The Great Global Warming Swindle

I watched a programme on television last week called the *Great Global Warming Swindle*. It presented a compelling case for the view that Global Warming is real, but is not caused by carbon dioxide put into the atmosphere by humans, but instead is due to variations in solar output. I personally found the whole thing rather shocking. Its direct implication was that the idea that CO_2 played a significant role in determining climate was a scam perpetrated by malign, money-grabbing scientists manipulated by eco-fascists and capitalist enviro-thugs. It was not a picture that I recognised

Anyway. At times like this I find it very helpful to look through the *American Institute of Physics* site on the history of climate science:

http://www.aip.org/history/climate/

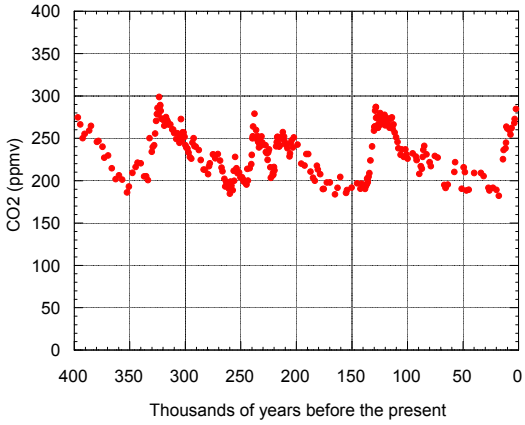
and in particular I enjoyed the essay there on the history of the effect of solar variability.

http://www.aip.org/history/climate/solar.htm

You can find these links on the Protons web site.

Returning to the programme, I found its major shortcoming was that it sought to 'disprove' the effect of increased CO_2 levels by pointing out technical details which were poorly understood in what one might called "the accepted model" (such as the absence of 'stratospheric warming'). However, its important to understand that there are degrees of wrongness. If you think the Earth is a perfect sphere, you are wrong. However, if you think the Earth is flat you are ***more*** wrong. Similarly, our present understanding does not permit us to explain every phenomenon. However it is important to realise that not being able to explain ***everything*** does not mean that we understand ***nothing***. In any case, the programme contained enough evidence for it to be fairly clear that it's arguments were rather weak.. The key facts seem to me to be these:

Milankovitch Cycles



The Milankovitch cycles are the small cyclic changes in the orbit of the Earth around the Sun which affect the angle of the Earth with respect to the Sun. These changes give rise to the Ice Ages. We can see their effect over the last one million years or so in the record of atmospheric gases preserved in the permanently frozen parts of the Earth: the North and South poles. I showed you data for the last 400 thousand years on one of the slides in Week 4 (see right).

These changes in global climate are driven by changes in the Earth's orbit which cause small changes to the total amount of solar radiation reaching the Earth. If the Sun's output was changing significantly over this timescale then we would not see the effect of the Milankovitch cycles. Instead we would see ice ages that were driven by the Sun's variability: this is not observed. From this we can conclude that the amount of solar radiation reaching the Earth must be rather constant. Recent observations indicate the Solar output changes from one sunspot cycle to another by a few tenths of a percent. These changes are considered in the models used to predict how we expect the climate to evolve over the next century.

In summary, the fact the Milankovitch cycles are recognisable in the climate record indicates that the solar output must be reasonably stable over the last million years or so, otherwise tiny changes in the attitude of the Earth could not have had a discernable effect.

