CLIMATE COUNCIL

EXPLAINER

15 September 2020

La Niña and Spring 2020 Outlook for Australia

1. Introduction

This briefing paper unpacks the latest climate outlook issued by the Bureau of Meteorology (BoM 2020a), describing the climate drivers La Niña and a negative Indian Ocean Dipole (IOD) that are primed for spring and early summer and how they are likely to influence conditions.

La Niña and a negative IOD are short-term modes of natural variability, useful to help us prepare on a 6-12 month timeframe. La Niña and a negative IOD briefly modify the long-term heating trend and can intensify some extreme weather events, e.g. heavy rainfall and flooding.

2. What are La Niña and the Indian Ocean Dipole?

Australia's weather is influenced by a number of climate drivers, including the El Niño Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD). These are cyclical fluctuations in ocean surface temperatures and ocean-atmosphere interactions in the Pacific and Indian Oceans respectively, and influence year-to-year variations in temperature, rainfall and other weather patterns in Australia. La Niña is one phase of the ENSO cycle.

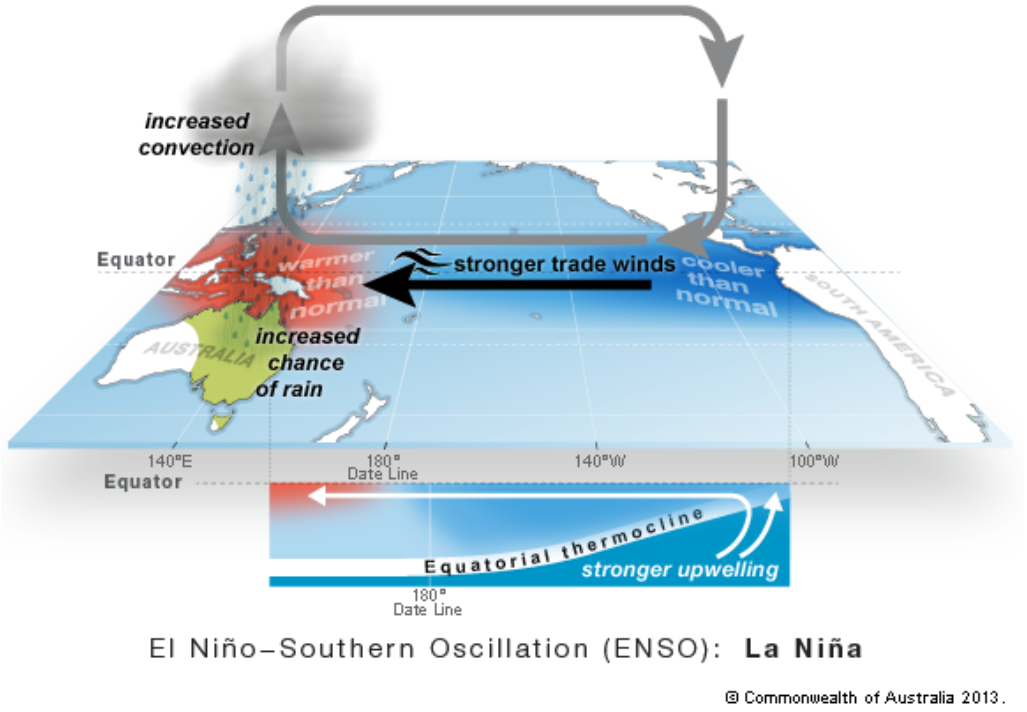
LA NIÑA

What causes La Niña?

La Niña occurs when equatorial trade winds become stronger, altering ocean surface currents and bringing cooler deep water up from below. This results in a cooling of the central and eastern tropical Pacific Ocean. The enhanced trade winds also help to accumulate warm surface waters in the western Pacific and to the north of Australia (Figure 1).

The warming of ocean temperatures in the western Pacific primes rising air, cloud development and rainfall. As a result, heavy rainfall can occur to the north of Australia. Conversely, over the eastern and central tropical Pacific, air descends over the cooler waters, resulting in less cloud and rain for the region. The air rising in the west and descending in the east enhances an atmospheric circulation – called the Walker circulation – which can cause global scale changes to the climate.

