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Anthropogenic Global Warming: A Skeptical Point of View

by Anthony R. Lupo, PhD

There is enough not known and enough incompletely understood complexity in the Earth-Atmosphere system that many scientists count themselves as skeptics regarding humans playing a large role in the current climate change.

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Introduction

It is a misconception that those who consider themselves skeptical of the human contribution to climate change do not believe that the climate is warming, and further, that a skeptical point of view is naïve, dangerous or worse. There is no doubt that the climate is changing today (Figure 1), and that it has changed in the past. There is no doubt even that it is warming as it has been since the mid-1800s. The climate has undergone radical change in Earth's history even before humans arrived on the scene.

Similarly, concern about the human contribution to climate change is not new either. Concern about the human impact on climate and the environment goes back to the beginning of the 20th century and before getting attention primarily from the work and pronouncements from Swedish physicist, Svante Arrhenius. One can find this evidence in more accessible media[1] or the scientific literature itself. [2]

The prevailing wisdom today within the popular media (and indeed among the general public) is that the earth is warming, human activity is the cause, and there is scientific consensus regarding this viewpoint. There is some solid science to support the theory that human induced climate is occurring.[2] However, there is also strong evidence to counter that point of view, or at least to create a healthy skepticism. This article will present research and scientific arguments for the reader to use in assessing the possibility that climate change has a human component, and then, to what degree.

The Rise in Carbon Dioxide and Its Correlation to Surface Temperatures

There is no doubt that today's CO2 amounts are higher than they were even in the mid-20th century (Figure 2). The cycle shown in Figure 2 is simply the annual cycle of atmospheric CO2 which can be linked to the seasonal growth and die-off of land vegetation. Indeed, it can easily be shown that there is a high correlation between these two variables on very long timescales (millennia). [2] The recent documentary, "The Inconvenient Truth," showed this correlation as part of the argument for supporting the view that anthropogenic (mankind caused) warming is real. There is even strong evidence to suggest that we can chemically "fingerprint" atmospheric CO2 and link this with human activities.

However, an examination of Figures 1 and 2 demonstrate that the temperature CO2 correlation is not as strong on

shorter timescales. There is also some scientific debate about whether or not temperature or CO2 leads on the timescale of months and years.[3,4] The argument that temperatures may lead CO2 amounts revolves around the fact that the oceans, under warmer climates, may give off more CO2 after they've warmed.[5]

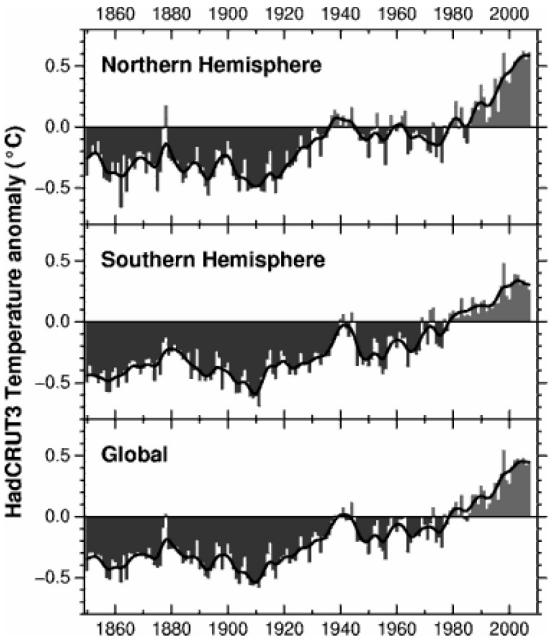

Figure 1
The global temperature trend since about 1860.
Climate Research Unit website at (http://www.cru.uea.ac.uk/cru/info/)

