The present may be considered more of a miscellany of delusions than a history - a chapter only in the great and awful book of human folly which yet remains to be written, and which Porson once jestingly said he would write in five hundred volumes!*". Viewed with such a perspective, the AGW will not look that impressive, just one very good chapter.

Nathaniel Keohane of the Environmental Defense Fund[367] (EDF) said "*it is worth nothing that the report was released by an administration that has persistently ignored the warnings of scientists, economists, businesses and community leaders that corroborate the report's findings. As long as government leaders sit on their hands, Americans will suffer for generations to come. The evidence is clear: the Trump administration is failing to protect the American people*". The EDF is so replete with cash with more than 150 millions per year and conflicts of interests in the matter, that designating the Trump administration as a political target is a disservice to their otherwise sometimes legitimate actions and serves only to point to the political agenda and motives underlying all AGW actions.

Nathaniel Keohane should meditate that "*However, whereas expert credibility and prominence may dominate the opinion of what is true, it can never alter truth itself*".

366 https://en.wikipedia.org/wiki/Extraordinary_Popular_Delusions_and_the_Madness_of_Crowds
367 https://en.wikipedia.org/wiki/Environmental_Defense_Fund

4.6. Deceptions, Manipulations and Frauds

Intentional Deceptions

Whenever you defend a just cause, there is no need to resort to distorted or exaggerated arguments to impress more people. In that respect, it is interesting to analyze how a High Court judge who ruled in the UK on whether climate change film, “An Inconvenient Truth”, could be shown in schools came to the conclusion that it contains nine scientific "errors". On October 10, 2007, Justice Michael Burton, ruled “*that it was clear that the film was substantially founded upon scientific research and fact, albeit that the science had been used, in the hands of a "talented politician and communicator", to make a political statement and to support a political program*”.

The judge ruled that An Inconvenient Truth contained nine scientific errors[368] and thus must be accompanied by an explanation of those errors before being shown to school children. The judge said that showing the film without the explanations of error would be a violation of education laws. In fact, Monckton of Brenchley (2007) lists 35 errors that he attributes to the film, but just one intentional deception would be worse than many accidental mistakes. It is to be feared that one can find more than one such breach of confidence and among the various “errors” pointed to by Justice Michael Burton it may be useful to be back on some of them and it will be done later. Probably the most controversial part or the ruling by judge Justice Michael Burton is when he stated “*that it was clear that the film was substantially founded upon scientific research and fact*“ as the film is just a massive deception that does not stand any scientific examination. Let's first list nine scientific "errors" spotted by Justice Michael Burton and then we'll comment briefly on them:

- Sea level rise of up to 20 feet (7 meters) will be caused by melting of either West Antarctica or Greenland;
- Low-lying islands in the Pacific Ocean are having to be evacuated because of the effects of global warming;
- The Gulf Stream would be shut down by global warming, causing sharp cooling in northwest Europe;
- There was an exact fit between graphs showing changes in carbon dioxide levels in the atmosphere and global temperatures over a period of 650,000 years;
- The disappearance of snow on Mount Kilimanjaro in Tanzania was due to global warming;
- The shrinkage of Lake Chad in Africa was caused by global warming => irrigation demands increased four-fold between 1983 and 1994, accounting for 50% of the additional decrease in the size of the lake;
- Hurricane Katrina was likewise caused by global warming;
- Polar bears were being found drowned after having to swim long distances to find the (melting) ice;
- Coral reefs were being bleached by the effects of global warming and other factors;

Let's review these one by one and see how they stand the slightest examination - for a more comprehensive critic of Al Gore's film and book see (Lewis, 2007):

- The sea level rise is the classical scare monger game that has been played for decades, starting with Schneider (who had just converted from his impending ice-age) in the "The Palm Beach Post" edition of the 8th of January 1979, while working for the National Center for Atmospheric Research at Boulder (Colorado) predicted that “*man-caused global warming would thus melt polar ice and raise sea levels by many feet". Schneider predicted this as a possibility to happen before the end of this century (understand before 1999) and teamed up with Robert Chen of MIT to add «sea-level rise of 15 to 25-foot. The nation's coastline would change markedly*”, and the same continued full steam after hurricane Harvey (2017) with Hansen (Wallace-Wells, 2017) and Mann contributing their own catastrophic forecasts and doubling down on scare tactics. So, it's been forty years that doom-sayers explain that we should already have been submerged by several meters of rising waters, the inconvenient truth is that so far, nothing significant happened as thoroughly explained in the corresponding section of this e-Book “Sea Level Changes”, p.157 ;
- The low lying islands will have to be evacuated in the Pacific! So far the only example available to pursue the active deception is the Carteret Islands (CI) which are Papua New Guinea territories located 86 km (53 mi) north-east of Bougainville in the South Pacific. The atoll appears as a coralline construction atop the rims of a hardly emerging old caldera (coral larvae attach to underwater rocks along the edge of a landmass) which does

368 https://en.wikipedia.org/wiki/Dimmock_v_Secretary_of_State_for_Education_and_Skills

not seem victim of sea-level rise but of natural geological subsidence and human destructions as reported by Fred Terry, the director of the United Nations Development Project on Bougainville, who said "*the destruction of reefs in the Carterets with dynamite might be the cause of flooding on Carteret Islands*". Contrary to recent journalistic and local commentary, the CI face multiple problems, and sea level rise is yet to have a significant influence on environmental change in the CI, if any to come. "*Flooding and coastal erosion have been the result not of climate change-induced sea level rise but of tectonic changes, seismic events, ENSO-related tidal and storm surges, cyclones, wind-driven waves, and local actions. Indeed, significant physical changes were occurring on coral atolls long before the late 1980s when the first news of the greenhouse effect, climate change and global sea level rise reached the Pacific region*". (Connell, 2018). Not surprisingly Islanders have no wish to be considered "tectonic refugees", victims of their own choice or rather of that of their ancestors, i.e. to settle on low lying (i.e. hardly emerging of more than one meter at most) and subsiding islands for natural reasons and would prefer to be considered "climate refugees" with a bill to pass on to someone else. Subsidence in these low-lying pacific islands can be quite dramatic as for example, between 1997 and 2009, the outcome of vertical plate movements was that the island of Tegua subsided by about 117 mm, one of the highest recorded subsidence rates in the world. The geodynamical context is very complex with a set of micro-plates facing a subduction zone. SLR has no role in Carteret's islands fate and it is clear that having only this to get under one's skin shows how poor the arguments of the AGW proponents are;

- The Gulf Stream would shut down and global warming would lead to cooling enabling the rewording to more flexible "climate change", knowing that climate ever changed but that from now on, any change is mankind responsibility and should lead to immediate ban of fossil fuel usage and compensation to someone paid by someone else (there must be a culprit somewhere); a load of stupid ideas with the sole aim of making someone feel or declared guilty (against one's will) and extorting taxes or financial compensation from him or her. Ridley et al. (2005) analyzed a climate with four times the pre-industrial CO_2 level and found relatively minor changes in the THC. Apart from unhinged conjectures, did anyone start seeing the slightest concrete signal of a mechanism that would shut down the Gulf Stream?
- The graphs over 650,000 years teach us that correlation is no causation and that Henry's law is the explanation but that seems beyond Al Gore comprehension (or intent). A complete section of this book deals with this correlation and the fact that CO_2 always lags temperature for very good physico-chemical reasons, see "*Wrong Causation, [CO_2] follows T*" p. 32;
- The case of Mount Kilimanjaro in Tanzania was dealt with section hosting Figure 71, p. 180 and has nothing to do with any global warming but is related to changes of the general atmospheric circulation in the region as seen before. "*... loss of ice on Mount Kilimanjaro cannot be used as proof of global warming*" (Mote and Kaser, 2007), p. 325;
- The shrinkage of Lake Chad in Africa is not caused by global warming and among other factors irrigation demands increased four-fold between 1983 and 1994, accounting for 50% of the additional decrease in the size of the lake;
- It is an ugly deception to affirm that Hurricane Katrina was likewise caused by global warming as no trend in cyclonic activity and certainly no individual tropical cyclone can be directly attributed to climate change. Even WMO also clarified that "*no individual tropical cyclone can be directly attributed to climate change*" (WMO, 2016). Furthermore as stated by SREX, p.8, (IPCC, 2012) "*There is low confidence in any observed long-term (i.e., 40 years or more) increases in tropical cyclone activity (i.e., intensity, frequency, duration), after accounting for past changes in observing capabilities*" and more "*The uncertainties in the historical tropical cyclone records, the incomplete understanding of the physical mechanisms linking tropical cyclone metrics to climate change, and the degree of tropical cyclone variability provide only low confidence for the attribution of any detectable changes in tropical cyclone activity to anthropogenic influences. Attribution of single extreme events to anthropogenic climate change is challenging*". SREX, p.9, (IPCC, 2012). If it is challenging for IPCC and SREX authors to attribute any change in tropical cyclone activity to anthropogenic influences, only Al Gore and his team can succeed being so deceitful!
- Four Polar bears have been found dead due to a storm (Lewis, 2007) p. 63, (Monnett and Gleason, 2006) but there is no doubt for Al Gore and his team, the world is crumbling, the poles are melting and we are all going to be submerged soon; don't worry, he doesn't put the cart before the horse. In fact, polar bear populations are fine and Crockford (2017) reports "*It is evident from data collected since 2006 that summer sea ice conditions are much less important to polar bear health and survival than previously assumed*" and she further adds "*The lack of a demonstrable 'sea ice decline = population decline' relationship for polar bears also invalidates more recent survival model outputs that predict catastrophic population declines should the Arctic become ice-free in summer*". The complete polar bear fantasy is detailed in Crockford (2019).

- We saw that coral reefs are not being bleached by the effects of global warming and we described in section starting p.206 that a host of reasons are at play to explain the observed situation and project the future of coral reefs, all unrelated to spurious AGW;

Deception goes full steam and if judge Justice Burton limited the ruling to 9 obvious intentional deceptions called "errors", Monckton of Brenchley (2007) uncovered "*35 Inconvenient Truths, The errors in Al Gore's movie*" and makes a more comprehensive review of the partisan and political nature of the movie. Of course Al Gore only competence is politics, so it is no wonder that he plays the game ad-nauseam, what else could we expect?

You thought that you had seen it all in matter of falsehoods, deceptions, hogwash with the "*An Inconvenient Truth*" propaganda, come on, there is more, Al Gore can always do more: in the middle of the NA blizzard, i.e. winter storm Grayson[369], which killed 22, lead to power outages ≥ 300,000, and damages > $1.1 billion, and was in the wake of the extreme cold that struck North America during the winter 2017-2017[370], with records low registered everywhere such as: on January 1, 2018 in Aberdeen, South Dakota, a new low temperature of −32 °F (−36 °C) was set; in Indianapolis, Indiana, the temperature reached a new low of −12 °F (−24 °C); on January 2, a daily record low in Sioux City, Iowa was set at −28 °F (−33 °C) and also Cedar Rapids, Iowa −23 °F (−31 °C), Pierre, South Dakota −21 °F (−29 °C), South Bend, Indiana −15 °F (−26 °C), Quincy, Illinois −12 °F (−24 °C) and Lynchburg, Virginia 3 °F (−16 °C); on January 5, Toronto broke a 59-year-old record with a morning low temperature of –23 °C (–9 °F) at the Pearson International Airport weather station, Al Gore had the gall as a comfort to his fellow citizens in distress and dying of cold to tweet the following (Richardson, 2018) :

Al Gore
✔@algore

It's bitter cold in parts of the US, but climate scientist Dr. Michael Mann explains that's exactly what we should expect from the climate crisis. http://ow.ly/Gdm230hAFv4

5:50 PM – Jan 4, 2018
- 6,2246,224 Replies
- 2,3282,328 Retweets
- 4,4244,424 likes

As Morano (2018b) indicated "*Gore's Oscar-winning documentary 'An Inconvenient Truth' did not warn of record cold and increasing snowfalls as a consequence of man-made global warming*," he further added "*and as recently as 2009, Gore was hyping the lack of snow as evidence for man-made global warming.*" Anthony Watts, who runs the climate-skeptical website Watts Up With That, blasted the "*sheer ridiculousness*" of Mr. Gore's comment in a post headlined, "*Goremongering and Mannhandling the reality of winter weather 'bombs.'*" and observing that Onians (2000) in a newspaper article entitled "*Snowfalls are now just a thing of the past*" (sic !) extensively quoted Dr David Viner a prominent senior climate pseudo-scientist at the climatic research unit (CRU) of the University of East Anglia who stated "*However, the warming is so far manifesting itself more in winters which are less cold than in much hotter summers*" and added within a few years winter snowfall will become "*a very rare and exciting event; Children just aren't going to know what snow is*".

Of course, if you try to go to the web page, you'll discover that it's gone, as Watts (2015) reports and that we are lectured with some additional deceptions telling us that in fact they don't really know much, that the climate is chaotic, but that in fact, they are nevertheless right, because if you did not get it yet, "*snowfalls are becoming less frequent in Britain... even with the experience of having two snowy winters on the run*" and Connor (2011) recommends now not to believe the hype over climate headline; he can rest quiet we don't believe at all their entire hogwash and organized pseudo-science. In case you thought that it was only in the US and the UK that people were getting mad, Court (2017) explains in the "pseudo-sciences" section of a leading French newspaper that *Polar cold waves are well linked to global warming*", simply egregious, ludicrous and preposterous. We'll have to teach those people that the slightest honesty in science is not to wipe out tracks of your mistakes (Watts, 2015) but to accept them and try to progress from them, including accepting that your theory could have been plain wrong. Plain wrong it is, I wrote, you heard. And this e-book will remain long after my death, I'm not going to change a line in it, nor to try to wipe it out of my intellectual legacy.

369https://en.wikipedia.org/wiki/January_2018_North_American_blizzard
370https://en.wikipedia.org/wiki/2017%E2%80%9318_North_American_cold_wave

In fact the theory of AGW can be easily summarized, listen to them: "*So, you did not understand that it is getting colder because of the global warming, that's normal now we call that 'global change': this means that whatever happens, much colder or warmer we always win and you always loose as in any case it's your fault and you have to pay more taxes, have less freedom and do what you are told and not what we do. You understand better, it's not climate change, it's climate totalitarianism.*" You get it now?

Figure 116. Not only contrary to what Onians (2000) stated it keeps snowing in temperate and northern regions but the whimsical climate doing what it pleases has started to surprise everybody by repeatedly snowing in unusual places where it had not for 40 years or simply ever (down-left), like the Moroccan or Algerian desert, and even in Saudi Arabia! It surely is because of global warming, isn't it? Upper left is Aïn Séfra, Algeria (Dec. 21 2016), upper/middle-right is the Moroccan desert in Ouarzazate, Riad Dar Chamaa[371] (Jan. 20 2017), (Photo credit: Christina Angell Ait Daoud), down-right is Merzouga snow-dunes early 2018 and the background picture is in Saudi Arabia (Jan 12 2020), where the Dahr Mountains and Jabal Al-Lowz in Tabuk Province were blanketed by large quantities of snow, but also Al-Lowz rural Center, Al-Abyad Valley (Al-Wadi Al-Abyad), Wadhil, Al-Uluw, Al-Mahraq and Maklaha.

So, stubbornly not only does it keep snowing in temperate and northern regions as it has always done (Chen et al., 2016), sometimes more, sometimes less and the children of these countries will certainly not be deprived of discovering the troubles the cold and the snow bring with them, sometimes tragically, such as with the 50,000 souls claimed by the excess winter deaths during the harsh 2017-2018 winter in the UK (Campbell, 2018), but it also seems that contrary to all expectations it even started to snow in the Sahara and in Saudi Arabia. For instance, Aïn Séfra (Arabic: عين الصفراء, lit. yellow spring), is a magnificent place in the Naâma province in Algeria, close to the border with Morocco, that had recorded for the first time ever a light snow fall on 18 February 1979. But again during the winters of 2016/2017 and 2017/2018 not only snow felt, but in large quantities, as an unusual blizzard hit the area on 20 January 2017, dumping snow in the municipality of Aïn Séfra of up to a meter thick in some places! It also snowed in Merzouga (Morocco) early 2018 (Jan./Feb.), and there, rather the opposite to what Onians (2000) had forecast happened, North-African children not ever supposed to see the snow had this improbable experience "*Our children have never seen the color of snow in their lives either, this year is the first time they have seen it and touched it with their hands. They were amazed by it and they gave it their all*" (Mdidech, 2018). Saudi Arabia was equally hit in January 2020 and many places were blanketed with snow as well. More generally, would the reader want to have a taste at how bad are the models (GCMs / CMIP5) at accounting for the snow cover over a 50 years of satellite data, the paper of Connolly et al. (2019) is instructive. Decidedly, global warming is not what it was supposed to be and the narrative will have to be adapted, but I've no doubt that climate misfortune teller will succeed in their crisis selling endeavor. They desperately need crises so that

371https://www.darchamaa.com/fr/fr_index.html Go visit Ourzazate , a magnificent place and don't forget to also go to Zagora.

the world would benefit of their prescient intelligence and foresight. What would mankind become without all those politicians, bureaucrats, civil servants and great leaders?

As far as deceptions and delusions are concerned, "*experts*" should know that they fall in a different category than politicians or journalists as they cannot invoke their professional incompetence or to have been abused by others to justify their mistakes and most judicial systems have a different appraisal of such situations and simply condemn what they consider intentional deceptions as criminal offenses on the basis of at least two fundamental principles: "fraus omnia corrumpit" see e.g. Lenaerts (2013) and "nemo auditur propriam suam turpitudinem allegans". Even though as will be explained hereafter, many researchers have today the feeling of siding with the power and of just fulfilling what they are ordered to It (also in order to keep their jobs and budgets), and thus protect their economic interest, they should not forget that as "*experts*" they wont be given the same fate as their politician fellows, would ultimately the card castle start to unravel and the public ask for explanations and justice for why they have been impoverished by shoddy science. The concept of fraud refers to situations in which a person attempts to gain rights granted by a rule of law on the basis of deception, malicious intent, or dishonesty, this is what "fraus omnia corrumpit" means. Any "*expert*" with a decent training in physics cannot claim that he was not aware of all the absurd hypotheses made to come up with frightening enough numbers resting on an inappropriate usage of some physics laws (e.g. SBL see p. 76), tactics used to put pressure on politicians, get fundings going and ultimately leading to economically devastating policies, this is also what "fraus omnia corrumpit" and "nemo auditur propriam suam turpitudinem allegans" mean.

As an example, in case the 68 researchers and their affiliates of the Le Quéré et al (2016) paper would come up with a decent carbon budget that would not incriminate unduly mankind but give its right place to Nature as we presented in p. 89, their research budgets would be immediately cut, their positions removed and their jobs sacked and their laboratories reduced to which added value they produce for society, which means they would simply have to look somewhere else for a real job. How many papers in how many disciplines have had to resort to 68 authors to produce a compendium devoid of rigor and originality trying to justify unproven hypotheses and flawed reasoning legitimating their salaries paid by forced customers, the taxpayers. All that rings an alarm bell to any person gifted of normal common sense, not just scientists. If there should be a wake up call, putting an end to this masquerade, it is this one. The only good question is how many scientists, not paid by the government, the IPCC or any organization getting funds to prove that the warming is anthropogenic, actually support the fantasy? How many scientists who are not deeply entrenched into that ugly conflict of interest defend the AGW theory? How can a mafia benefiting of all the credits to enforce by all means a weak and one-sided theory can trust all positions, bar from publication other opinions, keep running the show, influence the media and carry out political activities in crude light without never having to be held accountable? How can they have the gall to threaten others to force them to disclose any funding they might have had! I can tell them, one thing for sure, I have had no funding by anyone, just the deep will to do what intellectual honesty and justice commends.

Representative Raúl M. Grijalva of Arizona asked for complete disclosure of David Legates and Roger Pielke Jr. fundings because he stated that ""*My colleagues and I cannot perform our duties if research or testimony provided to us is influenced by undisclosed financial relationship*" (Schwartz, 2015), but to the contrary he and his colleagues can make their jobs sleeping well when other scientists are paid with taxpayers monies to conclude a done deal, that man-made emissions are responsible for climate change, executing a letter of command. Hundred of inquiry letters were signed by Edward J. Markey of Massachusetts, Barbara Boxer of California and Sheldon Whitehouse of Rhode Island and sent to fossil fuel companies, trade groups and other organizations asking about their funding of climate research and advocacy blaming the "*best junk science money can buy*". But the best junk science money can buy lies in plain sight, it is funded by the government with taxpayers monies to recruit and keep feeding the scholars that agree to blame mankind and fossil fuels for what remains not only unproven but highly suspicious and dubious and represents research "only-funded if foregone conclusions ensured". Roger Pielke Jr. summarized well the situation "*Climate McCarthyism alive & well*" and on his blog, he added that the pressure and smears had caused him to move away from climate research. In the end, the objective was reached, just silencing him directly or indirectly by pressure and intimidation. Representative Raúl M. Grijalva said that he had sent the letters "*because of the harm done to public confidence in our scientific and legislative procedures*". He missed the point, the harm is already done when research is so much oriented that it is only funded if it supports the storytelling of the government agencies funding bodies. I belong to the public and I have no confidence whatsoever in that research, rather to the contrary!

Of course, the confidence is so great that dissent comes from within whenever people feel that they are safe enough to speak not being fired. For example, as reported by Watts (2012) in 2012, "*49 former NASA scientists and astronauts sent a letter to NASA Administrator Charles Bolden admonishing the agency for it's role in advocating a high degree of* *certainty that man-made CO_2 is a major cause of climate change while neglecting empirical evidence that calls the theory into question*". The group, which includes seven Apollo astronauts and two former directors of NASA's Johnson Space Center in Houston, are dismayed over the failure of NASA, and specifically the Goddard Institute For Space Studies (GISS), to make an objective assessment of all available scientific data on climate change. They charge that NASA is relying too heavily on complex climate models that have proven scientifically inadequate in predicting climate only one or two decades in advance. Well, actually honesty would be to say that they cannot even forecast the climate one month in advance as was seen with heat-waves or other worth predicting events that climate models are completely unable to tackle.

But a journalist with a Master's Degree in physics from the University of California at Davis with hardly a couple of climate-related papers signed as lead author stated in a newspaper article for the Guardian "*As we suggested to William Happer, if climate contrarians want their opinions to be taken seriously, they should engage in real science within the peer-review system that works for every scientific field*" (Nuccitelli, 2012). It works so well that Minze Stuiver stated in 1978 in Science "*We learn that if present trends continue, with economics the only limit on the exploitation of fossil fuels, the CO_2 concentration will have doubled by 2020. Forty to 80 years after fuel burning peaks — that will come mid-century — the CO_2 concentration will be five to 10 times its present level*". Happer, a giant of physics with hundreds of top papers certainly needs the advice of the journalist of the Guardian; it would be funny if it were not tragic. And no, dissenters are not going to be censored and waste enormous amount of energy trying to be published by a system that only plays dice that are loaded[372]. The climate fortune-teller community mate-review their papers and they would expect others to have theirs torpidoed-reviewed just to pleasure them and make them waste time when in the end this will not ensure any more readership. But denialism of their "junk and politicized climate science" supported by the Guardian is such that Nuccitelli goes on calling names the heroes that made NASA, referring to them as a bunch of former NASA employees, retired know-nothing, including Harrison Schmitt and the Guardian's journalist whose ranting cannot be stopped goes on "*by my count they include 23 administrators, 8 astronauts, 7 engineers, 5 technicians, and 4 scientists/mathematicians of one sort or another (none of those sorts having the slightest relation to climate science)*".

For sure, had it been Greta she would have known perfectly the fantasy climate science. Again Michel Audiard would not be surprised and would have a good explanation and a proper quote for such a situation "*Les cons ça ose tout. C'est même à ça qu'on les reconnaît*". In the end, the bunch of former employees, achieved-nothing but went to the Moon, know-nothing in climate pseudo-science but are mankind heroes, can clearly see what will happen and state "*As former NASA employees, we feel that NASA's advocacy of an extreme position, prior to a thorough study of the possible overwhelming impact of natural climate drivers is inappropriate*" and ""*We believe the claims by NASA and GISS, that man-made carbon dioxide is having a catastrophic impact on global climate change are not substantiated, especially when considering thousands of years of empirical data. With hundreds of well-known climate scientists and tens of thousands of other scientists publicly declaring their disbelief in the catastrophic forecasts, coming particularly from the GISS leadership, it is clear that the science is NOT settled*"? Finally, they add "*We request that NASA refrain from including unproven and unsupported remarks in its future releases and websites on this subject. At risk is damage to the exemplary reputation of NASA, NASA's current or former scientists and employees, and even the reputation of science itself*".

H. Leighton Steward, chairman of the non-profit Plants Need CO_2[373] summarized well "*These American heroes – the astronauts that took to space and the scientists and engineers that put them there – are simply stating their concern over NASA's extreme advocacy for an unproven theory,*" said Leighton Steward. "*There's a concern that if it turns out that CO_2 is not a major cause of climate change, NASA will have put the reputation of NASA, NASA's current and former employees, and even the very reputation of science itself at risk of public ridicule and distrust"*. And this is simply what will happen when these lunacies will unravel and the castle of cards that goes along will crumble.

372I take on this opportunity for an homage to John Lawrence Daly (1943 – 2004) http://www.john-daly.com/. Just as the invention of the printing press destroyed the capacity of the ecclesiastical and political authorities of the 16th century to control what was written and spoken, the Internet has made possible open, independent, uncensored forums to be established, and for unfettered debate to occur outside official circles and for e-books like this one to exist and circulate. One of John's great legacies is the use of the Internet to publish scientific articles that had been rejected through the 'peer-review' control system. Because of the Internet, the specter of public nakedness now haunts the global warming establishment. This is due in no small part to the long hours which John Daly spent in his tiny study in Tasmania, corresponding around the world with admirers, interlocutors, and detractors, and preparing the next material to be loaded onto "Still Waiting For Greenhouse". His life is testimony to the fact that one person, if armed with intelligence, energy, perseverance and a commitment to the truth, can change events. Tasmania is still waiting, and might be doing so for very long, for sea-level rise to happen...

373https://plantsneedco2.org/

These mainstream journalists always working for extreme-left newspapers as Huet for Libération[374] (France) and having the gall to challenge Lindzen's credibility without the slightest scientific initial training (Huet, 2016) or here for the center-left Guardian[375] (UK) with Nuccitelli (2012) having the audacity to give advice to William Happer and publicly treating NASA's heroes legitimate doubts and qualms as unimportant has-been rantings, only demonstrate such levels of superciliousness as they have the feeling that whatever they do the political establishment will support them because the public opinion is now on their side after having been brainwashed for decades by unrelenting indoctrination. There is not the slightest scientific argumentation left, just taking political sides and defending by all means brutal stances such as you are with us or against us, and if you are against we will destroy you by all means. The political agenda is visible in plain sight and CO_2 and the climate misfortune telling alibi is just a pretext for wealth transfer across nations, massive fund raising (see section "Major Financial Stakes" p.344) in the billions then soon in the trillions with up to 2.5% of world GDP and management at the will of the new ecological power, increased control over peoples' lives removing from them the fundamental liberties that individual locomotion means had brought them or finding tortuous means to deter them from flying when the aeronautic industry has delivered one of the most enticing stream of innovation over decades and the greatest opportunities for mankind, enabling people to discover the world and other continents, their people and their culture.

And in such a situation it is not a matter of being peer-reviewed, mate-reviewed (Wegman et al., 2006, 2010) of torpedoed-reviewed, it is just a major stake unfolding before us with daunting societal and economical consequences and each and every individual having done his/her homework on the subject must take sides and stand by his convictions. How unfortunate that may be, science has been broken by a small bunch of scientists whose ideology has precluded them from remembering the basics of what was taught to them with respect to the normal scientific practice and have embarked on political crusades up to the point of being arrested protesting before the White House. When Freeman Dyson referred to Hansen and said "*But Hansen has turned his science into ideology. He's a very persuasive fellow and has the air of knowing everything*" he unveiled the extraordinary contempt of Hansen. When reached by telephone, Hansen sounds annoyed as he says, "*There are bigger fish to fry than Freeman Dyson,*" who "*doesn't know what he's talking about.*" (Dawidoff, 2009). The truth is that Dyson had a far broader spectrum of knowledge than any of these climate scientists, in mathematics, physics, astronomy (e.g. adaptative optics), engineering (Triga), biology, game theory (Press and Dyson, 2012) and several other disciplines and that if he became famous as early as 1949 with his paper in Physical Review, he had long been interested in climate issues, e.g. (Dyson, 1976). What does Hansen know that Dyson did not? How to read absorption spectra? How to compute radiative transfers? How to figure out how a black body behaves? Or simply how to write gimmicked software?

Come on, Dyson was a giant, he knew all what was required to have an informed opinion about their climate "misfortune telling" science, he knew that there was more politics than science in Hansen's answers. Otherwise, why Hansen did not want to meet with and explain to Dyson how he could be right with his models when just a few microns of water in the air, in the clouds, have such an optical depth that no thermal Infra-Red radiation can go through? This makes of the atmosphere such an opaque medium to radiative heat transfer that, even in the atmospheric window [24-35 THz], one needs clear sky for the surface IR radiations to manage to participate to the final OLR adding up to the water vapor radiation at the TOA.

Whenever clouds happen to be around (and they are most of the time), the contribution to the final OLR comes from the top of the clouds which being colder leads in such a case to a decrease of the OLR. CO_2 only happens to contribute marginally (5%) to the OLR from the stratosphere (say atop 0.2 atm) except for a short emission band around [18-22 THz], see Figures 13 p.56, 15 p.60, and 16 p. 61. Dyson knew all the physics Hansen could have talked him about and much more, and he would have reminded him that the models and the simulations are just what they are, everything but the reality, that the Earth is not yet reduced to a model in a computerized box obeying at will to the fantasies of the climate misfortune tellers. He would have reminded Hansen that the Earth is a thermodynamical machine where of the [234-244] Wm^{-2} of OLR, $20Wm^{-2}$ maximum come from the stratosphere, $22Wm^{-2}$ from the surface (average global mean) and all the rest, i.e. more than $200Wm^{-2}$, from water vapor and the clouds that Hansen's programs and GCMs handle so badly or rather not at all because they should go down at least to the proper scales and grids, i.e. smaller than 2.5x2.5 km, which they do not.

374 https://en.wikipedia.org/wiki/Libération

375 https://en.wikipedia.org/wiki/The_Guardian

As Randall, et al. (2007) p. 601 stated "*models continue to have significant limitations, such as in their representation of clouds, which lead to uncertainties in the magnitude and timing, as well as regional details, of predicted climate change*". In plain English, it simply means that models are unable to properly account for more than 85% of the energetic fluxes observed, which are not based on radiative transfers but rather on latent heat (evaporation, condensation, precipitation) and convection and sensible heat and advection all at scales not even properly represented by the so-called models and are responsible of what **makes** the climate. Furthermore, the amount of heat stored in the oceans is essential in the overall thermal balance of the Earth, Oceans, Atmosphere system, if only because the heat capacity of the atmosphere is only the equivalent of a 2.5 m layer of seawater. Veyres (2020e) reminds "*this amount of heat varies significantly throughout the year, but after a year it has changed as if it were only applied to it 0.3 W/m² or even a little more, i.e. about one thousandth of the incident solar flux (340 W/m² on average over the year); these 0.3 W/m² make in one year 3 thousandths of a degree on the first 700 m of sea water. Thanks to water vapor and the oceans, the Earth therefore has a very precise thermal regulation over the year, as is often the case with complex self-organized[376], irreversible and totally dissipative systems*".

Hansen will be remembered by History as an ideologist, a schemer ready to all excesses to promote his political agenda, when Dyson will remain what he was: a giant in Physics and more. But what Dyson also learnt is that with politics come attacks of a rare violence as he discovered himself variously described as "*a pompous twit*" "*a blowhard*" "*a cesspool of misinformation*" "*an old coot riding into the sunset*" and, perhaps inevitably, "*a mad scientist*". The situation was so odd that the considered opinion of the neurologist Oliver Sacks, Dyson's friend and fellow English expatriate, was solicited to check Dyson's abilities! Sacks confirmed that "*His mind is still so open and flexible*" and as noticed by Dawidoff (2009) "*Which makes Dyson something far more formidable than just the latest peevish right-wing climate-change denier*". Notice how we are immediately brought back to politics, if you dare wonder the robustness of the sacred "climate science" the conclusion is also foregone, you must be a right-wing denier! But as reminded by Dawidoff (2009) "*Dyson may be an Obama-loving, Bush-loathing liberal who has spent his life opposing American wars and fighting for the protection of natural resources, but he brooks no ideology and has a withering aversion to scientific consensus*" and he considered the broken science of global warming as "*the primary article of faith for 'a worldwide secular religion' known as environmentalism*". Don't tell me that all is well in the realm of climate pseudoscience when AGW supporters insult someone like Dyson and question his intellectual capacities when he uncovered at 88 years old the mathematics that address unsolved game theory problems in a PNAS paper (Press and Dyson, 2012). Such an unfathomable cattiness is only typical of fractious activists.

As always politics does not resort to reason and rationalism as science normally does, but to the emotions and good feelings of people. A typical example was when Dyson's own wife, Imme, who, after seeing the film "An Inconvenient Truth" looked at her husband out on the sidewalk and, with visions of drowning polar bears still in her eyes, reproached him: "*Everything you told me is wrong!*" she cried. "*The polar bears will be fine*" Dyson assured her. Of course Dyson is right, would the polar bears be so stupid and unsuited for their environment as to drown going adrift on floes (unless Greenpeace is filming with a well rehearsed scenario), there would not have remained any after the Holocene climatic optimum [9800-5600] B.P., see Figure 34, they also would have had dozens of occasions to disappear with each Dansgaard / Oeschger events over the last previous 60 kyr, see Figure 37, and so many other possibilities with each inter-stadial (starting with the warmer Eemian than the Holocene) and all other MIS recorded over 1.8 Myr, see Figure41, that we would never have seen any, they would have been gone for the netherworld of the disappeared species long ago; it is ludicrous. More on polar bear populations can be found in Crockford's (2017, 2019) and about their adaptation strategies in Durner et al. (2017) article.

