

REVIEW OF THE 2001 U.S. CLIMATE ACTION REPORT

Patrick J. Michaels, Ph.D., Professor of Environmental Sciences
State Climatologist for Virginia
Clark Hall
University of Virginia
Charlottesville VA 22903
Telephone (804) 924-0549
Fax (804) 295-7549
Email pjm8x@virginia.edu

INTRODUCTORY COMMENT

The *2001 U.S. Climate Action Report* (USCAR) is, in general, more balanced than analogous compendia, such as the Third Assessment Report of climate change recently published by the United Nations Intergovernmental Panel on Climate Change (IPCC) , or the U.S. National Assessment (USNA) of climate change.

However, certain portions of USCAR, particularly Chapter 6, rely heavily on the USNA or the 2001 report of the National Academy of Sciences (which itself relies heavily on the USNA). Whatever originates from the USNA is highly flawed because the USNA is based upon a true miscarriage of science: it is based upon two models for future projections of climate that perform worse than a table of random numbers when applied to recent climate. The producers of the USNA, mainly the U.S. Global Change Research Program, have ignored this glaring problem, even as it is well-known that they were aware of it. Further, the USNA is based upon a selection of the two most extreme climate models for U.S. temperature and precipitation, for which there is no scientific defense.

Consequently the quality of large sections of the USCAR has been fatally impaired by the acceptance of the nonscientific USNA. This applies mainly to Chapter 6, *Impacts and Adaptation*. These sections—and mainly Chapter 6—need either to be re-written, or a prominent note needs to be appended detailing the tragic flaws in the USNA.

It is hoped that these comments will force a re-opening of the USNA process, which was headed by the U.S. Global Change Research Program (USGCRP) with a specific investigation into how such a document could have been published, when USGCRP and the associated scientists knew that it was based upon models that simply did not work. As it stands, it is the blackest of marks upon U.S. Environmental Science in recent decades, and the historical credibility of our considerable efforts in this science are at stake. The blatant disregard of science in the USNA (and therefore in the USCAR) will not be noted today or next week. But, in coming decades, academic research carried out in a more dispassionate atmosphere than exists today will surely uncover these flaws and the attempts to cover them up. A responsible Agency would expose them NOW. This review affords that opportunity.

My main comments are directed at Chapter 6; however, there are a few others included below.

SPECIFIC COMMENTS

CHAPTER 1

Page 4, lines 10-11: For the last three decades, the amount of GDP produced per unit energy has increased, not just in the 1990s. This is an established long-term trend owing to financial pressures to reduce production costs. There is no reason to assume, as this does in lines 15-16, that the 1990s are an anomaly. Change this paragraph to accommodate reality.

Page 7, lines 1-5. As noted above and below, the USNA is fatally flawed. As this is the first reference to it, there should be a footnote regarding the central problem, or Chapter 6 should be re-written using more primary scientific literature rather than the USNA.

CHAPTER 2

Page 18, lines 28-29. In, general, as long as adequate moisture is maintained, warmer ecosystems are more diverse ecosystems. This needs to be noted.

CHAPTER 3

Page 10, lines 20-24. There is no Table 3-6 in my report. GWPs are highly suspect because the residence time of carbon dioxide is largely overestimated. Here IPCC is at some variance with a large body of literature indicating a residence of 50-100 years, not the >100 assumed by IPCC and this report. A footnote concerning this would be appropriate here.

CHAPTER 4

Page 13, lines 16-25. The PNGV has NOTHING to do with the two commercially available automobile hybrids, because they were developed independently by Toyota and Honda. Let's tell the truth: the PNGV has NOT resulted in a commercially available domestic hybrid, largely because there turns out to be very little market for them, as Honda will attest, having sold only 8,000 in two years.

CHAPTER 6

Page 1, line 23. There is no statistically significant increase in drought frequency or areal magnitude as measured by the Palmer Index in the last 100 years. There is an increase in the area of the country that is wet as measured by the same index. Change the text to reflect the truth: There is an increase in wet conditions but no increase in dry conditions.

Page 1, lines 23-24. The study referred to here, by Karl, describes increases in rain events that are not likely to have produced significant flooding. The increase in high-intensity rainfall works out to less than one inch per year, averaged nationally. This calculation can be readily deduced from his 1995 *Nature* paper. If you're going to assert a change, at least show how little it has been.

