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The Bell Can Be Un-Rung Climate Change Can Be Undone

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ABSTRACT

Commencing nearly a decade ago, the scientific literature has shown that changes in the concentration of water vapor, a greenhouse gas with a heating power 400 times greater than carbon dioxide, CO2, closely match changes in the average global temperature. The foregoing notwithstanding, while there is no correlation between changes in the average global temperature and changes in the concentration of CO2; still a large community of interests including the Intergovernmental Panel on Climate Change (IPCC), academia, agencies of government, various research institutions and enterprises, tens of thousands of scientists, public officials and policy makers which have worked for over three decades without proof, continue to assert that it is the increasing atmospheric concentration of CO2 that drives global warming. Thus, the myopic focus of this de-carbon community remains reducing carbon emissions. This is a major problem, because, while the data and the physics have clearly shown that when the global concentration of water vapor is reduced, the result is global cooling and reductions in catastrophic weather. and these relationships have not been discussed in the preeminent scientific literature. As a direct consequence, no steps to drive increased precipitation to reduce the concentration of water vapor have been undertaken. As each year passes, the size of the reduction sufficient to reverse global warming grows, thus, increasing the time necessary to effect this, which may take decades as annual devastation from catastrophic weather increases at a rate of $45 bn US every decade. To fight climate change, the policy must change to focus on encouraging the development of effective, efficient and sufficient means of increasing precipitation.

Key Policy Considerations

1. Annual global economic losses from the devastation wreaked by the increasing incidence and severity of catastrophic weather have grown by 1,400 % since the seventies, today, exceeding US $160 bn, increasing by US $5 bn annually.
2. Climate change, the growing incidence of catastrophic weather and global warming, is driven solely by the increasing concentration of water vapor.
3. Increasing global precipitation, thereby decreasing the average global concentration of water vapor, will reduce both impacts of climate change.
4. Therefore, the policy to address climate change must encourage development of sufficient, efficient and effective means of increasing global precipitation.

INTRODUCTION

Impact of Climate Change

Why have I devoted 10 years of my life, unpaid, to this research and this effort? Along with some plagues and the ice ages, the current and likely future changes in our climate are among the gravest problems humankind has ever faced. I care about humankind and the truth.

This is what we are facing. These catastrophic weather impacts are growing every year.

The combination of global warming and significant long-term alterations in weather patterns caused by extreme weather have caused prolonged and more extreme heat waves. The daily high temperature in London in July rarely exceeds 29 °C (84 °F). In 2022, the *New York Times* reported that Britain made meteorological history when temperatures in some places topped 40.3° Celsius (104.5° Fahrenheit) for the first time ever recorded in the United Kingdom [1]. In June and July of 2022, a Thousand People Died in Portugal and Spain from the Extreme Heat. [1] NASA's Goddard Institute for Space Studies clocks July 2023 as hottest month on record ever since 1880 [2]. Drought dried, brush fueled, and wind driven, massive wildfires are occurring far more often, worldwide as are more severe and longer droughts, coupled with the whiplash effects of severe drought followed by massive flooding on sunbaked soil, Turning Arable Land to Desert.

This is the Result. [3-5]

Since the seventies, as millions have died, been injured, displaced and lost their livelihoods, a large community comprised of the Intergovernmental Panel on Climate Change (IPCC), universities, governmental agencies, various institutions and enterprises and those in their employ, including thousands of scientists and public officials, have focused solely on and advocated the policy of reducing CO_2 emissions as the way to fight global warming. This "de-carbon industry" has reaped hundreds of billions in grants, revenues and carbon taxes, as the resulting increases in average, annual, global, economic costs from carbon emission reductions rose in the trillions.

The policy of battling global warming by limiting carbon emissions has had and can have no impact on global warming. Carbon dioxide, CO_2, does not play a role in global warming. Climate change, both the increasing average global temperature and the incidence and severity of catastrophic weather, which has increased by 1,400% since the decade of the seventies, is driven solely by cumulative changes in the concentration of water vapor resulting from changes in sea surface temperatures, SST, in the region of the Eastern Equatorial Pacific where El Niños arise, the ENSO region, five months earlier. As shown, almost every other year, by reducing the atmospheric concentration of water vapor, the result when average global precipitation exceeds evaporation, average global temperature and the incidence and severity of catastrophic weather, is reduced. That the increasing concentration of water vapor drives climate change is crystal clear. It is not debatable. The de-carbon faction of science is incurious. As a result, nothing is being done and something can and must be done to reduce these massive threats. There can be only one effective policy – reduce the concentration of water vapor, not carbon emissions, by increasing average global precipitation. Yet, as average global temperatures and losses wreaked by catastrophic weather continue to rise, the recognized climate "experts" virtually all of whom are part of the de-carbon faction of climate science, have failed to advocate as the data and physics demonstrate is required, for a reduction in the concentration of atmospheric water vapor to reduce the annual devastation caused by catastrophic weather events and drive global cooling. When an 11% reduction in the concentration of atmospheric water vapor could completely reverse climate change, no steps to effect this have been taken.

The Claim That the Increasing Atmospheric Concentration of CO_2 is the Driver of Global Warming is Wrong

The "proof" the de-carbon faction offers is that the atmospheric concentration of CO_2 is increasing at the same time the average global temperature is rising—ergo, the increasing concentration of CO_2 is driving global warming. Most agree with this point and that consensus is relatively easy to build and maintain when the scientific publications edited by the academic elements of this faction deny publication of any inconsistent suggestions out of hand and hold sway among the media and therefore with governments and society, not unlike how the concept of geocentricity (the Earth is the center of the universe) was generally accepted, holding sway for centuries, in part because the Sun and the sky rose in the East and set in the West and it was advocated by the Church. Disagreeing publicly meant being tried as a heretic, possibly being tortured and burned alive and in any event excluded from communion and denied entrance to heaven. This stood directly in the way of the advancement of science for several centuries. Because YoY changes in the concentration of CO_2 are unrelated to and do not correlate with YoY changes in the average global temperature, this CO_2 hypothesis is as valid as the assertion that the sun and all objects in the universe orbit Earth, as supposedly demonstrated by their rising in the east and setting in the west.

The Solution: Global Cooling

While geocentricity vs. heliocentricity was an academic and religious debate that had no impact, at the time on humanity, how to deal with climate change is not an academic debate. Today, climate change is a massive and growing, likely soon to be an existential, threat for many, for which the de-carbon faction offers no solutions—only the mistaken idea of slowing it by limiting carbon emissions. This stance has caused decades of delay in developing and implementing a global cooling solution consistent with the data and the physics, while the problems of climate change and the coffers of the de-carbon industry continue to grow. The approach of reducing atmospheric instabilities by reducing the concentration of water vapor and therefore, the devastation driven by catastrophic weather, through an increase in precipitation is proven by the physics and the data. The effectiveness of this approach is demonstrated nearly every other year as the concentration of atmospheric water vapor naturally declines, triggering global cooling. However, this evidence is not in accord with the ideas of the de-carbon faction and remains unexamined, at the cost of millions of deaths, injuries, displacements and loss of livelihoods.

SUMMARY

The Losses

Increasingly severe catastrophic weather has been the primary impact of climate change over the last 50 years.

Massive Annual Losses

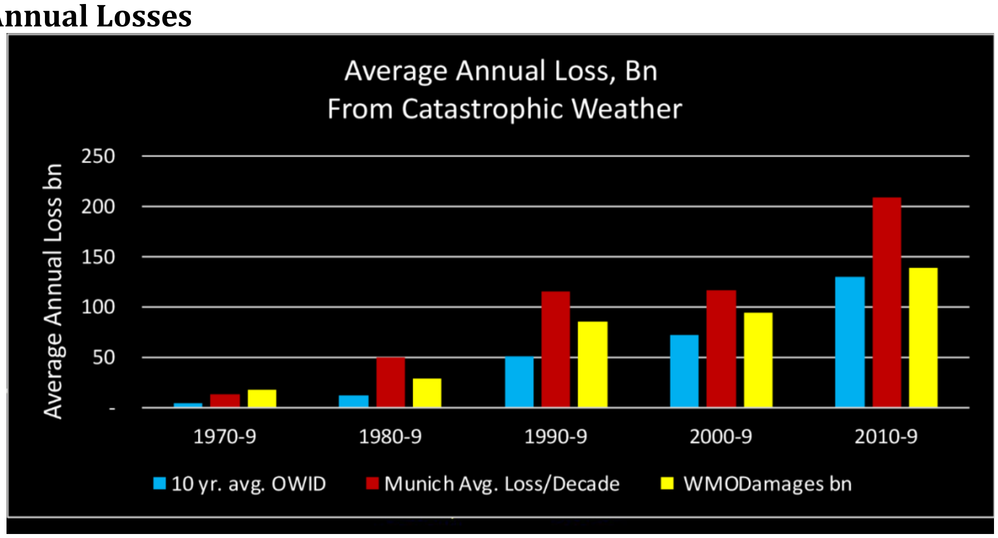


Figure 1: Decadal Average Climate Change–Driven Direct Economic Losses from Catastrophic Weather Events in Constant 2019 US from Munich Reinsurance [6,7], World Meteorological Organization, WMO [8,9], Our World in Data, OWID [10-13]

This is what humankind has been facing as a consequence of catastrophic weather events since the decade of the seventies [1-13] and will continue to face as the severity and incidence of catastrophic weather events continues to rise, increasing annual devastation by 250% every decade.

Relative Impacts

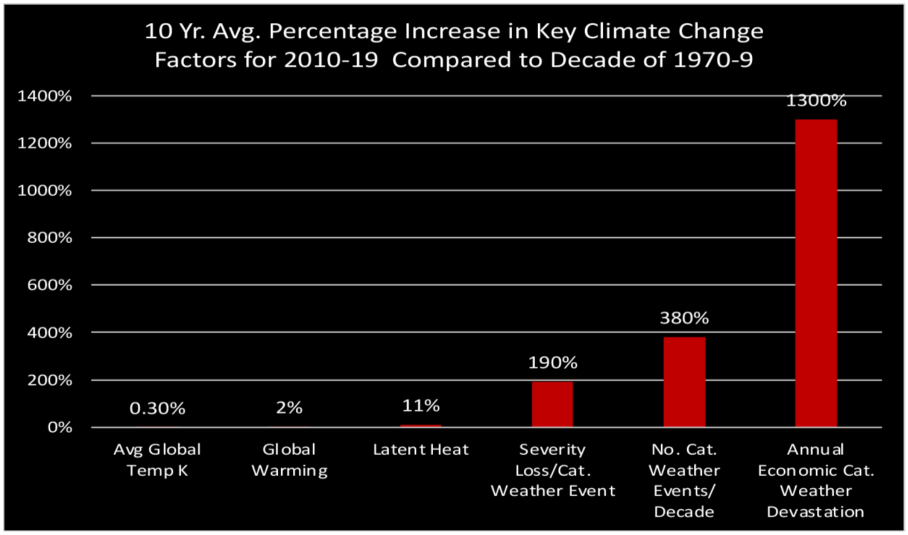


Figure 2. Decadal Average Loss Increase the Decade of 2010 over the Decade Commencing in 1970 [6-13]

It would appear from studying Figure 2 that global warming is a minor concern. In terms of temperature alone, that is true. However, 60% of the increase in total heating of the planet drives evaporation, and, as I show, it is the increasing concentration of water vapor that drives both global warming and the increasing severity and incidence of catastrophic weather.

Facts and Conclusions

The data prove that the increasing concentration of CO_2 is unrelated to the rising average global temperature.

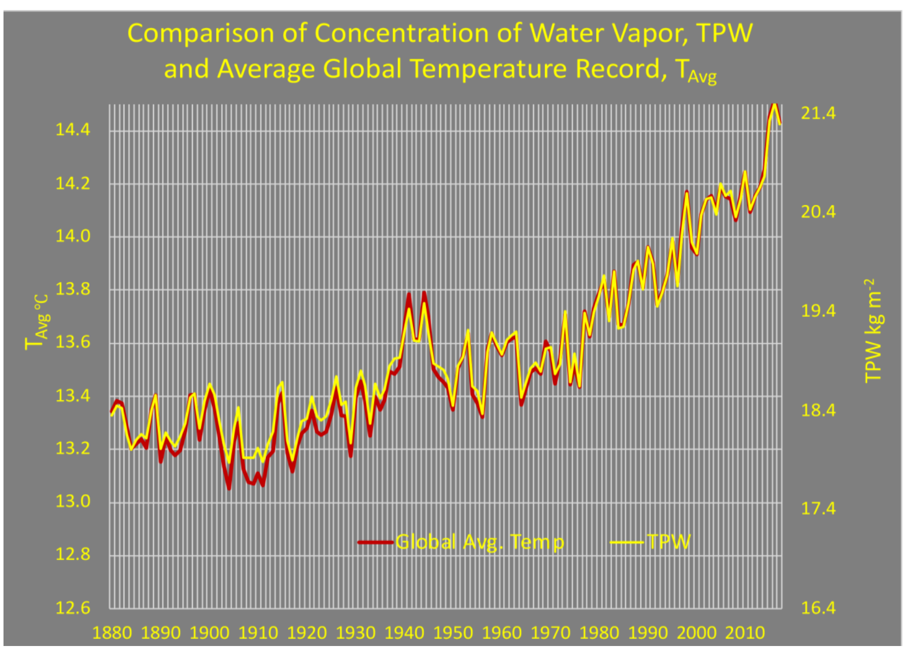


Figure 3a: Average Global Temperature (T_{Avg}) Plotted Against the Left Vertical Axis and Average Global Concentration of Water Vapor (TPW) Plotted Against the Right Vertical Axis

The heating efficiency of water vapor, when compared on a molecule-to-molecule basis, is 60 times that of CO_2 [14], and at an average concentration seven times greater, average global water vapor heating is 400 times more powerful than CO_2—twice that of average global solar heating. Water vapor is the dominant greenhouse gas.

