SYSTEMATIC AND LOGICAL PROBLEMS IN GLOBAL WARMING SCIENCE

by

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ABSTRACT
Arguments put forth in favor of anthropogenic global warming (AGW) are frequently lacking in objectivity due to the use of imprecise terms and unwarranted extrapolations. A salient characteristic of such arguments is, moreover, the seemingly arbitrary attribution of causes to certain phenomena [Singer, 2012a]. As a result, such arguments run counter to the reasoning that is a hallmark of the scientific method. The purpose of this paper is to reason about some of those erroneous arguments in order to better inform people about pitfalls from a misuse of the scientific method in arguments about AGW.

In a time when many scientists, scientific organizations, and educators have apparently been compromising their honesty and their integrity [Ball 2014a], S. Fred Singer stands out: As a rallying point for those who haven’t compromised, as a trusted source seeking the truth, and as a beacon for those who seek moral support to carry on the grand tradition of science. It is my pleasure to dedicate this essay to Fred (a scientist for all seasons), with gratitude and admiration, on his 90th birthday.

1. INTRODUCTION
From the major news media one may hear remarks such as the following: “The Earth’s surface temperature is increasing dangerously! Rising sea levels could flood cities! The severity of storms is intensifying! Glaciers are melting at an unprecedented rate! Polar bears are threatened! And human beings are to blame because of their activities which emit significant amounts of greenhouse gases, consisting primarily of carbon dioxide.” Such alarming claims are similar to the ones also being propagated by various scientists, by educators, by politicians, and in movies. Some people believe those scenarios — characterizing what is known as “anthropogenic global warming/climate change” (AGW) — to be true.

There are a variety of explanations for why they believe in AGW and why they believe it is dangerous. One reason is the pervasive repetition of the AGW-catastrophe message by those who seem not to have taken the trouble to investigate the issue more
carefully. But the deeper question (yet not one investigated here, though worth bearing in mind) of why some people persist in believing in AGW, would probably involve an explanation involving both psychological and sociological aspects. Here is an example from a classic work in social psychology explaining why it is often difficult to change a person’s conviction:

A man with a conviction is a hard man to change. Tell him you disagree and he turns away. Show him facts or figures and he questions your sources. Appeal to logic and he fails to see your point.

We are familiar with the variety of ingenious defenses with which people protect their convictions, managing to keep them unscathed through the most devastating attacks.

... Suppose an individual believes something with his whole heart; suppose further that he has a commitment to this belief, that he has taken irrevocable actions because of it; finally, suppose that he is presented with evidence, unequivocal and undeniable evidence, that his belief is wrong: what will happen? The individual will frequently emerge, not only unshaken, but even more convinced of the truth of his beliefs than ever before. Indeed, he may even show a new fervor about convincing and converting other people to his view. [Festinger et al, 1956]

On the educational level, here is an illustration of one of the problems with the current system in so far as it promotes AGW alarmism. In a recent book by professor Thomas Easton (Thomas College, Maine) one learns that “Members of the Academic Advisory Board are instrumental in the final selection of articles for each edition of TAKING SIDES.” [Easton, 2013]. Based on this seemingly unbiased approach to selecting the articles and also because the book was in its 15th edition, I ordered it for possible use in my course which would employ critical thinking about AGW. But his Introduction is primarily devoted to explaining what he claims are past, present, and possible future environmental disasters caused by humans. For example, he believes that “perhaps worst of all those on low-lying South Pacific islands, which are expecting to be wholly inundated by rising seas” [Easton, 2013, p. xxxii]. He seems to be unaware of any evidence which contradicts his belief; such as that given by Nils-Axel Mörner, distinguished researcher in paleogeophysics and geodynamics who is also an expert on sea levels [Mörner, 2011a]. And Easton also seems to be unaware of the fact that his concern has already been addressed by Mörner. [Mörner, 2011b]

In fact, there are few college courses that take a critical approach to examining the claims of anthropogenic global warming/climate change (AGW). This is partly due to the chilling intellectual climate surrounding those who would dare to express views critical of AGW through the press [Armstrong, 2013] or through scientific channels [Ball, 2014b].

