

ENDANGERED SCIENCE AND THE EPA'S FINDING OF ENDANGERMENT FROM CARBON DIOXIDE

While we have mentioned the matrix of professional incentives that distort science, the field of climate science has been especially politicized, with an annual federal research and technology development 2013 outlay of roughly \$6.4 billion. There is only one provider of climate research funding, and that is the federal government. A 2013 Office of Management and Budget report lists total "Federal Climate Change Expenditures" as a 2013 outlay of \$22.6 billion.¹ It is inconceivable that one important policy-related recipient of this largesse, the Environmental Protection Agency, would ever declare that carbon dioxide-induced climate change was not exceedingly dangerous to human health and welfare.

Thus did appear, on December 7, 2009, EPA's "Finding of Endangerment" from carbon dioxide and other greenhouse gases.

History of the Endangerment Finding

In 2006, the Supreme Court granted a writ of *certiorari* to "Massachusetts v. EPA", a case in which Massachusetts (alongwith 11 other states, the District of Columbia, and a plethora of environmental advocacy organizations) claimed that Clean Air Act Amendments of 1992 contained language requiring that EPA limit emissions of carbon dioxide from cars, because it was a "pollutant", something that endangered human health and welfare. EPA held that this was not the case because of scientific uncertainty concerning the amount of climate change actually caused by it. In 2005, the Appellate Court upheld by a 2-1 vote EPA's original decision that it did not have such authority, although the 38-page dissenting opinion by Judge David S. Tatel was impressive.²

¹ Source: Office of Management and Budget, 2013. Federal Climate Change Expenditures: Report to Congress. 48pp. This includes \$2.5 billion for the U.S Global Change Research Program, and additional funds that only seem justified by the climate issue, such as funding the Global Environmental Facility or the Clean Technology Fund, etc...resulting in a 2013 actual spending total of \$6.4 billion. The entire annual total given for all categories in the Report to Congress is \$22.6 billion.

² 38 pp. in

<https://www.cadc.uscourts.gov/internet/opinions.nsf/131F165AA3EA9E328525742B0055906B/%24file/03-1361a.pdf>

There were serious questions, acknowledged by the Supreme Court in its majority decision, that the Petitioners might have lacked sufficient standing to bring the case forward, but, nonetheless, writing for the majority, Justice John Paul Stevens said, “the unusual importance of the underlying issue persuaded us to grant the writ”. The June, 2007, 5-4 decision Supreme Court said that if the EPA deemed carbon dioxide a pollutant harming health and welfare, then it indeed could regulate under the Act. This being late in the George W. Bush Administration, EPA took a pass until after the 2008 election.

That changed about three minutes into the first Obama Administration, when global warming was the second action item in his First Inaugural Address (after health care). A mere 90 days later, EPA came out with a “Preliminary Finding of Endangerment”, foreshadowing its final Finding eight months later. The December 7 date was timed to provide a *bona fide* for the just-started 15th Conference of the Parties to the UN’s Framework Convention on Climate Change in Copenhagen, where the world was to meet to finally and definitively hammer out a new Agreement to replace the failed 1997 Kyoto Protocol to reduce emissions.

The Endangerment Finding has to be based upon some assumptions about future climate as modified by increasing atmospheric carbon dioxide, and we really have limited tools to make this important forecast. It is not simply a matter of going back in geological time to see when atmospheric concentrations of carbon dioxide were what they might be in 2100, and then looking for proxy indicators of global temperature. By 2100, concentrations will be what they were prior to the major glaciations that began roughly two million years ago. Even in the warm interglacial periods within the current glacial regime, large amounts of ice remained over Antarctica and Greenland likely also retained a substantial (though reduced) ice volume. The last time Earth saw such concentrations there was very little land ice.

One might infer cause-and-effect and say that the Greenland ice cap, as well as a substantial portion of Antarctic ice will be lost. Maybe—but it’s not going to occur anytime soon, but time is the essential matter here. If it takes only one or two hundred years, that’s catastrophic. If it takes thousands, the resultant sea level rise will be gradual enough for adaptation. It is noteworthy that around 125,000 years ago, for reasons having more to do

with the sun than with atmospheric chemistry, Greenland averaged 6°C (11°F) warmer than the 20th century average for approximately 6,000 years, and still only lost about 30% of its ice.³

One can extrapolate from the known changes the radiation balance from atmospheric carbon dioxide associated with the recent glacial cycles. Even though the changes in its concentration were much smaller than what we anticipate in the future, the warming effects of carbon dioxide are known to be the largest at its lowest concentrations, so there is some legitimacy to this approach. This method tends to reduce the expected warming from prospective computer models by about one-third.^{4,5}

The scientific bases for the Endangerment Finding are in an accompanying “Technical Support Document”, which ignores the historical studies and instead relies solely on the projections of what are called General Circulation Models (GCMs).⁶ These are complicated computer simulations of the earth’s atmosphere altered by human emissions of carbon dioxide. If these can be invalidated, then so can the Endangerment Finding.

