Global Warming Misunderstood

The Case for Fossil Fuels and Nuclear Power

By

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Introduction

This paper presents evidence to show the current general understanding of climate change is highly likely wrong. The paper is largely a compilation of data and evidence from various authoritative sources. This evidence has been put together with discussion that indicates mankind's emissions of carbon dioxide (CO_2) are not having a significant influence on global warming. The paper discusses options for electricity generation, the Paris Climate Agreement, the popular climate narrative and its political origins, fossil fuels, that the science is not settled, hurricanes, sea level rise, and nuclear power. The paper is not exhaustive. It provides sufficient information to show there is no real basis for the present actions and policies concerning climate change where these are based on the reduction or elimination of man-made carbon dioxide emissions.

Australian and other Governments are acting towards impoverishing their people by supporting power generation from sources with high costs and unreliability, all based on misguided beliefs about CO_2 emissions. In Australia, such actions are seriously hurting Australia's ability to compete in the global market.

The majority of Australians object to paying exorbitant electricity charges because of Government pandering to unsound science and vocal activists who speak from ideological viewpoints, not facts. They object to the destruction in Australia, both potential and immediate, of manufacturing and indeed all businesses that need reliable, secure and affordable power.

Basing climate science only on recent data without considering geological timescales can be and is grossly misleading. Mankind is delusional if believing Earth's climate should and can be kept within the ranges experienced by mankind within recent history, when this is but a snippet of Earth's climate over geological timescales.

The prevailing belief that man-made CO_2 emissions are the cause of or are significantly enhancing global warming will remain hypothetical unless and until the evidence and arguments presented in this paper can be scientifically refuted or explained differently.

Paris Climate Agreement

There is much in the media about the Paris Climate Agreement and the withdrawal of the United States from the Agreement.

The Agreement is an incentive for and driver of fossil fuel divestment. Under the Paris Climate Agreement, countries set their own targets (Nationally Determined Contributions) for reducing emissions. The targets are not legally binding and there are no penalties for non-compliance, but nations must update the targets every five years. The year 2005 is the baseline.

Money has been a sticking point throughout negotiations. Developing countries say they need financial and technological help to leapfrog fossil fuels and move straight to renewable energy sources. Currently they are promised US $100bn a year by 2020 - not as much as many countries would like. The agreement requires rich nations to maintain a $100bn a year funding pledge beyond 2020, and to use that figure as a "floor" for further support to be agreed by 2025. Such subsidies or grants can lead many countries

to sign the Agreement merely for financial gain, not because they believe in man-made global warming. Subsidies generally distort actions and results.

As of 26 January 2020, 187 out of 197 parties to the United Nations Framework Convention on Climate Change have ratified the Agreement. The countries still to ratify the Agreement formally were Angola, Eritrea, Iran, Iraq, Kyrgyzstan, Lebanon, Libya, South Sudan, Turkey, and Yemen.

Listed in the table following are the CO_2 emissions for five countries, alongside the Paris promises made by those countries:

Country	CO_2 Emissions (Mega Tonne) 2018[1]	% of Total World Emissions	Paris - Promised Reductions (%)[2]	By When
Australia	420	1.24	26-28	2030
China	10,065	27.52	Increases	2030
Russian Fed'n	1,711	4.68	25 to 30	2030
UK	379	1.04	40	2030
United States	5,416	14.81	Withdrawn	2018

Electricity Generation

The only sources of electricity generation able to meet the need for massive, low-cost and reliable power are fossil and nuclear fuels, both of which Australia has in varying and relative abundance. All renewable sources like solar and wind are neither reliable nor secure. They are not cost-effective and need subsidies to make them appear so.

Comparative examples of electricity production from various fuels in 2017 (rounded)[3]:

Source Fuel	% of Total Worldwide Production	% of Total UK Production	% of Total China Production	% of Total German Production	% of Total French Production	% of Total Australian Production
Coal	38	7	68	39	3	63
Oil	3	0	0	1	1	2
Gas	23	40	3	13	7	20
Nuclear	10	21	4	12	71	0
Hydro	16	3	18	4	10	6
Solar	2	3	2	6	2	3
Wind	4	15	4	16	4	5
Other*	3	13	1	12	11	1

Note: Other* includes bio-fuels, waste, geothermal, tide, municipal waste, renewable waste, refinery gas, liquefied petroleum gas (LPG), solvents, petroleum coke, lubricants, bitumen, wax, other refined products and refinery fuel.

[1] http://www.globalcarbonatlas.org/en/CO2-emissions
[2] https://www.carbonbrief.org/paris-2015-tracking-country-climate-pledges
[3] IEA Data and Statistics 2017, https://www.iea.org/data-and-statistics/data-tables/?country=CHINA&energy=Electricity&year=2017

Germany is replacing its nuclear units with renewable energy (wind and solar) as part of its energy transition. It is using mainly coal to back-up its intermittent renewable energy and, as a result, has increased its coal-fired generation. Due to the higher cost of wind and solar units, residential electricity prices have escalated to be 3 times that of the United States.

Worldwide, in July 2019, there were 615 coal-fired power stations under construction or in various stages of planning.[4]

Life cycle cost comparisons of various fuels used to generate electricity are complex. Some variables include financing costs, the IRR[5] used, fuel prices, whether or not storage systems are incorporated, life times selected, and distribution network costs.

Indicative, comparative, unsubsidized, and levelized life-cycle costs, in 2018 US dollars, for new sources of electricity in America are[6]:

Source	**Cost (US$/MWh)**
Conventional Coal	100
Nuclear	150
Natural Gas Combined Cycle	60
Natural Gas Peaking	180
Geothermal	95
Biomass	102
Hydro	66
Wind-Onshore	45*
Wind-Offshore	92*
Solar PV – Rooftop Residential	210*
Solar Thermal with Storage	140*

*The results displayed above show stand-alone power, but it is important to consider also the additional cost of backup power, usually coal or gas fired.

Note: The levelized cost represents the per-MWh cost (in real dollars) of building and operating a generating plant over an assumed financial life and operating duty cycle.

Importantly, the August 2020 report, “THE HIDDEN COST OF CLIMATE POLICIES AND RENEWABLES” by Dr Alan Moran, a noted Australian economist, states the financial impact of climate policies and renewable subsidies:

a. costs households at least $13 billion annually, or around $1300 per household;

b. accounts for 39% of household electricity bills, not 6.5% the Government typically quotes; and

c. causes a net loss of jobs in the economy (with every green subsidised job created, 2.2 jobs are lost).

[4] ENDCOAL Plant Tracker https://docs.google.com/spreadsheets/d/1kXtAw6QvhE14_KRn5lnGoVPsHN3fDZHVMlvz_s_ch1w/edit#gid=191821593

[5] Internal Rate of Return

[6] Various

The Popular Narrative and its Political Origins

Richard Lindzen was Alfred P. Sloan Professor of Meteorology at the Massachusetts Institute of Technology until his retirement in 2013. He is the author of over 200 papers on meteorology and climatology and is a member of the US National Academy of Sciences and of the Academic Advisory Council of GWPF[7]. He gave the Annual GWPF Lecture at the Institution of Mechanical Engineers, London, on 8 October 2018.[8]

His lecture included the following facetious statement about the prevailing and simplistic view of the Earth's climate system:

"Now here is the currently popular narrative concerning this (climate) *system. The climate, a complex multifactor system, can be summarized in just one variable, the globally averaged temperature change, and is primarily controlled by the 1-2% perturbation in the energy budget due to a single variable – carbon dioxide - among many variables of comparable importance.*

This is an extraordinary pair of claims based on reasoning that borders on magical thinking. It is, however, the narrative that has been widely accepted, even among many sceptics."

"Many politicians and learned societies go even further: They endorse carbon dioxide as the controlling variable, and although mankind's CO_2 *contributions are small compared to the much larger but uncertain natural exchanges with both the oceans and the biosphere, they are confident that they know precisely what policies to implement in order to control carbon dioxide levels.*

While several scientists have put forward this view over the past 200 years, it was, until the 1980s, generally dismissed. When, in 1988, the NASA scientist James Hansen told the US Senate that the summer's warmth reflected increased carbon dioxide levels, even Science magazine reported that the climatologists were sceptical. The establishment of this extreme position as dogma during the present period is due to political actors and others seeking to exploit the opportunities that abound in the multi-trillion dollar energy sector."

Consensus

There are several, differing, claims about how large is the "consensus" about climate change being caused, or affected, by mankind; keeping in mind that "consensus" is not proof. The popular belief that 97% of scientists agree mankind is causing global warming is an extrapolation to a belief of all scientists from a survey of some climate scientists, no proof, just a belief. More specifically, one source of the 97% figure (Cook et al - 2013) derives from a survey of the abstracts of 11,944 peer-reviewed papers containing the words "global climate change" or "global warming". Cook et al found 4,014 of those papers actually stated a position about human influence and 97.1% of those were judged as implicitly or explicitly endorsing the "consensus" [9]. This finding by Cook is the basis of the 97% belief.

However, 97.1% of 4,014 papers is 3,898 papers. This means 3,898 papers from the total of 11,944 papers endorsed the "consensus"; that is, only 32% of the initial 11,944 papers actually endorsed the "consensus", not 97%.

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[7] The Global Warming Policy Foundation. A London-based think tank.

[8] Richard Lindzen Lecture at GWPF: 'Global Warming for the Two Cultures', https://wattsupwiththat.com/2018/10/09/richard-lindzen-lecture-at-gwpf-global-warming-for-the-two-cultures/

[9] Consensus on consensus: a synthesis of consensus estimates on human-caused global warming – Cook et al (2013); https://iopscience.iop.org/article/10.1088/1748-9326/11/4/048002

When David Legates, a University of Delaware professor who formerly headed the university's Center for Climatic Research recreated Cook's study he found that "*only 41 papers — 0.3 percent of all 11,944 abstracts or 1.0 percent of the 4,014 — expressing an opinion, and not 97.1 percent,*" endorsed what Cook claimed.[10]

If you look at the literature, the specific meaning of the 97% claim is that 97% of those climate scientists agree there is a global warming trend and that human beings are the main cause. This means humans are more than 50% responsible. The Intergovernmental Panel on Climate Change (IPCC) goes slightly further, but is still non-specific, by stating, "It is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by anthropogenic increase in green house gas (GHG) concentrations and other anthropogenic forcings together." [11] These other forcings are due, for instance, to vegetation clearing and the "heat island" effects of cities, both exacerbated by increasing populations. According to the IPCC, these other forcings contribute about 20% of the temperature change, noting that all of the IPCC data have large uncertainties. Keep in mind, also, the funding sources and the terms of reference for many of the studies included in IPCC Reports.

In 2007, 31,487 American scientists signed a petition that in part states "*There is no convincing scientific evidence that human release of carbon dioxide, methane, or other greenhouse gases (GHG) is causing or will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere and disruption of the Earth's climate*".[12]

Climate change activists try to discredit this petition as they do with anything or anyone who contradicts their ideology. However, the petition stands.

The belief that anthropogenic CO_2 emissions are a significant driver of climate change is just that, a belief. Many published papers examine particular aspects that might influence climate, but all seem to lack a holistic perspective, probably because there remain too many unknowns.

[10] https://www.nationalreview.com/2015/10/climate-change-no-its-not-97-percent-consensus-ian-tuttle/
[11] IPCC Fifth Assessment Report, AR5 Synthesis Report: Climate Change 2014, Climate Change 2014, Summary for Policymakers
[12] See: http://www.petitionproject.org/

Fossil Fuels

Many people conflate the sulphur dioxide, nitrogen oxides, mercury, and aerosol particle pollution from burning coal with CO_2 emissions. The former are problematic pollutants that can cause serious atmospheric pollution and health issues. However, modern coal-fired generators essentially eliminate these pollutants, especially if burning clean coal that Australia has in abundance.

Carbon dioxide emissions are another story. Many people believe these emissions are causing global warming to an extent that will become critical for Earth's ecosystems. This belief is the problem.

The recent IPCC Special Report[13] says human activities are estimated to have caused approximately one degree Celsius of global warming above pre-industrial levels and the warming is currently increasing at 0.2 degree Celsius per decade.

Many scientists disagree with the statements by the IPCC and others that CO_2 emissions by man are a proven problem. However, in today's politically correct world, they are ignored or shouted down by the misguided, the ignorant, and by politicians and activists with other agendas.

The contribution of man-made GHG emissions to global warming is uncertain and likely small or none at all. The global surface temperature has increased by approximately 1.3 degrees over the past 110 years[14], that is, an average of 0.12 degrees per decade. The IPCC states, "*It is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations and other anthropogenic forcings together.*" [15] GHGs in the atmosphere include methane, nitrous oxides, chlorofluorocarbon, water vapour, and CO_2. Therefore, only part of the temperature impact is due to CO_2 emissions.

CO_2 constitutes only about 400 parts per million (ppm) of the atmosphere presently (i.e. 0.040%, or 4 molecules of CO_2 per 10,000 molecules of atmosphere), having risen from about 280 ppm (i.e. 0.028%, or 2.8 molecules of CO_2 per 10,000 molecules of atmosphere) at the beginning of the Industrial Revolution in about 1760. CO_2 is a trace gas in Earth's atmosphere, not a major component.

We know with better certainty that the Earth's temperature and temperature changes are affected, for example, by its internal radioactive processes, solar activity coupled with the Milankovitch Cycles (orbital, inclination and precession effects), the Earth's albedo, atmospheric water vapour, and the cosmic ray flux.

We know that the Earth's atmospheric concentration of CO_2 results from a complex combination of additions and subtractions. Additions include those from man-made sources and natural processes like vegetation and animal respiration, the weathering of carboniferous rocks such as limestone, sandstone, shale and coal beds, and the warming of oceans. Subtractions include plants and phytoplankton (photosynthesis), composting, the birth of all living things (including shellfish), and the weathering of most rocks. Weathering occurs when atmospheric carbon combines with water to form a weak acid—carbonic acid—that falls to the surface in rain. The acid dissolves rocks—a

[13] IPCC Special Report, Technical Support Group, Global Warming of 1.5°C , Summary for Policymakers. (https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf)
[14] NOAA Climate.gov, Climate Change: Global Temperature, graph "History of global surface temperature since 1880 (https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature)
[15] IPCC Climate Change 2014 Synthesis Report, Summary for Policymakers (https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf)

process called chemical weathering—and releases calcium, magnesium, potassium, or sodium ions. Rivers carry the ions to the ocean. The calcium ions combine with bicarbonate ions to form calcium carbonate. Shell-building organisms like shellfish and corals, and plankton, make most of the calcium carbonate. After these organisms die, they sink to the seafloor. Over time, layers of shells and sediment are cemented together and turn to rock, storing the carbon in stone; limestone and its derivatives. While some of these processes take a very long time, the Earth has always brought balance to the equation within average temperature limits of about 10 to 25 deg C, on the macroscopic scale (see graph on page 16).

We do not understand well enough the complex interactions of atmospheric water vapour with other climatic factors. The whole question about man's impact on global warming is fraught with uncertainty.

Regardless of what we do know, or think we know, we do not understand well enough the carbon cycles operating on the Earth. The proof of this is that none of the climate models produced by climate scientists, so far, correctly predicts present conditions when back-tested. That is, when applied to past data, the models do not replicate present conditions. If climate factors were truly understood, the models would accurately predict present and future conditions.

The unproven belief that CO_2 is a problem, against much of the evidence, is no reason for Australia's lemming-like rush to ruin by turning its back on the only reliable sources of power; fossil fuels and nuclear. We can have no meaningful impact on global emissions of CO_2 even if Australia closed down completely and immediately. Virtue signalling might raise the self-esteem of some people, but tilting at the trace gas windmill of CO_2 is highly likely a waste of time.

Scientists must prove that CO_2 has a serious, detrimental impact on global climate before mankind acts to stop or reduce CO_2 emissions. Climate models must correctly forecast temperature changes when back-tested.

The Science is Not Settled

Mankind does need to be careful with our planet. However, people manufacturing scenarios and selecting data to meet expectations or whereby they can profit should not sway us. Rigorous scientific method should inform our actions.

The science is not settled:

a. **A note about data.**

All evidence before about 250 years ago is from proxies, not measured accurately. The same proxy taken from different places across the world can give results that vary considerably, because there never has been uniformity of any factor across the world, including temperature, CO_2, and sea-level. Further, different proxies of a particular factor give different values at different places across the world (see the graph of Holocene temperature variations on the following page).

Proxy evidence has uncertainties both in time and magnitude measurements, sometimes large.

A further potential complication with proxy data is that there is uncertainty about what processes might be affecting the proxies over thousands of years. What might proxy data reveal about CO_2 and temperature today when measured in the year 3020, 1,000 years from now? Empirically, the temperature in Greenland only now is warming to what it was during the medieval-optimum about 1,000 years ago. The coast of Greenland could become green again as it was when settled by the Vikings from Iceland in the 10th century (see also page 26).

For example, accurate measurement of CO_2 started in 1958 at Mauna Loa in Hawaii, and in 1976 at Cape Grim in Tasmania. These very short periods give the measurements that appear so concerning today, of about 408 ppm. When compared, as it is, with the 280 ppm of the so-called pre-industrial era that started in the 1700's, it appears significant.

