Are Humans Causing Global Warming?

By Robert Pavlis

Source: https://www.gardenmyths.com/are-humans-causing-global-warming

I know that many of you think that this question has already been settled and that 97% of scientists agree that global warming is anthropogenic, i.e., it is human-caused.

The question is far from being settled

The goal for this post is to present some of the arguments presented by both sides of the debate.

Key Takeaways

- There is clearly no consensus about climate change among scientists.
- There is no consensus about the extent of human-caused global warming.
- We know a lot less about the climate than we have been led to believe.
- Society has been misinformed by the news - no surprise there!

Climate Alarmists vs Climate Realists

Scientists and the general public tend to fall into one of two camps: Climate Alarmists and Climate Realists. I am sure some people fall in the middle, but these are the two larger and better-defined groups.

Climate Alarmists:

Climate alarmists believe in anthropogenic climate change. Humans are producing too much CO2, which in turn is the major cause of global warming.

Global warming is causing a climate crisis, and if we don't act quickly, the Earth and future generations are doomed.

Climate Realists:

Climate realists believe that global warming is real. They also believe in climate change and the fact that the climate is always changing. Some people label this group, climate deniers, but that term is clearly wrong since they do believe in climate change.

This group also believes humans are contributing to some of the global warming, but it's not the major cause.

They also don't believe the Earth is in a crisis and facing imminent catastrophes. Instead, they would describe their view as, "Over the coming century, for most economic sectors, the impact of climate change will be small relative to the impacts of other drivers. Changes in population, age, income, technology, relative prices, lifestyle, regulation, governance, and many other aspects of socio-economic development will have an impact on the supply and demand of economic goods and services that is large relative to the impact of climate change". As Ross McKitrick has pointed out, this is from the IPCC 5th Assessment Report, Working Group II, Ch 10 - a group normally viewed as climate alarmists.

What Do These Groups Agree On?

There are some fundamental facts that both groups agree on, and some of these may surprise you.

- The climate is changing and has always been changing.
- Global warming is happening. Temperatures are rising.
- CO2 levels are rising.
- CO2 is a greenhouse gas that warms the atmosphere.
- Humans have contributed significantly to CO2 levels in the last hundred years. Much of this is from burning fossil fuels.

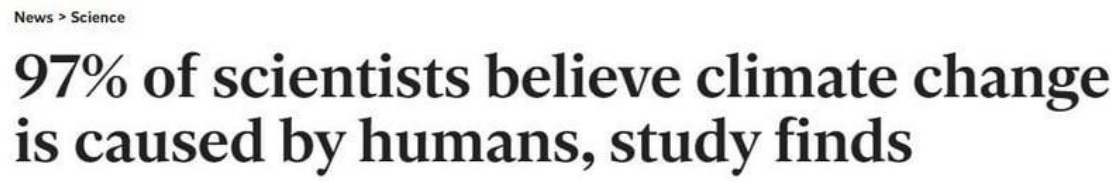
If there is so much agreement, what do the groups disagree on?

- The degree to which CO2 is causing the current warming.
- The effect global warming has on climate parameters. The realists believe the effect is relatively minor, while the alarmists believe we are close to a crisis.
- The future trend for global warming. One group predicts minor changes while the other predicts large changes, which are more likely to cause climate catastrophes.
- The accuracy of climate models.
- The impact humans have on global warming.

The differences are significant and have profound implications for what governments and citizens do going forward. For example, the movement towards wind and solar is largely driven by alarmists.

The 97% Consensus

I am sure you have seen the headlines: "97% of scientists agree that humans are causing global warming". Some, like this example, even extrapolate it incorrectly to "causing climate change".



Headline from the Independent, source Independent

The result of a survey is very dependent on the questions asked because it is very easy to skew the results by slight variations in the language used. For example, how was the term "caused" defined? Did it ask 'are humans mostly responsible', or did it say 'are humans somewhat responsible'? This is critical since even climate realists agree that humans have some contribution to global warming.

What questions were used in this survey? **Surprise! There was no survey**.

The 97% number stems from some work done by John Cook etal, in a letter published in ICP Science. They looked at the abstracts from 11,944 studies that used the terms ‘global climate change’ or ‘global warming’. They found that "66.4% of abstracts expressed no position on AGW (anthropogenic global warming), 32.6% endorsed AGW, 0.7% rejected AGW, and 0.3% were uncertain about the cause of global warming".

Out of the 33% that expressed a position on AGW, 97.1% endorsed the position that humans are causing global warming. The published letter correctly states the conclusion as "Among abstracts expressing a position on AGW, 97.1% endorsed the consensus position that humans are causing global warming."

