Climate forecasting

Some forty-odd years ago, when I was the Professor of Ocean Engineering at the University of Newcastle UK specialising in building oil platforms and pipelines on the seabed, I was looking for a cheap way of finding the strength of foundation materials because it's very expensive to test for engineering properties of sediment. One day I was scanning a paper in a weighty report of the international Deep Sea Drilling Project looking for anything that might correlate with engineering properties and came across a paper that showed the variation of hundreds of oxygen isotope records deep into the seabed and a few engineering properties: clearly it was cheaper to look at isotopes.

As it turned out there was no relationship whatsoever between isotopes and engineering but I thought I could detect a trend in the isotopes descending below the seabed for the last seven million years. Superimposed on the trend were cyclic variations representing a sine series comprising ever-halving periods and slightly decreasing amplitude. It was only at that stage that I discovered that the oxygen isotopes were describing the variation of past temperature change. I was hooked. Forget engineering - this was much more important.

From that accidental beginning, by finding other proxy climate records I extended the sine series over both longer and shorter periods until deriving an equation that covers natural global temperature change over all time scales from billions of years ago to a matter of years or less. The following papers describe this saga in more detail starting with a trivial little paper from 1981 (How to Build an Ocean), which shows the sneaky way in which I introduced my approach to climatology to students. The next two papers show some of the proxy temperature data ranging from billions of years down to less than a decade that contributed to the development of the forecasting model. Because that is what it was: it doesn't only match the past but can forecast future climate change.

Before we get carried away, the next paper (The Climate-Energy-Economy link) describes how the model matches those things. This is followed by another (Water Resource Forecasting) relating the model to watery things over the last few centuries.

At that stage – 1984 – the model described only natural climate change. Like so many people at the time, I hadn't heard of the greenhouse effect. However, in the next paper (The Greenhouse Affair) I added a manmade component to the natural temperature model, thereby enabling the composite model to match global temperature change since the industrial revolution as well as the distant past. The next paper (Sea-Level Modelling: The Past and the Future) takes both elements into account.

There was no need to consider the greenhouse effect in the next paper (Evolution and Environmental Determinism), which covers the evolution of marine invertebrates (about which I know nothing) over whole of the Phanerozoic timescale. Another thing about which I know nothing is earthquakes but that did not stop me compiling the next paper, which was published by The Seismological Press of China, on the relationship between the climate model and the distribution of Chinese earthquakes during the twentieth century.

Returning to mainstream climate forecasting, the next paper (Determining Natural and Manmade Climate Change …) appeared in the proceedings of a NATO advanced research workshop and describes not only the climate model but also, in its appendix, the mechanism for the world population growth that clearly feeds the greenhouse effect. The following seven single-page notes are from the same NATO proceedings and briefly cover such matters as the populating of South America by Polynesians at the end of the last ice age, the influence of the Universal Gravitational Constant on climate change, sea level rise, the value of deterministic modelling, drought forecasting and finally a practical means of reducing carbon dioxide by better energy generation in and ventilation of buildings.

The next (unpublished) paper (Solar Signature in Sedimentary Cycles) offers a brief consideration of solar cycles; a mechanism is shown to explain the occurrence of halving/doubling of the 11-year sunspot cycle from less than three years to tens of thousands of years.

The following two items (from Nature and New Scientist) point out that sea level rose at about 5 mm/year for about 2000 years at the end of the last ice age even without man's interference – enough to flood most of the world's major cities should the greenhouse effect cause it to happen again. There follows another note to relate the climate model to late twentieth century insurance claims for English building subsidence.

Getting near the end now. A summary (How to Tell Man-made and Natural Changes apart and Forecast the Future) is provided in a 2009 paper presented to a conference organised by the Institution of Civil Engineers. It notes that, after about four years of global cooling at the time of writing, there would be "a sharp rise of about 0.25°C or so about 2012": in fact, from 2011 to 2016 the global temperature rose by 0.27°C. No other model is known to have predicted that. The warning was repeated in the Sunday Telegraph letter that follows.

Finally an unpublished upbeat note is included to suggest that there could be a way out of the doom and gloom of the currently linked crises of excessive population growth and global warming. Instead, a wonderful future could lie ahead for all of the world's population living in stable economic equability within a few generations. Since it was written in the early 1990s the world population explosion has been largely defused, which makes the proposal even easier to achieve. However, it requires the developed world to stop its blind pursuit of economic growth and apply the rewards of each new scientific advance to helping the developing world to catch up. Is this too much of a challenge to human nature?