

# An Objective Analysis of Global Warming and a Possible Carbon Tax in the US

3/31/2019 --by Larry Von Thun, Lakewood, Colorado

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Global warming is occurring now. There is no question about that. Available data clearly show an overall warming trend since about 1650-1700. The last glacial period began about 120,000 years ago and reached a glacial maximum about 21,000 years ago. Average global temperatures dropped about 10-12 degrees centigrade (C) over that period (see Fig. 1 based on Antarctica ice coring).<sup>1</sup> Then, rapid warming began and sea levels rose markedly.<sup>2</sup> (see Fig. 2) Over the next 15,000 years sea levels rose about 400 feet (122 meters) and the temperatures rose about 10 deg. C. Then a sustained, warmer interglacial period began. The warmer interglacial period, in which we now live, has lasted for over 10,000 years and compared to the glacial period, global temperatures and sea levels are relatively stable. However, even in this “stable” period there are warmer and colder periods of significance. Prior to our Current Warm Period (CWP), the last four of these periods, (see Fig. 3), are termed the Roman Warm Period (RWP), the Dark Age Cool Period (DACP), the Medieval Warm Period (MWP), and the Little Ice Age (LIA). Historic records confirm sea level changes and movements of people in these periods of warming and cooling within the current interglacial period.

From the standpoint of tracking the current global warming trend, the most significant of these periods is the “Little Ice Age”. A temperature re-construction (Fig. 3A) over the last 2000 years by Swedish scientists<sup>3</sup>, indicates that global temperatures since the end of the “Little Ice Age” have shown a net rise of about 0.8 degrees C and are still trending upward. The rise is not steady, showing periods of warming and cooling. This warmer – colder variation of temperatures with time is key in determining if and how well these variations correlate with human emissions of CO<sub>2</sub>.

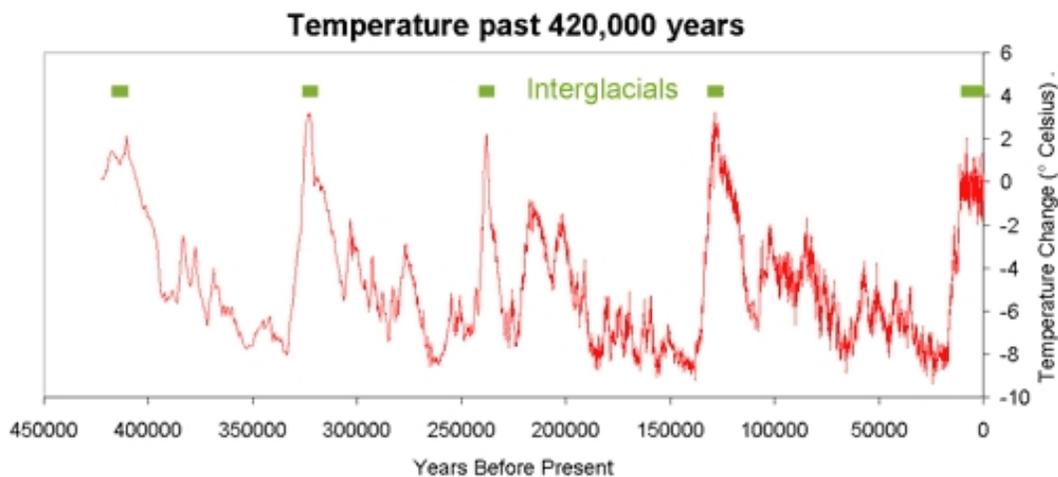


Figure 1- Record of global temperature changes<sup>1</sup> – illustrating glacial and interglacial periods

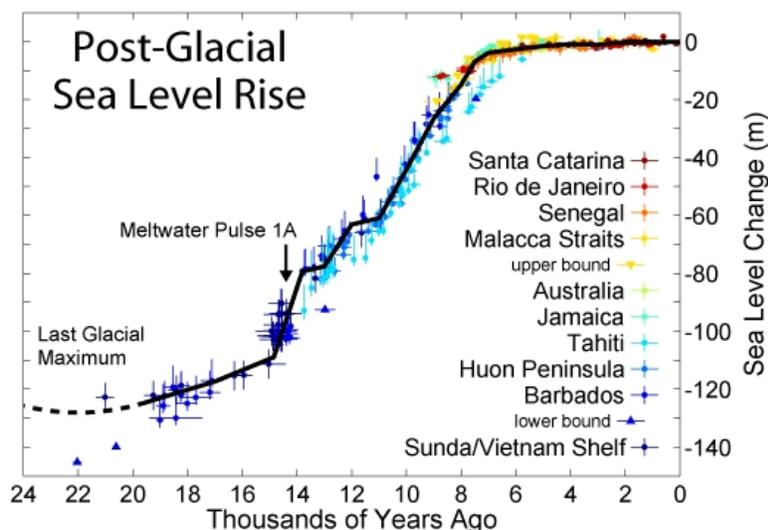


Figure 2 --Sea level rise since the end of the last glacial episode<sup>2</sup>

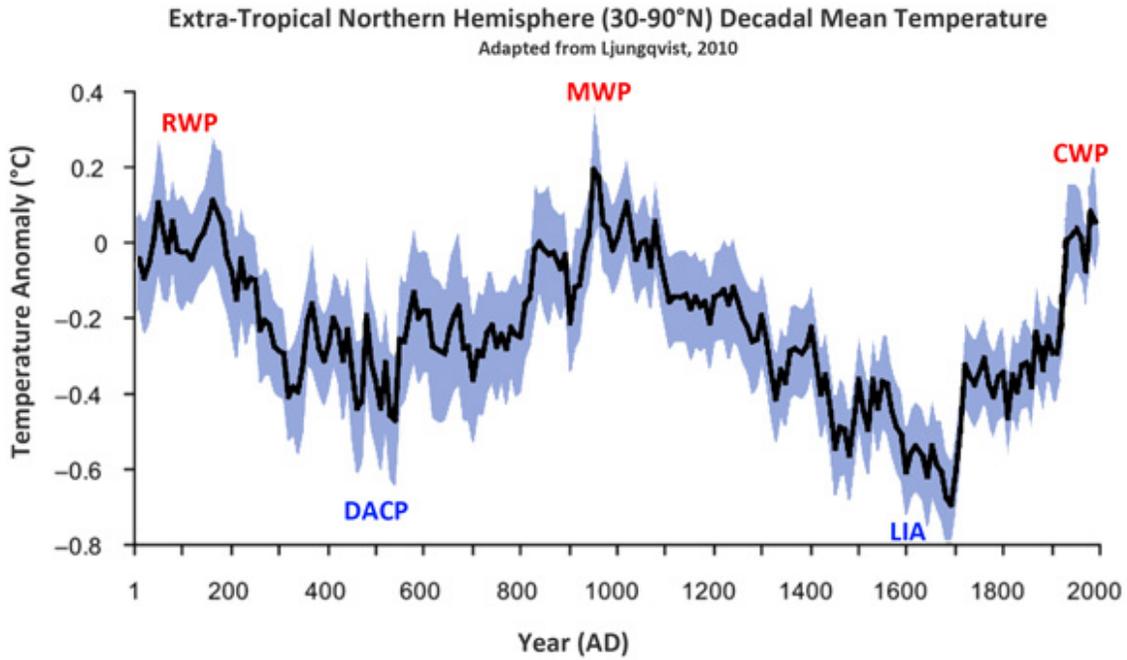


Figure 3A – Temperatures in the Northern Hemisphere over the last 2000 years <sup>3</sup>

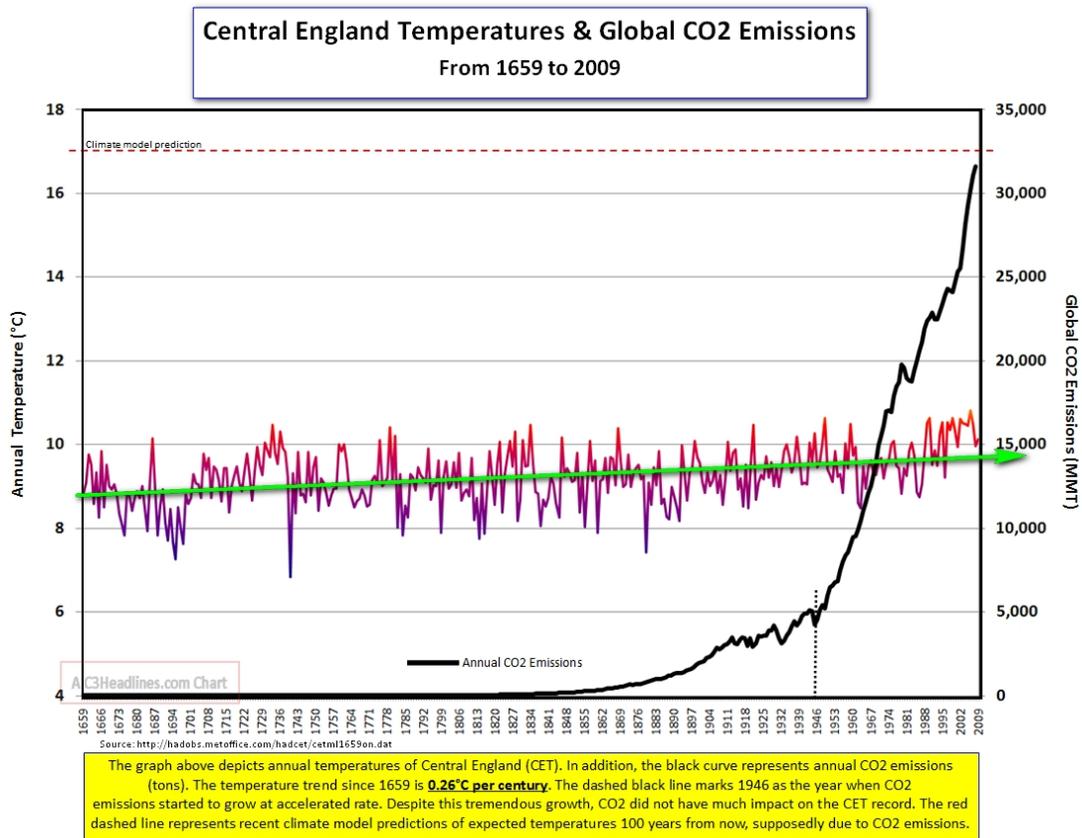


Figure 3B - Warming trend in central England since 1659 vs. CO<sub>2</sub> emissions <sup>4</sup> – source Hadley Centre