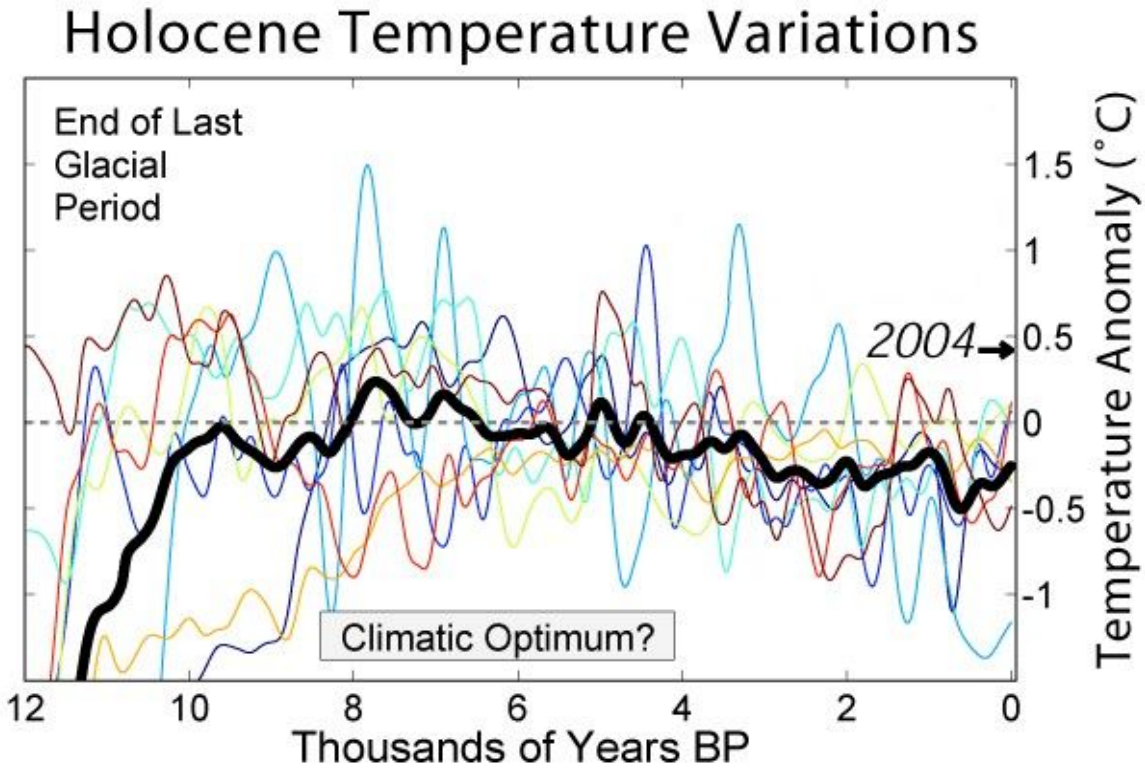
However, given it takes about 300 years of snow fall in Antarctica before ice entraps CO_2 completely within ice bubbles, the CO_2 measured in ice cores is approximately the average of atmospheric CO_2 over the previous 300 years. Combining the actual measured atmospheric CO_2 over the last 62 years from Mauna Loa with the previous 238 years of ice core estimation from Law Dome in East Antarctica gives an average CO_2 reading of 309 ppm, and this is without considering other factors like the acid-carbonate chemical reactions mentioned on page 15. So, what might be the the ice core reading of CO_2 entrapped today when extracted in the future? Possibly not far removed from historical readings.

Comparing accurate measurements taken today with past proxy estimations is fraught. Generalisations can be made and correlations hypothesised, but proof is another thing.

b. There is no doubt; mankind is affecting the environment, including by adding CO_2 to the atmosphere. However, the question remains, is this addition affecting global climate, and by how much?

c. **Uncertain Temperatures.** The first sealed thermometer was made in 1641. The development of today's thermometers began in the 18th Century. Our knowledge of data before then is from proxy evidence only, such as ice cores, pollens, sediment cores, etc, and then each only averaged over about 300 years.

The following graph and Data Sources[16] purport to show various temperature fluctuations of the Earth since the last Ice Age. The resolution is about 300 years.



Notes: BP means "Before the Present". The "Present" is set as the year 1950.
The Climatic Optimum is a generally agreed warmer period.

The records are plotted with respect to the mid 20th century average temperature, and the global average temperature in 2004 is indicated.

Data Sources

1. *The following data sources were used in constructing the main plot above:*
   - i. *(dark blue) Sediment core ODP 658, interpreted sea surface temperature, Eastern Tropical Atlantic.*
   - ii. *(blue) Vostok ice core, interpreted paleotemperature, Central Antarctica.*
   - iii. *(light blue) GISP2 ice core, interpreted paleotemperature, Greenland.*
   - iv. *(green) Kilimanjaro ice core, $\delta^{18}O$, Eastern Central Africa.*
   - v. *(yellow) Sediment core PL07-39PC, interpreted sea surface temperature, North Atlantic.*
   - vi. *(orange) Pollen distributions, interpreted temperature, Europe.*
   - vii. *(red) EPICA ice core, interpreted site temperature, Central Antarctica.*
   - viii. *(dark red) Composite sediment cores, interpreted sea surface temperature, Western Tropical Pacific.*

The thick black line on the graph above is the average of the several proxy lines. This black line is said to represent the actual temperature fluctuations of the Earth during the present interglacial period. Further, while 2004 appears warmer than any other time in the long-term average, and hence might be a sign of global warming, it

[16] https://commons.wikimedia.org/wiki/File:Holocene_Temperature_Variations.png

should also be noted that the 2004 measurement is from a single year. It is impossible to know whether similarly large short-term temperature fluctuations may have occurred at other times, but are unresolved by the available resolution. The next 150 years will determine whether the long-term average centered on the present appears anomalous with respect to this plot.[17]

A problem with this graph is that there is no weighting applied to the proxy data. This is because nobody knows which proxy might better represent the actual temperature fluctuations of the Earth. Accordingly, the actual temperatures in the past might be somewhat different to those depicted. Notwithstanding, the present measured temperature of the Earth is within the proxy ranges shown, noting also the comment in the preceding paragraph about unresolved large temperature fluctuations. See also pages 13 and 14 regarding relative temperature peaks.

d. **What comes first, and is there a Correlation?**

The suggestion put by the IPCC and others is that if the Earth is warmed from any reason, say the Milankovitch cycles, then the oceans, that collectively are the largest active sink of CO_2 on Earth, will release CO_2 into the atmosphere. This will cause further warming, the “greenhouse effect”.

Laboratory experiments[18] can show readily that when the atmosphere in a vessel has CO_2 added, its temperature increases with respect to that of a similar vessel without CO_2 when both vessels are exposed to a heat lamp. However, these experiments are done always with large volumes of CO_2 added. The author has yet to see a comparative experiment done with the CO_2 at 0.028% of the atmosphere in the vessel and repeated at 0.04%, to represent the actual concentrations of CO_2 in the Earth’s atmosphere before the industrial age and now, respectively.

Such experiments could be used to validate claims that doubling pre-industrial carbon dioxide levels to 0.056% of the atmosphere will likely cause global average surface temperature to rise between 1.5° and 4.5° Celsius.[19]

These experiments would be instructive but, even so, would not replicate the global climate system with its complex interactions.

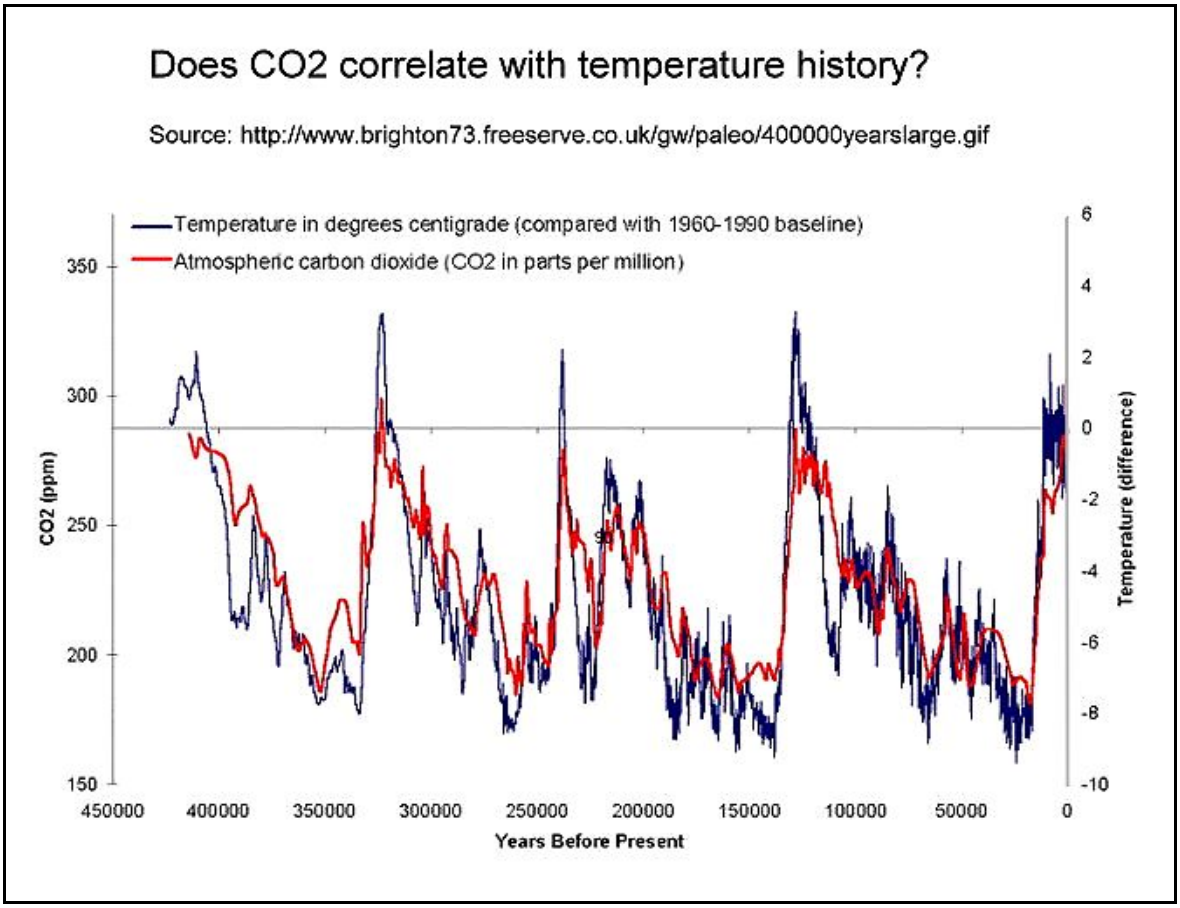
However, there is another experiment. The second law of thermodynamics effectively states that the concentration of any gas (say CO_2) able to be dissolved in water (as in soda water), is dependent on the temperature of the water. The higher the temperature the less the gas and the lower the temperature the more the gas. This is why a bottle of soda water exposed to the sun is likely to explode, while one placed in the refrigerator fizzes only gently when the cap is removed.

In both the above experiments, the change of one factor correlates with the change in the other.

The question that must be answered is, “What is the effect on global climate from man-made CO_2?” This is complicated because of the many other factors that might influence the answer when looking at the real world.

[17] https://commons.wikimedia.org/wiki/File:Holocene_Temperature_Variations.png
[18] https://www.youtube.com/watch?v=kwtt51gvaJQ
[19] https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_I_full_report.pdf

The next graph indicates a correlation between the CO_2 and temperature.



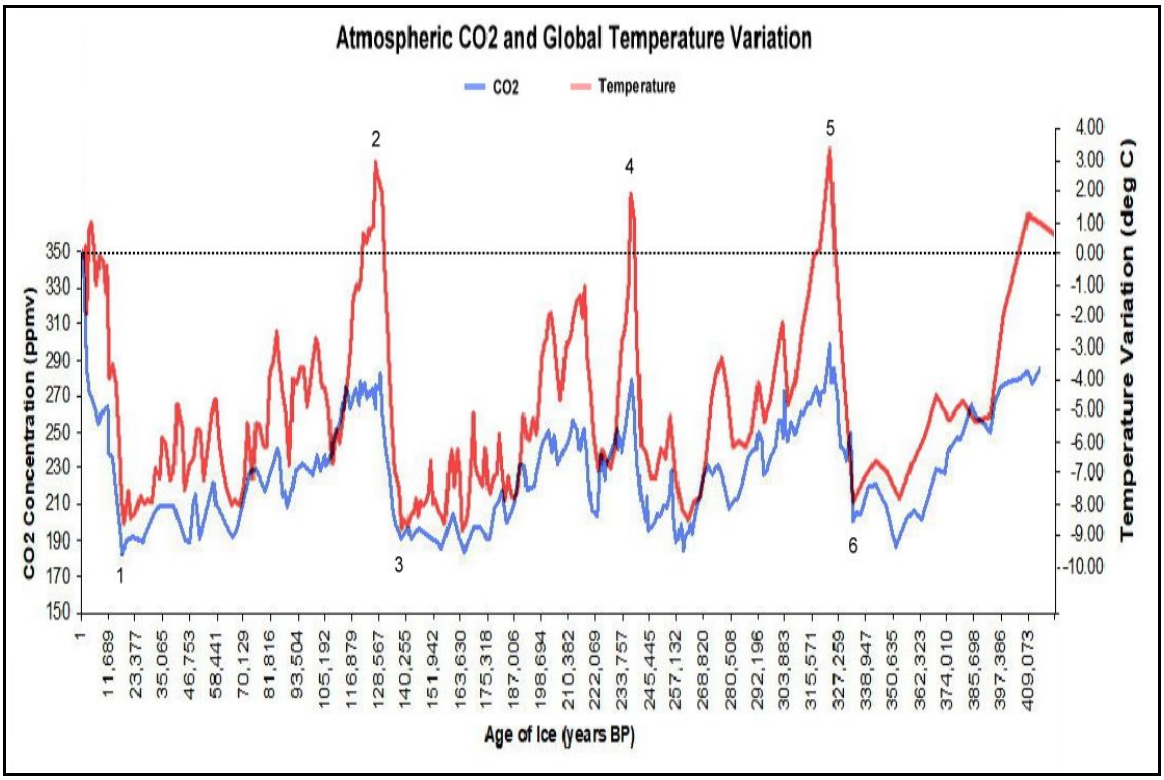
Scientists interpreted this data for many years as showing that temperature follows changes in atmospheric CO_2.[20] While there does appear to be a correlation between plots, there is no clearly leading factor. The resolution of ice core analysis prior to the 2000's was not detailed enough to determine clearly what came first, changes in temperature or CO_2. The expectation was that CO_2 came first because of the "green house effect" mentioned on the previous page. The media has convinced most of the public to believe this view. The alternative view that temperature changes might precede changes in CO_2 was not given much credence.

As can be seen from the graph above, major cooling and warming cycles have occurred approximately every 100,000 years for at least the past 400,000 years. Indeed, the pattern has continued for the past 800,000 years.

The author plotted the next graph using Vostok Ice Core data[21] to validate the previous graph.

[20] http://www.climatedata.info/forcing/gases/carbon-dioxide/, Figure 6. Once available on several websites, but now seemingly removed.

[21] Various sources, including: Barnola et al (France) 2003 and Jouzel, J., C. Lorius, J.R. Petit, C. Genthon, N.I. Barkov, V.M. Kotlyakov, and V.M. Petrov. 1987. Vostok ice core: a continuous isotope temperature record over the last climatic cycle (160,000 years). Nature 329:403-8. Jouzel, J., N.I. Barkov, J.M. Barnola, M. Bender, J. Chappellaz, C. Genthon, V.M. Kotlyakov, V. Lipenkov, C. Lorius, J.R. Petit, D. Raynaud, G. Raisbeck, C. Ritz, T. Sowers, M. Stievenard, F. Yiou, and P. Yiou. 1993. Extending the Vostok ice-core record of palaeoclimate to the penultimate glacial period. Nature 364:407-12. (https://cdiac.ess-dive.lbl.gov/ftp/trends/temp/vostok/vostok.1999.temp.dat and https://cdiac.ess-dive.lbl.gov/ftp/trends/co2/vostok.icecore.co2)



Note: The time scale on the X-axis is opposite to that of the previous and several other graphs in this paper. The 0 on the temperature scale represents the present day temperature. The expansion of the CO_2 axis is less than that on page 13.

This graph does validate that on page 13. No evidence of CO_2 lead or lag of temperature can be discerned by visual inspection of the graph. However, the actual data is instructive. The following table shows the number of years ago when the minimums and maximums labelled by numbers in the graph occurred, and what led what:

	1	2	3	4	5	6
CO_2	17,695	129,007	139,445	237,831	323,485	333,627
Temperature	18,530	126,749	138,756	237,755	323,482	333,106
CO_2 Lead		**2,258**	**689**	**76**	**3**	**521**
Temperature Lead	**835**					

The reversal of the leading factor at the end of the last Ice Age indicates that CO_2 and temperature are not correlated directly or that the data might be wrong; that is, inaccurate. The difficulties associated in knowing the accurate age of gases trapped in ice are significant. The diffusion and mixing of gases into adjoining layers of ice, thereby contaminating the results, can only be estimated. Likewise, the estimates of geological temperatures are vague at best, as is discussed on pages 10 to 12. These uncertainties make impossible any conclusions about what came first, CO_2 or temperature. However, there is an overall correlation within about 1,000 years on average.

