

Monthly Climate Bulletin

November 2021



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Photo Credit: Anetone Sagaga image of flooding in Apia 2019



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- La Niña is firmly established in the tropical Pacific with climate models suggest this will persist until February 2022.
- The current Madden-Julian Oscillation (MJO) pulse has weakened in recent days but is expected to track eastwards across the Maritime Continent and restrengthen in the coming week while in the Western Pacific region
- 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 November shows SSTs were warmer than average in the far western Pacific while cooler than average SSTs along the central and eastern equatorial Pacific Ocean.
- Coral bleaching status warning 'Alert Level 2' for parts of northern PNG mainland while 'Alert Level 1' for other parts of northern and southeast PNG, Palau and FSM. 'No stress' or 'watch' for the rest of COSPPac countries. Coral bleaching outlook remains at 'Alert Level 2' for northern and southern PNG for the next three weeks.
- A notable sea level anomaly of +300mm observed in Palau and FSM while other COSPPac countries recorded between +100mm to +250mm above normal sea level.
- For December 2021-February 2022, the dynamical models (including SCOPIC) agree on above normal rainfall for Palau, Guam, CNMI, FSM, southern RMI, southeastern 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, northern RMI, 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 significant increased risk in the weeks beginning 12 December and ending 25 December 2021 for the northwest Pacific, especially in areas around Philippines. There is also increased risks for the southwest Pacific region especially for PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji and New Zealand for weeks beginning 12 December and ending 18 December.



EL NIÑO–SOUTHERN OSCILLATION

La Niña firmly established in the tropical Pacific

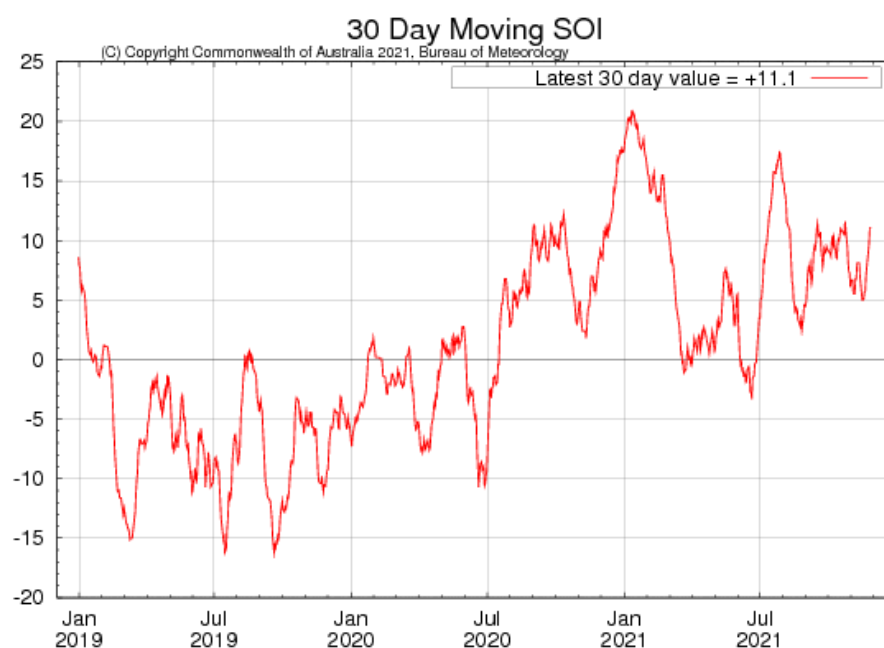
Click link to access [Climate Driver Update issued on 07 December 2021](#)

La Niña is firmly established in the tropical Pacific. Climate models suggest La Niña will persist until the late southern hemisphere summer (February 2022) or early autumn (March) 2022. La Niña events increase the chance of above average rainfall across much of northern and eastern Australia and the western Pacific Islands countries during summer.

Most El Niño Southern Oscillation (ENSO) indicators show clear La Niña patterns. Sea surface temperatures in the tropical Pacific have cooled to La Niña thresholds, with climate model outlooks expecting them to cool further. In the atmosphere, cloud and wind patterns are typical of La Niña, indicating the atmosphere is responding to the changes in ocean temperatures. This feedback process is known as "coupling", and it means La Niña conditions are now expected to be locked in until at least the end of summer.

The negative Indian Ocean Dipole (IOD) is near its end, with IOD index values in the neutral range. However, some signs of the negative IOD persist with increased cloud over the eastern Indian Ocean and strengthened westerly winds. Climate models predict the IOD will remain neutral for the coming months, consistent with its typical seasonal cycle.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 05 December was +13.8. The 90-day SOI value was +9.9. The 30-day SOI gradually has steadily increased over the second half of November.



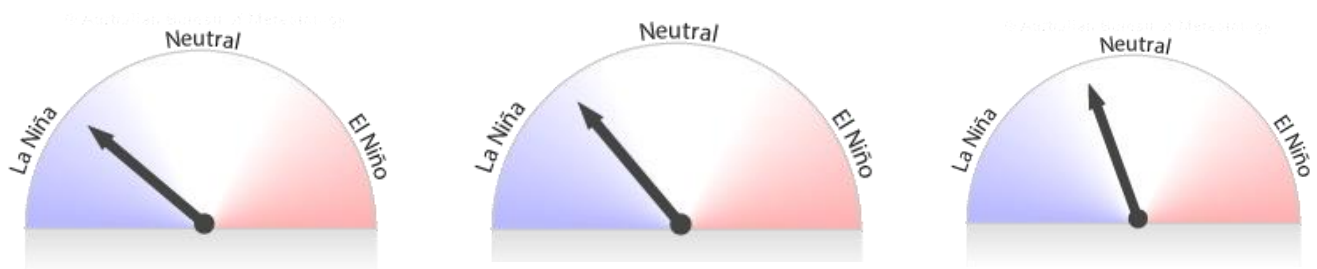


EL NIÑO–SOUTHERN OSCILLATION

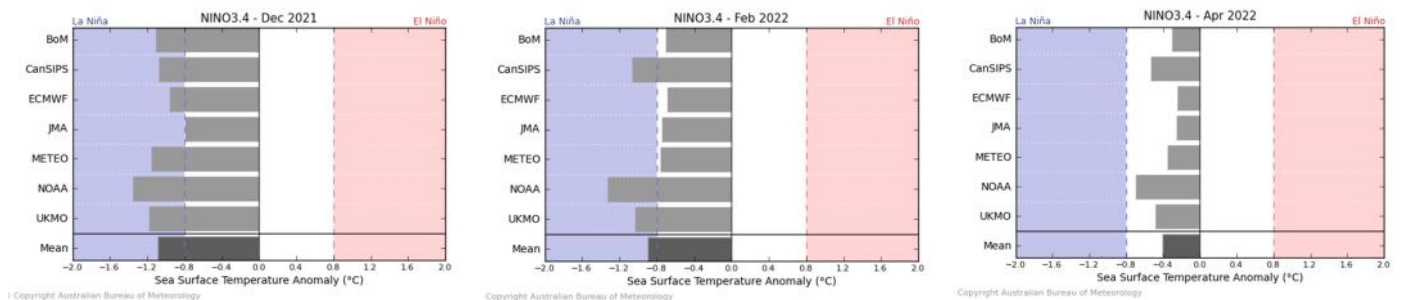
La Niña firmly established in the tropical Pacific

