Michael Crichton's "Scientific Method"

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Michael Crichton's latest fictional novel, "State of Fear", designed to discredit concerns about global warming, purports to use the scientific method. The book is sprinkled with references to scientific papers, and Crichton intones in the introduction that his "footnotes are real". But does Crichton really use the scientific method? Or is it something closer to scientific fraud?

Several people have pointed out to me that Crichton takes aim at my 1988 congressional testimony and claims that I made predictions about global warming that turned out to be 300% too high. Is that right?

In my testimony in 1988, and in an attached scientific paper written with several colleagues at the Goddard Institute for Space Studies (GISS) and published later that year in the Journal of Geophysical Research (volume 93, pages 9341-9364), I described climate simulations made with the GISS climate model. We considered three scenarios for the future, labeled A, B and C, to bracket likely possibilities.

Scenario A was described as "on the high side of reality", because it assumed rapid exponential growth of greenhouse gases and it assumed that there would be no large volcanoes (which inject small particles into the stratosphere and cool the Earth) during the next half century. Scenario C was described as "a more drastic curtailment of emissions than has generally been imagined", specifically greenhouse gases were assumed to stop increasing after 2000. The intermediate Scenario B was described as "the most plausible". Scenario B had continued growth of greenhouse gas emissions at a moderate rate and it sprinkled three large volcanoes in the 50-year period after 1988, one of them in the 1990s.

Not surprisingly, the real world has followed a course closest to that of Scenario B. The real world even had one large volcano in the 1990s, the eruption of Mount Pinatubo, which occurred in 1991, while Scenario B placed a volcano in 1995.

In my testimony to congress I showed one line graph with scenarios A, B, C and observed global temperature, which I update below. However, all of the maps of simulated future temperature that I showed in my congressional testimony were for scenario B, which formed the basis for my testimony. No results were shown for the outlier scenarios A and C.

Back to Crichton: how did he conclude that I made an error of 300%? Apparently, rather than studying the scientific literature, as his footnotes would imply, his approach was to listen to "global warming skeptics". One of the skeptics, Pat Michaels, has taken the graph from our 1988 paper with simulated global temperatures for scenarios A, B and C, erased the results for scenarios B and C, and shown only the curve for scenario A in public presentations, pretending that it was my prediction for climate change. Is this treading close to scientific fraud?

Crichton's approach is worse than that of Michaels. Crichton uncritically accepts Michaels' results, and then concludes that Hansen's prediction was in error "300%". Where does he get this conclusion?

Let's reproduce here (Figure 1) the global temperature curves from my 1988 congressional testimony, without erasing the results for scenarios B and C. Figure 1 updates observations of global temperature using the same analysis of meteorological station data as in

our 1988 paper (which removes or corrects station data from urban locations)[1]. The 2005 data point is a preliminary estimate based on the first eight months of the year.

The observations, the black curve in Figure 1, show that the Earth is indeed getting warmer, as predicted. The observed temperature fluctuates a lot, because the real world is a "noisy", chaotic system, but there is a clear warming trend. Curiously, the scenario that we described as most realistic is so far turning out to be almost dead on the money. Such close agreement is fortuitous. For example, the model used in 1988 had a sensitivity of 4.2°C for doubled CO_2, but our best estimate for true climate sensitivity[2] is closer to 3°C for doubled CO_2. There are various other uncertain factors that can make the warming larger or smaller[3]. But it is becoming clear that our prediction was in the right ballpark.

So how did Crichton conclude that our prediction was in error 300%? Beats me. Crichton writes fiction and seems to make up things as he goes along. He doesn't seem to have the foggiest notion about the science that he writes about. Perhaps that is o.k. for a science fiction writer[4].

However, I recently heard that, in considering the global warming issue, a United States Senator is treating words from Crichton as if they had scientific or practical validity. If so, wow -- Houston, we have a problem!

Acknowledgement. I thank Makiko Sato for reproducing and updating the figure.
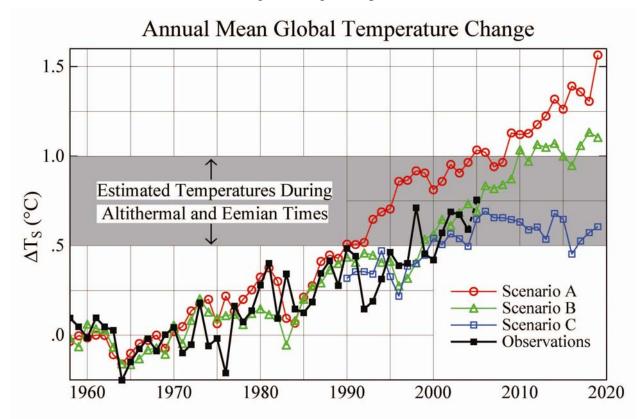
Footnotes

[1]The warming is slightly less (change less than 0.1°C) in our analysis of observations if we combine ocean temperature measurements with the meteorological station data. However, the result is slightly more warming in the British analysis of observations by Phil Jones and associates. So the observational analysis shown in Figure 1 is representative of the various analyses of global surface temperature change.

[2]Climate sensitivity is usually expressed as the equilibrium global warming expected to result from doubling the amount of CO_2 in the air. Empirical evidence from the Earth's history indicates that climate sensitivity is about 3°C, with an uncertainty of about 1°C. A climate model yields its own sensitivity, based on the best physics that the users can incorporate at any given time. The 1988 GISS model sensitivity was 4.2°C, while it is 2.7°C for the 2005 model. It is suspected that the sensitivity of the 2005 model may be slightly too small because of the sea ice formulation being too stable.

[3]Our papers related to global warming can be obtained from pubs.giss.nasa.gov

[4]Discussion of Crichton's science fiction is provided on the blog www.realclimate.org/index.php?p=74

Figure 1. Annual-mean global surface air temperature computed for scenarios A, B and C. Observational data are an update of the analysis of Hansen and Lebedeff [J. Geophys. Res., 92, 13,345, 1987]. Shaded area is an estimate of the global temperature during the peak of the current interglacial period (the Altithermal, peaking about 6,000 to 10,000 years ago, when we estimate that global temperature was in the lower part of the shaded area) and the prior interglacial period (the Eemian period, about 120,000 years ago, when we estimate that global temperature probably peaked near the upper part of the shaded area). The temperature zero point is the 1951-1980 mean.