

Monthly Climate Bulletin

October 2021



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Photo Credit: Anetone Sagaga image of flooding in Apia 2019



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SUMMARY

Issued 08 November 2021

- The El Niño Southern Oscillation (ENSO) is currently at La Niña ALERT. Most international climate models surveyed by the Bureau indicate weak La Niña conditions are likely for the coming months.
- The Madden-Julian Oscillation (MJO) is currently weak or indiscernible. Most models indicate the MJO is likely to remain weak over the coming week to fortnight.
- The Intertropical Convergence Zone (ITCZ) was active and shifted north of its normal position, while the South Pacific Convergence Zone (SPCZ) was active around New Caledonia, Vanuatu to New Zealand.
- The sea surface temperature anomaly pattern in October shows SSTs were warmer than average in the far western Pacific with cooler than average across the central and eastern equatorial Pacific Ocean.
- Coral bleaching status warning 'Alert Level 1' for parts of Palau, FSM and northern PNG. 'No stress' or 'watch' for almost all countries with patches of warning for Palau and FSM, northern Marshall Islands and PNG.
- A notable sea level anomaly of +250mm observed in the region 10° N of the equator.
- For November 2021 to January 2022, the dynamical models (as well as SCOPIC) agree on above normal rainfall for Palau, FSM, western and southern PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for northern PNG, southern RMI, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands, and the northern and central French Polynesia.
- The weekly tropical cyclone forecast from the ACCESS-S model shows increased risk in the weeks beginning 15 November and ending 21 November 2021 for the northwest Pacific, especially in areas around Philippines, Palau, Guam, Saipan, CNMI, FSM and RMI. Reduced risks for the southwest Pacific region for weeks beginning 8 November and ending 21 November.

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EL NIÑO–SOUTHERN OSCILLATION

La Niña ALERT continues—Likelihood of La Niña around 70%

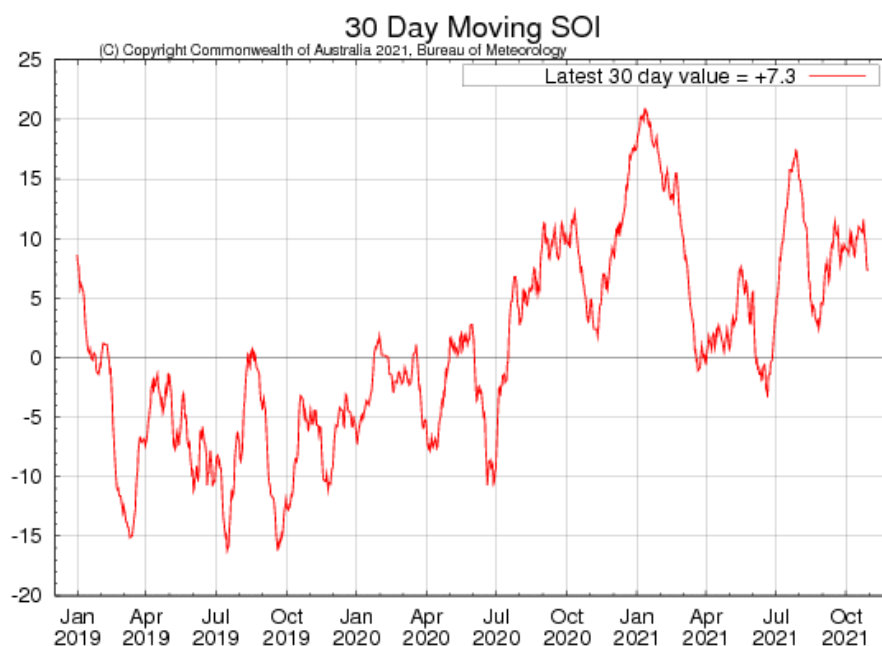
Click link to access [Climate Driver Update issued on 26 October 2021](#)

The Bureau's El Niño Southern Oscillation (ENSO) is at La Niña ALERT. This is due to continued cooling in the tropical Pacific Ocean and climate models showing sustained La Niña conditions over summer. In the past when La Niña ALERT criteria have been met, La Niña has subsequently developed around 70% of the time; this is approximately triple the normal likelihood. La Niña events increase the chances of above-average rainfall for northern and eastern Australia during spring and summer.

Sea surface temperatures in the central tropical Pacific Ocean have cooled over the past three months, edging closer to La Niña levels. These cooler surface waters are supported by cooler than average waters beneath the surface. Some atmospheric indicators, such as the Southern Oscillation Index (SOI) and cloudiness near the Date Line, are approaching La Niña levels. Most international climate models surveyed by the Bureau indicate weak La Niña conditions are likely for the coming months.

The Indian Ocean Dipole (IOD) remains in a negative phase. Models suggest the IOD will return to neutral levels in late spring or early summer. A negative IOD increases the chances of above-average spring rainfall for much of southern and eastern Australia, while a neutral IOD has little influence on Australian climate.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 24 October was +11.6. The 90-day SOI value was +7.5. The 30-day SOI has gradually increased over the past month.



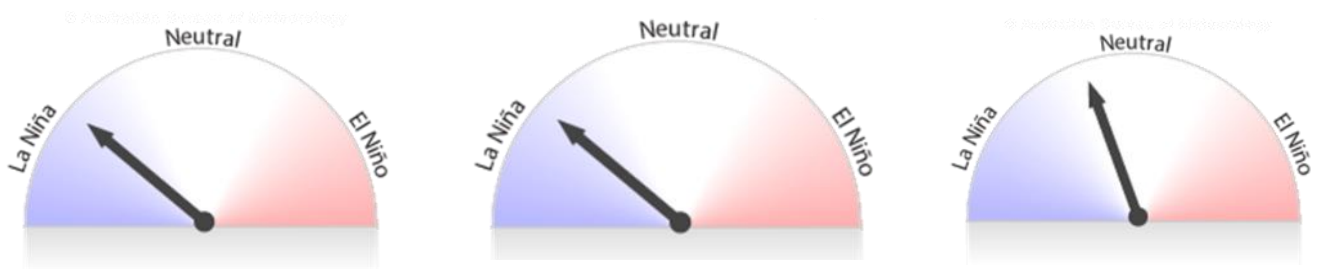


EL NIÑO–SOUTHERN OSCILLATION

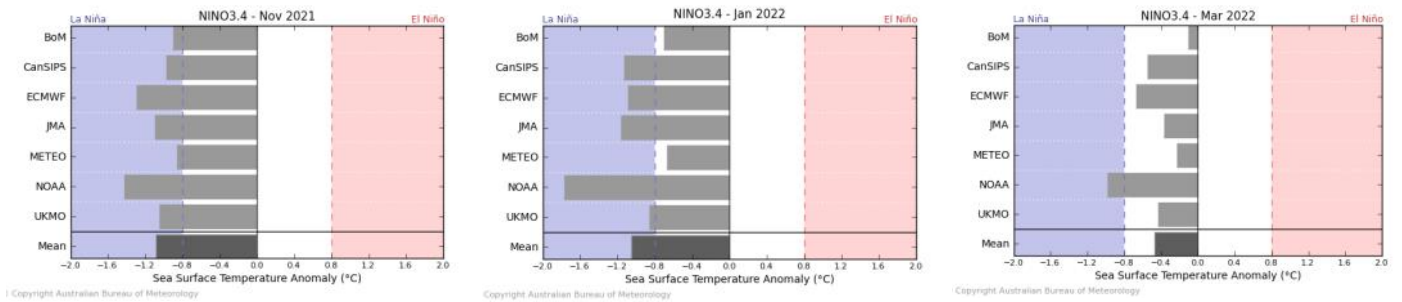
La Niña ALERT continues—Likelihood of La Niña around 70%

Click link to access [Climate Driver Update issued on 26 October 2021](#)

Bureau of Meteorology NINO3.4 ENSO Model Outlooks for November, January and March