Click link to access [Climate Driver Update issued on 07 December 2021](#)

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



Bureau of Meteorology NINO3.4 International Model Outlooks



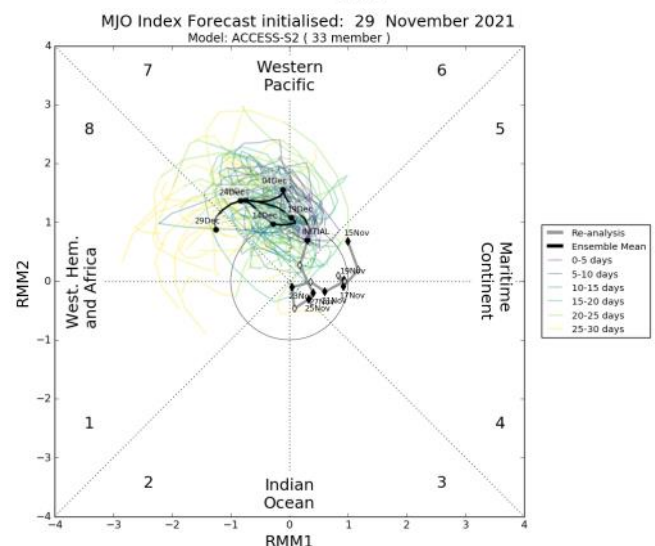
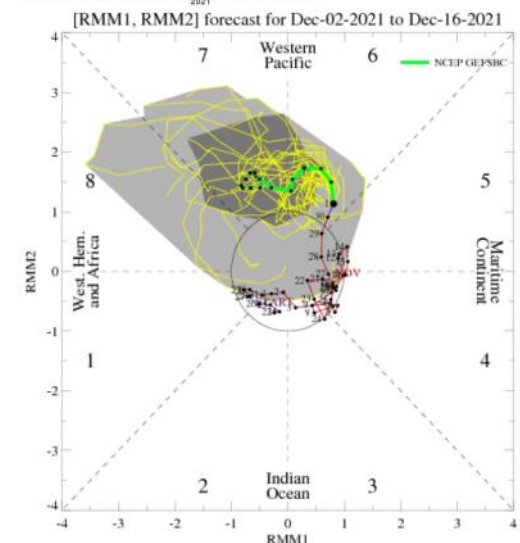
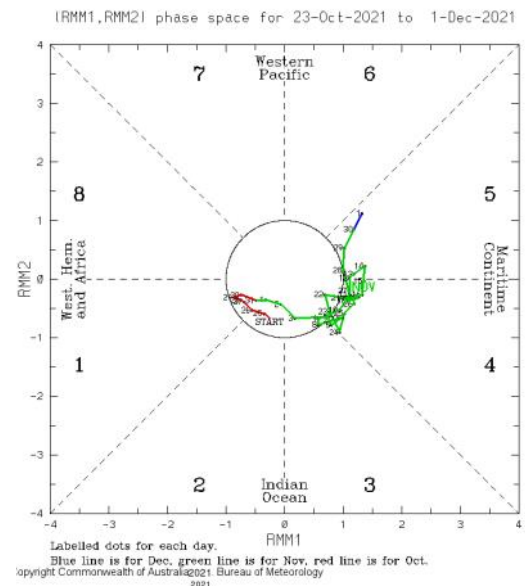
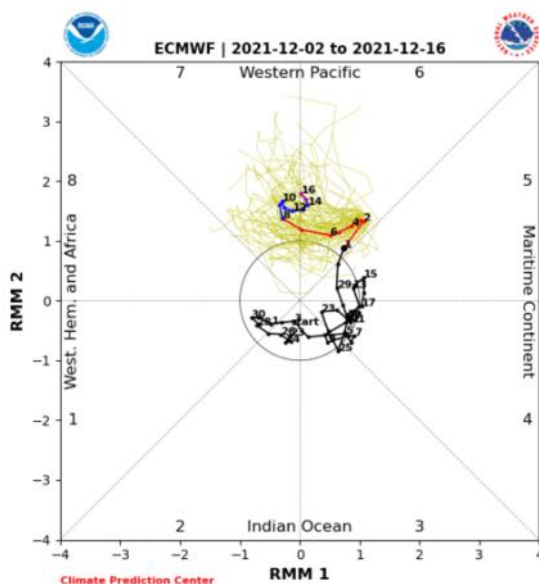
Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean>

MADDEN–JULIAN OSCILLATION

Click link to access [Tropical Climate Update](#) [Issued on Tuesday 30 November 2021]

During last two weeks of November, a weak to moderately strong pulse of Madden-Julian Oscillation (MJO) tracked across the Maritime Continent. In the past fortnight, a moderately strong pulse of the MJO was located over the Maritime Continent, to Australia's north. This pulse was likely a significant contributing factor in the formation of tropical cyclone Paddy, by providing conditions favourable for the development of the near equatorial trough in the south eastern Indian Ocean. The current MJO pulse has weakened in recent days but is expected to track eastwards across the Maritime Continent and restrengthen in the coming week while in the Western Pacific region. In this scenario, the MJO is likely to increase the chance of above-average cloudiness and rainfall over far northern Australia and the Maritime Continent. At this time of year, an MJO in these regions also increases the chance of broadscale westerly wind-flow developing over the region, including around northern Australia. As such, the MJO may assist the development of monsoonal flow in the southern hemisphere across Maritime Continent longitudes.

This is an abbreviated version of the Tropical Climate Update. Click on the [Weekly Tropical](#) for more information .



