Global Warming – A Geological and Astronomical Perspective

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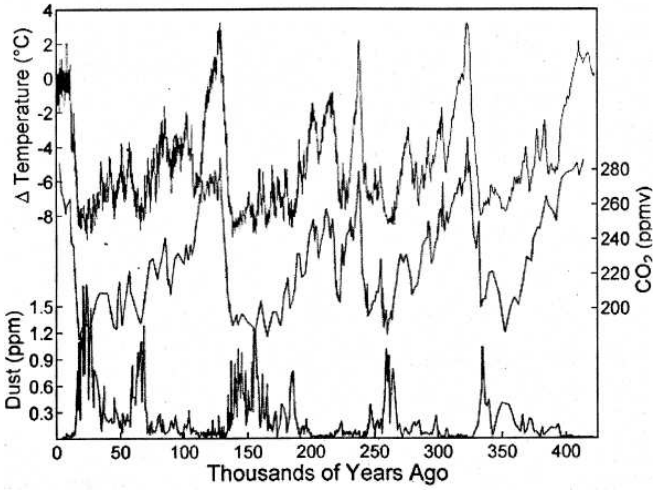
The Global Warming Scare has become the issue of our times. It would seem that every human activity is now to be evaluated not in relation to it's SO2, NOX or diesel particulate output but rather in terms of it's "carbon footprint". Is this based on sensible science or politically driven environmentalism?

Recent new evidence, mainly of a solar nature, has brought into question many of the earlier claims upon which the whole issue has been based. It is perhaps a good time for interested members of this organization to stand back and look at the critical data anew from a geological point of view. As geoscientists we have a unique perspective and, as Winston Churchill said: "The further backward you can look, the further forward you can see."

Global Temperature and Atmospheric CO2

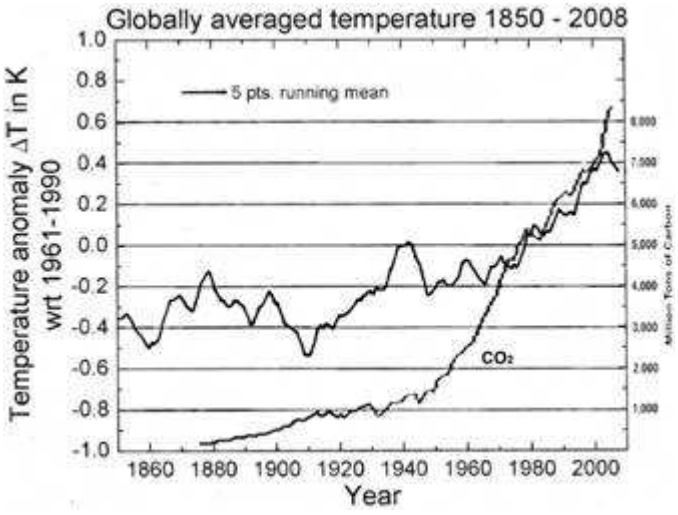
The first illustration (from Wikipedia) shows the Vostok Ice Core results for temperature, CO2 and Dust over the last 400,000 years:



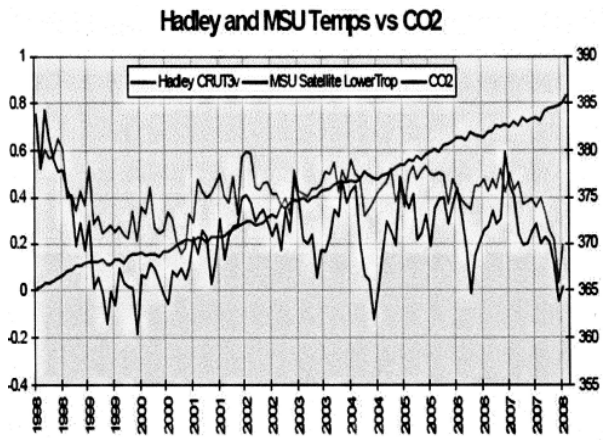
The two most striking observations from this data are that there is a clear correlation between temperature and CO2 and that the present day temperature is not at all unusual with respect to previous interglacials. There is insufficient detail at this scale to resolve the temperature/CO2 link, but at higher time resolutions as well as in other ice cores (eg. Dome C), more often than not, the temperature change leads the CO2 by up to 800 years. This is what one would expect

as rising temperatures cause additional CO2 to be released from the oceans which hold the vast bulk of readily accessible CO2.

