

# Monthly Climate Bulletin

May 2019



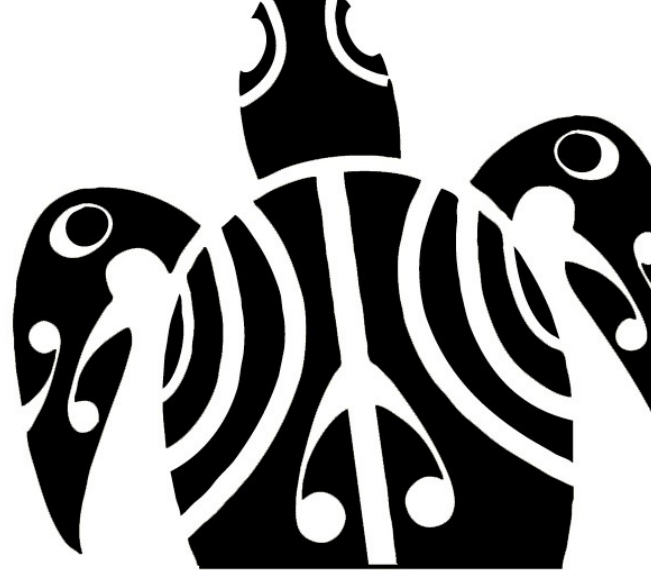
Australian Government  
Department of Foreign Affairs and Trade  
Bureau of Meteorology



Climate and Oceans Support  
program in the Pacific



Pacific  
Community  
Communauté  
du Pacifique



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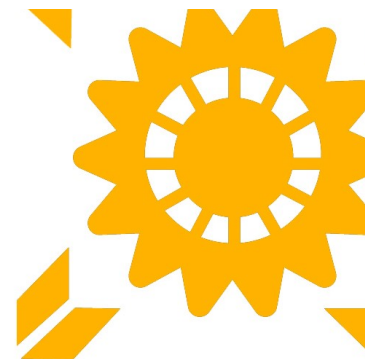
## Issued 09 June 2019

- The Pacific Ocean and overlying atmosphere remain close to El Niño thresholds, so the ENSO Outlook remains at El Niño WATCH. Models indicate the tropical Pacific Ocean will ease away from El Niño levels, becoming neutral during winter.
- The influence of the Madden-Julian Oscillation (MJO) over the Indian Ocean waned in the last week. The MJO signal is likely to continue to weaken as it tracks further east, prior to moving into the Indonesian-New Guinea region.
- The May mean sea level pressure (MSLP) anomaly map shows negative anomalies less than -1 hPa around and to the east of Samoa. Positive anomalies greater than +1 hPa were present in the western Pacific north and south Pacific..
- Sea level in May was higher than normal in the equatorial and most of the south Pacific. Sea level was more than 20 cm above normal around Marshall Islands and east of Samoa. Sea level below normal over the Coral Sea region and Palau.
- For June to August 2019, below-normal rainfall is favoured for most of mainland Papua New Guinea, eastern Solomon Islands, Vanuatu, mainland Fiji and central Tonga. Above-normal rainfall totals are most likely for Nauru, Kiribati, Tuvalu, Rotuma (Fiji) and the northern Cook Islands.
- Nine tropical cyclones formed in the 2018-19 south Pacific cyclone season, equal to the long term average. These cyclones affected Australia, PNG, Solomon Islands, Nauru, New Caledonia, Vanuatu, Tuvalu, Fiji, Tonga, Samoa and Niue.

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# EL NIÑO–SOUTHERN OSCILLATION



## Positive Indian Ocean Dipole likelihood increases

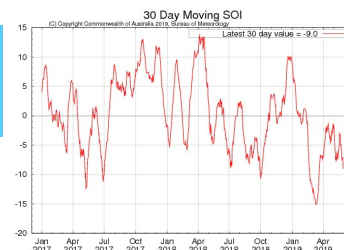
### ENSO Wrap-Up issued on 28 May 2019

The Pacific Ocean and overlying atmosphere remain close to El Niño thresholds so the ENSO Outlook remains at El Niño WATCH. Models indicate the tropical Pacific Ocean will ease away from El Niño levels, becoming neutral during winter.

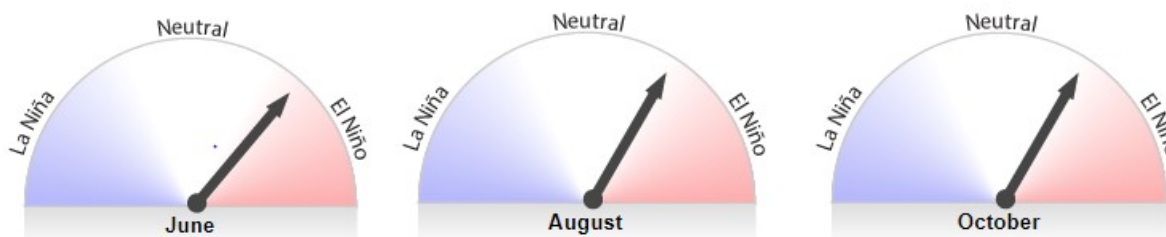
An active phase of the Madden Julian Oscillation in the last fortnight weakened the trade winds and brought a small rise in sea surface temperatures (SSTs) in the central and western tropical Pacific Ocean and a drop in the Southern Oscillation Index (SOI). This has sustained the El Niño like pattern in the Pacific. While a prolonged weakening of the trade winds could elevate El Niño chances once again, the majority of surveyed models suggest the tropical Pacific will cool to neutral levels during winter.

In the Indian Ocean, further warming off the horn of Africa has meant that the IOD index exceeded the positive threshold value this week. All but one of the models surveyed suggest positive IOD levels will be maintained throughout winter. To be considered an event, these values would need to be sustained for at least two months. A positive IOD often results in below average winter to spring rainfall over southern and central Australia.

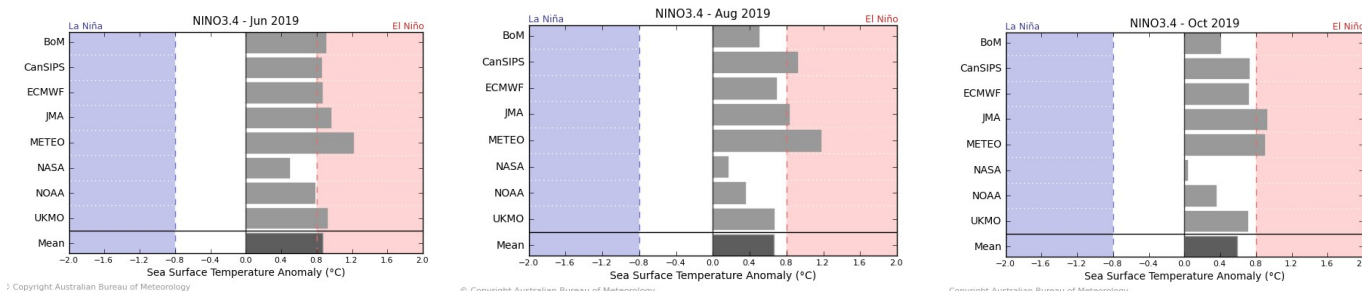
The approximate 30-day and 90-day Southern-Oscillation Index (SOI) values to 9 June were -10 and -6 respectively.