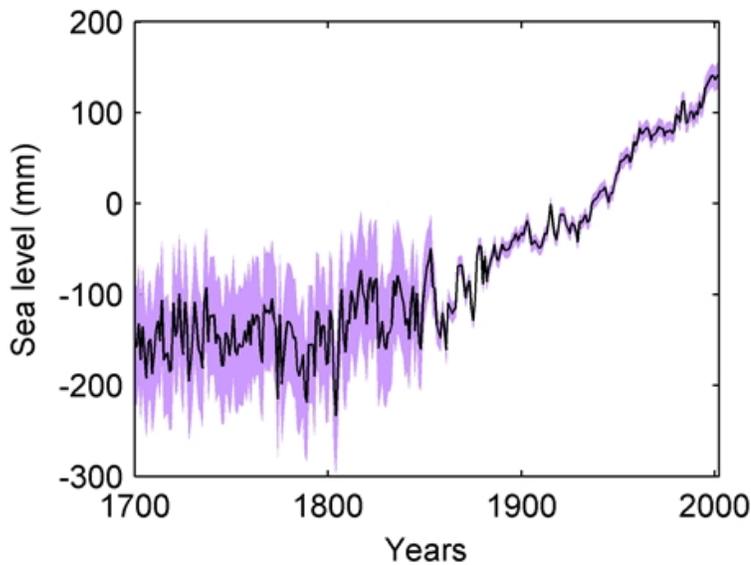


Figure 4 - Global Mean Sea Level Reconstruction since 1700 by Jevrejeva et al, 2008 <sup>5</sup>

Corresponding to the Fig 3A temperature reconstruction since 1700 <sup>5</sup>, Fig. 4 shows that sea levels, like temperatures have been increasing since the Little Ice Age. But by millimeters not by meters as occurred following the glacial maximum. The rate of rise has been about 15-20 mm (0.6-0.8 in) per decade over the last 150 years.

### Modern Records (post 1880) Clearly Document the Overall Global Temperature Increase and Sea Level Rise

The historic temperature and sea level assessments such as shown in the above figures include indirect estimates based on “proxies” (tree rings, ice cores, ocean sediments, etc.) which are used to extend the record back, prior to actual recorded measurements. Actual temperature and sea level measurements since about 1880 document and confirm an ongoing global warming trend <sup>7</sup> (Figures 6A and 6C). (Note: Both 6A and 6C are included because both are used in subsequent calculations – For some reason NASA changed its data/reference point/portrayal of global temperature following their 2012 edition thus Figure 6A is now archived). The 2012 edition was used in my earlier papers and it is a more “crisp”, easier to read plot. It provides a good visual of global warming history since 1880. The extent and accuracy of global temperature records have improved with time. For example, global temperatures in the lower atmosphere since 1979 have been measured via satellite <sup>6</sup> (Fig. 5) to help remove the inaccuracies due to many land stations being affected by “urban heat islands” associated with large population centers. The plots of changes in temperature or sea level with time in these records are shown with respect to a “0.0” frame of reference point based on an average over a period of time. Changes from that reference are referred to as “anomalies”.

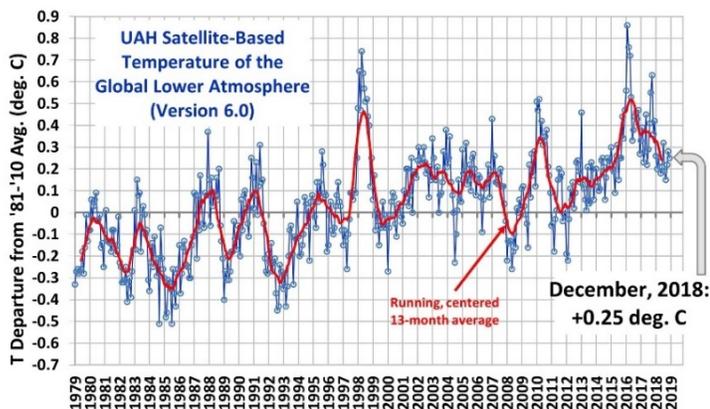


Figure 5—UAH Global Temp. <sup>6</sup>

In addition to temperature and sea level, the CO<sub>2</sub> emissions (introduced by human activities) has been estimated / measured and can be compared in time with the record of global temperature and sea levels. Figures 6A, 6C, 6B<sup>8</sup>, 7A<sup>9</sup> and 7B<sup>10</sup> allow juxtaposition of global temperatures and sea levels with CO<sub>2</sub> emissions since 1880 and 1800 respectively.

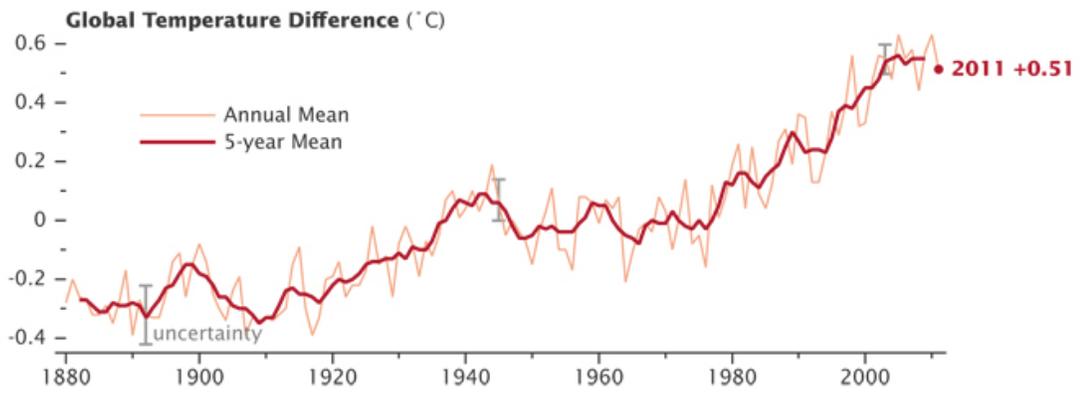


Figure 6A - NASA global surface temperature data plot – (NASA Headquarters release No. 12-020 - now archived)

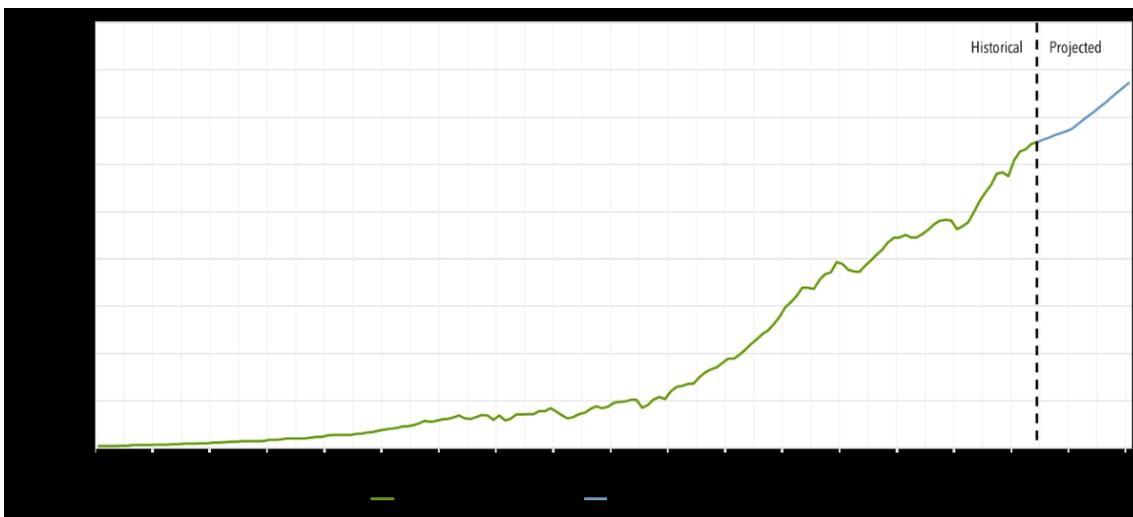
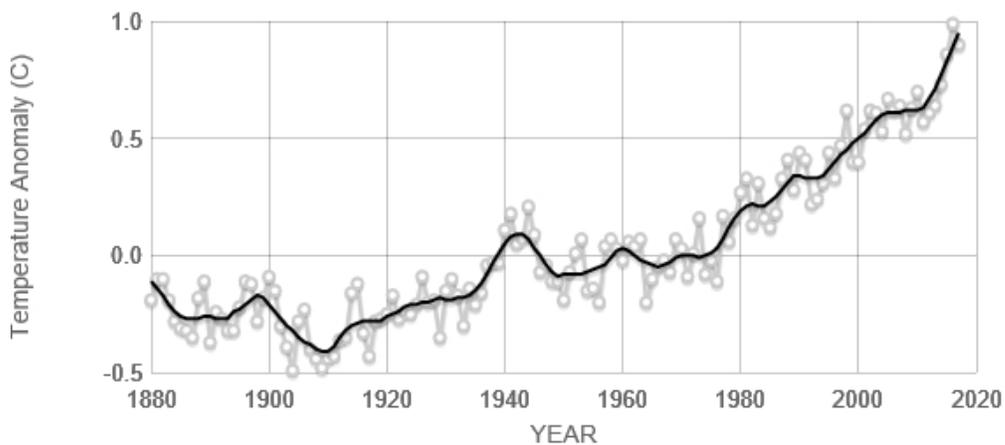


Figure 6B - Global Carbon Dioxide Emissions, 1850–2030 – Source - Center for Climate and Energy



