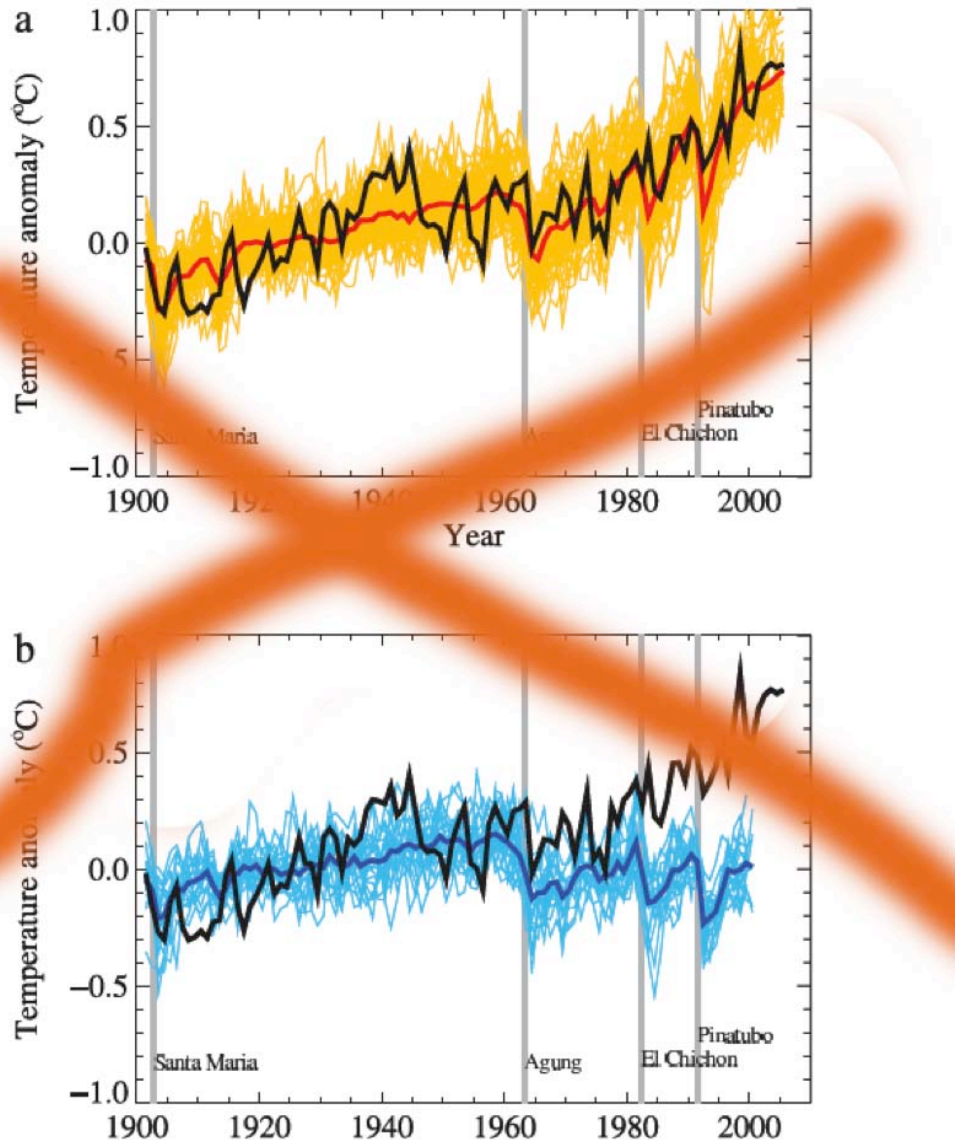

Figure 9.5. *Comparison between global mean surface temperature anomalies (°C) from observations (black) and AOGCM simulations forced with (a) both anthropogenic and natural forcings and (b) natural forcings only. All data are shown as global mean temperature anomalies relative to the period 1901 to 1950, as observed (black, Hadley Centre/Climatic Research Unit gridded surface temperature data set (HadCRUT3); Brohan et al., 2006) and, in (a) as obtained from 58 simulations produced by 14 models with both anthropogenic and natural forcings. The multimodel ensemble mean is shown as a thick red curve and individual simulations are shown as thin yellow curves. Vertical grey lines indicate the timing of major volcanic events. Those simulations that ended before 2005 were extended to 2005 by using the first few years of the IPCC Special Report on Emission Scenarios (SRES) A1B scenario simulations that continued from the respective 20th-century simulations, where available. The simulated global mean temperature anomalies in (b) are from 19 simulations produced by five models with natural forcings only. The multi-model ensemble mean is shown as a thick blue curve and individual simulations are shown as thin blue curves. Simulations are selected that do not exhibit excessive drift in their control simulations (no more than 0.2°C per century). Each simulation was sampled so that coverage corresponds to that of the observations. Further details of the models included and the methodology for producing this figure are given in the Supplementary Material, Appendix 9.C. After Stott et al. (2006b).*

If you point out to them that they've been fooled. They just gave their savings to someone who's a swamp real estate artist. They do not thank you for pointing it out. They are much more likely to blame you than the person who has just defrauded them or deceived them. Why? Because, they do not like to be told that they are gullible. People like to think they are smart and wised up.

Christopher Hitchens on living vicariously by supporting good causes[1].

It is not possible to engage in rational discussion with irrational beliefs. It is also not possible to engage in rational discussion with those whose interest in the global warming bandwagon is as a way to make money or build a career.

Prof. Jonathan Katz (Washington University)[2]

Worse Than the Hockey Stick

By Norm Rogers

This article is about one illustration in a 1000 page report produced by the Intergovernmental Panel on Climate Change. By examining how that illustration was created I hope to convince the reader that there is a lack of scientific substance and scientific honesty in the global warming movement.

What are are real scientists like as opposed to the idealized Hollywood image? The Hollywood scientist is intellectually rigorous and idealistically honest. Hollywood has also given us the mad scientist and a disproportionate number of Hollywood scientists are attractive young women. Real scientists may be crafty bureaucrats or green ideologues. Real scientists aren't indifferent to worldly goals. Typically they exaggerate the worth and reliability of their research, a normal human failing, but also useful for gaining support for their research. My point is that just because a scientist or a group of scientists say that it's so doesn't make it so.

The science behind global warming is basically a messy house of cards. The science is stuck because understanding the earth's climate just happens to be a hard problem. But scientists must publish or perish so they come up with results even if those results are unimportant or dubious. If their results predict a potential disaster that's a lot more interesting than adding another decimal point to some measurement.

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[1] Conversatons with History: Christopher Hitchens. University of California Television on Youtube at 34 minutes.

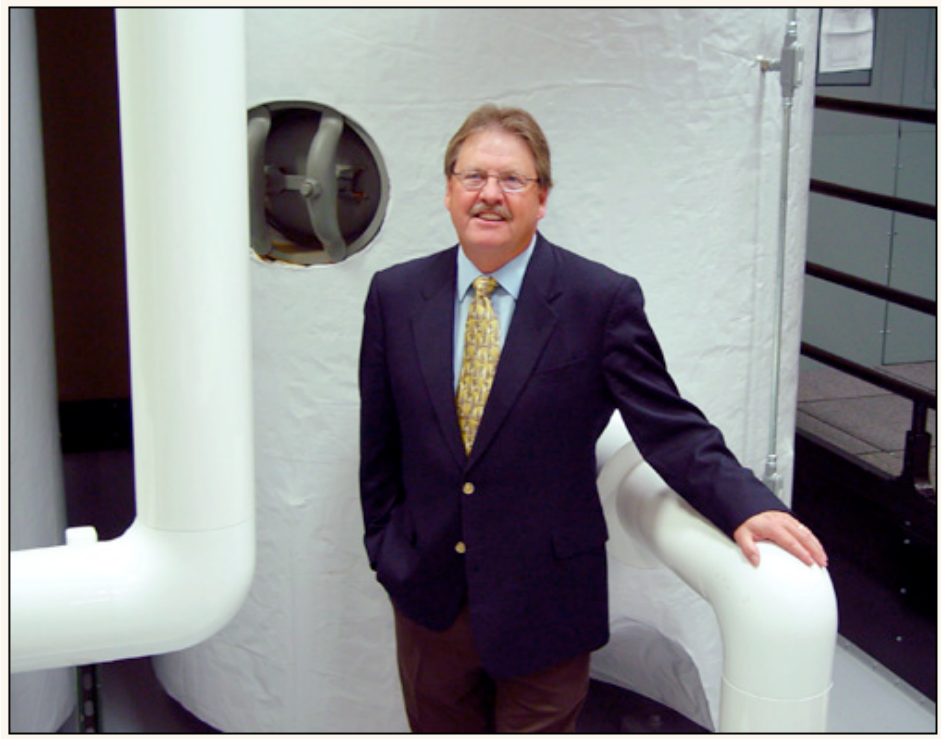
[2] As quoted in The Week That Was, May 23, 2009 Science and environmental Policy Project. (Dr. Fred Singer)

We are assured by the promoters of global warming alarmism that fossil fuel use is creating global warming and that the global warming will be a disaster. The evidence for the disaster is weak. The evidence that some scientists have been cooking the books is overwhelming. The political programs advocated to prevent global warming are completely illogical given that major countries such as China and India will not participate. Green ideology more and more is looking like a new religion with global warming as one of its doctrines.

Computers tend to instill confidence in the results they produce. That confidence is often an illusion. Climate science is highly dependent on computer models of the earth. It is generally acknowledged that these computer models have big shortcomings. In spite of a collective investment of many billions of dollars over decades, the models don't simulate the earth's climate very well. But climate models are seductive and you can write lots of papers about the results from your climate modeling.

Visit the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. See the modernistic building in the foothills of the Rocky Mountains.

Visit the public exhibit filled with certainties concerning global warming. Look at pictures of cute polar bears. Visit the giant computer. NCAR computers are measured by how much electricity they consume, like the heavy equipment in a steel mill.



Al Kellie by the liquid coolant reservoir for the 650-KW supercomputer bluefire.

Visit NCAR's website. Try to decipher the maze of acronyms: COMET, COSMIC, GLOBE, JOSS , ASP, CISL, EOL, ESSL, RAL, NSDL, VSP…

NCAR is one of dozens of similar research establishments around the world. Climate science is on a roll. Money is flowing. Climate scientists appear on television. Predictions of global warming disaster have been good for climate scientists.

Climate science is selling a global warming disaster, parked safely in the far future. Because the disaster is in the future the scientists will not live to see their predictions overturned. They can't be proven wrong. The supposed disaster can only be prevented if we spend billions for climate science research and trillions to eliminate fossil fuels. The scientists may be interested in the billions. I'm worried about the trillions.

The Vatican of climate science is the *Intergovernmental Panel on Climate Change* better known as the IPCC. The IPCC is located in Geneva, Switzerland and is part of the United Nations. The IPCC presents itself as a serious scientific organization providing objective information. My intention is to show that the IPCC is playing a dishonest game. I will focus on one issue: the simulation of 20th century climate by computers and its presentation in the *IPCC Forth Assessment Report (2007),* known as AR4.[3] The previous 3 assessment reports also predicted disaster.

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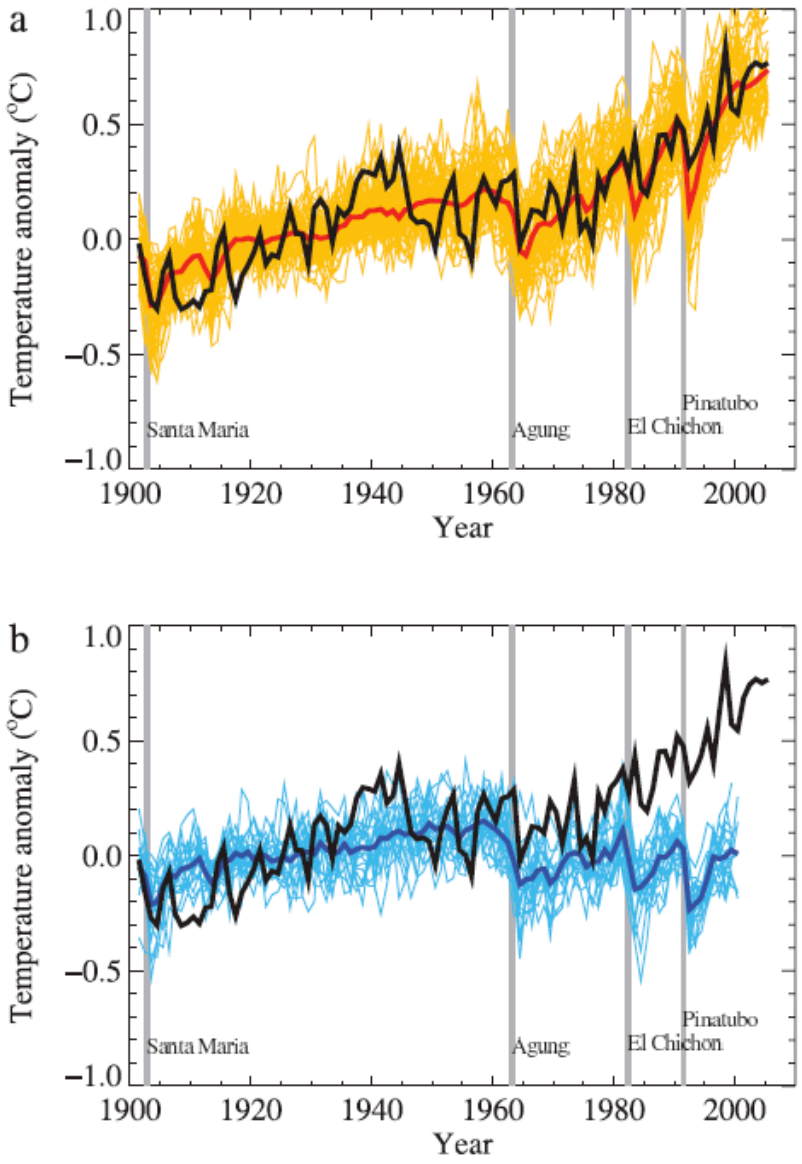
[3] Available on the IPCC's website The 4th assessment report follows previous 3 previous reports dating back to to 1990.