Figure 3a sets out the average global temperature (T_{Avg}) and the average global concentration of water vapor (TPW) [5]. The correlation between the two is almost exact, suggesting that changes in the concentration of water vapor drive changes in the average global temperature. As is seen in Figure 3a, since the seventies, the concentration of water vapor has risen by 2 kg m^{-2}, 11%, increasing the incidence and severity of catastrophic weather and driving global warming.

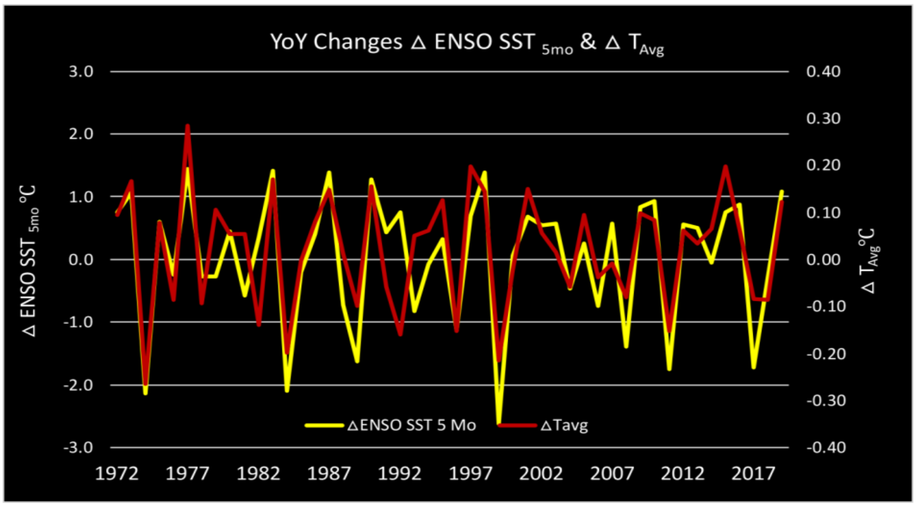


Figure 3b, Comparison of YoY changes in the 12 month average ENSO SST Five Months Earlier (To Account for the Time Required for Changes in ENSO SST, To Impact the Average Global Temperature) Plotted Against the Left Vertical Axis and YoY Changes in the Annual Average Global Temperature Plotted Against the Right Vertical Axis

These changes in the global concentration of water vapor are driven by changes in SST in the ENSO region in the eastern tropical Pacific 5 months earlier, as shown in this chart comparing the year-over-year (YoY) changes in the 12-month average ENSO SST for the period commencing in August of the previous year (△ENSO SST_{5mo}) [15,16] with the YoY changes in the T_{Avg} [17]. As shown in Figure 3b, the correlation is evident. The coefficient of correlation is 0.79.

The average difference between the average global temperature computed from changes in the ENSO SST_{5mo} and the National Oceanic and Atmospheric Administration (NOAA) average global temperature is 0.4%. Between 1970 and 2019, seven intense El Niños drove extraordinary increases in the ENSO SST, which increased the average global concentration of water vapor by 11%; greenhouse heating by 3%; the average global temperature by 1 °C; the moisture energy of the atmosphere, the latent heat energy that gives rise to the atmospheric instabilities driving weather, by the percentage increase in moisture concentration, 11%; and economic devastation by 120% for each 1% increase in the concentration of water vapor.

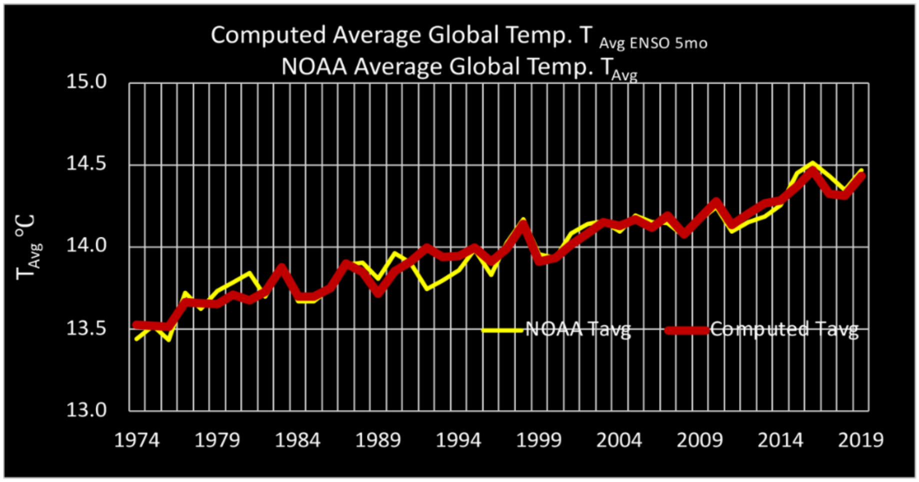


Figure 3c: Comparison of average global temperature computed from changes in the ENSO SST_{5mo} with the National Oceanic and Atmospheric Administration (NOAA) average global temperature record [17]

The result is that since 1980, there has been a fourfold increase in both the annual incidence and power of catastrophic weather events, an increase in annual devastation of 1,400% in constant dollars, and a total of 9,000 catastrophic weather-related events, including massive cyclones and flooding, record heat and droughts, and the consequential wildfires and famine, which together caused cumulative direct economic losses in excess of US $4 trillion [4, 8-13]. The annual losses from devastation wreaked by catastrophic weather events, already an existential threat to populations around the globe, increases by US $36 Billion every decade as millions perish or are injured or displaced or deprived of their livelihoods.

Physics

The physics can be summed up as follows:

- Global devastation increases by 120% for each 1% increase in the concentration of water vapor.
- The YoY change in the average global temperature measured in Celsius is 40% of the YoY change in the average global concentration of water vapor, measured in kg m^{-2} (The average differences in temperatures so determined when compared with the NOAA temperature record are within 0.15%). [18]
- The YoY change in the annual average global temperature is 10% of the YoY average change in sea surface temperatures in the ENSO region for the 12-month period commencing in August of the previous year. (The average difference in temperatures so determined, when compared with the NOAA temperature record, are within 0.5%.) [18]
- The YoY change in the average global concentration of water vapor, total precipitable water (△TPW) is 4% of the YoY change of the concentration of water vapor in the ENSO region ($\triangle ENSO_{TPW5mo}$). When the average global concentration of water vapor is determined from $\triangle ENSO_{TPW5mo}$, the results are within 1%. [18]

These physics enable the accurate determination of changes in the average global temperature and concentration of water vapor and the changes in the devastation from catastrophic weather to be derived from changes in the ENSO SST. These calculations demonstrate that climate change can be reversed by reducing the concentration of water vapor by a 0.2% increase in average global precipitation. Thus, by making it rain, we can potentially return the climate to the way it was in the seventies.

DISCUSSION

The substantiation for changing the policy of reducing carbon emissions to increasing average global precipitation to not only limit the rate of increase in, but to reduce the impacts of climate change, both catastrophic weather and global warming, follows.

Catastrophic Weather

Weather is driven by the moisture energy in the atmosphere.

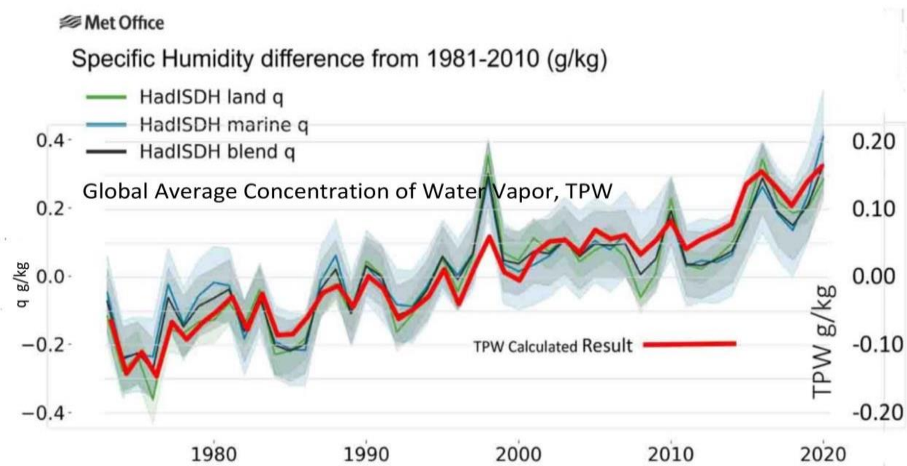


Figure 4: Specific humidity (q) and TPW, measured as grams of water per kilogram of air, both the difference from the average for the period 1981–2010 [19]

Figure 4 shows two different ways of viewing the record of changes in the concentration of water vapor, specific humidity, and TPW (the total mass of water per square meter averaged over the planet's surface that would result if all the moisture in the atmosphere were to precipitate out), calculated from changes in total heating and sea surface temperatures, △TPW, as:

$$\Delta TPW = 0.1\left(0.157\ \Delta TH + 17.5\left\{e^{[0.0686(\mathrm{SSTo}\,+\,\Delta\mathrm{SST})-288]} - e^{[0.0686(\mathrm{SSTo}\,+\,\Delta\mathrm{SST})-288]}\right\}\right) g/kg \quad (1)$$

where TH is total heating, both solar and greenhouse, and SST is the average global sea surface temperature (K).

Viewed either way, the average global specific humidity, q and the average global concentration of water vapor, TPW have both risen, increasing global warming and the total moisture energy, the latent heat of vaporization, of the atmosphere by 11% [18]. This is the driver of weather responsible for the decadal average increase in annual devastation from catastrophic weather of US $160 Billion since the decade of 1970 to 1980.

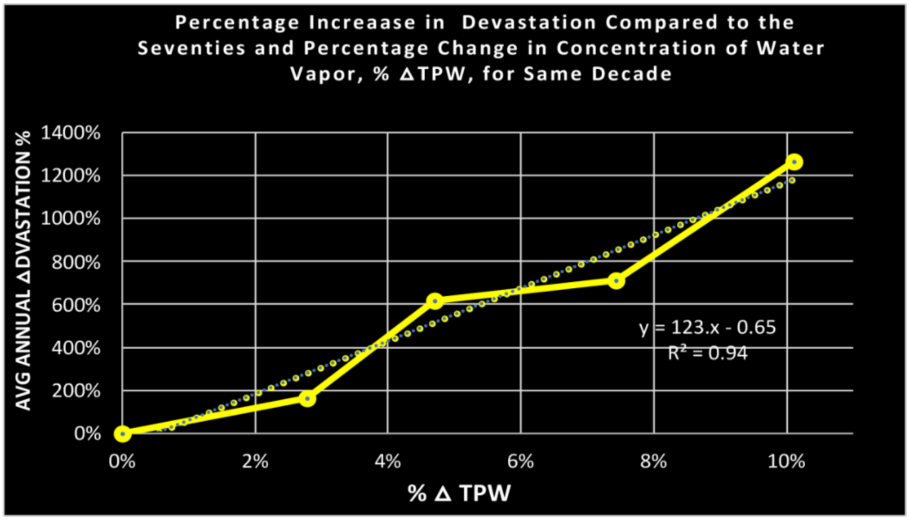


Figure 5: Decadal average percentage changes in annual devastation wreaked by catastrophic weather events as a function of percentage changes in the average concentration of water vapor (%△TPW)

Knowing the increase in the concentration of water vapor from Eq. 1, over this period, the percentage change in annual devastation wreaked by catastrophic weather events as a function of decadal percentage changes in the average concentration of water vapor (%△TPW) is:

$$\%\,\Delta Loss \;=\; 123 \;\times\; \%\,\Delta TPW \;-\; 65\% \tag{2}$$

Because it is atmospheric moisture energy, the latent heat of vaporization, that drives weather, as shown in Figure 5, the massive and increasing devastation wreaked by catastrophic weather set out in Figure 1 increases by 120% for each 1% increase in the concentration of water vapor. The R^2 for this trendline is 0.94.

Consensus Around Global Warming

The media and the public believe it when the IPCC states that the average global temperature has risen by 1 ºC as a consequence of an 80 parts per million increase in the concentration of CO_2 unaware that 80 parts per million is 30% of the increase in the concentration of water vapor and 0.5% of the increase in heating power of water vapor over this period. They do not demand proof any more than they would demand proof that "there is a good chance of rain today.

Hindcasts

The climate models, when applied retroactively to historical data (in what are called *hindcasts*), appear to work in much the same way as weather forecasts, even though the concentration of CO_2 for each past year is known.

The 95% envelope appears to be roughly equal to 50% of the increase in average global temperature since the mid-seventies. When average global heating is known, as it should be if CO_2 is the driver and its concentration is known, then calculating the average global temperature is a straightforward exercise in thermodynamics—the physics of heating—and the average global temperature can be determined with precision. It is not an exercise in probabilities. Therefore, it is reasonable to expect an explanation that is based on thermodynamic principles and calculated average global temperatures.

