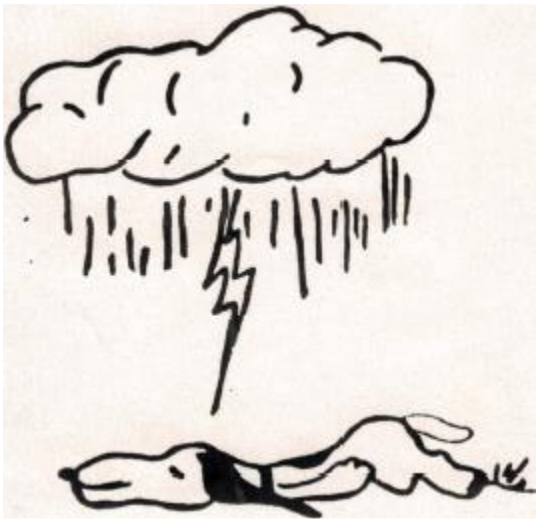

Prediction is very hard, especially of the future. Niels Bohr, 1926.

Peer & Public Review of "Global Warming in the Pipeline"

21 July 2023

James Hansen

The paper "Global Warming in the Pipeline," with the approval of the editor, was made available for review by the wider community, as well as normal peer review. Our objective is a broader review than would be obtained from two anonymous journal reviewers. In addition, I sent the paper to about 15 of the most relevant world experts, asking for their opinions – most of them responded, and their comments were very helpful.

We could have simply addressed the issues raised in the review process, but it occurred to me that the paper would be much stronger if we added a consistent analysis of the entire Cenozoic era, thus including climates warmer than at present. This took several months, added 10 pages to the paper, and it requires getting advice of experts in ocean core data.

Meanwhile, there are some misinterpretations that should be corrected. We did not say that the global temperature record to date shows an acceleration of the global warming rate. Quite the contrary, whenever we present the data we draw a straight line beginning in 1970, which shows that the warming rate has been linear (green line in Fig. 1). It takes little knowledge or courage for us or anyone to point out that the data are nearly linear from 1970 to 2022.

The physics informs us that, as the data set becomes longer, it will show a post-2010 acceleration of global warming. The physics is discussed in the present version of Global warming in the pipeline.[1] The main factor driving acceleration is reduction of human-made aerosols in the atmosphere, and the principal confirmation is Earth's measured energy imbalance.

We take no pleasure in being the bearer of bad news, but the physics tells us that humanity is in the process of driving an acceleration of global warming. Why report this? The same reason that we predicted that the Pinatubo volcanic eruption would cause global cooling. It is just conceivable that predictions and real-world confirmation may eventually persuade the darned fools that we know what we're talking about. I refer not only to those who deny the reality of human-caused climate change, but to those who pursue a wishful thinking policy approach.

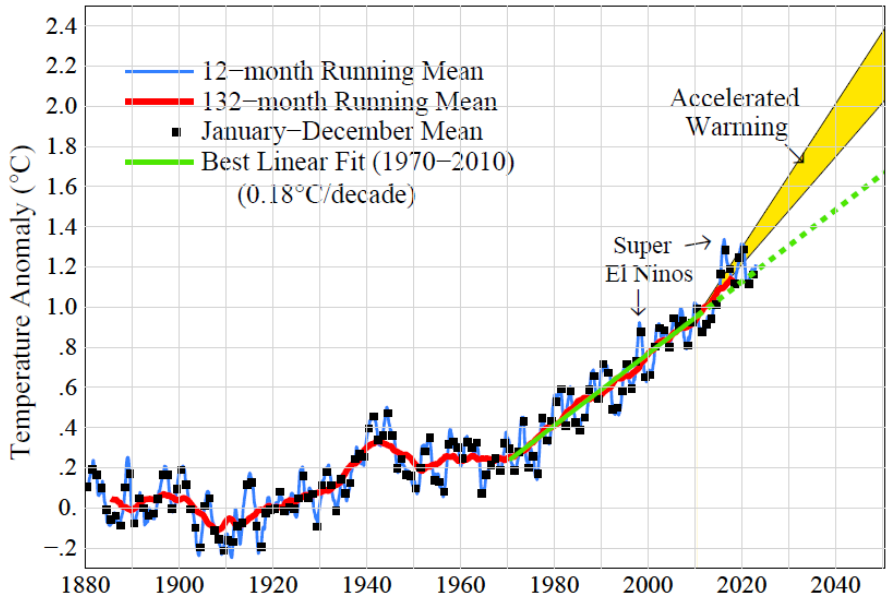

Fig. 1. Global temperature relative to 1880-1920. Edges of the predicted post-2010 accelerated warming rate (see text) are 0.36 and 0.27°C per decade.

It does not help when people who should know better muddy the water. No climate scientist should confuse equilibrium warming and committed warming. Equilibrium warming is the eventual warming that will occur if the present atmospheric composition were left in place indefinitely. That's the time-honored definition, which is used to define climate sensitivity. It's also useful, because it makes clear that we must reduce the present human-made climate forcing – by a lot.

There are many definitions for committed warming. One definition: human emissions cease instantly. In that case, because of Earth's energy imbalance today warming would continue briefly followed by cooling at a rate that slowly declines. Realistic scenarios depend upon how soon we can educate the public about the situation and affect policies (see Discussion section in our paper). For that purpose, we should all be working on the same side.

People still have the power to shape the future. The only thing we are committed to is working with young people – who will bear the consequences of climate change – and helping provide the knowledge needed to achieve a bright future.

[1] Global warming in the pipeline, draft paper, criticisms welcome.