### Bureau of Meteorology NINO3.4 ENSO Model Outlooks for June, August and October



### Bureau of Meteorology NINO3.4 International Model Outlooks



Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/>

Bureau of Meteorology ENSO Wrap-Up  
<http://www.bom.gov.au/climate/enso/>

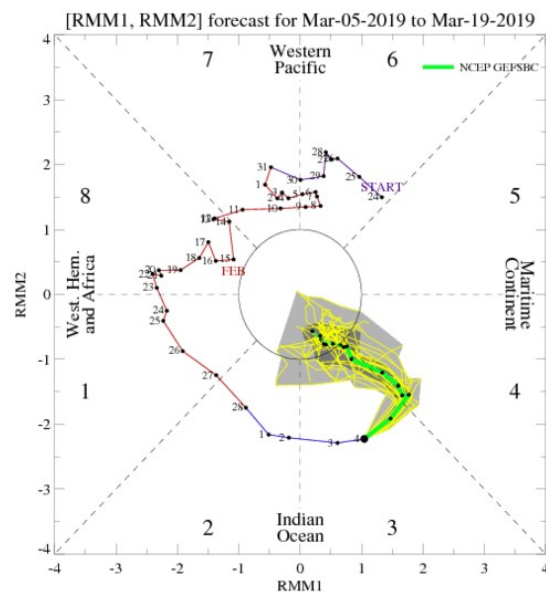
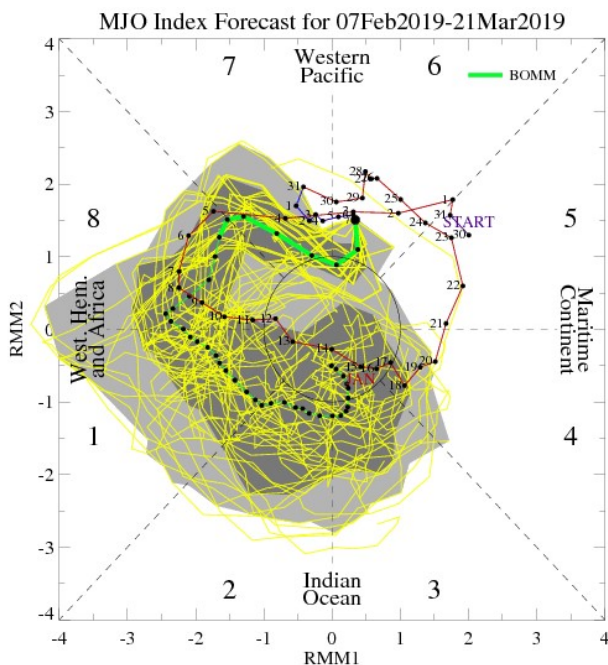
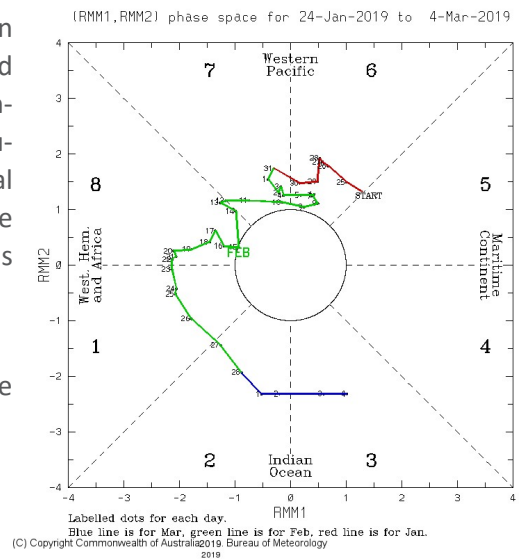
# MADDEN–JULIAN OSCILLATION



## Weekly Tropical Note [Issued on Tuesday 04 June 2019]

In the last fortnight, a moderate to strong pulse of the Madden Julian Oscillation (MJO) moved eastwards into the tropical western Indian Ocean. The location and strength of this pulse enhanced cloudiness and rainfall over the northern Indian Ocean and contributed to further northwards movement and development of the Indian monsoon. The influence of the MJO over this region waned in the last week. The MJO signal is likely to weaken as it tracks further east, prior to moving into Maritime Continent longitudes. As a result, the enhanced rainfall patterns across the north Indian Ocean may continue to reduce to near-average levels.

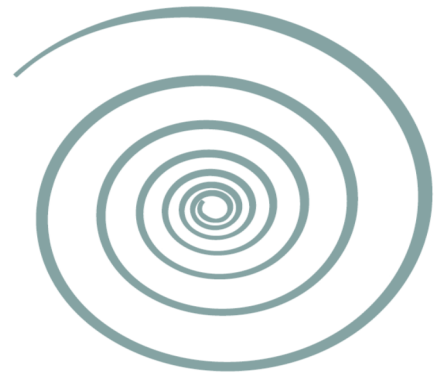
This is an abbreviated version of the Weekly Tropical Note. Click on the link below for the full version.



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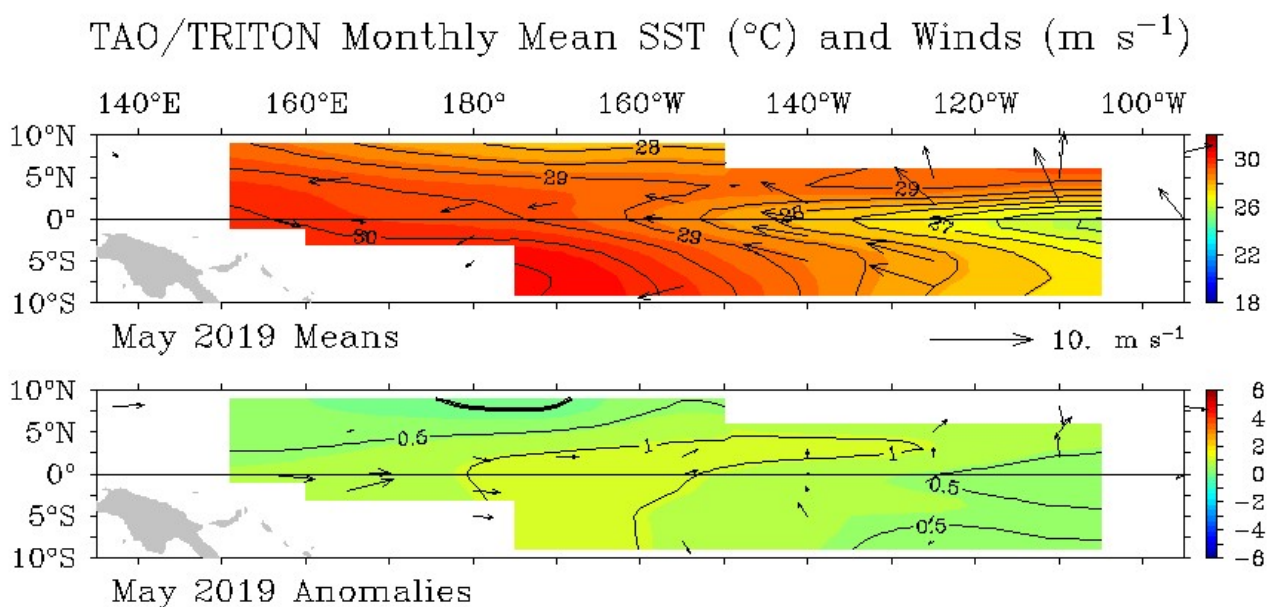
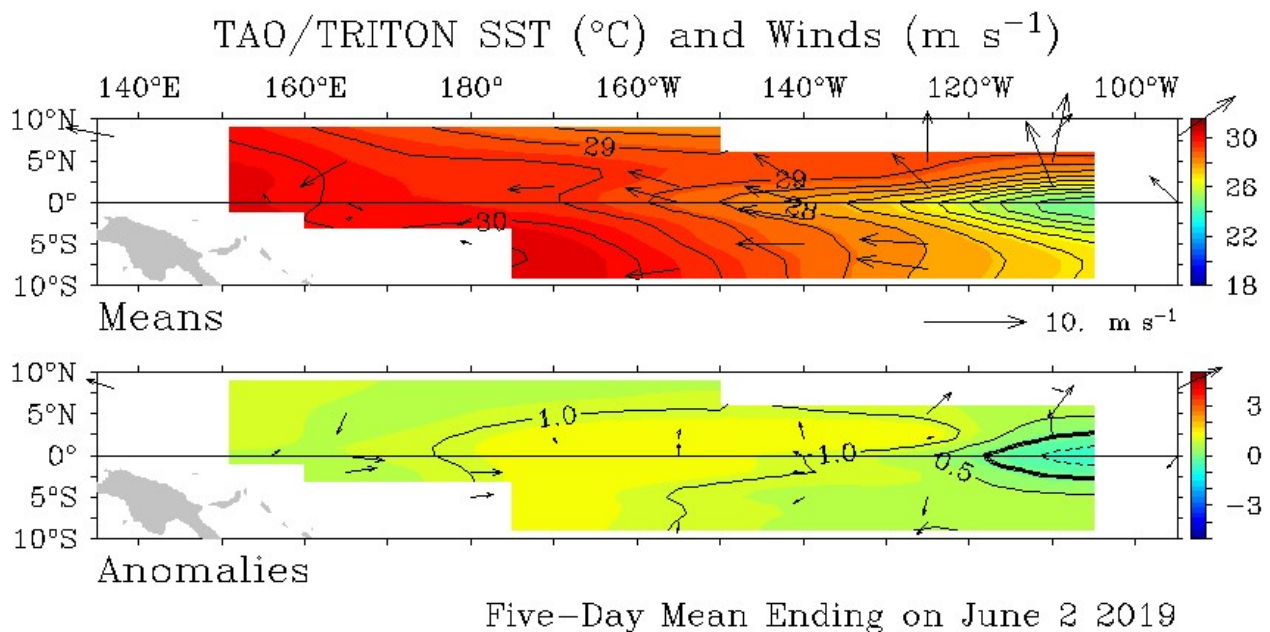
Bureau of Meteorology Weekly Tropical Climate Note Page: <http://www.bom.gov.au/climate/tropical-note/>

# WIND



The equatorial trade winds for the month of May show weak trade winds in the western Pacific while close to average in the eastern Pacific. The trade winds for the five days ending 2 June are weaker than average across most of the western half of the tropical Pacific, likely tied in with recent stalling of Madden-Julian Oscillation activity over the western hemisphere and Africa. Persistent weaker trade winds could lead to further warming of parts of the tropical Pacific Ocean, and raise the odds of El Niño once again.