The IPCC's Iconic Illustration Figure 9.5. Top graph is simulation by computer climate models of the 20th century. Bottom graph same but w/o CO2 and man-caused influences on climate. Black line is temperature history of 20th Century. Their claim is that the temperature increase of 20th century is caused by man and w/o man-caused influences temperature would not have increased.

A single illustration, Figure 9.5, in the IPCC report is my inspiration. This iconic illustration has been reproduced in various guises in hundreds of publications[4]. This

[4]Google google images with: "climate model natural anthropogenic twentieth century" to come up with 20,000 hits, many with variations of the iconic illustration.

may seem like a narrow topic, but those graphs have a story to tell and it is not very flattering for the IPCC or the advocates of global warming.

Background and Introduction

The prediction of environmental disaster has been popular for more than 50 years. Here are some well-known environmental disaster books: **Our Plundered Planet** by Fairfield Osborne (1948), **The Road to Survival** by William Vogt (1948), The **Silent Spring** by Rachel Carson (1962), **The Population Bomb** by Paul Ehrlich (1968), **The Limits to Growth by Dennis Meadows** (1972). **An Inconvenient Truth** by Al Gore is the most important recent disaster book and the only one that is mainly a picture book. Many of the pictures are pictures of Al Gore. There are 25 flattering pictures of the author in **An Inconvenient Truth**.

Environmental disaster stories are promoted as being based on science. The educated public doesn't have the specialized knowledge to critically evaluate the science. That allows disaster merchants to get away with exaggeration and even lies. The book **Scared to Death** by Christopher Booker and Richard North documents numerous environmental disaster crazes during the last 30 years. Global warming is the biggest and it has not yet run its course.

The IPCC has been attacked repeatedly over the years for presenting a one-sided view of climate science in the furtherance of ideological and institutional goals[5].

Just as war is too important to be left to the generals, environmental disaster predictions are too important to leave to scientists and professional environmentalists. A necessary check is disinterested analysis by outsiders.

Although advocates of global warming accuse skeptics of being in the pay of energy companies, it is actually the global warming advocates that are well-financed and self-interested. The great majority of energy companies are too timid to take the political risk of financing global warming skeptics. The CEO's even have reason to be afraid of going to jail. James Hansen, an advisor to Al Gore and head of an important government climate lab, is an aggressive promoter of global warming alarmism. He has demanded that CEO's of energy companies should be put on trial for "crimes against humanity" if they cause money to be given to non-profit think tanks that

[5] Google "lies of the ipcc" to get 248 hits.

disagree with Hansen[6]. Hansen allegedly has received large sums of money from left groups[7].

Some large companies are aggressive promoters of global warming for financial reasons. The electric utility, Exelon, is primarily nuclear powered and thus will, in theory, benefit from restrictions or taxes on the burning of fossil fuels. The chairman, John Rowe, is an aggressive promoter of global warming. General electric is in a position to benefit from various green initiatives and thus is another aggressive promoter of global warming. As General Electric says on its website: "…as we face the need to move from fossil fuels to other sources of energy. GE is leading the way…"

Extremely high taxes would be needed to substantially cut fossil fuel usage. For example gasoline would probably have to cost around $20 a gallon[8] to reduce consumption by 66%.

Global warming is welcomed by the love-the-earth-crowd. It gives an excuse to impose a new lifestyle on everyone, something they want to do anyway. For government global warming offers the enticing prospect of carbon taxes. Carbon taxes are the new sin taxes.

Computer climate models try to divide the atmosphere and oceans into boxes that may be 50 kilometers on a side and hundreds of meters thick and compute the physical parameters in each box every 15 minutes or so in simulated time. The problems are huge as are the number of boxes. The boxes are too big to represent many important aspects of the climate such as clouds. The computer time required is excessive, even for the most powerful computers in the world. Computer models are a logical approach to climate research, it's just that they don't work very well.

In this article I will deconstruct the iconic IPCC graph, Figure 9.5, and show that it is thoroughly phony. This has been done before with respect to a different graph, the

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[6] Hansen revealed fascistic tendencies on NPR's Diane Rehm Show on June 23, 2008: "…CEO's of these large energy companies are guilty of crimes against humanity if they continue to dispute what is understood scientifically and to fund contrarians …" Hansen also released a written statement on his website: "In my opinion, these CEOs should be tried for high crimes against humanity and nature." Hansen curries favor with the small is beautiful crowd: "Cheap, subsidized fossil fuels engendered bad habits. We import food from halfway around the world, for example, even with healthier products available from nearby fields." http://www.columbia.edu/~jeh1/2008/TwentyYearsLater_20080623.pdf

[7] Roy Spencer reported in his book, Climate Confusion[7], that Hansen received a $250,000 grant from a foundation headed by John Kerry's wife and then made a speech favoring Kerry in the 2004 campaign. (The Hatch Act restricts federal employees from engaging in partisan politics.) It was reported in the Investors Business Daily[7] that Hansen received $720,000 in 2006 from a foundation controlled by far left billionaire George Soros.

[8] Explaining the variation in elasticity estimates of gasoline demand in the United States: A meta-analysis Espey, Molly Energy Journal. Vol. 17, no. 3, pp. 49-60. 1996. Long term price elasticity for gasoline is estimated at -.58, meaning that a 10% increase in prices causes a 5.8% decline in consumption. The math works out that a 2/3 decline requires 5 or 6 times the price. The long term price elasticity assumes people have time to adapt by using smaller cars, etc. This estimate is necessarily speculative, but seems reasonable. If everyone drives tiny, slow cars that get 70 MPG they can afford to pay $20 a gallon, equivalent to paying around $8 with today's cars.

"hockey stick" graph[9] that appeared in the previous, 2001, report of the IPCC. In that case Steve McIntyre, a retired Canadian businessman, demolished the science behind the graph and it was widely discredited, including by a committee of experts appointed by the United States Congress[10]. The disappointing conclusion to that story is that the forces of global warming were hardly slowed. They brushed it off as a mistake, or said that the methodology was wrong but the conclusion was right.

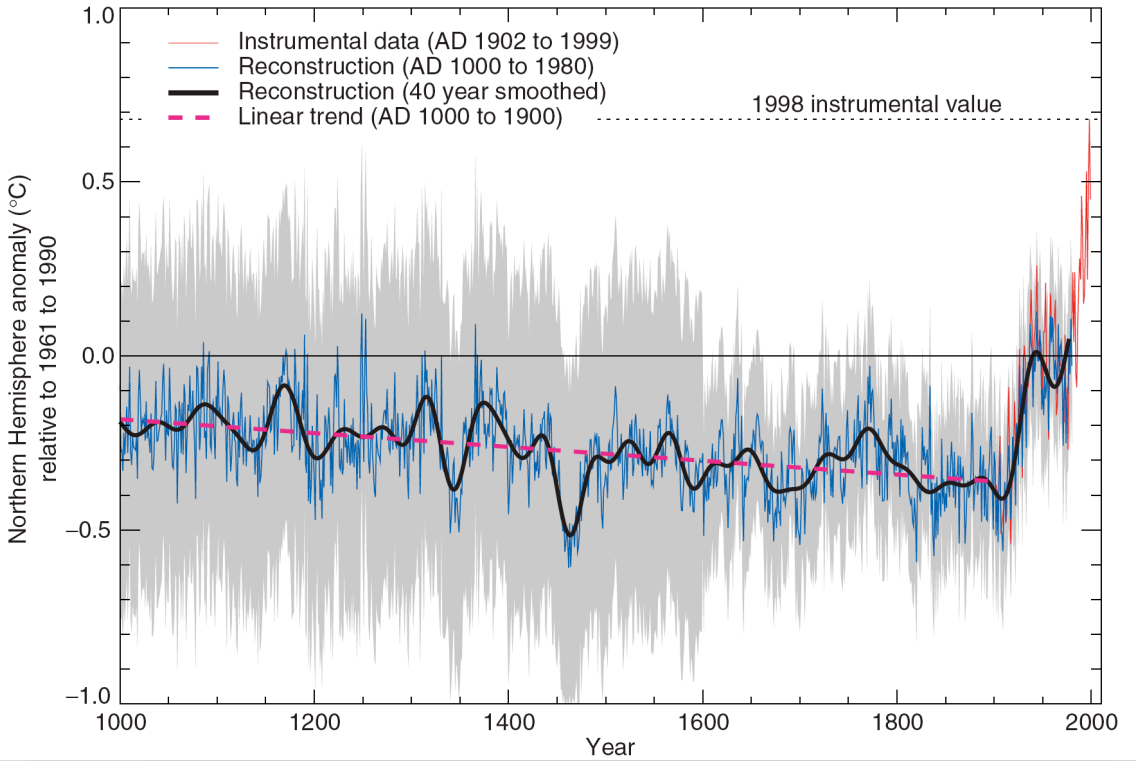

Figure 1A -The famous hockey stick graph from the IPCC 2001 report. Its essence is that the climate has gone to hell in the 20th century compared to the previous 900 years. The graph has been shown to be baseless.

Green ideology embraces the idea that there is a state of nature that amounts to heaven on earth if only we permitted its expression. Google "the lion shall lay down with the lamb" and you get stories about vegetarian lions and lionesses that adopt antelope calves. The Bible tells us to fill the earth with people and to rule over the

[9] The hockey stick purported to show by scientific study that the current time is warmer than the previous 1000 years when a cooler and more constant climate prevailed. The graph of temperature looked like a hockey stick lying on its side.

[10] See **The Wegman Report for Newbies** on McIntyre's website www.climateaudit.org

earth and all its animals[11]. The New York Times tells us that we have no more right to the earth than the animals[12]. That is the face of the new green religion. Of course everyone is entitled to his religion, but no religion is supposed to be established as an official state religion, at least not in the USA.

The graph below shows the temperature history of the 20th century for the entire earth. The black line is a monthly running annual average of temperature and the red lines are fitted to the data to show the major temperature trends of the 20th century (extending to 2007). The three major trends are the early 20th century warming, the mid 20th century cooling and the late 20th century warming. The left scale is arbitrary change in temperature relative to the mid century cooling. The average temperature of the earth is actually about 14 degrees C. The biggest problem with trying to explain the temperature history of the 20th century is that there is no good explanation for the early 20th century warming. The advocates for global warming explain the late century warming as being from greenhouse gas, mainly CO2 placed in the atmosphere from the burning of fossil fuels. The big problem they have is that the early 20th century warming can't be blamed on CO2, because at that time the world economy was small then and not that much CO2 had been added to the atmosphere.

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[11] Genesis 1:28: And God blessed them: and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it; and have dominion over the fish of the sea, and over the birds of the heavens, and over every living thing that moveth upon the earth.

[12] September 23, 1973 a TImes editorial titled "Survival or Extinction:" "The Dingell bill may well mean the difference between survival and extinction of animals whose existence should not in the first place have to depend on the whim or the greed of man."

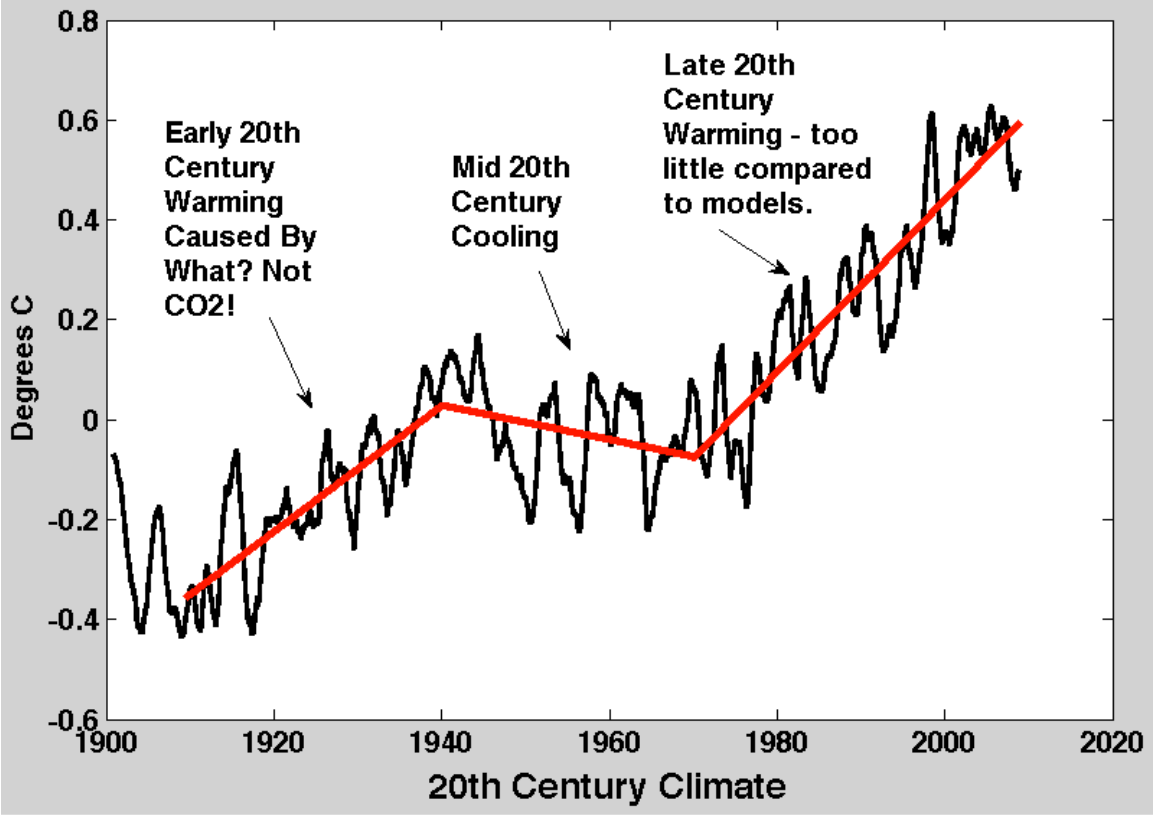

Figure 3

The Problems with Figure 9.5

The clever juxtaposing of a "man made climate" with a "natural climate" as is done in Figure 9.5 was apparently first done in a year 2000 paper by Peter Stott and coauthors that was published in Science[13].