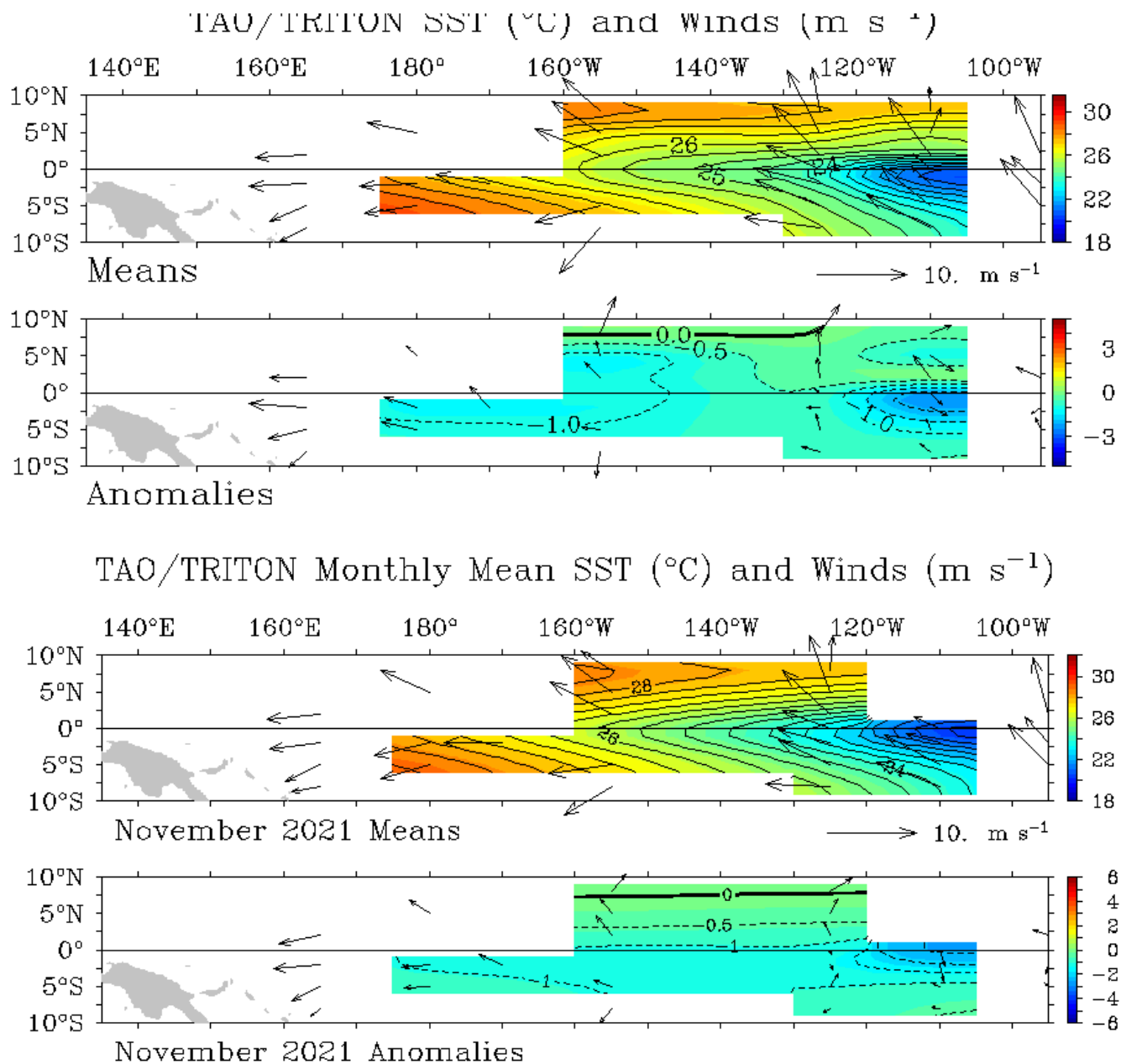
WIND



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

The trade winds in November 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

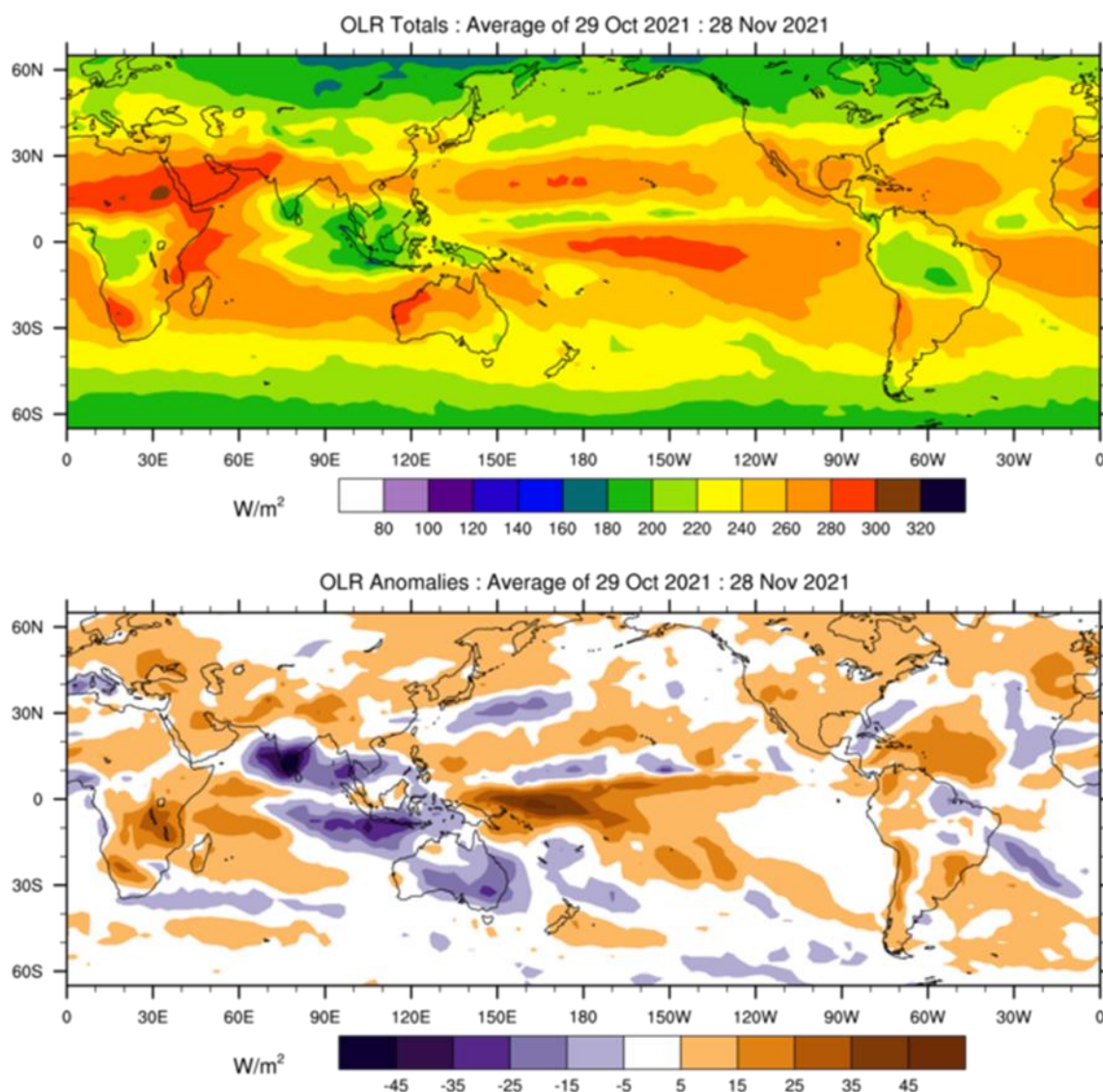
Click link to access [OLR](#)



The November 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 and shifted southwest around New Caledonia, Vanuatu to New Zealand.