Source: climate.nasa.gov

Figure 6C NASA - Update of figure 6A – through 2018

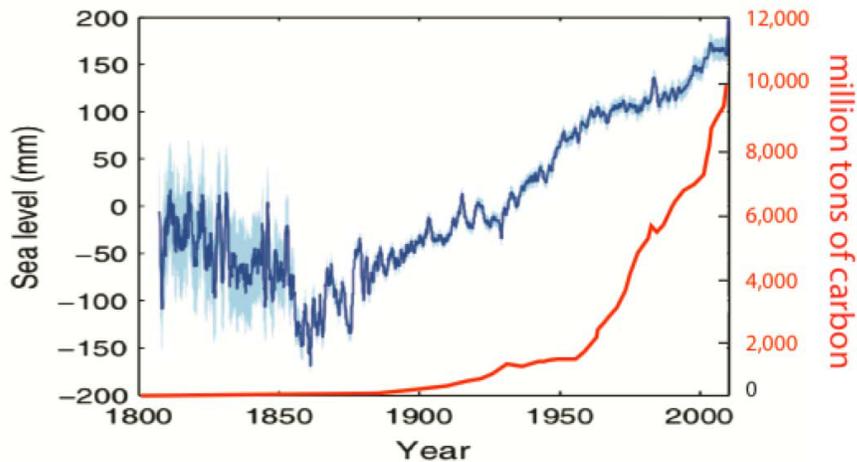
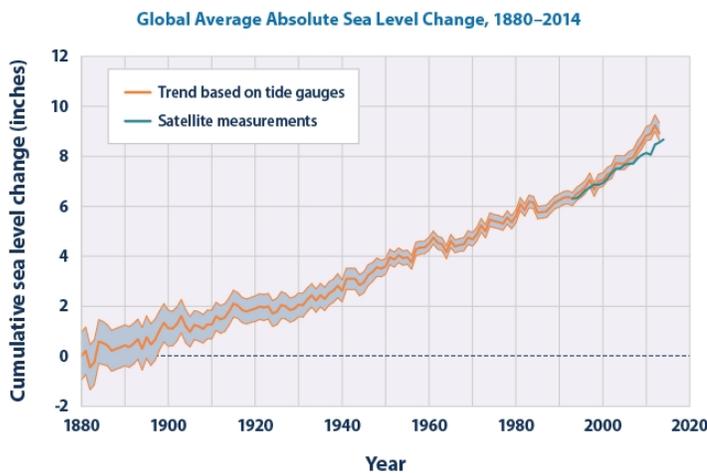


Figure 7A - Time series of sea level anomalies (blue) Jevrejeva et al. (2014). Million tons of carbon emitted from burning fossil fuels from the Carbon Dioxide Information Analysis Center (CDIAC 2014)



Data sources:  
 • CSIRO (Commonwealth Scientific and Industrial Research Organisation). 2015 update to data originally published in: Church, J.A., and N.J. White. 2011. Sea-level rise from the late 19th to the early 21st century. *Surv. Geophys.* 32:585-602. [www.cmar.csiro.au/sealevel/sl\\_data\\_cmar.html](http://www.cmar.csiro.au/sealevel/sl_data_cmar.html).  
 • NOAA (National Oceanic and Atmospheric Administration). 2015. Laboratory for Satellite Altimetry: Sea level rise. Accessed June 2015. [http://fbis.grdl.noaa.gov/SAT/SeaLevelRise/LSA\\_SLR\\_timeseries\\_global.php](http://fbis.grdl.noaa.gov/SAT/SeaLevelRise/LSA_SLR_timeseries_global.php).  
 For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at [www.epa.gov/climatechange/indicators](http://www.epa.gov/climatechange/indicators).

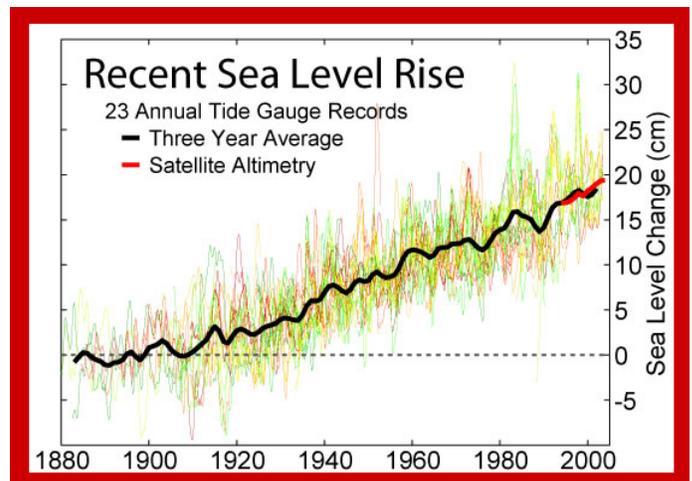


Fig 7B Global Sea Level Change<sup>10</sup> – 1880 -2014

## Human Emissions of Carbon Dioxide

Because of the wide spread claim that the current global warming being experienced (i.e. post 1979) is primarily due to human emissions of CO<sub>2</sub>, and because there are calls to tax those CO<sub>2</sub> emissions, it is instructive and important to show the increase in atmospheric CO<sub>2</sub> in ppm (Figure 8)<sup>11</sup> over time due to those emissions. Also instructive is the information on the country and regional sources of the emissions (Figures 9A, B)<sup>12</sup> that have caused the rise in atmospheric concentrations and how those contributions are changing with time. Typically, only the major economies are shown on these types of plots (9A). If the contribution of the CO<sub>2</sub> emissions from all "other countries" (about 30% of the world total emissions) are included, as shown as in 9B, the other countries contributions resemble the combined China + India contributions both in time and magnitude. In total, global human produced CO<sub>2</sub> emissions (2017) amount to about 33-36 billion metric tons. This is compared to 5 billion in 1944 and 20 billion in 1979. The CO<sub>2</sub> emission values for those two years are cited because of their later use in making comparisons with temperature records.

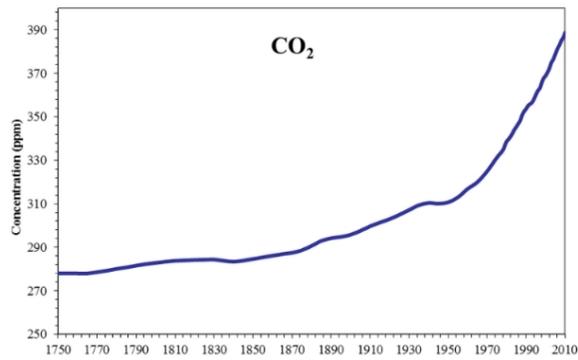


Figure 8 -- Atmospheric Carbon Dioxide Conc. <sup>11</sup> (Eur. Env. Agency, 2015)

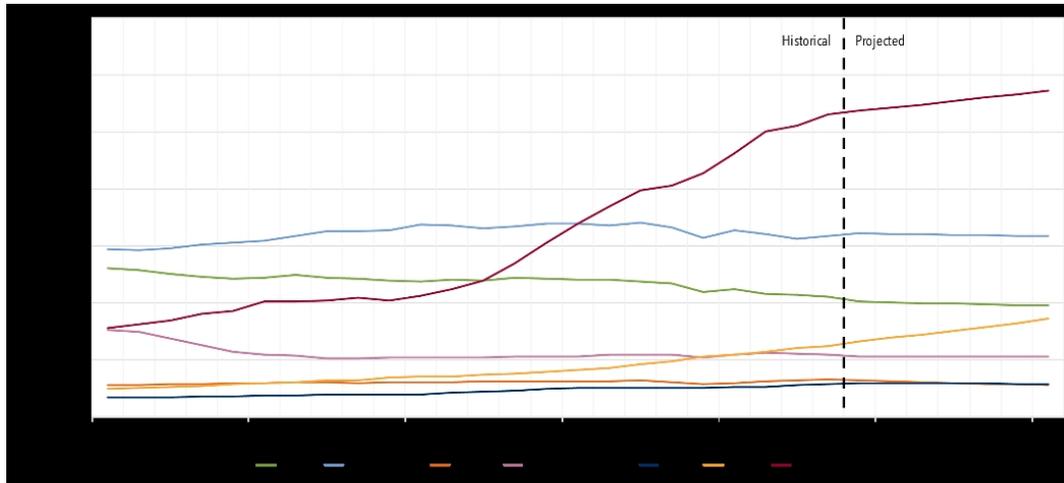
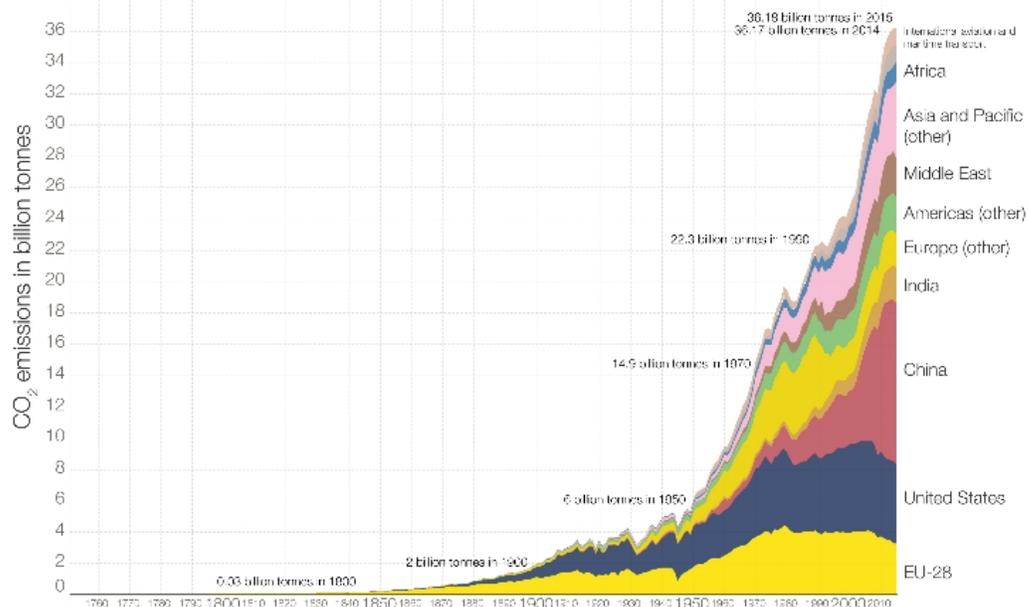


Figure 9A - CO<sub>2</sub> Emissions FOR Major Economies, 1990–2020 <sup>12</sup>

## Global CO<sub>2</sub> emissions by world region, 1751 to 2015

Annual carbon dioxide emissions in billion tonnes (Gt).