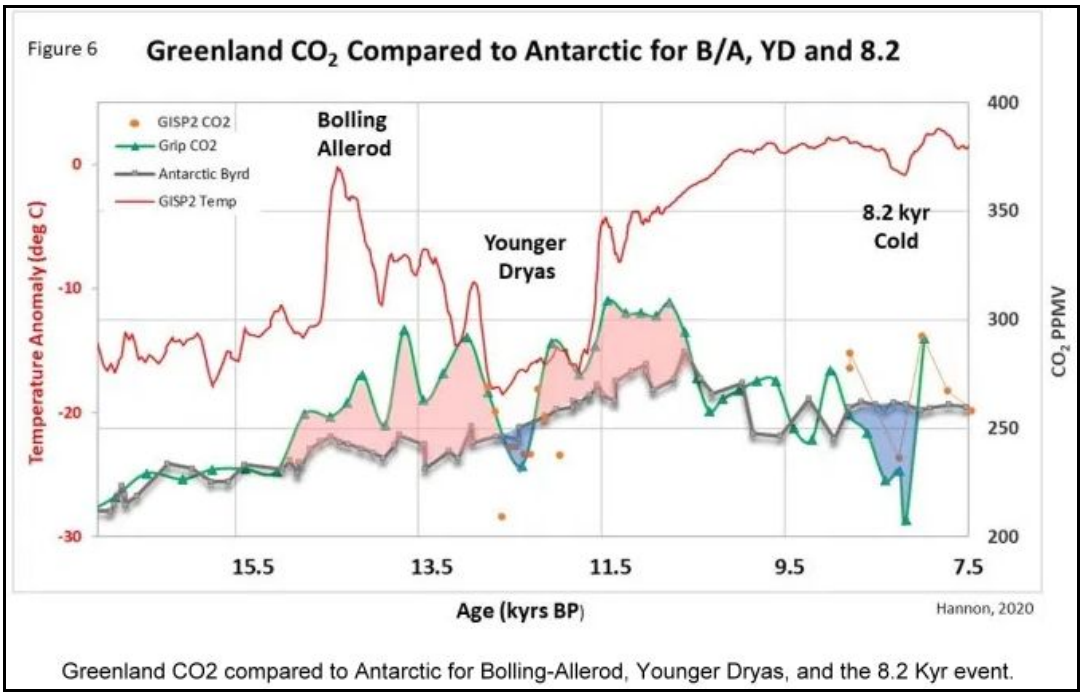
Importantly, note that the present day temperature, zero on the graph, is less than the peak temperature about 10,000 years ago (compare also with the proxies in the graph on page 11). Note, again, that the peak temperature at the start of the present interglacial is more than 2 deg C less than the previous three Interglacial peak temperatures. Present day temperatures are well within past ranges.

These cycles of temperature are believed to be initiated by the Milankovitch Cycles. The Milankovitch Cycles of the Earth's eccentricity, obliquity, and precession dictate the amount of solar radiation reaching the Earth, the insolation. The insolation correlates reasonably well with Earth's cyclic glaciations during the last 800,000 years, although not precisely. [22]

Importantly, newer evidence indicates that warming precedes increasing CO_2, possibly by about 800 years[23], at least at the end of an ice age. This tends to confirm the evidence presented in the table on page 14, data point 1.

Other evidence indicates there was no correlation over short timescales. "*Chylek et al. discovered that "summer temperatures, which are most relevant to Greenland ice sheet melting rates, do not show any persistent increase during the last fifty years." In fact, working with the two stations with the longest records (both over a century in length), they determined that coastal Greenland's peak temperatures occurred between 1930 and 1940, and that the subsequent decrease in temperature was so substantial and sustained that current coastal temperatures "are about 1°C below their 1940 values." Furthermore, they note that "at the summit of the Greenland ice sheet the summer average temperature has decreased at the rate of 2.2°C per decade since the beginning of the measurements in 1987." Hence, as with the Arctic as a whole, Greenland has not experienced any net warming over the most dramatic period of atmospheric CO2 increase on record. In fact, it has cooled during this period ... and cooled significantly.*"[24]

Interestingly, the variations of CO_2 in the Antarctic differ from those at Greenland. This graph shows the differences. Note: The Antarctic Byrd glacier data is for CO_2. The GISP2 and Grip data are Greenland data.[25]



Greenland CO2 compared to Antarctic for Bolling-Allerod, Younger Dryas, and the 8.2 Kyr event.

In the past, scientists hypothesised that the differences were caused by acid-carbonate chemical reactions in the Greenland ice bubbles creating a surplus of

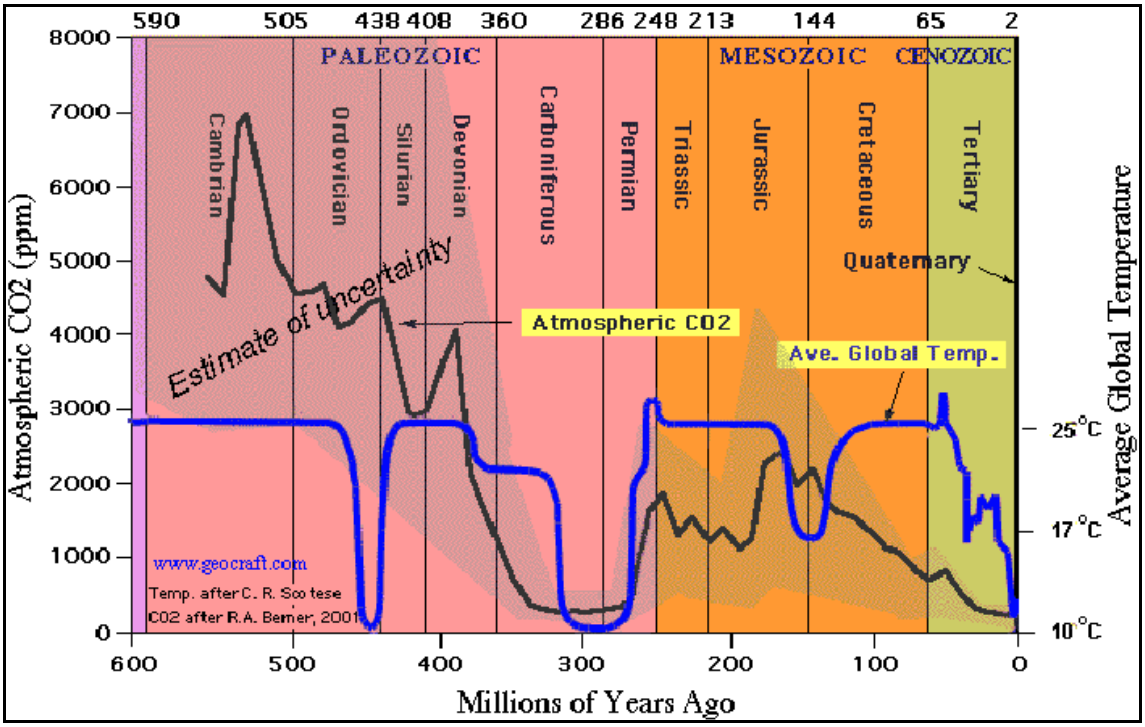
[22] https://en.wikipedia.org/wiki/Milankovitch_cycles#100,000-year_issue
[23] https://www.newscientist.com/article/dn11659-climate-myths-ice-cores-show-CO2-increases-lag-behind-temperature-rises-disproving-the-link-to-global-warming/
[24] Chylek *et al*. (2004): http://www.co2science.org/articles/V7/N12/EDIT.php
[25] https://wattsupwiththat.com/2020/01/07/greenland-ice-core-co2-concentrations-deserve-reconsideration/

CO_2, thereby distorting the Greenland data. Thereafter, Greenland data was essentially ignored. However, inspection of the graph shows that Greenland temperatures correlate well with CO_2 until about 10,500 years BP. After this date, Greenland CO_2 decreases while the temperature increases. This apparent anomaly is another like those mentioned on pages 14 and 15. Such anomalies must not be ignored. They indicate that the present understanding of climate change is not well understood.

While it is possible some of the Greenland CO_2 data could be contaminated, the assumption that ALL the CO_2 data is chemically altered in ALL the Greenland ice cores does not explain why CO_2 is so well behaved with Greenland temperatures or address the observations discussed above. It is also plausible the Greenland ice core CO_2 data has more detailed resolution and higher frequency than the subdued Antarctic ice core CO_2 record. Rapidly increasing CO_2 values measured during this Modern Warming may not be unprecedented compared with past natural fluctuations after all.[26]

There might well be missing factors in the data that influence either or both CO_2 and temperature, more than do the latter influence each other. One missing factor might be water vapour, the most prolific and effective GHG in the atmosphere. Water vapour is discussed on page 17. Another factor might be cosmic rays, discussed on page 20.

The next graph[27] shows the atmospheric CO_2 concentrations and Earth temperatures over the last 600 million years, as determined from proxy data. The wide areas of uncertainty when using proxy data to measure ancient CO_2 concentrations and temperature that were discussed on pages 10 to 12 apply here also.



Temperature after C.R. Scotese[28] CO_2 *after R.A. Berner, 2001 (GEOCARB III)* [29]

[26] https://wattsupwiththat.com/2020/01/07/greenland-ice-core-co2-concentrations-deserve-reconsideration/
[27] https://www.geocraft.com/WVFossils/GlobWarmTest/A6c.html
[28] https://www.sciencedirect.com/science/article/pii/S1342937X18302818

The graph indicates several important features that are discussed in the subparagraphs following.

(i) There is no correlation at all between atmospheric CO_2 concentrations and temperature over this geologically long timescale, at the resolution used, except for an apparent correlation near the end of the Permian. However, other causes of this single, apparent, correlation must be considered because of its isolated and, therefore, anomalous character.

(ii) The atmosphere has been as depleted of CO_2 as now only once before in this period, during the Carboniferous, and only twice before has the temperature been as low as today, at the end of the Ordovician and for a longer period in the Carboniferous and Permian.

(iii) There is an apparent cap of about 25 deg C on the smoothed temperature of the Earth. Note, the microscopic detail like the several "ice ages" the have occurred during the past 800,000 years are not shown at this resolution.

This graph clearly contradicts the idea of positive feedback, that a warming of the Earth causes CO_2 release from the oceans that then reinforces the warming.

There must be other influences at play.

e. **Correlation**

As for correlation, there is correlation and apparent correlation. Correlation means there is a connection between the things concerned; one affects the other. An apparent correlation between two things can occur when a third thing is correlated with each of the other things, affecting those things separately and, thereby, making the first two things appear correlated. However, many influences can make things appear correlated when they are not; the apparent correlation is a coincidence.

A warming Earth will increase atmospheric water vapour and CO_2. However, water vapour is a much more effective greenhouse gas than is CO_2. The water vapour might be the major issue and CO_2 of minor effect. There is a similar argument about the impact of methane and cosmic rays.

f. **Water Vapour**[30]

Water vapour is by far the most prolific and effective GHG in the Earth's atmosphere. A typical argument is that water vapour cannot cause climate change because it has a short atmospheric residence time and a physical limitation on its maximum concentration at any given temperature. However, as the planet warms, evaporation of water into the atmosphere increases thereby increasing the greenhouse effect. Hence, more water vapour can enter the atmosphere, compounding the greenhouse effect. While any particular quantum of water vapour might recycle through rainfall, for example, water is available always to replenish the atmosphere as temperature dictates. The GHG impact of water vapour includes that of clouds that reflect both incoming and outgoing thermal radiation, albeit to different extents.

"*Water vapour is one of the primary greenhouse gases, but some issues prevent its GWP* (Global Warming Potential) *to be calculated directly. It has a profound infrared*

[29] https://agbjarn.blog.is/users/fa/agbjarn/files/geocarb_iii-berner.pdf
[30] The Water Vapor Feedback, Yale Climate Connections by Zeke Hausfather, 2008 (https://www.yaleclimateconnections.org/2008/02/common-climate-misconceptions-the-water-vapor-feedback-2/)

absorption spectrum with more and broader absorption bands than CO_2 and, also, absorbs non-zero amounts of radiation in its low absorbing spectral regions. Next, its concentration in the atmosphere depends on air temperature and water availability; using a global average temperature of ~16 °C, for example, creates an average humidity of ~18,000ppm at sea level (CO_2 is ~400ppm and so concentrations of $[H_2O]/[CO_2]$ ~ 45x). Unlike other GHG, water vapor does not decay in the environment." [31]

"*Water vapor constitutes Earth's most significant greenhouse gas, accounting for about 95% of Earth's greenhouse effect.*"[32]

"*Climate scientists can quantify the effect of the water vapor feedback on the climate system, as shown by frequently modeled effects of doubling CO_2. In the absence of a water vapor feedback, doubled CO_2 would increase global temperatures by around 1 to 1.2 degrees C (1.8 to 2.2 degrees F). However, the additional water vapor in the atmosphere triggered by this initial warming will result in roughly 1.6 degrees C (2.9 degrees F) more warming, and positive feedbacks caused by changes in cloud formation add around 0.7 degrees C more (1.3 degrees F). This cloud feedback varies significantly between models, ranging from 0.3 to 1.1 degrees C (0.5 to 2 degrees F).*"[33]

Roger Pielke Sr., a research scientist at the University of Colorado, wrote in 2007 the following: "*The effect of even small increases in water vapor content of the atmosphere in the tropics has a much larger effect on the downwelling fluxes, than does a significant increase of the CO_2 concentrations. Thus, the monitoring of multi-decadal water vapor trends in the tropics should be a high priority. While the increase in CO_2 concentrations, and resulting increase in downwelling longwave flux can result in surface ocean warming, and thus increase evaporation into the atmosphere, it is the atmospheric water vapor signal that should be monitored for long term trends, as it is the dominant greenhouse gas that has the greater climate response.*

The fractional contribution of the effect of added CO_2, relative to a 5% increase of water vapor in the subarctic winter is significantly larger than in the tropical sounding. This is because the subarctic sounding is quite dry. An increase in absolute terms of water vapor similar to a 5% increase in the tropical sounding would, however, dominate the increase of downwelling longwave fluxes. This again indicates that the assessment of long term water vapor atmospheric concentrations needs to be a climate science priority."[34]

The IPCC states, "water vapour is the single most important greenhouse gas, but its atmospheric concentration is not significantly influenced by direct anthropogenic emissions."[35]

Major causes of global warming might well be missed and mankind's reactions to mitigate it might be misdirected if the IPCC is looking only to blame anthropogenic influences.

In summary, there is strong evidence that water vapour should be acknowledged as the major GHG, its affects dwarfing those of CO_2. The effect of water vapour on

[31] https://en.wikipedia.org/wiki/Global_warming_potential#Values
[32] https://www.geocraft.com/WVFossils/greenhouse_data.html
[33] https://www.yaleclimateconnections.org/2008/02/common-climate-misconceptions-the-water-vapor-feedback-2/
[34] https://pielkeclimatesci.wordpress.com/2006/05/05/co2h2o/
[35] https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_I_full_report.pdf

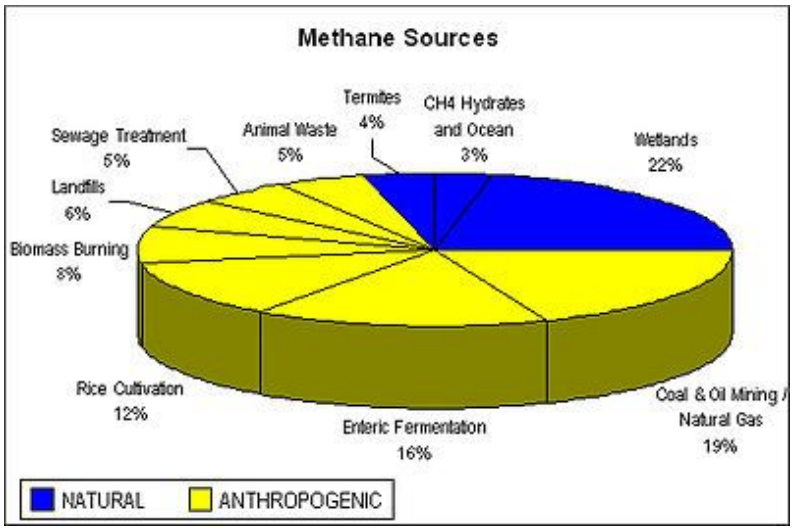
climate change and its importance relative to other GHGs demands further investigation before fixating on CO_2.

g. **Methane**

Methane is the second most prevalent GHG in the atmosphere. There are about 1,800 parts per billion of methane in the atmosphere, about 200 times less than the CO_2 concentration. However, methane is about 30 times more potent as a GHG than CO_2, averaged over about 100 years. Indeed, in the first two decades after its release, methane is 84 times more potent than carbon dioxide.[36] Other reports state that methane has a global warming potential (GWP) 104 times greater than CO_2 in a 20-year time frame.[37] Further, the methane concentration tends to follow temperature very closely, much more so than does CO_2.

Long term atmospheric measurements of methane by the National Oceanic and Atmospheric Administration (NOAA) show that the build up of methane levelled off during the decade prior to 2006, after nearly tripling since pre-industrial times. Since 2006, atmospheric methane has increased. Methane emissions levels vary greatly depending on the local geography. For both natural and anthropogenic sources, higher temperatures and higher water levels result in the anaerobic environment that is necessary for methane production.[38] Scientists have yet to understand sufficiently the reasons for the variability.

About 29% of all atmospheric methane comes from natural sources. Much is contained in wetlands and tundra because of microbial processes. These sources are removed during Ice Ages because of freezing. However, as a thaw sets in as an Ice Age ends, methane starts to be released. Sources of methane are shown in the pie chart and comment following.[39]



Comment. *Living plants (e.g. forests) have recently been identified as a potentially important source of methane, possibly being responsible for approximately 10 to 30 percent of atmospheric methane. A 2006 paper calculated emissions of 62–236 teragram per year* (a teragram is a trillion grams), *and "this newly identified source may have important implications". However, the authors stress, "our findings are preliminary with regard to the methane emission strength".*

[36] https://www.edf.org/climate/methane-other-important-greenhouse-gas
[37] https://en.wikipedia.org/wiki/Atmospheric_methane
[38] https://en.wikipedia.org/wiki/Atmospheric_methane#cite_note-86
[39] https://en.wikipedia.org/wiki/Atmospheric_methane

h. **Cosmic Rays**

Galactic Cosmic Ray Flux is estimated to contribute up to about 15 per cent of global warming. A paper published by the Science & Public Policy Institute concludes: “Clearly, in light of all the evidence …, the flux of galactic cosmic rays wields an important influence on Earth's climate, and likely much more so than that exhibited by the modern increase in atmospheric CO_2, making fluctuations in the Sun the primary candidate for "prime determinant" of Earth's climatic state.”[40]

In an article on Cosmic Rays and Climate, by Nir J. Shaviv, the statement is made, “In a later analysis, with Ján Veizer of the University of Ottawa and the Ruhr University of Bochum, it was found that the cosmic ray flux reconstruction agrees with a quantitative reconstruction of the tropical temperature (Shaviv & Veizer, 2003). In fact, the correlation is so well (sic), it was shown that cosmic ray flux variations explain about two thirds of the variance in the reconstructed temperature signal. Thus, cosmic rays undoubtedly affect climate, and on geological time scales are the most dominant climate driver.” [41]

i. **Plant Growth**

Noteworthy is that increased atmospheric CO_2 enhances plant growth. This is part of Earth’s self-regulating carbon cycle. Plants retain about 50% of the CO_2 they breathe in, as energy and structure. However, mankind is massively reducing the vegetation cover of the Earth by destroying forests and other types of vegetation, usually for timber production and agricultural purposes. These activities impact negatively on the Earth’s CO_2 processes and climate, including rainfall.