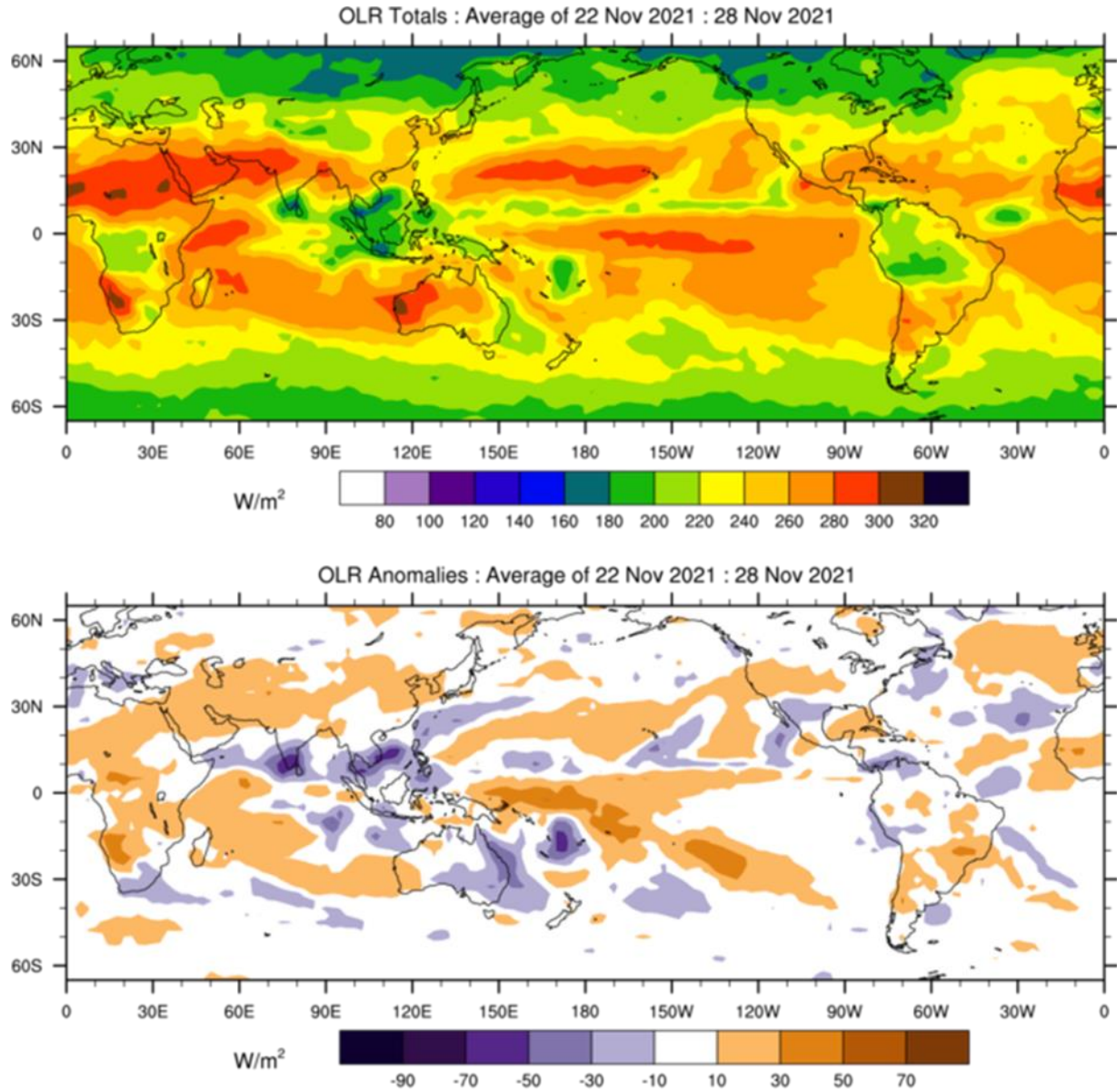
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

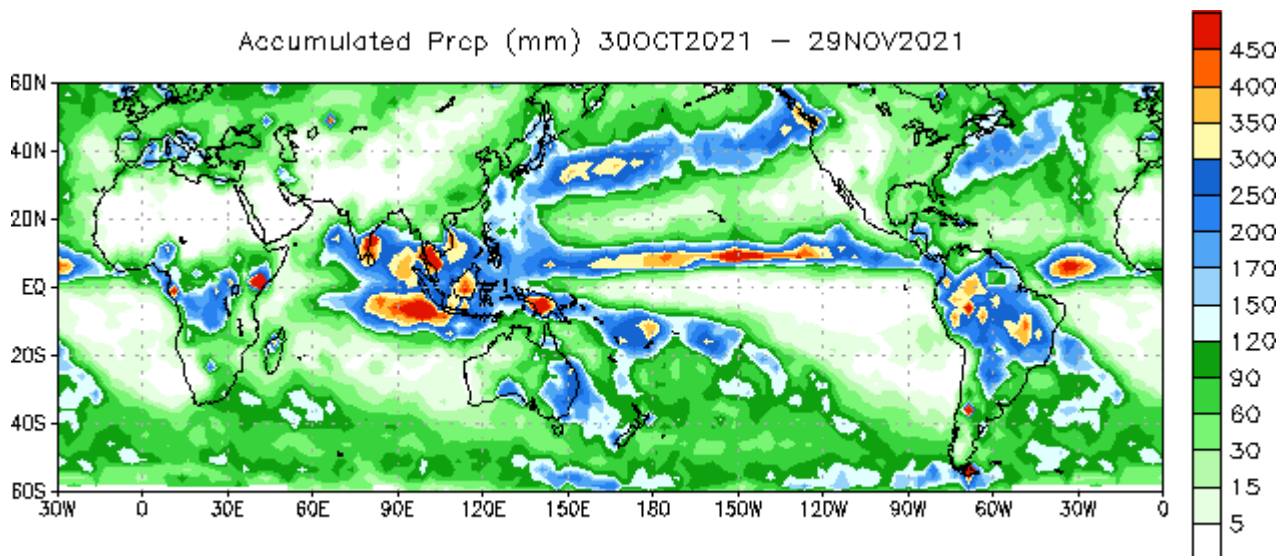


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OLR Total and Anomalies, 7 Day OLR

