

Monthly Climate Bulletin

September 2019



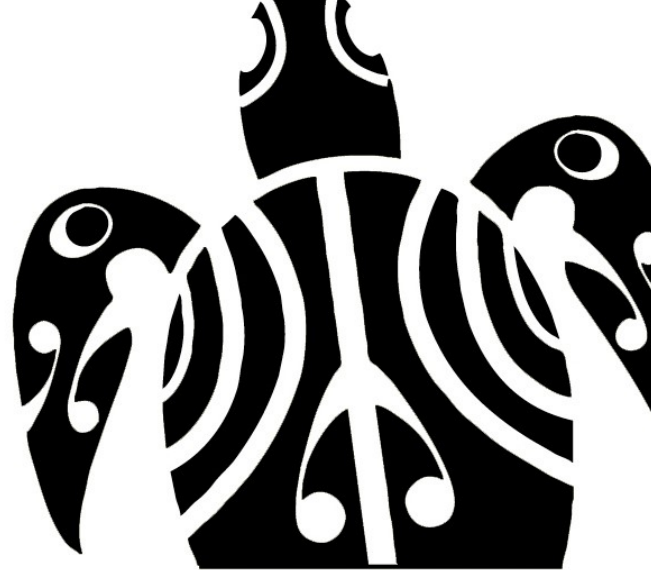
Australian Government
Department of Foreign Affairs and Trade
Bureau of Meteorology



Climate and Oceans Support
program in the Pacific



Pacific
Community
Communauté
du Pacifique



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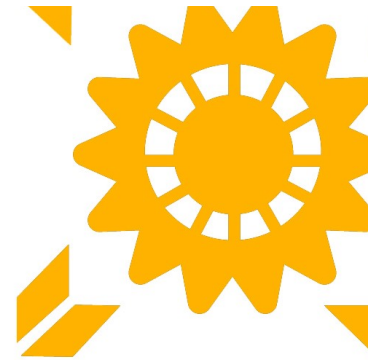
Issued 08 September 2019

- In the tropical Pacific Ocean, the El Niño Southern Oscillation (ENSO) remains neutral. The positive Indian Ocean Dipole (IOD) has strengthened, continuing its influence on the climate of western Pacific region including Australia and other parts of the globe.
- A pulse of Madden-Julian Oscillation (MJO) currently near Africa is expected to weaken in the coming fortnight, prior to moving across the western Indian Ocean. As the MJO becomes weak, its influence on tropical rainfall diminishes.
- The Intertropical Convergence Zone (ITCZ) was either weaker than normal on the equator side of ITCZ or the ITCZ was \ displaced north of its normal position. Extending southeast from Solomon Islands was the South Pacific Convergence Zone (SPCZ) which was more active than normal to about Samoa. There was below normal cloud cover over parts of Papua New Guinea, Marshall Islands, Nauru, Tuvalu and Kiribati.
- Sea level in September was higher than normal in the equatorial and most of the south Pacific. Most COSPPac countries also experienced positive sea level anomalies. PNG however experienced sea level within 50mm of normal. The main region of the positive anomalies was along the equator to 10°N, which saw the largest positive anomalies of 200-250mm in the Marshall Islands. Similarly, Nauru, Kiribati, Tuvalu, Samoa, Niue and the Cook Islands observed anomalies of +100-150mm.
- For October to December 2019, the SCOPIC and the APEC Climate Centre multi-model favour below-normal rainfall for Palau, western and central Federated State of Micronesia, northwest and southeast mainland Papua New Guinea and southern Vanuatu.

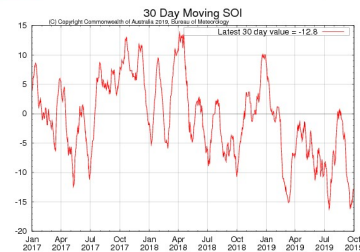
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EL NIÑO–SOUTHERN OSCILLATION



Positive Indian Ocean Dipole strengthens as ENSO remains neutral



ENSO Wrap-Up issued on 01 October 2019

In the tropical Pacific Ocean, the El Niño Southern Oscillation (ENSO) remains at neutral. The positive Indian Ocean Dipole (IOD) has strengthened, continuing its influence on the climate of western Pacific region including Australia and other parts of the globe.

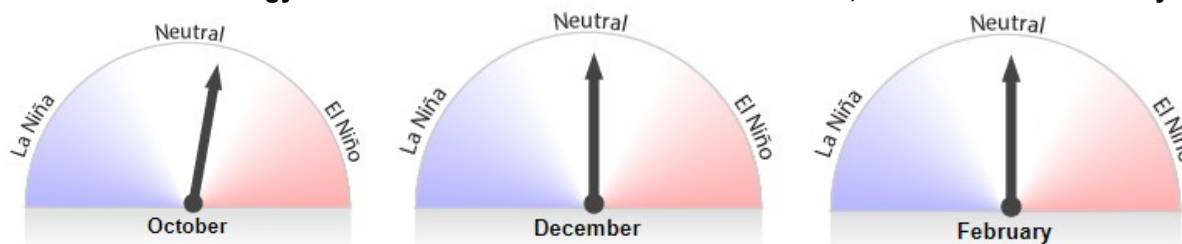
The very strong positive Indian Ocean Dipole event persists, characterised by cooler waters to the northwest of Australia and warmer waters further west. Values of the IOD index over the past fortnight have strengthened, and the latest value of +1.76 °C is the strongest positive weekly value since at least 2001.

All international climate models surveyed by the Bureau indicate the positive IOD is likely to persist at least until the end of the southern hemisphere spring (September to November). At the beginning of summer (December), the IOD pattern normally breaks down as the Monsoon Trough migrates into the southern hemisphere.

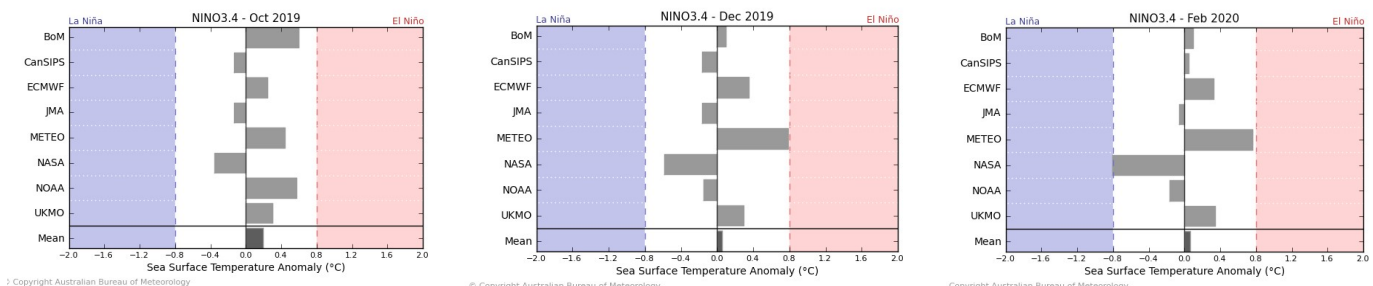
Most atmospheric indicators are neutral, although the Southern Oscillation Index (SOI) is negative due to very high atmospheric pressures at Darwin. International climate models forecast neutral ENSO for the remainder of 2019, and into early 2020. Usually ENSO neutral has little effect on Pacific climate, meaning other influences are more likely to dominate.

The approximate 30-day and 90-day Southern-Oscillation Index (SOI) values to 5 October were -12 and -9 respectively.

