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Systematic Problems in the Four "National Assessments" of Climate Change Impacts on the United States

Among the most influential compendia on climate change and its effects are the four "National Assessments" of global climate change impacts on our country. These documents are mandated by the Global Change Research Act of 1990. Four Assessments have been produced to date, with a fifth currently in the early stages of production.

It is fair to say that the four extant documents represent some of the most egregious distortions of science in service of policy that have ever been published. This brief summary will document why this is the case.

The First US National Assessment (2000)

The First (2000) National Assessment used models that were worse than a table of random numbers when applied to ten-year running means for the air temperature of the coterminous 48 states. In other words, applying these models resulted in a more inaccurate representation of United States temperatures than simply using the raw data.

The following analogy is precisely correct. Consider a four-choice multiple choice exam. If these models were applied to answer the questions, they would have been correct less than 25% of the time, which is what would be expected if each question were answered randomly. Somehow, the models used in the First National Assessment added noise to the raw data, which is the exact opposite of what a proper model is supposed to do. The science team guiding the First Assessment, headed by the well-respected Thomas Karl knew this, but proceeded anyway.[1] Given that these documents

[1] Karl wrote to me that "we ran the test you did but changed the averaging period" from 10-year running means to 1, 5, 10, 20 and 25 years. He kindly included a graph that showed *at all time intervals tested* that the residual variance after applying the models was larger than the raw variance. A modified version (for clarity) can be found as Figure 25, page 109 in Michaels (2016). This was first documented in "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. (2003), *Politicizing Science: The Alchemy of Policymaking*. Hoover, Palo Alto.

are very influential on national and international policy, this was (I choose my words carefully here) scientific malpractice.[2] The First National Assessment also employed the two most extreme models, for temperature and precipitation, of the suite that it examined.

The Fourth US National Assessment (2018)

The Second (2009) and Third (2014) National Assessments were also subject to considerable criticism. What deserves more attention here are the systematic errors in the Fourth (2018) National Assessment, currently the document of record.

The Fourth National Assessment, like the previous three, focused primarily on climate model prognostications. Quoting from Chapter 2:

> "The future projections used in this assessment come from global climate models (GCMs) that reproduce key processes in the Earth's climate system using fundamental scientific principles."

It follows that if, as an ensemble, these models are systematically flawed in a significant fashion, it is improper to use them to project the impacts of the climate changes that they predict.

The growing disparity between predicted bulk tropospheric temperatures and observed values, especially at altitude in the tropics (see the first figure which follows), casts overall doubt on the utility of the large ensemble of models used in the Fourth Assessment. That collection is known as the Coupled Model Intercomparison Project, Phase 3 (or CMIP-3). The mean "sensitivity" (the amount of equilibrium warming for a nominal doubling of atmospheric carbon dioxide) for these models is 3.4^0C.

Similarly, the second figure below shows the vertical distribution of the forecasted and observed trends. Commenting on it, Christy and McNider[3] note:

> "In every case, with the exception of the Russian model "INM-CM4" below 250hPa, individual tropospheric model trends are larger than the observational average below 100 hPa with the discrepancies largest in the upper troposphere…"

The Fourth Assessment simply ignores best scientific practice, which is to operationally use models that perform the best when compared to real-world observations. This type

