



## ENSO Wrap-Up

Current state of the Pacific and Indian Ocean

### El Niño likely past its peak

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A number of El Niño-Southern Oscillation (ENSO) indicators suggest that the 2015-16 El Niño has peaked in recent weeks. Tropical Pacific Ocean temperatures suggest this event is one of the top three strongest El Niño events of the past 50 years. Climate models suggest the 2015-16 El Niño will decline during the coming months, with a return to ENSO neutral likely during the second quarter of 2016.

In the central to eastern tropical Pacific Ocean, the sea surface and sub-surface have cooled in recent weeks, though temperatures remain at strong El Niño levels. In the atmosphere, the Southern Oscillation Index has eased to weak El Niño values. Recent bursts of westerly winds over the equatorial western Pacific may temporarily slow the decline of El Niño.

Based on the 26 El Niño events since 1900, around 50% have been followed by a neutral year, while 40% have been followed by La Niña. Models also suggest neutral and La Niña are equally likely for the second half of 2016, with a repeat El Niño the least likely outcome. Historically, the breakdown of strong El Niño events brings above average rainfall to parts of Australia in the first half of the year.

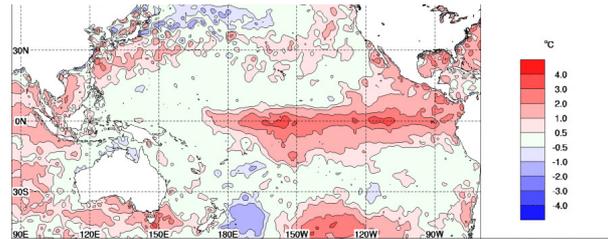
The Indian Ocean Dipole has little influence on Australian climate between December and April. However, Indian Ocean sea surface temperatures remain very much warmer than average across the majority of the basin. This basin-wide warmth may provide extra moisture for rain systems across Australia.

Next update expected on 19 January 2016 |

## Weekly sea surface temperatures

Sea surface temperatures across the tropical Pacific have undergone some cooling in the past fortnight. Away from the equator, warm anomalies around Australia have decreased, with some small areas of cool anomalies appearing to the north. Further cooling has occurred in parts of the northeast of the basin adjacent to the North American coastline.

Anomalies for the week ending 3 January exceeded +2 °C across the equatorial Pacific east of the Date Line, with some areas exceeding +3 °C. Warm anomalies are present along most of the equator in the eastern and central Pacific, across much of the northeast of the Pacific Basin and to the south of Australia. Similarly, warm anomalies extend across most of the Indian Ocean.



Index	Previous	Current	Temperature change (2 weeks)
NINO3	+2.4	+2.2	0.2 °C cooler
NINO3.4	+2.3	+2.2	0.1 °C cooler
NINO4	+1.6	+1.5	0.1 °C cooler

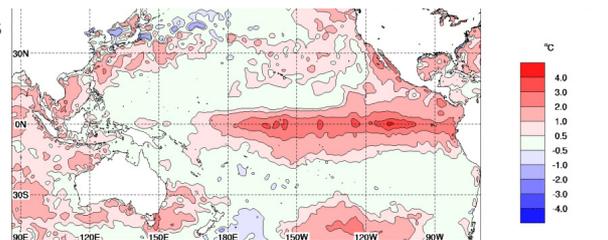
Baseline period 1961–1990.

## Monthly sea surface temperatures

The SST anomaly map for December 2015 shows warm SST anomalies extended across nearly the entire equatorial Pacific. Warm anomalies were also present across some of the eastern half of the Pacific Basin in the northern hemisphere.

Compared to November, warm anomalies decreased slightly in some areas along the equator, and over the northeast of the Basin. Moderate to strong warm anomalies persisted across much of the Indian Ocean but showed some reduction in waters immediately adjacent to Australia.

In December, the NINO3 index in the eastern Pacific remained steady, while NINO3.4 and NINO4 showing some small decline from their event peak in November. Values in the Bureau dataset were +2.4 °C, +2.3 °C, and +1.6 °C respectively, and remain indicative of a strong El Niño event.



Index	October	November	Temperature change
NINO3	+2.4	+2.4	no change
NINO3.4	+2.4	+2.3	0.1 °C cooler
NINO4	+1.7	+1.6	0.1 °C cooler

Baseline period 1961–1990.

## 5-day sub-surface temperatures

The sub-surface temperature map for the 5 days ending 3 January shows warm anomalies, present in the top 125 m in the eastern Pacific, continue to contract to the east along the thermocline. Anomalies in the eastern Pacific, though remaining warmer than average, have shown up to a 3 °C drop in temperature in some areas over the past fortnight.

