

Monthly Climate Bulletin

March 2021



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Photo Credit: Tuvalu Meteorological Services (2011 Drought Impacts on water supply)



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SUMMARY

Issued 09 April 2021

- La Niña 2020-21 fades as El Niño Southern Oscillation returns to neutral.
- The Madden-Julian Oscillation (MJO) is moderately strong and recently moved into western Maritime Continent longitudes, to the north of Australia. Climate models indicate it will maintain or increase strength in the coming week as it tracks eastwards across the Australian region.
- The Intertropical Convergence Zone (ITCZ) was active along its normal position. The South Pacific Convergence Zone (SPCZ) was active and shifted to the southwest of normal.
- Satellite imagery showed active convection over the Maritime Continent, northern Australia, and the southwestward-shifted SPCZ.
- Coral bleaching was on Alert Level 1 and 2 just north and east of PNG and southern Cook Islands.
- For April to June 2021, the dynamical models (as well as SCOPIC) agree on above normal rainfall for Palau, FSM, Marsh all Islands, southern and Momase Regions of PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands and central and northern French Polynesia.

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EL NIÑO–SOUTHERN OSCILLATION

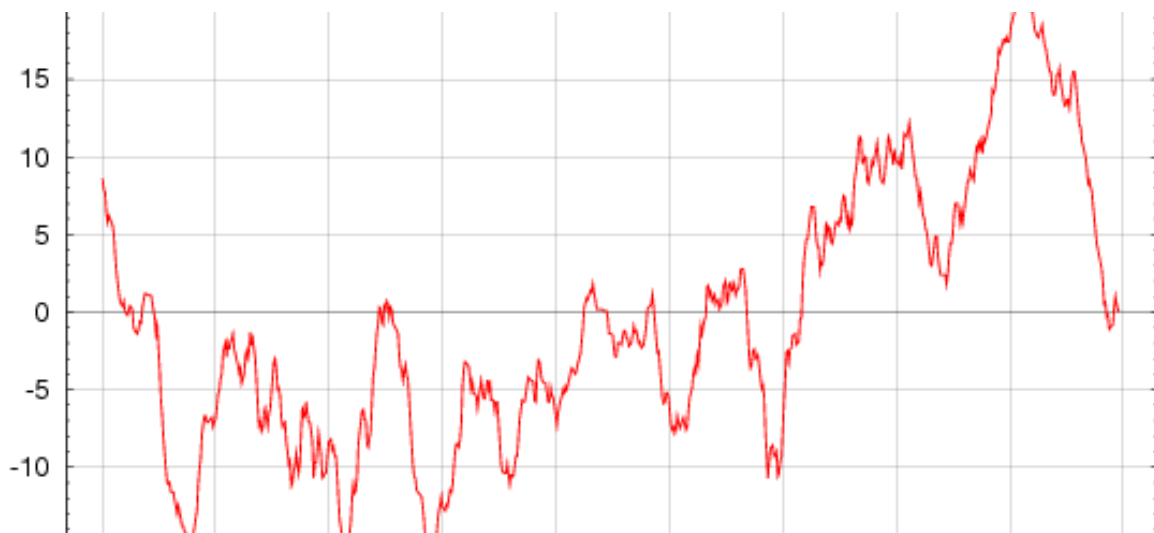
La Niña 2020 -21 fades as El Niño Southern Oscillation returns to neutral

Click link to access [Climate Driver Update issued on 30 March 2021](#)

The Bureau's ENSO Outlook has moved from La Niña to INACTIVE as most El Niño Southern Oscillation (ENSO) indicators have now returned to neutral levels. Climate model outlooks suggest the Pacific will remain at neutral ENSO levels at least until the August 2021.

Tropical Pacific Ocean sea surface temperatures have persisted at ENSO neutral values for several weeks. Below the surface, much of the tropical Pacific is now at near average temperatures. Atmospheric indicators are also generally at neutral ENSO levels. The Southern Oscillation Index (SOI) is close to zero, while trade winds are currently being enhanced by the Madden Julian Oscillation (MJO). Only cloudiness near the Date Line continues to show a weak La Niña like signature.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 28 March was +0.5. The 90-day SOI value was +10.9. The 30-day value has remained within ENSO neutral values over the past two weeks.



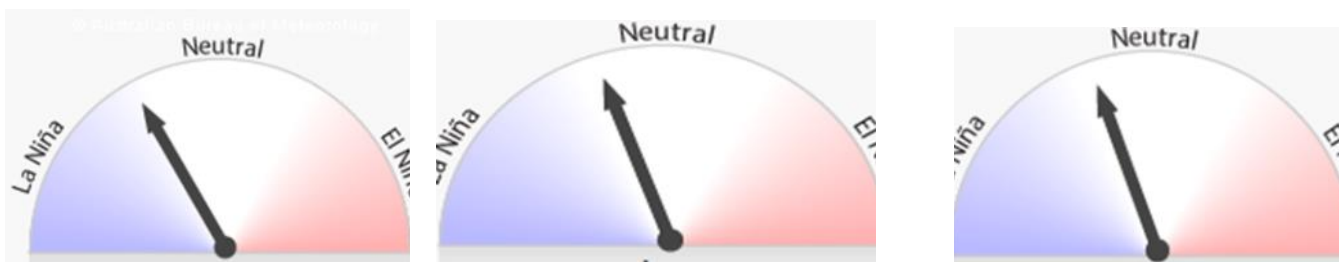


EL NIÑO–SOUTHERN OSCILLATION

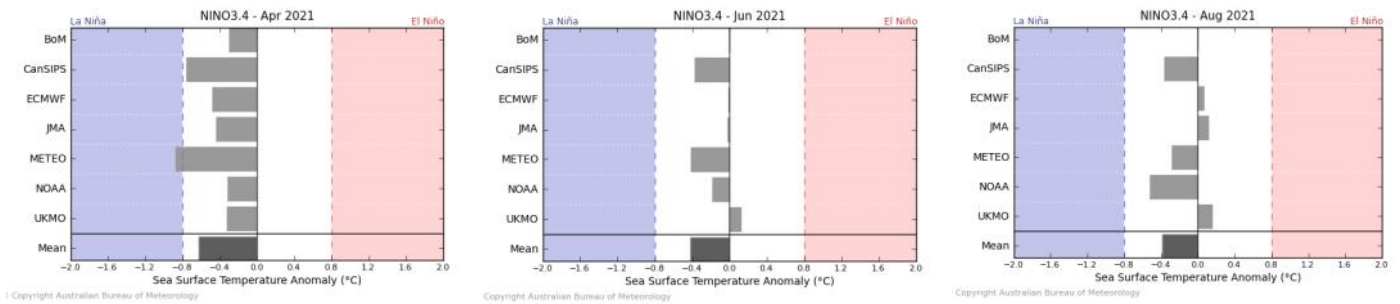
La Niña 2020 -21 fades as El Niño Southern Oscillation returns to neutral

Click link to access [Climate Driver Update issued on 30 March 2021](#)

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



Bureau of Meteorology NINO3.4 International Model Outlooks



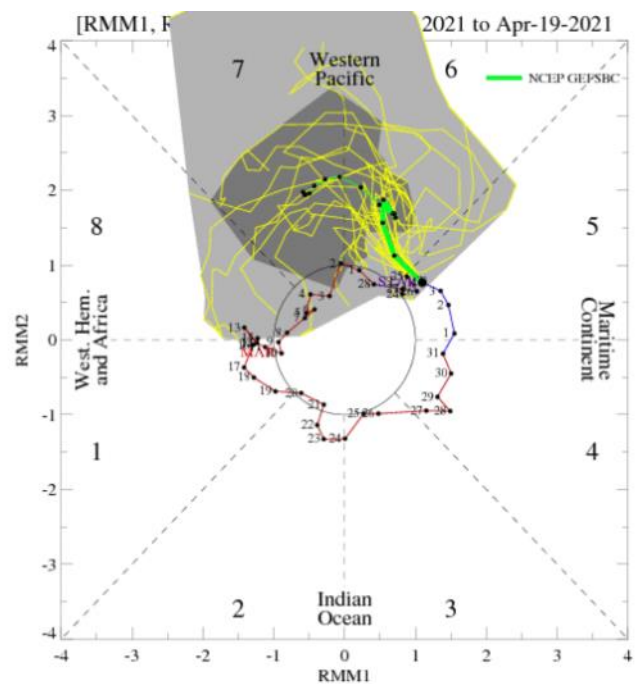
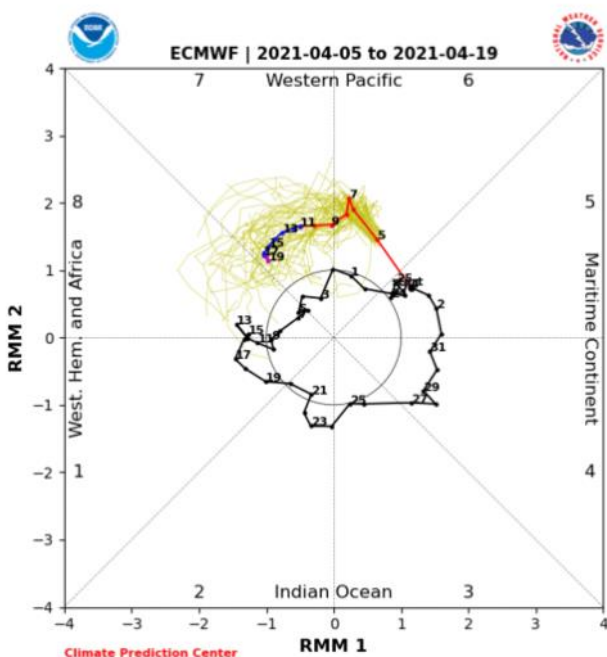
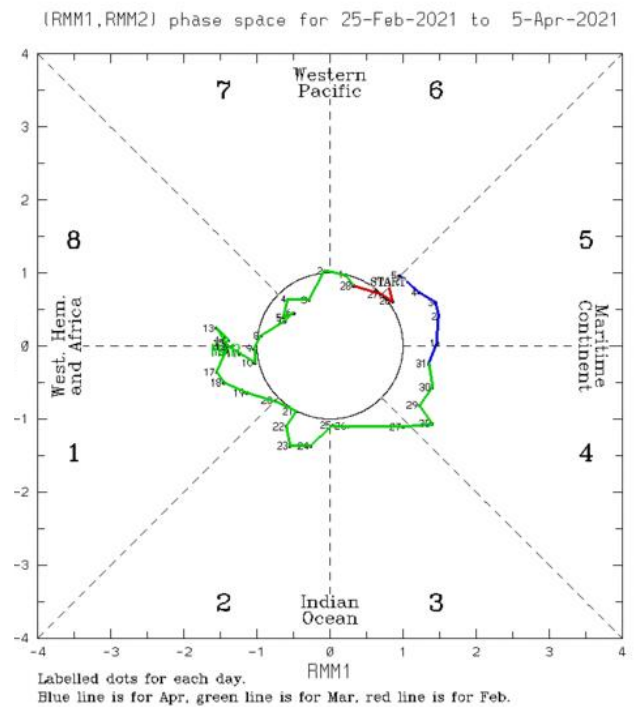
Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean>