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, or even reversal, of the trade winds.



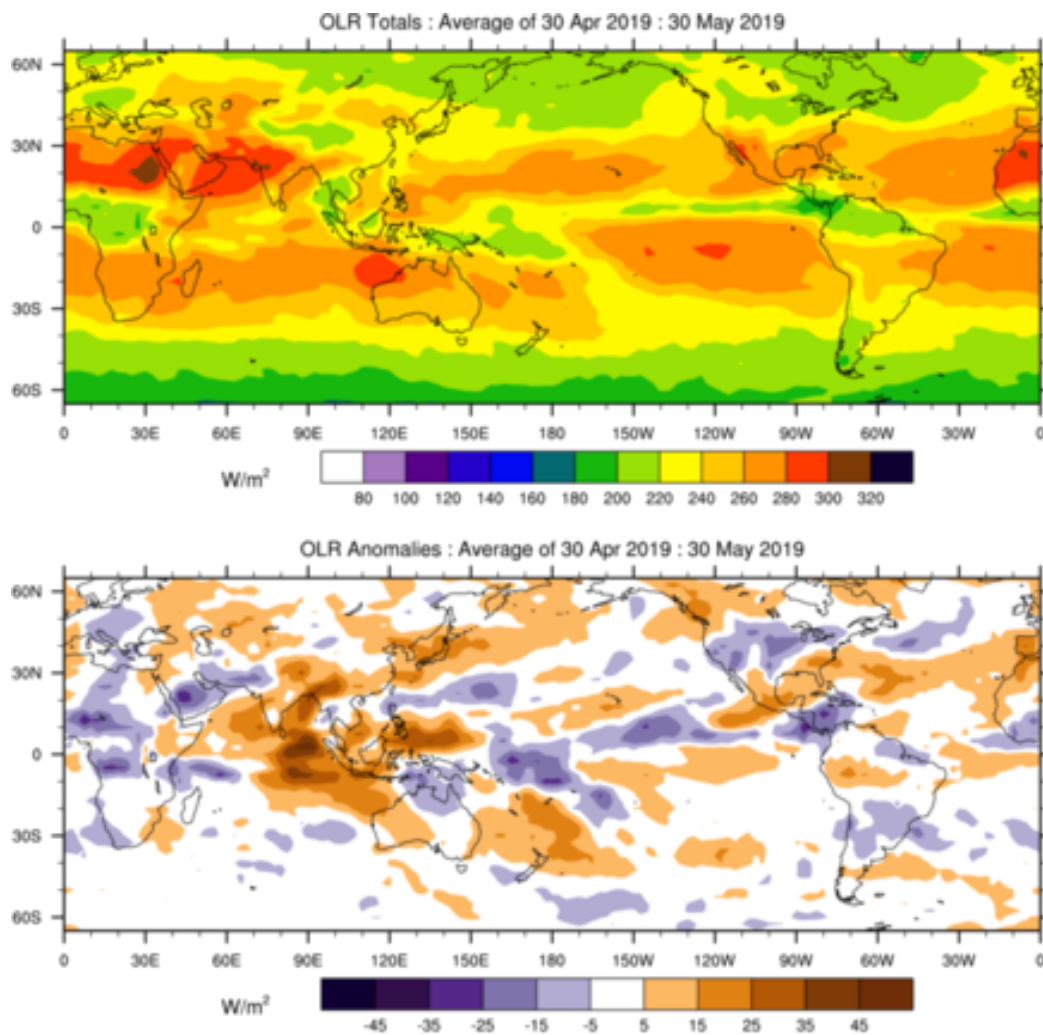
# CLOUD AND RAINFALL



The May 30-day OLR anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was displaced southward resulting in enhanced cloud cover over the central and eastern equatorial Pacific especially over Nauru and Kiribati. In the south Pacific, the South Pacific Convergence Zone (SPCZ) was enhanced over the eastern Solomon Islands as well as Tuvalu and Samoa. Elsewhere there was below normal cloud cover over New Caledonia, Vanuatu, Fiji and southern Tonga in the south Pacific. In the north Pacific, rainfall was suppressed over Palau, western and central Federated State of Micronesia (FSM) and the Marshall Islands. TRMM maps were not available during the month of May.

Note: Global maps of OLR below highlight regions experiencing more or less cloudiness. The top panel is the total OLR in Watts per square metre ( $W/m^2$ ) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in  $W/m^2$ . In the bottom panel, negative values (blue shading) represent above normal cloudiness while positive values (brown shading) represent below normal cloudiness.