Bureau of Meteorology NINO3.4 International Model Outlooks



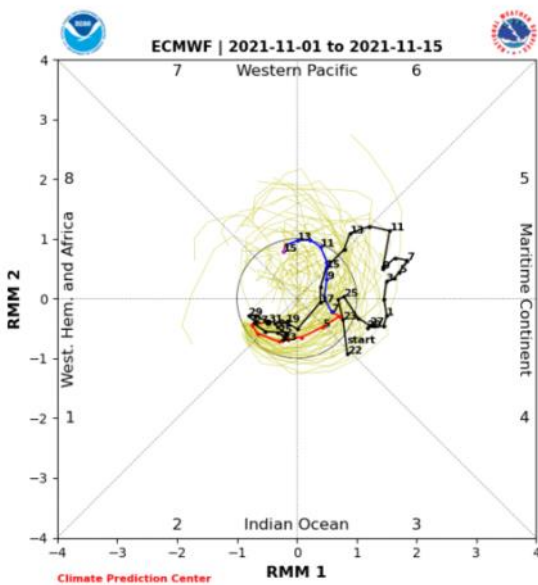
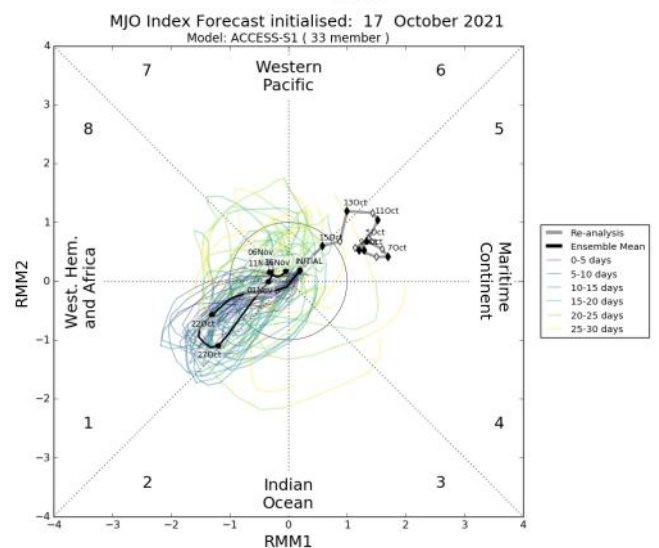
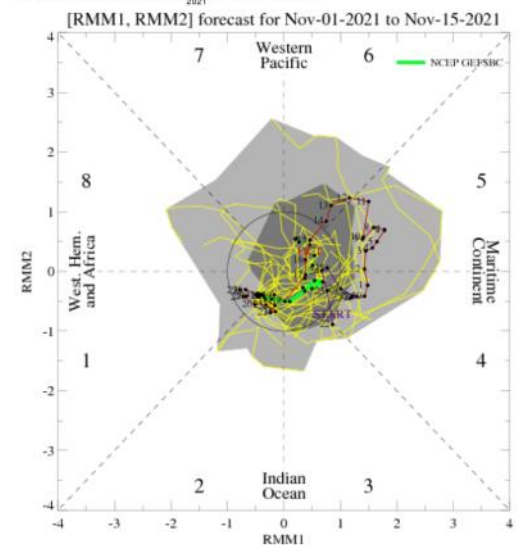
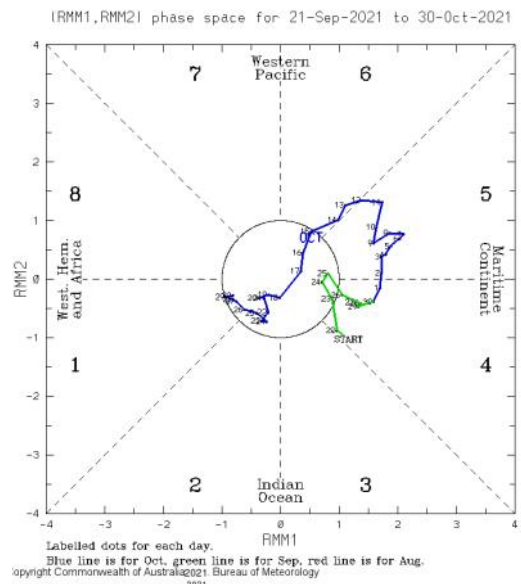
Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean>

MADDEN–JULIAN OSCILLATION

Click link to access [Tropical Climate Update](#) [Issued on Tuesday 03 November 2021]

During first two weeks of October, a moderately strong pulse of Madden-Julian Oscillation (MJO) tracked across the Maritime Continent before weakening towards the end of the month. The Madden-Julian Oscillation (MJO) is currently weak or indiscernible. Most models indicate the MJO is likely to remain weak over the coming week to fortnight. When the MJO is weak or indiscernible, it has little influence on tropical climate.

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



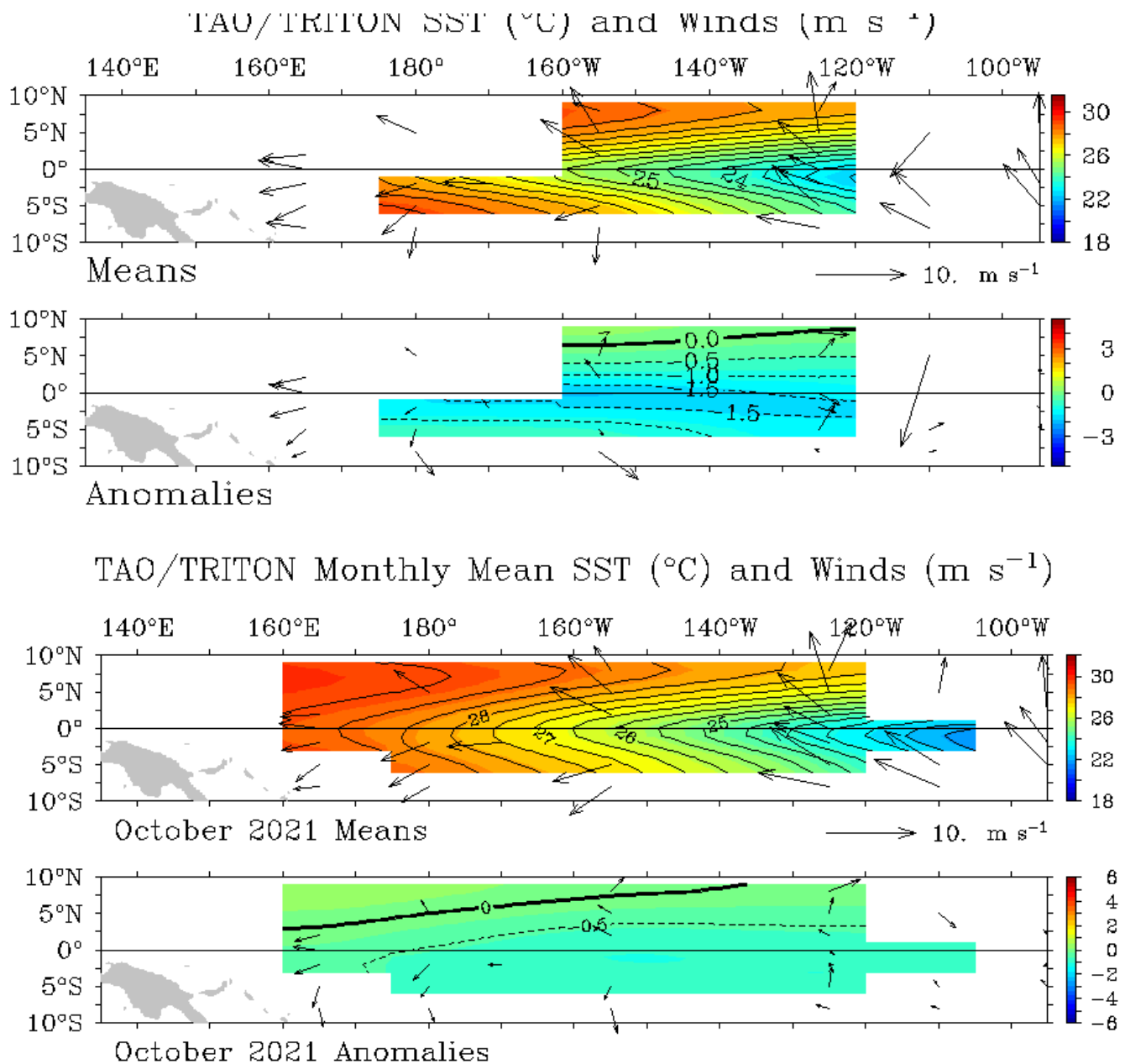


WIND

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

The trade winds in October were stronger over the west and close to average over the central and eastern equatorial Pacific for most of the month.

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

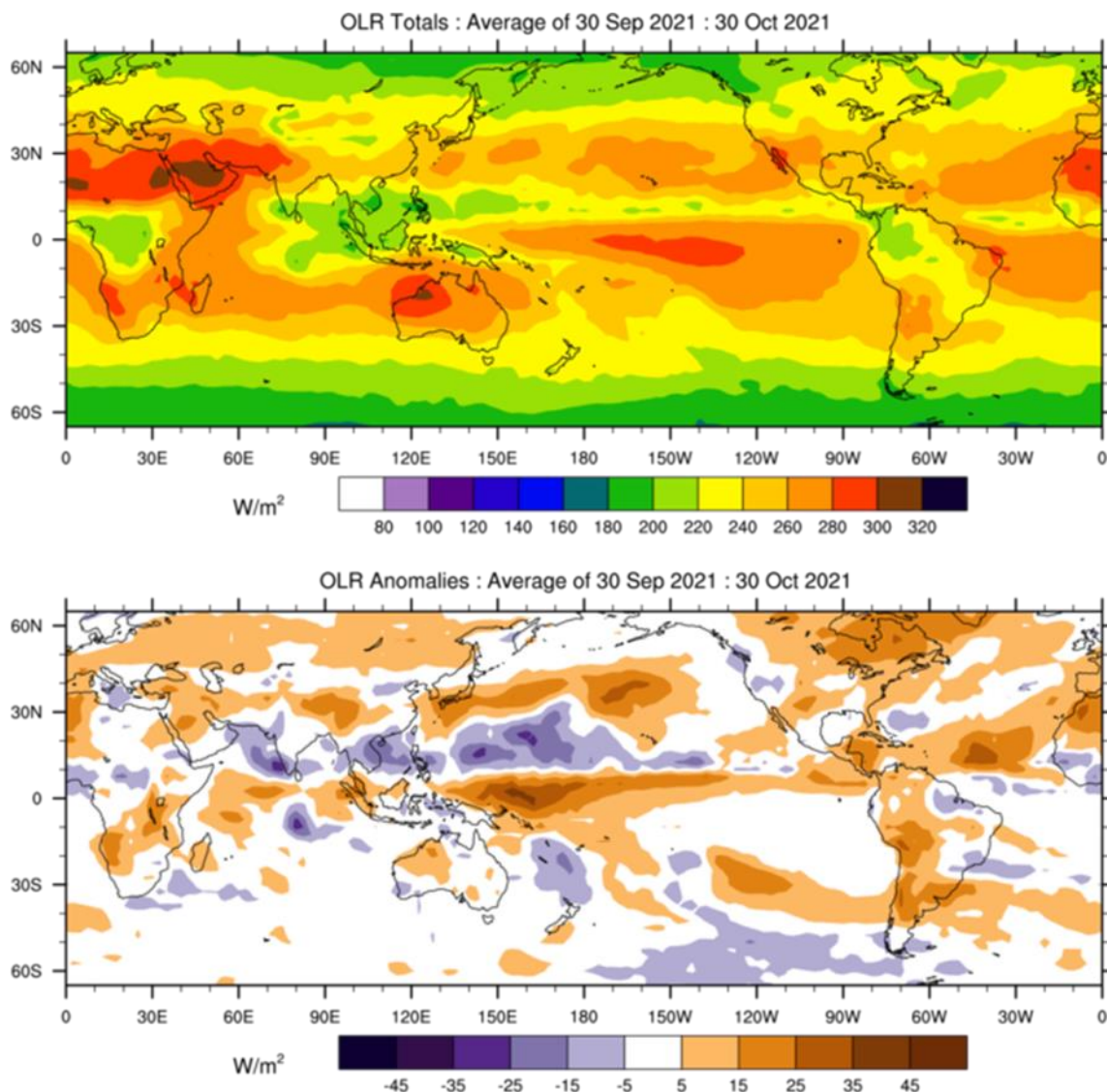
Click link to access [OLR](#)