MADDEN–JULIAN OSCILLATION

Click link to access [Weekly Tropical Note](#) [Issued on Tuesday 06 April 2021]

A pulse of the Madden-Julian Oscillation (MJO) which has been tracking eastwards across the Maritime Continent to Australia's north, is likely to move further east into the Western Pacific region in the coming days. This pulse remains moderately strong, but as it tracks further east, its influence on rainfall patterns across northern Australia is likely to lessen. At this time of the year, an MJO in the tropical Western Pacific typically increases the chance of above-average rainfall across the islands of the South-west Pacific, with some increased chance of above-average cloudiness and rainfall for far northern Australia.

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



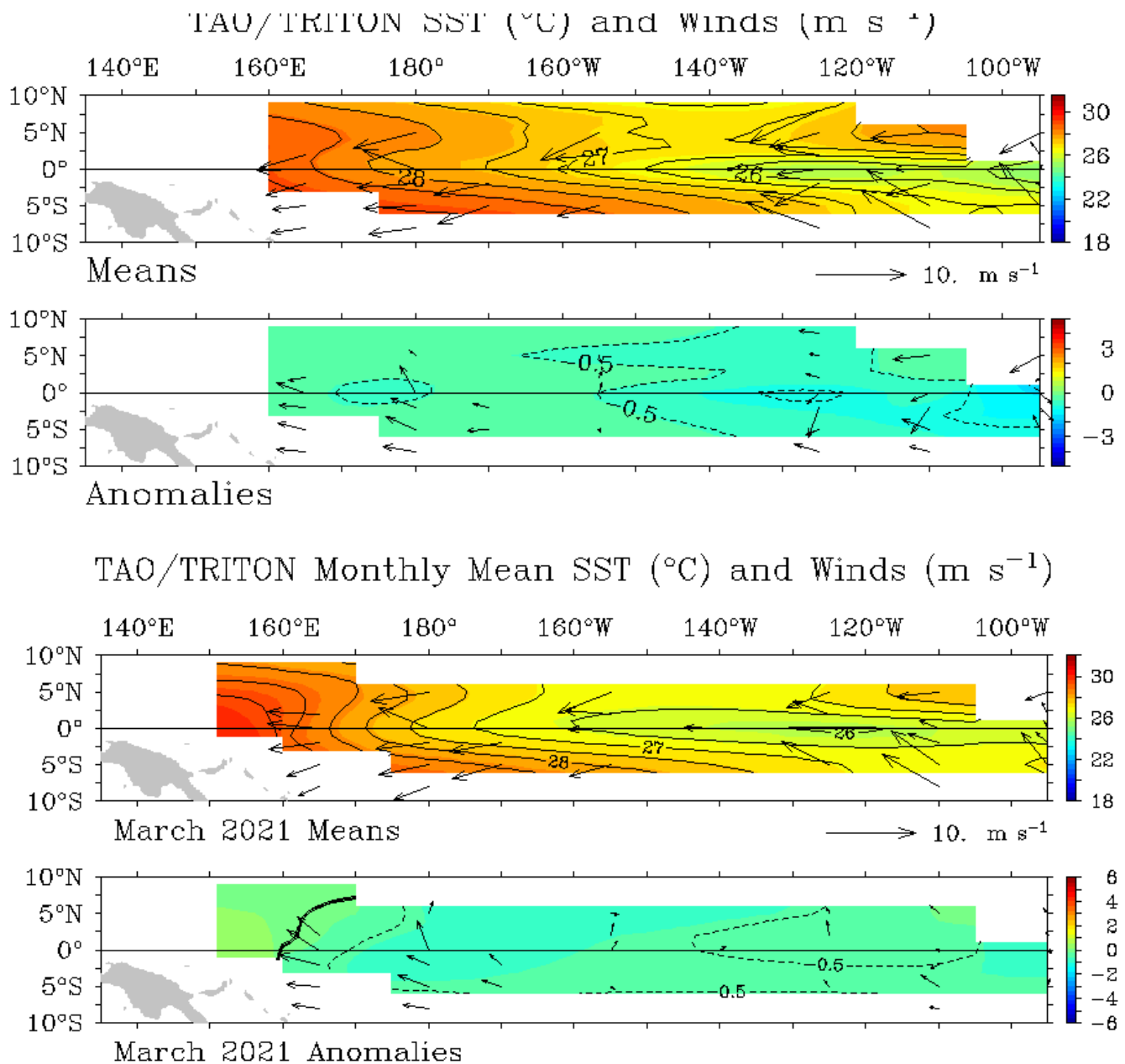


WIND

Click link to access [Wind plots link](#)

The trade-winds in March were close to average over the central and eastern equatorial Pacific, but were stronger than normal close to, and west of the Date Line.

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

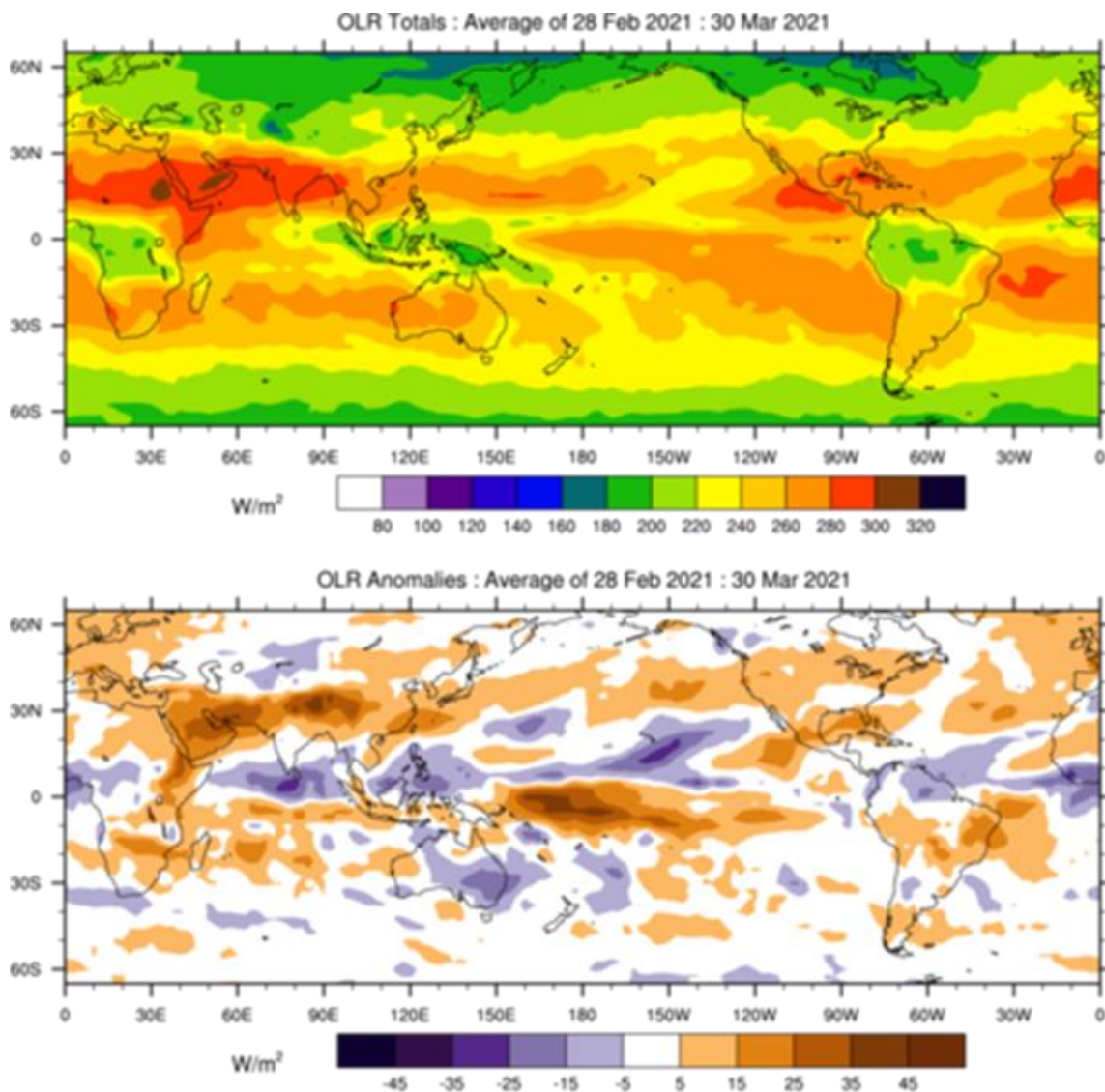
Click link to access [OLR](#)



The March 30-day OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was active in its normal position. The South Pacific Convergence Zone (SPCZ) on the other hand, was active and shifted southwestwards over Fiji and Tonga.