Freeman Dyson disappeared on the 28th of February 2020, the very year of the writing of this e-book at age 96, fighting until the end for the correctness of his ideas saying about Hansen "*By the public standard he's qualified to talk and I'm*

376 For example, Ramanathan and Collins (1991) results suggest that there should be a sea-surface temperature "cap" at temperatures above 303 K due to cirrus cloud shielding. What Ramanathan and Collins found was that for very warm ocean temperatures and in the regions where cumulus clouds are generated (perhaps for more than 10% of the earth's warmer surface) there may very well be a strong negative feedback. Furthermore, the biosphere has its say, with unexpected players like Emiliania huxleyi, an abundant coccolithophore algae which also has a role in the formation of clouds. CO_2 excess is compensated by an increase of coccolithophoride life, increasing the amount of CO_2 locked in the ocean floor. Coccolithophorides increase the cloud cover, hence control the surface temperature, help cool the whole planet and favor precipitations necessary for terrestrial plants. Lately the atmospheric CO_2 concentration has increased and there is some evidence that concentrations of ocean algal blooms are also increasing. See also Castelvecchi (2016) for some cloud-seeding surprises. Who could be naive enough as to think that the Earth would observe a doubling of [CO_2] and nothing would change or happen! IPCC career-indebted scholars? Perhaps...

not. ***But I do because I think I'm right****. I think I have a broad view of the subject, which Hansen does not. I think it's true my career doesn't depend on it, whereas his does. I never claim to be an expert on climate.* ***I think it's more a matter of judgment than knowledge***" (Dawidoff, 2009) and it is with the great respect due to such a towering figure that his stance on climate change was briefly reminded here. He was also of the opinion "*that humans have a duty to restructure nature for their survival*" and that not only science is not settled but understanding climate will take a very long time. The modest work I have achieved will try to follow his advice: be subversive whenever necessary.

But intentional deception which goes from the Carbon Budgets where Nature has no say, to the drowning bears and more has now been acknowledged as normal practice! The climate misfortune tellers and their AGW theory not only believe that their dubious ends justify their shady means, they institutionalize "information manipulation" as a tactic, host panels about it at climate conferences and publish it in journals, e.g. Hong and Zhao (2014) state "*It appears that news media and some pro-environmental organizations have the tendency to accentuate or even exaggerate the damage caused by climate change. This article provides a rationale for this tendency by using a modified International Environmental Agreement (IEA) model with asymmetric information.* ***We find that the information manipulation has an instrumental value, as it ex post induces more countries to participate in an IEA, which will eventually enhance global welfare***". Amazing, your arms are falling off, no?

The criticisms became much more prominent and serious following the release of the so-called "Climategate" emails from the University of East Anglia in November 2009 (Montford 2010). Most of the emails consisted of exchanges among participants in the IPCC report-writing process, and many contained discussions about how to finesse or work around contradictory or uncertain evidence regarding modern and historical climatic warming" (McKitrick, 2011)

Climategate and other Conflicts of Interest

Before addressing this sensitive subject, let me first assert that, obviously, I reprove the hacking of any private data, communication or the obtainment of any proprietary data or information by whatever improper means be it and by whatever person, moral or physical. Having said that, one must notice that the notion of "principle of fairness of evidence" has recently been in some countries at least, mauled or subject of some interpretation to say the least, like what was stated recently by the highest French jurisdiction, i.e. Cour de cassation «*Si les enregistrements opérés ont constitué un procédé déloyal à l'égard de ceux dont les propos ont été insidieusement captés, ils ne doivent pas pour autant être écartés du débat et ainsi privés de toute vertu probante par la seule application d'un principe énoncé abstraitement, mais seulement s'il est avéré que la production de ces éléments a concrètement porté atteinte au droit à un procès équitable, au principe de la contradiction et aux droits de la défense de ceux auxquels ils sont opposés*» (Ass. plén. 7 janv. 2011, n° 09-14.316, 09-14.667). The automated translation (google), as I would not like to take such a responsibility, gives "*If the recordings made have constituted an unfair process with regard to those whose comments have been insidiously captured, they should not however be excluded from the debate and thus deprived of any convincing virtue by the sole application of an abstractly stated principle , but only if it is proven that the production of these elements has concretely infringed the right to a fair trial, the principle of contradiction and the rights of defense of those to whom they are opposed*".

As the content of the "Climategate[377]" emails did not deprive the authors of these exchanges to clarify the positions they expressed or practices they resorted to and therefore did not infringe their principle and right to bring contradiction, it will be further assumed that, as per the position reminded to us by Robert (2019), and given that what will be further discussed has materially been publicly revealed and is freely available on websites defending both sides of the discussion, one can, not on a legal or moral standpoint which is not what we consider ourselves entitled to – of course, but on an epistemological viewpoint at least address the consequences of the facts revealed for modern science and its acceptance by society.

Public awareness of corrupted climate science attached to IPCC political agendas has been raised through release of leaked communications obtained from Britain's East Anglia University Climate Research Unit (the "Climategate" scandal). Among more than three thousand documents is an e-mail from its director, Phillip Jones, regarding a way to fudge data to hide evidence of recently falling global temperature comments, "*I've just completed Mike's Nature [journal] trick of adding the real temperatures to each series for the past 20 years [i.e., from 1981 onward] and from 1961 for Keith's to hide the decline*" The referenced decline relates to estimated temperature changes based upon tree

377 https://www.conservapedia.com/index.php?title=Climategate

ring proxy data which ultimately proved opposite of what actually occurred, characterized in climate-speak as a "divergence problem[378]". "Mike" in this instance, refers to Michael Mann who created the now (in)famous "hockey stick" chart that has appeared repeatedly in IPCC reports to portray accelerated global warming beginning with the Industrial Revolution, hence caused by humans. The chart has been thoroughly debunked thanks to careful analysis of McIntyre and McKitrick (2003, 2005), McIntyre (2006a-b, 2009a), Wegman et al. (2006, 2010), McIntyre and McKitrick (2009) who uncovered a variety of serious problems. Included are exclusion of natural climate change evidence of the Medieval Warm Period and Little Ice Age, calculation errors, data used twice, and a computer program that produced a hockey stick out of whatever data was fed into it. McIntyre and McKitrick (2003) report "*The data set of proxies of past climate used in Mann, Bradley and Hughes (1998, "MBH98" hereafter) for the estimation of temperatures from 1400 to 1980 contains collation errors, unjustifiable truncation or extrapolation of source data, obsolete data, geographical location errors, incorrect calculation of principal components and other quality control defects. We detail these errors and defects. We then apply MBH98 methodology to the construction of a Northern Hemisphere average temperature index for the 1400–1980 period, using corrected and updated source data. The major finding is that the values in the early 15th century exceed any values in the 20th century. The particular "hockey stick" shape derived in the MBH98 proxy construction – a temperature index that decreases slightly between the early 15th century and early 20th century and then increases dramatically up to 1980 — is primarily an artefact of poor data handling, obsolete data and incorrect calculation of principal components*".

To put it in layman terms, the trouble with Principal Component Analysis (PCA) as for any other kind of Factor Analysis (FA) is that it substitutes to real, physical variables mathematical constructions based on eigenvectors which are supposed to represent a process that one needs to provide an interpretation for. This always lead to difficulties as, for example, the major geochemical processes that such an analysis had identified and that I reported in (Poyet, 1986, 1992) were not considered as geochemical reactions per se and dismissed by the French Academy of Sciences when I tried to publish my results at the time. For instance, in (Poyet, 1992) p 38 and p. 54, the 3 major rotated factor scores represented each a different aquifer (and corresponding geochemical composition) of the Corbigny (France) area, i.e. the first factor corresponds to the silica-rich water-level, the second to the basement ground water seepage with high He content, and the third to the superficial water layer, the factor model delivering for each sample, the proportions (i.e. loadings) of the different groundwaters involved, therefore the mixing of the aquifers. It is funny though, that this model was rejected at first for publication on the grounds that it did not correspond to any measurable geochemical processes or reactions and was more considered as a mathematical modeling exercise (ranting) than anything else, whereas Michael Mann managed to put the Earth on fire (no pun intended), using the same mathematical modeling techniques. Anyone who has used these techniques, knows that the data are often "prepared", outliers removed, etc. and that the results, even in the best case of coherent practices, must be taken with caution.

Mann et al., (1998) work is acknowledged as, "*Their global reconstruction was a major breakthrough in evaluation of past climate dynamics, and the first eigenvector-based climate field reconstruction (CFR) incorporating multiple climate proxy data sets of different types and lengths into a high-resolution global reconstruction*[379]", but it is worthwhile to notice that these methods (PCA, factor analysis, multi-variate analysis) were accurately described in Davis (1973), 25 years before their usage by Mann et al., (1998). From 2001 Mann stopped using this PCA method and introduced a multivariate technique based on the regularized expectation–maximization[380] (RegEM) method, which is even more of an indirect representation and processing of the raw data.

Whatever one may think of the aforementioned reconstruction techniques, the Wegman et al., (2006, 2010) Ad Hoc Committee Report on the 'Hockey Stick' Global Climate Reconstruction states "*Additionally, we judge that the sharing of research materials, data and results was haphazardly and grudgingly done. In this case we judge that there was too much reliance on peer review, which was not necessarily independent. Moreover, the work has been sufficiently politicized that this community can hardly reassess their public positions without losing credibility. Overall, our*

378 Whatever side of the divergence problem you consider, e.g. (McIntyre, 2009b) or (Cook, 2015) any reasonable person will conclude that **these methods are not reliable enough** to decide on policies that will have far reaching consequences for the standard of living of billions of persons. In fact, it goes further into ethics, as tree-ring based reconstructions just showed a decline for the 20th century, which was most unwelcome for the AGW-proponents, "Mike's trick" simply consisted to do the unbelievable, i.e. paste at the end of reconstructed temperatures, instrumentally measured temperatures that would show the increase that the proxies did not! This led ,after Mann sued Steyn to attempst to silence him, to the book "*A Disgrace to the Profession: The World's Scientists on Michael E Mann, his Hockey Stick and their Damage to Science*" by Steyn (2015a-b). Also see Montford (2010) and McIntyre (2011).

379 https://en.wikipedia.org/wiki/Hockey_stick_controversy

380 https://en.wikipedia.org/wiki/Expectation-maximization_algorithm

committee believes that Mann's assessments that the decade of the 1990s was the hottest decade of the millennium and that 1998 was the hottest year of the millennium cannot be supported by his analysis" and later "*In general, we found MBH98 and MBH99*[381] *to be somewhat obscure and incomplete and the criticisms of MM03/05a/05b to be valid and compelling*".

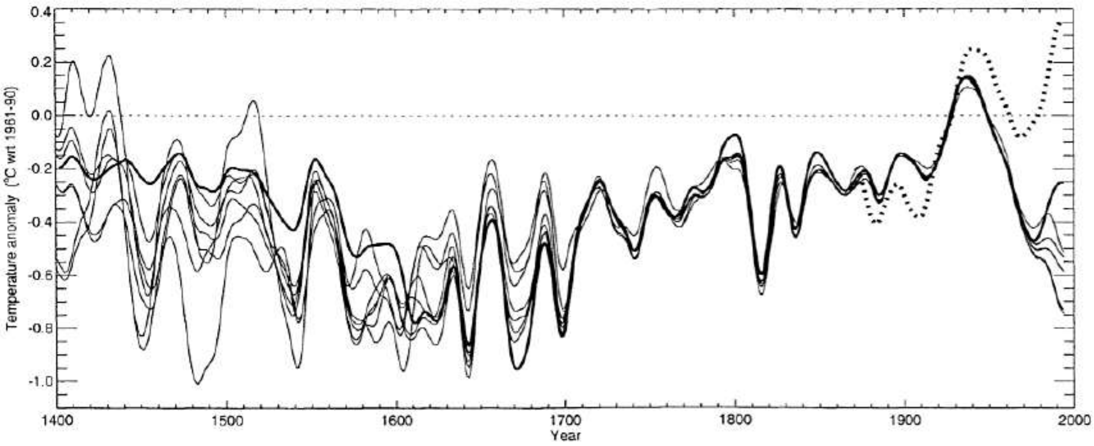

Figure 117. Eight *alternative reconstructions of the mean temperature over all land north of 20°N (observations shown by dotted line for 1871-1994). The preferred reconstruction based on principal component regression is shown by the thick line for 1402-1994. Source: Briffa et al. (2001).*

As one can see from the Figure above 117, i.e. Fig. 4 from Briffa et al. (2001), the LIA is very well visible as is also the Medieval Warm Period (MWP) and the only worrying thing I would notice is the discrepancy between the "preferred reconstruction" of the authors and the observations, as the gap widens a lot for the most recent period, raising questions about the reliability of the techniques used. Furthermore, someone will have to explain to me how these two sentences can belong to the same abstract of the Briffa et al. (2001) paper: "*One exception is the reconstruction for northern Siberia, where 15th century summers are now estimated to be warmer than those observed in the 20th century... The 20th century is clearly shown by **all** the paleoseries composites to be the warmest during this period (i.e. last 600 years)*". It must be all **except** the northern Siberia? So it is not all?

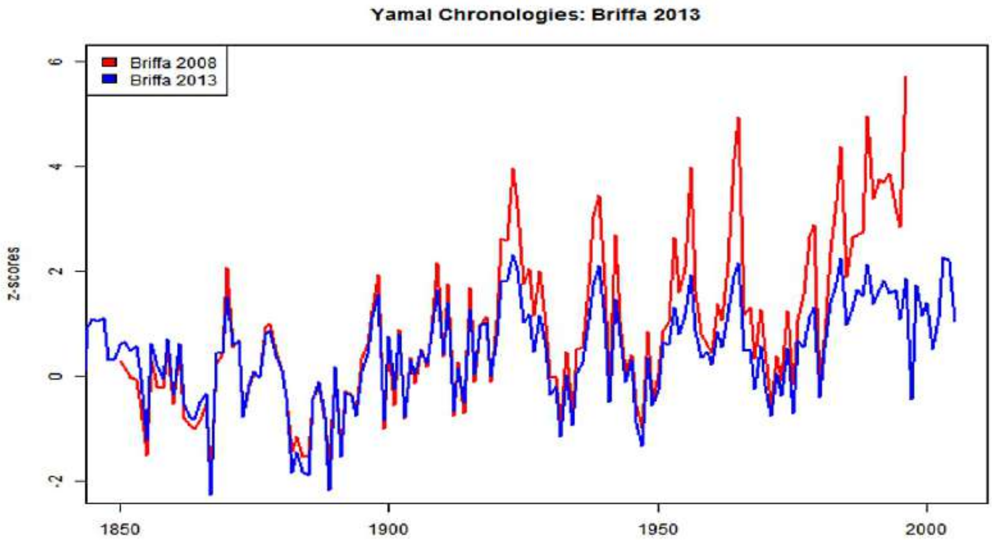

Figure 118. Comparison of Briffa et al 2008 superstick to yamal_trw chronology of Briffa et al 2013. Both in z-scores. Source: McIntyre (2013).

As the Figure from Briffa et al. (2001) does not show much of a Hockey Stick (HS) and would probably not succeed to frighten anybody, new studies were released to nudge up a bit the thermometer as shown in Figure 118, and in that respect we have (Briffa et al., 2008) and more importantly (Kaufman et al., 2009) but after a lot of thorough analysis revealing the "divergence problem" (McIntyre, 2009b) and insistent quest for the data, McIntyre (2009c) demonstrated the outcomes of the Impact of the Yamal "divergence problem" on the Spaghetti Graph (always convenient to hide annoying segments) and the dependence of the Kaufman reconstruction on the Yamal series.

381 Mann, Bradley and Hughes 1998, "MBH98" and 1999 "MBH99" and MM refers to McIntyre and McKitrick

But in the end, not too far later by the way, which is just four years, McIntyre (2013) could report that "*CRU Abandons Yamal Superstick*" and produces comparisons between (Briffa et al., 2008) and (Briffa et al., 2013). The "superstick" effect is gone and as for the MBH98, the HS properties seem to have been very transient, in fact good enough to secure funding for the labs but not sound enough to survive careful investigations from McIntyre and McKitrick (2003, 2005), McIntyre (2006a-b, 2009a), Wegman et al. (2006, 2010), McIntyre and McKitrick (2009). This is sad, as for the poor Briffa[382] (1952-2017) we already talk about his scientific legacy and what might be feared is that wise scientists of the end of the XXI century will have to conclude that all these reconstructions were just misleading enough to trigger delirious decarbonation policies but not solid enough to make it into long-term science books. In that respect, the general opinion expressed by Frank et al. (2010) is lukewarm and does not give a lot of strength the anthropogenic factor "*Despite significant efforts and progress, the spatial representation of reconstructions is limited, and the inter-annual and centennial variation are poorly quantified*" and later "*However, respecting uncertainties in both the temporal course and efficacy of solar and volcanic activity, a large amplitude over the past millennium may equally well indicate a greater role of natural factors in dictating past (and future) climate variation*".

It is worth observing that as reported by McIntyre (2009c) "*Some commentators have been very quick to seize on one more example of perceived Team iniquity. That I had been publicly seeking this data for a long time and that Briffa had withheld the data not just from me (but also from D'Arrigo et al, for example) lent an unsavory aspect to CRU's conduct, fresh after widespread unfavorable publicity for CRU's withholding of temperature data (by Briffa's long-time colleague and mentor, Phil Jones.)*" and these aspects will be briefly addressed in the next section "Historical Scientific Practice Baffled". Furthermore, prominent members of the CRU e-mail network clearly used their considerable influence to block the publication of research by climate crisis skeptics, thus preventing inclusion of contrary findings in IPCC reports. They also conspired to withhold and delete data from release by circumventing Freedom of Information Act requirements.

Unfortunately, "climate science" has proven that it has provided more than its normal share of bad practice, irreproducibility, retraction, pal review and gate-keeping. This is reminded to us by Christopher Essex and Matt Ridley in their "Foreword" to Laframboise (2016) "*The Climategate emails of 2009 revealed gatekeeping at its most blatant. Who can forget Phil Jones writing to Michael Mann on 8 July 2004 'can't see either of these papers being in the next IPCC report. Kevin and I will keep them out somehow – even if we have to redefine what the peer-review literature is!' Or Steve McIntyre and Ross McKitrick struggling to publish (leading to a US Congressional hearing, no less) their comprehensive demolition of the statistical errors and data-selection issues in the infamous 'hockey stick' paper? Or Richard Tol's exposure of the practices employed in the Cook et al '97% consensus' paper? Again and again, peer-reviewed climate papers have fallen apart under post-publication scrutiny from the likes of McIntyre, Willis Eschenbach, Donna Laframboise, Judith Curry and Nic Lewis. And these do not even touch on the challenge of independently reproducing climate model output without the machinery and resources necessary to do so, as Laframboise rightly observes in the following paper, i.e. (Laframboise, 2016)*".

The CRU is not the only place were practices deviated from usual scientific integrity. Matkin (2017) ventures to provide some hindsight into Hansen's career «*Dr. James Hansen is a lead IPCC scientist who conspired to fudge climate data to make the past look colder and present look warmer. But in the year 2000, NASA and NOAA altered the historical US temperature record, which now shows that there was about one degree centigrade US warming during the century before 1989. The animated image below shows the changes which Dr. Hansen made to the historical US temperature record after the year 1999. He cooled the 1930s, and warmed the 1980s and 1990s. The year 1998 went from being more than half a degree cooler than 1934, to warmer than 1934*».

Hansen who probably in the end will leave more of a legacy as an activist than as a scientist, though he made a good start with his Ph.D on Venus's atmosphere, went on to say: "*CEOs of fossil energy companies know what they are doing and are aware of long-term consequences of continued business as usual. In my opinion, these CEOs should be tried for high crimes against humanity and nature*". Additionally Dr. Hansen has been arrested several times for committing crimes in "defense of the planet". Matkin (2017) goes on «*Without Hansen's bold move into massive data tampering, the global warming scam would have been dead decades ago. Hansen quickly learned that he could use the trust NASA had built up during the Apollo program as cover to turn cooling into warming. All things become possible once a scientist makes the move into data tampering and fraud. Make no mistake about it, the people behind this scam are criminals – not scientists. They have nothing but failed predictions and fraud in their past and present*».

382 https://en.wikipedia.org/wiki/Keith_Briffa

After the Goddard Institute for Space Studies/NASA (GISS) data error was revealed, Hansen finally agreed to make public the method he uses to generate "official" temperature records from the actual readings. That process has been revealed to be thousands of lines of source code, containing hundreds of arbitrary "bias" adjustments to individual sites, tossing out many readings entirely, and raising (or lowering) the actual values for others, sometimes by several degrees. Many areas with weak or no rising temperature trends are therefore given, after adjustment, a much sharper trend. A full audit of the Hansen code is currently underway, but it seems clear that Hansen has more explaining to do.

In 2001, the Heinz Foundation "awarded" James Hansen with a payment of $250,000 for his work on global warming. According to the foundation: "*It was Dr. Hansen who, in the sweltering, drought-scorched summer of 1988, went where few scientists were willing to go-before Congress, to explain just how serious the potential for global warming truly was*". This is confirmed by NASA[383]. As reported by Sussman (2008) «*The Heinz Foundation, directed by the wife of U.S. Senator and former presidential candidate, John Kerry, is widely known for its support of liberal causes. Is it any surprise that James Hansen also endorsed John Kerry for President in 2004? The quarter of a million was just a tease of additional monies to come. In 2007, Hansen split a $1 million prize from the Dan David prize category of "Future Quest for Energy" (layman's translation: a world without oil). In addition he also reported to have acted as a consultant to Gore's global whining slide show, which was the impetus to the Prince of Peace's film, "An Inconvenient Truth." In fact, in 2006 Hansen had the gall to appear on a New York City stage with Mr. Gore to promote the then upcoming film- though he did reportedly inform the audience, "I'm not speaking as a government employee."*»

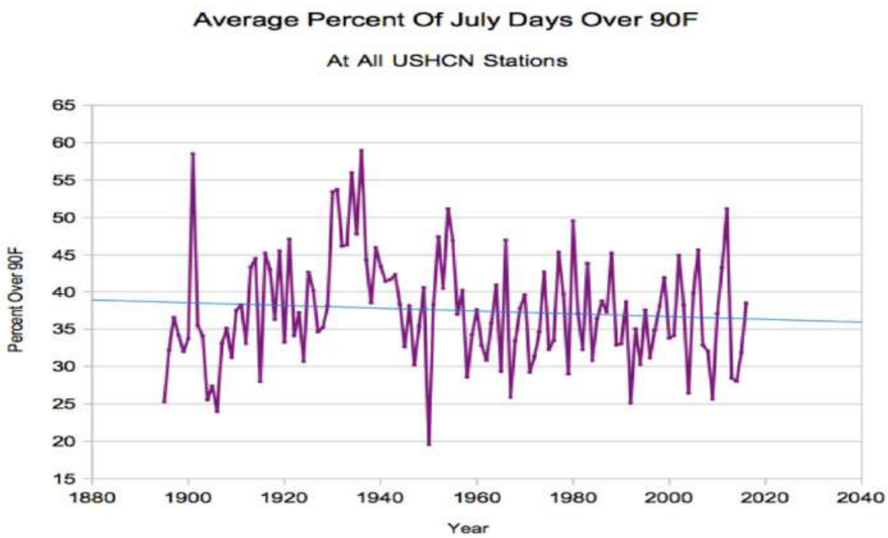

Figure 119. % of days for all United States Historical Climatology Network (USHCN[384]) stations over 90 degrees F. Source: Steven Goddard[385] (Heller, 2016).

How many people, for instance, know that James Hansen, a man billed as a lonely 'NASA whistle-blower' standing up to the mighty U.S. government, was really funded by [George] Soros' Open Society Institute (OSI), which gave him 'legal and media advice'? That's right, Hansen was packaged for the media by Soros' flagship 'philanthropy' by as much as $720,000, under the OSI's 'politicization of science' program." Hansen denied any relationship with OSI. But when you go through the Soros Foundations network Report 2006 «Building Open Societies», (Open Society Institute, 2007) you can read p. 123 the following «*Scientist Protests NASA's Censorship Attempts James E. Hansen, the director of the Goddard Institute for Space Studies at NASA, protested attempts to silence him after officials at NASA ordered him to refer press inquiries to the public affairs office and required the presence of a public affairs representative at any interview. The Government Accountability Project, a whistle-blower protection organization and OSI grantee, came to Hansen's defense by providing legal and media advice. The campaign on Hansen's behalf resulted in a decision by NASA to revisit its media policy*».

383 https://www.giss.nasa.gov/research/news/20010305/

384 The USHCN stations is a high quality data set of daily and monthly records of basic meteorological variables from 1218 observing stations across the 48 contiguous United State. One simple measure having a statistical strength is based on % of days over 90 degrees F, for a given month, i.e. here July, for all USHCN stations. So either 90°F is reached any given day and the station scores +1 or it does not and it scores 0. For the months of July, 1901, 1930, 1931, 1934, 1936 and 1954 all had more days over 90 degrees than 2012 did, yet NOAA shows 2012 as the hottest.

385 https://realclimatescience.com/2016/08/noaa-adjustments-increase-us-july-warming-by-1000/

As reported by Morano (2008a) «*Al Gore, the most famous face of the global warming-industrial complex, has been saying for years that the debate is over, that science has declared humans are responsible for climate change. He, of course, is wrong. There are skeptics in the scientific community, literally thousands of them. Many are on the leash, however, afraid to speak out for fear of being bullied, denied research grants and ostracized for expressing politically incorrect doubt. For them, the debate is indeed over. Those who refuse to be browbeaten, though, are in danger of seeing their careers ruined or, perhaps someday, sharing a prison cell with the oil executives Hansen wants to try.* ***Criminalize dissent****: That's one way to ensure the debate is over. Hansen's comment is revealing. It's the sort of declaration made by a desperate man trying to hang on to his declining relevance. Hansen knows the climate of fear he has stoked is receding as more people start to see through his nonsense*».

It is worth noticing that Hansen's position to seek criminalization of people who dissent in 2008 is now being followed by Van Ypersele attempt before EU MPs to obtain the same kind of censorship by requesting that social media platform would not permit any dissenting opinion to be aired, usually referred to as «Fake News» (Marmol and Mager, 2019). What a beautiful science that one who needs the threat of justice or censorship to bring reason to recalcitrant colleagues.

Unfortunately, when it comes to the average citizen trying to figure out, using simple tools, how much warming has been recorded, he/she can be dismayed as by looking at the previous Figure 119, he/she will not see any warming at all and could wonder, for example in the U.S. why federal "climate change" funding was $13.2 billion across 19 agencies in 2017 (according to Office of Management and Budget).

Same question could be risen in any other G20 country at more or less similar ratios of funding to respective GDP. The frequency of 90 degree days in the US has declined since the start of records in 1895 as seen on Figure 119. July 2016 (NASA's hottest July ever) was almost exactly average since 1895, as per Tony Heller[386]. Seen using these spectacles, the matter does not look neither that urgent nor that worrying. This is exactly what the climate science cartel does not want.

Historical Scientific Practice Baffled

To better illustrate the position that will be defended here, it will be reported an example from another domain, i.e. Astrometry, a branch of astronomy that deals with measurements of positions and movements of celestial bodies, and in particular the calculation of double stars orbits. Astronomers have ever been interested in knowing the *physical* mass of stars and the only method delivering such masses (not from empirical astrophysical relationships) is by means of the calculation of an orbit provided that the parallax of the system be known (Poyet, 2017a-b-c). Once the system has been discovered, it takes decades but sometimes centuries or more to gather enough observations so that a preliminary orbit could be computed. These observations which up to now were mainly gathered by individual observers were published and compiled in at least two databases, i.e. the Washington Double Star Catalog[387] (WDS) maintained by the United States Naval Observatory and SIDONIE[388] (Site Informatique des étoiles Doubles de Nice), the Double Star Website of Nice Observatory (France). Observations, requiring dedication, skill and more often than not significant observation means, are freely contributed by all observers. These data are maintained to the benefit of the astronomical community by the two organizations aforementioned and anyone can either directly access the website or send a request to USNO to obtain for any system(s) the measurements made so far. This allows astronomers to calculate and publish orbits and humanity to know the masses of a number of systems and of a limited number of individual stars (these are real physical masses as per kepler's laws). Any other astronomer, considering an orbit, must and can have access to the data and method used to calculate the orbit and therefore total transparency is ensured. Whenever an orbit can be improved, because it was preliminary and new observations are added or for any other reason, the process keeps repeating itself until a definitive orbit, or considered such, is obtained. **This is the way science has operated for centuries** and should keep doing so. Of course, it has happened that the discoverer of a system presenting particular characteristics (e.g. high parallax) would delay the publication of the discovery (sometimes up to a decade or a bit more) in order to be the first to publish the orbit, but by doing so the discoverer would expose him/her self to the risk of having another astronomer spot the binary and publish his/her discovery in his/her place. The

386https://www.desmogblog.com/steven-goddard

387http://www.astro.gsu.edu/wds/

388https://sidonie.oca.eu/Sidonie/Default.htm in English https://sidonie.oca.eu/Sidonie/scripts/SidonieWelcome.htm risk would balance the benefit of trying to keep the data private so as to be the first to compute the orbit. In any case, the data (i.e. observations or measurements whatever the means used) and the orbit would be published as soon as they would make sense. Sometimes, more often than not, too early as the orbits would be so preliminary that they would need to be corrected many times.

So, after this reminder, let's see how things work in the "climate science" community, just using a compelling example. It does not look like some researchers produce very happily and willingly their data as is the case for astrometrists. A telling example is provided by the University of East Anglia (UEA), using all kinds of quibbles to avoid providing their data to Steve McIntyre, who not just had to send an email to the researchers to get a link to a ftp address to download the files, no! He had to go to court and amazingly it was not what you could have expected, that these data collected and paid by the taxpayers would be made available to the public who funded them easily, no! The "*UK's Information Tribunal rejected on appeal a request by McIntyre to force scientists at the University of East Anglia to release information related to tree ring measurements which were being used as part of ongoing research*". Following that kind of reasoning, you can always find some on-going research to procrastinate delivery and action. The university had refused the requests on the grounds that the work was part of ongoing research which would eventually be published in full. One of the co-authors objected to the release of the draft paper on the basis that "*it is not helpful, and may be misleading or confusing to release versions of non-finalised documents*" (ThirtyNine, 2013).

The scientists later accused McIntyre of engaging in a failed campaign to discredit them, based on false claims. McIntyre had pursued the information for more than two years. After making his first request in April 2011, the UEA issued a refusal letter in July that year. McIntyre challenged the decision, but the UK's Information Commissioner refused that request. McIntyre again appealed, taking the decision to the Information Rights Tribunal (HMCTS, 2013; English, 2013). The Tribunal rejected McIntyre's appeal. In the decision notice, Judge Taylor wrote: "*We found Mr McIntyre's argument that the authors had in some way jeopardized any right to a safe space for research by virtue of having published other articles uncompelling. Likewise, his argument that the authors of the 2008 Paper had misinformed the public by failing to disclose relevant adverse results in the requested chronology did not carry force if it was accepted that the chronology and related paper was not complete*" (HMCTS, 2013). According to the judgment, Mr McIntyre had pushed the case because it would '*show a long-standing academic fraud by the Climatic Research Unit*'. McIntyre had also claimed it was in the public interest to have the information disclosed, even though it was part of a work-in-progress, which seems obvious (HMCTS, 2013). But, Judge Taylor added: "*We did not find any public interests in favour of disclosing the information at the time of the request. There was a strong public interest for scientific research to be the subject of scrutiny, but not prematurely whilst incomplete*" (HMCTS, 2013).

IPCC deception with the Hockey Stick flawed evidence (appearing on page 3 of the TAR "Summary for Policymakers") remains a case of pathological science as well analyzed by Professor Jonathan Jones, a physicist at Oxford University[389] who stated "*The hockey stick is an extraordinary claim which requires extraordinary evidence…the evidence is extraordinarily weak…its defenders were desperate to hide this fact…I'd always had an interest in pathological science, and it looked like I might have stumbled across a really good modern example…The Hockey Stick is obviously wrong. Everybody knows it is obviously wrong.*" (Steyn, 2015, Kindle loc. 731). Furthermore, as an aside matter, Jones had to make a Freedom of Information (FOIA) request so that a judge would rule that the Climatic Research Unit (CRU) at UEA had to provide the data they used and would finally comply with what is basic scientific practice, which led Jones to state "*My sole aim* [in pursuing the case] *is to help restore climate science to something more closely resembling scientific norms*". The poor Briffa, deputy director of the Climatic Research Unit, died in 2017. If one were to ask for his records and complete tree-ring data he used, one should reasonably be prepared to hear that nobody knows where they are.

Move along, there's nothing to see.

389 https://en.wikipedia.org/wiki/Jonathan_A._Jones

4.7. IPCC and Their Unlikely Physics of Climate Change

«*Not only is the Kyoto approach to global warming wrong-headed, the climate change establishment's suppression of dissent and criticism is little short of a scandal. The IPCC should be shut down».* Nigel Lawson[390]

«*In the absence of a critical analysis of results taken at face value and in the absence of any research strategy to remedy the most obvious shortcomings, I believe that the IPCC has exerted an overall negative influence on the development of climate sciences*». (Morel, 2013)[391]

What you pay is what you get, it does also apply to Science. When the conclusion is made before even beginning the work started, because the order getting the grant or the contract was clear, here is what can be read as the first sentence in the introduction of a "climate-science" paper: "*Humanity is now the dominant force driving changes of Earth's atmospheric composition and climate (IPCC, 2007a)*" (Hansen et al., 2013a). This is simply amazing ! But repeating thousand times an unsubstantiated claim does not make it a truth as far as Science is concerned, politics could be different as Goebbles used to say[392], but has James Hansen forgotten his science for his ideology? as Freeman Dyson observed. Psychologists know that with repeated lying, the mind gradually adapts to listen to it, to perceive it and then finally incorporates it into its field of thought. In the case of the great lies of power, it is also a response to fear or insecurity and the AGW creed keeps fueling the fear with uncontrollable sea-level rise that will reshape our coasts and wipe out low lying countries, with supposedly extreme weather events increasing like droughts, floods, tornadoes and even tsunamis and earthquakes for a former French president! (Hollande, 2015b), with agricultural disruptions and bad crops when the opposite is true and CO_2 is a great plus increasing plants' yields. The great lies of power offer an understandable explanation of what people don't know or what they don't understand. And as the saying goes, there is nothing so closed as a closed mind, so once the receiver of the message has been well conditioned, whatever the arguments one can bring in order to unravel myths, lies and so forth, the natural defense mechanisms operate and people just dismiss what they consider a new position or explanation that would challenge their beliefs and are victims of some sort of cognitive dissonance.

"*This episode is a reminder that the IPCC is, as its founder Maurice Strong had always intended, a political and not a scientific body. It is pursuing a partisan, self-serving and in some respects scientifically disreputable course. It has a direct, financial vested interest in prophesying doom. For if it were to admit what is now becoming apparent, that CO_2 will have a modest, slow and harmless warming effect, and that even if warming were to occur at the predicted rate and cost it would be orders of magnitude more expensive to mitigate today than to adapt the day after tomorrow, governments would – rightly – see no further need to fund it*" (Monckton of Brenchley, 2013).

