Australian Temperature Variations - An Alternative View

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Appendix by Dr. Thomas Quirk added 17 October 2007

Australia's temperature since 1950 (see Figure 1) is usually described as a relatively consistent increase. Many, like the 2007 climate report from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), claim that the increase has been caused by the increasing concentration of greenhouse gases. That the correlation between temperature and the increasing concentrations of carbon dioxide is far from strong and consistent has apparently been of no concern.

There is however an alternative hypothesis that accounts for the major aspects of the temperature changes that is based on a natural cause rather than supposed a human influence on climate.

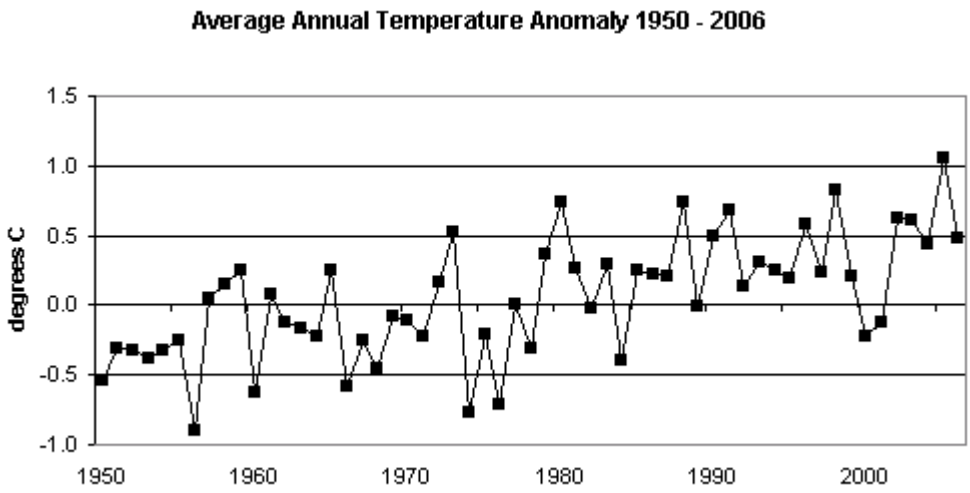

Figure 1 - Australia's annual average temperature 1950-2006

The Great Pacific Climate Shift of 1976

During early 1976 the climate of the Pacific Ocean underwent a substantial shift. The causes of this shift are not clear but they appear to have been abrupt and of great magnitude, factors which rule out the gradual increase in the concentration of atmospheric carbon dioxide and cast serious doubt on any human involvement of any kind.

Guilderson and Schrag (1998) examined ocean water near the Galapagos Islands and identified a substantial change in the amount of carbon-14 in the water from which they concluded that a massive reduction in deep water upwelling had occurred.

McPhaden and Zhang (22002) took this further and estimated that the upwelling in the tropical Pacific decreased by about 25%, from 47 sverdrups in the1970s to 35 sverdrups in the 1990s (1 sverdrup = 1 million cubic metres/second).

That reduction in cold water upwelling is highly significant because it previously cooled the ocean. With less upwelling it is to be expected that El Nino conditions would be more common and La Nina to be less common, and this is borne out by the relevant data.

The Southern Oscillation is not a three-state entity of La Nina, a neutral and El Nino conditions but a range of conditions for which a sustained period at one end of the range is called La Nina and a sustained period at the other is El Nino. The average Southern Oscillation Index (SOI) for the 25 years prior to 1976 was +1.97 and in the subsequent 25 years -2.88, indicating a definite shift in the direction of El Nino conditions (see Figure 2).

