

Monthly Climate Bulletin

April 2020





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SUMMARY

Issued 08 May 2020

- The tropical Pacific Ocean remains neutral with respect to the El Niño Southern Oscillation (ENSO) with negative Indian Ocean Dipole phase possible in mid-2020. International climate models forecast ENSO-neutral until July 2020.
- A moderate to strong pulse of the Madden Julian Oscillation (MJO) has moved into Maritime Continent longitudes, to the north of Australia. The pulse is likely to weaken in the coming days and become indiscernible within a week.
- The Intertropical Convergence Zone (ITCZ) was marginally weak than normal in the western Pacific, shifted slight north and extended further east than normal. The South Pacific Convergence Zone (SPCZ) was enhanced and shifted south of its normal position over Vanuatu, Fiji, Tonga, Samoa and Niue resulting in higher than normal rainfall for these islands.
- Sea level in April was higher than normal in the central and eastern equatorial Pacific while some countries in the south and north Pacific experienced lower than normal sea level.
- The Coral Bleaching Alert for early May shows a region of potential bleaching spanning northern Fiji and Samoa. Areas of Warning exist around northern PNG, Palau and FSM. The Coral Bleaching Outlook for May favours bleaching persisting around Samoa. Bleaching is also favoured around PNG, Solomon Islands, Fiji, Samoa and the northern Cook Islands.
- For May to July 2020, a majority of the models used in this summary favour below normal rainfall for Nauru, northern Tuvalu and Kiribati. Warmer than average maximum and minimum temperatures are favoured for all the COSPPac countries except for Kiribati with near average temperature close to the equator.
- Eight tropical cyclones formed in the southwest Pacific region including four severe cyclones. Harold was one of the most intense cyclones to make landfall in the Pacific Islands in April.

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EL NIÑO–SOUTHERN OSCILLATION

ENSO neutral with negative Indian Ocean Dipole possible in 2020

ENSO Wrap-Up issued on 28 April 2020

The El Niño Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) both remain neutral. Neutral ENSO conditions are likely to persist over the coming months, with some likelihood a La Niña like state could develop in the tropical Pacific Ocean late in the southern hemisphere winter (August) or spring (September–November) less than 50% chance). Most models suggest a negative IOD could develop in the Indian Ocean from mid-winter.

Atmospheric and oceanic indicators of ENSO including the Southern Oscillation Index (SOI), trade winds, cloudiness near the Date Line, and sea surface temperatures in the tropical Pacific Ocean generally persist at levels consistent with a neutral ENSO state. Sub-surface temperatures in the tropical Pacific Ocean have cooled over the past two months, indicating increased potential for cooling at the surface in the coming months under the right conditions.

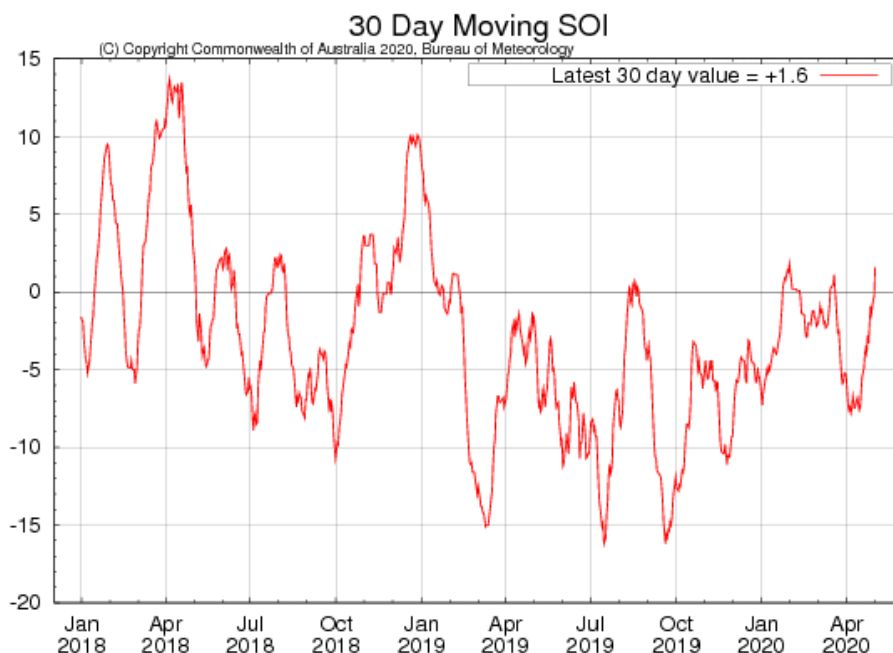
Some warmer than average tropical surface waters, near to and west of the Date Line, are generating persistent cloudiness in the region. This pattern in the western Pacific may be reducing the impact of anomalously warm local sea surface temperatures around this region, which would typically tend to increase rainfall.

Most climate models surveyed by the Bureau indicat-

ed ENSO is likely to stay neutral through the southern hemisphere winter (June–August). By late winter/early spring (August–September), three of the eight climate models surveyed by the Bureau reach or exceed La Niña levels, while the remaining five stay neutral. ENSO predictions made during autumn (March–May) tend to have lower accuracy than predictions made at other times of the year, so current ENSO forecasts should be used with some caution. The Bureau's ENSO Outlook remains at INACTIVE but conditions and outlooks will be assessed regularly against the criteria needed for elevation to La Niña WATCH.

The Indian Ocean Dipole (IOD) is currently neutral. All six international climate models surveyed suggest negative IOD conditions could develop from the middle of the southern hemisphere winter (July). However, each of the models show a broad spread of possible scenarios between the neutral IOD and negative IOD levels, with almost no sign of a re-emergence of a positive IOD event. But again, caution must be taken as accuracy of IOD forecasts made at this time of year is low, with forecast accuracy improving from late autumn (May).

The approximate 30-day and 90-day Southern Oscillation Index (SOI) values to 30 April were -0.5 and -2.4 respectively.



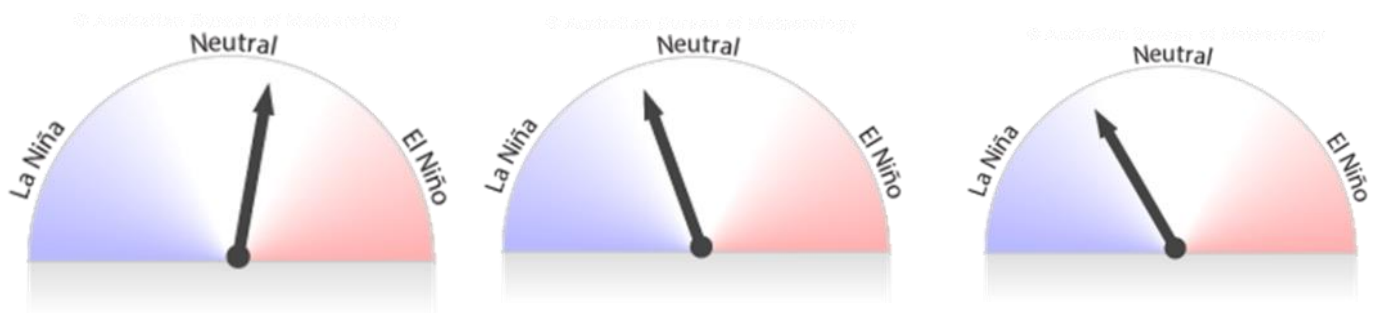
EL NIÑO–SOUTHERN OSCILLATION

ENSO and Indian Ocean Dipole Neutral

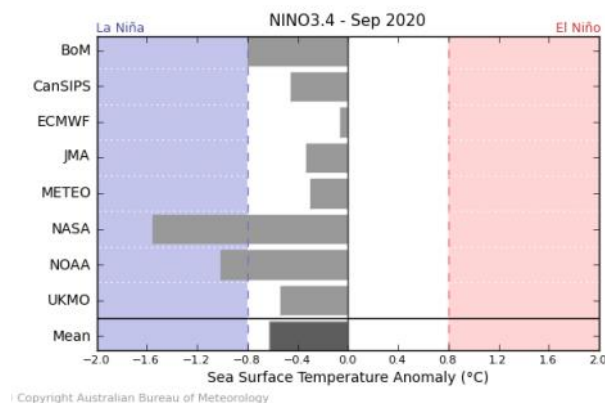
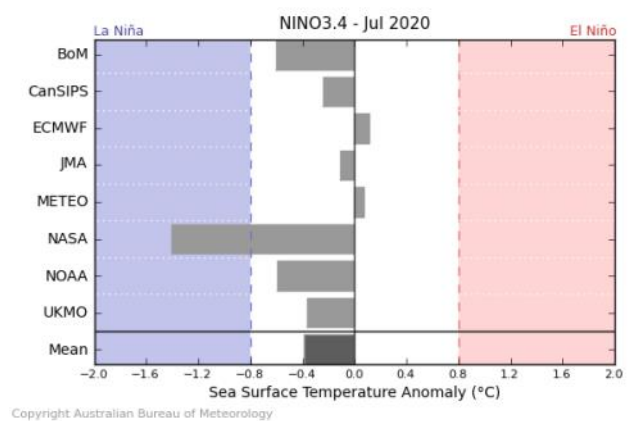
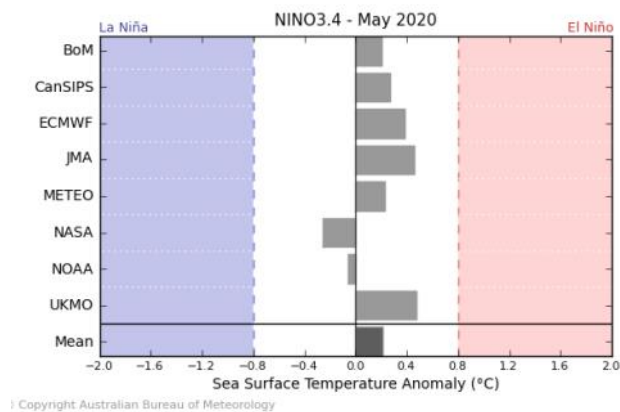
ENSO Wrap-Up Issued on 28 April 2020