It would serve students well if all members of the academic community would encourage open discussion on all issues, as has the president of my university [Harrison, 2010], while being particularly sensitive to any attempts at censorship. In
particular, there should be no censoring of those who critique the claims of AGW. As one prominent researcher in climate science writes [Pielke, Jr., 2008]:

“More specific to academia, in 1975 Yale University published a report on freedom of expression which was adopted as formal university policy and is often referred to as a authoritative statement in support of freedom of expression. Here is an excerpt of some of its eloquent and forceful prose (emphases added):

The primary function of a university is to discover and disseminate knowledge by means of research and teaching. To fulfill this function a free interchange of ideas is necessary not only within its walls but with the world beyond as well. It follows that the university must do everything possible to ensure within it the fullest degree of intellectual freedom. The history of intellectual growth and discovery clearly demonstrates the need for unfettered freedom, the right to think the unthinkable, discuss the unmentionable, and challenge the unchallengeable. To curtail free expression strikes twice at intellectual freedom, for whoever deprives another of the right to state unpopular views necessarily also deprives others of the right to listen to those views.”

In order to raise awareness of the educational possibilities for countering the incessant drumbeat of AGW alarmism I offer the following commentary, stimulated by the insightful work done over the years by Fred Singer.

2. CLARIFYING LANGUAGE WITH REGARD TO AGW

In today’s politicized science “global warming” and “climate change” [DEFRA, 2009] appear to serve, primarily, as code words which at least implicitly refer to anthropogenic events. Such code words appear to have co-opted the normal meaning of those terms; a meaning which refers to both “natural” and anthropogenerated change. The effect of this is to, gradually, have the average person thinking of global warming and climate change as only human-caused.

So now, whenever one refers to those terms, it is worthwhile making a clear distinction between “anthropogenic global warming”/“anthropogenic climate change” and “natural global warming”/“natural climate change”. And if someone refers to “global warming”/“climate change” it is preferable to immediately try to request a clarification: “Do you mean anthropogenic global warming/anthropogenic climate change or do you mean natural global warming/natural climate change?” That sets the stage for continuing an honest conversation.

A similar course of action is suggested with regard to the term “carbon pollution” because it is not carbon but carbon dioxide that has been the issue with regard to AGW. Carbon dioxide is not necessarily a pollutant (an emission that causes harm to human health and welfare) in the context of AGW discussions: It is a colorless, odorless, gas that promotes the growth of plants and thereby aids in providing food for all; the resultant increase in supply lowers prices, which is clearly important to those on the financial margin. So in conversations, for example, one might immediately try
to request a clarification: “Do you mean carbon or do you mean carbon dioxide?” This also sets the stage for continuing an honest conversation.

3. “SCIENCE” IN THE CONTEXT OF AGW

Although the word “science” continues to be frequently used with regard to AGW, it is not clear what people mean by the word, nor is it clear that they even mean the same thing. Reports about AGW might include phrases like: “Scientists agree that… “, or “Scientific studies have shown… “, or “There is a scientific consensus… “, or “The science is settled.” But if a person does not know the meaning of “science” they would generally not know how to distinguish science-based statements from those that are, say, pseudo-science-based.

Here is a possible definition of science that appears to capture what is usually known and believed as a result of studying what is normally called the scientific enterprise:

Science can be defined … as a rational and systematic study of the natural world with the objective of formulating general laws or theories. Rational means “based on reason,” which is the use of logic in conjunction with the evidence of the senses. Today, the term science (scientia is a Latin word for “knowledge”) usually refers to what we call the “natural sciences” (such as physics and chemistry) and the “life sciences” (such as biology and zoology), although the term was once more generally employed. For example, Aristotle (384–322 BCE) includes metaphysics, a branch of philosophy, as a science. [Gould, 2007, p. 82]

Science is a search for causal explanations of natural events (even in classical statistical theories and in quantum theories). It is a search for why things are the way they are and act the way they do.

3.1 Normative modes of science

Truth and falsehood in science are often not clearly defined. There are various theories of truth, such as the correspondence theory, the coherence theory, and the pragmatic theory (“what ‘works’”). [Hospers, 1967, pp. 115-118] So I will take definitions that I think are used in science:

TRUE — “When a sentence is used to report a state-of-affairs, and the state-of-affairs the sentence is used to report is actual, then the proposition that the sentence expresses is true.” [e.g., “A stone released from my hand, under normal conditions, will fall.”]

FALSE — “By contrast, a false proposition reports a state-of-affairs that does not occur ….” [e.g., “A stone released from my hand, under normal conditions, will turn into a rose bush.”] [Hospers, 1967, p. 115]

There is also a lack of clarity with regard to “models” in science. The types of models relevant here are theoretical models and mathematical models.
Theoretical models… are used in an attempt to explain or account for observed phenomena by creating a conceptual or hypothetical mechanism or process.

... 

Mathematical models… may be closely related to a theoretical model[s]. … [and] attempt to represent reality, or aspects of reality, by using mathematical concepts, symbols, and relations.