That **means 32% of the 11,944 research papers** endorsed anthropogenic global warming!

Here are some key points:

- **No survey was done** to reach this conclusion.
- The scientists who created the studies examined in the report were never asked for their opinion.
- This work examined the belief in global warming, not climate change. The title of the work is "Quantifying the consensus on anthropogenic global warming in the scientific literature". News outlets and reporters changed the wording from global warming to climate change to sensationalize the story.
- The data gives us no insight into what "scientists believe".

At best, it can be claimed that 32% of research papers endorsed anthropogenic global warming!

There is NO 97% consensus!

A real survey was done in 2012 by the American Meteorological Society (AMS). It received 1,862 responses from 7,000 members. Only 52% said they think global warming over the 20th century has happened and is mostly man-made. The remaining 48% either think it happened, but natural causes explain at least half of it, or it didn't happen, or they don't know.

Furthermore, 53% agree that there is conflict among AMS members on the question. Clearly not a 97% majority!

S. Fred Singer (a climate realist) said in an **interview with the National Association of Scholars** (NAS) that "the number of skeptical qualified scientists has been growing steadily; I would guess it is about 40% now." This is an opinion and not a survey, but it does indicate that the 97% number is far from being correct.

Climate Alarmist View:

Climate alarmists repeat the 97% number regularly, inferring it is proof of their position. Either they don't understand how the data was analyzed, or they choose to ignore the fact and just repeat it to convert people to their side?

Climate Realist View:

They don't dismiss the idea that many, maybe even a majority of scientists, believe in anthropogenic global warming, but they don't accept the 97% value.

They also point out that the "number" is irrelevant in the discussion and does not indicate the correctness of either side. Many key discoveries in the past started with almost no scientific support, only to end up with a consensus. For example, the belief in the theory of continental drift.

The Hockey Stick Trick

I am sure you have seen the 'hockey stick' graph showing sudden warming starting around 1900 (see below). This has led to claims such as:

“Temperatures are higher than they’ve ever been.”

Followed by, "it must be anthropogenic warming because it lines up perfectly with human activity and CO2 production".

There is more to the story.

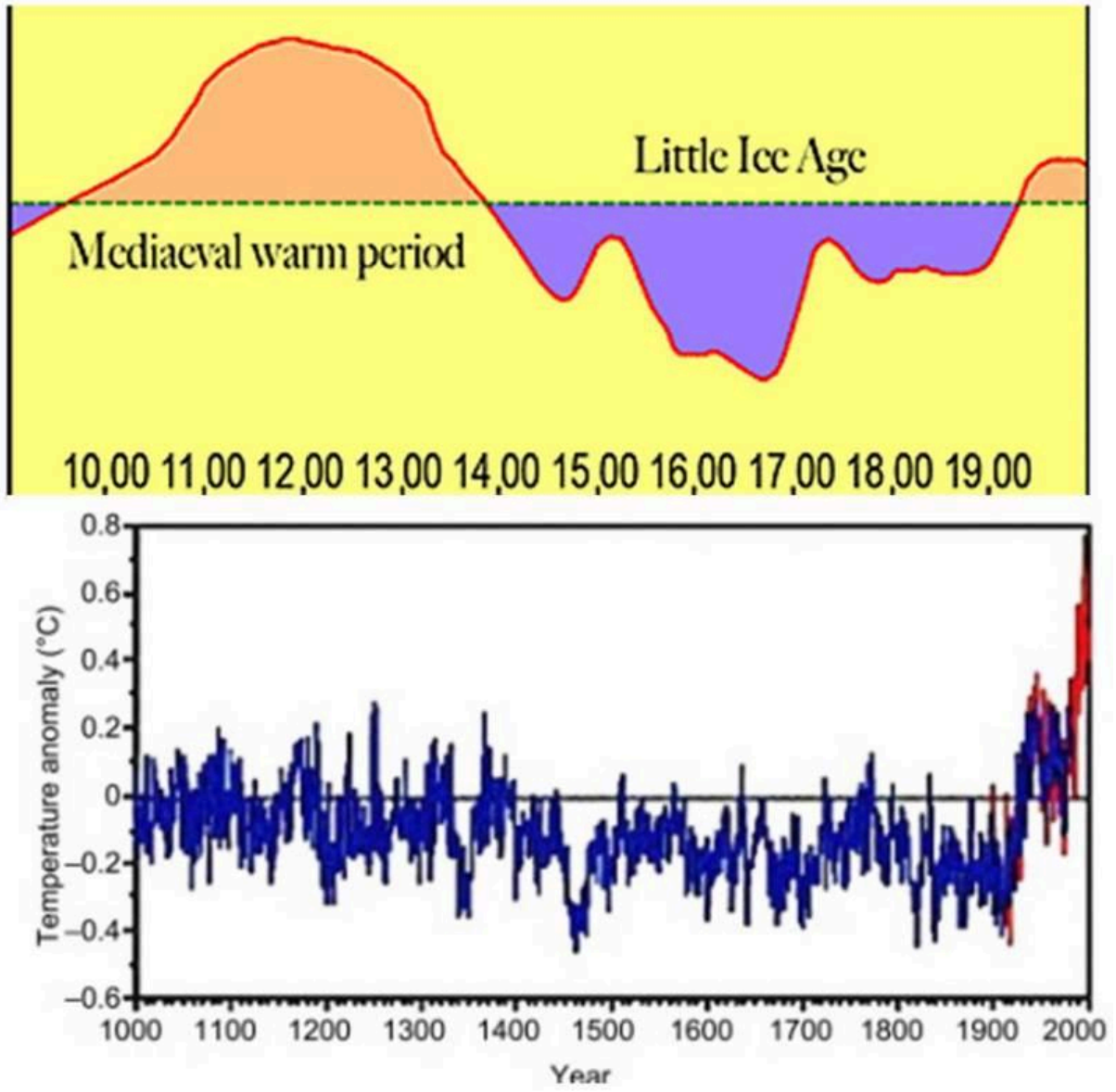
Over a period of many decades, hundreds of papers were published establishing the Medieval Warm Period from about 900 A.D. to 1300 A.D. and the Little Ice Age from about 1300 A.D. to 1915 A.D.