Bureau of Meteorology NINO3.4 ENSO Model Outlooks for May, July and September



Bureau of Meteorology NINO3.4 International Model Outlooks



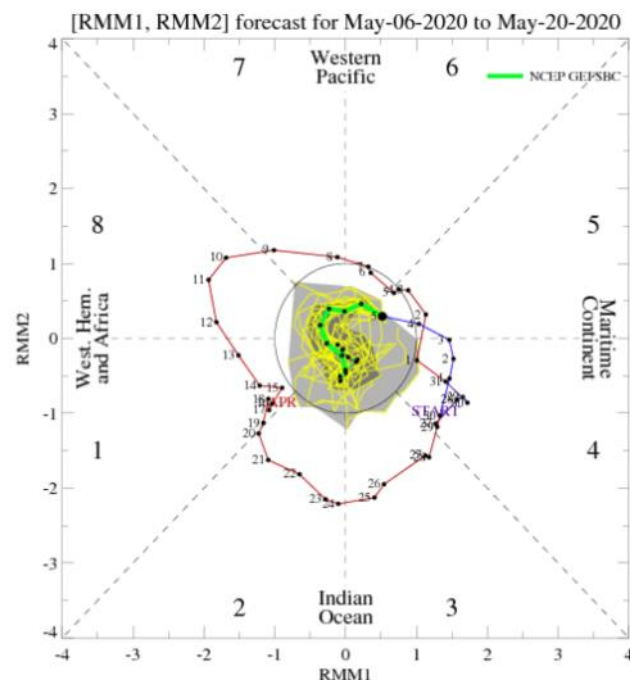
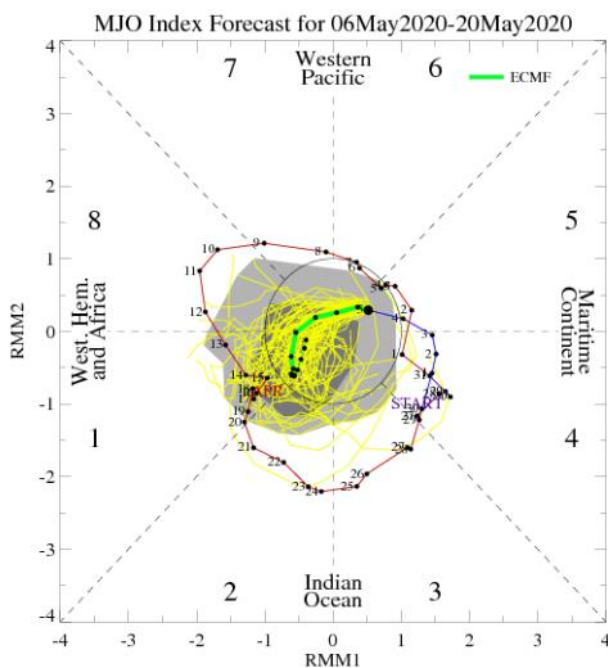
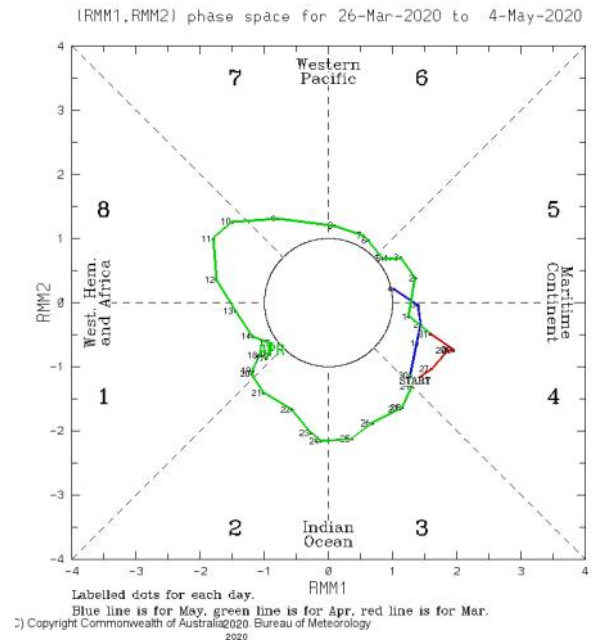
MADDEN–JULIAN OSCILLATION

Weekly Tropical Note [Issued on Tuesday 05 May 2020]

A moderate strong pulse of the Madden Julian Oscillation (MJO) has moved into Maritime Continent longitudes, to the north of Australia. The consensus of international climate models is that the pulse is likely to weaken in the coming days and become indiscernible within a week. At this time of the year, the influence of the MJO over northern Australia (and western Pacific Islands) is relatively weak.

Parts of northern Queensland (Australia) typically see above average rain, but the greatest effects are felt to the north of Australia, over the near-equatorial region including parts of Papua New Guinea and Indonesia.

This is an abbreviated version of the Weekly Tropical Note. Click on the *Weekly Tropical* for more information

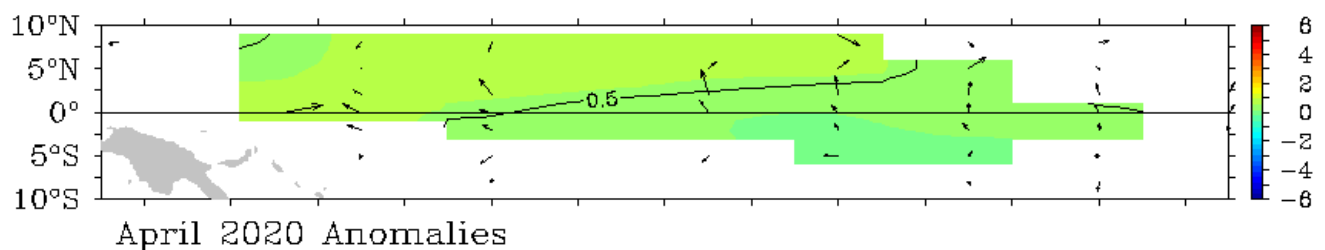
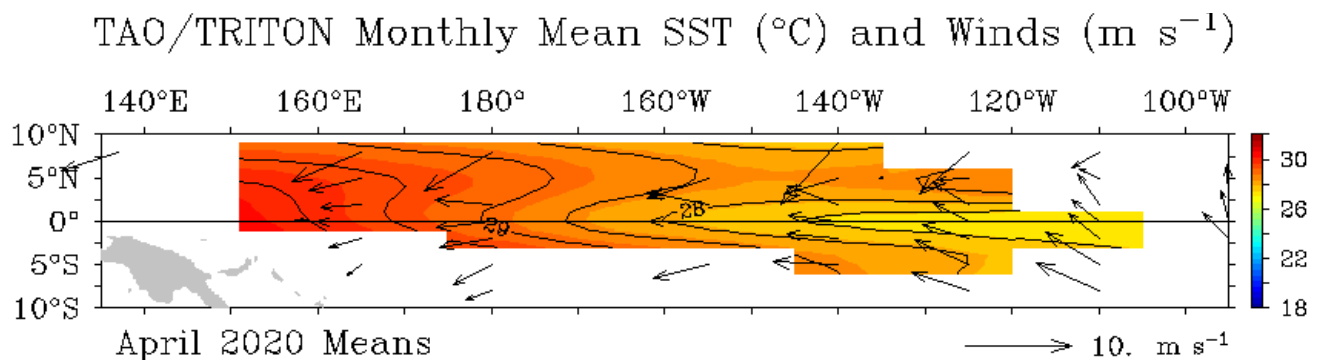
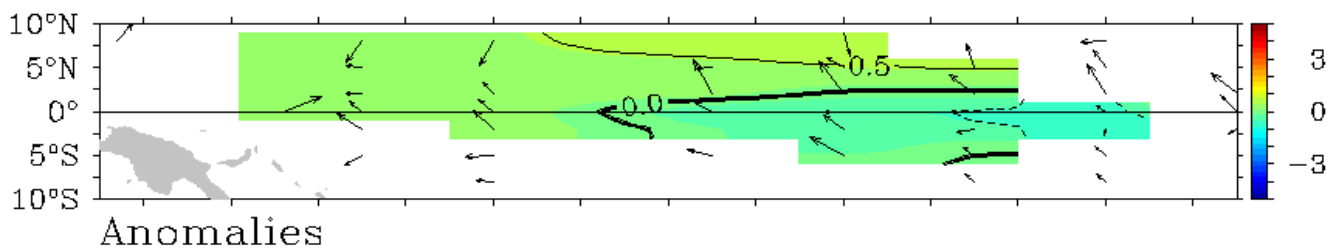
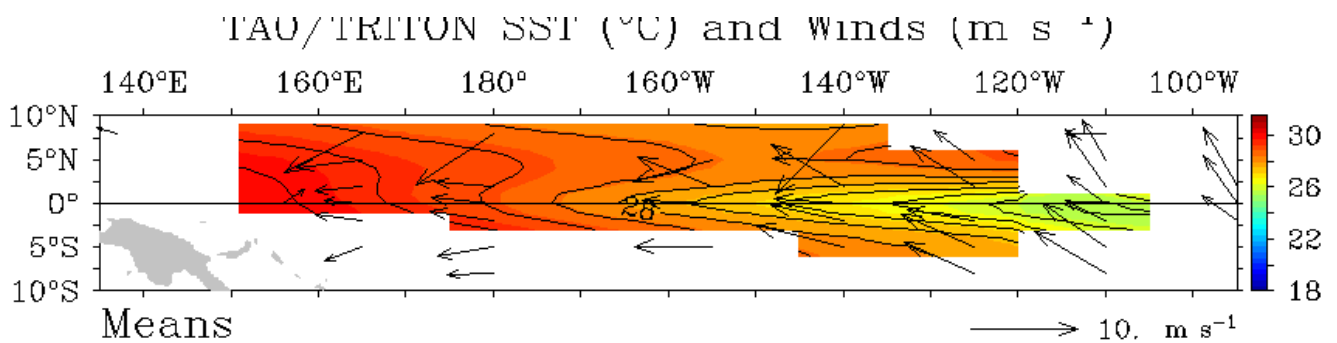




WIND

The equatorial trade winds in the 5-day snapshot ending 29 April and for April show near normal trade winds across the equatorial tropical 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.