Summary

Scientists do not understand well enough the possibly self-regulating carbon cycle of the Earth to be sure that Earth cannot cope with our emissions in the longer term. Similar uncertainties apply to other GHG cycles, some more potent than CO_2. Note that water vapour is by far the most prolific and effective GHG in the Earth’s atmosphere.

The evidence shows that atmospheric CO_2 and temperature seem to correlate at particular timescale resolutions but not at others. This lack of close correlation applies particularly within the habitable plateau of the present interglacial period and over long geological timescales (see pages 15 and 16).

Many more questions remain to be answered. Particularly important is that none of the present models produced by the IPCC and others who believe that climate change is man-made are proved accurate. When these predictive models are back-tested, using historical data to forecast present events, they fail. That is, they are not validated and, therefore, should not be used as a basis for policy. Rigorous scientific method should inform our actions.

The evidence presented above indicates that there must be significant influences on climate other than atmospheric CO_2. Fixating on CO_2, and to a lesser degree methane, might be too convenient, if done because a portion of these gases have anthropogenic origins and, therefore, are able to be reduced.

We need to be sure that we are not reacting to the wrong signals.

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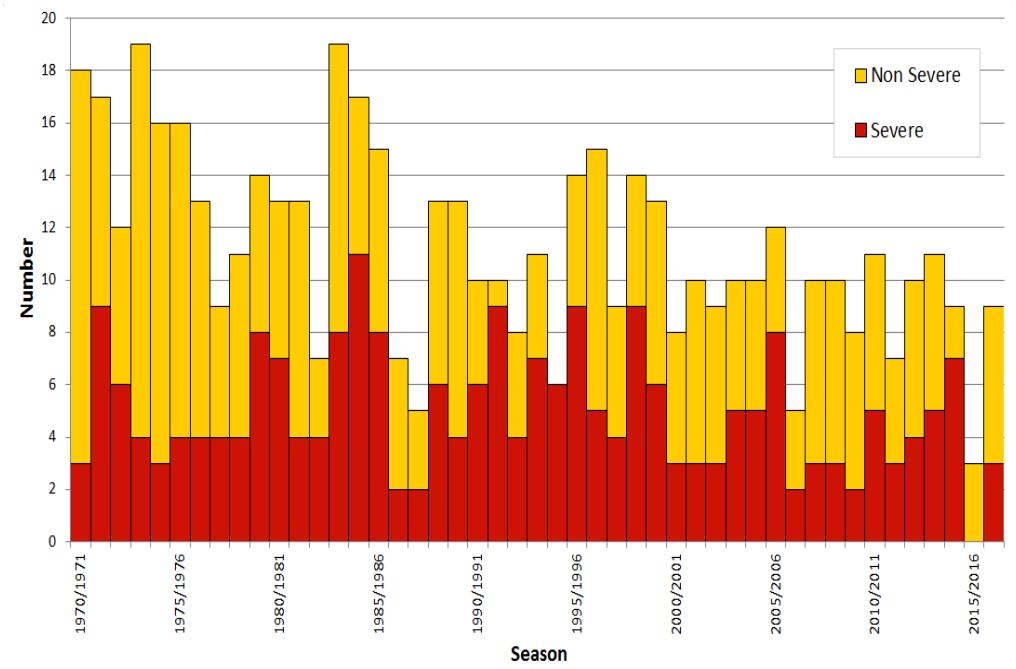
[40] Center for the Study of Carbon Dioxide and Global Change. "Solar Influence Climate: Cosmic Rays.” Last modified May 1, 2013. http://www.CO2science.org/subject/e/summaries/extraterrestrial.php.

[41] http://www.sciencebits.com/CosmicRaysClimate

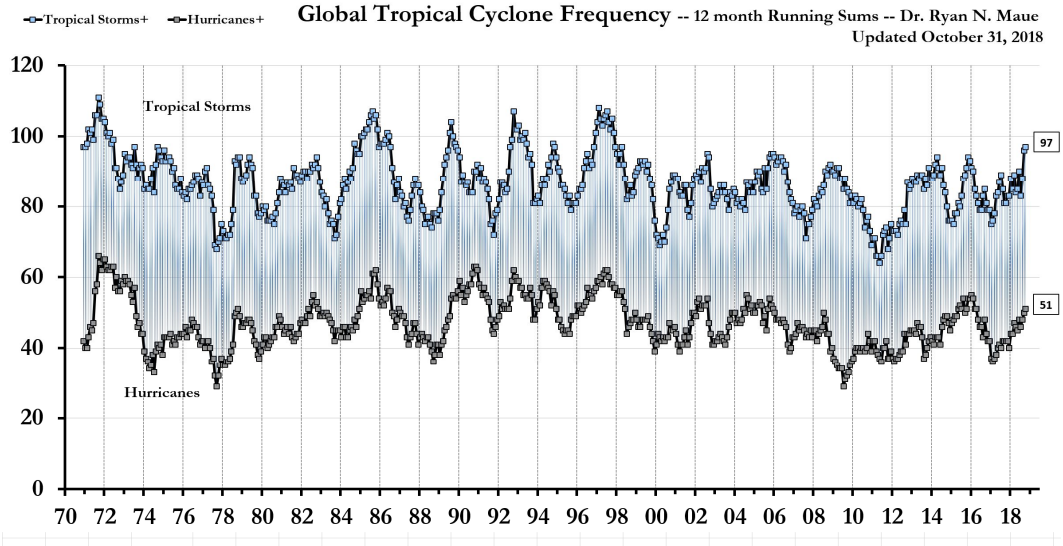
Hurricanes

The IPCC and most climate change commentators state that increased warming of the planet will cause increased hurricane (cyclone) and storm activity. The following graph shows the actual number of severe and non-severe tropical cyclones **in the Australian region** from 1970-2017.[42]



There is no increase in either the frequency or intensity of these cyclones during the period shown.

The graph following shows the Total **Global** Tropical Storm (TC) and Hurricane frequencies, as 12-month running sums.[43] The top time series is the number of TCs that reach at least tropical storm strength (maximum lifetime wind speed exceeds 34 knots). The bottom time series is the number of hurricane strength (64 knots+) TCs.



Again, there is no increase in global tropical storm or hurricane frequencies or intensities.

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[42] http://www.bom.gov.au/cyclone/climatology/trends.shtml
[43] http://www.thegwpf.com/global-hurricane-activity-historical-record/

This graph is reported to be part of the information presented to the US Senate that resulted in the US withdrawing from the Paris Climate Agreement.

These empirical graphs show there is no increase in the number of global storms and hurricanes, clearly contradicting prevailing theoretical models and popular belief. Importantly, as with much of the data used by the IPCC and others to comment on global warming and climate change, the timescales used in these storm graphs are very short. Such snapshots in time should not be used to make explicit statements about long-term trends in climate variability.

Be Careful of the Data

"*Recent papers (Vecchi and Knutson 2008; Landsea et al 2010; Vecchi and Knutson 2011; Villarini et al. 2011) suggest that, based on careful examination of the Atlantic tropical storm database (HURDAT) and on estimates of how many storms were likely missed in the past, it is likely that the increase in Atlantic tropical storm and hurricane frequency in HURDAT since the late-1800s is primarily due to improved monitoring.*"[44] This is likely true for all measured climate extremes.

Australian climate policies must be based on true science, not on unvalidated models, vested interests, or ideological demands, as seems to be the case at present.

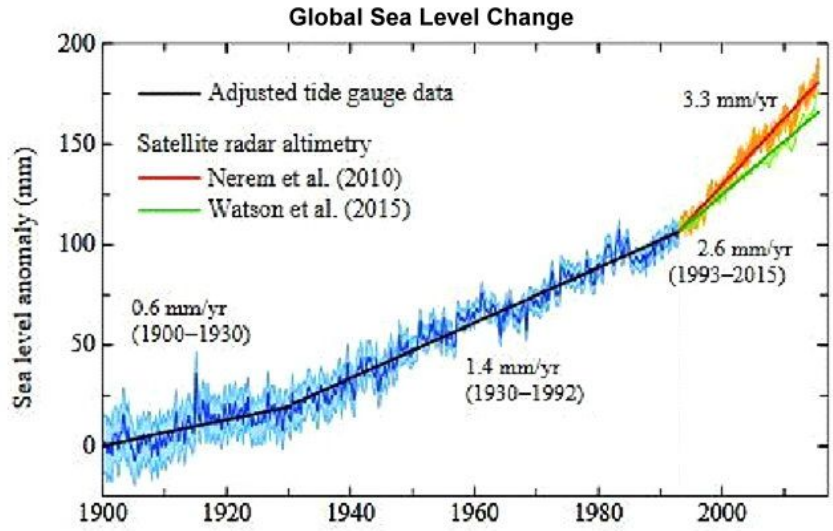
[44] https://www.gfdl.noaa.gov/historical-atlantic-hurricane-and-tropical-storm-records/

Sea Level Rise

The global sea level is undoubtedly rising, in part because the Earth is warming and the glaciers and ice caps are melting. However, the hypothesis that mankind is causing this rise because of their CO_2 emissions are not proven.

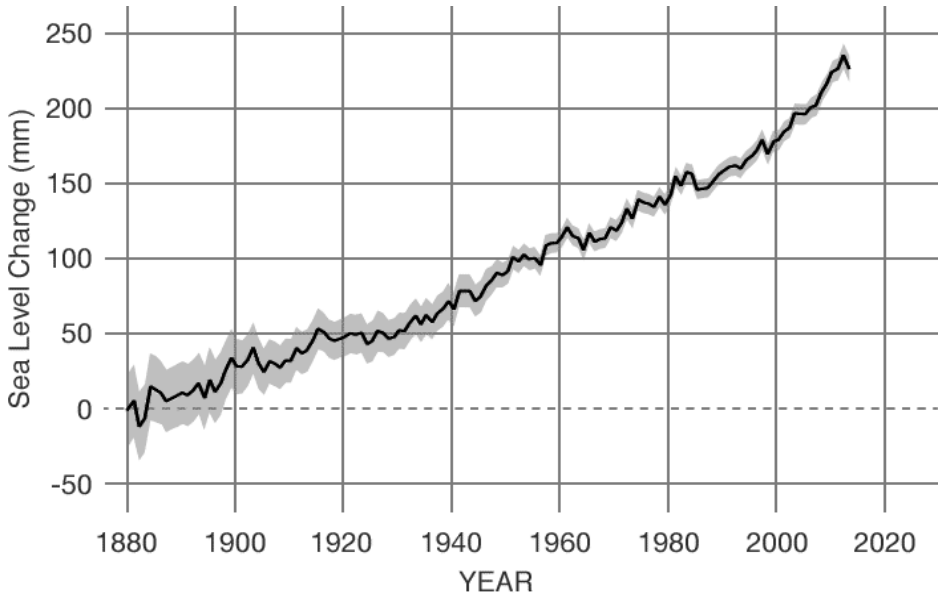
The Trees and the Forest

The following graph (Hansen et al[45]) typically is used to show recent sea level rise and to highlight an apparent rapidly increasing rate from about 1990; the 3.3 mm/yr extension:



The sudden, disjointed, increases in trend in about 1930 and 1990 are interesting but appear artificial. This disjointedness is not explained in the reference, but might result from trying to connect data from different sources: different tide gauges, different datums, and then satellites. That is, the graph might contain errors.

The next graph shows that using tide gauge data alone does not have the disjointedness.[46]



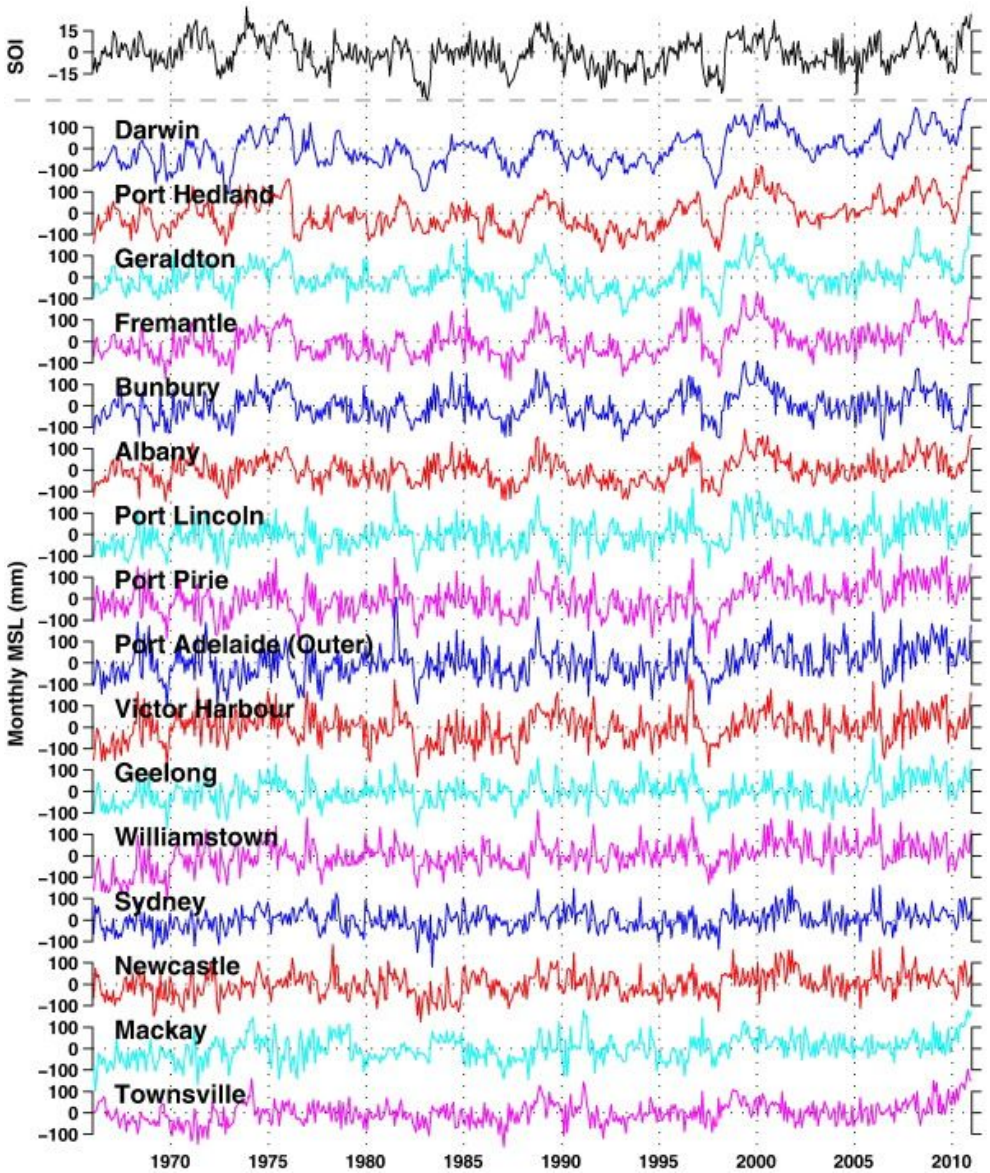
[45] Hansen et al. Ice melt, sea level rise and superstorms. Atmos. Chem. Phys. (https://www.atmos-chem-phys.net/16/3761/2016/acp-16-3761-2016.pdf)
[46] https://climate.nasa.gov/vital-signs/sea-level/

The upper graph on the previous page shows an average change in sea level throughout the period of about 1.6 mm/yr. The lower graph shows 1.74 mm/yr. The lower graph is highly likely more accurate because of its continuous recording.

Of interest is the data for sea levels around Australia. Earth-Science Reviews Volume 136, September 2014, Pages 155-174 has an article entitled, "*Australian sea levels—Trends, regional variability and influencing factors".*[47]

The article contains data for mean sea-level (MSL) at up to 41 sites around Australia. It discusses raw data and that corrected for climate variability and Glacial Isostatic Adjustment (GIA). In part, it concludes for the raw data, "*The most complete comparisons are available for periods 1966 to 2009, 1990 to 2009 and 1993 to 2009 as the tide gauge-based GMSL data finishes in 2009.For these periods the average trends of relative sea level around the coastline are 1.4 ± 0.3, 4.2 ± 0.9 and 4.5 ± 1.3 mm yr*$^{-1}$".

This conclusion is based on the data forming the next graph of coastal tide gauge data from 1966 to 2010, uncorrected for the many climate variables or glacial isostatic adjustment (GIA):



[47] https://www.sciencedirect.com/science/article/pii/S0012825214000956

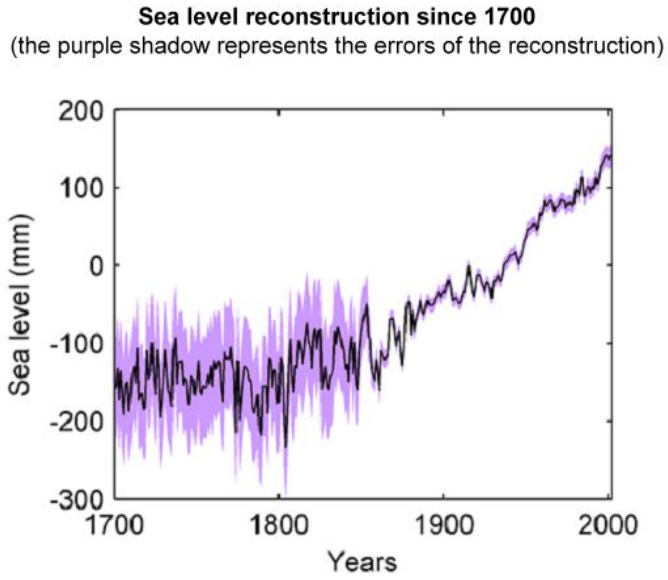
While the article also presents a version of this graph corrected for climate variability and coastline movements, these corrections are complicated and based only on what is known presently about these variability indexes. Similarly, MSL is defined in the article to be "*relative to an Earth-fixed reference frame with its coordinate origin at the time-averaged centre of mass of the Earth (the geocentre)*". Such corrections and reference frames are possibly moot. If the sea levels are changing, the impacts will take place with climate variability, coastal land movements, GIA, and tectonic plate movements in place. Sea-level is relative to present land boundaries and prevailing weather.

