

PRELIMINARY DRAFT

The Nature of Arguments for Anthropogenic Global Warming

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"Anthropogenic climate change, driven by emissions of greenhouse gases, is already underway and likely responsible for most of the observed warming over the last 50 years—warming that has produced the highest temperatures in the Northern Hemisphere during at least the past 1000 years."

From letter prepared by The Union of Concerned Scientists (an environmental advocacy group sometimes referred to as The Union of Confused Scientists) and signed by hundreds of scientists, most of whom have absolutely no involvement in the science of climate.

Given, the ever more frantic insistence that doubters must concede that anthropogenic global warming is an established fact with dire consequences, it may be helpful to review what exactly the arguments for global warming amount to. For this purpose, I will initially restrict myself to the issue of global mean temperature. Other issues like alpine glaciers retreating, major ice sheets collapsing, infectious diseases spreading, and polar bears scrambling for ice floats will be considered briefly later, but they are largely devices to promote alarm with little basis in fact, and frequently at odds with the IPCC, itself.

The primary argument for the attribution of recent warming to anthropogenic increases in CO₂ is due to the Hadley Centre, the UK Met Office's climate research group. Their argument is quite simple. It begins with the assumption that their climate model is correct. They then subject their model to forcing by volcanos and solar variations, and find that they can replicate the observed global mean temperature until about 1976¹, but that the increase in global mean temperature of a few tenths of a degree since then could not be reproduced without additional climate forcing. This additional forcing, they assert, is due to man. The argument is based fundamentally on the assertion that the model is correct. The confirmation for this assertion is that the model was capable of replicating earlier changes in global mean temperature in the instrumental record for the period 1880 to 1976. Hence, they are confident that the attribution of the recent warming to man is correct, and that the forecasts for future warming are correct as well. Although this sounds simple enough, the problems with the argument are huge, and leave one without any logical grounds to stand on. The following are the major problems (and all of them have already

¹ Although the Hadley argument pertains to the past 30 years, somehow this got transformed into 50 years in IPCC Summary for Policymakers. The use of the 50 year time frame allows one to clearly distinguish those parroting the Summary from those who read the text.

been noted by the IPCC):

1. Forcing by volcanoes and solar variability are essentially unknown. Hence, the ability to replicate observations prior to about 1976 depends on arbitrary choices which are tantamount to 'tuning.' The claim that models are capable of replicating the past record is really a statement that the models can be adjusted to replicate the record. Even with such adjustments, the models fail to replicate regional changes in climate.

2. Although it is claimed that models cannot replicate global mean surface temperature since about 1976 without additional forcing, it is found that the model response to increasing CO₂ is so sensitive that anthropogenic greenhouse forcing leads to about 3 times as much warming as needed to replicate the data². This presents a political problem. Even if the warming since 1976 were due to greenhouse gas additions to the atmosphere, it suggests relatively low sensitivity. On the other hand, high sensitivity is needed to produce alarming scenarios. Modelers at the Hadley Centre deal with this by replacing anthropogenic greenhouse forcing with just plain anthropogenic forcing which they claim includes aerosols sufficient to cancel two thirds of the anthropogenic greenhouse forcing. However, the community of aerosol scientists maintain that aerosol forcing is thus far unknown. Thus, aerosols too form an arbitrary adjustment designed to bring models and observed global mean temperature into agreement. In order to maintain the politically crucial alarm, it is proposed that aerosols will cease cancelling greenhouse forcing shortly.

3. Finally, in what sense does the fact that a model cannot duplicate a warming of a few tenths of a degree constitute evidence that anthropogenic forcing is necessary? The alternative hypothesis is that the warming is simply natural unforced internal climate variability. It is well known that the climate does indeed fluctuate without any external forcing. There are several reasons for this. At the most fundamental level, the atmosphere and oceans are turbulent fluids, and it is a general property of such fluids that they can fluctuate widely without external forcing. There are moreover specific features of the oceans and atmosphere that lend themselves to such changes. The most obvious is that the oceans are never in equilibrium with the surface. There are exchanges of heat on all time scales between the abyssal oceans and the near surface thermocline region. Such exchanges are involved in phenomena like El Nino and the Pacific Decadal Oscillations, and produce large variable forcing for the atmosphere. In addition, the turbulent motions of the atmosphere randomly deposit heat in locations having varying water vapor and cloudiness (the two main greenhouse substances in the atmosphere) thus potentially leading to

