THE SCIENTIFIC ALLIANCE

26th September 2008

The quiet Sun

The debate continues over what the effect of known changes in the Sun's activity have on the Earth. As the primary source of heat and light and energy, it sustains life on the planet, and variations in its output can be expected to influence climate in significant ways. A common example of this is the 11- and 22-year cycles of sunspot activity, during which the number of dark visible spots on the Sun's surface varies between maximum and minimum values (which are different for each cycle). Higher numbers of sunspots are evidence of a more active Sun.

Economists have recognised for many years (from at least Adam Smith's time) that there is a link between sunspot activity and crop yields, having seen that wheat prices rose at times of low activity (the quiet Sun). And when there are a number of years of low activity, the effect on weather patterns can be very significant significant. The best known example of this is the so-called Maunder minimum. From 1645 to about 1715, very few sunspots appeared (only about 0.1% of the normally expected number). This lack of solar activity coincided with the Little Ice Age, when there are well-documented accounts of cool summers and bitterly cold winters afflicting the northern hemisphere.

Proxy records suggest that European annual average temperatures were about 1.5 degrees Celsius lower than in the twentieth century; many rivers were regularly frozen and sea ice extended as far south as Iceland and southern Greenland for long periods. The mechanism of this regional climate change is not settled, although it could be primarily due to different wind patterns. The mainstream scientific consensus is that changes to the overall radiation output of the Sun are not in themselves sufficient to account for average temperature changes of this magnitude (or, indeed, to account for the roughly 0.6 degree average temperature rise over the twentieth century).

Nevertheless, in the absence of any other credible drivers, changes in the Sun's activity would seem to have been the root cause of the Little Ice Age, which suggests that similar quiet periods could also have a cooling effect on the present climate. Since, despite the best efforts of the modellers, a comprehensive understanding of the drivers, interactions and complexity of the global climate systems still seems some way away, any real-life observations which add to our knowledge would be invaluable. And that's exactly what we may be getting with the current behaviour of the Sun.

For some time, it has been clear that the Sun has moved from being highly active in the later part of last century to a current quiet period. The current sunspot cycle (24, marked by a reversal of the magnetic field) has started much later than usual and, by some reckoning may not even have started at all. Certainly, there have been

only occasional small spots for an extended period. This coincides with a report from scientists responsible for the Ulysses satellite that the solar wind - the stream of charged particles which extends for billions of kilometres to form the heliosphere - is weaker than it has been for 50 years. Confirmation of this comes from the Voyager probes, launched in the 1970s, and now moving beyond the heliosphere into interstellar space earlier than was originally expected.

Whether this cyclical change in the Sun's behaviour is behind the current climate pattern - an apparent halt to any global warming trend after the peak average temperatures of 1998 - is a moot question, but certainly cannot be ruled out. The jetstream has stayed further south than normal, leading to two miserable summers in northern Europe, and such alterations in wind patterns seem also to be at least a contributory factor (and perhaps even the primary driver) of the changing patterns of summer ice loss in the Arctic, including irregular opening of the North-West passage.

But perhaps the most intriguing prospect is to be able to observe the effect a quiet Sun has on cloud formation. Svensmark and others have hypothesised that a weakening of the solar wind allows more high-energy cosmic rays to enter the Earth's atmosphere and that these create a greater number of nuclei around which clouds can form. Put simply, if the Sun is quiet, cloud cover will on average be greater and average temperatures will be lower. The credibility of this is due to be tested at CERN in the CLOUD experiment, but real-life observations may already have provided much of the evidence by the time the results are in.

Many mainstream scientists dismiss the Sun as the major driver of climate, whether directly via radiance changes or indirectly by a mechanism such as that proposed by Svensmark. But all professional scientists, whatever their current views, should look forward eagerly to the collection of climate data as the Sun continues through its quiet period, however long that may be. The scientific method relies on careful and systematic gathering of evidence to try to falsify hypotheses. No true scientist should ignore the observations of solar activity and weather patterns over the next few years.

Green hypocrisy

A survey reported this week in the Guardian showed that, while 59% of people thought that the government should go much further in promoting energy conservation issues, over 70% were unwilling to pay higher taxes to tackle environmental issues. This could be primarily cynicism about higher taxes introduced by politicians who they don't trust. Or it could be putting their own immediate comfort and financial security before less personal and longer-term issues. Either way, there seems to be a disconnect; governments apparently have sold their electorates on the need to take action, but these same people don't feel the need to pay for this action themselves.

In the same edition of the paper, it was reported that researchers at Exeter

university had concluded that those people who were most aware of environmental issues and took the greatest care to recycle waste were also the most likely to take long-haul flights. According to the lead researcher "Green living is largely something of a myth. There is this middle class environmentalism where being green is part of the desired image. But another part of the desired image is to fly off skiing twice a year. And the carbon savings they make by not driving their kids to school will be obliterated by the pollution from their flights."

In both cases, the apparent buy-in to the concepts of environmentalism does not, for the majority of people, translate to a real change in lifestyle, whatever examples some opinion-formers try to set. For good or ill, this simply illustrates how people behave: very few of us do not put family and self first, and sacrifices for other causes are likely to be relatively small or of a token nature.

It also shows why governments are unwilling to match tough talk and stringent long-term targets on climate change with effective policies here and now: they know the electorate won't stand for them. The only sure way to make real changes in democratic societies is to offer people better alternatives. Most people would be perfectly willing to accept electric cars charged from a nuclear-powered national grid, but no acceptable level of taxation will force them off the road.

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