One way we know about this warm period is that the Vikings started settling Greenland at this time. These settlements existed in a warm climate that allowed agriculture, and they lasted for about 500 years until the start of the Little Ice Age. There are many historical papers supporting these facts, and it was accepted as fact in the IPCC-AR1 (1990) report.

Around 1998, Mann et al. published a paper declaring that all of the past work was wrong and neither the Medieval Warm Period nor the Little Ice Age happened. The evidence was based largely on tree ring data. I guess the Vikings couldn't tell the difference between green land and snow-covered land?

This also became the official position of the 2001 Intergovernmental Panel on Climate Change (IPCC). In one simple step, the research effort of thousands of scientists was dismissed.

Mann's study presented the data in the now-famous hockey stick graph shown below.



The top graph is the original graph from IPCC-AR1 (1990), showing the Medieval Warm Period and the Little Ice Age. The bottom graph shows the new Mann et al. 'hockey stick' version from IPCC-AR3 (2001), source: Independent Institute.

Climate alarmists argue that the work done by Mann corrected the past mistakes of hundreds of scientists.

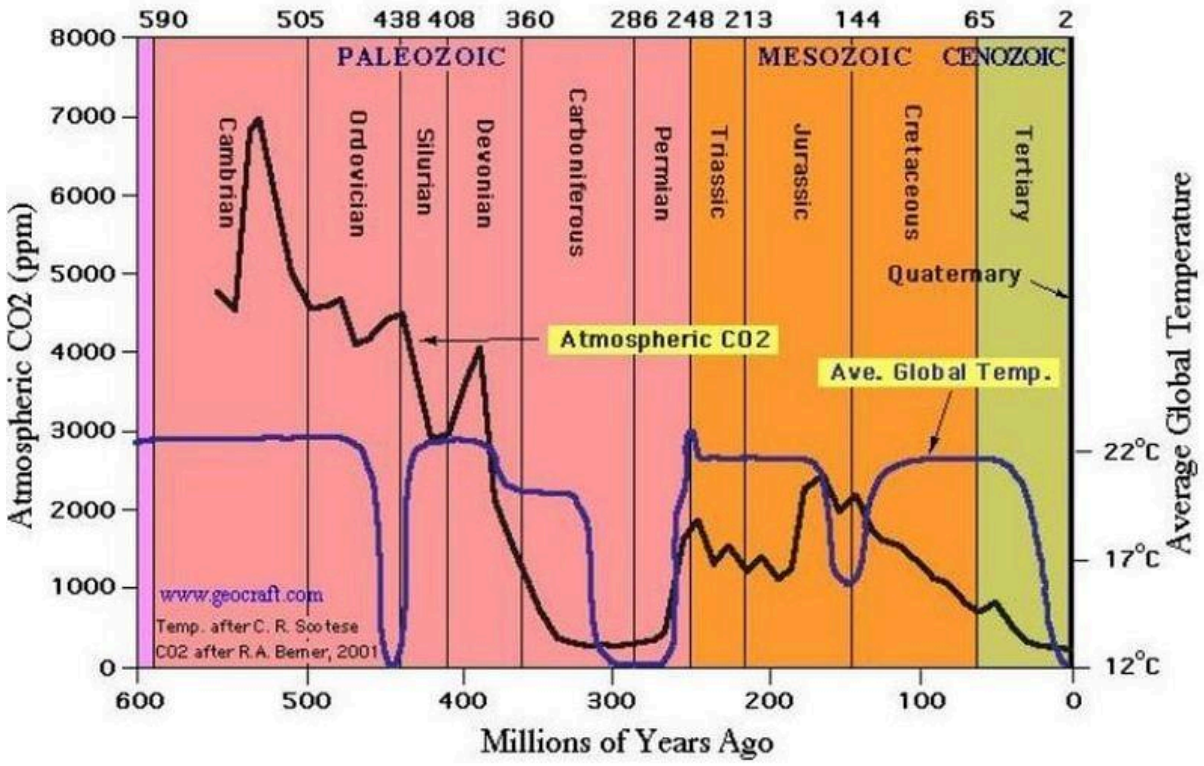
On the other hand, climate realists, such a McIntyre and McKitrick (2003, 2005), have shown that the methodology used by Mann to create the hockey stick graph has several important flaws. McKitrick has commented that some are so basic that it is hard to believe they were not caught during the review process. The hockey stick graph is wrong, but the IPCC continues to use it.