## OLR Total and Anomalies, 30 Day OLR

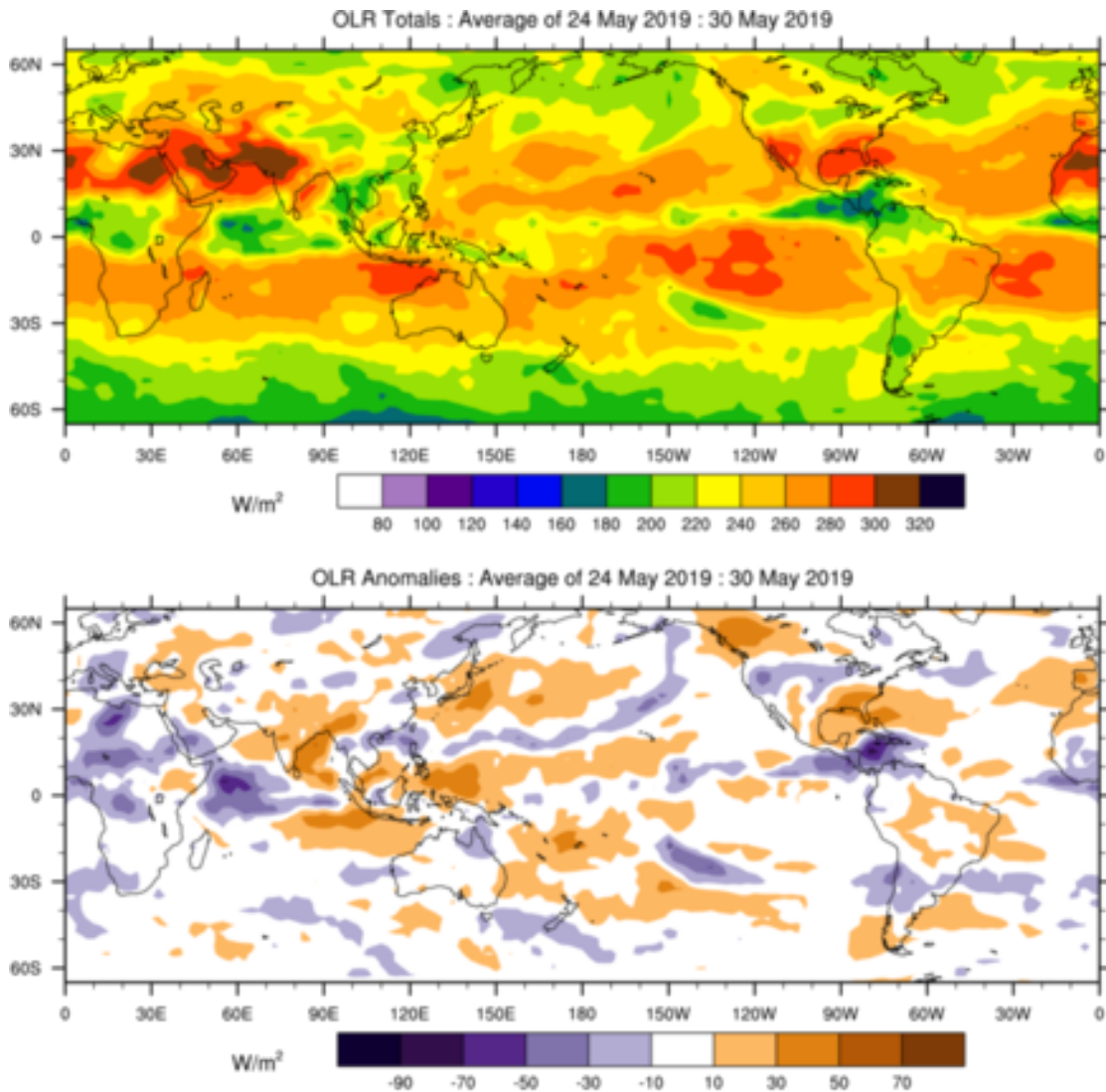


(C) Copyright Commonwealth of Australia 2019. Bureau of Meteorology

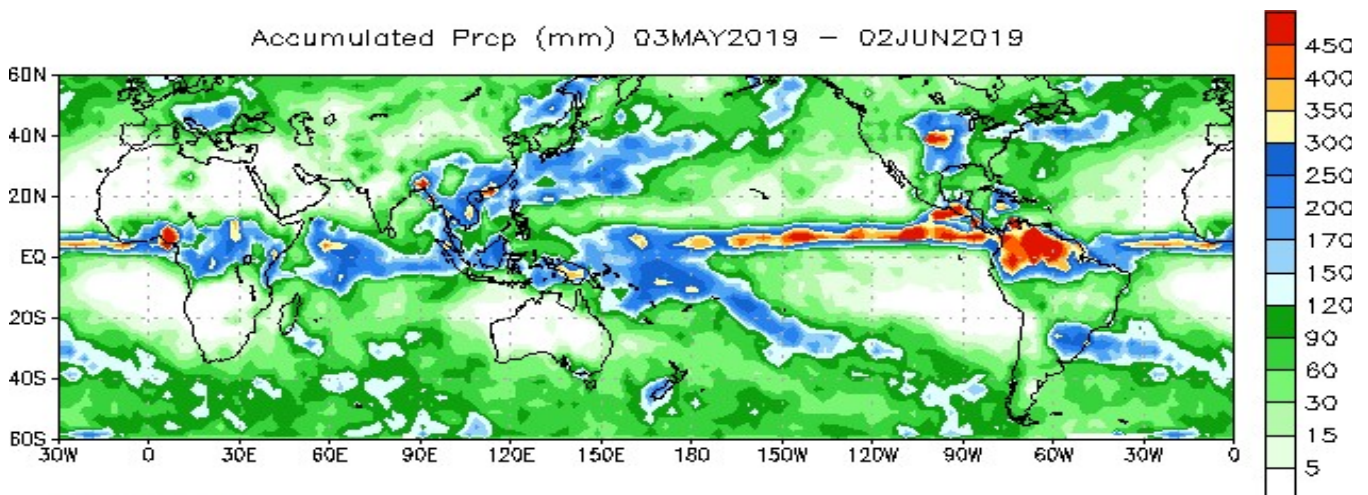
# CLOUD AND RAINFALL



## OLR Total and Anomalies, 7 Day OLR



(C) Copyright Commonwealth of Australia 2019. Bureau of Meteorology



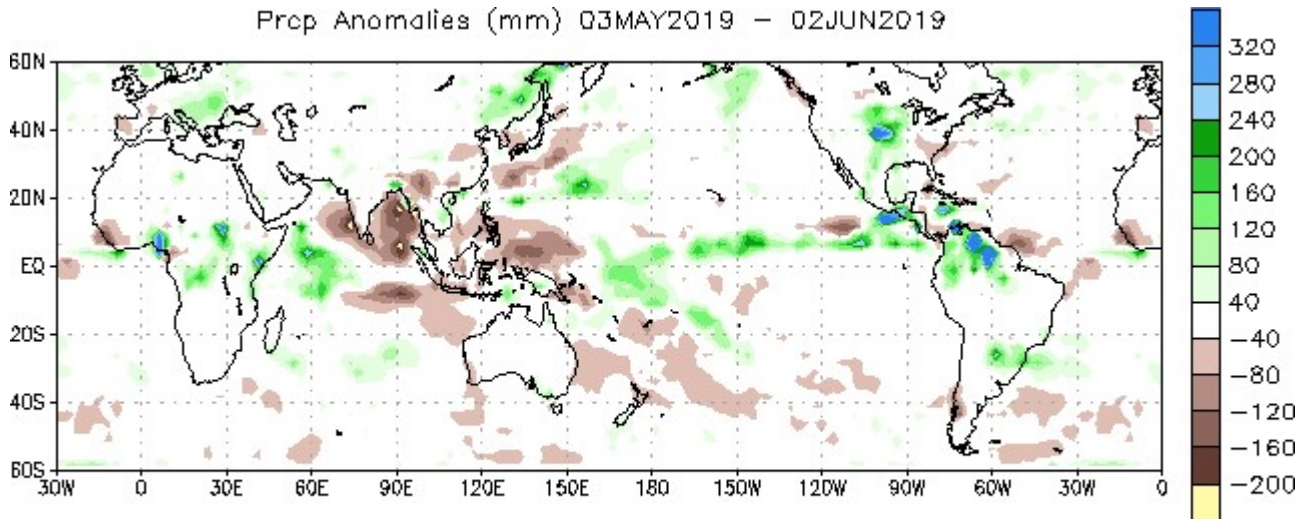
Data Source: NCEP CMAP Precipitation



# CLOUD AND RAINFALL

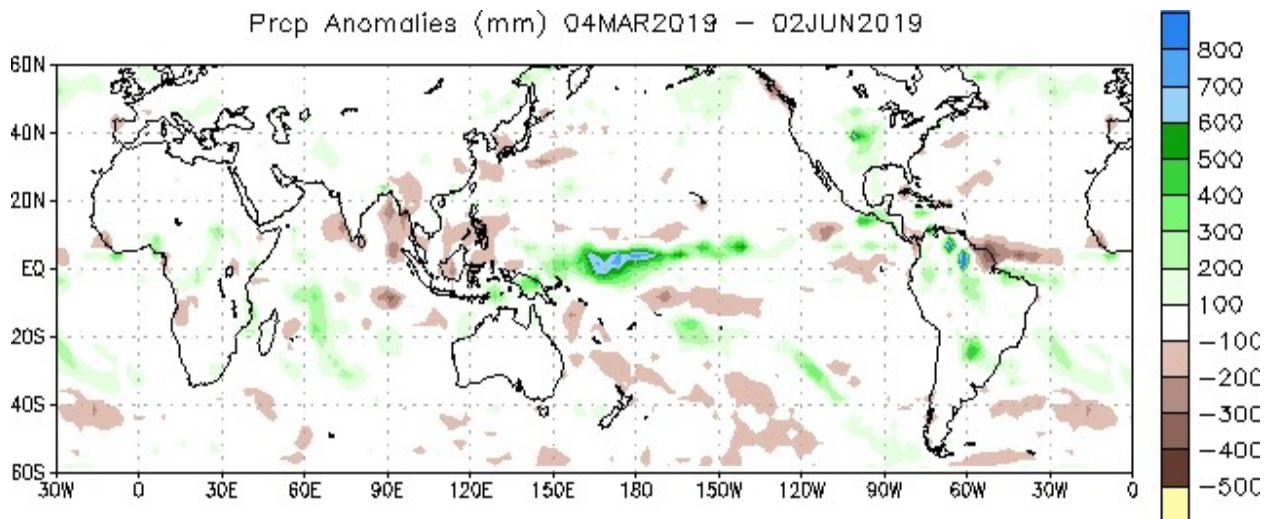


## 30-Day Rainfall Anomalies



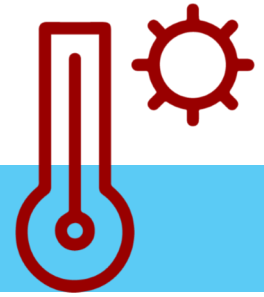
Data Source: NCEP CMAP Precipitation  
Climatology (1979-1995)

[https://www.cpc.ncep.noaa.gov/products/Global\\_Monsoons/Global-Monsoon.shtml](https://www.cpc.ncep.noaa.gov/products/Global_Monsoons/Global-Monsoon.shtml)



Data Source: NCEP CMAP Precipitation  
Climatology (1979-1995)

# OCEAN CONDITIONS



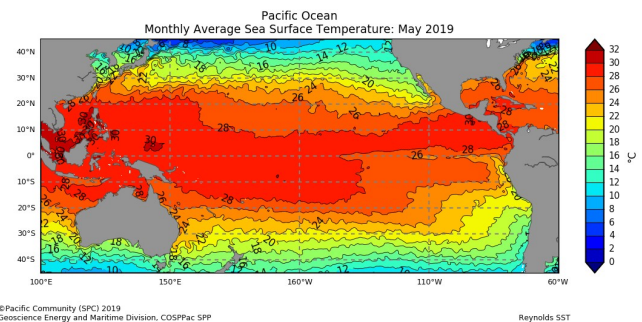
## SEA SURFACE TEMPERATURE

Sea surface temperature (SST) anomalies for the week ending 27 May were warmer than average across nearly the entire tropical Pacific Ocean. Compared to two weeks ago, the surface of the central tropical Pacific Ocean has warmed slightly, in response to recent Madden-Julian Oscillation activity and associated weakening of the trade winds. The tropical Pacific region has large regions that are half to one degree warmer than average, with some small regions north of the equator up to 2 degrees warmer.