² The fact that models predict that we should already have seen much more warming may come as a surprise to some readers. It should not. A doubling of CO₂ would give rise to a climate forcing of about 3.5 Watts per Square Meter. Interestingly, the anthropogenic greenhouse forcing at the moment is about three quarters of this. About 1.5 Watts per Square Meter comes from CO₂ while the remainder comes from methane and other gases. Note that the impact of CO₂ per unit CO₂ goes down as CO₂ increases. The impact goes logarithmically rather than linearly with the amount of CO₂.

fluctuations in global mean temperature. In general, models simulate such phenomena rather poorly. Thus, it should be no surprise that they might fail to replicate a natural cause for recent warming, and this constitutes no meaningful demand for anthropogenic forcing. How do modelers deal with this logical problem? In general, the response consists in the embarrassing assertion that they cannot think of any alternative to anthropogenic forcing. Alan Thorpe, head of NERC, the main UK funding agency for climate research, defended this position as follows:

"The size of the recently observed global warming, over a few decades, is significantly greater than the natural variations in long simulations with climate models (if carbon dioxide is kept at pre-industrial levels). Only if the human input of greenhouse gases is included does the simulated climate agree with what has been recently observed. Measurements prior to the modern instrumented record are probably insufficiently frequent and detailed to say whether such a global warming over a few decades has occurred before. However in any case, the real issue is whether human activity is causing the current warming because, if so, then we are able to do something about it.

Climate models attempt to include all the natural factors that might lead to significant climate variations on the time scales of interest, i.e. years to decades to centuries. Clearly factors currently unknown to science can't be included, but we have no reason to suppose they exist."

The issue is thus reduced to essentially religious faith. It is no accident that various agencies refer to the fact that scientists *believe* that recent warming is due to man. Thorpe's defense is interesting on, at least one other ground. Note his last sentence. In point of fact, there appear to have been numerous occasions in the past of significant climate change occurring without anthropogenic or any other known external forcing. Most notable was the so-called medieval optimum. As late as the first IPCC Scientific Assessment, the climate community was in general agreement that the middle ages were characterized by significantly warmer temperatures than we currently have. Thus, there did indeed exist factors unknown to modelers that had led to substantial warming in the absence of human contributions. What was done about this inconvenient truth? As David Deming, a paleoclimatologist, noted, the word went out that one had to get rid of the medieval warm period. Sure enough, in a notorious paper by Mann et al, a few handfuls of proxy data (primarily from tree rings) were used to assert that there had been no medieval warm period. This paper served as the key result for the Third Assessment of the IPCC, and was the basis for the oft-repeated claim that current global mean temperatures were unprecedented for the last 1000 years. To be sure, this claim did nothing to change the fact that observed warming was much less than models predicted we should be seeing. However, it did eliminate the inconvenient fact that models were incapable of replicating past warming, and permitted defenders of climate attribution to continue to claim that unknown causes were 'unlikely to exist.' Unfortunately, as noted in two extensive reviews of the Mann et al work, the methodology was severely flawed and would produce similar results from random inputs. Under the circumstances, Thorpe's claim is unsustainable, and the basis for attribution disappears. It should be noted that one of the reviews was by the NRC. Although the text of the review was

clear on this matter, the front end was intentionally misleading. This practice of attaching misleading front ends to otherwise reasonable documents is ubiquitous in climate science.

In point of fact, Mann's claims could have been dismissed on simpler grounds. Even if their methodology had been reasonable, it would nonetheless have required the regression of the small number of proxy records on the present climate. In order for such regressions to be valid tools for estimating past Northern Hemisphere temperature, it would have been necessary for the geographic pattern of temperature change to have been invariant. Now, the documentation of the Medieval Warm Period for Europe and the North Atlantic is pretty solid. Mann et al, however, argued that this was a local climate change and not characteristic of the whole Northern Hemisphere. For this to have been the case, the geographic pattern of temperature change would have to have changed. Such a change, itself, is sufficient to invalidate the analysis. Unfortunately, logic has ceased to be a significant factor in the so-called climate debate; neither is data integrity. In normative science, there ought to be healthy conflict between observations and calculations. In climate science, one sees a remarkable attempt to bring data into agreement with model calculations.

A particularly illustrative example is the matter of atmospheric as opposed to surface temperature change. Few issues better illustrate the exploitation of widespread ignorance, and the avoidance of basic physical questions. Beginning in 1979, atmospheric temperatures were measured by microwave sensors on NOAA satellites. In contrast to surface temperature data, these atmospheric measurements failed to show warming. Immense pressure arose (sometimes explicitly from Al Gore) to 'correct' the atmospheric data. This is a much easier task than one might suppose. All data analyses have errors. The basic assumption is that these errors are accidental and hence likely to be random. If, in searching for genuine errors, one selectively chooses only those that change results in one direction, one relinquishes any claim that the remaining errors are random³. Rather, one has introduced a bias into the analysis. Thus, a recent review of the temperature situation by an NRC panel, now found that the satellite data could be

³ The business of inadvertent bias is both obvious and extremely difficult to deal with.