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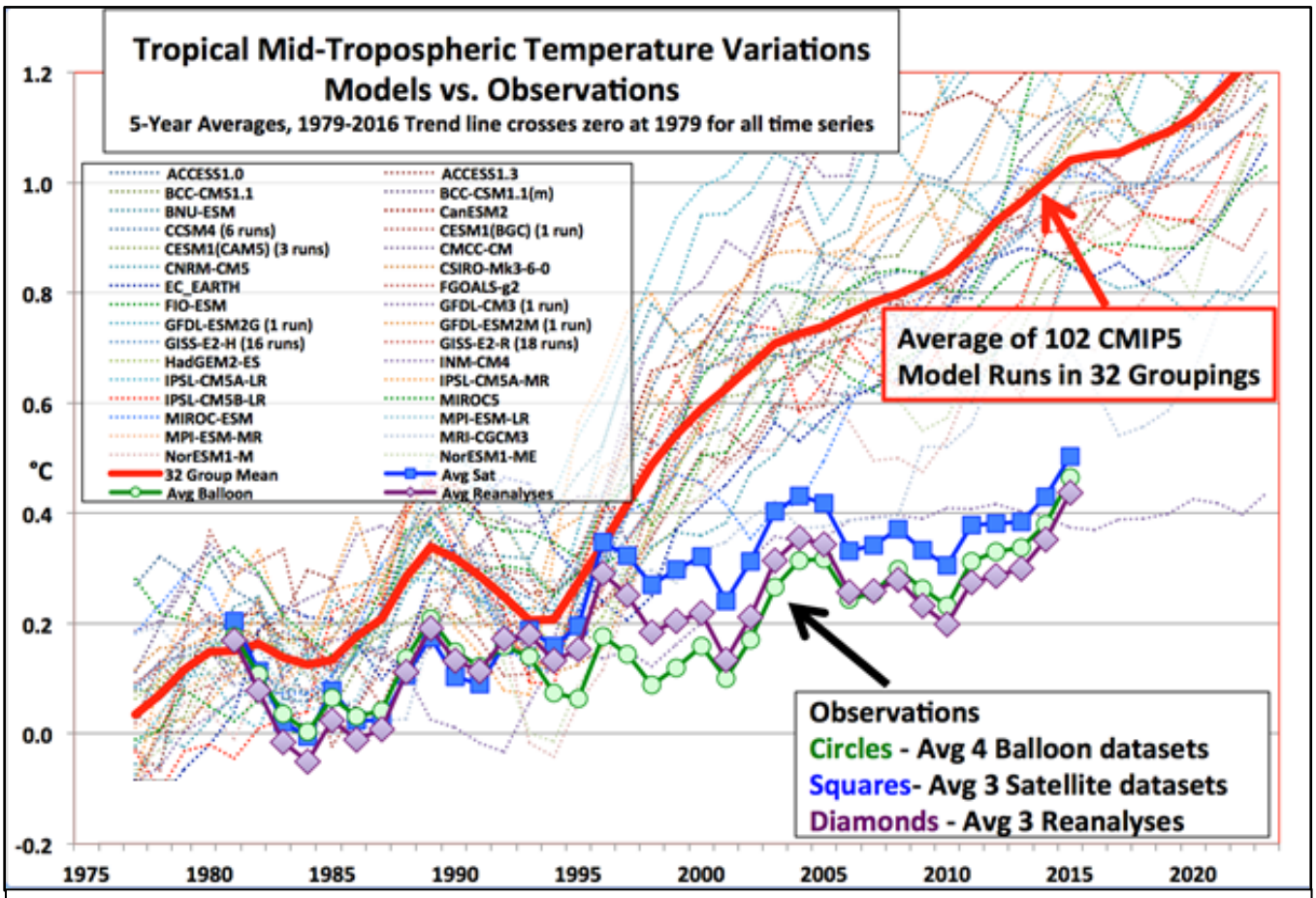
[2] This action was exactly analogous to a physician prescribing a medication he or she knows will make the patient worse.

[3] Christy, J.R., and R.T. McNider (2017): Satellite bulk tropospheric temperatures as a metric for climate sensitivity. *Asia-Pacific Journal of Atmospheric Science*, **53**, 511-518.



Modeled and observed mid-tropospheric (850-300 mb; approximately 5,000 to 30,000 feet) temperatures. From testimony of John Christy to the House Committee on Science, Space and Technology, March 29, 2017. The one model that tracks the observations is the Russian model (INM-CM4). The data also are available in tabular form in the American Meteorological Society's *State of the Climate* report for 2016.

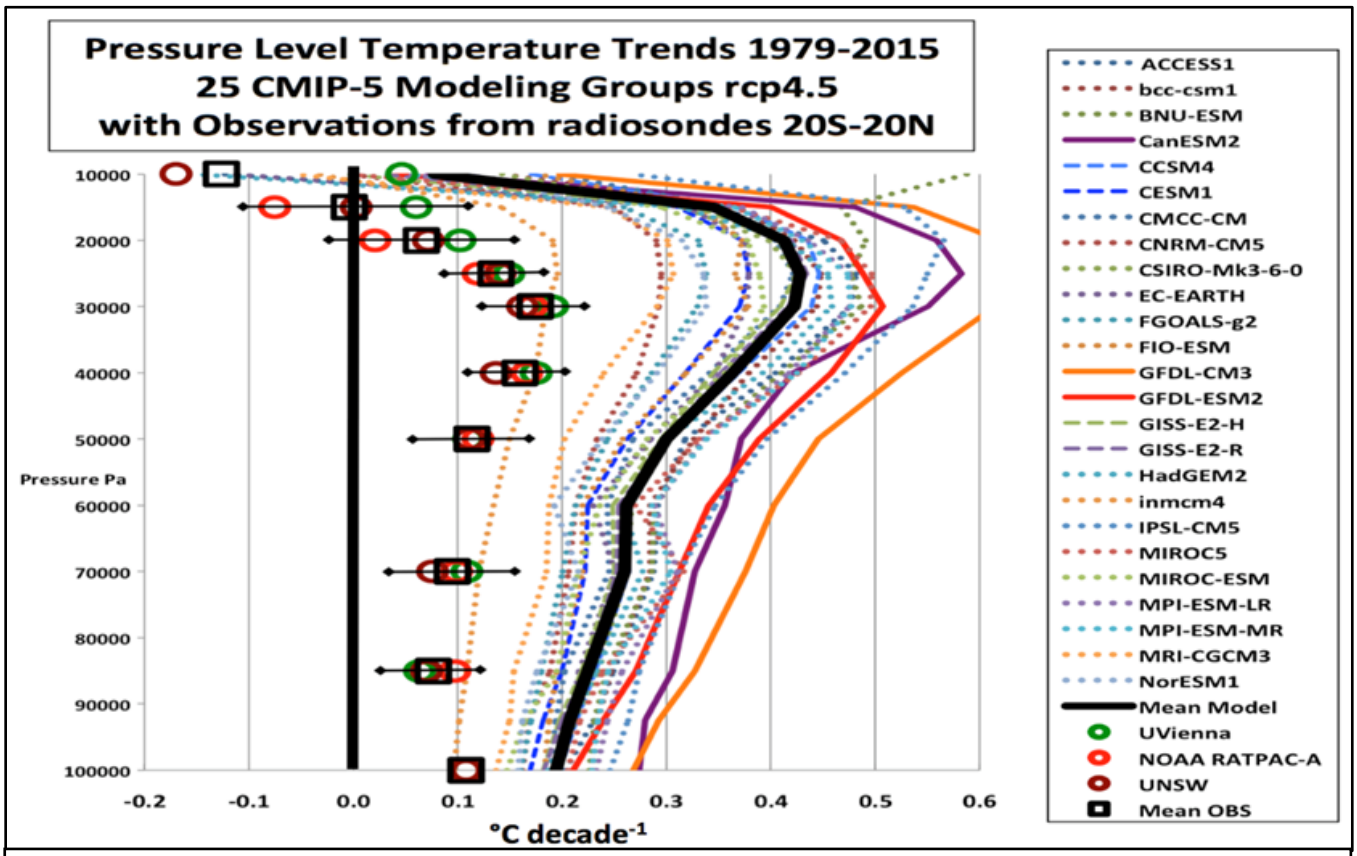
of exercise is undertaken daily in forecast meteorology. Often, many global and regional forecast models give conflicting results for a given weather situation. Forecasters then examine which ones have been performing well, or which perform better given the situation, and then settle upon one or a blend of models to arrive at the final forecast. *They rarely average them all*, which is exactly what the Fourth Assessment does.