Figure 1: Pacific Ocean - La Niña



Source: BoM 2020b.

How is La Niña detected and what are the current conditions?

In the atmosphere, the El Niño Southern Oscillation (ENSO) is monitored using the Southern Oscillation Index (SOI), a measure of atmospheric circulation that calculates the difference of atmospheric pressure between Darwin and Tahiti. In the ocean, ENSO is usually monitored through observed sea surface temperatures within a region of the central and eastern tropical Pacific known as NINO3.4. La Niña events are typically defined when SOI values are sustained above +7 and NINO3.4 temperatures are more than –0.8°C below average. Events that maintain index values on the cusp of these thresholds are usually considered 'moderate to weak', while events that greatly exceed them are classified as 'strong' (BoM 2016).

La Niña ALERT

We are currently on a La Niña ALERT (70% chance of La Niña in the coming weeks and months) (BoM 2020c). However, evidence of a pending La Niña event is a little less pronounced than usual for this time. Normally, we would see some clearer

signs by September if a La Niña is on the way, but it seems currently likely to only become mature in October, and models suggest that it is not going to be a strong event, unlike the La Niña in 2010-12 with devastating flooding in Brisbane and elsewhere. A weak to moderate strength La Niña would likely start breaking down over summer.

Box 1: La Niña Facts

- Half of all La Niña events have lasted for 2 or 3 years
- On average they occur every 3 to 7 years
- 18 La Niña events have occurred since 1900
- 12 have led to widespread wet conditions
- Australia's wettest 2-year period was during the 2010-12 La Niña
- The 2010-12 La Niña saw a 5 mm drop in global sea level (as more evaporated sea water rained over land than normal)

Source: BoM 2016

For more information about La Niña, please refer to the Bureau of Meteorology website, 'What is La Niña and how does it impact Australia?'.