In the IPCC's Figure 9.5, the upper graph, the climate shaped by man, is like the shampoo made from chemicals, while the lower graph, the climate shaped by only natural forces, is like the shampoo made from tree bark. Unless you were born yesterday you know which is supposed to be better. Figure 9.5 meshes nicely with modern fads and prejudices.

Those modern prejudices are prejudices of rich people who live in North America, Western Europe, Japan and a few other places. The other 85% of the world's population can't afford shampoo made from tree bark, nor can they afford to give up fossil fuels.

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[13] External Control of 20th Century temperature by Natural and Anthropogenic Forcings by Peter S. Stott et. Al. Science 15 December 2000.

The upper graph in Figure 9.5 shows how the computer models, if driven by the climate forces shaping the 20th century, are allegedly able to reproduce the climate of the 20th century. This graph has been improperly manipulated as we will explain in detail. Most of those climate forces, or forcings as they are called, are man made – such things as greenhouse gases and aerosol smoke from burning fossil fuels. In the lower graph those unnatural climatic forces are taken away and we are left with natural forces, without the evil forces of industrial civilization. Those natural forces include occasional volcanoes and tiny solar variations. The lower graph climate is natural and nice, sort of like the garden of eden before man screwed things up. Nature isn't always nice. Only 20,000 years ago the Laurentide ice sheet covered North America as far as Long Island and Ohio; an ice sheet that killed every living thing and literally moved mountains. Somehow the polar bears survived.

Figure 9.5 appeals to popular prejudices, but is it scientifically sound? It is generated by combining climate simulations produced by different computer climate models at different laboratories around the world. This method, pretentiously called a *multi-model ensemble*, is basically an opinion poll of climate models. One computer thinks that doubling CO2 in the atmosphere will raise the temperature of the earth by 4 degrees centigrade, another thinks it will be only 2 degrees. So, is the truth somewhere in between? If one computer thinks the oceans are made of red wine and another thinks they are made of white wine it does not follow that the oceans are made of pink wine.

The multi-model ensemble idea may spring from a faulty analogy. Climate models, like the climate, are chaotic in nature. Slightly alter the starting conditions of the computer program and the generated climate goes down a different chaotic path, much like the weather variations from one year to the next. For that reason it does make sense to create many computer runs, an ensemble, and average the results together, just as the weather bureau averages together the temperature records over many years to create annual means. Apparently someone got the idea to average together the results from different computer models created by different laboratories. The trouble is that now we are averaging together the climates of the Venus, Mars and Jupiter. The different climate models are very different, not just in the predictions of temperature increase from CO2, but in all the multi-dimensional details of the earth's climate, be it persistent drought in Africa or a excessive precipitation in Iowa.

The use of multi-model ensembles in climate is a recent development, beginning around the year 2000. The alleged usefulness of multi-model ensembles rests on the claim that better fits to climate are obtained by using them. The claim is actually correct in certain limited circumstances, but it is a faulty analogy to extend the claim to circumstances where it no longer applies. It is an open question whether the scientists involved simply didn't understand the fault in their logic or they chose to conveniently ignore it. The multi-model ensemble idea has the huge political advantage that it is not necessary to choose between the models of one's colleagues around the world. Instead it becomes possible to simply average everyone's results

together. Multi-model ensembles may be one of those stories that are too good to check.

The climate models that enter into the multi-model ensembles in AR4 differ. The climate sensitivity, the amount of warming from doubling CO2, the single most important characteristic of a climate model, varies by more than 2-1. But, the models can be very similar if they are manipulated or *tuned* to fit a certain set of data. The relevant sets of data are either the static climate of the earth or the temperature history of the 20th century.

The first *Climate Model Intercomparison Project* (CMIP1) was performed using an earlier generation of climate models in the late 1990's. Each climate model was run without changes in the input forcings, such as changing CO2 or changing solar intensity. Under such circumstances the models attempt to simulate an earth climate with no trend. The outputs of the models were compared with each other and with observations of the earth's climate. In a paper published in 2001, Lambert and Boer[14] noticed that there was some evidence that an ensemble of models gave a better result than any one model. They also explained why this could be so. The reason is that the models are tuned by changing internal parameters to try to make them fit the climate of the earth. The climate of the earth is a multidimensional set of data involving temperature, precipitation and many other items mapped over time and over the surface of the earth. In other words mathematical curve fitting is going on. The parameters that control the behavior of the model are manipulated to try to make the fit to the earth climate as good as possible. The goodness of fit to the data is masked by the chaotic behavior of the models that essentially adds random noise to the model output. If enough independent runs of the same model are added together the noise will average out and the remaining error is the fitting error due to the mismatch between the model and the earth. Now, for a given model the fitting error is constant. You will always get the same fit if you average enough runs, although it is not clear that anyone has proved this due to the excessive computer time that climate models require. But the fitting error is a collection of error points that are different for different models. When you average together different models the fitting errors are averaged. How the total fitting error changes as more models are added to the ensemble depends on the correlation between the fitting errors in the different models. If the fittings errors are 100% correlated, differing only by a common scale factor, then the total average fitting error will not improve as models are added, unless, of course, the added models simply have better fits. If the fitting errors are uncorrelated then they will combine like random numbers The average will get smaller as more models with similar quality of fit are added to the ensemble. The average will drift smaller approximately inversely as the square root of the number of models. With 16 models of similar fit quality the total error will be reduced to about 1/4th as great. As a practical matter the growth of fitting error is probably somewhere between these two extremes of perfectly correlated or

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[14] CMIP1 evaluation and intercomparison of coupled climate models by S.J. Lambert and G.G. Boer. Climate Dynamics (2001).

uncorrelated. The total error has two parts, the random chaotic part and the systematic fitting error. If the random chaotic part dominates, then adding models, or especially multiple runs from the same model, will improve the fit. If the remaining fitting error is large even after averaging together the maximum number of models, then adding more runs won't help matters much beyond a certain point because the fitting error will dominate. The improvement in the fit by averaging multiple models is a mathematical consequence of using different fitting algorithms to fit to a common target as well as a consequence of simply averaging out random, chaotic error. It has nothing to do with the opinions of many climate models being averaged being smarter than any one climate model.

The second relevant case is from the third Climate Model Intercomparison Project (CMIP3). This project begun around 2004 is described in a paper my Meehl and coauthors[15]. CMIP3 was as series of modeling experiments run by various modeling groups around the world. The results were used in AR4, including the creation figure 9.5. One of the experiments in CMIP3 was the following as described by Meehl:

> Twentieth-century simulation to year 2000 (preferable starting from pre-industrial conditions in the late 1800s) with anthropogenic and natural forcings as modeling groups deemed appropriate;

These are very strange instructions. Each modeling group can use forcings as it sees fit. But there is only one set of forcings that drive the climate of the earth. If everyone uses a different forcing, then you effectively have different earths, but all the earths have the same climate if each modeling group, with its different model, accomplishes a good fit to the earth's climate. In practice it seems that the modeling groups adjusted aerosol forcing, which is fairly uncertain anyway, in order to obtain a good fit to the 20th century temperature with the disparate models. If the fits are good enough, and they should be, the multi-model ensemble may give better results compared to individual models. But, once again this is a mathematical artifact, not a scientific insight.

It is common to *backtest* computer models. For example if you create a model to predict movement of the Dow-Jones stock index during the next 6 months you could backtest it against historic data to see if it works. Of course, if such a model would work all the model designers would be very rich. In order to properly design and test such a model you might take alternate decades of data to use in creating and testing the model. Then in order to backtest the model you would take the alternate decades of data that you didn't feed into the model previously and see if the model still works. It probably won't in this case.

The problem with complex models that have a lot of adjustable parameters is that they can easily fit historic data simply by reason of having lots of adjustments, but

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[15] The WCRP CMIP3 Multimodel Dataset by Gerald A. Meehl et. Al. Bulletin of the American Meteorological Society (BAMS) September 2007.

then they fail to predict the future because the fit to historic data was curve fitting, not a fit that reflects insight to the process that is being modeled.

In order to build a climate model to make predictions of future climate you might create and test the model based on 1950 to 2000 data and then backtest it on 1900 to 1949 data. As we will see it is possible to create a model that roughly fits the late 20th century based on greenhouse gases and aerosols, but this model won't fit the early 20th century at all, because the warming in the early 20th century can't be explained by greenhouse gases and aerosols. You might say that this test is unfair because the second half of the 20th century is different due to the vastly greater concentration of greenhouse gases, but that observation does not invalidate the backtest because we are simply withdrawing the greenhouse gas. We just don't know what caused the early 20th century warming, part of the long list of things we don't know about the earth's climate.

The upper graph in figure 9.5 may seem like a backtest of the IPCC's multi-model ensemble, but it is actually a curve fit because, as Meehl has pointed out, each model was individually adjusted to have a good fit to the data. The modeler's were given carte blanche to use such forcings as they "deemed appropriate." A forcing is simply an adjustable curve fed into the model and by changing the forcing you can make any temperature record come out of the model that you may desire. Of course scientific decency is not consistent with entirely arbitrary forcings, but within the bounds of scientific decency there is a lot of room to get a good fit to the 20th century temperature history.

The IPCC takes the giant leap of assuming because multi-model ensembles can give better results when the models are individually fitted to a historic record they will still give better results when used to predict the future climate of the 21st century with a common set of forcings. In section 10.1 of AR4 this reason for this is given explicitly:

> Many of the figures in Chapter 10 are based on the mean and spread of the multi-model ensemble of comprehensive AOGCMs (*Atmosphere/Ocean General Circulation Model*). The reason to focus on the multi-model mean is that averages across structurally different models empirically show better large-scale agreement with observations, because individual model biases tend to cancel (see Chapter 8). The expanded use of multi-model ensembles of projections of future climate change therefore provides higher quality and more quantitative climate change information compared to the TAR.

As we have shown, the "better large-scale agreement" is a mathematical artifact arising from the effects of averaging random and uncorrelated functions. The IPCC is dressing up what is nothing more than an opinion poll of climate models with mathematical ribbons and flowers. It is perfectly possible that none of the climate models are right and thus there is every reason to believe that the multi model ensemble is a consensus of possibly mistaken beliefs.

You can't make junky information that is not homogeneous be good by averaging a lot of it together. On the other hand if you want to know if a coin is biased or a die is loaded you can construct a statistical experiment to toss it many times that will tell you with ever greater accuracy how biased it is. These are examples of the difference between the misapplication and the application of statistics. The IPCC iconic illustration is an illustration of the proverb that there are lies, damned lies and statistics.

How good are the computer models of the climate? Just because billions of dollars have been invested in the models does not prove that they are good. But it does give a motivation for playing down their deficiencies. The scientific organizations can't tell the government that they have been trying to improve the models for 20 or 30 years and little progress has been made, but give us more money and we'll keep trying. Kevin Trenbreth is one of the most prominent climate scientists in the world. He is a senior scientist and the Head of the Climate Analysis Section at NCAR. He said this about climate models.

> … None of the models used by IPCC are initialized to the observed state and none of the climate states in the models correspond even remotely to the current observed climate. In particular, the state of the oceans, sea ice, and soil moisture has no relationship to the observed state at any recent time in any of the IPCC models. There is neither an El Niño sequence nor any Pacific Decadal Oscillation that replicates the recent past; yet these are critical modes of variability that affect Pacific rim countries and beyond. The Atlantic Multidecadal Oscillation, that may depend on the thermohaline circulation and thus ocean currents in the Atlantic, is not set up to match today's state, but it is a critical component of the Atlantic hurricanes and it undoubtedly affects forecasts for the next decade from Brazil to Europe. Moreover, the starting climate state in several of the models may depart significantly from the real climate owing to model errors. I postulate that regional climate change is impossible to deal with properly unless the models are initialized.
>
> The current projection method works to the extent it does because it utilizes differences from one time to another and the main model bias and systematic errors are thereby subtracted out. This assumes linearity. It works for global forced variations, but it can not work for many aspects of climate, especially those related to the water cycle[16]. …

As an NCAR and IPCC insider Trenbreth certainly isn't claiming that climate models are useless, but he is making it clear that they have shortcomings.

Richard Lindzen, another of the most important climate scientists in the world and a professor at MIT has been highly critical of global warming and the bureaucratic organization of climate science. Here are some quotes from a recent article he wrote[17]:

> The temptation to politicize science is overwhelming and longstanding. Public trust in science has always been high, and political organizations have long

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[16] Posted on **Climate Feedback the climate change blog** on Nature.com June 4, 2007

[17] **Climate Science: Is it currently designed to answer questions?** Available on his website at MIT.

> sought to improve their own credibility by associating their goals with 'science' – even if this involves misrepresenting the science.
>
> The influence of the environmental movement has effectively made support for global warming, not only a core element of political correctness, but also a requirement for the numerous prizes and awards given to scientists.
>
> Perhaps the most impressive exploitation of climate science for political purposes has been the creation of the Intergovernmental Panel on Climate Change (IPCC)…
>
> Data that challenges the hypothesis are simply changed. … many scientists feel that it is the role of science to vindicate the greenhouse paradigm for climate change as well as the credibility of models. Comparisons of models with data are, for example, referred to as model validation studies rather than model tests.

Public trust in science is high because the public does not know what goes on behind the scenes. Bureaucratic scientific organizations that are dependent on government financing routinely exaggerate the worth of their work. The employees of the organization, scientists included, are expected to go along with the sales pitch and of course, it is in their career interest to do so. The sales pitch may hold out hope of future advances, for example a cure for cancer, or it may use fear to motivate the public and the politicians. Claiming that global warming will take place and be a disaster is a sales pitch based on fear.

That's the preview, now let's get into more details.

The Mental and Mathematical Model of Global Warming

Climate science has a way of thinking about the climate that is both a mental model and a mathematical model. The model says that *forcings* cause the climate to warm or cool. Forcing is a technical term with numerical value. If the sun suddenly got hotter more energy would fall on the earth and that would be a forcing. Greenhouse gases create a forcing that can be computed with at least rough accuracy. The reason greenhouse gases create a forcing is that they inhibit the escape of infrared radiation from the atmosphere. That in turn, all other things being the same, causes the temperature of the earth to rise sufficiently so that the normal increase of outgoing radiation with temperature overcomes the inhibition created by the additional CO2. (It's actually quite a bit more complicated than that.) The incoming sunlight and outgoing radiation have to be equal in the long run. If they are unequal for a substantial period it indicates that the ocean as a whole is warming or cooling. The ocean is the main heat sink that can store energy.