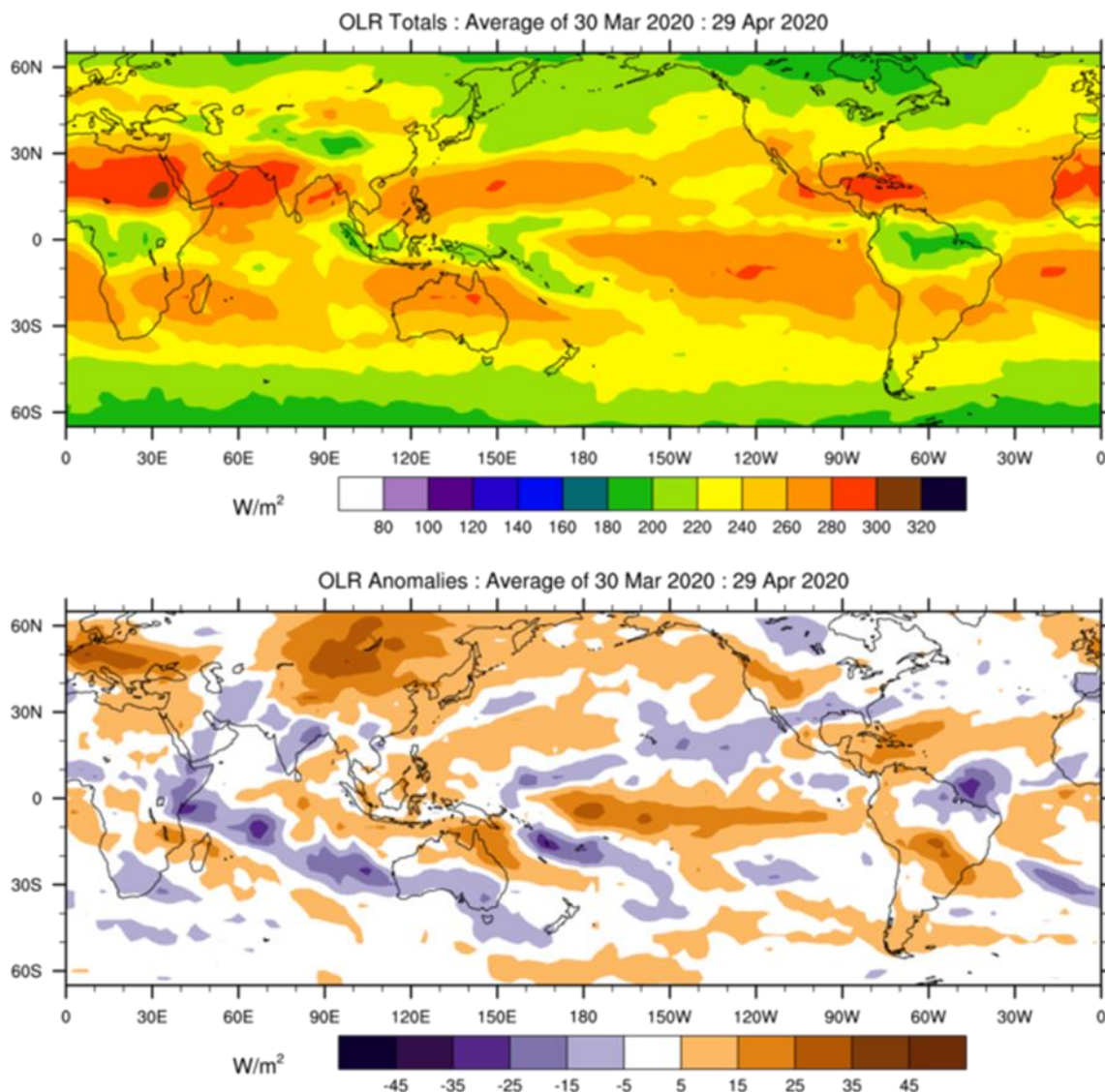
CLOUD AND RAINFALL



The April 30-day OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was marginally weakened in the western Pacific, shifted slightly north from its normal position and extended further east than normal. The South Pacific Convergence Zone (SPCZ) was enhanced and shifted southwards of its normal position over Vanuatu, Fiji, Tonga, Samoa and Niue resulting in higher than normal rainfall for these islands. The ITCZ and SPCZ appear to have merged further east than is normal for April, just north of the Solomon Islands.

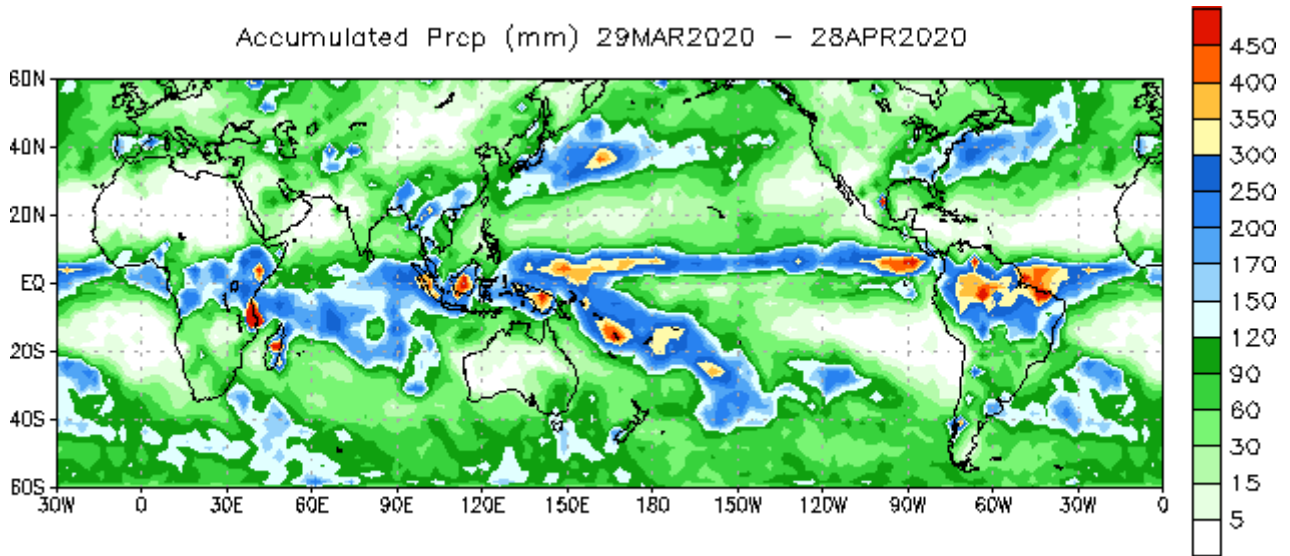
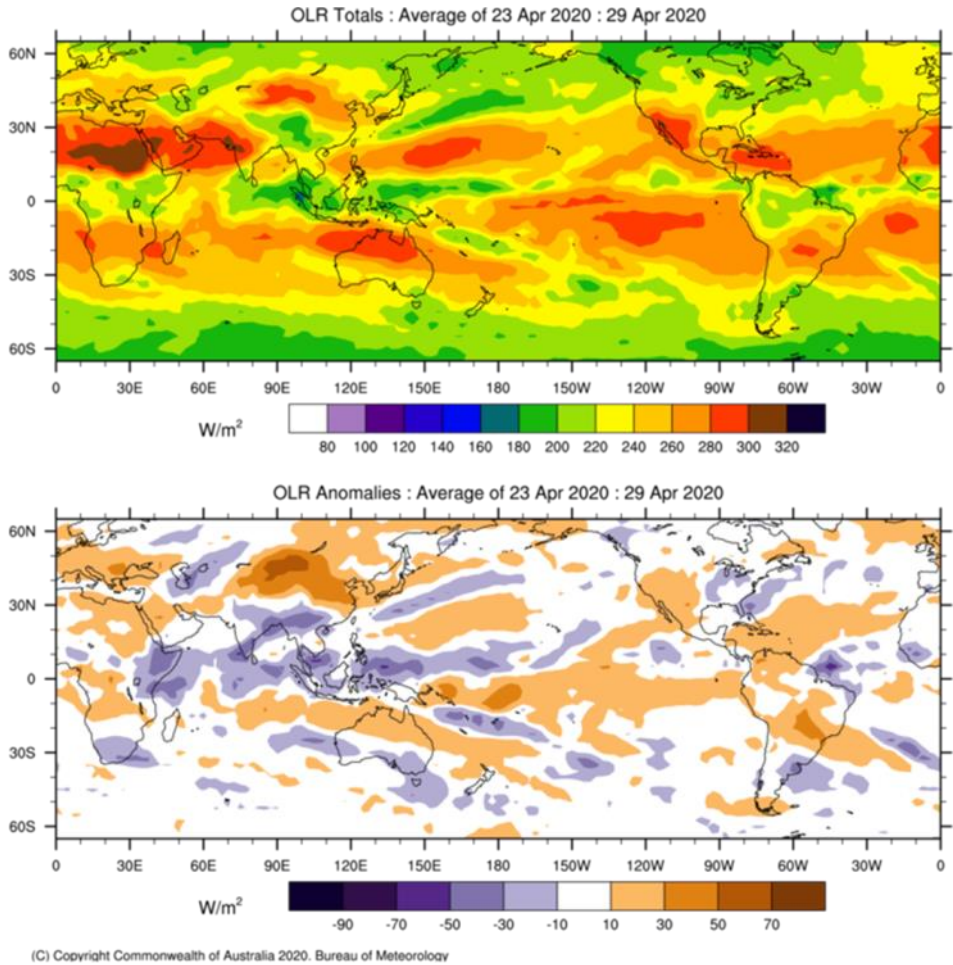
Note: Global maps of OLR below highlight regions experiencing more or less cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading) represent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

OLR Total and Anomalies, 30 Day OLR



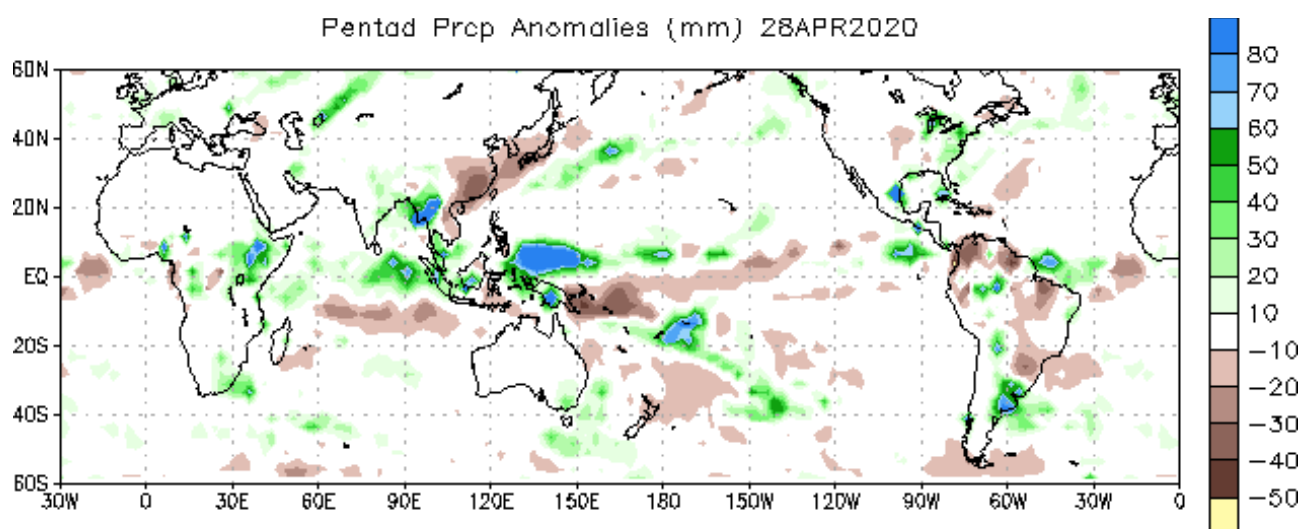
(C) Copyright Commonwealth of Australia 2020. Bureau of Meteorology