«*The Intergovernmental Panel on Climate Change was created in 1988. It was set up by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) to prepare, based on available scientific information, assessments on all aspects of climate change and its impacts, with a view of formulating realistic response strategies. The initial task for the IPCC as outlined in UN General Assembly Resolution 43/53 of 6 December 1988 was to prepare a comprehensive review and recommendations with respect to the state of knowledge of the science of climate change; the social and economic impact of climate change, and possible response strategies and elements for inclusion in a possible future international convention on climate. … The scientific evidence brought up by the first IPCC Assessment Report of 1990 underlined the importance of climate change as a challenge requiring international cooperation to tackle its consequences. It therefore played a decisive role in leading to the creation of the United Nations Framework Convention on Climate Change (UNFCCC), the key international treaty to reduce global warming and cope with the consequences of climate change.*»[393].

390 https://en.wikipedia.org/wiki/Nigel_Lawson

391 Quote originally in French, automatically translated with https://translate.google.com/

392 Attributed to Joseph Goebbles "If you tell a lie big enough and keep repeating it, people will eventually come to believe it. The lie can be maintained only for such time as the State can shield the people from the political, economic and/or military consequences of the lie. It thus becomes vitally important for the State to use all of its powers to repress dissent, for the truth is the mortal enemy of the lie, and thus by extension, the truth is the greatest enemy of the State."

393 https://archive.ipcc.ch/organization/organization_history.shtml

Oslo, 10 December 2007 - The Intergovernmental Panel on Climate Change and Albert Arnold (Al) Gore Jr. were awarded the Nobel Peace Prize "*for their efforts to build up and disseminate greater knowledge about **man-made climate change**, and to lay the foundations for the measures that are needed to counteract such change*"

So the mass has been said since at least 2007, Climate Change is man-made and only «research» providing support to this view is acceptable.

Does that sound like Science?

The way the IPCC operates is well described by Richard S. Courtney[394] in a post commenting (Watts, 2013) "*The UN Intergovernmental Panel on Climate Change (IPCC) only exists to produce documents intended to provide information selected, adapted and presented to justify political actions. The facts are as follows. It is the custom and practice of the IPCC for all of its Reports to be amended to agree with its political summaries. And this is proper because all IPCC Reports are political documents although some are presented as so-called 'Scientific Reports'. Each IPCC Summary for Policymakers (SPM) is agreed "line by line" by politicians and/or representatives of politicians, and it is then published after that the so-called 'scientific' Reports are amended to agree with the SPM. This became IPCC custom and practice when prior to the IPCC's Second Report the then IPCC Chairman, John Houghton, decreed, «we can rely on the Authors to ensure the Report agrees with the Summary». This was done and has been the normal IPCC procedure since then. This custom and practice enabled the infamous 'Chapter 8' scandal (Ball et al., 2011) so perhaps it should, at long last, be changed. However, it has been adopted as official IPCC procedure for all subsequent IPCC Reports. Appendix A of the most recent IPCC Report (the AR5) states this where it says «Reports approved and adopted by the Panel will be the Synthesis Report of the Assessment Reports and other Reports as decided by the Panel whereby Section 4.4 applies mutatis mutandis» This is completely in accord with the official purpose of the IPCC. The IPCC does NOT exist to summarize climate science and it does not. The IPCC is only permitted to say AGW is a significant problem because they are tasked to accept that there is a "risk of human-induced climate change" which requires "options for adaptation and mitigation" that can be selected as political policies and the IPCC is tasked to provide those "options". This is clearly stated in the "Principles" which govern the work of the IPCC[395]. Near its beginning that document says: The role of the IPCC is to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. IPCC reports should be neutral with respect to policy, although they may need to deal objectively with scientific, technical and socio-economic factors relevant to the application of particular policies. This says the IPCC exists to provide*

- *(a) "information relevant to understanding the scientific basis of risk of human-induced climate change" and*
- *(b) "options for adaptation and mitigation" which pertain to "the application of particular policies".*

Hence, its "Role" demands that the IPCC accepts as a given that there is a "risk of human-induced climate change" which requires "options for adaptation and mitigation" which pertain to "the application of particular policies". Any 'science' which fails to support that political purpose is 'amended' in furtherance of the IPCC's Role. This is achieved by amendment of the IPCC's so-called 'scientific' Reports to fulfil the IPCC's political purpose is achieved by politicians approving the SPM then amending the so-called 'scientific' Reports to agree with the SPM. All IPCC Reports including the IPCC AR5 are pure pseudoscience intended to provide information to justify political actions; i.e. Lysenkoism."

The Chapter 8 controversy mentioned by Richard S. Courtney involved the most important part of all IPCC reports, namely, the evidence of a 'human signal'. Chapter 8 didn't have specific evidence of a human signal (May, 2020; Poyet, 2021). The original draft submitted by Santer read: "*Finally we have come to the most difficult question of all: When will the detection and unambiguous attribution of human-induced climate change occur? In the light of the very large signal and noise uncertainties discusses in the Chapter, it is not surprising that the best answer to this question is, We do not know*».

In the 1995 2nd Assessment Report of the UN IPCC the scientists included these three statements in the draft:

- 1. "None of the studies cited above has shown clear evidence that we can attribute the observed (climate) changes to the specific cause of increases in greenhouse gases."

394 https://www.desmogblog.com/richard-s-courtney
395 http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles.pdf

- 2. “No study to date has positively attributed all or part (of observed climate change) to anthropogenic (i.e. man-made) causes.”
- 3. “Any claims of positive detection of significant climate change are likely to remain controversial until uncertainties in the natural variability of the climate system are reduced.”

The “Summary” and conclusion statement of the IPCC report was written by politicians, not scientists. As explained before, the rules force the ‘scientists’ to change their reports to match the politicians’ final ‘Summary’. Those three statements by ‘scientists’ above were replaced with this: “*The balance of evidence suggests a discernible human influence on global climate*”. This was done in a way reminded by May (2020) “*John Houghton, the lead editor of the entire IPCC WG1 second assessment didn’t care what the authors concluded. He insisted that the young Benjamin Santer change the chapter and bring it into agreement with his summary*”. The final politically edited conclusions, released in the May 1996 summary version, were therefore startlingly different and in stark contradiction with the most recent peer-reviewed research of the time (Barnett et al., 1996)[396] including Santer's et al. (1995)[397] own work that was certainly less assertive. The Chapter 8 lead author, Ben Santer, under Houghton's pressure had excised denials of any scientific evidence of man-made warming, agreed to by all 36 authors of Chapter 8 summarized as “*we have no yardstick against which to measure the manmade effect. If long-range natural variability cannot be established, then we are back with the critique of Callendar in 1938, and we are no better off than Wigley in 1990*”, replacing them with statements asserting the opposite:«*The body of statistical evidence in Chapter 8, when examined in the context of our physical understanding of the climate system, now points toward a discernible human influence on global climate*». (Ball et al., 2011) p 125. The complete story and more is available in the book published by May (2020).

Does that sound like Science?

«*The IPCC and those who were chosen to participate were locked in to a conclusion by the rules, regulations and procedures carefully crafted by Maurice Strong. These predetermined the outcome - a situation in complete contradiction to the objectives and methods of science. As evidence grew that the hypothesis was scientifically unsupportable, adherents began defending the increasingly indefensible rather than accept and adjust. The trail they made is marked by the search for a clear human signal, identified in modern parlance as 'smoking guns'. They turned increasingly to rewriting history and producing biased results - thus expanding the gap between what they claimed and what the evidence showed. The main report is then reviewed to make sure it 'aligns' with the summary. Here again is the instruction in the IPCC procedures "Changes (other than grammatical or minor editorial changes) made after acceptance by the Working Group or the Panel shall be those necessary to ensure consistency with the Summary for Policymakers (SPM) or the Overview Chapter." Of course, even minor editorial changes can be problematic. In 1995, Chapter 8 lead author Benjamin Santer made such changes to accommodate the SPM to the political - in contradiction to the agreed text*». (Ball *et al*., 2011).

Does that sound like Science?

In fact, and more generally, what happens to those big literature survey compilations leading to the AR-reports? As Roy Spencer, a principal research scientist at the University of Alabama-Huntsville observes: “*they go through bureaucratic reviews where political appointees dissect them line-by-line to glean out the best stuff in support of what IPCC wanted to say in the first place. These cherry-picked items are then assembled and spun into condensed summary reports calibrated to get prime time and front page attention*”. Climatologist Hans von Storch (2009) wrote in the Wall Street Journal “*What we can now see is a concerted effort to emphasize scientific results that are useful to a political agenda by blocking papers in the purportedly independent review process and skewing the assessments of the U.N.’s Intergovernmental Panel on Climate Change (IPCC). The effort has not been so successful, but trying was bad enough*”.

Does that sound like Science?

IPCC was also guilty of making a fraudulent claim that the Himalayan glaciers will be gone by 2035. IPCC was not paying close enough attention to what reviewers said about the example. That false assertion had prompted great alarm across southern and eastern Asia where glaciers feed major rivers, and while many glacier experts considered it

396 “*current model estimates of natural variability cannot be used in rigorous tests aimed at detecting anthropogenic signals.*” (Barnett et al., 1996)

397 “T*his analysis supports but does not prove the hypothesis that we have detected an anthropogenic climate change signal.*” (Santer et al., 1995)

preposterous, the IPCC kept it in their report. The way things go is that a baseless scare story is issued, taken for granted and republished from one source to the next without any verification. The first paper from the New Scientist environmental correspondent, Fred Pearce, was published in 1999 and read "*All the glaciers in the middle Himalayas are retreating," says Syed Hasnain of Jawaharlal Nehru University in Delhi, the chief author of the ICSI report. A typical example is the Gangorti glacier at the head of the River Ganges, which is retreating at a rate of 30 metres per year. Hasnain's four-year study indicates that all the glaciers in the central and eastern Himalayas could disappear by 2035 at their present rate of decline*". From thereon, another scaremonger specialist, the WWF, published in 2005 its report, An Overview of Glaciers, Glacier Retreat, and Subsequent Impacts in Nepal, India and China and cited former Pearce's article: "*The New Scientist magazine carried the article "Flooded Out – Retreating glaciers spell disaster for valley communities" in their 5 June 1999 issue. It quoted Professor Syed Hasnain, then Chairman of the International Commission for Snow and Ice's (ICSI) Working Group on Himalayan Glaciology, who said most of the glaciers in the Himalayan region "will vanish within 40 years as a result of global warming". The article also predicted that freshwater flow in rivers across South Asia will "eventually diminish, resulting in widespread water shortages*". As if all these deception techniques were not enough, in 2007 IPCC cherry picks the WWF deception "*Glaciers in the Himalaya are receding faster than in any other part of the world (see Table 10.9) and, if the present rate continues, the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps warming at the current rate. Its total area will likely shrink from the present 500,000 to 100,000 km2 by the year 2035 (WWF, 2005)*". In fact, it appears that Indian glaciologist, Syed Hasnain worked for a research company headed by none other than IPCC's chairman, Rajendra Pachauri. IPCC author Marari Lai admitted the reason for including it to the Daily Mail, " *We thought that if we can highlight it, it will impact policymakers and politicians and encourage them to take action*".

No wonder that Rajendra Pachauri, a railroad engineer who led the IPCC for more than 13 years with no knowledge whatsoever in Earth sciences, would support or even organize these inept deceptions. Pachauri did not know what any 14-year-old schoolboy following a course in geography does, i.e. that it is not glacier melt-water that enables irrigated farming in the densely populated plains of India, Bangladesh, Burma, the Indochinese peninsula and China. With the exception of the high valleys with low densities, it is the monsoon that sets the rhythm of the agricultural calendar, determines the crops and conditions the irrigation systems. The monsoon is the source of the flow of between 80 and 90% of the large rivers in the Himalayas. Furthermore, it is not one-sixth of the world's population that is concerned as Rajendra Pachauri asserted, because that would correspond to the entire population of the Indian Union. There are of course not 1.1 billion inhabitants in the cities and countryside of the Ganges and Brahmaputra basins. Such an ignorant leadership could not show better the political nature of the IPCC.

Does that sound like Science?

The IPCC is not a person, it is a NGO associated with the UN and the WMO and made up of people who voluntarily associate with it because they find it in their professional and personal interests to do so. The most common factor in my reading of what is published by the IPCC is not science but politics with a hidden but intended ideological objective, i.e. socialistic public policy. While the underlying reasons for the individuals to participate may vary, the public policy implications they draw always converges on the same socialistic goals: bigger government, less personal freedom, less prosperity, lower personal energy usage. This is made far worse by the grant-making process they control in what research gets funded and what does not. It is reinforced by the AGW community reaction targeting scientists who accept funding from third parties who do not accept the AGW theory. Because IPCC's members ideology is more reliable than their research, the IPCC is a means to an end, a socialistic end.

Does that sound like Science?

Furthermore, IPCC has been doomed by conflicts of interests which instead of being solved by resorting to better and rigorous procedures have been deeply ingrained into the organization even though many people demurred[398], e.g. (Gray, 2008), (McKittirck, 2011), (Bell, 2011). McKitrick (2011) reminds the case of the infamous IPCC's Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) accompanied by a press release on the May 9th (2011) stating that "*Close to 80 percent of the world's energy supply could be met by renewables by mid-century if backed by the right enabling public policies a new report shows*" This claim originated in a report jointly published by Greenpeace and a renewable energy industry lobby group, the author of which had subsequently been selected by the IPCC to be a Lead Author for the SRREN!

398 inter alia, Singer 1998, Michaels and Balling 2000, 2009, Essex and McKitrick 2002, Boehmer-Christensen and Kellow 2002, Lawson 2008, Plimer 2009, Montford 2010, Carter 2010, Laframboise 2011, Johnson 2012

Does that sound like Science?

Former National Academy of Sciences president Frederick Seitz detailed his objections to that kind of illegitimate rewrite that were reported before in a June 12, 1996 Wall Street Journal article titled "A Major Deception on Global Warming" (Seitz, 1996). He commented that "*I have never witnessed a more disturbing corruption of the peer review process than events that led to this IPCC report*". Dr. Seitz is certainly not alone in questioning the politicization of IPCC processes. The U.K . House of Lords' "Scientific and Economic Analysis Report" prepared for the July 2005 G-8 Summit stated, "*We have some concerns about the objectivity of the IPCC process, with some of its emissions scenarios and summary documentation apparently influenced by political considerations*". The InterAcademy Council, an Amsterdam-based association of the world's leading academic national science academies has concluded that a "fundamental reform" of IPCC's management structure is needed. In a report released on August 30, 2010 following a review of practices and methodologies leading to the IPCC's latest 2007 report, the Council found two types of errors. Its chairman, Harold T. Shapiro, stated that, "One is the kind where they place high confidence in something where there is little evidence. The other is where you make a statement …with no substantive value"

Does that sound like Science? And this sort of activity warrants a Nobel Peace Prize awarded to the IPCC (along with Al Gore) that same year?

Finally, (IPCC, 2013) dubbed here the "Unlikely Physics of Climate Change" demonstrate an amazing way to practice Physics. (IPCC, 2013) states that "*the following terms have been used to indicate the assessed likelihood of an outcome or a result: virtually certain 99–100% probability, very likely 90–100%, likely 66–100%, about as likely as not 33–66%, unlikely 0–33%, very unlikely 0–10%, exceptionally unlikely 0–1%. Additional terms (extremely likely: 95–100%, more likely than not >50–100%, and extremely unlikely 0–5%) may also be used when appropriate. Assessed likelihood is typeset in italics, e.g., very likely (see Chapter 1 and Box TS.1 for more details)*".

This is truly an incredible way to practice any scientific discipline. A mathematical demonstration is not likely or unlikely, a physical phenomenon is not likely or unlikely it does exist or not and one has a decent representation of it so that he/she can compute something meaningful with this representation or not, e.g. by using Kepler's laws one can compute orbits, it is not a question or not of knowing how likely one can compute an orbit with Kepler's laws. Since there are 1732 occurrences (!) of the word or sub-word "likely" in this IPCC 2013 document, which means that it discusses more or less likely conjectures, some less likely than others which could be already not very likely and makes them less than less likely and as there are also 190 occurrences of the word "unlikely", which means that 190 times in this document were discussed unlikely or even more than unlikely conjectures, one certainty is: it is very unlikely that this document shares any relationship with normal science.

This 'Unlikely Physics of Climate Change (IPCC, 2013)' has got a copycat of that strange sort of physics available in USGCRP (2017) 'Climate Science Special Report: Fourth National Climate Assessment, Volume I' with even more puzzling sub-divisions (Fig. 2, p.7) and the same kind of baseless affirmations all along and similar deceptions, including for example the falsely accelerated rate of SLR. One can wonder why, in order to sort of duplicate the available IPCC reports with no additional convincing evidence, it was necessary beyond NOAA to mobilize 13 other federal agencies included the DOA, DOC, DOD, DOE, HHS, DOI, DOS, DOT, EPA, NASA, NSF, Smithsonian Institution, and the USAID? The reason was to make mainstream medias claim that "impacts of climate change are intensifying" (Rice, 2018)!

It is on such shoddy, and as seen before sometimes fraudulent science that the UN and their cronies want to undertake some of the worst crimes against humanity ever seen. Depopulation, de-industrialization, de-modernization, forcing billions of people back into preindustrial subsistence can cause disaster of a scale never been seen ever before. Solar and wind power won't be sustainable to prevent any of that. Cost of electricity and fuel is already causing suffering to poor and middle class people worldwide. That's billions of people. They won't die from climate change. They will die from the "solutions" proposed by the UN led social engineering, New World Order, global socialism. There will have to be something like the Nuremberg trial for the engineers of this human disaster in the making.

We all know (or we should) that correlation is not causation and we need to define and test a mechanism of causation to prove cause. No study about climate change has been specifically designed to study cause. Cause is always assumed, never tested. If pressed about the causal mechanism one may hear hand waive references to Fourier, Arrhenius, Tyndall etc. and the classical argument of authority that "everybody knows that" carbon dioxide absorbs Infra Red

Radiations (IRR) and that a glass panel will let visible light in but not IRR out[399]. So the IRR absorbed by carbon dioxide supposedly gets "stuck" in atmosphere, staying there until doomsday making atmosphere hotter than it should be, this what was detailed into the "The Greenhouse Mess" section. Even though there's no glass panels in the sky letting visible light in but not letting IRR out. And that, somehow, will make earth's surface hotter too, even though nobody can come up with the mechanism of heat transfer from atmosphere to earth's surface that would make earth's surface hotter than it should be (and infringe one of the most famous principle of thermodynamics doing so[400], as the air atop the ground, colder than it, cannot warm it).

Even though many prominent scientists have long stressed the need to profoundly reform the IPCC, reporting worrying abuses like former National Academy of Sciences president Frederick Seitz did in Seitz (1996)[401], and even though detailed proposals have been made for that, as for example what is suggested by McKitrick (2011), the sad truth is that IPCC has entrenched in a way of running its operations that is entirely politically motivated. The use of scientific evidences is made at will with an established bias only aiming at demonstrating that man-made emissions are responsible of climate-change, which is a denial of any proper scientific principle where the search for the truth requires to investigate all possible causes and hypotheses and not pursuing one and unique foregone established conclusion. In doing so, by the very definition of its own mission, IPCC is out of the realm of science and plagued by an inherent design flaw that prevents it of delivering any impartial, independent and scientific contribution. It will become, time showing the scale of the blunder, a sign of its time, of the imprint the bureaucrats left on our societies. Vincent Gray stated from first hand experience in 2007 "*IPCC Has Become too blinkered and corrupt to save*" (Covington, 2014).

"*If the IPCC is incapable of following its most basic procedures, it would be best to abandon the entire IPCC process, or at least that part that is concerned with the scientific evidence on climate change, and look for more reliable sources of advice to governments on this important question.*" Seitz (1996).

The overall objective of IPCC and their unlikely physics of climate change is to come up with every round of report with a supposedly less unlikely signal that they would have managed to more clearly identify through the "attribution processes". Of course, all that does not bear even a remote relationship with science as was explained and has been constantly refuted by the observations so far demonstrating that nothing stands beyond natural variability which has been at play at all time-scales from decade to million of years.[402]

In that respect the conclusion of the NIPCC are very telling and Idso et al. (2013) state: "*We conclude neither the rate nor the magnitude of the reported late twentieth century surface warming (1979–2000) lay outside normal natural variability, nor was it in any way unusual compared to earlier episodes in Earth's climatic history. Furthermore, solar forcings of temperature change are likely more important than is currently recognized, and evidence is lacking that a 2°C increase in temperature (of whatever cause) would be globally harmful. (…) Policymakers should resist pressure from lobby groups to silence scientists who question the authority of the IPCC to claim to speak for "climate science."*

399 This is refuted by some authors with the following reasoning Godwin (2020) "*Glass absorbs and emits. Emissions are isotropic, half get emitted out of the greenhouse and half back in. That gets absorbed by the ground and re-emitted. Once again half goes out and half back in which is now a quarter of the incident packet of radiation. It is exponential and takes just 30µsecs for all of the incident packet to escape the greenhouse*". For the way CO_2 molecules get 'deactivated' see also Geuskens (2019).

400 Harde (2013) diverges on that point stating that "Thermal radiation is electromagnetic radiation and no heat. Therefore, in the same way, as radio waves can propagate from a colder antenna to a warmer receiver, microwaves can be absorbed by a hot chicken,..., so any back radiation from colder and higher atmospheric layers can be absorbed by the lower and warmer layers, and this back radiation can also be absorbed by a warmer surface of the earth without violating the 2nd law of thermodynamics. As long as the surface is assumed to be a black or gray absorber, it does not filter any frequencies of the incoming radiation, in the same way as it does not reject any frequencies of the broad Planck spectrum of a thermal radiator, independent, if it has a higher or lower temperature than the earth. Radiation converts to heat after an absorption, followed by an emission in accordance with a newly adjusting thermodynamic equilibrium, which only requires that the net energy transfer is in balance"

401 Bolin was quick to pretend in the WSJ, 23rd July, 1996 that "*The changes made followed the clear decision at Madrid to accept the draft chapter subject to its modification to improve its presentation, clarity and consistency...*". Consistency means re-writing to match delegates politically motivated positions. This is clearly a dialog of the deaf.

402 A copycat of that strange sort of physics is available in USGCRP (2017) "Climate Science Special Report: Fourth National Climate Assessment, Volume I" with even more puzzling sub-divisions (Fig. 2, p.7) and the same kind of baseless affirmations all along and similar deceptions, including for example the falsely accelerated rate of SLR. One can wonder why, in order to sort of duplicate the available IPCC reports with no additional convincing evidence, it was necessary beyond NOAA to mobilize 13 other federal agencies included the DOA, DOC, DOD, DOE, HHS, DOI, DOS, DOT, EPA, NASA, NSF, Smithsonian Institution, and the USAID? The reason was to make mainstream medias claim that "*impacts of climate change are intensifying*" (Rice, 2018)!

Climate Change Reconsidered II: Physical Science reveals a scientific community deeply uncertain about the reliability of the IPCC's computer models, its postulates, and its interpretation of circumstantial evidence."

Why would NIPCC scholars Idso et al. (2013, 2015, 2019) be less credible than IPCC researchers and all governmental and NGO's workers who re-frame their studies to the sole avail of dubiously demonstrating man-made responsibility in a minute warming that started long before anthropogenic emissions became significant and observed since the end of LIA, and who make their bread and butter of the climate scare story?

4.8. Major Financial Stakes

In 2015, the 200 page Climate Change Consulting Report was delivered by the Climate Change Business group, editor of the Climate Change Business Journal[403] (CCBJ) for $995.

The question raised by Driessen (2015) "*So how do White House, EPA, UN, EU, Big Green, Big Wind, liberal media, and even Google, GE and Defense Department officials justify their fixation on climate change as the greatest crisis facing humanity? How do they excuse saying government must control our energy system, our economy and nearly every aspect of our lives – deciding which jobs will be protected and which ones destroyed, even who will live and who will die – in the name of saving the planet? What drives their intense ideology?*" is easily answered in the aforementioned report: the annual revenue of the Climate Crisis and Renewable Energy Industry has become a **$1.5-trillion-a-year business**!

This tax-payer funded carbon tyranny will take control of each and every aspects of your lives through all facets of economic activity, including low carbon and renewable power, carbon capture and storage, energy storage (such as batteries), energy efficiency, green buildings, transportation, climate change adaptation, and consulting and research and the future biggest commodity market based on carbon trading (don't forget that if you trade corn on the CME you are a shameful speculator but if you trade carbon emission rights you help mankind redeem its sins).

As it grows at a [17-24%] rate annually (Harper, 2015) and considering an average growth rate of 20%, one immediately sees that we talk most probably of a monster-industry wasting in 2020 (at 20% discounted growth rate over five years) and at a global scale sort of (1.2^5=2.488) 2.48*1.5=3.73 trillion-a-year (in USD). Yes an industry the size of the GDP of Germany (3436 B€ in 2019), based not only on vested interests but on massive forced spoliation of the taxpayers and deliberate delusion of the citizens, as Nova (2015) explains "*it's the only major industry in the world dependent on consumer and voter ignorance. This is not just another vested interest in a political debate; it's vested-on-steroids, a mere opinion poll away from extinction. You can almost hear the captains of climate industry bellowing: Keep 'em ignorant and believing, or the money goes away!*". Furthermore, as Delingpole (2016) states "*I call climate change 'the gift that goes on giving' because day in day out I get an endless stream of stories to write about the corruption, incompetence, skullduggery of the climate alarmism industry. (…) Can it be right that people who have worked hard for their money should have it taken from them and then wasted in so spectacular fashion?*".

In the guise of saving the world's environment, massively funded green-lobbies and ideas could advance and impose all their usual obsessions: control, regulation, state intervention, moralistic Troyan horses, compulsory impoverishment but though this time with a smiling, fluffy face, because all these hardships are for the sake of your salvation and that of your children ; the string is big but works wonderfully, brainwashed people kept in the constant climate-scare gale ask for more.

As reminded by Yeo (2019a) "*Estimates of how much climate finance is flowing around the world depend on who is doing the counting. The Climate Policy Initiative (CPI), an international thinktank that publishes annual analyses, says that total climate-related financing was $510 billion to $530 billion in 2017, the latest figures available, up from $360 billion in 2012. The UN's Framework Convention on Climate Change (UNFCCC), put it at $681 billion in 2016*", but already in 2014, the Standing Committee on Finance (SCF) of the UNFCCC estimated "*the current volume of climate finance worldwide to be in the range of 340 to 650 billion dollars. Within this amount, the flows from North to South countries are estimated in the range of 40 to 175 billion dollars of which public flows total between $35 to 50 billion*" also see for a confirmation of some figures (OECD-G20, 2015). This is no small money, but as never enough, it is stated in (IPCC, 2018b), D.5.3. p.24, that an annual investment of **$2.4 trillion** is needed in the **energy system alone** until 2035 to limit temperature rise to below 1.5 °C from pre-industrial levels, that is around 2.5% of the world's economy (Yeo, 2019a). And the effort to tackle climate change goes beyond transforming energy systems: it includes spending on so many other things, as for example reforestation, coastal-defense systems and many other wasted efforts to cut emissions and adapt to rising temperatures.

403 https://ebionline.org/climate-change-business-journal/

But it does not stop there: who funds the Green Climate Fund[404]? U.S. President Obama committed the US to contributing US$3 billion to the fund. In January 2017, in his final 3 days in office, Obama initiated the transfer of a second $500m installment to the fund, leaving $2 billion owing. It happens that the new Trump administration stopped the waste of monies but this did not prevent many other countries to double their pledges so that the fund would grow to an actual 9.8 billions USD (Yeo, 2019b). As amazing as it may seem, many of the contributing countries that have doubled their pledges actually run major fiscal deficits whereas their own populations have already been substantially impoverished by years of statism, big government policies and as we will see in the next section an increase of the price of the energy and electricity particularly that strikes the most the middle class that has problems making ends meet. As we will see later, Naomi Seibt is silenced to the pretext that she should not receive any funding from abroad as this would mettle into domestic politics (see p.362) but the Germans export massively their green-inspired disaster in the making throughout many institutions, one of the prominent of them being the Heinrich Böll Foundation[405] (i.e. Heinrich-Böll-Stiftung e.V.), affiliated with the German Green Party, and having offices worldwide.

They state that their main tenets are among others ecology and sustainability and democracy and human rights. This puts in crude light the vision of democracy the foundation promotes when one listens to Liane Schalatek, an associate director at the Heinrich Böll Foundation, a non-profit organization in Washington DC who states "*For a government like the Trudeau government, which has prided itself on pushing the climate agenda forward, I think this is definitely not good enough*", of course never be thrifty with your people's money when they are bludgeoned with taxes, then she adds that "***now that the election is over, there is nothing to prevent the Canadian government from increasing its GCF contribution***" (Yeo, 2019b). Read this last sentence again, what a sleaze understanding of democracy, now that the election is over the government can decide to do whatever it pleases and waste as much money as the Sirs Humphreys think appropriate for your well-being. The only correct value of this foundation seems to be their motto "Meddling is the only way to stay relevant" and they have been far better at doing it and influencing, better say distorting people's views and understanding of the matter, than climate-realists who have been pushed aside and ridiculed. Congrats for manufacturing a fake climate-crisis, congrats for siphoning off people's money with or without their will throughout taxes, congrats for your making of a high-style lavish living on the back of gullible and manipulated peoples. As Sir Humphrey would say it, they well deserved it, clueless as they are.

Furthermore, as acknowledged by the U.S. Government Accountability Office[406] "*Over the past 20 years, the federal government has spent billions of dollars to address climate-related risks. Coordination and planning are critical to effective and efficient efforts*"; well given that according to the Office of Management and Budget (OMB) reports, federal climate change funding was $13.2 billion across 19 agencies in 2017, one can easily imagine that we rather talk of several hundreds of billions over 20 years, just to fund climate-oriented research. This is of course how you get reports like USGCRP (2017, 2018); how could this populace of well tax-payer funded scholars conclude something else than the world end is nigh if their credits are not renewed and if ever more stringent policies are not always enacted?

How funny then when the climate-purists come with their suspicions of coy virgins and keep relentlessly asking of where the monies of the climate-realists come from. We talk of pennies or not even (sometimes nothing as for myself) and certainly not of nearly four trillions of $, as most of these isolated resistants fund themselves through blogs, sales of books or small life-lines supports from contrarian institutes. This sheds new light on the statement already mentioned of Rep. Raúl M. Grijalva of Arizona who asked for complete disclosure of David Legates and Roger Pielke Jr. fundings because he stated that "*My colleagues and I cannot perform our duties if research or testimony provided to us is influenced by undisclosed financial relationship*" (Schwartz, 2015). As already reported, but it needs to be reminded here, hundred of inquiry letters were signed by Edward J. Markey of Massachusetts, Barbara Boxer of California and Sheldon Whitehouse of Rhode Island and sent to fossil fuel companies, trade groups and other organizations asking about their funding of climate research and advocacy blaming the "*best junk science money can buy*" but they do not see any problem with the 3.73 trillion dollars a-year industry that they have, themselves and their peers, created by the force of the law worldwide and do not notice that $13.2 billion a year across 19 agencies is where lies in plain sight the best junk science money can buy as no ethics can resist such a funding gorilla.

The operating costs of IPCC over the years, approaching now the 200 millions $, appear paradoxically in this deluge of wasted monies not as shocking as they should. The operating costs, as described in (IPCC, 2020), corresponding to the contributions to IPCC (Fund 430200) since inception (1989) as at 30 November 2019 amounts to: 173,659,184 CHF (in

404 https://en.wikipedia.org/wiki/Green_Climate_Fund
405 https://en.wikipedia.org/wiki/Heinrich_Böll_Foundation
406 https://www.gao.gov/key_issues/climate_change_funding_management/issue_summary

Swiss Francs). The IPCC receives funding through the IPCC Trust Fund as aforementioned, established in 1989 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO), but costs of the Secretary and of housing the secretariat are provided by the WMO, while UNEP meets the cost of the Deputy Secretary. This of course is more than enough to produce the biased IPCC reports and to keep the circus going, while inquiring like the inquisition on the pennies dissenters might have been given as a minuscule support.

The same dystopian policies are followed by the European Union and on December 11, 2019, the European Commission, never short of bad ideas, presented the 'European Green Agreement' whose ambition is to make the EU the world's first climate neutral bloc by 2050. The cost of the green pact is known to be astronomical. One hundred billion € over seven years to overcome the reluctance of Poland, the Czech Republic and Hungary, plus 1,000 billion € that the European Investment Bank promises to mobilize over ten years. In addition, the Commission has acknowledged that at least 260 billion € of additional investment will be needed annually between now and 2030 (or about 1.5% of the GDP of 2018), which can only come from national budgets. This soviet-like tyranny will impose its views on the member states that will have to comply with the EU so-called "recommendations". Still surprised of the Brexit?

Lindzen (2013, 2016) summarizes well this **extraordinary web of special interests** leading to a crazy machine feeding itself with its own delusions to keep fundings flowing and starts with the image "*The Sad Tale of the Iron Triangle and the Iron Rice Bowl*", i.e. 1) Scientists make meaningless or ambiguous statements => 2) Advocates and media translate statements into alarmist declarations => 3) Politicians respond to alarm by feeding scientists more money => GO TO 1. Lindzen (2016) adds: "*Of course, scientists are hardly the main beneficiaries. The current issue of global warming/climate change is extreme in terms of the number of special interests that opportunistically have strong motivations for believing in the claims of catastrophe despite the lack of evidence. In no particular order, there are:*

- *leftist economists for whom global warming represents a supreme example of market failure, as well as a wonderful opportunity to suggest correctives;*
- *UN apparatchiks for whom global warming is the route to global governance;*
- *Third World dictators, who see guilt over global warming as providing a convenient claim on aid, in other words the transfer of wealth from the poor in rich countries to the wealthy in poor countries;*
- *environmental activists, who love any issue that has the capacity to frighten the gullible into making hefty contributions to their NGOs;*
- *crony capitalists, who see the immense sums being made available for 'sustainable' energy;*
- *government regulators, for whom the control of a natural product of breathing is a dream come true;*
- *newly minted billionaires, who find the issue of 'saving the planet' appropriately suitable to their grandiose pretensions;*
- *politicians, who can fasten on to CAGW as a signature issue where they can act as demagogues without fear of contradiction from reality or complaint from the purported beneficiaries of their actions (the wildly successful London run of 'Yes, Prime Minister' dealt with this);*
- *etc., etc.*

All of the above special interests, quite naturally, join the chorus of advocates".

