Is human-induced climate change causing the current Australian drought?

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Is the ongoing drought in the Murray-Darling Basin being made worse by human-induced climate change? This is obviously a very important question for farmers, scientists and policymakers, the answer to which may have a big impact on future production and policy decisions.

The simple answer is that there is no direct evidence that change in atmospheric CO₂ concentration over recent decades has had any significant effect on the severity or extent of the current drought, despite claims to the contrary. Like it or not, that is the current status of the science. Despite this, many would have us believe that the evidence that human-induced climate change is contributing to the current drought is irrefutable, and that the issue is proven and not debatable.

To understand this issue, it is first necessary to understand the relationship between El Niño and La Niña events and the Australian climate. The term El Niño refers to a period during which there is extensive warming of the central and eastern Pacific Ocean that leads to a major shift in weather patterns across the Pacific. In Australia (particularly eastern Australia), El Niño events are associated with sustained, strongly negative Southern Oscillation Index (SOI) values (the SOI being an index calculated from seasonal fluctuations in the air pressure difference between Tahiti and Darwin). El Niño events bring with them an increased probability of drought conditions. The opposite of El Niño is a La Niña event. La Niña is the term used to describe a period during which there is extensive cooling of the central and eastern Pacific Ocean. La Niña events are associated with strongly positive SOI values, and in Australia (particularly eastern Australia) with increased probability of wetter conditions.

The current drought was caused by an entirely natural climatic phenomenon – the 2002 El Niño event. This led to particularly low rainfalls across eastern Australia. The subsequent years have been characterised by either neutral or weak El Niño conditions. Significantly, neutral El Niño conditions are not sufficient to break a drought. Again in 2006, Australia experienced a return to El Niño conditions which further exacerbated the drought. What Australia has not experienced in recent years is a strong La Niña event.

Last year did finally see the occurrence of a La Niña event but it was relatively weak. It did produce a number of major storms in coastal areas and some useful rainfall in the Murray-Darling Basin and elsewhere. As a result, approximately half of NSW drought declared areas were removed from drought status (albeit into ‘marginal’ status), and the volume of water in Sydney’s water storages doubled in the space of a few months.

This was the first rain-bearing La Niña since 1999 but proved insufficient to break the drought. In short, the drought was initiated by El Niño, protracted by further El Niño events and perhaps more importantly, has persisted in the absence of substantial La Niña events.

Despite the known causes of the drought, many have claimed that elevated atmospheric CO₂ concentrations, caused by increased man-made greenhouse gas emissions, are to blame. There have been arguments put forward to justify this claim, all eagerly adopted by various groups, but none of which has serious merit.

A key claim is that the multiple occurrences of El Niño events in a relatively short period of time are a sign of climate change. This claim is speculative at best. A recent analysis (Verdon & Franks 2006) showed that the 9 year absence of La Niña is not unusual. In fact long-term records
demonstrate alternating periods of 20–40 years where El Niño is dominant followed by similarly extended periods where La Niña dominates. Ominously, the data demonstrate that it is possible to go some 14–15 years without any La Niña events. The consequent drought would be devastating, but entirely natural.

Analysis of the actual flood and drought history in Australia also shows periods where floods and droughts alternate in dominating the climate record. These changes in climate between periods of flood and periods of drought perfectly mirror the changes in El Niño and La Niña dominance of climatic systems.

Perhaps of even greater intrigue is the fact that the periods of El Niño dominance are associated with periods of global warming whilst the periods of La Niña dominance appear associated with global cooling.

For example, the period between 1910 and 1945 was a period of marked global warming despite little change occurring in atmospheric CO₂ concentrations over that period. During that period, Australia experienced dominant El Niño events and frequent drought conditions.

The following period between 1945 and 1975 represented a major change in climate. Global temperatures were actually cooling despite increasing atmospheric CO₂, while Australia suffered frequent and strong La Niña events and major floods.

Since 1975, Australia has returned to a period dominated by frequent El Niño events and persistent drought, which has coincided with a period during which global temperatures have also been increasing.

The accumulated history of El Niño events and their impact on Australian climate indicates that we should expect to return to a period extending for several decades which will be characterised by more frequent La Niña events and a wetter climate. Moreover, the data say that this change could be expected to occur at any time in the next ten or so years. Indeed, if Australia’s climate did not eventually change back to a period dominated by La Niña and flood, then this may actually be much stronger evidence of the possible impact of man-made climate change than the current drought.

The observation that El Niño and La Niña events cluster on 20–40 year, multi-decadal timescales is therefore an important one. It demonstrates that Australia should always expect major changes as a function of normal natural climatic variability. When viewed in this light, the current drought is not obviously CO₂-induced, but is most likely to simply be a continuation of the fluctuations that have characterised the Australian climate for thousands of years.

A more recent and related proposal by some commentators is that higher temperatures, which some assume to be associated with increases in atmospheric CO₂, are leading to increased evaporation of available moisture, and therefore reduced runoff into water storages. While perhaps seeming to be logical, such a claim is in fact contrary to scientific knowledge.