It is apparent from the graph that the MSL at all stations closely follows the Southern Oscillation Index (SOI), shown as the topmost plot. However, the calculation of the rate of change in sea level over the period shown appears to suffer from a common ailment, selection bias. That is, trend lines that start from a selected low point and end at a selected high point (as seems to have happened in this article) will be different from lines that start at a high point and end at a low point. Selection bias is commonplace and must be considered when examining all data and reports, including those presented by the IPCC.

The data shown in the graph on the previous page starts in 1966 when the SOI was low and ends in December 2010 when it was high. What would be the trend if, say, the starting point were the year 1970. What if started in 1970 and ended at 2005? Certainly, the trends would be much different. Start in 1975 and end in 2005 and the oceans are on a trend to disappear.

Such graphical depictions can distort perceptions and understandings because of either the very short timescales used or the selected terminal point data. It can be a case of looking at the trees and not seeing the forest.

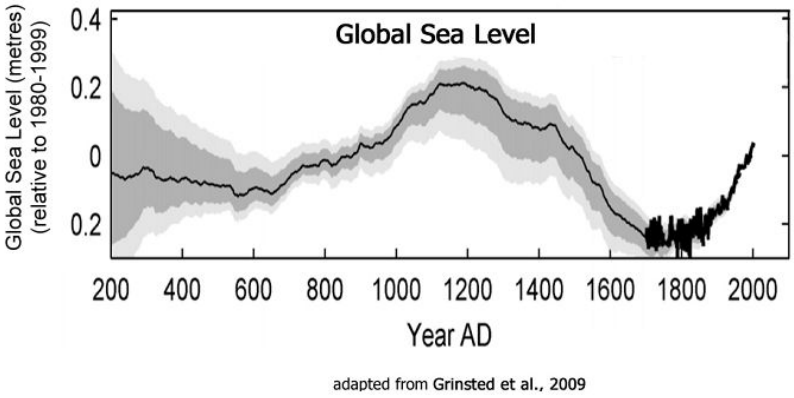
S. Jevrejeva et al did a sea level reconstruction using several European tide gauges and correcting for Glacial Isostatic Adjustment (GIA) in 2008 [48] as shown in the graph following. It includes the periods depicted in the two previous graphs, and gives some perspective:



Jevrejeva's graph shows a rise of about 300 mm since the end of the Little Ice Age in about the year 1800. This averages 1.5 mm per year to the year 2000. Note that this rise began before mankind began burning fossil fuels in earnest from about 1850.

[48] http://www.psmsl.org/products/reconstructions/jevrejevaetal2008.php

The following graph[49] places the present rise in sea-level into context with even longer-term changes, having nothing to do with mankind. It shows particularly the medieval warm period between about 800 AD and 1400 AD. It includes the periods depicted in the graphs on pages 23 and 25, for an even better perspective.

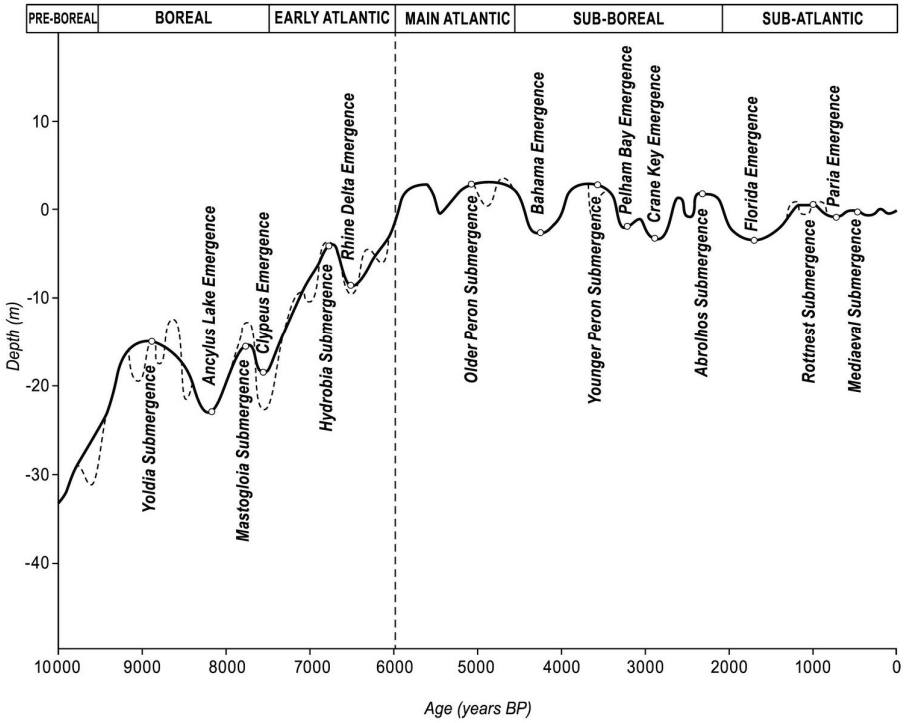


adapted from Grinsted et al., 2009

The medieval warm period peaked at about 1,200 AD. During this time, the Earth's temperature was about 1.5 degrees C warmer than today and the Vikings settled and farmed for about 500 years on a land they named Greenland.

The next graph shows eustatic[50] sea-level fluctuations globally since the last ice age.[51]

Sea-Level changes since the last Ice Age



While there are uncertainties in the data, this graph indicates that sea levels varied by up to about 5 metres repeatedly throughout much of this period. Comparing the sea

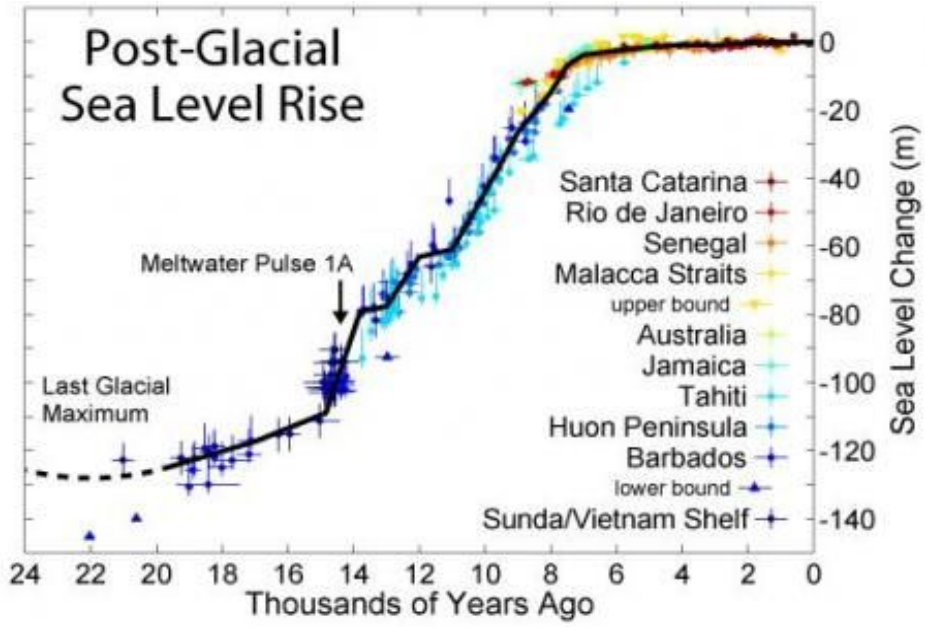
[49] Grinsted et al. (2009), Reconstructing sea level from paleo and projected temperatures 200 to 2100AD. Clim. Dyn.

[50] Eustatic means a global change in the amount of water stored in the oceans, or a change in the geometry of the ocean basins which alters the volume of water they can hold.

[51] Quaternary Sea-Level Changes, Ch 7, pps. 320-368. Colin V. Murray-Wallace et al, University of Wollongong, NSW, Cambridge University Press, 2014.

level fluctuations during the period from 6,000 years ago until now on this graph with the temperature fluctuations during the same period, as indicated by the Holocene Temperature Variations graph on page 11, show that temperature fluctuations of about 0.7 deg C apparently caused sea-level fluctuations of about 5 metres, albeit noting the uncertainties with proxy data. However, the IPCC states that the "*Projected GMSLR*[52] *for 1.5°C of global warming has an indicative range of 0.26 – 0.77m, relative to 1986–2005, (*medium confidence*).*" [53] This IPCC statement and the evidence represented in the two graphs mentioned above conflict markedly. Which result is more correct?

The following graph represents the changes in sea level from the time of the last ice age.[54]



The graph shows various proxy data that indicate the sea level rose between 120 and 140 metres during the period from about 20,000 to about 4,500 years ago when glacial melting had essentially ceased. This is an average rise of 9 mm per year. The rise was in stages, however, with very rapid rises and falls during this period, with rates at the Great Barrier Reef varying from minus 20 mm/yr to plus 30 mm/yr.[55] Similar rises and falls occurred elsewhere.[56] This approximately 140 metre rise occurred during an overall temperature increase of about 10 deg C during which CO_2 rose too, but with precedence uncertain (see pages 13 to 17).

At about 6,500 years ago, the sea levels within Moreton Bay, Queensland, and indeed throughout most of Asia, were about 1 metre higher than today.[57]

By 3,000 years ago, the sea levels had essentially stabilized at about today's level.

Importantly**,** none of these sea-level changes had anything to do with mankind, seemingly none were triggered by CO_2, and a uniform correlation between CO_2 and

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[52] GMSLR is the acronym for global mean sea level rise.
[53] https://www.ipcc.ch/sr15/chapter/chapter-3/
[54] https://en.wikipedia.org/wiki/Sea_level_rise#column-one
[55] New evidence for episodic post-glacial sea-level rise, central Great Barrier Reef, Australia, P. Larcombe et al. (https://www.sciencedirect.com/science/article/abs/pii/0025322795000598)
[56] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4217469/
[57] GHD Study Area Coastal Assessments (https://www.moretonbay.qld.gov.au/files/assets/public/services/publications/bribie-semp-study-area-coastal-assessments.pdf)

temperature is not evident at all timescales likely because of global influences not understood.

Care must be taken not to confuse natural variations with mankind's influence. Rigorous science must be used, not ideological imperatives.

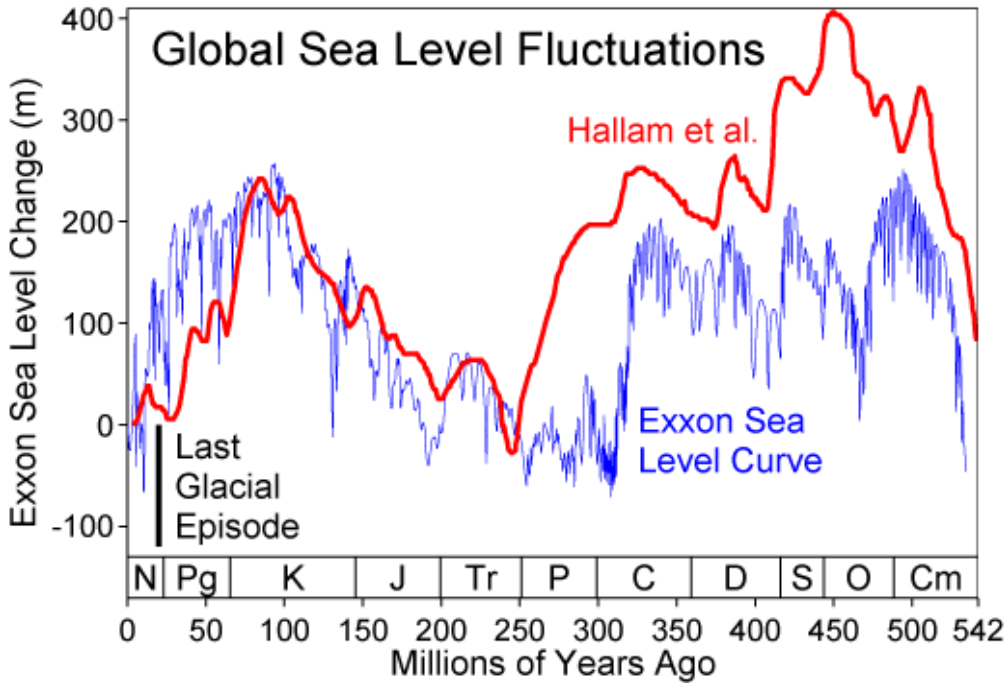
The sea level might continue to rise for a time during this interglacial period with the remnant glaciers and ice caps continuing to melt. If the presently claimed rise of about 3 mm/yr is continued, the sea level will increase 30 cm by 2120. Likewise, other fluctuations of a few metres could continue as has happen in the past, for reasons not well understood.

This trend will change when the present interglacial period ends with the onset of the next major cooling cycle, assuming the pattern persists as it has very roughly every 100,000 years for at least the past 800,000 years. Each cycle ends in what is described generally as an Ice Age, the last ending about 18,000 years ago.

The beginning of each previous interglacial period has had temperatures relatively close to those of today. Each time, the periods of temperature that are easily "habitable" have lasted for about 10,000 years before temperatures started to decrease towards the following Ice Age (see the graphs on pages 13 and 14). Today's interglacial "habitable" period has continued already for about 10,000 years. If the current solar minimum continues for a few more years, and/or other factors not yet fully understood occur, the present interglacial climate will change significantly, as it heads towards the next Ice Age.

Other Effects on Sea Levels

Apart from global temperature fluctuations, many mechanisms can cause sea levels to change. To provide even better perspective, the following graph[58] plots sea levels over the past 540 million years, since the Cambrian era. **Note:** The time series axis of this graph is opposite to that used in some of the previous graphs.



Absolute sea level changes (in meters) over the last 540 million years.
Present sea level is zero meters. Blue curve is from Exxon; red curve is from Hallam.

[58] Wikipedia CC BY-SA 3.0 (Creative Commons)

While temperature would have had an influence, other factors were more significant. A comparison of the temperature graph on page 16 with the sea-level graph on the previous page indicates the disconnect between temperature and sea-level during this period and at the resolutions shown. Tectonic plates moved significantly throughout this time, affecting ocean sizes, depths, and current patterns, as well as land and sea heights. For reference, zero on the sea level axis on the graph is the current sea level.

Sea level changes at specific locations might be more or less than the global average, due to local factors such as land subsidence caused by natural processes and the withdrawal of groundwater and fossil fuels, changes in atmospheric pressure, changes in regional ocean currents, and whether the land is still undergoing isostatic rebound from the compressive weight of Ice Age glaciers.

A more detailed explanation of some of the factors that affect sea level follows: [59]

a. Intrinsic Causes of Sea Level Change.

   Global or eustatic sea level can oscillate due to changes in the volume of water present within the ocean basins relative to storage of that water on land. Short-term sea level change can be driven by sudden tectonic events (e.g., earthquake-induced subsidence/uplift), and tidal processes, but sea level change on the scale of decades to thousands of years is primarily driven by changes in the Earth's climate system that can be influenced by both intrinsic and extrinsic phenomena.

b. The Water Cycle.

   The water on the planet is constantly being cycled through various states, such as water vapor in the atmosphere, liquid water in oceans, rivers and groundwater, and ice in ice sheets and glaciers. This cycling happens at different rates from rapidly (measured in days) to very slowly (measured in thousands of years or more). Water evaporated from the oceans can become locked up on land and prevented from cycling back to the ocean. The USGS estimates that some 8,500,000 cubic miles of water is trapped on land either as ice or as freshwater. When and if this water makes its way back to the ocean (and if it is not replaced on land), sea levels can rise significantly.

c. Isostatic Changes – Glacial Isostatic Adjustment.

   Huge amounts of water can be stored as ice during colder periods in Earth’s history. When the planet warms and ice melts, this water is returned to the ocean basins (causing a rise in sea level). When ice sheets and glaciers covered the land during the Ice Ages of the Pleistocene, the weight of the ice depressed the elevation of the land. Over the 20,000 years since the last glacial maximum, the landmasses, relieved of their burden of ice, have gradually rebounded. This rebound is called Glacial Isostatic Adjustment or GIA. The level of the land relative to the sea level increases. This can cause a regional sea level change effect and is still impacting parts of Alaska and other northern coasts.

d. Thermosteric Sea Level Change - Thermal Expansion and Sea Level Rise.

   As temperatures of the ocean increase, the volume of seawater increases and can produce a higher sea level. Conversely, as seawater cools down, the density increases as the volume decreases. This produces lower sea levels.

[59] https://www.e-education.psu.edu/earth107/node/1499

e. Plate Tectonics and Sea Level Change.

The tectonic processes at work on the Earth influence the size of ocean basins and, therefore, sea levels in many complex ways. The following list gives an idea of some of these processes and their interactions and feedback mechanisms:

(a) rifting of tectonic plates at divergent plate boundaries;

(b) assembly of micro-continents, volcanic terrains, continents - especially supercontinents like Rodinia, Pangea, etc.;

(c) subduction of tectonic plates at ocean trenches at convergent plate boundaries;

(d) eruption and formation of large igneous provinces that originate from massive extrusions of lava, oceanic plateaus, hotspot volcanic island chains, etc.;

(e) high rates of volcanism on the seafloor volumetrically displace water out of the ocean basin producing higher sea levels (called transgression of sea level);

(f) low rates of volcanism allow water to return to the ocean basin and sea levels drop (called regression of sea level);

(g) when rocks cool from a molten state, they contract in volume; this allows subsidence to occur, especially along the mid-ocean ridges, and sea levels fall;

(h) when rates of volcanism are low, rocks tend to cool faster and sea levels drop as subsidence occurs; and

(i) conversely, when rates of volcanism are high, it takes longer for the rocks to cool, and sea level remains higher for longer periods of time after the rate of volcanism subsides.

f. Extrinsic Drivers of Sea Level Change.