Cool anomalies at depth in the western Pacific have shown some slight strengthening and continue to push to the east including the development of an area cooler than 1 °C in the eastern Pacific around 140°W. An area in the far western equatorial Pacific sub-surface between 100 and 200 m depth is more than 3 °C cooler than average, and has extended out to around 165°E. A small area has emerged with anomalies more than 4 °C cooler than average.

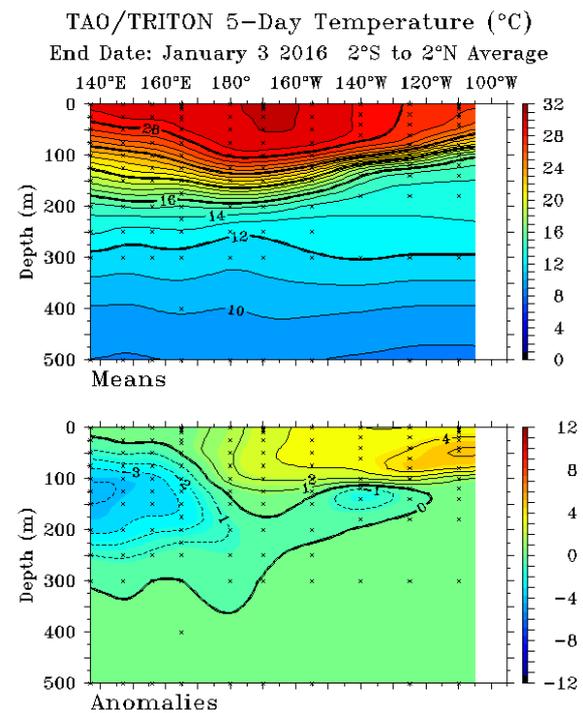
The pattern of warm anomalies in the eastern sub-surface and cool anomalies in the west is consistent with a well-established strong El Niño. However the continued eastward extension of the cooler than average anomalies can be a precursor to the breakdown of the warm anomalies in the east, as has happened at the subsurface over the past month.

In the mean 5-day values (upper panel), the thermocline has lifted slightly in the east in recent weeks (see animation link). This tilting of the thermocline in the east is associated with the contraction of warm anomalies in the eastern sub-surface to above 125 m depth, and further indicates El Niño may be starting to decline. An almost flat thermocline tends to only occur during strong El Niño events.

## Monthly sub-surface temperatures

The four-month sequence of sub-surface temperature anomalies (to December) shows a decrease in warm sub-surface anomalies and an eastward expansion of cool sub-surface anomalies compared to November.

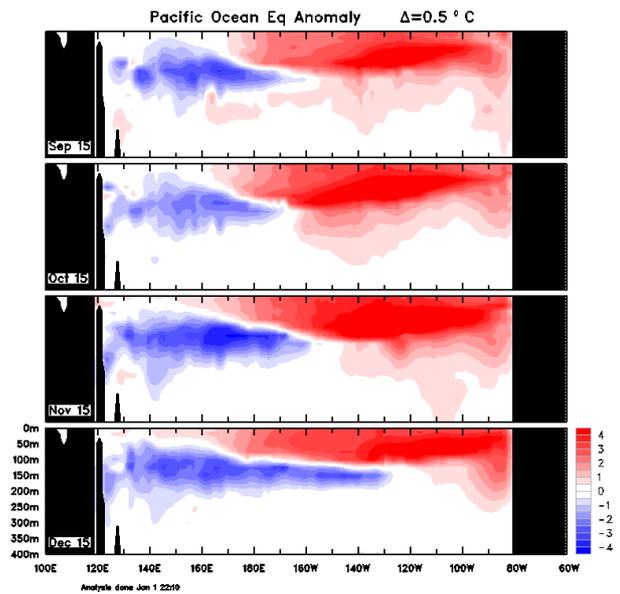
During December, warm anomalies have been present in the top 150 m of the equatorial Pacific sub-surface, extending between about 160°E and the South American coastline. Monthly anomalies



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reached more than +4 °C across large areas of the eastern equatorial Pacific east of 135°W. Cool anomalies for December covered much of the western and central Pacific at around 150 m depth, underlying warm anomalies in the central region.

