

climate change

“Australia’s climate is becoming hotter and average yearly rainfall is declining along the entire eastern seaboard – where most of us live ...”

Australia is suffering its worst drought in 100 years. Now, I realise we can't take just one year in one city, or even in one continent as proof that something unusual is happening. And I am no scientist, but I do know how to assess a risk – and this one is clear. Climate change poses clear, catastrophic threats. We may not agree on the extent, but we certainly can't afford the risk of inaction.

Rupert Murdoch, speech delivered to the employees of News Corporation, New York, 9 May 2007

Like every other country, Australia is influenced by global climate and ocean-current systems. Against this backdrop, a characteristic feature of our climate is its variability (for more on this, see the Variability section on pages 19–20).

While this climatic variability can be influenced by several factors, we now know that a major indicator is what we call the Southern Oscillation Index (SOI). When sea-surface temperatures in the eastern Pacific (near South America) are low relative to temperatures in the western Pacific (near Australia), Australia experiences 'La Nina-type' conditions and rainfall is generally above average. When this temperature difference narrows because of warming in the western Pacific, Australia experiences 'El Nino-type' conditions and rainfall is usually below average. Each set of conditions can remain dominant for several years at a time.

The IPCC concludes that 'El Nino events have become more frequent, persistent and drying over the last 20 to 30 years compared to the

previous 100 years.¹ If this trend continues, we can expect generally hotter and drier weather patterns in Australia. Our tropical rainfall system will move further south in Queensland and Western Australia, but there will be less annual rainfall in the southern half of the mainland and more extreme weather events around the country.²

In the Murray-Darling Basin, annual temperatures are projected to increase by up to 2°C by 2030, and up to 6°C by 2070.³

There is now strong evidence that global temperatures are rising. While the debate continues in some quarters as to whether this is a natural event or is induced, at least in part, by human greenhouse-gas producing activities, there is a striking parallel between this temperature rise and the accumulation of carbon dioxide in the atmosphere. Irrespective of the causes, a sustained rise in global temperatures will be mirrored by rises in the temperatures of the world's oceans. These

temperature increases will directly affect climate systems, causing even more variability and greater extremes.

COMPUTED CLIMATE PREDICTIONS

Access to supercomputers during the last 20 or so years has made it possible to develop and refine mathematical models of our climate systems. These models also describe the ways in which the anticipated changes in rainfall patterns will unfold across the southern half of the Australian mainland.

According to these models, a new rainfall pattern will first become evident on the western side of the continent and will slowly work its way west to become the dominant pattern over a large part of the eastern seaboard. While most people are aware of the expected hotter summers and warmer winters, they probably don't appreciate that, with a medium rise in average daily temperatures (of about 0.85°C), annual rainfall across southern Australia is predicted to decline

climate change



on average by about 15%. An immediate consequence of this annual rainfall reduction will be a reduction in the volumes of surface water running into rivers and streams.

This predicted change will bring a new edge to Australia's climate. Our weather will become even more variable than it is now. At the same time, it is predicted there will be more hot days, more dry days and more extreme storm events.

Now here is the double whammy! Whenever rain does fall, higher ambient temperatures mean that more water will evaporate from the land surface, while at the same time the drier soils will absorb more of this water, causing surface water runoff to reduce even further. Our major storages will fill at slower rates and our groundwater aquifers will also be recharged more slowly. Keep in mind here that, even without this further reduction in runoff, surface water and groundwater in many parts of the country are already being removed at rates exceeding the ability of these sources to be replenished naturally.

Cyclones may move further south creating local flooding in places which have seldom experienced such impacts. An alarming observation for eastern seaboard dwellers is that when Australia's weather systems are under the influence of El Niño conditions, cyclones in the northeast have tended to move south AND to the east. A lot of the rain associated with these

systems has fallen over the Pacific Ocean rather than over northern and central Queensland. In contrast, the northern regions of Western Australia have been getting wetter, with weather patterns moving in from the Indian Ocean and progressing in an easterly direction.

In addition, it has been suggested that land-use practices in Indonesia are contributing to this emerging pattern. Fire is used extensively to clear vegetation, resulting in smoke particles forming an aerosol haze in the upper layers of the atmosphere. This causes monsoonal winds to move south towards Australia, and more rain to fall in the north of Western Australia.⁴

In February 2007 the IPCC released a follow-up report to the reports on greenhouse-gas emissions and climate change that it released in 2004. This latest report confirms that atmospheric concentrations of the greenhouse gases – carbon dioxide, methane and nitrous oxide – have continued to rise.⁵ Furthermore, 11 of the years between 1955 and 2006 are included in the 12 warmest years since 1850.⁶ A previous prediction of average daily temperature rises by 2030 gave a figure of 0.85°C in a temperature range of 0.54°C–1.24°C.⁷ The new report calculates that during this century, the rise in average daily temperatures will be between 2.0°C and 4.5°C, and most probably closer to 3.0°C. The average rise in global temperatures by the end of the century is unlikely to be less than 1.5°C.⁸

