

meteoLCD Weblog

A weblog on climate, global change and climate measurements

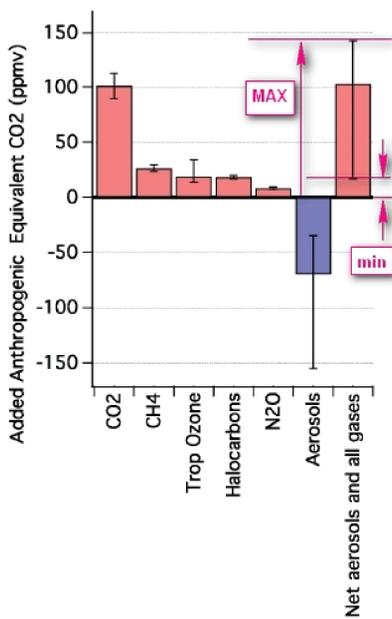
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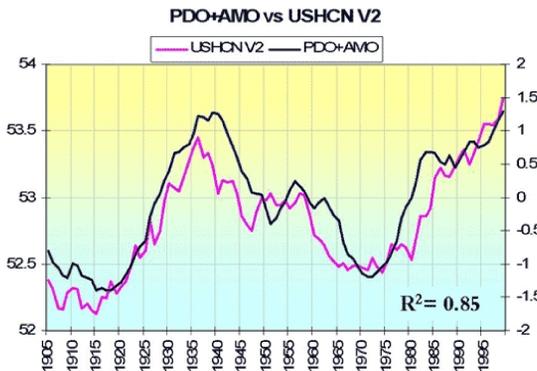
In this 3rd comment I will make some reflections on equivalent CO2 concentration and CO2 residence time.

Let us start with a graph given at page 60 which shows the added anthropogenic equivalent CO2 contributions: these include all GHG whose radiative forcing is estimated being greater than 0.15 Wm⁻²: CO2, CH4, ground (=tropospheric) O3, N2O (laughing gas) and aerosols:



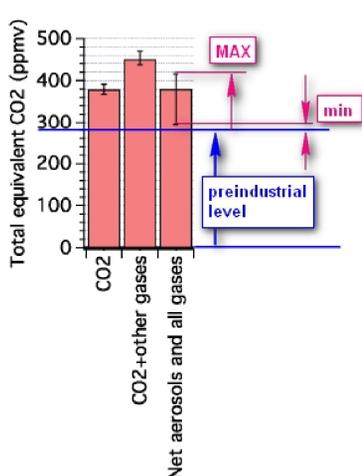
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I have added arrows to point to the maximum and minimum levels which correspond to the uncertainty range: this range is huge, and the question on the importance of human emitted aerosols remains largely open. Climate alarmist usually have a quick and simple explanation for the temperature dip observed from 1940 to 1970: this lower temperatures were caused aerosols (emitted mostly by burning dirty, SO2 emitting fuels, with SO2 particulates being effective in blocking sun light). Another quite different explanation is that this period coincides with the negative phase of the AMO and PDO, and as such the lower temperatures are the result of natural cycles.



This is the graph given by meteorologist Joe d'Aleo ([link](#)) from [icecap](#). It shows that the continental US temperatures, as given by the US historic climate network (USHCN) follow the combined PDO+AMO cycle very nicely, and that this natural relationship is all what's needed to explain the post WWII cooling and the warming at end of the 20th century.

The big aerosol uncertainties are one of the major problems in climate models. Let us look at the right part of the NAP figure 2.1, which shows the total equivalent CO2 concentration. I added the base line corresponding to the pre-industrial situation (CO2 appr. 280 ppmv):



This variation from what is assumed being the pre-industrial situation (this level may well be too low!) is not so spectacular anymore, if you extend your left axis down to zero. The lower limit corresponding to the greatest aerosol influence even is astonishing close to that situation (even if CO2 levels increased possibly by about 100 ppmv).

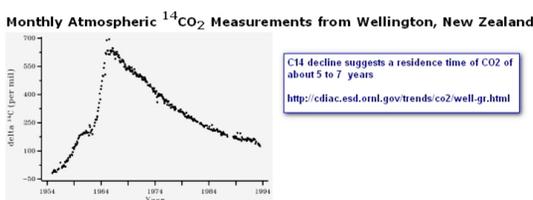
Most industrial countries certainly will try hard to diminish their reliance on imported fossil fuels. Carbon low energies certainly will play a bigger part in the energy mix of the future, even if the bulk still comes from fossil fuels and nuclear. But it could well be that these fossil fuels will rely more and more on relatively clean burning gas (shale gas or methane clathrates).

The **atmospheric residence time** of the released CO2 is another important parameter: if it is short, even large increases in emitted CO2 will have only a passing effect at most, if it is large, the equilibrium, long-term warming might be much more important. The question of this RT (residence time) is still open. The IPCC consensus, also adopted in the NAP report, is that emitted CO2 remains for hundred of years in the atmosphere. The reasoning goes like this: even if an individual CO2 molecule remains about 5 years at most in the air, before being absorbed by the ocean, the concentration (better: mixing ratio) in the atmosphere will stay higher for a long time (hundreds to thousand years), because every molecule absorbed will be replaced by a molecule released. The (alarmist) blog [skepticscience](#) writes: "However, in most cases when a molecule of CO2 leaves the atmosphere it is simply swapping places with one in the ocean". (see also this [short paper](#) by H. Lam from Princeton University). This can not be true, as for instance we have the famous 40% "missing carbon" quantity: about 40% of the carbon emitted from burning fossil fuel disappears from the atmosphere, and this percentage has remained practically constant throughout the industrial period ([link](#)).

Many researchers question the IPCC consensus of a long residence time.

The most recent paper comes from Robert Essenhigh ([abstract](#)), who finds an RT of about 5 years, in good accordance with prior results from Tom Segalstad ([link1](#), [link2](#)).

The analysis of C14 variations (C14 created during atmospheric atomic bomb tests: neutrons released turn nitrogen atoms into carbon-14 atoms) confirms this time span of 5 to 7 years ([link to comment](#)):



At least one can not but agree with H. Lam who concludes his paper with: "If indeed our policymakers are betting the future of our world on the consensus IPCC value of τL ($= RT$) being wrong (too big by a large factor), the general public ought to be told".

So we have here again a very important climate parameter on which there is no agreement. If we reflect on all the uncertainties and all the parameters in dispute, the necessity of immediate and drastic actions like the 80% reduction in CO2 emissions in 2050 repeatedly given as mandatory in the NAP report could possibly be an exaggerated goal.

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