The importance of the Endangerment Finding as it stands is that it will serve as the touchstone for continual litigation of any attempt to weaken, roll back, or eliminate greenhouse gas regulations by an Administration opposed to them.

The rationale for invalidation would obviously be a demonstration that the GCMs are systematically failing in their forecasts of warming. The evidence for this is as stark as two illustrations from Dr. John Christy at University of Alabama-Huntsville.^{7,8} The first shows

³ NEEM Community Members, 2013. Eemian Interglacial Reconstructed from a Greenland Fored Ice Core. *Nature* **493**, 489–494.

⁴ Schmittner, A., et al., 2011. Climate Sensitivity Estimated from Temperature Reconstructions of the Last Glacial Maximum. *Science* **334**, 1385-1388.

⁵ Hargreaves, J. C., et al., 2012. Can the Last Glacial Maximum Constrain Climate Sensitivity. *Geophys. Res. Lett.* **39**, L24702.

⁶ US Environmental Protection Agency, 2009. Technical Support Document for the Endangerment and Cause or Contribute Findings for Greenhouse Gases. 198pp.

⁷ Christy, J. R., “U.S. House Committee on Science, Space & Technology, 29 Mar 2017”, <https://science.house.gov/sites/republicans.science.house.gov/files/documents/HHRG-115-SY-WState-JChristy-20170329.pdf>

⁸ Christy, J. R., 2017. State of the Climate in 2017. Special supplement to *Bulletin of the American Meteorological Society* **98**, Figure S10.

predicted and observed tropical (20°N-20°S) temperatures in the middle of the earth's active weather zone—technically the mid-troposphere, roughly from 5,000ft to 30,000ft elevation. The predicted values are from the 102 climate model realizations from 32 different base model groups. These are from the most recent science compendium of the UN's Intergovernmental Panel on Climate Change (IPCC).⁹

⁹ United Nations Intergovernmental Panel on Climate Change, 2013. Climate Change 2013. The Physical Science Basis. Cambridge, 1535pp.

The observations are running means of the three principal analyses of lower atmospheric temperatures determined from satellite-sensed changes in the microwave emissions of oxygen, which vary with temperature, the average of the four commonly used compilations of weather-balloon sensed temperatures, and a “reanalysis” set of lower atmospheric temperatures derived from the initialization temperature fields from three different daily weather forecasting models.

The difference between to predicted changes observed changes is striking, with only one model, the Russian INCM4, appearing realistic. In its latest iteration, its climate sensitivity (the net warming calculated for a doubling of the atmosphere’s carbon dioxide concentration) is 1.4°C (2.5°F) compared to the average of 3.2°C (5.8°F) in the family of models used in the IPCC science compendium.