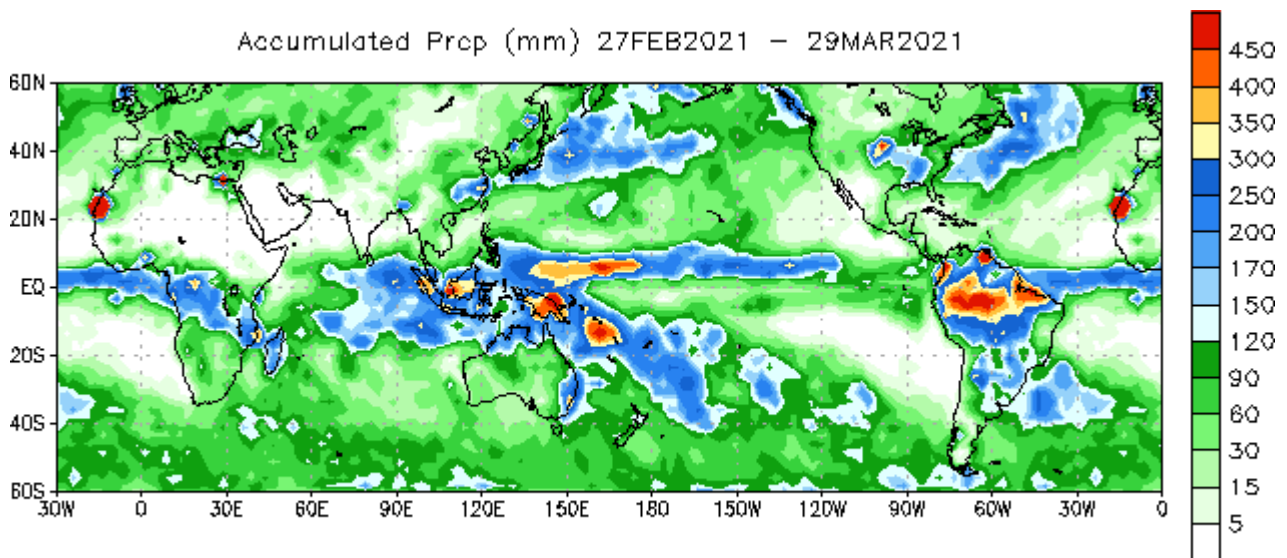
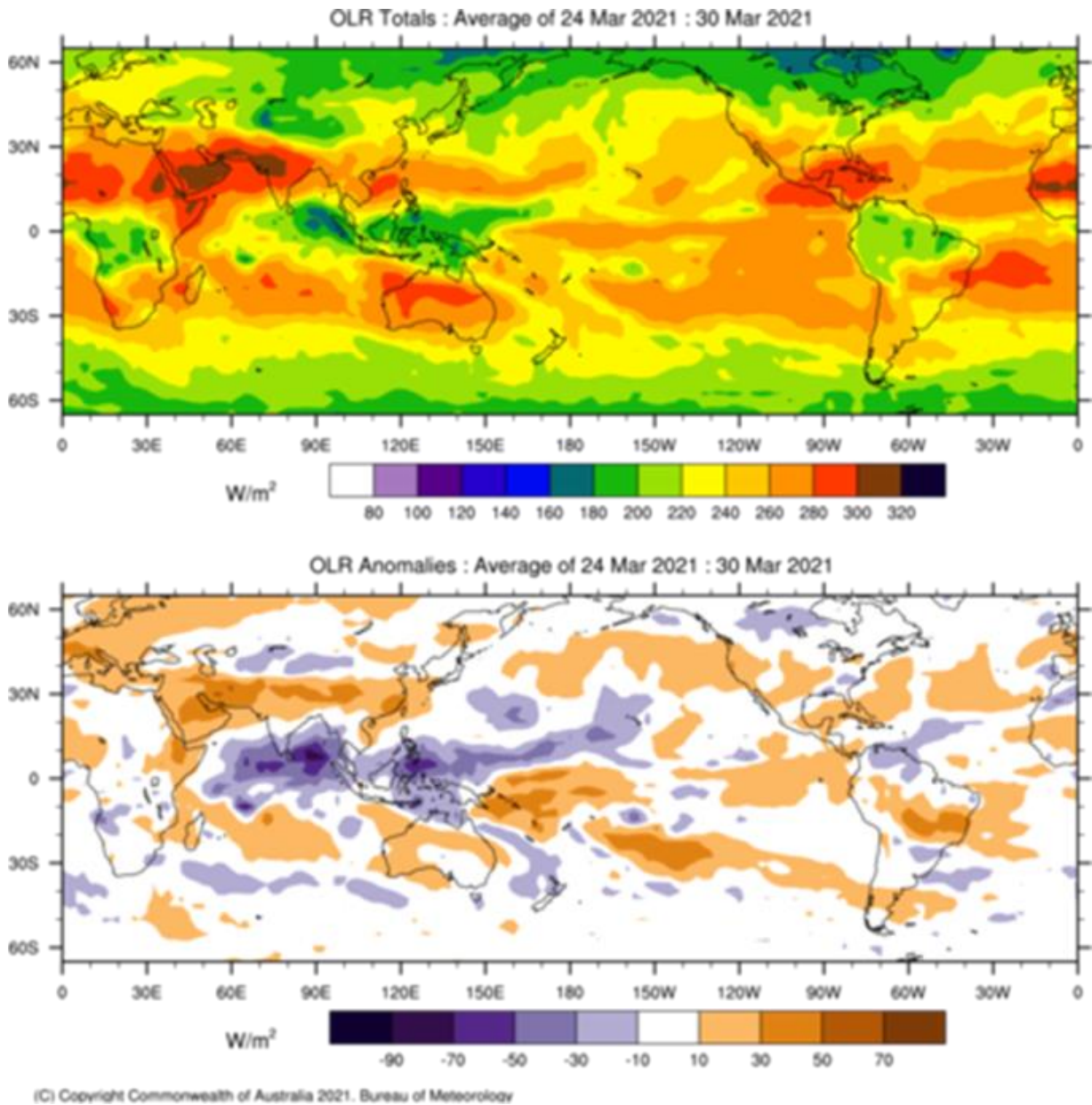
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR



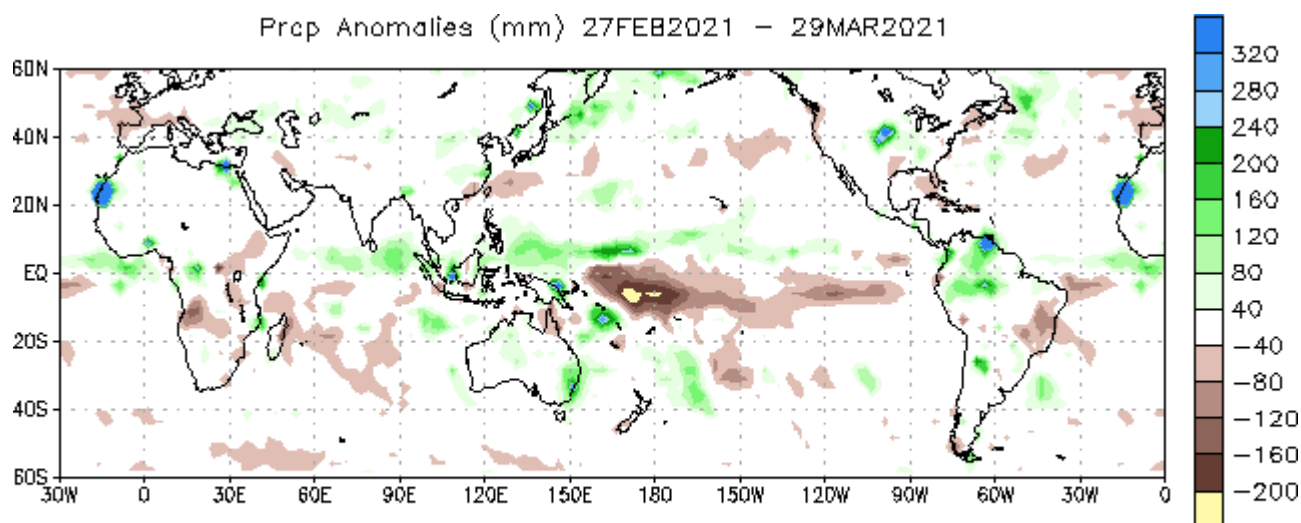
(C) Copyright Commonwealth of Australia 2021. Bureau of Meteorology

