Monthly Climate Bulletin

December 2020

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Photo Credit: T.Tofaeono (Sunset —Manono Island, Samoa)

SPREP
Secretariat of the Pacific Regional Environment Programme

Australian Government
Department of Foreign Affairs and Trade
Bureau of Meteorology

Australian Aid

Climate and Oceans Support Program in the Pacific

Pacific Community
Communauté du Pacifique

CONTENTS

SUMMARY

Issued 05 January 2021

- La Niña has likely reached its peak but impacts likely through January to March of 2021.
- A weak pulse of the Madden-Julian Oscillation (MJO) is located over the Indian Ocean. The climate models forecast suggest that the MJO will not influence tropical weather in the Australian region in the coming fortnight.
- The OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was less active than normal, in contrast to the situation in November. The South Pacific Convergence Zone (SPCZ) on the other hand, was active especially over Vanuatu, Fiji, Samoa, Tonga and Niue. This enhanced activity spawned severe Tropical Cyclone Yasa.
- The December Rainfall image is dominated by a large area of reduced convection stretching over the western to central equatorial Pacific, with the main center west of the Date Line.
- The December mean sea level pressure (MSLP) anomaly map shows relaxation of the subtropical highs and an active broad area of low pressure present over Vanuatu, Fiji Samoa region.
- Apart from some isolated small patches, sea level was above normal in December over COSPPac countries.
- For January to March 2021, the dynamical models (as well as SCOPIC) agree on above normal rainfall for Palau, central to northern Marshall Islands, areas in Southern Regions of PNG, central and eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for southern Marshall Islands, New Guinea's Momase and Islands regions, Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands and central and northern French Polynesia.

EL NIÑO–SOUTHERN OSCILLATION

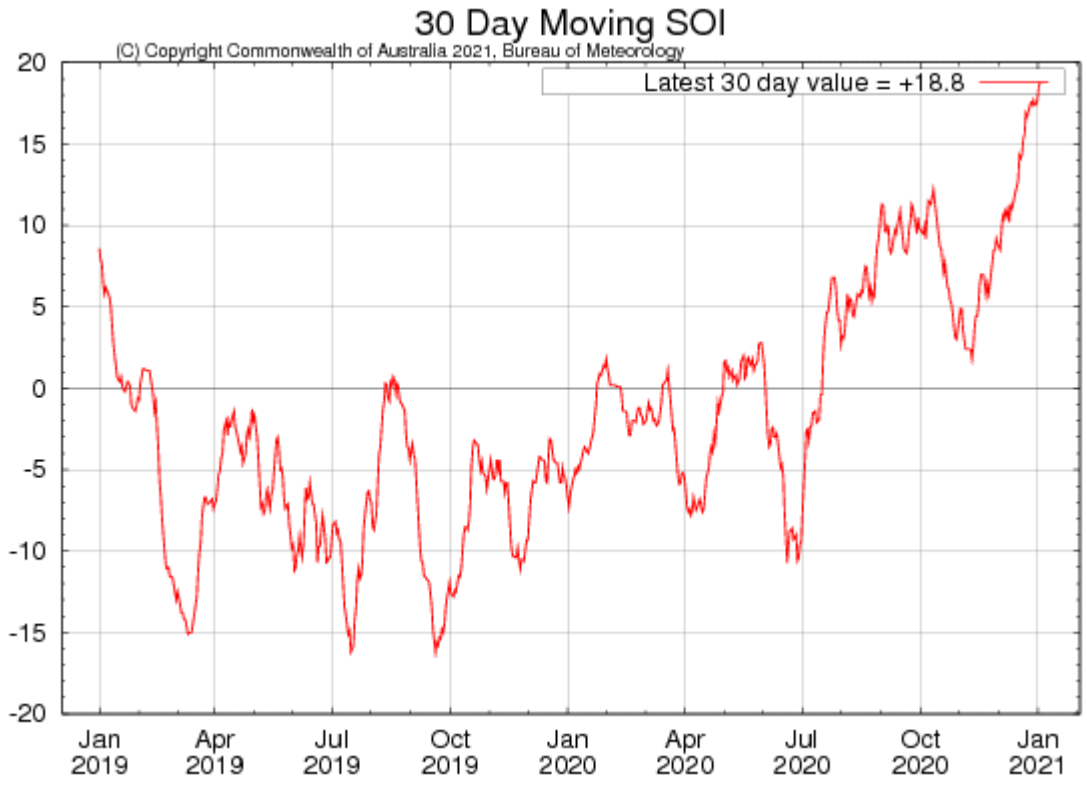
La Niña has likely reached its peak, but impacts likely through first quarter of 2021.

Climate Driver Update issued on 5th January 2021

The 2020-21 La Niña is likely to have peaked in terms of sea surface temperatures in the Pacific Ocean. However, impacts associated with La Niña such as above-average rainfall, are expected to persist across the western pacific through January to March.

Over the past fortnight here has been little change in sea surface temperatures across the central Pacific Ocean, which have been close to the La Niña threshold of 0.8°C below average since early December. However, the Southern Oscillation Index has risen sharply and is currently at +18.8, well above the La Niña threshold of +7.

Model outlooks indicate the strength of La Niña is likely to ease in the coming weeks with a likely return to neutral conditions during the late southern summer or early autumn.
The 30-day Southern Oscillation Index (SOI) for the 30 days ending 3 January was +18.8. The 90-day SOI value was +11.8.



EL NIÑO–SOUTHERN OSCILLATION

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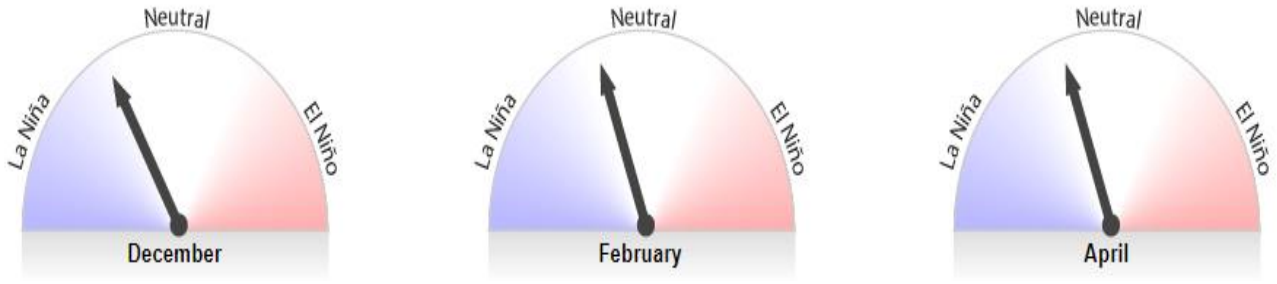
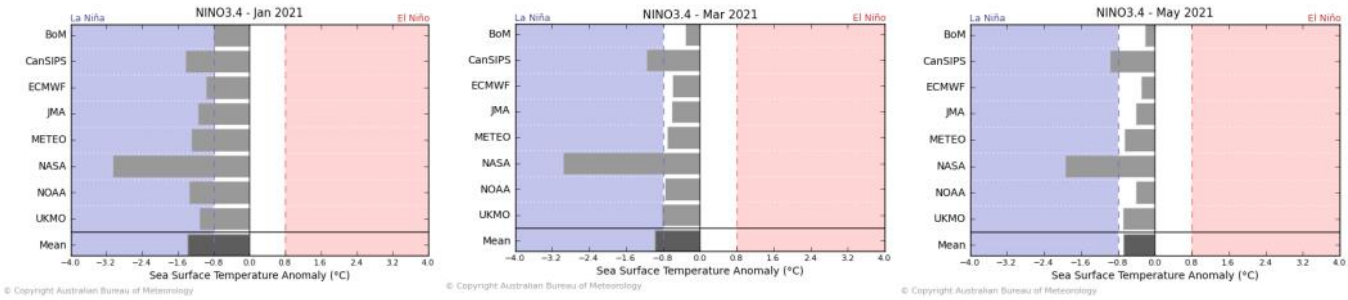
Bureau of Meteorology NINO3.4 ENSO Model Outlooks .



Bureau of Meteorology NINO3.4 International Model Outlooks



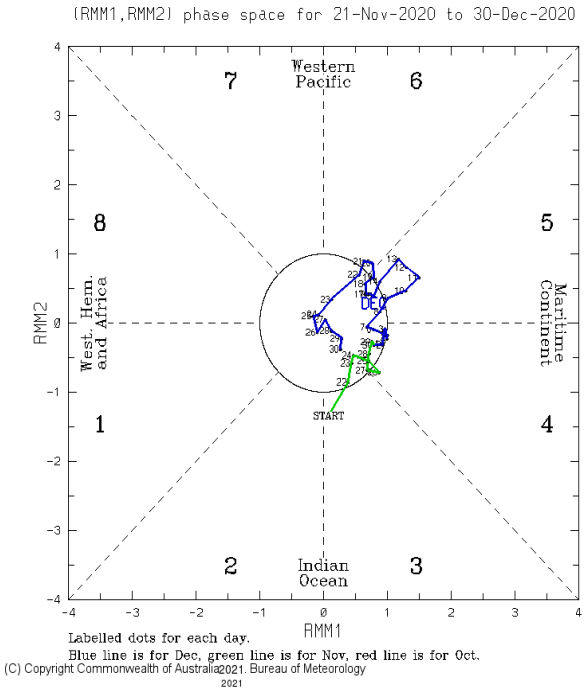
Bureau of Meteorology summary of international model outlooks for NINO3.4:

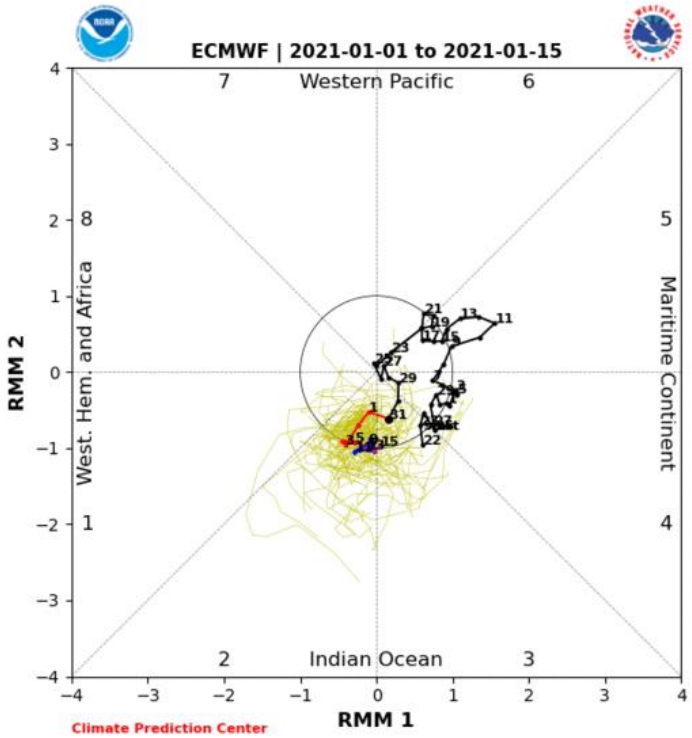
MADDEN–JULIAN OSCILLATION

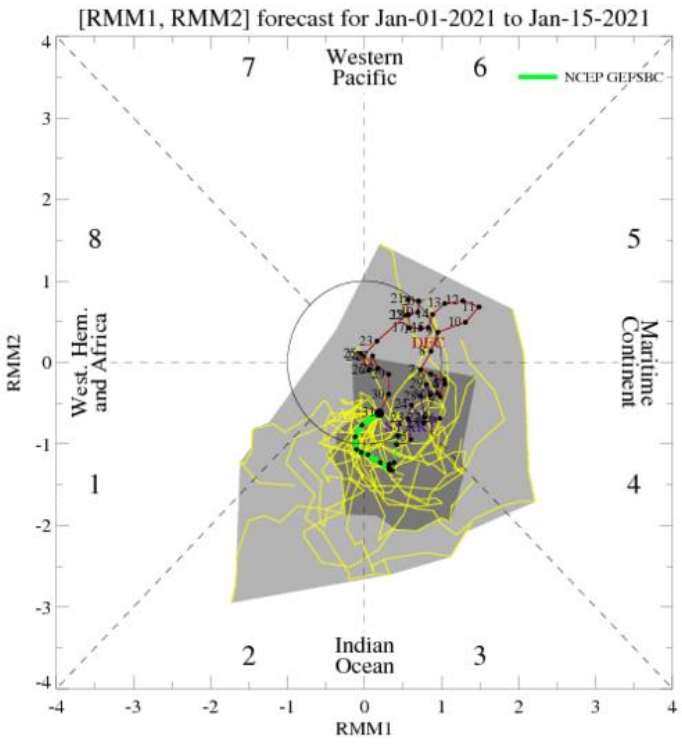
Weekly Tropical Note [Issued on 05th January 2021]

The Madden-Julian Oscillation (MJO) is located over the Indian Ocean. It is relatively weak, although most models indicate it may strengthen marginally in the coming week. The MJO is not expected to significantly influence tropical weather in the Australian region in the coming fortnight.

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





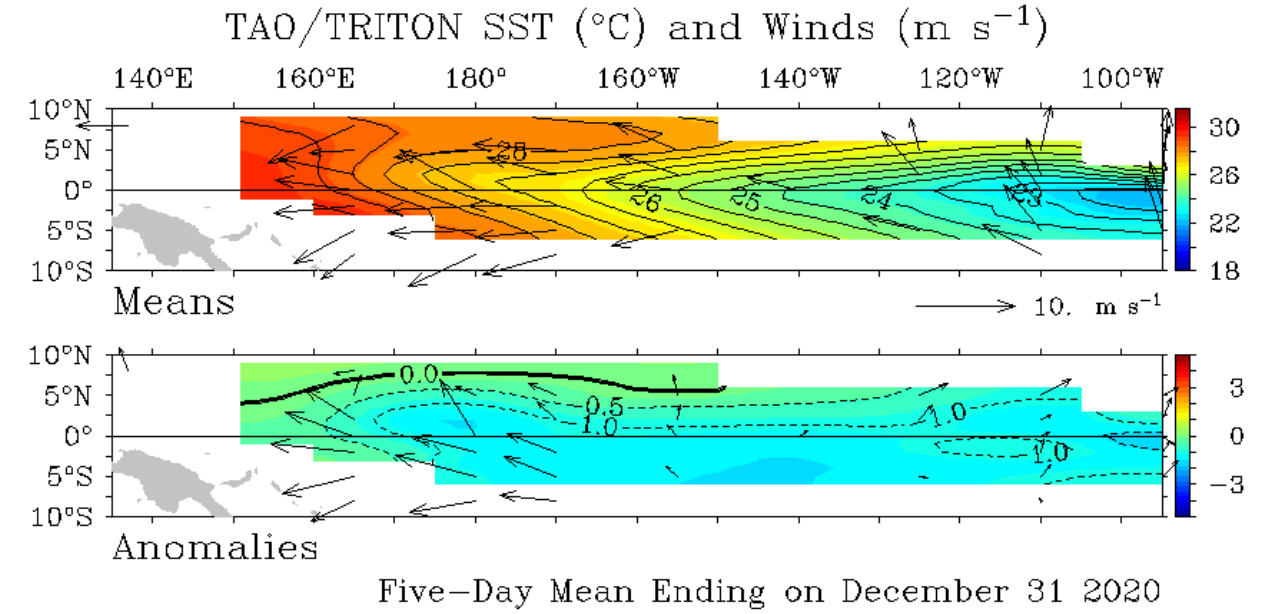


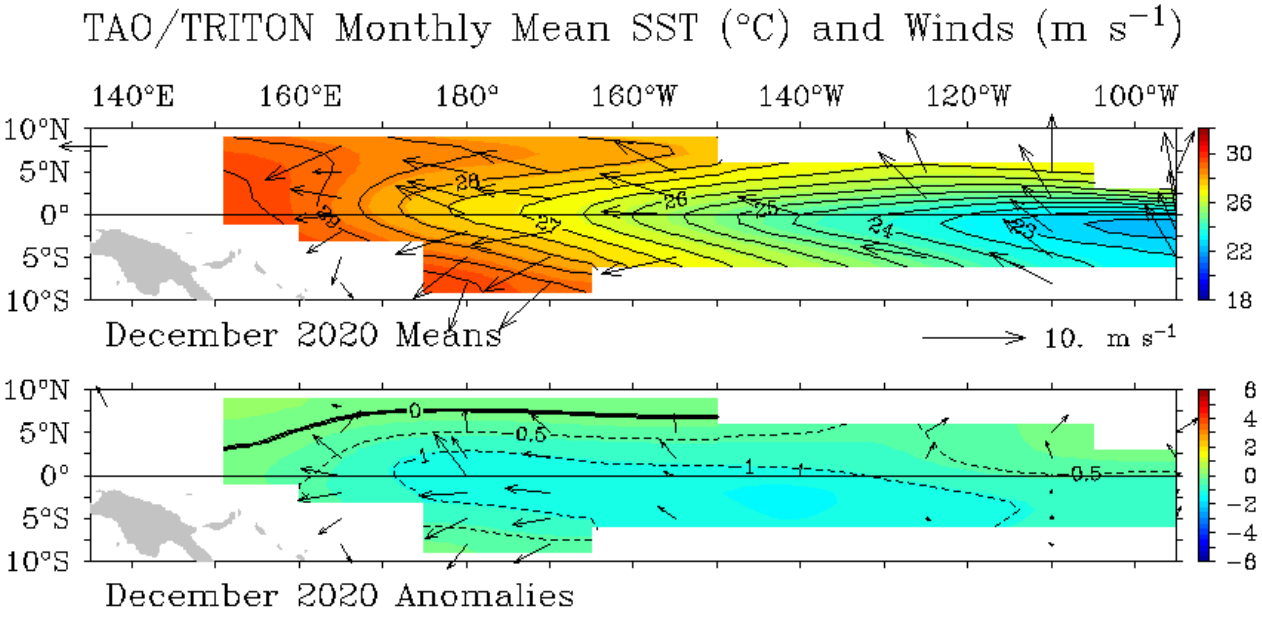
WIND

Display link

The trade winds were mainly stronger than normal over the western and central equatorial Pacific during December, which is consistent with the La Niña. In the eastern Pacific, the Trades tended to be weaker than average, which is consistent with the slight rise in NINO3.

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.