Bureau of Meteorology NINO3.4 ENSO Model Outlooks for October, December and February



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

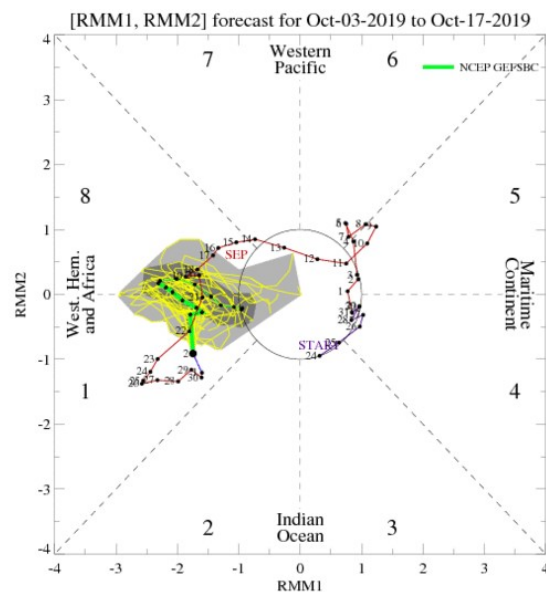
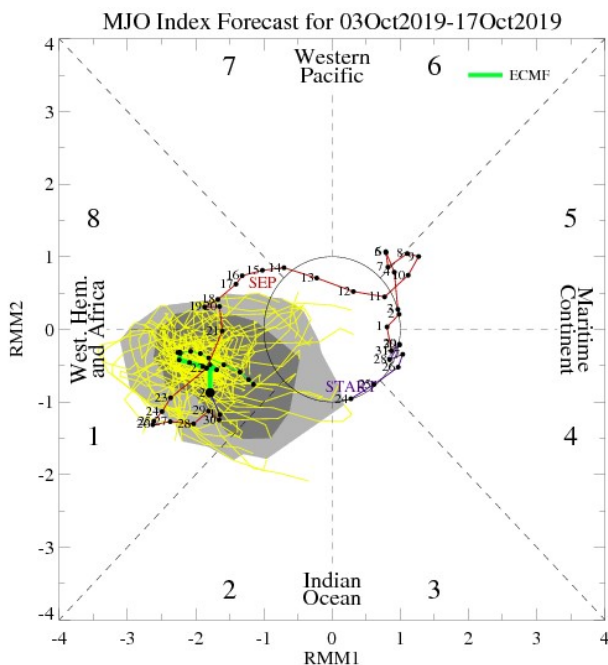
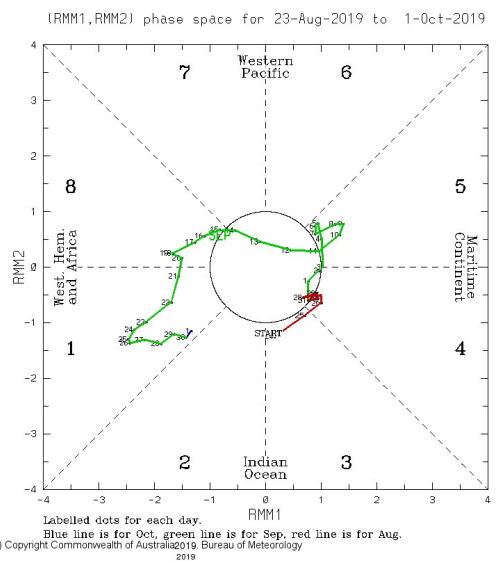


Weekly Tropical Note [Issued on Tuesday 01 October 2019]

A pulse of Madden-Julian Oscillation (MJO) currently near Africa is expected to weaken in the coming fortnight, prior to moving across the western Indian Ocean. As the MJO becomes weak, its influence on tropical rainfall diminishes.

Rainfall across the Maritime Continent appears likely to be influenced by the forecast development of a tropical trough. This is a result of seasonal changes, related to the movement of troughs and deep convection from the northern to southern hemisphere. The trough is expected to extend across Papua New Guinea and northern Indonesia, potentially enhancing rainfall across these regions in the coming weeks.

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

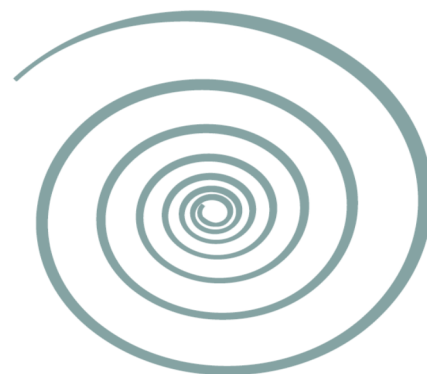


This is an abbreviated version of the Weekly Tropical Note. Click on the link below for the full version.

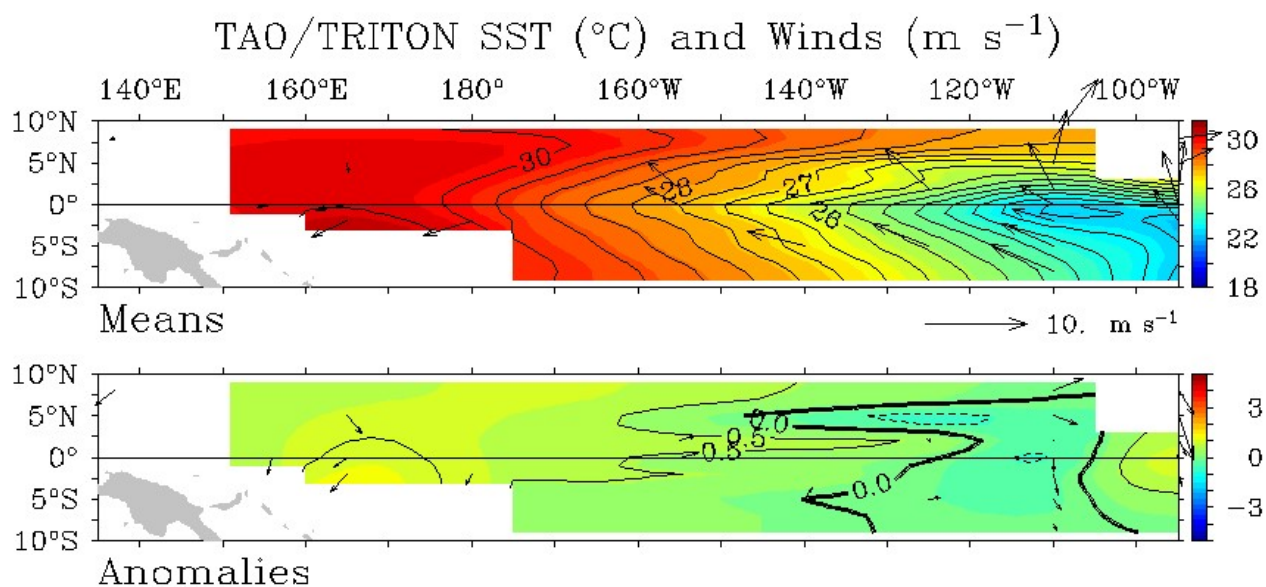
Bureau of Meteorology Weekly Tropical Climate
Note Page: <http://www.bom.gov.au/climate/tropical-note/>