... 

In general, a model is judged by how well it accomplishes the task for which it was intended. If it was designed to explain, then it should provide an acceptable description of the observed phenomena.

[Maki and Thompson, 2006, pp. 1-3]

The last point may be contrasted with pseudo-models: ones that are designed to fit reality by changing parameter values when the model’s output does not accurately describe observed phenomena — in order to obtain a desired output. The *ad hoc* addition of sulphate cooling in climate models, required to keep them from calculating too much warming, is a typical example. The radiational effects of these aerosols are simply not known with any precision, so any value can be selected (within a large range) that improves model fit.

In contrast, a model from early 20th century physics demonstrates how models should work. The Lorentz (“plum pudding”) model of the atom was the dominant one. However, the *predictions* of that model of the atom were contradicted by the Rutherford, Marsden, Geiger scattering experiments of alpha particles (which are helium nuclei) sent through gold foil — for the alphas did *not* go through the foil as the Lorentz model predicted. As a consequence of this (and, of course, other) experiments the “plum pudding” model of the atom (which postulated a smear of positive charge in which are imbedded electrons, like plums in a pudding) were replaced by the Rutherford (or “planetary”) model of the atom (which hypothesized that the atom consists of a small region of positive charge around which revolve the electrons, like planets going around the sun).

Although the Lorentz model was (and is) fundamentally *false* the model had value because some of its predictions did agree with experimental results. So, before the Rutherford scattering experiments, it was perfectly *rational* to believe in the Lorentz model of the atom. After the Rutherford scattering experiments it was *irrational* to believe the Lorentz model as fundamentally correct.

The principle of logic, applicable to models, is of the form:

*If A is true then C is true.*
*C is false.*
*Therefore, A is false.*

The principle of logic is known as *modus tollens* [Kelley, 1990, p. 225]. That principle of logic is also a *cardinal* principle in the scientific method, of the form:
If A is true then C is true.
As evidence shows, C is false.
Therefore, A is false.

Thus —

If the Lorentz model of the atom is true then the alphas should go through the foil as the Lorentz model predicted.
As evidence shows, the alphas did not go through the foil as the Lorentz model predicted.
Therefore, the Lorentz model of the atom is false.

A similar situation occurs for Newton’s “2nd Law of Motion” and combined with his “Universal Law of Gravitation”. They have wide agreement with the evidence at some level of accuracy (note the caveat), such as predicting (given initial conditions) the trajectory of a batted ball, or of a satellite sent into orbit around the Earth, or of a space probe sent to the Moon. Indeed (being cognizant of the caveat) we still have good reason to teach them and use them widely today. However (beside fundamental conceptual problems in their theoretical foundations) they are false because their predictions of what should be observed are contradicted by what is observed (e.g., objects cannot be accelerated up to the speed of light). Different theoretical starting points resulted in the principles of Einstein’s “Special Theory of Relativity” (to which Newton’s “2nd Law of Motion” is an approximation) and Einstein’s “General Theory of Relativity” (to which Newton’s “Universal Law of Gravitation” is an approximation). [Einstein, 1931; Misner et al., 1973]

There are many examples from AGW where one can see the apparently arbitrary attribution of a cause, “global warming/climate change”, to a phenomenon, “warming”; and that occurs not only in the popular press but in some scientific reports as well. This leads into what is, in my considered opinion, the most widespread fallacy used in AGW.

The error of logic is known as the fallacy of affirming the consequent. The fallacy is of the form —

If A is true then C is true. [C is referred to as the “consequent” and A as the “antecedent”]
C is true.
Therefore, A is true

It looks a bit like modus tollens but, in the last two statements of modus tollens, the words “false” have been replaced by “true”; turning a valid argument into an invalid argument.

When applied to the scientific method the fallacy would have the form —
If A is true then C is true.
As evidence shows, C is true.
Therefore, A is true.

A simple example is:

If it rained on my street then my street would be wet.
As evidence shows, my street is wet.
Therefore, it rained on my street.

A moment’s reflection is all it takes to realize that there can be other causes for the streets being wet. It could have snowed, or street-cleaning trucks could have been spraying water.

