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## Competition In Climate Science

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The classical liberal, like the ordinary Australian, has a general aversion to revolutionary change. This is justified in the spheres of politics and economics. When it comes to science, however, history shows that it is principally through revolution that progress is made. In his seminal 1963 book, *The Structure of Scientific Revolutions*, Thomas Kuhn showed that every significant scientific development, including those associated with the names Copernicus, Newton, Lavoisier and Einstein, required the rejection, indeed the complete overthrow, of time-honored scientific theory in favor of another incompatible theory. A second important point that Kuhn makes, one much more aligned with classical liberal thinking, is that competition between segments of the scientific community is the only historical process that actually precipitates such revolutions.

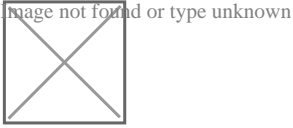
This presents a more significant problem than generally recognised by the growing number of non-scientists who would like to see the overthrow of the anthropogenic global warming (AGW) theory. It suggests that rather than simply ridiculing AGW theory, they will need to find, and also actively support competition. To this end, it is important to realise that simply repeating claims that climate change is natural, a point often correctly made by many sceptical geologists, is not enough. Indeed, stating that climate change is natural does not constitute a theory amenable to falsification. Furthermore, support for the myth that weather and climate are essentially chaotic and therefore unpredictable helps sustain the theory of AGW.

A good test of the value of any scientific theory to those external to the discipline is its utility. For example, the calendars that were developed based on Nicolas Copernicus' Heliocentric Theory of the Universe were better calendars than those based on Ptolemy's Handy Tables. The new calendars, based on a new theoretical approach, more precisely predicted the position of the sun and the planets and thus the seasons, which, of course, influence the weather. In the same way, those who want to see AGW theory discarded need to increase their expectations of climate science and in particular demand some practical benefit from the billions of dollars spent on the development of the General Circulation Models (GCMs) that underpin AGW theory. For example, there could be an expectation that GCMs were able to provide useful medium-term rainfall forecasts and that these forecasts were presented as the actual quantity of anticipated rainfall in millimetres for specific localities for particular periods of time.

Consider this issue from a different perspective. It can be argued that in science, theories and



their overarching paradigms gain their status because they are successful in solving important problems. AGW theory, with its focus on carbon dioxide emissions, solves a problem that has preoccupied activists for years: it provides proof that industrial activity is despoiling the earth. An alternative theory of climate, for example, one that is useful to industry, might make as its focus detailed and accurate climate and weather forecasts.



The very wet summer of 2010-2011 severely affected mining operations in Queensland. It is estimated that 85 per cent of Queensland coalmines had to either restrict production, or close entirely. By May 2011, Queensland's coal mining sector had recovered to only 75 per cent of its pre-flood output. These events led to a loss of \$5.7 billion, equivalent to 2.2 per cent of Queensland's gross state product for the financial year ending June 2011. A report prepared for Australia's National Climate Change Adaptation Research Facility concluded that currently available climate forecasts lack localised information, and other micro details, to enable focused advanced planning and risk management.

The Bureau of Meteorology (BOM) has directed most of its research efforts over recent decades towards modeling climate systems as part of a global effort that began back in the 1950s when a small team of American scientists set out to model the atmosphere as an array of thousands of numbers. By the mid-1970s, computing power was catching up with their ambition and by the 1980s, there was a growing confidence in the models and, in particular, their ability to forecast the impact of increasing levels of carbon dioxide on climate.

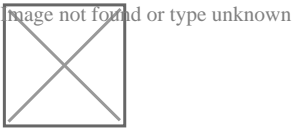
Australia's version of this global effort, POAMA, the Predictive Ocean Atmosphere Model for Australia, is promoted as a state-of-the art seasonal to inter-annual forecast system. However, despite such a claim being made for many years now, until winter 2013, POAMA had not been used for the official seasonal rainfall forecasts issued by the BOM. This is because rainfall forecasts from POAMA are not very good. In fact, they are often consistently worse than the forecast a school kid could generate based on simply calculating the monthly mean rainfall for a particular locality with a pencil and pad. Such an average value is known as climatology.

While most of the BOM research budget has gone on POAMA, rather than use forecasts from POAMA, until this winter 2013, the BOM based its official seasonal rainfall forecast on a simple statistical modeling technique developed in the 1980s to compute a conditional probability of rainfall being greater than or less than a seasonal median. Of course, over the last thirty years there have been significant advances in statistical modelling, in particular though developments in artificial intelligence. But this science has been ignored by the BOM, and all their eggs have been placed in the AGW basket underpinned by a belief it will one day be possible to accurately model weather and climate from first principles.