WIND

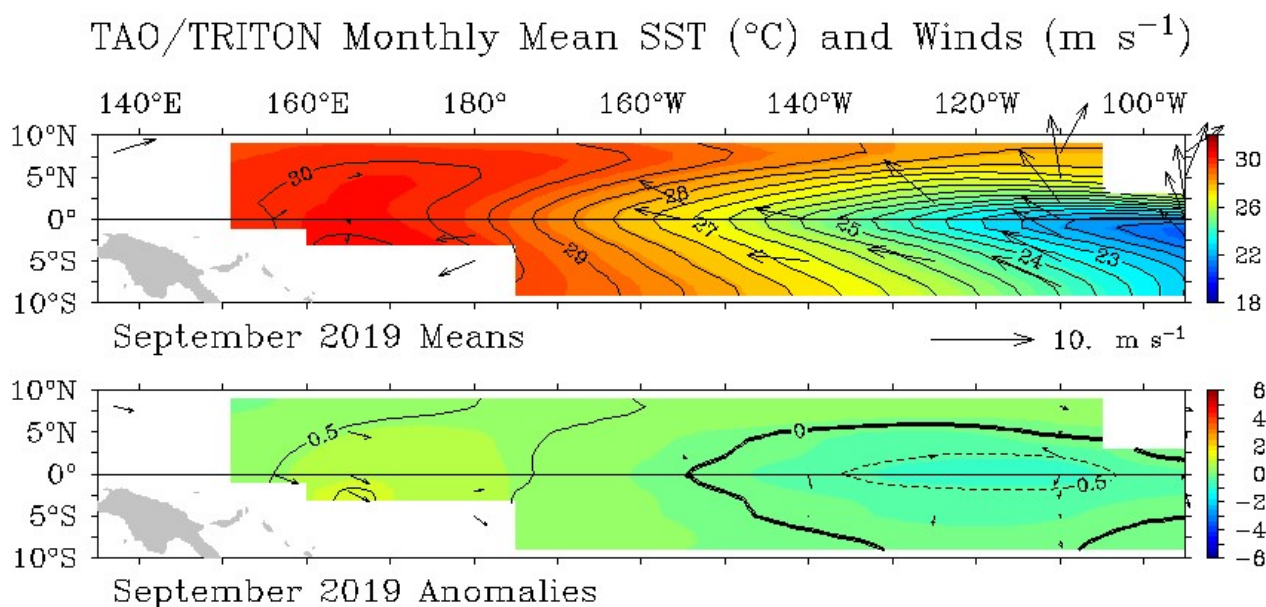
The equatorial trade winds for the month of September were near normal across most of the equatorial Pacific with westerlies anomalies in the far western Pacific. The 5-day snapshot ending 29 September shows the trade winds were near normal across equatorial Pacific.



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.



Five-Day Mean Ending on October 2 2019



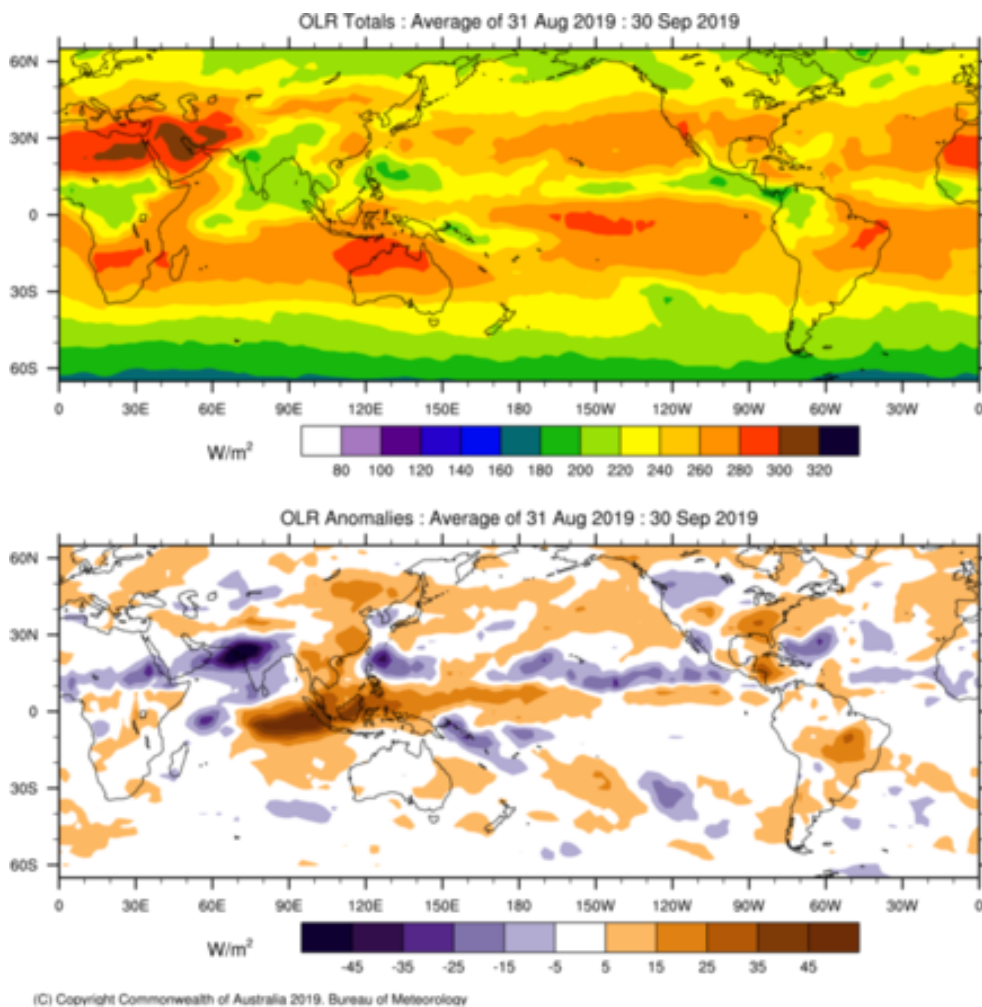
CLOUD AND RAINFALL



The September 30-day OLR and NOAA NCEP CAMP total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was either weaker than normal on the equator side of the ITCZ or the ITCZ was displaced north of its normal position. Extending southeast from Solomon Islands was the South Pacific Convergence Zone (SPCZ) which was more active than normal to about Samoa. There was below normal cloud cover over parts of Papua New Guinea, Marshall Islands, Nauru, Tuvalu and Kiribati.

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.