The October 30-day OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was active and shifted north of its normal position, while the South Pacific Convergence Zone (SPCZ) was active around New Caledonia, Vanuatu to New Zealand.

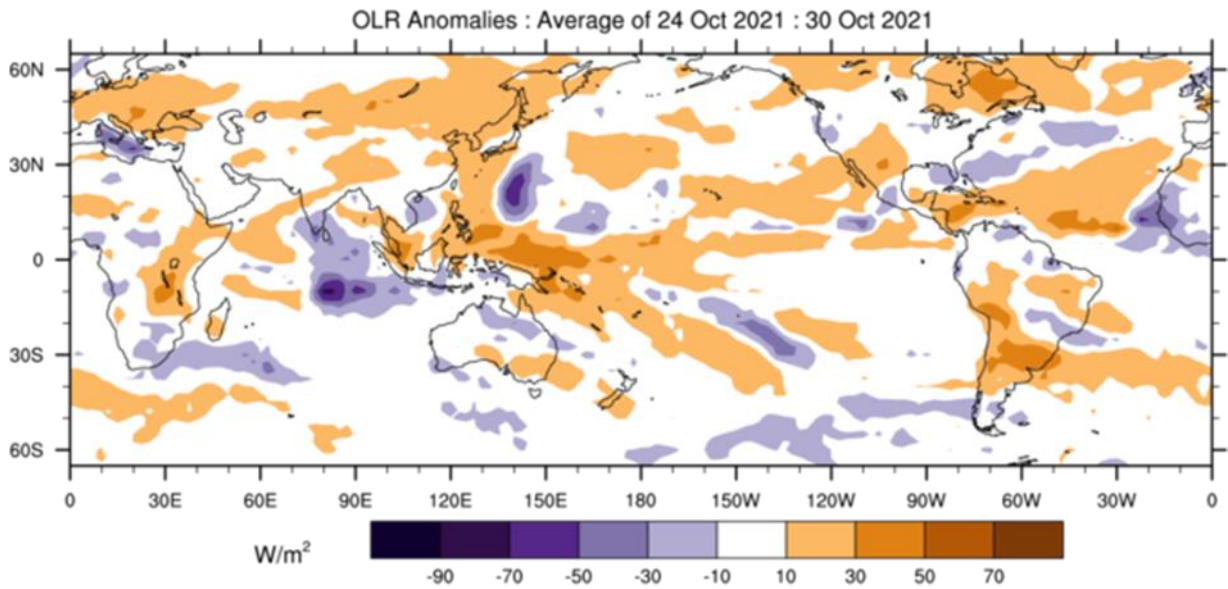
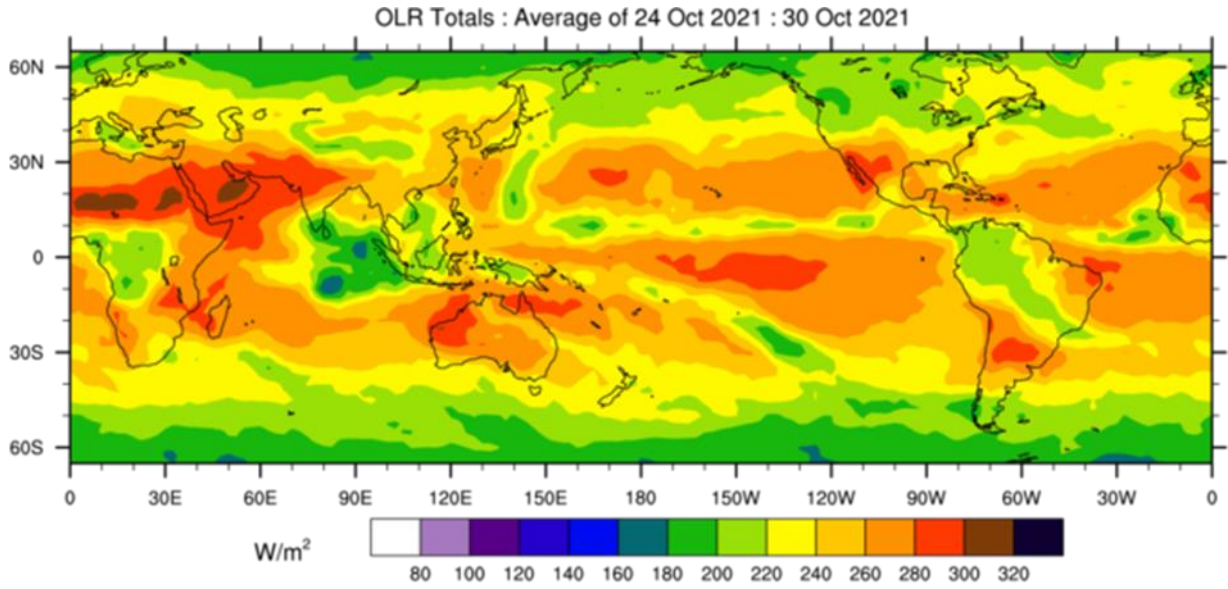
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

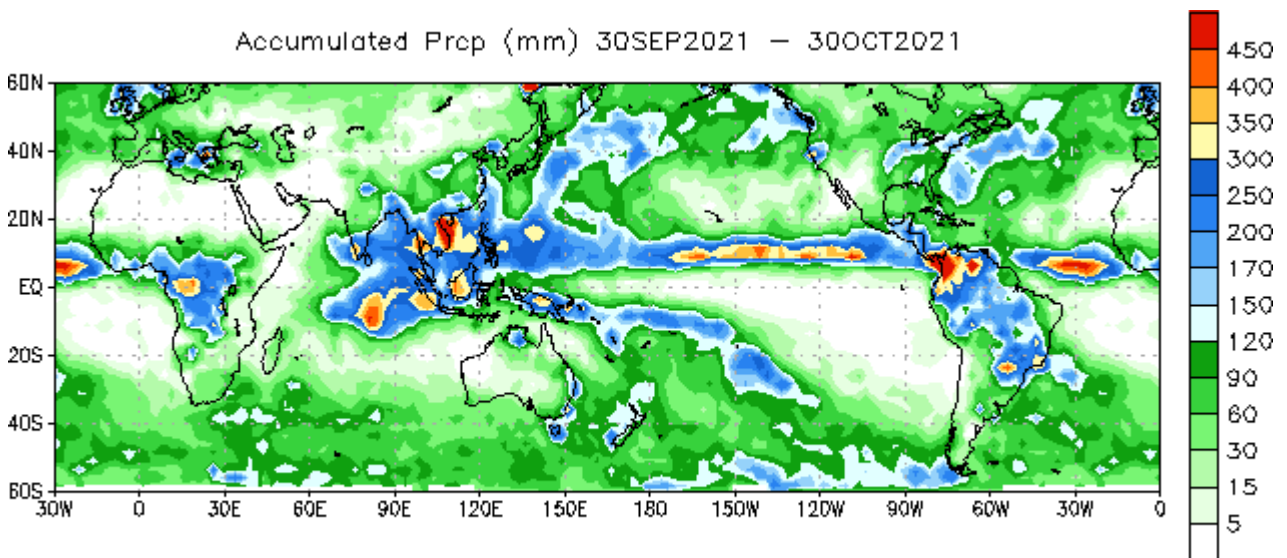


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OLR Total and Anomalies, 7 Day OLR