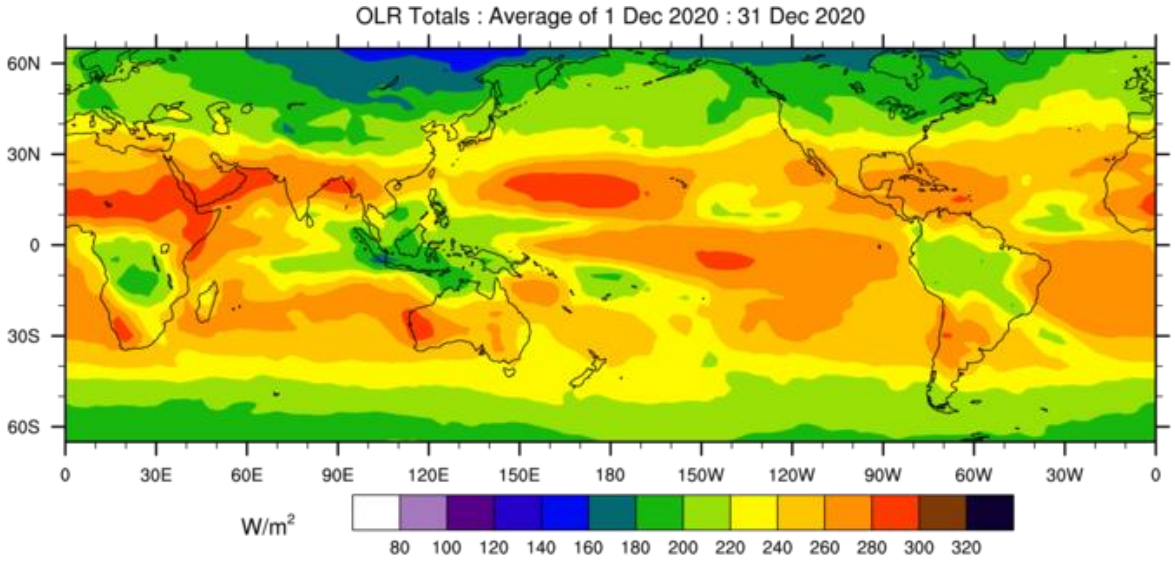
CLOUD AND RAINFALL

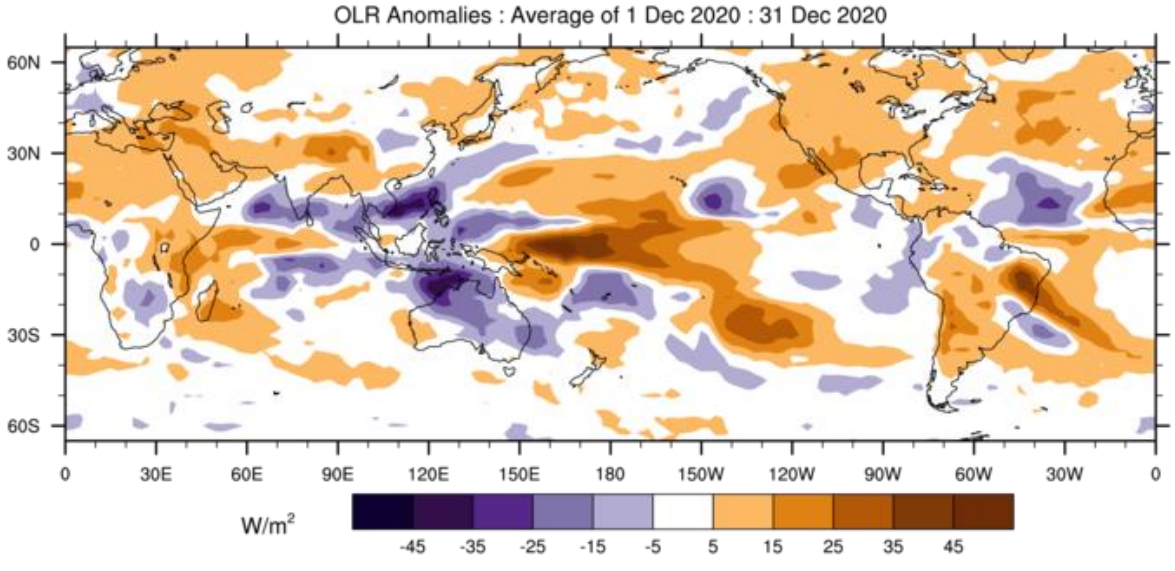
OLR link

The December 30-day OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was less active than normal, in contrast to the situation in November. The South Pacific Convergence Zone (SPCZ) on the other hand, was active especially over Vanuatu, Fiji, Samoa, Tonga and Niue. This enhanced activity spawned severe Tropical Cyclone *Yasa*. Elsewhere, the SPCZ was shifted to the southwest.

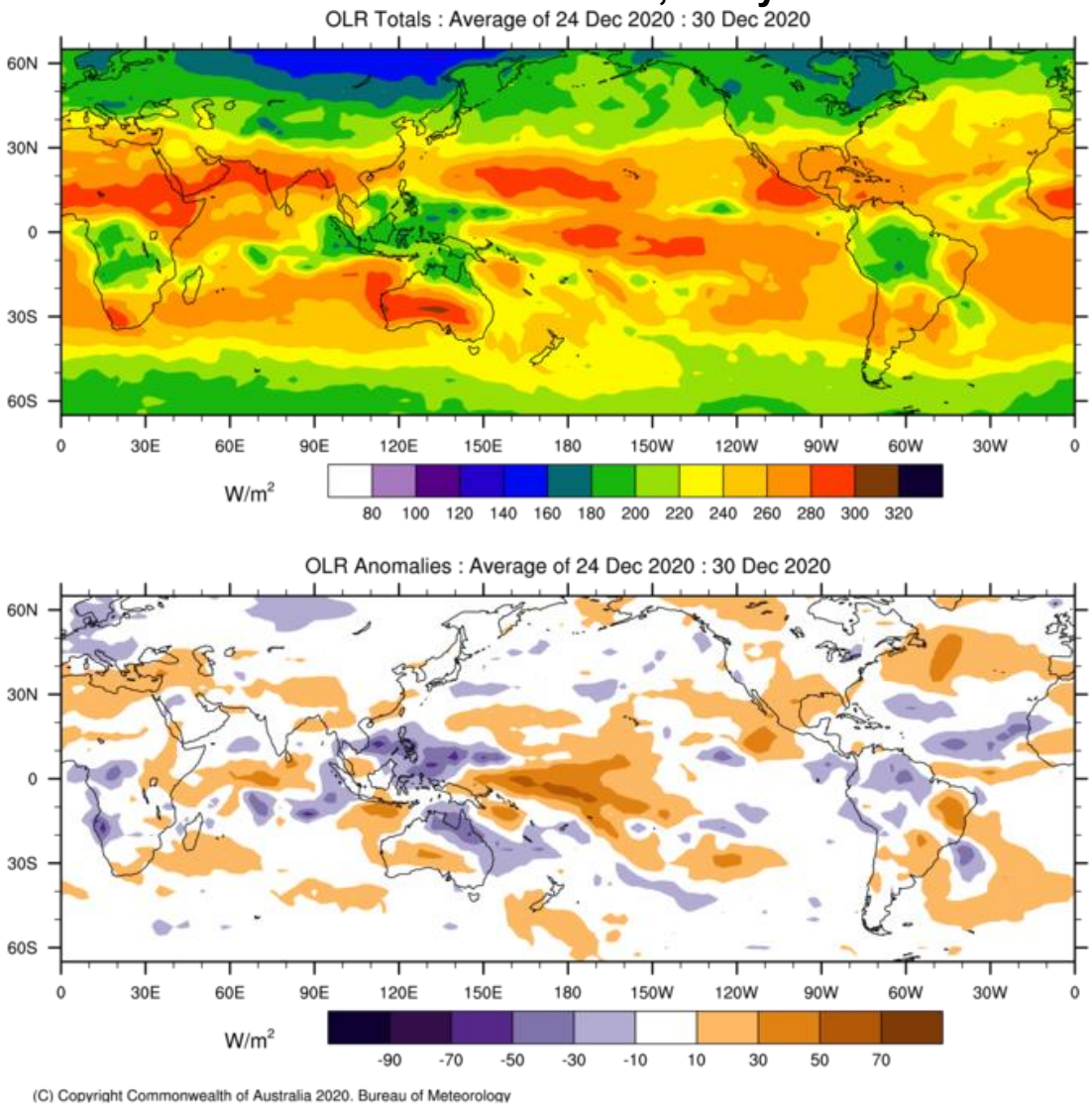
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2. In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