OLR Total and Anomalies, 7 Day OLR

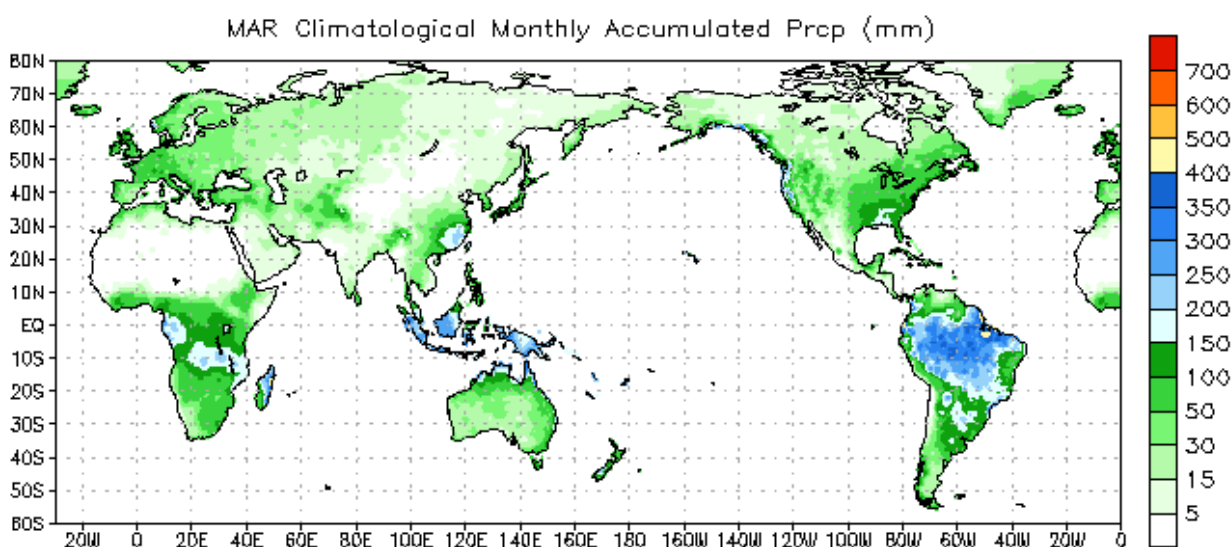


Data Source: NCEP CMAP Precipitation

30-Day Rainfall Anomalies



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



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

NOAA Climate Prediction Centre - NCEP CMAP precipitation:

https://ww.cpc.ncep.noaa.gov/products/Global_Monsoons/Global-Monsoon.shtml

OCEAN CONDITIONS

SEA SURFACE TEMPERATURE

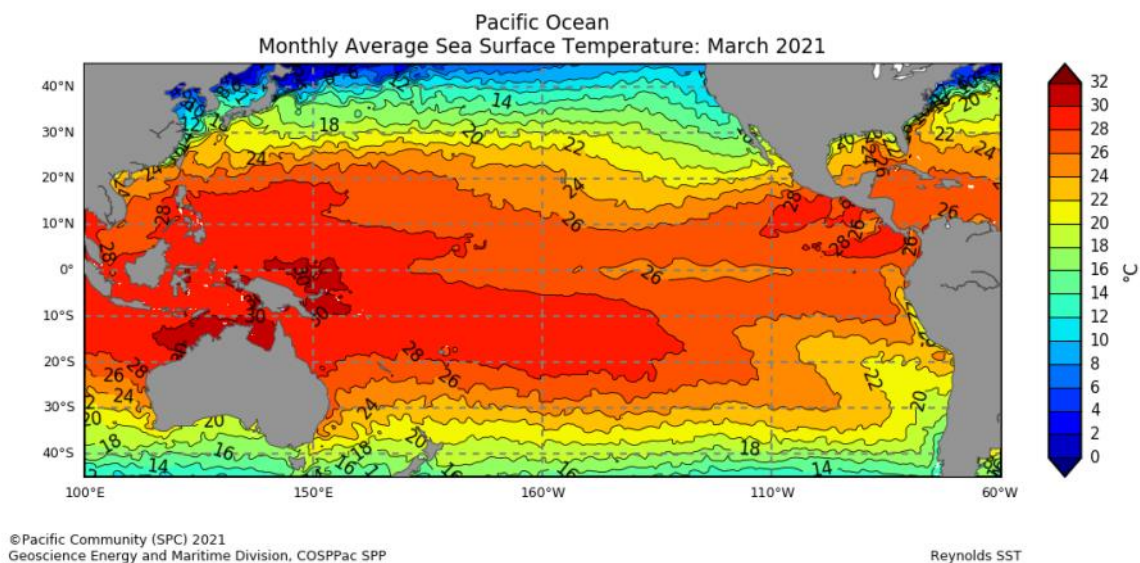


Click link to access [Pacific Community COSPPac Ocean Portal](#)

The SST anomaly pattern in March continued to show the classic La Niña shape, with below average temperatures prevailing along the equator up to Nauru. The usual boomerang shape of above average temperatures surrounding the cool equatorial anomalies, had a break around Fiji where negative anomalies prevailed. Highest anomalies were experienced by southern Cook Islands where ocean temperatures were 1.5 to 2.0 degrees above average. Similarly, PNG, FSM and Palau experienced positive anomalies of 1.0 to 1.5 degrees. The Kiribati group continued to experience cool anomalies of 0.5 to 1.5 degrees.

In terms of the deciles, regions of Highest-on-Record for March occurred in much of Palau, parts of FSM, PNG, and Cook Islands. Regions of above average to very much above average (deciles 8-10) SSTs spanned RMI, Tonga, Samoa, Niue and central Cook Islands. In contrast, below average to very much below average (deciles 1-3) SSTs were observed in Kiribati, central and southern Vanuatu and Fiji-particularly around Vanua Levu and Viti Levu where a region of lowest on record persisted.

Mean Sea Surface Temperature

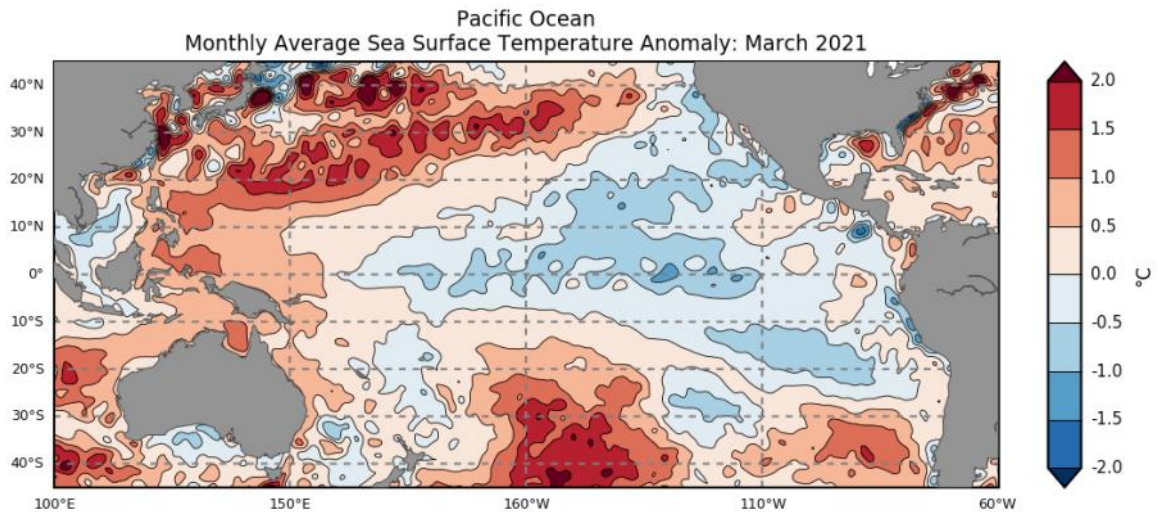


OCEAN CONDITIONS

Click link to access [SEA SURFACE TEMPERATURE](#)



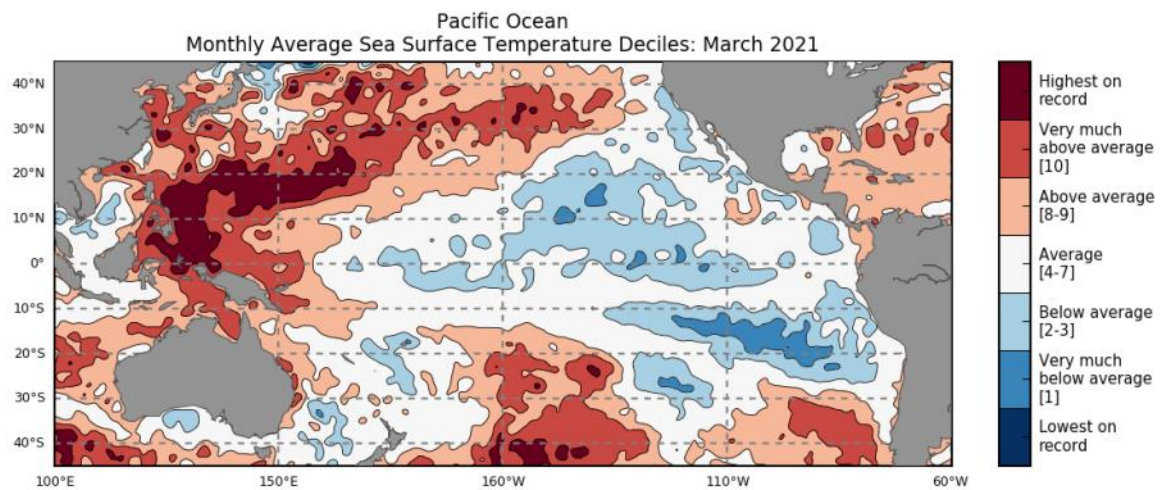
Anomalous Sea Surface Temperature



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Geoscience Energy and Maritime Division, COSPPac SPP