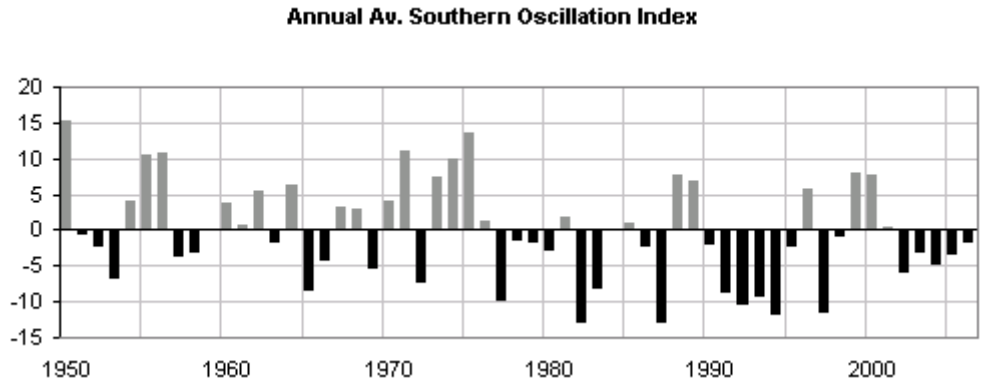

Figure 2 - Annual average Southern Oscillation Index (1950 - 2006)

Another way to examine this change is by aggregating the SOI values. This technique is used because the index is centred on zero and any important turning points in the sequence of SOI values will be quite obvious.

Figure 3 is a graph of the aggregate SOI since 1950 (as per the above graph) and the turning point corresponding to the Great Pacific Climate Shift is obvious.

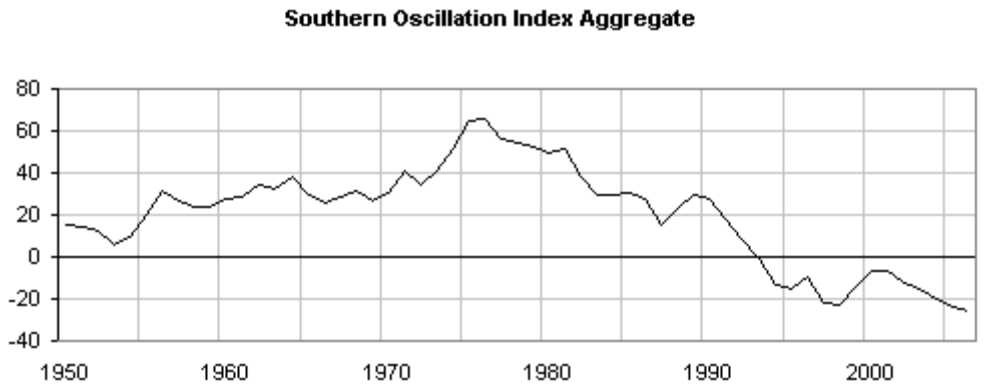

Figure 3 - Aggregated values from figure 2

Australia's temperature graph (see Figure 1) likewise indicates an abrupt change around 1976 but it is a change which took about 5 years to settle. One likely cause of the delayed equlibrium is the time required for the impact of the climate shift to be carried to regions offshore from coast of Western Australia, but perhaps other factors such as a slow reduction

in surface and near surface water contributed with a change in the amount of heat used by evaporation processes.

Comparison of Temperatures and trends before and after the shift

Over the 25 years from 1951 to 1975, which is the period before the climate shift, the average temperature anomaly across Australia was -0.194ºC, i.e. 0.194ºC below the 1961-1990 average. The standard deviation associated with these temperatures was 0.332ºC and the standard error was 0.0664ºC.

During the 25 years from 1981 to 2005, which is immediately after the climate shift, the average temperature anomaly was +0.315ºC with a standard deviation of 0.338ºC and a standard error of 0.0675ºC. In other words the two periods were statistically very similar except for the change in average temperature.

For the period 1950 to 1974 the temperature trend was an increase equivalent to 1.13 ºC/century and the trend from 1981 to 2005 was 1.66 ºC/century. The trend across the entire 1950-2005 period was also 1.66 ºC/century and in order for this to be correct from the two 25-year periods and a 5 year period not included in either preceding trend, a very strong increase must have occurred across that 5 year period.

In fact the temperature change between 1976 and 1980 was a very substantial 1.46ºC, which is equivalent to a trend of 29.2 ºC/century, or more than 20 times the trends in the pre- and post-shift periods..

