



## ENSO Wrap-Up

### Current state of the Pacific and Indian Ocean

## Tropical activity slows El Niño decline

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A strong El Niño persists, but ocean temperatures in the tropical Pacific are showing a gradual cooling signal. Climate models suggest El Niño will decay over the coming months, with a likely return to neutral conditions in the second quarter of 2016.

The eastern tropical Pacific sub-surface has cooled by up to 3 degrees since late November. Weekly sea surface temperatures likewise show a cooling trend, evident since late November. However, recent tropical cyclone activity in the central tropical Pacific has produced strong westerly winds along the equator which may temporarily slow the decline of El Niño. Such short-term re-intensification of El Niño has happened before. For example, 1997–98 saw a re-strengthening of El Niño conditions in early 1998, before the event eventually decayed.

Based on the 26 El Niño events since 1900, around 50% have been followed by a neutral year, and 40% have been followed by La Niña. Models also suggest neutral and La Niña states are about 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.

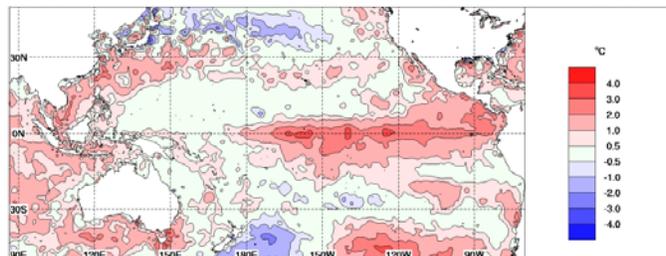
The Indian Ocean Dipole has little influence on Australian climate between December and April. However, Indian Ocean sea surface temperatures remain at record warm levels across the majority of the basin. This basin-wide warmth may provide extra moisture for rain systems across Australia.

Next update expected on 2 February 2016 |

### Weekly sea surface temperatures

Sea surface temperatures across the tropical Pacific remain generally similar to two weeks ago. Surface waters across the northwest and far west of the Pacific Basin, around Australia, and across the Indian Ocean have seen a strengthening of warm anomalies compared to two weeks ago.

Anomalies for the week ending 17 January exceeded +2 °C across the equatorial Pacific east of the Date Line, with small pockets exceeding +3 °C. Warm anomalies are also present across most of the northwest of the Pacific Basin, around South and Southeast Asia, around Australia, and across most of the Indian Ocean.



Index	Previous	Current	Temperature change (2 weeks)
NINO3	+2.2	+2.1	0.1 °C cooler
NINO3.4	+2.2	+2.2	no change
NINO4	+1.5	+1.2	0.3 °C cooler

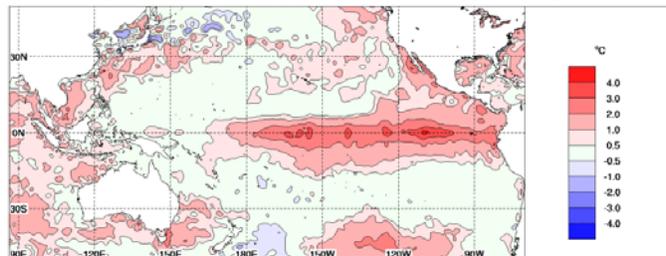
Baseline period 1961–1990.

### 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	November	December	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.