The INM-CM4 model is decidedly a lukewarm model. Its estimate of the warming of the twenty-first century is approximately 1.5°C. This is consistent with the warming calculated by Christy and McNider.[3]

Emphasis on the <u>Wrong</u> Future Emissions Pathway

The most recent (2013) comprehensive scientific assessment of the global warming issue by the United Nations' Intergovernmental Panel on Climate Change (IPCC) employs several scenarios for future emissions. The one with the most warming is called Representative Concentration Pathway 8.5 (RCP 8.5), which assumes a net increase in radiation for the lower atmosphere of 8.5 Watts per square meter by 2100.

The lowest scenario that does not include an immediate curtailment of carbon dioxide emissions is RCP 4.5 (*i.e.*, a 4.5 Watt per square meter increase in radiation by 2100).



The vertical discrepancy between radiosonde-measured and model-predicted air temperature trends, from 20°N to 20°S latitudes, is persistent and very large in the mid- and upper-troposphere. From Christy and McNider (2017). Note again that the exception is the Russian model, INM-CM4.

A vast scientific literature has emerged around RCP 8.5, even though the IPCC notes that it is an unlikely outlier. Last year, the authoritative International Energy Agency (IEA) downplayed RCP 8.5 and found that the actual emissions path we are on is slightly *below* the lowest (RCP 4.5) realistic emissions scenario. The RCP 4.5 scenario yields a total warming of just 2.5°C from the industrial revolution to the year 2100. Note that a half of a degree of warming occurred between 1910 and 1945, beginning when carbon dioxide emissions were too small to have such climatic consequences. The IEA is really saying that the path we are on is for a human-induced warming of around 2.0°C by 2100. That just happens to be the goal of the UN's 2015 Paris Agreement ("treaty") on Climate Change.

The IEA estimates are based upon an assumption that the amount of warming (called the "sensitivity" of temperature to a doubling of atmospheric carbon dioxide) is 3.0°C. But studies based upon observed radiation and temperature changes by John Christy and Richard McNider of University of Alabama-Huntsville and Nic Lewis and Judith

Curry, former chair of the Earth and Atmospheric Science School at Georgia Tech, yield sensitivities between 1.5 and 1.75°C – nearly half that of the IEA assumption.

These low sensitivities, which are "real-world" calculations, coupled with the IEA's new estimates for reduced effects of human emissions, change the effects of carbon dioxide-induced climate change from a net cost to a net benefit.[4] Perhaps this explains why, as surface temperatures rose in the 20th century, life expectancy nearly doubled in the developed world, and is now increasing dramatically elsewhere.

Conclusion

The four "National Assessments" of climate change impacts on the United States have dramatically overstated the effects of our changing climate, in large part because the climate models used have systematic biases coupled with over-estimates of the expected changes in lower atmospheric radiation resulting from human activities.

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For Further Information

Michaels, P.J. and P.C. Knappenberger (2016): *Lukewarming: The New Climate Science That Changes Everything*, Cato Institute:Washington, DC.

[4] Dayaratna, K.D., R. McKitrick, and P.J. Michaels (2020). Climate sensitivity, agricultural productivity and the social cost of carbon in FUND. *Environmental Economics and Policy Studies* **22,** 433-448.