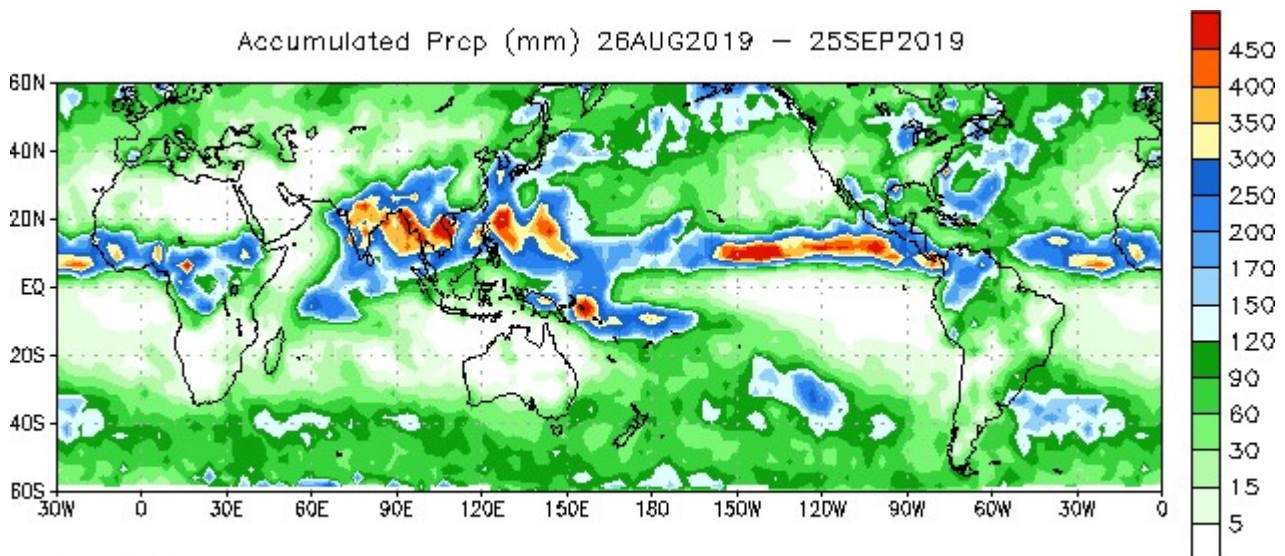
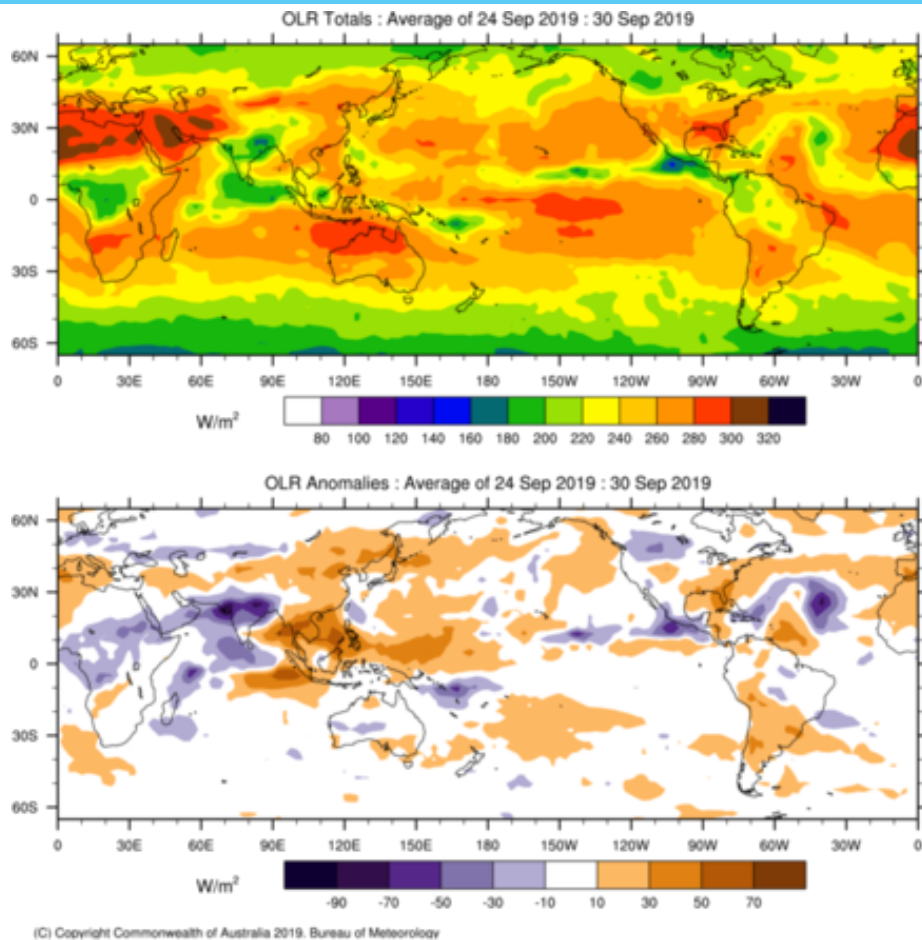
OLR Total and Anomalies, 30 Day OLR



CLOUD AND RAINFALL



OLR Total and Anomalies, 7 Day OLR

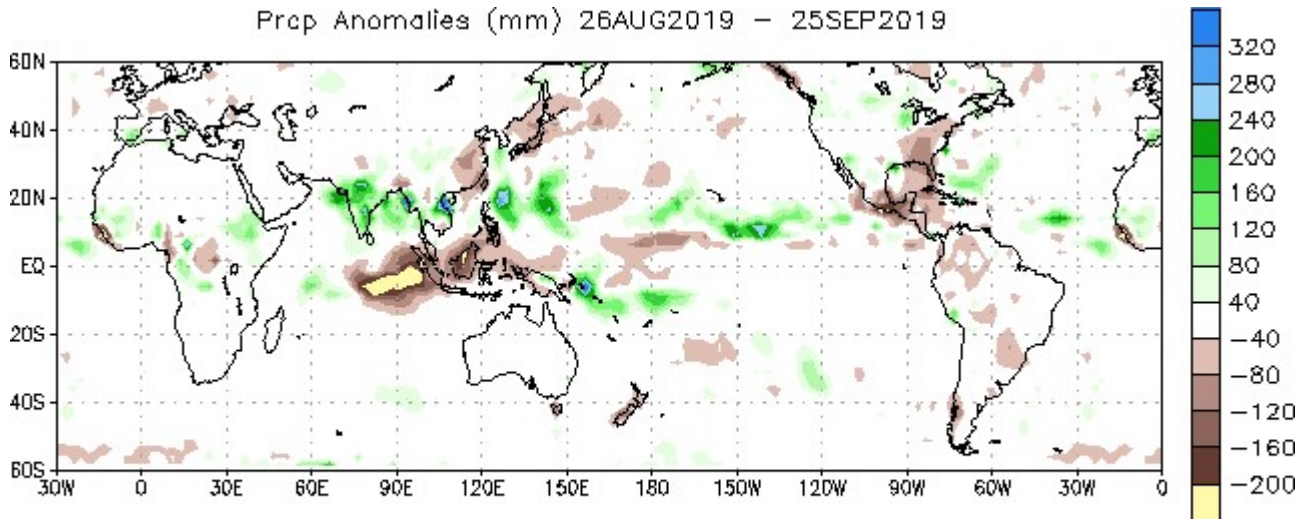


Data Source: NCEP CMAP Precipitation

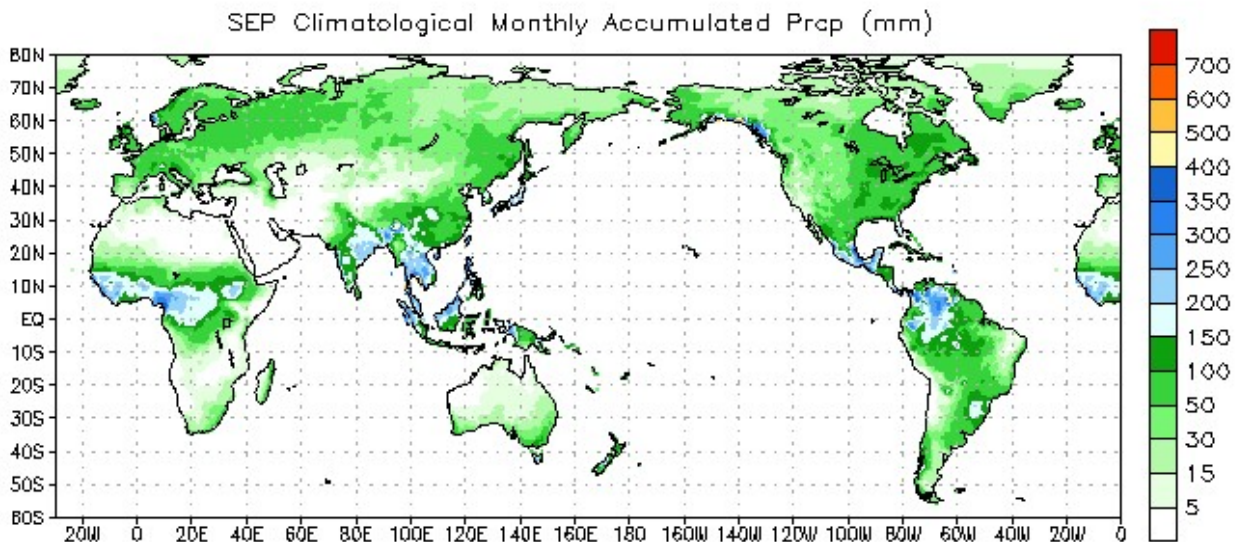
CLOUD AND RAINFALL



30-Day Rainfall Anomalies



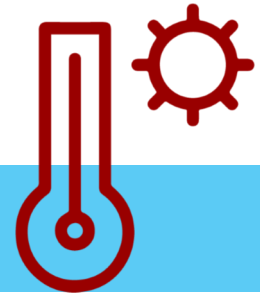
Data Source: NCEP CMAP Precipitation
Climatology (1979–1995)