(a) The Milankovitch Cycles. See page 15.

(b) Galactic Cosmic Rays. See page 20.

Island Subsidence

Researchers, organisations, and people generally, can miss facts, misunderstand research or can cherry-pick particular results to further political or other agendas. An example[60] is when, in 2005, the United Nations declared the inhabitants of Lateu (Lataw), a village in the Torres Islands of Vanuatu, to be Earth's first climate change refugees. The coconut palm plantations were flooded and housing was threatened. Between 2002 and 2004, with the support of the Vanuatu government and Canadian aid, the village was moved several hundred metres to escape the rising water. International bodies interpreted this rise as an effect of global warming, which melts the ice caps and dilates the oceans' surface waters.

However, the real cause of the flooding has been reported differently:

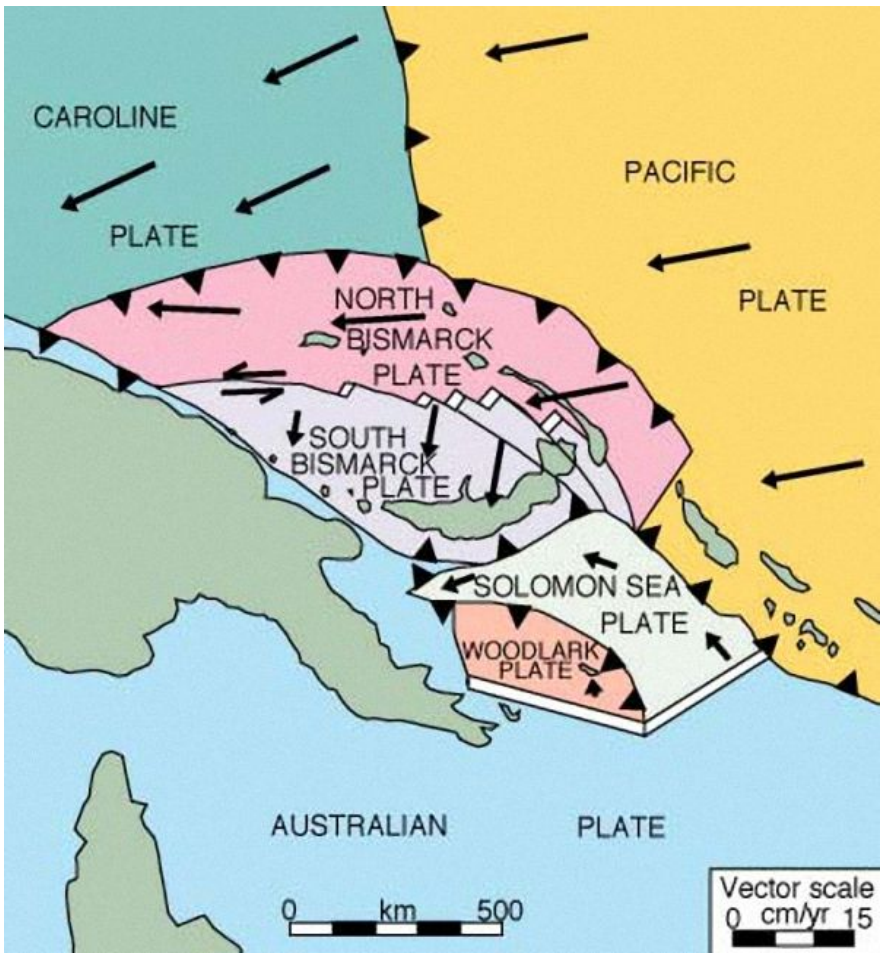
Following an earthquake in 1997, whenever there was a tide with a high coefficient or a passing low atmospheric pressure system, seawater flooded the village to waist height. These repeated incidents led the village chiefs to consider relocating the only village

[60] Institut de recherché pour le developpement (IRD), Scientific News, No 386 dated October 2011

community on the island (39 inhabitants according to the 1999 census) to a place known as Lirak. The residents of Lateu did not move until 2004, however, as they were unwilling to leave the fresh water source, despite the occasional risk of rising water and their awareness of the potential dangers of the ocean. It was a 2001 visit by a Vanuatu government official in charge of national environmental issues, in the context of a regional project on adaptation to climate change led by SPREP (Secretariat of the Pacific Regional Environmental Program) and funded by CIDA (Canadian International Development Agency), that helped convince the population of the urgency to move—by attaching the words "climate change" and "rising sea levels" to the events they had experienced. [61]

The relevant fact is the 1997 earthquake. Vanuatu, like the Solomon Islands, sits atop the Solomon Tectonic Plate. This Plate is being subducted under the Pacific Plate, the South Bismark Plate and the Woodlark Plate. Hence, Vanuatu and the Solomons will eventually disappear completely in geological timescales, not because of sea level rise but because they will be pulled into the Earth's mantle. This is island subsidence.

In the meantime, earthquakes will continue to occur and the Islands and the sea floor in the area will continue to rise and fall. Sea level rise can be real or apparent. Many factors are at play.



This diagram shows the Solomon Tectonic Plate in relation to its neighbouring Plates

[61] Population Movement and Environmental Changes in the Torres Islands (Vanuatu, Melanesia). CAIRN.INFO International Edition. (https://www.cairn-int.info/article-E_AG_685_0219--the-myth-of-the-first-climate-refugees.htm

The levels of the seas are affected by global processes well outside the proven impact of mankind. The seas can be expected to continue to rise significantly, as they have done many times throughout Earth's history if the planet continues to warm, as is shown by the graphs on pages 23 to 28. On the other hand, if the global cycle enters the expected next glacial stage, then the sea levels will start to fall and will fall considerably.

There is no absolute evidence that mankind is causing the sea level to rise, only suppositions and theories. Selecting CO_2 as the culprit may create happiness in those caught in the echo chamber of academia, the scientifically illiterate, those with ideological issues, and those with vested interests. However, misguided solutions are likely to lead to serious social and economic harm.

Adaption to climate change is the only sensible and pragmatic way forward.

Vanuatu, Kiribati, and Tuvalu

Much has been said in the media about crises of the island states of Vanuatu, Kiribati, and Tuvalu, amongst others in the western Pacific Ocean. Stories of inundation by the rising seas abound. Nations such as Australia are being pressured to save the people of those islands by stopping the production of CO_2 that supposedly is causing global warming and the sea levels to rise.

As well as subsidence, discussed above, English naturalist Charles Darwin discovered an important fact regarding atolls and sea level rise. He realized that coral atolls essentially "float" on the surface of the sea. When the sea rises, the atoll rises with it. They are not solid, like a rock island. They are a pile of sand and rubble. Atolls exist in a delicate balance between new sand and coral rubble being added from the reef, and atoll sand and rubble being eroded by wind and wave back into the sea or into the lagoon. As sea level rises, the balance tips in favor of sand and rubble being added to the atoll. The result is that the atoll rises with the sea level. This is not to deny the affect of sea level rise.

Climate scientists now realize that many low-lying Pacific islands are growing, not sinking. Islands in Tuvalu, Kiribati and the Federated States of Micronesia are among those that have grown, largely due to coral debris, land reclamation and sediment. The findings, published in the magazine New Scientist, were gathered by comparing changes to 27 Pacific islands over the last 20 to 60 years using historical aerial photos and satellite images.

Auckland University's Associate Professor Paul Kench, a member of the team of scientists, says the results challenge the view that Pacific islands are sinking due to rising sea levels associated with climate change.[62]

"*Eighty per cent of the islands we've looked at have either remained about the same or, in fact, gotten larger*", he said.

"*Some of those islands have gotten dramatically larger, by 20 or 30 per cent.*"

"*We've now got evidence the physical foundations of these islands will still be there in 100 years.*"

Dr Kench says the "*growth of the islands can keep pace with rising sea levels*".

"*The reason for this is these islands are so low lying that in extreme events waves crash straight over the top of them,*" he said.

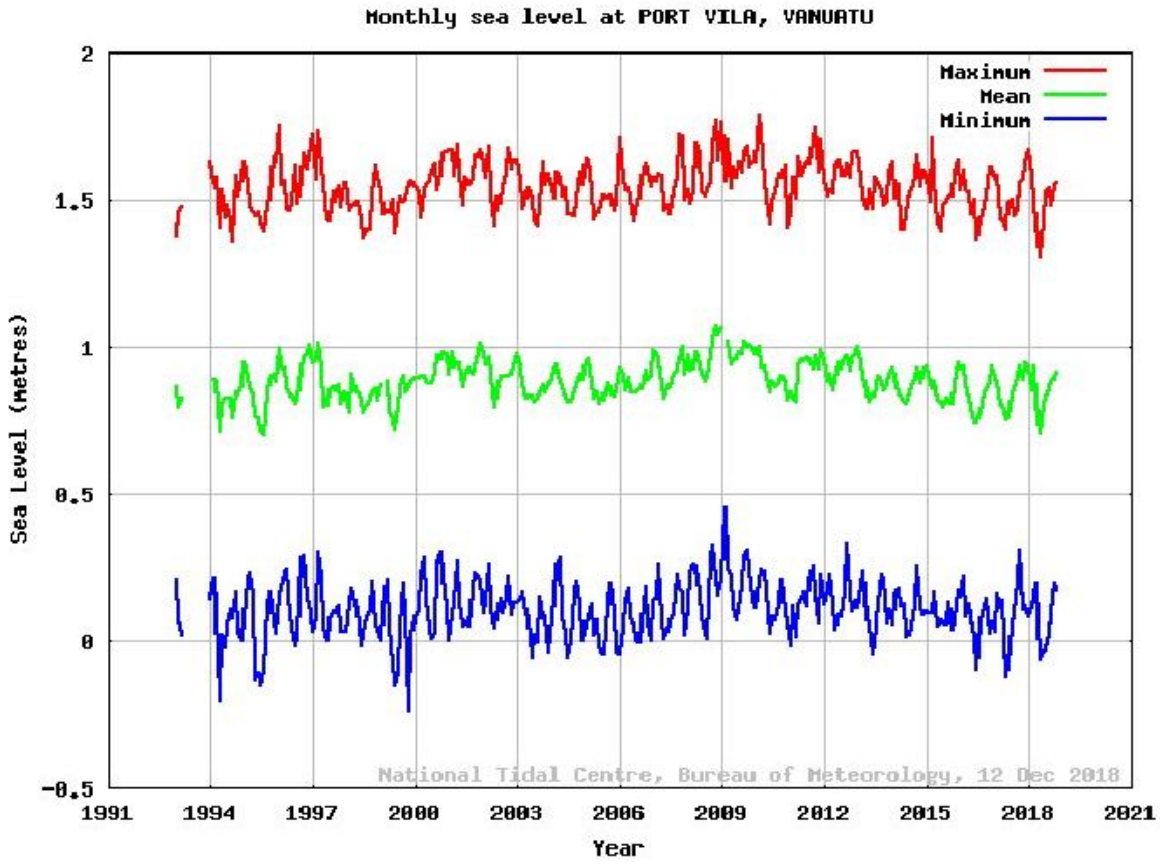
[62] https://www.abc.net.au/news/2010-06-03/pacific-islands-growing-not-sinking/851738

"*In doing that they transport sediment from the beach or adjacent reef platform and they throw it onto the top of the island.*"

However, Dr Kench says this does not mean sea does not pose dangers; "*The land may still be there but will they still be able to support human habitation?*"

Therefore, if the global sea level continues to rise at the present rate then, while most of these islands might not be submerged, they might eventually become uninhabitable. Presently, most are not being affected, except by normal storm surges and usual weather phenomenon. Storm surges near Kiribati typically range between 2.8 and 3.0 metres above normal sea level.[63] Storm surges that happen during high tide are more serious. Compare this with Severe Tropical Cyclone Larry that crossed the tropical north Queensland coast near Innisfail during the morning of 20 March, 2006. Very large storm surges (debris lines to 5 m above Mean Sea Level) were measured in the Bingil Bay area.[64]

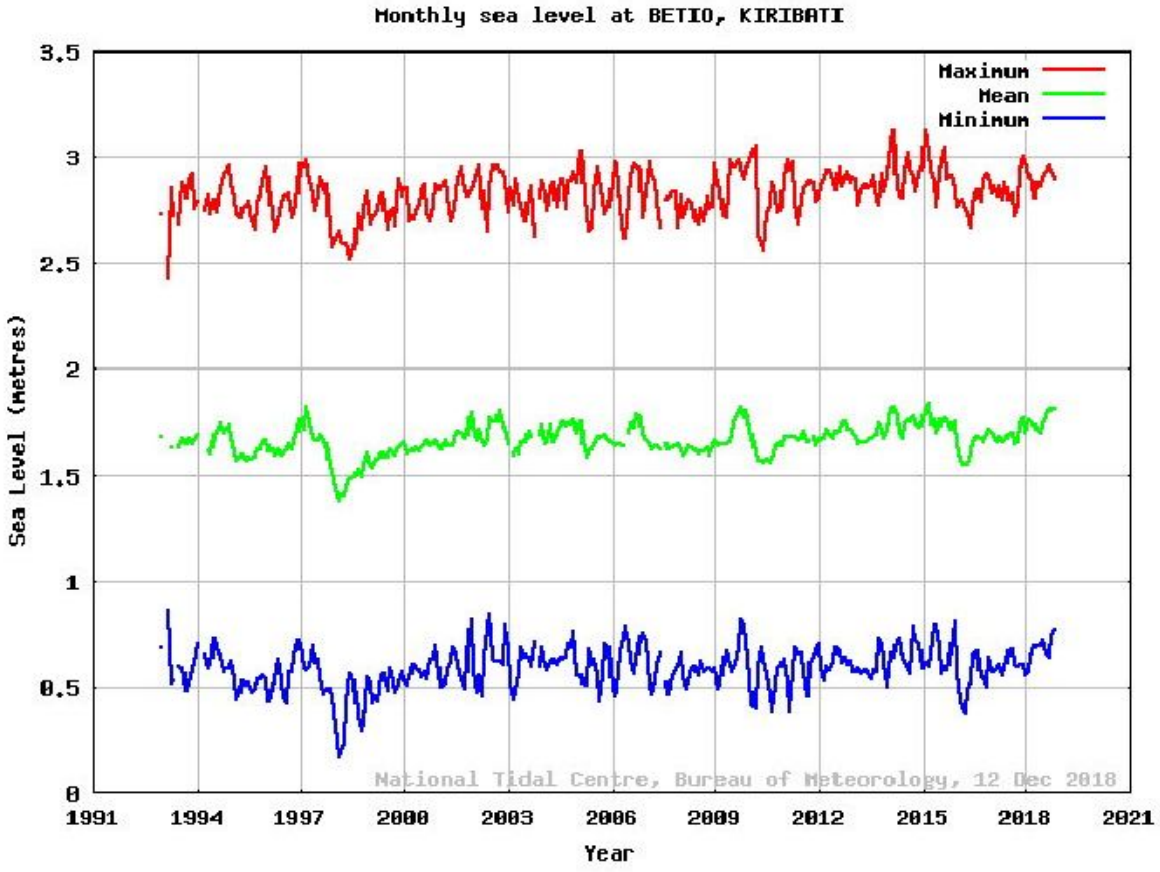
The Australian Bureau of Meteorology (BOM) measures the sea levels in the western Pacific Ocean, including for these islands. [65] The data for Vanuatu, Kiribati, and Tuvalu are shown following:

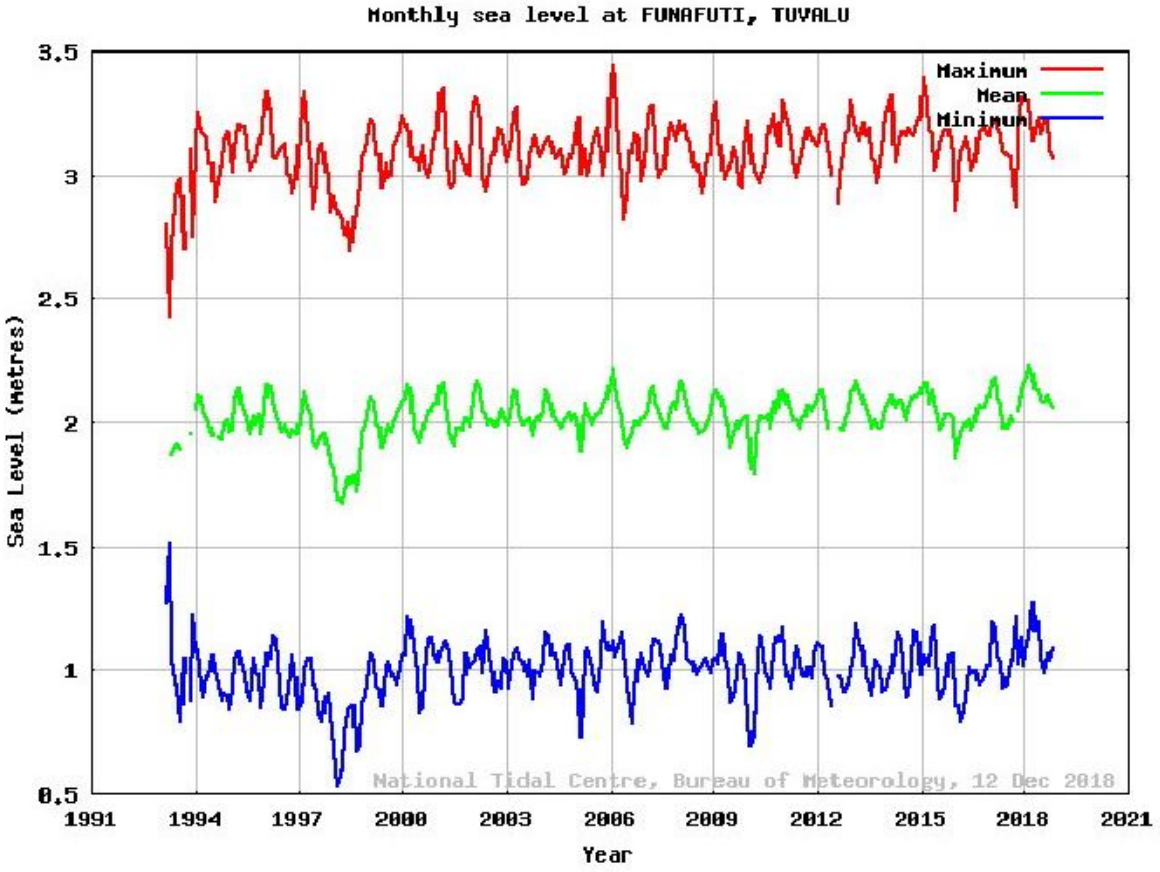


[63] Kiribati Adaptation Programme. Phase II: Information for Climate Risk Management. Sea levels, waves, run-up and overtopping. NIWA Client Report: HAM2008-022 September 2008 Updated April 2010 NIWA Project: GOK08201

[64] Historical Impacts Along The East Coast. http://www.bom.gov.au/cyclone/history/eastern.shtml

[65] http://www.bom.gov.au/pacific/


Monthly sea level at BETIO, KIRIBATI
Maximum
Mean
Minimum
Sea Level (metres)
3.5
3
2.5
2
1.5
1
0.5
0
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021
Year
National Tidal Centre, Bureau of Meteorology, 12 Dec 2018


Monthly sea level at FUNAFUTI, TUVALU
Maximum
Mean
Minimum
Sea Level (metres)
3.5
3
2.5
2
1.5
1
0.5
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021
Year
National Tidal Centre, Bureau of Meteorology, 12 Dec 2018

The timescale used in these three graphs is short, from 1991 to December 2018, a snapshot in time. However, these graphs show the sea level rise around Kiribati and Tuvalu is presently no more than 1 mm per year, if that, noting the selected start and end points of the data. There is no rise indicated on the graph for Vanuatu. Note also the varying heights of the sea levels surrounding each of these islands with respect to the Mean levels and to the annual variations. This confirms that sea levels change significantly on a local scale without mankind's impact.