OLR Total and Anomalies, 7 Day OLR

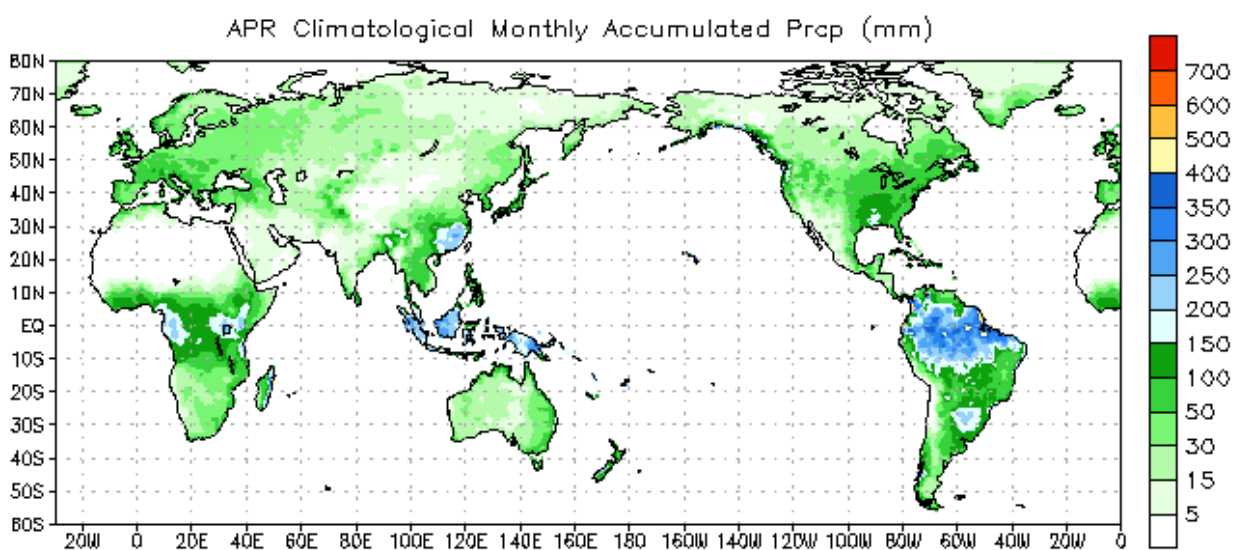


Data Source: NCEP CMAP Precipitation

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

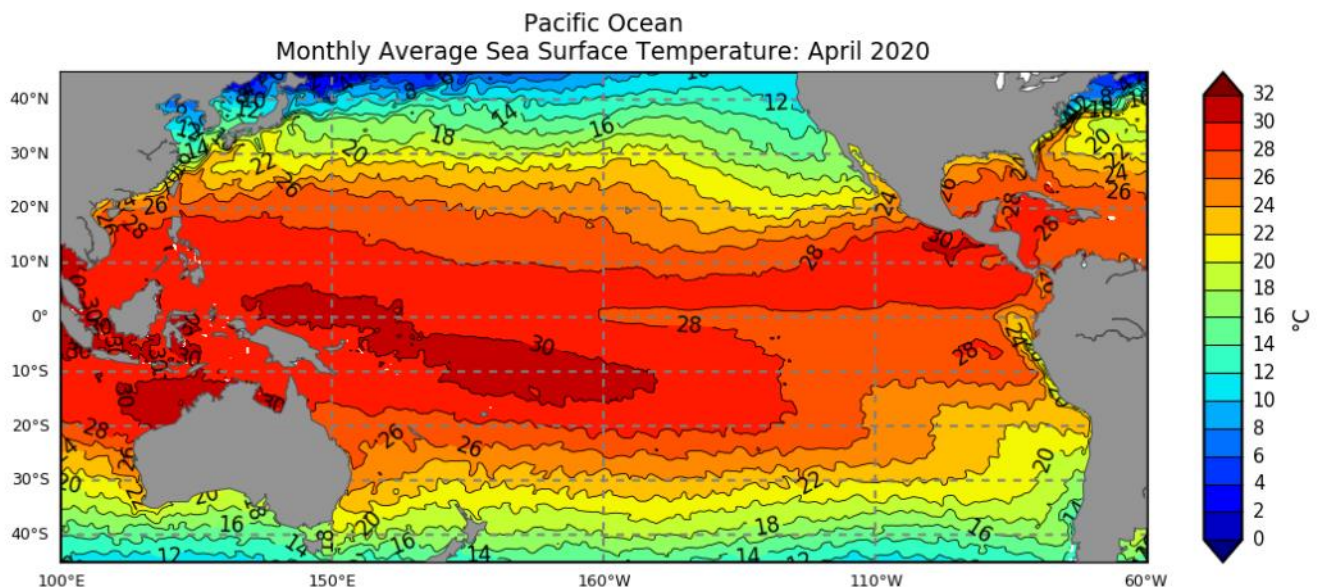
SEA SURFACE TEMPERATURE



Sea surface temperatures (SSTs) for April were slightly warmer than average across most of the equatorial Pacific Ocean but remain within the neutral range. The eastern equatorial Pacific has warmed slightly compared to two weeks ago, while temperature anomalies in the central region have decreased slightly.

SSTs also remain warmer than average around the COSPPac countries. SSTs ranged from half to one degree warmer than average around Pacific, and up to one and half degree warmer than average around northern PNG, Samoa, Niue and southern Cook Islands. Cooler than average SST were around the Vanuatu EEZ. In terms of the deciles, regions of Highest on Record for April spanned across PNG, FSM, Tuvalu, Fiji, Samoa and Niue EEZs. Average to below average (2-7) spanned across PNG, Solomon Islands, Vanuatu and Fiji EEZ. In comparison to March, SSTs for the NINO regions show higher positive anomalies for NINO 3 and 3.4 region while NINO4 has reduced warming. All regions indicate ENSO neutral range. The April SST anomalies for the NINO3, NINO3.4 and NINO4 regions were $+0.7^{\circ}\text{C}$, $+0.5^{\circ}\text{C}$ and $+0.4^{\circ}\text{C}$, respectively.

Mean Sea Surface Temperature



©Pacific Community (SPC) 2020
Geoscience Energy and Maritime Division, COSPPac SPP