The temperature trend in the period following the Climate Shift includes the extreme value of 1.06ºC in 2005. Replacing this value with the average of the two adjacent values (0.44 and 0.46ºC respectively) appears to be a relatively minor change but the impact on trends in considerable. The trend for the 1981-2005 period falls from 1.66 ºC/century to 1.1 ºC/century, which is very close to the trend for 1950-1974. The overall trend from 1950 to 2005 falls far less, only from 1.66 C/century to 1.56 ºC/century, indicating once again that the long-term trend is greatly influenced by the temperature from 1976 to 1980.

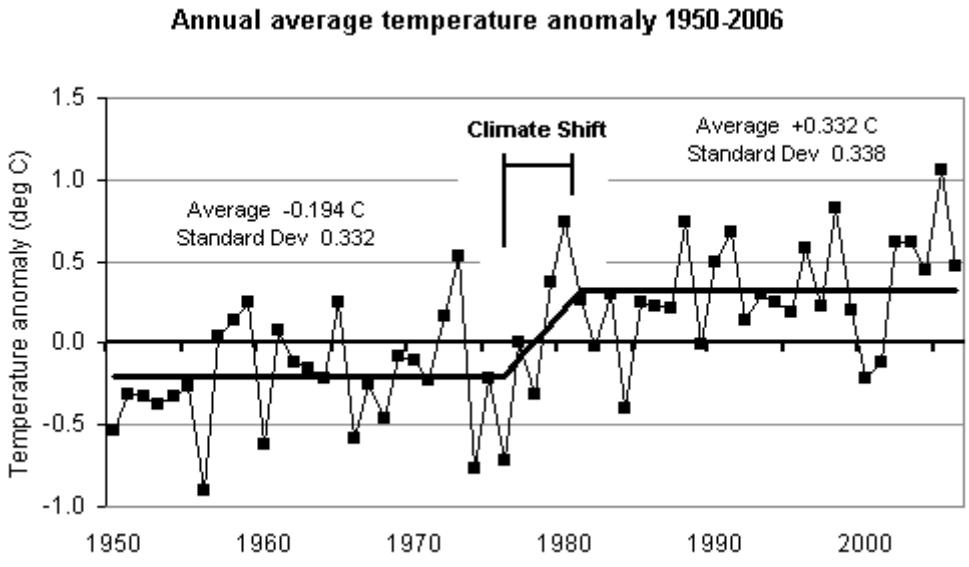

Figure 4 - Australian annual average temperatures with the climate shift indicated

Discussion

The 5-year period in which the Pacific Climate shift made its presence felt in Australia temperatures is a disruptive period but we see similar temperature patterns before and after that event.

The Pacific Climate shift appears to have increased temperatures by about 0.5ºC, which is just over half of the 0.9ºC by which temperatures increased between 1950 and 2006, but the pre- and post-shift temperature ranges about the averages are statistically very similar.

The temperature trends in the two periods are of similar magnitude and cannot on their own account for the overall temperature trend from 1951 to 2005. This implies that the overall trend is greatly influenced by the temperature shift from 1976 to 80.

The general trend of about 1.1 ºC/century might appear significant and may be due to a variety of factors, including perhaps some contribution due to carbon dioxide emissions but also plausibly to variations in other climate factors.

The sensitivity of these 25-year trends to very few years of atypical temperatures was illustrated above, when a relatively minor adjustment to the data for one year reduced the trend by more than 0.55 ºC/century, so the trend may be largely the product of chaotic effects of various climate factors.

Carbon dioxide concentrations have increased in a consistent and near-regular fashion since 1958. This correlates poorly to the irregular rises and falls in Australia's temperatures and to the abrupt Climate Shift. If carbon dioxide has any influence at all on Australia's temperature then it would seem to be a minor role which is easily masked by other factors.