The referenced 1 mm per year rise depends, again, on the selected start and end points of the data. This 1 mm per year is at variance with the 3.3 mm per year referenced in the graph on page 23, and the 1.6, 1.74, and 4.5 mm per year referenced on page 24.

These discrepancies can be due to the several corrections that can be applied to data including for climatic factors like the Indian Ocean Dipole and the Southern Oscillation Index, and for landmass rebound affects like the Glacial Isostatic Adjustment. The selection of when to start and finish a trend has a profound impact on the slope of the trend, as mentioned above.

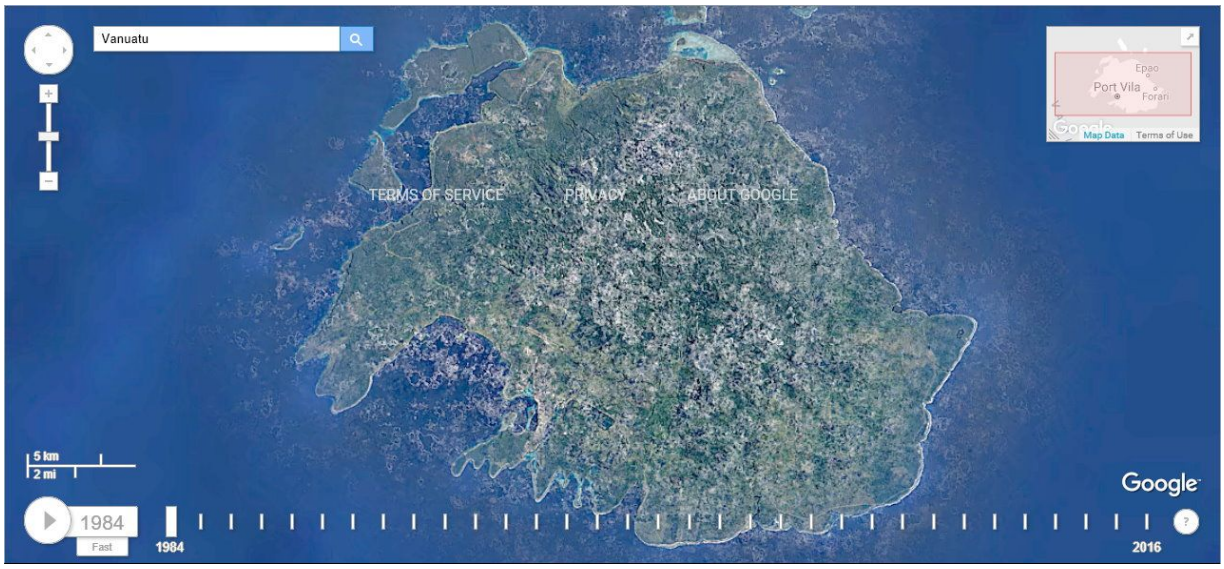
Where is the rigorous science? Where is the truth?

Satellite Imagery of Islands

A magnified examination of satellite images on “Google Earth Engine – Time Lapse” [66] reveals the detail described in the images following. Within the limits of the resolutions available, satellite images of many islands show no inundation. This accords generally with the data presented in the BOM graphs on pages 33 and 34.

Comparative satellite photos of Efate, Vanuatu, show no sea level rise impacts.

EFATE ISLAND, VANUATU - 1984



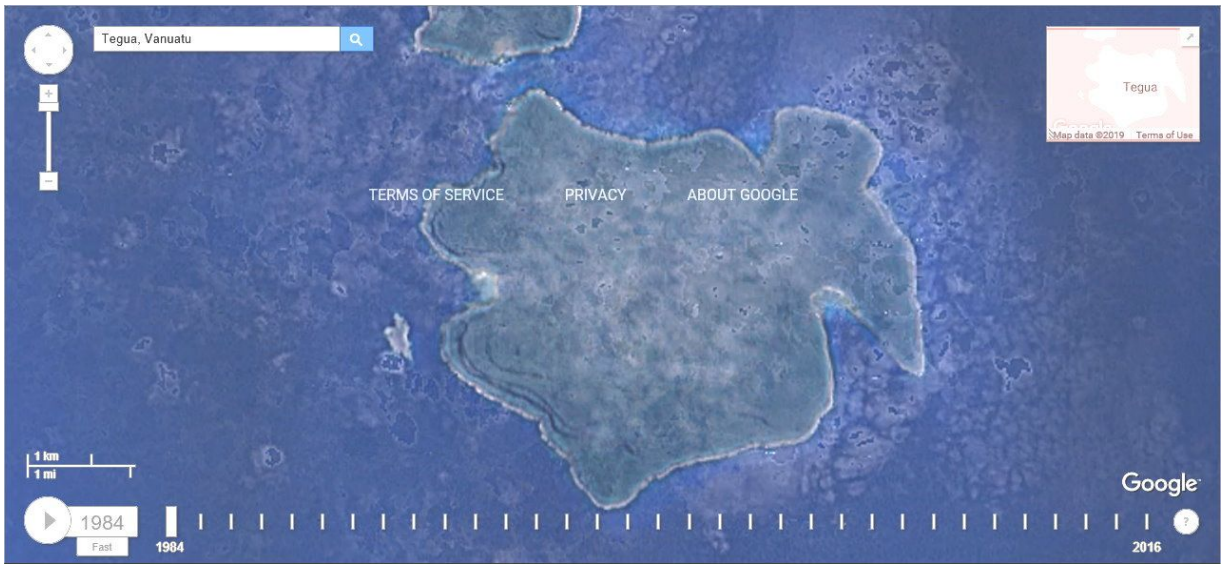
EFATE ISLAND, VANUATU – 2016

The highest point on Efate is Mt. McDonald at 647 metres above sea level. The capital, Port Vila sits at about 50 metres in the south-west of the island. This is a high island. Sea level rise is highly unlikely to impact it in an existential way. However, it does sit on the Solomon Tectonic Plate, so subsidence will affect it eventually, as is discussed on pages 29 and 30.

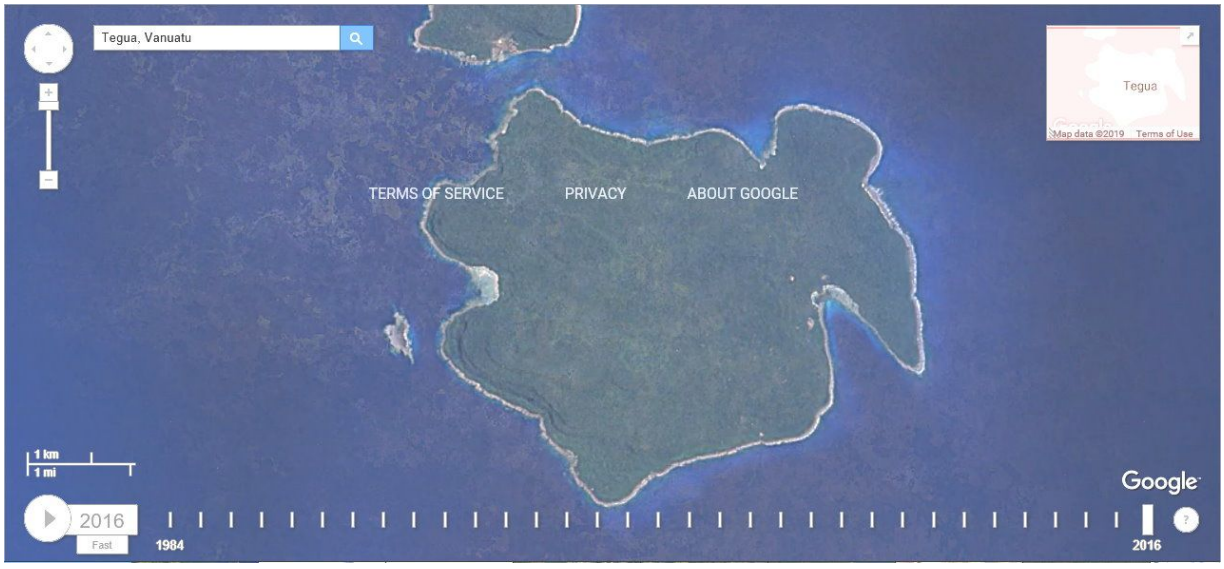
[66] Google Earth Engine, Time Lapse (https://earthengine.google.com/timelapse/)

The village of Lateu (Lataw) is located on Tegua Island, Vanuatu. The supposed sea level rise problem for this Island was discussed on page 30. However, these images do not indicate any relative sea level rise.

TEGUA ISLAND, VANUATU – 1984 (LATAW VILLAGE IS ON THIS ISLAND)



TEGUA ISLAND, VANUATU – 2016 (LATAW VILLAGE IS ON THIS ISLAND)



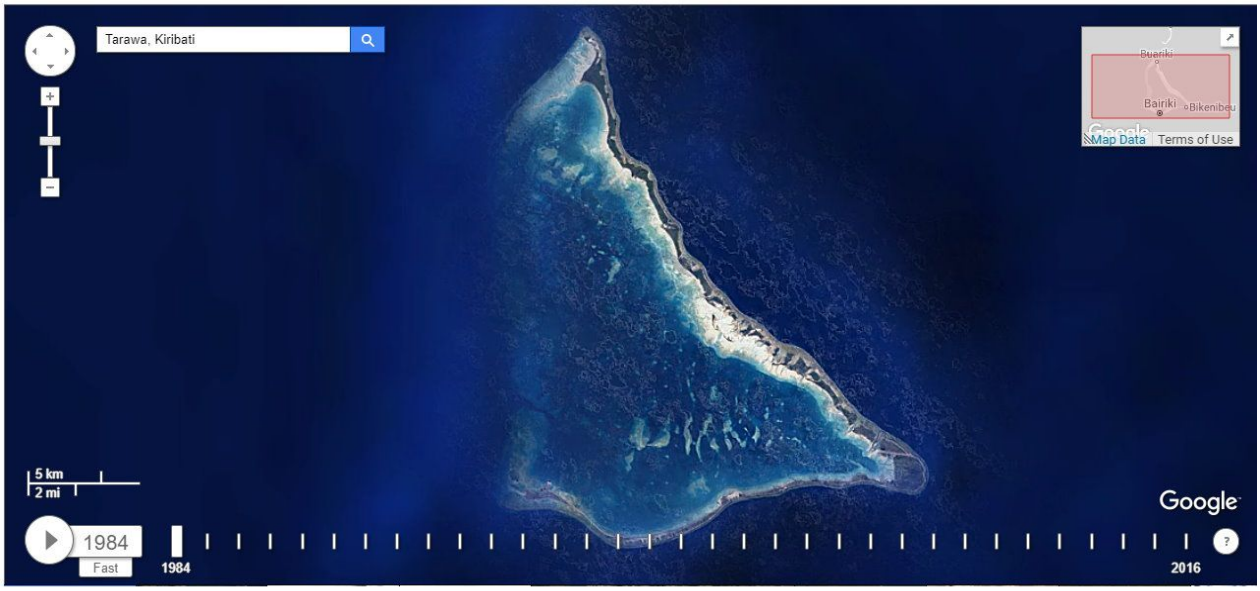
Tegua is a high island. Its highest point is about 230 metres above sea level, presently.

The IRD report[67] stated that this type of subsidence almost doubled the apparent rise in sea level over the Torres Islands.

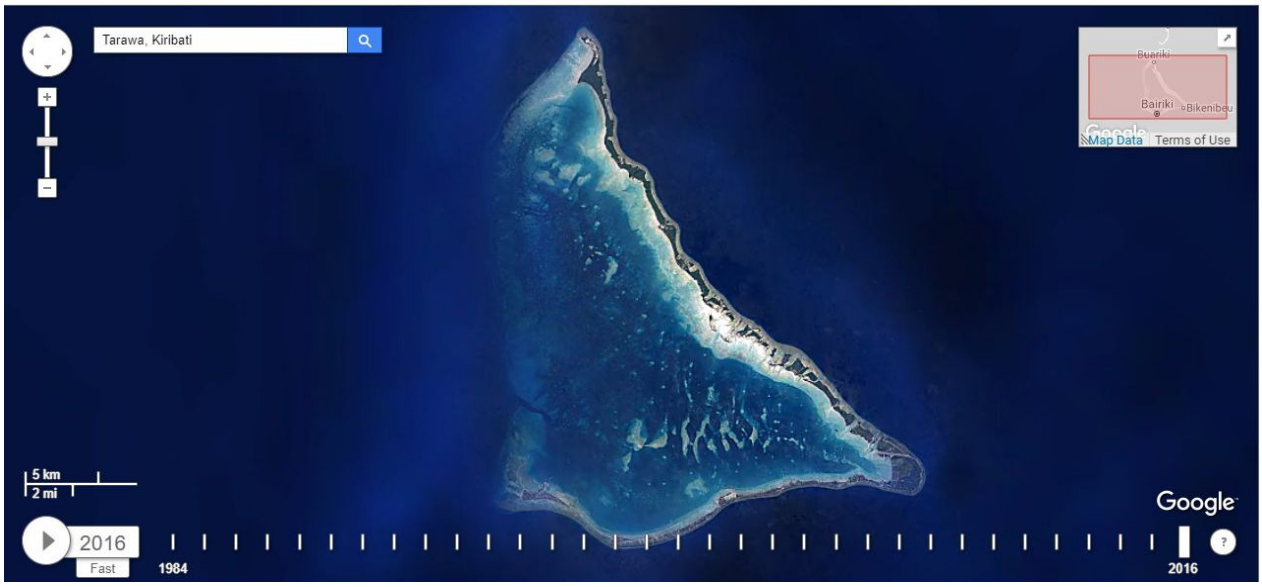
[67] Institut de recherché pour le developpement (IRD), Scientific News, No 386 dated October 2011

The photos below illustrate there has been no inundation of the main population centre of Kiribati (the Tarawa Atoll) since 1984, despite claims to the contrary.