OurWorld  
in Data



Data source: Carbon Dioxide Information Analysis Center (CDIAC); aggregation by world region by Our World In Data. The interactive data visualization is available at [OurWorldInData.org](http://OurWorldInData.org). There you find the raw data and more visualizations on this topic.

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Figure – 9B - CO<sub>2</sub> Emissions by Major Economies and by Region,

The above graphs (Fig. 9A and B) show the contributions and rates of change in human source CO<sub>2</sub> emissions, note the leveling off of the US and the EU post 1960 while the other countries emissions continue to rise rapidly . Worldwide percentage contributions are also instructive. As of 2017 the Asia Pacific region emitted almost 50% of CO<sub>2</sub>, Europe contributed 12%, the US 15%, Russia and the Middle East 13%, Central and South America 4%, Canada and Mexico 3% and Africa 3.6%. From 2006 to 2016 Europe, the United States and Russia decreased their emissions annually by -1.5% , -1.2% and -0.2% respectively. All other regions had an annual increase in CO<sub>2</sub> emissions over the 2006-2016 period on the order of 2 to 3%.

Two other important facts with respect to global warming and a tax on CO<sub>2</sub> are: (1) “Water vapor accounts for, by far, the largest greenhouse effect (85 -90%)” (from Evidence Based Climate Science by D. J. Easterbrook), and (2) there are other important greenhouse gas emissions – methane, nitrous oxide and fluorocarbons (Fig. 10)<sup>13</sup> . More CO<sub>2</sub> is emitted but these other gases have much higher global warming potentials (GWP, a measure which accounts for both potency and longevity of the gasses). For example, Methane is roughly 30 times more potent as a heat-trapping gas than CO<sub>2</sub>, Nitrous Oxide has a GWP of around 280 and Chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6) (called high-GWP gases) have GWP’s in the thousands and tens of thousands. [From – epa.gov - Understanding Global Warming Potentials <sup>14</sup>].

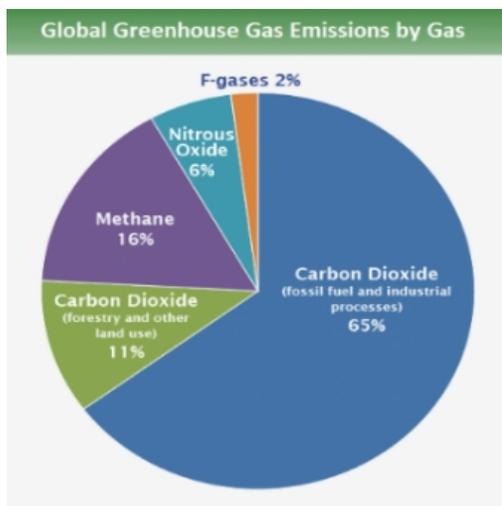


Figure 10 Global Manmade Greenhouse Gas Emissions by Gas, 2014 EPA <sup>13</sup>

The above material provides a synopsis of the most relevant available data and information on global temperatures, sea levels and carbon dioxide emissions. These factual data clearly show (1) that significant global warming and sea level rise occurred following the end of the last glacial period up to the beginning of the interglacial period and (2) during the ensuing 10,000+ year interglacial period, in which we now live, both global warming and sea level rise have been trending higher, since around 1650-1700. Further these data show that the rate of human source CO<sub>2</sub> emissions increased greatly after 1950 and have continued to rise at that accelerated rate. However, **very importantly**, over the last 20-30 years US, Europe and Russia CO<sub>2</sub> emissions have decreased while those of China and developing countries have increased dramatically and now fully account for the continued global increase in emissions. Now we look at three important questions:

1. What is the basis (evidence) for CO<sub>2</sub> being the primary driver of the current global warming?
2. What evidence illustrates that the on-going global warming is due to natural variability, with relatively small anthropogenic effects?
3. Would a U.S. tax on carbon have any significant effect on global warming?

### What is the Evidence for CO<sub>2</sub> being the primary driver of the current global warming?

Global temperatures began to rise steadily from 1979 to 1988 after a global “cooling” period that had lasted 35 years (1944-1979 - see figure 6A). During that period the global temperature for 1944 was not exceeded till 1980. That extended cooler period had some scientists (and some media) predicting the beginning of a “new ice age”. However,

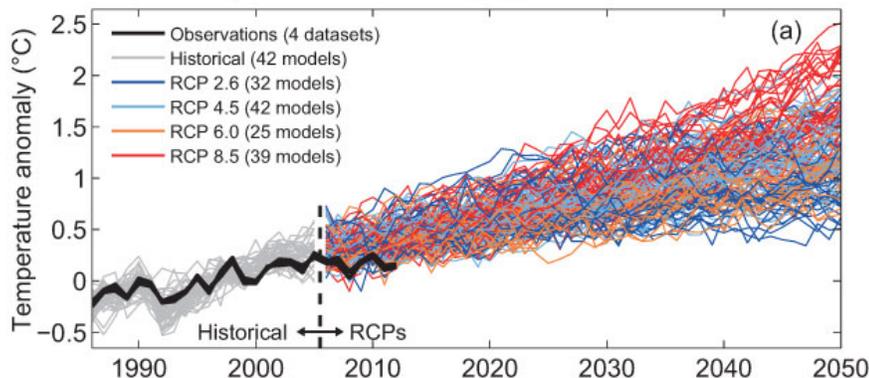
after a subsequent decade of global warming, and with increased attention on reliance on fossil fuels, due to the energy crisis in the 1970's, concerns about global warming and its possible cause understandably became heightened. **The increased concern was based on four facts and observations (which were all true).** These four factors were the genesis of the present-day anthropogenic global warming hypothesis (theory) that human source CO<sub>2</sub> emissions are the **primary** cause of the global warming currently being experienced. But remarkably, and in divergence from the scientific method, there was not, and has not been a concerted effort carried out to prove or verify that theory. The four facts and observations which provided the foundation of the anthropogenic (CO<sub>2</sub>) global warming theory actually became prime “evidence” in “proving” the theory. These facts are:

1. **A decade long observation of relatively sharp global temperature rise** (which continued for another decade),
2. **Increased consumption of fossil fuels** exemplified by the **quadrupling of CO<sub>2</sub> emissions** between 1950 and 1980 (Fig 3B and 6B) from 5,000 million tons to 20,000 million tons per year and continuing to increase year over year.
3. **Vivid pictures and well publicized reports of observations of the effects of global warming** (e.g. melting glaciers, impacts on animals, Artic Ice Sheet shrinking).
4. **The knowledge that carbon dioxide was a recognized greenhouse gas.** CO<sub>2</sub> is indeed a greenhouse gas, albeit a minor one in terms of Global Warming Potential (GWP = 1.0) in comparison to other greenhouse gases.

Two added arguments for anthropogenic global warming theory came subsequently. One of these was, “correlation of the rise of CO<sub>2</sub> with temperature increase in the Vostok, Antarctica ice core data”. The CO<sub>2</sub> and temperature juxtaposition, shown on a 800,000 year scale was a “convincing” visual used by Al Gore (2002) to argue that “CO<sub>2</sub> drove historical global temperature change”. This claim, originally postulated from initial review of the data, circa 1995, was found to be in error by the time of Al Gore’s “Inconvenient Truth” presentation. However, the claim was carried forward as “truth” by Al Gore. It is now clearly recognized that CO<sub>2</sub> increases actually follow temperature increases!!

The second piece of subsequent support for and quantification of the anthropogenic global warming theory, which are accurate in fact but suspect in formulation, are the results from “climate models assessed by the IPCC”. **These models showed significant future increase in global warming and attributed this rise to CO<sub>2</sub>. The models served and continue to serve as the major “scientific” basis of the IPCC findings and projections of future global temperatures and sea levels. However, they cannot be regarded as independent proof because the output is dependent on the input “forcings” provided by the modelers. The model results have routinely significantly overestimated the actual global warming being experienced (over the last 30 years). They are products of judgments on the relative contributions of climate model parameters assigned by each investigator. Each global temperature influencing factor that comprise climate models is a judgment not a fact. Fig. 11 is a plot<sup>15</sup> of data from 5<sup>th</sup> IPCC report.** These two added arguments, for anthropogenic global warming, (not facts as were the first 4 above), are examined in detail below.

Global mean temperature near-term projections relative to 1986–2005



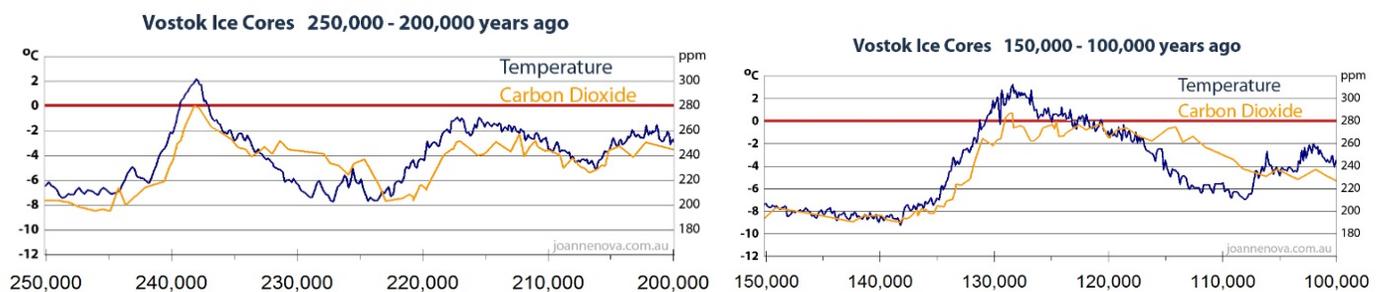
**Figure 1, overheated computer models:** The UN IPCC's infamous “Spaghetti Graph” that appeared in its 2013 Fifth Assessment Report provides a stunning admission that all of its expensive, “sophisticated” computer models have been spectacularly wrong. The tangle of “spaghetti” lines represents temperature projections, all of which show predictions of escalating global temperatures. The dark black line shows the *actual* observed temperature trend, showing essentially no warming, which falsifies the global-warming projections of the computer models.