Forcings are generally expressed in terms of watts per square meter on the earth's surface, measured above the clouds[18]. The average solar energy falling on the earth measured above the clouds is about 340 watts per square meter[19]. Obviously none falls at night and more during the day, but the average is about 340 watts per square meter. On average 100 watts per square meter is reflected back into space, leaving a net of 240 watts per square meter. If this suddenly increased to 242 watts then we would say that there was a forcing of 2 watts per square meter. The 2-watt forcing could be the result of fewer clouds with less sunlight reflected or it could be an increase in the sun's energy output. CO2 forcing reduces the ease with which infrared radiation (heat radiation) can escape the earth so less energy leaves the earth. If CO2 reduces outgoing infrared by 2 watts per square meter, that too would be a forcing of 2 watts per square meter.

According to climate research and the IPCC, doubling CO2 in the atmosphere would be equivalent to a forcing of about 3.7 watts per square meter. They say this would increase the temperature of the earth by about 3 degrees C. If they wake up on the wrong side of the bed, they may say 5 degrees, or even more. How much the temperature increases for a given amount of CO2 and other greenhouse gases is a crucial point and is the main question that climate science tries to answer. Some forcings are negative – they cause cooling. For example, according to the IPCC, aerosols, or small particles floating in the atmosphere, create a negative forcing of about -1.1 watts per square meter at the present time. Most aerosols create a negative forcing because they reflect (scatter) sunlight back into space, reducing the amount hitting the earth. Aerosols also promote the formation of cooling, reflective clouds by providing nuclei for the condensation of water droplets. The illustration below is from the IPCC's 2007 report. It shows the various forcings that the IPCC considers.

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[18] Measured at the tropopause or where the troposphere ends and the stratosphere begins ranging from 11 to 17 km above the surface depending on latitude. The altitude where temperature stops decreasing rapidly with altitude.

[19] The sun's output at the earth's orbit is about 1360 watts/m2. Divide this by 4 to get 340, the difference between the area of a circle and the surface area of a sphere with the same radius.

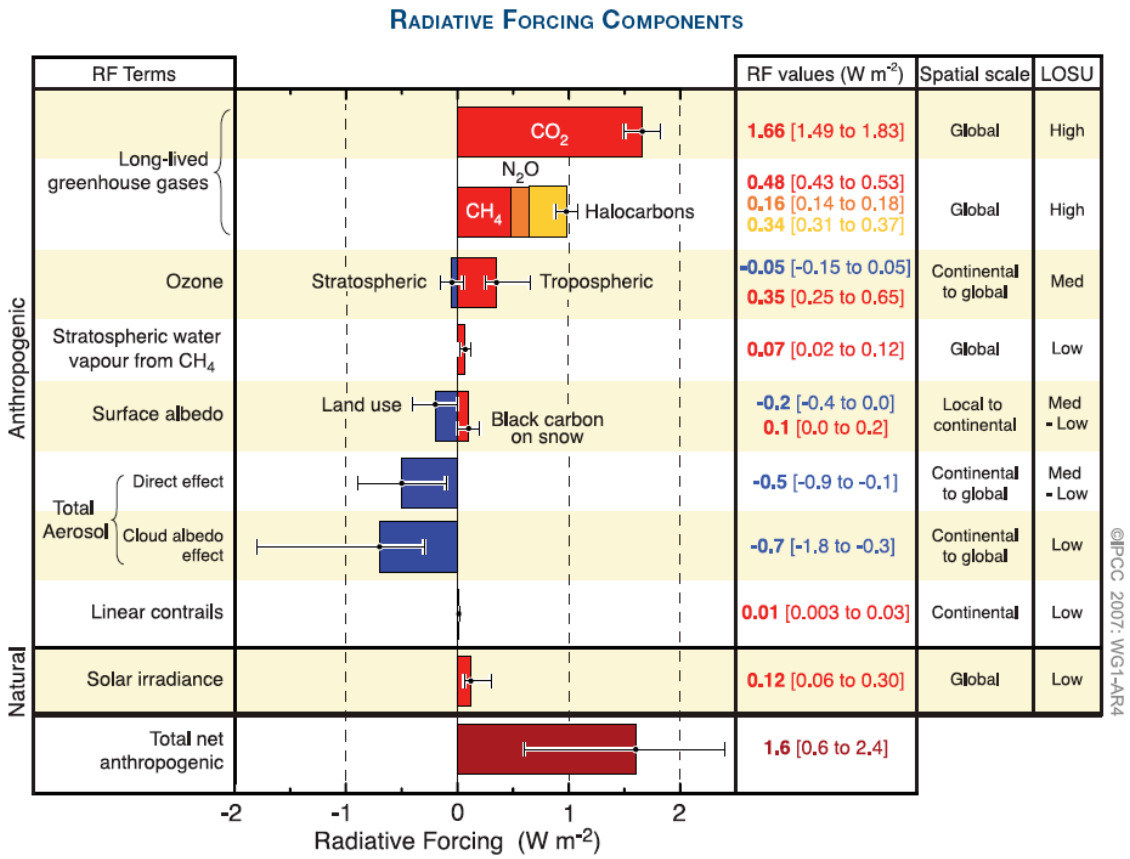

Figure 1B – (IPCC Figure SPM.2) – Increase in forcings since 1750.

According to the climate science model, a forcing brings about an increase in the earth's temperature that is proportional to the forcing. If there are several forcings, positive and negative, you just add them together to get the net forcing[20]. The amount of temperature change for a given forcing is called the climate sensitivity. There are two ways of commonly expressing the climate sensitivity. We can express the climate sensitivity[21] as how many degrees the earth would warm if CO2 doubled[22] without any other forcings. The IPCC says that the climate sensitivity expressed this way is about 3 degrees C. In other words, if CO2 doubles and exerts a forcing of 3.7 watts per square meter then earth's average temperature should

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[20] This assumption of linearity may have exceptions for some forcings or it may be very wrong, but this is a basic assumption of climate science.

[21] Equilibrium climate sensitivity is the amount of warming from doubling of CO2 if the ocean is given time after CO2 doubles to equalize with the climate. Transient climate sensitivity is the amount of warming immediately after CO2 reaches double. I argue that the two are quite similar for the recent warming given its small magnitude and the data on ocean temperature. When I refer to climate sensitivity I mean equilibrium climate sensitivity.

[22] Other gasses, such as methane are also important greenhouse gasses. This is just a historical shorthand way to express climate sensitivity.

increase by 3 degrees C. The other way of expressing climate sensitivity is to say how many degrees of temperature change there is for each watt per square meter of forcing. In this case 3 degrees for CO2 doubling is the same as 0.81 degrees per watt per square meter (3/3.7). It is more common to talk about climate sensitivity indexed to doubling of CO2. Doubling of CO2 might happen in about 70 years if it continues to increase at the present rate. To get another 3 degrees another doubling would be required, or 4 times as much CO2. This is not likely to happen in the foreseeable future.

If this model of how the earth's climate works is correct we should be able to apply it to the past to explain climate history. We have fairly good surface temperature records for the 20th century and we have fairly good insights to the forcings during the 20th century. That is what the IPCC is trying to do with the iconic illustration below.

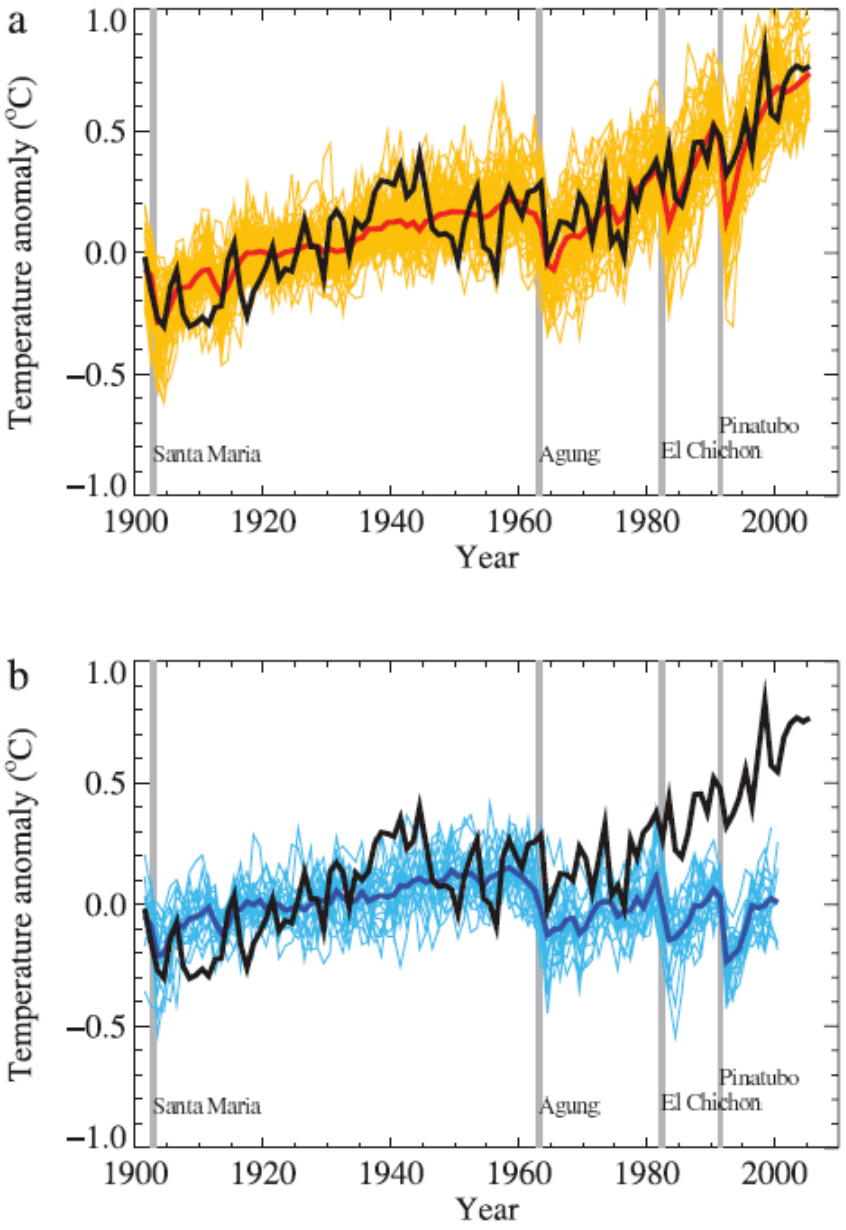

Figure 2 – (IPCC Figure 9.5) – Earths climate with and without man-made forcings as simulated by climate models. Black line is the measured temperature. Red (upper) and blue (lower) are computer simulation results from many computer runs (fine lines in background). (Names at bottom are names of volcanoes.)

This illustration is repeated in one form or another in most explanations of global warming. It purports to show that the climate models simulate the 20th century climate quite well and that if it weren't for man-made forcings, such as greenhouse gases and aerosols added to the atmosphere, the climate would have remained practically constant rather than warming. (The earth's climate has undergone many

much more drastic changes in temperature long before industrial man was on the scene.) It appears to prove that the climate science mental/mathematical model works and that man is responsible for the warming of the 20th century. These graphs are very convincing and very deceptive.

Let's examine the climate of the 20th century. We are going to consider 1910 to 2008, a little less than 100 years. The graph below shows the temperature change for this period.

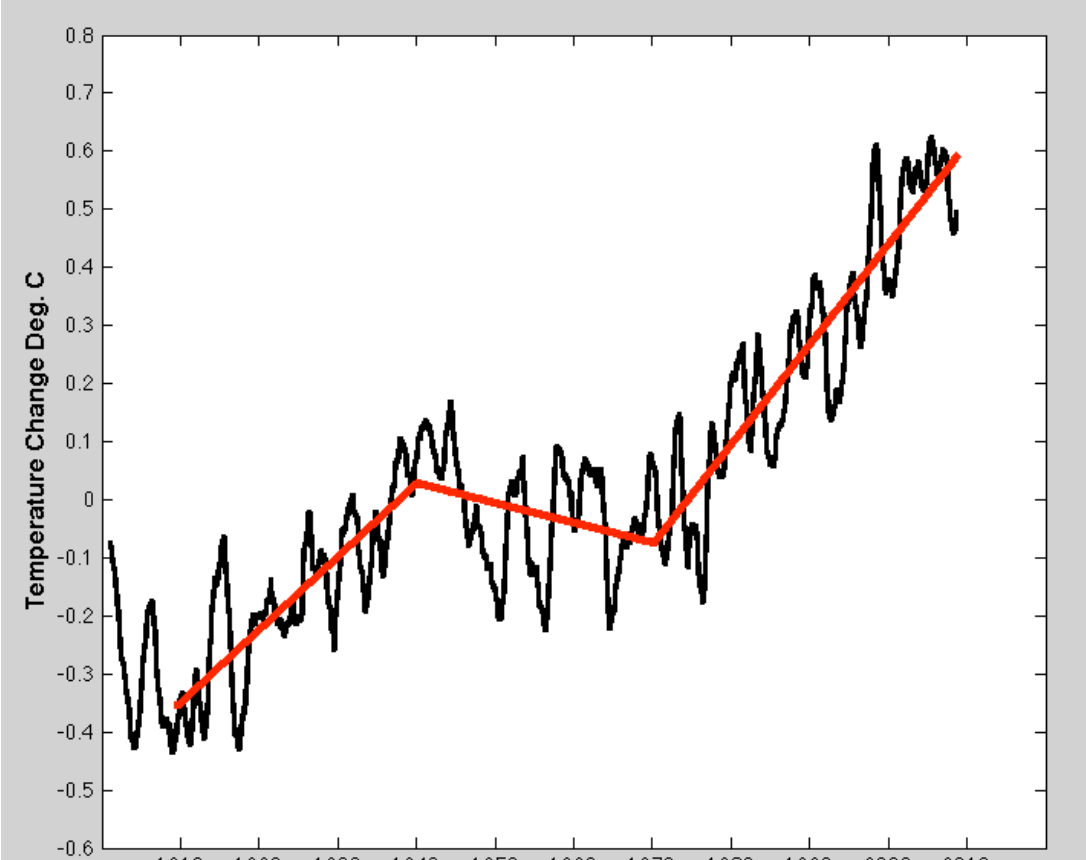

Figure 3 - 20th Century Climate

The temperature change, called temperature anomalies, in this graph is an average from the 3 major science groups that keep track of this by analyzing the data from

thousands of surface observations taken over the past 100 years[23]. The straight lines are fitted[24] to the data to show the 3 major temperate change eras of the 20th century. The early 20th century warming took place from 1910 to 1940 and warmed the earth by about 0.4 degrees C. The mid 20th century cooling went from 1940 to 1970 and cooled the earth by about 0.1 degrees C. The late 20th century warming went from 1970 to 2008 and warmed the earth by about 0.65 degrees C. The left scale is relative and in this case is normalized so that 0.0 is around the middle of the century. This is not the average temperature of the earth, which is about 14 C, but simply a relative scale showing changes.