The figure below (Akasofu, 2009) is a plot of global temperature from 1850-2008 overlaid with CO2 levels. This shows the situation from the end of the Little Ice Age (began c.1300-ended mid-1800s) to the present. It is instructive to note that the increase in temperature from about 1910 does not correlate with the rapid increase in CO2 which occurred after WWII in the 1940s when industrial CO2 emissions were rapidly increasing. In fact the post-1910 temperature rise occurs at a relatively constant rate despite rapidly increasing CO2.



The most recent data is shown below based on the UK Meterological Office Hadley Centre for Climate Change and satellite data from the MSU (Microwave Sounding Unit).

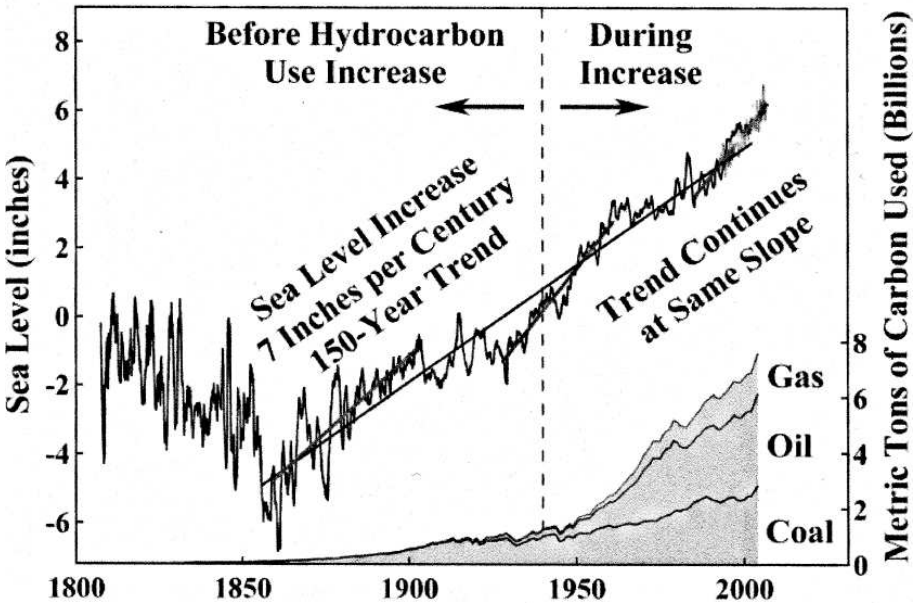


This shows very clearly that global temperatures have stabilized (and may even have been falling slightly) since about 2002. This cooling trend has continued into May 2009. This is despite steadily increasing CO2 levels. Not one of the many IPCC models had predicted this.

Sea Level Changes

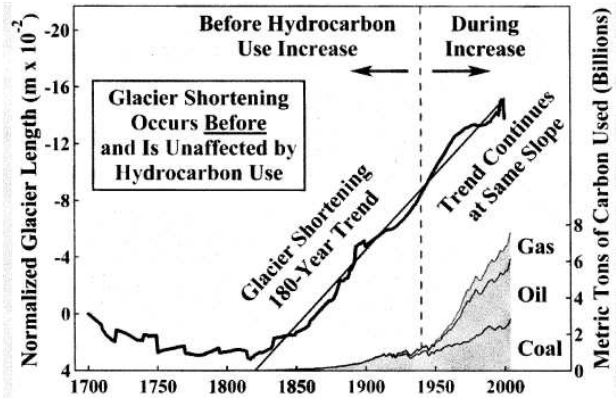
The following figure (Robinson, 2009) shows the dramatic turn around in sea level occurring at about 1860, as the world moved out of the Little Ice Age into the 20th Century Modern Warming. Once again it is interesting to note that there is no change in the rate of rise despite the dramatically increased carbon input from post war industrialization and fossil fuel use.

Other more recent satellite measurement studies by the University of Colorado have actually shown a decrease in the rate of sea level rise from about 2004 which could possibly be a consequence of the temperature stabilization noted above.