It is not the intention of this document to examine global temperatures in any detail but the "HadCRUTv3" dataset from Britain's Climatic Research Unit (CRU) also indicates a sharp increase in annual global average temperature of more than 0.3ºC between 1976 and 1981. That figure is slightly more than half of the total 0.57ºC change in average global temperature between 1976 and 2006, so again the climate shift is a substantial part of the total, which means that other forces make a lesser contribution.

Conclusions

The variation in Australian temperature since 1950 is often assumed to be a relatively consistent increase but this document has shown an alternative explanation - that the Great Pacific Climate Shift can directly account for more than half of Australia's total increase in average temperature since 1950

At most, other climate forces are needed to account for less than half of the overall increase but those forces might be only the normal chaotic forces on climate because the temperatures are statistically very similar for the 25-year periods before and after a 5-year period of adjustment to that shift. It is not at all clear that a steady increase in carbon dioxide concentrations makes much contribution at all.

The apparently global influence of the Great Pacific Climate Shift and this alternative view of temperatures patterns across the largely rural Australian environment provide some interesting challenges to assumptions about man-made global warming.

References:

Guilderson, T.P and D.P. Schrag (1998),
"Abrupt Shift in Subsurface Temperatures in the Tropical Pacific Associated with Changes in El Nino", *Science* 281, 240 (1998);
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"Slowdown of the meridional overturning circulation in the upper Pacific Ocean", *Nature, 415*(7), 603–608 (2002).

APPENDIX

"The conclusion is that the year on year changes in temperature are random with the exception of 1975 to 1980."

- Dr. Tom Quirk, MSc Melb, DPhil, MA Oxford, SMP Harvard Business School
(also fellow of three Oxford Colleges, former physicist and collaborator with colleagues at Harvard University and the Fermi Institute, University of Chicago)

The Australian Temperature Anomaly

by
Dr Thomas Quirk

The increase in the mean temperature for Australia is often quoted as 1ºC per century but this is an overall figure that simplifies what has actually happened.

The measurements reported by the Bureau of Meteorology are presented in Figure 1 as an anomaly against departures from the mean of temperatures from 1961 to 1990.

However it is clear that around 1975 to 1980 there was a shift, a step in the temperature, that can be seen by looking at a frequency distribution of the measurements in Figure 2

By breaking the temperature series into two parts the differences can be clearly displayed (see Figure 3).

The resulting temperature movements are summarized below

Period	Temperature change ˚C per century	Error on Temperature change ˚C per century
1910-2003	0.90	+/-0.13
1910-1975	0.34	+/-0.17
1980-2003	0.50	+/-0.94

This data is often presented as a rise of 1ºC over the last century but the appropriate conclusion is that the there may be three different temperature regimes -

(a) 1910 to 1975 with a 0.34ºC warming per century,
(b) a step rise in the period 1976 to 1979; and
(c) within the limits of the measurements, no significant increase since 1980.

One of the concerns in dividing the data is that the distribution of measurements has an unusual frequency distribution and errors can be difficult to estimate, however the temperature distribution in Figure 2 shows that this is not the case given the limited number of measurements.

A correlation analysis has been made looking for other trends in the temperature measurements. This analysis looks at the sum of squares of nearby temperature differences while increasing their separation. It can be related to the variance of the temperatures over their time series. Constant values with increasing separation are an indication that there are no correlated trends.

