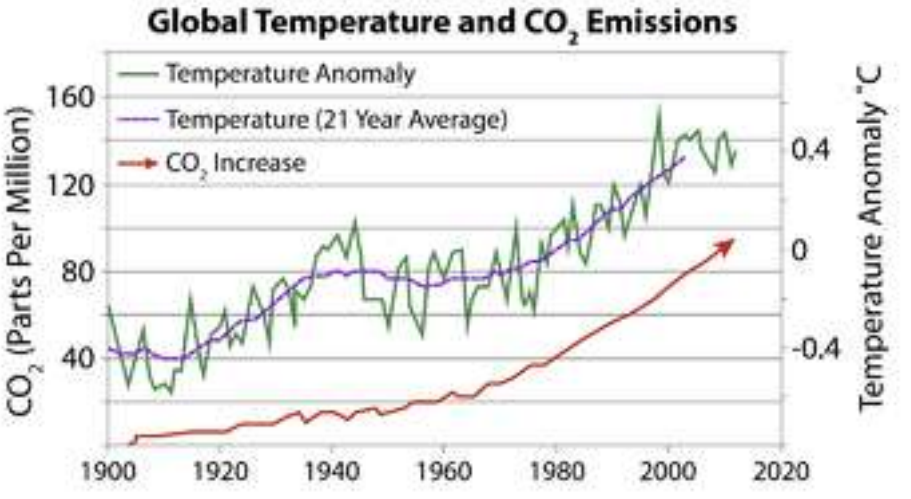
Temperature Doesn't Follow CO_2 As Alarmists Claim

by Benjamin Deniston

The narrative of an impending man-made climate change catastrophe is based on an assertion that the Earth's climate is extremely sensitive to increases in CO_2 emissions and that CO_2 ranks among the most important factors determining climate across many timescales. When you hear about rising human CO_2 emissions causing everything from devastating droughts to worsening storms, from sea level rise to mass extinctions, realize that these are all based on computer models built on the assertion that changes in CO_2 will have a strong effect on global climate. However, there is one minor problem with their arguments: reality does not support that assertion.

FIGURE 1



The annual average global temperature is from the Hadley Center in the United Kingdom. The cumulative emissions are from the international inventory data base of the USA Department of Energy. The CO_2 levels prior to 1959 are from NOAA records of Antarctic ice cores, and CCO_2 levels after 1959 are from measurements at Mauna Loa, Hawaii. CO_2 increases are measured above a 1900 baseline value of 300 parts per million (by volume). Graphic adapted from an original by Ferdinand Engelbeen.

The climate is always changing, with many factors involved (as discussed in the accompanying article, "What Causes Climate Change? The Sun, the Solar System, and the Galaxy"), and the historical and geological evidence tells us that CO_2 is a relatively *minor* factor (if much of a factor at all).

Case 1: 20th Century

Start by comparing CO_2 levels and temperature over the past century. From 1900 to the present, a relationship existed between human emissions of what are called "greenhouse gases" and the yearly average global temperature is far from self-evident. **Figure 1** compares global average temperature with increases in greenhouse gas and CO_2 emissions (expressed as an increase above the pre-industrial baseline of 300 parts per million).

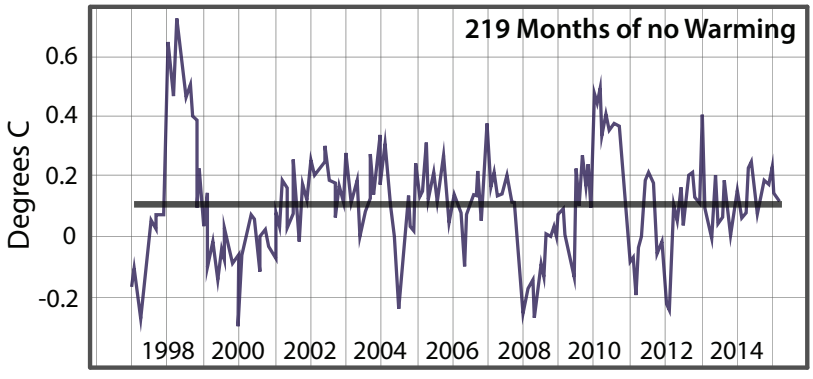
The data reveal a global temperature increase from 1910 to 1945, during a period when human greenhouse emissions were relatively low. As the rate of CO_2 increase began to accelerate over the following 30 years, global temperatures did not increase along with them; the temperatures went flat from 1945 to 1975. The only period where these processes correspond is the recent warming phase, from 1975 to 1998. However, since 1998 global temperatures have again gone flat, breaking from the upward trend in CO_2 emissions.