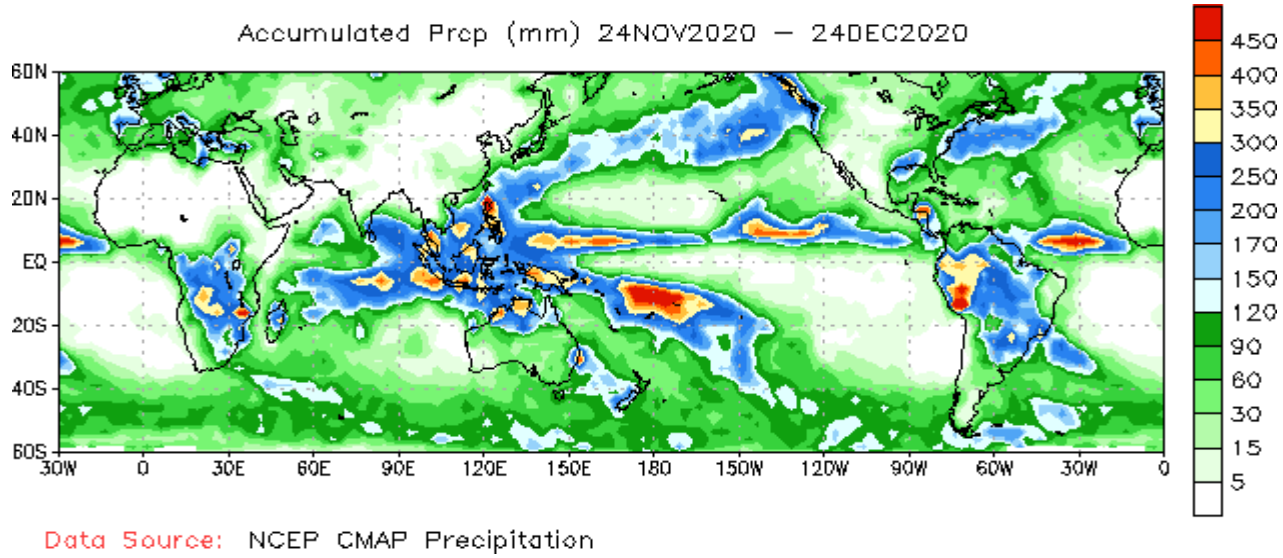




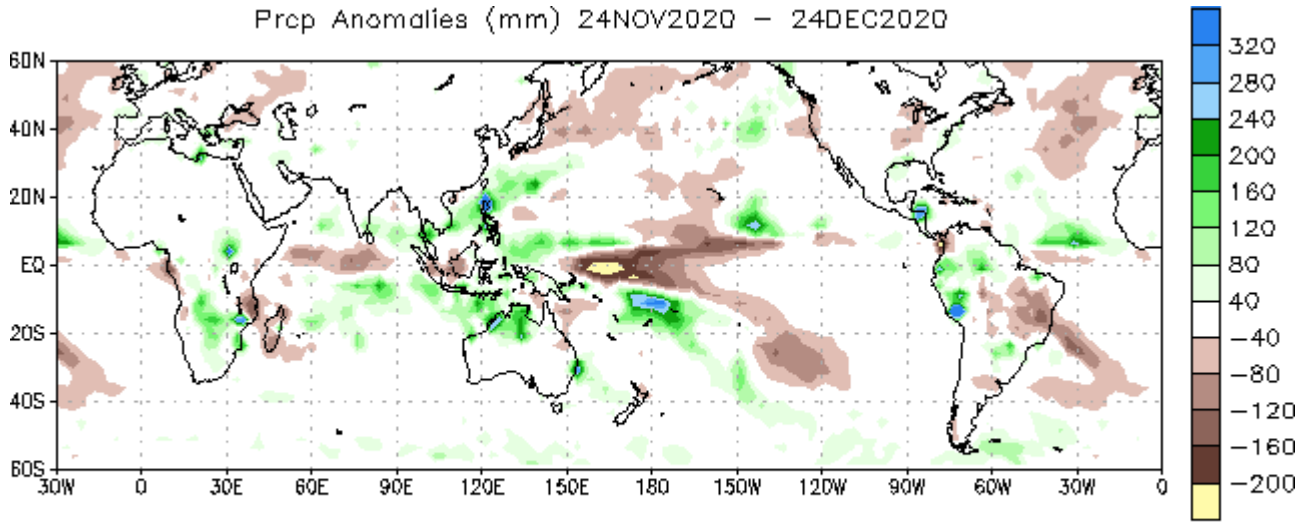
OLR Total and Anomalies, 7 Day OLR



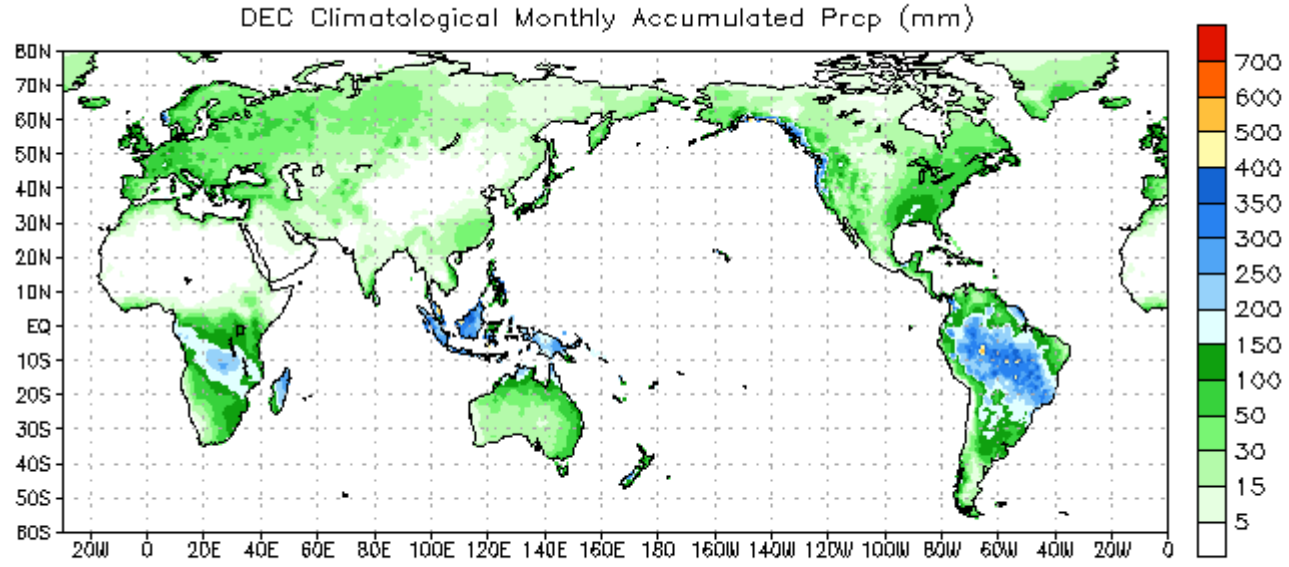
The December Rainfall image is dominated by a large area of reduced convection stretching over the western to central equatorial Pacific, with the main center west of the Date Line. Reduced convection is also evident along the normal axes of the ITCZ and SPCZ, indicating a northward shift of the former, and a southwestward shift in the latter. Further west, increased convection is indicated over the Maritime Continent, with filaments extending into each hemisphere (e.g. across Australia). The overall picture is consistent with a mature La Niña.



30-Day Rainfall Anomalies



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



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

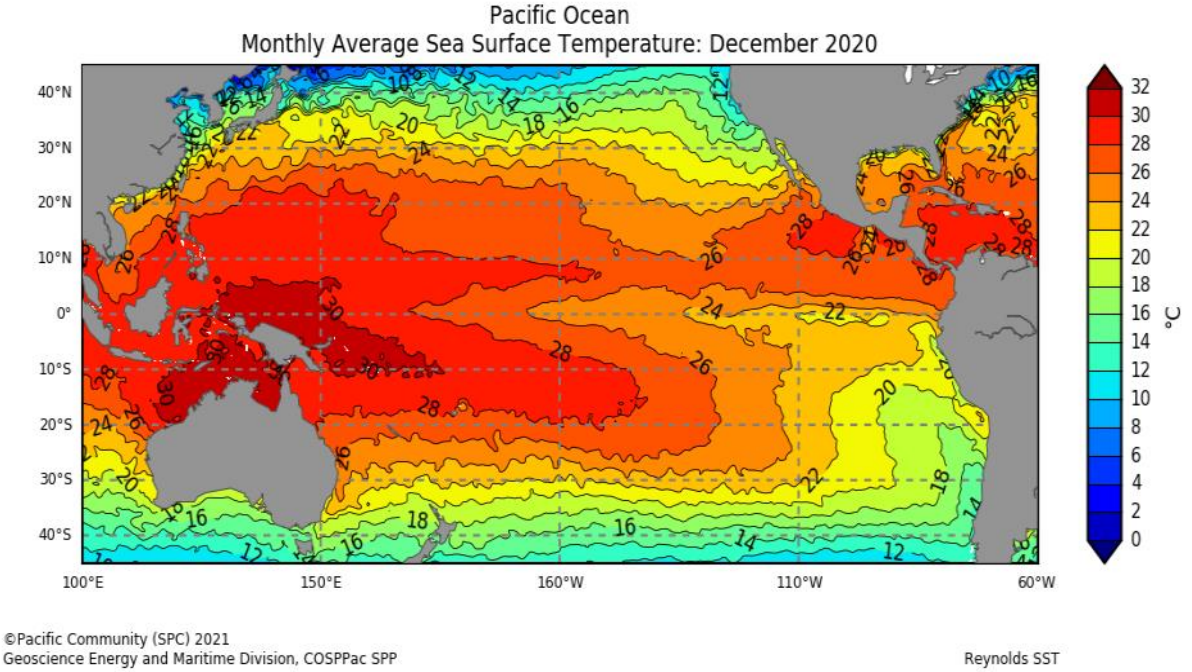
NOAA Climate Prediction Centre - NCEP CMAP precipitation:

