



### Recent El Niño behaviour is unprecedented in the last 400 years

#### ARC Centre Of Excellence for Climate Extremes Briefing Note 7

- El Niño events have a profound impact on the climate of Australia and other countries around the Pacific Rim.
- Researchers at the ARC Centre of Excellence for Climate Extremes have helped to produce a new record of El Niño events that shows that the behaviour of El Niño since the 1980s is unprecedented in the last 400 years.
- This recent unprecedented behaviour is consistent with modelling that suggests that El Niño might be changing in response to global warming. If this is so, we can expect further changes in El Niño and its impacts in the future.
- The changes in El Niño mean that observations of past El Niño events, upon which much of our current knowledge of the impacts of El Niño is based, may not be a good guide to the impacts of El Niños in the future.

#### What is an El Niño?

An El Niño is a naturally occurring phenomenon whereby parts of the tropical Pacific Ocean are temporarily warmer than average. El Niño events occur irregularly, usually every 2-7 years, and last for 9-24 months. The ocean warming is associated with changes in wind and rainfall patterns around the Pacific that can impact activities such as agriculture and fisheries and even human health<sup>1</sup>. El Niño often brings drier than average conditions to eastern and northern Australia in winter and spring and warmer than average conditions to southern Australia<sup>2</sup>. The Australian Bureau of Meteorology notes that most major Australian droughts, including the severe droughts of 1982, 1994, 2002 and 2006, have been associated with El Niño events. Other potential impacts of El Niño on Australia noted by the Bureau include increased frost risk, reduced tropical cyclone numbers, later monsoon onset, increased fire danger in southeast Australia and decreased alpine snow depths.



#### The two types of El Niño

We know that not all El Niños produce these impacts. For example, not all El Niños bring drought to Australia. One of the contributing factors to this is that there are two different types of El Niño:

- Eastern Pacific El Niños, where the greatest warming of the ocean occurs in the far eastern tropical Pacific, and
- Central Pacific El Niños, where the greatest warming occurs further to the west and north<sup>3</sup>.

The two types of El Niño are associated with different changes to temperature and rainfall around the Pacific<sup>1</sup>. For this reason, it is important to understand how frequently each of the different types occurs. Hence researchers have been working to produce a long record of past occurrences of the different types of El Niño.

#### How Australian researchers produced a 400-year-long El Niño record

A recent scientific study involving the ARC Centre of Excellence for Climate Extremes<sup>3</sup> has used coral samples to create a record of past occurrences of Eastern Pacific and Central Pacific El Niños going back 400 years to 1617. As coral grows, the precise chemical composition of new growth varies with the temperature of the sea that the coral lives in. By analysing the composition of coral samples taken from 27 different sites across the Pacific, the authors of the study have been able to create a long record of the temperature of the sea at each site. By comparing the temperatures records for the different sites, they have been able to identify periods during which either an Eastern Pacific or Central Pacific El Niño occurred.

## Why the 400-year-long record is important

Until the 400-year long record was produced researchers had to rely on a much shorter “instrumental” record of past occurrences of El Niño, deduced from measurements of ocean temperatures taken from ships, buoys and satellites. This shows that Central Pacific El Niños have been far more common and Eastern Pacific El Niños much rarer since 1980 compared to earlier in the 20th century. However, because this record only goes back as far as the late 19th century, scientists have been unable to say how unusual the recent abundance of Central Pacific El Niños and scarcity of Eastern Pacific El Niños is.

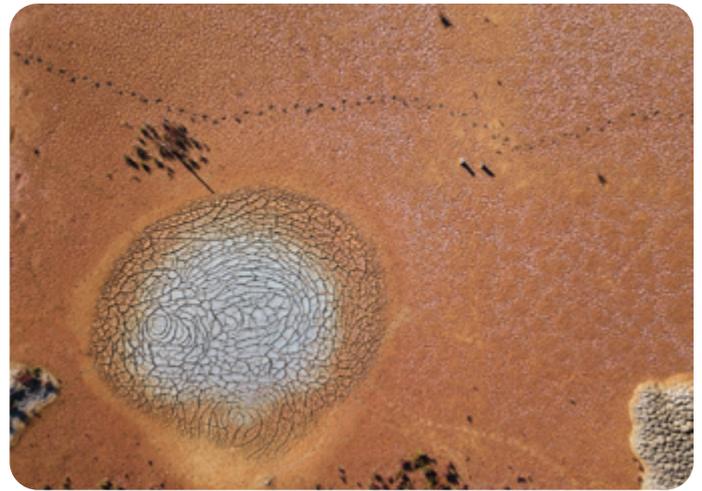
## What the new record tells us

The new El Niño record reveals, for the first time, that the large number of Central Pacific El Niños since 1980 is unprecedented in the last 400 years. It also suggests a recent trend towards more intense Eastern Pacific El Niños, when these events do occur.

The increase in the frequency of Central Pacific El Niños is a particularly important result. It supports computer modelling that predicts such a change as a consequence of global warming. This modelling shows these changes continuing into the future if the Earth continues to warm<sup>4</sup>. However, the scale of the changes in the new record is greater than would be expected from some of the model simulations. This could be due to imperfections in the computer models used. If this is the case, it will be important to improve the simulation of El Niño by these models. The changes in El Niño mean that observations of past El Niño events, upon which much of our current knowledge of the impacts of El Niño is based, may not be a good guide to the impacts of future El Niños.

## Conclusion

El Niño is one of the most important influences on Australia’s climate. The new record has improved our understanding of how it may change in a warming world and increases our confidence in climate modelling that predicts future changes to El Niño. However, the record also highlights the need for further evaluation of climate models. The simulation of El Niño by these models will become increasingly important if El Niño changes to the point where the historical record cannot be used as a guide to the impact of future El Niños.



## References

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