Figure 1

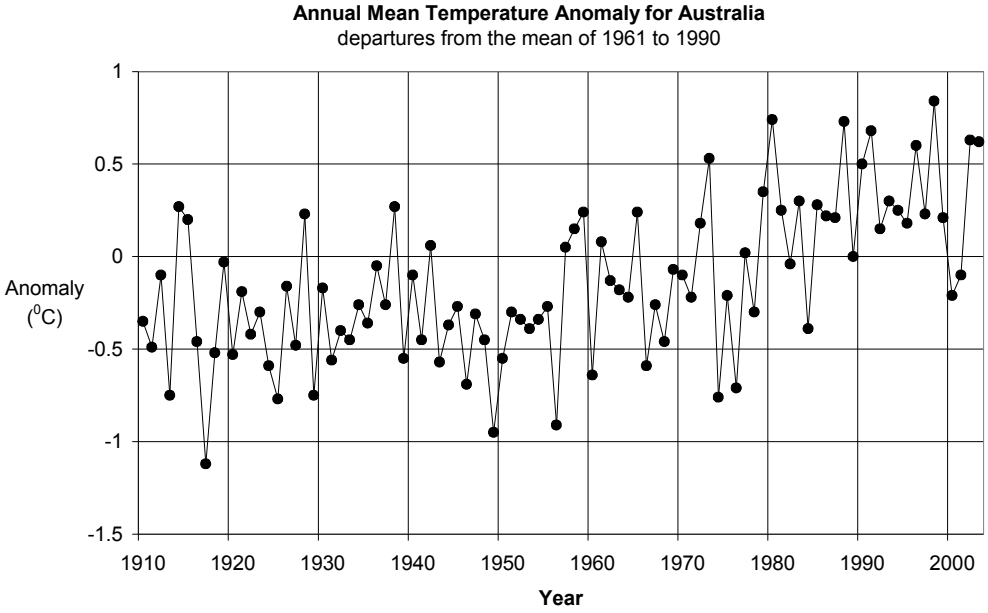


Figure 2.