What caused these warmings and coolings during the 20th century? The early 20th century warming is the most difficult case. We know it wasn't greenhouse gases because there wasn't enough increase in greenhouse gas during that period to create that much warming for any reasonable climate sensitivity. It wasn't aerosols, because aerosol emissions are tied to the burning of fossil fuels and there wasn't much fossil fuel usage (compared to now) back then. Besides, aerosols cause cooling, not warming. The IPCC throws in some solar forcing based on speculation that there might have been some increase in the sun's output in the early 20th century. But, as you can see in figure 9.5, their fit is not very good in the early 20th century.

The mid 20th century cooling is usually attributed to rapid increase in aerosols associated with industrialization. This not inconsistent with their thinking. The aerosol cooling had to be sufficient to slightly overwhelm greenhouse gas warming, creating the slight cooling.

According to the IPCC and advocates of the IPCC models, the late 20th century warming is caused by greenhouse gases partly cancelled out by increasing aerosols and by heat buried in the ocean. I'll discuss the ocean issue later in this article.

On the plot below I've added some green and yellow lines.

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[23] I could be criticized for using a multi-model ensemble. By averaging the 3 groups I avoid the burden of picking one over the other. The temperature graph is constructed by averaging together the temperature anomaly histories produced by 3 scientific groups that compile a world temperature history from meteorological stations and measurements of sea surface temperature. The three groups are: National Oceanic and Atmospheric Administration (NOAA USA), Climatic Data Center:
ftp://ftp.ncdc.noaa.gov/pub/data/anomalies/monthly.land_and_ocean.90S.90N.df_1901-2000mean.dat
The NASA Goddard Institute for Space Studies (NASA-GISS USA):
http://data.giss.nasa.gov/gistemp/tabledata/GLB.Ts.txt
and the UK Hadley Met office HadCRUT3 global temperatures: http://hadobs.metoffice.com/hadcrut3/diagnostics/global/nh+sh/annual
The monthly temperatures are averaged for one year centered in each month. In the case of the HadCRUT3 temperatures the annual temperatures for each year are linearly interpolated to each month. An arbitrary constant makes the mid 20th century anomaly approximately zero. There are good reasons for thinking that the temperature record exaggerates warming due to urban heat island effects.

[24] A least squares fit. The ends of the intervals are adjusted so that the straight lines meet.

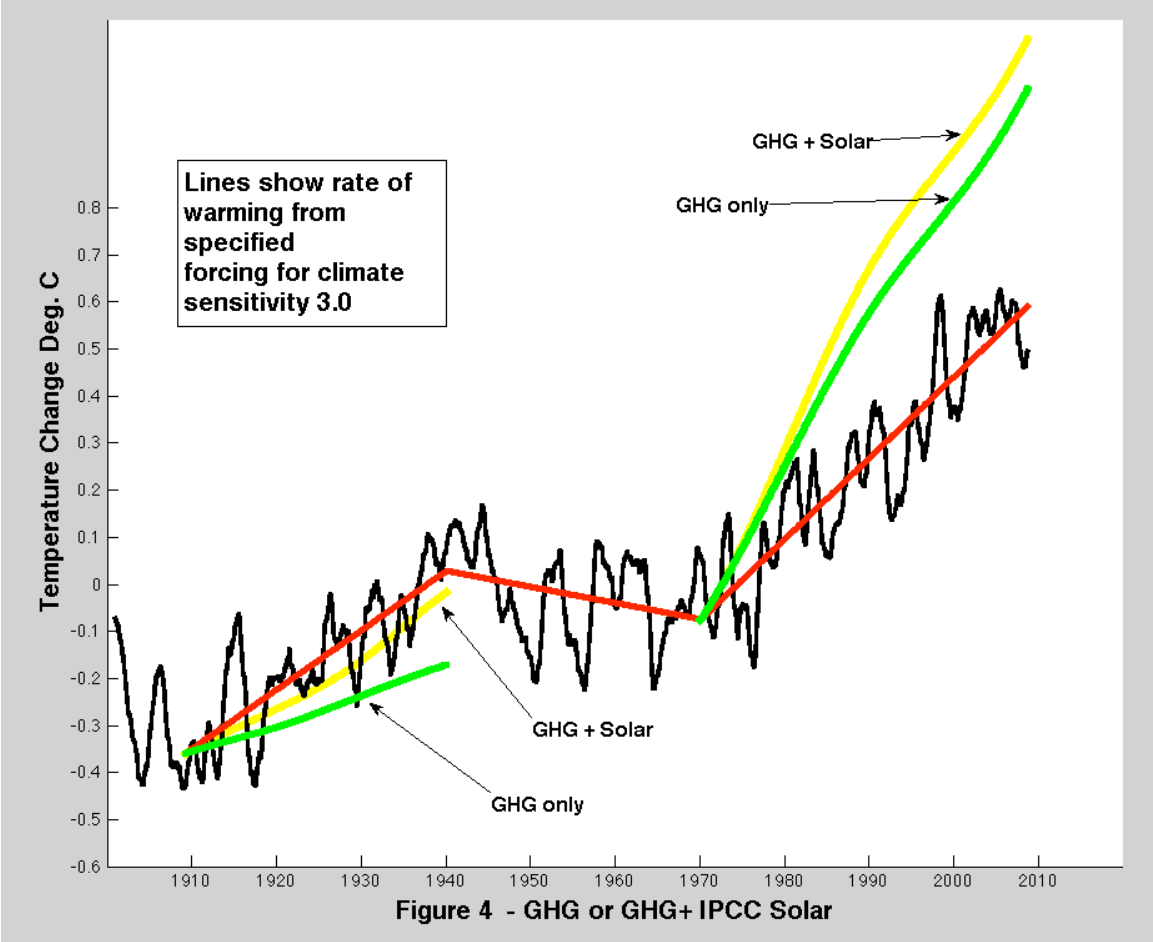

Figure 4 - GHG or GHG+ IPCC Solar

These lines show the rate of warming that the known greenhouse gases by themselves would cause if the climate sensitivity is 3.0 degrees for doubling CO2. The yellow lines show the rate of warming from both the CO2 and the IPCC solar warming combined. This early 20th century ramp up of the sun's output is speculative according to Judith Lean author of the principal articles on which the IPCC relies. She said the following[25]:

> Since direct irradiance observations exist for only two decades and in limited spectral regions, estimating historical solar spectral irradiance involves speculations and assumptions.

The early 20th century solar ramp was obviously an attractive addition since it makes the fit better. The early century fit still has problems due to aerosols that are increasing and dragging against the solar boost advocated by the IPCC.

The IPCC advocates a high climate sensitivity of about 3.0 deg C. Without high climate sensitivity the global warming crisis could not be a crisis, it would be more

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[25] Evolution of he Sun's Spectral Irradiance Since the Maunder Minimum by Judith Lean. Geophysical Research Letters (2000)

like an amusing speculation. High climate sensitivity creates problems in explaining both the early and late 20th century warmings.

The early warming is quite strong, but the increase in greenhouse gas is weak, so you can't explain it by greenhouse gas. By adding solar with a strong boost in the sun's output they can come closer to explaining it. They did not put enough solar in to explain the early warming and at the same time overcome a cooling from increasing aerosols (not included in Figure 4). For that reason their fit in the early 20th century (Figure 2) is not great. There are hints of cherry picking in the selection of the solar forcing that I will discuss later.

The problem with the late 20th century is that with a 3.0 degree climate sensitivity, the greenhouse gas caused temperature increase is very strong. The earth should have warmed much faster than was actually experienced. It appears that an aerosol forcing curve of the right shape and strength was added to slow down the modeled warming in the late 20th century.

The plot below (Figure 5) shows how the climate can be fit for a climate sensitivity of 3.0 deg. C for CO2 doubling if a judicious amount of aerosol forcing is added in the late 20th century and the speculative solar forcing is added in the early 20th century. The practice of using an aerosol forcing with a strong cooling effect in the late 20th century I refer to as judiciously boosted aerosol.

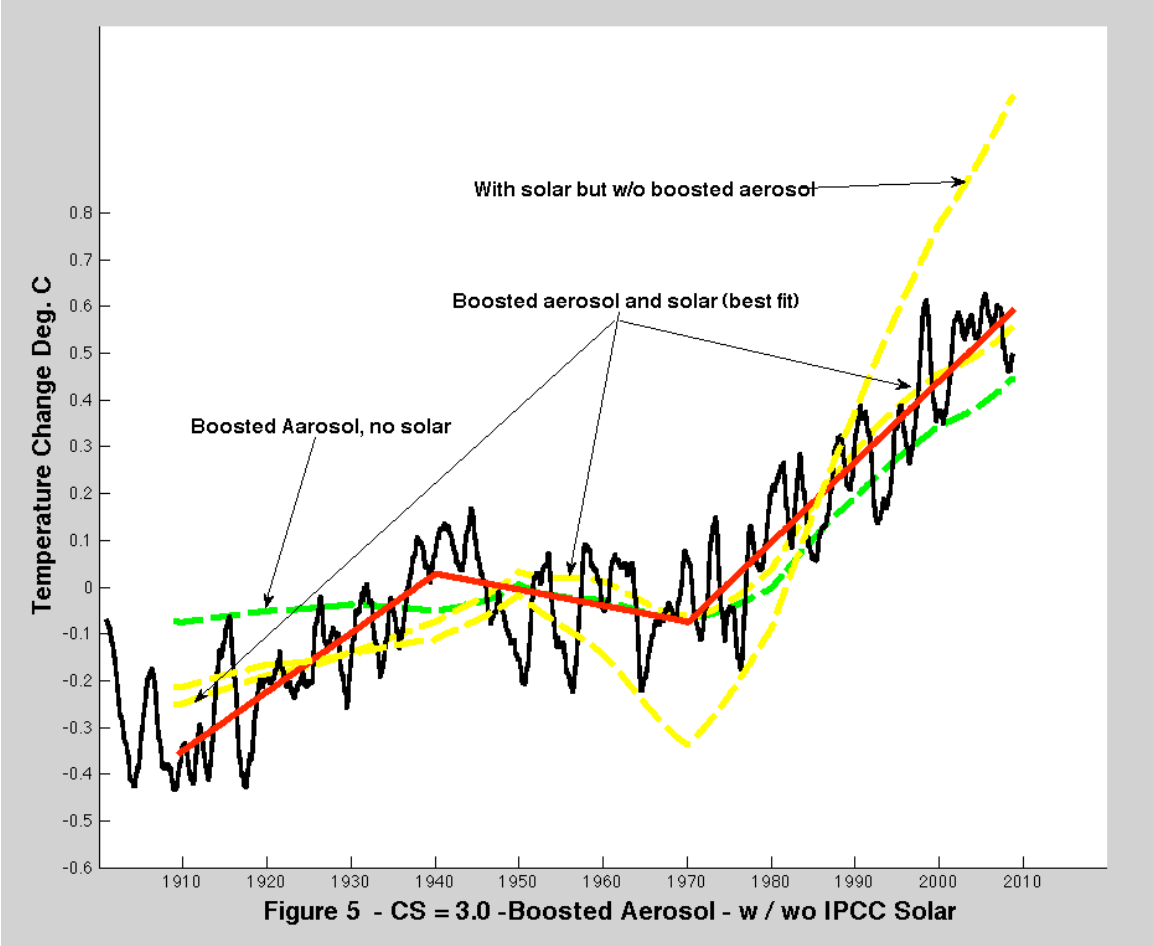

Figure 5 - CS = 3.0 -Boosted Aerosol - w / wo IPCC Solar

As can be seen in Figure 5, if the speculative solar forcing is not added, the early 20th century fit is much worse. If the boosted aerosol is not added, the late 20th century will not fit because the warming associated with a climate sensitivity of 3.0 is too fast.

Exactly what do I mean by a "judicious" amount of aerosol forcing? I mean enough aerosol forcing to make the graph come out right. But that's circular reasoning, right? Climate scientists prefer to call it the *inverse method*. With the inverse method the assumption is that everything else is right so the aerosol forcing must be whatever is left over and that is needed to make the graph fit the data. The graph above with the best fit (Figure 5) bears a strong resemblance to the upper graph of the IPCC figure 9.5 that we previously displayed and that is reproduced below as Figure 6. The chaotic variations are missing since we are not using a large-scale climate model that has irregular variations in output simulating similar variations in the earth's climate.