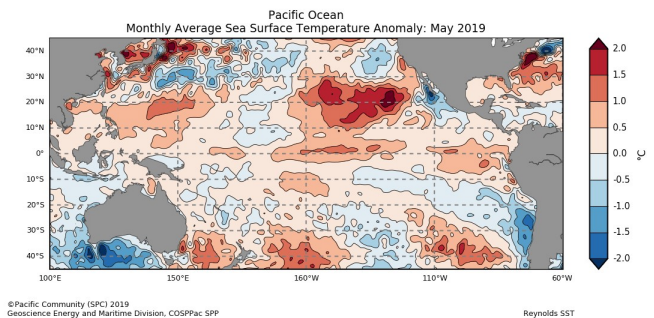
Waters are also warmer than average across much of the southern Pacific Ocean, particularly across areas south of 30°S. SSTs are up to two degrees warmer than average over a broad area extending across the Tasman Sea, along the New South Wales coast, and well to the east of New Zealand. SSTs for the three NINO regions have cooled in May, and are below the ENSO neutral range for two NINO regions. The weekly SST anomalies to 27 May for the NINO3, NINO3.4 and NINO4 regions were +0.7 °C, +0.8 °C and +0.7 °C, respectively.

The SST decile map for May shows a large region of deciles 8 to 9 in the central equatorial Pacific extending to north Pacific, surrounding a large area of 10 and highest of record. An area of decile 2 to 3 over Papua New Guinea islands, east of New Caledonia and Vanuatu towards Tonga and Niue.

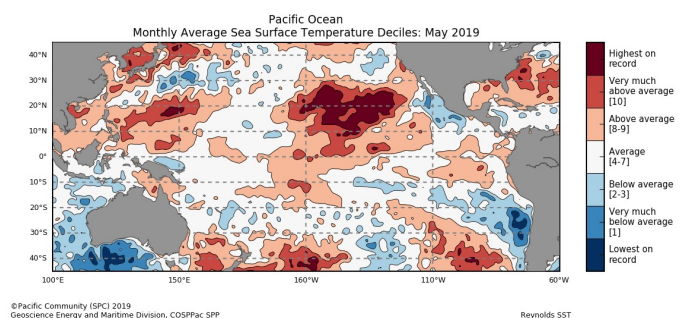
### Mean SST



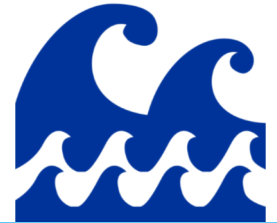
### Anomalous SST



### SST Deciles



# OCEAN CONDITIONS

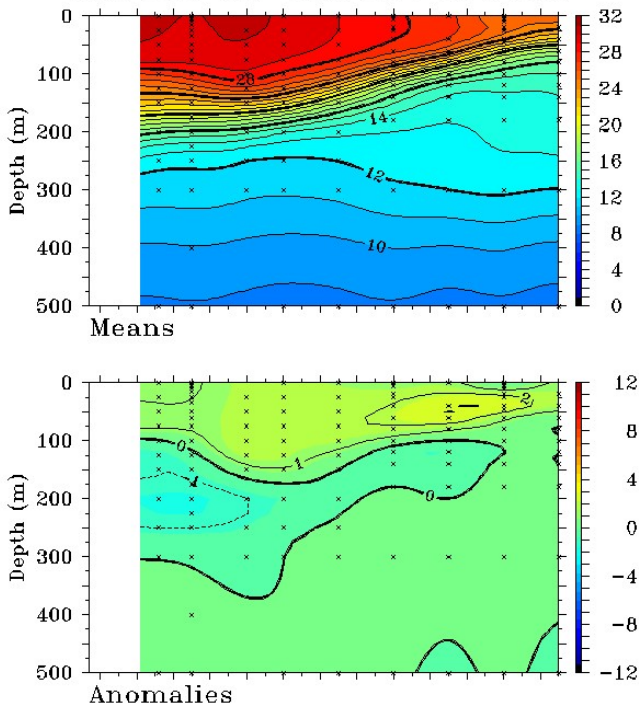


## SUB SURFACE

The Bureau of Meteorology's four-month sequence of equatorial sub-surface temperature anomalies (to 23 May) shows a similar pattern of sub-surface anomalies for May to those for April, although anomalies are generally weaker this month than last. Very weak positive anomalies persist across most of the top 100 m of the sub-surface, with most of this region with half a degree of average. Below 100 m depth, weak cool anomalies also persist, with some parts of the sub-surface up to two degrees cooler than average.

### Anomalous SST

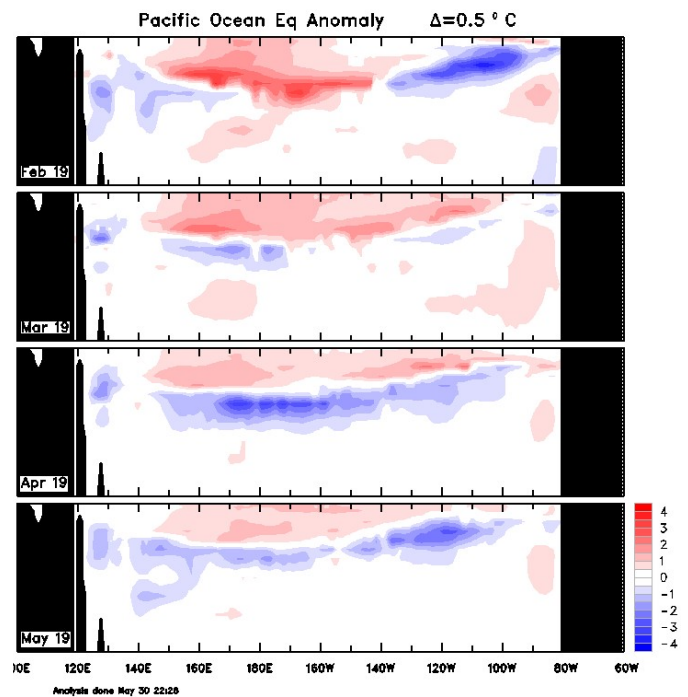
TAO/TRITON 5-Day Temperature (°C)  
 End Date: June 2 2019 2°S to 2°N Average  
 140°E 160°E 180° 160°W 140°W 120°W 100°W



TAO Project Office/PMEL/NOAA

Jun 3 2019

### Mean SST

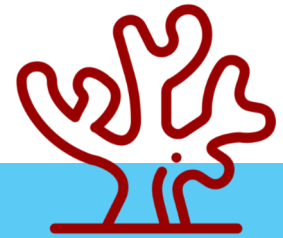


Bureau of Meteorology Sea Temperature Analysis: <http://www.bom.gov.au/marine/sst.shtml>

TAO/TRITON Data Display: <http://www.pmel.noaa.gov/tao/jsdisplay/>



# OCEAN CONDITIONS



## CORAL BLEACHING

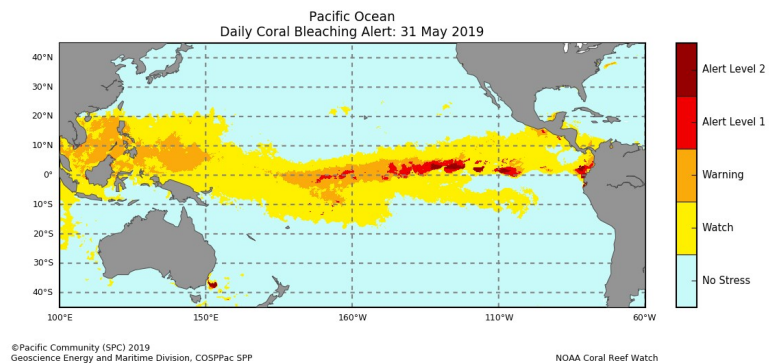
The daily Coral Bleaching Alert for 31 May 2019 shows Alert level 1 and warning for Kiribati and northern Cook Islands while remainder of the region is on watch alert or no stress. The Coral Bleaching Outlook for 02 June shows Alert level 1 and warning over Kiribati and Palau. significant effect on rainfall patterns across the tropics during this period.