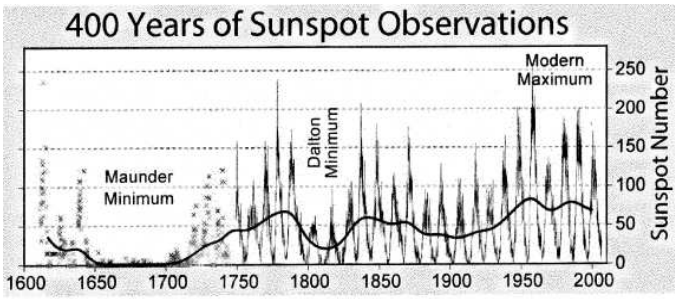
Glacial Retreat

The figure below (Robinson, 2009) shows global glacial advance in the Little Ice Age turning to a steady retreat at about 1820. Once again, there is no effect from increased fossil fuel use after the war.



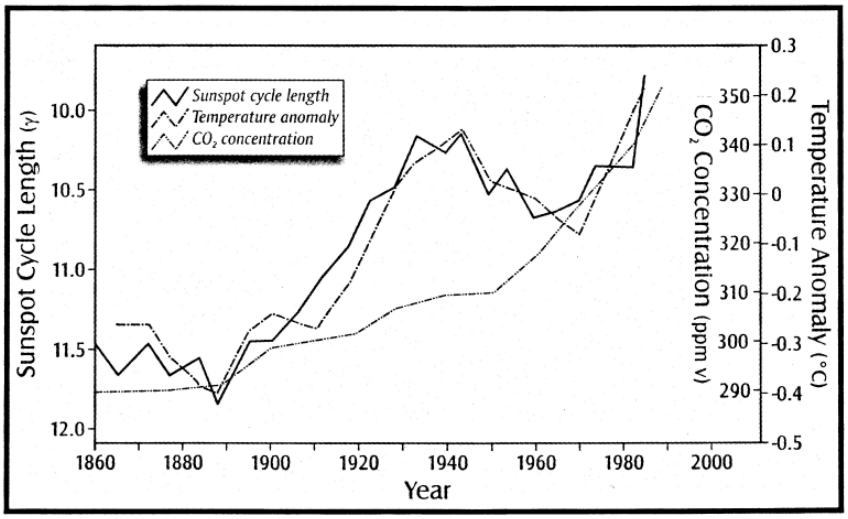
The Solar Connection

It is clear from the above examples that there is no causative correlation between increases in CO2 and global temperature increases, sea level rise or glacial retreat. However, our sun is a well studied G2 class variable star with it's electromagnetic activity varying on several scales, the best known of which is the 11 year sunspot cycle (which is actually a 22 year cycle). Superimposed on this are a number of much longer cycles which, through harmonic interaction, can produce extended periods of lowered solar output; an easily observable consequence of which is reduced sunspot levels. The figure below (http://images.suite101.com/443491) shows several such periods over the last 400 years:



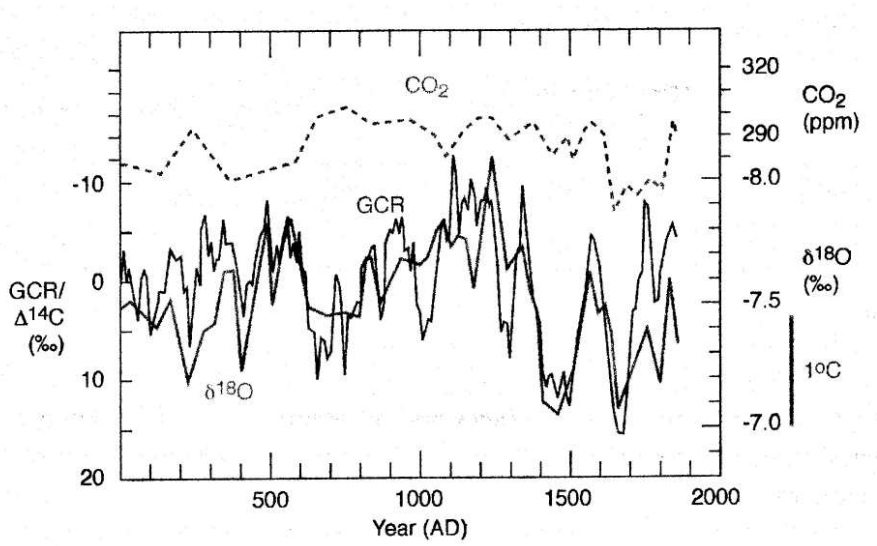
It is significant to any analysis of global warming that many of the periods of low sunspot activity coincided with very cool periods on the earth such as the Maunder Minimum and Dalton Minimum which were superimposed on the already cold Little Ice Age (c.1300-mid 1800s). Two earlier cool periods in the LIA before 1600, the Sporer Minimum and Wolf Minimum are not shown but coincided with reduced solar activity after the Medieval Warm Period (c.900-1300). It is worth noting that the present solar sunspot level is at an extremely low level, and this low part of the solar cycle is lasting much longer than most had predicted. It is quite possible that there may well be a connection between this reduced activity and the current global temperature stabilization and cooling mentioned above.