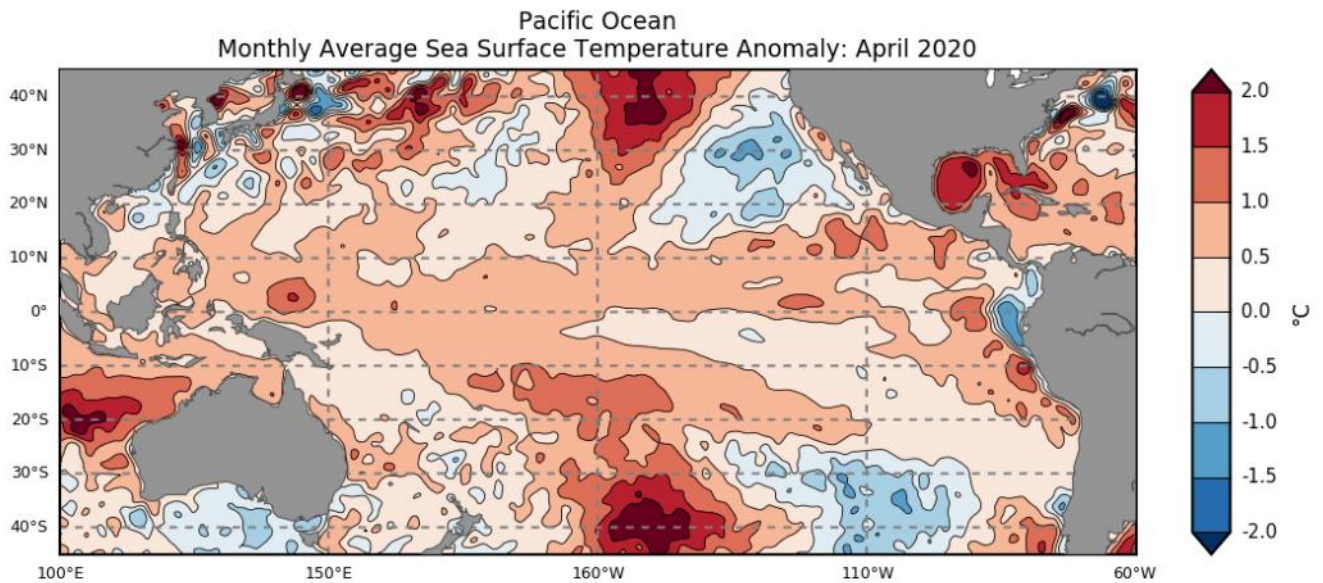
Reynolds SST

OCEAN CONDITIONS

SEA SURFACE TEMPERATURE



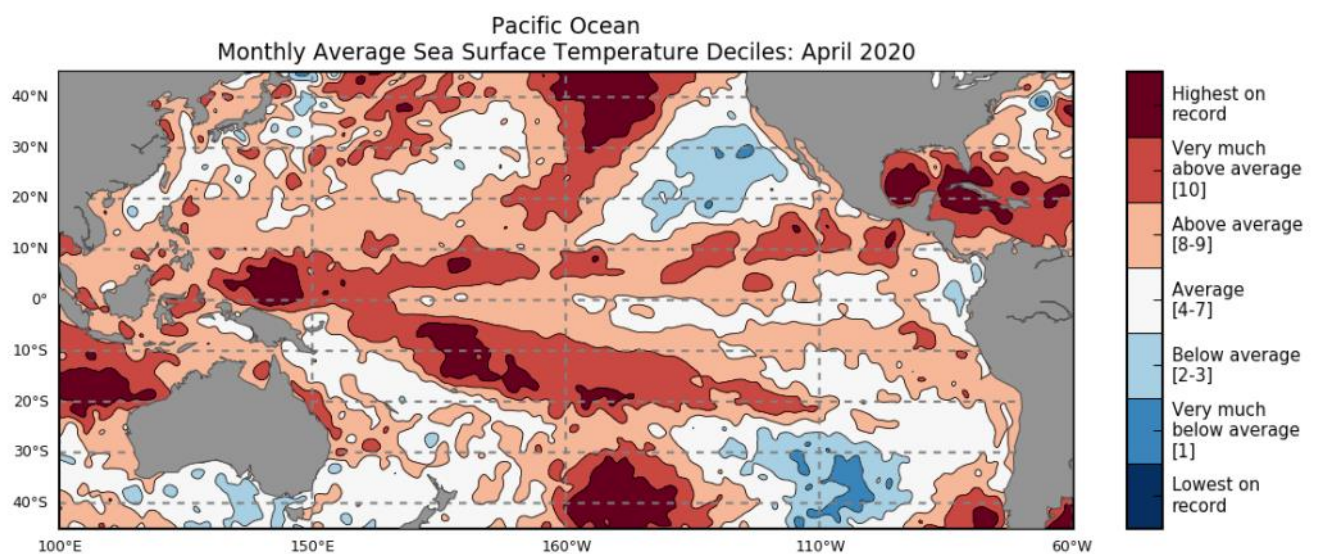
Anomalous Sea Surface Temperature



©Pacific Community (SPC) 2020
Geoscience Energy and Maritime Division, COSPPac SPP

Reynolds SST

Sea Surface Temperatures Deciles



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Reynolds SST

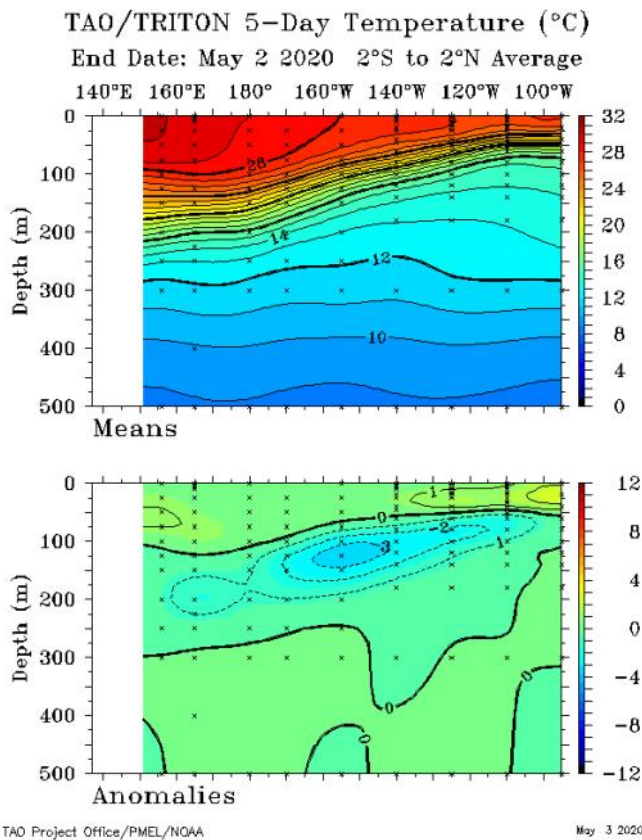
OCEAN CONDITIONS

SUB SURFACE

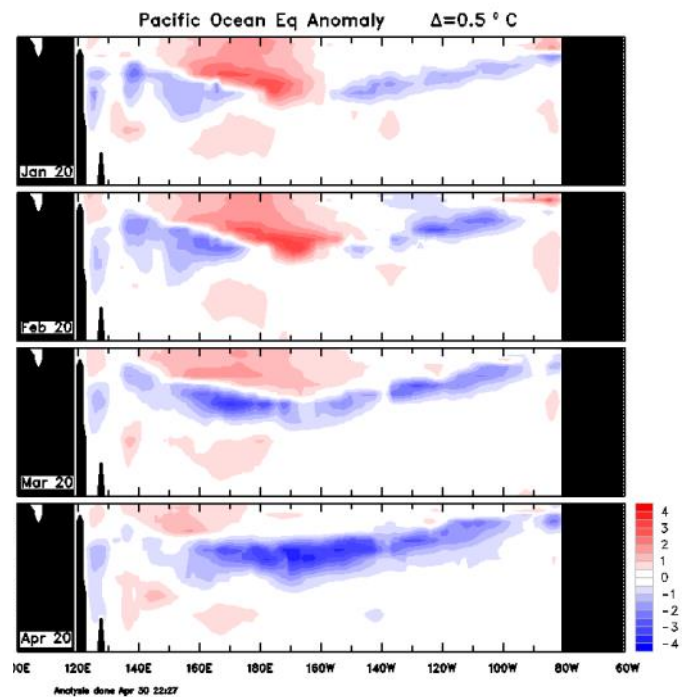


The Bureau of Meteorology's four-month sequence of equatorial sub-surface temperature anomalies (to 23 April) shows cooler than average waters extend in a band across most of the equatorial Pacific, between about 100 and 200-m in the western to central equatorial Pacific and rising to a depth of around 50-m at the eastern edge of the equatorial Pacific. In the western equatorial Pacific very weak warm anomalies persist in the top 150 m, but have decreased significantly in strength and extent compared to March. Since January, warm anomalies in the western equatorial Pacific near the surface have decreased, while the pattern of cooler anomalies at depth has strengthened.

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

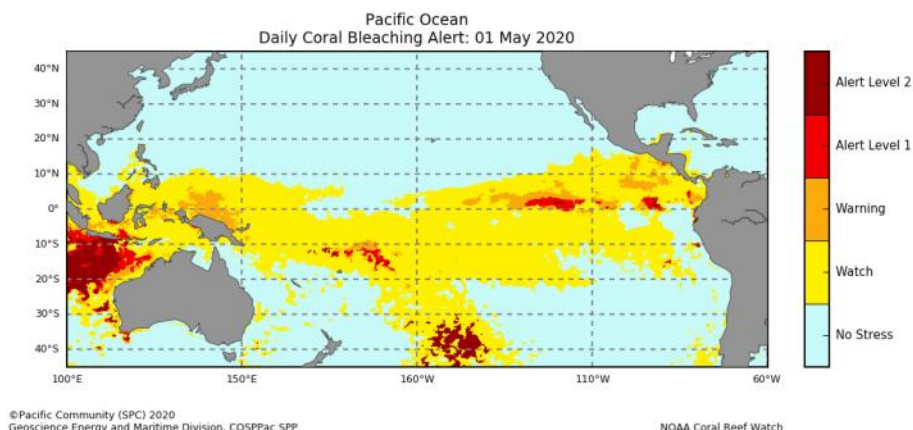
CORAL BLEACHING



The daily Coral Bleaching Alert for 01 May 2020 shows a region of Alert Level 1 spanning northern Fiji and Samoa. Areas of Warning exist around northern PNG, Palau and FSM EEZ. The remainder of south west Pacific Island countries are on Watch. The four weeks Coral Bleaching Outlook till 24 May shows the region of Alert Level 2 to persist around the Samoa EEZ. Areas of Alert Level 1 exist in PNG, Solomon Islands, Fiji, Samoa and northern Cook Islands EEZ. The remainder of the south west Pacific countries are on warning, Watch or no stress.

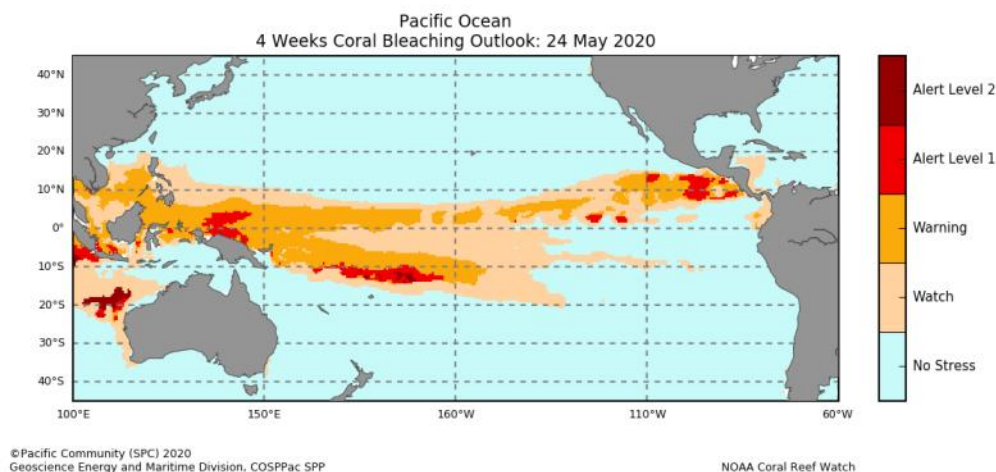
Daily Coral Bleaching Alert

(Source: [Pacific Community COSPPac Ocean Portal Coral Bleaching](#))



4-Weeks Coral Bleaching Outlook

(Source: [Pacific Community COSPPac Ocean Portal](#))



OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

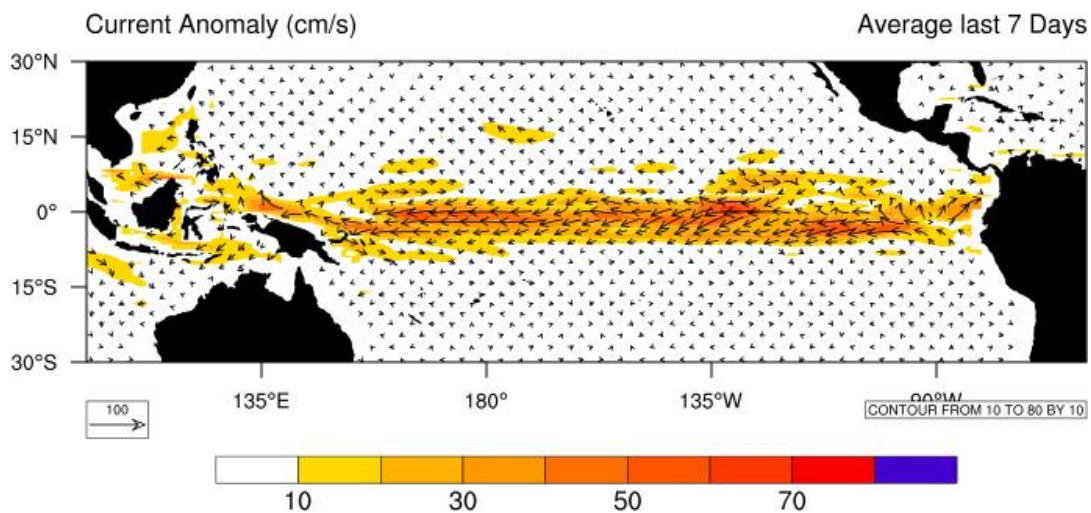


The most recent 7-day ocean surface currents plot shows a stronger than normal westward flowing Equatorial Current in the equatorial Pacific.

