# Australia's record-breaking winter warmth linked to climate change

September 1 2017, by Andrew King

This winter had some extreme low and high temperatures. Credit: Daniel Lee/Flickr, CC BY-NC

On the first day of spring, it's time to take stock of the winter that was. It may have felt cold, but Australia's winter had the highest average daytime temperatures on record. It was also the driest in 15 years.

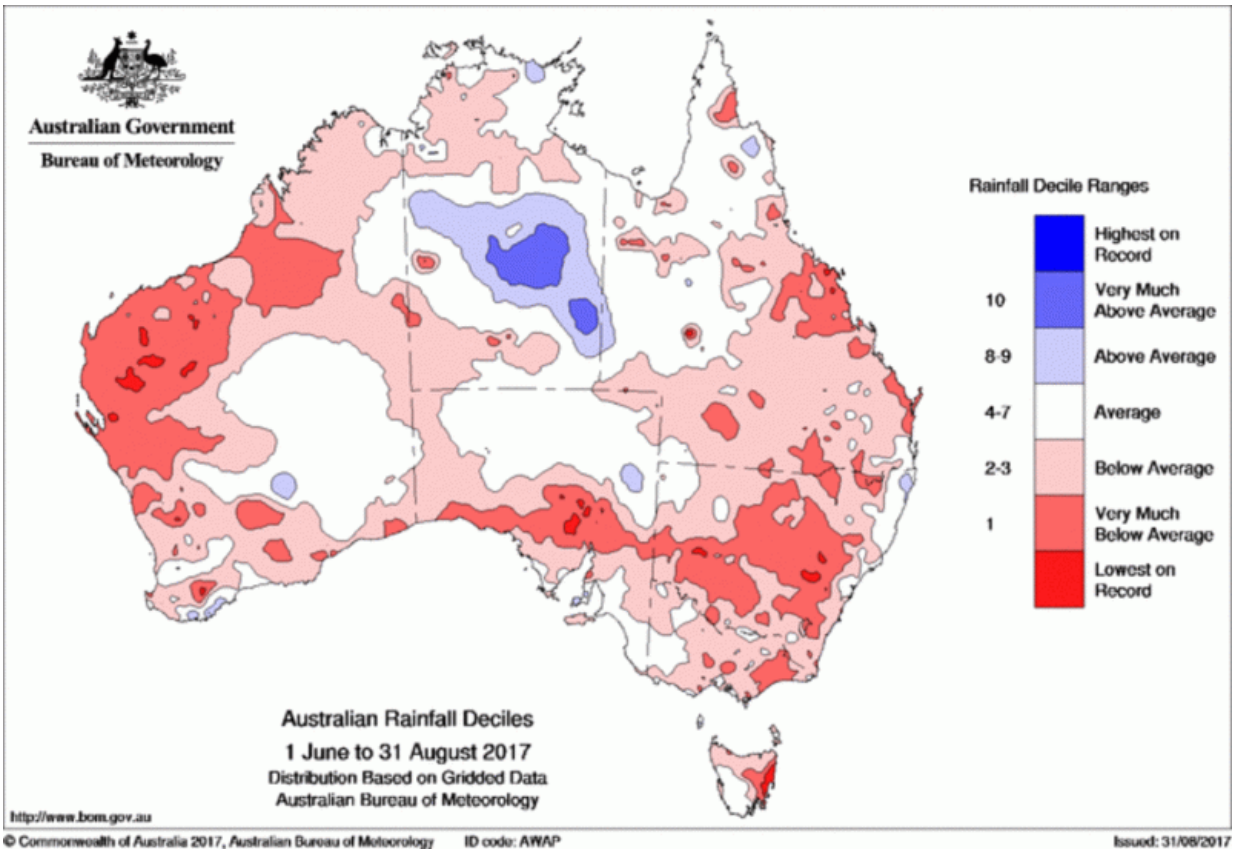
Back at the start of winter the Bureau of Meteorology forecast a warm, dry season. That proved accurate, as winter has turned out both warmer

and drier than average.

While we haven't seen anything close to the weather extremes experienced in other parts of the world, including devastating rainfalls in Niger, the southern US and the Indian subcontinent all in the past week, we have seen a few interesting weather extremes over the past few months across Australia.

Drier weather than normal has led to warmer days and cooler nights, resulting in some extreme temperatures. These include night-time lows falling below -10°C in the Victorian Alps and -8°C in Canberra (the coldest nights for those locations since 1974 and 1971, respectively), alongside daytime highs of above 32°C in Coffs Harbour and 30°C on the Sunshine Coast.

During the early part of the winter the southern part of the country remained dry as record high pressure over the continent kept cold fronts at bay. Since then we've seen more wet weather for our southern capitals and some impressive snow totals for the ski fields, even if the snow was late to arrive.