The length of individual 11 year solar cycles also varies somewhat as is shown in the figure below (Plimer, 2009). As can be seen global temperatures correlate well with this variation in length and not all well with CO2 levels (the lower trend line in the figure).



Our knowledge of the Sun-Earth environment is increasing rapidly, with much assistance being provided by recent satellite observations so that now a theoretical framework for the solar effect on climate is being worked out.

The most likely explanation for the effect is that when there is a period of low solar activity the solar wind decreases in a similar manner to the 50+ year low we are currently experiencing. These periods of low flow allow an increase in the galactic cosmic ray (GCR) flux to the atmosphere. The GCRs consist mainly of protons and highly energetic relativistic electrons produced mainly from supernova-type events in the galaxy and when they interact with molecules in the upper atmosphere produce a cascading shower of particles down through the atmospheric column. Some of these form aerosols which can act as condensation nuclei for water droplets and may produce the increase in low cloud cover that correlates with the solar cycle. A consequence of the increased cloudiness is increased albeido resulting in less of the sun's radiation reaching the earth producing a cooling effect. Temperature and GCR proxies also produce correlations on other timescales as shown below independent of CO2 variations:



Solar and galactic-sourced dust levels also vary with solar activity and our position in our spiral arm of the Milky Way Galaxy. In the last decade or so it has become evident that increases in dust level can correlate with cooler periods and ice growth in both Greenland and Antarctic ice sheets on time scales from 100,000 to 800,000 years. These long periods may be the result of the solar system's slow movement through interstellar dust patches and, on a longer timescale (c. 34 million years), oscillation up and down through the galactic plane and it's dust-laden arms as the sun moves in it's slow orbit around the galaxy. An even longer period of approximately 150 million years may be due to the solar system crossing from one galactic spiral arm to another. This timing coincides with the onset of many glacial periods throughout the Phanerozoic.

An increase in very high altitude (80km) noctilucent clouds has also been relatively recently identified during periods of low solar activity and this may have a similar cooling effect to the GCR-induced low altitude clouds. This could be a consequence of low solar activity promoting cooling of the upper atmosphere allowing ice crystals to form more readily.

An additional consequence of the present lull in solar activity had been a 56 year low in solar radio emissions. The effect of this on climate is unknown. Possibly the greatest unknown is the role of aerosols in the atmosphere…their effect is poorly understood but potentially huge – perhaps even greater than any role CO2 may play. Similarly the role of soot (black carbon) deposition on arctic ice and northern glaciers from forest fires, fossil fuel combustion, third world cooking fires, etc. may be a highly significant contributor to melting but little research has been done and great uncertainty remains. Global warming science is far from settled!

References

Akasofu,S. 2009. Two Natural components of the Recent Climate Change: (1) The Recovery from the Little Ice Age and (2) The Multi-Decadal Oscillation. *Second International Conference on Climate Change, New York*

Plimer, Ian, 2009. Heaven + Earth *Connor Court Publishers, Ballan, Victoria, p. 131*

Robinson, Arthur, 2009. Noble Prize for Death *Second International Conference on Climate Change, New York*

Historical Studies Group

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Convenor

Over the past year or so the number of articles being submitted for publication in the group's journal has significantly declined. As a consequence it was decided not to publish in March of this year but instead carry over the articles on hand. There are now sufficient articles to justify publication in September although more articles can still be sent to the editor Tony Hocken at:

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Tony after editing and overseeing printing of the journal for the past five years will be retiring from that role after publication of the September issue. If the journal is to continue we require both articles and an editor. If these two objectives are not realised then the journal will cease, or at least go into abeyance, after September.

After eight years it is also time for a change in convener and in November, following the Geosciences'09 Conference, Simon Nathan will take up this role. Over the next few months we will evaluate options with respect to the journal as well as assessing the roles HSG could play within the Geological Society. We welcome members' views and ideas on these matters. There will be an HSG meeting during the conference.