Before going on, it should be emphasized that this disagreement is evident in the most recent historical data

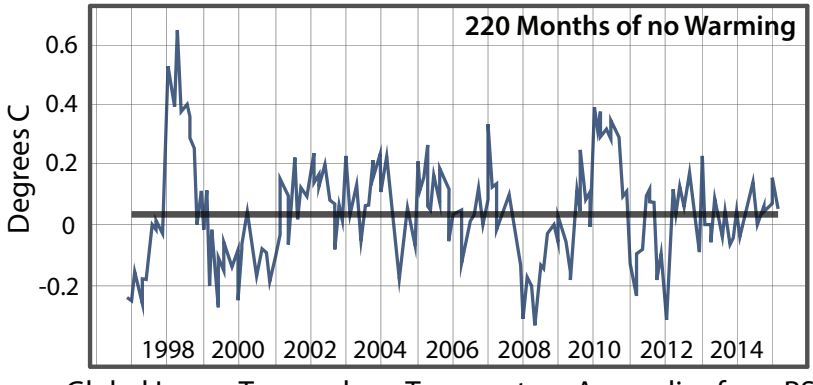
provided by NOAA and other government agencies. As will be discussed in the accompanying article, "The 'Methods' of Climate Alarmists," we have strong reasons to question the accuracy of the historical data provided by government agencies with a vested interest in the man-made climate change catastrophe narrative, as they have repeatedly cherry-picked the data that supports their assertions, and even "adjusted" historical data to fit their claims. That stated, even with these biases in the data selection and adjustment processes, we *still* see this disagreement between CO_2 and temperature.

FIGURE 2

Satellite Data Shows No Global Temperature Rise for 18 Years



Global Lower Troposphere Temperature Anomalies from UAH (University of Alabama in Huntsville) Analysis of Satellite Data
(Version 6.0 beta; January 1997 to March 2015; Reference 1981-2010)



Global Lower Troposphere Temperature Anomalies from RSS (Remote Sensing Systems) Analysis of Satellite Data
(December 1996 to March 2015; Reference 1979-1998)

The RSS (Remote Sensing Systems) and UAH (University of Alabama in Huntsville) analysis of satellite measurements show that there has been no trend of global temperature increase since the late 1990s. Graphics reproduced from originals by Bob Tisdale.

Case 2: The Pause

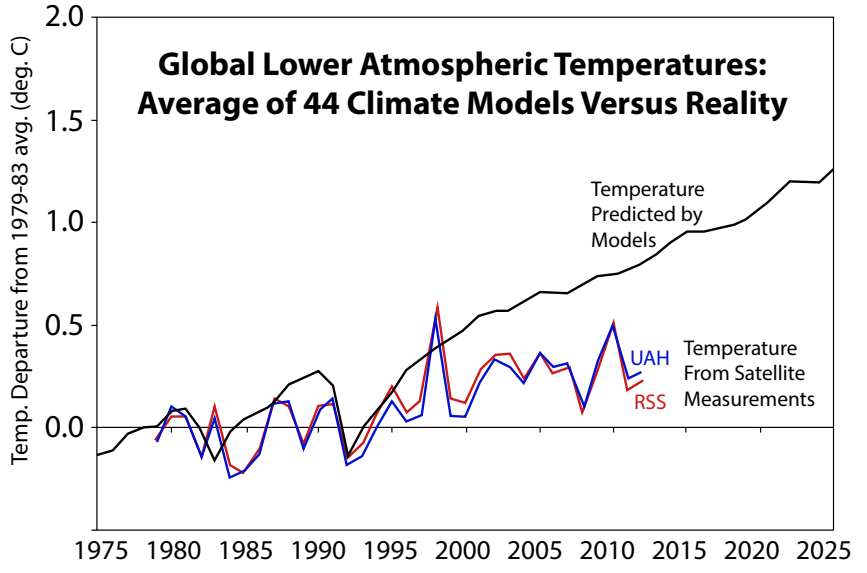
Focusing on this more recent period (1998 to the present), two different assessments of global temperature based on satellite measurements both show that global temperatures have shown no increasing trend since 1998 – despite the relatively large increase in CO_2 levels. These satellite measurements represent an important, independent temperature record, free from the manipulations of surface temperature records discussed in the accompanying article, "The 'Methods' of Climate Alarmists."