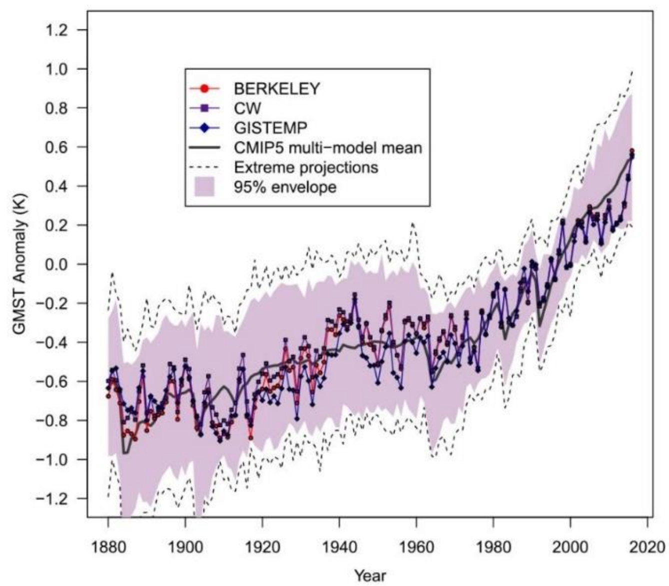


Figure 6: Typical results of computer models of changes in average global temperature

Correlations Do Not Prove Cause and Effect

But such an explanation is not provided. Instead, this is the type of chart used by the IPCC to show the correlation between the increasing average global temperature and the increasing concentration of CO_2 that many offer as "proof" or "evidence" that the increasing concentration of CO_2 drives global warming.

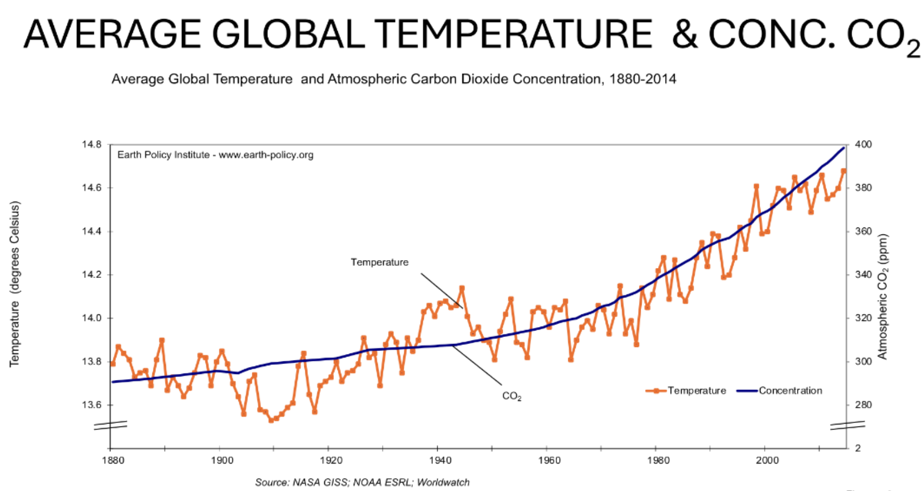


Figure 7: Average Global Temperature Record between 1880 and 2015, Shown in Black Plotted Against the Left Vertical Axis and the Concentration of CO_2 Shown in Orange Plotted against the Right Vertical Axis.

There is a correlation between the increasing average global temperature and concentration of CO_2 with a correlation coefficient of 0.94. However, correlations do not prove cause and effect and should be taken as suggestive only under circumstances where a plausible scientific explanation exists for causation at the magnitude of the effects shown. Such an explanation for CO_2 as cause does not exist.

WATER VAPOR

Analysis

Imagine that you are seeking to determine the cause of global warming, which you believe to be driven by greenhouse heating, and there are only two realistic possibilities:

1. A greenhouse gas with a heating power that is a minor percentage of total greenhouse heating, 0.2%, and that has not been shown, on the basis of physical principles, to account for the 1 ºC increase in the average global temperature, the concentration of which is gradually and smoothly increasing and certainly cannot account for the significant YoY variances in temperature; or
2. The dominant greenhouse gas with a heating power 400 times greater than the first, the concentration of which varies almost exactly like the YoY changes in the average global temperature and that is wholly independent of changes in the concentration of the other greenhouse gas.

The first is CO_2, and the second is water vapor.

Legitimate Proof: Comparison of Water Vapor and CO_2

This is the same chart, with the addition of the concentration of a greenhouse gas with a heating power 400 times greater than CO_2—water vapor, the dominant greenhouse gas—in purple [21].

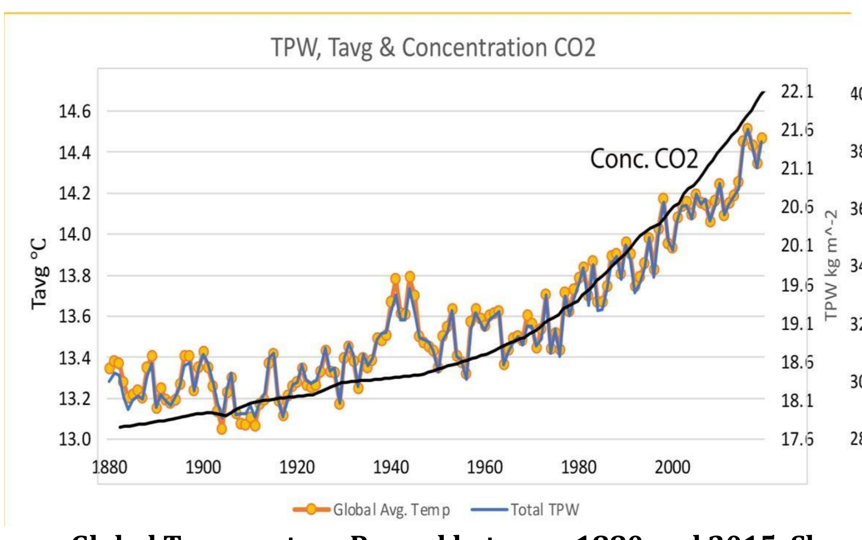


Figure 8: Average Global Temperature Record between 1880 and 2015, Shown in Black Plotted Against the Left Vertical Axis and the Concentration of CO_2 Shown in Orange Plotted against the Right CO_2 Vertical Axis with the Addition of the Concentration of Water Vapor in Purple, Plotted against the Right TPW Vertical Axis

What is causing global warming and cooling? Referring to Figure 8, the answer is obvious: changes in TPW, the result of evaporation and transpiration, primarily evaporation from the seas the concentration of which is seven times greater than that of CO_2 while it possesses a heating efficiency at least 60 times that of CO_2 [14]. The correlation between the average global concentration of water vapor—the TPW record—and the average global temperature is almost exact, with a coefficient of correlation of 0.998. The notion that the increasing concentration of CO_2 is not the cause of global warming is in line with the conclusion reached in a recent paper titled "On Hens, Eggs, Temperatures and CO_2: Causal Links in Earth's Atmosphere" [22], in which the published data show that changes in the average global temperature precede changes in the concentration of CO_2; in other words, global warming is the cause, and changes in the concentration of CO_2 are the effect.

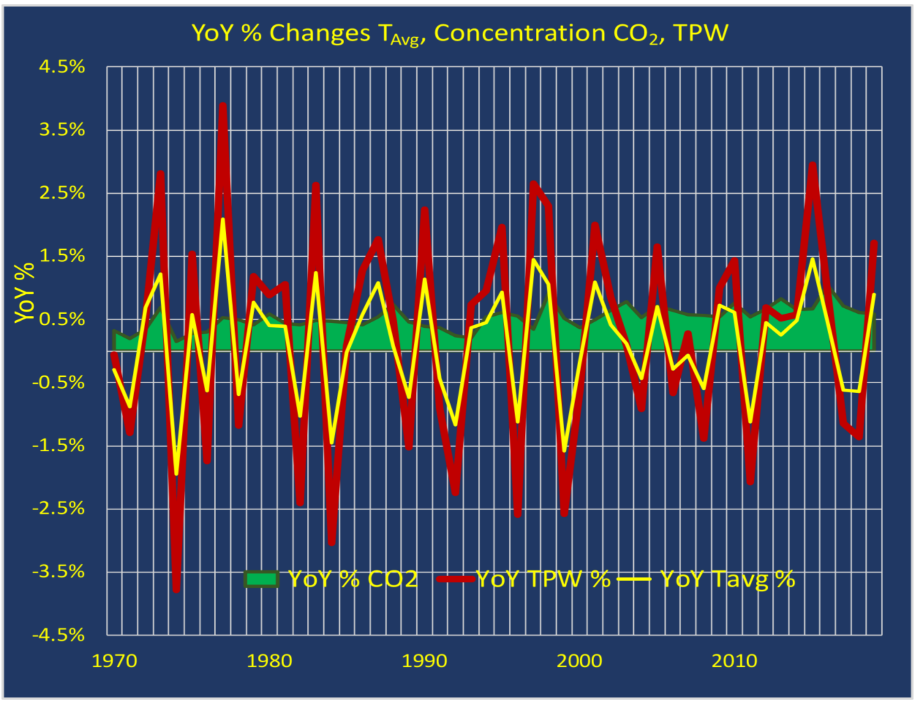


Figure 9: The YoY % Change for Each Year from 1970 through 2019 for the Average Global Temp. T_{Avg} in Celsius in Yellow, TPW in Red, and the Annual Average Percentage Change in the Concentration of CO_2 in Green

Consistent with this finding, the NOAA data prove that the increasing concentration of CO_2 does not drive global warming. The conclusion that CO_2 cannot be the driver of global warming, and that water vapor is the driver of global warming, is shown by Figure 9, a plot of the YoY percentage changes in concentration for each element of CO_2, TPW and T_{Avg} from 1970 through 2019.

As shown in Figure 9, the average YoY global temperature change in Celsius varies annually by as much as ± 1.7%, and the average global concentration of water vapor by as much ± 4%, which, when compared with changes in the average global temperature, clearly correlates with these temperature changes, with a correlation coefficient of 0.998. Given that changes in greenhouse heating vary with changes in the concentration of the greenhouse gas, if climate change were driven by changes in the concentration of CO_2, the YoY change in the average global temperature should track the YoY changes in the concentration of CO_2. But as Figure 9 demonstrates, it clearly does not. The YoY changes in the average global concentration of CO_2 always show increases, meaning that greenhouse heating from CO_2 is always increasing, while the YoY change for the average global temperature goes from positive to negative and from negative to positive ~ 40% of the time.

For example, in terms of average global temperature, it was 13.9 °C in 1991 and 13.7 °C in 1992, a YoY decrease of -0.2 °C, while the concentration of CO_2 in 1991 was 355.6 parts per million (ppmv), and in 1992 was 356.4 ppmv, a YoY *increase* of 0.8 ppmv. Thus, we must conclude that an increase in the concentration of a greenhouse gas cannot drive a decrease in temperature.

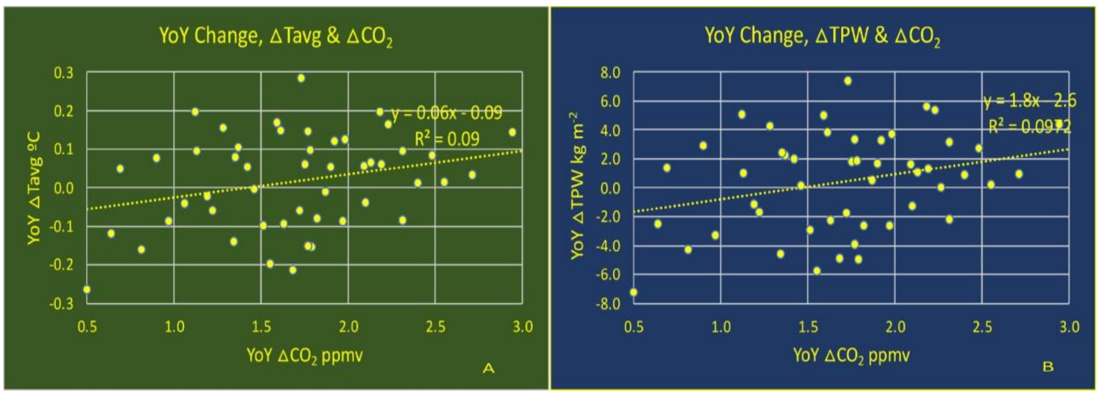


Figure 10A: A plot of the YoY change of the △T_{Avg} and the corresponding YoY change in the concentration of CO_2 for the same year.

As noted, if the increasing concentration of CO_2, a greenhouse gas, drives global warming, an increase in the concentration of CO_2 should drive an increase, not a decrease, in temperature. The chart in this figure shows multiple negative rates of change in temperature that occurred as the corresponding YoY change of CO_2 increased. For example, for the same increase in the concentration of CO_2, 1.8 ppmv, the average global temperature increased by 0.3 ºC and decreased by -0.15 ºC. These unadjusted data also show that the YoY changes in the average global temperature are unrelated to the YoY changes in the concentration of CO_2. As the data suggest, the trendline is meaningless. The R^2 is 0.06—random.

No Synergistic Water Vapor Effects

Figure 9 also shows that changes in both temperature and concentration of water vapor are unrelated to and independent of changes in the concentration of CO_2. Consistent with this finding, Figure 10B is a plot of the YoY change of the concentration of water vapor, △TPW and the corresponding YoY change in the concentration of CO_2 for the same year. Contrary to the assertion that changes in the concentration of water vapor are driven by, are synergistic with, and complement the changes in the concentration of CO_2, Figure 10B shows that changes in △TPW are unrelated to the YoY changes in the concentration of CO_2. If changes in the concentration of water vapor were to amplify the greenhouse impact of CO_2, the increasing concentration of CO_2 should drive an increase in the concentration of water vapor, thereby amplifying the greenhouse impact of CO_2. Instead, this chart shows multiple negative rates of change in the concentration of water vapor as the concentration of CO_2 increased. For example, for the same increase in the concentration of CO_2, 1.8 ppmv, the average global concentration of water vapor increased by 2 kg m^{-2} and declined by -2 kg m^{-2}. As should also be expected, the trendline is meaningless. The R^2 is 0.097. Compared to changes in the concentration of CO_2, the changes in both the average global temperature and the concentration of water vapor are completely random. Thus, changes in the concentration of CO_2 are unrelated to changes in the average global temperature; no relationship with changes in the concentration of water vapor exists. These changes do not complement or amplify the warming effects of and are unrelated to changes in the concentration of—and therefore the heating from—CO_2. The question, then, is: What drives global warming?