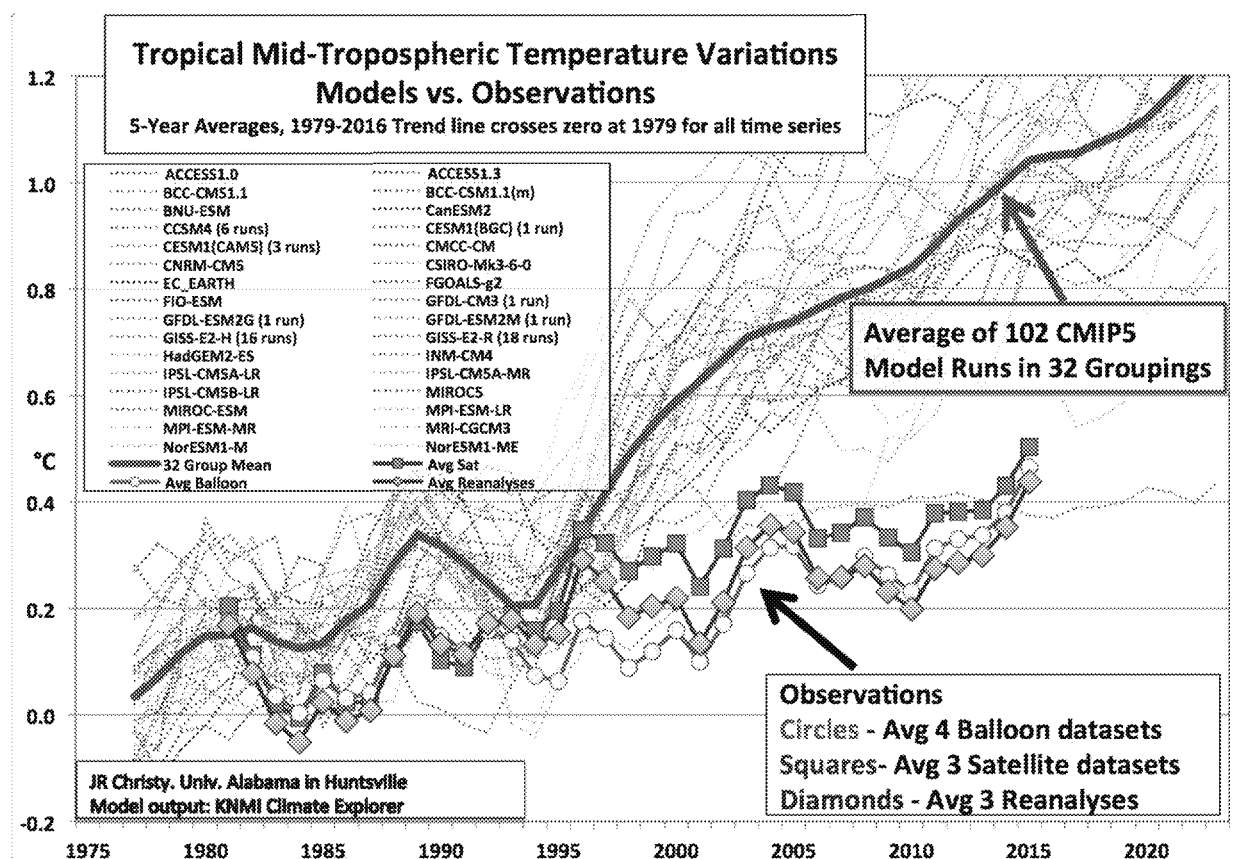


Figure x.1. Observed and predicted (colored “spaghetti” plots; see legend) temperatures in the lower atmosphere from John Christy, University of Alabama-Huntsville, beginning in 1979,

when the satellite data begins. From the testimony of John Christy to the House Science Committee, March 29, 2017. Data also shown in tabular form in the *Bulletin of the American Meteorological Society*.⁸

Next is a somewhat more complicated illustration. It shows vertical temperatures in the tropics. The Y-axis is height, and the x-axis is temperature change since 1979 predicted by the average of the 108 models (red) and observed from weather balloons (green). The altitude is given as the atmospheric pressure in hectaPascals (hPa)¹⁰, with approximate values also given in feet. In reality, the altitude of different pressure surfaces vary slightly with the average temperature of the layer through which the balloon has ascended.