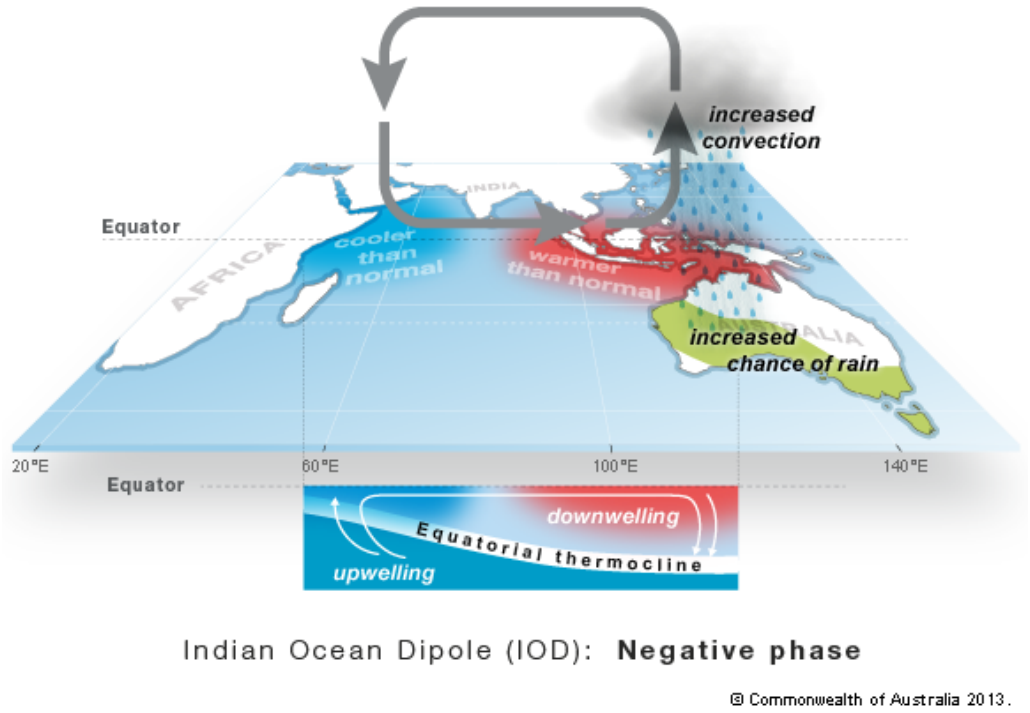
INDIAN OCEAN DIPOLE

The Indian Ocean Dipole (IOD) is a similar phenomenon to the El Niño Southern Oscillation (ENSO), but in the Indian Ocean. The IOD, which is defined as the difference in ocean temperatures between the west and east tropical Indian Ocean, can shift moisture towards or away from Australia. An IOD event can affect Australia from May to December and last for 2 to 7 months.

The IOD has three phases: neutral, positive and negative. Events usually start around May or June, peak between August and October and then rapidly decay when the monsoon arrives in the southern hemisphere around the end of spring. Since 1960, when reliable records of IOD began, to 2016, there have been 11 negative IOD and 10 positive IOD events (BoM 2020d).

A negative Indian Ocean Dipole (IOD) event (Figure 2) is likely for spring 2020. A negative IOD phase occurs when westerly winds intensify along the equator, allowing warmer waters to pool near Australia. A temperature difference is established across the tropical Indian Ocean, with warmer than normal water in the east and cooler than normal water in the west. A negative IOD typically results in above-average winter–spring rainfall over parts of southern Australia as the warmer waters off northwest Australia provide more available moisture to weather systems traversing the continent.

Figure 2: Negative phase of the Indian Ocean Dipole.



Source: BoM 2020d.

For more information, please refer to the Bureau of Meteorology website, '[About the Indian Ocean Dipole]' (BoM 2020d).

3. La Niña and IOD impacts on Australia and Spring Outlook 2020

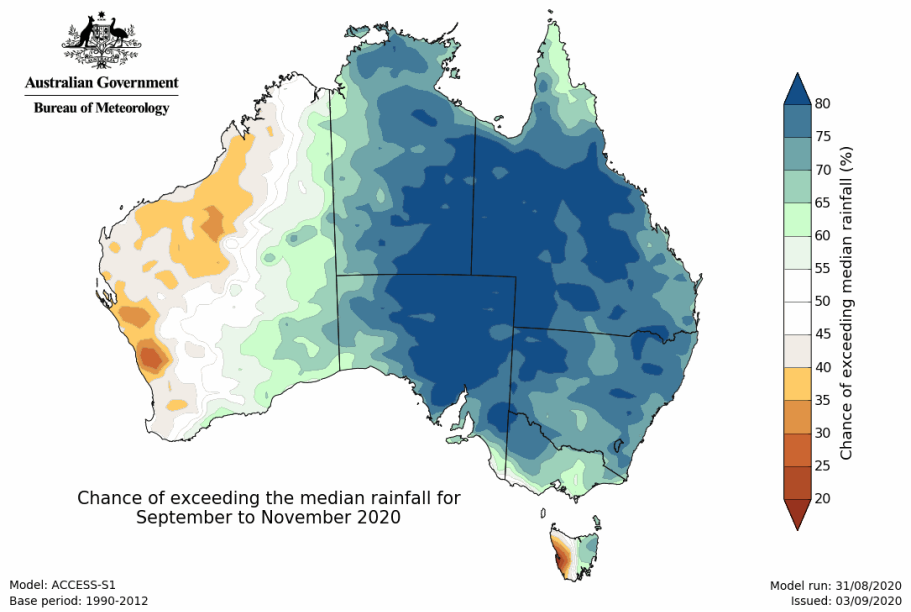
Over spring and early summer 2020-21, it is likely that a La Niña event will occur at the same time as a negative Indian Ocean Dipole (IOD). When this happens, rainfall is above average over large parts of Australia.