OCEAN CONDITIONS

SEA SURFACE TEMPERATURE

Pacific Community COSPPac Ocean Portal

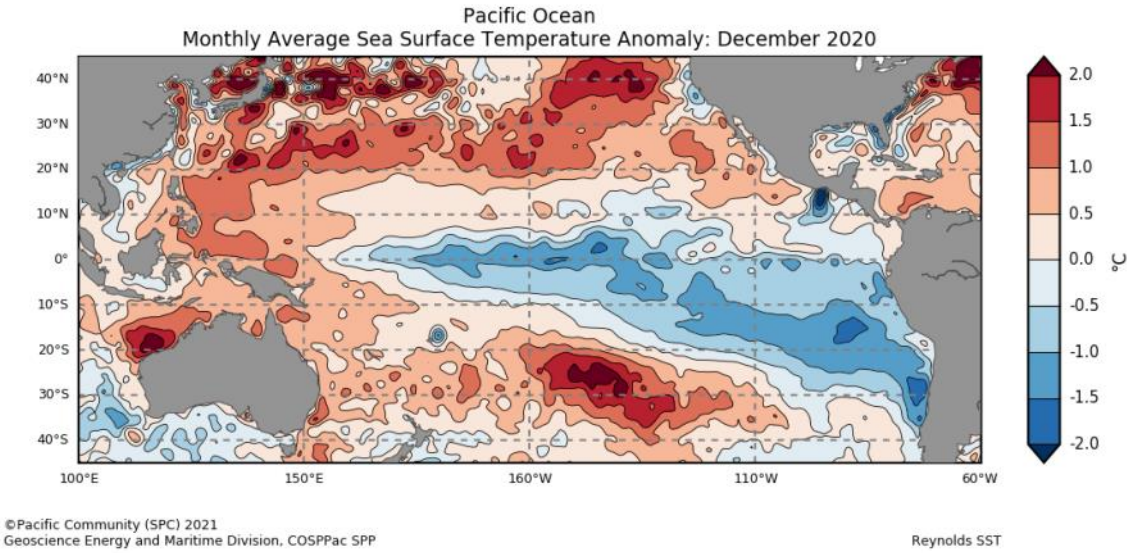
The SST anomaly pattern in December showed the classic La Niña shape, with cool anomalies along the equator surrounded by a boomerang-shape of positive anomalies. In the central Pacific, negative anomalies were not as strong as in November, reaching -1.5C to -2.0C in a few small patches near the equator between 160°W and 140°W. A local cool bullseye near Vanua Levu, Fiji, is a result of severe TC Yasa. Kiribati had anomalies in the -1.0C to -1.5C range, while weak negative anomalies occurred in Nauru, the northern Cook Islands, and southern Marshall Islands. Remaining COSPPac countries recorded positive anomalies between +0.5C and +1.5C. Between November and December, there was a mix of warming and cooling in the equatorial Pacific: modest cooling occurred between 150°E and 145°W, while somewhat stronger warming was observed between 150°W and 90°W. The strongest warming occurred east to southeast of Tonga.



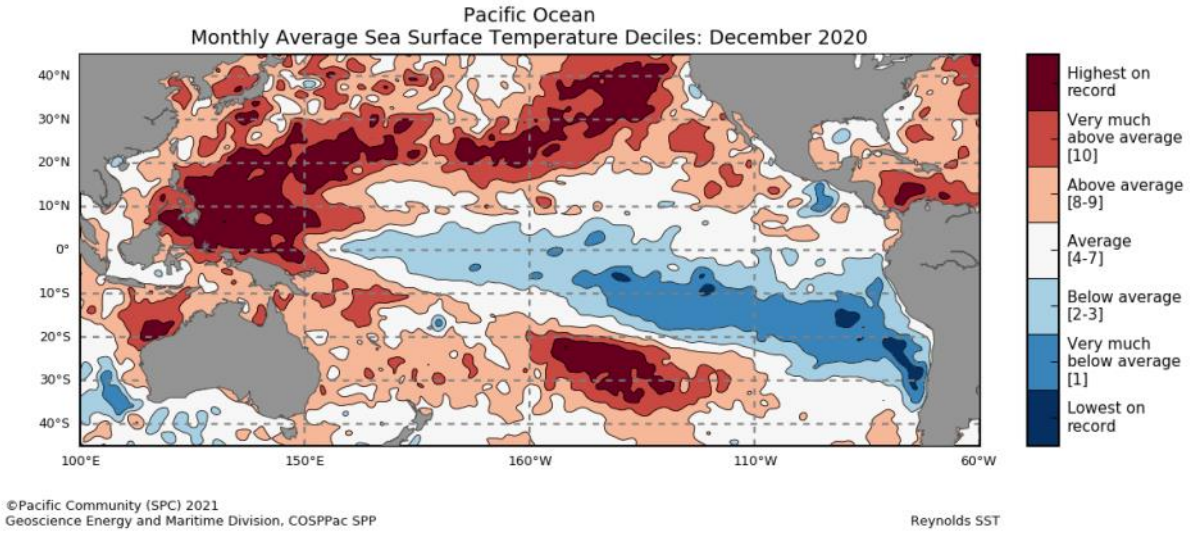
OCEAN CONDITIONS

SEA SURFACE TEMPERATURE

Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles

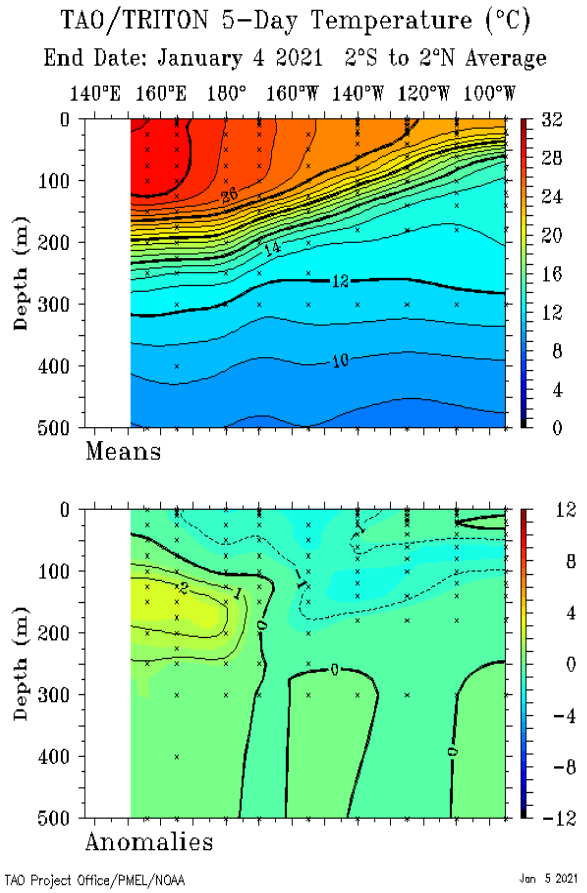


OCEAN CONDITIONS

SUB SURFACE

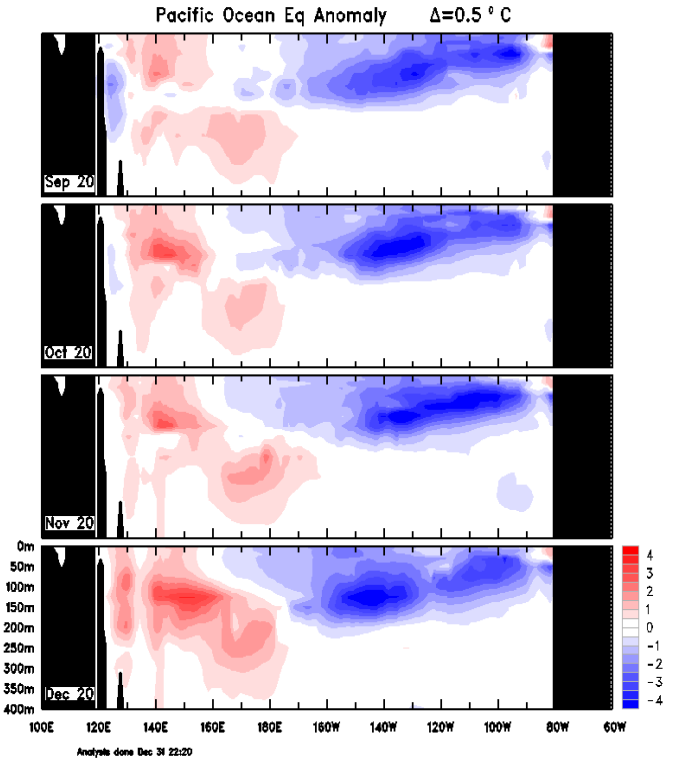
Cool anomalies persisted in the central to eastern Pacific sub-surface during December, in line with the maturing La Niña. The cool signal strengthened in the central Pacific in line with the enhanced trade winds and rising SOI.

Weekly Temperatures Mean and Anomalies



[TAO/TRITON Data Display:]

Monthly Temperatures Anomalies



[Bureau of Meteorology Sea Temperature Analysis:]

