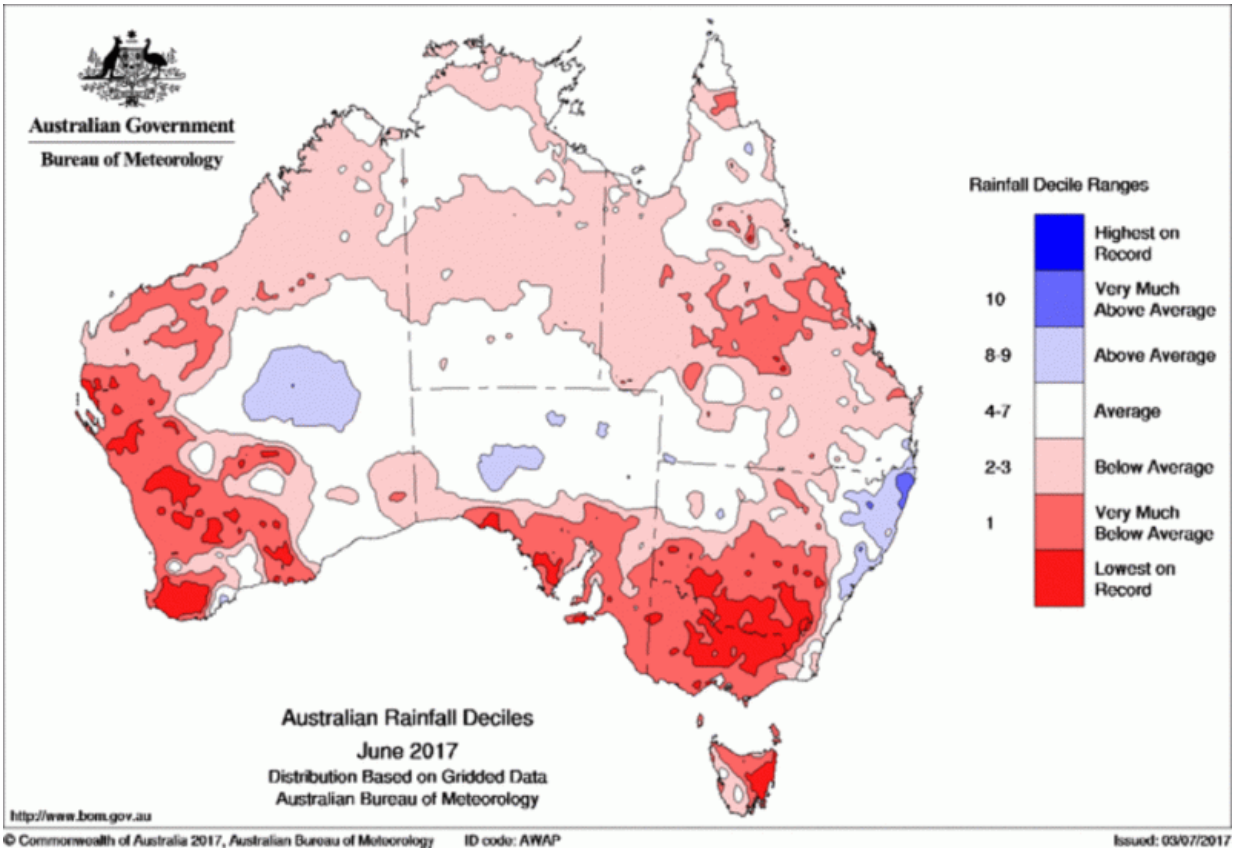
Australia's dry June is a sign of what's to come

July 6 2017, by Andrew King



Australia's second-driest June on record saw unusually dry conditions over most of the continent but more rain than average for Sydney and northeast New South Wales. Credit: Bureau of Meteorology

This June was the seventh-warmest and second-driest on record for

Australia. Parts of the southwest and southeast saw record dry conditions as frontal systems passed further south than normal and high pressure exerted its influence on the continent.

While many of us will have enjoyed warm, dry weather, farmers in the south of the country will be concerned at the lack of winter rain for their crops. Winter is the dominant season for rainfall, especially in the southwest of the continent, so a return to wetter conditions would be welcome.

