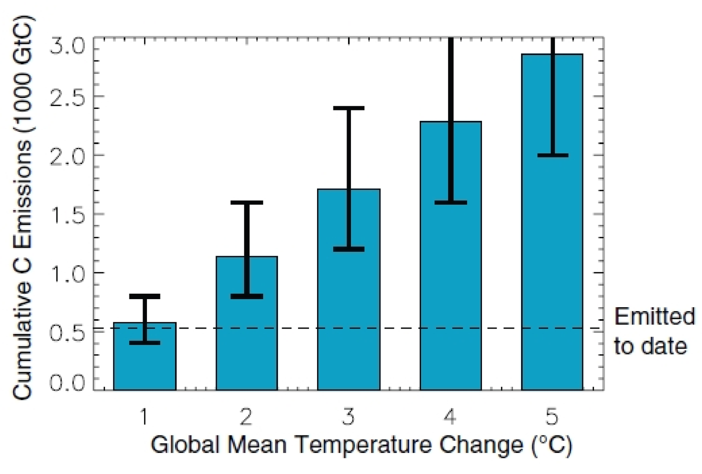
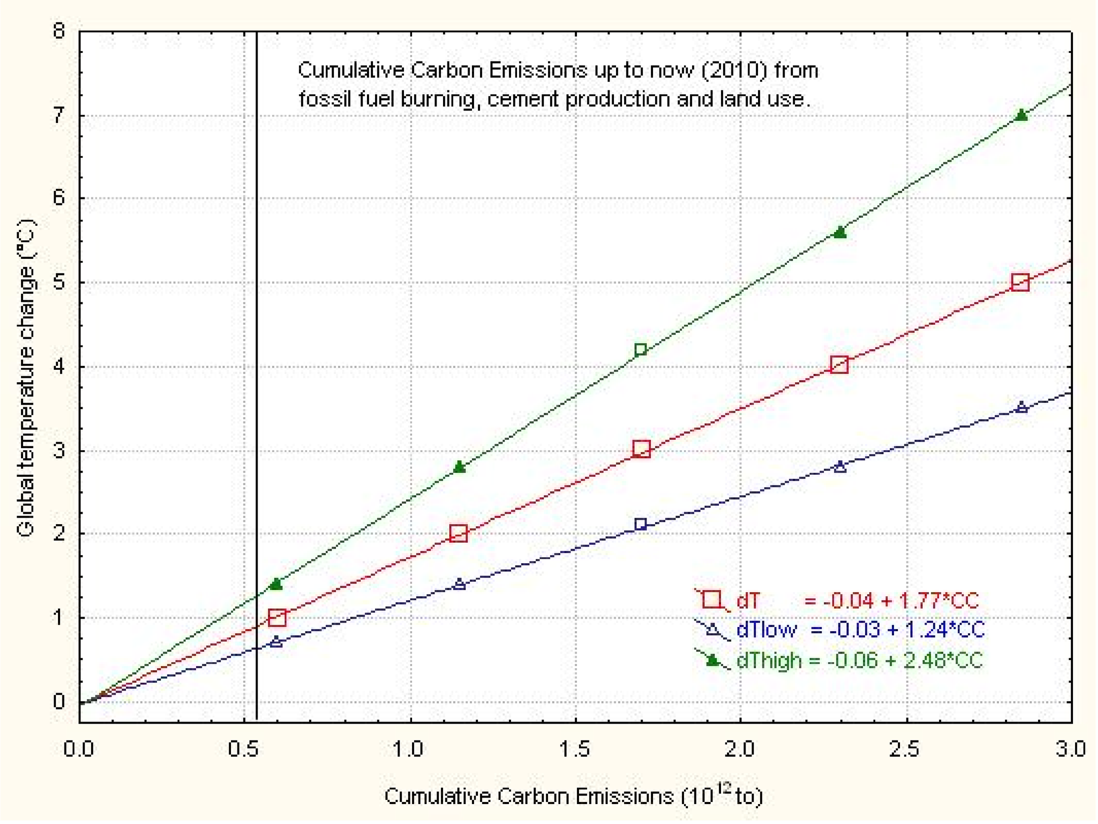
NAP book (2)



In my previous comment on the new NAP book "Climate Stabilization Targets" I wrote that the main metrics to quantify climate change used are the cumulative carbon emissions and global temperature change. The first parameter has been proposed by Matthews et al. in 2009 ("The proportionality of global warming to cumulative carbon emissions", Nature 459). Emissions of carbon include those related to the burning of fossil fuels, cement production and land use. Up to 2010 these emissions are estimated at a total of approx. 0.52*10E12 metric tons of carbon (i.e. 0.52 teratons). I assume that this total is calculated starting at 1750, the date usually taken as the start date for the calculation of radiative forcings (i.e. the start of the industrial age).