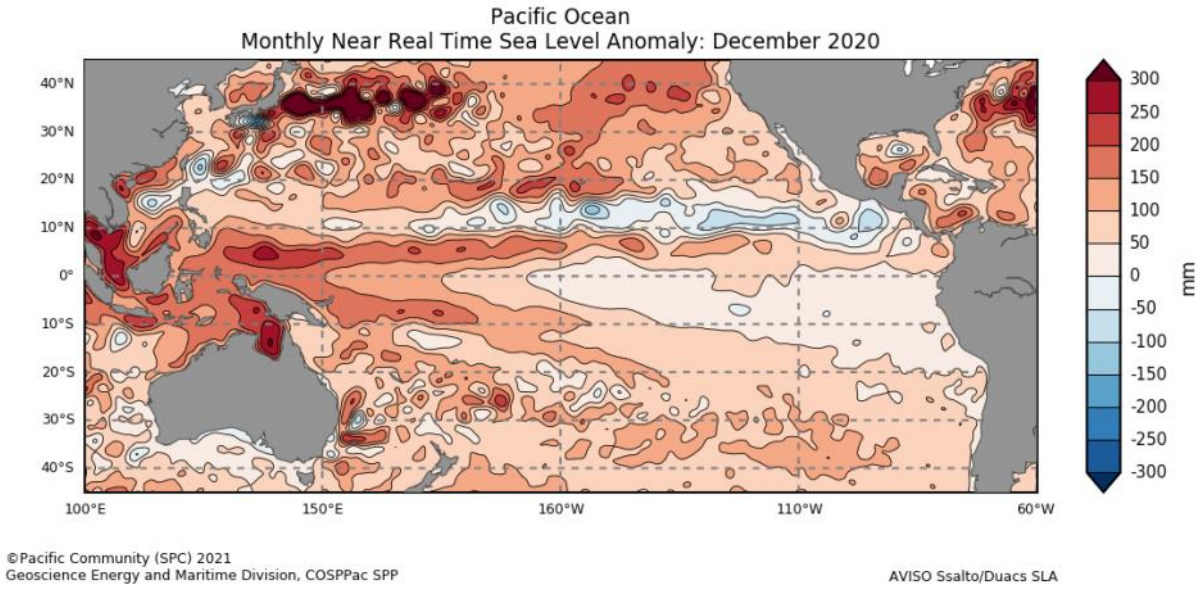
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Apart from some isolated small patches, sea level was above normal in December over COSPPac countries. Even though La Niña has persisted, there was very little change in the small area of below average sea level along the equator near 135°W. Affecting Palau, FSM, RMI and Kiribati was a band of positive anomalies between 5°N and 7°N, with values between +150mm and +250mm, plus some small areas over +250mm in FSM and Palau. Another weaker band of positive anomalies extended southeastward from PNG across the Solomon Is, Tuvalu, Samoa to the central and northern Cook Is.

Monthly Sea Level Anomalies

Source: Pacific Community COSPPac Ocean Portal

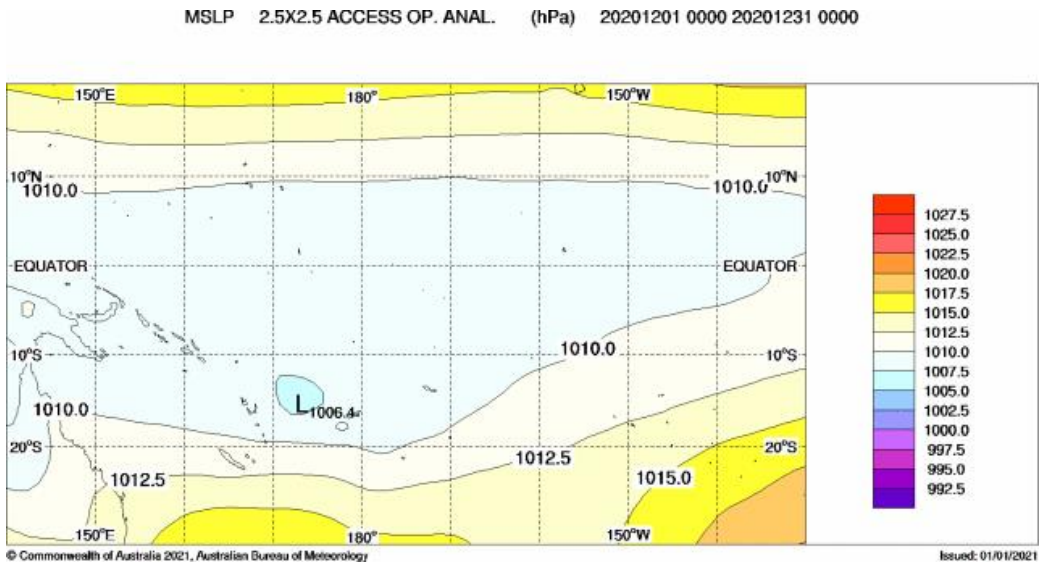


MEAN SEA LEVEL PRESSURE

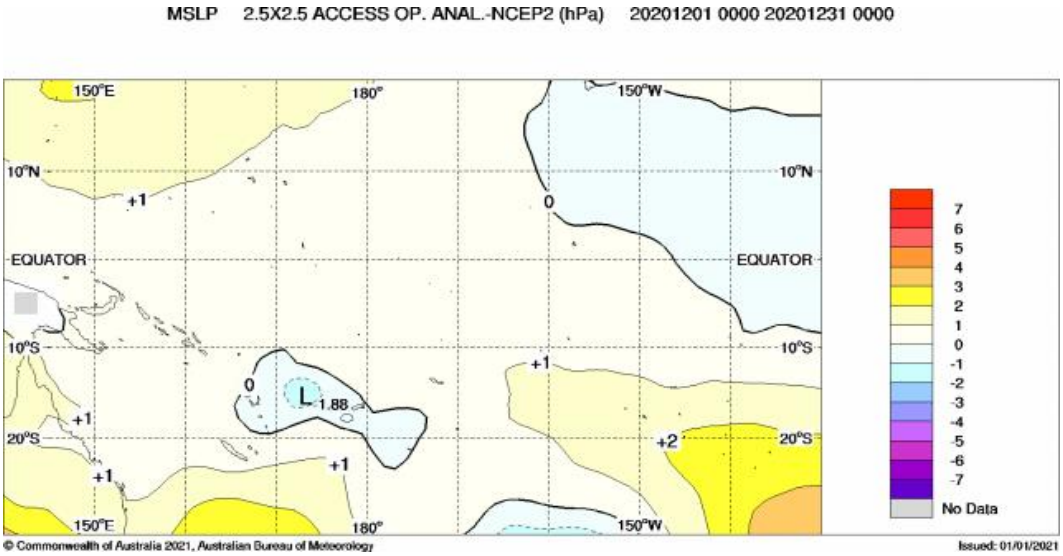
The December mean sea level pressure (MSLP) anomaly map shows relaxation of the subtropical highs and an active broad area of low pressure present over Vanuatu, Fiji Samoa region.

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

Mean



Anomalous



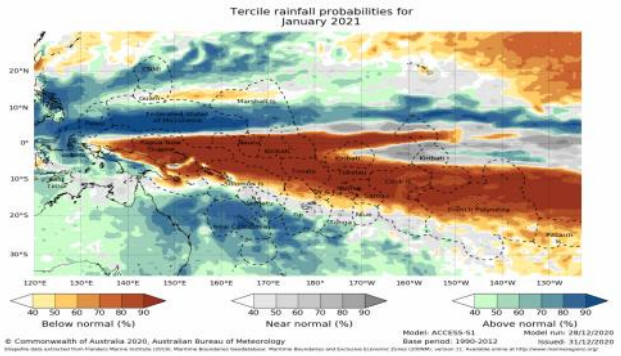
Bureau of Meteorology South Pacific Circulation Patterns:

SEASONAL RAINFALL OUTLOOK

January — March 2021

The ACCESS-S model forecast for January 2021 strongly favours below normal rainfall for Nauru, Kiribati, Tuvalu, Tokelau, the northern Cook Islands and parts of central and northern French Polynesia, extending as far west as the northern and eastern areas of the PNG mainland. Above normal rainfall is favoured in a boomerang-shaped zone wrapping around the below normal wedge. Countries affected include Palau, FSM, northern and central Marshall Islands, southern parts of PNG mainland, the far south of the Solomon Islands, New Caledonia, Vanuatu, Fiji and central and southern Tonga. The three-month rainfall outlook (January-March) is very similar to the January pattern: it shows a strong dry signal along the equator, surrounded by bands of increased chance wetter in both hemispheres. It is a typical La Niña pattern. Note the very strong gradient in probabilities as you transition from drier to wetter in both hemispheres. FSM is a good example because in the northern two-thirds of the region there is a very strong chance of wetter than average, while the reverse is true in the southern parts of its EEZ. Above normal maximum and minimum temperatures are favoured for all COSPPac countries, except for areas close to the equator east of 150°E, namely the far southern Marshall Islands, Nauru, Kiribati, northern Tuvalu, Tokelau, northern Cook Islands and northern and central French Polynesia where near-normal to below normal temperatures are favoured.

Monthly ACCESS-S Maps



The Copernicus multi-model outlook for January to March favours below normal rainfall for the northern Momase and New Guinea Islands region of PNG, western Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands and northern and central French Polynesia. Above normal rainfall is favoured for Palau, parts of southern PNG, central and eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, southern Tuvalu, Tonga, Samoa, Niue and southern Cook Islands.

The SCOPIC statistical model for January to March favours below normal rainfall for northern PNG, Kiribati, northern and central Tuvalu, and northern Cook Islands. Above normal rainfall is favoured for Palau, FSM, southern Marshall Islands, the southern region of PNG, Solomon Islands, Vanuatu, Fiji, southern Tuvalu, Tonga, Samoa, Niue, and southern Cook Islands.