### Daily Coral Bleaching Alert

About Coral Bleaching:

<http://oceanportal.spc.int/portal/app.html#coral>

[about\\_coralbleaching.pdf](#)

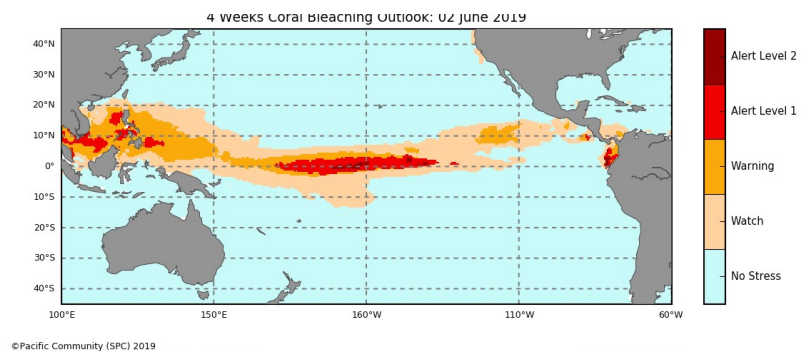


### 4-Weeks Coral Bleaching Outlook

Pacific Community COSPPac

Ocean Portal:

<http://oceanportal.spc.int/portal/app.html#coral>



# OCEAN CONDITIONS



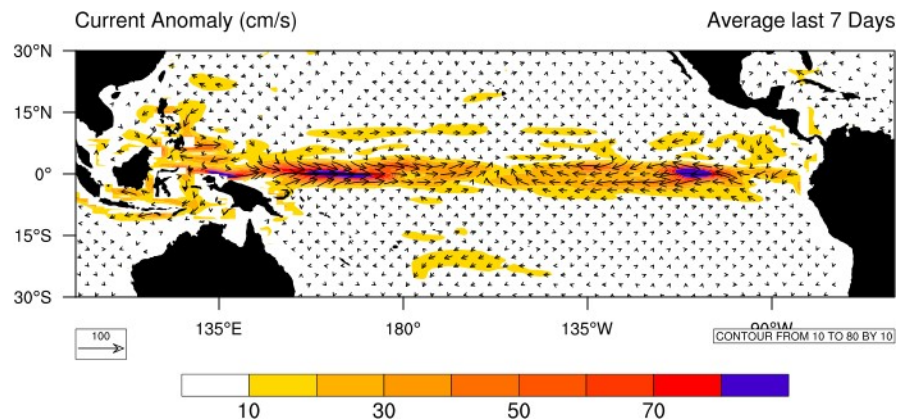
## OCEAN SURFACE CURRENTS AND SEA LEVEL

The most recent seven-day ocean surface currents plot shows a stronger than normal westward flowing Equatorial Counter Current in the eastern equatorial Pacific. Stronger than normal eastward flowing South Equatorial counter current from the western and central Pacific.

Sea level in May was higher than normal in the equatorial and most of the south Pacific. Sea level was more than 20 cm above normal around Marshall Islands and east of Samoa. Sea level was below normal over the Coral Sea region just north of Palau.

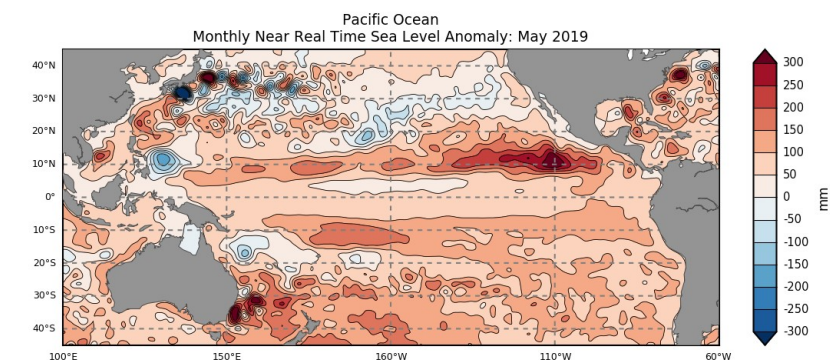
### Ocean Surface Currents (Last 7-Days)

Bureau of Meteorology POAMA  
[http://poama.bom.gov.au/  
ocean\\_monitoring.shtml](http://poama.bom.gov.au/ocean_monitoring.shtml)



### Monthly Sea Level Anomalies

Pacific Community COSPPac Ocean Portal:  
[http://oceanportal.spc.int/portal/  
app.html#sealevel](http://oceanportal.spc.int/portal/app.html#sealevel)



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Geoscience Energy and Maritime Division, COSPPac SPP

AVISO Ssalto/Duacs SLA

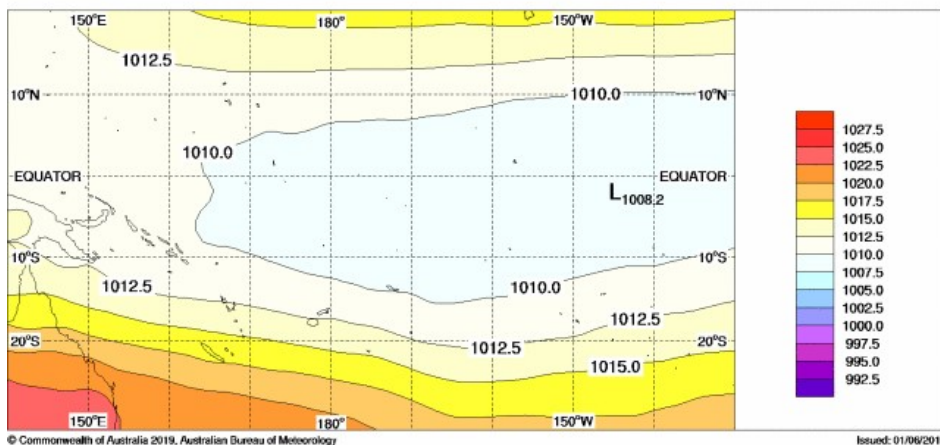
# MEAN SEA LEVEL PRESSURE

The May mean sea level pressure (MSLP) anomaly map shows negative anomalies less than -1 hPa around and to the east of Samoa. Positive anomalies greater than +1 hPa were present in the western Pacific especially over western and central Federated States of Micronesia in the north Pacific and west of New Caledonia, Vanuatu, Solomon Islands, Papua New Guinea and Queensland, Australia in the south Pacific.

Areas of above (below) average MSLP usually coincide with areas of suppressed (enhanced) convection and rain throughout the month.