It is a good graph for convincing people that we are suddenly in a warming crisis. It allowed Gore (2007) and others to claim that "Our civilization has never experienced any environmental warming similar to this".

Why is the Medieval Warm Period so important to this discussion? Climate scientists have trouble explaining why and how it existed, creating more questions about our understanding of climate and the climate models. How can the Medieval Warm Period exist when CO2 levels were still low?

The warm period also provides a sense of comfort with the realization that even with recent warming, temperatures remain colder than what has been the case during most of the era of human civilization, in the past 6,000 years.

Bond *et al*. and an international team of scientists, studying this time period, claimed that the Little Ice Age and Medieval Warm Period were (1) real, (2) global, and (3) solar-induced.



Global Temperature and CO2 levels over 600 million years, source: MacRae, 2008

What Do Climate Models Tell Us?

Climate models and weather models are large, complicated equations that have numerous parameters. Scientists and climatologists populate the values of the parameters and use the results to predict future events.

We have been using weather models to predict the weather for quite a while, and compared to climate models, they are much less complicated. They also focus on a very specific area of the globe. If you think back 20 years ago, a 5-day forecast was fairly inaccurate. Today it is quite good.

The reason for this improved accuracy is that we understand the parameters better and have fine-tuned the formulas to give more accurate information. This was possible in part because climate experts can make changes, wait 5 days, and see if the changes are correct. Then fine-tune the equations and values and repeat the process many times.

Climate models are much more complex, and they predict climate changes in the next 30 or 100 years. It is hard to wait 30 years to see if they are right and then make adjustments to improve them. There are also a lot of things we don't understand about climate.