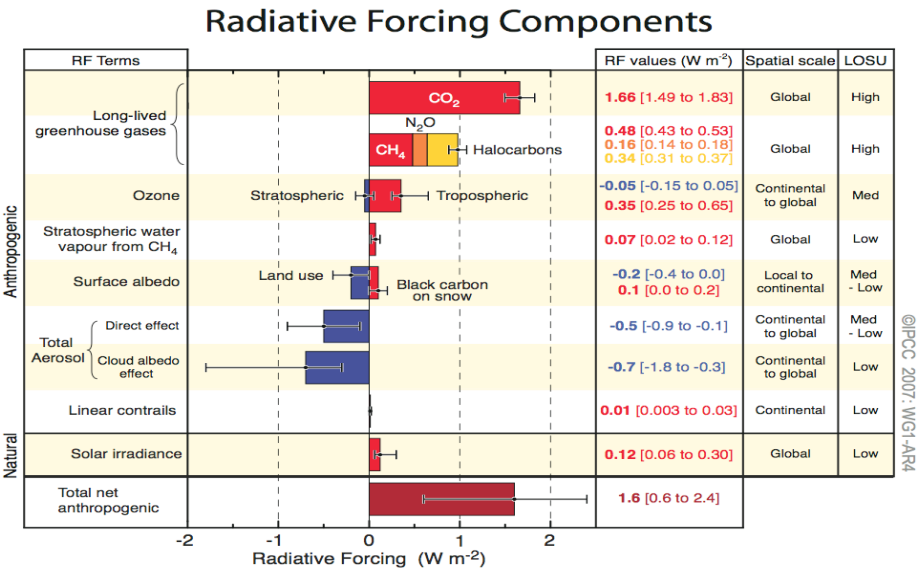
Forget about whether the Earth is warming or not!

CO_2 ***is*** a greenhouse gas. This is a fact, and we saw why in Week 4. And humans are increasing its concentration in the atmosphere. This is also a fact. So it is not hard to conclude that this is likely to have an impact on climate. The models scientists have constructed – and they are some of the most complex computer programs ever written – are attempts to discern what effect that increased concentration of CO_2 will have. The models are not perfect, and the scientists who have constructed them would be the first to admit their imperfections. However, they are also rather impressive, being able to 'predict' the current climate of the Earth pretty accurately. These models confirm the general idea that increasing the concentration of CO_2 in the atmosphere will increase the average surface temperature of the Earth.

So, whether or not the observed changes in global climate are due to CO_2 from human activity, our best estimate is that the CO_2 ***will have*** an effect. The Channel 4 programme failed to even consider the effect that increased concentrations of CO_2 will have and how that might compare to the effect of solar variability. However, that's just the sort of thing that real scientists do calculate, so just for the record, the numbers from the report of the *Intergovernmental Panel of Climate Change* (IPCC) published in February are given below.

- "Climate forcing" by the CO_2 and H_2O in the atmosphere is estimated to have historically amounted to around 150 watts per square metre.
- Solar variability is currently responsible for an extra + 0.12 watts per square metre of the current amount of climate forcing. This is our best estimate, but the uncertainties involved in this in this indicates that it actually could be between +0.063 and +0.30 watts per square metre.
- CO_2 is responsible for an extra +1.66 watts per square metre The uncertainty in this indicates that it actually could be between +1.49 and +1.83 watts per square metre.

In other words the effect of human emissions of CO_2 is around 14 times more significant than the natural solar variability. The other contributions considered are given in the figure below extracted from the IPCC summary report. Notice the 'un-polemical' nature of the figure caption, and the very plain indication of LOSU – the level of scientific understanding. As I said above, "not knowing everything" is very different from "knowing nothing at all".



Global-average radiative forcing (RF) estimates and ranges in 2005 for anthropogenic carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and other important agents and mechanisms, together with the typical geographical extent (spatial scale) of the forcing and the assessed level of scientific understanding (LOSU). The net anthropogenic radiative forcing and its range are also shown. These require summing asymmetric uncertainty estimates from the component terms, and cannot be obtained by simple addition. Additional forcing factors not included here are considered to have a very low LOSU. Volcanic aerosols contribute an additional natural forcing but are not included in this figure due to their episodic nature. Range for linear contrails does not include other possible effects of aviation on cloudiness. {2.9, Figure 2.20}

Michael de Podesta: March 12 2007