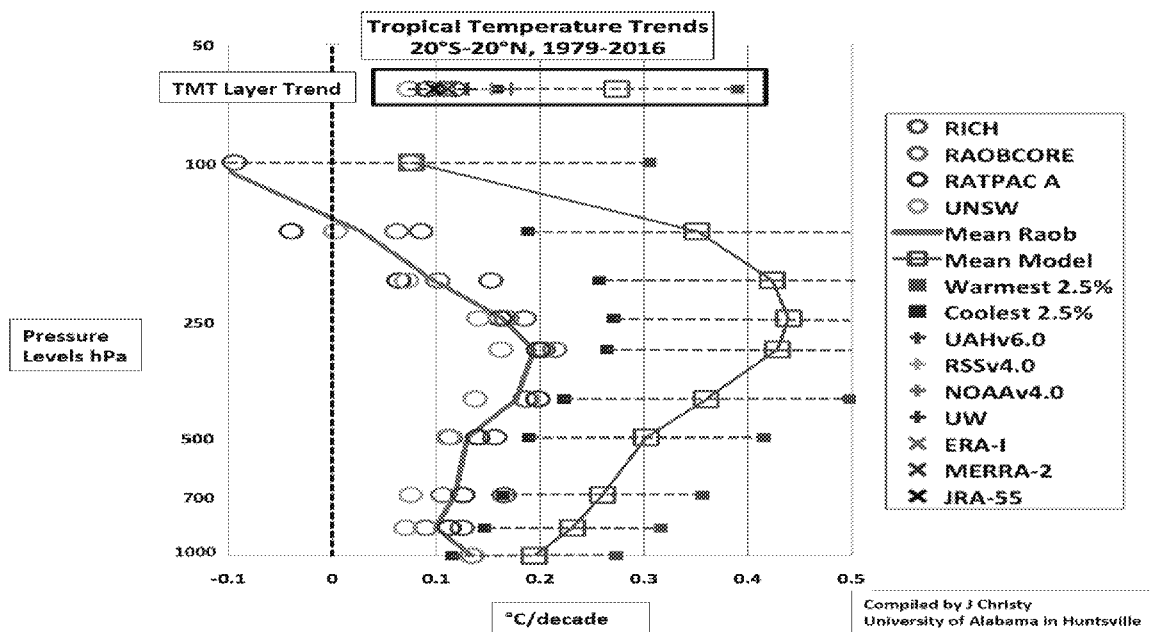


Figure x.2. Predicted (red) and observed (green) temperature trends ($^{\circ}\text{C}/\text{decade}$). From testimony of John Christy to the House Science Committee, March 28, 2017, and the *Bulletin of the American Meteorological Society*.⁸ See text for explanation.

It is obvious that there is a massive systematic problem with the climate models over the vast tropics since 1979. They clearly forecast a “tropical hot spot” centered from a

¹⁰ A note on units. The entire weight of the atmosphere is approximately 1000 hectapascals (hPa). Therefore a when the balloon senses 500 hPa, about half of the atmosphere (by weight) is above it, and half is below.

pressure of approximately 500hPa (approximately 18,000 feet in altitude) to the top of the earth's active weather zone, known as the tropopause (literally translated as "where motion stops") when compared to warming near the surface (1000hPa). The predicted warming rate at the surface is almost twice the observed value, and, at the level of around 50,000 feet, the predicted rate is around seven times what is being observed.

The consequences of this error are enormous. The vertical distribution of temperature in the tropics is central to the formation of precipitation. When the difference between the surface and the upper layers is large, surface air is more buoyant, billowing upwards as the cumulonimbus cloud of a heavy thunderstorm. When the difference is less, storm activity is suppressed. As shown on the chart, the difference is supposed to be becoming less and less, which would result in a general tendency for tropical drying. In reality, the vertical temperature changes at the surface are very similar to those aloft (the green line is the average of four observed datasets) until roughly 35,000 feet. Above that level the warming rate is much *less* than at the lower levels, which should result in an *increase* in clouds, rather than the decrease forecast by the climate models.

Missing the tropical hot spot provokes an additional cascade of errors. When the sun shines over a wet surface, the vast majority of its incoming energy is shunted towards the evaporation of water rather than direct heating of the surface. This is why in the hottest month in Manaus, Brazil, in the middle of the tropical rainforest and only three degrees from the equator, high temperatures average only 91°F (Not appreciably different than humid Washington DC's 88°F). To appreciate the effect of water on surface heating of land areas, high temperatures in July in bone-dry Death Valley average 117°F

Getting the surface temperature wrong will have additional consequences for precipitation. If the tropical hot spot were there, the resultant decline in precipitation, combined with very hot temperatures, could force the climate-vegetation models to generate scrub vegetation or even a semidesert when in reality a region remains a lush and vibrant tropical rainforest.

Every person actively involved in running a climate model knows all of the above. They know that much of the downstream “weather” resulting from an inaccurate hot spot over the entire tropics (which cover nearly 40 per cent of the planet) will simply be wrong, or if it is right, only fortuitously so.

We can sum up the implications of Figures x.1 and x.2 as **Endangerment Finding Flaw #1: The climate models are making multiple systematic errors with regard to three-dimensional atmospheric temperatures that disqualify them as the basis for the Endangerment Finding.**

Model Tuning

Left to their own devices, it has long been known that climate models run with increasing atmospheric carbon dioxide produce too much warming. As a result, internal parameters that ultimately predict future climate are altered in search of what has been called an “anticipated acceptable range”.¹¹

With regard to tuning, a fortuitous flap of a chaotic butterfly wing has unleashed the perfect storm for the climate models and therefore for the Endangerment Finding.

The story begins in 2010, when 32 modelling complexes were required to submit “frozen code” output so that standardized models could be compared for the upcoming 2013 IPCC scientific summary. This process is overseen by the U.S. Department of Energy (DOE), and it is called a “Climate Model Intercomparison Project” (CMIP). This was the fifth iteration of the intercomparison, or CMIP5.

But where and when to freeze the code? That turns out to be highly subjective. In 2010, the Max-Planck Institut (MPI) needed to submit its version to DOE, but the lead researcher, Erich Roeckner, was unavailable. So it devolved to the postdocs, junior scientists, and graduate students to get the model in shape to be shipped. Which they could not do with ease. It appears that Roeckner alone had the facile expertise to tune certain model parameters in

¹¹ Hourdin, F., et al., 2017. The art and science of climate model tuning. *Bulletin of the American Meteorological Society*. <https://doi.org/10.1175/BAMS-D-15-0013335.1>

order for it to produce something that looked like a realistic climate. They finally produced a proper model, but it projected over 7°C of warming as a result of doubled atmospheric carbon dioxide.¹² This would make their model by far the hottest of any that would appear in the subsequent IPCC compendium. Despite having told *Science* that “it was a damn good model”, they tuned that large warming away by adjusting other parameters, such as the dispersal of heat through the ocean. Finally, after many months, MPI had a product for the CMIP.