95th percentile 24-hour precipitation in the U.S. is approximately 1.3 inches (based upon a preliminary analysis of U.S. HCN data from 1900 through 1987). That is *not* intense. Even using the two-inch threshold, 11% of the 34 inches of average annual national rainfall comes from that category, or 3.74 inches. As Karl et al. showed in *Nature* in 1995, the increase in this class was from 9% to 11%. That works out to 2% of 34 inches, or 0.68 inches *per year*.

Page 1, line 25. Parmesan's butterfly study shows a large decline in frequency in a grid cell that is actually *cooling* (!), with major expansions in the northern part of the range, which is warming. In Europe, she finds a large expansion of range, implying increased biodiversity. She never checked the weather data for Southern California, which is available from the IPCC nor did she comment on the range expansion, nor is the writer of this paragraph in the USCAR familiar with these truths.

OVERALL USE OF THE USNA AS BACKGROUND

The essential problem with the USCAR is that it is based upon the USNA. That report is based largely on two climate models, neither one of which, when compared with the 10-year smoothed behavior of the lower 48 states (a very lenient comparison), reduces the residual variance below the raw variance of the data. The one that generates the most lurid warming scenarios—the Canadian Climate Centre (CCC) Model—produces much larger errors than are inherent in the natural noise of the data. That is a simple test of whether or not a model is valid (see attached Figures 1 and 2)—and both of the models used in the USNA fail. All implied effects, including the large temperature rise, are therefore based upon a multiple scientific failure. The USNA's use of those models and that approach is a willful choice to disregard the most fundamental of scientific rules. (And that they did not find and eliminate such an egregious error is testimony to grave bias). For that reason alone, the USCAR should be withdrawn from the public sphere until it becomes scientifically based.