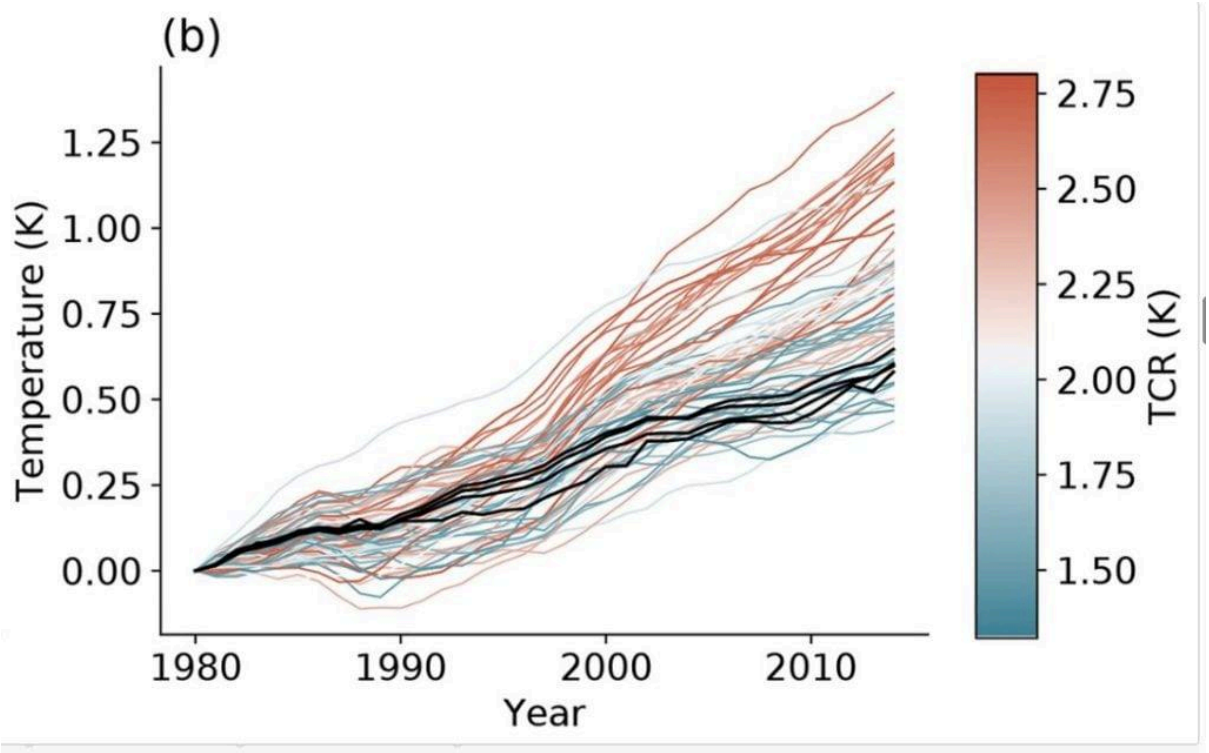
Take clouds, for instance. I have heard several climate alarmists agree that we don't know enough about clouds, and yet they have a huge impact on temperature and climate. The variables and values we use for clouds in the models are only poorly understood, and that leads to errors in model predictions.

The process of predicting future climate makes use of many models because we don't know which ones are correct. They are run using recent data to predict today's climate. Any model that does not perform well is eliminated from the bunch, without knowing why, except that we know it is wrong. The remaining models are then used to predict the future, without knowing if any of them are correct.

Gavin Schmidt, director of the NASA Goddard Institute and a climate modeler, had this to say. The year 2023 was the hottest on record (ocean + land), and our models were completely wrong in predicting the event. "We did not understand something". The models account for solar cycles, but mostly, it is still a mystery to predict their effects. The models are also poor at taking the effect of aerosols (dust, sea salt, human-caused particulates) into account. In fact, NASA is launching a new satellite to measure these. Aerosols have a large impact on model predictions for warming.

The models predict that global warming will cause the oceans to warm. However, the western Pacific has warmed, while the eastern Pacific has cooled. There is a 1.5 °C difference between the two sides, and this was a complete surprise to climate scientists because climate models did not predict it.

Some of you think that the idea of anthropogenic warming has been settled, but it hasn't. A recent paper by Green & Soon compared the IPCC anthropogenic-based climate models with solar-based ones and found that models based on solar variables consistently produced more accurate forecasts across various estimation periods, suggesting that the fundamental model design used by the IPCC is flawed and that human-caused CO2 is not responsible for global warming.