Much of the country had drier conditions than average, especially in the southeast and the west. Credit: Bureau of Meteorology

This warm, dry winter is laying the groundwork for dangerous fire conditions in spring and summer. We have already had early-season fires on the east coast and there are likely to be more to come.

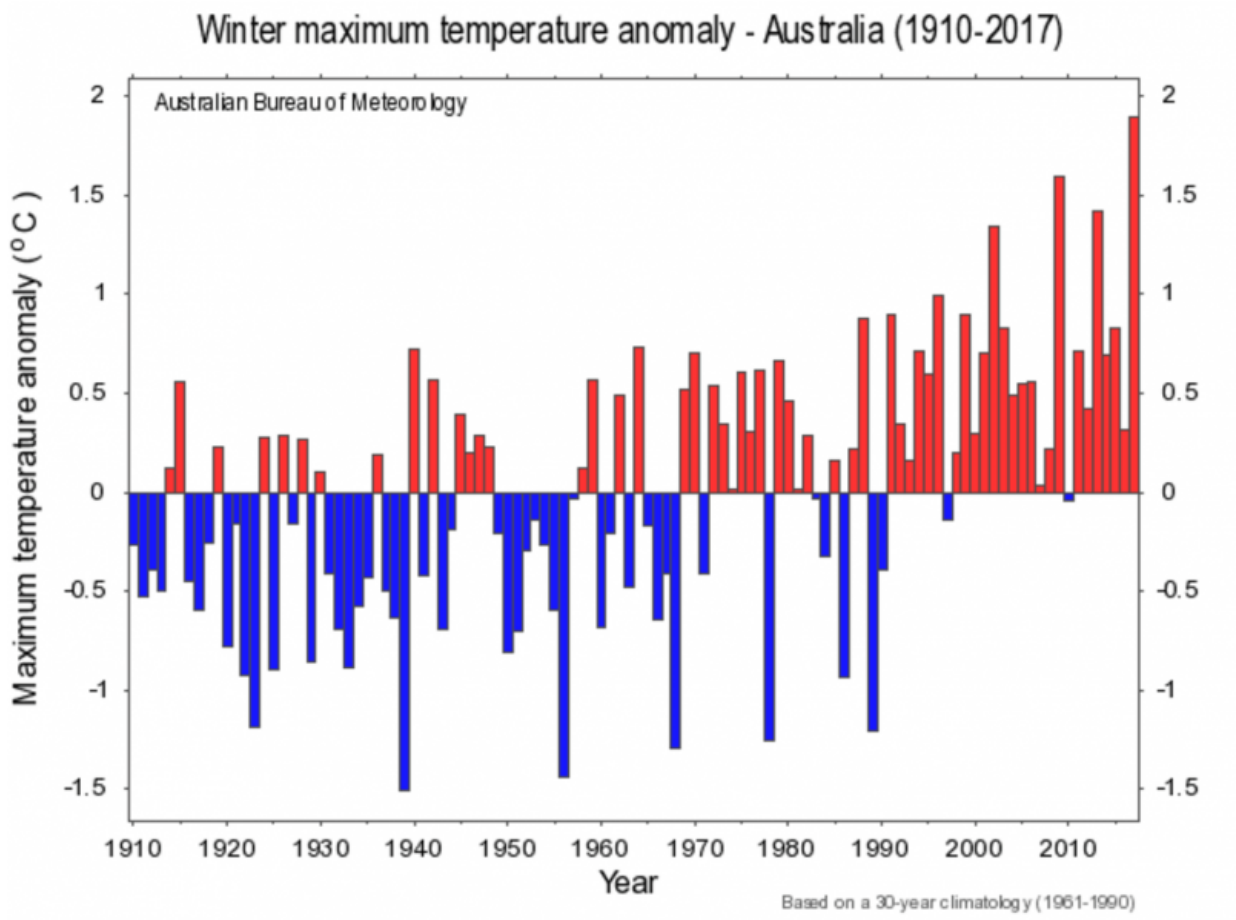
## Climate change and record warmth

Australia's average daytime maximum temperatures were the highest on record for this winter, beating the previous record set in 2009 by 0.3°C. This means Australia has set new seasonal highs for maximum temperatures a remarkable ten times so far this century (across summer,

autumn, winter and spring). The increased frequency of heat records in Australia has already been linked to climate change.

The record winter warmth is part of a long-term upward trend in Australian winter temperatures. This prompts the question: how much has human-caused climate change altered the likelihood of extremely warm winters in Australia?

I used a standard event attribution methodology to estimate the role of climate change in this event.