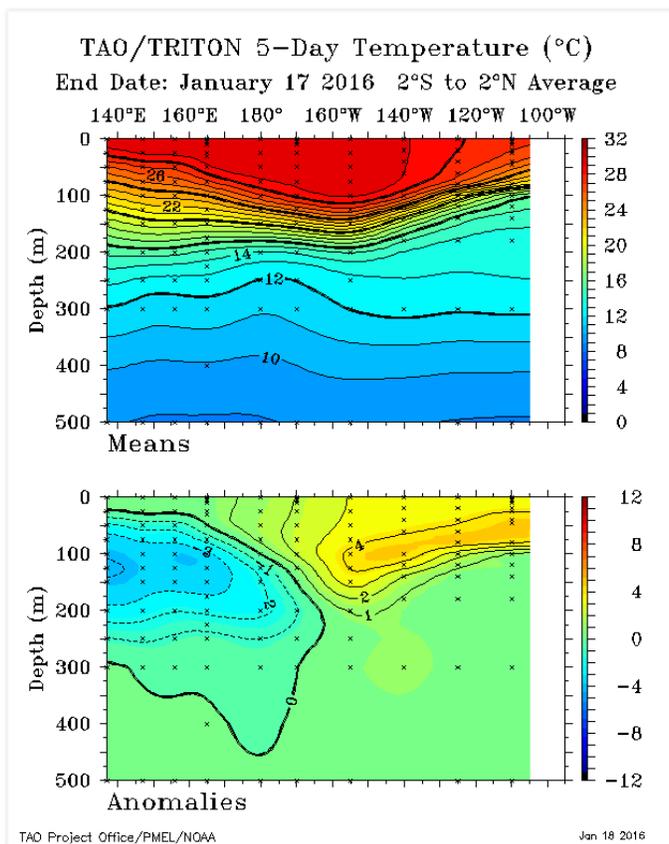
## 5-day sub-surface temperatures

The sub-surface temperature map for the 5 days ending 17 January shows temperatures were warmer than average in the top 125 m of the eastern half of the equatorial Pacific and cooler than average below the surface of the ocean in the western half. Water in the central Pacific sub-surface has warmed compared to two weeks ago. An area around 100 m depth across the eastern Pacific is more than 4 °C warmer than average.

Cool anomalies in the western equatorial Pacific also remain similar to two weeks ago, but have extended further into the central Pacific. An area in the western equatorial Pacific sub-surface between 75 and 200 m depth are more than 3 °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 continued eastward extension of cool anomalies, as seen during recent weeks, can be a precursor to the breakdown of the warm anomalies in the east.

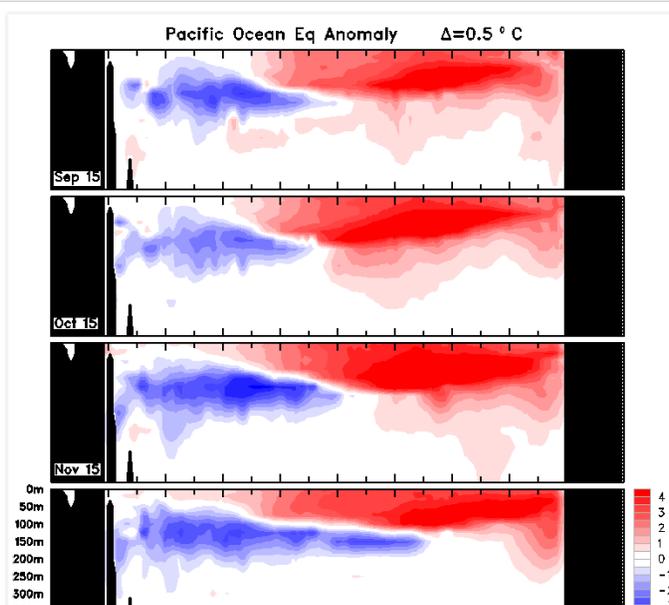
The thermocline (upper panel of the mean 5-day values) has continued to lift in the east in recent weeks (see animation link). Tilting of the thermocline in the east is associated with the contraction of warm anomalies in the eastern sub-surface to above 125 m depth, and also indicates the El Niño may be starting to decline.

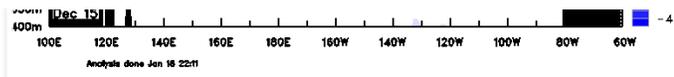


## Monthly sub-surface temperatures

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 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.



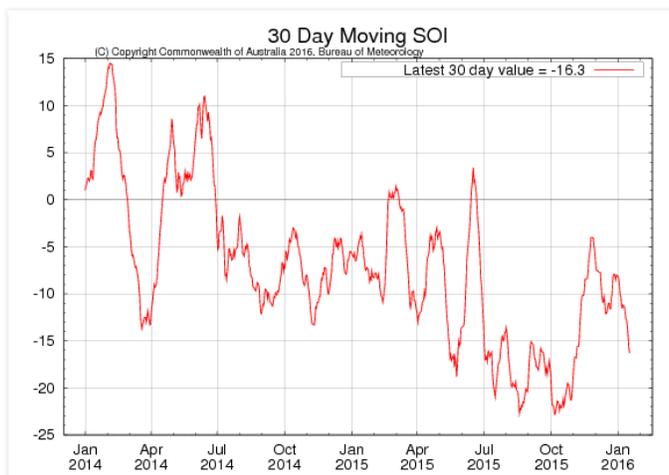


## Southern Oscillation Index

The Southern Oscillation Index (SOI) has dropped over the past two weeks. The 30-day SOI value to 17 January was  $-16.3$ . The SOI is likely to fall further in coming days due to the extended break in monsoon conditions over Darwin.