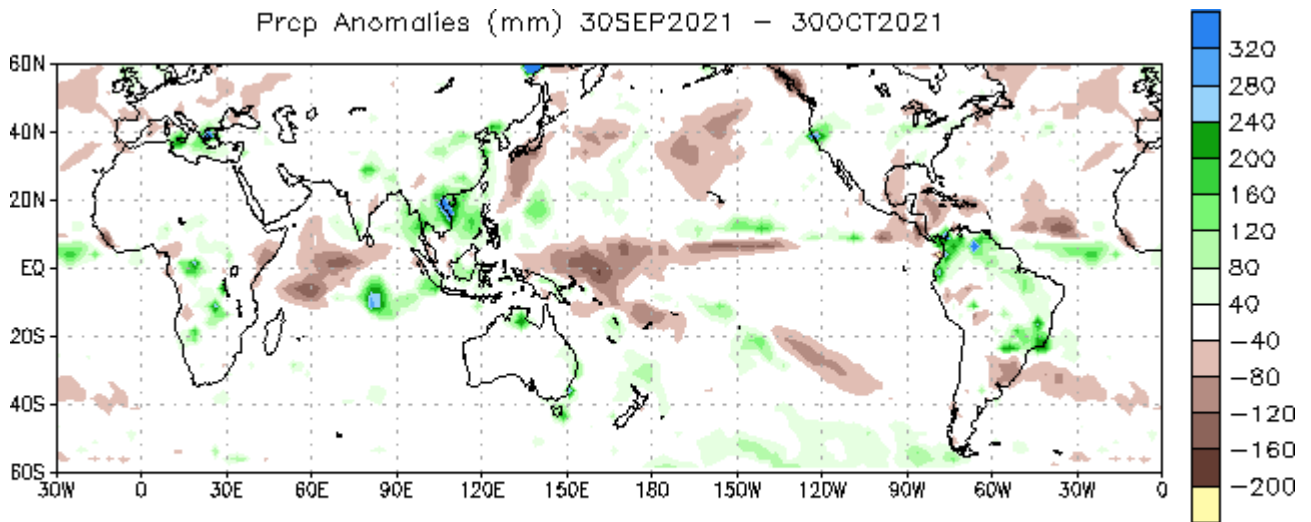


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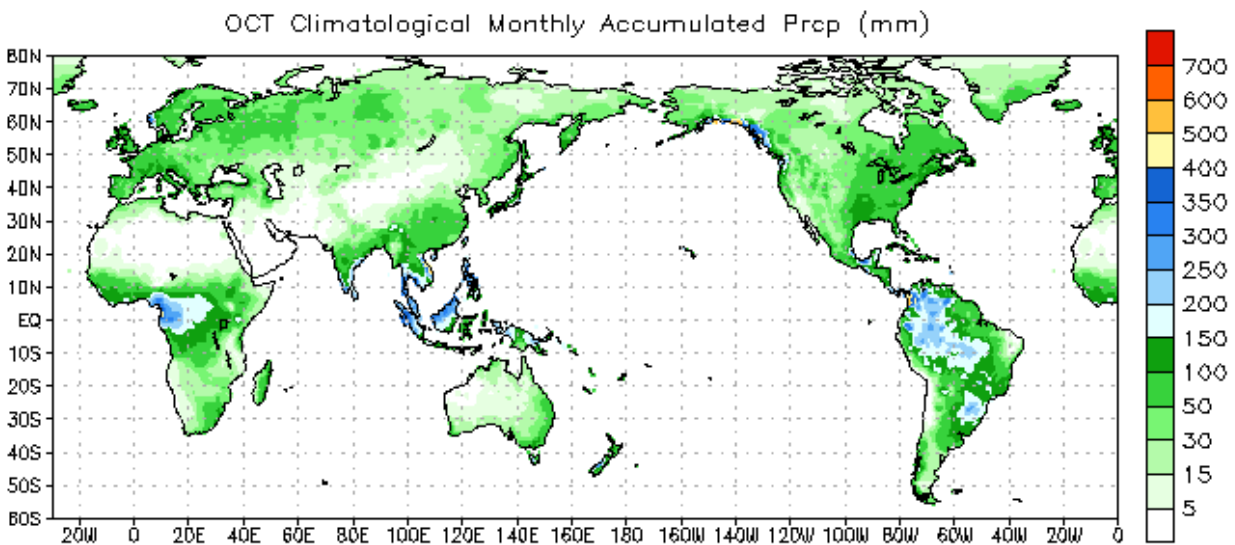


Data Source: NCEP CMAP Precipitation

30-Day Rainfall Anomalies



Data Source: NCEP CMAP Precipitation
Climatology (1991–2020)



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

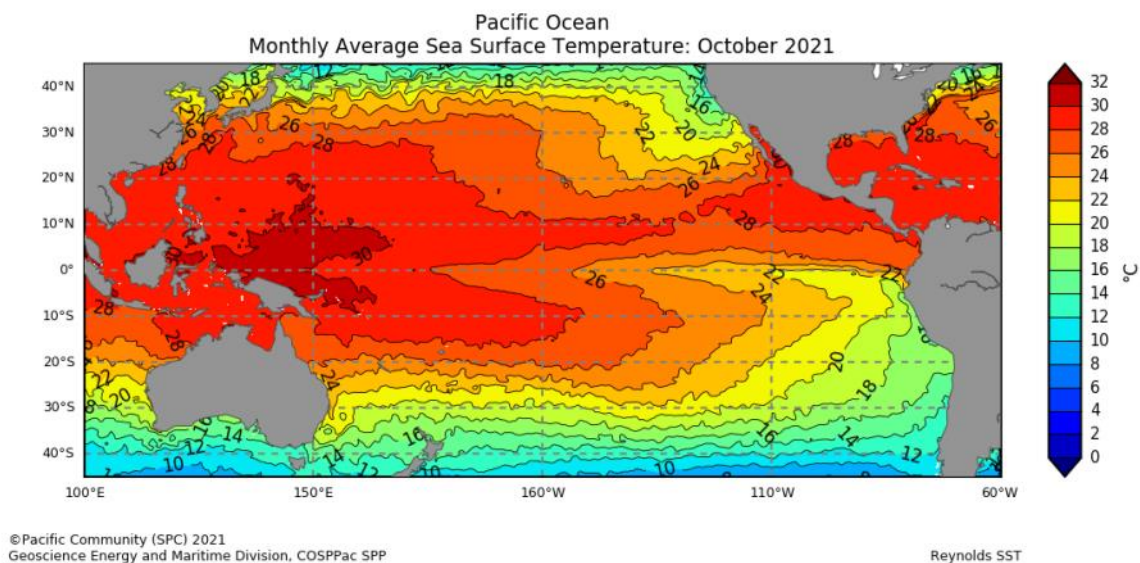


Click link to access [Pacific Community COSPPac Ocean Portal](#)

The SST map for October 2021 shows SSTs were warmer than average in the far western Pacific while cooler than average SSTs along the central starting at 160° E towards the eastern equatorial Pacific and the South American continent. A pattern typical of a developing La Niña. SSTs were warmer than average in waters around the west, much of the east of Australia and the COSPPac countries.

In terms of the deciles, highest on record occurred in southeast PNG, Coral Sea region, southern Solomon Islands, northern Vanuatu and southern French Polynesia. Patches of highest on record deciles were also observed in FSM, Fiji, Tonga and southern Cook Islands. Regions of very much above average (deciles 10) SSTs spanned across parts of Palau, PNG, Solomon Islands, Vanuatu, Fiji, Tonga, Samoa, Niue, central and southern Cook Islands, and southern French Polynesia. The regions of above average (deciles 8-9) for October occurred across majority of the COSPPac countries from Palau to French Polynesia. In contrast, below average (deciles 2-3) SSTs were observed in Nauru, northern Tuvalu, Tokelau, Kiribati with patches of very much below average (decile 1) over northeastern Tuvalu, and western and central Kiribati.