Sea level in April was higher than normal in the central and western equatorial Pacific. The highest sea level anomalies (1.5-3cm) were situated around eastern Palau, western FSM, northern Solomon Islands, Tuvalu, Samoa and northern Cook Islands. Parts of FSM, PNG, Solomon Islands, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands experienced negative sea level anomalies .

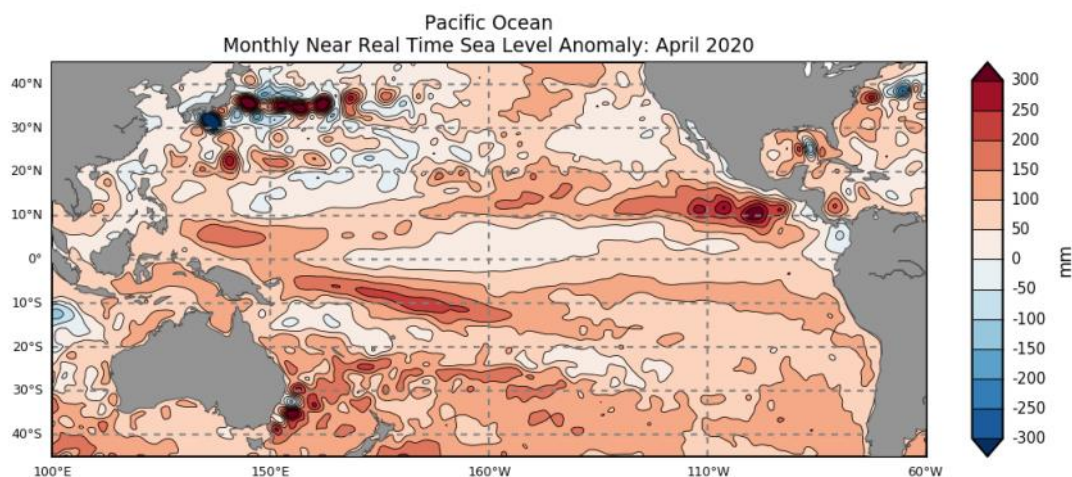
Ocean Surface Current (Last 7-Days)

[Bureau of Meteorology POAMA](#)



Monthly Sea Level Anomalies

Source: [Pacific Community COSPPac Ocean Portal](#)



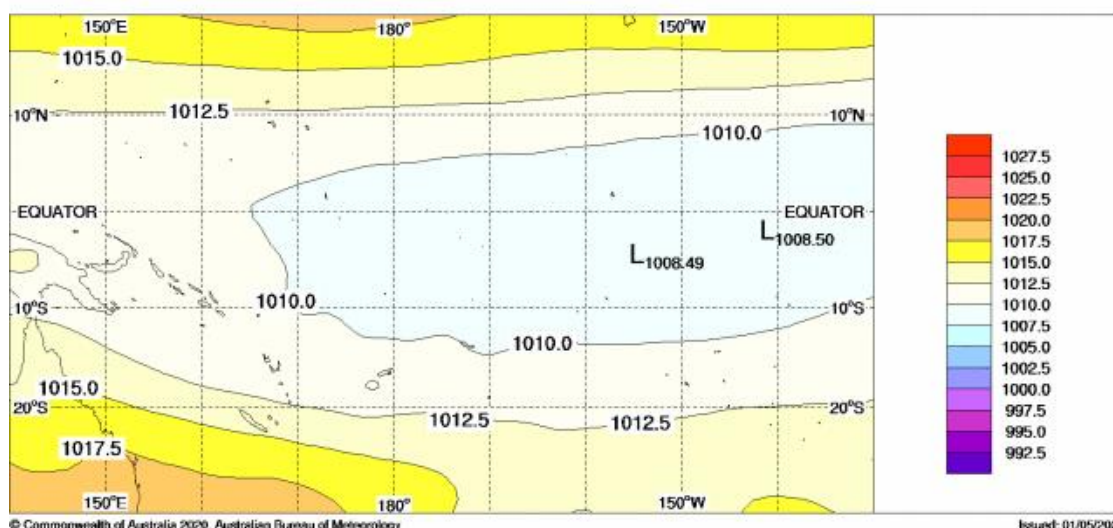
MEAN SEA LEVEL PRESSURE

The April mean sea level pressure (MSLP) anomaly map shows negative anomalies east of about 160°E. Positive anomalies were present in the western Pacific, over northeast Australia, FSM, Marshall Islands, Papua New Guinea and Solomon Islands.

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

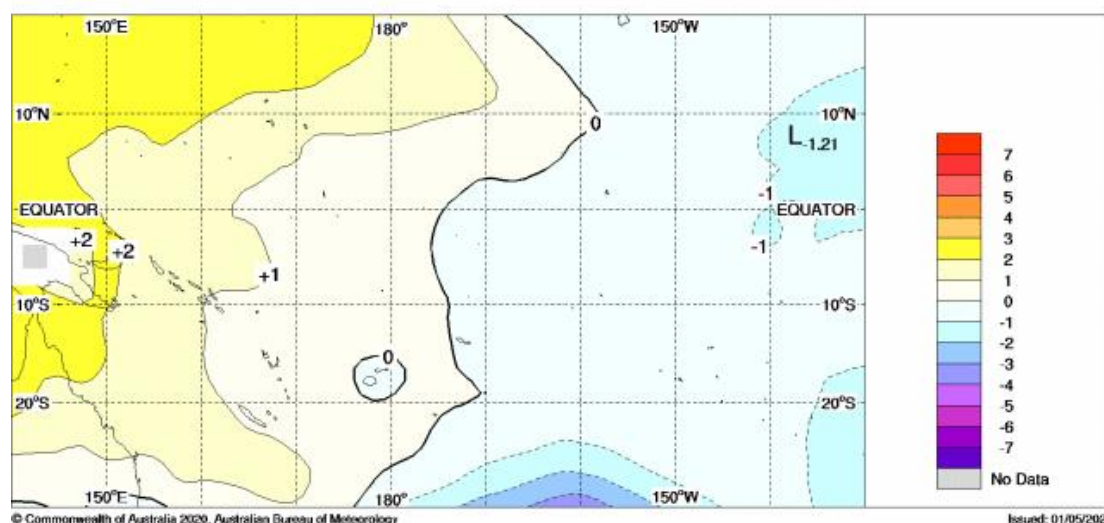
Mean

MSLP 2.5X2.5 ACCESS OP. ANAL. (hPa) 20200401 0000 20200430 0000



Anomalous

MSLP 2.5X2.5 ACCESS OP. ANAL.-NCEP2 (hPa) 20200401 0000 20200430 0000



SEASONAL RAINFALL OUTLOOK

May—July 2020



For the month of May, the ACCESS-S model favours drier than average conditions for the northern Marshall Islands, New Caledonia, parts of Vanuatu, Nauru, northern Tuvalu, northern Cook Islands, northern and southernmost French Polynesia and Kiribati. Wetter than average conditions is favoured for Palau, FSM, the New Guinea highlands region, PNG Islands, southern PNG, southern Marshall Islands, western and eastern Solomon Islands, northern Fiji, Tonga, Samoa and parts of the southern Cook Islands and central French Polynesia. The three months outlook (May-July) favours a similar outlook to that for May with drier than average conditions extending to southern FSM and Fiji but not for the northern Marshall Islands. Wetter than average conditions are also favoured also for the central Cook Islands and Niue. Warmer than average maximum and minimum temperature is favoured for all COSPPac countries except for Kiribati with near average temperature.

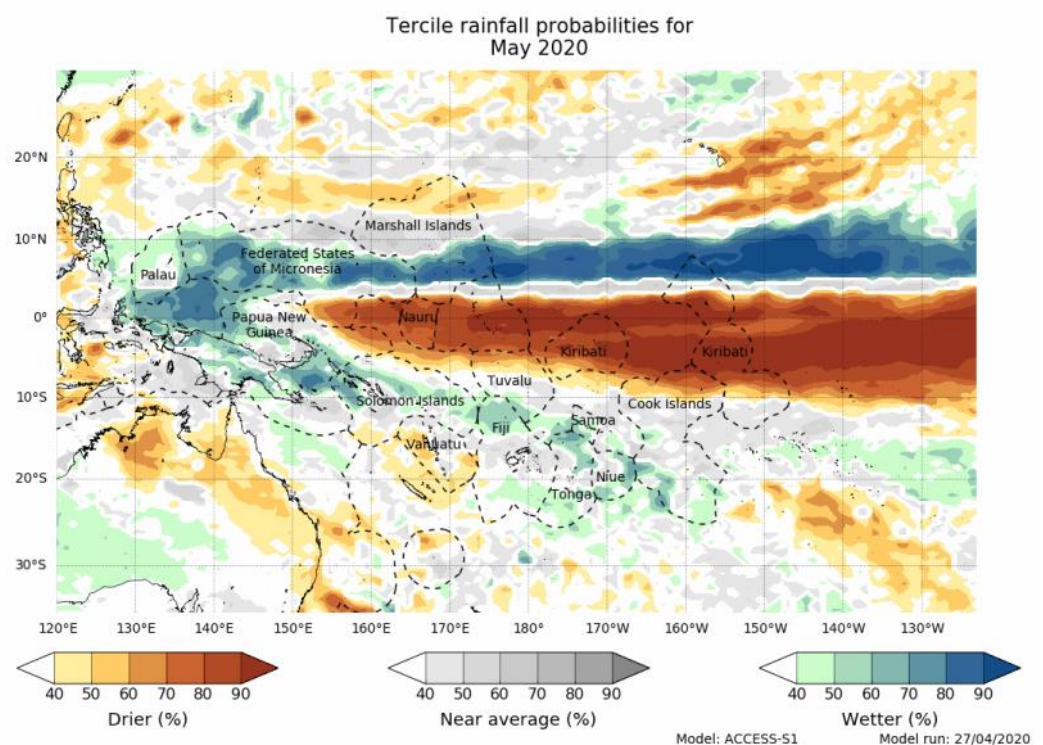
The Copernicus multi-model outlook favours drier than average conditions for Nauru, Kiribati and northern Tuvalu and wetter than average conditions for Palau, southern FSM, southern Marshall Islands, Rotuma (Fiji), Wallis and Futuna and Samoa.