Fluctuations of the SOI during Australia's northern wet season (October–April) are common 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  $-12.7$ .

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.

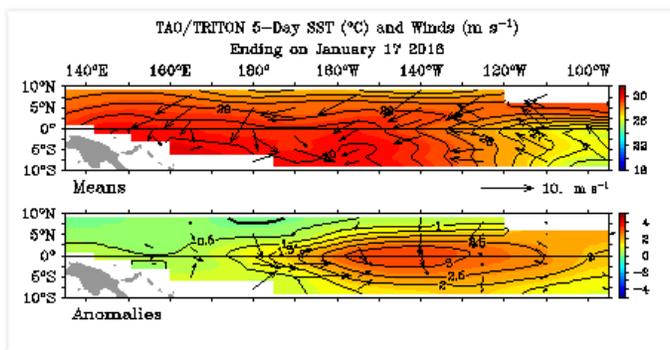


## Trade winds

Trade winds for the 5 days ending 17 January show westerly wind anomalies across areas of the central equatorial Pacific. This is the tail end of a strong pulse of westerly anomalies which was associated with tropical cyclone activity (hurricane *Pali* in the northern hemisphere and tropical cyclone *Victor* in the southern hemisphere) in the central equatorial 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.

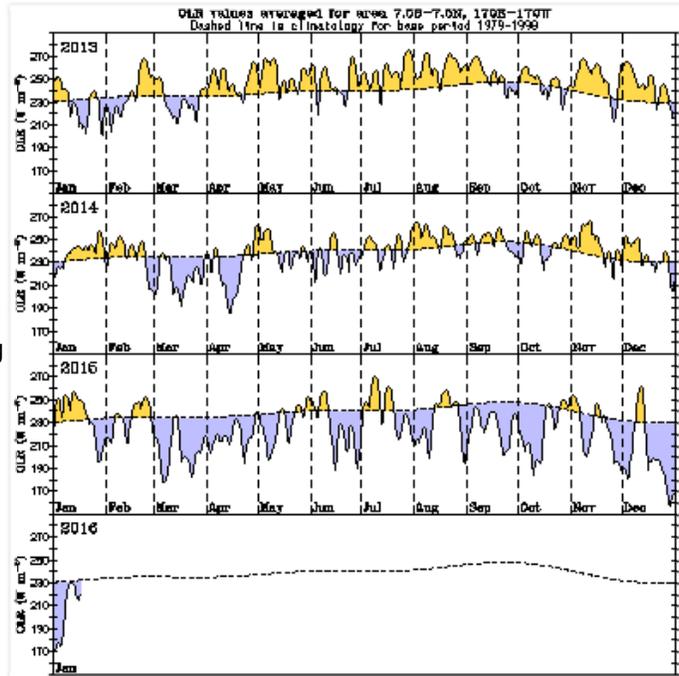
During La Niña events, there is a sustained strengthening of the trade winds across much of the tropical Pacific, while during El Niño events there is a sustained weakening of the trade winds.



### Cloudiness near the Date Line

Cloudiness near the Date Line has been above the long-term average during January. Cloudiness near the Date Line has generally been above average since March 2015.