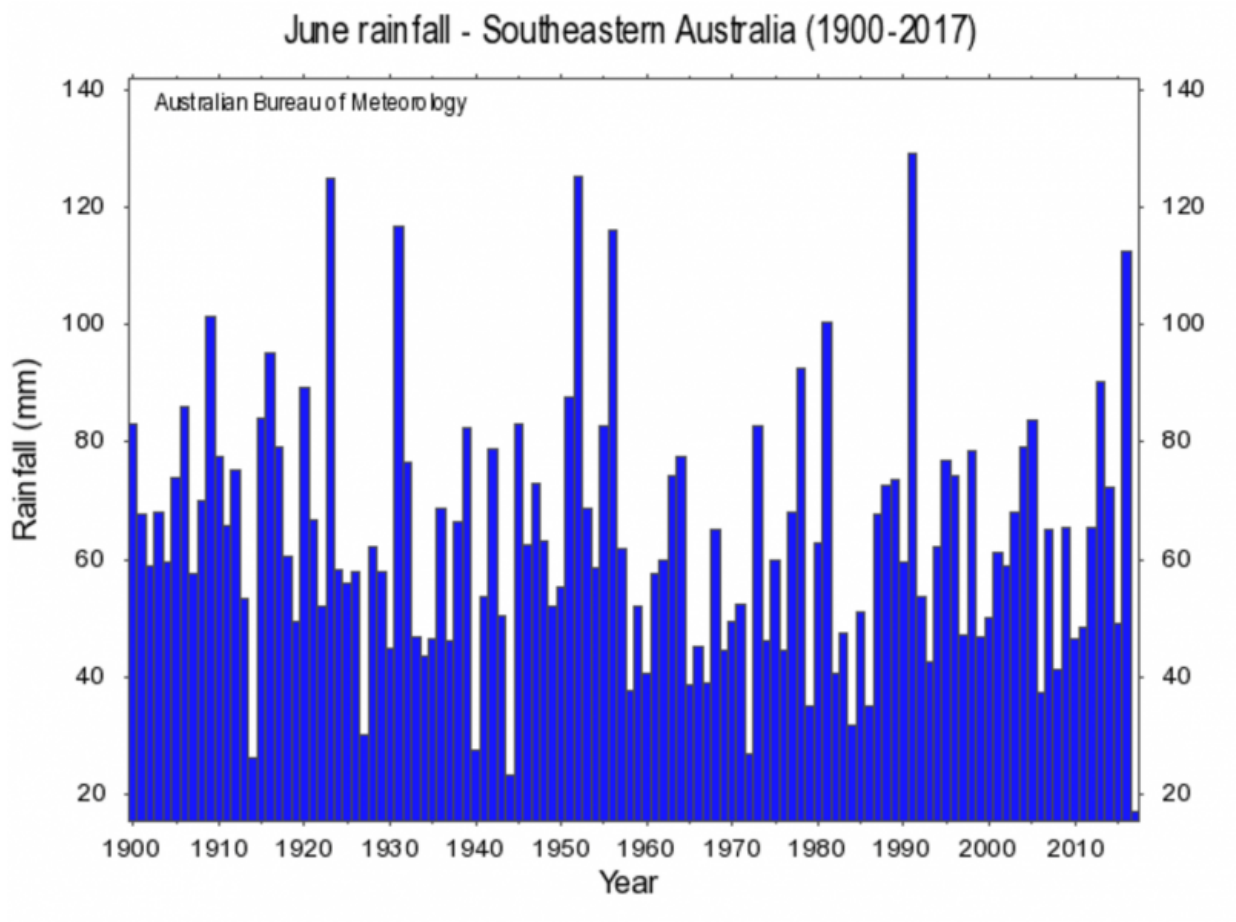
There are already indications of drought developing across the west coast of Western Australia and in other areas of the country.

Did climate change play a role?

To deduce whether climate change had an influence on this particular event, I used two sets of climate model simulations: one representing the world of today and another representing a world without human influences (that is, with pre-industrial greenhouse gas concentrations).

I compared the likelihood and magnitude of dry Junes in the two sets of simulations to determine the net effect of human-caused climate change.

I looked at the climate change influence on very dry Junes (such as the one we've just experienced) both for Australia as a whole, and for the southeast, which had its driest June on record. Both of these areas received well below half of their average June rainfall in June 2017.



Southeast Australia had its driest June on record this year. Credit: Bureau of Meteorology

For Australia-wide June rainfall, I found a clear climate change signal towards drier conditions.

According to my analysis, climate change has increased the likelihood of very dry Junes by at least a third. The driest Junes now are about 12% drier than they would be in the absence of human greenhouse emissions.

When I looked at southeast Australia, however, I found that the influence of climate change is less clear.

My analysis suggested that climate change has probably increased the chance of dry conditions, although there is more uncertainty than for Australia as a whole.

That said, the driest Junes appear to be drier in the world of today than they would have been without climate change, by about 8% in the case of southeast Australia.

It's not surprising that the result for southeast Australia is less distinct. Generally speaking, the smaller the area, the harder it is to detect an influence of climate change, as there is more year-to-year variability.

Likelihood of dry Junes like 2017

		Chance of similar event per year			
LOCATION	2017 EVENT	NATURAL	CURRENT	1.5°C	2°C
Australia	2nd Driest	6% (5-9%)	11% (8-16%)	12% (9-16%)	15% (11-19%)
SE Australia	Driest	3% (2-4%)	5% (2-7%)	4% (2-6%)	4% (3-6%)

Climate change is increasing the likelihood of dry Junes for Australia as a whole, but the signal is less clear over the southeast. The best estimate likelihoods are shown with 90% confidence intervals in parentheses. Author provided

What can we expect in future?

The Paris Agreement aims to hold global warming well below 2°C and preferably at around 1.5°C above pre-industrial average temperatures. For context, we have had a little over 1°C of global warming so far, so we're more than two-thirds of the way to the 1.5°C target already.

Under either a 1.5°C or 2°C global warming target, I project that dry Junes in Australia will become more frequent. For the southeast of the continent the picture is less clear, with high uncertainty in the change we might see.

The trend towards drier Junes across Australia is related to the southward shift in the storm track, the prevailing westerly winds that bring frontal weather systems across southern Australia. June 2017 is a very clear example of this effect.

Scientists use the Southern Annular Mode (SAM) to describe the position of the storm track. It has been trending towards more "positive" conditions, reflecting a poleward movement in the frontal systems which typically causes them to pass to the south of the Australian landmass.

These positive SAM phases bring drier conditions to most of Australia, but wetter conditions to coastal New South Wales. This is precisely what we have seen in June 2017.

As the effects of climate change intensify in the coming years, scientists expect to see the frontal systems that bring vital rainfall to the south of Australia moving further and further south. This increases the chance of Australia experiencing more dry Junes like the one just passed. Increasing temperatures will cause greater evaporation when there is rainfall, further exacerbating drought conditions.

You can find full details of the methods used in this analysis here.

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