Consider a difficult measurement: for example, equatorial sea surface temperatures during the last glacial maximum. A program called CLIMAP determined some 20 years ago that these temperatures were indistinguishable from today's. At the same time, it was the practice of the modeling community to assume that glacial maximum was due to reduced CO₂, and they concluded that equatorial sea surface temperatures should have been considerably colder than those at present. As I have noted, all measurements involve errors (errors in actual measurements, errors in sampling, errors in assumptions underlying measurement techniques, etc.) An implicit assumption in such situations is that the errors – even if unknown – are random so that we can hope that they will largely cancel out. Let us imagine that we have all these errors in a box. We take out each error and examine it to see if it will help reconcile the models with the observations by decreasing the estimate of equatorial sea surface temperature. If it does, we apply the correction; if not we throw it back in the box. At the end of the process, the observations agree with the model, and the errors that were corrected were genuine errors that were genuinely corrected, but it is pretty safe to assume that the errors remaining in the box are no longer random, and that applying them will lead to increasing equatorial sea surface temperatures and increased differences between models and observations. The difficulty with the situation in reality is that the errors are often unknown at first, and so any error identified has a legitimate claim to be corrected. However, the fact that in climate science, such corrections inevitably lead to reconciliation of observations with the models leads one to strongly suspect bias. Demonstrating such bias is, nonetheless, difficult unless one has the expertise and resources to search for and examine other sources of error.

made to show some warming. This, it was asserted, meant that there was no fundamental discrepancy with surface thermometric records. However, despite the bias that was likely introduced into the ‘corrections,’ the resulting analysis still actually failed to address the science. The scientific question was not whether there was warming in the atmosphere, but rather whether there was more warming in the atmosphere than at the surface as required by both greenhouse theory and modeling results – especially in the tropics. This was not found – even with the biased corrections. This result further contradicts the attempt to attribute surface warming over the past thirty years or so to greenhouse gas emissions. The confusion between well focused scientific questions and the mere citation of the sign of a trend is typical of the dumbing down of the public discourse.

Befuddling the public has become a primary activity of warming enthusiasts. Thus, when trends are absent, one speaks of record breaking years. For example, there has been no significant trend in global mean temperature for almost ten years. However, we have been at a high value for globally averaged surface temperature since about 1997. Thus, the normal year-to-year fluctuations in temperature are expected to produce record breakers. This has nothing to do with trends. Indeed, the absence of a sequence of record breaking years since 1998 argues strongly against the existence of any trend during this period. Even with trends, the fact that such quantities as global mean temperature and total land ice are always changing, gives rise to emphases on which direction any of these quantities is going at any given moment. However, in science this is not, in general, the issue. Rather we are interested in the magnitude of the trend and whether it is larger or smaller than natural fluctuations and, most important, how observed trends compare to alarming forecasts. Moreover, climatically relevant trends can only be determined over long periods – typically 100 years or more.

As in any issue dominated by propaganda, there is a focus on ‘show stoppers.’ Here, changes in global mean temperature of a few tenths of a degree tend to lack caché. Retreating alpine glaciers, starving polar bears, hugely rising sea levels, invasions of infectious disease, even when false or irrelevant to global warming, are obviously more impressive and more telegenic. There is nonetheless something profoundly pathetic about some politician or movie star being flown to a remote location in order to witness a retreating glacier (even when that glacier may have been retreating since the early 19th century or when a few miles away there is another advancing glacier, or when the retreating glacier is associated with decreasing rather than increasing temperatures), and proclaiming to the world that they have seen ‘global warming’ with their own eyes. Just for the record, polar bear populations have been increasing for decades – largely because of curbs on hunting. Malaria is still found in Siberia and was once common throughout the US; it is a disease more associated with poverty than with climate. Alpine glaciers have been retreating since the beginning of the 19th century, though since 1970 they are advancing again in some parts of the world. The earths major ice sheets, Greenland and Antarctica are in near balance between accumulation at their centers and ablation at their edges. The net impact on sea level is anticipated to be no more than millimeters per century. One could go on at length, but the point is simply that the earth is a very dynamic planet, and its dynamism has little to do with man. Clinging to alarmist scenarios for which there is no evidence, is simply exploitation of public gullibility.