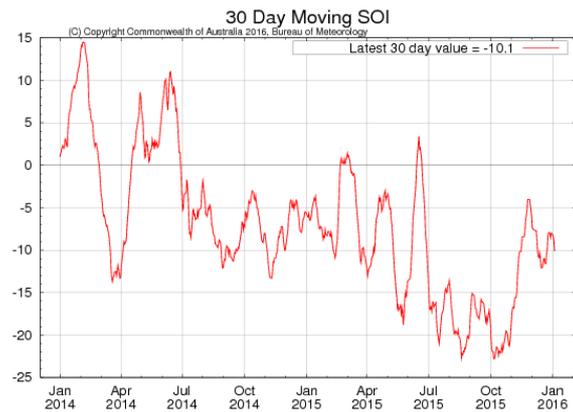


## Southern Oscillation Index

The Southern Oscillation Index (SOI) has shown a small drop over the past two weeks. The 30-day SOI value to 3 January was -9.0.

Fluctuations of the SOI during Australia's northern wet season (October–April) are not unusual as the passage of tropical systems affects atmospheric pressure. During this period, the SOI should be used cautiously; 90-day values may provide a more reliable guidance. The current 90-day SOI is -11.4.

Sustained positive values of the SOI above +7 typically indicate La Niña, while sustained negative values below -7 typically indicate El Niño. Values of between about +7 and -7 generally indicate neutral conditions.

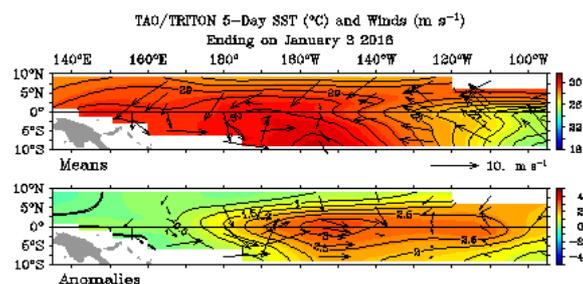


## Trade winds

Trade winds for the 5 days ending 3 January shows some increase in westerly wind anomalies across the western equatorial Pacific. The spatial extent and strength of westerly anomalies has increased compared to two weeks ago. This is likely related to the passage of an [MJO](#) event into the western Pacific.

Trade winds have been consistently weaker than average, and on occasion reversed in direction (i.e. westerly rather than easterly), since the start of 2015.

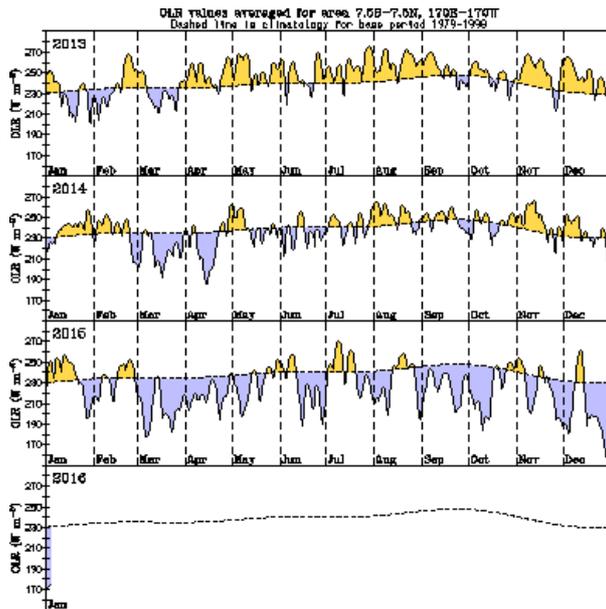
During La Niña events, there is a sustained strengthening of the trade winds across much of the tropical Pacific, while during El Niño events there is a sustained weakening of the trade winds.