Data Source: CPC Unified (gauge-based) Precipitation
Climatology (1979–1995)

https://www.cpc.ncep.noaa.gov/products/Global_Monsoons/Figures/curr.p.30day.figb.gif

OCEAN CONDITIONS



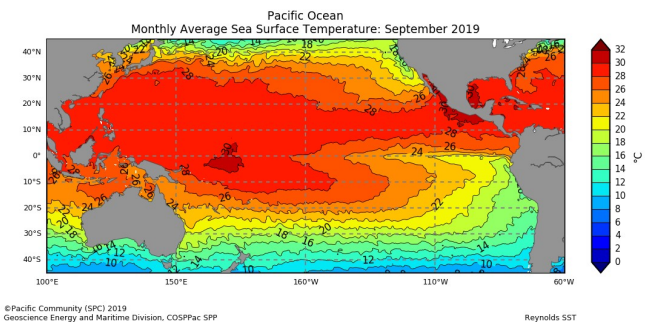
SEA SURFACE TEMPERATURE

Sea surface temperatures (SSTs) for September were warmer than average in the central tropical Pacific Ocean, and cooler than average in some parts of the eastern and western equatorial Pacific, extending into the south Pacific close to South America and Vanuatu.

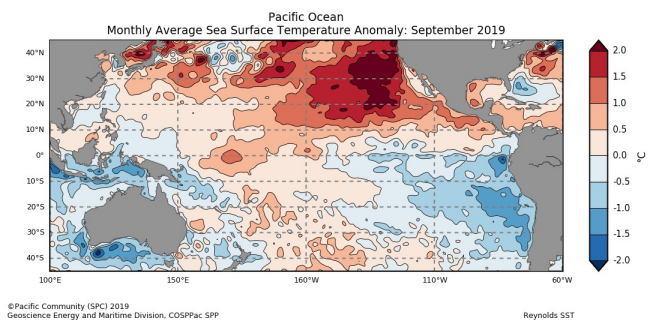
SSTs were warmer than average across most COSPPac countries including most of Australia's east, with this warmth extending across the Tasman Sea and well to the east of New Zealand, although anomalies were lower than during August. Kiribati, Nauru and northern Tonga group experienced positive anomalies of up to 1.0°C while weak negative anomalies affected parts of Palau, northern Australia, PNG, the Solomon Islands, Vanuatu, New Zealand, northern Cook Islands and the eastern tropical Pacific. SSTs for the three NINO regions has warmed in September, and are in the ENSO neutral range for all NINO regions. The September SST anomalies for the NINO3, NINO3.4 and NINO4 regions were +0.1 °C, +0.2 °C and +0.8 °C, respectively.

The SST decile map for September shows a small region of deciles 8 to 9 in the central equatorial Pacific extending to north and south Pacific, surrounding a large area of decile 10 affecting Nauru and Kiribati. Most of the COSPPac countries are in regions of deciles 4-7, 8-9 or 10 with exception of Palau, PNG, Solomon Islands and parts of Vanuatu, which are in low temperature record, deciles 2-3 and less.

