

(8) NATURE DOES IT AGAIN: CLIMATE SENSITIVITY AND EDITORIAL POLICIES

Lubos Motl's Reference Frame, 13 May 2006

<http://motls.blogspot.com/2006/05/climate-sensitivity-and-editorial.html>

Climate sensitivity is defined as the average increase of the temperature of the Earth that you get (or expect) by doubling the amount of CO₂ in the atmosphere - from 0.028% in the pre-industrial era to the future value of 0.056% (expected around 2100).

If you assume no feedback mechanisms and you just compute how much additional energy in the form of infrared rays emitted by (or reflected from) the surface will be absorbed by the carbon dioxide (refresh your knowledge about Earth's energy budget), you obtain the value of 1 Celsius degree for the climate sensitivity.

While the feedback mechanisms may shift the sensitivity in either direction, Prof. Richard Lindzen of MIT, a world's leader in the sensitivity issue, will convince you that the estimate is about right but the true value, with the mostly unknown feedback mechanisms, is likely to be lower. Why is it so?

You should realize that the carbon dioxide only absorbs the infrared radiation at certain frequencies, and it can only absorb the maximum of 100% of the radiation at these frequencies. By this comment, I want to point out that the "forcing" - the expected additive shift of the terrestrial equilibrium temperature - is not a linear function of the carbon dioxide concentration. Instead, the additional greenhouse effect becomes increasingly unimportant as the concentration increases: the expected temperature increase is something like

> * 1.5 (1 - exp[-(concentration-280)/200 ppm]) Celsius

The decreasing exponential tells you how much radiation at the critical frequencies is able to penetrate through the carbon dioxide and leave the planet. The numbers in the formula above are not completely accurate and the precise exponential form is not quite robust either but the qualitative message is reliable. When the concentration increases, additional CO₂ becomes less and less important.

In particular, there exists nothing such as a "runaway effect" or a "point of no return" or a "tipping point" or any of the similar hysterical fairy-tales promoted by various Al Gores. The formula above simply does not allow you more than 1.5 Celsius degrees of warming from the CO₂ greenhouse effect. Similar formulae based on the Arrhenius' law predicts a decrease of the derivative "d Temperature / d Concentration" to be a power law - not exponential decrease - but it is still a decrease.

One might also want to obtain a better formula by integrating the formula above over frequencies:

see <http://motls.blogspot.com/2006/05/climate-sensitivity-and-editorial.html>

In all cases, such a possible warming distributed over centuries is certainly

nothing that a person with IQ above 80 should be producing movies about.

When you substitute the concentration of 560 ppm (parts per million), you obtain something like 1 Celsius degree increase relatively to the pre-industrial era. But even if you plug in the current concentration of 380 ppm, you obtain about 0.76 Celsius degrees of "global warming". Although we have only completed about 40% of the proverbial CO₂ doubling, we have already achieved about 75% of the warming effect that is expected from such a doubling: the difference is a result of the exponentially suppressed influence of the growing carbon dioxide concentration.

In reality, the increase of the temperatures since the pre-industrial era was comparable or slightly smaller than 0.76 Celsius degrees - something like 0.6 Celsius degrees. It is consistent to assume that the no-feedback "college physics" calculation of the CO₂ greenhouse effect is approximately right, and if it is not quite right, it is more likely to be an overestimate rather than an underestimate, given the observed data.

The numbers and calculations above are actually not too controversial. Gavin Schmidt, a well-known alarmist from RealClimate, more or less agrees with the calculated figures, even though he adds a certain amount of fog - he selectively constructs various minor arguments that have the capacity to "tilt" the calculation above in the alarmist direction. But the figure of 1 Celsius degree - understood as a rough estimate - seems to be consistent with everything and Schmidt claims that only intellectually challenged climate scientists estimate the sensitivity to be around 5 Celsius degrees (I forgot Schmidt's exact wording).

Three weeks ago, Hegerl et al. have published a text in Nature that claims that the 95 percent confidence interval for the climate sensitivity is between 1.5 and 6.2 Celsius degrees. James Annan decided to publish a reply (with J.C. Hargreaves). As you might know, James Annan - who likes to gamble and to make bets about the global warming - is

- * an alarmist who believes all kinds of crazy things about the dangerous global warming;
- * a weird advocate of the Bayesian probabilistic reasoning.

However, he decided to publish a reply that

- * the actual sensitivity is about 5 times smaller than the Hegerl et al. upper bound which means that the warming from the carbon dioxide won't be too interesting;
- * Hegerl et al. have made errors in statistical reasoning; the error may be summarized as an application of Bayesian priors which are unscientific.

The second point means that Hegerl et al. simply use a "prior" (a dogma or a random religious preconception that is a crucial part of the Bayesian statistical reasoning) that simply allows the sensitivity to be huge a priori - and such a huge preconception is then not removed by the subsequent procedure of "Bayesian inference". Such an outcome is a typical result of Bayesian methods: garbage in, garbage out. I am convinced that the fact that Annan was able to appreciate these incorrect points of Hegerl et al. is partially a result of my educational influence on James Annan.

Nevertheless, Annan's reply was rejected by Nicki Stevens of Nature without

review with the following cute justification:

We have regretfully decided that publication of this comment as a Brief Communication Arising is not justified, as the concerns you have raised apply more generally to a widespread methodological approach, and not solely to the Hegerl et al. paper.

In other words, Annan's reply could have the ability to catch errors that influence more than one paper, and such replies are not welcome. Imagine that Nicki Stevens is the editor of "Annals der Physik" instead of Max Planck who received Albert Einstein's paper on special relativity. Even better, you can also imagine that Nicki Stevens is the editor who receives the paper on General Relativity whose insights apply more generally. ;-)

When we apply my reasoning more generally to a widespread methodological approach, we could also wonder whether the person named Nicki Stevens realized that one half of the internet was going to discuss how unusually dumb she was.