FIGURES

Maximum Temperatures

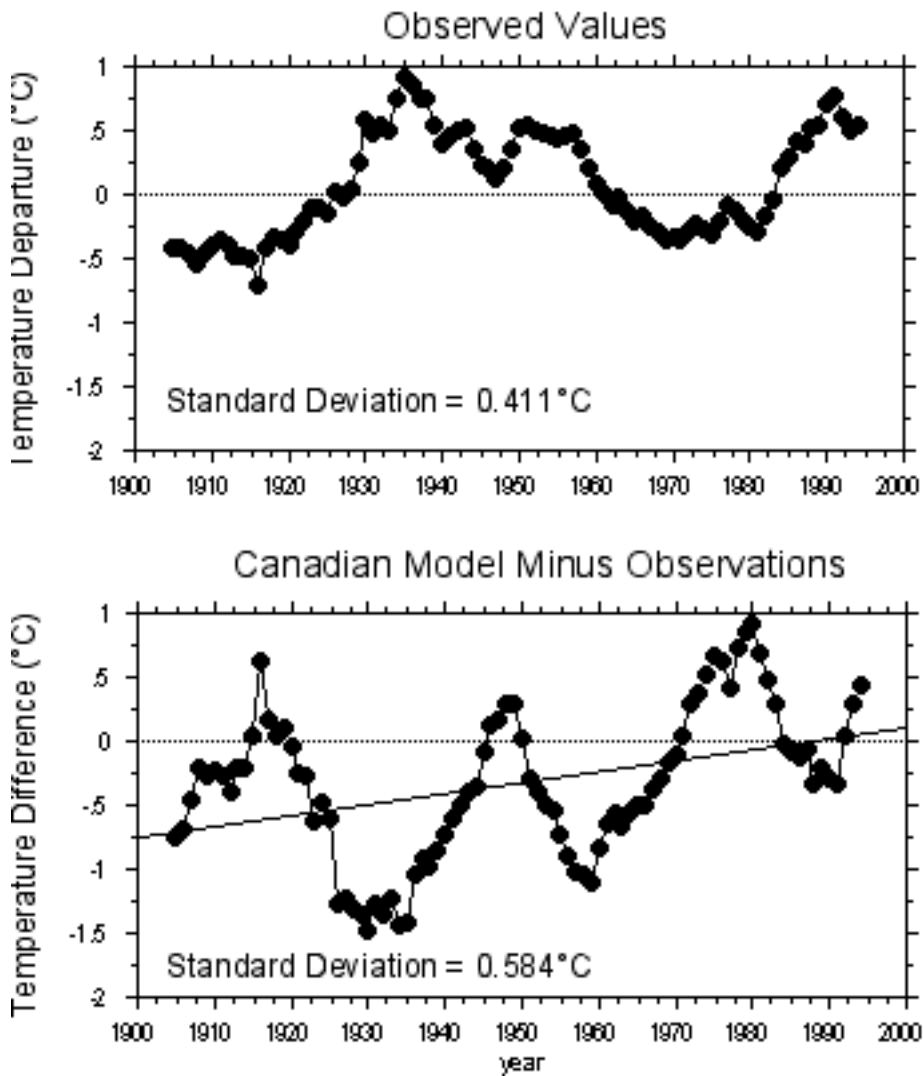


Figure 1.

TOP: Observed 10-year smoothed averaged maximum temperature departures from the recent climatological mean over the lower 48 states. BOTTOM: Predicted minus observed averaged maximum temperature departures for the CCC model the USNA used. The residual error standard deviation is actually larger than the standard deviation of the observed data, which is *prima facie* evidence for a scientifically invalid model.

Maximum Temperatures

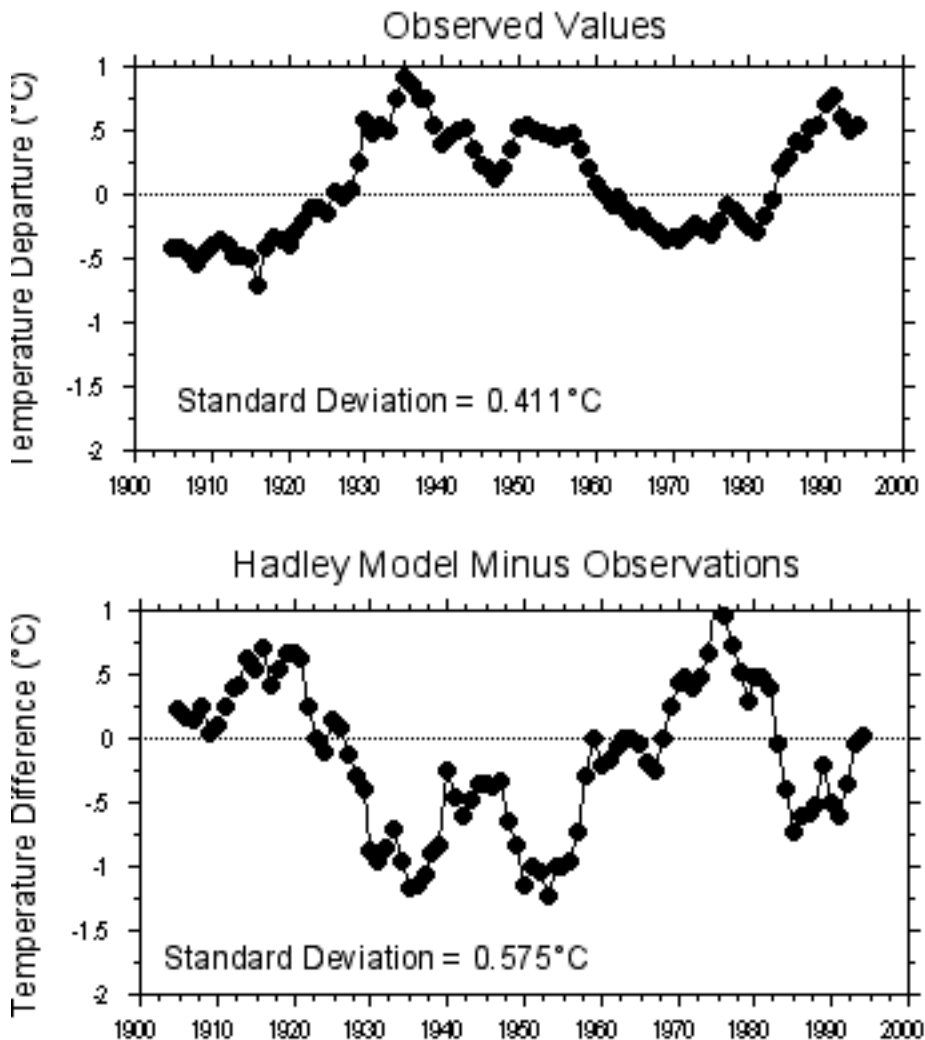


Figure 2. Same as Figure 1, this time for the Hadley model the USNA used. The model error may be the same as the CCC's, but at least it doesn't have the obvious trend bias.