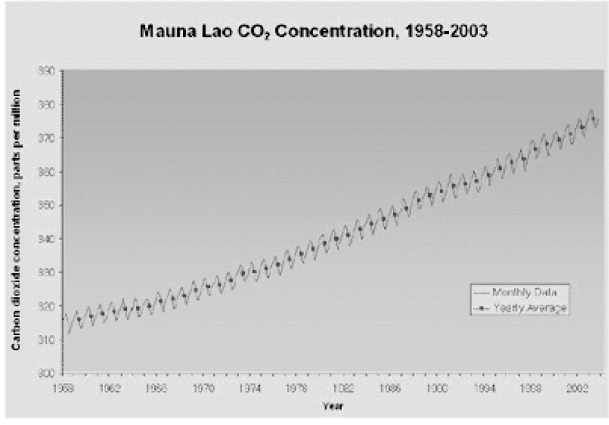

Figure 2
The atmospheric concentration of carbon dioxide from 1958 to 2003.
Courtesy of the National Aeronautic and Space Administration

The Climate System is Not Completely Understood

One of the implications of the anthropogenic climate change paradigm is that we understand how the climate works, or that there is little left to be learned. A second implication is that humans have overwhelmed natural processes. However, the climate system is quite complicated and made up of numerous interlocking subsystems which interact with each other in ways which we sometimes do not fully understand.

For example, there are processes called "feedbacks" which exist in the climate system. These feedbacks, both positive and negative, are processes which arise from non-linear forcing in the climate system, within a sub-system, or occurring at the boundaries (interactions) of each subsystem.[6,7] Some of these are understood, for example we can describe the "ice – albedo feedback". It is well known that ice and snow act to reflect more sunlight off a surface than if it were bare. A weather forecaster knows that snow covered areas will experience colder temperatures during the day due to snow cover. This works the same way in climate, giving rise to the "ice-albedo" feedback. Albedo is simply the percentage of sunlight reflected off a surface.

Some are not as well understood. For example the role of volcanism in the climate system is generally thought to be a negative feedback. The insertion of ash and dust into the atmosphere (especially the upper atmosphere- a portion we call the stratosphere) has consistently led to cooling, the most recent famous example being Mt. Pinatubo in the Philippines.[8] Some eruptions do cause warming, especially if the dust remains low in the atmosphere. Some scientists feel that the lack of recent (150 – 200 years) volcanic activity may be contributing some to the current warming.

In many cases, however, there is considerable uncertainty about whether changes in climate would result in creating or enhancing feedbacks. With some feedbacks or physical mechanisms there is uncertainty as to how they work. The oceans and atmosphere interact with each other in ways we do not completely understand. In fact, there are interactions with the deep oceans that aren't even taken into consideration yet in our climate models. Thus we must make some assumptions as to how they work, and we tend to represent such processes very simply in models.[6] Such simplifications mean our climate models are doomed to a high failure rate.

Climate Models: Do They Predict Doom?

Many supporters of anthropogenic climate change lean on the projections of climate models which demonstrate that the average temperature of the Earth may warm as much as 12 degrees Fahrenheit within the next century.[2] Temperature rises of this magnitude would truly be devastating. Skeptics would be quick to point out that these are the same models that cannot predict the weather three to five days from now. These skeptics are partly right since our climate (and weather forecast) models suffer from the problems (some outlined above) that prevent them

"To capture the public imagination, we have to offer up some scary scenarios, make simplified dramatic statements and little mention of any doubts one might have. Each of us has to decide the right balance between being effective and being honest."

From: "An Inconvenient Book: Real Solutions to the World's Biggest Problems." Quote attributed to: Stephen Schneider, 2007 UN IPCC report author, 1989.

from being 100% effective. [9,10,11]

In order to define what an atmospheric model is and is not, the "scientific method" must be invoked, which is a procedure that should guide good and credible scientific investigation. The method is at least as old as Sir Isaac Newton, and possibly even before him.[12] Thus, a model is simply a tool through which we accomplish this process. In fact, a computer weather or climate model itself is simply a hypothesis on how we feel the atmosphere works.