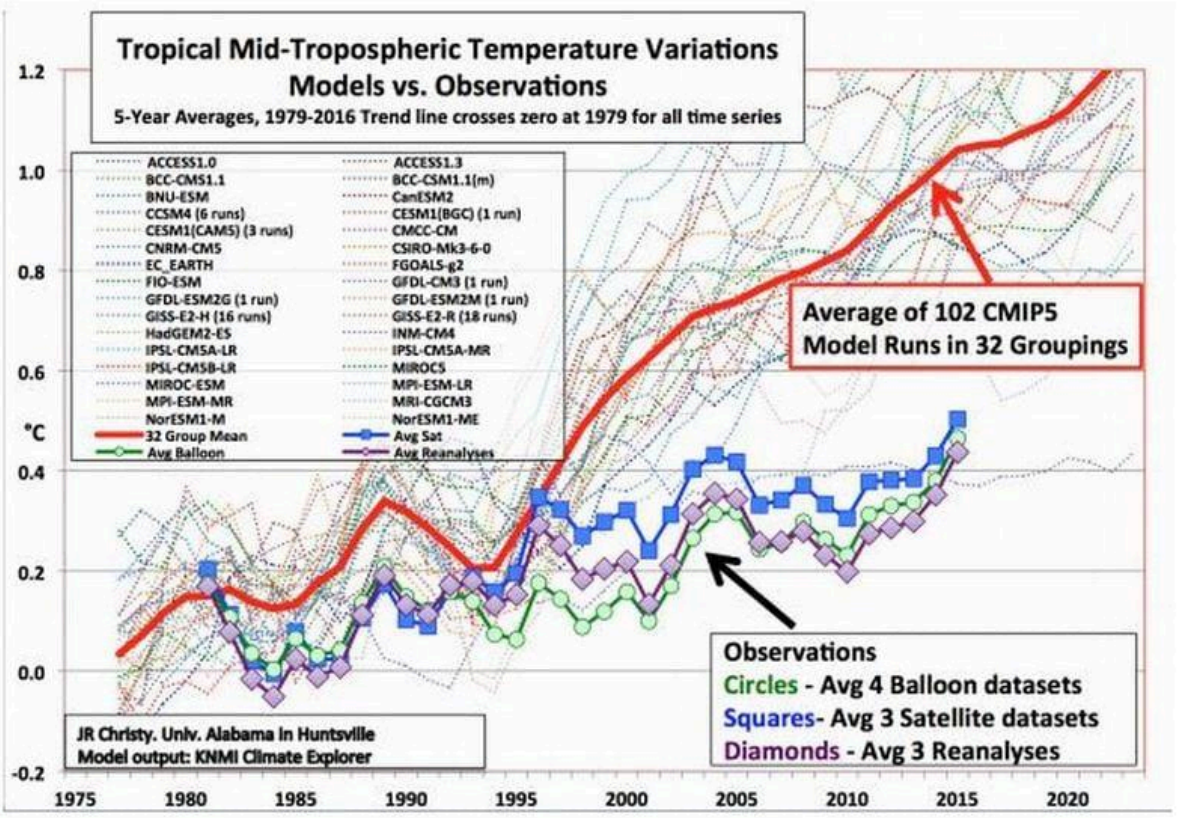


Measuring the accuracy of climate models. Black lines are actual data from several sources. The color lines are the predictions by the models, source: Femke J. M. M. Nijsse et al

The above chart is a comparison of the CMIP6 models and actual temperatures. Some of these models are used by the IPCC. The colored lines are the predicted temperatures by the models, and the solid black lines are from 3 real data sets. The models clearly have difficulty predicting the temperatures over the last 40 years, so there is no reason to accept their values for the next 40 years.

The chart below compares 102 IPCC CMIP5 climate model data to actual measured data from air balloons and satellites. The fine lines are the predictions from climate models, and the red line is the average of the models. The circles, squares, and diamonds are actual measured data.

Why should we have confidence that the future predictions of the models are accurate?



Comparison of models and actual data, source: [Fraser Institute]

There is another very important concept used to build the models. The process starts by making some assumptions. The models are then built on these assumptions. In the case of many climate models, especially the ones used by the IPCC, the assumption is that warming is anthropogenic. The models are then modified and tweaked to confirm the assumption is correct. This builds in an automatic bias for anthropogenic warming.

What do both sides agree on?

Both sides agree that the climate models are not perfect. They also agree that there are several key climate properties, like clouds and ocean currents, that are poorly understood and therefore are not properly reflected in the models.

Surprise events like the 2023 heating or the cooling of the Pacific Ocean indicate imperfections in the models.

Climate Alarmists:

Climate alarmists understand there are limitations in the models, but downplay their importance. They still use the models to predict the future.

Climate Realists:

Climate realists have very little faith in the models for three reasons. First is the reason stated above, that there are far too many unknowns to make them reliable. We don't know enough to know how inaccurate they are. Secondly, scientists have found fundamental flaws in the way they are created and tested, and thirdly, they are inherently flawed because of their bias toward anthropogenic warming.

The Reality:

Climate modelling is hard, uncertain, and lacks good data. Models are getting better over time, and they may provide some insight into the future. However, they are not yet good enough to validate anthropogenic warming, and they certainly should not be used to direct government policy.

Can CO2 Cause The Warming?

Let's start by listing things that both sides of the debate agree on.

- The Earth is warming.
- CO2 is a greenhouse gas that is responsible for some warming.
- The greenhouse effect is real.

The disagreement between the sides is mostly based on the amount of warming caused by CO2.

Climate realists believe that the current level of CO2 in the air is at a saturation point, and it has caused almost all the warming that it can. Doubling CO2 levels will increase temperatures very little. For this reason, human-caused CO2 can't be responsible for the current warming trend and is certainly not going to cause any significant future warming.

Climate alarmists also seem to accept the saturation principle, but they point out that CO2 does more than just warm because of the greenhouse effect. It also activates so-called feedback loops, which also cause warming. As humans produce more CO2, they are activating these feedback drivers, which in turn cause more warming.