MODEL SELECTION PROBLEMS

Then there is the problem of model selection in the USNA. As shown in Figure 9.3 of the Third Assessment of the United Nations Intergovernmental Panel on Climate Change, the behavior of virtually every General Circulation Climate model (GCM) is the production of a linear warming, despite assumptions of exponential increases in greenhouse forcing. In fact, only one (out of, by my count, 26) GCMs produces a substantially exponential warming—the CCC model. Others may bend up a little, though not substantially, in the policy-relevant time frame. The USNA specifically chose the outlier with regard to the mathematical form of the output. No graduate student would be allowed to submit a

thesis to his or her committee with such arrogant bias, and no national committee should be allowed to submit such a report to the American people.

Even worse, the CCC and Hadley data were decadal smoothed and then (!) subject to a parabolic fit, as the caption for the USNA's Figure 6 makes clear. That makes the CCC even appear warmer because of the very high last decadal average.

One of the two models chosen for use in the USNA, the Canadian Climate Center (CCC) model, predicts the most extreme temperature and precipitation changes of all the models considered for inclusion. The CCC model forecasts the average temperature in the United States to rise 8.1°F (4.5°C) by the year 2100, more than twice the rise of 3.6°F (2.0°C) forecast by the U.K. model (the second model used in the USNA). Compare this with what has actually occurred during the past century. The CCC model predicted a warming of 2.7°F (1.5°C) in the United States over the course of the twentieth century, but the observations show that the increase was about 0.25°F* (0.14°C) (Hansen, J.E., et al., 1999: GISS analysis of surface temperature change. *Journal of Geophysical Research*, **104**, 30,997–31,022), or about 10 times less than the forecast. If the observed ratio continues into the future, the U.S. temperature increase by the year 2100 will be less than 1°F and hardly noticeable. The CCC forecast of precipitation changes across the United States is nearly as extreme. Of all the models reviewed for inclusion in the USNA, the U.K. model predicted more than twice the precipitation change than the second most extreme model, which was the CCC model. The CCC model itself forecast twice the change of the average of the remaining, unselected models. Therefore, along with the fact that GCMs in general cannot accurately forecast climate change at regional levels, the GCMs selected as the basis for the USNA conclusions do not even fairly represent the collection of available climate models.

Why deliberately select such an inappropriate model as the CCC? Tom Karl, a NOAA scientist, told me that the reason the USNA chose the CCC model is that it provides diurnal temperatures; this is a remarkable criterion given its base performance. Consider the logic: *Because we want to include the minute detail of diurnal temperatures, let's select the most extreme climate model in existence, in terms of exponentiality.*

Thus the USCAR is driven by a model that 1) doesn't work over the United States; 2) is at functional variance with virtually every other climate model. It is simply impossible to reconcile this skewed choice with the rather esoteric desire to include diurnal temperatures. This reviewer leaves it to everyone else to speculate on the obvious reason.

It is clear that reliance on the USNA in the Climate Action Plan gravely compromises the validity of Chapter 6. It is therefore necessary to write some type of disclaiming footnote showing that the models used there are not valid and are an extreme selection.

Page 4, lines 18-21. The models in figure 6.2b are worse than random numbers (see above). It is scientific malpractice to use them. I choose my words carefully here. If a physician prescribed medication that demonstrably did not work, he would lose his

license. If this continues in the report, critics will probably write nasty op-eds that will discredit the entire process.

Pages 5-29. These are based heavily on the US National Assessment. APPENDIX 1 contains comments on the National Assessment. These were by-and-large unanswered when they were submitted; consequently, they apply as well to the Climate Action Report.

Note added after original review.* A re-analysis of U.S. data from the National Climatic Data Center now places the trend at 0.9°F, which still leaves the CCC model in error by 300%. However, this analysis has also been questioned as the adjustments of the raw data all produce warmer temperatures. See Balling, R.C., Jr., and C. Idso, 2002, Analysis of Adjustments to the U.S. Historical Climate Network (USHCN) Temperature Database, *Geophysical Research Letters* **29, 25-28.