A general discussion of the fallacy is given in books on logic or philosophy. Here is one description (footnote numbers are omitted) —

… to show that the facts agree with the consequences of the hypothesis is not to prove it true. To show that is often called verification [his emphasis followed by a lengthy footnote]; and to mistake verification for proof is to commit the fallacy of [affirming] the consequent, the fallacy of thinking that, because if the hypothesis were true, certain facts would follow, therefore, since those facts are found, the hypothesis is true. … A theory whose consequences conflict with the facts cannot be true; but so long as there may be more theories than one giving the same consequences, the agreement of the facts with one of them furnishes no ground for choosing between it and the others. Nevertheless in practice we often have to be content with verification; or to take our inability to find any other equally satisfactory theory as equivalent to there being none other. [Joseph, 1916, p. 523]

Please note that a scientific hypothesis or theory is, strictly speaking, said to be “verified” rather than to be “true” if the latter means “cannot be changed in light of more knowledge.” That is so even though many would refer to theories that have been successful as “true”; e.g., Einstein’s Special Theory of Relativity is often said to be true because it is successful. However, if, say, Newton’s theory of motion had been referred to as “true” (before Einstein came on the scene) because it was successful then one would have a contradiction because Einstein’s theory of motion has a theoretical base which is in contradiction with that of Newton. But that doesn’t mean Newton’s theory is now false; it means that it never was true.

The fallacy of affirming the consequent is a tricky issue for the scientific method, particularly if one has a rather lengthy or convoluted or seemingly silly hypothesis. Thus —

If gravity gremlins exist then they would be the cause of the falling of objects.
As evidence shows, when I let go of an object it falls.
Therefore, there are gravity gremlins.
Let us say that someone is investigating how a dropped object, such as a stone, falls to the ground. Observations show that as the stone falls, its speed increases. We could claim that it does so because there exist invisible “gravity gremlins.” One gremlin standing on the ground has another gremlin standing on its shoulders, which in turn has a gremlin standing on its shoulders, and so on, all the way up to the top gremlin who has grabbed the stone that was just released. The grabbed stone is then passed down the line of gremlins in such a way that as it gets closer to the ground, the gremlins pass the stone along faster and faster.

But this is not a rational explanation, for several reasons. (1) No argument is given for why the invisible source has to be gremlins. It could as well be angels, or the ghosts of all scientists who died within the last 2,000 years. (2) There is no description of how the stone speeds up. For example, when the stone is halfway to the ground, is it going half as fast as when it is just about to strike the ground? (3) There is no explanation of why gremlins work faster when they are closer to the ground. (4) There is no explanation of why a stone takes longer to reach the ground when it is released at a greater height.

On the other hand, with a high degree of accuracy, Newton’s Second Law of Motion, in conjunction with his Universal Law of Gravitation, can account for the various aspects of a stone’s motion when it is released. The Newtonian predictions have been confirmed in countless experiments. They are not held to be true based on faith, as would be the case if someone were to claim: “I believe in the sanctity of Newton’s laws as the only laws governing the physical world.” [Gould, 2007, pp. 85-86]

For many AGW arguments the facts are often clear. But facts, per se, do not count as evidence. As a result one has an apparently widespread use of the fallacy of affirming the consequent in accepting the AGW theory (if there is one) as verified.

Some examples of the fallacy have been indicated at the beginning of the Introduction. Here is another mention of such (supposed) calamities but looked at through the scientific eye of Fred Singer. Notice the implicit use of the fallacy and his arguments against the facts being interpreted as evidence [Singer, 2012b):

“Glaciers are melting, sea ice is shrinking, storms are increasing, droughts and floods are increasing.” Even if any of these were true, they don’t reveal the cause and certainly cannot furnish temperature data like thermometers.

“Sea levels are rising.” But they have been rising for 18,000 years, and there is no evidence that the current rate of rise is affected by temperature; 20th-century data show no acceleration.

For many examples of the fallacy run rampant, see the 600+ links on the page titled “Everything is Caused by Global Warming” [Brignell, 2007]

4. DO CLIMATE MODELS CONSTITUTE “TRUTH”?
With regard to General Circulation Models (GCMs) of climate, important predictions are clearly contradicted by the observations (e.g., satellite and radiosonde
measurements) as well as by the observations that there is — in contradiction to the predictions of the supposed theory on which the models are based — no “hot spot” at around 300 hPa (corresponding to a height where there is about a third of normal atmospheric pressure) in the tropical troposphere between about –20 and +20 degrees latitude (Singer, 2011). In the GCMs, there were certain predictions for how the climate would behave under an increase of greenhouse gases, primarily CO2. The predictions were contradicted by the observations.

And there is a continuing divergence between the predictions by GCMs and the observations (Fig. 1).