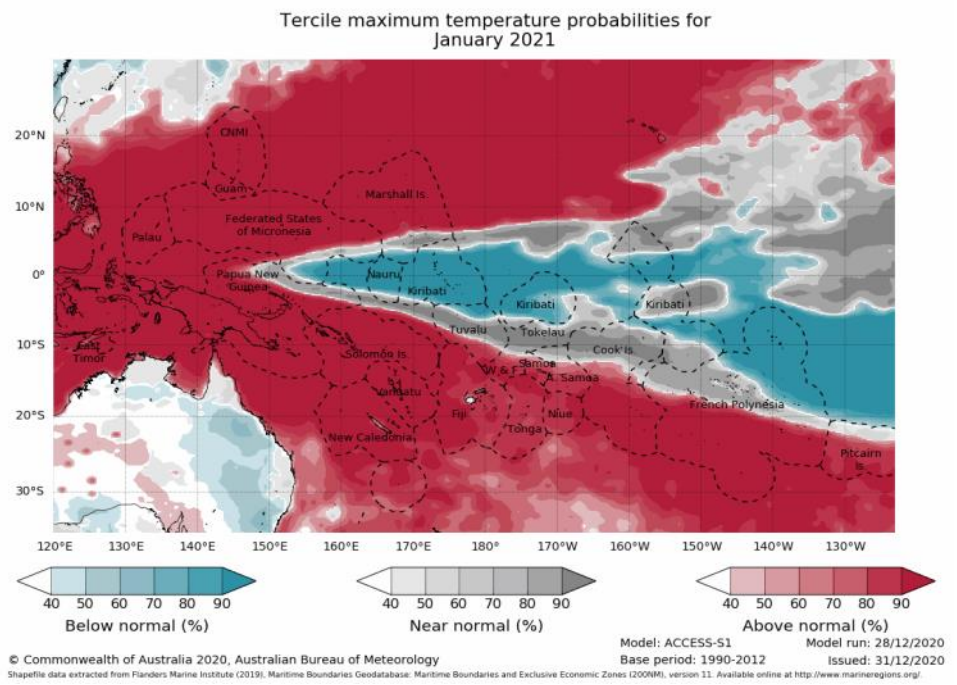
The APEC Climate Centre multi-model for January to March favours below normal rainfall for eastern FSM, far southern Marshall Islands, the northern Momase, Highlands and New Guinea Islands regions of PNG, western Solomon Islands, Nauru, Tuvalu, Kiribati, Tokelau, northern Cook Islands and northern and eastern French Polynesia. Above normal rainfall is favoured for Palau, western and central FSM, southern PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Samoa, Niue, central and southern Cook Islands and parts of southern French Polynesia.

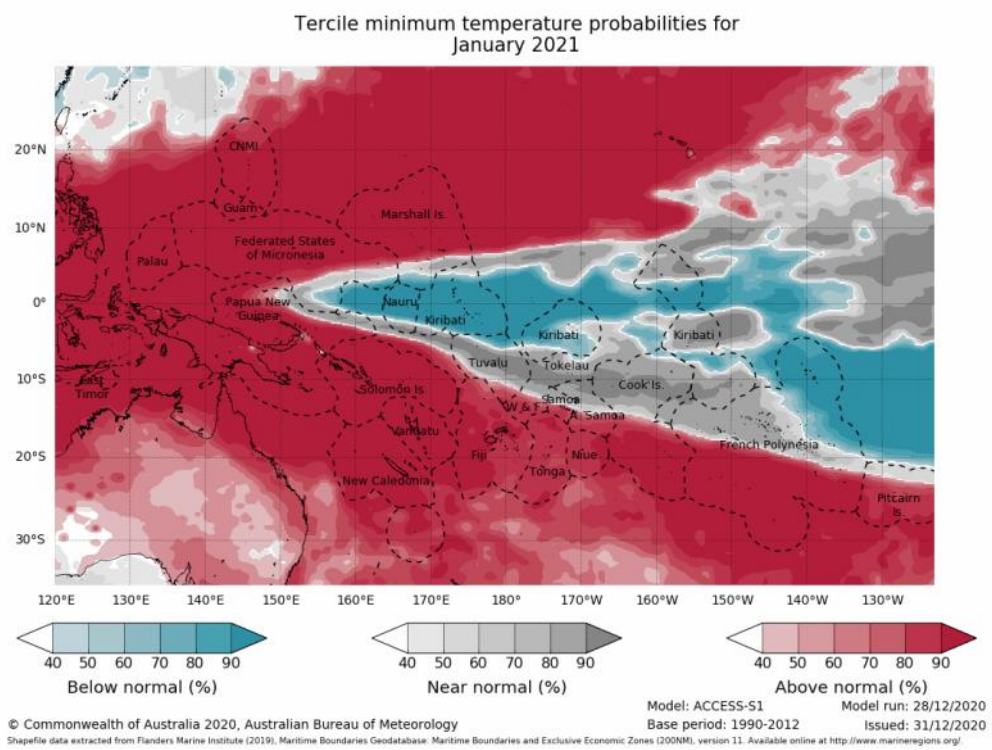
For January to March 2021, the dynamical models (as well as SCOPIC) agree on above normal rainfall for Palau, central to northern Marshall Islands, areas in Southern Regions of PNG, eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, southern Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for southern Marshall Islands, New Guinea's Momase and Islands regions, Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands and central and northern French Polynesia.