What would be kind of ironic is that after having spent trillions of $/€ trying to figure out whether CO_2 had any impact on the climate and coming up with a nonsensical consensus and fudged temperature series as the only proof of it and kept frightening people of future "imminent" death in 2100 requiring immediate remediation policies based on brutal and coercive policies, mankind would really disappear further to one of the many real catastrophic hazards that we face, including for example a deadly encounter with a NEO that nobody would have seen coming in time. But dangerous asteroids, and there are certainly many more than we know of as reminded p. 136, represent a real danger to mankind long term survival but do not benefit (yet) of an entire international organization dedicated to frighten populations and leverage politically on their fears (whereas the danger is here real and not hypothetically far-fetched) to divert by taxation and phony regulations nearly four trillions a year.

4.9. Rogue Policies

"*None of the world's challenges loom as large as climate change*", the United Nations chief told a major climate action summit on Tuesday, reiterating his belief that "***global warming poses an existential threat to humanity***". Secretary-General António Guterres (UN News, 2018)

"*On peut dire que la lutte contre le changement climatique est contraire aux libertés individuelles et donc sans doute avec la démocratie*." "*It can be said that the fight against climate change is contrary to individual liberties and therefore undoubtedly to democracy.*" François-Marie Bréon (Coulaud, 2018).

Unfortunately for these climate-extremists:

«*The Kyoto Treaty, based on assertions that mankind's generation of carbon dioxide will cause global warming, is an example of such a foolish and damaging thing. There is no surer way to build a powerful bureaucratic empire in a democracy than to promote a supposed peril and then staff up a huge organization to combat it».* (Happer, 2003)

Questioned by Ball (2014) Will nuclear energy be part of the future, despite the Fukushima nuclear disaster in Japan? "*A lot of investment in green technology has been a giant scam, if well intentioned*" James Lovelock

"*By extension, GCMs are not fit for the purpose of justifying political policies to fundamentally alter world social, economic and energy systems. It is this application of climate model results that fuels the vociferousness of the debate surrounding climate models*" (Curry, 2017)

Despite trillions of dollars in squandered subsidies, "green energy" has increased from 1% in 2008 to only 5% of global primary energy in 2019 as per Looney (2020) and observing Table 1., p. 4 of that report, giving "*Fuel shares of primary energy and contributions to growth in 2019*" fossil fuels provide 84.3% of global primary energy, essentially unchanged in decades, and unlikely to change in decades to come with Oil (33.1%), Gas (24.2%), Coal (27.0%), Hydroelectric (6.4%) and Nuclear (4.3%). This, despite the fact that it be touted that the share of renewables in power generation increased from 9.3% to 10.4% in 2019-2020, surpassing nuclear for the first time while coal's share of generation fell 1.5 percentage points to 36.4%, the lowest since 1985.

"Green energy" schemes are not green and produce little useful, i.e. dispatchable energy, because they require almost 100% conventional backup from fossil fuels, nuclear or hydroelectric when the wind does not blow and the Sun does not shine. Dispatchable generation refers to sources of electricity that can be dispatched on demand at the request of power grid operators, according to market needs. Dispatchable generators can adjust their power output according to an order and to the market needs. Non-dispatchable renewable energy sources such as wind power and solar photovoltaic (PV) power cannot be controlled by operators as they depend by definition on unreliable sources, the wind and the Sun. Intermittent energy from wind and / or solar generation cannot supply the electric grid with reliable, uninterrupted power, as stated with an euphemism by Bazilian et al. (2004) "*Wind's inherent intermittency and unpredictability make its increased penetration into the electricity network an area requiring significant further analysis*". There is no widely-available, cost-effective means of solving the fatal flaw of intermittency in grid-scale wind and solar power generation, see the Wind Report by Teyssen and Fuchs (2005) and for example, analyzing the week 20-26 Dec 2005, Figure 6 of their report illustrates that "*Whilst wind power feed-in at 9.15am on Christmas Eve reached its maximum for the year at 6,024MW, it fell to below 2,000MW within only 10 hours, a difference of over 4,000MW. This corresponds to the capacity of 8 x 500MW coal fired power station blocks.*" and Fig. 7 of the same report is even more destructive of all illusions as it asserts "*The more wind power capacity is in the grid, the lower the percentage of traditional generation it can replace. As a result, the relative contribution of wind power to the guaranteed capacity of our supply system up to the year 2020 will fall continuously to around 4%. In concrete terms, this means that in 2020, with a forecast wind power capacity of over 48,000MW (Source: dena grid study), 2,000MW of traditional power production can be replaced by these wind farms*". Eliminate fossil fuels tomorrow as radical green activists insist, and almost everyone in the developed world would be dead in a few months from starvation. Would the climate reverse to its mean, as most natural systems tend to do as they are self-regulated otherwise they would have diverged long ago, and temperature unfortunately start cooling, then foolish politicians would have brewed the perfect storm. They have adopted dysfunctional climate-and-energy policies to "*fight global warming*" and have crippled energy systems with intermittent, expensive "*green energy*" schemes that destabilize the electric grid, at a time when catastrophic global warming is not happening and moderate global cooling may be imminent.

But the disruptions to market economy go far beyond as current government regulations typically force wind power into the grid ahead of conventional power, and pay the wind power producer equal of greater sums for wind power versus conventional power, which artificially makes wind power appear more economic. This practice typically requires spinning backup of conventional power to be instantly available, since wind power fluctuates wildly, reportedly at the cube of the wind speed. The cost of this spinning backup is typically not deducted from the price paid to the wind power producer. The true factor that reflects the intermittency of wind power Is the Substitution Capacity (SC), which is about 5% in Germany – a large grid with a large wind power component. Substitution Capacity is the amount of dispatchable (conventional) power you can permanently retire when you add more wind power to the grid. In Germany they have to add ~20 units of wind power to replace 1 unit of dispatchable power. This is extremely uneconomic and a first estimate is given by Allan MacRae[407] where it is considered "*that the substitution capacity of ~5% is a reasonable first approximation, that is 1/20th of the value of reliable, dispatchable power from conventional sources. Anything above that 5% requires spinning conventional backup, which makes the remaining wind power redundant and essentially worthless*", this breaks down preconceived ideas about the reassuring but misleading Capacity Factor[408] (CF) of wind power, which for examples in Germany equals about 28%. However, as explained before, the CF is not a true measure of actual usefulness of the grid-connected wind power. Therefore, vital electric grids to modern societies and energy prices have been destabilized and manipulated, electricity costs have soared (Labunets, 2014), and Excess Winter Deaths[409] (EWD) have increased due to grid-connected green energy schemes.

Allan MacRae reminded in May 2018 that cheap, abundant and reliable energy is the lifeblood of society; it's that simple. Driving up energy costs with intermittent and costly "green energy" schemes is proving to be a disaster, as he confidently predicted in his 2002 written debate for APEGA (2002)[410]. From the excellent E-On Netz Wind Report 2005 one can assess that sadly, green energy is not all that green. While it produces little useful energy, intermittency and the lack of practical energy storage are their major flaws. Allan MacRae further states "*Germany has calculated that it needs 95% spinning backup of conventional energy (e.g. natural gas turbines) to support their wind power schemes – it would make much more economic sense to just scrap the wind power and use the gas turbines. Driving up energy costs just increases winter mortality, which especially targets the elderly and the poor. Early estimate are about 48,000 Excess Winter Deaths in the UK this year, half the annual average of the USA, which has FIVE times the population of the UK. The bottom line is when politicians fool with energy policy, real people suffer and die. Most politicians are so scientifically illiterate they should not even opine on energy, let alone set policy. Posterity will judge this green energy nonsense harshly, as the most costly and foolish scam in human history*".

One of the countries most affected by the "green policies" is Germany. It's shocking and ironic to observe that Germany has shut down most of its nuclear plants following political / ideological lobbying by ecologists and that when it needs electricity mostly in winter, it ends re-starting gas and coal powered plants when intermittent production systems are off and even in last resort it must buy electricity from its neighbors, mainly France having the largest installation of nuclear plants in Europe. But this is not the only oddity and as explained by Prof. Fritz Vahrenholt "*Worse, it's a gigantic redistribution from the bottom to top, from the poor who cannot afford a solar system to rich property owners who own buildings with large roof areas. The German Minister of Environment fears a burden of 1000 billion euros by 2040. Twenty billion euros are being paid out by consumers for renewable energies in Germany each and every year. Currently that amounts to 250 euros per household each year and it will increase to 300 euros next year. It is truly outrageous that 1) 40% of the world's photovoltaic capacity is installed in Germany, a country that sees as much sunshine as Alaska, 2) we are converting wheat into biofuel instead of feeding it to the hungry, and 3) we are covering 20% of our agricultural land with corn for biogas plants and thus adversely impacting wildlife. We are even destroying forests and nature in order to make way for industrial wind parks. On windy days we have so much power that wind parks are asked to shut down, yet they get paid for the power they don't even deliver. And when the wind really blows, we "sell" surplus power to neighboring countries at negative prices. And when the wind stops blowing and when there is no sun, we have to get our power from foreign countries. In the end we pay with the loss of high-paying industrial jobs because the high price of power is making us uncompetitive*". Unfortunately for the German citizens who did not vote for these

407 https://clintel.org/interview-allan-macrae/

408 Capacity Factor equals (total actual power output)/(total rated capacity assuming 100% utilization)

409 Excess winter deaths are defined by the Office for National Statistics as the difference between the number of deaths during the four winter months (December to March) and the average number of deaths during the preceding August to November and the following April to July

410 The Association of Professional Engineers and Geoscientists of Alberta.

foolish lunacies, this may be only the start of much worse as the WBGU (2011) programme "*Main Report, Changing World, Social Contract for a Great Transformation*" becomes a reality, or a total nightmare come true.

Germany is not the only country affected by these deranged policies. Based on a quote from the SEPP article – TWTW Oct 21, 2017 (SEPP, 2017) relying on the numbers provided by the U.S. Energy Information Administration[411] (EIA) a disturbing example of the inefficiency of the renewable energy sector in the U.S. is highlighted. But from there, one can extrapolate elsewhere and that bodes badly for energy costs in the future. In SEPP (2017) is stated "*Number of the Week: 2.2 million workers needed to replace 52 thousand?*" One should remind that one of the sillier essays in Politico stated: "*And as jobs go, coal mining is now a tiny sliver of the U.S. economy, employing about 52,000 Americans last month, down 70 percent over three decades… By contrast, the solar and wind industries employed almost 10 times as many Americans last year, and they're both enjoying explosive growth*". Thus, if this essay is correct (the definitions are vague), the energy industry that employed only 52,000 in mining produced 30% of the US Electricity in 2016, but wind and solar required 520,000 employees to produce 7% (6% wind and 1% solar). To generate the electricity produced by the coal industry, the wind and solar industries would need 2.2 million workers. Who can afford such inefficiency?

In terms of power generation, let's also see how inefficient it is. As we have already reminded the reader, one cannot compare a controllable means of production, referred to as dispatchable source of energy or dispatchable power plant, with a randomly intermittent and unpredictable generation system such as wind and solar energy with a load rate of 22% and 12.5% respectively. Because with a randomly intermittent generation system, since it does not necessarily provide at the moment when the customer presses the switch, for 1 MW of randomly intermittent generation system, 1 MW of dispatchable generation system is required. To give some context, let's look at the installed power-mix of Germany with 220 GW for 100 GW of "renewable" (cumulated solar plus wind) while France has 130 GW installed for 27 GW of "renewable" (solar plus wind). Then, let's make the following small calculation further to a discussion with Christian Semperes[412] to fix ideas and give orders of magnitude: a 1300 MW nuclear power plant, with 75% load rate, produces on average 1300 x 75% = 975 MW, actually supplied over 1 year. Let's determine what is the equivalent for wind power: 975 / 22% = 4400 MW of installed power. Thus, one needs 1100 wind turbines to produce the equivalent of one single "average" nuclear power plant (1300 MW), knowing that they will not produce when the customer needs them, so the same amount of MW of average dispatchable power must be provided (as a backup). Otherwise, the customer will be in the dark, 78% of time. For solar, it is necessary to count 1 MWp (MW peak) for 2 ha of solar panels installed. MWp is the power in the best conditions of sunshine, no clouds, at the summer solstice, sun at the zenith at 12 h. The average load rate observed in France is 12.5% of the installed nameplate capacity, thus to obtain an equivalent production for the 975 MW nuclear plant, it takes 975 / 12.5% = 7800 MW of installed solar power. So converted in area 7800 MW x 2ha / MW = 15,600 ha. Given that the area of Manhattan is 5,913 ha, one can easily grasp that the solar equivalent of a nuclear power plant is not far from 3 times the surface of Manhattan entirely covered with photo-voltaic panels, always knowing that the production will not be synchronous with the customer's needs. In particular for the solar, it is generally at night that we illuminate the light... it will therefore require another dispatchable means of production to illuminate the customer's house.

Thus, not only these industries are inefficient and simply do not make sense as they constantly need a dispatchable production means as a backup, but they are also ecological only in name. In particular, it seems that if the polar bears are doing fine, the bats will not survive the wind farms. The source of electricity preferred by global warming alarmists - wind power - kills nearly a million bats each year, not to mention the more than 500,000 other birds also killed each year in the U.S. alone (Hayes, 2013; Hein and Schirmacher, 2016). Even if some curtailment techniques could lower the dramatic impact on numerous species of bats (Baerwald et al., 2009; Hayes et al., 2019), this appalling death toll occurs every year even while wind power produces just 3% of U.S. electricity. Ramping up wind power to some significant percentage of U.S. electricity production would likely increase annual bat kill to several millions every year, but if the polar bear receive a lot of useless attention it seems that bats and birds can be killed in numbers without the ecologists frowning a bit as the wind is trendy. Unfortunately, bats are K-selected species, i.e. long-lived animals and very slow reproducers and their populations rely on very high adult survival rates and can only recover from big losses very slowly. Bats will not handle such damage year after year and will not survive the turbine carnage (Frick et al., 2017), but who cares, wind farms can exterminate bats and nearly kill a million birds a year on current run-rate, but only labeled as ecologically trendy. This is one more example of a creepy cognitive dissonance (see section p. 293), when biologist Cris Hein of the nonprofit group Bat Conservation International states as reported by Amos (2016) "*We see the impact of climate change on bats, and so we're in favor of renewable energy (…) It's unfortunate that one of those - wind energy-*

411 https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php

412 https://www.linkedin.com/in/christian-semperes-74109694/ Christian has 35 years of experience of nuclear energy production.

has this negative impact". So the bats have survived to 52 millions years of climate change (Simmons et al., 2008) but they are going to be decimated over less than a decade for their good because they were suffering of the illusory "man-made" climate change. Well played. Of course, we talk of a global disappearance in the making as these bird-slicing, bat-chomping eco-destroying devices entail the same effects worldwide, e.g. German turbines decimate more then 200,000 bats every year, as well as many birds coming from far away, as far as more than 1,500 km. This will first reduce the populations but soon will eliminate many bird species in Europe.

So why do these wind-farms keep flourishing? The answer was given by Newman (2012a) in his paper 'Against the Wind' "*I am not a conspiracy theorist, but we have witnessed the birth of an extraordinary, universal and self-reinforcing movement among the political and executive arms of government, their academic consultants, the mainstream media and vested private sector interests (such as investment banks and the renewables industry), held together by the promise of unlimited government money. It may not be a conspiracy, but long-term, government-underwritten annuities have certainly created one gigantic and powerful oligopoly which must coerce taxpayers and penalise energy consumers to survive*". Newman (2012a) concludes with a frightening perspective, alas becoming true in most countries run by high-ranking civil servants representative of the Sir Humphrey Appleby[413] syndrome "*But don't expect help from academia, mainstream media or the public service. They are members of the same establishment and worship together at the altar of global warming. By ruthlessly perpetuating the illusion that wind farms can somehow save the planet, they keep the money flowing. All the while the poor become poorer, ever more dependent on welfare and colder in winter. The conclusion is clear. Our once independent public service is no longer servant but master! Sir Humphrey is firmly in control*". Well, isn't that the idea; to keep us dependable and them ruling and taking care of us.

"*The cost of intermittent, unreliable wind energy is roughly twice the market rate for onshore wind; three times the market rate for offshore*" (Delingpole, J., 2016). Of course, that kind of lousy business plan and feckless kind of operations cannot operate on a free-market and the only way to make it happen, to force it into fraudulent existence, is when people are mandated by the government(s) to do so: which is what of course is happening across Europe and in the US. Plimer's (2017) book was reviewed by Derek Wyness who stated "*This book is an exposure of the on-going greed, corruption, fiscal waste, skulduggery, moral and political ineptitude of governments and energy shysters the world over today.*" The Climate Policy Initiative (CPI), an international think-tank that publishes annual analyses, says that total climate-related financing was $510 billion to $530 billion in 2017 and overall, renewable-energy systems, energy-efficiency projects and sustainable transport take the lion's share of climate financing, the CPI analysis shows (Yeo, 2019a). It appears that adaptation projects receive limited fundings of $22 billion a year, whereas the mitigation activities such as building solar power plants and bat-chomping wind-farms were supported by $436 billion of tax-payers' monies.

More generally, reporting on various "experiences" led in the US, Legates (2019) reports: "*I have watched issues of climate stabilization play out in Delaware. I implore the Commonwealth of Pennsylvania to not make the same mistake. Let me provide you with an example from Delaware. To facilitate a green economy and cut carbon dioxide emissions, the State of Delaware has given millions of dollars to Bloom Energy to create green energy jobs. We are on the hook for another ten years of subsidies. This boondoggle is funded by Delmarva Power ratepayers through a feed-in tariff which has made electricity in Delaware more expensive. Amazingly, Delaware declared natural gas as a renewable energy resource – but only if consumed in a Bloom Energy fuel cell. This allowed Bloom Energy to qualify for subsidies under the Renewable Portfolio Standards Act (RPSA). Less than 300 jobs were ultimately created, and the removal of hazardous waste that Bloom claimed its fuel cells do not create has been an ongoing problem. Presently, a consortium of both Conservative and Environmental groups is fighting to get the Bloom Energy deal repealed. Unfortunately, the Delaware State Legislature has no spine and refuses to remedy the problem. And all of this has occurred as a direct result of our intent to lower greenhouse gas emissions according to their climate action plan. Let me conclude by saying that no one should vote to make electricity less affordable and more expensive, especially for the poor. High-cost electricity does not "create jobs", and history has shown it destroys them as energy-intensive businesses will flee the state. And when all is said and done, Pennsylvania's climate will be virtually unaffected for all the pain these policies will cause*".

Being obsessed by CO_2 in a baseless way still enable Hansen et al. (2017) to come up with lucid recommendations to maintain or even strengthen nuclear capacity "*Any reduction in France's nuclear generation will increase fossil fuel generation and pollution given the low capacity factors and intermittency of solar and wind. Germany is a case in point. Its emissions have been largely unchanged since 2009 and actually increased in both 2015 and 2016 due to nuclear plant closures. Despite having installed 4 percent more solar and 11 percent more wind capacity, Germany's generation*

413 https://en.wikipedia.org/wiki/Humphrey_Appleby

from the two sources decreased 3 percent and 2 percent respectively, since it wasn't as sunny or windy in 2016 as in 2015....And where France has some of the cheapest and cleanest electricity in Europe, Germany has some of the most expensive and dirtiest. Germany spent nearly EUR 24 billion above market price in 2016 for its renewable energy production feed-in tariffs alone, but emissions have remained stagnant. Germany is set to miss its 2020 emission reduction goals by a wide margin. Despite its huge investment in renewables, only 46 percent of Germany's electricity comes from clean energy sources as compared to 93 percent in France". The only merit of France is to rely on the General de Gaulle nuclear energy policies that have delivered for half a century reliable and cheap electricity. This has changed as up to more than 40% of the price are now embedded taxes (with VAT), including disguised subventions to the "renewable" sector. Of course, the skyrocketing of electricity prices due to the subsidies allocated to the renewable is something that has struck customers in most countries where these moot policies have been followed, e.g. price increases have been 51% in Germany during its expansion of solar and wind energy from 2006 to 2016; 24% in California during its solar energy build-out from 2011 to 2017; over 100% in Denmark since 1995 when it began deploying renewables (mostly wind) in earnest. This leads Shellenberger (2018) to ask a good question in his paper "*If Solar And Wind Are So Cheap, Why Are They Making Electricity So Expensive?*". We've already seen the answer, because they are so ineffective. Finally, the notion of renewable is more subtle than it seems as if you have an infinite stock with respect to projected consumption that will ever be made by mankind (e.g. ultimate stock of U that can be recovered from the oceans), then the situation is not that different from a pure renewable which in any case requires to make use of non unlimited resources to be implemented and deployed. In that respect, one will notice that if Uranium (U) is mined today the situation might differ in the future, because an increase of the price will make other technologies competitive, and U can and will be extracted from the oceans using adsorbents or other resins, the resource if not strictly speaking renewable is infinite with respect to the limited nuclear fuel consumption of the nuclear plants, see e.g. (Slocum and Haji, 2017). Furthermore, the nuclear industry has several other technical offers that make the industry much more promising than renewable and has proven itself as a reliable baseline power supplier, what most renewable will never be. Also, as Sornette (2015) pointed it out, investing 2% GDP annually to strengthen our nuclear capacities and technologies would create an economic boost of significant importance and benefit many sectors of science and technologies.

In the wake of climate change, there are major efforts of global social engineering, including global socialism (Bastasch, 2014) aiming at the destruction of our despised so-called "capitalists" systems, see e.g. (Hornborg, 2017), deindustrialization and population reduction (Harte and Socolow, 1971) as "solutions" to problems not yet proven to even exist which have already led to economically disruptive accords based on frauds as for example, the so-called "*Paris Accord*" (Godwin, 2018). The great transformation or "reset" of WBGU (2011) or the great transition[414] of Hornborg (2017) are disruptive, perhaps even revolutionary political attempts to overturn our global economic system and to substitute them with miserable ideas that have already failed whenever and wherever they have been enforced. The only way they can sustain themselves once the economic disasters are instituted is by state violence. The weapon to achieve these disasters is climate change. They dream of a "*post-capitalist society*" that would heal "*deepening global injustices*". What injustices? Like paying fat university salaries to the saboteurs of the very system that sustains them to produce stupid ideas? Hornborg (2017) goes on "*For the planet to stand any chance, the global economy must be redesigned*." Why? Everything is working fine as it is, as long as those ship scuttlers do not have a hand on the wheel, what a ludicrous statement and they keep going "*Climate change and the other horrors of the Anthropocene don't just tell us to stop using fossil fuels - they tell us that globalisation itself is unsustainable*". Climate has always changed long-before their "Anthropocene", a made up word with no meaning which has no place in science. As Brendan Godwin asserts "*Alf Hornborg is essentially saying in all of this that the capitalist system is unsustainable. It has given us a modern world with all it's creature comforts. Jobs with comfortable living standards. All modern technology. It has dragged billions out of poverty*".

All these "great transformation / transition" are just great socialist or communist illusions and deceptions, they are the systems that have failed badly everywhere they have been tried. China abandoned it decades ago realizing it was a failure and instigated a capitalist globalized system. Venezuela was one of the richest countries in the world, a founding OPEC member. It took socialism just 10 years to turn that country into one of the poorest nations that now needs to import oil and blames for their failure the U.S. It's population have to fight in the dumpsters for food. Russia, slowly recovering of 70 years of the "great soviet transformation" has still a GDP the same as Australia while being one of the richest nations on Earth with respect to mineral and natural resources. Australia divides it cookie jar among 25 million people. Russia has to divide the same cookie jar among 144 million people. Cuba is an absolute disaster. These

414 https://greattransition.org/contributor/alf-hornborg

dystopian visions of socialist inspiration share a common weapon to achieve these economic calamities: climate change[415]. The "solutions" proposed will have massive impact on global society and change the course of history like nothing we ever saw. Billions of people will die of poverty and increased malnutrition if global deindustrialization and demodernization happens. The Earth can survive the impacts of modern industrialization as long as care is taken to avoid pollution and the obvious undesirable side effects of certain activities, but society cannot revert to the regime of subsistence of hunter-gatherers. That will leave a scorched earth more than any climate change.

Socialism is never far away when discussing climate-nonsense. Recently James Hansen stated his support for **a revenue-neutral fee and dividend system to impose a price on carbon that returns the money collected from the fossil fuel industry equally to all legal residents of the United States**. In an interview on CBC television on March 3, 2015, Dr Hansen stated "*The solution [to climate change] has to be a rising price on carbon and then the really dirty fuels like tar sands would fall on the table very quickly. They make no sense at all if you look at it from an economic-wide perspective. If we would simply put a fee on carbon – you would collect from the fossil fuel companies at the source (the domestic mines or the ports of entry) and then distribute that money to the public, an equal amount to all legal residents, that would begin to make the prices honest. And that's what the economy needs in order to be most efficient. Right now the external costs of fossil fuels are borne completely by the public. If your child gets asthma, you pay the bill, the fossil fuel company doesn't. What we need is to make the system honest*". So the government must tax the product that you need by making "carbon" prices rise, then redistribute your own money to make people believe that they cannot make a living without government subsidies and care, and if your child get asthma – even if there not the slightest relationship with any fossil fuel company - believe that someone else than you will foot the bill. Hansen is a socialist political illusionist and wizard who as all leftists explains you that with more taxes on the product you need (direct, indirect, or sophisticated as carbon emission rights that the final customer pays anyway), you'll be richer and will be better of. Note that as all illusionists of his kind, he has himself always been very well off thanks to the taxpayer's money that has kept flowing throughout his entire and long career.

As far as the "*Paris Accord*" is concerned, it is reminded by Viv Forbes that "*China, India, Russia, Brazil, South Africa and Indonesia will ignore Paris. USA has already quit and Japan even withdrew from the Kyoto Treaty. Germany will fail to meet its obligations and Poland will not try very hard. France relies heavily on nuclear power and naturally supports imposing Paris handicaps on competitors. Australia has huge coal, gas, oil and uranium resources. To export these, while we hobble our industries with windmill power, is insane*". Basically, the burden of the devoid of reason reductions of man-made emissions will fall on a small number of countries, that unfortunately deserve these stupid policies as they have the greatest contingents of green and anti-capitalists voters all joining in an effort to destroy the economies that sustain them and the hand that feeds them. In the meantime, most of the rest of the developing world are just attending climate conferences, hanging around in there, hoping for a flood of cash coming from the climate compensation fund or from selling phony carbon credits.

Follow the money is certainly a better way to understand what is on-going than trying to comprehend the intricacies of the science, as there is no science but a lot of monies at stake. Considering carbon dioxide as a pollutant has led to an incredibly complex exchange system of carbon permits that are traded on many regulated markets with the fat fingers of the supra-national bureaucracies (like the EU who allocates the permits), with the stated intent to observe a market-driven increase of the cost of the permits by reducing their numbers and making economic agents bid them up. This is supposed to lead to a decrease in emissions, without imagining the disastrous consequences on the costs of products, services and energy, which in fact impoverishes mainly the European population. But, these consequences do not appear to matter much to our great leaders that will reign over a field of ruined citizens and industries, as is always the case when bureaucracies follow their stupid and heavy handed policies. The soviet union had been a good example of follow the line of the party and the bureaucrats know better than everybody, but it seems that no lesson was drawn.

The consequence is that trading in emission permits is one of most mind blowing and fastest-growing segments in financial services in the City of London with a market which was already estimated to be worth about €30 billion in 2007, whereas it started just two years before in 2005, as part of the Kyoto Protocol and bears the imprimatur of the United Nations[416]. Louis Redshaw, head of environmental markets at Barclays Capital, predicts that "*carbon will be the world's biggest commodity market, and it could become the world's biggest market overall*" (Kanter, 2007). He might be right as the market grew up to an incredible record $214 billion last year (Reuters Staff, 2020), and the world's largest

415 https://www.conservapedia.com/Socialism_and_global_warming

416 That process began in Rio de Janeiro in 1992, when 160 countries agreed the UN Framework Convention on Climate Change (UNFCCC).

carbon market, the EU's Emissions Trading System[417] (ETS), makes up of almost 80% of traded volume (plus derivatives, i.e. options and futures). This sort of emissions trading scheme or ETS, also known as cap and trade, is a "*market-based approach to controlling pollution by providing economic incentives for reducing the emissions of pollutants*"[418]. This is simply insane as CO_2 is not a pollutant, has never been and will never be, it is the gas of life and one can see how far into delirious policies the UN and Kyoto have already led us into. Carbon dioxide has been bundled up with other GHGs such as methane (CH_4) – who will buy emissions permits for the termite ants?, nitrous oxide (N_2O), hydroflurocarbons (organic compounds that contain the carbon-fluoride bond), perfluorocarbons (C_xF_y), sulphur hexafluoride (SF_6), sulfur dioxide (SO_2), etc. The benefits of limiting the emissions of some of these gases could be debated, but unfortunately they weigh nothing in the grand scheme of things where CO_2 has been designated as the great culprit without the slightest beginning of rationality, rather to the contrary. Be ready to have to buy some time in the future an emission permit to enable you to expire the air you breathed.

All these unbelievable policies run under the totally unproven assumption that CO_2 will harm the climate, whereas rather the contrary can be expected. They are under the responsibility of the European Commissioner for Climate Action. The position was created in 2010, being split from the environmental portfolio to focus on fighting climate change and was first occupied from 9 February 2010 to 31 October 2014 by Connie Hedegaard[419] who holds an MA in Literature and History, then by Miguel Arias Cañete[420] from 1 November 2014 to 30 November 2019, who after graduating in 1974 reading Law at the Universidad Complutense joined the Spanish Civil Service at the State Lawyers Corps. His first position was in the Spanish Tax Agency at Jerez de la Frontera, before transferring to the Cadiz office. In 1978 he resigned as a civil servant to become a Professor of Law at the University of Cádiz, where he remained until 1982. He is succeeded by the current commissioner who is Frans Timmermans[421] who entered the Radboud University Nijmegen, where he graduated with an MA degree in French Literature in 1985. In 1984, he also enrolled at the Nancy-Université in Nancy, France, where he read European law, French Literature and History, obtaining LL.M. Eur and MA degrees in 1985 and later pursued a diplomatic career. It's always instructive to know who those high civil servants are who dedicate their lives to steering these ambitious climate change policies that will contribute to ruin European peoples.

All these ideas started a long time ago as on April 23, 1990, Richard Stewart, E. Donald Elliott, and David Hawkins (Breger et al., 1991) spoke before the Administrative Conference of the United States on the use of economic incentives in environmental regulation. Presented during the Congressional debate over the Clean Air Act Amendments, the speeches focused on the use of emissions trading as an alternative form of pollution control and describe in a fairly reasonable manner the insane mechanisms that will be later enforced. What appeared to be a discussion between legal experts and jurists has turned 30 years later into a nightmare that may cost trillions to the people of the unfortunate countries that will be affected by these policies. Because the cost and suffering is never borne by the illuminated that devised and implemented such ideas but by the middle-class family that will not make ends meet any longer and will see its standards of living crumble under the weight of disguised taxes, supposedly redeeming them from their pollution sins. The resulting inflexible limitations on GHG growth could entail very large costs, perhaps running into many trillions of dollars globally, if countries have to solely rely on their own domestic measures, and this is one important economic reality recognized by many of the countries that signed the Kyoto Protocol.

If you want to get a glimpse of how unhinged green-inspired gurus think, the paper from O'Neil (2020) "*Covid-19: a glimpse of the dystopia greens want us to live in*" is well worth it, but he also warns "*Greens really should be careful when they talk about Covid-19, because it won't be long before more and more people realise that this unpleasant emergency we are living through is just like the warped dystopia greens want to build*". As if UN's eco-medievalists, EU bureaucrats indoctrinated by years of relentless lies by illuminated climate-bonkers like outgoing Potsdam Institute director Hans-Joachim "John" Schellnhuber[422] and deranged green activists like "god" David Attenborough who has said

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417 https://en.wikipedia.org/wiki/European_Union_Emission_Trading_Scheme

418 https://en.wikipedia.org/wiki/Emissions_trading

419 https://en.wikipedia.org/wiki/Connie_Hedegaard

420 https://en.wikipedia.org/wiki/Miguel_Arias_Cañete

421 https://en.wikipedia.org/wiki/Frans_Timmermans

422 As reported by Gosselin (2018) in an on-line article titled "*Climate Change Like An Asteroid Strike*" appearing in Germany's national daily Süddeutsche Zeitung (SZ), journalist Alex Rühle reports on the outgoing director of Germany's alarmist Potsdam Institute for Climate Impact Research (PIK), Prof. Hans-Joachim "John" Schellnhuber who states "*What man is doing today is similar to the asteroid strike known as the Cretaceous–Paleogene extinction event*". Obviously the deranged Schellnhuber knows nothing to what he speaks about as the K-T impact he references as similar to the damages mankind is supposed to inflict to the poor Earth now is simply 10 billion times more powerful than the Hiroshima bomb which released an estimated 6.3 x 10^{13} J

humans are "*a plague on the planet*" (Gray, 2013). If that were not enough, the top of insanity comes with Timperley (2020) who reports on "*The law that could make climate change illegal*", yes read it again, a Danish law "*could turn out to be one of the closest things yet to a law that would make climate change – or at least the lack of effort to stop it – genuinely illegal*". This is the ultimate non-sense after all, these gesticulations could also try to make the rain or tides illegal, and alas is along the lines of one especially noteworthy ruling in 2015, a court in the Hague ordered the Dutch government to cut its emissions by at least 25% within five years, even though nobody is able to assert with the slightest confidence which effect this could have on climate. The case, brought by Urgenda[423], was based on the legal obligations of the government to exercise a duty of care to Dutch citizens. One should note that this kind of ruling will have no effect on climate which cannot care less, but based on the fallacious argument that in order to protect human rights under EU policy cutting emissions was a requirement, this will lead to the impoverishment of all the Dutch citizens for their good while bureaucrats, ONGs, activists and judges will consider that it was their duty to take care of them!

Based on the same requirement to take care of the citizens, another sort of deranged policies is to enforce an "individual carbon quota". Delphine Batho a former French Minister of Ecology, Sustainable Development and Energy proposed the idea of establishing an "individual carbon quota" in order to limit air travel. "*The idea that we defend is to set up a carbon quota system where each year, all people, on an equal basis, have the same carbon quota, which we can accumulate over time, in order to be able to take a trip from time to time. The idea is to allow the French to take a great trip, but not every year, and certainly not several times a year*" she argues with her colleague François Ruffin an extreme leftist representative to the French National Assembly affiliated with the anti-capitalist movement. Know what you ask for and who you vote for, you're going to get it; for your good you'll spend your holidays at home (Domenech, 2020). The reader interested in a French perspective on all these matters can read Beauzamy et al., (2015a-b). Impact on all industries and economic sectors is already measurable through a host of coercive regulations, air transport being just one of the unjustified targets, see e.g. Bourgeois (2018).