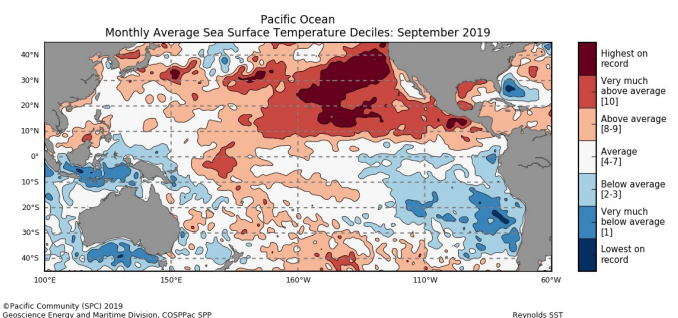
Mean SST



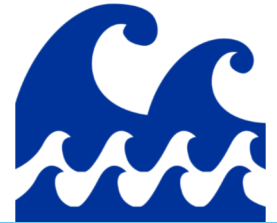
Anomalous SST



SST Deciles



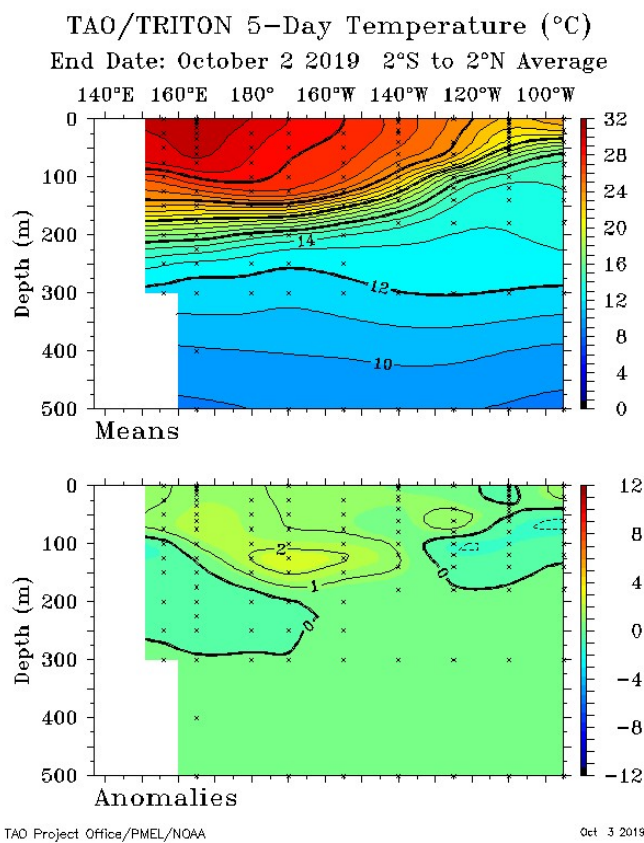
OCEAN CONDITIONS



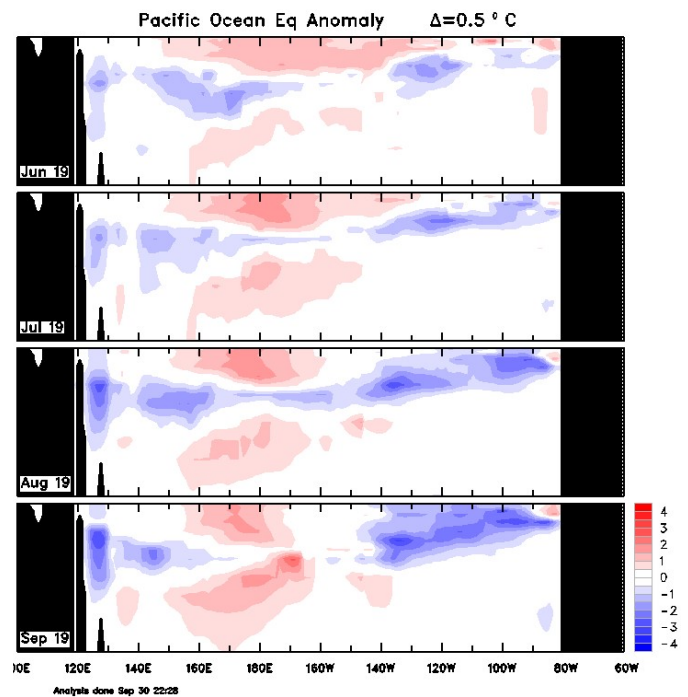
SUB SURFACE

The Bureau of Meteorology's four-month sequence of equatorial sub-surface temperature anomalies (to 28 September) shows a pattern of weak cool anomalies extending across the equatorial Pacific, at a depth of around 100 to 200 m in the west of the Basin, and 0 to 150 m depth in the east. Weak warm anomalies extend across most of the column depth between about 160 °E and 160 °W. This general pattern has been in place since July. Cool anomalies in the east have intensified in September and reach more than 3 degrees cooler than average, while warm anomalies in the west are weaker, reaching up to 2 degrees warmer than average.

Weekly Temperatures Mean and Anomalies



Monthly Temperatures Anomalies

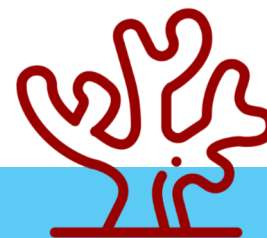


Bureau of Meteorology Sea Temperature Analysis: <http://www.bom.gov.au/marine/sst.shtml>

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



OCEAN CONDITIONS



CORAL BLEACHING

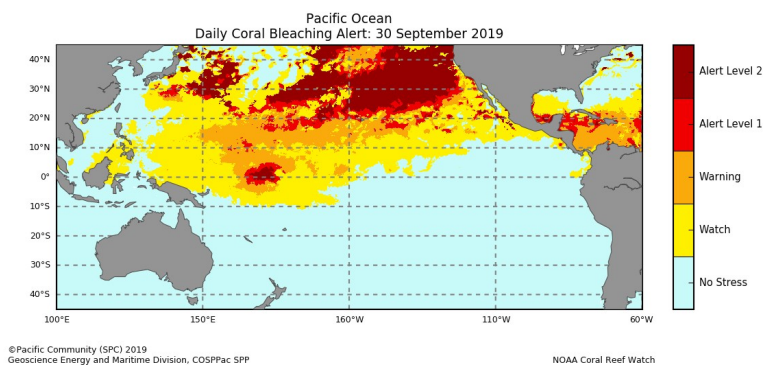
The daily Coral Bleaching Alert for 30 September 2019 shows warning areas mostly affecting eastern Federated States of Micronesia, Marshall Islands, with Nauru and Kiribati on Alert level 1 and 2. The remainder of the CO-SPPac region is on watch alert with regions south of 10° on no stress. The Coral Bleaching Outlook for 29 September shows warning area expected in eastern Federated State of Micronesia, Marshall Islands, New Guinea Islands, northern Solomon Islands, Tuvalu, Nauru and Kiribati, with a small Alert level 2 affecting the latter two.

Daily Coral Bleaching Alert

About Coral Bleaching:

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

[about_coralbleaching.pdf](#)

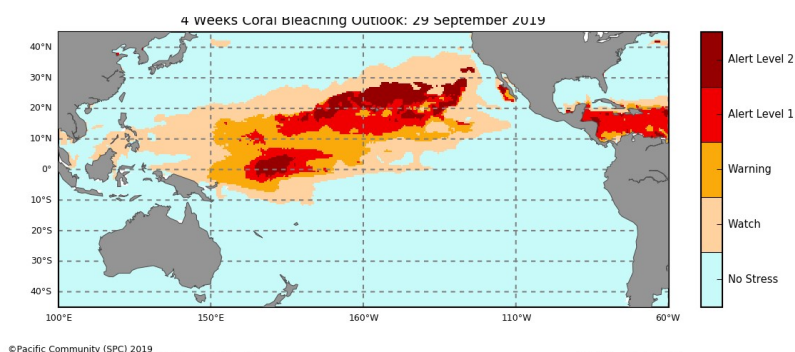


4-Weeks Coral Bleaching Outlook

Pacific Community COSPPac

Ocean Portal:

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



OCEAN CONDITIONS



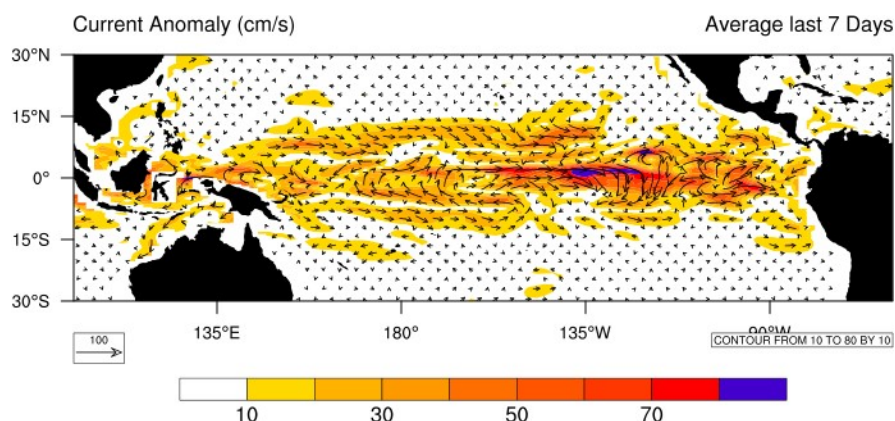
OCEAN SURFACE CURRENTS AND SEA LEVEL

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

Sea level in September was higher than normal in the equatorial and most of the south Pacific. Most COSPPac countries experienced positive sea level anomalies. PNG however experienced sea level within about 50mm of normal. The main region of the positive anomalies was along the equator to 10°N, which saw the largest positive anomalies of 200-250mm in the Marshall Islands. Similarly, Nauru, Kiribati, Tuvalu, Samoa, Niue and the Cook Islands observed anomalies of +100-150mm.

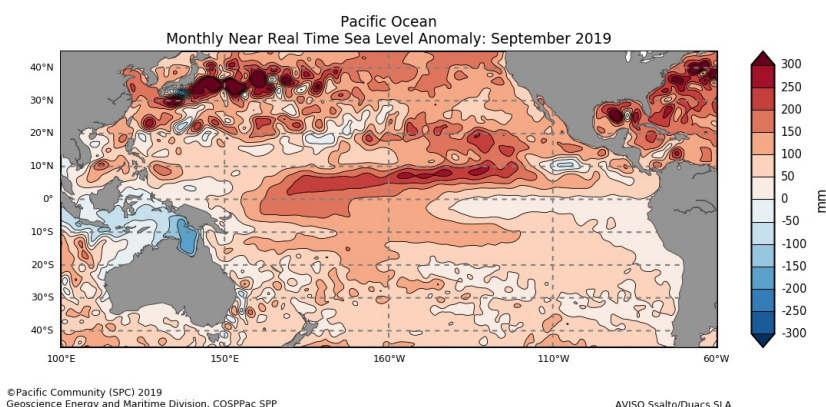
Ocean Surface Currents (Last 7-Days)

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)