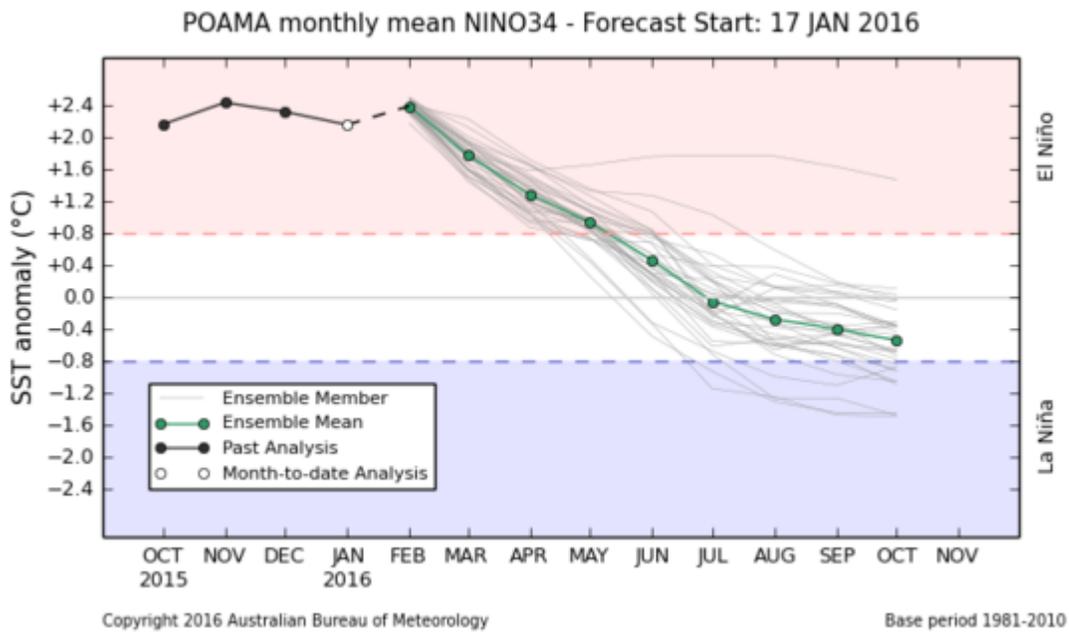
Cloudiness along the equator, near the Date Line, is an important indicator of the El Niño–Southern Oscillation (ENSO), as it typically increases (negative OLR anomalies) near and to the east of the Date Line during El Niño and decreases (positive OLR anomalies) during La Niña.



### Model outlooks

All eight of the international [climate models](#) surveyed by the Bureau indicate that the current El Niño is declining but is likely to persist well into autumn.

All surveyed models indicate the current El Niño will steadily decline over the remainder of summer and into autumn, with all but one model having returned to neutral values of NINO3.4 by June.

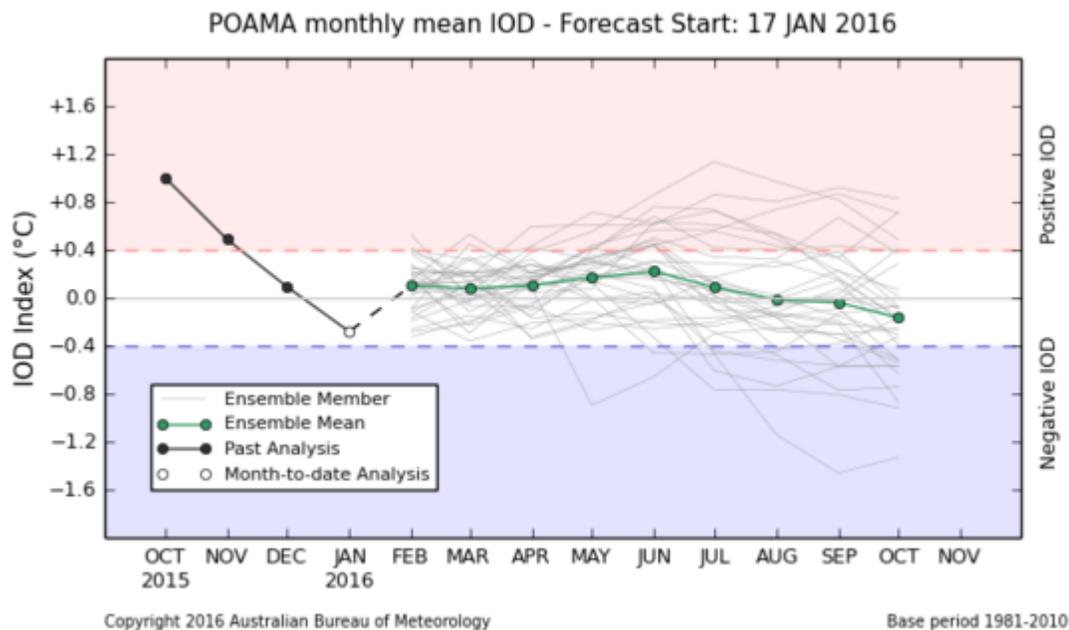


## Indian Ocean Dipole

The Indian Ocean Dipole (IOD) is neutral. The index value to 17 January was  $-0.37$  °C.

Sea surface temperatures (SSTs) remain significantly warmer than average across most of the Indian Ocean basin, with the southern hemisphere Indian Ocean continuing its run of monthly record temperatures, with the warmest December on record.

The IOD is usually neutral during the months December to April and therefore is not considered to have an impact on Australian climate at this time of year (when the monsoon trough shifts south over the tropical Indian Ocean). However, widespread record-warm sea surface temperatures across the Indian Ocean may 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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