However, for the first time in recent memory, Roekner’s group decided to document what they had done. Thorsten Mauritsen, another of MPI’s senior scientists published the 2012 paper in *Journal of Advances in Modelling Earth Systems*, noting that this paper was hardly the definitive encyclopedia of tuning, because it is apparently impossible to know what was done to the models over their historical development. In Mauritsen’s words, “model development happens over generations, and it is difficult to describe comprehensively”.¹³

That’s because so many of the people who work on these models are temporary or ephemeral, like graduate students and postdoctoral fellows, and they don’t always leave notes about what they did, tuning-wise. In fact, they generally don’t. Significant portions of climate models are therefore black boxes with varying degrees of subjectivity. It is the subjective modeler and not the objective model that determines future climate

The tendency for carbon dioxide-driven models to overheat was explicitly recognized by the United Nations’ Intergovernmental Panel on Climate Change in its 1995 “Second Assessment Report”, when it stated that “most GCMs [climate models] produce a greater warming than has been observed, unless a lower climate sensitivity is used”, and it claimed “growing evidence that increases in sulfate aerosols are partially counteracting the [warming].¹⁴

¹² P. Voosen, 2016. Climate Scientists Open up their Black Boxes to Scrutiny. *Science* **354**, 401-402

¹³ Mauritsen, T., et al, 2012. Tuning the Climate of a Global Model. *J. Adv. Modelling Earth Systems* **4**, DOI: 10.1029/2012MS000151

¹⁴ “Sensitivity” is the amount of warming that ultimately develops for a concentration of atmospheric carbon dioxide that is doubled from the preindustrial background of 280 parts per million. As such it is a largely theoretical concept as by the time that warming is ultimately realized, the concentration is likely to have gone far beyond a H

This latter hypothesis has always troubled those critical of the models because the huge uncertainty previously associated with the sulfate cooling can easily be used to tune the models to reproduce the climate of the 20th century, and Voosen's blockbuster *Science* report noted that all climate models are tuned to do so.¹⁵ Indeed, in Mauritsen et al. we find a tremendous number of tuned parameters. It seems telling that while almost all models are tuned to replicate known global temperature of the 20th century, the range of various model sensitivities is on the order of several degrees Celsius. According to the paper,

Rational explanations are that 1) either modelers somehow changed their climate sensitivities, 2) deliberately chose suitable forcings, or 3) that there exists an intrinsic compensation such that models with strong aerosol forcing also have a high climate sensitivity.

The problem with model tuning is that code is changed in ways that may not be physically realistic in search of the match with the 20th century global temperature history. As a result, these same alterations, now existing in "frozen code" for the IPCC climate compendium, make their 21st century predictions with parameters that in some cases are simply not correct. This is a very plausible explanation for the massive departures from reality in both horizontal and vertical temperatures that have developed and are growing, as shown in figures x.1 and x.2.

A more comprehensive discussion of the pros and cons of model tuning was published in 2017 by Frederic Hourdin, Mauritsen and 13 coauthors. Called "The art and science of climate model tuning" it reveals several disturbing facts that could be used to vacate EPA's Endangerment Finding.¹⁶

The paper was certainly published with trepidation. In the aforementioned *Science* article about a preprint of it, reporter Paul Voosen said

¹⁵ From Voosen, 2016: "Indeed, whether climate scientists like to admit it or not, nearly every model has been calibrated precisely to 20th century climate records—otherwise it would have ended up in the trash. "It is fair to say that all models have tuned it", says Isaac Held, a scientist at the Geophysical Fluid Dynamics Laboratory, another prominent modelling center in Princeton, New Jersey."

¹⁶ Ibid (11).

For years, climate scientists had been mum in public about their “secret sauce”: What happened in the models stayed in the models. The taboo reflected fears that climate contrarians would use the practice of tuning to seed doubt about [the] models¹⁷

Voosen went on to describe what happened with the MPI model. When preparing their frozen code model for the Department of Energy

MPI hadn’t tuned for sensitivity before—it was a point of pride—**but they had to get that number down.** [emphasis added]

In his landmark paper, Hourdin described the process:

One can imagine changing a parameter which is known to affect the sensitivity, keeping both this parameter and the ECS [equilibrium climate sensitivity] in the **anticipated acceptable range**...[emphasis added]

Voosen was right: “contrarians would use the practice of tuning to seed doubt on [the] models”, only, more accurately, “could” should have been substituted for “would”.