The SCOPIC statistical model favours below-normal rainfall for most parts of PNG, FSM, central Solomon Islands, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands. Above normal rainfall is favoured for western Solomon Islands, Tuvalu, Kiribati and northern Cook Islands.

The APEC Climate Centre multi-model favours below normal rainfall for Palau, PNG, Nauru, Tuvalu, Kiribati and northern Cook Islands. Above normal rainfall is favour for southern Marshall Islands.

For May to July, most of the models agree on below normal rainfall for Nauru, northern Tuvalu and Kiribati.

Monthly ACCESS-S Maps



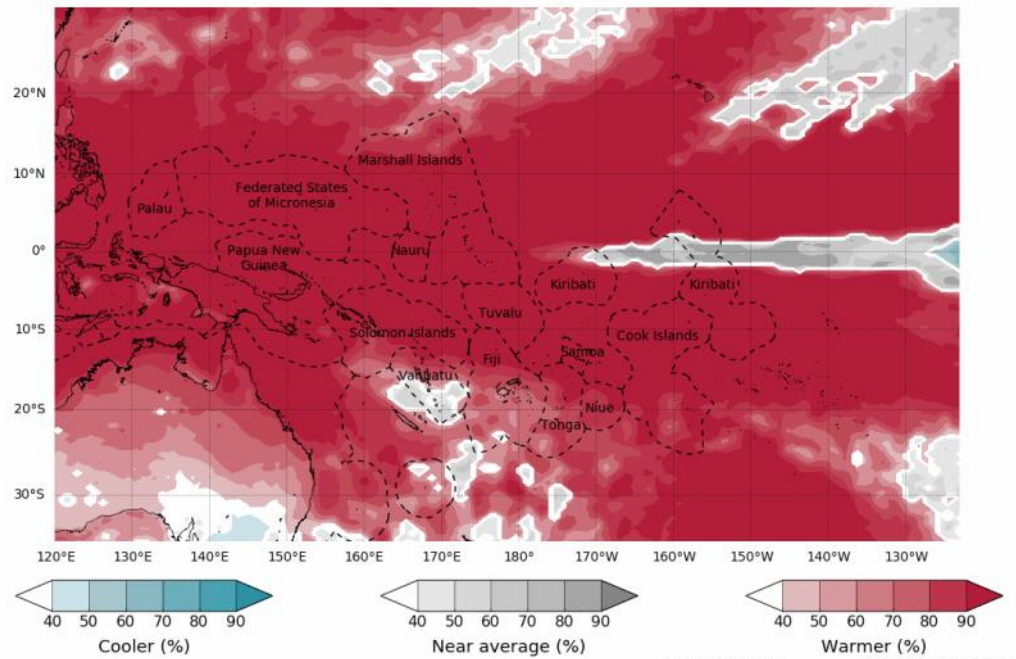
SEASONAL RAINFALL OUTLOOK

May—July 2020



Monthly **ACCESS-S** Maps

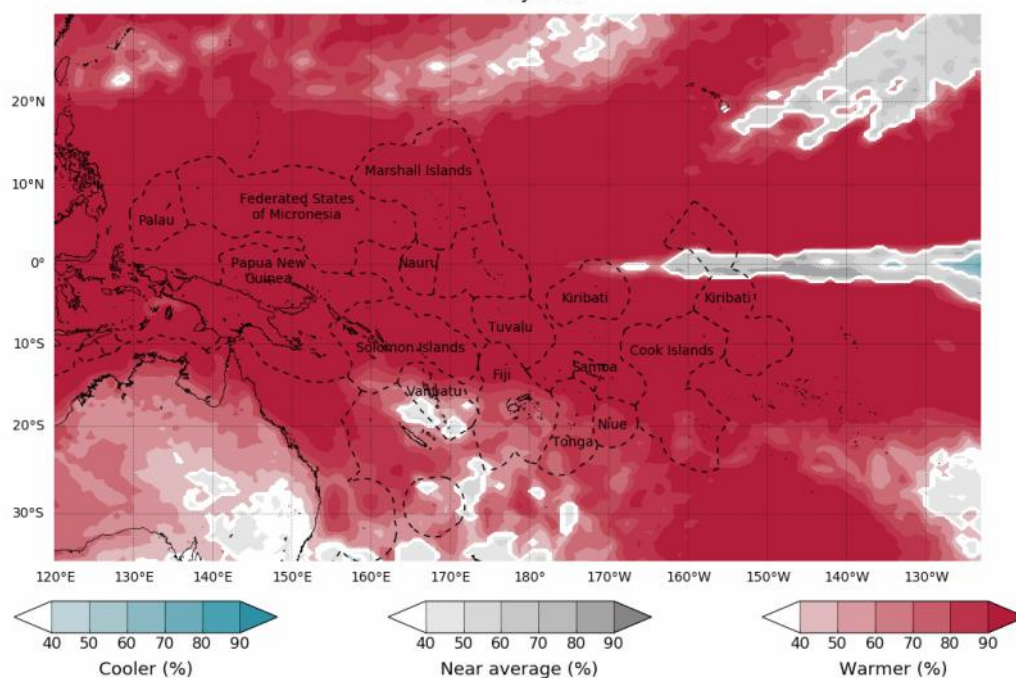
Tercile maximum temperature probabilities for May 2020



© Commonwealth of Australia 2020, Australian Bureau of Meteorology
Shapefile data extracted from Flanders Marine Institute (2019), Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at <http://www.marinerregions.org/>

Model: ACCESS-S1 Model run: 27/04/2020
Base period: 1990-2012 Issued: 30/04/2020

Tercile minimum temperature probabilities for May 2020



© Commonwealth of Australia 2020, Australian Bureau of Meteorology
Shapefile data extracted from Flanders Marine Institute (2019), Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at <http://www.marinerregions.org/>

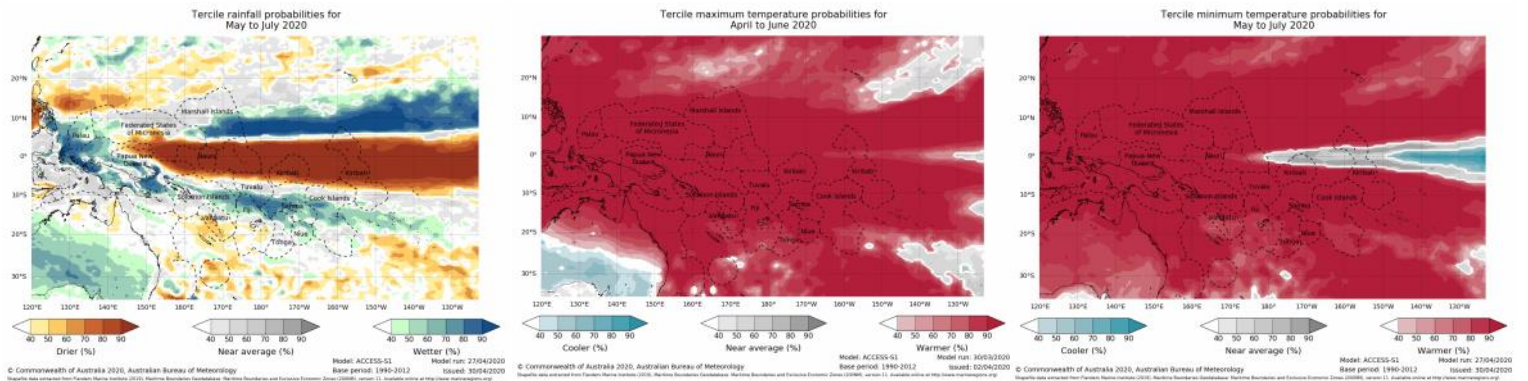
Model: ACCESS-S1 Model run: 27/04/2020
Base period: 1990-2012 Issued: 30/04/2020

SEASONAL RAINFALL OUTLOOK

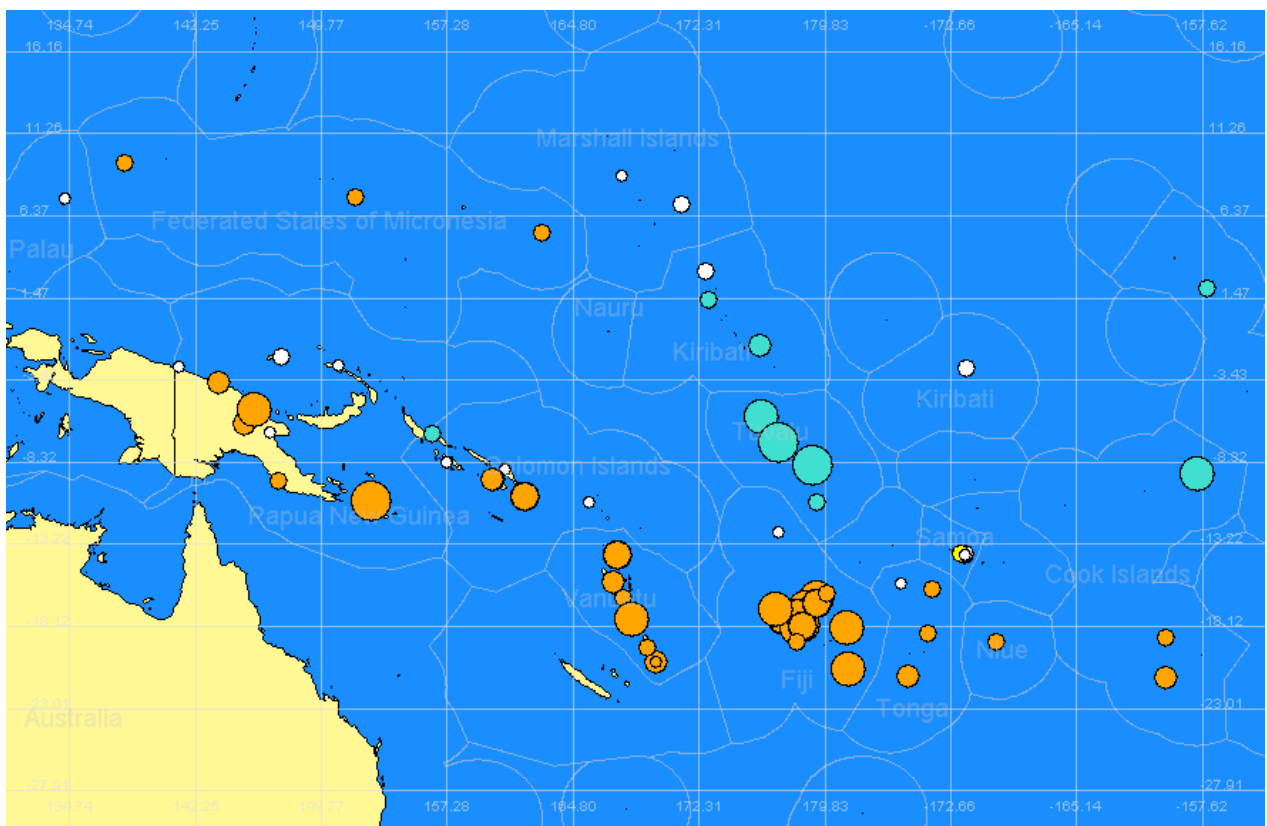
May—July 2020



Seasonal ACCESS-S maps



SCOPIC



Legend

- Bias towards below-normal rainfall
- Bias towards normal rainfall
- Bias towards above-normal rainfall
- No bias in forecast (Climatology)