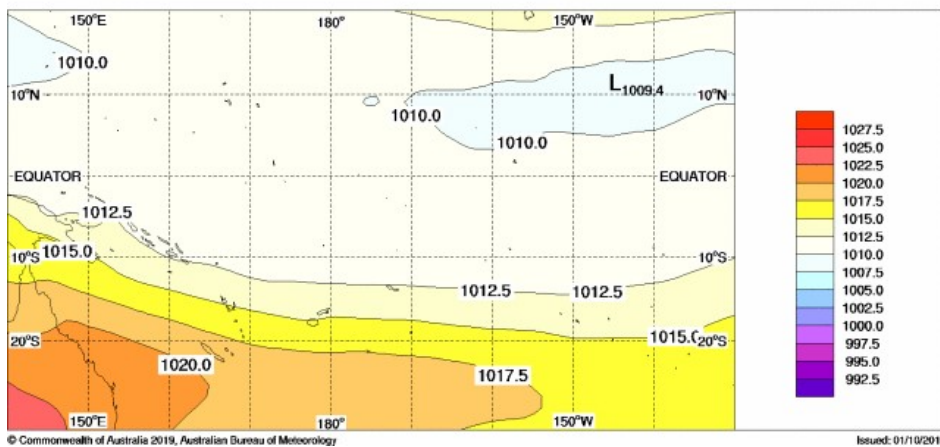
MEAN SEA LEVEL PRESSURE

The September mean sea level pressure (MSLP) anomaly map shows negative anomalies less than -1 hPa around the 150-130° W and 10-13° N. Strong positive anomalies greater than +2 hPa were present in the far western Pacific western New Caledonia, Papua New Guinea and northeast Australia.

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

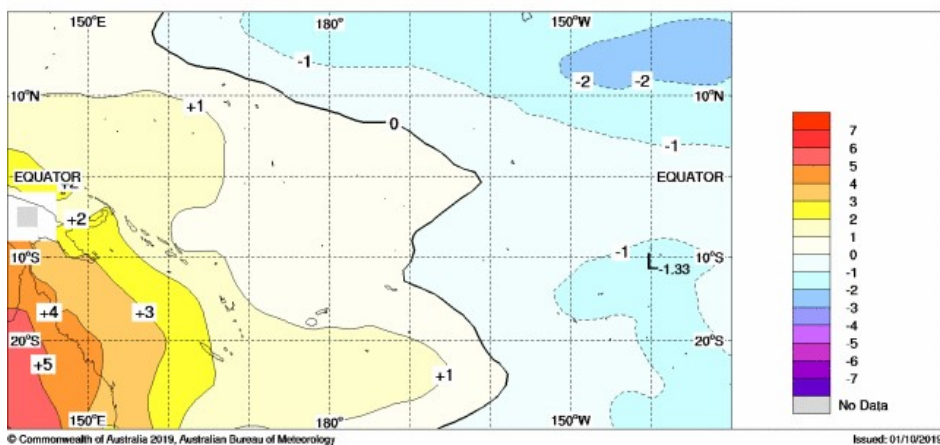
Mean

MSLP 2.5X2.5 ACCESS OP. ANAL. (hPa) 20190901 0000 20190930 0000

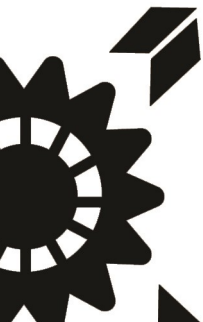


Anomalous

MSLP 2.5X2.5 ACCESS OP. ANAL.-NCEP2 (hPa) 20190901 0000 20190930 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>

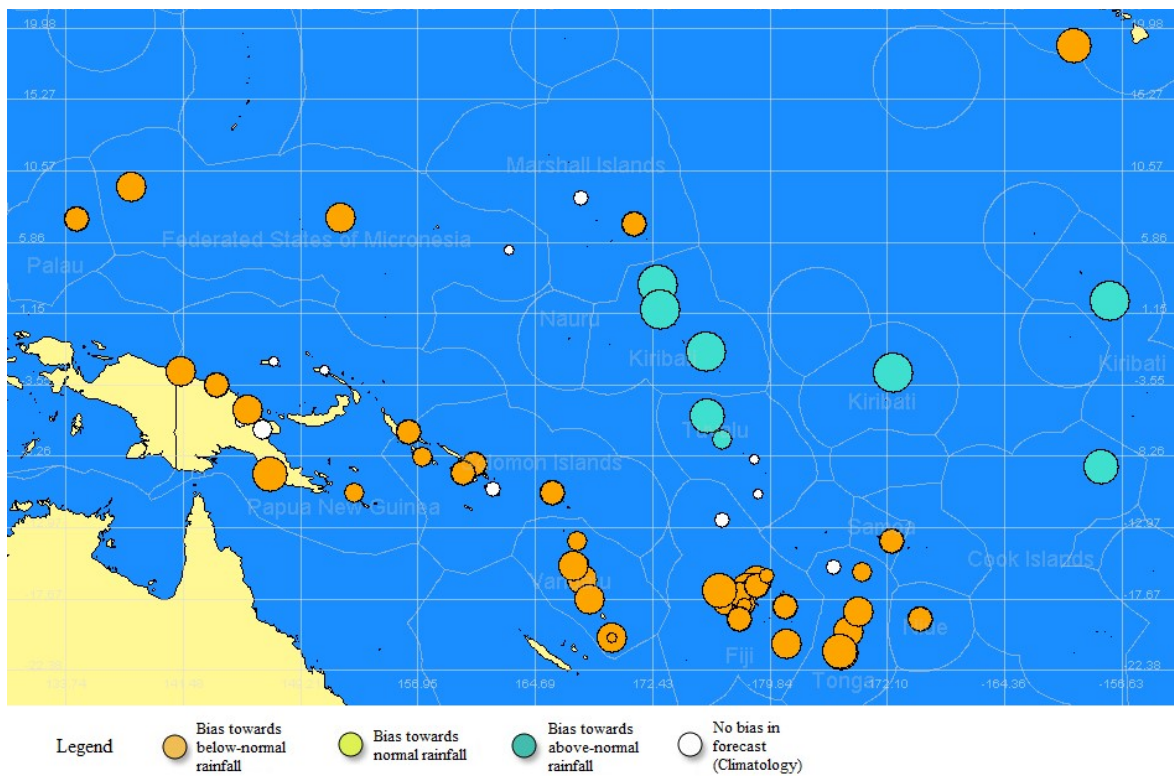


SEASONAL RAINFALL OUTLOOK



October—December 2019

SCOPIC and the APEC Climate Centre multi-model favour below-normal rainfall for Palau, western and central Federated State of Micronesia, northwest and southeast mainland Papua New Guinea and southern Vanuatu. The model disagree elsewhere.