Reynolds SST

Sea Surface Temperatures Deciles



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Geoscience Energy and Maritime Division, COSPPac SPP

Reynolds SST

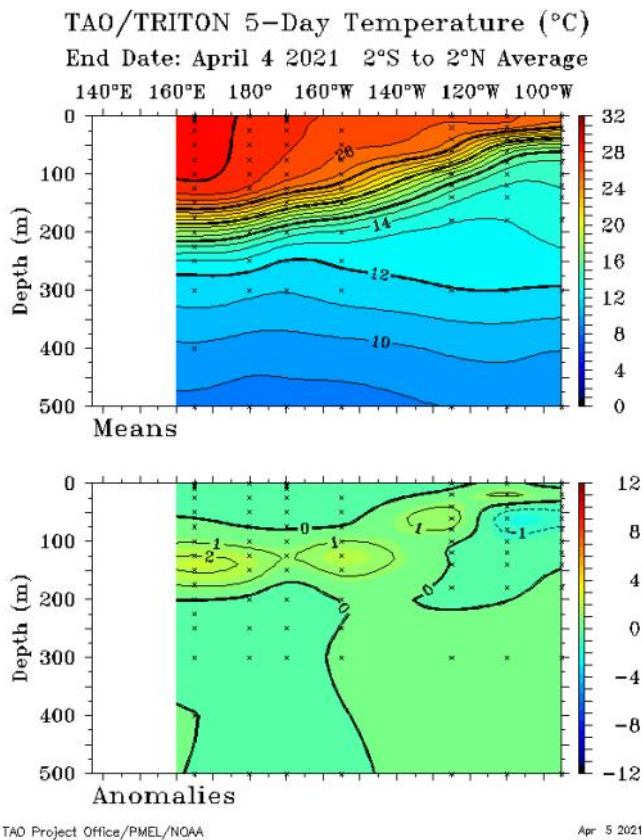
OCEAN CONDITIONS

SUB SURFACE

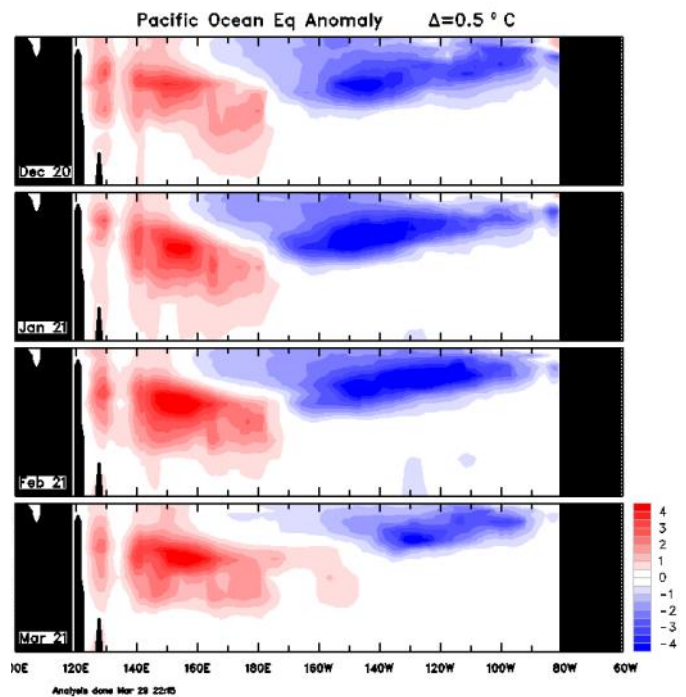


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 25th March) shows cooler than average water extending across the top 100 to 150 m of the sub-surface of the equatorial Pacific east of the Date Line. The strength and depth extent of the cool anomalies has decreased significantly compared with February, in line with the break down of the 2020-21 La Niña. Warm anomalies persist across large parts of the column depth west of 160 ° W, with stronger anomalies west of the Date Line. These warm anomalies remain similar in strength compared with last month but have extended farther eastward during March.

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

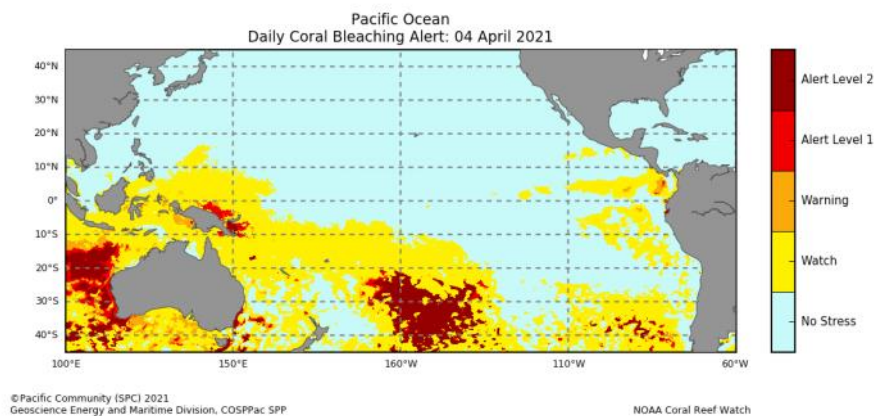
CORAL BLEACHING



The daily Coral Bleaching Alert for 4th April 2021 shows 'Watch' for much of the COSPPac partner countries, peaking at Alert Level 1 and 2 just north and east of PNG and southern Cook Islands. The four weeks Coral Bleaching Outlook to 25th April shows the 'Watch' alert continuing for most of the countries in the region with PNG and Solomon Islands on alert level 1 and 2.

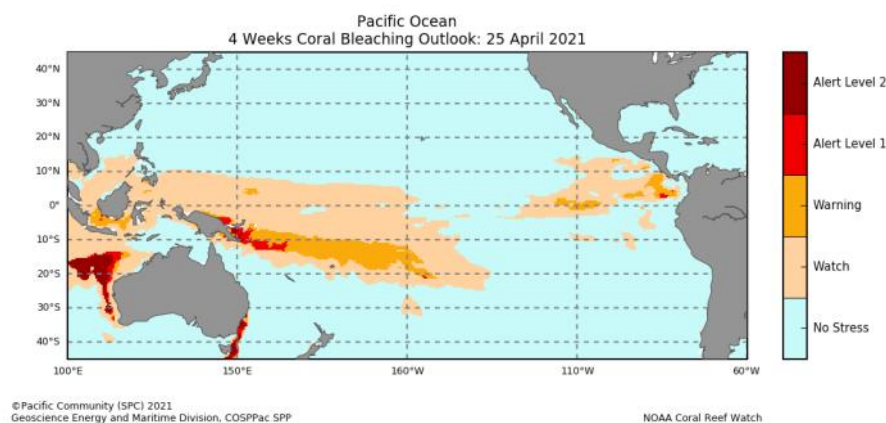
Daily Coral Bleaching Alert

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



4-Weeks Coral Bleaching Outlook

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



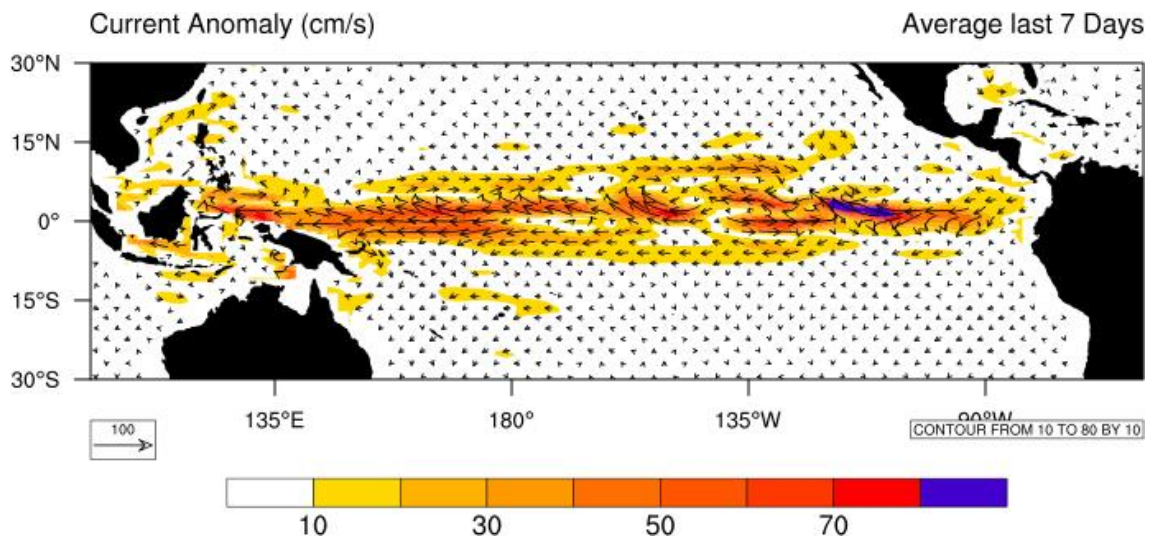
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL



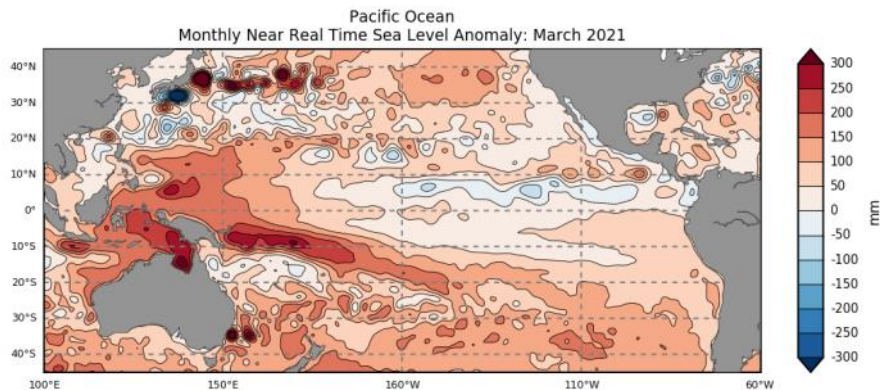
Sea level was above normal for most of the western Pacific region. The distinct boomerang shape was still present with highest anomalies above +200mm spanning from Palau, FSM, across PNG, through Solomon Islands, Tuvalu, Fiji, Samoa and Cook Islands. Marshall Islands, and Nauru were also above average from 100 mm to 150 mm.