Typical impacts on Australia's climate during a La Niña include rainfall increases in eastern, central and northern parts of the continent, and daytime temperature decreases south of the tropics. Other impacts include more tropical cyclones; increased chance of widespread flooding; longer duration heatwaves in the southeast, but less intense; earlier first rains across northern Australia; and increased chance of Indian Ocean heatwaves (BoM 2016; BoM 2020b). A negative IOD is associated with more rainfall over eastern and southern Australian, cooler days in the south, warmer nights in the north, and increased risks of floods. A negative IOD is more likely to coincide with La Niña (BoM 2020d).

Spring 2020 Outlook for Australia

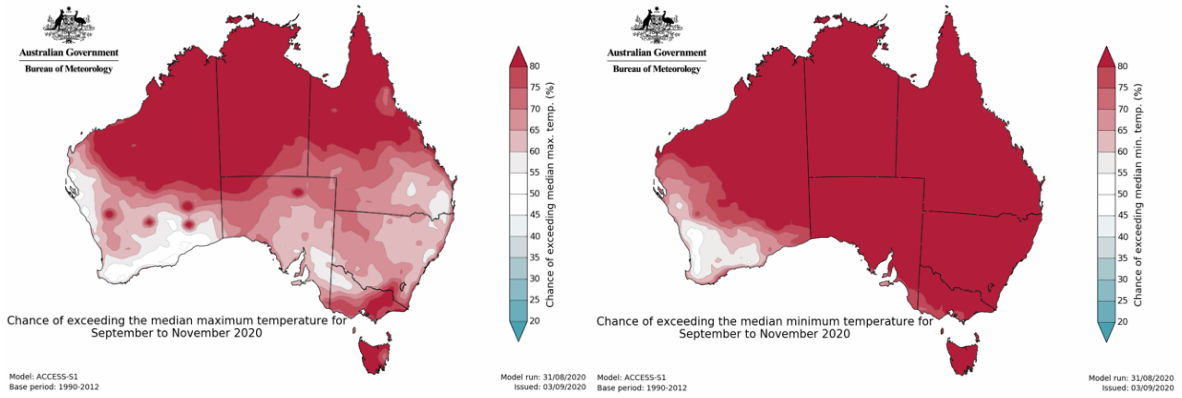
Above average rainfall is more likely for eastern Australia, but the western coastal regions of Western Australia are likely to be drier (Figure 3). Warmer than average temperatures (both days and nights) are expected across most of the country, with the exception of southwest WA (Figure 4).

Figure 3: Chance of exceeding median rainfall for September to November 2020.



Source: BoM 2020a.

Figure 4: Chance of exceeding the median maximum temperature (left) and minimum temperature (right) for September to November 2020



Source: BoM 2020a.

Severe weather - Spring and Summer 2020-21

The Bureau of Meteorology uses its rainfall, temperature and streamflow outlooks to assess the likelihood of severe weather events. Figure 5 provides a snapshot of BoM's assessment of severe weather that is likely over spring and summer 2020-21.

Figure 5: Severe weather – Spring and Summer 2020-21

Impact	Likelihood compared to most years	
Bushfire activity	Similar	●
Heatwave	Similar	●
Widespread flooding	More likely	▲
Severe storms	Similar	●
Continued drought	Improvement likely	▼
Dust	Similar	●
Coral bleaching	Similar	●
Tropical cyclones	More than average	▲
Coastal flooding / erosion	More likely	▲

Source: BoM 2020e.

Bushfires
Greater than normal risk of bushfires in the Kimberley region and eastern Queensland.

Heatwaves
Longer in duration but less intense heatwaves in the southeast.

Rainfall and flooding
Wetter than usual in the north and an early start to the wet season. Increased risk of flooding.