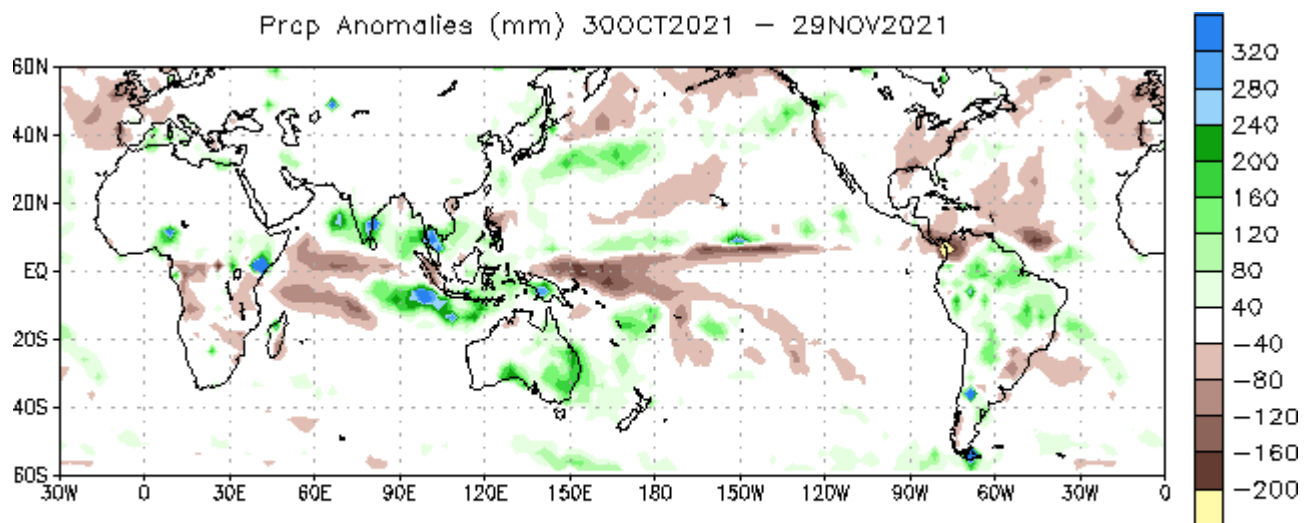


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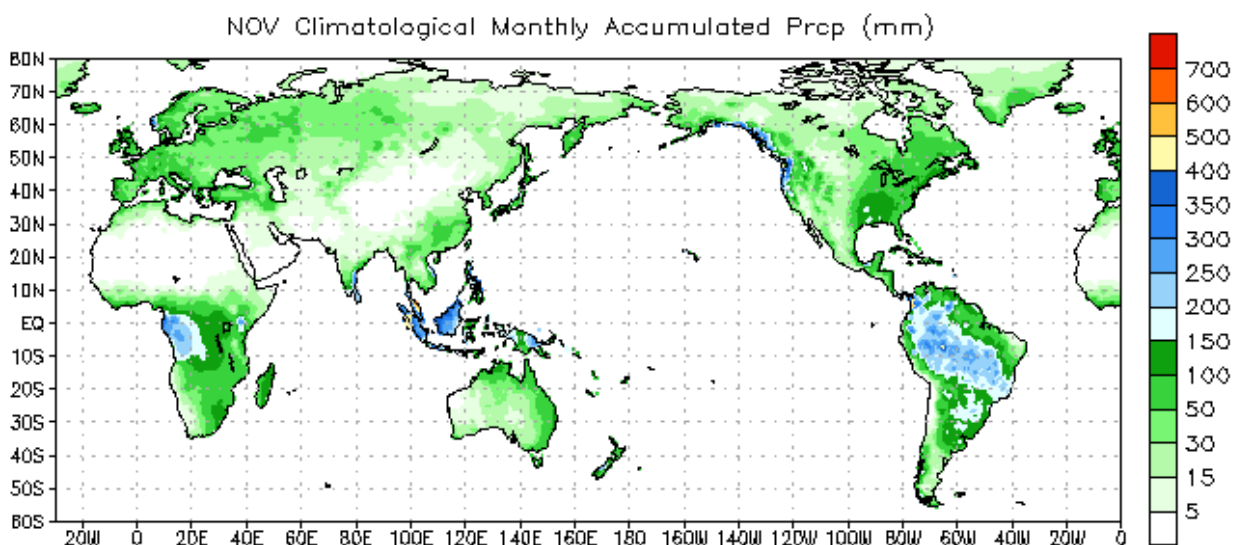


Data Source: NCEP CMAP Precipitation

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

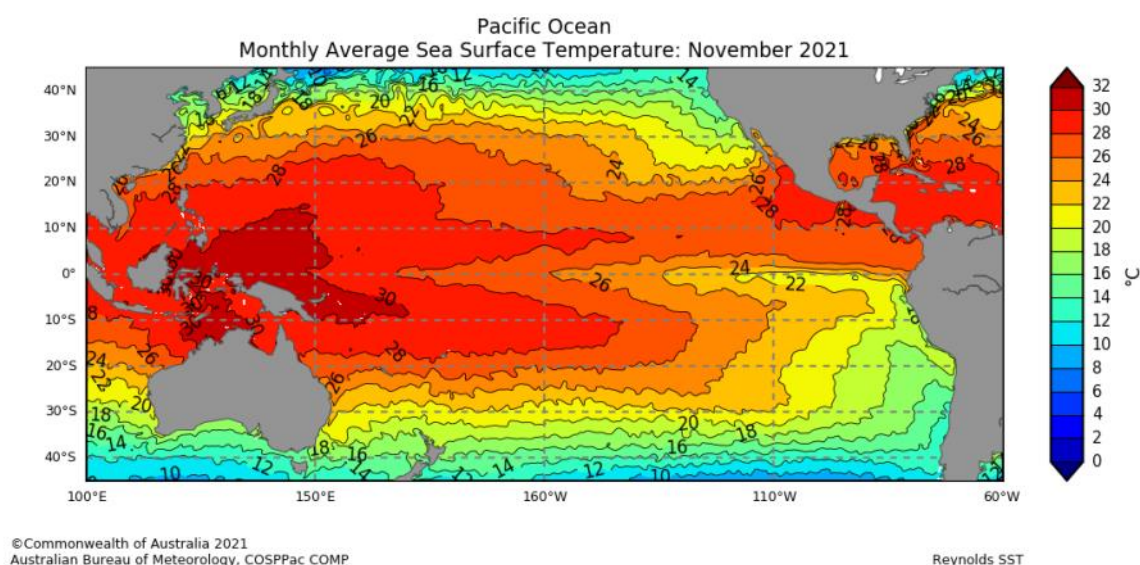


Click link to access [Pacific Community COSPPac Ocean Portal](#)

The SST map for November 2021 show weak cool SST anomalies were present across most of the equatorial Pacific, while warm SST anomalies were largely present across the remainder of the basin west of 160°E, including around the Maritime Continent and northern Australia.

In terms of the deciles, highest on record occurred in Palau, western FSM, northern and eastern PNG, Coral Sea region, western and southern Solomon Islands, northern Vanuatu, southern Fiji and Tonga. Patches of highest on record deciles were also observed in New Caledonia and New Zealand. Regions of very much above average (deciles 10) SSTs spanned across parts of Palau, western RMI, FSM, PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji and Tonga. The regions of above average (deciles 8-9) for November occurred across majority of the COSPPac countries from Palau to southern Cook Islands. 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 parts of Nauru and eastern Kiribati, and western Kiribati.