When confronted with the feedback narrative, climate realists argue that most of these feedback mechanisms are negative feedback loops, which cause a cooling effect. Any positive feedback loops have minimal effects on warming because they are overshadowed by the negative ones. Besides, most of these are not well understood and only show positive effects in the climate models, which are themselves incorrect.

There seem to be two important questions that need to be answered before you can discuss the effect of CO2 on global warming.

- Has CO2 reached a saturation level?
- What effect do feedback loops have on warming?

Has CO2 Reached a Saturation Point?

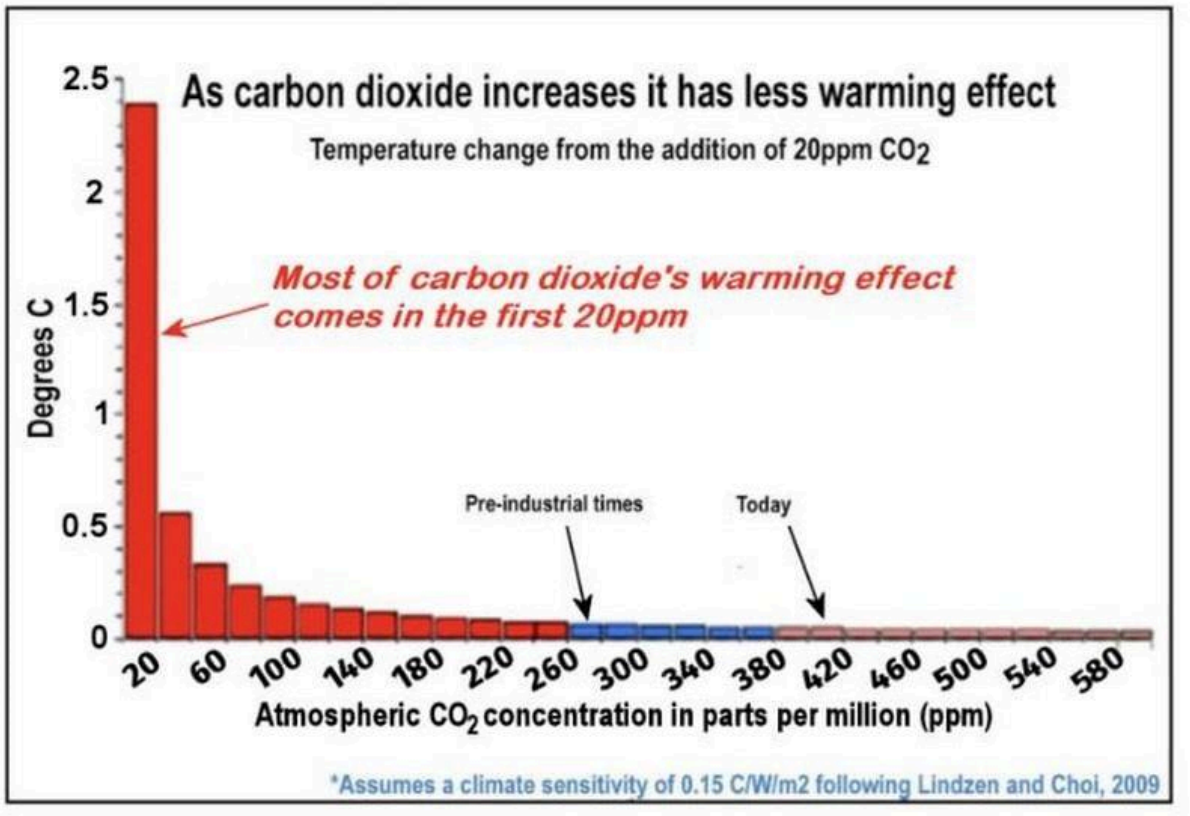
The saturation point has been well documented and published. Much of this work was done by Dr. Will Happer, at Princeton University, and Dr. Richard Lindzen, at MIT, two experts in atmospheric physics.

The chart below summarizes their conclusions about CO2. It does have a warming effect, but as levels rise, the subsequent effect of warming diminishes dramatically. Increases above today's 420 ppm level have almost no effect on warming.

Dr. Will Happer claims that a doubling of atmospheric CO2 would cause a maximum of approximately 1°C of warming. At the current rate of human CO2 production, we won't reach this level until 2100. The link for Dr. Happer explains the physics of this very well.

Climate realists argue that reducing CO2 emissions is pointless since they will have almost no effect on reducing global warming.

It is important to point out that the science behind the saturation claim is not normally in dispute by climate alarmists.