Mean Sea Surface Temperature

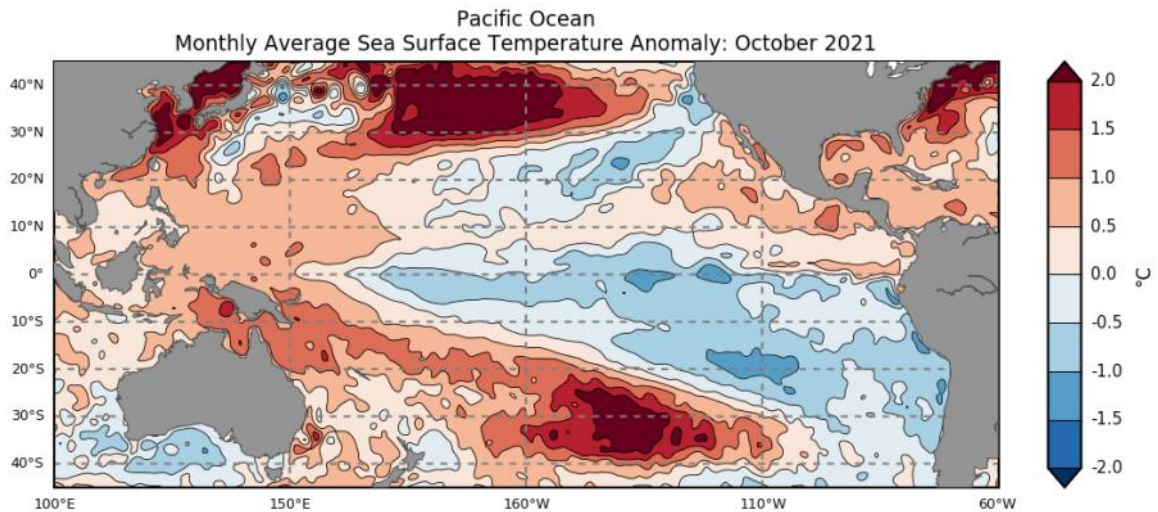


OCEAN CONDITIONS

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



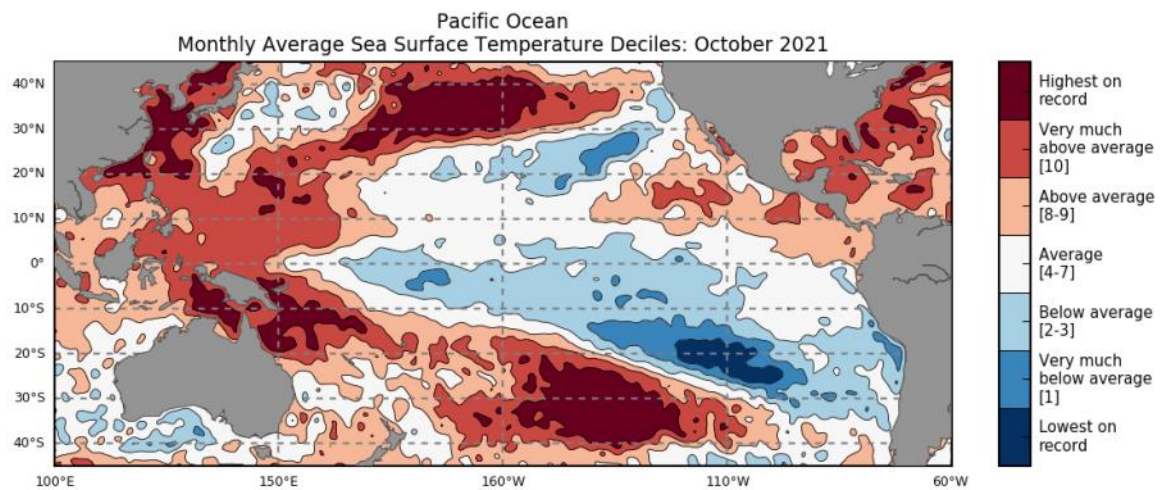
Anomalous Sea Surface Temperature



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

Reynolds SST

Sea Surface Temperatures Deciles



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

Reynolds SST

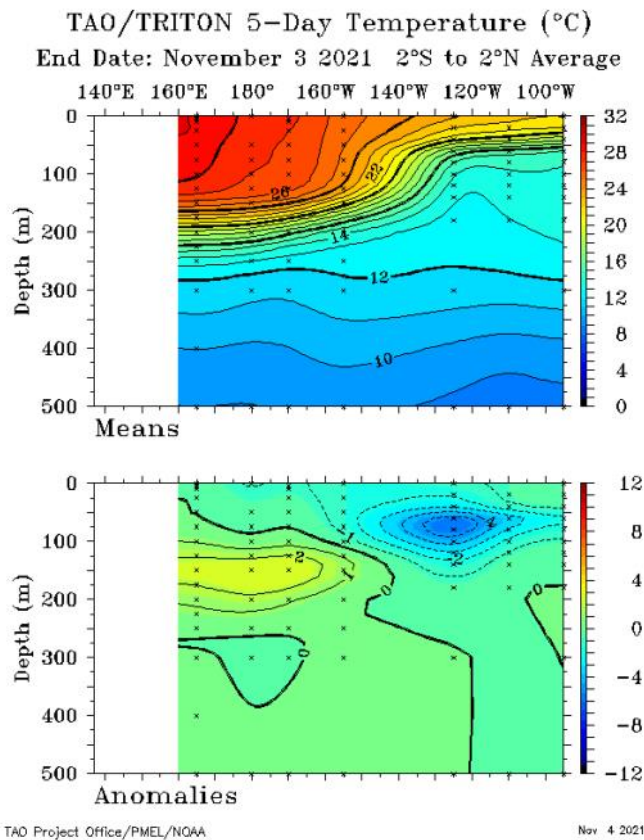
OCEAN CONDITIONS

SUB SURFACE

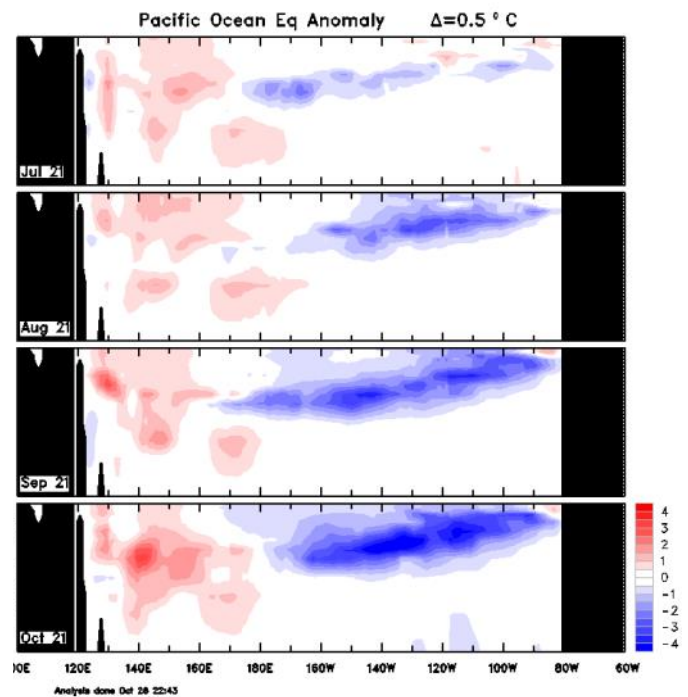


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 25 October 2021) shows cool anomalies have developed in the sub-surface of the central to eastern equatorial Pacific, with a marked increase during September and October compared to previous months. Waters were up to three degrees cooler than average across a large region, and reach up to four degrees cooler than average in the central equatorial Pacific around 150° W and 150 m depth. Warm anomalies continue across parts of the column depth west of the Date Line.

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

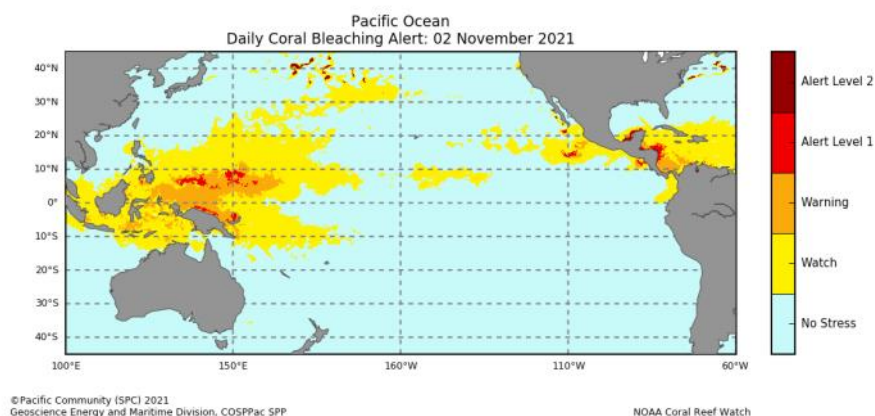
CORAL BLEACHING



The daily Coral Bleaching Alert for 02nd November 2021 shows 'Alert Level 1' for parts of Palau, FSM and northern PNG. 'Warning' for parts of Palau, most of FSM, and northern PNG. 'No Stress or Watch' for the rest of COSPPac partner countries. The four weeks Coral Bleaching Outlook to 28th November shows 'Alert Level 1' for parts of Palau, most of FSM, northern and southern PNG. 'Watch' and 'Warning' for most parts of Palau, FSM, RMI, PNG, Solomon Islands, Vanuatu, northern Fiji, Parts of Nauru, western Kiribati, Tuvalu, northern Tonga, Tokelau and Samoa.

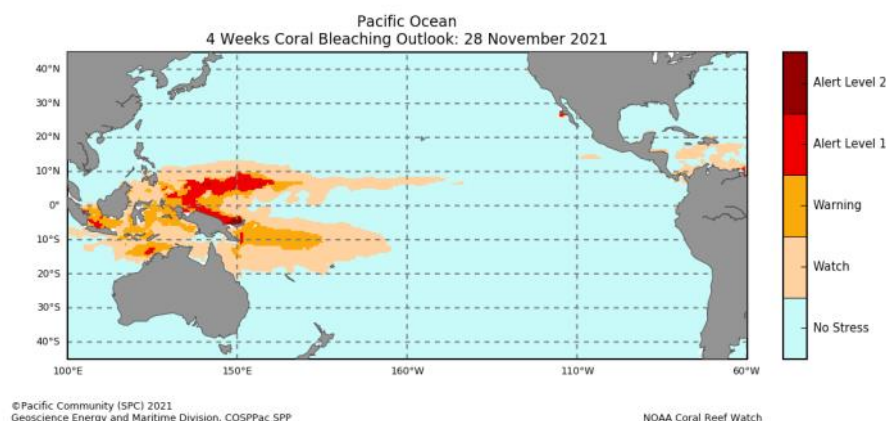
Daily Coral Bleaching Alert

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



4-Weeks Coral Bleaching Outlook

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



OCEAN CONDITIONS

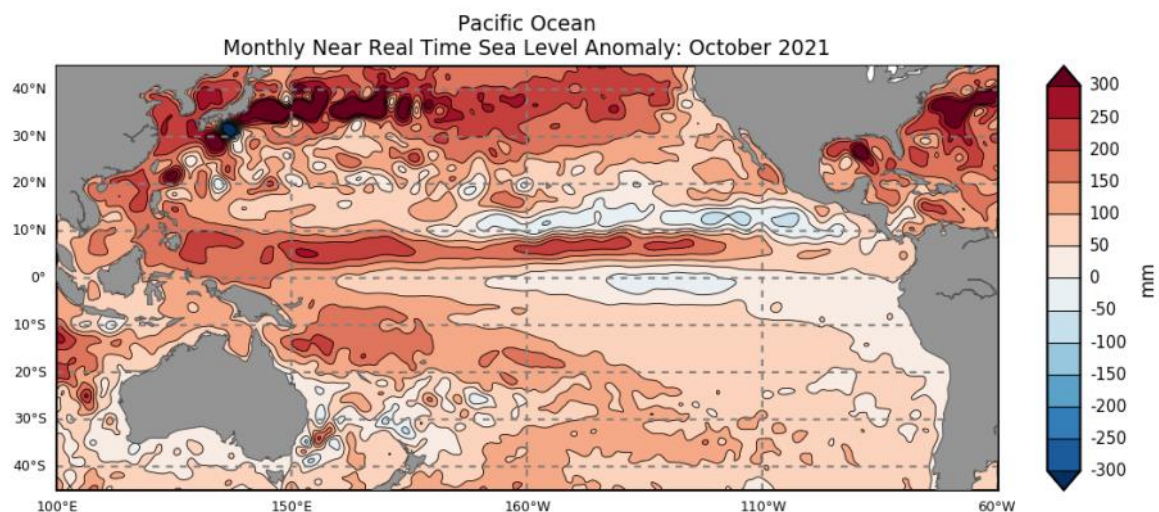
OCEAN SURFACE CURRENTS AND SEA LEVEL



Sea level was above normal for most of the COSPPac countries. The highest anomalies above +250mm were observed for countries 10°N of the equator which includes Palau, FSM, RMI, and northern Kiribati. Patches of near normal to below normal sea levels were observed east of 160° W along the equator and for countries south of 20° S.