The form here is (*modus tollens*):

*If AGW models are true then certain observations predicted from AGW models should be found.*

*As evidence shows, those observations predicted from AGW models are contradicted by what is found.*

*Therefore, AGW models are false.*
Moreover, as noted by Howard Hayden (Singer, 2014):

“If the science were as certain as climate activists pretend, then there would be precisely one climate model, and it would be in agreement with measured data. As it happens, climate modelers have constructed literally dozens of climate models. What they all have in common is a failure to represent reality, and a failure to agree with the other models. As the models have increasingly diverged from the data, the climate clique have nevertheless grown increasingly confident — from cocky in 2001 (66% certainty in IPCC’s Third Assessment Report) to downright arrogant in 2013 (95% certainty in the Fifth Assessment Report).”

5. ACKNOWLEDGEMENT OF MODEL FAILURE

In science (as elsewhere) we need to acknowledge error. It is important for a scientist to check on work done in order find out whether or not their own work is confirmed and thus gain insights into new directions. Hence a scientist should not fail to cite valid contradictory views. Here is the issue as explained in more general terms by Richard Feynman in his 1974 Caltech commencement address. When talking about a “feature that is missing from Cargo Cult Science” he refers to the idea of

...a kind of scientific integrity [my stress], a principle of scientific thought that corresponds to a kind of utter honesty [my stress]—a kind of leaning over backwards. For example, if you’re doing an experiment, you should report everything that you think might make it invalid—not only what you think is right about it: other causes that could possibly explain your results; and things you thought of that you’ve eliminated by some other experiment, and how they worked—to make sure the other fellow can tell they have been eliminated. Details that could throw doubt on your interpretation must be given, if you know them. You must do the best you can—if you know anything at all wrong, or possibly wrong—to explain it. If you make a theory, for example, and advertise it, or put it out, then you must also put down all the facts that disagree with it, as well as those that agree with it. [Feynman, 1974]

...the IPCC makes the extraordinary claim that this difference, between the models without greenhouse gases and the observations, must be due to anthropogenic effects of greenhouse gases. Mind you, they have ignored everything else. They have ignored the effects of solar activity. They ignored the effects of cosmic rays. They’ve ignored the work of Svensmark in Denmark.
They’ve ignored the work of Vahrenholt and Lüning. They’ve ignored everything. They just make the bold claim, that this difference [points to graph] must be due — must be due — to anthropogenic greenhouse gases. And that is the evidence — that is all the evidence — that they bring forth to support their summary statement in the Summary of the report. [Singer, 2012c]

Notice that his criticism is so severe because (I guess) — as a person who has been doing normal science for most of his life — it is unconscionable that the IPCC ignored other explanations for the observations (effectively going against what Feynmann says should be a salient characteristic of good scientists). Dr. Singer is rejecting a particularly virulent application of the fallacy of affirming the consequent —

*If* there are anthropogenic effects of greenhouse gases *then* the observed temperatures will occur.  
The observed temperatures *do* occur.  
*Therefore*, the cause of those observed temperatures *are* the anthropogenic effects of greenhouse gases.

For such arguments one philosopher of a text on reasoning wrote, “Affirming the consequent... is the most common error in reasoning about explanations. We all want things to make sense, and it’s all too easy to accept the first plausible explanation we find.” [Kelley, 1990, p. 495] However, “to accept the first plausible explanation” is especially not a correct way of proceeding for a scientist.

6. CONCLUSION
The preceding remarks explained some of methods that have been used in arguing about AGW and where problems can occur. The remarks, it should be noted, include only a small sample of how the IPCC has distorted the science of climate change.

Although the IPCC claims to be unbiased and to have based its assessment on the best available science, we have found this to not be the case. In many instances conclusions have been seriously exaggerated, relevant facts have been distorted, and key scientific studies have been ignored.  
A careful reading of the chapters below [i.e., following the Preface] reveals thousands of peer-reviewed scientific journal articles that do not support, and indeed often contradict, the IPCC’s alarmist perspective on climate change. … 
Either the IPCC purposely ignores these articles because they run counter to their predetermined thesis that man is causing a climatic crisis, or the IPCC’s authors are incompetent and failed to conduct a proper scientific investigation. Either way, the IPCC is misleading the scientific community, policymakers, and the general public by telling only half the story about the science of climate change. [NIPCC, 2013, Preface]

The science of climate change — *real* climate change — has been seriously distorted. The distortion has been (and continues to be) subtle. Yet as time passes
more and more of the details of the distortion are becoming exposed. But such exposure will not repair the damage that has been done to the practice of science, to the environment, and to people’s lives. Nor will such exposure regain the public’s trust:

Where scientific enquiry is stunted the intellectual life of the nation dries up, which means the withering of many possibilities of future development. This is what we have to prevent.


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