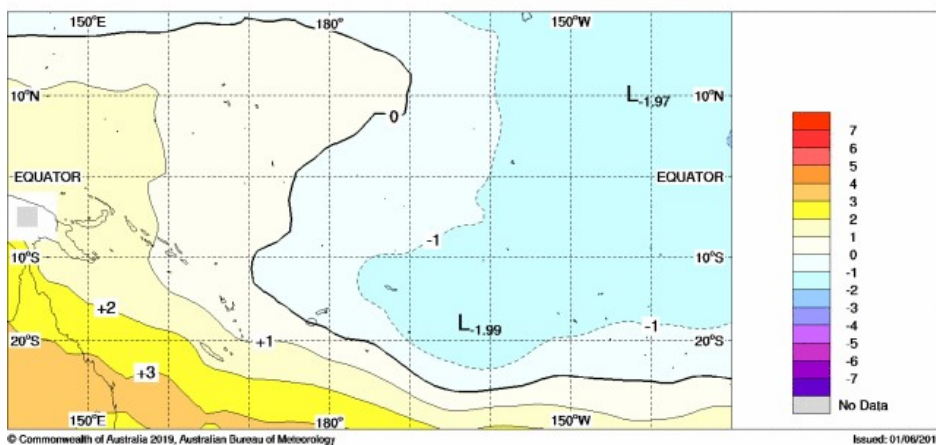
MSLP 2.5X2.5 ACCESS OP. ANAL. (hPa) 20190501 0000 20190531 0000

## Mean



## Anomalous

MSLP 2.5X2.5 ACCESS OP. ANAL.-NCEP2 (hPa) 20190501 0000 20190531 0000



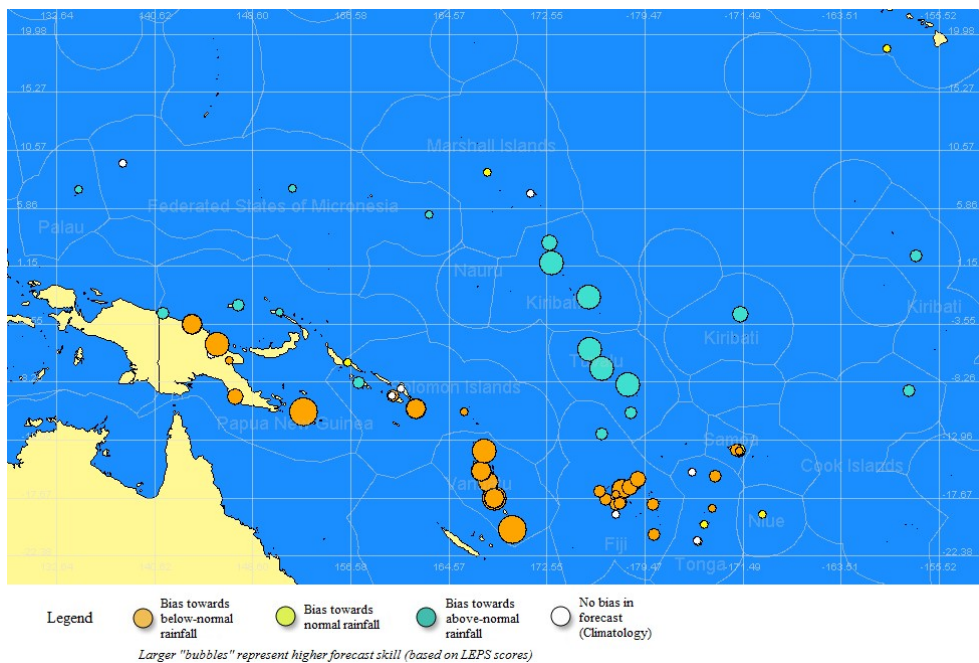
Bureau of Meteorology South Pacific Circulation Patterns: <http://www.bom.gov.au/cgi-bin/climate/cmb.cgi?variable=mslp&area=spac&map=anomaly&time=latest>

# SEASONAL RAINFALL OUTLOOK



June—August 2019

SCOPIIC and the APEC Climate Center multi-model favour below-normal rainfall for most of mainland Papua New Guinea, eastern Solomon Islands, Vanuatu, mainland Fiji and central Tonga. Above-normal rainfall totals are most likely for Nauru, Kiribati, Tuvalu, Rotuma (Fiji) and the northern Cook Islands. The models disagree elsewhere.



'About SCOPIIC' [www.pacificmet.net/project/climate-and-ocean-support-program-pacific-cosppac](http://www.pacificmet.net/project/climate-and-ocean-support-program-pacific-cosppac)

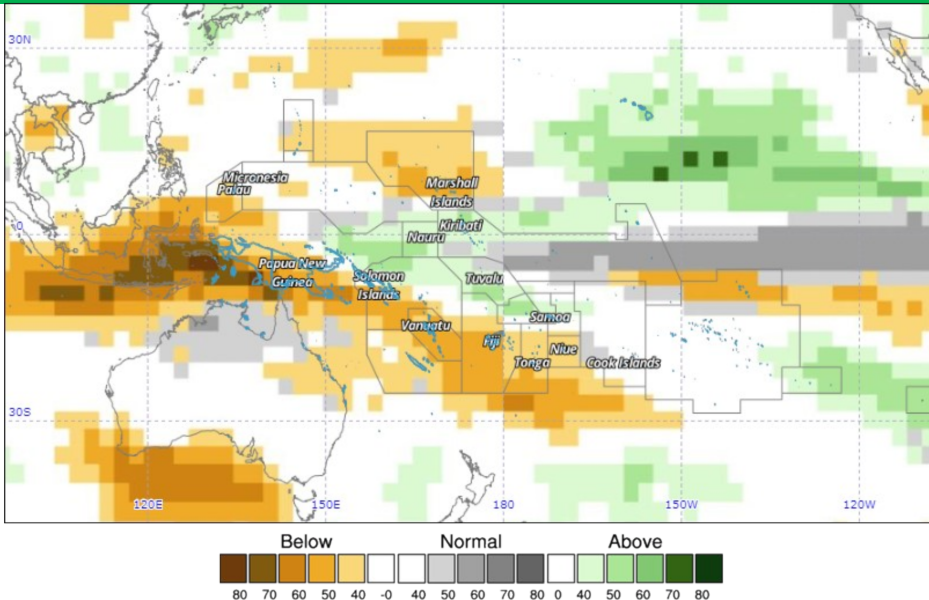
COSPPac Online Climate Outlook Forum: <https://www.pacificmet.net/products-and-services/online-climate-outlook-forum>



# SEASONAL RAINFALL OUTLOOK



June—August 2019



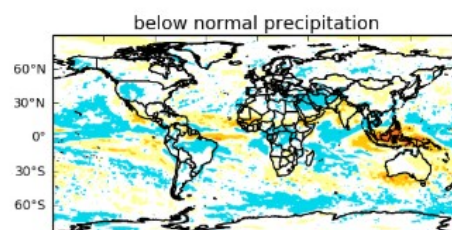
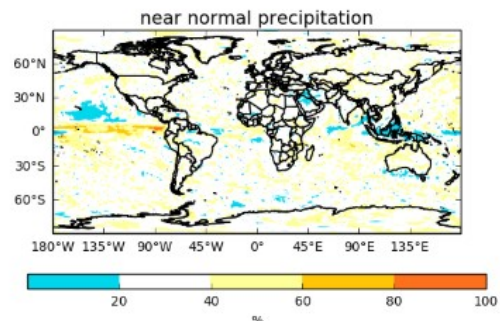
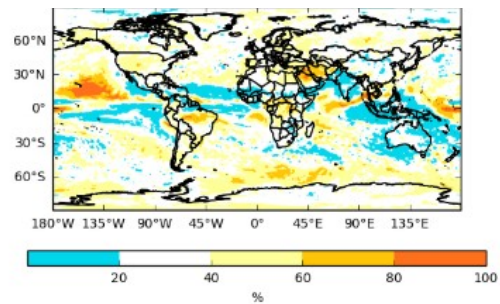
APEC Climate Information Toolkit for the Pacific: <http://clikp.sprep.org/>

Year: 2019, Season: JJA, Lead Month: 3, Method: GAUS  
Model: APCC, CWB, MSC, NASA, NCEP, PNU, POAMA  
Generated using CLIK® (2019-6-1)

## UKMO Pacific region tercile categories

<http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/glob-seas-prob>

© APEC Climate Center



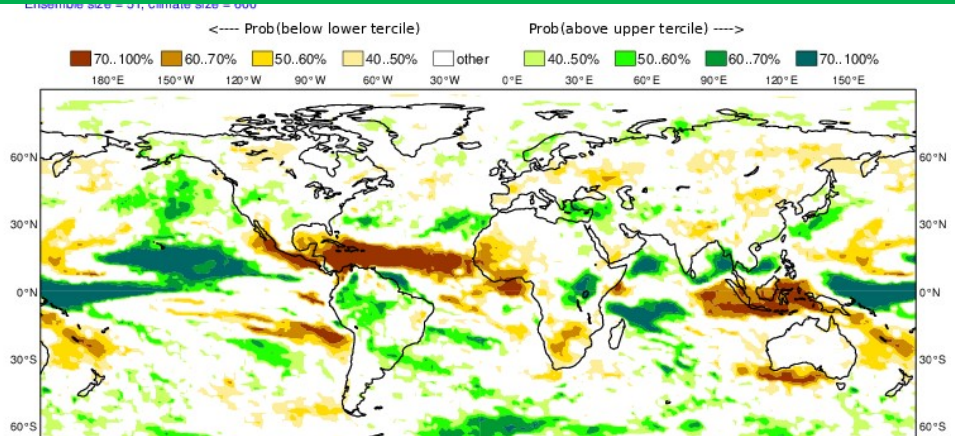


# SEASONAL RAINFALL OUTLOOK



June—August 2019

## ECMWF Tropics tercile summary



<http://www.ecmwf.int/en/forecasts/charts/catalogue/>

### Individual Model Links

UKMO Global long-range model probability maps: <http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/glob-seas-prob>