Monthly Sea Level Anomalies

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



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Geoscience Energy and Maritime Division, COSPPac SPP

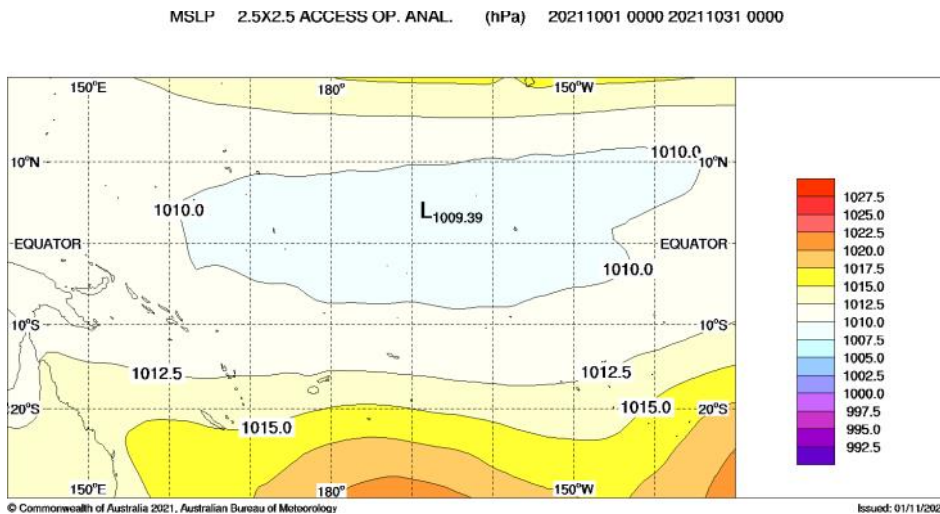
AVISO Ssalto/Duacs SLA

MEAN SEA LEVEL PRESSURE

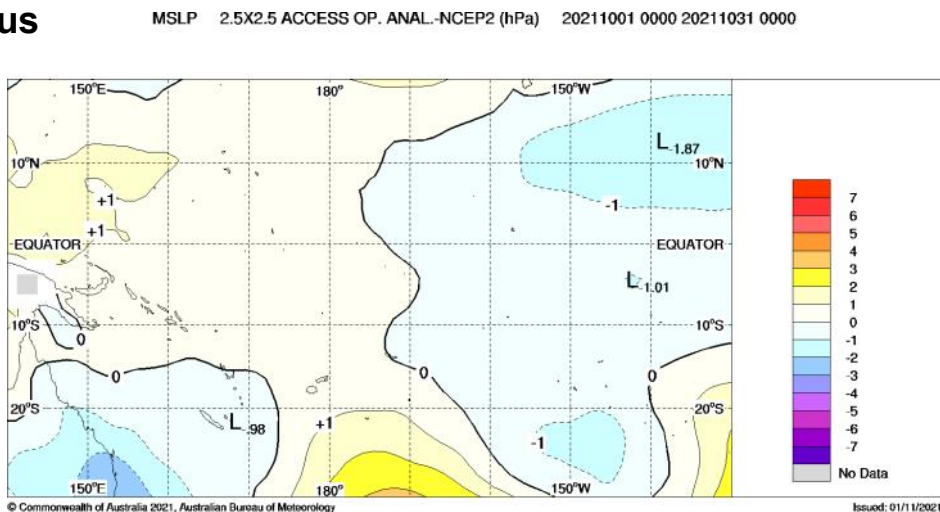
The October mean sea level pressure (MSLP) anomaly map shows positive anomalies over south of Fiji towards New Zealand. Negative anomalies were present over the eastern equatorial Pacific around 5°N and 18°N and 155°E.

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

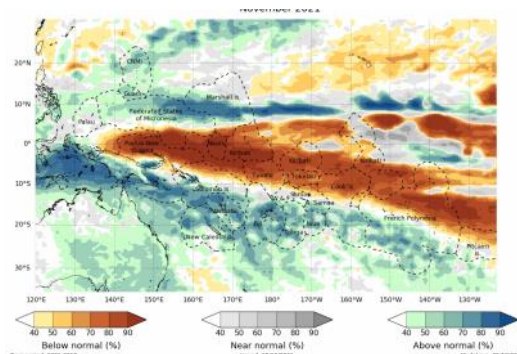
November 2021—January 2022



The ACCESS-S model forecast for November 2021 strongly favours below normal rainfall for northern PNG, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, the northern Cook Islands, northern and French Polynesia and Pitcairn Island. Above normal rainfall is favoured for FSM, CNMI, Guam, most of PNG, Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga, Niue and parts of southern Cook Islands and French Polynesia.

The three-month rainfall outlook (November 2021-January 2022) shows a strong dry signal affecting northern PNG, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands, northern and central French Polynesia and Pitcairn Island. In contrast, the models show an increased chance of wetter in Palau, Guam, CNMI, FSM, RMI, western and southern PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and French Polynesia. Above normal maximum and minimum temperatures are favoured for most COSPPac countries, except for some areas east of 160°E, namely Nauru, Kiribati, northern Tuvalu, Tokelau, northeastern Cook Islands, and northern French Polynesia, where near-normal to below normal temperatures are favoured.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for November 2021-January 2022 favours below normal rainfall for the north-eastern PNG Islands, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands, northern and central French Polynesia, and Pitcairn Island. Above normal rainfall is favoured for Palau, FSM, southern Marshall Islands, western and southern PNG, central and eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands and French Polynesia.

The SCOPIC statistical model for November 2021-January 2022 favours above normal rainfall for most of the COSPPac countries except for Palau, Kiribati, northern Tuvalu, and northern Cook Islands with normal to below normal rainfall.

The APEC Climate Centre multi-model for November 2021-January 2022 favours below normal rainfall for northern and southern Marshall Islands, northern PNG, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands, and central to northern French Polynesia. Above normal rainfall is favoured for Palau, most of FSM, western and southern PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia.