The Effects of Changes in the Concentration of Water Vapor

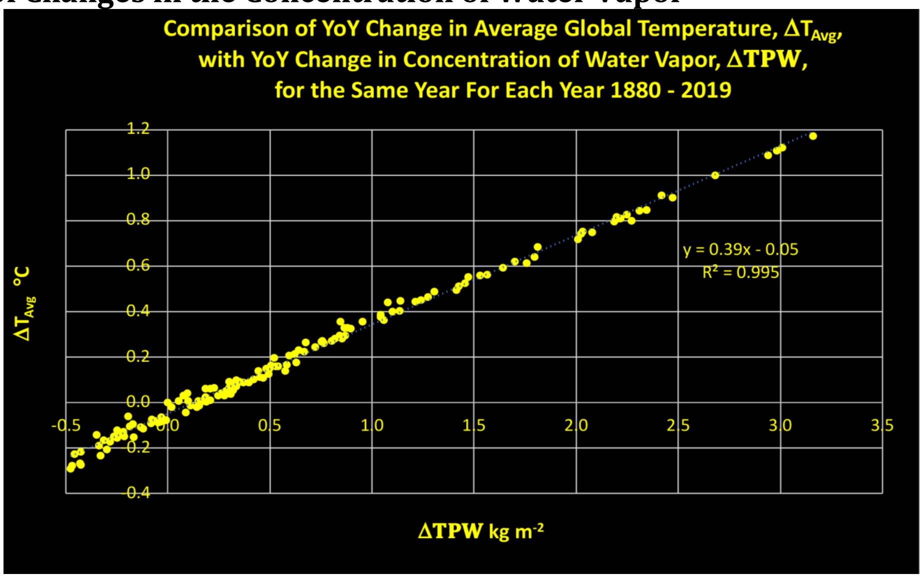


Figure 11: Comparison of YoY Changes in △TAvg and YoY Changes in △TPW for Each Year, 1880–2019

Figure 11 offers a plot of YoY changes in the concentration of water vapor, △TPW[i] and changes in △TAvg for the same year. The trendline, with an R^2 of 0.995,[ii ii] shows the relationship between changes in △TPW and changes in $\triangle T_{Avg}$ as set out in Eq. 3. The average global temperature data from the National Oceanic and Atmospheric Administration (NOAA), dating back nearly 140 years [18], show that the change in the average global temperature, △TAvg is 40% of the change in the concentration of water vapor, total precipitable water (△TPW), determined from the NOAA data on changes in average global sea surface temperatures and total heating of the planet [23] in accordance with Eq. 3.

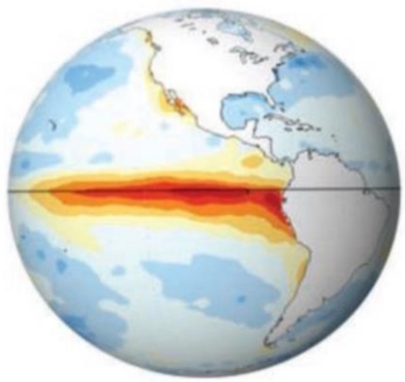
$$\Delta T_{Avg} = 0.4\,\Delta TPW - 0.05 \tag{3}$$

This is due to the fact that water vapor, with an average concentration seven times greater and, when compared on a molecule-to-molecule basis, a heating efficiency 60 times greater, has a heating power 400 times greater than CO_2. Today, water vapor heating, accounts for roughly 2/3rds. of the total heating of the planet.

This works both ways. This also means that when the concentration of water vapor declines, so does the average global temperature. With a sufficient increase in annual global precipitation, the rate of increase in devastation from catastrophic weather and global warming can be reduced and not just the rate of increase; in other words, both annual devastation and global warming can be reduced. With a cumulative global increase in precipitation roughly equal to 0.2% of average annual global precipitation, these tragedies can be eliminated.

ENSO

Changes in Sea Surface Temperatures in the ENSO Region Drive Changes in the Average Global Temperature:



ENSO REGION

The Region in the Eastern Tropical Pacific where El Niños and La Niñas arise, the El Niños Southern Oscillation or ENSO Region. From El Niños to La Niñas, changes in ENSO sea surface temperatures are driven by changes in undersea, upwelling currents and the Tradewinds.

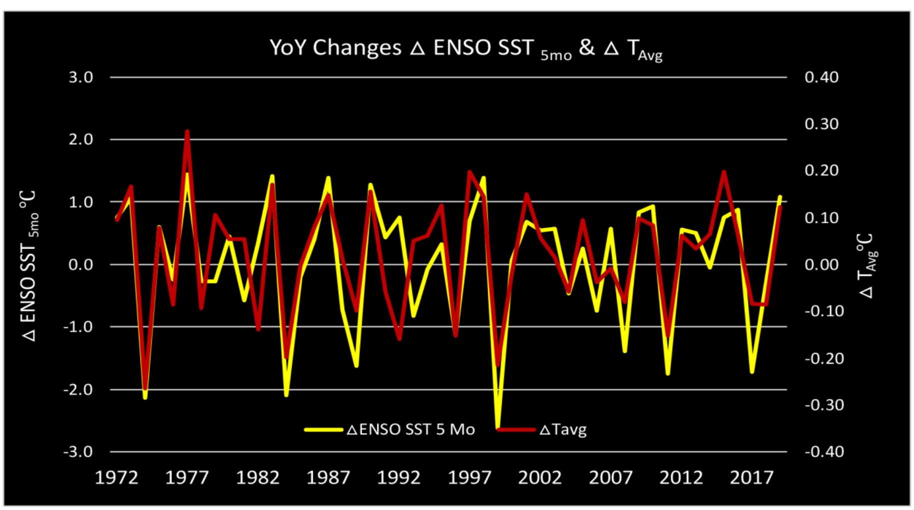


Figure 12: YoY Change differences in The Average Global Temperature Shown in Yellow, Plotted Against the Right Vertical Axis and the YoY change differences in the 12 month Average Sea Surface Temperatures in the ENSO region for the 12-Month Period Commencing in August of the Previous Year, in Red Plotted Against the Left Vertical Axis.

Figure 12 shows a comparison of the YoY changes in the average global temperature, $\triangle T_{Avg}$ with the YoY changes in the 12-month average sea surface temperatures, $\triangle$ENSO SST_{5mo} in the ENSO region for the 12-month period commencing in August of the previous year [18].

The YoY changes in the average global temperature correlate with changes in the ENSO Sea Surface Temperatures, ENSO SST, 5 months earlier, the time required for the effect of these changes to spread worldwide and be captured in the average global measure of temperature.

Although the changes in $\triangle$ENSO SST_{5mo} are an order of magnitude greater than changes in the average global temperature, the correlation of these ~ two 50-year data sets is strong and evident. The correlation coefficient is 0.79[iii], and for both periodicity and direction of the change differences, it is almost exact: 0.97.

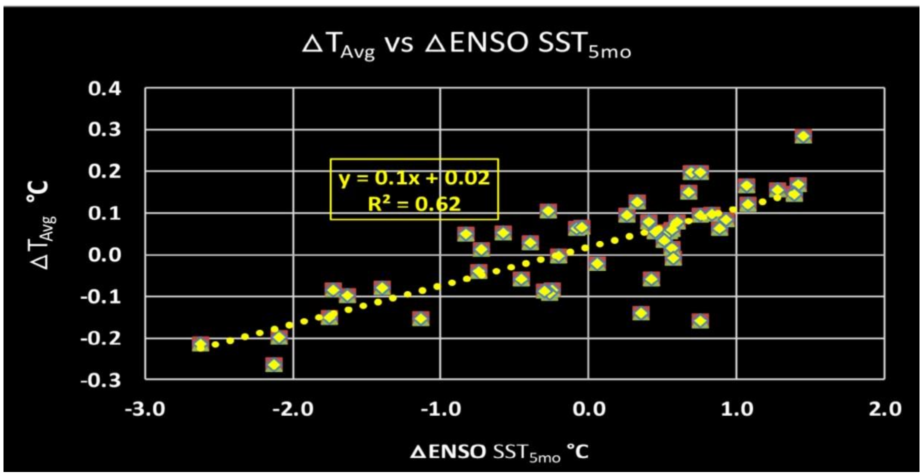


Figure 13: YoY Change differences in the Average Global Temperature, $\triangle T_{Avg}$ and the Corresponding YoY Change differences in the Average ENSO Sea surface temperatures for the 12 Month Period Commencing August of the Previous Year, $\triangle$ENSO SST_{5mo}, for the Same Overlapping Years.

This is a plot of the YoY changes in the $\triangle T_{Avg}$ and the YoY changes in the 12-month $\triangle$ENSO $SST_{5mo,}$ for the same overlapping years. The linear regression, thus the apparent relationship, for the change in average global temperature based on the $\triangle$ENSO SST_{5mo} is:

$$\triangle \mathbf{T_{Avg}} = \mathbf{0.1} \triangle \mathbf{ENSO\ SST_{5\ mo}} + \mathbf{0.02}\ °\text{C yr}^{-1} \quad (4)$$

with an R^2 of 0.62.

Thus, changes in the average global temperature stem from changes in sea surface temperatures in the ENSO region of the Eastern Tropical Pacific.

To test the accuracy of this expression, calculate the changes in the average global temperature for each year based on the YoY changes in the average ENSO sea surface temperatures, $\triangle$ENSO SST_{5mo}, sum up the calculated YoY changes in average global temperature, and compare the annual average global temperatures so determined to the actual annual average global temperature record. This is the result.

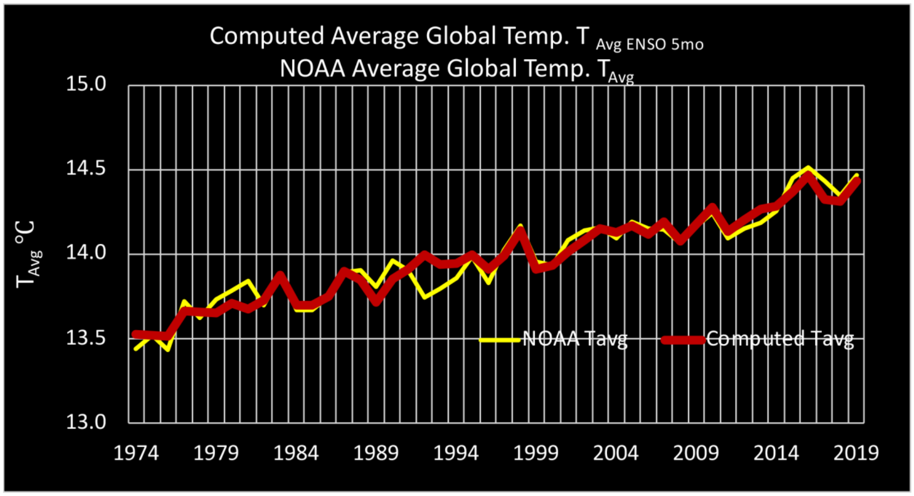


Figure 14: This is the NOAA Average Global Temperature T_{Avg} Record from 1974–2019 in Yellow and the Average Global Temperature Computed from the YoY Changes in Sea Surface Temperatures in the ENSO Region ($T_{Avg\ ENSO\ 5mo}$) in Accordance with Eq. 4, shown in Red.

With reference to the 0.1° to 0.3 °C difference in 1991–1994, it is likely that the Mount Pinatubo Eruption in 1991, the largest eruption of the 20th century, is responsible for the 0.3 °C difference in 1992, the 0.2 °C difference in 1993, and the 0.1 °C difference in 1994, because, as noted, "Effects on climate were a cooling of perhaps as large as -0.4 °Celsius over large parts of the Earth in 1992–93" [24]. That changes in the ENSO sea surface temperatures drive global warming is proven by the fact that the average global temperature computed from the changes in sea surface temperatures in the ENSO region tie out, as shown in Figure 14, to the average global temperature record within 0.4%—0.06 °C—notwithstanding the fact that the cooling effects of Mount Pinatubo Eruption in 1991 are not taken into account. The correlation coefficient is 0.96. There can be no doubt that 5-month earlier changes in the ENSO sea surface temperatures drive [19] changes in the average global temperature.

Changes in the Concentration of Water Vapor in the ENSO Region Drive Changes in the Average Global Concentration of Water Vapor

Changes in the global concentration of water vapor stem from the changes in SST, and thus evaporation, in the ENSO region of the Eastern Tropical Pacific. From El Niños to La Niñas, changes in ENSO sea surface temperatures, driven by changes in undersea, upwelling currents, and the Tradewinds, affect atmospheric moisture around the globe.

The changes in the concentration of water vapor in the ENSO region are an order of magnitude greater than changes in the average global concertation of water vapor; the correlation is evident. The correlation coefficient between these two ~ 50-year data sets is 0.76.