This winter, the BOM discarded the old statistical models relied on for the past 20 years and adopt POAMA as the basis for all climate forecasting. Interestingly, the reason for the change relates not

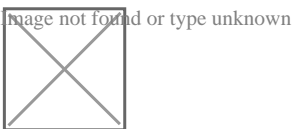


to demonstrated improved forecast skill. Rather it is theoretical, and based on concerns that the old statistical method uses historical rainfall data that will be of little value into the future because the Australian climate has changed and is on a new and different trajectory because of AGW. Therefore, the reasoning goes, past patterns will be of diminishing value in forecasting future climate because the relationships between the predictor and the predicted have broken down.



If this were indeed the case, if the Australian climate is now fundamentally different from what it was, then all methods that rely on historical data would be equally incapable of making forecasts. But this is not the case. Statistical models based on artificial neural networks, ANN, developed from the latest advances in artificial intelligence, can generate forecasts better than POAMA and better than climatology by using relevant climate indices (e.g. SOI), local variables (e.g. minimum temperature) and historical rainfall data as input information.

The comparative skill of prototype ANN models, versus POAMA and also climatology, can be easily and objectively compared using root mean square errors, RMSE. This is a number that simply adds together all the differences between observed and forecast rainfall results —the bigger the number, the worse the forecast. Comparisons can also be made visually through charting. For example, the chart on page 23 shows output from an ANN model for Nebo in the Bowen Basin, which anticipated the extreme rainfall of December 2010. In contrast, the official statistical method, and the new system based on POAMA simply provide a probability relative to the long-term median. For example, in November 2010, the BOM issued a seasonal forecast for the Bowen Basin, claiming a 50-55 per cent probability of above median rainfall over summer, accompanied by a coloured diagram, above. Such a forecast, that there is a 55 per cent chance of above average rainfall over a three-month period, tells you very little about what to expect. It is almost equivalent to a system for forecasting the outcome of the Melbourne Cup that only tells you the winner will be a horse with four legs and a tail. While accurate, the forecast does not provide relevant information to someone wishing to place a well-informed bet.



The Commonwealth Scientific and  
Industrial Research Organisation (CSIRO)

Climate scientists at the BOM, and those who control Australian Research Council funding, acknowledge that ANNs can produce superior medium-term rainfall forecast for localities in Queensland right now. However, they apparently dismiss this methodology on the conviction that as the Australian climate changes, such statistical models will fail. Another criticism is that the ANN models simply constitute mathematical analysis of data, while GCMs are real science



because they describe climate processes from first principles. Of course a skilled medium-term rainfall forecast based on pattern analysis has an intrinsic real value to the community and industry even if it is not developed from a first principles understanding of physical processes. Indeed such a criticism could be interpreted as evidence that the climate science community is more interested in politics and theory than the utility of the research it undertakes; that it is more interested in the authority of its theory than its value for inquiry.

It is not contested that the aspiration of accurately forecasting climate based on theoretical principles is a worthy ideal. The same is true of generating the energy requirements for all of humanity from nuclear fusion; essentially using a component of seawater as the fuel for a process analogous to the way the sun generates energy. Hundreds of millions of dollars have been spent on this ideal by governments over the past 50 years, but with no practical outcome. Some may recall the great excitement around the world in 1989 when 'cold fusion' was announced, a claim that was later discredited. Controlled nuclear fusion to produce our power is a worthy ideal that, one day, may happen. In the meantime, we do not all expect to sit freezing in the dark waiting for practical fusion to arrive. Rather, we use other methods that have present utility to generate electricity for our homes and industries. In the same way, it may be the case that BOM should deploy the best practical solutions in the present, rather than have its staff make nonsense pronouncements based on ineffective GCMs claiming extreme dry was the 'new climate' for Australia, just before the very wet summer of 2010-11.

Richard Lindzen, professor of atmospheric sciences at the prestigious Massachusetts Institute of Technology, wrote in a recent article for the *Journal of American Physicians and Surgeons*, that global climate alarmism has been both costly to society, and damaging to science. According to Professor Lindzen, this form of climate science has become a source of authority rather than a mode of inquiry and has successfully taken over all of institutional climate science research.

The history of science provides some insight into how to respond effectively. It suggests that the overthrow of an established paradigm only occurs when there is competition. Competition can manifest as something wholly political and strictly within the scientific discipline, or it can be about the evaluation of a theory based on its utility to those external to the discipline. Indeed if skillful medium-term rainfall forecasting was a goal of climate research, then evaluating the relative skill of competing theories could be an objective measure of their respective utility and by extension we would argue, their essential truth.

In short, those skeptical of AGW theory may be able to help precipitate its overthrow by demanding better medium-term rainfall forecasts. At the moment, however, there is no understanding that such a choice potentially exists. The BOM is a taxpayer-funded monopoly that, with the assistance of CSIRO and participating universities and cooperative research centers, enforces a particular paradigm. Indeed in Australia, and the west more generally, unless significant political pressure is brought to bear, entire research and development budgets will continue to be spent on POAMA and other GCMs with limited utility beyond politics simply because they are modern climate science.