The effect different amounts of CO2 concentrations have on global warming, source: Lindzen and Choi, 2009

The Feedback on Feedback Loops

Feedback loops refer to natural processes that either speed up or slow down an environmental change. A positive feedback loop accelerates the environmental change, and a negative feedback loop slows it down.

An example of a positive feedback loop for CO2 warming is the melting of permafrost. The Earth warms, which causes melting of permafrost, which increases microbial activity in the soil. The microbes produce CO2, which leads to more warming, and the cycle repeats itself.

An example of a negative feedback loop is plant growth. Extra CO2 in the air causes plants to grow better and larger. This consumes more CO2, reducing CO2-caused warming. Plants growing with higher CO2 levels also need less water, which helps explain why the deserts are greening.

It is also interesting that plants growing in higher CO2 levels need to take in less air, so they grow fewer stomata. Fewer stomata result in less water loss. We can even see the difference between today's trees and those collected 150 years ago.

Another common feedback loop deals with clouds. CO2 causes warming, which in turn increases water evaporation on the surface of the Earth. Extra moisture in the air increases cloud cover, which reduces the amount of sunlight reaching the surface of the Earth, leading to cooling. Based on this description, it is a negative feedback loop for warming caused by CO2.

However, climate models used by the IPCC assume that clouds provide a large positive feedback, greatly amplifying the small warming effect of increasing CO2. A detailed analysis of cloud behavior from satellite data by Dr. Roy Spencer of the University of Alabama shows that clouds actually provide a strong
negative feedback, the opposite of what is assumed by the climate modelers.

The paleodata indicates times when CO2 levels were more than 100 times higher than today. And during some of those periods, temperatures were much lower than today. At first glance, this can be taken as evidence that CO2 is not driving warming, but it is important to understand that many other factors affect the climate. Drivers of past climate change include variations in solar output, continental drift, orbital variations (known as Milankovitch cycles), volcanism, and ocean variability.

CO2 might have caused warming, but these other factors caused even more cooling. The key point here is that we don't understand these factors very well.

The interaction between the climate and environment is very complex, and there are many such feedback loops, some negative and some positive. Most are not well understood. You will find people talking about the loops in a general way, as I have done, but I have found no assigned numbers to the effects.

The only place to find numbers for the effects is in the climate models. But the latest science strongly suggests these models may be missing key parameters. For example:

- Plants absorb 31% more CO2 than previously thought.
- Warming oceans should be outgassing CO2 due to warming, but the IPCC insists oceans are absorbing CO2, driven by biological processes and circulation patterns.
- Rivers are emitting old CO2, which can't be distinguished from CO2 created by burning fossil fuels.
- The effect of sun radiation is more extreme than accepted by some scientists.

Climate alarmists are of the opinion that the positive feedback loops are predominant, and they make CO2 warming a lot worse. This is their main way of overcoming the saturation limitation discussed above.

One alarmist made the statement that "We (i.e. humans) are accelerating positive feedback loops. The years 1016, 1019, and 2020 are the warmest on record, and this will lead to more extreme weather events".

The claim that these years are the hottest on record is not correct. Above, I have discussed the Medieval Warm Period, which was even warmer. Secondly, there is no evidence of "extreme weather events", as I documented in my previous post. The evidence for the claim of "accelerating" positive feedback loops in this statement is a guess.

Climate realists claim the opposite; negative feedback loops are more common and keep temperatures low. They also point out that almost every natural event that has been studied is affected mostly by negative feedback loops. The Earth and its climate tend to be stable. It is difficult to change conditions on Earth because of positive feedback loops.

Why would warming by CO2 be any different? No one tries to explain that.

There are other mysteries that we do not understand. To understand these better, watch "*Greatest Mysteries of Climate Change*".

Are Humans Causing Global Warming?

Both sides of the debate agree that the Earth is warming and that humans are contributing to the warming. It is the amount of anthropogenic warming that is in dispute. Climate alarmists claim that it is mostly anthropogenic, while climate realists believe it is only a small amount.

What accepted scientific facts do we have to determine the amount?

The science of greenhouse gases and CO2 saturation seems to be accepted by both camps. Direct anthropogenic warming from CO2 is minimal.

The contribution from CO2 feedback loops is far from settled, with both sides claiming extremes. The problem with feedback loops is that we don't understand them well, and at best, we can estimate them using climate models. These are inaccurate, and therefore, we can not consider them as accepted facts.

Today, the scientific community does not agree on the impact of feedback loops. There is no consensus about the overall effect being negative or positive, nor is there agreement on the magnitude.

I have not found another fact-based reason that determines the extent of anthropogenic warming that is accepted by both sides of the debate.

Based on this limited consensus, we can only conclude that the currently accepted science suggests that