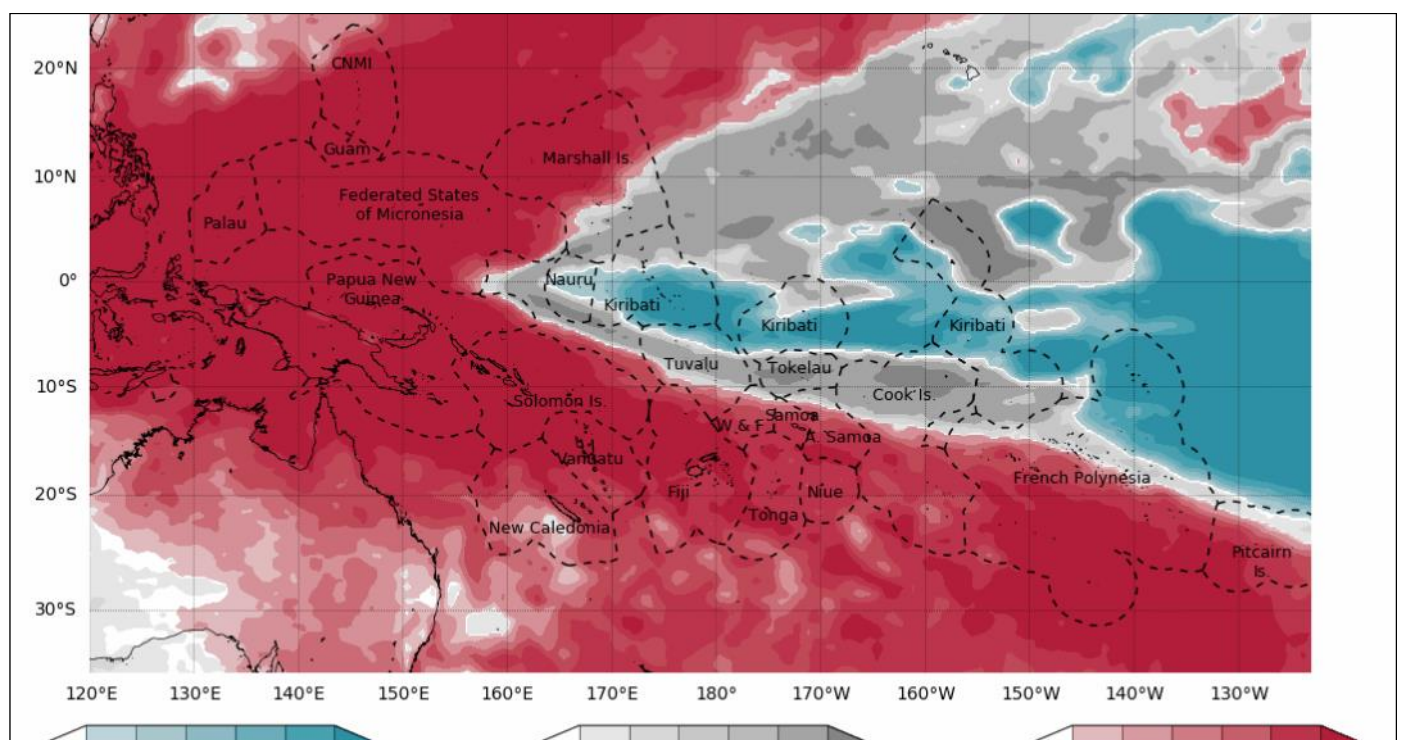
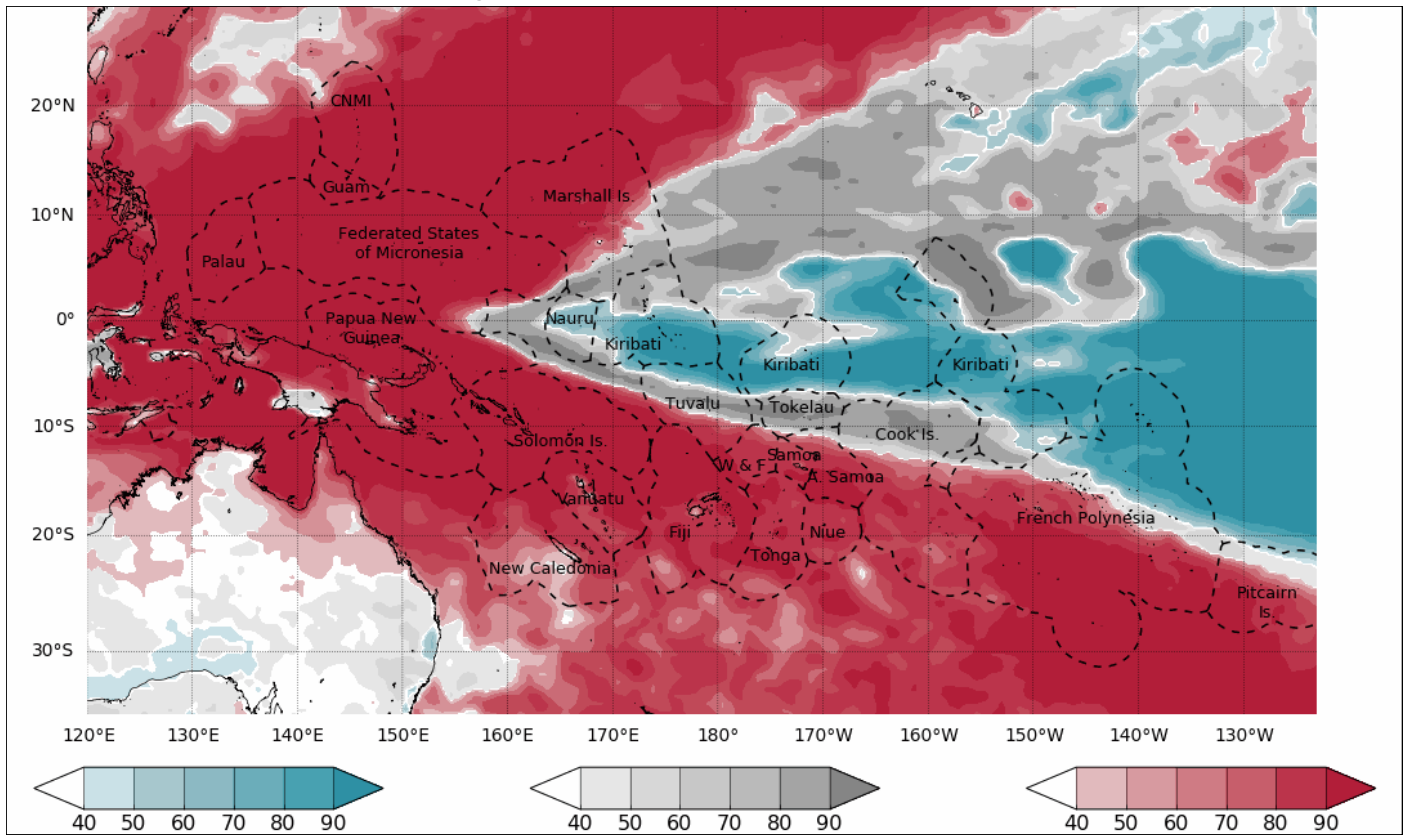
For November 2021-January 2022, the dynamical models agree on above normal rainfall for Palau, FSM, western and southern PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for northern PNG, southern RMI, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands, and the northern and central French Polynesia.

SEASONAL TEMPERATURE OUTLOOK

November 2021—January 2022



Monthly Tmax and Tmin ACCESS-S Maps



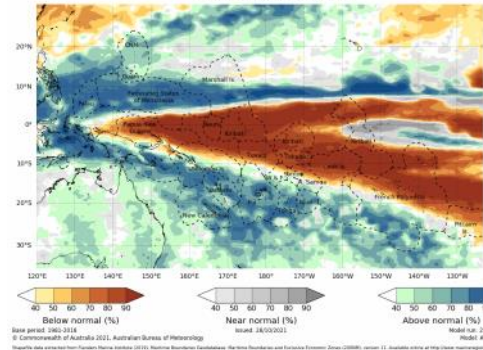
SEASONAL RAINFALL OUTLOOK

November 2021—January 2022

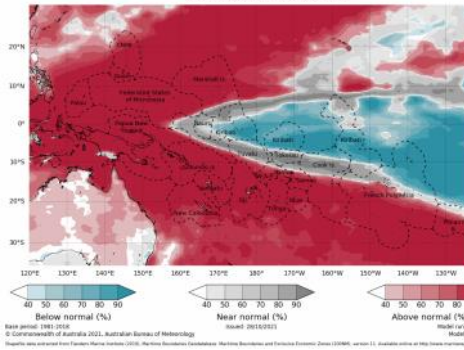


Seasonal ACCESS-S maps

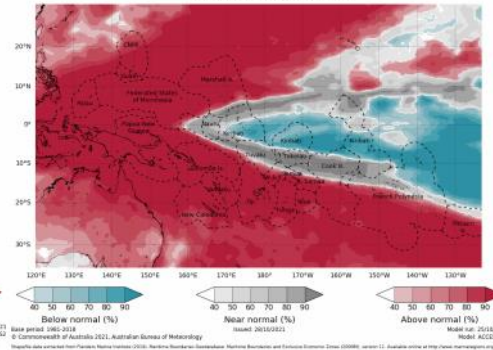
Tercile rainfall probabilities for November 2021 to January 2022



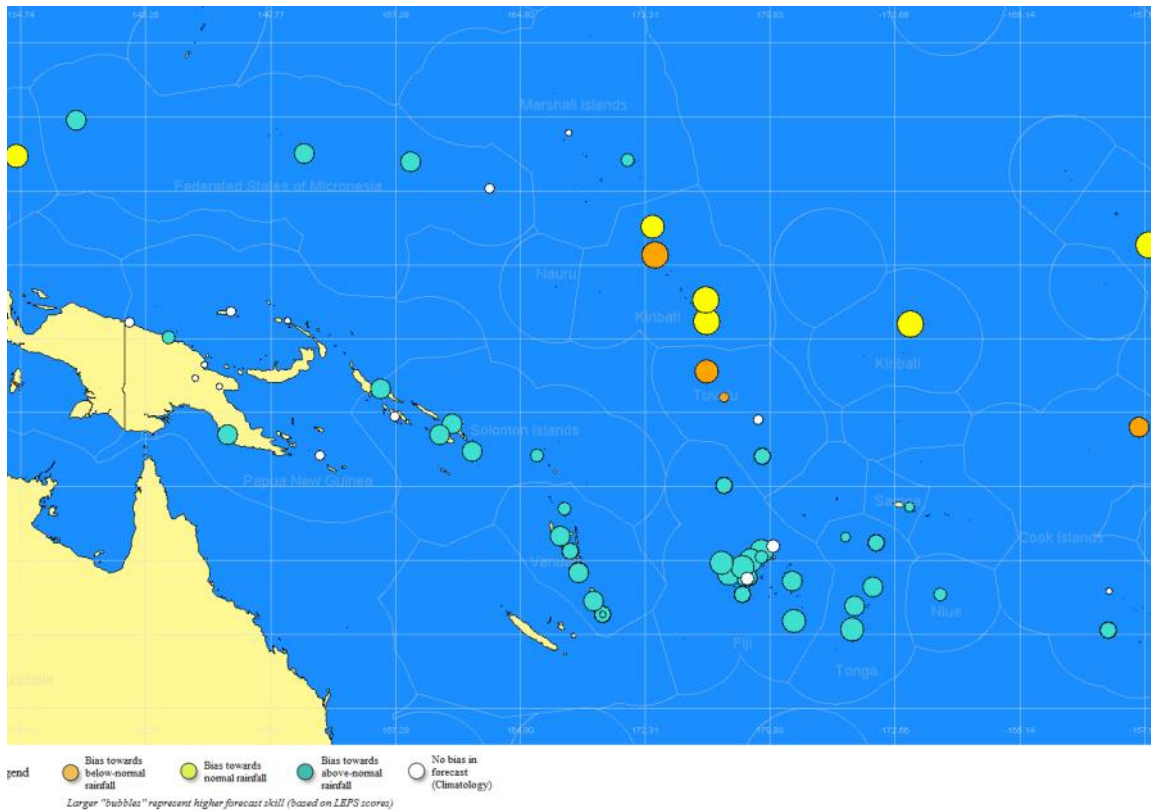
Tercile maximum temperature probabilities for November 2021 to January 2022