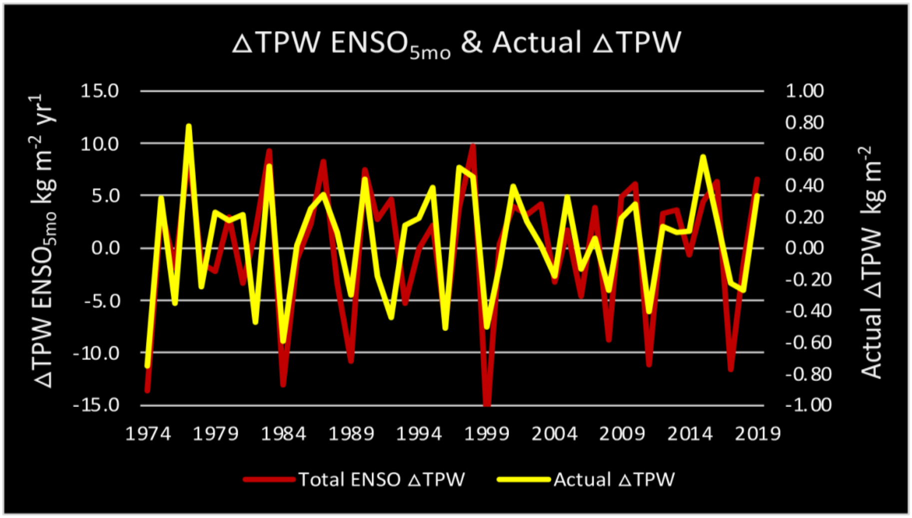


Figure 15: Comparison of YoY Changes in the Annual Global Concentration of Water Vapor in Yellow Gauged against the Right Vertical Axis and YoY Changes in the Average 12 Month Annual Concentration of Water Vapor in the ENSO Region, for the Period Commencing in August of the Prior Year, in Red Gauged against the Left Vertical Axis for the Period Between 1972 and 2019.

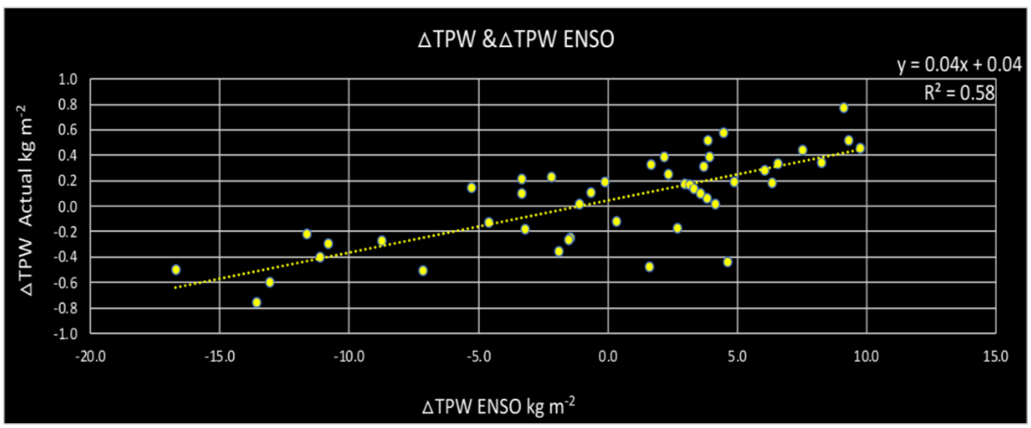


Figure 16: YoY Change differences in △TPW and the Corresponding YoY Change differences in the Average ENSO Concentration of Water Vapor for the 12-Month Period Commencing August of the Previous Year, △TPW $ENSO_{5mo}$, for the Same Year.

Figure 16 offers a plot of the YoY changes in △TPW and the YoY changes in the average △TPW $ENSO_{5mo}$ [18] for the same overlapping years. According to the linear trend shown, this is the relationship between changes in △TPW and changes in $△TPW_{ENSO}$ 5 months earlier $△TPW_{ENSO\ 5\ mo}$ (the time it takes for changes in the ENSO region to affect changes in the concentration of water vapor across the globe):

$$\triangle \mathbf{TPW} = \mathbf{0.04} \triangle \mathbf{TPW_{ENSO\ 5mo}} + \mathbf{0.04} \text{ kg m}^{-2} \text{ yr}^{-1} \quad (5)$$

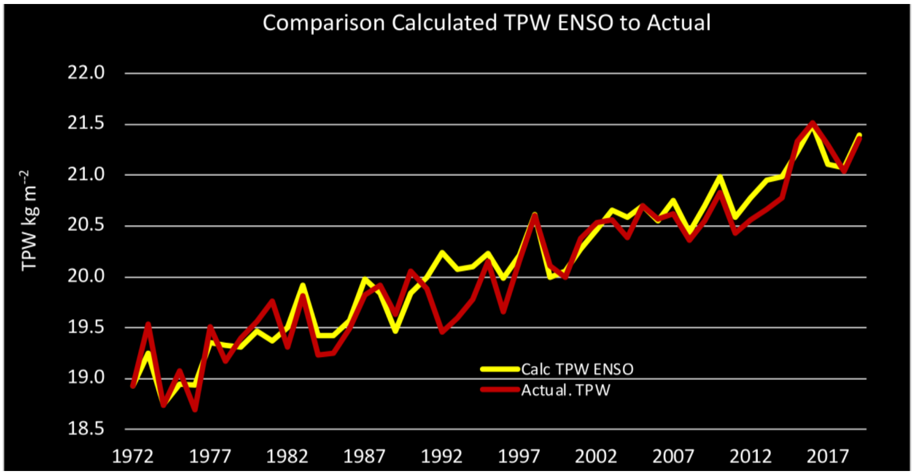


Figure 17: Comparison Calculated Average Global Concentration of Water Vapor from Changes in TPW_{ENSO}, Shown in Yellow, and TPW, Shown in Red.

The yellow line is the average global concentration of water vapor computed from changes in $\triangle TPW_{ENSO}$ compared with the computed average global concentration of water vapor record, shown in red. The results match within 1%. The correlation coefficient is 0.96.

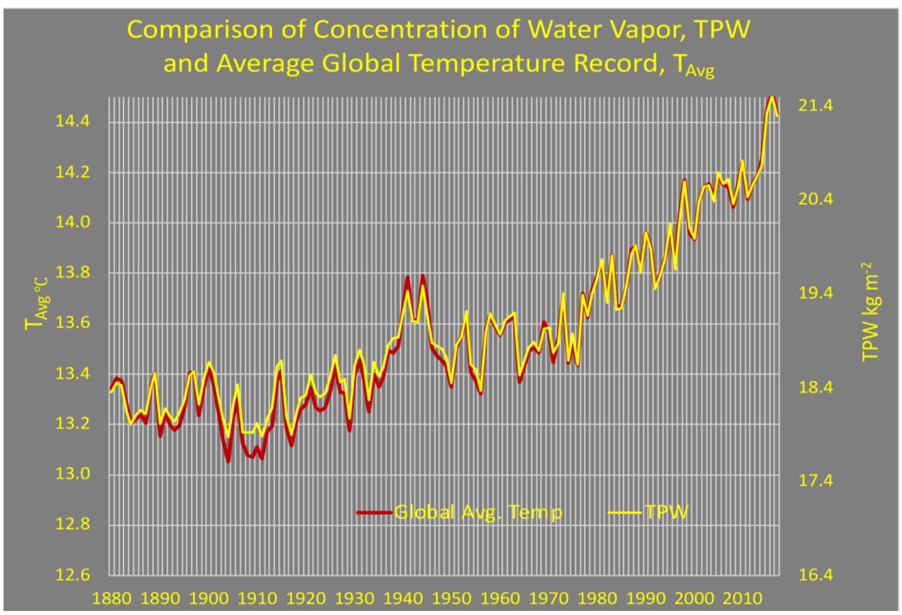


Figure 18: NOAA Average Global Temperature Record (TAvg) Plotted Against the Left Vertical Axis and Average Global Concentration of Water Vapor (TPW) Over Time Plotted Against the Right Vertical Axis [17]

This not a smooth increase. The YoY changes are as great as 0.2 ºC, 20% of the 1 ºC increase between 1970 and 2019. These changes are significant. YoY global warming and periodic global cooling occur when the average global concentration of water vapor is lower than it was in the previous year, and the average global temperature goes down. The correlation is almost exact. In terms of cause and effect, since changes in the concentration of water vapor in the ENSO five months earlier region, which are wholly unrelated to current changes in the average global temperature drive changes in the average global concentration of water vapor, it is evident that changes in the global concentration of water vapor that drive and are the cause of changes in the average global temperature.

SPECIFIC HUMIDITY

The Relationship Between Global Specific Humidity and the Average Global Concentration of Water Vapor:

Water Vapor Rising from Water Warmer than the Air and Condensing as It Does so, during a Winter Sunrise in Maine.

What you see is the condensation. Evaporation cannot be seen. Water vapor is clear and invisible. The average global concentration of water vapor concentration can be gauged by measuring global specific humidity.

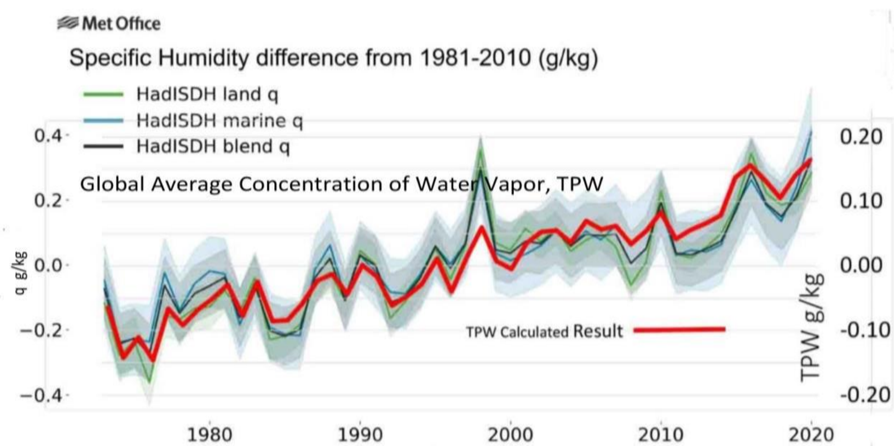


Figure 19: Average Global Specific Humidity (q) Shown in Black and Plotted Against the Left Vertical Axis and TPW shown as Grams of Water Per Kilogram of Air Plotted Against the Right Vertical Axis, Both Measured as the Difference from the Average for Years 1981–2010 [19,20]

Figure 19 shows two different ways of viewing the record of changes in the concentration of water vapor, specific humidity (q), which has been measured for decades, and TPW, the total mass or water per square meter averaged over the planet's surface that would result if all the moisture in the atmosphere were to precipitate out, calculated from changes in total heating and sea surface temperatures, △TPW, as set out in Eq. 1. Clearly, changes in the global concentration of water vapor correlate well with changes in specific humidity.

Latent Heat

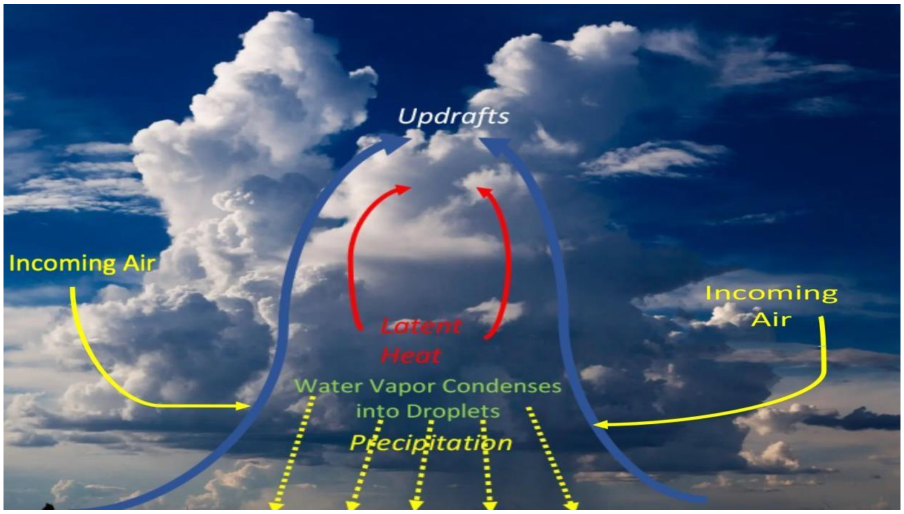


Figure 20: As the Sea Surface Heats, Water Molecules are Energized. When Energized Sufficiently to Break the Bonds Retaining Them in a Liquid Form, They Undergo a Phase Change to the Gaseous Form, Water Vapor. This is Evaporation. The Energy of Vaporization is Termed Latent Heat. As Water Vapor Cools It Condenses, Releasing Its Latent Heat into the Surrounding Air Causing It to Rise.

Not only is water vapor the dominant greenhouse gas, but it also possesses a property unique among the atmospheric gases: continual evaporation and then condensation within ~10 days and a normal range of atmospheric temperatures. The energy that drives the phase change from liquid water to water vapor is termed the *latent heat of vaporization* and does not result in a temperature increase.

To permit condensation, water vapor must be cooled sufficiently, transferring the energy of vaporization to the cooler surrounding air and releasing the latent heat energy that caused it to vaporize. The water vapor then condenses, forming water droplets that become raindrops.
Changes in global latent heat energy are directly proportional to changes in the global concentration of water vapor. As latent heat energy is given up upon condensation, it is transferred to and warms the surrounding air, making it lighter, which causes it to rise and create updrafts. As the air rises, more air flows in as condensation increases, and clouds increase in size, sometimes causing storms to arise. An increase in latent heat represents an increase in potential convective and precipitative energy. This is what makes latent heat the driver of storms. Because changes in latent heat energy are directly proportional to changes in the concentration of water vapor, it should be expected that changes in the concentration of water vapor affect the weather, resulting in devastation like that shown in Figure 21.

Loss from Catastrophic Weather Events and Latent Heat

There is no question that, as is shown in Figure 1, climate change poses an ever-increasing existential threat to populations across the globe.