### Cloudiness near the Date Line

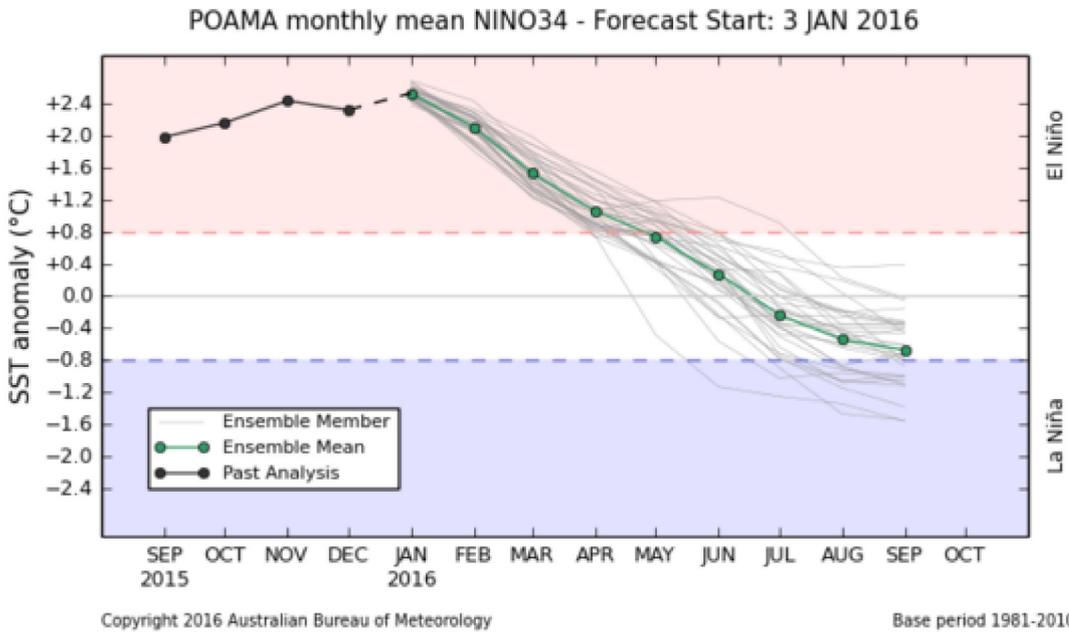
Cloudiness near the Date Line has been above the long-term average during most of December, with a brief fluctuation into below average values. Cloudiness near the Date Line has generally been above average since March.

Cloudiness along the equator, near the Date Line, is an important indicator of the El Niño–Southern Oscillation (ENSO), as it typically increases (negative OLR anomalies) near and to the east of the Date Line during El Niño and decreases (positive OLR anomalies) during La Niña.



### Model outlooks

All of the eight international [climate models](#) surveyed by the Bureau indicate that the current El Niño will show a steady decline from early 2016, with all returning to neutral values during the late iaustral autumn to early winter (second quarter of 2016).

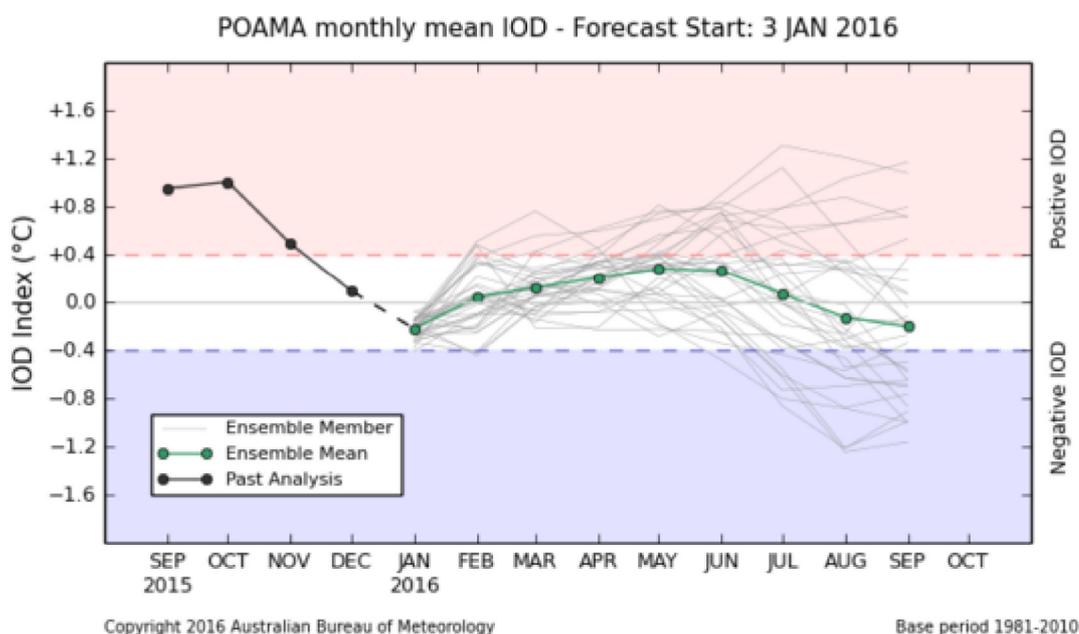


## Indian Ocean Dipole

The Indian Ocean Dipole (IOD) is neutral. The index value to 3 January was -0.36 °C.

Sea surface temperatures (SSTs) remain significantly warmer than average across most of the Indian Ocean basin.

The influence of the IOD on Australian climate is weak during the months December to May as the monsoon trough shifts south over the tropical Indian Ocean. However, widespread record-warm sea surface temperatures in the Indian Ocean are likely to influence Australian climate during the summer months. These warm waters act as a source of moisture, and may provide extra moisture for rainfall systems developing over Australia.



See also: [IOD forecasts](#)

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