Mean Sea Surface Temperature

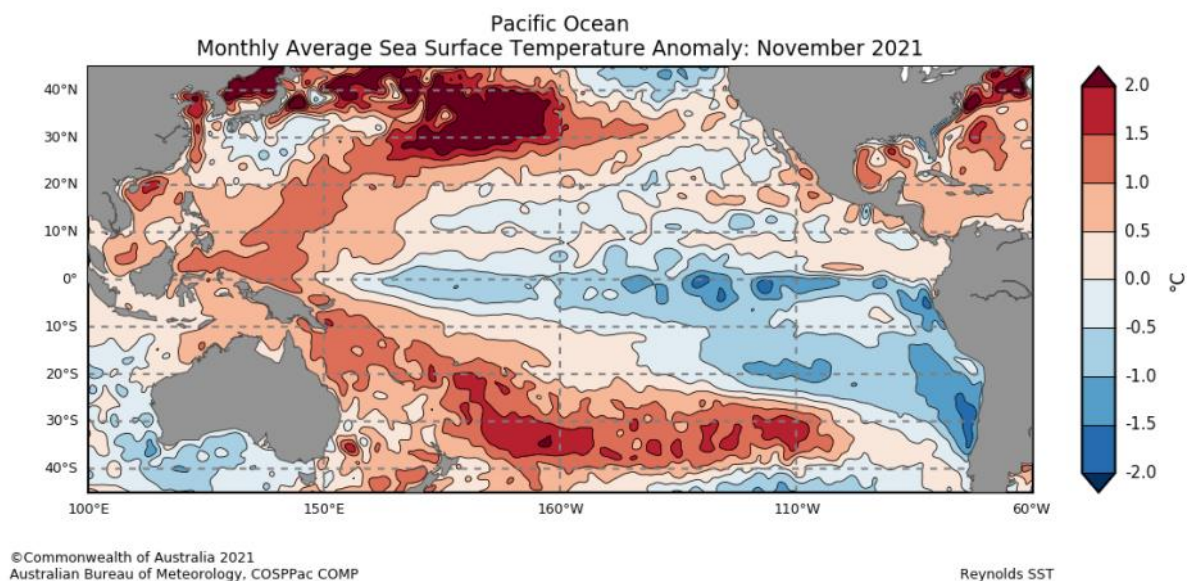


OCEAN CONDITIONS

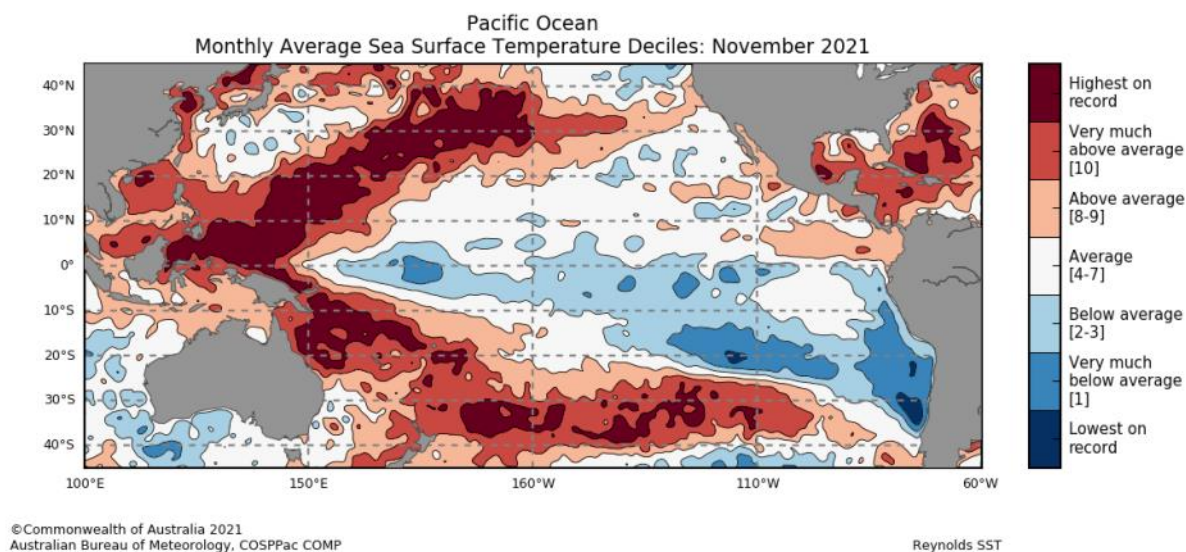
Click link to access [→ SEA SURFACE TEMPERATURE](#)



Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles



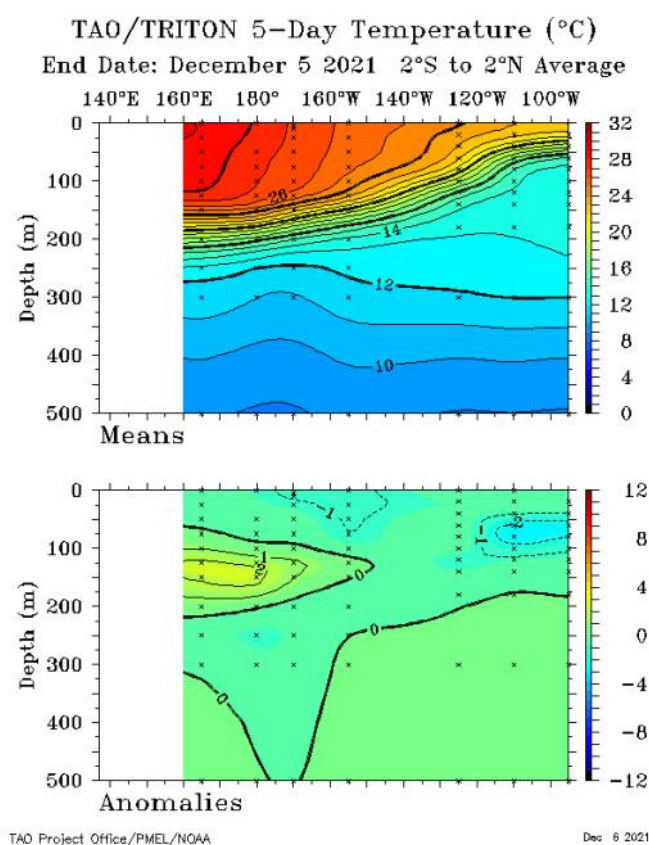
OCEAN CONDITIONS

SUB SURFACE

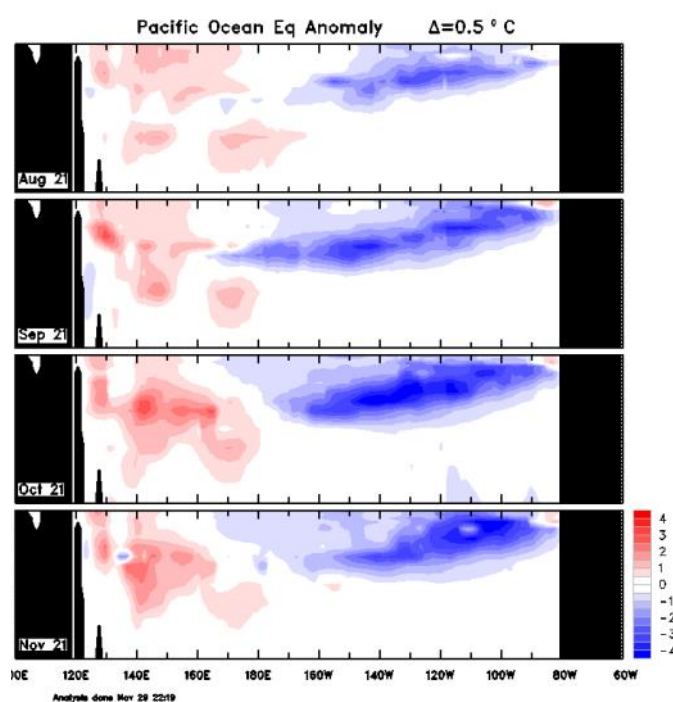


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 18 November 2021) shows cool anomalies have persisted across the sub-surface of the central to eastern equatorial Pacific over the past three months. For November to date, waters were more than three degrees cooler than average across a large region east of 140°W, and reach up to four degrees cooler than average in some areas. Weak warm anomalies continue across parts of the column depth in the far west of the equatorial Pacific.