The real atmosphere is a system that displays "chaotic" tendencies.[10] Model simulations of any system that is considered to be "chaotic" are particularly sensitive to the conditions set for in the simulations. There is even an acronym to describe the situation -- SDIC, for sensitively dependent on the initial conditions. To scientists, that is like a warning label on a medicine to be cautious in how something is used. In the case of climate models, the initial conditions are the data that are used at the start of the model simulation. SDIC means that even two sets of a system's initial conditions that are very similar, or even the same, can evolve along widely divergent paths. Thus, the more model simulations that are used or the longer the time line of the simulation or both occur, the greater the range of results that can be expected.

The upper end of the range in global temperature increases cited above can be quite frightening to think about. Many times, those proponents of global warming will show the more extreme scenarios in the upper part of the range. They do this—as even they will often concede— to provoke people into action.

Even if we concede the point that the current climate change is driven by humans, and we were to believe that the models are reliable, the odds are with the naysayers. Most of the model runs that are used to create the temperature ranges tend to cluster at the lower end of the range (1.0o C – 3o C or 1.8o F – 5.4o F) where there is a slightly greater warming over the next century than has occurred over the last 100 – 120 years. This is a warming we can adapt to.

Natural Cycles and Forcing

Many who are skeptical of global warming point out that natural cycles may be the reason that warming is occurring now. If we accept the premise that we don't understand climate completely, then it is reasonable to assume that we may not understand completely, or even know the role natural cycles are playing in climate change.

Some natural cycles are familiar to the general public and becoming well understood by science. We understand how the El Nino works and its impact on climate [13,14,15] but we don't completely understand what the triggering mechanism is. El Nino and its counterpart La Nina are an atmosphere – ocean interaction which has an impact on Earth's climate on the time-scale of months to years.

There are other cycles which are not known by the public and earth scientists have only a cursory understanding of them and how they work. These are longer term cycles, some of which have been known (The North Atlantic Oscillation), and some of which have been "discovered" within the last decade.[16] These cycles in turn can influence or modulate shorter term cycles such as El Nino. Even if we concede that human induced climate change is occurring, these natural cycles would still exist causing warming and cooling.[17] There would not be a steady warming as depicted by many scientists for the next century.

Many cycles have even longer term impact, such as changes in the strength of ocean currents such as the Gulf Stream. This mechanism can act on the time scales from decades to centuries[2], and is linked to the strength of a mechanism known as the "thermohaline circulation". This is a world-ocean current which is driven by density differences in ocean water (saltier water being denser, thus sinking). The connection of this process to climate is quite complex and also involves many subsystems.

Finally, the impact of solar forcing and solar cycles cannot be ignored. Many papers have shown that there is a strong correlation between processes which cause solar output to change, and the

earth's climate.[18] This connection has not been accepted by all, even though it would seem reasonable that if there are changes in the sun's output, which is responsible for more than 99% of the energy in the Earth-Atmosphere system, that it would impact earth's climate. This is especially true since terrestrial energy budgets are the key to climate changes.[2]

Discussion and Conclusions

In spite of the concern about the possibility that human activity is causing detrimental changes to the earth's climate and environment, there are important reasons to be skeptical. It is often reported that the Intergovernmental Panel on Climate Change (IPCC), which recently shared the Nobel Peace Prize with Albert Gore Jr., is a consensus body. It is reported that all the scientists within this body share the opinion regarding global warming and that there are only a few skeptics left. These skeptics are marginalized as being on the payroll of industry and not being widely published.

However, this is not the case. There is a range of opinion that exists within the IPCC (to their credit), and the real debate among these scientists seems to center around two points: 1) the degree to which human kind is contributing to climate change, and 2) what should be done about this. There are reasons to believe that climate change may still be largely naturally driven and many of these have been investigated here. These include, but are not limited to:

- the continuing debate about the role of carbon dioxide in the carbon cycle,
- the lack of a complete understanding about the workings of earth's climate
- the inability of effectively replicate the climate in models and therefore, predict it's future, and,
- the role of natural cycles and forcing.

There is enough not known and enough incompletely understood complexity in the Earth-Atmosphere system that many scientist count themselves as skeptics regarding humans playing a large role in the current climate change.

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Disclosure

None reported.