'About SCOPIC' www.pacificmet.net/project/climate-and-ocean-support-program-pacific-cosppac

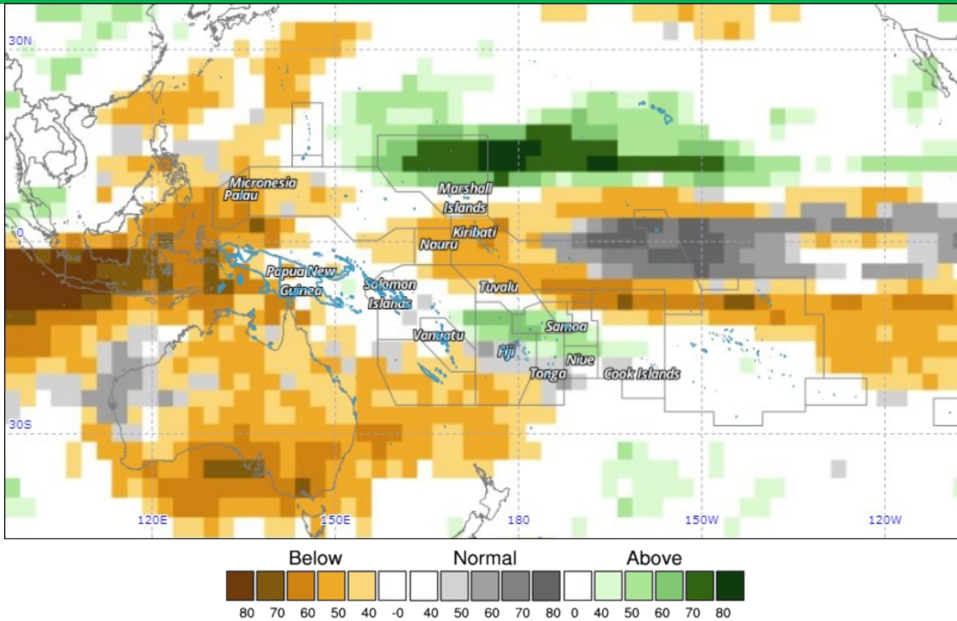
COSPPac Online Climate Outlook Forum: <https://www.pacificmet.net/products-and-services/online-climate-outlook-forum>



SEASONAL RAINFALL OUTLOOK



October—December 2019



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

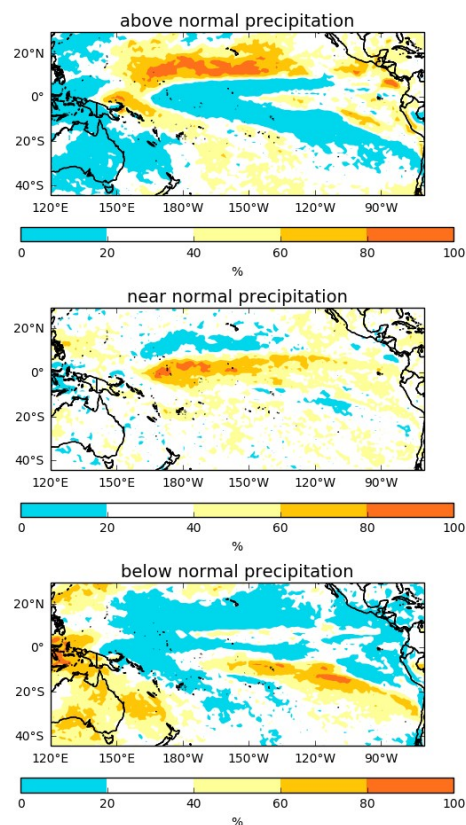
Year: 2019, Season: OND, Lead Month: 3, Method: GAUS
Model: APCC, NASA, NCEP, PNU, POAMA
Generated using CLIK® (2019-10-3)

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Probability of tercile categories Oct/Nov/Dec Issued September 2019

UKMO Pacific region tercile categories

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

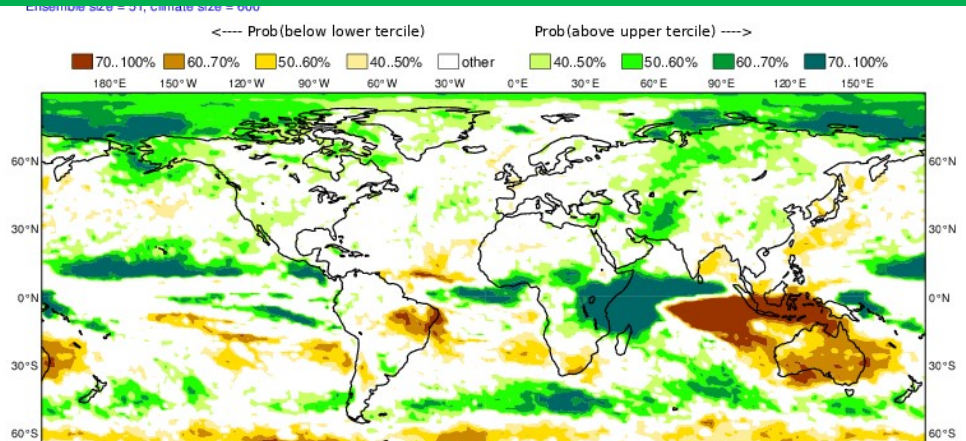


SEASONAL RAINFALL OUTLOOK



October—December 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/>

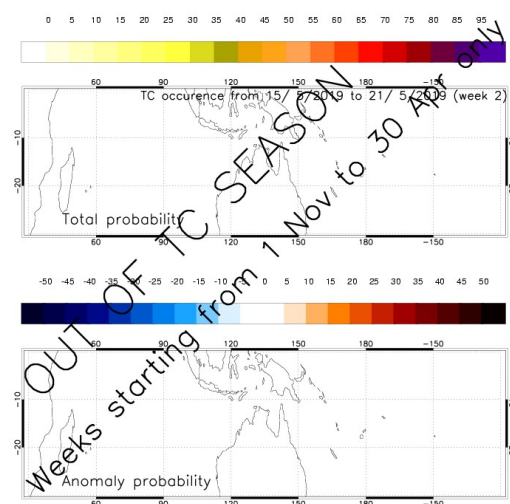
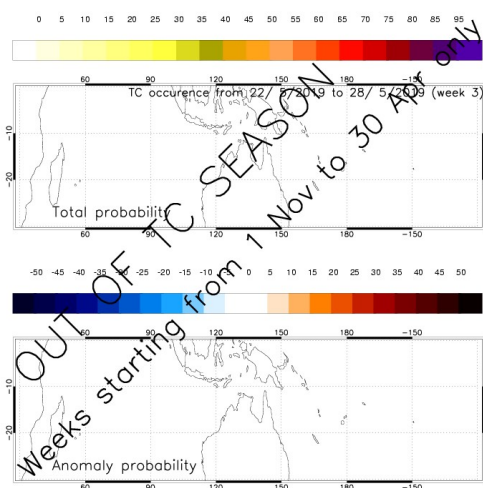
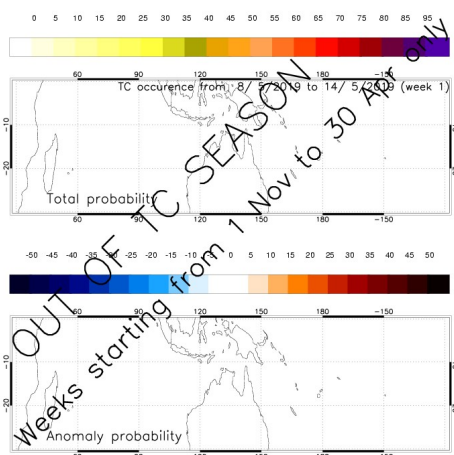
CYCLONES & OTHER INFORMATION



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.

The tropical cyclone season outlook for 2018-19 is available via: <http://www.bom.gov.au/climate/cyclones/south-pacific/>

MeteoFrance Tropical Cyclone Weekly Fore-



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

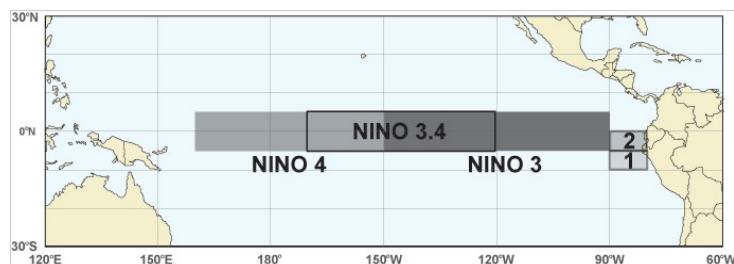
20 degrees Celsius Isotherm Depth

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