SEASONAL TEMPERATURE OUTLOOK

January — March 2021

Monthly ACCESS-S Maps

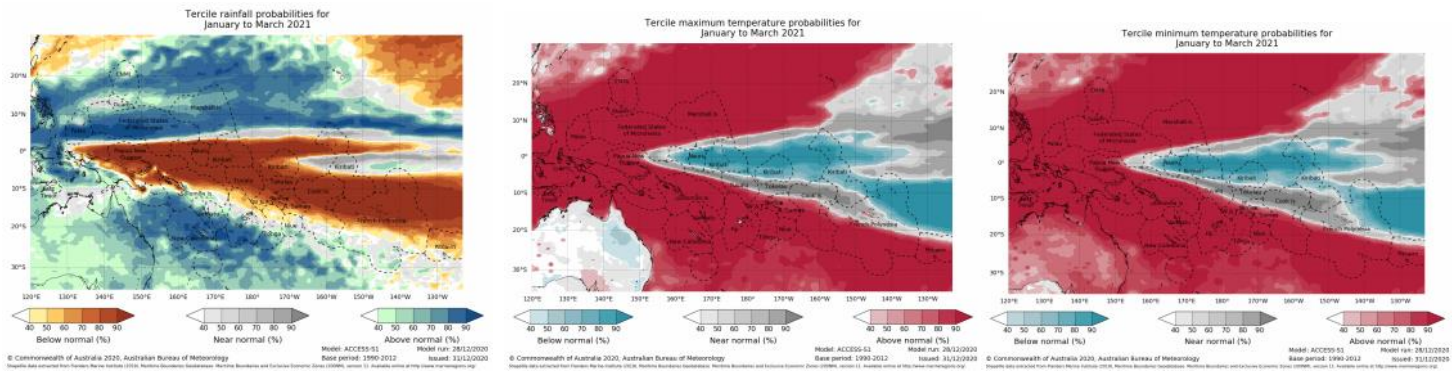




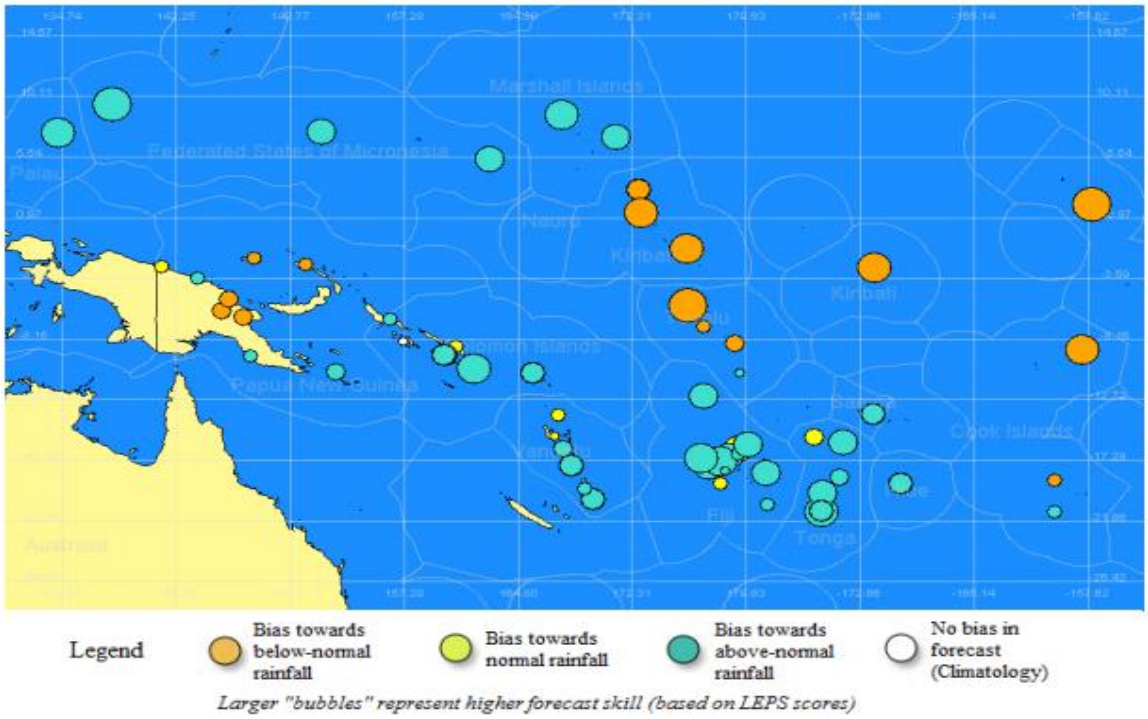
SEASONAL RAINFALL OUTLOOK

January — March 2021

Seasonal ACCESS-S maps



SCOPIC

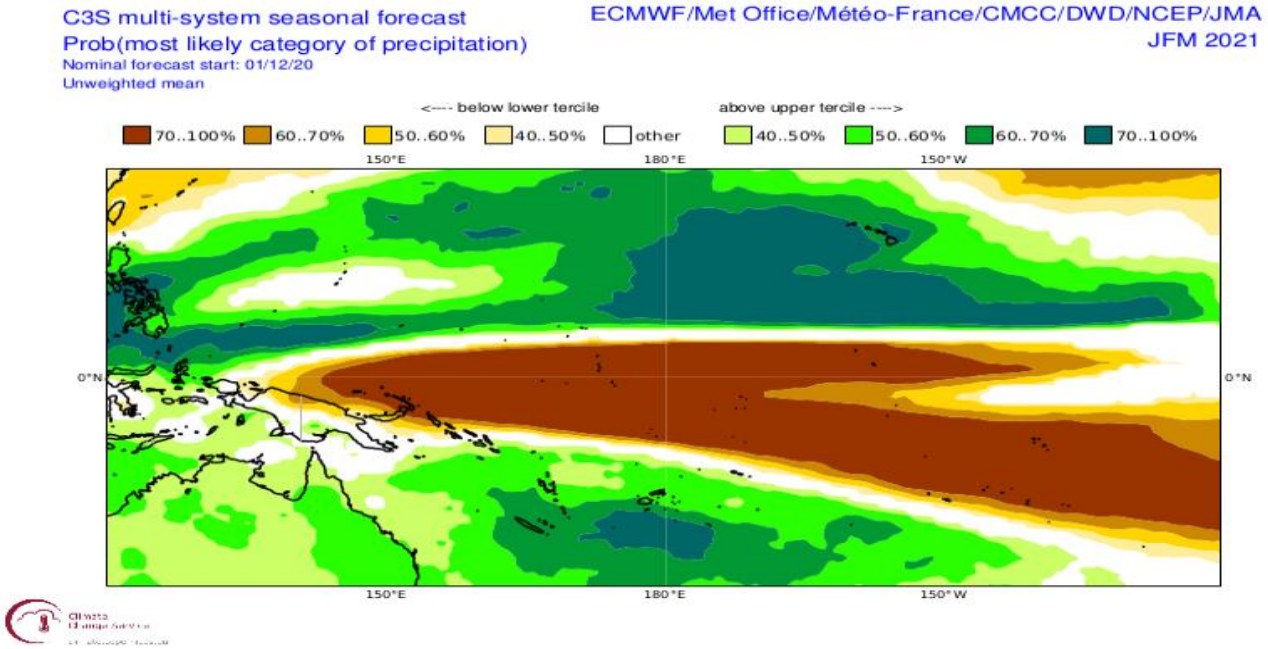


About: SCOPIC

SEASONAL RAINFALL OUTLOOK

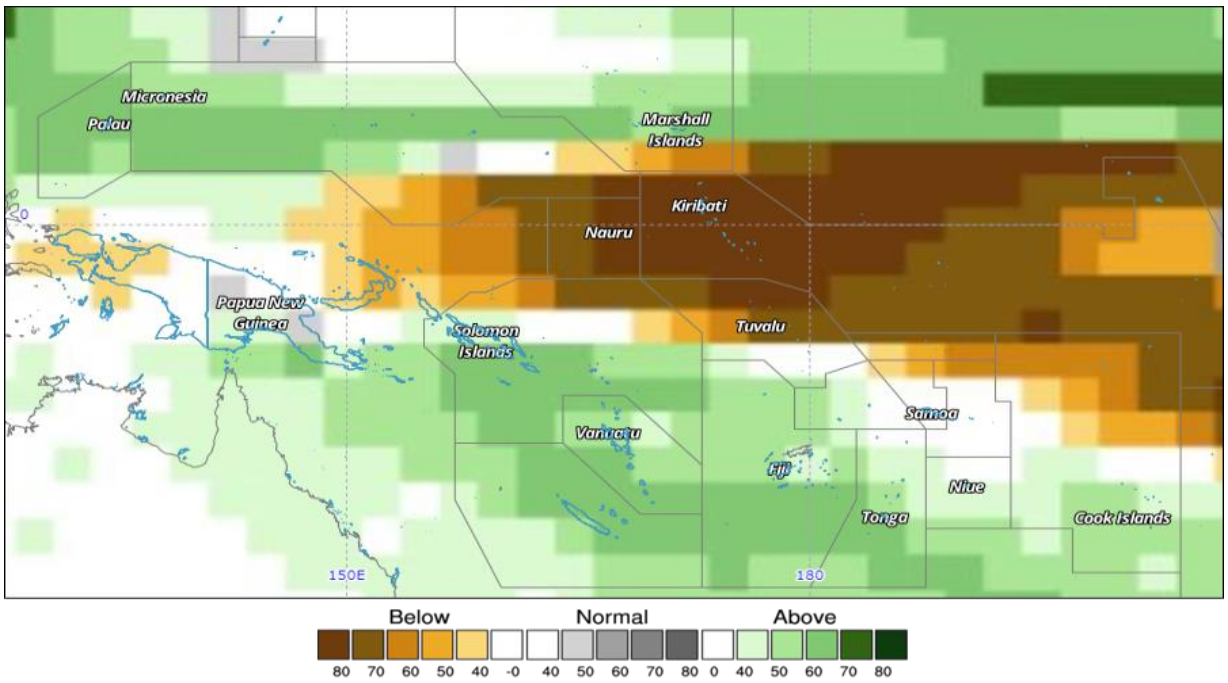
November 2020—January 2021

Copernicus (C3S multi-system)-Rainfall



[Copernicus Rainfall]

APEC Climate Information Toolkit for the Pacific:



TROPICAL CYCLONE

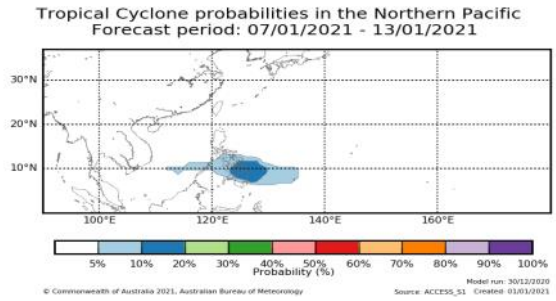
2020/2021 Season

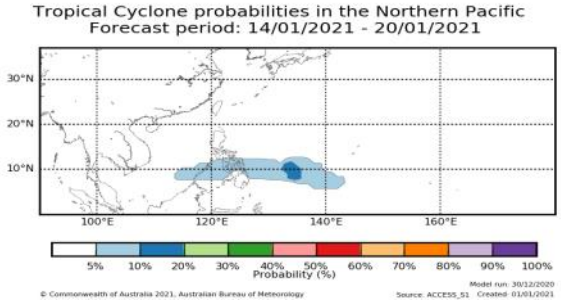
In December 2020, there were three (3) Tropical Depression (TD) developed over the Southwest Pacific Region, where 2 TD's intensified into Tropical Cyclone (TC's) namely TC Yasa (Category 5) and TC Zasu (Category 2).

The weekly tropical cyclone forecast from ACCESS-S model shows elevated risk in the week ending 13 January 2021 for the southwest Pacific; especially areas in between 15° to 20° South and 140°E to 165°E. For the northwest Pacific areas between 10°N and 115°E to 140°E.

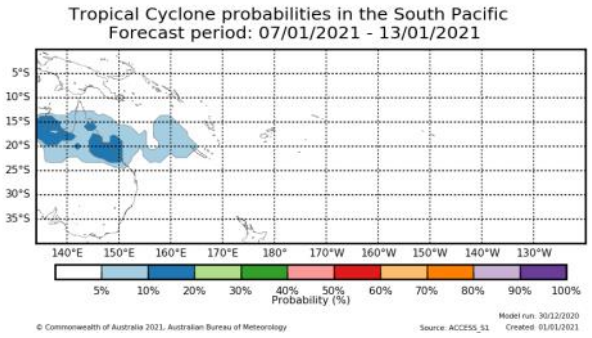
Click for the **tropical cyclone season outlook for 2020-21**

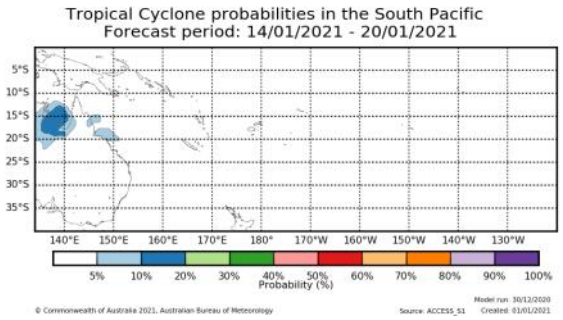
ACCESS-S Weekly Forecasts –Northwest Pacific





ACCESS-S Weekly Forecasts –Southwest Pacific





Individual Model Links

UKMO Global long-range model probability maps:

ECMWF Rain (Public charts) - Long range forecast:

POAMA Pacific Seasonal Prediction Portal:

APEC Climate Center (APCC):

NASA GMAO GEOS-5:

NOAA CFSv2:

IRI for Climate and Society:

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.

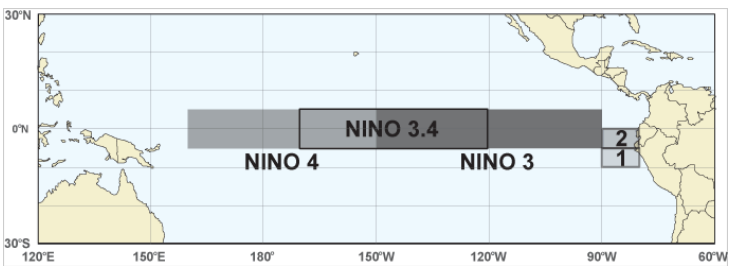
20 degrees Celsius Isotherm Depth

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