This recent flat-line in global temperature has been popularized as a global warming "pause" or "hiatus." Even with CO_2 and other greenhouse emissions continuing to accelerate over the past two decades, *the Earth hasn't warmed in response*. There are literally dozens of purported explanations for why this leveling off does not bring into question the narrative that the climate is extremely sensitive to CO_2 levels and continued human CO_2 emissions will cause catastrophic climate change. But these explanations are all post hoc excuses. *None of the climate models predicted this pause before it occurred, yet we are now told to trust those same climate models for* future *predictions of how CO_2 increases will devastate the Earth's climate.*

The spectacular failure of computer models to accurately predict how the Earth's climate will respond to changes in CO_2 levels can be further illustrated by comparing the predictions made by dozens of computer models with the actual results that occurred. As can be seen in **Figure 3**, actual temperature has remained below the vast majority of all climate model predictions, and well below the average of all predictions.

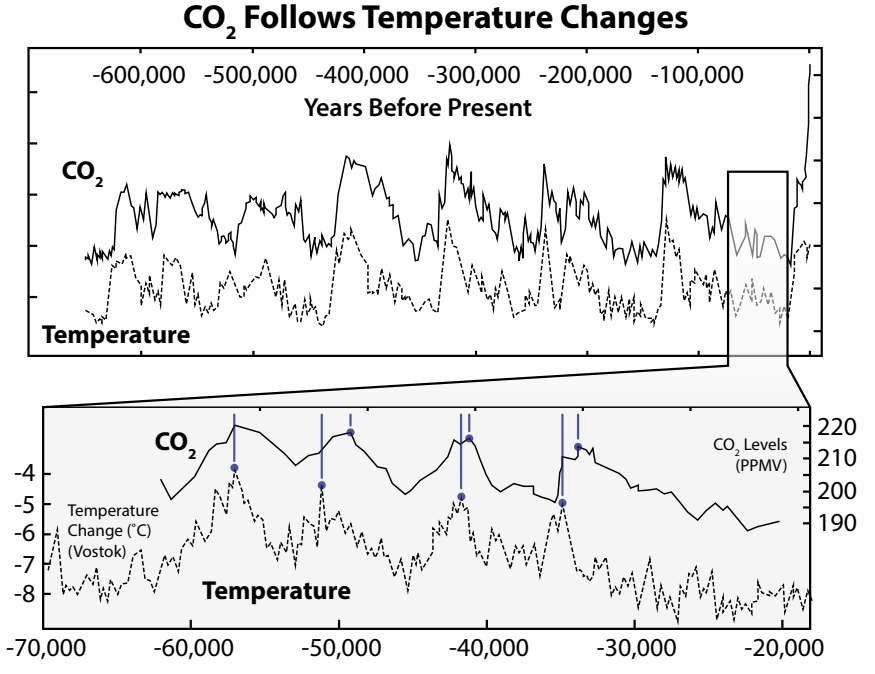
These results indicate that the Earth's climate is not responding to CO_2 emissions as claimed by those sup-

FIGURE 3



The global temperature predicted by an average of 44 climate models compared against actual global temperatures measured by satellites. Image adapted from Dr. Roy Spencer, "95% of Climate Models Agree: The Observations Must be Wrong," February 7th, 2014, http://www.drroyspencer.com/

FIGURE 4



Measurements of temperature and CO_2 for the past 600,000 years. When the entire period is viewed, a very clear correlation is apparent, but which is causing the other to change? When examined more closely, we see that temperature changes first, followed by changes in CO_2 levels (which appear to be responding to the temperature changes). Image adapted from "Analysis of ice core data from Antarctica," by Indermühle et al. (GRL, vol. 27, p. 735, 2000), and the science fiction film An Inconvenient Truth.

porting the man-made climate change crisis narrative. Surprised? You shouldn't be. This is completely consistent with historical and geological records, which paint the picture of a climate that is *not* highly responsive to CO_2 levels. On certain timescales we see the *opposite* of what we're generally told by alarmists, CO_2 levels being determined by climate (rather than CO_2 determining climate).