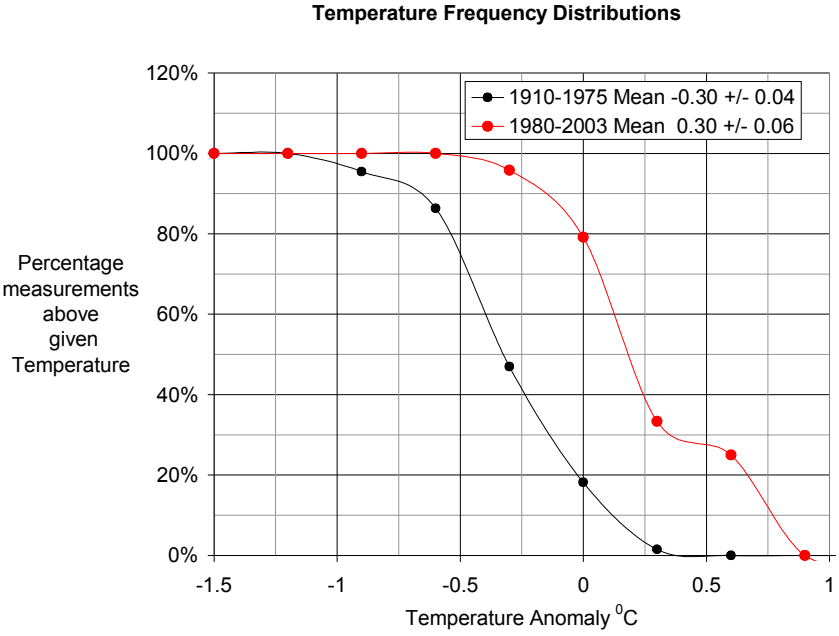


Figure 3

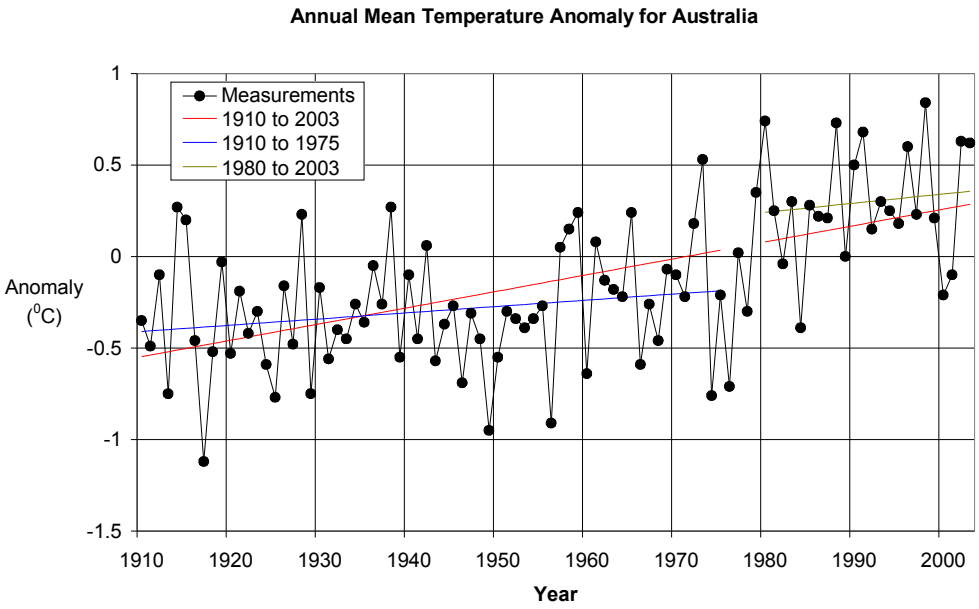
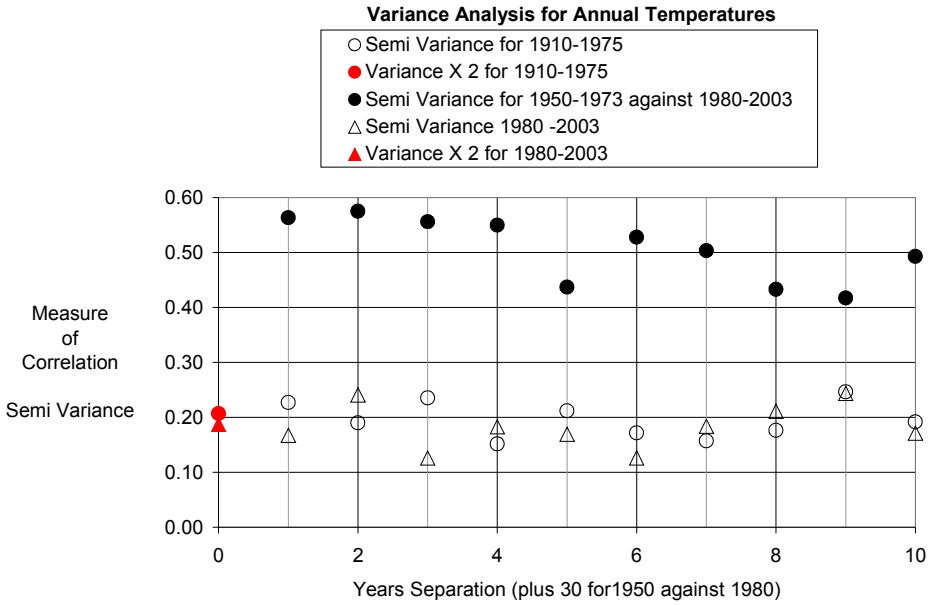


Figure 4



The analysis shows that year on year measurements are not correlated as the semi variance values (Figure 4) do not move away from the variance. On the other hand there is a step change in comparing measurements before and after the 1975-1980 period.

The conclusion is that the year on year changes in temperature are random with the exception of 1975 to 1980.

The temperature step is connected with the Great Pacific Climate Shift of 1976, an event whose origins are uncertain, but widely acknowledged, even in IPCC reports, and discussed as a possible source of Australia's temperature change. This event appears to be related to a reduction in the up-welling of cold waters to the surface of the tropical Pacific Ocean.

So the proper description of the temperature behaviour is a warming of 0.3ºC per century but with a step of 0.5ºC in 1976 to 1979.

Whether either the gradual increase or the step is related to rising concentrations of atmospheric carbon dioxide must be uncertain because there is no direct observational evidence to support this.

Further, since no modelling of the climate currently includes the complicated ocean-atmosphere interactions in the Pacific Ocean, no reliance should be placed on any climate predictions.

The situation is thus exposed as more complicated than a simple warming trend and illustrates the complexities involved in interpreting climate changes.

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