The core claim that will be used against the endangerment finding, which is solely based upon these models for future climate, is this: Rather than the physics of the model determining future warming, it is the modeler that will ultimately choose what warming is scientifically acceptable. Tuning climate model matters because there are so many tunable parameters, and the range of possible parameter values can be so large as to allow any result.

Hourdin et al. (2017) note that the various model tunings are not even required model documentation by the Department of Energy team that supplies them to the U.N. “In fact, the tuning strategy was not even part of the required documentation in the CMIP5 simulations”, which refers to the periodical collations of climate models made by DOE for model intercomparisons. Hourdin et al. go on:

¹⁷ Ibid (12)

Why such a lack of transparency? Maybe because tuning is often seen as an unavoidable but dirty part of climate modeling...There may also be some concerns that explaining that models are tuned, may strengthen arguments of those claiming to question the validity of climate change projections.

On her popular blog, Climate etc.. (www.judithcurry.com), now-retired Georgia Tech climate scientist Judith Curry wrote about the Hourdin et al. paper, “[i]f ever in your life you are to read one paper on climate modeling, this is the paper that you should read.”

ENDANGERMENT FINDING FLAW #2: Climate models are “tuned” to produce what is a subjectively determined “acceptable” about of climate change. They are simply not mature enough to be used as the basis for expansive policies.

It is fair game to ask what prompted the publication of Hourdin’s candid manuscript on model tuning. According to the *Bulletin of the American Meteorological Society*, it was received in final form on July 9, 2016, and published online on March 17, 2017. It’s fair to say that the manuscript was in preparation for much of 2015. If submitted around January, 2016, the date of final manuscript would mean it was probably subject to two revisions at the suggestion of reviewers.

Obviously, copies (one that I have) were circulating everywhere prior to official publication. Curry’s highly-cited blog post was published on August 1, 2016, and Voosen’s very widely read *Science* news story was October 28, 2016. It interviews authors of the paper but never mentions the manuscript itself, obviously to keep *Science* in the good graces of the American Meteorological Society by not scooping it.

As noted by Voosen, modelers felt that revealing the extent and the subjectivity of the tuning process could jeopardize climate policy, except for one fact that was for sure true: At the time, *there was no way on earth that Donald Trump would be elected president, and every reason to believe Hillary Clinton was the next Chief Executive*. In that case there would be some noises made by the usual suspects when the paper ultimately appeared, but it is ludicrous to think that it would have caused Clinton to reverse or moderate Obama administration policies, including his legacy Clean Power Plan and Paris Agreement on climate change. Not only was it

OK to publish, but it was also very likely that a Clinton Administration would substantially increase support in an effort to ameliorate the tuning problem.

Systematic Flaws in U.S. National Climate Assessments

As noted above the Technical Support Document (TSD) for EPA's Endangerment Finding is model-based, which, given recent scientific developments. The TSD in turn heavily relies on the second of four serial documents put out by what is usually called the U.S. Global Change Research Program (USGCRP). According to the Global Change Research Act of 1990, which created the USGCRP and mandated that it produce periodic assessments of the effects of global climate change on the U.S. For brevity, these are called "National Assessments", the first of which appeared in November, 2000, after Election Day (but not after the Election was settled!) and before the inauguration of George W. Bush.

It was a prospective document that used the temperature and precipitation output of two climate models to drive "effects" models on various sectors, such as agriculture, forestry and human health. The USGCRP Synthesis Team, headed by Tom Karl, then-Director of the National Climatic Data Center in Asheville, North Carolina, had nine such models to choose from, and it settled upon two: one from the Canadian Climate Centre, and the other from the Britain's Hadley Center, a portion of the United Kingdom Meteorological Office that specialized in climate modeling.

It turns out that the Canadian model produced the largest temperature changes of any of the nine models, and the Hadley version produced the largest precipitation changes. When I asked the director of the USGCRP, Mike MacCracken about this, he replied that they "wanted to look at the most extreme possibilities".

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Testing a Model

Every scientific "model" is actually a hypothesis about the way a system behaves, and hypotheses need to be tested with real-world data to see if they can continue to be entertained, or if they need to be modified.

In the case of a climate model, the hypothesis is that the model is significantly simulating temperature changes in the real atmosphere as carbon dioxide rises. Having read earlier that all models are tuned to be able to mimic the global temperature history of the 20th century, this should seem like a cinch, right?

Except that the global models used in the 2000 National Assessment were chosen because they simulated the largest changes in temperature (Canadian model) and precipitation (Hadley model) of the nine considered models. Could that mean that they might be exaggerating observed climate change in the U.S.?