Ocean Surface Current (Last 7-Days)



Monthly Sea Level Anomalies

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



©Pacific Community (SPC) 2021
Geoscience Energy and Maritime Division, COSPPac SPP

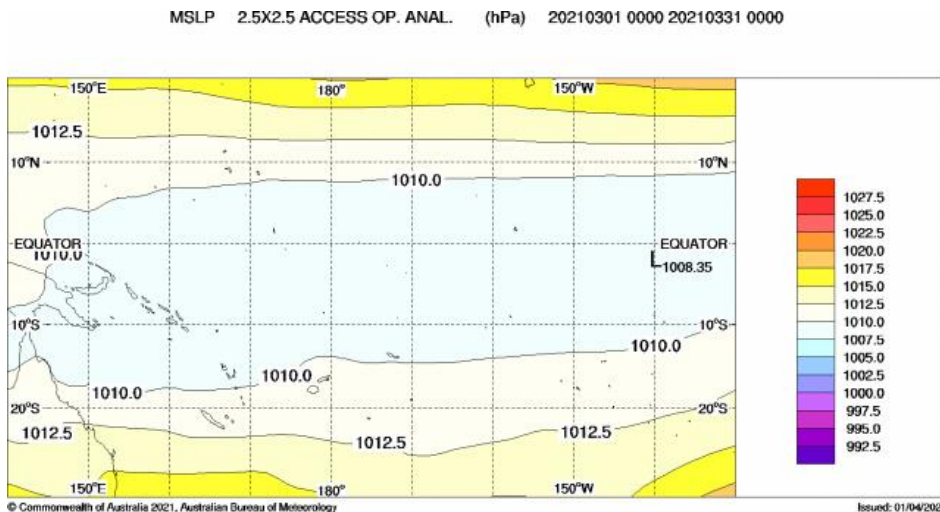
AVISO Ssalto/Duacs SLA

MEAN SEA LEVEL PRESSURE

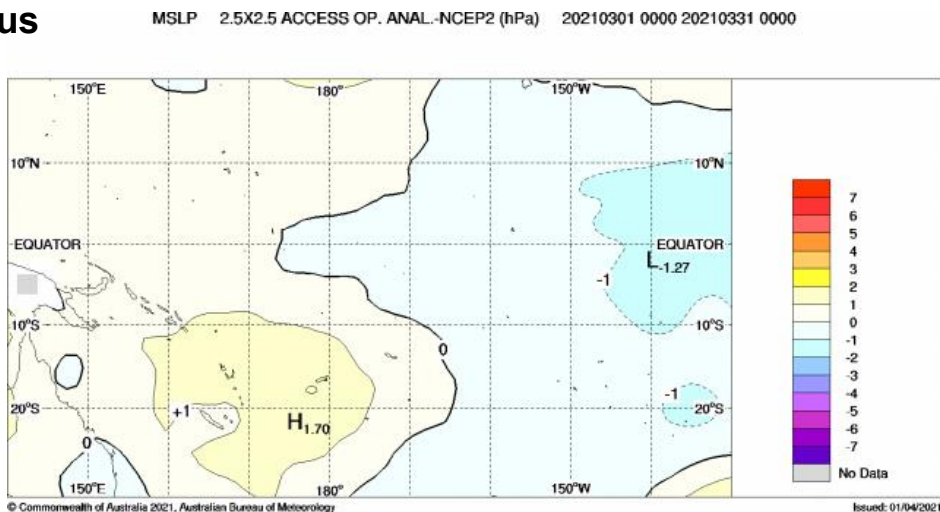
The March mean sea level pressure (MSLP) anomaly map shows negative anomalies over east of about 150° in the tropical Pacific. Positive anomalies were present over the Vanuatu, Fiji and Tonga region.

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

Mean



Anomalous



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

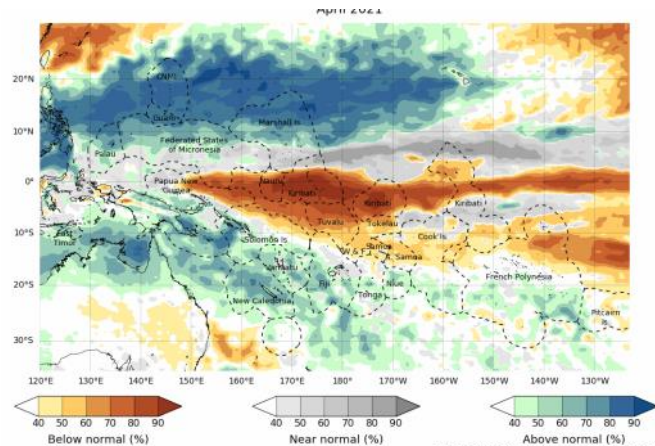
April—June 2021



The ACCESS-S model forecast for April 2021 strongly favours below normal rainfall for far northern PNG and Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, the northern Cook Islands, and parts of northern French Polynesia. Above normal rainfall is favoured in most parts of Palau, FSM, northern and central Marshall Islands, southern and Momase regions of PNG, western Solomon Islands, New Caledonia, Vanuatu, parts of Fiji and Tonga, Niue and parts of southern French Polynesia.

The three-month rainfall outlook (April-June) is very similar to the March pattern: it shows a strong dry signal along the equator, surrounded by bands of increased chance wetter in both hemispheres. Above normal maximum and minimum temperatures are favoured for many COSPPac countries, except for some areas east of 170°E, namely Kiribati, northern Tuvalu, northern Cook Islands, plus northern and central French Polynesia, and areas southwest of New Caledonia where near-normal to below normal temperatures are favoured.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for April to June favours below normal rainfall for northern PNG, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, northern and central Cook Islands, and northern and central French Polynesia. Above normal rainfall is favoured for Palau, FSM, RMI, southern and western PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands.

The SCOPIC statistical model for April to June favours below normal rainfall for Kiribati, Tuvalu, and northern Cook Islands. Above normal rainfall is favoured for Palau, western FSM, Marshall Islands, parts of southern and Momase region of PNG, eastern Solomon Islands, Vanuatu, Fiji, central Tonga, and southern Cook Islands.

The APEC Climate Centre multi-model for April to June favours below normal rainfall for New Guinea Islands, northern regions of the Solomon Islands, Nauru, Tuvalu, Kiribati, Tokelau, Samoa, northern Cook Islands, and central to northern French Polynesia. Above normal rainfall is favoured for Palau, most of RMI, southern PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and parts of southern French Polynesia.