The politicization of science is, alas, nothing new, with lurid consequences. In fact the subject is so tainted that even an article as the one produced by Wikipedia cannot write two paragraphs without enunciating blatant contradictions. See for yourselves: "*The politicization of science is the manipulation of science for political gain. It occurs when government, business, or advocacy groups use legal or economic pressure to influence the findings of scientific research or the way it is disseminated, reported or interpreted. The politicization of science may also negatively affect academic and scientific freedom. Historically, groups have conducted various campaigns to promote their interests* ***in defiance of scientific consensus****, and in an effort to manipulate public policy*"[424]. So, the reader has not gone further than the first paragraph before the notion of consensus is brought to him / her. But one page later, and curiously dealing with "Global Warming" the reader is instructed that "*However, as* ***the scientific method does not accept consensus as a method for supporting scientific theories****, claims related to global warming cannot be assumed accurate based on consensus alone*". But when reading the article dealing with "scientific consensus"[425], strangely nowhere is reminded that this does not match the scientific method and that this notion does not belong to science but politics as soundly established by Karl Popper on the basis of falsification. In the same set of articles, it is stated that some interest groups would have taken money from Exxon, forgetting the billions funneled by the governments and research agencies sympathetic to their views or simply thinking that the best chances to get a contract are not to go against the agencies' policies, how obvious?

Examples of pseudo-science massively funded by government purses and strongly supported by many scientists and prominent personages are numerous. The paper dealing with "politicization of science " reminds us that "*Nazi Germany under Adolf Hitler was well known for eugenics programs which attempted to maintain a "pure" German race through a series of programs that ran under the banner of Racial Hygiene. The Nazis manipulated scientific research in Germany, by forcing some scholars to emigrate, and by allocating funding for research based on ideological rather than scientific merit.* ***In the early 20th century, Eugenics enjoyed substantial international support, from leading politicians and scientists****. The First International Congress of Eugenics in 1912* ***was supported by many prominent persons****, including: its president Leonard Darwin, the son of Charles Darwin; honorary vice-president Winston Churchill, then First*

whereas the originator of the Chicxulub crater that led to the K-T extinction event (see p. 237) liberated sort of 4.67 10^{23} J, i.e. 10 billion times more than Hiroshima. Instead of pontificating and being the architect of the delirious "*Great Transformation*" (WBGU, 2011) and advising head of States and the EU, he should get a crash course in geology to stop spouting non-sense.

423 https://en.wikipedia.org/wiki/State_of_the_Netherlands_v._Urgenda_Foundation A foundation representing a mere 886 indoctrinated Dutch citizens!

424 https://en.wikipedia.org/wiki/Politicization_of_science

425 https://en.wikipedia.org/wiki/Scientific_consensus

Lord of the Admiralty and future Prime Minister of the United Kingdom; Auguste Forel, famous Swiss pathologist; Alexander Graham Bell, the inventor of the telephone; among other prominent people. (…) There was a strong connection between American and Nazi Eugenics research. Nazis based their Eugenics program on the United States' programs of forced sterilization, especially on the eugenics laws that had been enacted in California". Decidedly and sadly, it seems that California executives never miss one occasion to go astray, their AGW policies will put them back into History books.
Then the article touches upon the formidable success that was Lysenkoism for the Soviet Union and its great leaders taking care of their peoples and reminds "*In the Soviet Union, scientific research was under strict political control. A number of research areas were declared "bourgeois pseudoscience" and forbidden. This has led to significant setbacks for the Soviet science, notably in biology due to ban on genetics (see "Lysenkoism") and in computer science, which drastically influenced the Soviet economy and technology*". It is worth reminding that "*from 1934 to 1940, under Lysenko's admonitions and with Stalin's approval, many geneticists were executed (including Isaak Agol, Solomon Levit, Grigorii Levitskii, Georgii Karpechenko and Georgii Nadson) or sent to labor camps. The famous Soviet geneticist and president of the Agriculture Academy, Nikolai Vavilov, was arrested in 1940 and died in prison in 1943*". As a result of Lysenkoism and forced collectivization, 15-30 million Soviet and Chinese citizens starved to death in the Holodomor and the Great Chinese Famine. Notice that Helmer (2016) in the "The Lessons of Lysenko" states "*The term Lysenkoism can also be used metaphorically to describe the manipulation or distortion of the scientific process as a way to reach a predetermined conclusion as dictated by an ideological bias, often related to social or political objectives*", perfect definition of current climate-pseudo-science. Also stressed is the difference with Lysenkoism that remained regional destroying the agricultural systems of the Soviet Union and its neighbors but nor reaching a global scale as misleading current alarmism does: Helmer (2016) "*Climate alarmism, on the other hand is broadly speaking global (even if some countries merely pay lip-service to the orthodoxy). It is imposed not by a violent autocracy, but by an intolerant and often vindictive establishment - scientific, media and political. It threatens not imprisonment and murder, but the destruction of careers. Scientists who dare to challenge the prevailing view are denied tenure, and publication, and perhaps worst of all, grant funding. As a result, those who do dare to challenge the orthodoxy tend to be older scientists secure in their careers (and their pension funds). In fact the parallels with the Soviet Union go further. On the outer fringes of the Warmism movement we see demands for "**Nuremberg-style trials**" of "**climate deniers**" and the imprisonment of directors of fossil fuel companies"*.

Unfortunately, pseudo-science can last for very long: the geocentric concept of our planetary system had widespread scientific acceptance for 17 whole centuries, from Aristotle until Nicolaus Copernicus put the Sun at its right place. During all this time the rival heliocentric concept of Aristarchus existed and had only a few followers. The geocentric model was the predominant description of the cosmos in many ancient civilizations, such as those of Aristotle in Classical Greece and Ptolemy in Roman Egypt. Interestingly, it is reminded in the Wikipedia paper on the geocentric model[426] that "*The geocentric model held sway into the early modern age, but from the late 16th century onward, it was gradually superseded by the heliocentric model of Copernicus (1473-1543), Galileo (1564-1642), and Kepler (1571-1630). There was much resistance to the transition between these two theories. Some felt that a new,* ***unknown theory could not subvert an accepted <u>consensus</u> for geocentrism***". Giordano Bruno his perhaps the most famous of the martyr freethinkers. On Thursday, February 17, 1600, on the Campo de' Fiori, he was delivered alive to the flames in front of the crowd of pilgrims who had come for the Jubilee. He is naked. Out of refinement of cruelty and to silence him, his tongue was nailed to a wooden bit. The Catholic Church has made no progress since 1600 and on May 24, 1889, at the time of the inauguration of the statue that some wanted to erect at Bruno's memory in Rome, Pope Leo XIII made public the Declaration "*Amplissimum Collegium*", and one month later, on June 30, 1889, condemning even more harshly and solemnly the monument erected in Rome to G. Bruno, Pope Leo XIII promulgated this time the encyclical "*Quod Nuper*". In 1923, 1930 and 1931, in quick succession, Pope Pius XI beatified, canonized and declared Cardinal Robert Bellarmin a Doctor of the Church. Cardinal Bellarmin had been charged, by order of his distant predecessor Clement VIII, with the task of instructing the trial of G. Bruno before the tribunal of the Roman Inquisition. By these solemn and irreversible acts, Pius XI signified that he was confirming, albeit indirectly, the permanence and finality of the judgment rendered by the Church. Finally, as proof of the Church's condemnation without return of G. Bruno, we will take as proof the definitive opinion issued by the Special Commission "for the study of the Ptolemaic-Copernican controversy in the sixteenth and seventeenth centuries", in which the Galileo case is included, a commission instituted on July 3, 1981 by Pope John Paul II. The Commission's final opinion is based on a study of the Ptolemaic-Copernican controversy in the sixteenth and seventeenth centuries. The Pontifical Commission finally returned to the condemnation of Galileo Galilei, while explaining the circumstances of the case, but it reaffirmed once again the formal condemnation of the Church against Giordano Bruno: "*Bruno's condemnation for heresy, regardless of the judgment*

426 https://en.wikipedia.org/wiki/Geocentric_model

that one wishes to make on the death penalty imposed on him, is presented as fully motivated (for theological reasons), [because] ***Bruno's Copernicanism is of no interest from the point of view of scientific reasons***". Read it again if you cannot believe it, no progress made over four centuries.
And it does not stop there, as five-year-old emails within the Pontifical Academy of Sciences have surfaced to show just how some top Vatican officials were kin to suppress any voices skeptical of the science of climate change as reported by Pentin (2021). There is no need to nail the tongue of the skeptics to a wooden bit, but more modern techniques apply as an invitation the academy had made to professor Philippe de Larminat, to speak at an important Pontifical Academy of Sciences-hosted high-level summit on "*The Moral Dimensions of Climate Change and Sustainable Development*" organized in April 28, 2015, was canceled. The meeting coincided with both Pope Francis' environmental encyclical Laudato Si (On Care for Our Common Home) published a month later, and the creation that year of the U.N.'s Sustainable Development Goals[427] (SDGs). As reported by Pentin (2021) "*Ramanathan believed that the only option was to disinvite the dissenting scientist [i.e. de Larminat] and do everything possible in order 'to avert an undesirable outcome'. Bishop Sanchez wrote back, telling them, 'Don't worry because even if this Professor de Larminat should come, he has no authorization to speak or make any kind of intervention'*". Decidedly, this Catholic Church does not nail tongues any more before burning dissenters alive, but they still silence them, and they are going to ever remain trapped into group-think, the new geocentricism being man-made climate change".

The good news is, that it won't take 17 centuries for the climate to show how flawed the AGW theory is, as natural variability over two millenniums will overturn these baseless ideas (see section p. 95). Though not as well known as the controversy of heliocentric versus the geocentric representation is the geosyncline (Knopf, 1948) versus the plate-tectonics theory controversy that lasted for decades before Wegener's model would be accepted as correct.

Laframboise (2017) clearly reminds us of why the IPCC organization can only deliver political statements in her paper "*US Scientific Integrity Rules Repudiate the UN Climate Process*". Therefore, the reader should now have it clearly understood that as soon as politics fray into the scientific arena and claim that a consensus exists to impose coercive decisions, troubles lie ahead and some people will have their names remembered into History book, but not the for good of mankind.

The money spent on the Hoax "Climate Change" was being wasted as opposed to all what can be done on real problems: pollution remediation, water supply and treatment for needy populations, natural resource exhaustion (e.g. fisheries, etc) and so much more. Billions have been spent to "prove" that CO_2 is responsible for some climate change in such an inconclusive way that the only proof asserted is "consensus", "consensus"! The Wood's (1909) experiment dismissed the "green-house effect" (refer to the halite glass experiment) which further appears to infringe one of the fundamental laws of thermodynamics (the second[428] expressed by Rudolph Clausius in the 1850s) that states that the energy flux cannot go from the cold troposphere towards the warmer Earth's surface to "heat it back". All geological and astronomical observations (including simple orbital parameters changes) concur to demonstrate that climate change has ever existed for good reasons and will keep doing so for the same good reasons, but CO_2 has become a simplistic, exclusive and obsessional rationale for most. How can it be ?

Things go even further as so-called remediation geo-engineering projects are now being started. Crowley and Rathi (2021) tell us that Occidental Petroleum Corp. (OXY), one of the largest oil & gas producer company worldwide plans to develop a direct air capture (DAC) plant that will remove carbon dioxide from the atmosphere, and add "*The company will license the DAC technology from Carbon Engineering, a Canadian startup that counts Occidental, Chevron Corp., and Bill Gates among its investors*". Think about it, based on shoddy science and false claims, that carbon dioxide would be a pollutant, a deception slowly but steadily insidiously infiltrated into minds since Revelle (1965), whereas it is the gas of life, these people are going to withdraw an essential component from the atmosphere that does not belong to them, taking the higher moral ground that it is undesirable, just a pollutant! In doing so they are depriving the poor of the world, each and every peasant, of the much needed CO_2 that enables them so far to grow and feed their families by benefiting from an increased crop productivity. Photosynthesis has been strengthened by a slight increase of $[CO_2]$ and marginal warmth that we have benefited of during the XX century. So while commercial greenhouses routinely pump in carbon dioxide so as to enhance the growth rates of plants, and the optimal level for plant growth is considered to be between 700 and 900 ppm, OXY and others are going to deprive the world peasantry of their basic resource to satisfy ideological green activists and NGOs, shoddy UN supervised and sponsored science and badly briefed worldwide leaders. The IPCC AR5 WGI (2013) report p. 502 acknowledges that "*field experiments provide a [sic] direct evidence of*

427 Jeffrey Sachs is the SDG's chief architect, Columbia University economist and population control advocate.
428 https://en.wikipedia.org/wiki/Second_law_of_thermodynamics

increased photosynthesis rates and water use efficiency...in plants growing under elevated carbon dioxide". IPCC (2013), Annex II, p. 1401, also notes that this effect occurs in more than two thirds of the experiments and that net primary productivity (NPP) increases by about 20–25% if carbon dioxide is doubled relative to the pre-industrial level. Goklani (2015) states "*A database of peer-reviewed papers assembled from studies of the effect of carbon dioxide on plant growth by the Center for the Study of Carbon Dioxide and Global Change (CSCDGC) shows that for the 45 crops that account for 95% of global crop production, an increase of 300 ppm of carbon dioxide would increase yields by between 5% and 78%. The median increase for these crops was 41% and the production weighted yield increase was 34.6%*". But the benefits are not just limited to increased and accelerated growth, Goklani adds "*the efficiency with which [plants] consume water is also increased. Consequently, all else being equal, under higher carbon dioxide conditions, less water is needed to increase a plant's biomass by any given amount*". Idso (2013) has attempted to translate these yield increases into a monetary value. He finds that over 50 years the extra produce grown by farmers has been $274 billion for wheat, $182 billion for maize and $579 billion for rice, and that the current value of the carbon dioxide fertilization effect on all crops is currently about $140 billion a year.

So basically while the poor are going to be progressively deprived of $140 billion a year coming from a natural resource, CO_2, that does not belong to anyone and that has been mainly out-gassed by the oceans as the Carbon Budget presented p.89 proves, OXY and consorts taking the high moral ground will be removing this highly critical resource to make their business "green-ideologically compatible" and as stated by Crowley and Rathi (2021) "*If governments around the world take climate targets seriously, models estimate that the world will need to bury as much as 10 billion tons of CO_2 underground annually by 2050. That's about a quarter of current global emissions. And **the industry** that does that job **could by then rake in $1.4 trillion in annual revenue**, equal to what the entire global oil and gas industry takes in today*".

So the poor will be poorer of $140 billion a year of a natural resource that will diminish on the pretext of global warming, sorry rather climate change, sorry rather climate disruption, sorry climate fantasy, while the climate fabricators will have led oil and gas companies that were just before serving the needs of their customers to embark on dubious plans, still trying to compensate their business losses on one side by new profits on the other. While M. Gates, the great benefactor of mankind, will certainly not donate his monies for these spurious schemes, but will invest it to get richer.

The destructive ideology of the "green" is also spooky as nobody can understand why people keep wishing to replace nuclear power, which delivers reliably large amounts of clean energy (and BTW produces no CO_2), with disruptive production systems that only deliver power when some conditions are met (e.g. windy, sunny), which do not necessarily match when energy is required by the consumer and create problems over electricity networks due to their intermittent nature. Cheap and reliable energy is key to maintain our societies operating and we will certainly not succeed doing so with costly whims. Instead of blindly following the dreadful political lunacies of the Eco-loons filled of intermittent, inefficient and ruinous energetic policies, mankind will only survive the inception of the Next Ice Age Challenge[429] (NIAC) if massive baseline power is available at full strength to counteract the whimsical Nature which will fail us. As Sornette (2015) pointed it out, investing 1-2% GDP of G20 countries annually to strengthen our nuclear capacities and technologies would create an economic boost of significant importance and benefit many sectors of science and technologies "*A 1% GDP investment over a decade in the main nuclear countries could boost economic growth with a focus on the real world, epitomized by nuclear physics/chemistry/engineering/economics with well defined targets. By investing vigorously to obtain scientific and technological breakthroughs, we can create the spring of a world economic rebound based on new ways of exploiting nuclear energy, both more safely and more durably*".

Cao et al. (2016) are also strong proponents of innovative nuclear programs mainly motivated by a reduction of CO_2 emissions whereas a decrease of pollution would be more than enough to justify rationally, especially in China. They propose to explore both new technological routes and new installation and exploitation possibilities, going as far the deployment of gigawatt-scale nuclear offshore platforms based on the same highly-resistant and well tested technologies as those deployed in hostile weather conditions for oil-drilling platforms in the North Sea, and try to promote a Sino-U. S. Cooperation to achieve a breakthrough. As Cao et al. (2016) report "*Some studies project that a doubling to quadrupling of nuclear energy output is required in the next few decades, ..., in order to achieve deep cuts in fossil fuel use while meeting the growing global demand for affordable, reliable energy. Technologies under development include small modular light-water, molten salt, gas-cooled, and liquid-metal–cooled reactors development*

429 So funny is the fact that the consensus in the 70ies was a return of an ice-age (Cordato, 2013) and that will just be what will happen in a millennium or two.

of large floating nuclear plants—constructed in shipyards before being towed and anchored 10 to 20 km off shore—has promise to reduce cost, speed deployment, reduce tsunami and earthquake risk, and enhance security".

Mankind needs to embark on the NIAC with the utmost desire to move up into the Kardashev Scale[430] and to do whatever it takes to succeed and certainly not to return into the cave with the Eco-fascists. Carl Sagan, who made me dream with his Cosmos series as a youngster, considered that humanity is currently going through a phase of technical adolescence, "*typical of a civilization about to integrate the type I Kardashev scale*". Michio Kaku[431] suggested that, "*if humans increase their energy consumption at an average rate of 3 percent each year, they may attain Type I status in 100–200 years, Type II status in a few thousand years, and Type III status in 100,000 to a million years*". So far we are a lowly Type 0 civilization and we have a very long way to go before being promoted to a type I civilization, that we will be given no chance to ever attain would the Eco-fascists keep running the show and mastermind the grip they have taken on people's brains with Malthusian, retrograde and nihilist ideas and succeed to run their sinister societal suicide program, using CO_2 as their opportunistic scapegoat.

Mankind faces two major risks and CO_2 is none of them: 1) collision with another celestial body (e.g. comet, asteroid, NEO in general), 2) the inception of the next glacial cycle (which should take place in 1,500-2,500 yr in the future) as this is what the current orbital variations lead us to (i.e. due mainly to a decrease of the obliquity). We can be lucky for some time with the first but the second will require a lot to be overcome. CO_2 is a chance, not a threat as it enhances plant productivity. If you think at what Earth looked like at the end of the previous glacial maximum just 25,000 years ago, there is no way to feed billions of persons in these conditions, not even speaking of the tides and coastal impact after the massive oceanic regressions that it will entail (Griffiths and Peltier, 2008), this is not a transgression of 1.6 mm yr^{-1} SLR ! As MacRae (2019) rightly surmises "*The Next Great Extinction Event Will Not be Global Warming – It Will Be Global Cooling*" and in the meantime people keep dying of the cold during winter time as the excess mortality shows in many countries and even in the UK (Campbell, 2018) with more than 50,000 deaths that cannot be blamed on the flu alone.

Remember that as stated in an excellent paper well written in clear terms for the layman by Forbes (2018) "*Humanity is best served by those who use good science to study geology, astronomy and climate history searching for clues to climate drivers and the underlying natural cycles and trends hidden in short-term weather fluctuations*". The AGW theory and its cohorts of state-funded researchers who recite like psalms their AGW motto do not belong to that category.

As reported by Bell (2013) and speaking at the Rio conference, Deputy Assistant of State Richard Benedick, who then headed the policy divisions of the U.S. State Department said: "*A global warming treaty [Kyoto] must be implemented even if there is no scientific evidence to back the [enhanced] greenhouse effect.*"

Could not be clearer to conclude.

430 https://en.wikipedia.org/wiki/Kardashev_scale
431 https://en.wikipedia.org/wiki/Michio_Kaku

4.10. Thought Police and the Fledgling of Eco-Dictatorship

«*The idea that human beings have changed and are changing the basic climate system of the Earth through their industrial activities and buming of fossil fuels - the essence of the Greens' theory of global warming - has about as much basis in science as Marxism and Freudianism. Global warming, like Marxism, is a political theory of actions, demanding compliance with its rules. Global warming, in particular, is a creed, a faith, a dogma that has little to do with science».* Paul Johnson[432]

«*Lord Kelvin's understanding of the earth's age was limited by his ignorance of nuclear interactions. The current debates about global climate change are complicated by our not understanding the physics of the sun or of the earth's atmosphere and oceans well enough to dismiss them as major causes of climate change on the earth. Dramatic climate changes like the medieval warm period at the time of the Viking settlements of Iceland and Greenland from about a.d. 900 to 1250, and the subsequent "little ice age," from about 1250 to 1700, which led to extinction of the Greenland settlements, were certainly not caused by man-made changes in the concentration of carbon dioxide in the atmosphere. Subtle changes of the sun's output and perhaps other poorly understood factors must have been much more important in causing those large climate changes than changing levels of atmospheric carbon dioxide*». William Happer

Roger Revelle at the end of his life will co-author with Fred Singer (Singer at al., 1992) an article denouncing the extravagant predictions of climate alarmism; after the death of Revelle, Al Gore, then vice president will try by pressures, threats and legal procedures to make withdraw the name of Revelle from this article; Fred Singer will stand firm and win a lawsuit against the minions of Al Gore. But ecologists as Brendan Montague are ready to go as far as claiming that Singer abused Revelle who given his diminished physical ability could not pay attention for many minutes because his intellectual capacity was severely diminished. What an insult for Revelle, as reminded by Lindzen (2012) «*To be sure, everyone who knew Revelle, felt that he had been alert until his death*». Some as Lancaster (2006) go as far as claim that Revelle never agreed nor did work with Singer, but contradict themselves « *My understanding, from conversations with Roger in 1991 and Christa in 1992, was that Roger was pressed and worn down in a single* ***multi-hour session*** *on a single day in February of 1991. This was a time when Christa and I limited our own working sessions with Roger to 15-20 minutes, because he would fatigue so quickly.* ***Apparently the session with Singer was hours long****. Shortly after publication of the Cosmos article, Roger showed it to me, saying, with clear embarrassment: S. Fred is a rather persuasive fellow*» (Lancaster, 2006). Lancaster went as far as «*He later added the charge that I had pressured an aging and sick colleague, suggesting that Dr. Revelle's mental capacities were failing at the time.*» as reported by Singer. A complete account of that shameful story is given by Andy May in his book, May (2020).

Lindzen (2012) goes on and mentions that «*occasionally, prominent individual scientists do publicly express skepticism. The means for silencing them are fairly straightforward. Will Happer, director of research at the Department of Energy (and a professor of physics at Princeton University) was simply fired from his government position after expressing doubts about environmental issues in general*». His case is described in Happer (2003) «*In my own case, I lost a federal position because of citing scientific research findings that undermined a politician's rhetoric…, but my dismissal surely serves as a warning to other government scientists and, perhaps more importantly, to non-government scientists who act as advisers to the government, that politics can trump science even in purely technical topics*». Happer (2003) explains how dissident scientists are stifled and funds made unavailable to any idea that dissents from the mainstream «*At the present time, it is very difficult to obtain funding, either from U.S. governmental sources or from private foundations, for research that does not presuppose impending environmental doom. Suggestions that moderate global warming may actually be a good thing for humanity are treated with ridicule and hostility*». Of course, this is hijacking tax-payer monies and funneling it in an arbitrary manner so as to try to get the conclusions the power expects. But as recalled by Happer (2003) in his paper in the section dealing with Lysenko «*The Lysenko episode shows that an entire scientific discipline can be destroyed if the attractions of false science are great enough and if its proponents are ruthless enough*». Happer became director on the National Security Council under the Trump administration and has fought CO_2 demonization as much as he could based on his exceptional credentials in Physics[433].

432 https://en.wikipedia.org/wiki/Paul_Johnson_(writer)
433 https://en.wikipedia.org/wiki/William_Happer

it is reported that Happer disputed in June 2019 basic climate science (i.e. Lysenkoism) in the testimony of Schoonover (2019), a senior analyst in the State Department's Bureau of Intelligence and Research, and called it a "*propaganda slogan for the scientifically illiterate*" Schoonover later resigned over the incident. It is so funny to read on Wikipedia that «Happer has no formal training as a climate scientist». It would be better that climate scientists demonstrate correct understanding of basic physics, starting with the understanding of the second principle of thermodynamics and of a proper usage of the Stefan-Boltzmann law which does not apply to the gas. Congratulation and respect to Will Happer for fighting for the truth at 80 years old, what a strength!

The goal is always the same, intimidate scientists who disagree and treat them as political opponents rather than disagreeing colleagues, and by all means make them practice self-censorship, which is more convenient than to silence them by other dints when they overtly dare to speak. In the end, targeted people demonstrate well conditioned Pavlovian reactions and practice self-censorship as they know that they have no chance to be heard or published. Whenever someone dares develop divergent views, like François Gervais (2016b) in: "L'innocence du carbone", defenders of the AGW theory jump start to discredit the imprudent dissident and argue that «*By completely distorting the words of climatologists, by presenting the data in a totally biased manner, or by making it appear that certain fundamental questions are being ignored, Mr. Gervais does not fuel the scientific debate, the debate of ideas, but fuels distrust and discredit. He is not in doubt or skepticism, but in deception and bashing*» (Dufresne, 2019). Some journalists with no scientific training have even gone as far as claiming that François Gervais, an emeritus professor of Physics at a French University, had no knowledge in «Climate Science». Everybody knows that their climate science bears no relationship with real Physics and needs to resort to «forcing», «feedbacks» and the like. One would laugh if it were not so sad.

John Christy, who maintains one of the most reliable temperature data set at the University of Alabama in Huntswille (UAH), a set of observations that make visible in plain sight how the computerized fantasies that prognostic 3 times more warming at least than observed are disjunct from reality, reported during his testimony before U.S. Senate House Committee on Science, Space and Technology that "*Because this result challenges the current theory of greenhouse warming in relatively straightforward fashion, there have been several well-funded attacks on those of us who build and use such datasets and on the datasets themselves. As a climate scientist I've found myself, along with fellow like-minded colleagues, tossed into a world more closely associated with character assassination and misdirection, found in Washington politics for example, rather than objective, dispassionate discourse commonly assumed for the scientific endeavor. Investigations of us by congress and the media are spurred by the idea that anyone who disagrees with the climate establishment's view of dangerous climate change must be on the payroll of scurrilous organizations or otherwise mentally deficient*". As if attacks and disparagements were not enough, criminals shot bullets at Christy's office windows at the University of Alabama in a terror attack (Spencer, 2017; Goldstein, 2017).

The first woman in the world to receive a PhD in meteorology, Dr. Joanne Simpson[434], declared she was "*skeptical*" of catastrophic man-made warming, but had to wait to say so... "*Since I am no longer affiliated with any organization nor receiving any funding, I can speak quite frankly*" Simpson, formerly of NASA who has authored more than 190 studies, wrote in a public letter on February 27, 2008. Simpson was described by former Colorado State Climatologist Roger Pielke, Sr. as among the most preeminent scientists of the last 100 years. "*The main basis of the claim that man's release of greenhouse gases is the cause of the warming is based almost entirely upon climate models. We all know the frailty of models concerning the air-surface system. We only need to watch the weather forecasts*" Simpson explained. "*But as a scientist I remain skeptical*" she added (Inhofe, 2008), (Watts, 2008). One will notice the decency and discretion of Simpson as compared to the permanent use of Hansen's position at NASA to push to the forefront his opinions.

As Laframboise (2016) reminds us: «*Policymakers, journalists, and members of the public need to abandon the idea that peer-reviewed research is a sound foundation on which to base public policy*». Therefore, the reader will easily understand that I have preferred from the very beginning of my involvement in this subject the e-book format rather than trying to slice what I had to say in various papers and to waste my time trying to submit to journals (Morano, 2008b), especially as the objective was to bring a comprehensive vision on this multidisciplinary climate topic. This book was written for free download for the benefit of the scientific community to inform and involve everyone for proper dialog and discussion. Beyond the initial peer-reviewed process performed by volunteer colleagues who provided constructive criticism, it is also very positive to enable each reader, whatever their take on the subject, to formulate observations and critiques so that the document be improved as an on-going process. It looks like a

434 https://en.wikipedia.org/wiki/Joanne_Simpson

significantly more modern way of doing things that the "bet the ranch" on a couple of anonymous reviewers when submitting to the traditional process. Peer-reviewing and publishing of scientific productions will certainly have to evolve to adapt to the changing XXI century world with more transparency, more flexibility, more benevolent involvement of the review process in improving research rather than barring non-conforming ideas.

This e-Book has been written to the best of my knowledge and scientific honesty and all corrections and improvements brought by the constructive reviewers who have contributed their time and efforts have been taken into consideration to make it the most accurate as possible, but censoring it for ideas that would not fit with the «consensus» or the editorial line would not have been acceptable to me. Second, the idea of being deprived of my intellectual property rights and to contribute to the business of some publisher who will establish a pay-wall that will remain in place for decades, does not seem to be the best way to ensure a wide dissemination to the ideas developed here. Some of the papers we wrote 30 years ago still remain inaccessible to a wider audience (Poyet and Detay, 1989), (Poyet, 1990), (Poyet et al., 1990) to name a very few, and whatever the impact factor of the journal, this situation does not seem to increase the readership nor justifiable as the publisher did not contribute at all to the work done in the first place, it is just a business. By publishing an e-book and encouraging each reader who considers that some good points were made to widely share and make the document viral, I anticipate having more of an impact than through journals which remain confidential to a limited audience.

I have no need to accumulate any «impact factor points» and this document is intended to be as widely distributed as possible and therefore free of charge: I wrote it out of simple scientific conviction, and do not expect any remuneration from it. Make it known and spread it around you: it will be my greatest reward. I am of course open to criticism, as it enriches the scientific debate, but I will defend my scientific positions with the utmost conviction against any illegitimate disparagement, as such ad-hominen attacks have often been noticed against the now dubbed «climate confusers» as if skeptical was not enough. We are just climate realists[435]. No funding for the work done has been granted by anyone and certainly not by the petrol, gas, coal or nuclear industries, nor by the IPCC, climate NGOs, governmental bodies and climate alarmists as you would also expect! It won't be an easy angle of attack as it was illegitimately used against Courtillot. Finally, I am ready to be treated as incompetent by all journalists and climate ayatollahs, especially those who have never obtained a science degree, as I graduated in geology, geochemistry, remote sensing, data analysis and processing, applied computer science and as a professional computer scientist developed for decades computer programs and models and as I perfectly know the limitations (and interest) of these representations of some reality and I do not confuse them with THE reality as Dyson reminded us. Anyone can disagree with what has been written here and the sources I used, but their utmost responsibility if they respect science, is to convince us of why and where we are mistaken. In the meantime, I can tell all my detractors and future foes, and I anticipate them to be many, their onslaughts will not prevent me from sleeping. To the contrary, I feel relieved to have told the truth and tried to empower people so that they can better decide of their own fate not relinquishing their destiny to schemers.

Dwarfed in the on-going battle, I should at least avoid the worst and strange fate of deathbed conversion to global warming alarm only reserved to prominent dissidents. Lindzen (2012) recalls these awkward events: «*One of the more bizarre tools of global warming revisionism is the posthumous alteration of skeptical positions. Thus, the recent deaths of two active and professionally prominent skeptics, Robert Jastrow (the founding director of NASA's Goddard Institute for Space Studies, now headed by James Hansen), and Reid Bryson (a well known climatologist at the University of Wisconsin) were accompanied by obituaries suggesting deathbed conversions to global warming alarm. The death of another active and prominent skeptic, William Nierenberg (former director of the Scripps Oceanographic Institute), led to the creation of a Nierenberg Prize that is annually awarded to an environmental activist. The most recent recipient was James Hansen who Nierenberg detested*».

However, if I am not converted post-mortem, the AGW theory and its proponents will have succeeded to steal the dream of my life. I remember as a kid watching Neil and Buzz landing on the Moon on a black and white TV set, absolutely bewildered, then in 1976 watching the first images of Chryse and Utopia Planitiae as something unreal after having seen Mars so many times and so small through a telescope, later in the 80s the Voyager probes were to reveal us, amazed, the outer solar system and all these great achievements were the success of a distant spatial agency, in a far country, the United States, the land of the free, the land of discoveries, the land of the XXI century science. The way the AGW theory has led to extreme politicization of science by so few who happen to be supported by powerful intergovernmental organizations, by the mainstream media and research laboratories having a stake to keep running the game, all this to push their ideology and a liberal agenda has had a depressing effect on my vision of the world. The

435 https://www.climato-realistes.fr/

respect that I had for all these research organizations, NASA included, these prestigious universities was considerably eroded and I began to understand Steve Jobs who did not want to have his adoptive father go into debt for him to attend an expensive university. My wonder for science and my will to try to understand and participate in this great adventure of mankind was dashed. My illusions have gone, only remains the desire and the strength not to give up, if only for István Markó (1956-2017) [see Watts (2017)] and all those who have fought for the correctness of their ideas. Let these survive them and let's hope that fall into oblivion the fraudsters, manipulators and other ideologists blinded by their certainties. Mascart (1925), the astronomer who made a monumental work on climate, already regretted then "*that researchers cherish the hope of finding simple and unique origins to climatic variations*". Thus, he would certainly be appalled by the convenient but illusory hypothesis whereby CO_2 explains everything upon which relies entirely the very weak AGW theory. It also reminds us of the excellent work of Feyerabend (1978) in his book "*Science in a Free Society*" where he defended the idea that the separation of church and state should therefore be supplemented by the separation of science and state. Feyerabend (1978) proposed that the citizens and not the government would exert a control over science (SEP, 2020), but this appears to lead to an inefficient kind of circular reasoning, because the political offer, acting as a market, already proposes choices that are backed up by the majority of the voters through the election process. Thus the political agenda that determines where the public funds go to support some research directions and stifle others is already baked into choice of the citizens. The dismal effects of a science under entire control of the governments is well addressed by Andy May (2020).