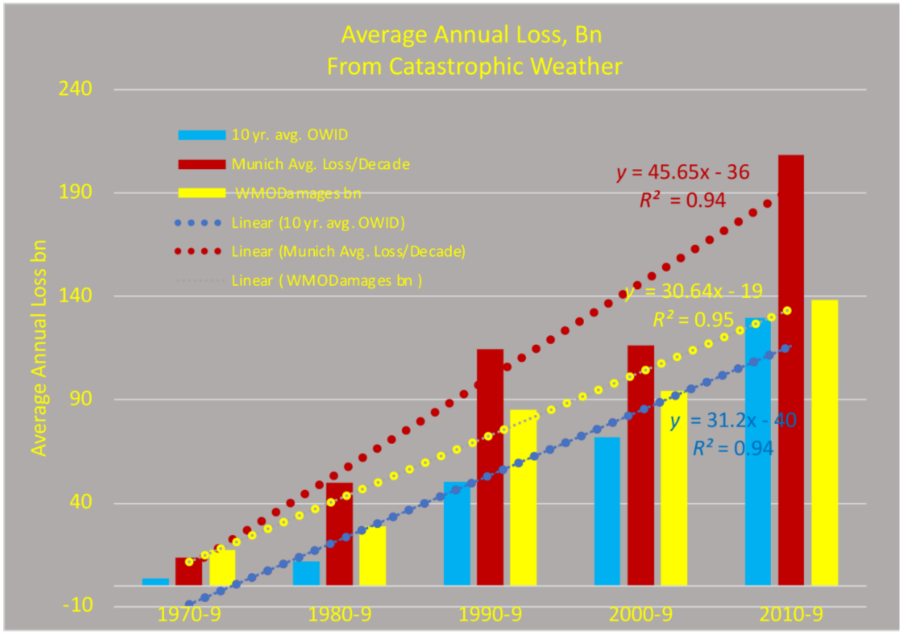


Figure 21: Decadal Average Climate Change Driven Direct Economic Losses from Catastrophic Weather Events in Constant 2019 US from Munich Reinsurance [6,7], World Meteorological Organization (WMO) [8,9], Our World in Data (OWID) [10-13]

Although each database shows growth, the Munich Reinsurance data, which offers the most robust database trendline, show that the average economic loss grows by US $45 Billion each decade. These increasing losses over time are driven by the increasing concentration of water vapor.

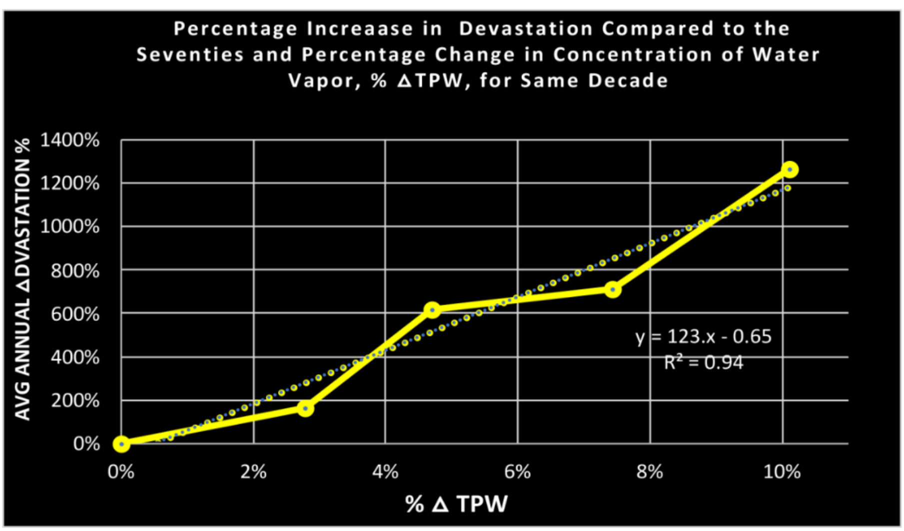


Figure 22: Percentage Change in 10-Year Average Annual Economic Losses Caused by Catastrophic Weather and Percentage Change in Concentration of Water Vapor Over the Same 10-Year Period. [18]

As the concentration of water vapor has risen, the total moisture energy, atmospheric latent heat, the driver of weather responsible increase in devastation from catastrophic weather increases by the same percentage, 11% [21] since the decade of 1970 to 1980 increasing devastation by 1,400%. Figure 21 shows that direct economic losses from devastation caused by catastrophic weather grows by 120% for each 1% increase in the average global concentration of water vapor. [18]

$$\%\,\Delta Loss = 123 \times \%\,\Delta TPW - \mathbf{65}\% \qquad \text{(Eq. 2)}$$

The trendline shown has an R^2 of 0.94. If nothing is done, these losses are highly likely to continue to grow.

GLOBAL WARMING – THE GREENHOUSE EFFECT

Energizing the Greenhouse Gases

Let's look now at the driver of evaporation: greenhouse heating. This is how the greenhouse gasses warm the planet.

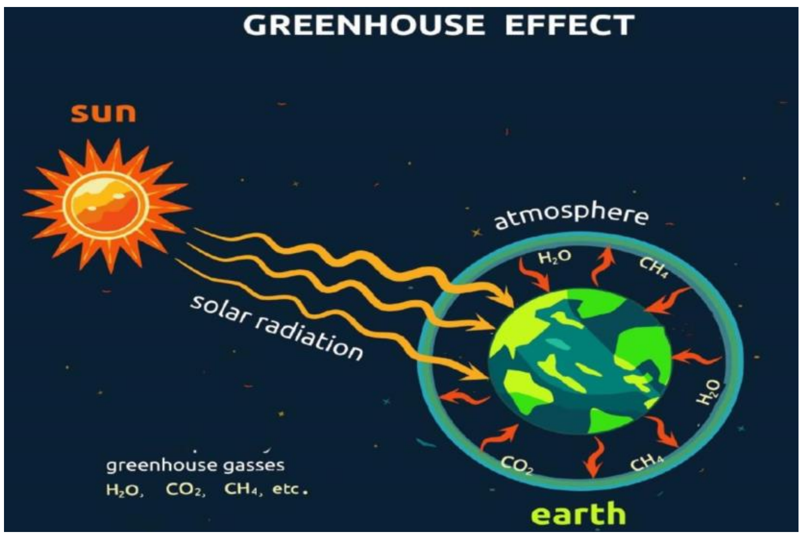
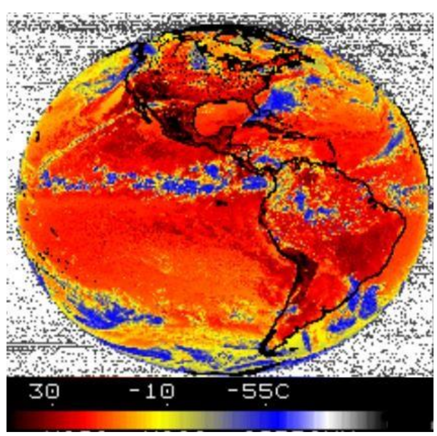


Figure 23: Illustration, Earth warmed by the Sun and the Greenhouse Gases in the Atmosphere Earth is warmed by the Sun and the greenhouse gases in the atmosphere, which are, primarily, water vapor (H_2O) and CO_2. As this satellite image shows, the warm Earth radiates heat.



The majority of the infrared heat emissions are absorbed by and energize the atmospheric greenhouse gases. The greenhouse gases, energized by the thermal radiation emitted by our warm planet, in turn emit infrared radiation, heating our planet. Greenhouse heating accounts for the preponderance of the total heating of the planet [26] and is responsible for the 1 ºC increase in the average global temperature since the early seventies, as shown in Figure 3a [18].

Determining Which Greenhouse Gas Drives Global Warming

In terms of gauging how greenhouse gases drive global warming, evaluating the greenhouse effect on the planet is not unlike testing the response of a variety of materials to two heat lamps of different and variable powers, producing infrared heating at some overlapping and different wavelengths, simultaneously, on a variety of materials, over an 8-day period. In this example, the temperature of each tested material is measured hourly over 8 days.

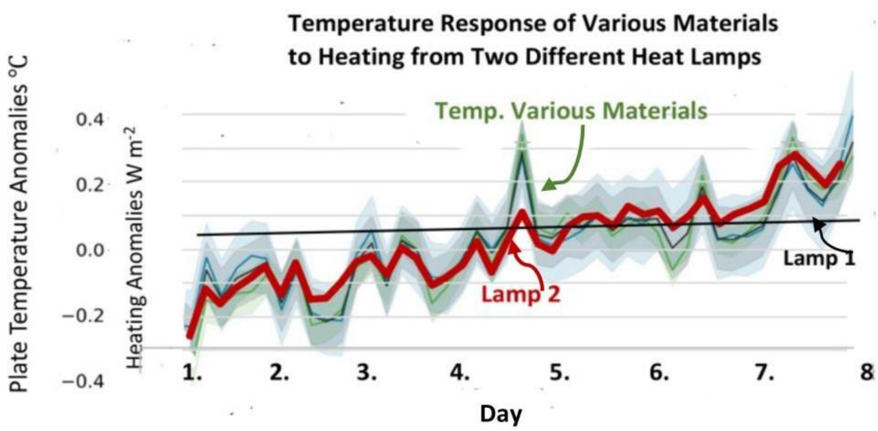


Figure 24: Temperature Anomalies of Various Materials Shown by Green Shaded Area, Average Temperature of These Materials Shown by Solid Dark Green Line—the Heating Anomalies from Lamp 1 by the Black Line and Lamp 2 by the Red Line

The range of temperature anomalies of the various heated materials is shown by the green shaded area. The average temperature of these materials is shown by the solid dark green. There is a difference in the temperature responses to the two lamps. The heating power of Lamp 1 is slightly and quite smoothly increasing day over day. There is no correlation between the changes in heating from Lamp 1 and the changes in the temperatures of the materials.

The heating from Lamp 2, set out in red, is two orders of magnitude greater than that of lamp one; it fluctuates daily by as much as ± 0.2 W m^{-2}, with a strong correlation to the changes in the temperatures of the materials, and rises or falls in the same direction and with the same periodicity as these temperatures, the correlation of which is almost exact.

Let's return to greenhouse heating and examine the effects of greenhouse heating on the average global temperature.

Changes in Specific Humidity and the Average Global Temperature

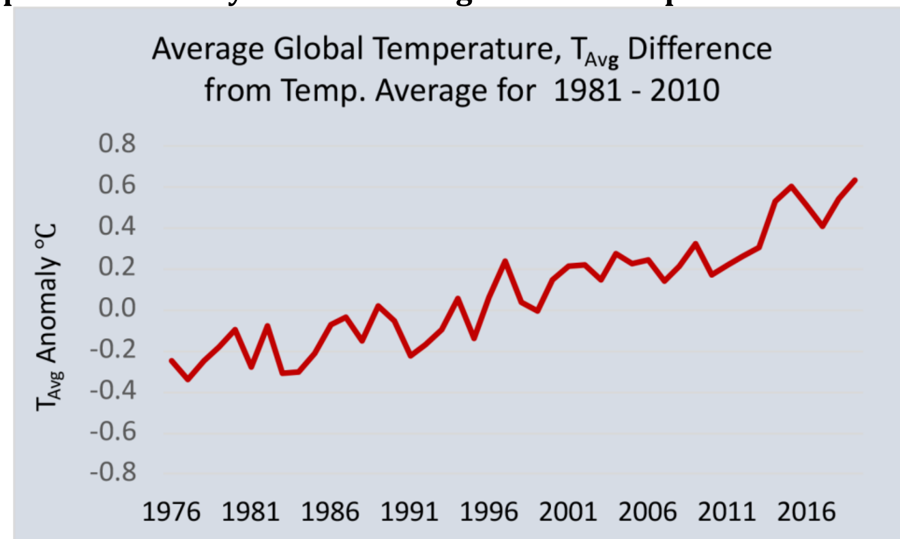


Figure 25: Average Global Temperature for 1976–2019 Difference from the Temperature Average for 1981–2010 for the years 1973–2020 [17].

For some years, the YoY change is 20% of the total 1 °C degree increase in the average global temperature between 1976 and 2019. These fluctuations are significant, yet they are seldom discussed.

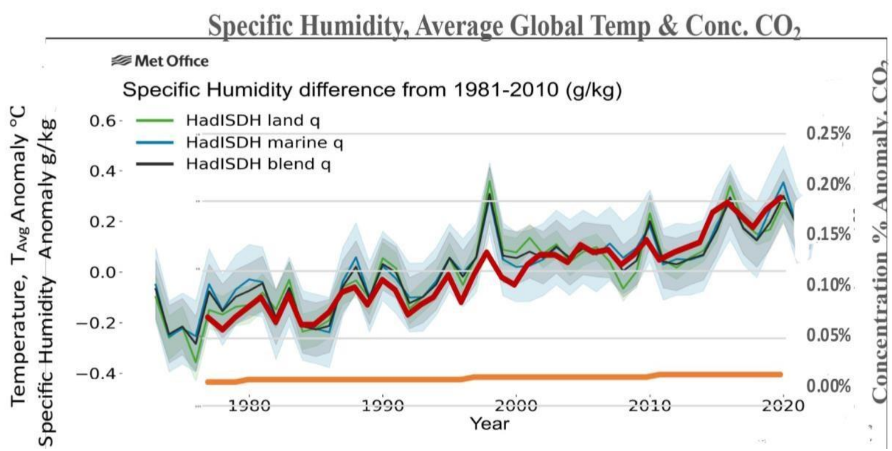


Figure 26: For the Years 1973–2020, Annual Average Global Temperature, T_{avg} ºC from Figure 25, in Red & Plotted Against the Left Vertical Axis with the Addition of Global Time Series of Ranges of Average Global Specific Humidity, Light Green Shaded Area and Annual Average Specific Humidity in Dark Green also Plotted Against the Left Vertical Axis and the Percentage Concentration of CO_2, Orange, Plotted Against the Right Vertical Axis, Each Relative to the Average for 1981–2010

This is Figure 25 with the Average Global Temperature shown in red, to which has been added global specific humidity, shown in green and the concentration of CO_2, shown in orange. For each, this is the difference from the average for 1981–2010 [19,20]. Like all greenhouse gases, the heating power of CO_2 and water vapor grows with an increase in concentration and declines with a reduction in concentration. Over this period, the concentration of CO_2

increased by 25% and, unlike the changes in the average global temperature, the YoY changes were smooth and all positive. For water vapor, the increase in concentration was 11%. Given a 0.2% average concentration for water vapor, the increase in concentration of water vapor was three times greater than that for CO_2 and, when compared on a molecule-to-molecule basis with a heating efficiency 60 times greater than CO_2, the relative increase in heating for water vapor is 400 times greater than for CO_2. Also, as shown, the correlation of changes in the global specific humidity, a good proxy for changes in the concentration of water vapor, to changes in the average global temperature is strong—for periodicity and direction, it is exact. Referring again to Figure 24, it would appear unproductive for scientists to focus on Lamp 1 as the sole or primary driver of changes in material temperatures, the equivalent of selecting changes in the concentration of CO_2 as the sole or primary driver of global warming. However, that is exactly what the de-carbon faction has done.