Figure 13 – Temperature projections from Climate Models – IPCC 5<sup>th</sup> assessment report <sup>15</sup>

5. **Ice Core Data** – The initial Vostok (Antarctica) ice core data plots (1990’s data and interpretation), appeared to show CO<sub>2</sub> and temperature pretty much in lock step – as temperature rose, CO<sub>2</sub> increased or, conversely, as CO<sub>2</sub> increased temperature rose. This observation led to an “obvious but erroneous” conclusion (in conformance to anthropogenic global warming theory) that carbon dioxide was driving the cyclic temperature episodes over the last 800,000 years. This conclusion was incorrect on two counts:

First, it is clearly evident from detailed Ice Core plots<sup>16</sup> (Figure 12A and B) that other, much more influential factors/effects other than CO<sub>2</sub>, caused temperatures to cyclically increase and decrease, because: *“Temperatures begin their rise precisely when CO<sub>2</sub> levels are at their lowest. Temperatures begin their fall precisely when CO<sub>2</sub> is at its highest. Even when at its highest Ice Core levels, CO<sub>2</sub>-caused warming is powerless compared to something else that causes Temperatures to drop! We know that [that] something else has nothing to do with Human activities, because virtually all of the Ice Core record is before the advent of Humans on Earth.”*<sup>17</sup> (Ira Glickstein, Dec. 2016) Thus, the original data plots showed an interesting correlation between CO<sub>2</sub> and temperature historically but they did not show causation of temperature rise due to CO<sub>2</sub>.

Secondly, by 2003, after more data and more careful interpretation of the data had been carried out, it was clear and has now been widely accepted, that the rise in CO<sub>2</sub> **lagged the rise in temperature** by 400-1400 years (on average 800 years). Out gassing of CO<sub>2</sub>, due the oceans heating, is the common-sense reason given for the lag. [Note - A recent study in Scientific American -2013, found that the lag may only be about 200 years]. This understanding of the CO<sub>2</sub> lag, from better data and interpretation, was well known by the time Al Gore (and his scientific advisors) presented the “Inconvenient Truth” in 2006. But Al Gore told the audience: *“The relationship is very complicated. But there is one relationship that is more powerful than all the others and it is this. When there is more carbon dioxide, the temperature gets warmer, because it traps more heat from the sun inside....”* Gore missed “the inconvenient truth” of the CO<sub>2</sub> lag and the audience and the media were thus misled and drew the opposite, and soon to be publicized “desired conclusion” that increased CO<sub>2</sub> emissions indeed drove increased warming in the historic record. Thus, the ice core data did not “prove” the theory and in fact Al Gore misrepresented the facts in (1) claiming that the ice core plots showed the CO<sub>2</sub> warming effect is **more powerful** than the others, when in fact they show the opposite (temperatures began dropping when CO<sub>2</sub> was at its highest levels), so other, natural factors clearly dominated over CO<sub>2</sub> and (2) claiming that CO<sub>2</sub> was driving the temperature when in fact its response lagged the temperature response.



Figures 12A and 12B – juxtaposition of CO<sub>2</sub> and Temperature as estimated from Ice Cores<sup>16</sup>– These plots show that CO<sub>2</sub> levels rose after temperatures rose and that temperatures dropped when CO<sub>2</sub> levels were at their highest.

6. **Climate Model Assessments and Climate Data Review by the United Nations IPCC** – Clearly the model studies provided by the IPCC (International Panel on Climate Change) reports show increased future global warming. Based on these studies the IPCC (1990) best estimate was that global temperatures would rise about 0.3 deg C per decade. (Note: the global temp rise was about 0.1 deg C per decade over the 1910 to 2000 period.) These future global temperature projections were made based on models that incorporated each investigators judgment on many climatological factors and included inputs on the adverse warming effects of increasing atmospheric CO<sub>2</sub>, and on their estimates of feedback effects from that warming. The studies assessed by IPCC provided what is widely regarded as the “science” (and thus the evidence) that “settled” the question of anthropogenic global warming. The IPCC’s work (the assessments they made and continue to make and the periodic reports they have prepared) is generally regarded and accepted as completing the step in the scientific process of taking “theory to fact”.

However, the Panel was not really charged with that task nor did they accomplish it. They were actually charged with demonstrating “**the extent to which human activity affects climate**”. That CO<sub>2</sub> was a prime cause was essentially taken as a given. As per their charge, the IPCC and their supporting governmental agencies have funded and the IPCC has assessed multiple climate models and climate studies that show how significantly human activity will increase global warming in the future. Based on these studies, which likewise typically considered and incorporated CO<sub>2</sub> as a prime cause, resulted in the initial and ensuing IPCC reports attributing CO<sub>2</sub> emissions as the major factor producing the “enhanced” global warming being experienced. The IPCC work thus supplemented the four valid facts and observations cited above as the supporting evidence for CO<sub>2</sub> emissions culpability in global warming.

It is noted that the policy makers overview of the IPCC’s First Assessment report stated: (1) “*There are many uncertainties in our predictions particularly with regard to the timing, magnitude and regional patterns of climate change, due to our incomplete understanding of: sources and sinks of GHGs; clouds; oceans; polar ice sheets, and* (2) *global mean surface air temperature has increased by 0.3 to 0.6 C over the last 100 years...; The size of this warming is broadly consistent with predictions of climate models, but it is also of the same magnitude as natural climate variability. Thus, the **observed increase [in recent years] could be largely due to this natural variability;** - [bold added]*

Finally, the other more recent fact that is “implied evidence” of anthropogenic global warming, and is considered to be an item of great concern, is that 7 of the warmest global temperature years on record (based on satellite data) have occurred in the last decade. Further, land-ocean NASA temperature data show the last 4 years to be the hottest 4 on record. While this observation would be consistent with the theory of “CO<sub>2</sub> as the primary source of the current global warming”, it does not provide evidence for it as warmer temperatures with advancing time is fully consistent with the natural variability that has produced the recognized long-term pattern of global warming (since 1650-1700). As long as the long-term trend of global warming continues via natural variability or CO<sub>2</sub> enhancement, the warmest years will in general be the most recent ones (e.g. 1944 was once the hottest on record, then 1998, then 2016). However, until such time as the natural variability in climate does not reverse and produce a short-term period of cooling (e.g. post 1944 till 1979) or there is a long-term reversal in trend (i.e. end of the Medieval Warm Period or end of the interglacial period), it would be expected that as the years advance the warmest years on record would advance with them, with or without any CO<sub>2</sub> effect. Although, as can be seen from the plots of global temperature rise post 1700 and/or post 1880, it is a fact that there is an ongoing temperature rise with time due to natural variability. What is really proposed via the anthropogenic / CO<sub>2</sub> global temperature effect is that CO<sub>2</sub> is causing “increased or enhanced” global warming. However, the way the issue is presented and discussed, the public is given the impression that all the global warming occurring is anthropogenic, (i.e. due to CO<sub>2</sub> emissions), thus intentionally or unintentionally crediting this effect with much more influence than intended and thus incorrectly giving the impression that elimination of this effect could produce greater results than it really could. The analysis in this paper will present estimates of what the empirical data show as the incremental “increased or enhanced” global warming that could possibly be attributed to anthropogenic / CO<sub>2</sub> effects.

Looking at the above facts and observations and on the model studies and the assessments by the IPCC, allows an inference that CO<sub>2</sub> is responsible for what appears to be enhanced global warming post 1979. The operative conclusion is often, “What else could it be? “. However, it can be clearly seen from the above evaluation of the evidence, that ascribing culpability to CO<sub>2</sub> as the primary driver of “significantly enhanced global warming” is based on circumstantial evidence not on any specific, rigorous evidence constituting scientific proof.

## **What evidence is there that the on-going global warming is due to natural variability with relatively small anthropogenic effects?**

Prior to presenting the empirical evidence below, note that there is simple, clear, evidence that **we are now in a warming trend** and have been since around 1700 due to natural climate variability, prior to the advent of significant CO<sub>2</sub> emissions. Just look at the data beginning in 1880 -Fig. 6A (NASA’s global temperature plot) and Fig. 7B Sea level rise and you can see that the current global warming and sea level rise trends began before the advent of the escalation of CO<sub>2</sub> emissions around 1950. The global warming and sea level rise initiating around 1700 (coming out of the Little Ice Age) is still on a rising trend at roughly the same incline. This fact can be readily observed, both from historic data (post 1700 – Fig 3A) and more modern data (Figs. 6A, 7B). Thus, the determination of an anthropogenic contribution to global warming needs to assess what add-on the anthropogenic effects may show. The current perception and the concept

being promulgated politically, in the media and perhaps by the IPCC, is that all the current global warming is driven by CO<sub>2</sub> emissions. A more in-depth look at the available data below will attempt to discern and quantify the degree to which anthropogenic effects could be ascribed to adding to the long-term pattern of global warming. If successful these findings will show the possible anthropogenic effect accurately and equitably.

Although rarely presented or discussed, there is direct empirical evidence: (1) that global warming and sea level rise may only be marginally enhanced (over the pre-1950 rates), following the accelerated level of CO<sub>2</sub> emissions from 1950 to the present (a 7-fold increase) and (2) that, remarkably, increased CO<sub>2</sub> emissions have not and do not consistently, correlate with increased global warming.

The available data clearly show, and it is generally accepted, that prior to 1950, CO<sub>2</sub> emissions were relatively small and had not raised atmospheric CO<sub>2</sub> levels significantly (i.e. still in the range experienced during the interglacial warm periods over the last 800,000 years). However, after 1950 the annual rate of CO<sub>2</sub> emissions drastically increased (see figs 3, 6B and 7A). CO<sub>2</sub> emissions rose from 5,000 million tons to 20,000 million tons per year during the period 1950 to 1980. Between 1980 and 2015 emissions continued to rise and reached over 33,000 million tons per year by 2017. Atmospheric CO<sub>2</sub> levels from 1700 to 1950 increased slowly and gradually, consistent with historic levels, from 280 ppm to 305 ppm. From 1950 to 2017 atmospheric CO<sub>2</sub> levels dramatically rose from 305 ppm to 405 ppm, a 34% increase. Thus, to technically and scientifically evaluate, the influence of CO<sub>2</sub> emissions on global temperature and on sea level rise, it is reasonable to compare and contrast the response of each within the pre and post 1950-time frames. These time frames had distinctly different annual and cumulative amounts of CO<sub>2</sub> emissions and atmospheric CO<sub>2</sub> and thus if CO<sub>2</sub> is the major player in global warming and sea level rise, a distinct difference should be evident in the data.