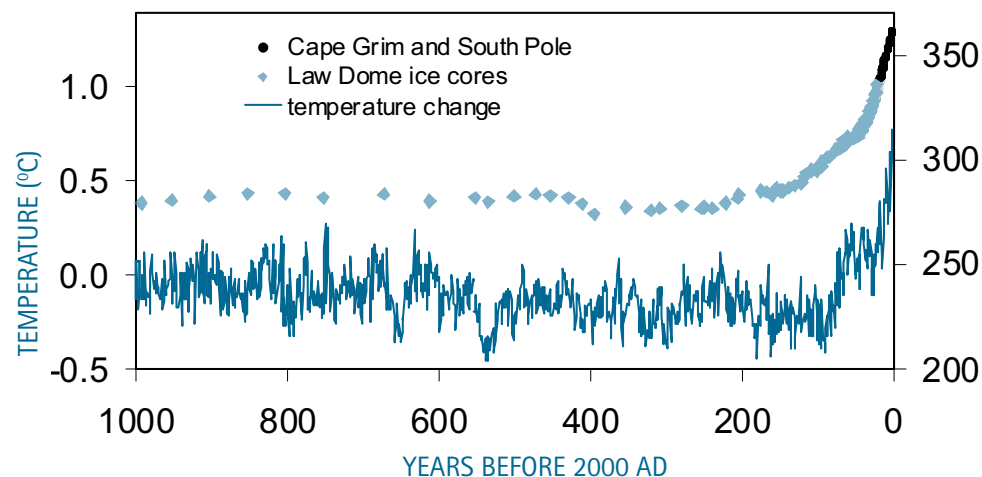
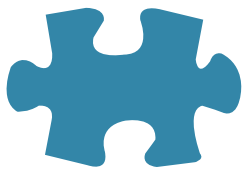


Figure 1. Measurements of temperature and carbon dioxide levels in the Earth's atmosphere

Carbon dioxide and temperature measurements are available for the past 1000 years. Each has been rising steadily over the last 100 years or so – since the Industrial Revolution.

Source: CSIRO, *Climate change projections for Australia*, CSIRO, Canberra, 2003, <<http://www.cmar.csiro.au/e-print/open/>>.



THE BIG PICTURE climate change

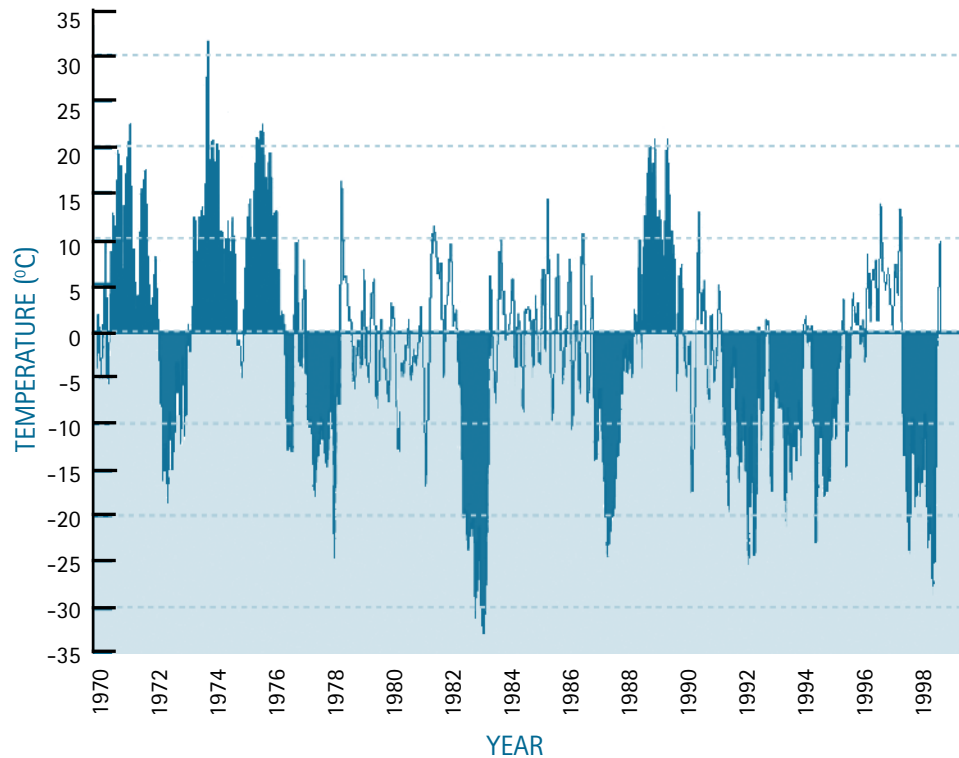


Figure 2. The Frequency of El Nino conditions in Australia's climate

Since 1970 at least, El Nino conditions have had a dominant influence upon Australia's climate. We have had only four La Nina wet periods and nine El Nino dry periods. The Inter-governmental Panel on Climate Change predicts that these dry periods will continue to prevail.

Source: R Miles & KN Purnell, 'Climate change: How real is it, the issues and implications?' *Geographical Education*, no. 18, 2005, pp. 32-54.

▶ REFERENCES

1. Inter-governmental Panel on Climate Change, *Climate change meeting – Geneva*, Cambridge University Press, 2001.
2. Australian Greenhouse Office, *Climate change science: questions answered*, AGO, Canberra, 2005, <www.greenhouse.gov.au/science/qa/index.html>.
3. Department of Sustainability and Environment, *Securing our water future together*, DSE, Melbourne, 2004, p. 9, <www.dse.vic.gov.au>.
4. N Nicholls, 'Detecting and attributing Australian climate change: a review', *Australian Meteorology Magazine*, 55, 2006, pp. 199-211.
5. Inter-governmental Panel on Climate Change, *Climate change 2007: the scientific basis, Summary for policymakers*, Cambridge University Press, 2007, p. 3.
6. *ibid.*, p. 5.
7. Inter-governmental Panel on Climate Change, *op. cit.*
8. Inter-governmental Panel on Climate Change, *Climate change 2007: the scientific basis, Summary for policymakers*, Cambridge University Press, 2007, p. 12.

Some other useful sources

- Australian Greenhouse Office, *Climate change science – questions answered*, AGO, Canberra, 2005, <www.greenhouse.gov.au/science/qa/index.html>.
- Wentworth Group of Concerned Scientists, *Australia's climate is changing Australia*, WGCS, Sydney, 2006, <www.wentworthgroup.org/articles>.