Where things become even more worrying is that, when I started this e-book, I had never imagined that in this section "Thought Police and Dictatorship of Thought" I would have to deal with another matter than the ostracism that has struck the academics and the pal-reviewing system. This is in itself a very serious subject, but is nothing comparable to what comes next. While this e-book was not far from being finished I came across a number of extremely grave stories; one of them very representative of how far the delirium has gone, is the latest to be German motto "you shut up for sake of freedom of speech" and this should have special resonance in this particular country, given its History and the immense cost paid by its citizens, neighboring Europeans, the Jews, tsiganes, etc. to give again to the word freedom some meaning. In Germany, hiding behind a rogue law, as was the case in 1933, the police of thought is now targeting all citizens, a recent appalling example is provided by the problems that Naomi Seibt met when she was summoned, for the sake of freedom of speech, to remove videos from her "Youtube" account.

What is the offense?

A functionary wrote to her that she is not "climate-friendly" (sic !), understand she is not struck, like her indoctrinated generation, by blind hysteria leading to ask for immediate political action, green-inspired, compatible with the watermelon agenda, requiring to destroy our industries, our energy production system and our standard of living for 0.01% of additional CO_2 over two centuries in the atmosphere, most of it not being even anthropogenic anyway. The Landesanstalt für Medien NRW confirmed to Reuters (Reuters, 2020) via email that: "*Ms. Seibt was requested to delete two YouTube videos because they violate German law. The basis of our decision is the prohibition of third party influence on the editorial content in audiovisual media according to articles 7 para. 7 sentence 1 in connection with 58 para. 3 sentence 1 of the Interstate Broadcasting Treaty (Rundfunkstaatsvertrag-RStV). Ms. Seibt was heard on the facts of the case. Her statement was not able to invalidate the accusation of illegal thematic placement (in German „Themenplatzierung"). Unlike in America, in Germany it is prohibited by law to provide media content, if a third party has exerted influence on it and if the cooperation is based on a compensation. Unlike in America, in Germany Freedom of speech is not touched by this ban*".

Figure 120. Landesanstalt für Medien NRW[436], i.e. State Agency for Media NRW, slogan: Der Meinungsfreiheit verpflichtet, i.e. Committed to freedom of expression (sic!), Orwell would not believe his nightmares have become everyday truth as per his dystopian social science fiction novel, see Orwell, G., (i.e. Blair, E. A.) 1949.

If we were to believe the State Agency for Media NRW and its motto "Committed to freedom of expression" ***she has to remove the videos for the sake of Freedom of speech****, what a shame, Germany revisiting its own History 87 years later*

436https://www.medienanstalt-nrw.de/ send your emails there to protest.

after the promulgation of the infamous "Verordnung des Reichspräsidenten zum Schutz von Volk und Staat" see footnote454, p. 375. Reuters (2020) state "Regional German telecommunication regulators have not fined Seibt, but have requested she delete two YouTube videos for violating German law. Seibt has appealed this decision and the matter will now be decided by a court". What would be funny if it were not tragic, is that Reuter's fact checkers just confirm the very essence of the non-sense, Seibt has to remove her video for the sake of freedom of speech and had to cease her relationship - for her good - with the Heartland Institute presented as a Alt-right organization when they are libertarians and considered by the climate-communists as scientifically illiterate whereas Fred Singer[437] (1924-2020) used to be the director of Heartland's Science and Environmental Policy Project, the rest being just menial details about the fine or not. Take care the climate-totalitarianism is going to crush us all very soon now, they are all getting mad!

As put by Monckton of Brenchley (2020a-b) "I have seldom come across so striking an example of Orwellian Newspeak. To Orwell's 'War is Peace, Freedom is Slavery, Ignorance is Strength' we can now add 'Silence is Free Speech' ". and adds "*The new law in Nordrhein-Westfalen, being defiantly incompatible with the Convention[438], is itself unlawful. The Convention expressly defends freedom of thought (Art. 9), of expression (Art. 10), and of assembly and association (Art. 11), as well as freedom from discrimination on ground of any opinion (Art. 14). The Authority's prosecution offends directly, materially and flagrantly against all these Articles, as well as against Article 6 (Right to a fair trial).* As further mentioned "*To add insult to injury, Naomi has just received a package from the Bundeszentrale für Politische Bildung[439] (the Federal Agency for Political Re-Education). Inside the package were two magazine-style propaganda tracts rebarbatively regurgitating the Party Line on global warming*". The package is just a complete set of hogwash, from the classical "-18° without an atmosphere" (how could such an absurd hypothesis make sense), to the cow farts endangering our presence on Earth. If I would subscribe to reducing meat consumption because of cruelty in the way the animals are processed (like goods), my qualms have nothing to It with CH_4 emissions. But the litany of indoctrination goes full steam, forgetting that leaking old soviet pipelines are just in competition with termite ants for the CH_4 budget (Nauer et al., 2018). One will also notice that Nauer et al. (2018) are also surprisingly vague for a PNAS paper, as they report "*20 to 80% of termite-produced CH_4 being mitigated before emission to the atmosphere*", euh..., 20% and 80% that's not exactly the same, no?

In fact, what we see now in Germany, i.e. an outright trampling of the freedom of speech, could even go further and a hint to future rogue and dystopian policies could be sensed by the drift trying to criminalize discourse that does not suit politicians and do not comply with political correctness and what Spakovsky (2016) reported is simply spooky "*In news that should shock and anger Americans, U.S. Attorney General Loretta Lynch told the Senate Judiciary Committee on Wednesday that not only has she discussed internally the possibility of pursuing civil actions against so-called "climate change deniers," but she has "**referred it to the FBI to consider whether or not it meets the criteria for which we could take action**.*". Imagine that Lynch was responding to a question from Sen. Sheldon Whitehouse, D-R.I. (71st Attorney General of Rhode Island from 1999 to 2003), who urged Lynch to prosecute those who "*pretend that the science of carbon emissions' dangers is unsettled*". Would Sheldon Whitehouse be a grassroots activist from an agitated organization missing any understanding of the most fundamental U.S. constitutional rights of the American citizens, one would not even notice such deviations to the essential values of this great nation. But with a BA from Yale University and a JD from the University of Virginia, that sort of excuse certainly cannot be raised. Let's remind that "*In the United States, the First Amendment protects freedom of speech. ... In general, the First Amendment guarantees the right to express ideas and information. On a basic level, it means that people can express an opinion (even an unpopular or unsavory one) without fear of government censorship*". There might be some exceptions[440], and the most troubling though also interesting are related to false statements of fact. In United States constitutional law, false statements of fact are an exception from protection of free speech under the First Amendment following Gertz v. Robert Welch, Inc. (1974). First, false statements of fact can lead to civil liability if they are "*said with a sufficiently culpable mental state*". The second category is a subset of the first: *knowingly false statements* (deliberate lies). This includes things like libel and slander. These sorts of statements are specifically punishable because they contain malice (intent to do harm). A third category are "*negligently*" false statements, which may "*lead to [some] liability*" and there exists two others sorts. Even though these exceptions are legitimately based on the observation that "*there is no constitutional value in false statements of fact*" one should notice that it opens the door to many interpretations. For example, the intent expressed by Sheldon Whitehouse to prosecute those who "*pretend that the science of carbon emissions' dangers is unsettled*" means that he is asserting with the strongest certitude that, at least in that domain "*science is settled*". If it were not

437 https://en.wikipedia.org/wiki/Fred_Singer

438 European Human Rights Convention

439 Federal Center for Political Education https://www.bpb.de/

440 https://en.wikipedia.org/wiki/United_States_free_speech_exceptions https://en.wikipedia.org/wiki/False_statements_of_fact

the case, simply because science is never and has never been settled in any area, what should be thought of that statement? Simple mistake as the Senator is not a scientist or can one consider that there is an intent to harm dissident scientists labeled *"climate change deniers"* by U.S. Attorney General Loretta Lynch based on false statements. Notice that the term "deniers" is not only distasteful, sneaky and spiteful as it intentionally tries to associate those scientists who legitimately question the rationale of a fragile and so far unproven theory with obnoxious people who denied the Holocaust but also plain wrong as everybody agrees that climate warmed since the end of LIA and that climate has changed and ever changed but not primarily as a result of man-made emission. Is there an intent to harm in doing so? Would referring in that way to honest scientists pursuing in their most inner conscience the quest for truth and wondering whether an additional 0.01% of CO_2 could have the effects claimed, to be an example of false statements of fact?

Along those lines, Pandora's box is opened. Science and societies have only progressed when ideas could be freely expressed and confronted to realities. The reality is that there are not 60 millions of climate refugees, that the sea level rise is minimum and started 170 years ago long before man-made emissions, that Arctic bear populations are thriving and not in danger, etc. and that none of the catastrophic forecasts made, based on the AGW theory, have never ever materialized so far and that the only damages observed will be the result of inadequate policies enforcing rogue decisions that will hamper citizen's life to no effect on the emissions and certainly no result on the climate which cannot care less.

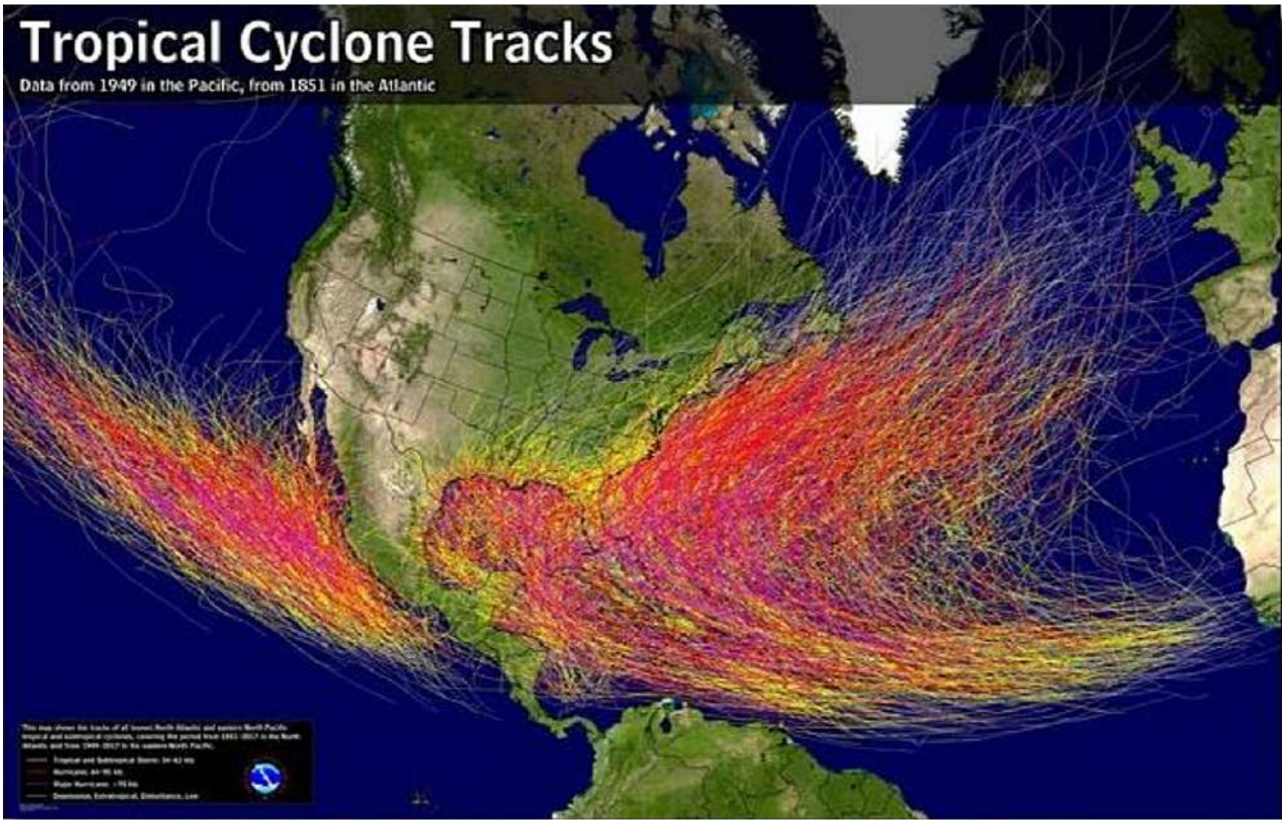

Figure 121. *Tropical Cyclone Tracks, since 1949 in the pacific and since 1851 in the Atlantic. Mark Hertsgaard must tell the deniers which one they are responsible of? Which cyclone must the scapegoats be accountable of? Does Mark Hertsgaard believe that even if mankind were to disappear entirely from this planet, tropical cyclones would suddenly cease to exist? How come? Appalling.*

Of course, the most vocal, aggressive and intolerant are those who understand the least as reported by Jackson (2017) who states for example: '*Mark Hertsgaard typed a screed in The Nation which ran under the headline:"Climate Denialism Is Literally Killing Us: The victims of Hurricane Harvey have a murderer — and it's not the storm." then "How long," Hertsgaard asked, "before we hold the ultimate authors of such climate catastrophes accountable for the miseries they inflict?*" As Mark Hertsgaard is clearly very clever, knowledgeable and prescient and knows that climate-deniers are responsible with energy providers of the hurricane catastrophes, I'll let him show us on the next picture displaying cyclones tracks since 1949 in the pacific and since 1851 in the Atlantic, which one exactly are the deniers responsible of. I'm sure he'll be doubtless pointing Harvey with great certitude in the spaghetti plot. Does Mark Hertsgaard believe that even if mankind were to disappear from this planet, tropical cyclones would suddenly stop?

Reading the brief Jackson's (2017) paper, one will discover, amazed, that Mark Hertsgaard is not alone on the ranting and future firing squad.

In an excellent paper entitled "*The Climate-Change Derangement Syndrome: Undermining Science and Demonizing Skeptics*" Jayaraj (2018) details all the dire consequences of such mental disorders and observe that these people "*will cause permanent and lasting damage to the field of climate science and stifle progress in our efforts to understand our climate system*". They will in fact ruin science (see p. 292), to which most of them understand nothing of, as they are simply scientifically illiterate, and this will have lasting outcomes undermining for long public confidence in science and scientists. The harm done by these few will be considerable. For those scientists who entrenched in their ideology misled the public and gullible politicians, they will face their conscience to know whether their stance was a forgivable mistake of whether they knew that their shenanigans were intentional, knowingly false statements. From the murky content of the climategate emails revealed, I sense that some might not be at ease with their legacy.

All these Fouquier-Tinville[441] of the new eco-revolution seem to have completely forgotten the Article 27 (1) of the Universal Declaration of Human Rights (UDHR) which states "*(1) Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits*". The right to participate and to share in scientific advancement is certainly not the obligation to submit to clueless injunctions uttered by restless potty activists going to war against common sense and logical thoughts based on observations.

Unfortunately Einstein was more than correct stating "*The world will not be destroyed by those who do evil, but by those who watch them without doing anything*" - Albert Einstein

and "*To sin by silence when they should protest makes cowards of men*" - Abraham Lincoln

Let's quote István Markó[442] to finish:

«*To begin, I believe in science: I mean that I believe in the possibility of objectively knowing reality through science. I believe that there are truth and falsehood, that science allows us to distinguish between the two, and that truth must be known; that scientific knowledge must be placed in the hands of the population. I also believe in freedom. I believe that every man is entitled to lead his life and to manage his goods as he sees fit, that he is the only possessor of himself, and that statist socio-economic control is as morally reprehensible as it is harmful in its social, economic, and environmental consequences. I note two things distressing me: firstly, the population is increasingly misinformed scientifically; and secondly, the media and governments take advantage of this to propagate a theory that is doubtful, namely that of anthropogenic warming, and to promote coercive measures on its behalf. If there is one final message I would like to convey, it is that we have to be concerned about the real ecological problems — noxious pollutants, unmanaged waste, untreated human sewage. We have to cease letting ourselves be manipulated by causes that purport to be good for our planet, but that are simply pretexts for enslaving and tying up humanity. The agreement of the Paris COP 21 was not signed to save the planet and to prevent us from roasting due to an imaginary temperature increase of +2°C. Behind all that masquerade is hidden, as always, the ugly face of power, greed, and profit. All the industrialists who are in favor of that commitment, which will ruin Europe and immensely impoverish its citizens, do so for the good reason they find in it a huge and easy source of income. As for NGOs, when they are not simply motivated by greed, their motive consists in a resolutely Malthusian ideology. Their object is to return the world to a very small population, on the order of a few hundred million people. To do so, they impoverish the world, remove the power of fossil fuel energies, and thus ensure that the number of deaths increases.*».

Thanks István.

441 https://en.wikipedia.org/wiki/Antoine_Quentin_Fouquier-Tinville
442 https://www.researchgate.net/profile/Istvan-Marko

4.11. Why a Warmer World is a Better Place to Live

"*That is to me the central mystery of climate science. It is not a scientific mystery but a human mystery. How does it happen that a whole generation of scientific experts is blind to obvious facts?...Indur Goklany has assembled a massive collection of evidence to demonstrate two facts. First, the non-climatic effects of carbon dioxide are dominant over the climatic effects and are overwhelmingly beneficial. Second, the climatic effects observed in the real world are much less damaging than the effects predicted by the climate models, and have also been frequently beneficial. I am hoping that the scientists and politicians who have been blindly demonizing carbon dioxide for 37 years will one day open their eyes and look at the evidence*" Freeman Dyson

There are only advantages to having more CO_2 and a marginally warmer world will make it a better place to live for the vast majority:

- Cooler and colder is always riskier as taught by the history of mankind. The great famines of 1315-22 (see note 118 p.99) (Baek et al., 2020) coincided with the end of the Medieval Warm Period and the Mount Tarawera eruption (Nairn et al., 2004; Hodgson and Nairn, 2005). Between 1310 and 1330, northern Europe saw some of the worst and most sustained periods of bad weather in the entire Middle Ages, characterized by severe winters and rainy and cold summers. This 1315-1322 period was marked by a dramatic death tool of up to 25% of the population in the cities and extreme levels of crime, disease, mass death, and even cannibalism and infanticide, followed by the famines of 1661-62 (known in France as the crisis of advent of the King Louis XIV) and also of 1692-93. All were due to the rain and the cold, with a little scalding (1693). At the time, after favorable harvests, the number of seeds one could eat per seed planted showed a ratio that could be as high as 7:1, but after unfavorable harvests it was as low as 2:1, that is, for every seed planted, two seeds were harvested, one for next year's seed, and one for food. By comparison, modern farming has ratios of 30:1 or more thanks to an extraordinary agricultural productivity due to fertilizers, mechanization, good weather and CO_2 bonanza. More generally, civilizations have historically endured hardships when the weather got cooler or worse became cold enough to create upheavals. The fall of the Ming dynasty[443] when the last Ming Chinese Emperor hanged himself in 1644AD (23 January 1368 – 25 April 1644) is a telling example, when the regime collapsed at the beginning of the 1640s, masses of Chinese peasants who were starving, unable to pay their taxes, and no longer in fear of the frequently defeated Chinese army, began to form into huge bands of rebels. In this early half of the 17th century, **famines became common in northern China because of unusual dry and cold weather that shortened the growing season**; these were effects of the Little Ice Age. The famine and drought (but also occasional floods) in late 1620s and 1630s contributed to the rebellions that broke out in Shaanxi led by leaders such as Li Zicheng and Zhang Xianzhong. On 26 May 1644, Beijing fell to a rebel army led by Li Zicheng; during the turmoil, the Chongzhen Emperor hanged himself on a tree in the imperial garden right outside the Forbidden City. In Europe, the 1783 A.D. through 1784 A.D., Grímsvötn (Laki or Lakagigar) effusive eruption (14.7 km^3 of basaltic lava) led to major disruptions, including famine and fluoride poisoning in several countries. In 1788 and 1789 there were poor harvests, this caused in France bread prices to rise in conjunction with falling wages, and hence led to further discontent and rural revolt. Even though the causes of the French revolution starting in 1789 and lasting 10 years are still debated among historians, the cold and unsettled weather for several years (Fuster, 1845) was the straw that broke the camel's back, as these events contributed significantly to an increase in poverty and famine. Noteworthy, in North America, the winter of 1784 was the longest and one of the coldest on record, a huge snowstorm hit the South; the Mississippi River froze at New Orleans and there were reports of ice floes in the Gulf of Mexico. There are other examples of a collapse of civilizations or of a meltdown of economies with massive societal disorders as **colder is always risker for mankind**. During the mid-seventies legitimate cooling scare, the CIA (1974) was perfectly aware of the risk and stated "*The potential implications of a changed climate for the food-population balance and for the world balance of power thus could be enormous (...) In bad years, when the US could not meet the demand for food of most would-be importers, Washington would acquire virtual life and death power over the fate of multitudes of the needy. (...) More likely, perhaps, would be ill-conceived efforts to undertake drastic cures which might be worse than the disease; e.g., efforts to change the climate by trying to melt the arctic ice-cap*". Demiurgic geo-engineering ideas were already around the corner, though better justified;

443 https://en.wikipedia.org/wiki/History_of_the_Ming_dynasty

- Photosynthesis is stimulated by having more CO_2 and plant productivity increases e.g. (Goklany, 2015; Schimel et al., 2015; Taub, 2010), both for the marine life as well as for all terrestrial ecosystems. Phytoplankton, sea algae and autotrophs are the substratum of all marine food web as zoo-planktons feeds with it and all the species further down the food chain depend on the primary productivity of the oceans and on the strength of the photosynthesis of the euphotic zone. Warmth and humidity of course favor the development of terrestrial ecosystems on land and there is no need of complex computer models to compare the exuberance and life of the tropical forest resting on warmth and rain and the dearth of the tundra or worse of polar regions where the cold annihilates most living species, where survive only a limited number of extremely well adapted forms of life. Naturally, "*A warmer climate helps promote species diversity*" says Munich zoologist Josef Reichholf;

- A warmer environment favors crops productivity and extension to higher latitudes. Since the end of LIA, the conditions have considerably improved to cultivate far more agricultural surfaces than otherwise possible (Goklani, 2015), rather than returning to a new cool period. Even a slightly milder climate extends the growing season, enhancing the food security of the populations. A more friendly climate also strongly decreases the cost of heating the housing and greenhouses where crops have to be protected to reach maturity;

- Many diseases that thrive during cold conditions, e.g. influenza and other respiratory afflictions, will be reduced by a warmer environment. This is worth noting as the positive aspects of a warmer climate on people's health are always underestimated (WHO, 2003). For example, Dr. Richard Tol, the director of the Centre for Marine and Atmospheric Science, and a prominent economist with Hamburg University in Germany, dismissed the UN IPCC touted Stern Report on the economics of climate change as "*preposterous*". Tol has also asserted that the benefits of a warmer world are frequently overlooked. Tol noted that "*warming temperatures will mean that in 2050 there will be about 40,000 fewer deaths in Germany attributable to cold-related illnesses like the flu*" according to a May 7, 2007 article in Der Spiegel (Stampf, 2007). Beyond diseases, one must just understand that people die more of cold waves and cold climate than of warmer conditions or even hot-waves. Mortality data from several countries, regions and cities with cold, temperate, subtropical and even tropical climates show that average daily mortality is even or sensibly higher in cold months than in warm months (Guo et al., 2014) and Vardoulakis et al. (2014) state "*In UK regions, cold-related mortality currently accounts for more than one order of magnitude more deaths than heat-related mortality. In Australian cities, approximately 33 and 2 deaths per 100,000 population are associated every year with cold and heat, respectively*". Goklani (2015) adds "*The risk of death is higher in the winter not only in countries in cold climates, but also in Thailand and Brazil*". ;

- By slightly warming the Arctic region (not the Antarctic as seen in section), the contrast between cold polar air masses and hot and humid tropical ones is reduced and the encounter of these conflicting air-masses generates less adverse conditions that lead to less extreme weather events, contrary to what has been wrongly postulated by AGW theory advocates. Legates (2019) states "*Warmer conditions, such as what we currently are experiencing, exhibit less climate variability than colder conditions. The Equator-to-Pole temperature gradient drives the poleward transport of energy in the climate system. Under a warmer world, the Tropics warm but the Poles warm even more. Consequently, the Equator-to-Pole temperature gradient lessens and the outbreak of much severe weather – driven by the interaction of cold polar air with warm tropical air – diminishes. Hurricane landfalls, for example, were much more frequent in South Carolina, New England, and China during colder periods*". Legates' statement is further supported by an extensive study by Liu et al. (2001) considering a 1,000-Year History of Typhoon Landfalls in Guangdong, Southern China, where they state "*this article, we produce a 1,000-year time series of typhoon landfalls for the Guangdong Province in southern China, based on Chinese historical documentary records.* ***Remarkably, the two periods of most frequent typhoon strikes in Guangdong*** *(AD 1660–1680, 1850–1880)* ***coincide with two of the coldest and driest periods in northern and central China during the Little Ice Age***". As rightfully pointed out by Leroux (1993), an increase of extreme events would result of a more severe and more regular confrontation of polar anticyclonic air masses arising from Mobile Polar Highs (MPHs) and colliding with warmer tropical or temperate air masses and would be a sign of a global cooling, not the opposite, which would just resume the neo-glacial trend that started some 5,000 years ago as displayed on Figure 34, p. 105. Such excursions of deadly MPH have recently happened such as the one that froze Moscow in 2011 (KZ, 2011) with temperature as low as -30°C, homeless people dying and others more lucky having only hands and feet freezing. This episode followed the 2010 Russian heat wave which was rightfully attributed by Dole et al. (2011) to natural variability due to a long-lived blocking event, an anticyclone characterized by high atmospheric pressures which refused to budge, forcing any cool air and rains to detour around it, acting as the equivalent of the winter MPHs but with an opposite effect. Leroux's disciples already see these events as the proof of the truthfulness of their Master's thesis and consider that they reflect a change in the global circulation, supposed to be speeding up, change that was according to them initiated in the 1970s. I agree with them that there is no connection with [CO2] changes, as these events have been observed many times in history. Interestingly, Nakamura et al. (2005) for the European heatwave of 2003 or Dole et al. (2011) for the Russian heatwave of 2010 concur that there was no means to forecast meaningfully these events just two week before they happened, even with super-computers permanently fed up with the latest data, on-site measurements, updated SSTs, aircraft real-time reports and more. How using similar software systems as those that are unable to predict 15 days ahead or even just a week ahead dramatic events like these heat-waves one could place any confidence into models supposed to tell us the what the temperature in 50 years will be? Let's be serious.

Schulze-Makuch et al. (2020) propose an interesting study where they recommend what has already been stressed here, i.e. that life generally speaking flourishes in warmer and wetter conditions (e.g. tropical forests) and struggles to survive in colder and dryer environments (e.g. Arctic, Antarctic, Siberia, etc.), which is really pushing open doors but given the hysteria about the minimal warming observed so far which would be more than welcome if it kept happening, is not a useless reminder. Schulze-Makuch et al. (2020) state "*Life requires a certain range of temperatures, which is dependent on its biochemistry, and complex life on Earth has a narrower range than microbial life (Table 1). No empirical evidence is available, however, on what that optimum is, aside from the case of life as we know it on Earth. Based on our experience from Earth, the highest biomass and biodiversity is present in tropical rain-forests, and the least in cold polar regions (Brown, 2014; Kraft et al., 2011).* ***Thus, higher temperatures than currently existing on Earth seem to be more favorable***".

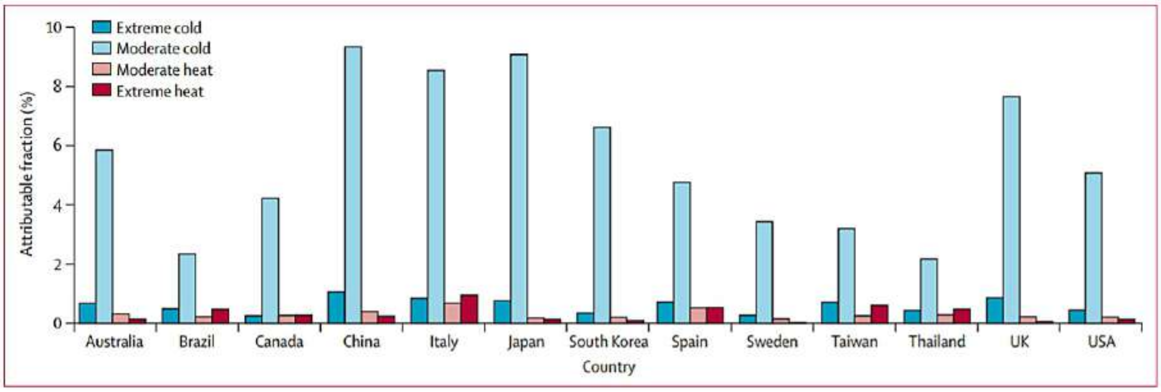

Figure 122. *Fraction of all-cause mortality attributable to moderate and extreme hot and cold temperature by country. Extreme and moderate high and low temperatures were defined with the minimum mortality temperature and the 2.5th and 97.5th percentiles of temperature distribution as cutoffs. From Gasparrini et al. (2015).*

As a picture is worth a thousand words, Figure 122 resulting from a study of *more than* **74 million cases** by Gasparrini et al. (2015), show that cold, not heat, is by far the greater killer of humanity. Today, cool and cold weather kills about 20 times as many people as warm and hot weather. **Excess Winter Deaths**, defined as more deaths in the four winter months than equivalent non-winter months, **total over two million souls per year**, in both cold and warm climates.

Ironically, Arrhenius rejoiced of the possible perspective of a milder climate and stated "*we may hope to enjoy ages with more equable and better climates*" potentially making poor harvests and famine a thing of the past. Arrhenius was merely expressing a view that was firmly entrenched in the collective consciousness of the time: warm times are good times; cold times are bad. How could so many people forget this evidence? Especially among the most well educated part of the populations, e.g. researchers and climate scientists? Never forget that the consequences of the colder temperatures that plunged civilization into the so-called Little Ice Age for several centuries after 1300 were devastating. Summers were rainy, winters cold, and in many places temperatures were too low for grain crops to mature. Famines and epidemics raged, and average life expectancy dropped by 10 years. In Europe, tens of thousands of villages were abandoned and entire stretches of land depopulated. Is that what you would prefer?

When common sense is so much defeated, one must admit that their climate-science does not smell science at all but stinks politics all over the place. Science has been tragically corrupted and sacrificed on the altar of a new world agenda made of social control of populations and world government projects in the hands of international bureaucrats, resorting to fears, be it COVID-19 or CO_2, in order to frighten people and make them willingly submit to the agenda of the dominants. The next Mencken's quote looks tragically actual because even though it comes now already from some bygone past, it is yet still so relevant so many years later. His past insights to those whose lives are addicted to the seeking of power, or control, or fame, or money is still as valid today, as it was 70 years ago. The threat to the world is not man-made global warming or climate change. The threat to the world, as is always the case, is a current group(s) of humans who want to impose their values and visions on others.

"*The whole aim of practical politics is to keep the populace alarmed — and hence clamorous to be led to safety — by menacing it with an endless series of hobgoblins, all of them imaginary." And, "The urge to save humanity is almost always only a false face for the urge to rule it.*" H. L. Mencken[444]

Furthermore, it has become increasingly clear that high solar activity protects us from deadly viral mutations that appear related to an increase of Galactic Cosmic Rays (GCRs) and lead to further widespread pandemics. A recent paper from Kamath and Kamath (2020) states "*Almost all the previous pandemics occurred during solar minimum years when the Sun spots were lowest or absent and when the solar activity was at the lowest. This study suggests that the present Covid 19 pandemic is triggered by the mutated viromes in bats from latitudes above 30 degrees N. The increase in cosmic ray flux during the solar minimum of solar cycle 24 has contributed to this*". This conjecture is also supported by Wickramasinghe (2020) who sees a direct relationship between the cosmic ray spike measured in late November 2019 and the on-spread of the recent pandemics.

Measurements of GCRs intensity and their modeled distribution (at various altitudes and latitudes) are performed by Matthiä et al. (2013) who show how geomagnetic shielding (strongly related to the solar wind) and primary particle intensity mainly influence the potential disruptions caused by GCRs on Earth. In that respect, one can conclude that GCRs have a double whammy effect, first acting on the global cloudiness and albedo changes and leading to cooling and unsettled weather during low solar activity cycles and second by triggering the onset of miserable sanitary conditions that plague mankind, which is just what can be observed over the last 2,000 years, when these circumstances were met. Over more recent timescales, Cliver et al. (1998) observe "*During the past ~120 years, Earth's surface temperature is correlated with both decadal averages and solar cycle minimum values of the geomagnetic aa index. Extrapolating the aa-temperature correlations to Maunder Minimum geomagnetic conditions implies that solar forcing can account for ~50% or more of the estimated ~0.7–1.5°C increase in global surface temperature since the second half of the 17th century*".

Beyond this short-term effect and immediate consequences of the solar activity on our well being on Earth, this brief reminder of the role of the GCRs leads us not to forget our place in the Galaxy (Shaviv, 2003; Redd, 2016; Xu et al., 2016) as we are indeed traveling on this Earth spatial vessel and following our Sun located in the Orion-Cygnus Arm, between the Sagittarius and Perseus arms, orbiting the central part of the barred Milky Way Galaxy (which resemble UGC 12158) at a distance (orbiting at a radius) of roughly 25-26k light years for a diameter of our own orbit of roughly 15-16 kpc. This is our true fate, mankind keeps thinking that it can act on and control everything, climate included, when we are just passengers of a spatial body that can hardly care less of our future and undergoes its own life.

Finally, this warmer world might remain wishful thinking if Ollila's (2017a) analysis and model happen to be straight on, and it could well be. Ollila combines the natural variability of the climate reconstructed since the Little Ice Age with an anthropogenic contribution that he adjusts for a climatic sensitivity of 0.6° (thus still reasonably high). He takes the Sun into account in an estimate of natural variability according to 4 scenarios, and includes astronomical resonances (in particular the 60-year cycle) and accounts for past climate to within 0.09°C, which is much better than the complex IPCC CMIPx models. By taking into account the continuation of an increase of 3 ppm per year (i.e. more than 50% of the average 2 ppm observed), he concludes, in all scenarios, to a decrease in temperature from 2020 onwards. Projections between now and 2100 give the same temperature as in 2020 if the TSI does not change, but it would be 0.1 to 0.3°C lower if the TSI were to fall, which would logically be expected from solar activity cycle studies (Zharkova et al., 2015, 2019; Zharkova, 2020).