#### **Increase in sea level rise that could be attributed to anthropogenic effects based on empirical data**

With respect to sea level rise, Figures 7A and 7B show the sea level rise since 1800 and 1880 respectively. Visually, these two plots of global sea level rise with time, developed independently, do not appear to show a distinct change post 1950. Certainly nothing like the drastic change in CO<sub>2</sub> emissions observable in plots over comparable time periods. However, scaling of the rates on the two figures show that based on the NASA plot, sea level rise from 1880 to 1950 was about 14 mm per decade and from 1950 to 2014 was about 20 mm per decade and based on the Jevrejeva plot, sea level rise from 1900 to 1950 was about 20mm per decade and from 1950 to 2014 was about 19 mm per decade. Thus, some increase in sea level rise per decade is shown post 1950 based on one of the two sea level rise estimates and none on the other. However, both sets of data show the sea level rise to be about 20 mm per decade over the last 6 decades or about a one-foot rise in 150 years. This is only 1/3 of the first, “best estimate” rate of expected sea level rise made by the IPCC in 1990. There are many factors contributing to the estimates of sea level rise that contributors to the IPCC use in their models (e.g. thermal expansion of the oceans, ice accumulation, melting of continental glaciers, etc.) and there is considerable uncertainty in the contribution of each of these factors. This uncertainty is reflected in the IPCC’s upper bound estimate of sea level rise by the year 2100 in their 1<sup>st</sup> through 5<sup>th</sup> assessment reports which were: (367cm, 124 cm, 77 cm, 59cm and 110 cm) respectively and in their 1<sup>st</sup> through 5<sup>th</sup> estimates of the lower bound sea level rise by 2100 which were: (10,3,11,18 and 45 cm) respectively. Based on the above evaluation of the data on rising sea levels and its potential relation to the post 1950 anthropogenic CO<sub>2</sub> influence on the natural variability, it is clear that simple, direct empirical evidence shows that the ongoing sea level rise is relatively consistent with historical trends, prior to the “explosion” of CO<sub>2</sub> emissions. More recent satellite data (since 1993) show that sea level rise has been steady (not accelerating) at about 30mm/decade. At this rate sea levels would rise by 24cm or about 8 inches by 2100. While increasing sea levels are certainly worthy of attention with regard to preventative measures, the projected rise is not catastrophic in nature (at the current rate) and they clearly show, at most, a relatively small (10mm/decade) effect that could be attributable to anthropogenic warming.

#### **Increase in global warming that could be attributed to anthropogenic effects based on empirical data**

With respect to temperatures, NASA’s global temperature plot from 1880, Fig 6A, along with the UAH satellite data plot (Fig. 5 - 1979-2018) provide the means for making temperature increase comparisons. The NASA plot provides the annual mean temperature for each year (annual values on light line) and the five-year running mean (dark heavy line). Figure 5 provides the monthly temp. anomaly and a 13-month running average.

There are various ways to compare the rate of increase in global temperatures furnished in NASA's records for the pre and post 1950 period. Visually examining figure 6A reveals that there are multi-year periods of rising and decreasing global temperatures. Calculating the rate of rise of global temperature for similar ranges of distinct temperature rise, (i.e. - from the last low point before a steady rise to the peak global temperature year before a leveling or decrease) is one means. This rate of rise was calculated for the periods 1917 to 1944 (pre-1950) and 1978-2003 (post-1950). The incremental rise in global temperature (scaled from Figure 6A) during the 27-year period from 1917 to 1944, was approximately 0.58 deg C, a rate of **0.215 deg C per decade**. A similar period of sharp temperature rise is observed on Fig 6A within the period of greatly enhanced CO<sub>2</sub> emissions from 1978 to 2003. During that 25-year period the global temperature rose approximately 0.71 deg C or **0.263 deg C per decade**. NASA's updated / revised global temperature plot (Figure 6C) was also used to make the same type of comparison for the periods 1917 -1944 and 1976-2005 and the results were similar, increasing by **0.237 deg C** per decade for the earlier period and **0.272 deg C** per decade for the latter period. From these comparisons, if the difference is fully attributed to anthropogenic effects, it would mean there has been an increase in global warming due to anthropogenic effects of from about 0.035 to 0.05 deg C per decade. Another way to quantify an estimate of the effect on global warming due to the greatly increasing rate of CO<sub>2</sub> emissions post 1950 is to compare the slope of trend lines through the running average of global temperature for each of the time frames. For the 60 year period 1890 to 1950 the slope of the temperature trend line shows an estimated global warming rate of **.074 deg C per decade** and for the 60 year period 1950 - 2010 (Fig 6A) the trend line shows an estimated increase in global temperature of **0.112 deg. C per decade**, yielding a difference of 0.038 deg C per decade. Similarly, using the UAH satellite data the warming trend from 1979 to 2018 was estimated by scaling to show an increase in global warming of 0.112 per decade. (Reported as 0.13 deg C/decade by UAH) Thus, using actual empirical data the increase in global warming that could be attributed to anthropogenic effects post 1950, using both methods (general trend line or min to max during the sharp warming periods) is on the order of 0.04 degrees Centigrade per decade. This would mean an increase of 0.4 degrees C over a 100-year period that could be analytically attributed to anthropogenic effects using the modern historic record of annual global temperature.

These data clearly show that the natural variability, which was driving the global warming in the modern Warm Period (prior to the advent of high-level CO<sub>2</sub> emissions and continuing to through the present), remains the primary driver of global warming. Anthropogenic effects can, at most, be credited as responsible for about 1/3 of the current warming.

### **Lack of correlation of CO<sub>2</sub> emissions with the global warming history records**

The NASA record of global temperature since 1880 (figures 6A and 6C), while revealing an overall increasing warming trend is irregular in the advance of warming with time. There are extended periods where the yearly global temperature remains lower than an earlier (past year) global temperature. These periods, that do not show warming year after year are typical followed by a period of a steady rise in global temperatures for a number of years. For example, the record of annual global temperatures (Figs. 6A and 6C) show that the global temperature recorded for 1944 was not exceeded until 1980 – a period of 36 years. Likewise, the global temperature for 1900 was not exceeded till 1937 (although it was equaled in 1926). This variable pattern is also evident in the global temperatures of the lower atmosphere being recorded presently by satellite data (Figure 5). From 1979 through 1998 (an el Nino year) there was a steady rise in the measured global temperatures. However, after reaching a peak in 1998, global temperatures (recorded monthly) did not exceed the 1998 levels until 2016. By contrast annual CO<sub>2</sub> emissions, which were relatively small until around 1950 accelerated at that point and have continued to increase steadily year over year ever since. Thus, clearly, if there was a direct correlation of global warming with increased CO<sub>2</sub> emissions as the primary driver, one would expect (post 1950) a steadily increasing rate of global warming because: (1) CO<sub>2</sub> emissions are steadily increasing year over year, and, (2) the cumulative effect of CO<sub>2</sub> emissions retained in the atmosphere from previous years. However, as will be shown below, this has not been the case.

A clear example of the lack of correlation of CO<sub>2</sub> emissions with respect to its professed role as the primary driver of the current global warming, is the lower global temperatures recorded during the period of dramatic increase in CO<sub>2</sub>

emissions during the 1944 – 1980 period. Not only is there not a correlation of increased CO<sub>2</sub> and global warming during that 36-year period, a reverse correlation is indicated. Such a reverse correlation is, of course, not being suggested, the facts simply illustrate that other factors than CO<sub>2</sub> emissions dominated during that period and in the long term and in the present pattern of global temperature rise and fall. A few simple calculations are provided below (Table 1) to show the distinct lack of correlation of annual and cumulative CO<sub>2</sub> emissions with the empirical record of global temperature advance.

It is understood in the assessment of the Global Warming Potential (GWP) of greenhouse gases, such as CO<sub>2</sub>, that the portion of the annual CO<sub>2</sub> emissions which are not taken up by plants, soils, and the ocean and end up in the atmosphere (in the range of 40%-60%), stay there for many years (more than 100 years). Whatever adverse effect CO<sub>2</sub> emissions on global warming might have in any given year would not be just a function of the emissions in that year but on the cumulative amount of the emissions that have been introduced to the atmosphere previously over an extended period of years. As noted, it is recognized that only a percentage of the total emissions remain in the atmosphere, (as reflected in the advancing ppm of CO<sub>2</sub> in the atmosphere), but that value is a function of the total emissions, thus the total emissions can be used to illustrate and reflect the relative amounts of CO<sub>2</sub> that are being added to the atmosphere. To examine the correlation of CO<sub>2</sub> emissions with global temperature rise for about the last 100 years of record of global warming (1917-2016), the following calculations and comparisons were made:

1. Assume CO<sub>2</sub> emissions (in million metric tons = MMT) introduced post 1917 through 2016 accumulate and contribute to global warming. (neglect the pre-1917 emissions).
2. Obtain (from Figure 6B) the CO<sub>2</sub> emissions at the start and end of “the following variable global warming periods”: 1917 – 1944, 1944 -1979, 1979-1998, 1998-2013, 1998-2015 and compute the cumulative CO<sub>2</sub> emissions from each period and the total “operative” at the end of each period.
3. Compare the total “operative” CO<sub>2</sub> emissions for each period with the incremental temperature change (Temp at end of period – Temp at start of each period, as obtained from Figures 5 and 6C).

To make the comparisons the time periods examined were, of course, the periods of (1) distinct, relatively steady rise in global temperature and (2) the periods where the global temperatures generally remained below the global temperature measured at the start of the period. As can be noted the periods covered in the calculations span the entire period from 1917 to 2015.