Case 3: CO_2 Lags Behind Temperature

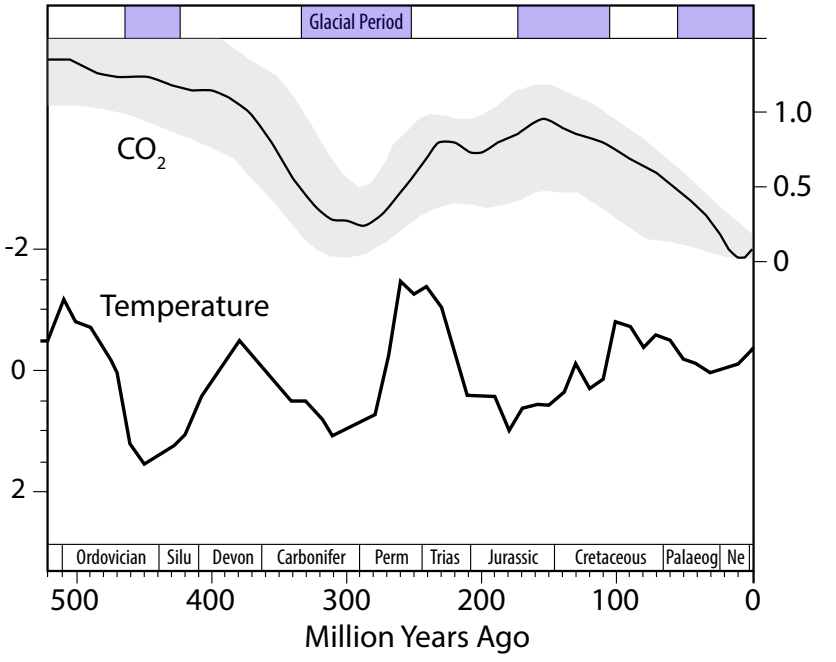
One of the more infamous illustrations of this comes from the evidence popularized by Al Gore in his science fiction film, *An Inconvenient Truth*. Gore presented a close correlation between CO_2 levels and temperature records going back a half million years (recorded in ice core samples from Antarctica). This was presented as conclusive evidence that CO_2 changes drive changes in global temperature, with Gore stating "there is one relationship that is far 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." There's a good reason Gore provided no explanation of what would have caused these past changes in CO_2.

What he didn't mention was that the changes in CO_2 levels came *after* changes in temperature, indicating that CO_2 was not causing the climate to change, but rather *responding* to temperature change. This is no surprise. The oceans absorb, store, and release large amounts of CO_2, and the temperature of the ocean water determines how much CO_2 it can hold. Consequently, changes in climate (and ocean temperature) can increase or decrease the CO_2 in the

atmosphere. For example, warming causes more CO_2 to be released into the atmosphere, so a CO_2 increase would be expected to come after (lag behind) a temperature rise.[1]

Records of CO_2 changes following temperatures have repeatedly been shown in multiple studies. A 1999 study showed that CO_2 changes followed behind temperature changes by 600 years during the last three transitions from ice ages to interglacial periods.[2] A 2000 study found that CO_2 lagged temperature changes by 1,200 years in Antarctic ice cores between 60,000 and 20,000 years ago (see **Figure 4**).[3] A 2001 study demonstrated an 800 year CO_2 lag in the beginning of the most recent interglacial. And a 2005 study showed CO_2 lagging temperature changes in temperature by 1,900 years in Antarctic data.

FIGURE 5



Temperature and CO_2 levels for the past 500 million years. Image adapted from Berner and Kothavala, 2001 and Veizer et al., 2001.

Case 4: The Phanerozoic

The lack of climate sensitivity to CO_2 is further supported when we look at longer timescales, covering hundreds of millions of years. For records covering the entire time of advanced animal life on Earth (the Phanerozoic Eon, from 540 million years ago to the present) we see no evidence that varying CO_2 levels drive global climate, or are even correlated with climate changes. We see periods where CO_2 levels were much higher than today, with lower global temperatures (as in the Ordovician and Jurassic periods). And we see long-term trends of CO_2 increase associated with temperature decrease, followed by CO_2 decrease being associated with temperature increase (from the late Permian, through the Triassic, Jurassic, and Cretaceous). Again, this shows the absurdity of the assertion that the Earth's climate is highly responsive to atmospheric CO_2 levels, and the criminality of the alarmists' demands that human CO_2 emissions be drastically cut back.

Whether we look at the recent changes of the Earth's climate over the past decades and centuries, or longer-term records covering the past hundreds of thousands or hundreds of millions of years, we see clear evidence that CO_2 is not a major factor determining the Earth's climate. As discussed in the accompanying article, "What Causes Climate Change? The Sun, the Solar System, and the Galaxy," the Earth's climate is always changing, but not because of CO_2.

Bottom line: is CO_2 a greenhouse gas? Yes. Could an increase in CO_2 levels affect the climate? Sure, that is possible, but the evidence indicates it wouldn't be much of an effect (if any). Is there any reason to believe that human CO_2 emissions are going to bring the world climate system to the verge of some catastrophic change, requiring concerted, costly, and drastic efforts to slash emissions? *Absolutely not.*

1. Many supporters of the man-made climate change crisis narrative don't dispute that CO_2 changes follow behind temperature changes, but they argue that different causes (other than CO_2) initiate the temperature change, which then releases more CO_2, and then the CO_2 acts to amplify these temperature changes. However, this is just reasserting their thesis, and providing no proof. According to this scenario these geological records don't provide *any* evidence to support the claim that the climate is highly sensitive to CO_2 change (as Gore claimed)..
2. Fischer et al., *Science*, vol 283, p. 1712, 1999.
3. Indermühle et al., GRL, vol. 27, p. 735, 2000.