In this case we (myself and Paul C. Knappenberger) were looking at 10-year running means of U.S. temperatures, i.e. 1901-1910, 1902-1911, etc...This would seem to be a very simple test. We first looked the period-to-period variability of the raw data. If a model is working and we apply it to this data, what's left over (i.e. *not* explained by the model) will have a variability that is significantly less than the raw data. In other words, the model will "explain" a portion of the variability of the raw data. If this isn't the case, and somehow the model-minus-observed data variability is *greater* than that of the raw data, the model has seemingly done the impossible. It has added negative knowledge.

This is no different than a student scoring less than 25% on a four-option multiple choice exam. It means that his or her synthesis of the subject matter is somehow worse than it was before taking the course. This is precisely the behavior of the two climate models that underpinned the first National Assessment.¹⁸

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Now that you've read our sidebar, let's see how the First National Assessment models worked.

They didn't. Both the Canadian and Hadley models somehow *added* variability to the raw data when applied to it.

¹⁸ Documented in: Michaels, P. J., 2003. Science or Political Science? An Assessment of the U.S. National Assessment of the Potential Consequences of Climate Variability and Change. In Gough, M., Ed., *Politicizing Science: The Alchemy of Policymaking*. Hoover, Palo Alto. 313pp.

So, after completing my peer review, I reported my findings to Karl. I explained to him my finding, adding that to use these models to assess the effects of climate change on the U.S. is exactly analogous to a physician prescribing a medication to a patient that she knows has an opposite effect than what is desired. It would be like prescribing Ritalin for high blood pressure, and that would be called malpractice.

Amazingly, Karl emailed back. His team had applied not only my ten-year test to the models, but also to one, five, twenty, and twenty-five year running means. *At all time frames the models added variability to the raw data* instead of reducing it. The relevant illustration is here:

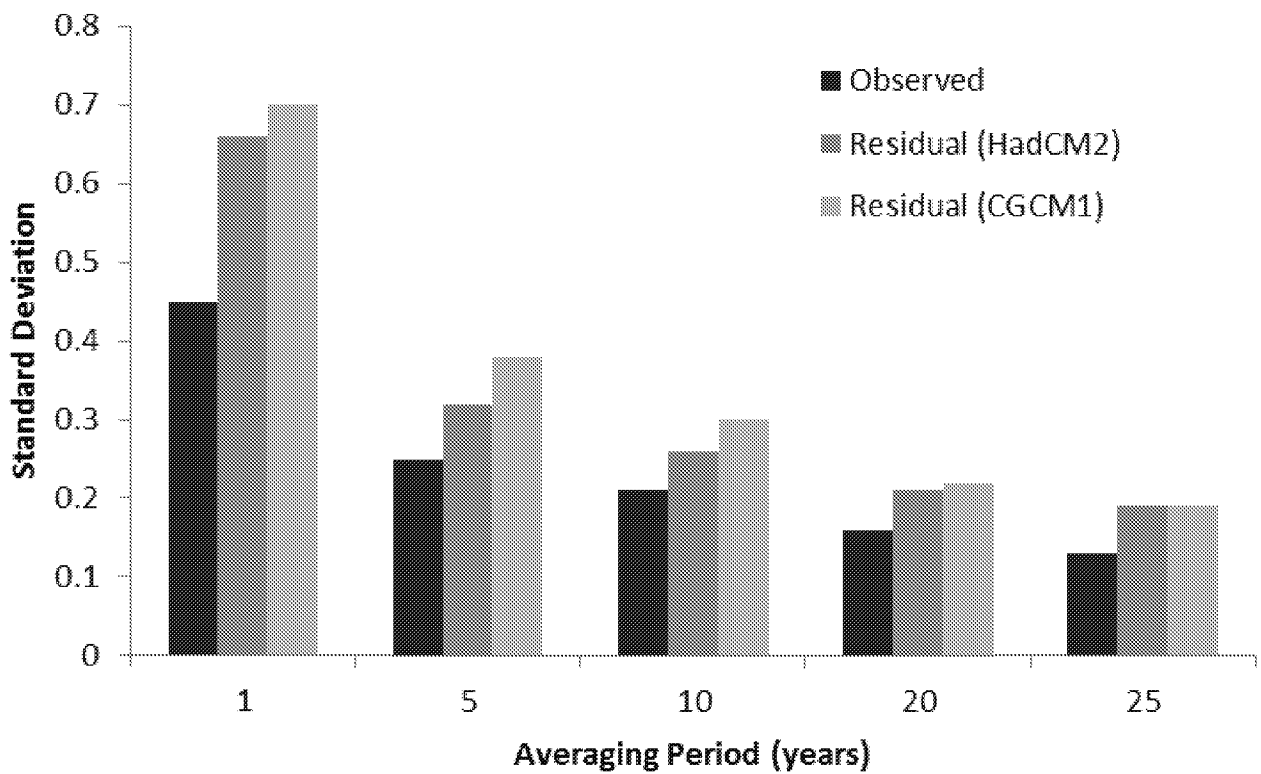


FIGURE X.4. RED—Raw US temperature data variability; DARK BLUE—Variability after the Hadley model was applied; LIGHT BLUE—Variability after the Canadian model was applied. For both models, and at all time intervals, the models did the seemingly impossible—they increased the variability of the data after they were applied. (Original data supplied in personal communication from Tom Karl, 2000.)

The second National Assessment came out soon after the end of the George W. Bush Administration, in June, 2009. It was obviously produced almost exclusively during his

Administration, as such reports take years to develop. Our peer review, dated August, 2008, began with this paragraph:

Of all of the “consensus” government or intergovernmental documents of this genre that [we] have reviewed in [our] thirty years in this profession, there is no doubt that this is the absolute worst of all. Virtually every sentence can be contested or does not represent a complete survey of a relevant literature.

To prove our point, we assembled a six-person team to produce a palimpsest called “ADDENDUM: Global Climate Impacts in the United States”. It was entirely analogous to the 2009 federal report. For example, under “Key Findings”, the government version says

7. Risks to human health will increase. Harmful health impacts are related to increasing heat stress, waterborne diseases, poor air quality, extreme weather events, and diseases transmitted by insects and rodents. Reduce cold stress provides some benefits. Robust public health infrastructure can reduce the potential for negative impacts (p.89).

The Cato palimpsest says:

7. Life expectancy and wealth are likely to continue to increase. There is little relationship between climate and life expectancy and wealth. Even under the most dire climate scenarios, people will be much healthier and wealthier in the year 2100 than they are today (pp 139-45, 158-61).

The ADDENDUM was especially richly referenced in the “Agriculture” and “Ecosystems” sections, two fields that have a much more balanced literature than, say, climate science. The reasons this occurred are documented in my 2016 book *Lukewarming*. In part, because of that substantial literature, the ADDENDUM had nearly twice as many scientific citations as did the second federal National Assessment. The lead author of the second Assessment was none other than Tom Karl¹⁹

¹⁹ Karl, T., J. Melillo, and T. Peterson (Eds.) (2009) *Global Climate Change Impacts in the United States*. Cambridge University Press, Cambridge, United Kingdom.

As noted above, the second Assessment was a critical component of the Technical Support Document for the EPA's 2009 Endangerment Finding. Its prospective forecasts on all of the impact areas (agriculture, human health, etc...) and regions (Southeast, Northeast, etc...) are all based upon models that have massive systematic errors including an incapability to simulate the evolution of lower atmospheric temperatures since 1979, and an erroneously project upper-atmospheric "hot spot" over the entire tropics, a substantial portion of the globe, as shown earlier in this chapter.

The Technical Support Document for the Endangerment Finding is largely based upon the 2009 National Assessment, which itself necessarily summarized a literature heavily biased by the incentive structure in modern science, as detailed in our chapter on the nature of Big Science.

In addition, the models themselves turn out to be much more arbitrary and subjective than previously thought, thanks to what was probably a major political miscalculation by the modeling community with regard to the 2016 presidential election in the U.S.

ENDANGERMENT FINDING FLAW #3: The Technical Support Document for the Endangerment Finding is largely based upon the 2009 National Assessment, which is itself based upon a literature demonstrably biased towards dire climate findings.

Five years later, the third Assessment was published. This one was blatantly couched in the context of the Obama Administration activism on climate change. In fact, in the May 6, 2014 introduction, the National Oceanic and Atmospheric Administration wrote that

The report, *a key deliverable of President Obama's Climate Action Plan*, is the most comprehensive and authoritative scientific report ever generated about climate changes that are happening now in the United States and further changes that we can expect to see throughout this century [emphasis added].²⁰

²⁰ Melillo, J. M., et al., eds., 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment* (Washington DC: Government Printing Office, 2014).

All three National Assessments are deeply flawed. The first broke a cardinal and normative rule of science: that models only should be used if they have explanatory capability. The second was so incomplete that it could provoke an entire palimpsest with nearly twice as many refereed citations, and the third was specifically designed as a part of the Obama Administration policy thrusts on climate change.²¹

²¹ A fourth National Assessment was in press at the time of this writing. The same problems inherent in the second and third Assessments also accrue here.