TARAWA ATOLL, KIRIBATI - 1984



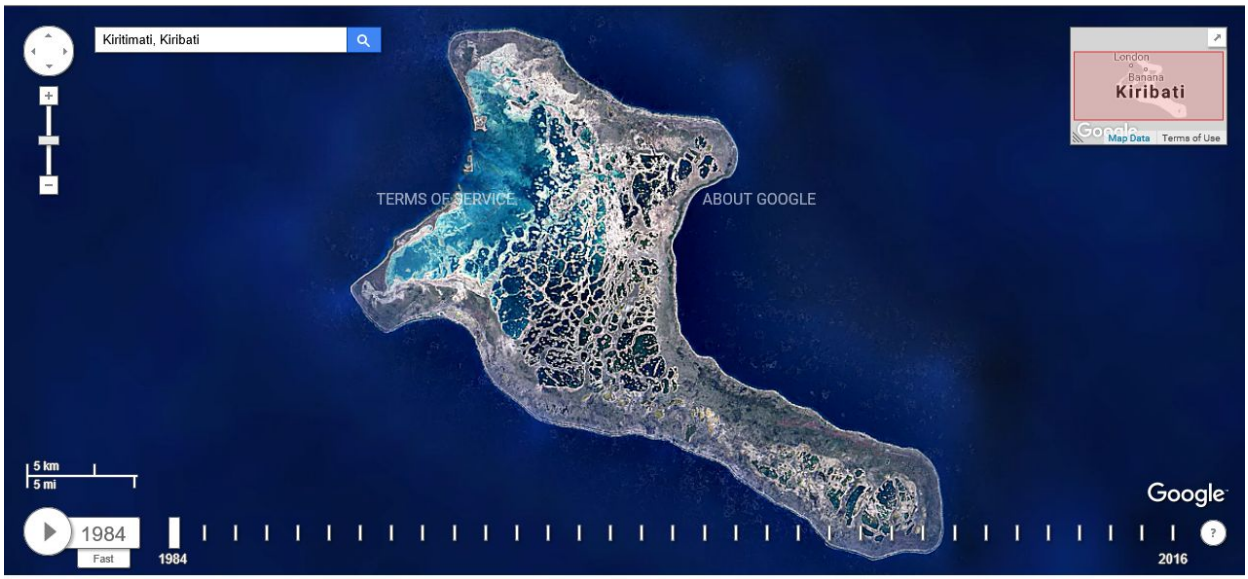
TARAWA ATOLL, KIRIBATI - 2016



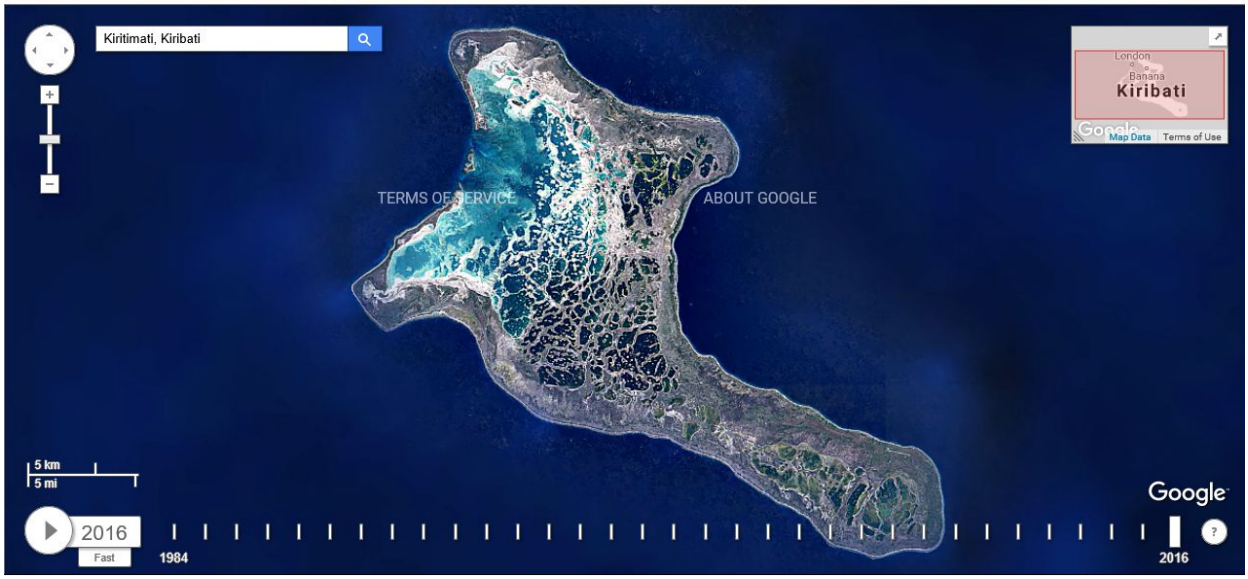
Most of Kiribati's population live on Tarawa Atoll. The city of Tarawa is between 5 and 12 metres above sea level, as are most of the raised parts of the Atoll.

Likewise, there has been no inundation of the Kiritimata Atoll since 1984, as can be seen in the following satellite photos.

KIRITIMATI, KIRIBATI - 1984



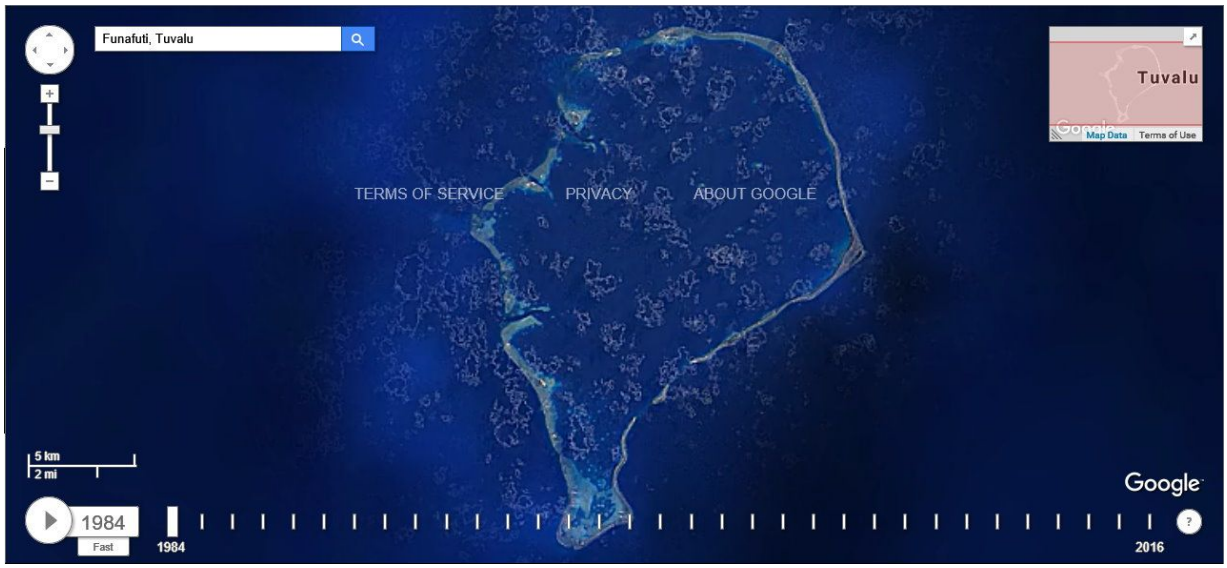
KIRITIMATI, KIRIBATI - 2016



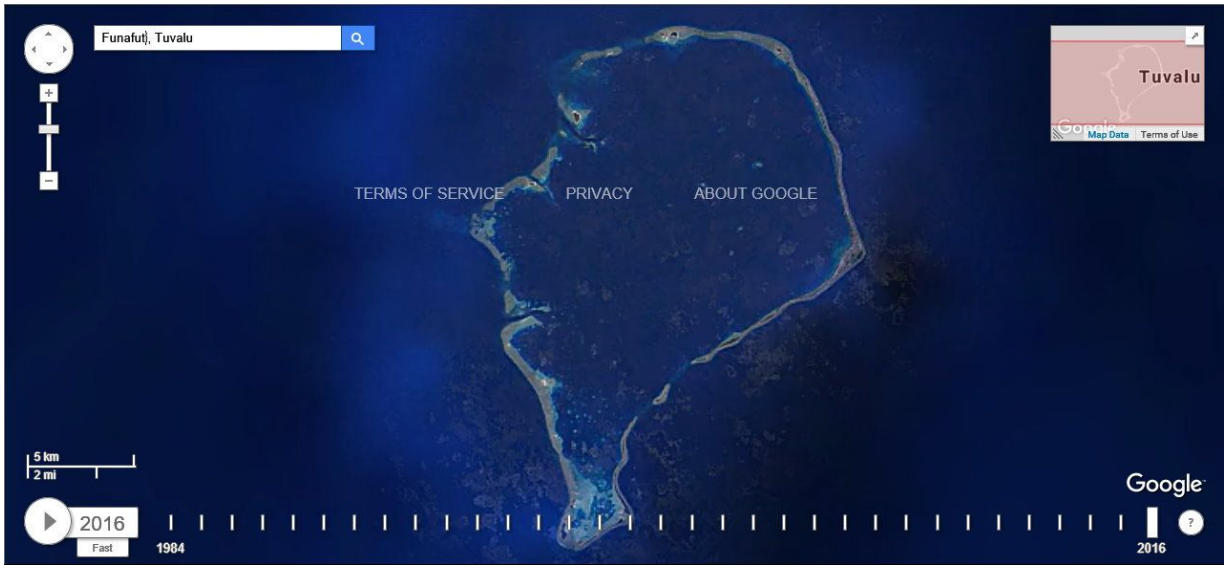
The highest point on Kiritimati Atoll is about 12 metres above sea level. There are several parts at about 5 metres, but most of the raised parts of the Atoll are about 3 metres above sea level. This is a low island.

Satellite photos of the Funafuti Atoll, Tuvalu, the main atoll of Tuvalu, show that the land area of this atoll has increased over the period, because of accretion events.

FUNAFUTI ATOLL, TUVALU - 1984



FUNAFUTI ATOLL, TUVALU - 2016



The highest part of Funafuti Atoll is at the airport on the easternmost part of the atoll, being 5 metres above sea level. The average height of the atoll is 3 metres. This is a low island.

Coastal erosion and some flooding of these and other Islands is inevitable, even without sea level rise. These impacts can be caused by normal storm activity, the removal of coastal and reef sands for building purposes and by the need to build in lower lying areas to accommodate the increasing population. This latter factor makes occasional flooding more noticeable, as happens in some population centres in many parts of the world when housing is built on river flats and deltas that do flood occasionally. Some sinking of these Islands might be expected also because of a lowering of the water table due to over-extraction of drinking water, for example.

On the other hand, storm activity can cause the accretion of sands on these atolls, thereby increasing their area and height above sea level, as mentioned on page 32.

Nuclear Power

Australia has about 28% of the world's known recoverable resource of uranium, almost twice that of any other country. Nuclear power generation produces no greenhouse gases.

See the table at page 5 for comparative cost of nuclear electricity.

There is a popular belief in Australia that there are two serious problems with nuclear power generation that should stop its acceptance. These are the disposal of nuclear waste and the danger of nuclear accidents. Both are exceedingly overstated.

A comparison of some energy sources, the mortality rate, and the proportion of electricity generated per energy source is instructive. The following data was published in 2012: [68]

Energy Source	**Mortality Rate (deaths/trillionkWhr)**
Coal – global average	100,000 (41% global electricity)
Coal – China	170,000 (75% China's electricity)
Coal – U.S.	10,000 (32% U.S. electricity)
Oil	36,000 (33% of energy, 8% of electricity)
Natural Gas	4,000 (22% global electricity)
Biofuel/Biomass	24,000 (21% global energy)
Solar (rooftop)	440 (< 1% global electricity)
Wind	150 (2% global electricity)
Hydro – global average	1,400 (16% global electricity)
Hydro – U.S.	5 (6% U.S. electricity)
Nuclear – global average	90 (11% global electricity, incl. Chern&Fukush)
Nuclear – US	0.1 (19% US electricity

Note: 1 trillion kilowatt-hours is equivalent to 1 Terawatt-hour.

Deaths related to fossil fuels occur because of mining accidents like fires, explosions, and mine collapses, and overwhelmingly from air pollution. It is notable in the table above that the U.S. death rates for coal are so much lower than for China, strictly a result of regulation, particularly the Clean Air Act (Scott et al., 2005). Coal does not have to be dirty, particularly if exhaust scrubbers are used to remove pollutants. Hydro deaths are due to dam failures. Nuclear deaths from radiation were due to the one and only accident that was not substantially contained within the reactor, Chernobyl. The total number of deaths in this incident was 31. There were no deaths at Fukushima due to radiation exposure. The mortality rate of 90 shown in the table is likely inflated by deaths from accidents from radioactive products unrelated to electricity production. Of course, these mortality rates should be compared with mortality rates in other industries and from other causes, like road accidents.

When comparing coal and nuclear electricity generation, particular note should be taken of the quantities of fuel required and the emissions produced. On average, in a

[68] https://www.forbes.com/sites/jamesconca/2018/01/25/natural-gas-and-the-new-deathprint-for-energy/#5b915c085e19

developed country like Australia, one person uses about 8,000 kilo Watt hours (kWh) of electricity per year; that is, 8 Mega Watts.

This amount of electricity can be produced, for example, by:

a. Coal. Typically, this requires 3 tonnes of black coal and produces by-products of 300 kg fly ash and 8 tonnes of gas, predominately CO_2, depending on the coal used.

b. Nuclear. There are several radioactive materials that are and could be used for power generation, including uranium, plutonium and thorium. There are several types of reactor also. As an example, the following facts relate to uranium as it is used in two different types of reactor. Between 30 kg and 70 kg of uranium ore are needed to produce 230 gm of uranium oxide concentrate. This is the amount needed to generate 8 Mega Watts of electricity.

   (i) If used directly in a CANDU reactor, this 230 gm produces a by-product of 230 gm of spent fuel.

   (ii) If enriched, the 230 gm produces about 30 gm enriched uranium fuel and 200gm of depleted "tails". Used in a light water reactor, the enriched uranium produces about 20 ml of liquid high-level waste when reprocessed. This can then be incorporated into less than 1 cm^3 of "synthetic rock" (Synroc) that weighs about 6 gm and is highly radioactive.

Nuclear Waste Disposal [69] [70]

- Nuclear power is the only large-scale energy-producing technology that takes full responsibility for all its waste and fully costs this into the product.
- The amount of waste generated by nuclear power is very small relative to other thermal electricity generation technologies.
- Used nuclear fuel may be treated as a resource or simply as waste.
- Nuclear waste is neither particularly hazardous nor hard to manage relative to other toxic industrial waste.
- Safe methods for the final disposal of high-level radioactive waste are technically proven; the international consensus is that geological disposal is the best option.

High-level wastes can be considered the "ash" from "burning" uranium. It makes up only about 3% of the volume of all radioactive wastes worldwide. If reprocessed, high-level waste comprises just 0.2% of all radioactive waste. However, high-level waste contains 95% of the total radioactivity.

High-level waste decays rapidly and can be effectively and economically isolated. After about 40 years, the radioactivity has reduced to less than one thousandth of its initial state[71]. Disposal is not then a problem, generally the waste is placed in corrosion proof containers and isolated geologically. The transuranic elements in the waste have a long half-life. However, by 1,000 years, a blink of the eye in geological timescales, the

[69] World Nuclear Association, Radioactive Waste Management. (https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-waste-management.aspx)
[70] Australian Parliament, House of Representatives Committee Report (https://webcache.googleusercontent.com/search?q=cache:EZlha9pw0l0J:https://www.aph.gov.au/Parliamentary_Business/Committees/House_of_Representatives_Committees%3Furl%3Disr/uranium/report/)
[71] Harvard University. (http://sitn.hms.harvard.edu/flash/2016/reconsidering-risks-nuclear-power/)

radioactivity has fallen to a level that is much the same as the corresponding amount of natural uranium ore.

Nuclear Today

Today there are about 450 nuclear power reactors operating in about 30 countries with a combined capacity about 400 GWe. In 2017, these provided 2,506 billion kWh, about 11% of the world's electricity.[72]

About 50 power reactors are currently being constructed in 15 countries, notably China, India, UAE and Russia.[73]

In November 2018, there were 151 reactors planned and another 337 proposed.[74]

165 nuclear power stations will be closed down in Europe by 2030. There will be a total of 297 power station closures worldwide by 2030.[75]

Today, due partly to the high capital cost of large power reactors generating electricity via the steam cycle and partly to the need to service small electricity grids under about 4 Gigawatts[76], there is a move to develop smaller units. These can be built independently or as modules in a larger complex, with capacity added incrementally as required.[77]

Unlike nuclear power generation, the monetary cost of the waste products from coal-fired generators, such as CO_2 and fly ash, are not counted.

Nuclear power has the lowest CO_2 emissions of all commercial baseload energy sources.[78] The only CO_2 emitted due to nuclear power plants is that released indirectly from developing the construction materials. None is emitted by the generation of electricity. On the other hand, coal power emits GHG's equivalent to 820 gm of CO_2 for every kilowatt-hour (g CO_2eq/kWh) of electricity produced. Gas has a lower output at 490 g CO_2eq/kWh. Nuclear power is responsible for a mere 16 g CO_2eq/kWh when construction emissions are included and amortized.

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[72] http://world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx

[73] http://world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx

[74] http://www.world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-and-uranium-requireme.aspx

[75] https://www.statista.com/statistics/275879/closure-of-nuclear-power-stations-worldwide/

[76] One billion watts, that is, 10^9 watts.

[77] World Nuclear Association, Small Nuclear Power Reactors (https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/small-nuclear-power-reactors.aspx)

[78] Harvard University. (http://sitn.hms.harvard.edu/flash/2016/reconsidering-risks-nuclear-power/)

Conclusions

a. There appears to be a correlation between global atmospheric CO_2 concentration and temperature throughout most of the past 800,000 years at coarse resolution, but the leading factor is uncertain.

b. There is no correlation over geologically long periods or within parts of the Holocene epoch; that is, since the last ice age.

c. Atmospheric CO_2 concentrations lag temperature changes especially since the last Ice Age, contrary to the presently accepted greenhouse gas theory.

d. Other factors might be influencing either or both temperature and CO_2, making a causal correlation seem real when it is secondary.

e. The Earth might be warming, but global changes are well within historical ranges and there are many possible causes for the warming trend.

f. Global sea levels might be rising on average, but changes are widely variable across the world. Factors other than warming can affect relative sea levels, giving false impressions as to causes.

g. The carbon cycles operating on the Earth are not understood fully.

h. At a minimum, climate models must be validated. They must accurately predict the facts today when loaded with historical data, before being used to predict the future. All present climate models fail such tests.

i. The Paris Climate Agreement is likely popular with most of its signatories regardless of the real impact of CO_2 because most are poorer nations standing to benefit from the windfall funding attached to the Agreement.

j. The frequency and strength of tropical storms and hurricanes are not increasing as the prevailing models and popular opinion claim.

k. Many scientists reject the hypothesis that man-made CO_2 emissions are significantly affecting climate. However, they are rarely allowed to be heard.

l. Governments should act to have electricity produced from the most cost-efficient and reliable fuel sources and processes available.

m. Governments should create a true level playing field for competing fuel sources. All subsidies should be withdrawn or be applied according to the amount of electricity produced. Taxes should be applied with an even hand, without discrimination as to source.

n. If governments insist on reducing CO_2 emissions from electricity generation by minimizing coal use, then they should objectively endorse nuclear power.

o. The governments of Australia, both Federal and State, indeed of the world, should ensure policies about global warming are based on true and verifiable science, not a manufactured “consensus”.

p. Adaption to climate change is highly likely the only effective action. Tilting at trace gas windmills will be futile.

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