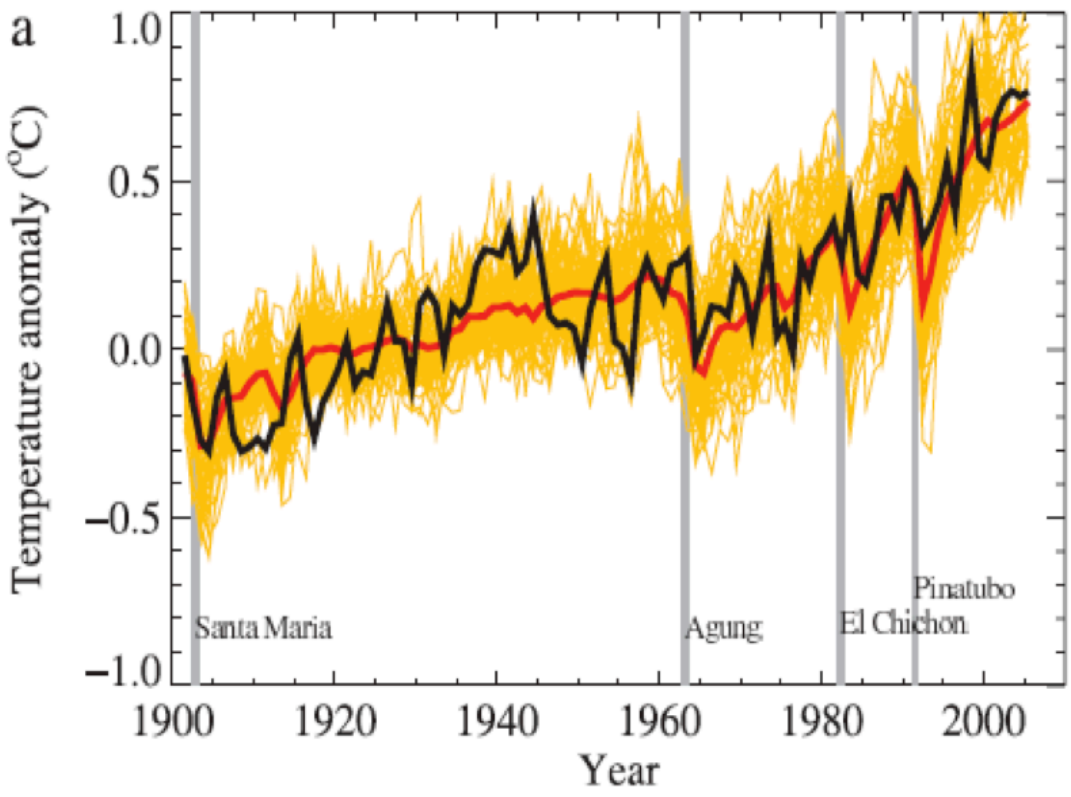

Figure 6

The red line is the temperature resulting from averaging all the runs and the black line is the climate record. The yellow lines in the background are explained as follows.

The yellow lines in the graph are the output of 50 computer runs of 13 separate large-scale climate models, mostly from different labs around the world[26]. Some models only contributed 1 run. One model contributed 9 runs. The red line is a best fit to these 50 runs. Isn't it redundant to include 9 runs from one model? Wouldn't they all be the same? They would be, except the starting conditions on each run are slightly changed. Due to the chaotic nature of climate the multiple runs turn out different, much as the temperature graph from 10 different years of Julys would look different, but only within the bounds of extreme temperatures for July. The average of enough runs should converge to what the model thinks the real climate is. What about mixing together runs from entirely different labs with different climate models? This is what is known as a multi-model ensemble. It's sort of like an opinion poll. Does this make the result better? Probably not, but it makes for better politics.

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[26] The details are from AR4 Chapter 9 supplementary material table S9.1.

All those different labs got some say in the IPCC study. Nobody was left out[27]. However, some labs were left out of this graph. The IPCC actually had results from 25 different climate models, but only 13 of the 25 contributed to the 20th century fit using natural and man-caused forcings. None of the models that were excluded used early century solar forcing, but every model that was included did. More confusingly, the lower graph in figure 9.5 (Figure 2), natural forcings only, did not use the same models as the upper graph. Only 5 of the 13 models in the upper graph contributed to the lower graph. It appears that a lot of high-powered scientific cherry picking went into figure 9.5. Using a multi-model ensemble is supposed to get at the truth by averaging in a wide variety of opinions. If certain models are excluded this goes against the motivation of multi-model ensembles. If the excluded models were excluded because the results were inconsistent with a predetermined conclusion the IPCC wants to propagate, science was turned into propaganda.

The most interesting thing about these different climate models is that the differ - differ a lot - in climate sensitivity. A couple of models have a climate sensitivity of 2.1 degrees/doubling CO2. One model has 4.4 degrees. The average is close to 3 degrees with ½ degree standard deviation.

Why do the models disagree so much on climate sensitivity? Like the stock analysts, the different modeling groups use different approaches to the problems. For example, climate models cannot directly simulate clouds from first physical principles, because clouds are too complicated and are below the scale or cell size that the climate models use. So the climate models have to use an empirical *parameterization* to describe the effect of clouds. Not only does each group have its own approach, but it is generally understood that parameterization of clouds by climate models is very poor. Further it is hard to make climate models that work. For many years they couldn't be made to even conserve energy. For that reason there is probably no easy way to change the climate sensitivity in a given model without disturbing some other critical feature of the model.

How in the world could all these models group be so close together in the graph when they differ so much in their response to greenhouse gases? A number of

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[27] And they all got to bask in the glory of the Nobel Peace Prize, half to Al Gore and half to the IPCC. The Nobel Peace Prize is awarded for political, not scientific reasons.

scientists have asked the same question with a strong criticism of the IPCC implied[28] [29] [30].

The answer to this puzzle is that probably each modeling group added its own judicious amount of aerosols. They may have also fudged other things such as the greenhouse gas forcing and the early century solar forcing. They were not required to use the same input forcings, even though we know that there is one and only one real set of forcings associated with the physical earth. In fact, they were told that they could simulate the 20th century in any way they saw fit[31]. This makes for a pretty graph, but it is mixing apples and oranges.

My next graph (Figure 7) shows how by adding an appropriate aerosol history a wide range of model climate sensitivities, from 2 to 4, can made to fit the 20th century by adding enough aerosol to keep the late century greenhouse warming under control. The speculative solar forcing in the early century is also included.

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[28] Kiehl, J twentieth century climate model response and climate sensitivity. Geophysical Research Letters, Volume 34 (2007) - Kiehl's modest suggestion is that investigators should adopt standard aerosol forcings (instead of making up a different forcing for each model to get the right result).

[29] In the paper: Knutti, R. (2008), Why are climate models reproducing the observed global surface warming so well?, Geophys. Res. Lett., 35, L18704, doi:10.1029/ 2008GL034932. Reto Knutti, a scientist working in Switzerland, said: "The agreement between the CMIP3 simulated and observed 20th century warming is indeed remarkable … But do the current models simulate the right magnitude of warming for the right reasons? How much does the agreement really tell us?"

[30] In an article (Quantifying climate change – too rosy a picture?) in the July 2007 Nature Reports (www.nature.com/reports/climatechange) climate scientist and aerosol expert Stephen Schwartz and co-authors, examined the fits to the 20th century climate in the IPCC 2007 report. Their reaction to the near perfect fit to the 20th century climate was: "How can this be? Evidently a variety of forcings and different representations of these forcings were used in simulations with the different models."

[31] The WCRP CMIP3 Multi-model Dataset A New Era in Climate Change Research, Gerald A Meehl, et. al Bulletin of the American Meteorological Society (BAMS) September 2007.

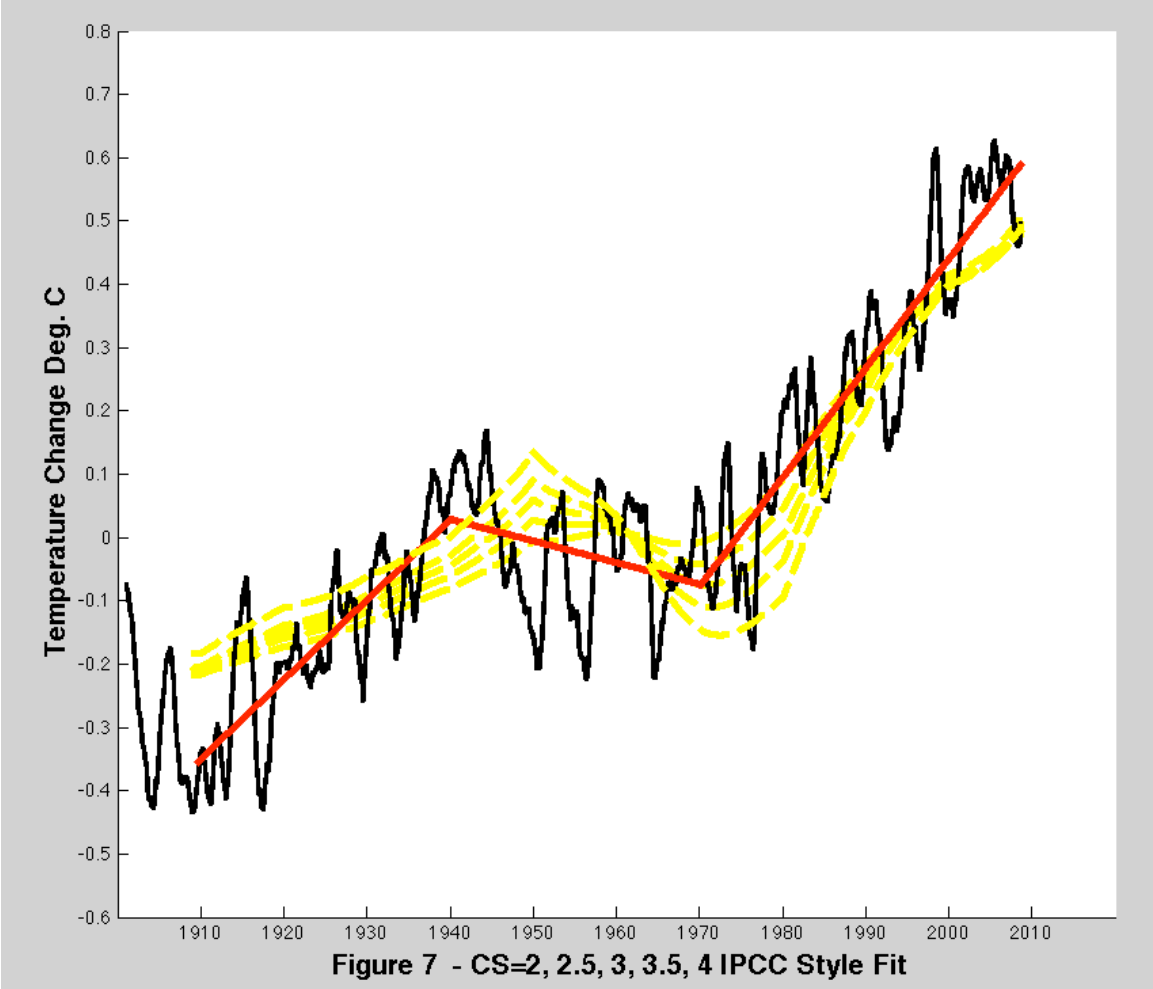

Figure 7 - CS=2, 2.5, 3, 3.5, 4 IPCC Style Fit

There is one problem with the aerosol function used to generate these graphs. It does not follow known facts about 20th century aerosols. Measurement of aerosols in the air is difficult and we do not have a century of measurements. However, most aerosols important for climate forcing trace their origin to sulfur emissions and it is possible to reconstruct sulfur emissions for the last 100 years. When fossil fuels are burned, particularly coal, a certain amount of sulfur is burned. This puts sulfur compounds in the air that eventually become sulfate aerosols. The record of sulfur emissions can provide us with the shape of the aerosol forcing curve[32], but not the overall strength. We know that forcing should be proportional to sulfur emissions but it is not clear exactly how strong the forcing is for a given rate of sulfur emissions. Sulfates aerosols have a short lifetime in the air and are constantly replenished as sulfur is added to the air. The following graph (Figure 8) shows the various forcing elements that are supposed to drive climate The aerosol forcing graph has a branch (dashed line). The branch represents the boosted aerosols in the late 20th century that allows aerosols to cancel greenhouse warming. The other

[32] For the curve shape of sulfur emissions I used the graph from: Global Sulfur Dioxide Emissions By Source (Pacific Northwest National Laboratory Report PNNL-14537). A reasonable guess supplied results for the 1st decade of the 21st century.

branch, the solid black line, is an aerosol forcing that agrees with 20th century sulfur emissions. This graph with boosted aerosol has a forcing strength sufficient to make a best fit to climate for climate sensitivity of 3.0. You can see that it will cancel much of the late 20th century greenhouse gas forcing. The total forcing line does not include the boost.