Winter 2017 stands out as having the warmest average daytime temperatures by a large margin. Credit: Bureau of Meteorology

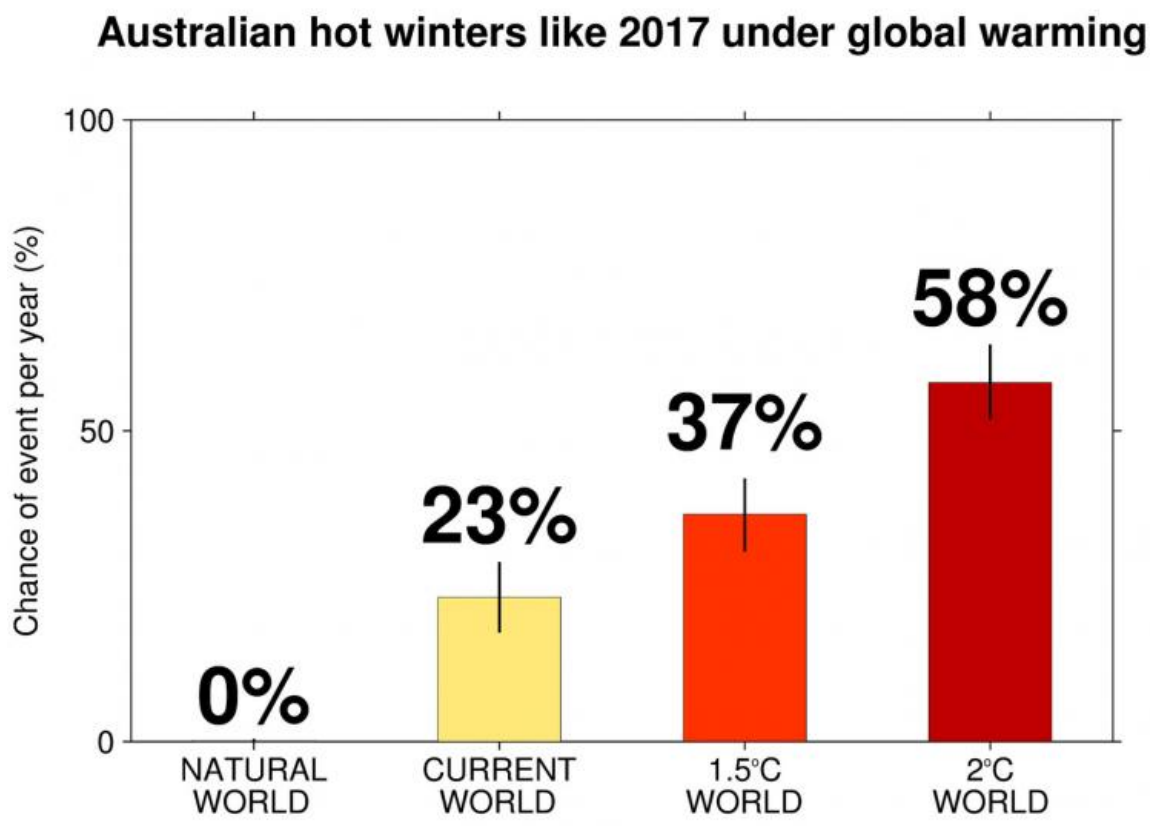
I took the same simulations that the Intergovernmental Panel on Climate Change (IPCC) uses in its assessments of the changing climate, and I put them into two sets: one that represents the climate of today (including the effects of greenhouse gas emissions) and one with simulations representing an alternative world that excludes our influences on the climate.

I used 14 climate models in total, giving me hundreds of years in each of my two groups to study Australian winter temperatures. I then compared the likelihood of record warm winter temperatures like 2017 in those different groups. You can find more details of my method here.

I found a stark difference in the chance of record warm winters across Australia between these two sets of model simulations. By my calculations there has been at least a *60-fold increase* in the likelihood of a record warm winter that can be attributed to human-caused climate change. The human influence on the climate has increased Australia's temperatures during the warmest winters by close to 1°C.

## More winter warmth to come

Looking ahead, it's likely we're going to see more record warm winters, like we've seen this year, as the climate continues to warm.




The likelihood of winter warmth like this year is rising. Best estimate chances are shown with the vertical black lines showing the 90% confidence interval.

Under the Paris Agreement, the world's nations are aiming to limit global warming to below 2°C above pre-industrial levels, with another more ambitious goal of 1.5°C as well. These targets are designed to prevent the worst potential impacts of climate change. We are currently at around 1°C of global warming.

Even if global warming is limited to either of these levels, we would see more winter warmth like 2017. In fact, under the 2°C target, we would likely see these winters occurring in more than 50% of years. The record -setting heat of today would be roughly the average climate of a 2°C

warmed world.

While many people will have enjoyed the unusual winter warmth, it poses risks for the future. Many farmers are struggling with the lack of reliable rainfall, and bad bushfire conditions are forecast for the coming months. More winters like this in the future will not be welcomed by those who have to deal with the consequences.

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