The Atlantic optimum that dates back to the 4th millennium B.C., happened just before the neo-glacial started (figure 34), and is known from forests reconstructions and palynological studies (Kalis et al., 2003; Marquer et al., 2014, 2017; Roberts et al., 2018; Zanon et al., 2018) and shows that a mixed forest of oak, hazelnut, alder and linden trees covered

444 https://en.wikipedia.org/wiki/H._L._Mencken – This quote is not an endorsement of Mencken ideas, more generally speaking.

the whole of northwestern Europe at that time. The average temperature was then higher than today's, because the plant associations characteristic of this period never reappeared. Comparing, over the entire Holocene, forests extension and the observed associations of vegetation gives a reasonable clue to whether the Holocene Climatic Optimum (HCO) was higher than now and by how much. With respect to vegetation and forest extension, Marquer et al. (2017) state that "*The overall results indicate that climate is the major driver of vegetation when the Holocene is considered as a whole and at the sub-continental scale, although land use is important regionally*". Then Kalis et al. (2003) Fig. 12 p. 14-15, can be used to see how the forests extension has kept decreasing since the HCO.

Finally, while exchanging with Michael Calvin MacCracken[445], he asked me the following question "*While criticisms are always useful to consider, does your book offer an alternative hypothesis for why* ***such strong warming*** *is presently occurring?*". My answer to him was the following: your reasoning starts from a supposedly observed "*strong warming*". Is it indeed? Is the current Modern Optimum (MO) very different from the Medieval Warm Period (MWP), the Roman Warm Period (RWP), or the Minoan (MiWP)? Do we have reasonable tools to answer that question as we are going to compare short measured time-series (maximum since 1724) to much longer reconstructed temperatures. What I'd like to stress here, is that there is only one certitude, the MO is still very far from the Holocene Climatic Optimum (HCO) that happened naturally in between [-9000/-6000 BP]. There are several strong evidences: a) the extension of the forests, well studied in Europe over the entire Holocene (Kalis et al., 2003; Marquer et al., 2017) and the associations of vegetation (mixed forest of oak, hazelnut, alder and linden trees covered the whole of northwestern Europe at that time) sensitive to the cold that could never re-establish themselves, because the MO remains way colder than the HCO, (Heiri et al., 2015; Roberts et al., 2018; Zanon et al., 2018) b) study by Bohleber et al. (2020) who investigate the neoglaciation history of high-elevation glaciers throughout the Alps showing a clear gradient in the onset of neoglaciation progressing from the higher summits of the Alps (> 4,500 m) that were ice-free before -9000 BP, down to 3,400 m around -6000 BP and finally since around -4000 m have gone down to a level of 2,700 m being characteristic of the neo-glacial regime. Within this ne-glacial that we're still in, two counter-trend warming are very visible and evidenced by changes in the altitude of the tree-lines (Nicolussi et al., 2005) see Figure 123, namely the RWP and the MiWP, the MWP is not very distinctive whereas the MO is starting to show off c) the global atmospheric and oceanic circulation that remains characteristic of the neo-glacial, i.e. the ITCZ is strongly shifted South and prevents the African monsoons to move North as they did when the Sahara was green 6000 years ago, see Figure 33.

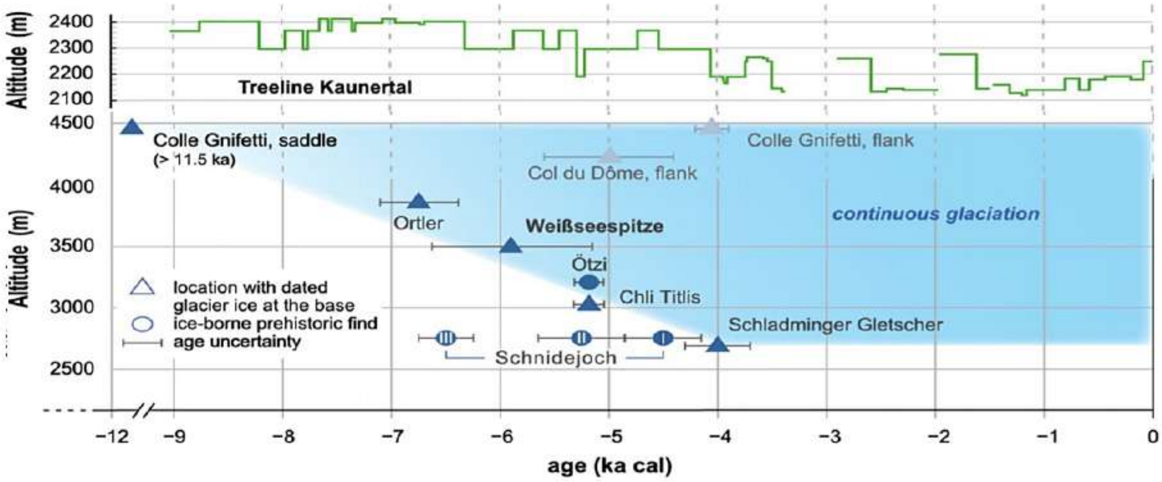

Figure 123. Sequence of dated past neoglaciation events at high-elevation locations in the Alps. Note the general correspondence between glacier maximum age and its altitude. The blue shaded area indicates the period of continuous ice cover. Also shown are the tree line reconstruction from Kaun*ertal (Nicolussi et al., 2005). After B*ohleber et al. (2020).

It is remarkable that Bohleber et al. (2020) state "*Our dating of the ice just above bedrock indicates that the ice body at WSS*[446] *formed earlier than (5.9±0.7) ka cal* ***and has been glaciated continuously ever since****. This implies that even the WSS summit location at 3500 m altitude was ice-free during an interval prior to (5.9±0.7) ka. (...). Likewise, at around 5.3–5.1 ka cal, no ice existed at nearby Tisenjoch, at 3210 m. The end of the so-called "Holocene Climatic Optimum" is also observed in Austrian stalagmite records, indicating the onset of a cooling period around 5.9 ka.* ***During those warm periods, the tree line was up to 165 m above the 1980 tree line in Kaunertal****, (…)* ***summits around 3000–4000 m were likely ice-free during the Mid-Holocene*** *or covered by glaciers distinctly smaller than today*". Another confirmation is

445 https://www.researchgate.net/profile/Michael_MacCracken https://en.wikipedia.org/wiki/Michael_MacCracken personal email exchange over "RG" on December 29th, 2020.

446 WSS stand for the Weißseespitze summit glacier

given by the work of Rosenthal et al. (2013), who used, among others, Mg/Ca measurements in the benthic foraminifer *Hyalinea balthica* for reconstructing Intermediate Water Temperatures (IWTs) in various places. From thereof, these authors state "*Our reconstructions show that **IWTs at all depths were substantially warmer in the early and middle Holocene than during the late Holocene** (Fig. 1). Specifically, IWT at 500 m was ~10°C between 10.5 and 9 thousand years ago (ka), increased to a maximum of ~10.7°C between 8 to 6 ka, and began decreasing after 6 ka, reaching ~7.8°C at the core top (~100 years B.P.)*". Not only do they confirm that the HCO was much higher than current MO using different proxies, strengthening all evidences available, but they also assert that the MWP was also warmer than now, latter observation that is also asserted by a completely different technique by Huang et al. (2008), using borehole temperature flux calculations.

Thus my take on Michael Calvin MacCracken's premise "*such strong warming*" is that the MO is still way colder than the HCO was and that I would not rate it unusual when compared to the MWP, the RWP or the MiWP each probably a little warmer than the previous one as in a "bear market trend" (see Figure 124). As far as the RWP is concerned, one remembers that Hannibal crossed the Alps in 218 BC by the "Col de la Traversette" (2,947 meters) the highest of the Alps with his elephants at the end of October (see p. 179) and that in no way, he would succeed doing that now, and certainly not this year (2000) with meters of snow there since early October. Still with respect to the RWP, as we reported, p. 99, Theophrastus (371 B.C.-287 B.C.) wrote that date palms could grow in Greece if they were planted, but that they could not bear fruit. This is the case today, suggesting that average summer temperatures in the southern Aegean in the 4th and 5th centuries BC were at least at a comparable level to those of today (see page 99). The illusion or the deception that current Modern Warming (MW) would be extraordinary both in magnitude and / or in its rate of change is unsupported by any evidence.

So having compelling evidences that the MO is not exceptional, what is the cause of it? First, one must observe that it started long before man-made emissions became significant and the reader remembers that Trutat (1876) stated long ago (see p. 12) «*Since I have been exploring the Pyrenees, I see the glaciers melt before my eyes and in the Lys valley and in the area of Oo, they are receding at a frightening speed*» and this was noticed in many places and is not a regional observation (Nussbaumer et al., 2011; Fig. 4 and 5). Then one must dismiss the fact that the warming which started for natural reasons, say 1800-1850, accelerated recently simply because SLR measured have not accelerated or marginally (see Figures 60 and 61).

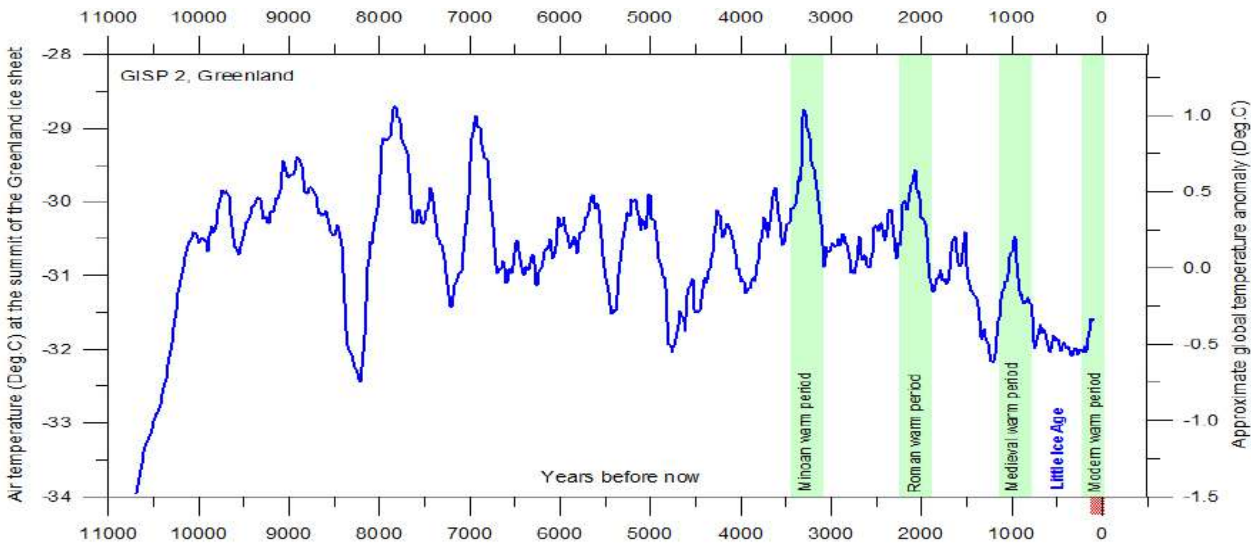

Figure 124. One reconstruction of the air temperature of the Northern Hemisphere, i.e. at the summit of the Greenland ice sheet, derived from Greenland ice cores, GISP-2. It provides a brief context to show the wider natural range of temperature over the last 11,000 years, some variations exceeding ±3°C over a century or so (e.g. 8.2 kyr event). *Also notice that At the beginning of the Holocene, the Central Greenland ice core record shows 10°C (18°F) of warming in 144 years, from 11,755 BP to 11,611 BP (May, 2020). From climate4you.com*[447] *but also matches perfectly Fig. 5, p. 1219 given by Akasofu (2010) and Ball (2016). Data from* ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/greenland/summit/gisp2/isotopes/

Establishing that the system is not geocentric, i.e. that carbon dioxide does not regulate the temperature nor the climate on Earth is not enough, the second part of the question raised by MacCracken is "*does your book offer an*

447 http://www.climate4you.com/images/GISP2 TemperatureSince10700 BP with CO2 from EPICA DomeC.gif

alternative hypothesis" as most of the time, even though all evidences point to the fact that AGW fails, AGW folks will return to it by saying "we do not have a better alternative, thus what else?" this is what MacCracken does by adding "*Going back tens of millions of years and more, there is really no way to explain the large changes in climate that have occurred without changes in atmospheric composition playing a significant role. And so now humans are changing atmospheric composition by a significant amount*". This statement does not stand examination as one should remind that if we just go back 20-25 millions years ago (see p. 127), the distribution of plates and mountain belts is already so different that the global atmospheric and oceanic circulation must have been entirely incomparable to the one presently observed. From the western Alps to the distant Himalayan, there were subduction zones, epi-continental seas with a very large tethys and para-tethys, molassic basins, etc., instead of the current mountain belts. This appears as a much more potent climate-change driver (e.g. acting on monsoons and the entire circulation) than any CO_2 or other atmospheric change. I am always amazed when I read papers where the authors address very distant geological configurations and try to make CO_2 changes the scapegoat for worlds apart that share next to nothing together, e.g. Klages et al. (2020).

So unless one is able to come up with an heliocentric system, even though the geocentric does not fit the bill, it will not be enough to deter the AGW proponents from supporting it, and they will always be reverting to it.

Then what is the "*alternative hypothesis*", the new heliocentric model? First, one needs to put things in a broader perspective, since the HCO, Earth's climate has been in a downtrend (for 6,000 years) mainly because the tilt (41kyr cycle between 22.1° and 24.3°) is reducing NH summer insolation and the 500-600 years fluctuations that have been reminded, i.e. RWP, MWP, and the MiWP, (the MO being just one of them) are super-imposed on the longer term global cooling trend. The MO may have been very marginally increased by man-made emissions, but the atmospheric sensitivity to CO_2, albeit probably not null, is way smaller than asserted by IPCC. The anthropogenic contribution, if any, may in fact come much more from large scale irrigation and thus from a small observed increase of the RH of the lower troposphere (Pangburn, 2018) p. 261, water vapor being a much more potent GHG than CO_2. In the end, there is no need to be looking for an extraordinary "*alternative hypothesis*" for this MO more than for the three preceding cycles that have already been mentioned (RWP, MWP, and the MiWP).

So many factors play a role and the Sun is the elephant in the room that IPCC refuses to see. We are probably gravely mistaken to consider it as such a stable star, the solar constant might only have its name constant, furthermore supposedly acting for the IPCC only through its TSI changes, when albedo changes are related to the solar wind, the global electro-magnetic activity of the Sun (not just TSI) and its influence on the Earth's geomagnetic field and GCRs action on the nucleation processes as convincingly evidenced by so many authors. These changes, coupled a) with variable volcanic activity throughout the ages both in terms of intensity, frequency and clustering of the manifestations, and b) with the reaction of the biosphere itself (see page 153) (Després et al., 2012; Bianchi et al., 2016), lead to more than enough triggers to modulate the low-pass filter oceanic calorimeter that stores long term heat and appears as one of the main drivers of the climate.

Thus, so many factors are intertwined, that an heliocentric representation is not going to be simply substituted to a geocentric one as what happens when a brutal paradigm shift occurs when people realize they've been mistaken for long. In fact one may envision slow progresses where each factor acting on the climate will progressively be evidenced and their relationships established until a satisfactory global scheme will be fathomed. CO_2 may have a place in that very complex climate framework to be established, but not only will it not be in the driver seat, but that could only be a very remote back seat. It stands forefront as the gas of life, this is its ultimate role, the real wizardry of that planet.

5. Conclusions

"*Many people, especially ignorant people, want to punish you for speaking the truth, for being correct, for being you. Never apologize for being correct, or for being years ahead of your time. If you're right and you know it, speak your mind. Speak your mind. Even if you are a minority of one, the truth is still the truth*." Mahatma Gandhi

A climatologist is sort of a meteorologist (as they both use similar General Circulation Models[448]) who has forgotten that no decent 15 days forecasts can be made but who has deluded him/her self into believing that he/she knows what the weather will be in a century[449]. This statement is not overly surprising as IPCC admitted in 2001 that «*The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future climate states is not possible*», IPCC – 2001 – TAR-14 – «Advancing Our Understanding», p. 771. Since 2001, the state of art in underlying physics (Navier–Stokes equations[450]), discretization (by means of the finite difference method) and computing has not dramatically changed. Even if the computing power has increased significantly, let's remind why Gerlich and Tscheuschner (2009) dismissed climate models "*It cannot be overemphasized that even if these equations are simplified considerably, one cannot determine numerical solutions, even for small space regions and even for small time intervals. This situation will not change in the next 1000 years regardless of the progress made in computer hardware*".

Notwithstanding this evidence, AGW supporters will immediately claim that this is irrelevant, that climate is concerned with long term trends, etc. By saying that they just acknowledge that the core of their dogma naively relies on equating an increase of temperature to an increase of CO_2 and that they have completely forgotten what defines the Climate as per Köppen-Geiger[451] (Köppen, 1884a-b, 1936; Kottek et al., 2006). Let's recall climate predictions require knowledge of precipitations that consists of the five main groups, i.e. A (tropical), B (dry), (temperate), D (continental), and E (polar) which are further divided into seasonal precipitation patterns, and temperature changes follow.

But if no meteorological forecast is able to predict where the next major depression will be in 15 days, or hurricane or else, it also entails that beyond 15 days there is no solution to knowing where the precipitations will happen. There are of course very good reasons for that, which is that the most important component of the weather and climate, i.e. water and water vapor with clouds and complex cloud systems, are so complex and uncertain that computer climate models resort to crude representations based on "parametrization". Convection, one of the major components of heat distribution in the atmosphere thanks to further change of state of water vapor, is so badly taken into account by climate models that it must be handled via parameters. Clouds are also typically handled using a parameter, for a similar reasons. Limited understanding of clouds has impaired the success of the models and has made them unable, as we have seen before, to just reproduce the climate (integral over time of the weather) back to the LIA. How could they forecast anything meaningful?

Let's summarize a bit where we stand:

As far as Physics is concerned:

- Arrhenius calculations were wrong and his conjecture is flawed: CO_2 only plays a marginal role in the climate system ;

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448 https://en.wikipedia.org/wiki/General_circulation_model A general circulation model (GCM) is a type of climate model. It employs a mathematical model of the general circulation of a planetary atmosphere or ocean. **GCMs and global climate models are used for weather forecasting,** understanding the climate, and **forecasting climate change**.

449 The classical delusion and deception is one such as expressed by Randall et al. (2007) "*Note that the limitations in climate models' ability to forecast weather beyond a few days do not limit their ability to predict long-term climate changes, as these are very different types of prediction*". In fact, multi-decadal climate predictions are claimed to be different types of prediction (i.e. called "boundary forced" as distinct from "initial value" problems), but, of course, they are also initial value predictions, as discussed in Pielke Sr. (1998) and Pielke Sr. et al. (1999). The predictability (as defined in geophysics) of these predictions is null. If an astronomer were to tell you that he does not know where an object will be in 10 days but that he knows where it will be in 20,000 years you would call him an astrologer, in our case you call him a "climatologist".

450 Navier-Stokes equations, a system of partial differential equations, were established in **1822** by French engineer Henri Navier with a seminal contribution by George Stokes.

451 https://en.wikipedia.org/wiki/Köppen_climate_classification

- Anthropic CO_2 is a tiny 6% of the overall atmospheric CO_2 concentration as most of the total increase has come from a natural process, i.e. the out-gassing of the oceans due to a natural increase of the global temperature since the end of LIA ; the residency time in the atmosphere of each CO_2 molecule is less than six years[452];
- Because of a very obvious reason, i.e. Henry's law, CO_2 follows T and not the other way round, effect cannot precede cause, therefore the AGW theory is based on an erroneous causation ;
- Temperature results essentially from the gravitation lapse rate ;
- 99.9618% of the CO_2 ever present in the atmosphere has been removed by various natural processes (mainly weathering) over geological times and stored in one form or another; longer term the lack of CO_2 is the risk;
- Atmospheric sensitivity to CO_2 is greatly exaggerated and the role of water vapor vastly underestimated ;
- The Greenhouse effect is the only phenomenon in Physics (absorption of IR radiations by some gases) that is so badly defined and intentionally kept confusing ;
- Water and water vapor, the main player, is dismissed as it resists modeling and entails that climate cannot be forecast beyond what the state of the art in meteorology is already struggling to achieve, i.e. 15 days.

As far as other sciences are concerned (e.g. Astronomy, Geology, etc.):

- Past climates, at all timescales, show that the climate has always changed for natural causes;
- Solar and orbital variations are among the main causes that drive the climate;
- Sea Level changes measured since 1907 show no acceleration (1mm y^{-1}), half of it being originated by steric effects[453] and are greatly exaggerated by selectively picking starting and ending dates at a hollow and a top of a temporal local sinusoidal wave and used as a politically sensitive argument to strike minds and threaten people into submission to the AGW theory ;
- Natural climatic oscillations ENSO (El Niño - La Niña), AMO, NAO, PDO are much more relevant to climate than CO_2 concentration ;
- Glaciers have been receding since the end of the LIA and long before anthropic emission became significant and no acceleration is noticeable. Arctic and Antarctic, considered jointly, are stable. The North-West Passage, a good proxy for Arctic sea-ice extent, was open to shipping in 1945, and Amundsen passed through in a sailing vessel in 1903;
- Extreme events remain within known boundaries;
- The acidification of the oceans is a myth;
- Major volcanic eruptions can be disruptive but are dismissed;
- The biosphere benefits of the little plus that a small increase of CO_2 brings and the risk is a lack of CO_2 as it is the gas of life, nothing less!

Climate models are deluding as they give a false impression of established science based on irrefutable computer calculations, but:

- Climate Models have even failed to account for recent past observations;
- They are tinkered with to try to fit non-scientific objectives ;
- They use data which are adjusted, or tampered with;
- They have little or no validity, beyond the 15 days meteorological forecast horizon, as they are just fit for political objectives.

Policies that will result from the dogma will be deceitful and will destroy western economies and our ways of living with no reasons:

- Many people aim benefit surreptitiously from these coercive policies for their personal gains whilst claiming the “general good of the population” as their motivation;

452 IPCC is still searching for the “missing C and sink conundrum” in their budgets, e.g. (Kheshgi et al., 1996), (Houghton et al., 1998), but a lot more CO_2 than thought could be transformed into organic matter as calculating surface ocean productivity has been quite challenging to say the least and carbon budgets are gravely affected. Ocean surface productivity could be exporting as much as 100 to 1,000 times more organic carbon to the deep ocean food webs than had been previously reported (Burd et al., 2010), or else a lot more CO_2 could be integrated into the soils and vegetation sinks has explored in the carbon budget defended in this e-book, p. 89.

453 i.e. temporal changes in the global mean density.

- Prophets of doom have been making false claims for decades. They bank on the emotional response of the people to propagate their misguided prophecies that have never come about in reality;
- Deceitful political messages have ignored factual information and deceived people intentionally;
- Thought police have been more active than ever in treating non-conforming scientists as political opponents, discouraging and/or even silencing them with threats.

You want more political ecology? Well go on, but do not come back later saying that you have not been warned! Eco-fascism, as all previous forms of fascisms have demonstrated[454] starts with the enactment of a "state of emergency"[455], and then will run its course crushing people for their own sake...

NOW, YOU HAVE BEEN WARNED.

In the end one should observe that as explained in the section "Atmospheric Sensitivity to CO_2", starting page 54, YES a doubling of atmospheric CO_2, if possible to occur instantaneously to satisfy the computers, will provide some marginal warming with some reasonable confidence. But one should welcome this extremely minor bonus to the natural warming that already occurred since the end of the Little Ice Age (starting around 1800). Food security of Mankind has been greatly improved by the "greening" that results from the small increase of the gas of life which stimulates plants, vegetation and crops and benefits everybody. Milder climate conditions are welcome, they are essentially due to natural causes, and they only have positive consequences. There are no detrimental side-effects to this slight warming and the fables of extreme climatic events getting more frequent and harsher are just plain hogwash. History teaches us that civilizations have often collapsed whenever the climate became too cold and resources too scarce (e.g. Viking's settlement in Greenland, long Chinese history of the fall of Emperors, etc.), and we have plentiful of such examples, never when it became warmer.

As scientists, we first need state not more that we know, and surely we do not know much despite our long quest for knowledge. Climate is a tremendously complex and multi-disciplinary subject and has always been changing, at all timescales, and this is in its very nature. Studying why is a passionate endeavor, but claiming that one knows what will be the temperature or the rainfall, globally or regionally, in a century is a plain deception, a mere lie. Scaring populations with a minuscule increase of a trace gas, which has only positive consequences is a grave political treachery, designed to undertake underground social engineering. As was demonstrated throughout this document the climate responds to so many other triggers and influences in a somewhat chaotic manner that focusing exclusively on small variations of a trace gas is ridiculous (Lindzen, 2017). Claiming that the coral reefs will be gone by 2050, that Sea Level Rise will compromise the lives of millions and threaten the wealth of even more when the only example they can provide is the subsiding Carteret Islands[456], that extreme meteorological events will be more frequent and more severe, etc. do not resort to reason and only undermine the credibility of science and scientists in general as those who talk that kind of nonsense are considered as such by the public and the media. They either delude themselves or worse they follow some ideological agenda, stressing uselessly the public, feeding the extremism of some NGOs and putting unnecessary pressure on politicians who will end up enacting laws to no avail that will bring major disruptions to our modern, complex and fragile societies. Scientists need to be **rational**, do their homework for as long as required and not raise red flags unless absolutely necessary when conditions are met to be beyond any **reasonable** doubt. This is clearly not the case and they will bear a heavy responsibility in the future course of action of mankind.

The heritage of religions was so strong for centuries that man found it difficult to get out of the habit of thinking of an earth-centric universe, and placing himself at the center. Galileo faced inquisition and imprisonment for his view. It was astronomy that rescued us from zealots and geology confirmed that their beliefs were erroneous, both in space and in time. Such has it been throughout the history of scientific disciplines that have endured long struggles over time against anthropocentrism and other unwelcome, misguided beliefs or agendas. The hypothesis that CO_2 is such a potent

454 https://en.wikipedia.org/wiki/Reichstag_Fire_Decree The Decree of the Reich President for the Protection of People and State (German: Verordnung des Reichspräsidenten zum Schutz von Volk und Staat) was issued by German President Paul von Hindenburg on the advice of Chancellor Adolf Hitler on 28 February 1933 in immediate response to the Reichstag fire. **The decree nullified many of the key civil liberties of German citizens**. With Nazis in powerful positions in the German government, the decree was used as the legal basis for the **imprisonment of** anyone considered to be **opponents** of the Nazis, and **to suppress publications** not considered "friendly" to the Nazi cause. The decree is considered by historians as one of the key steps in the establishment of a one-party Nazi state in Germany.

455 https://climateemergencydeclaration.org/

456 The Carteret Islands is a sunken caldera of which just small parts the rims are above the sea-level and which is victim of normal geological subsidence. https://en.wikipedia.org/wiki/Carteret_Islands

climate driver that after a century of large man-made emissions the IPCC is still desperately looking for a clear anthropogenic signal is based itself on belief and it has been falsified by science and by observation; that would be comical were it not for the loathsome and dire perspective that a future dystopian world has in store for mankind. AGW appears like pathological science (Langmuir, 1989) that as managed to divert huge resources to its profit that will cruelly be missed for more meaningful endeavors. One needs to stop scaring people with baseless fears, like indomitable epidemiological spreads or climatological Armageddon and not impoverish populations with rogue policies that will harm everybody and will discredit science.

So do not call me a skeptic, that would be both incorrect and too easy to dismiss all the evidences I have brought to light in this document. I did my homework to the best of my ability and I have put my ideas in writing so that as many people as possible may calmly read, think and agree or disagree, but hopefully form a more informed opinion. I would ask all those who consider that my work was worth the effort they put in reading it to share the http:// address of where to get it for free, as knowledge and reason must prevail.

This is a climate e-book for rational people, hopefully scientists included. Let's not allow History to repeat itself and throw hundred of millions into chaos for baseless ideologies, creating damage that will far outreach eventual costs required to adapt to an ever evolving climate, and would we be responsible or not of part of the change. Scientists need to be responsible, the unfounded problems they may create will far exceed the benefits of securing funds for the next year. I strongly support James Hansen's and co-signatories pledge for a comeback to the forefront of nuclear power and all forms of energies that may show reliability and efficiency while keeping working on more safety.

We need to remain optimists, but even then one should observe that mankind faces two real threats: the first is cooling and certainly not warming as the end of the beloved inter-glacial Holocene, this friendly interlude in mankind history, will come sooner than later and the second is a possible collision with a Near Earth Object (NEO). For each of these problems we can engineer some solutions as long as we stop wasting our time in fantasies like the AGW and fighting a mistakenly designated foe which is our friend instead, CO_2.

CO_2, my **friend**, hopefully and optimistically you will finally be acknowledged for what you are. You well deserve it, as you have been supporting life on this planet for billions of years and have never let us down. Please never fall under the fateful threshold, below which photosynthesis ceases and life ends. You will be missed for what you are, a **benefactor**.

There is no climate crisis and no climate urgency. Let's be rational, repel myths and the dreadful policies that might emerge. Carbon and warmth support life and this has always been so over geological times. Let's thwart suicidal plans, but let's be optimistic.

Above all, may the treasures of Science and scientific method prevail!

6. Epilogue

The Earth is an aging planet, after 4.54 billion years (Gyr) of a buoyant existence in a 13.8 billion year old Universe (life itself can be traced back to more than 3.5 Gyr) and geologists have a very good understanding of the last 570 million years as shown on Figure 28. All other telluric planets in the solar system have died long ago either as active geological bodies (except tide driven volcanism for satellites like Io) or as platforms able to host and support life (if they ever were), each for very specific reasons. Comparative planetology is very telling and teaches us that the Earth has become an old lady, an aging celestial body. Never the Earth has been so cold over its entire geological history of 4.54 Gyr, and the climate has kept getting more and more hostile since the last Paleocene-Eocene Thermal Maximum (PETM), 56 million years ago as visible on Figure 48, and the last 2.58 million years, i.e. the entire Quaternary Period, have been a nearly constant ice-house age, because at least one permanent large ice sheet, i.e. the Antarctic ice sheet has existed continuously and was only interrupted by short inter-glacial periods, see Figure 41.

During the early Quaternary, the fluctuation period between two successive glacial episodes was about 41,000 years due to the interplay of precession, obliquity and eccentricity (see explanations p. 142), but following the Mid-Pleistocene Transition it has slowed to about 100,000 years, as the Earth continued cooling and will return soon to an ice-age in 1,500 years (see Figure 44). Over the past 740,000 years there have been eight glacial cycles, and mankind had difficulties surviving both the Toba explosion (a VEI-8 catastrophic volcanic event, ~75,000 yrs ago) and the hostile climatic conditions that prevailed. The planet managed to exit the ice-ages only one out of three attempts offered by the tilt cycle of 41 kyr as it took 120,000 years since the Eemian (MIS-5e; 131–114 kyr ago) to return to milder conditions, i.e. the Holocene.

At the end of the Last Glacial Maximum (LGM), i.e. 23,000 years ago, CO_2 concentration in the atmosphere went as low as 180 ppm, a very dangerous level and life was on the brink of exhaustion as under 150 ppm the photosynthesis stops and thus all life would cease to exist. Hopefully some 13,000 years ago, coming in the aftermath of the "Younger Dryas", the temperature has increased rapidly as visible on Figure 37 due to a favorable set of orbital conditions, the ice-sheets that covered most of Septentrional Europe and Northern America have receded and a marine transgression of more than 130 meters over 8,000 years, stopping -4.500 years ago, invaded the continents (see Figure 64). The temperature reached an optimum, known as the Holocene Climatic Optimum (HCO), some [9,500-5,500] years ago as displayed on Figure 34, the Sahara was green, all favorable conditions that were never experienced again as the cooling trend re-established itself and still prevails. The Holocene, this blessed period of 13,000 years that humanity has just lived, that accounts for a tiny 0.00029% of the entire Earth's history will soon and alas come to an end as the orbital decision to terminate this interglacial is already baked in the astronomical cards (see Figure 36). Science knows, but this knowledge is of no avail to mankind's survival if ruined by special interests and scuttled by politics and ideologists.

Over the last 2,500 years we had three positive favorable small counter-trends of this already cooling inter-glacial, the Roman Warm Period (RWP), the Medieval Warm Period (MWP) and the Modern Optimum (MO) which owe nothing to the level of CO_2 concentration in the atmosphere, the RWP being slightly the warmer of the three as proven by many records, see page 99. We should of course celebrate the MO, being slightly warmer than the Little Ice Age which ended around 1850, happened to be a trying period for humanity, with famines and widespread sufferings (see footnote 99). The increase of the CO_2 concentration in the atmosphere since the end of the LGM is the result at 94% of the natural out-gassing of the oceans as per Henry's law (1803), man-made emissions which accelerated since 1950 providing the remaining 6% of a trace gas that overall represents a tiny 0.04% of the global atmospheric composition.

CO_2 is a trace gas having next to zero influence on the climate. It is essential to the very existence of life on Earth and the increase from a dangerous low level 23,000 years ago to safer levels of 400 ppm has re energized an old planet, triggered increased photosynthesis and resulted in the incorporation of 570 Gt-C into CO_2 sinks since 1900 as per the CB presented in Figure 27. It has provided more food to all living species on Earth, regardless of its position in the food chain. If mankind marginally contributes to it, this should be welcomed as it helps to sustain life on Earth. 99.9618% of the CO_2 ever present on Earth has already been removed (see p. 49) and is stored in limestones, chalks and sediments in the range of [66,000,000 Gt-C – 100,000,000 Gt-C] and as fossil organic materials in excess of 13,000,000 Gt-C. Thus the risk to life on this planet is a lack of CO_2 not an excess of it.

Climate models and atmospheric science give a myopic view on an otherwise much broader and complex Earth system by focusing on the IR absorption properties of a trace gas which plays a marginal climate role, given the fact that the Earth is first and foremost a thermodynamic machine based on a complex hydrological and hydrodynamic cycle and where most of the heat is stored in the oceans with longer response time than most short-sighted General Circulation atmospheric Models (GCMs) can handle. The drastic limitations of these GCMs in succeeding to attribute even part of the warming observed during the MO to man-made emissions and their inability to make any unequivocal forecast at the climate timescale is now acknowledged by the very scholars who develop them. No compelling evidences of the role that man-made CO_2 emissions could have on the climate are available and focus should be given to adaptation to an ever changing natural environment, and to remediation measures especially within the context of rapid changes of land use.

Finally a warmer world is a better one and we will be brutally reminded of this when the inter-glacial period ends.

The bigger picture is that contributions from around 15 scientific disciplines need to be deployed, mostly in the Earth and Space sciences, to give the right perspective on where we stand and on the risks humanity faces. These include: dropping below the fateful CO_2 threshold of 150 ppm, or a collision with a Near-Earth Object (NEO)[457] that had not been detected in time, or that could not be destroyed or diverted (TF-PHA-NEO, 2000).