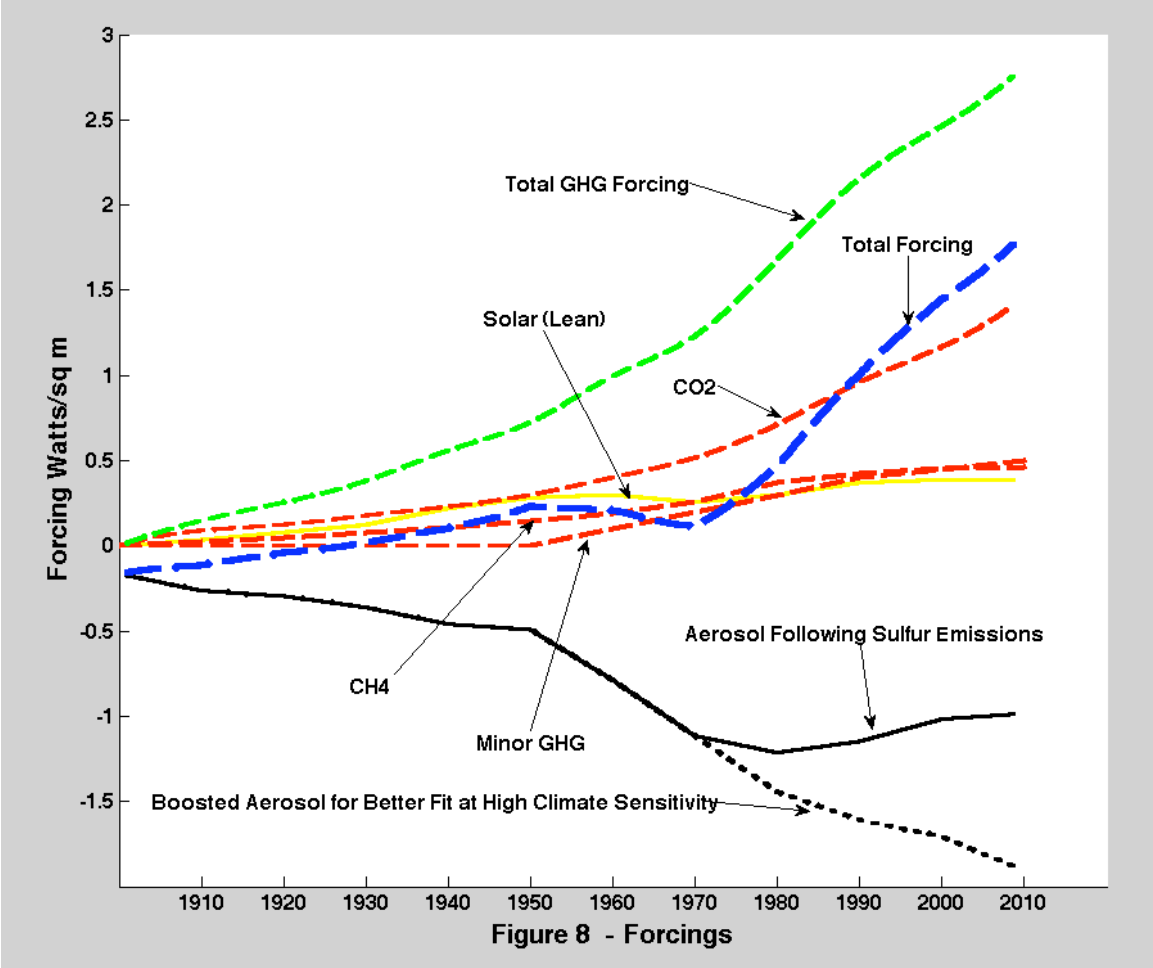

Figure 8 - Forcings

Sulfur emissions began declining in 1980 due to emission controls in the U.S. and Europe. This is reflected in the "Aerosol Forcing Following Sulfur Emissions" graph in Figure 8. However, in order to get a good fit it is necessary to use the "Aerosols Boosted for Better Fit" aerosol history in Figure 8. (That the graph lines do not all come together at the left in Figure 8 does not affect the argument since we are looking at changes since 1910.)

A significant point about aerosol forcing that results from sulfur emissions is that the forcing is nearly flat from 1970 to the present, the same period defined as the

late 20th century warming[33]. Because it is flat, you cannot change the simulated temperature slope by changing the contribution strength of aerosols. If two straight line graphs are added, the slopes add and if one slope is zero it can't affect the slope of the sum. If you accept that aerosol forcing must follow sulfur emissions, then the entire IPCC scheme of balancing excessive greenhouse warming with aerosols in the late 20th century will not work for the high climate sensitivities being advocated, because you cannot reduce the slope of the rapid increase of late century temperature by adding more aerosols[34].

The graph below shows the fit to the 20th century climate for various climate sensitivities with honest aerosols and honest solar (i.e. no speculative early century solar forcing and no late 20th century aerosol boost). This fit in late century cannot be improved by increasing the aerosol weighting, only by relatively boosting the late century aerosols and adding speculative early century solar. This is what the IPCC graph would look like without fudging.

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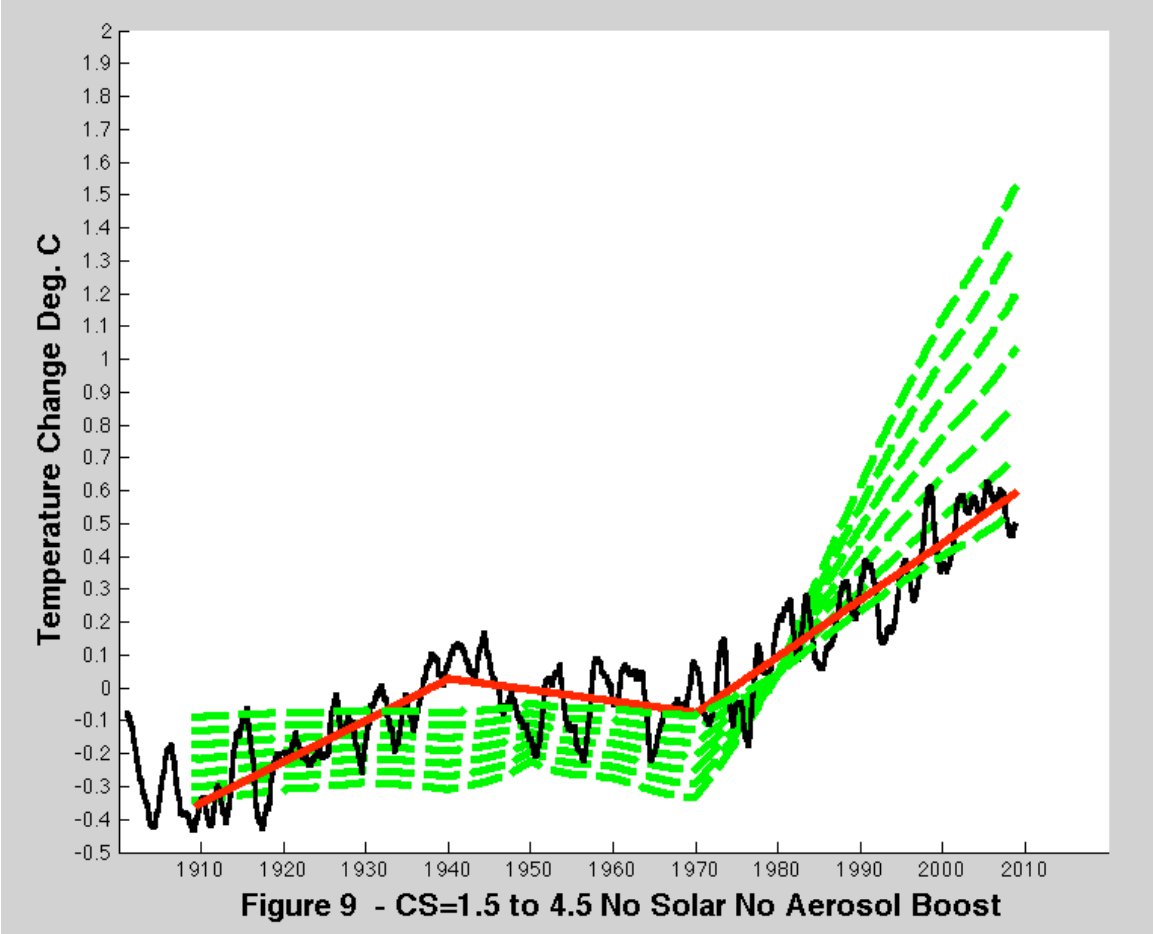
[33] Andronova, N. G. and Schlesinger, M. E.: 2000, 'Causes of Global Temperature Changes during the 19th and 20th Centuries', *Geophys. Res. Lett.* **27**, 2137–2140. This paper has a graph showing flat aerosols in the late 20th century.

[34] That the distribution of aerosols is not homogeneous complicates the situation.



I Play the Speculation Game

Since the IPCC is using speculative solar forcing and non-physical aerosol forcing I decided to look at some other papers on solar forcing. There are dozens of scientific papers on this subject. Solanki, et. al. wrote a 1998 paper that provided a different solar forcing function. By plugging in Solanki's function, which rises faster in the early century and is flatter in the later century this is the best fit obtained:

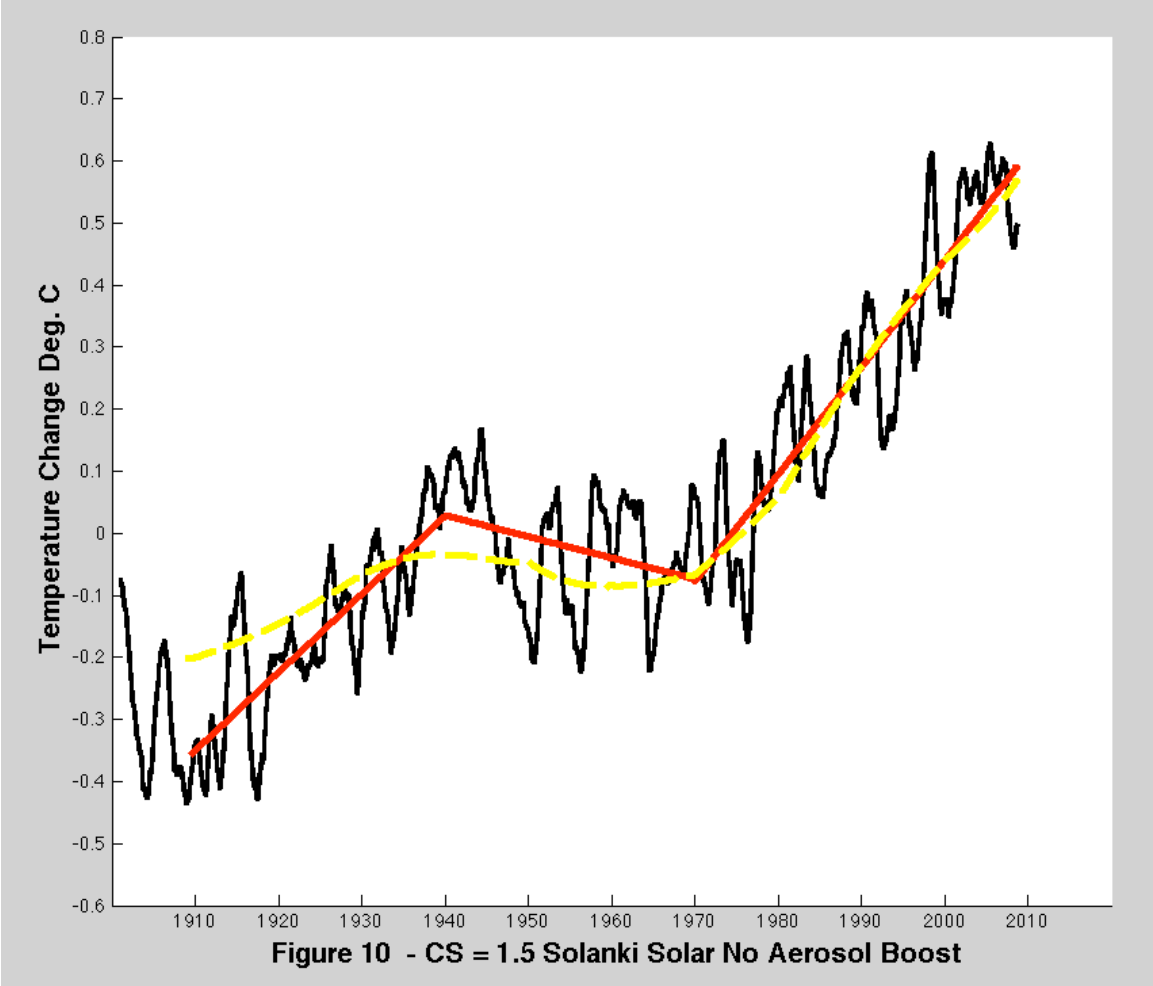


Figure 10 - CS = 1.5 Solanki Solar No Aerosol Boost

The fit is excellent, in fact the best fit obtained in any experiment in this article, with an RMS error of about 0.04 deg C. The climate sensitivity is 1.5 for this best fit. Further the fit is much more strongly constrained compared to an IPCC style fit with boosted aerosol and climate sensitivity of about 3.0 deg.

The graph below compares the two situations. The bowl shaped graphs are 10x the RMS error of the fit as a function of climate sensitivity. The other graphs show the aerosol weighting (roughly watts/m^2 of negative forcing at 1970) for the best fit at each climate sensitivity. The dotted line is for the fit using the Solanki solar function with no boost in aerosol. The sold line is the Lean (IPCC) solar function with aerosol boosted in the late 20th century to permit higher climate sensitivity. The bowl shaped graph with the steeper slope constrains the climate sensitivity more strongly.