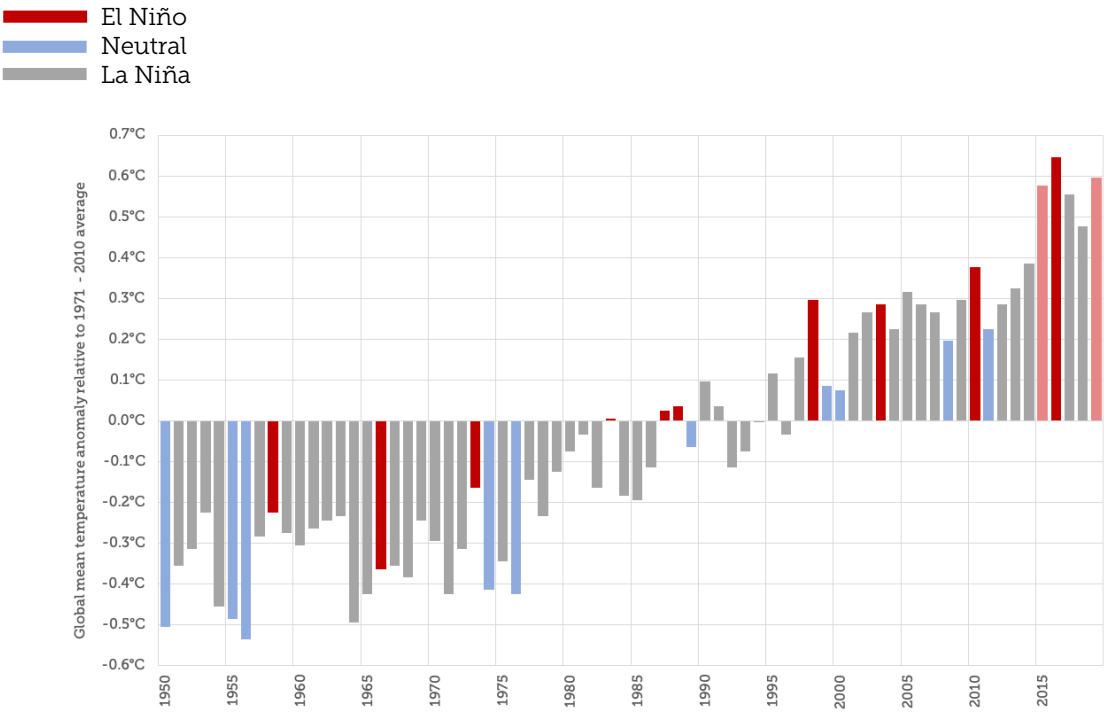
Tropical Cyclones
More tropical cyclones making landfall.

Coastal flooding
Increased risk of coastal flooding.

4. Climate drivers set against a long-term warming trend

The long-term trend since the mid-20th century of increasing global temperatures is undeniably driven primarily by greenhouse gas pollution from human activities, but from year-to-year, modes of natural variability can add tweaks to the long-term trend. One of the most important modes of variability is the El Niño Southern Oscillation (ENSO) phenomenon. Globally, an El Niño event provides an extra boost to the global average temperature, typically around 0.1 – 0.2°C (Trenberth et al. 2002; Foster and Rahmstorf 2011). El Niño years stand out as being somewhat warmer than the years around them, and, conversely, La Niña years (the opposite phase of ENSO to El Niño) are somewhat cooler (Figure 6), but they do not alter the long-term, multi-decadal global warming trend.

Figure 6: Global temperature anomalies relative to the 1981–2010 average, showing El Niño, Neutral and La Niña years.



Based on data from NOAA.

5. What could a wet spring mean for summer bushfire threat?

The 2020/21 fire season will be driven by a very different set of drivers than the devastating Black Summer of 2019-20, which was characterised by extreme bushfires, drought and heatwaves.

Both La Niña and negative IOD typically increase the chance of above average rainfall across much of Australia during spring. Rainfall (timing and amount) is an important consideration in assessing bushfire danger. Rain suppresses bushfire risk in the near term but also increases vegetation growth, and therefore the amount of fuel available, which can dry off quickly following the rain. A wetter than

average spring can therefore be followed by a summer of elevated fire risk, and in particular the risk of fast running fires in grasslands and cropping areas.

While it is too early to make confident predictions about the 2020/21 fire season in Australia, there is no question that, in general, climate change is leading to more dangerous fire seasons.

For more information, please visit the Bushfire and Natural Hazards Cooperative Research Centre, https://www.bnhcrc.com.au/ .

References

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