ECMWF Rain (Public charts) - Long range forecast: <http://www.ecmwf.int/en/forecasts/charts/seasonal/rain-public-charts-long-range-forecast>

POAMA Pacific Seasonal Prediction Portal: <http://poama.bom.gov.au/experimental/pasap/index.shtml>

APEC Climate Center (APCC): <http://www.apcc21.org/eng/service/6mon/ps/japcc030703.jsp>

NASA GMAO GEOS-5: <http://gmao.gsfc.nasa.gov/research/ocean/>

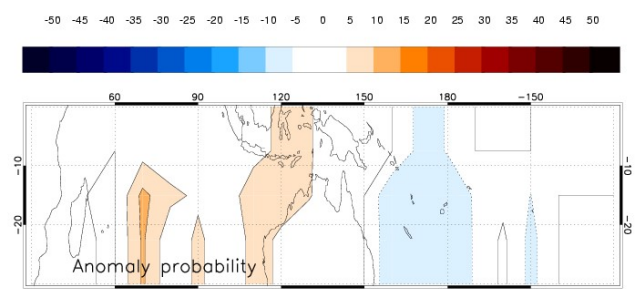
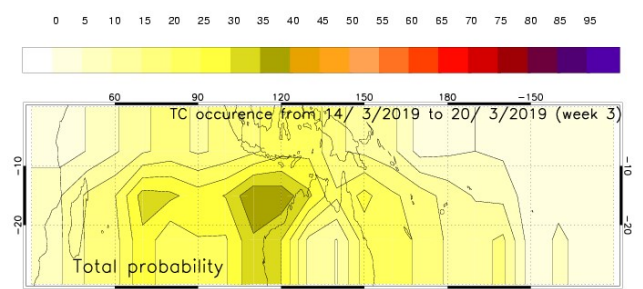
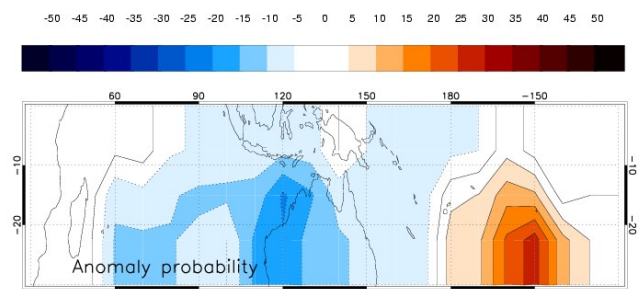
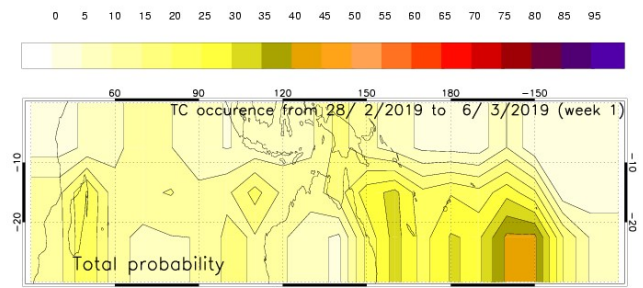
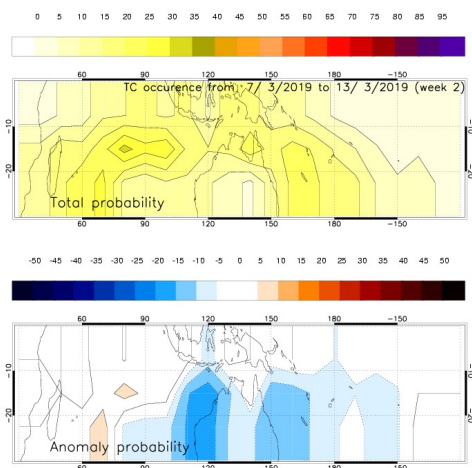
NOAA CFSv2: <http://www.cpc.ncep.noaa.gov/products/CFSv2/CFSv2seasonal.shtml>

IRI for Climate and Society: <http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/>

# CYCLONES & OTHER INFORMATION



Nine tropical cyclones (Liaa, Owen, Penny, Mona, Neil, Oma, Pola and Trevor and Ann) formed in the 2018-19 south Pacific (east of the tip of Cape York, Queensland) cyclone season. These cyclones affected Australia, PNG, Solomon Islands, Nauru, New Caledonia, Vanuatu, Tuvalu, Fiji, Tonga, Samoa and Niue. The long-term average for the period 1969-70 to 2017-18 is nine cyclones. The official cyclone season ended on 30 April 2019. When out-of-season cyclones develop, they tend to do so when an El Niño event exist. Weekly tropical cyclone forecasts from the Meteo France will resume in October 2019.



## Individual Model Links

UKMO Global long-range model probability maps: <http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/glob-seas-prob>

ECMWF Rain (Public charts) - Long range forecast: <http://www.ecmwf.int/en/forecasts/charts/seasonal/rain-public-charts-long-range-forecast>

POAMA Pacific Seasonal Prediction Portal: <http://poama.bom.gov.au/experimental/pasap/index.shtml>

APEC Climate Center (APCC): <http://www.apcc21.org/eng/service/6mon/ps/japcc030703.jsp>

NASA GMAO GEOS-5: <http://gmao.gsfc.nasa.gov/research/ocean/>

NOAA CFSv2: <http://www.cpc.ncep.noaa.gov/products/CFSv2/CFSv2seasonal.shtml>

IRI for Climate and Society: <http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/>

# OTHER INFORMATION

## Further Information:

### Southern Oscillation Index

The Southern Oscillation Index, or SOI, gives an indication of the development and intensity of El Niño and La Niña events across the Pacific Basin. The SOI is calculated using the difference in air pressure between Tahiti and Darwin. Sustained negative values of the SOI below  $-7$  often indicate El Niño episodes. These negative values are usually accompanied by sustained warming of the central and/or eastern tropical Pacific Ocean, and a decrease in the strength of the Pacific Trade Winds. Sustained positive values of the SOI greater than  $+7$  are typical of La Niña episodes. They are associated with stronger Pacific Trade Winds and sustained cooling of the central and eastern tropical

### Multivariate ENSO Index (MEI)

The Climate Diagnostics Center Multivariate ENSO Index (MEI) is derived from a number of parameters typically associated with El Niño and La Niña. Sustained negative values indicate La Niña, and

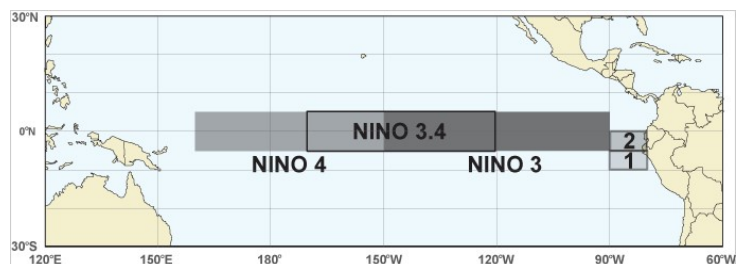
### 20 degrees Celsius Isotherm Depth

The 20°C Isotherm Depth is the depth at which the water temperature is 20°C. This measurement is important, as the 20°C isotherm usually occurs close to the thermocline, the region of most rapid change of temperature with depth, or the division between the mixed surface layer and deep ocean. A deeper than normal 20°C isotherm (positive anomaly) implies a greater heat content in the upper ocean, whilst a shallower 20°C isotherm (negative anomaly) implies a lower than normal heat con-

### Regions

SST measurements may refer to the NINO1, 2, 1+2, 3, 3.4 or 4 regions. These descriptions simply refer to the spatially averaged SST for the region described. The NINO regions (shown in the figure

Region	Latitude	Longitude
NINO1	5-10°S	80-90°W
NINO2	0-5°S	80-90°W
NINO3	5°N to 5°S	150-90°W
NINO3.4	5°N to 5°S	120-170°W
NINO4	5°N to 5°S	160°E to 150°W



NOTE: NINO1+2 is the combined areas 1 and 2