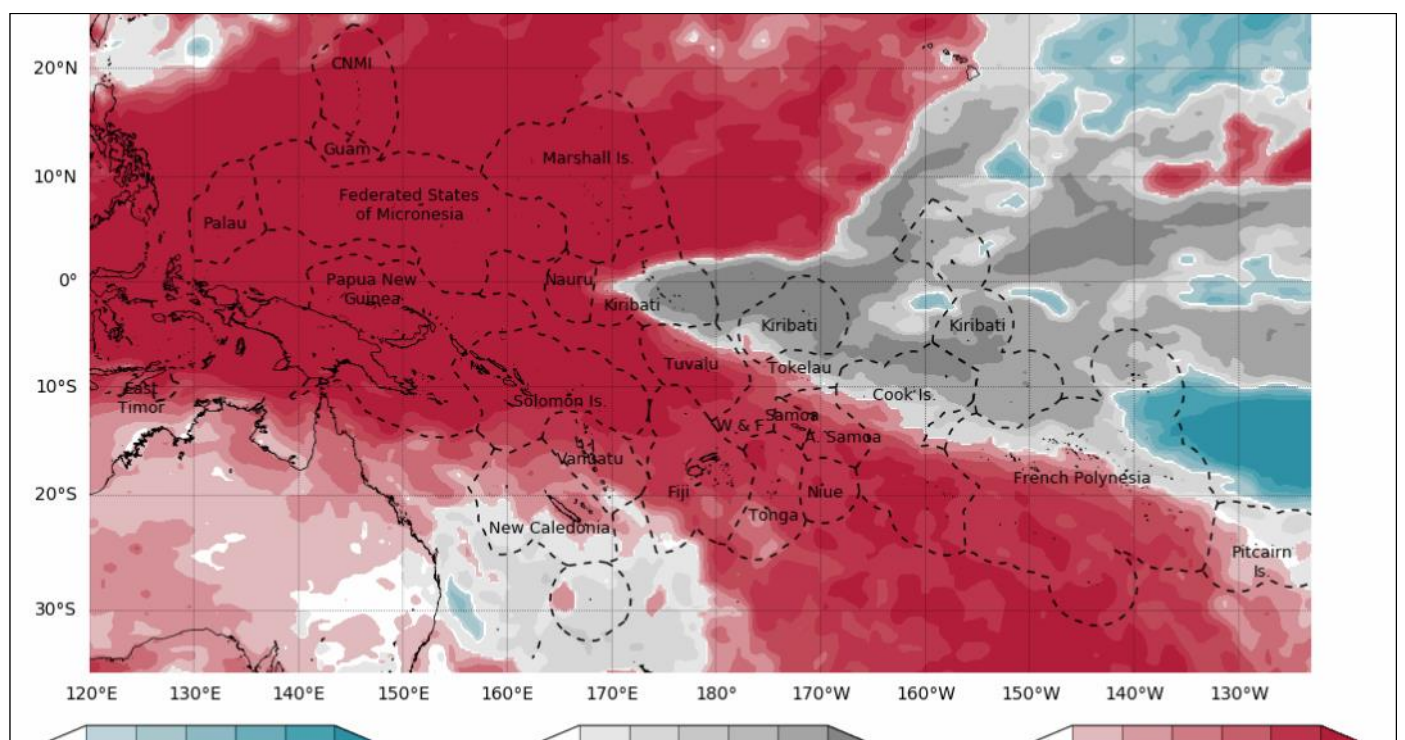
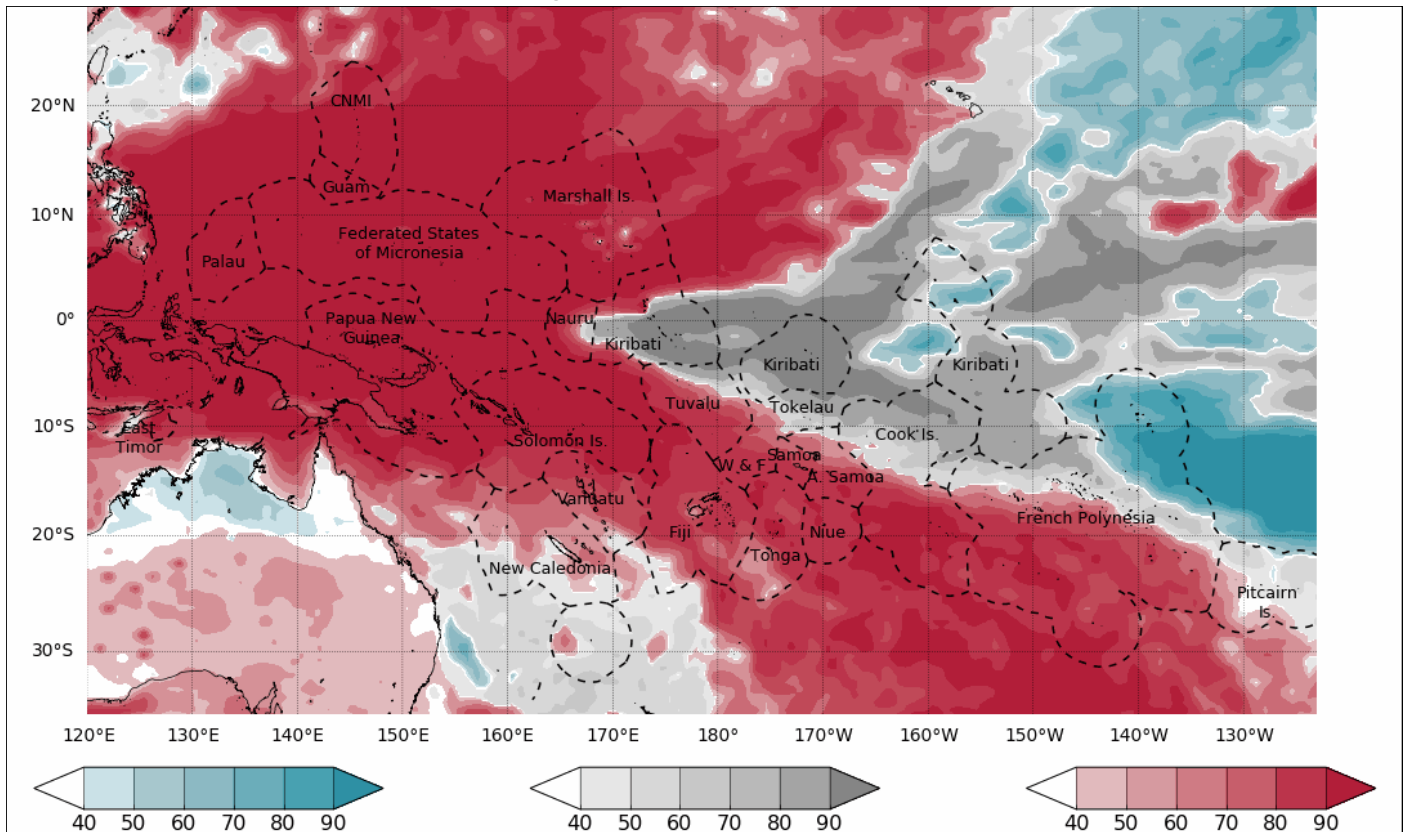
For April to June 2021, the dynamical models (as well as SCOPIC) agree on above normal rainfall for Palau, FSM, Marshall Islands, the southern and Momase regions of PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands and central and northern French Polynesia.

SEASONAL TEMPERATURE OUTLOOK

April—June 2021



Monthly **ACCESS-S** Maps



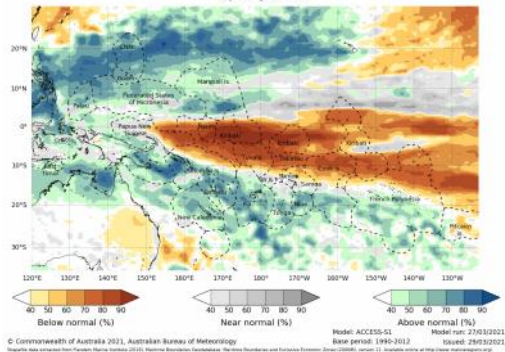
SEASONAL RAINFALL OUTLOOK

April—June 2021

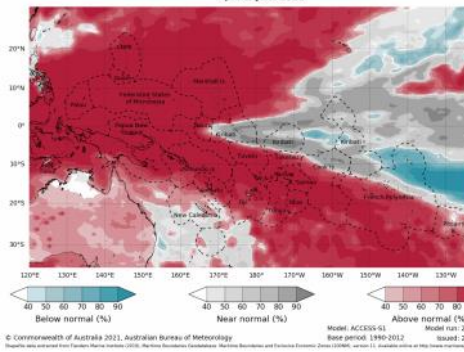


Seasonal ACCESS-S maps

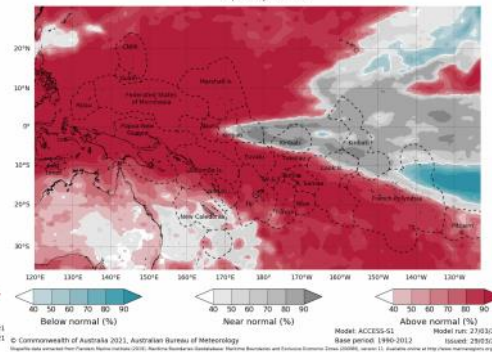
Tercile rainfall probabilities for April to June 2021



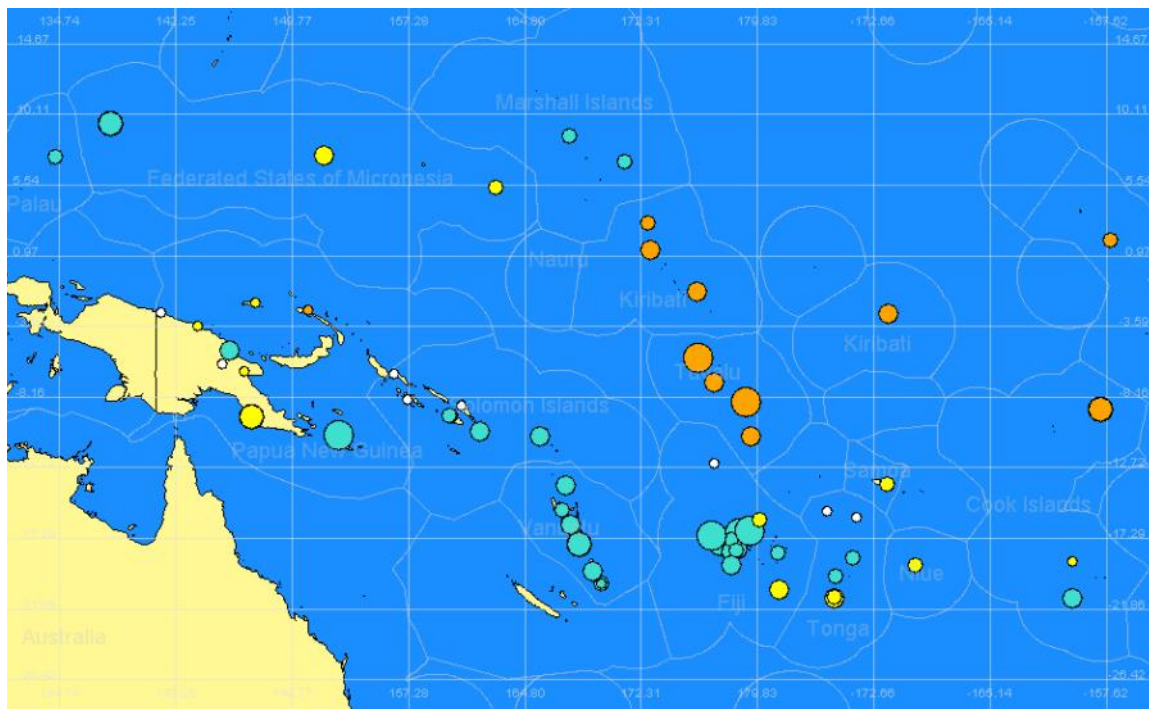
Tercile maximum temperature probabilities for April to June 2021



