

## **On the Futility of Long-Range Numerical Climate Prediction**

By William M. Gray

My 60-year experience in meteorology has led me to develop a profound disrespect for the philosophy and the science behind numerical climate modeling. The simulations that have been directed at determining the influence of a doubling of CO<sub>2</sub> on the earth's temperature have been made with flawed and oversimplified internal physical assumptions. These modeling scenarios have shown a near uniformity in CO<sub>2</sub> doubling causing a warming of 2-5°C (4-9°F). There is no physical way, however, that an atmospheric doubling of the very small amount of background CO<sub>2</sub> gas would ever be able to bring about such large global temperature increases.

It is no surprise that the global temperature in recent decades has not been rising as the climate models have predicted. Reliable long-range climate modeling is not possible and may never be possible. It is in our nation's best interest that this mode of prophecy be exposed for its inherent futility. Belief in these climate model predictions has had a profound deleterious influence on our country's (and foreign) governmental policies on the environment and energy.

The still-strong—but false—belief that skillful long range climate prediction is possible is thus a dangerous idea. The results of the climate models have helped foster the current political clamor for greatly reducing fossil fuel use even though electricity generation costs from wind and solar are typically 3-5 times higher than generation from fossil fuels. The excuse for this clamor for renewable energy is to a large extent the strongly expressed views of the five Intergovernmental Panel on Climate Change (IPCC) reports, which are based on the large (and unrealistic) catastrophic global warming projections from the climate models.

The pervasive influence of these IPCC reports (from 1990 to 2013) derives from the near-universal lack of climate knowledge among the general population. Overly biased and sensational media reports have been able to brainwash a high percentage of the public. A very similar lack of sophisticated climate knowledge exists among our top government officials, environmentalists, and most of the world's prestigious scientists. Holding a high government position or having excelled in a non-climate scientific specialty does not automatically confer a superior understanding of climate.

Lack of climate understanding, however, has not prevented our government leaders and others from using the public's fear of detrimental climate change as a political or social tool to further some of their other desired goals. Climate modeling output lends an air of authority which is not warranted by the unrealistic model input physics and the overly simplified and inadequate numerical techniques. (Model grids cannot resolve cumulus convective elements, for example.) It is impossible for climate models to predict the globe's future climate for at least three basic reasons.

One, decadal and century-scale deep-ocean circulation changes (likely related to long time-scale ocean salinity variations), such as the global Meridional Overturning Circulation (MOC) and Atlantic Thermohaline Circulation (THC), are very difficult to measure and are not yet well enough understood to be realistically included in the climate models. The last century-and-a-half global warming of ~0.6°C appears to be a result of the general slowdown of the oceans' MOC

over this period. The number of multidecadal up-and-down global mean temperature changes appears also to have been driven by the multidecadal MOC. Models do not yet incorporate this fundamental physical component.

Two, the very large climate modeling overestimates of global warming are primarily a result of the assumed positive water-vapor feedback processes (about 2°C extra global warming with a CO<sub>2</sub> doubling in most models). Models assume any upper tropospheric warming also brings about upper tropospheric water-vapor increase as well, because they assume atmospheric relative humidity (RH) remains quasi-constant. But measurements and theoretical considerations of deep cumulonimbus (Cb) convective clouds indicate any increase of CO<sub>2</sub> and its associated increase in global rainfall would lead to a reduction of upper tropospheric RH and a consequent enhancement (not curtailment) of Outgoing Longwave Radiation (OLR) to space.

The water-vapor feedback loop, in reality, is weakly negative, not strongly positive as nearly all the model CO<sub>2</sub> doubling simulations indicate. The climate models are not able to resolve or correctly parameterize the fundamentally important climate forcing influences of the deep penetrating cumulonimbus (Cb) convection elements. This is a fundamental deficiency.

Three, the CO<sub>2</sub> global warming question has so far been treated from a “radiation only” perspective. Disregarding water-vapor feedback changes, it has been assumed a doubling of CO<sub>2</sub> will cause a blockage of Outgoing Long-wave Radiation (OLR) of 3.7 Wm<sup>-2</sup>. To compensate for this blockage without feedback, it has been assumed an enhanced global warming of about 1°C would be required for counterbalance. But global energy budget considerations indicate only about half (0.5°C, not 1°C) of the 3.7 Wm<sup>-2</sup> OLR blockage of CO<sub>2</sub> should be expected to be expended for temperature compensation. The other half of the compensation for the 3.7 Wm<sup>-2</sup> OLR blockage will come from the extra energy that must be utilized for surface evaporation (~1.85 Wm<sup>-2</sup>) to sustain the needed increase of the global hydrologic cycle by about 2 percent.

The earth experiences a unique climate because of its 70 percent water surface and its continuously functioning hydrologic cycle. The stronger the globe’s hydrologic cycle, the greater the globe’s cooling potential. All the global energy used for surface evaporation and tropospheric condensation warming is lost to space through OLR flux.

Thus, with zero water-vapor feedback we should expect a doubling of CO<sub>2</sub> to cause no more than about 0.5°C (not 1°C) of global warming and the rest of the compensation to come from enhanced surface evaporation, atmospheric condensation warming, and enhanced OLR to space. If there is a small negative water-vapor feedback of only -0.1 to -0.3°C (as I believe to be the case), then a doubling of CO<sub>2</sub> should be expected to cause a global warming of no more than about 0.2-0.4°C. Such a small temperature change should be of little societal concern during the remainder of this century.

It is the height of foolishness for the United States or any foreign government to base any energy or environmental policy decisions on the results of long-range numerical climate model predictions, or of the recommendations emanating from the biased, politically driven reports of the IPCC.

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