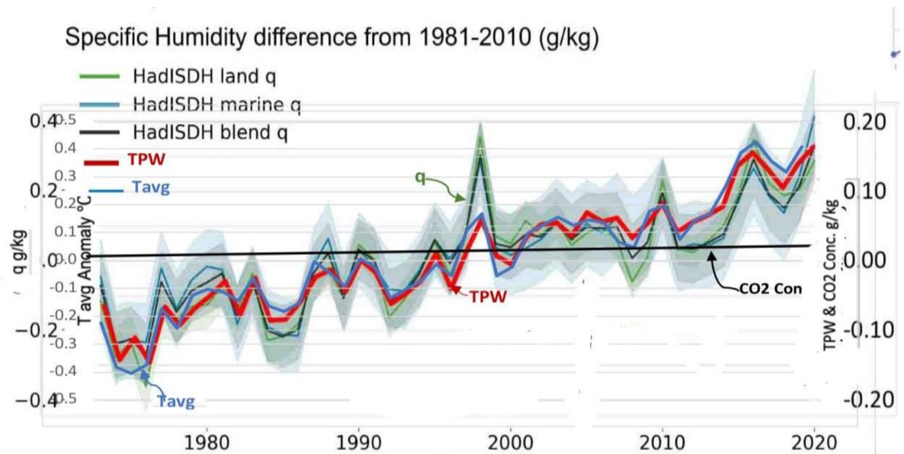


Figure 27: For the Period 1973–2013, Timeline of Ranges of Specific Humidity Differences in Light Green and Average Specific Humidity in Dark Green both Plotted Against the Outer Left Vertical Axis, T_{Avg} in Light Blue Plotted Against the Inner Left Vertical Axis and the Average Global Concentration of Water Vapor, TPW in Red Plotted Against the Right Vertical Axis and Concentration of CO_2 in Black also Plotted Against the Right Vertical Axis. All Differences from the Mean for 1981–2010 [19,20]

A similar correlation between changes in the average global temperature and the concentration of water vapor—the dominant greenhouse gas—is shown in Figure 29. Changes in the average global temperature track and correlate with changes in specific humidity and the concentration of water vapor. The coefficient of correlation is 0.994. It is also clear that the changes shown in the average global concentration of water vapor are unrelated to the YoY changes in the concentration of CO_2. Thus, changes in the concentration of water vapor are unrelated to and do not amplify the effects of changes in the concentration of CO_2.

What the Literature Taught at Least as Early as 2015

Below is a chart from a climate monitoring data base published in 2015 [19] by Dr. Willett and colleagues. It compares the record of seven climate factors, including specific humidity and average global temperature anomalies, between 1973 and 2014.

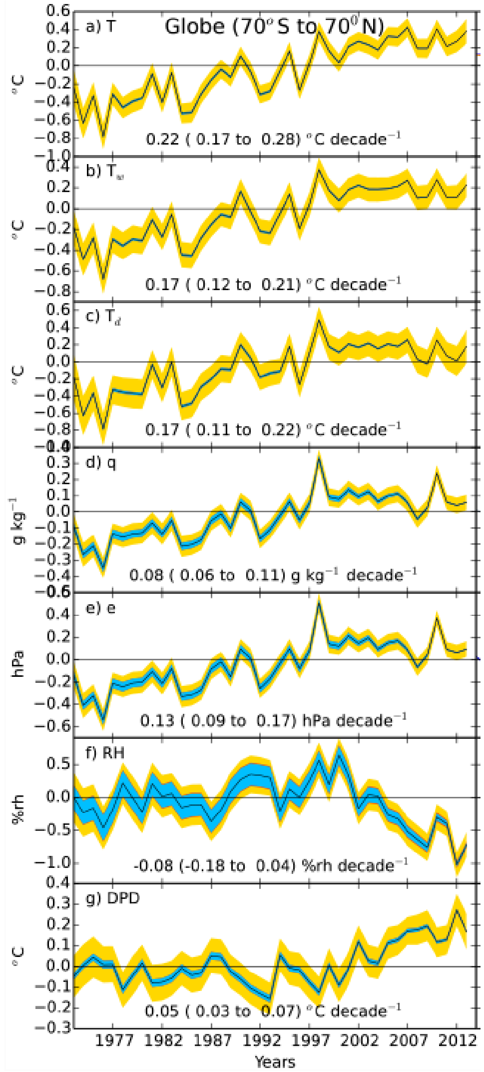


Figure 28: 1973–2014 Global Temperature, Wet Bulb Temperature, Dew Point Temperature, Specific Humidity, Vapor Pressure, Relative Humidity and Dew Point Depression Anomalies Compared with the Period 1976–2005 [19] (Figure 12)

This is a chart combining charts 12 a) and 12 d) from Figure 28.

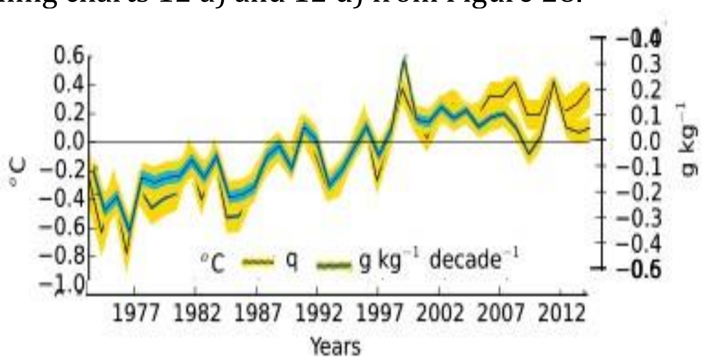


Figure 29: Overlay of Figure 12 d) Specific Humidity Difference in Blue Green Plotted Against the Right Vertical Axis over Figure 12 a) Average Global Temperature, T_{Avg}, in Black Plotted

Against the Left Vertical Axis 1973–2013, Both from the Willet 2014 Paper, [19] (Fig. 12) Difference from the Mean for 1976–2005

Referring to Figure 29, this overlay shows the relative magnitude, timing, and direction of variations in global specific humidity, a measure of the concentration of water vapor and the average global temperature. It is evident that they are correlated. In terms of timing and direction, the comparison shows a very strong correlation—close to an exact match. This data showing a clear correlation between changes in specific humidity and temperature was available to researchers by 2015 at the latest.

Given that water vapor is the dominant greenhouse gas, this is a complete explanation of global warming. Why scientists did not change the focus of their climate change theories and actions after this information was published is unclear.

THE DRIVER OF GLOBAL WARMING: SEVEN EXTRAORDINARY EL NIÑOS SINCE 1972

The El Niños changes are set out in Figure 30.

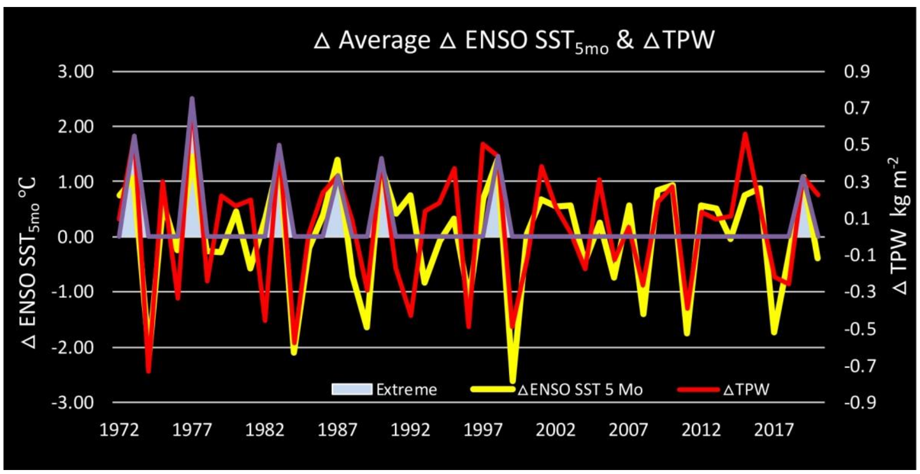


Figure 30, Comparison of the Change in Average Annual Global Concentration of Water Vapor, △TPW Shown in Red and Gauged Against the Right Vertical Axis & the Change in ENSO SST, △ENSO SST, for 12-mo. Period Commencing August of the Previous Year Shown in Yellow and Gauged Against the Left Vertical Axis and the Change in the Concentration of Water Vapor When the Change in the ENSO SST5mo > 1 °C Is Shown in Gray

The magnitude of the rate of change in the ENSO SST affects the rate of evaporation within the ENSO region as reflected in the magnitude of changes in the △TPW. Referring to Figure 30, it is clear that the larger the rate of change in the ENSO SST, the larger the subsequent rate of change in global atmospheric moisture content.

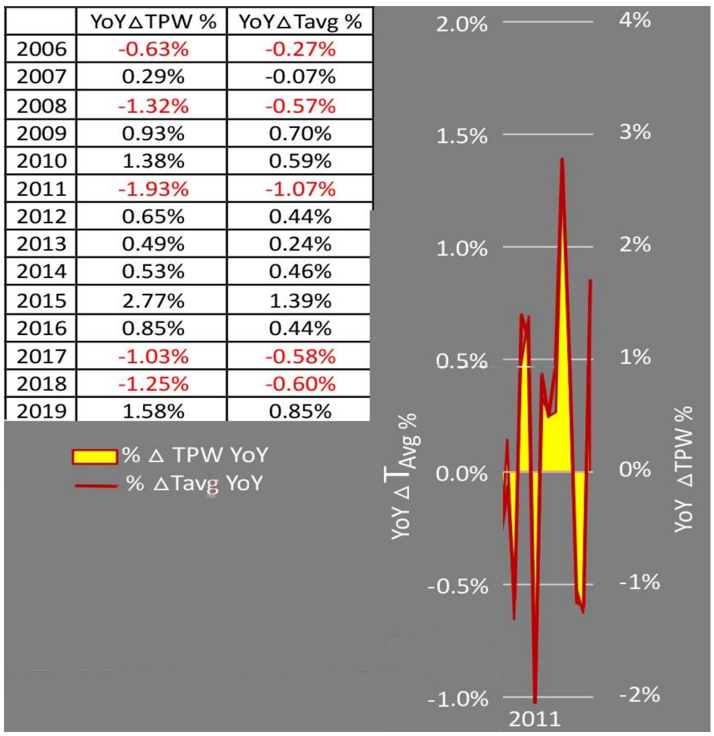
The gray areas correspond to significant El Niños, defined as increases in the ENSO $SST5_{mo}$ > 1 △C, which was a record in terms of changes this great. The sum of the corresponding changes in TPW is 3.3 kg m^{-2} from the significant El Niños compared with the total increase since 1972 of 2 kg m^{-2}. It is evident that these significant El Niños drove the 11% increase in the concentration of water vapor over this period.

GOOD NEWS: GLOBAL COOLING

We know that global warming exists. Figure 30 shows that there is also a reduction in the average global temperature as the result of a reduction in the concentration of water vapor nearly every other year. Because reductions in the global concentration of water vapor cause reductions in the average global temperature, in accordance with Eq. 3,

$$\Delta T_{Avg} = 0.4\,\Delta TPW - 0.05$$

global cooling occurs nearly every other year and is driven by reductions in the concentration of water vapor, in accordance with Eq. 3.



	YoY△TPW %	YoY△Tavg %
2006	-0.63%	-0.27%
2007	0.29%	-0.07%
2008	-1.32%	-0.57%
2009	0.93%	0.70%
2010	1.38%	0.59%
2011	-1.93%	-1.07%
2012	0.65%	0.44%
2013	0.49%	0.24%
2014	0.53%	0.46%
2015	2.77%	1.39%
2016	0.85%	0.44%
2017	-1.03%	-0.58%
2018	-1.25%	-0.60%
2019	1.58%	0.85%

Figure 31: YoY Percentage Change Differences in the Average Global Temperatures & Concentration of Water Vapor 2006–2019.

Further to the point, this chart demonstrates that, just as global warming increases when the concentration of water vapor increases, when that concentration declines, global cooling as described in Eq. 3 occurs. Since 1970, there have been 20 reductions in temperature for a cumulative -2 °C decrease over this roughly 50-year period. This is global cooling. Each global cooling event undoes the previous global warming to some degree.