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

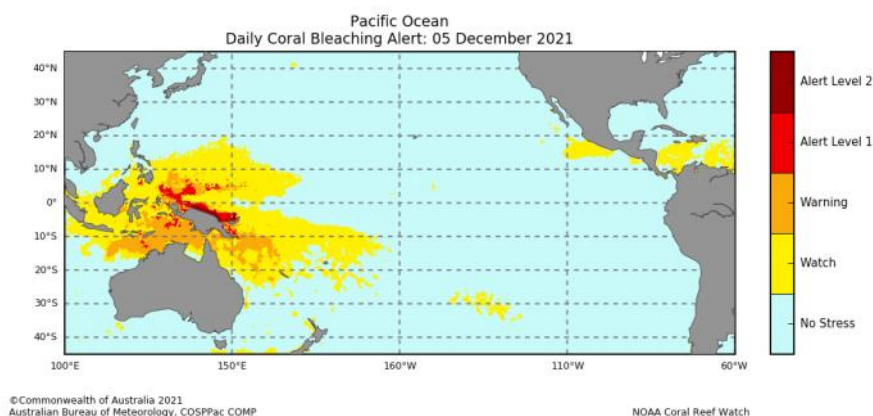
CORAL BLEACHING



The daily Coral Bleaching Alert for 05th December 2021 shows 'Alert Level 2' for parts of northern PNG mainland while 'Alert Level 1' for other parts of northern and southeast PNG, Palau and FSM. 'Warning' for southern Solomon Islands. 'No Stress or Watch' for the rest of COSPPac partner countries. The four weeks Coral Bleaching Outlook to 26th December shows 'Alert Level 2' for parts of northern and southern PNG. 'Alert Level 1' for southern FSM. 'Watch' and 'Warning' for Palau, most of FSM, other parts of PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji, Tuvalu, Tonga, Tokelau, Samoa, Niue and southern Cook Islands.

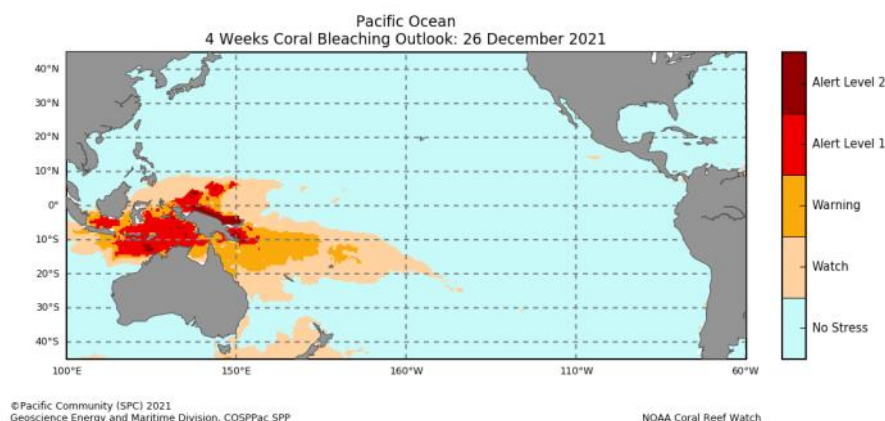
Daily Coral Bleaching Alert

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



4-Weeks Coral Bleaching Outlook

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



OCEAN CONDITIONS

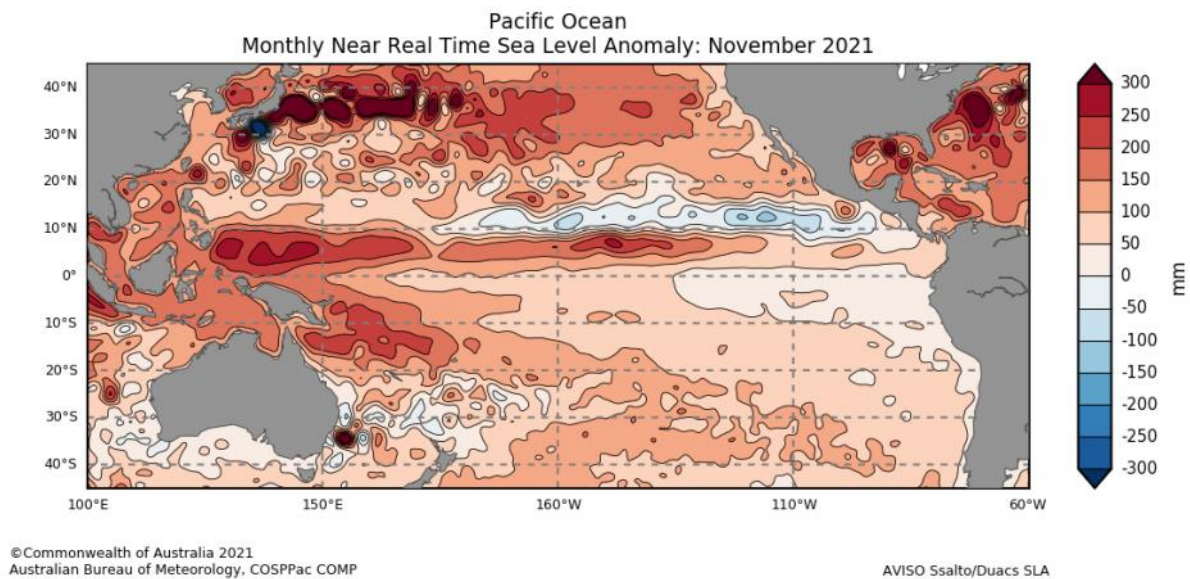
OCEAN SURFACE CURRENTS AND SEA LEVEL



Sea level was above normal for most of the COSPPac countries. The highest anomalies above +300mm were observed for Palau and FSM. Other COSPPac countries recorded between +100mm to +250mm above normal sea level. Patches of near normal to below normal sea levels were observed east of 170° E along the equator.