**Table 1 – Change in global warming vs cumulative amount of CO<sub>2</sub> emitted (1917-2015)**

Period	CO <sub>2</sub> emitted Annually - MMT	CO <sub>2</sub> emitted in the period MMT	Accumulated CO <sub>2</sub> emissions MMT	Temp. change + or -	Temp. rise / year
1917-1944	3,500 -5000	114,750	114,750	+ 0.68 deg C	+0.025
1944-1979	5,000-20,000	287,500	402,205	- 0.05 deg C	
1979-1998	20,000-24,000	462,000	864,205	+ 0.47 deg C	+0.025
1998-2013	24,000-32,000	420,000	1,284,000	- 0.06 deg C	
1998 -2015	24,000-32,000	476,000	1,350,000	- 0.30 deg C	UAH satellite data

Examination of this table readily shows, by inspection, that there were two extended periods, one of 35 years and one of 15 years in NASA’s global temperature index, (17 years in the UAH Satellite Based Global Temperature in the lower Atmosphere), during which **there was a much greater quantity of CO<sub>2</sub> emissions during the period and a much greater quantity of CO<sub>2</sub> emissions accumulated in the atmosphere than in the previous time period but during which global temperatures did not rise.** The “overall” observation is that global temperatures are rising and CO<sub>2</sub> is rising and is true but the “detailed” examination of the data show that there is no direct, temporal correlation of CO<sub>2</sub> emissions and global temperature rise and thus other “natural variability factors” dominate both the overall global warming increase

and the periodic warmer and cooler fluctuations in the warming trend. This conclusion is decisively illustrated by contrasting the conditions and the results of the 1998-2015 period. During that period, over 10 times the CO<sub>2</sub> emissions had been introduced and existed in the atmosphere as had existed in the 1917-1944 period. Certainly, if CO<sub>2</sub> emissions were the primary driver of global warming, it would be expected that with 10 times the CO<sub>2</sub> now in the atmosphere, not only would year over year global warming be occurring but it would be occurring at a rate higher than measured in the 1917-1944 era. But nothing like that occurred. Global temperatures decreased after the 1998 peak and remained essentially flat till 2016 (UAH data – figure 5). Ten times greater CO<sub>2</sub> emissions should have easily been able to confirm / bolster the anthropogenic theory but it did not. The 1998-2015 period was “incorrectly” ballyhooed by some as evidence against global warming, but that was not true. That period, like the 1900-1937 and the 1944-1979 periods was only a hiatus in the on-going global warming advance. The evidence from the detailed examination of the empirical data clearly refutes the theory that CO<sub>2</sub> emissions are the primary driver of current global warming. The timing is all off to establish a correlation. Interestingly, the relationship of temperature and atmospheric CO<sub>2</sub> based on estimates in geologic time<sup>18</sup> also do not show a correlation (Figure 12). These data also show that much, much higher atmospheric concentrations of CO<sub>2</sub> existed in the past, but one can be sure many and varied climate factors (e.g. sun’s intensity) existed at these times, so no particular conclusion is being drawn from this observation.

The point of the above analysis is to illustrate what the accumulation of this huge quantity of emissions of CO<sub>2</sub> **did not do** during extended periods of time. In contrast, and to get a grasp on the magnitude of the CO<sub>2</sub> emissions that were made in the 1944-1979 period, just reflect on what the millions of tons of **nitrous oxides, sulfur oxides, carbon monoxide, ozone and particulates** from fossil fuel emissions into the air **did do** (and their quantity was orders of magnitude less). During the 1944 to 1979 period the release of the above listed pollutants from the burning of fossil fuels for transportation, heating and energy production produced smog, filthy air, and acid rain throughout the country. These pollutants each comprised only a fraction of the quantity of CO<sub>2</sub> released and look at the magnitude of their effect. This pollution led to a national awakening, the Clean Air Act and great improvements in reducing and controlling these pollutants from cars, factories and power plants. It is just common sense that if the effect of these known pollutants from fossil fuels was so evident and so physically observable that some discernable, direct effect from CO<sub>2</sub> on global temperatures would have been recognized, measured, and assessed during this era of environmental awakening and it was not. Only later was CO<sub>2</sub> branded as a pollutant primarily on the basis of circumstantial evidence, a sudden rush to judgment, as a convenient scapegoat, and as a new foil against use of fossil fuels. Now, on the basis of “conventional wisdom” spread by media propaganda, CO<sub>2</sub> emissions are being used as a political tool by those with little knowledge of the actual facts.

It should be abundantly clear from the analysis of the data above that CO<sub>2</sub> is not the primary driver of the current and overall global warming trend evident in Figures 6A and 6C and that other factors dominate. The data demonstrate that the rate of global warming has marginally increased (by about 35%) since 1950, however the data also clearly do not show that this increase correlates with CO<sub>2</sub> emissions. The increase could be natural variability or it could be other anthropogenic effects. This does not mean that there is no contribution from CO<sub>2</sub> because there certainly is. But, just as the IPCC, correctly inferred in their first report, the actual contribution of CO<sub>2</sub> can be masked by other factors. And while the IPCC made that comment to warn that the CO<sub>2</sub> emission effects could be greater than their estimates, the empirical data, as evidenced by the lack of year over year global warming, under a greatly increased presence of CO<sub>2</sub> emissions, actually suggests that the CO<sub>2</sub> effect is small enough to be readily masked.

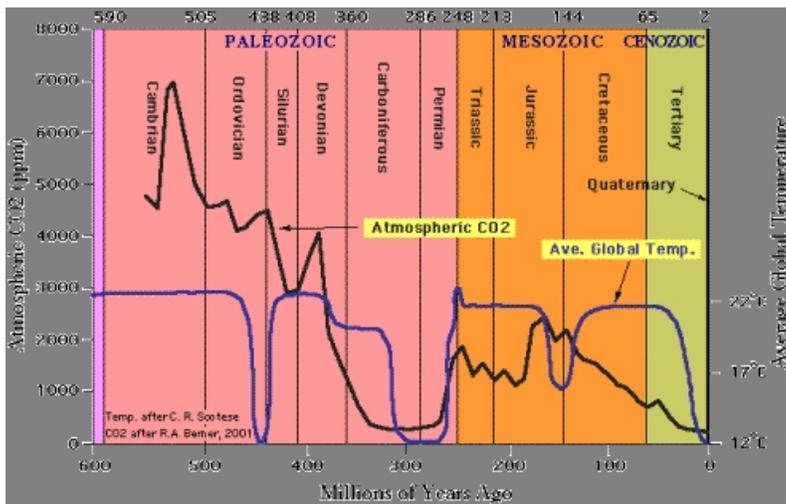


Figure 12 – Temperature and CO<sub>2</sub> in Geologic Time <sup>18</sup>

## The Fallacy and Futility of Imposing a “Carbon Tax”

The data and analyses above will now be drawn on in order to illustrate the fallacy and futility of imposing a “carbon tax” in the United States in order to meaningfully influence (reduce) global warming. This is not to say anything against reducing fossil fuel use (which produces known pollutants – NO<sub>2</sub>, CO, particulates, etc.) or against increasing the use of cleaner energy alternatives. Developing cleaner energy sources that do not adversely impact the environment is a great objective. However, such actions should not be conflated with crediting CO<sub>2</sub> as the primary cause of the global warming being observed and with the idea that taxing CO<sub>2</sub> emissions in the US would result in some meaningful reduction of global warming. There are five overarching, strongly compelling reasons why imposing a tax on CO<sub>2</sub> does not make sense. These lines of evidence consist of both empirical, scientific data and information and realistic facts about what has already occurred and what is occurring worldwide with respect to CO<sub>2</sub> emissions. The reasons are simple, common sense, and conform to scientific principles of evaluation of the available (empirical) and theoretical data. They are:

1. Putting a tax on CO<sub>2</sub> in order to produce a reduction in global warming without any actual, demonstrable proof or evidence to illustrate and quantify the potential of any measurable effect by cutting CO<sub>2</sub> emissions is irrational and irresponsible. The backbone of the current scientific “evidence” of CO<sub>2</sub> culpability comes from model studies which input the level of CO<sub>2</sub> forcings and resultant feedbacks, thus they do not constitute independent verifiable proof of the role of CO<sub>2</sub> emissions but simply confirm the input assumptions being made. There has never been an observation of, or any physical (measured) evidence gathered to show that reducing the CO<sub>2</sub> in the atmosphere results in a lowering of global temperatures, as is claimed would be the result if CO<sub>2</sub> emissions were reduced. This is because such a condition has never existed to be measured since the notion was promulgated (CO<sub>2</sub> has continually increased since before 1880). Conversely the condition of a dramatic increase in the amount of CO<sub>2</sub> emissions resulting in a decrease in global temperatures has been observed (post 1944 condition for 30+ years).
2. Current United States CO<sub>2</sub> emissions annually (5,000 MMT) are already being cut and are now below what they were in 1993. They now (2017) comprise 15% of the total annual worldwide CO<sub>2</sub> emissions (33,500 MMT). Meanwhile, (since 1993), annual worldwide CO<sub>2</sub> emissions have increased by 56% (12,500 MMT), or 2.5 times US emissions. Imposition of a CO<sub>2</sub> tax, to cut US emissions, would have an insignificant impact on the continually increasing worldwide emissions. Even if CO<sub>2</sub> were culpable in causing global warming, US reductions would not result in a perceptible change to global warming.
3. The available empirical data clearly show that massively increased CO<sub>2</sub> emissions, present in the atmosphere during the periods 1944-1979 and 1998-2015, did not correlate with increased global warming. Thus, CO<sub>2</sub> cannot logically be credited as the primary cause of the subsequent rise in global warming post 1979 and post 2015.
4. Despite this lack of correlation and the recognition that a reduction of US emissions would be relatively insignificant with respect to the worldwide emissions, let us assume that CO<sub>2</sub> emissions indeed produce a “significant”, enhanced global warming effect and examine the efficacy and potential usefulness of applying a