Tercile minimum temperature probabilities for April to June 2021



SCOPIC



Legend

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

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

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

SEASONAL RAINFALL OUTLOOK

April—June 2021



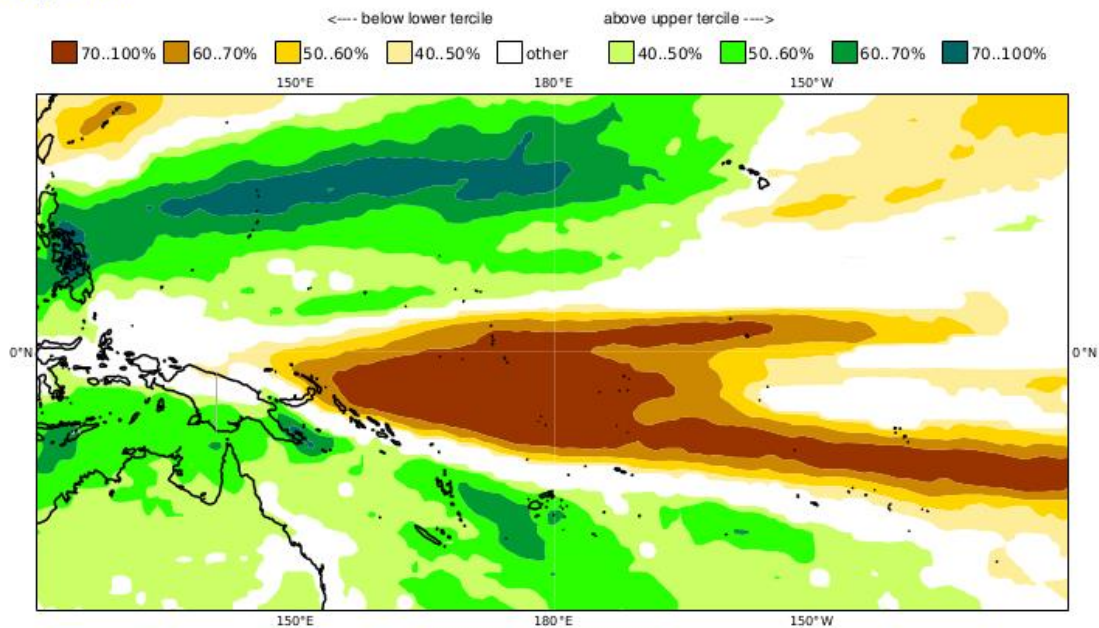
Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

AMJ 2021

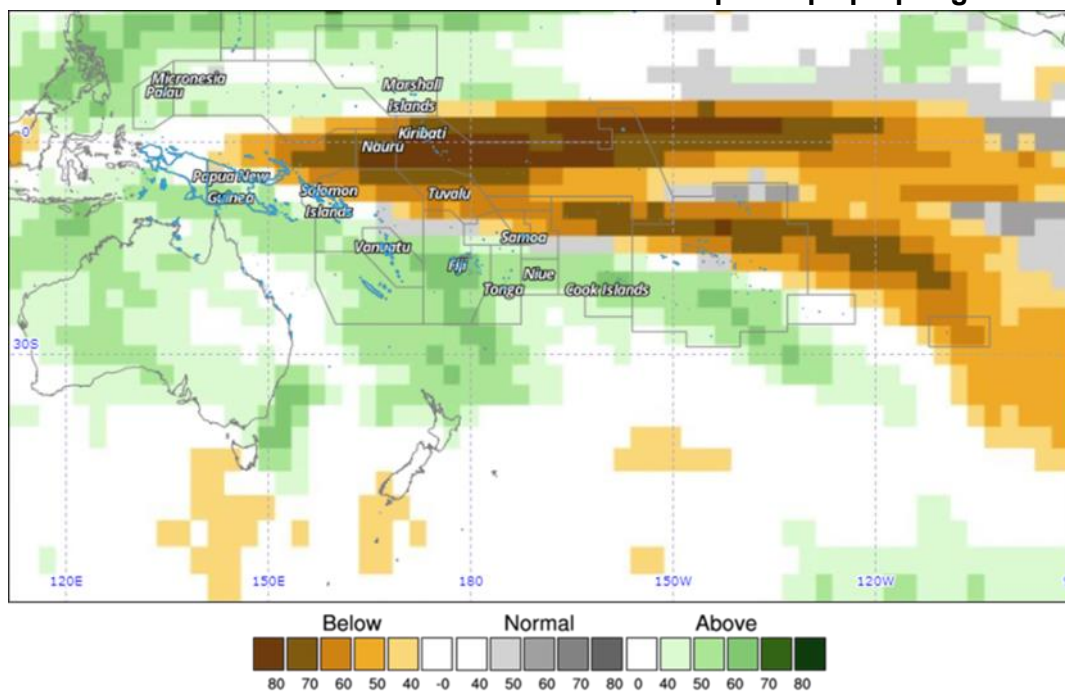
Nominal forecast start: 01/03/21

Unweighted mean



Copernicus Rainfall: <https://climate.copernicus.eu/charts/>

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



Year: 2021, Season: AMJ, Lead Month: 3, Method: GAUS

Model: APCC, CWB, MSC, NASA, NCEP, PNU, POAMA

Generated using CLIK® (2021-4-4)

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TROPICAL CYCLONE

2020/2021 Season



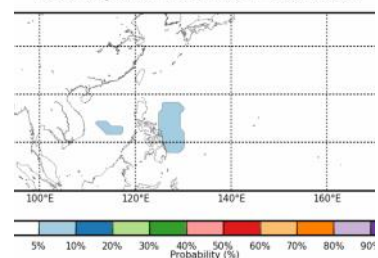
There were twelve (10) Tropical Depressions (TD) where 6 TD's intensified into Tropical Cyclone (TC's) namely TC Yasa (Category 5), TC Zasu (Category 2), TC Ana (Category 3), TC Bina (Category 1, TC Lucas (Category 2) and TC Niran (Category 5).

The weekly tropical cyclone forecast from ACCESS-S model shows some risk in the weeks beginning 10 April and ending 23 April 2021 for the southwest Pacific, especially in areas around Vanuatu, New Caledonia and the central Coral Sea. There is also some tropical cyclone risk for the northwest Pacific in the week ending 23 April.

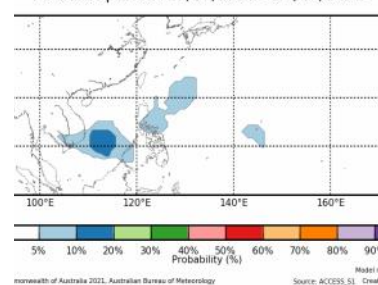
The tropical cyclone season outlook for 2020-21 is available via: <http://www.bom.gov.au/climate/cyclones/south-pacific/>

ACCESS-S Weekly Forecasts –Northwest Pacific

Tropical Cyclone probabilities in the Northern Pacific
Forecast period: 10/04/2021 - 16/04/2021

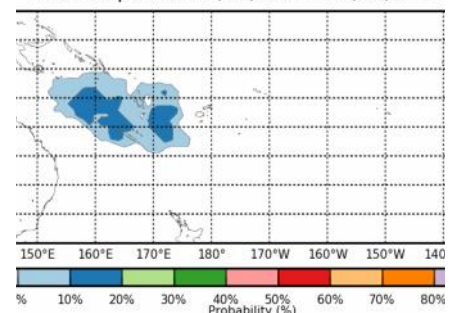


Tropical Cyclone probabilities in the Northern Pacific
Forecast period: 17/04/2021 - 23/04/2021

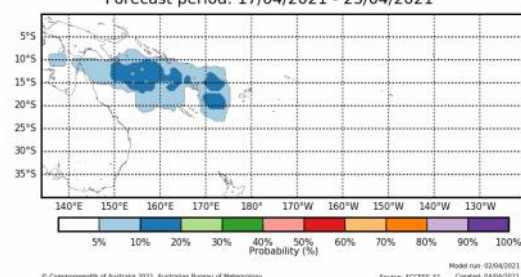


ACCESS-S Weekly Forecasts –Southwest Pacific

Tropical Cyclone probabilities in the South Pacific
Forecast period: 10/04/2021 - 16/04/2021



Tropical Cyclone probabilities in the South Pacific
Forecast period: 17/04/2021 - 23/04/2021



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.

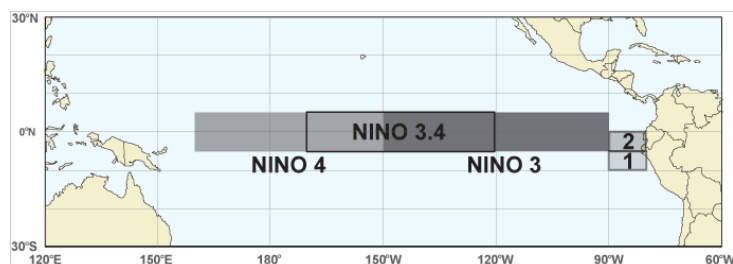
20 degrees Celsius Isotherm Depth

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 20°C isotherm that is deeper than normal (positive anomaly) implies a greater heat content in the upper ocean, while 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