The AGW theory is the worse ever stupid idea that the failed XXI century science[458], harnessed by political motives and supported by ideologists, will leave in its records and is being used by the dominants to enslave the gullible public.

"*Give me liberty or give me death!*" Patrick Henry[459] (1739-1799), one of America's most outspoken Founding Fathers.

Now come the morale of the story: this is the fable of the atmospheric physicist and the climate scientist.

Fable of the atmospheric physicist and the climate scientist
or a development without merit!

Within the limits of their ability in science and with the fastest computers, atmospheric physicists are hardly able to make any reliable weather forecast fifteen days ahead. Nevertheless, by deciding that the problem was no longer depending on the initial conditions, but rather a boundary one enabling sensitivity studies, and by adding one single grossly irrelevant variable, carbon dioxide, they felt entitled to become climate scientists and to make forecasts of changes for decades or a century ahead: this notwithstanding the fact that a number of natural cyclic driving climate have time constants well in excess such short timescales. There are irregular variations too. It was of course a hoax. The attraction to the proponents and followers of the hoax was that it provided much leverage for politicians, always eager to increase their control of the general population, and it proved to be irresistible for them. Subsidies attract followers from those with vested interests. For the rest, it unfortunately inflicts severe damage by way of reduced prosperity and more generally, erosion of the progress of society as a whole. The morale of the fable is that integrity of science has been tarnished by this quackery and group-think.

457 Near-Earth objects (NEOs) are defined as all small Solar System bodies with orbits that lie partly between 0.983 and 1.3 astronomical units (149,597,870 km). If a NEO's orbit crosses the Earth's, and the object is larger than 140 meters (460 ft) across, it is considered a potentially hazardous object (PHO). As of this writing, the list provided by the Center for Astrophysics, Harvard & Smithonian at the minor planet center contains 2156 such objects: https://www.minorplanetcenter.net/iau/lists/t_phas.html. Geology and astronomy teach us that an object of at least 1km causes a global catastrophe not like fantasized CO_2 threat. As resources are always scarce mankind should focus them on where they are the most useful. A warmer climate if it were to happen is good news whereas colliding a >1.7 km NEO is a global catastrophe destructing an area the size of a large state, and an impact in the range [3-7 km] would lead to continental scale destruction and most probably to the end of mankind's story (NSTC, 2018; NASEM, 2019).

458 Unfortunately, this will not be the first failed superseded theory and in a funny way "global cooling" is listed as one of them, see https://en.wikipedia.org/wiki/Superseded_theories_in_science. When the Holocene will end soon and the stadial will resume it will be time to replace it with global warming and / or its substitutive designations, i.e. global change (how stupid), green revolution, etc.

459 https://en.wikipedia.org/wiki/Patrick_Henry

7. Acknowledgments

This work would not have been possible without the support of Camille Veyres[460] and the remarkable fight for the truth that he and his co-workers pursue with the association of the “climato-realists”[461]. He sent me many documents that I have used as a basis for elaborating this work, always answered my questions when I was in doubt, and furthermore his exceptional knowledge in physics and his broad understanding of the subject have given me the strength to dare put forward my ideas, not fearing to be immediately crushed by herds of critics. One should certainly not underestimate this aspect, the disparagement goes pedal down to the metal and those who dare dissent must feel strong enough to defend their informed opinion when everything is made by the AGW theory supporters to deter them from even trying; this is self-censorship encouraged, and this is what works best. I also thank Camille Veyres for having proof-read some parts of the document and having spotted some mistakes that I left behind whatever the care I put to write this book to the best of my scientific honesty and ability.

I am very grateful to Jacques Duran[462] who ran for years the website in French language http://www.pensee-unique.fr (one-track thinking) and provided so many useful analyses and insights into this strange discipline, i.e. “climate science”. Jacques Duran was initially the young student (in quantum physics) of Pierre-Gilles de Gennes, the Nobel Prize laureate in physics in 1991[463], who helped and encouraged him a lot during his early work on the diffusion of energy in disordered isotopic materials, and then in the following years, particularly with regard to the research they carried out on the physics of granular matter. In 1996, P.-G. de Gennes, then director of ESPCI, proposed to Jacques Duran to come and work with him as Director of Studies and their collaboration continued until de Gennes' disappearance in 2007.

Duran's death in 2018 put very unfortunately an end to the critical analysis of the many articles he reviewed on his website. It is by reading Jacques Duran that I was confirmed in my opinion that nothing was going well in this discipline. Duran reminds what Gennes and Badoz (1996) wrote about their confidence in simulations “*Environmental problems are often managed by "simulation" specialists, i.e. people whose competence is more in computers than in scientific data. Using a large computer, they produce predictions that seem respectable, even if the data are insufficient. This is one of the great plagues of our time. The misfortune is that many people still believe that the computer tells the truth and predicts the inevitable (the same type of belief existed in the 19th century with regard to printed text). The computer simulator is credible because its machine has a power and speed of calculation that no human brain is capable of. The snoring power of numbers plus the power of images: enough to maintain a magical pre-rational mentality in the public mind*”.

The Covid-19 time might be one extraordinary example of the damages caused by the *"simulation specialists"* of de Gennes, as Neil Ferguson's Imperial College model could be the most devastating software mistake of all time (Richards and Boudnik, 2020), the most costly self-inflicted pain ever. This has been an extraordinarily challenging period for many people, including investors who rely on their investments to make a living. What ended being just slightly worse than a seasonal flu in terms of its epidemiological consequences, and could have been diagnosed as such rapidly, has led to bloated consequences by dints of disproportionate government response and generalized lock-downs. This led to flatten everything, businesses, portfolios, hopes in the future and the only thing that was not flattened was the unemployment curve which exploded.

In the wake of this disaster, scare mongers like Gates (2020) have hinted to the pretext for next massive coercion, climate change. Unfortunately, it seems that from some recent statements made by Heads of States that the terms of the “Heidelberg Appeal” made by 425 leading researchers including de Gennes and dozens of Nobel laureates has been forgotten; let's remind the following excerpt “*We want to make our full contribution to the preservation of our common heritage, the Earth. We are, however, worried at the dawn of the twenty-first century, at the emergence of an irrational ideology which is opposed to scientific and industrial progress and impedes economic and social development.* ***We do,***

460 Camille Veyres graduated from Ecole Polytechnique (X67), Ecole Supérieure des Télécommunications and also holds a MBA from HEC (École des hautes études commerciales de Paris) school of management.

461 https://www.climato-realistes.fr/

462 https://fr.wikipedia.org/wiki/Jacques_Duran and http://www.pensee-unique.fr/auteur.html

463 Pierre-Gilles de Gennes was also one of the signatories of the “Heidelberg Appeal” which was signed by 425 members of the scientific and intellectual community skeptical of the claims of the global warming alarmists that warming was a scientifically verifiable event (HAHSG, 1992; DeWeese, T., 2002).

however, forewarn the authorities in charge of our planet's destiny against decisions which are supported by pseudo-scientific arguments of false and non relevant data".

The climate change narrative had been itching me for a long time, but this was the last straw which broke the camel's back and the hankering to put things straight became simply too great to resist. A bunch of civil servants, paid whatever happens, had not yet finished to ruin our economies with policies that destroyed all our fundamental freedoms that they jump head-on to what will be the next curse: climate change! What climate change? As long as it was just paying more taxes, the fight was not worth it, but now, here they are, ideologists talk about brutal choices: that means implementing dystopian policies on large scale. This is how I decided to gather what remained of my bruised strengths and to try, as an honest scientist, to demonstrate how foolish these future Eco lunacies and policies of fascist scents are (WBGU, 2011), (Vahrenholt von, 2011).

I am grateful to Michel Detay[464] who encouraged me in various ways going trough this challenging time and kick-started my effort by sending me the must-read book from Allègre (2010) and who urged me to re-edit all equations to improve their readability and provided me with many papers on volcanology, to Pierre Haren[465] for making many suggestions to help improve the book but I am afraid that a new version will have to be edited to match his expectations, to Brendan Godwin for pointing to inconsistencies in my first attempt to devise a new Carbon Budget (p. 89) and for the various excellent papers he pointed my attention to, thanks to Michael Brown who made much appreciated improvements, to Jean-Claude Maurin[466] for his careful, kind and insightful reviewing, to the Pr. Harald G. Dill, Badar Latif, Dan Pangburn, Dr. Janusz Pudykiewicz, to Michael Sidiropoulos for his kind and supportive words, to Kosma Szutkowski and all colleagues who cheered me up, especially on Researchgate, whenever necessary.

Special thanks to Zark Bedalov[467], from Vancouver (British Columbia, Canada), the author of Wiley book "*Practical Power Plant Engineering*[468]", for the extremely careful reading he made of the entire document in a very supportive way, to Achim Lohse and also to other individuals who checked the book but wished to remain anonymous. I am grateful to "Researchgate" and "Academia" who facilitate the work of independent researchers, who otherwise meet difficulties getting some articles when they do not benefit of the access facilities offered to affiliated persons and institutions. They truly contribute to lifting the embargo otherwise put on knowledge by some dominant publishers. I am very grateful to the Apache Software Foundation and the OpenOffice Community, this document would not exist without them. Finally the "pdf" file generated is compressed to make it smaller and easier to download using a great tool: https://www.ilovepdf.com/compress_pdf

I also thank, and they might be surprised, all those who have kept challenging me on Researchgate on the various threads of discussion dealing with the subject. They have contributed by bringing a skillful opposition to the ideas I developed to making them clearer, better expressed and therefore stronger. It may not have been their intent, but in the end it was the result.

Finally a couple of individuals, deserve a special mention, because full of their self-confidence and bloated of conceit and contempt for the other scientists, by thinking that they are the only ones to understand exceptionally complex notions such as a log-response when any 15 years old youngster who gets a basic training in science already knows it, and one of them calling "dissenters" like me morons, gave me even more strength to smirk at their slighting and work more to debunk the fake arguments of these pompous windbags full of condescension. I refer to them as the professors "know everything understand nothing", they will recognize themselves. They also reminded me the saying of Georges Courteline[469] ""Passer pour un idiot aux yeux d'un imbécile est une volupté de fin gourmet." or as automatically translated by Deepl[470] "Looking like an idiot in the eyes of a fool is a gourmet's delight." Isn't it ?

464 https://www.researchgate.net/profile/Michel_Detay (D.Sc. 1987) is a renowned expert in hydrogeology and hydrovolcanology.

465 Pierre Haren graduated from Ecole Polytechnique (X73) (1976) and Ecole des Ponts et Chaussées (1978) and also defended a thesis at MIT: https://www.lajauneetlarouge.com/auteur/pierre-haren-73/. Pierre initially specialized in fluid dynamics, hydrodynamics, equations of motion (Haren, 1979; Haren and Mei, 1979, 1980, 1981, 1982). He joined INRIA to lead a project aiming at creating expert-system shells for engineering design. I joined his project late spring 1986 and I was the first employee of ILOG corporation (Pierre acting as CEO) even before it started thanks to Eurosept corporation led by Marc Fourrier (X73, Ponts et Chaussées) who hired me in the meantime. I'm grateful to both.

466 https://www.science-climat-energie.be/author/jc-maurin/, J.-C. Maurin is "professeur agrégé de physique".

467 https://www.linkedin.com/in/zark-bedalov-035921153/

468 https://www.amazon.fr/Practical-Power-Plant-Engineering-Engineers/dp/1119534941

469 https://en.wikipedia.org/wiki/Georges_Courteline

470 https://www.deepl.com/ is a very good automated translator and I thank them for the support they provided for this work.

One of them has even become the dregs of the “troll” activity, posting messages everyday on Researchgate discussion threads, pretending making a “review” of my book when it is just an accumulation of libel, disparagement, slanders, etc. Such deranged individual would normally not deserve a single line in a book like this, but they are so much representative and living caricatures of the arrogance of some in this climate science community that I could not refrain mentioning them elliptically. The goal is of course, by these despicable means, to try to silence people like me. The stakes must be high for those people to resort to such hatred and such obnoxious methods. One must know that by exposing the castle of cards of the pseudo-science used to scare the gullible people, one becomes a target. One will observe that this individual was affiliated with ECN, a dutch organization that drew some attention for the curious ethics of its former director (nos, 2016; rondjeschagen, 2016). Those in the role and their fellows will recognize themselves, they well deserve a medal, I let the reader decide which one.

Now that the e-book has been around for nearly two months and that nearly 15,000 downloads of it have been made, I must also mention all those who cheered me up, congratulated me for the good work and encouraged me to go further. Hopefully they have been many and I will thank especially Guus Berkhout, Martin Capages Jr., Marcel Crok, Robert David, Pierre Gosselin, Paul Homewood, Andy May, Benoît Rittaud, Gregory Wrightstone, and all those who helped me disseminate my work on their excellent web-sites. I apologize for all those not mentioned but not forgotten, I am also grateful to them.

I could only fly over this immense subject, certainly with great pleasure, but also with a certain lightness in order to tell the extraordinarily complex history of the climate over time and the parameters influencing it. I am sure I will be criticized in places for accommodating what should be an even more rigorous presentation, but the reader will keep in mind that each chapter or section deserves a book of its own. A narrative choice had to be made that would preserve the interest of the reading without distorting the subject too much, while showing its very large scope. At least, I hope to have demonstrated by the breadth of the topic that there is no way to regard carbon dioxide as the climate’s ultimate magical ‘control knob’, a stance sadly promoted by the catastrophists for which the science is largely irrelevant anyway as politics is their bread and butter. I also thank the Deepl translator team for their product which provides an efficient way for a lonesome writer with limited means to achieve reasonable quality at no cost. Upgrading to professional version will be a must even for small companies.

Whatever my efforts to make this e-book as accurate and reliable as possible, and the kind contributions of all the peer-reviewers who helped me improve this work and there were many, physicists, earth-scientists, engineers, etc., I must state that all mistakes (there will be some, how could it be otherwise?), be they scientific, technical, linguistic (spelling or grammar) will remain mine and I apologize in advance for them and commit myself to correcting them as soon as they will be pointed out to me. I thank all the competent readers in advance who will help me improve this document.

Disclosure of interests

The author declares not to have any conflict of interests. For the research I was not given any grant. I received no funding whatsoever. Nor is he member of any climate committees (political or other) or is he linked to companies or NGOs, financially or otherwise. He is not member of any political party or movement. This is an independent work that does only represent the personal opinion of the author based on the work exposed. The author is a recent regular member of the association of the climato-realistes.fr/, since October 2020.

To whom this e-book is Dedicated

This work was carried out from the Republic of Malta (EU) at Iklin where I live and I am grateful to the Maltese people for their warm welcome during all these years. This work is dedicated to late scientists, authors and intellectuals who fought for the truth until their very last days, and I apologize in advance for all those I forgot to mention. I admire the courage, the lucidity and the will to truth of all those I have the honor to mention now: Robert M. Carter[471] (1942-

471 https://en.wikipedia.org/wiki/Robert_M._Carter. Shame on William Connolley for his post (Connolley, 2016) who grossly paraphrasing Max Planck supposedly saying "*A new scientific truth does not triumph by convincing its opponents and making*

2016), Roger W. Cohen[472] (1939-2016), Michael Crichton[473] (1942-2008), John L. Daly[474] (1943-2020), Jacques Duran[475] (1942-2018), Freeman Dyson[476] (1923-2020) who passed away on 28 February 2020, Hugh W. Ellsaesser[477] (1920-2015), Vincent Gray[478] (1922-2018), William M. Gray[479] (1929-2016), Zbigniew Jaworowski[480] (1927-2011), Karin Labitzke[481] (1935-2015), István Markó[482] (1956-2017) who supported me until he left us on 31 July 2017, Axel-Nils Mörner[483] (1938-2020) who died on 16 October 2020 and was just starting a new journal "*Science of Climate Change*" to which I would have had the pleasure to contribute, Frederick Seitz[484] (1911-2008), Joanne Simpson[485] (born Gerould) (1923-2010), Fred Singer[486] (1924-2020). We will thoroughly miss their intelligence and scientific honesty.

them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it". Stated "*Today brings us news of another such advancement in science, with the reported death of Robert Carter*". Shame on you, William Connolley, scientific truth advances because it is proven correct, not because an entire generation of illiterate have been indoctrinated while waiting for the death of your opponents. You are despicable and disgusting. You just confuse science and politics.

472 https://physicstoday.scitation.org/do/10.1063/pt.5.6265/full/ and https://co2coalition.org/members/roger-cohen-phd/

473 https://en.wikipedia.org/wiki/Michael_Crichton and https://en.wikipedia.org/wiki/State_of_Fear

474 Eulogy by Ball (2016), http://www.john-daly.com/, https://en.wikipedia.org/wiki/John_Lawrence_Daly,

475 https://fr.wikipedia.org/wiki/Jacques_Duran

476 https://en.wikipedia.org/wiki/Freeman_Dyson

477 https://www.researchgate.net/scientific-contributions/80246443-Hugh-W-Ellsaesser

478 https://en.wikipedia.org/wiki/Vincent_R._Gray

479 https://en.wikipedia.org/wiki/William_M._Gray

480 https://en.wikipedia.org/wiki/Zbigniew_Jaworowski

481 https://de.wikipedia.org/wiki/Karin_Labitzke

482 https://fr.wikipedia.org/wiki/István_Markó https://www.researchgate.net/profile/Istvan_Marko

483 https://en.wikipedia.org/wiki/Nils-Axel_Mörner

484 https://en.wikipedia.org/wiki/Frederick_Seitz

485 https://en.wikipedia.org/wiki/Joanne_Simpson see also Pielke, R. A., Sr. (2008)

486 https://en.wikipedia.org/wiki/Fred_Singer

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9. Glossary, Acronyms and Abbreviations

AABV	Antarctic Bottom Water
AAM	Atmospheric Angular Momentum
AAO	Antarctic oscillation
ACC	Antarctic Circumpolar Current
ACD	Aragonite Compensation Depth (see footnote p.131)
ACR	Antarctic Cold Reversal
AIM	Antarctic Isotope Maximum warm events
AL	Aeronomy Laboratory of NOAA, USA
AMO	Atlantic Multidecadal Oscillation
AMOC	Atlantic Meridional Overturning Circulation
AMS	Accelerator mass spectrometry
AMSU-B	Advanced Microwave Sounding Unit
AO	Arctic Oscillation
ARC	NASA Ames Research Center, USA
ARM	Atmospheric Radiation Monitoring
ARTS	Atmospheric Radiative Transfer Simulator
ATP	Adenosine 5'-triphosphate. ATP is a "currency unit" for energy in cells.
BA	Bølling–Allerød warm period
BAO	Bronze Age Optimum, warm period around1350 BC – 1200 BC
BCP	Biological Carbon Pump
BHM	Bayesian Hierarchical Modelling
C3	plants are plants in which the initial product of the assimilation of carbon dioxide through photosynthesis is 3-phosphoglycerate, which contains 3 carbon atoms
C4	plants—including maize, sugarcane, and sorghum—avoid photo-respiration by using another enzyme called PEP during the first step of carbon fixation. This step takes place in the mesophyll cells that are located close to the stomata where carbon dioxide and oxygen enter the plant
CCD	Calcite (or Carbonate) Compensation Depth (see footnote p.131)
CCN	Cloud Condensation Nuclei
CCR	Clear Column Radiance
CDD	Cognitive Dissonances Disorders
CGCM	Complex coupled Global Circulation Models
CMDL	NOAA Climate Monitoring and Diagnostics Laboratory, USA
CNRS	Centre National de la Recherche Scientifique, France
CRU	Climatic Research Unit
DIC	Dissolved Inorganic Carbon, DIC = $[CO_2] + [HCO_3^-] + [CO_3^{2-}]$ which is 90% in the form of bicarbonate ion HCO_3^-, 9% in carbonate ion CO_3^{2-} and 1% in carbonic acid H_2CO_3 or CO_2; see (Zeebe and Wolf-Gladrow, 2001) the re-balancing between these different forms is done rapidly when the temperature, DIC or TAlk parameters change.
DO	Dansgaard-Oeschger Cycles
DOE	Department of Energy, USA
DOI	Digital Object Identifier[496]
DRE	Dense Rock Equivalent
DTR	Diurnal Temperature Range
ECMWF	European Centre for Medium-Range Weather Forecasts
EHIM	Early Holocene Insolation Maximum
EI	Emission Index
ELPS	European Late Pleistocene Shift
ENSO	El Niño Southern Oscillation (El Niño - La Niña)
EOS	Earth Observing System (of NASA's global satellite system)
FD	Forbush Decrease
FWHM	Full Width Half Maximum

496 https://www.doi.org/index.html

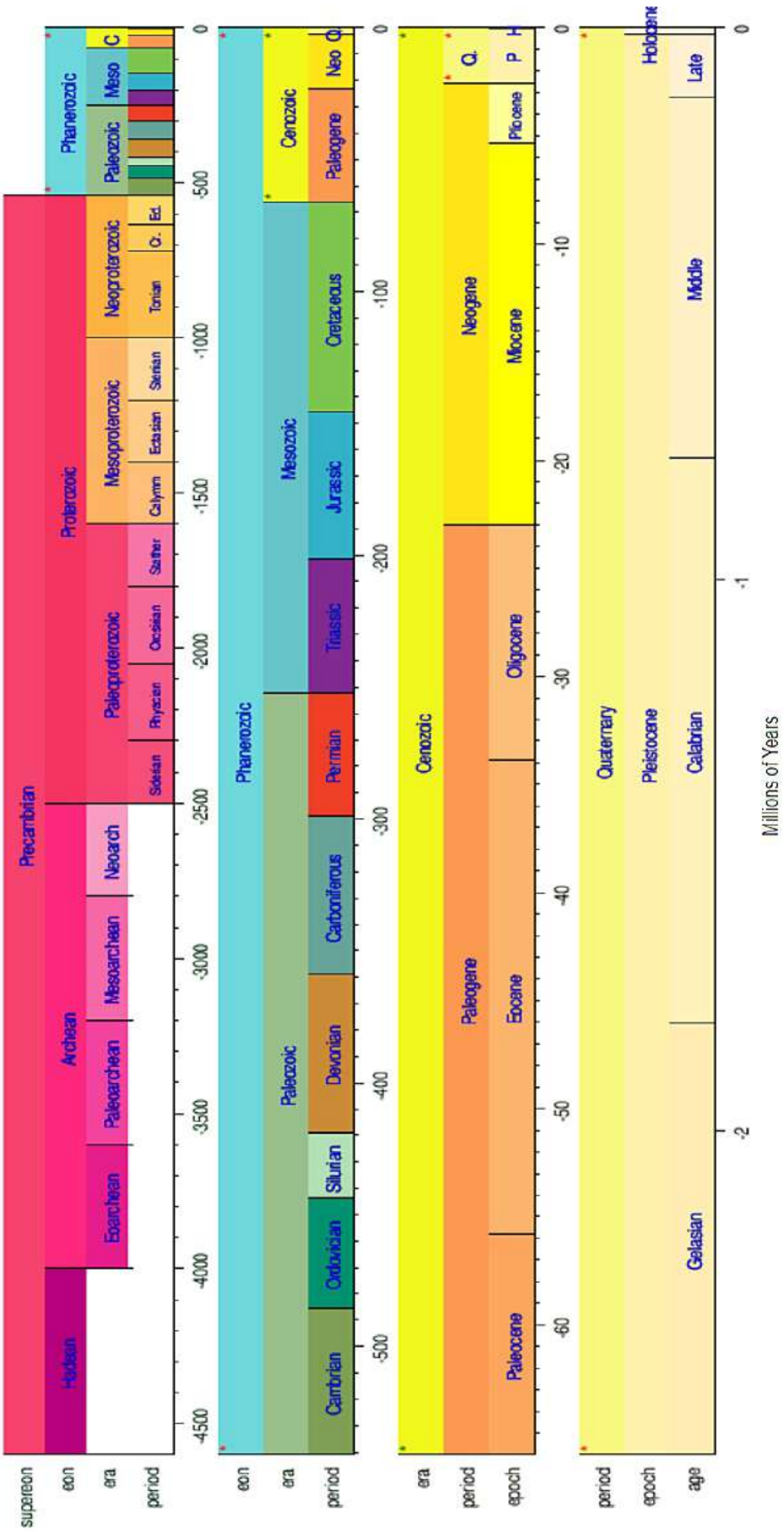
GAOHC	Global Average Ocean Heat Content
GCR	Galactic Cosmic Rays
GF	Geothermal Flux
GISP2	Greenland Ice Sheet Project II
GRIP	Greenland Ice-core Project
Gt-C	gigatons of carbon or billion tonnes of carbon contained in carbon dioxide molecules
Gyr	(Giga) i.e. Billion years
HCO	Holocene Climatic Optimum
HITRAN	HIgh-resolution TRANsmission
IPCC	Intergovernmental Panel on Climate Change
IPO	Interdecadale Pacific Oscillation
IRAG	Infra Red Absorption Gases
I/RAO	Iron/Roman Age Optimum, aka the Roman Warm Period between 250 BC and 400 AD
IRD	Ice-Rafted Debris
IRF	Impulse Response Function, i.e. a transfer function (mostly used for CO_2)
ITCZ	Inter-Tropical Convergence Zone
KNMI	Koninklijk Nederlands Meteorologisch Instituut
kyr	(kilo) thousand of years
LALIA	Late Antique Little Ice Age
LGM	Last Glacial Maximum
LIA	Little Ice Age
LIS	Last Interglacial Stage
LOD	Length Of Day
LS	Lower Stratosphere
LW	Longwave radiation
MAS	Microwave Atmospheric Sounder
MGW	Modern Global Warming, i.e. a warming supposed to be different than pasts, CO_2 driven
MIS	Marine Isotope Stage
MLO	Mauna Loa Observations (or Observatory)
MO	Modern Optimum, equivalent meaning to MGW
MOC	Meridional Overturning Circulation
MPAE	Max-Planck-Institut für Aeronomie, Germany
mtDNA	mitochondrial DNA
MSU	Microwave Sounding Unit
MiWP	Minoan Warm Period (3400-3100 BP)
MWP	Medieval Warm Period (920-1100 BP)
Myr	Million years
NADW	North Atlantic Deep Water
NAM	Northern Annular Mode
NAO	North Atlantic Oscillation
NASA	National Aeronautics and Space Administration, USA
NASDA	National Space Development Agency, Japan
NBS-19	a carbonate standard, which has a $\delta^{13}C$ value of +1.95‰ (Friedman et al., 1982)
NCEP	National Center for Environmental Prediction, USA
NGO	Non Governmental Organization
NH	Northern Hemisphere
NIAC	Next Ice Age Challenge is what Nature has in store for Mankind (1,500-2,000 yrs from now)
NIST	National Institute for Standards and Technology, USA
NOAA	National Oceanic and Atmospheric Administration, USA
NRL	Naval Research Laboratory, USA
OCD	Obsessive Compulsive Disorder
ODP	Ocean Drilling Programme
OLR	Outgoing Longwave Radiation (or radiative flux)
pc	parsec=210,000 astronomical units, and equates to about 3.3 light-years
PDB	Pee Dee Belemnite ($\delta^{13}C$ original standard)
PDO	Pacific Decadal Oscillation
PETM	Paleocene Eocene Thermal Maximum

PF	Polar Front
ppm	number of CO_2 molecules per million air molecules or parts per million
ppmv	parts per million (by volume), i.e. 10^{-6}
PV	Potential Vorticiy
QBO	Quasi-Biennal Oscillation
RCP	Representative Concentration Pathway (IPCC)
RH	Relative humidity
RMS	Root-Mean-Square
RT	Radiative Transfer
RWP	Roman Warm Period (2200-1900 BP)
SGM	Solar Grand Maximum
SH	Southern Hemisphere
SOA	Schedule of Adjustments
SOI	Southern Oscillation Index
SPICE	Stratospheric Particle Injection for Climate Change
SSI	Solar Spectral Irradiance
SST	Sea Surface Temperature
SSU	Stratospheric Sounding Unit
SW	Shortwave radiation
TAlk	Total Alkalinity, i.e. $[HCO_3^-] + 2\,[CO_3^{2-}] + [B(OH)_4^-] + [OH^-] + [HPO_4^{2-}] + 2\,[PO_4^{3-}] + [H_3SiO_4^-] + 2[H_2SiO_4^{2-}] + [HS^-] + 2[S^-] + [NH_3^+] + [Org^-] - [H^+] - [H_3PO_4]$ where Org− represents a collective term for organic acids (Hunt el al., 2011), simplified Talk = $[HCO_3^-] + 2\,[CO_3^{2-}] + [OH^-] - [H^+] + [B(OH)_4^-]$. Thus $[HCO_3^-] + 2\,[CO_3^{2-}] + bt[S]\ Kb / (Kb + [H^+])$ difference of the total charges of the major ions of the dissolved salts except carbonates and borates; Kb is the base dissociation constant, a measure of how completely a base dissociates into its component ions in water: $Kb = [B^+][OH^-]/[BOH]$; Salinity S=34.78 in calculations for pH; see e.g. Dickson et al. (2007), Millero (2007).
THC	Thermo-Haline circulation
TIGR	TOVS Initial Guess Retrieval
TIO	Tropical Intra-seasonal Oscillation
TL_TTT	Thin Layer (TL) at the high Troposphere up To the Tropopause (TTT) 300-100 mbar from which originate most of the emissions towards the cosmos
TOA	TOp of the Atmosphere
TOVS	TIROS Operational Vertical Sounder
TSI	Total Solar Irradiance
UEA	University of East Anglia
UKMO	United Kingdom Meteorological Office, UK
UT	Upper Troposphere
UTH	Upper Tropospheric Humidity
VEI	Volcanic Explosivity Index
VGP	Virtual Geomagnetic Pole
VSSI	Volcanic Stratospheric Sulfur Injection
WCRP	World Climate Research Program
WMGG	Well Mixed Greenhouse Gases
WMO	World Meteorological Organization

10. Index of the Figures

497 http://www.climate4you.com/images/GISP2 TemperatureSince10700 BP with CO2 from EPICA DomeC.gif

GEOLOGICAL EONS



Source: Wikipedia. Provided to help the reader figure out where he/she stands when reading some sections of this e-Book referencing geological eons or periods.

11. About the Author's Motivations

I graduated in Geophysics, Geochemistry and Remote Sensing with a DEA from Ecole des Mines de Paris / CTAMN (1982) - First in my class ("*Mention Très Bien*", i.e. grade point average > 18/20). I defended a D.Sc. in Geochemistry, Geo-Mathematics and Geo-Informatics (1986) at Nice University and INRIA (National Research Institute in Computer Science and Automation) - "*Mention très honorable et félicitations du jury*".

As co-founder and very first employee of ILOG in 1986 (even before the formal creation of the corporation), I contributed to the development of this software company which later had offices in Europe, US and Asia and was listed on the NASDAQ stock exchange before a buy out by IBM in 2009. I joined CSTB in 1989 and led the Computer Integrated Division until 2001. I was involved in many European research projects in the area of integration in manufacturing. I also was an active reviewer in ESPRIT and was involved in assessing projects in different areas. In 2001 I created and led the SAIL department (Software Applications and Integration) with 5 divisions: software development, virtual reality, data and systems' integration, facilities management, advanced models for finite element analysis. In 2004, I was in charge of software matters and policy before I left CSTB in 2005. I am also an experienced trader since 1996 and developed together with my associate a state of the art expert-system to implement our trading methods (i.e. TEXSOL, Trading Expert-Systems On-Line) and to develop the art and technique of trading automation, with deployment on the US and French markets (stocks, ETFs, indexes).

I have an interest in various domains like Earth and Planetary Sciences, Astronomy, Finance and Trading, Integration in Manufacturing and Design, Simulation and Defense Systems, etc. I published 38 articles mostly in peer-reviewed scientific journals, 6 books jointly-reviewed with colleagues, 6 peer-reviewed chapters in books, 64 papers in peer-reviewed conferences, one D.Sc. thesis (1986), and 32 scientific and technical reports for demanding public and private clients and acted as an expert reviewer for several EC R&D projects. I have been using in this e-book my initial training and my passion for Earth and Space sciences to completely revisit the subject of climate and paleo-climates. Why?

I had been in stark disagreement with the official doxa for decades, but the first startling alert came when François Hollande (a former French President) stated (in French) at the 70th session of the UN General Assembly in New York, on September 28, 2015 that **tsunamis and earthquakes** will be the result of uncontrolled anthropic global warming (Hollande, 2015b). He was obviously deluded by his own entourage who certainly ensured him that no doubt remained, that science was settled and that the alleged urgency would require to further force the line in his presentation to maximize political impact. How Heads of States would know? But for a Geo-scientist like me, if he had said that the Earth was flat would not have been more shocking.

Unless plate-tectonics and convective motions in the Earth's mantle driving the drift of the plates and thus earthquakes and tsunamis would become sensitive to extremely scarce CO_2 molecules in the atmosphere by some magical thinking, how such statements could be made? it was a clear message that the official word of a great scientific and industrial nation was totally discredited. When the dominants and the "warmunists" unveiled their agenda further in a clearer way, saying that if Covid was bad, wait until climate-change to see what we can impose on you, the people, I thought that no one could remain idle awaiting the violation of the most fundamental rights of the citizens based on a pretext relying on some fallacious conjecture and phony science. The more I dug into the subject for which I had had a long standing interest anyway and for which I had gathered a massive pool of articles and references, the more I had to acknowledge how little science there was left in the official group-think and how much politics was in fact at play. That triggered me into action and the truth, not always good to say, remains a legitimate ideal.

“*In the modern world, science and society often interact in a perverse way. We live in a technological society, and technology causes political problems. The politicians and the public expect science to provide answers to the problems. Scientific experts are paid and encouraged to provide answers. The public does not have much use for a scientist who says, “Sorry, but we don’t know.” The public prefers to listen to scientists who give confident answers to questions and make confident predictions of what will happen as a result of human activities. So it happens that the experts who talk publicly about politically contentious questions tend to speak more clearly than they think. They make confident predictions about the future, and end up believing their own predictions. Their predictions become dogmas which they do not question. The public is led to believe that the fashionable scientific dogmas are true, and it may sometimes happen that they are wrong. That is why heretics who question the dogmas are needed.*”

— Freeman Dyson

Frederick S. Pardee Distinguished Lecture (Oct 2005), Boston University. Collected in 'Heretical Thoughts About Science and Society', A Many-Colored Glass: Reflections on the Place of Life in the Universe (2007), 43-44.

“I would rather have questions that can't be answered than answers that can't be questioned.”

— Richard Feynman

"*Your book is amazing. I may not agree with everything in it, but the intensity of your research is beyond anything that I've seen. Best wishes for a better 2021, Dick*" Richard Lindzen, personal communication December 15th, 2020.

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