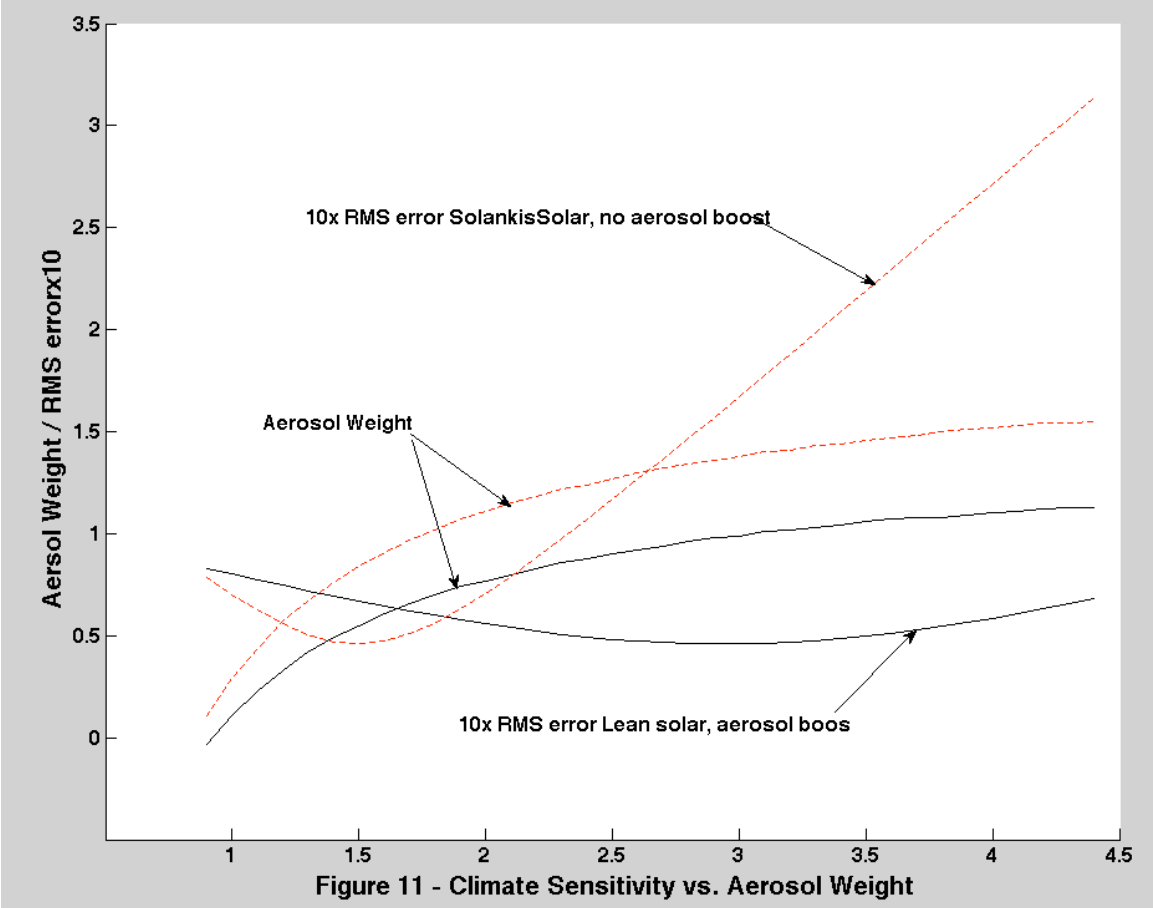


Figure 11 - Climate Sensitivity vs. Aerosol Weight

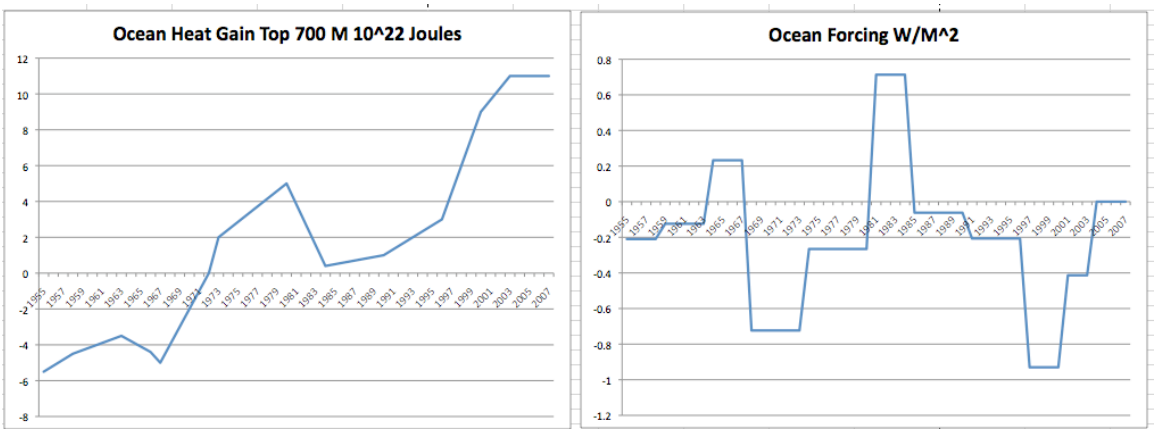
I'm not claiming that this proves anything beyond that a climate sensitivity of 1.5 deg. C is consistent with assumptions more realistic than the IPCC's.

The Ocean

The ocean has a great heat capacity and can serve as a handy excuse for insufficient global warming. The argument is that as global warming takes place the air temperature and ocean temperature are out of equilibrium and part of the global warming forcing goes to heating the ocean rather than warming the climate. The effect will be to delay full global warming until the ocean has a chance to warm up and come into equilibrium with the atmosphere. For this reason in the climate modeling world they speak of transient climate sensitivity and equilibrium climate sensitivity. Transient climate sensitivity is defined as the temperature increase when CO2 just doubles after increasing 1% per year and equilibrium climate sensitivity is defined as the final temperature increase if the model is continued to run without further increase in CO2 until the temperature ceases to increase.

The question we will ask here is can ocean drag explain the lack of warming in the later part of the 20th century. Since about 1955 there have been measurements of ocean heat storage. These measurements have been done by lowering thermometers

on cables from ships or by dropping disposable torpedos that trail an uncoiling wire that returns temperature information. Unfortunately the millions of measurements made over the years are subject to various hard to correct errors. Beginning in 2003 the Argo system of robotic floats was deployed and more accurate measurements became available. These devices drift in the ocean and can periodically submerge to take temperature profiles that are communicated to satellites. The graphs below show accumulated ocean heat storage and the climate forcing due to heat entering or leaving the ocean.



The left graph shows ocean heat storage changes in units of 10^22 joules. It is adapted from two scientific papers, one by Levitus[35] covering the period from 1955 to 2003 and one by Willis[36] covering the period from 2003 to 2007. As can be seen from the graphs the flow of heat into and out of the ocean is irregular. The general trend is for the ocean to be warming, although there are periods when the ocean is warming when the climate is cooling (1955 to 1970) and the climate is warming but the ocean is cooling (1979-1983). Significantly, during the 2003 to 2007 period the ocean is not warming although one would expect that after 40 years of greenhouse warming the ocean would be lagging the climate and warming rapidly. The right graph translates ocean heat changes into equivalent forcing expressed in watts per square meter over the earths surface. If we look at the last 15 years from 1993 to 2007 the average negative forcing from heat being diverted to the ocean is less than 0.4 watts per square meter while the greenhouse gas forcing (see figure 8) is more than 2 watts per square meter. Thus ocean drag on warming could account for at most a 20% reduction in warming.

To this point the discussion of the effect of the ocean is oversimplified. The measurements presented above cover only the upper 700 meters of the ocean while half the ocean is deeper than 3700 meters. The deep ocean is a vast reservoir of cold water accumulated over thousands of years from cold, salty water in the arctic and

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[35] Warming of the world ocean 1955-2003 by S. Levitus et. al. Geophysical Research Letters 2005.

[36] Assessing the globally averaged sea level budget on seasonal to interannual timescales by Josh K. Willis et. al. Journal of Geophysical Research 2008.

antarctic sinking to the bottom of the ocean and spreading out over the bottom of the world's oceans[37]. In different times and places the cold bottom water returns to the surface or the cold diffuses upward. This circulation, sinking cold water and upwelling cold water constitutes the *thermohaline* circulation. When cold water sinks it warms the climate because the cold water that would otherwise return toward the tropics is instead stashed away in a place that is not well connected to the earth's climate, the bottom of the ocean. Upwelling cold from the depths cools the climate by bring cold water to the surface. Upwelling takes place along certain coastal area and at the equator. When sinking and upwelling get out of balance, which they can, the thermohaline circulation can add significant forcing, comparable to that caused by greenhouse gases. Thus, we really don't know how much of the changes in ocean heat storage, in the first 700 meters, is related to heat transfer from the atmosphere and how much from heat transfer to or from the deep ocean.

To make thing worse, the figures presented in the graphs above, especially prior to the deployment of Argo in 2003, are speculative in nature due to the measurement uncertainties. Some observers think that ocean warming is exaggerated[38].

The climate models simply don't accurately simulate the oceans. They can't because we don't understand the oceans. The abrupt changes in ocean warming could well be an indicator of changes in the thermohaline circulation. It is interesting that when at long last a fairly good ocean monitoring system was installed in 2003 (Argo) the ocean no longer warmed.

Objections to my Argument

Climate science is an immature science. For this reason there are few certainties agreed to by all. It is also a science that has backed itself into a corner. Too many climate scientists have become public figures announcing to the world that the science is firm and there is a consensus. If there is really a consensus and if the science really is firm there is no need to run around making that point to one and all.

If you or any scientist really wants to believe the IPCC, reasons can be found. If you think it is impossible that a United Nations organization would exaggerate and misrepresent in order to feather their own nest then you certainly will dismiss my arguments. If you think scientists are paragons of high ethical behavior you may dismiss my argument, but you will have to dismiss the many scientists that are on

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[37] Unlike fresh water sea water becomes denser as it gets colder. Fresh water has its maximum density at 4 C. For the sea water to sink it must also be especially salty a condition that can come about due to evaporation of water in the tropics that is subsequently transported to the poles or due to rejection of salt from the formation of sea ice.

[38] How much is the ocean really warming? by Viktor Gouretski and Klaus Peter Koltermann. Geophysical Research Letters 2007.

my side. If you think that the Nobel Peace Prize for Al Gore and the IPCC proves something, you don't know the history of the Nobel Peace Prize[39].

Global warming supporters can always invoke the precautionary principle. Maybe the IPCC is right so we have to take out an insurance policy. But there are many potential dangers[40] lurking in the world that we pay little or no attention to, so why is this one so important?

Could the ocean have affected the climate in the early century? We don't know, but Schlesinger and Ramankutty[41] suggested that the 70 year Atlantic Multi-decadal Oscillation could explain much of the early 20th century warming. It would also appear to be a possible cause of the mid century cooling and late century warming. The AMO appears to cause a global temperature oscillation of 0.2 deg. C.

Some may say that I have vastly over-simplified the problem. They are certainly correct. Temperature is only one dimension in a multidimensional description of the earth's climate. There are many other dimensions, such as humidity, precipitation, cloud type and density and all these things vary with latitude and longitude and the seasons. However this over-simplification is what the IPCC and the advocates of global warming use in their presentations to the public, so I'm using it too.

Climate Sensitivity

What is the real climate sensitivity? If you look at the record of the last 100 years a case can be made for 1.5 deg/2xCO2 if you assume that a mysterious forcing was responsible for the early warming and that mysterious force turned off for the late warming. Then the early warming is explained by the mysterious force and the late warming by greenhouse warming. The middle century cooling is explained by aerosols. Candidates for the mysterious force include solar irradiance, the Atlantic multi-decadal oscillation, solar modulation of cosmic rays, ocean release of heat (i.e. the ocean cools, perhaps by evaporating water) and other known or unknown things. If the mysterious force continued to increase into the late century, then a case can be made for even lower climate sensitivity, because the late warming is then attributable only partly to greenhouse gas.

Perhaps you can also make a case for high climate sensitivity if you assume that the ocean is out of equilibrium with the climate and is temporarily delaying the warming. Certainly this is an important argument of the advocates of global

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[39] Some previous peace prize winners: Linus Pauling brilliant scientist who became vitamin C crackpot. Rigoberto Menchu supposed Guatemalan peasant who turned out to be fake in every way. Yassar Arafat, terrorist. Jimmy Carter, critic of the United States. The prize is awarded by politicians for political reasons.

[40] Astroid striking the earth. Man made pathogen killing human race. Nuclear war. Nuclear bomb destroys all electronic devices by electromagnetic pulse. Giant earthquake in American Midwest from New Madrid fault. Nanoparticle pathogen. Lack of research to discover unknown dangers.

[41] Schlesinger M,. E., and N. Ramankutty An oscillation in the global climates system of period 65-70 years, Nature, 367, 723-726, 1994

warming when they try to explain the lack of warming. You can also reject the hypothesis that aerosol cooling is proportional to sulfur emissions and then get cancellation of late century warming by aerosols. This amounts to more mysterious forces to explain why we don't see rapid warming in the late century.

You can also question the concept of climate sensitivity as a linear or proportional relationship between forcing and temperature. We know that some climate effects are very non-linear with sharp thresholds. For example the open ocean surface temperature seems to have an absolute upper limit to the temperature it can reach of about 30C. Evaporative processes kick in and keep the ocean from getting hotter. We also know that hurricanes don't start unless the ocean surface temperature is above 26.5C. It is a sharp threshold.

Scientist Richard Lindzen proposed that the earth has an iris, something like iris in a camera, that opens and closes to regulate the temperature. The mechanism he proposed involved a change in clouds related to temperature. His hypothesis was based on satellite observational evidence. His paper was vigorously attacked, unfairly in his view.

Scientist Roy Spencer examined the relationship between outgoing radiation and surface temperature using satellite data. The outgoing radiation includes both infrared and reflected sunlight. Since the incoming sunlight is quite constant this is similar to a forcing change. If the earth warms the outgoing radiation should increase. If it increases a lot for a small change in surface temperature this would indicate a low climate sensitivity because the earth would strongly resist an increase in temperature by increasing outgoing radiation to get rid of the heat. Note that there are two ways to get rid of the heat, increase outgoing infrared or increase reflection of sunlight. An increase in low cloudiness will increase reflected sunlight without reducing outgoing infrared as much. The problem with this is the confusion of cause and effect. Changing the temperature changes the radiation balance but the reverse, changing the radiation balance changes the temperature. Changes in surface temperature are also caused by effects other than radiation, such as evaporation and condensation. Spencer came up with an empirical approach to untangling cause and effect and the indications he came up with are that the climate sensitivity is extremely low, perhaps ½ degree for doubling CO2. This indicates that powerful mechanisms exist that inhibit warming, a kind of air-conditioning that kicks in when it gets too hot. Spencer's theory is climatically incorrect, so even though he is an established scientist with many publications, he has been unable to publish this theory in a scientific journal in spite of submitting papers a number of times. For logical closure Spencer also made some alternative suggestions (to greenhouse gas) for the causes of the temperature record of the 20th century, relating temperature changes to the multi-decadal oscillations in the oceans.

Conclusion

The IPCC has tried very hard to convince us that the climate models can reproduce the 20th century climate. If the models can't do that, neither the models nor the IPCC

would have much credibility. Allowing each modeling group to customize forcing to make its model show a good fit is unscientific. It is a trick. There is no excuse for trying to fool people with fudged graphs. Adding speculative solar forcing in the early 20th century suggests cherry picking in order to make the fit look better. I showed that I could pick a better cherry if the climate sensitivity was allowed to be 1.5 deg.

Clearly, the IPCC is engaging in slanting the presentation for propaganda reasons. They've done it before with the hockey stick. Dozens of commentators have pointed out many more inconsistencies and distortions by the IPCC.

From this analysis is should be obvious that the canonical model of climate science, and the best efforts of the IPCC, cannot explain the 20th century. We don't know what caused the early 20th century warming. The late 20th century warming can't be explained by greenhouse gas and aerosols because if we accept that aerosols peaked in 1980 and have been declining since it is not possible for the aerosols to cancel out the excessive greenhouse warming implied by the high climate sensitivities proposed by the IPCC.

My view is that climate science is over-reaching, drawing conclusions and making predictions that are not justified by what climate science really knows.