tax on carbon dioxide emissions. Based on NASA's recorded history of global warming (post 1880 – Fig 6A), the anthropogenic CO<sub>2</sub> effect would have logically begun with the sharp rise in the global temperatures after 1979. Considering CO<sub>2</sub> emissions as causative of enhanced global warming before that time would not make sense because global temperatures had remained below the 1944 level for the preceding 35 years. So, to stay on the anthropogenic global warming CO<sub>2</sub> emissions theory / scenario, it would follow that by 1979 enough human CO<sub>2</sub> emissions had been introduced into the atmosphere for them to become the primary driver of the observed steady rise in global temperatures from 1979 to 1998. This period of temperature rise generated and sustained global warming concerns. The quantity of CO<sub>2</sub> emissions by 1979 was on the order of 400,000 MMT as shown by the above calculations. Thus, following the theory of anthropogenic warming one could deduce that the CO<sub>2</sub> emissions had to have reached a cumulative total of around 400,000 MMT (raising the atmospheric CO<sub>2</sub> level to about 330ppm) before their effect overtook the other factors producing natural global temperature variability. Following that logic and continuing to recognize the cumulative effect of the portion of the CO<sub>2</sub> emissions that reach the atmosphere remain there for over 100 years, two corollaries follow: (1) Continued accumulation of CO<sub>2</sub> emissions post 1979, which as of 2018 have reached 1,450,000 MMT would have not just sustained but also accelerated the annual rate of global warming, and (2) most importantly, with respect to curtailing the continuing anthropogenic increase in global warming effect due to CO<sub>2</sub> emissions, ostensibly **the quantity of CO<sub>2</sub> emissions in the atmosphere would have to be reduced to a level below the level existing in 1979** (402,000 MMT). Since the current human induced CO<sub>2</sub> emissions stand at 1,450,000 MMT and are increasing at an annual rate of 33,000 MMT per year and the current atmospheric level of CO<sub>2</sub> in the atmosphere is at 410ppm, accomplishing such a task is unreasonable to fathom. It would mean not only reducing worldwide emissions to minimal values but somehow removing from the atmosphere the portion of the over 1,000,000MMT of CO<sub>2</sub> emissions added over the last 40 years. What the above analysis of the quantity of CO<sub>2</sub> emissions that human activity has already and are continuing to introduce into the atmosphere is that if indeed our CO<sub>2</sub> emissions cause grave, perilous global warming consequences when they rise above the levels experienced in the last 800,000 years, then that ship has sailed and there is no recalling it back to port. The incredible quantities of CO<sub>2</sub> that have already been introduced into the atmosphere, according to the theories and predictions (made 30 years ago) of the harm that CO<sub>2</sub> emissions will cause should have been readily and demonstrably observable. Fortunately, no drastic effects have occurred, and rather than following the global warming model projections presented by the IPCC (5<sup>th</sup> report), global warming has marched on at a pace only marginally above what had occurred previously (since 1700) and based on ice core records has not yet reached the peaks evident in earlier global warming and cooling cycles over the last 420,000 years (Figure 1). *(Fortunately, empirical temperature data clearly indicate that such a task is not necessary since (1) global warming since 1979 does not indicate an acceleration in rate consistent with a tripling of the amount of human produced CO<sub>2</sub> emissions present in the atmosphere and (2) increasing CO<sub>2</sub> emissions do not consistently correlate with increasing / decreasing global temperatures over the modern period of record.)*

5. The empirical data do indicate a discernable incremental increase, in the rate of global warming of 0.04deg C per decade post 1950. That increase could of course be natural variability or it could be due to anthropogenic effects. Certainly, it is reasonable to expect that all of our combustion activities must have some effect on surface and lower atmospheric temperatures (e.g. there is a distinct temperature difference between a major city and the adjacent rural area). Further, as noted above the very potent greenhouse gases of methane, nitrous oxides and fluorocarbons could be contributing to this effect. A more thorough and rigorous study to verify the cause of this incremental increase and determine the possible means of rectification should be undertaken.

## Conclusion

An objective look at the historic record of global temperatures shows that the case for ascribing CO<sub>2</sub> as the primary driver of the current global warming, postulated to catastrophically raise global temperatures and sea levels and the associated case for taxing carbon dioxide emissions as a means to alter this course, do not stand up to a simple examination of historic data. These are the facts and information from readily available sources:

1. We are in a 10,000 year+ inter-glacial period that has had several episodes of warming and cooling. **We are in a period of global warming** and have been since about 1700 at the close of the Little Ice Age.
2. Within our current interglacial period there have been long periods (hundreds of years) of a rising temperature trend followed by periods of a falling temperature trend. These changes in the interglacial periods have been on the order of about 0.5 to 0.9 deg. C, as opposed to about a 10-degree fluctuation between glacial periods.
3. Atmospheric CO<sub>2</sub> rose following the Little Ice Age minimum from about 280 ppm (1700) to 300 ppm (1917).
4. From 1880 to 1944 CO<sub>2</sub> emissions were relatively small but there were significant global temperature fluctuations. The NASA global temperature record shows that between 1880 and 1917 global temperatures gradually decreased, dropping by 0.34 deg C from the 1881 value to that estimated for 1917, and rising by 0.65 deg. from the 1917 value to the 1944 peak. During the same time frame (1880 -1944) sea levels continued to rise at a relatively uniform rate of about 1.5 -2.0 mm per year.
5. Beginning in 1950 the annual rate of human source CO<sub>2</sub> emissions accelerated dramatically. Annual CO<sub>2</sub> emissions rose 4-fold between 1950 and 1979, from 5,000 MMT /yr to 20,000 MMT/yr. As of 1979, an estimated 402,205 MMT of human source CO<sub>2</sub> had been emitted and the atmospheric CO<sub>2</sub> concentration had reached 330 ppm, a higher level than had existed, based on ice core data, in the last 800,000 years.
6. Despite this great increase of human source CO<sub>2</sub> during the 1944-1979 period and despite the resultant higher atmospheric concentration of CO<sub>2</sub>, global temperatures **declined**, remaining below the 1944 level for 35 years.
7. From 1979 till 1998 the annual CO<sub>2</sub> emission rate continued to increase year after year. But now global temperatures also rose, peaking in 1998. Global temperatures increased over the period 1979 to 1998 by 0.46 deg C (NASA Data). These temporal, parallel increases fostered and entrenched the perception of a link between CO<sub>2</sub> emissions and global warming. Note, however, that the annual rate of global temperature rise from 1917 to 1944 ( ) prior to the great infusion of human source CO<sub>2</sub> into the atmosphere, **was identical** to the annual rate of rise (0.25 deg C /decade) between 1979 and 1998. The rush to judgment in condemning CO<sub>2</sub> did not recognize, or ignored, the historic record. Meanwhile by 1998 cumulative human source CO<sub>2</sub> emissions had now reached 864,000MMT.
8. **From 1998 until 2015** (based on lower atmosphere UAH satellite data), and from 1998 until 2012 (NASA data) once again **there was a pause in global temperature rise**. Human source CO<sub>2</sub>, however, continued to be emitted worldwide at ever increasing rates, reaching 33,000 MMT/yr. This was despite declining CO<sub>2</sub> emissions in the US and Europe. Cumulative CO<sub>2</sub> emissions during this pause in global temperature rise were now over 1,000,000 MMT, ten times the amount that had existed between 1917 and 1944 during a period of substantial global warming. The extended periods of no increase in global temperature between 1944 and 1979 and between 1998 and 2015, even though enormous amounts of CO<sub>2</sub> had been emitted and the atmospheric CO<sub>2</sub> had been raised to over 400 ppm clearly demonstrated that there was not a direct correlation between CO<sub>2</sub> emissions and global temperature rise.
9. It is observed that the substantial increase in CO<sub>2</sub> emissions (and likewise other human source pollutants) began post 1950. Therefore, close examination of the overall sea level rise trend and the global temperature trend pre and post 1950 should indicate whether or not there has been an increase that could be attributed to anthropogenic effects. That examination indicates that the rate of global warming has increased by about 0.04 deg C / decade post 1950 and that sea level rise has increased by about 10mm /decade since 1993. These increases could be due to natural variability or they could be due to anthropogenic effects. In either event three things are clear (1) the possible anthropogenic effects are not “primary” drivers, (2) the overall increases in

global warming rates and sea level rise rates are not catastrophic in magnitude, and (3) the rate of rise trends have been relatively uniform over the last 30 years rather than accelerating.

10. The two most significant conclusions reached during this examination of the data and information, relative to trying to affect the on-going global warming via a “carbon tax” within the United States are:
  - If indeed CO<sub>2</sub> were the primary driver responsible for the currently observed global warming, then it would follow that that influence had to have begun at or after 1979 when global temperatures (and concerns) began to rise after an extended period of cooling. At that point in time 462,000 MMT of CO<sub>2</sub> had been emitted and the atmospheric CO<sub>2</sub> had been raised to 330 ppm. One could thus conclude, using the Anthropogenic Global Warming argument, that that quantity of human source CO<sub>2</sub> emissions had now been great enough to now serve as the primary driver of increased global warming. Further, increased CO<sub>2</sub> emissions would logically accelerate the global warming. Since 1979 there has been another 1,000,000 MMT of CO<sub>2</sub> emitted and the atmospheric CO<sub>2</sub> levels are now at 410 ppm. Thus, it would be logical to conclude that: (1) global warming rates should be accelerating and (2) to halt anthropogenic induced increases in global warming it would be necessary to return the atmospheric CO<sub>2</sub> conditions equivalent to those in 1979. This would mean eliminating CO<sub>2</sub> emissions and extracting 1,000,000 MMT of CO<sub>2</sub> from our atmosphere. Such requirements are incomprehensible and unrealistic to consider. So, if CO<sub>2</sub> emissions were indeed the primary driving force behind the current global warming, it is clear that the quantity of CO<sub>2</sub> already emitted and currently being emitted is so great **we are well beyond the point of realistically doing anything about that**. Fortunately, what is obvious from the data is that (1) CO<sub>2</sub> emissions do not correlate with global warming, (2) global warming and sea level rise has not accelerated in a manner consistent with the assumption that emissions of CO<sub>2</sub> are the primary driver of global warming, and (3) the incremental increase in the rate of global warming and sea level rise that could be attributable to anthropogenic warming are relatively small and should be addressed via mitigation efforts.
  - Noting that United States CO<sub>2</sub> emissions have declined since 1993 and assuming that CO<sub>2</sub> emissions are either the primary driver or a measurable contributor to the current global warming, even a significant further reduction in US emissions via a tax on them would have no significant effect on reducing global warming. This is because the world wide emissions are so large and the amount of emissions already in the atmosphere is so great.

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