Tercile minimum temperature probabilities for November 2021 to January 2022



SCOPIC



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

SEASONAL RAINFALL OUTLOOK

November 2021—January 2022



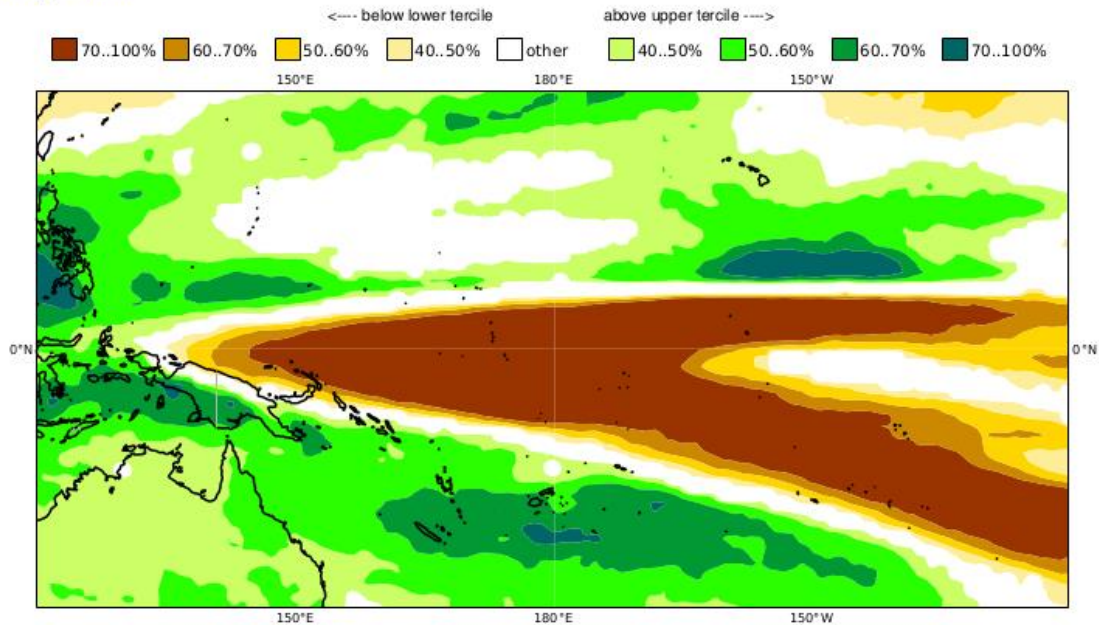
Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

NDJ 2021/22

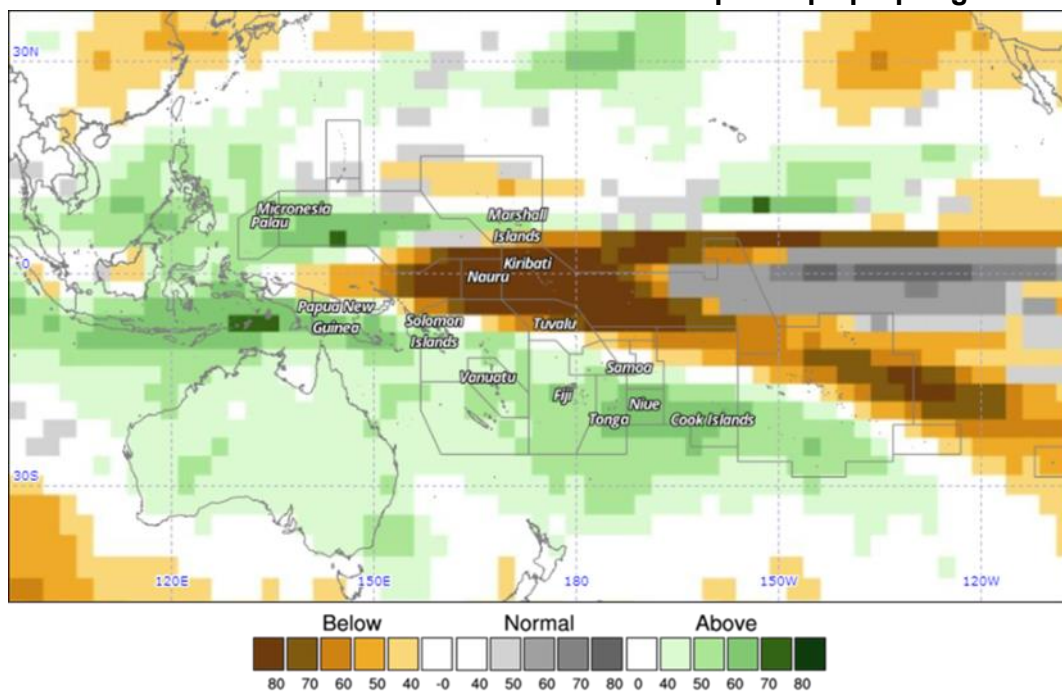
Nominal forecast start: 01/10/21

Unweighted mean



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

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



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

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

Generated using CLIK® (2021-11-3)

© APEC Climate Center

TROPICAL CYCLONE

2021/2022 Season



The cyclone activities in the western north Pacific occurs year around with near normal to below normal numbers of TCs anticipated. So far in 2021, there have been 24 typhoons in the western North Pacific. There were 4 tropical depressions, 13 tropical storms, 4 typhoons and 3 super typhoons affection Palau, FSM, RMI, Guam, Saipan and CNMI. In the southwest Pacific, the tropical cyclone season 2021-22 started on the 01 November, 2021. The outlook for the season is enhanced risk for tropical cyclone activity in the western part of the basin over November to April. In the central part of the region, cyclone risks are generally near normal, with reduced chances farther east.

Its important to remember that it does not take a severe cyclone to produce severe impacts. Coastal and river flooding rainfall can occur with a distant, weak or former cyclone. Communities should remain vigilant, and follow forecast information provided by their National Meteorological and Hydrological Service (NMHS).

The weekly tropical cyclone forecast from the ACCESS-S model shows increased risk in the weeks beginning 15 November and ending 21 November 2021 for the northwest Pacific, especially in areas around Philippines, Palau, Guam, Saipan, CNMI, FSM and RMI. Reduced risks for the southwest Pacific region for weeks beginning 8 November and ending 21 November.

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/>

ACCESS-S Weekly Forecasts –Northwest Pacific

Difference from normal chance of Tropical Cyclone's in the Northern
Forecast period: 08/11/2021 - 14/11/2021



Rated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2021, Australian Bureau of Meteorology
Source: ACCESS_S2
Model run: 02/11/2021

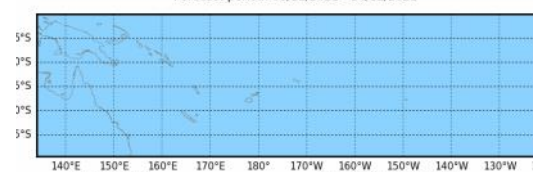
Difference from normal chance of Tropical Cyclone's in the Northern
Forecast period: 15/11/2021 - 21/11/2021



Rated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2021, Australian Bureau of Meteorology
Source: ACCESS_S2
Model run: 02/11/2021

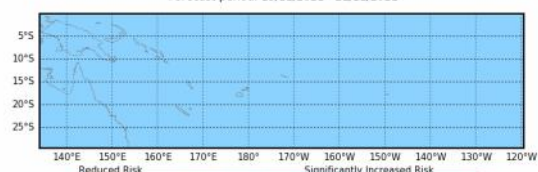
ACCESS-S Weekly Forecasts –Southwest Pacific

Difference from normal chance of Tropical Cyclone's in the South Pacific
Forecast period: 08/11/2021 - 14/11/2021



Calibrated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2021, Australian Bureau of Meteorology
Source: ACCESS_S2
Model run: 11/11/2021
Created: 02/11/2021

Difference from normal chance of Tropical Cyclone's in the South Pacific
Forecast period: 15/11/2021 - 21/11/2021



Calibrated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2021, Australian Bureau of Meteorology
Source: ACCESS_S2
Model run: 11/11/2021
Created: 02/11/2021

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.

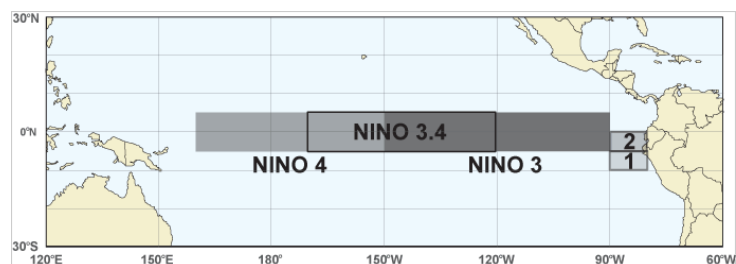
20 degrees Celsius Isotherm Depth

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