With,

$$\triangle \mathbf{TPW} = \triangle \mathbf{Evap} - \triangle \mathbf{Precip} \text{ mm m}^{-2} \quad (6)$$

Where △Evap is the YoY change in annual global evaporation; and, △Precip is the YoY change in annual global precipitation

$$\therefore \triangle T_{Avg} = \mathbf{0.4}\,(\triangle \mathbf{Evap} - \triangle \mathbf{Precip}) - \mathbf{0.05}$$

Thus, when $\triangle$Precip > $\triangle$Evap, $\triangle T_{Avg} < 0$. Therefore, global cooling is caused by reducing the atmospheric concentration of water vapor, which occurs when average global precipitation exceeds average global evaporation.

The goal of reducing the concentration of water vapor worldwide by increasing the average global precipitation is daunting. However, the source of the increasing average global concentration of water vapor is the ENSO region, an area ~1% of the total surface area of the planet. This means that we know where the focus should be and can concentrate our efforts to increase precipitation in this region. Because it is in the Pacific and, except for the Galapagos, presents no risk of flooding, this should be an excellent location in which to increase rainfall.

Given that there are very different temperature regions at different times across the Enso Region [16] and are therefore differences in evaporation, it would be worthwhile to consider focusing on the area downwind of the warmer regions, areas smaller still than the entire Enso region. The smaller area, of course, requires a greater increase in precipitation per square meter. Solving for $\triangle TPW_{ENSO\ 5mo,}$ from Eqn. 5, the relationship as shown earlier is:

$$\triangle \mathbf{TPW_{ENSO\ 5mo}} = \mathbf{25} \triangle \mathbf{TPW} - \mathbf{1}\ \text{kg m}^{-2}\ \text{yr}^{-1} \qquad (7)$$

Since the seventies, average annual global evaporation has increased by 2 mm m^{-2} over average global precipitation. Therefore, increasing cumulative average global precipitation over evaporation by 2 mm is the key to completely undoing climate change.

Applying Eq. 7, to achieve that reduction from a reduction in the concentration of water vapor in the ENSO region requires a reduction of 62.5 kg m^{-2} or 62.5 mm m^{-2} in the ENSO concentration of water vapor.

For example, if the goal were to achieve this in 10 years, the required additional average annual reduction would be 6.25 kg m^{-2} or 6.25 mm m^{-2} yr^{-1} or 0.3% of average annual western tropical Pacific rainfall of 200 cm.

For decades, people have used cloud seeding to increase rainfall. Today, experiments in triggering widespread condensation through electrostatic ionization, including ionization from unmanned aerial vehicles (UAVs) are ongoing, and laser ionization has been suggested as another approach. The science also suggests that the injection of ice-nucleating particles at high altitudes in the tropical entryway to the stratosphere could achieve substantial removal of water.

The narrow focus of the de-carbon faction on CO_2 has resulted in the science of global cooling's being overlooked, despite the evidence that the effects of changes in the concentration of water vapor should be examined. This failure to recognize that the science of global cooling could undo climate change has been a major impediment to the adoption and implementation of methods of increasing precipitation and undoing climate change. Whatever the reason for the insistence that the increasing concentration of CO_2 is the driver of global warming, the theory is not based upon science or the data.

COURSE CORRECTION REQUIRED

The assumption that CO_2 is the cause of climate change cannot be justified from any scientific perspective. One publication in 2015, and other publications dealing with specific humidity since then, have debunked this theory. Reducing carbon emissions is an incredibly costly, massive, and unscientific experiment. Limiting carbon emissions will not control global warming. Yet this theory has remains a bar to the acceptance of other considerations and the adoption of effective mechanisms to reduce global warming.

This myopic focus on CO2 has meant failing to examine the role played by water vapor. This is a gross miscarriage of science. This causal ignorance has resulted in the complete failure to discover whether something can be done to not only slow the rate of increase in, but reduce the massive threat posed by, both global warming and increasingly catastrophic weather. The assumption that CO2 is the driver of global warming has thus hijacked the science.

The economic losses resulting from the ongoing climate change will grow by roughly US $1.2 trillion each decade as millions perish, are injured and displaced. Yet there has been no discussion of attempting to increase global cooling and reduce the devastation from catastrophic weather events by simply reducing the concentration of water vapor. If this approach had been proven effective and implemented decades ago, human suffering and economic loss would have been reduced significantly.

In sum, global cooling is real and can be expanded. Recognition of the true driver of climate change can lead to the undoing of a real existential threat. The policy focus must shift from reducing CO_2 emissions to effective means of increasing the concentration of water vapor.

THE BARRIER TO LEARNING: THE DE-CARBON FACTION

Since the early seventies, the members of this faction have received grants and funding and have earned combined revenues and carbon taxes in the hundreds of billions of dollars for work in support of or related to the proposition that the increasing concentration of CO_2 is the sole or primary driver of global warming. This is a major industry—one invested not only in the idea that the increasing concentration of CO_2 drives global warming but also in spreading this belief. Those who earn a living in this field certainly have nothing to gain by questioning this hypothesis or supporting those who do. For that reason, they cannot be viewed as independent when writing, publishing, reviewing, or evaluating papers related to climate change.

Since 2018, I have consulted with the deans of schools of technology and science of three major universities, all of which are part of the de-carbon community, without criticism of the theories, physics or results set out, nor explicit approval or endorsement; the latter, possibly because of a concern of the possible negative impact on the university's climate research funding if such approval were revealed. Commencing in 2020, the underlying data, physics and results have, in various stages, been submitted to and published under my name in the three peer reviewed scientific journals referenced [18, 21, 23]. However, the editors of the relevant and well-regarded scientific publications dealing with climate are usually academics employed by universities that fall within the de-carbon faction. These academics are the gatekeepers regarding the acceptance of papers for publication. While they too, can hardly be considered independent when they are presented with and judging the validity of differing hypotheses about the driver of climate change, one should expect that a scientific publication would publish peer reviewed papers accepted by the reviewers inconsistent with the consensus and simply disavow concurrence by noting that the publication of an article does not imply an endorsement of the conclusions reached or views or policies suggested. It has been my experience that submissions at odds with the views of the de-carbon segment do not reach the peer review stage at the highly respected journals and without any proof of error are rejected out of hand for matters of form, not substance. I have seen this occur with one other author's work which was both elegant and correct. I would not doubt that this is the experience of others attempting to publish papers setting forth different views.

Academics notoriously must publish or perish. For that reason, they are unlikely to challenge the editor of a prestigious publication that turns down a submission that is inconsistent with this belief. Nor are they likely to even pursue legitimate and possibly controversial paths of inquiry, or to conduct the research necessary to author a paper they are certain will never be published by the premier scientific journals.

For these reasons, no articles are available in the principal scientific literature that expressly suggest that the increasing concentration CO_2 may not be the primary driver of global warming. This is so even though:

1. The "hindcasts" of the general circulation models for the years in which the concentrations of CO_2 are known, result in a wide range of global temperatures.
2. The annual changes in the concentration of CO_2 do not track with the annual increases and decreases in the average global temperature.
3. For several decades, the published NOAA data prove that YoY changes in the concentration of CO_2 cannot have driven the YoY increases and decreases in average global temperature; and,
4. Since at least 2015, the published data have shown that both positive and negative YoY changes in global specific humidity, which represent changes in the concentration of the dominant greenhouse gas (water vapor), clearly correlate with YoY increases and decreases in average global temperature.

In other words, the de-carbon faction appears to have had a chilling impact on the development of climate science. While the world relies on their determinations, this faction's climate "experts" appear to be generally incurious when it comes to discerning what else might be driving global warming.

Reducing carbon emissions is an incredibly costly, massive, and unscientific experiment—an experiment in which the billions of us humans are involuntary lab rats, and one that is destined to fail. The de-carbon faction's consensus assumption that the increasing concentration of CO_2 is the cause of global warming appears to have led to the evident blocking of other considerations and of the adoption of effective mechanisms to reduce global warming, even though limiting carbon emissions to control global warming will not be effective.

Thus, it appears that as a result of the exclusive focus on CO_2 as the assumed driver of global warming:

1. The science concerning the role played by water vapor, a far more powerful greenhouse gas, has not been developed.
2. The impact of a number of extraordinary El Niños over the last 50 years on the concentration of atmospheric water vapor, and therefore climate change, has been ignored.
3. The following have not been discussed by others in the principal scientific literature:
    a. Both global warming and devastation from catastrophic weather are reduced naturally almost every other year when the concentration of atmospheric water vapor declines; and
    b. Something can be done; humankind may not have to simply suffer and endure the increasingly massive and, for many, existential threats of climate change.
4. Because alternative theories have not been explored, the world is unaware that something can be done.

THE BARRIER TO INNOVATION: THE DE-CARBON FACTION

In speaking with a dean of science and engineering at a large and well-regarded state university aligned with this faction, the dean did not question my science; however, the dean suggested that increasing precipitation at this scale has never been done and that achieving this would be extremely difficult, a massive undertaking; the implication was that this approach is impracticable. Yet, when many are currently at existential risk—a risk that may eventually expand to the majority of humankind—what excuse do we have not to try? We cannot know that an idea consistent with the physics and data on climate is wholly impracticable until we have seriously addressed it.

I worked in the later years of a complex and mammoth project that started from scratch, designed and built the massive Saturn V Rocket, and 8 years later put two men on the moon and, more importantly, returned them safely. That had never been done before.

However, increasing precipitation by seeding clouds has been done for decades and experiments in triggering condensation by means of electrostatic ionization [25] are ongoing, and laser ionization has been suggested. The science also suggests that the injection of ice-nucleating particles at high altitudes in the tropical entryway to the stratosphere could achieve substantial removal of water. While difficult, there is a likelihood that this approach will succeed.

CONTEXT OF THE AUTHOR

I am a wholly independent and self-taught climate scientist with a Bachelor of Science degree from Penn State in aeronautical engineering and a Master of Science degree from MIT in aeronautics and astronautics. I am also a lawyer, a graduate of the Boston University and Harvard Schools of law who has practiced patent, civil trial, administrative, and antitrust law, followed by international corporate and business law, over 42 years. Before attending law school, I was a senior scientist, part of a team of mostly MIT grads engaged in aerothermodynamic research and development for the design of hypersonic vehicles and additionally wrote software in support of my work—in short, a rocket scientist with expertise in programming and thermodynamics, which is the science of both global warming and cooling. I have devoted the last 10 years to the full-time study and acquisition of an in-depth knowledge of the science of climate change and to writing four comprehensive scientific papers on climate change. On this problem I am now an advocate for all of humankind.

CONCLUSION

As this paper delineates, increasing precipitation will both induce global cooling and reduce the devastating impacts of climate change. A cumulative increase in average global precipitation of 2 mm m^{-2} (0.2% of average global average precipitation) in excess of evaporation should reduce the annual devastation caused by catastrophic weather events by 90% and cause global cooling sufficient to reduce the average global temperature by 1 ºC, thereby completely reversing climate change—in short, un-ringing the bell.

APPENDIX

Principles of Climate Change

Average global changes as a function of average global changes

1. $\triangle$ **TPW** = $\triangle$ **Evap** _ $\triangle$ **Precip** mm m^{-2}
2. $\triangle \mathbf{TPW} = \mathbf{0.157} \triangle \mathbf{TH} + 17.53 \left\{ e^{[0.686(\mathrm{SSTo}+\triangle\mathrm{SST}) - 288]} - e^{[0.686(\mathrm{SSTo})-288]} \right\}$ kg m^{-2}
3. $\mathbf{TPW_n} = \mathbf{17.53}\, \boldsymbol{e}^{[\mathbf{0.686}(\boldsymbol{SST_n}-\mathbf{288})]} + \sum_{o}^{n} \mathbf{0.157}\, (\mathbf{TH}_{\mathbf{n}} - \mathbf{TH}_{\mathbf{n-1}})$ kg m^{-2}
4. $\triangle \mathbf{T_{Avg}} = \mathbf{0.4} \triangle \mathbf{TPW}$ $\triangle$C yr^{-1}
5. % $\triangle$**Loss** = **123** × % $\triangle$**TPW – 65%**

Average global changes as a function of changes in the ENSO Region

6. $\triangle \mathbf{T_{Avg}} = \mathbf{0.1} \triangle \mathbf{ENSO\ SST_{5\ mo}} + \mathbf{0.02}$ °C yr^{-1}
7. $\triangle \mathbf{TPW} = \mathbf{0.04} \triangle \mathbf{TPW_{ENSO\ 5\ mo}} + \mathbf{0.04}$ kg m^{-2} yr^{-1}
8. $\triangle \mathbf{T_{Avg}} = \mathbf{0.0145} \times \triangle \mathbf{TPW_{ENSO\ 5mo}} + \mathbf{0.017}$ °C yr^{-1}

Nomenclature

TPW: Total Precipitable Water kg m^{-2} or mm m^{-2}
Evap: Average Annual Global Evaporation mm
Precip: Average Annual Global Precipitation mm
$\mathbf{T_{Avg}}$: Average Global Temperature ºC
SST: Average Global Sea Surface Temperature ºC unless otherwise noted
Loss: Decadal Average Global Economic Loss 2019 US $

Data Availability Statement

All the relevant underlying data and the derivations of the physics and principles set out above and in the Appendix are set forth in these papers [18,21,23].

Independence

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[i] The Greek letter delta, △, means rate of change per year, YoY change.

[ii] R-squared, R^2, explains the extent to which the variance of one variable explains the variance of the second variable. It indicates the extent to which the pairs of numbers for two variables lie on a straight line. It goes from 0 to 1, where 1 indicates a perfect fit of the model to the data.

[iii] The correlation coefficient is used to measure the strength of the relationship between two variables. It ranges from -1.0 to +1.0. A correlation value of -1.0 means a perfect negative correlation, whereas a correlation of +1.0 means a perfect positive correlation; a correlation of 0.0 means no linear relationship between the movement of the two variables.