Larger "bubbles" represent higher forecast skill (based on LEPS scores)

SEASONAL RAINFALL OUTLOOK

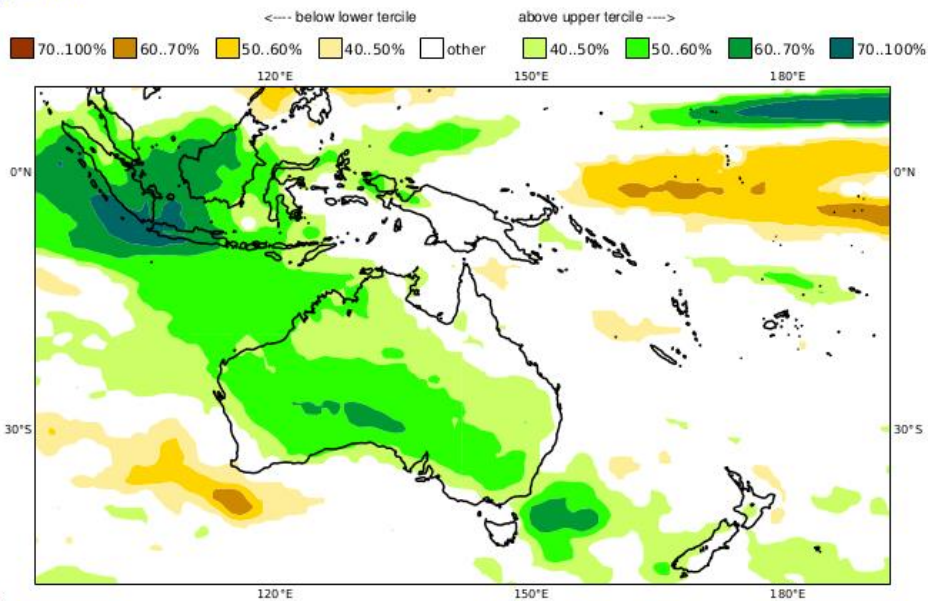
May—July 2020



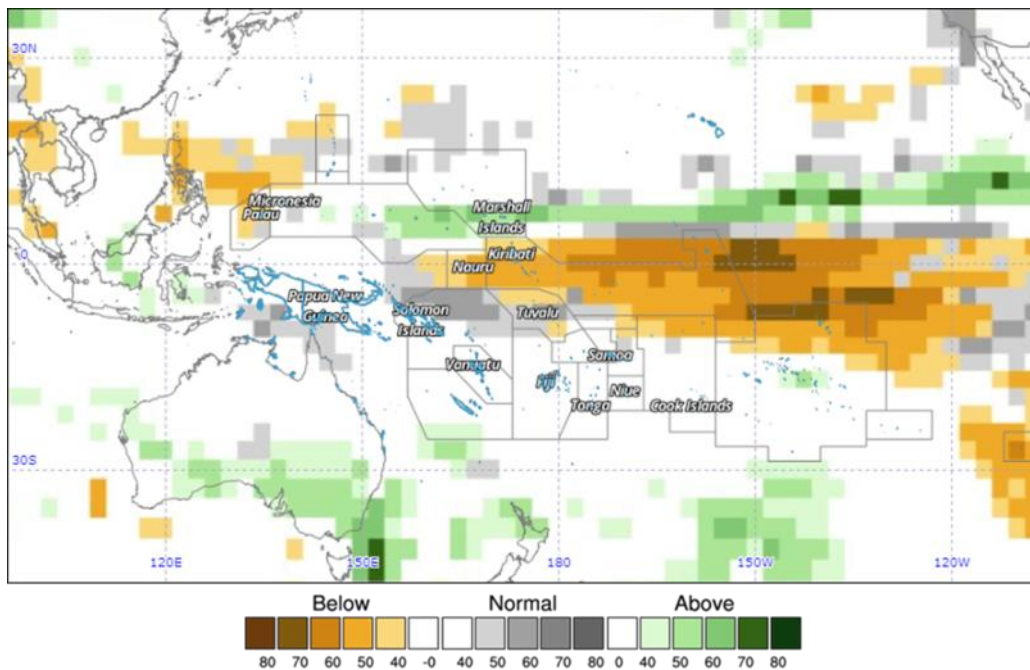
Copernicus (C3S multi-system)-Rainfall

C3S multi-system seasonal forecast
 Prob(most likely category of precipitation)
 Nominal forecast start: 01/04/20
 Unweighted mean

ECMWF/Met Office/Météo-France/CMCC/DWD/NCEP
 MJJ 2020



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



Year: 2020, Season: MJJ, Lead Month: 3, Method: GAUS

Model: APCC, NASA, NCEP, PNU

Generated using CLIK® (2020-5-3)

© APEC Climate Center

TROPICAL CYCLONE

2019/2020 Season

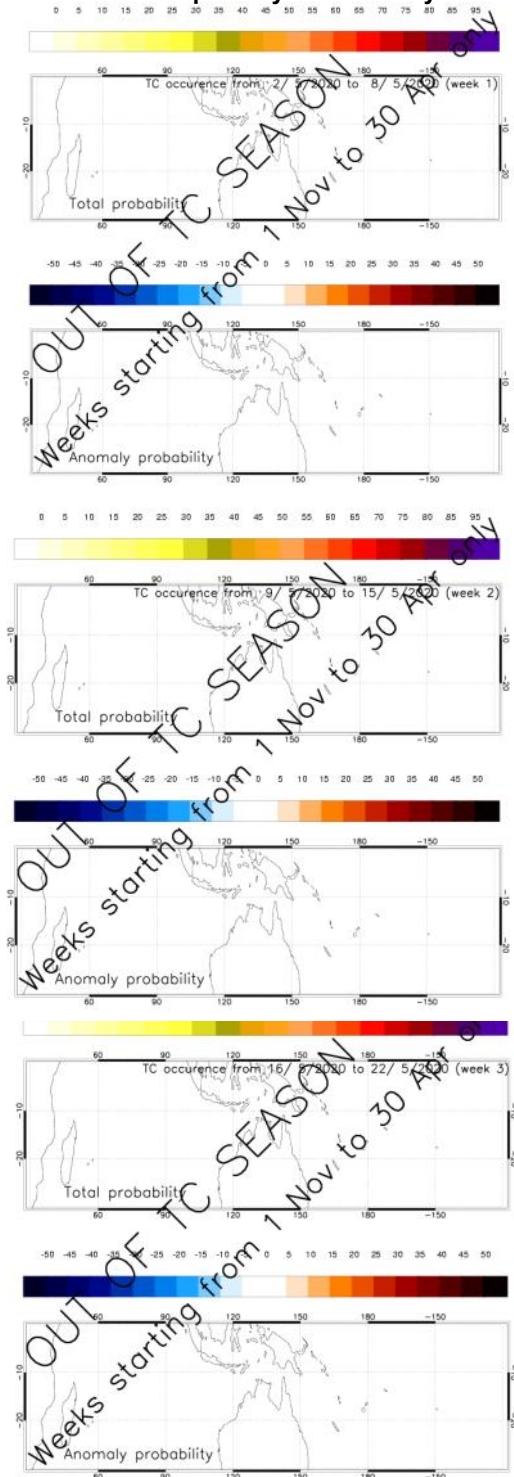


Eight tropical cyclones (Rita, Sarai, Tino, Uesi, Vicky, Wasi, Gretel and Harold) formed in the 2019-20 south Pacific (east of the tip of Cape York, Queensland) cyclone season. These cyclones affected Solomon Islands, New Caledonia, Vanuatu, Fiji, Wallis and Futuna, Tonga, American Samoa, Samoa and Niue. Out of the eight cyclones, four severe cyclones: Rita, Tino, Uesi, and Harold. Harold was one of the most intense cyclones to make landfall in the Pacific Islands during April on record (minimum mean sea level pressure 912 hPa). The long-term average for the period 1969-70 to 2017-18 is nine cyclones. Although the official cyclone season ended in April 2020, historical data has shown that cyclones can form outside the normal cyclone season. Updates on tropical cyclone forecast from the MeteoFrance weekly forecasts will resume in October 2020.

The tropical cyclone season outlook for 2019-20 is available via: <http://www.bom.gov.au/climate/cyclones/south-pacific/>

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

MeteoFrance Tropical Cyclone Weekly Forecasts



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

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 Pacific Ocean. In contrast, ocean temperatures to the north of Australia usually become warmer than normal.

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 sustained positive values indicate El Niño.

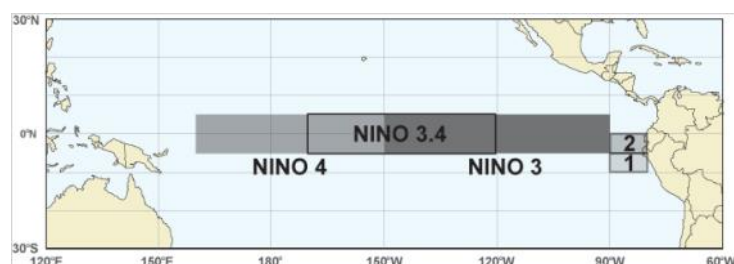
20 degrees Celsius Isotherm Depth

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 content in the upper ocean.

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 below) cover the following areas:

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