The Australian Bureau of Meteorology acknowledges that rainfall from September 2001 until the present has not been the lowest ever recorded, however much has been made of the fact that, during this same period, consequent inflows of water to major watercourses and storages have been the lowest ever recorded. It has been claimed that increased evaporation as a consequence of higher temperatures explains why watercourse and storage inflows have been lower than should be anticipated, given available rainfall. Indeed, Dr. Wendy Craik, the Chief Executive of the Murray Darling-Basin Commission (MDBC) is reported as having stated that temperatures were warmer, leading to more evaporation and drier catchments (Daily Telegraph, 3 September 2008).

If the quotation is correct, it is somewhat disturbing to hear this statement being made by the head of the MDBC as it is completely at odds with the known physics of evaporation. Whilst it sounds intuitively correct, it is actually quite wrong.

When the soil surface contains relatively high amounts of moisture, a large portion of the sun’s energy that strikes the earth’s surface is absorbed in evaporation of that moisture, and consequently there is less heating of the soil surface, and near-earth air temperatures are cooler. When soil moisture content is low (as occurs during drought) nearly all of the solar energy that strikes the earth is available to heat the soil surface, resulting in a hotter earth surface, and an increase in near-earth air temperatures. Consequently, higher air temperatures are due to the lack of evaporation, not a cause of higher evaporation.

Cloud cover also has a major effect on air temperatures. During El Niño periods there is less rainfall and also less cloud cover. This has a major impact on the amount of the sun’s energy reaching the land surface, hence temperatures increase during these periods. This effect on temperatures is far greater than the trivial increase in radiant energy that is caused by increased atmospheric CO₂.

These are known and accepted processes of environmental physics and are not contentious. They are ignored, presumably because they detract from the simplistic message some wish to convey that we should ‘sign up’ to the concept of ‘dangerous human-induced climate change’ and therefore the proposed solution which is a greenhouse emissions trading scheme. After all, the community is hardly likely to agree to the costs associated
with a reduction in greenhouse emissions, or the costs of climate change research unless the majority is convinced that increased atmospheric CO₂ levels are resulting in damaging changes to the Australian climate.

None of the above is to say that increased atmospheric CO₂ is not having some effect – global atmospheric CO₂ concentration has increased over recent decades and this increase is largely attributable to anthropogenic emissions. CO₂ is a radiatively-active gas and does lead to a minor increase in downward radiation by trapping infra-red radiation reflected back from the earth’s surface that would otherwise escape into space. However, there is no evidence that this effect is in any way significant, in comparison with naturally-varying cycles such as El Niño and La Niña that are the dominant reasons for rainfall and temperature variability in Australia.

It is actually well understood why inflows to watercourses and water storages are so low and why various ecosystems of the Murray-Darling are in crisis – the system is over-allocated and has experienced a growth in groundwater extraction, and in the number of farm dams preventing rainfall from becoming runoff. As a result, when a prolonged drought strikes, the system collapses. This is a man-made problem but not one that is attributable to atmospheric CO₂ concentrations.

It should be pointed out that one cannot and should not blame individual farmers for this. The problem has arisen due to a failure of planning, management and leadership from the relevant authorities whose job it is to manage these things. Perhaps these authorities should spend less time and resources developing complex computer models to help in their search for proof of human influence on climate, and instead put some serious resources into better managing Australian water resources.

Australian water resource managers are not alone in their desire to view CO₂-induced climate change as proven and contributing to the current drought. Numerous politicians, environmentalists and especially scientists have made spectacular leaps of faith in their adherence to the doctrine of human-induced climate change over recent years – too many to document here. However, the prize for the most literally fantastic claim on climate change must go to the Prime Minister, who has guaranteed that rainfall will decline over coming decades, based, one can only assume, on deficient climate models and bad advice.

Perhaps our leading climate authorities who have played such a prominent role in fomenting speculation about human-induced climate change on the basis of modelling results and who apparently adhere to the notion that climate is amenable to such precise and long-term prediction should also point out that these models cannot reproduce the observed multi-decadal variability of El Niño and La Niña in anything like a realistic manner.

Given the model’s inability to predict future El Niño and La Niña events (which are the biggest factors influencing future Australian climate) then claims that future climate changes can be predicted with any certainty are highly questionable, and should be regarded as advocacy, rather than scientific information that can be relied on.

It is not often appreciated that the academic argument between climate changes due to carbon dioxide emissions, and those that may be due to natural processes (in particular solar variability), has been raging for over 100 years. I argue that we are no nearer to resolving the issue today with the current scientific approaches.

Science in its purest sense is very easy to identify and define. Science is the act of developing a hypothesis about how something works, designing an experiment that aims to test the hypothesis, and replacing the hypothesis should it be found to fail in the light of the experiment. In principle science is simple, but in practice it is hard. This though is no excuse for scientists and others to make statements of belief under the guise of science. A scientist’s opinion can be distinctly different from a scientist’s findings.

Above all, science is not about speculation and fear. Science is not about who can shout the loudest, or who can make the most emotive or persuasive movies. Science is certainly not about consensus. It is about experiments and direct evidence.

There remains no direct evidence that changes in atmospheric CO₂ concentrations are having an impact on the severity or duration of the current drought, nor is there any rational basis for predicting what rainfall different areas of Australia may experience in 30 years time. One just hopes that once the current infatuation with theories of human-induced climate change subsides, our leaders will recognise the need for an increased focus on the development of sensible and sustainable water management policies that will better enable struggling rural communities to weather the vagaries of both climatic and political extremes.

References


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