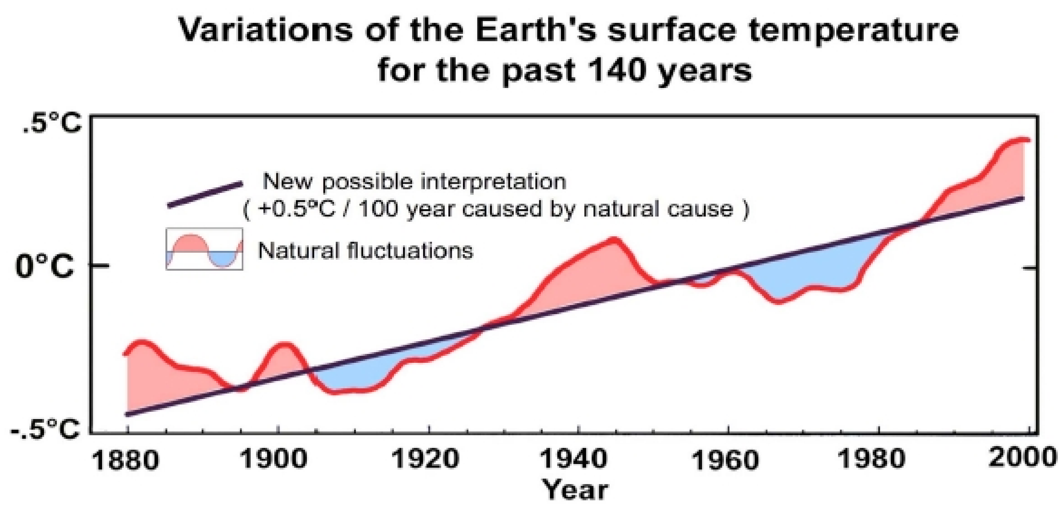
The graph given confuses independent and dependent variables: we want to know "what will the global temperature change dT be when the cumulative carbon emissions CC reach a certain level?". I made a knew plot, using the numbers picked from the NAP graph and plotting dT versus CC. The fit lines were calculated by linear regression. I also added the upper and lower limits of the uncertainties, which are obtained by multiplying the dT by 1.4 (upper limit) and by 0.7 (lower limit). Here is this graph:



We see that **dT= -0.04 + 1.77*CC**, with dT in °C and CC in trillion tons. It is obvious that this model gives practically no temperature change if the emissions had been zero. This formula implicitly says that if there had been no carbon emissions (neither from fossil fuels nor land use), global temperature would have remained stable at the cool level of the LIA. Or a planet leaving a little ice age is warming in a natural way; this process seems to be ignored in the model applied.

Global temperatures were at least 0.4 °C lower than in the reference period 1950-1980 (link). So adding the temperature change caused by the 0.52 Tto emitted should give a global temperature change of -0.4+0.88 = 0.48 °C for today. We know this to be incorrect, as the most probable value is 0.7 to 0.8 °C. The difference can only come from the natural warming caused by the end of the LIA. This suggests that natural warming could be approx. of the same order as that caused by human emissions.

But there is another possibility to explain the observed warming. Akasofu has written several papers on the Earth recovering from the LIA, and he gives this figure in his 2009 paper "Two Natural Components of the Recent Climate Change" (link):



In fact, he says that actual warming can be seen as a superposition of two **natural** trends: an ongoing warming due to the end of the LIA and a periodic warming/cooling from the different oceanic oscillations (PDO, AMO, …). Carbon emissions do not even need to be taken into account!

As a conclusion:

The cumulative emission formula does not allow to predict actual global temperature change for the future. It can only speculate what the additional warming caused by carbon emissions can be. As it ignores natural causes of warming/cooling, the formula seems suspect. The model contains only one single parameter (cumulative carbon emissions) as a cause for global warming; we know this is not true, reality is much more complex. The predictive value of the formula is low.

Just to show how wildly the different climate models differ in their predictions, look at the fig. 3.5 from the report:

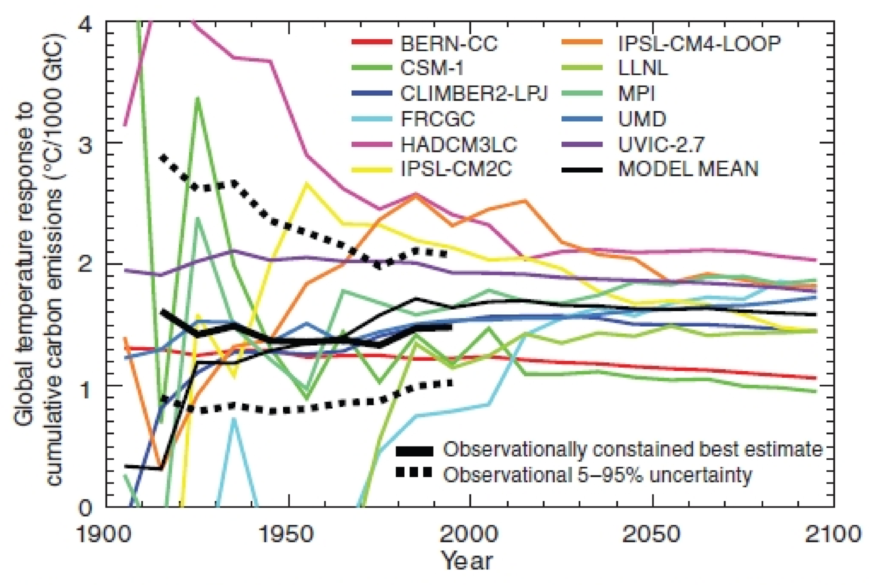


FIGURE 3.5 Temperature response to cumulative carbon emissions from coupled climate-carbon model simulations (thin colored lines) and historical observations of CO_2-induced warming and anthropogenic CO_2 emissions (thick black line solid and dotted lines). (Figure adapted from Figures 3 and 4 of Matthews et al., 2009).

The NAP report correctly writes (p.15): *"Uncertainty in the carbon dioxide emissions and concentrations corresponding to a given temperature target is large"*, and this will be the last word of my comment #2.

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