Monthly Sea Level Anomalies

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

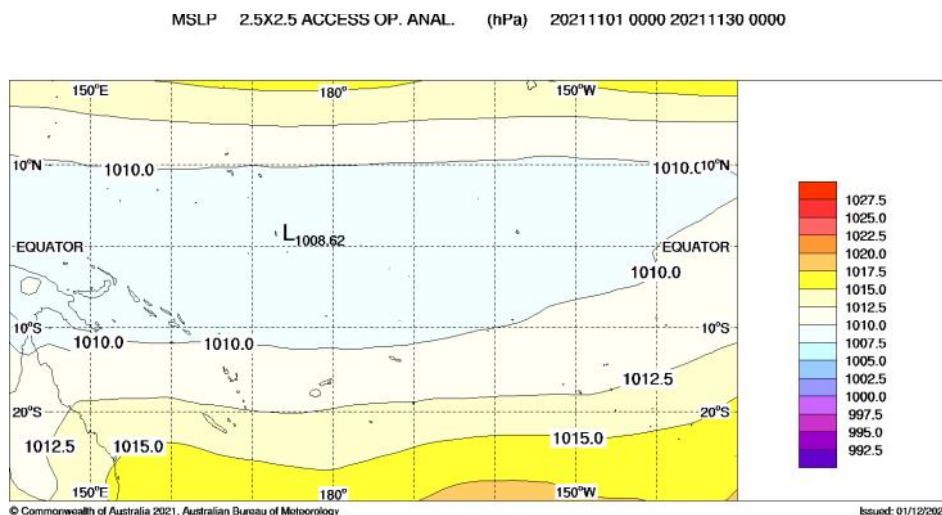


MEAN SEA LEVEL PRESSURE

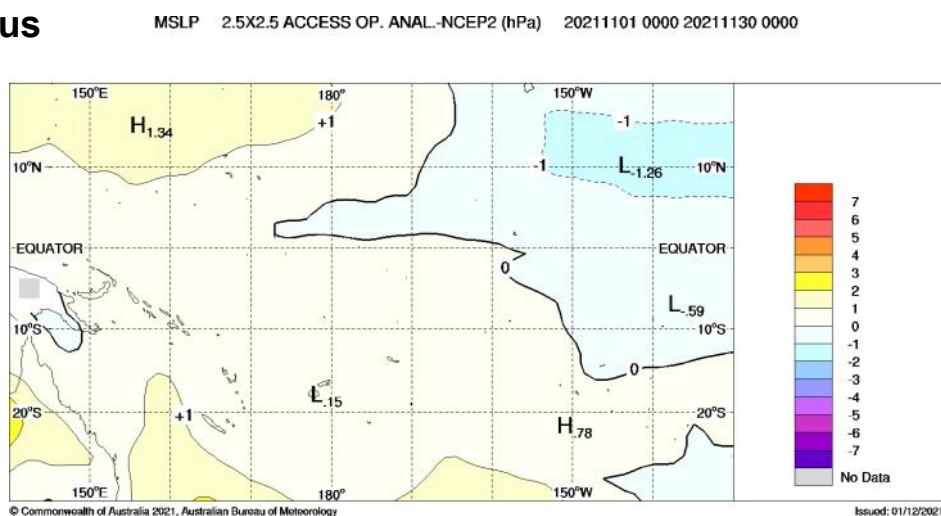
The November mean sea level pressure (MSLP) anomaly map shows positive anomalies over west of New Caledonia towards New Zealand. Negative anomalies were present over the eastern equatorial Pacific around 10°N and 17°N and 154°E.

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

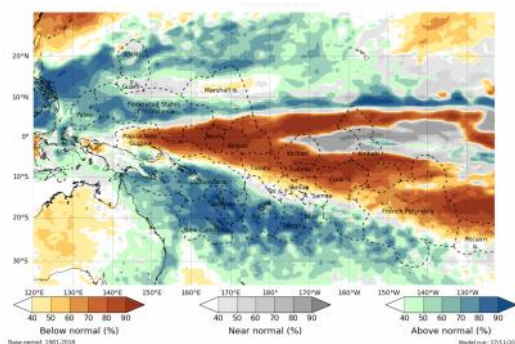
December 2021—February 2022



The ACCESS-S model forecast for December 2021 is very likely to be below normal rainfall for northern PNG, Nauru, Kiribati, Tuvalu, Tokelau, the northern Cook Islands, northern and central French Polynesia. Above normal rainfall is very likely for FSM, central CNMI, southern RMI, southeastern PNG, Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga, Niue and parts of southern Cook Islands and French Polynesia.

The three-month rainfall outlook (December 2021-February 2022) shows a strong dry signal very likely to affect northern PNG, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Samoa, American Samoa, northern and central Cook Islands, northern and central French Polynesia and Pitcairn Island. In contrast, the models show an increased chance of wetter very likely in Palau, Guam, CNMI, FSM, southern RMI, southeast PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and French Polynesia. Above normal maximum and minimum temperatures are very likely 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 December 2021-February 2022 is very likely to be below normal rainfall for the northeastern PNG Islands, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands, French Polynesia, and Pitcairn Island. Above normal rainfall is very likely for Palau, FSM, Guam, CNMI, southern Marshall Islands, western and southeastern PNG, central and eastern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands.

The SCOPIC statistical model forecast for December 2021-February 2022 is very likely to be above normal rainfall for most of the COSPPac countries except for northern PNG, Kiribati, northern Tuvalu, and northern Cook Islands very likely to have normal to below normal rainfall.

The APEC Climate Centre multi-model for December 2021-February 2022 forecast is very likely to be 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 very likely for Palau, most of FSM, western and southeastern PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia.

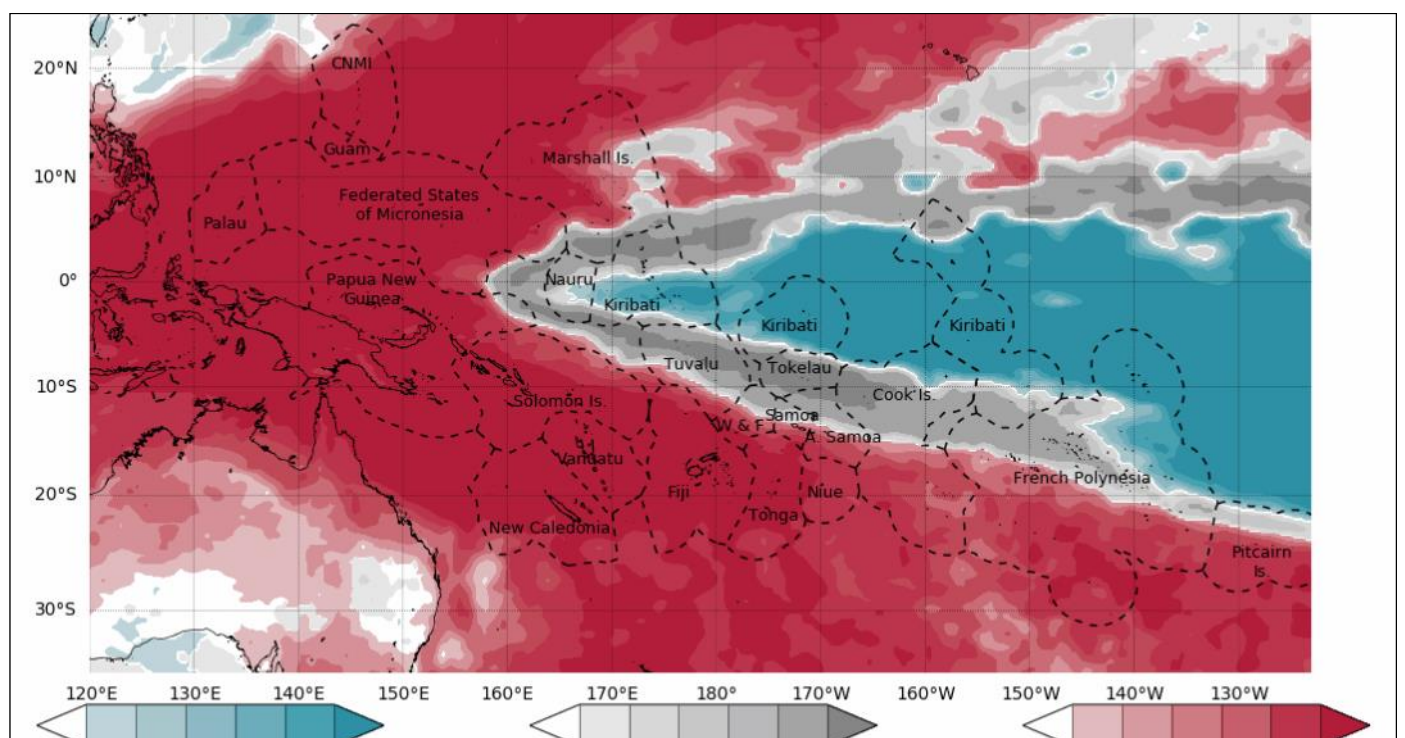
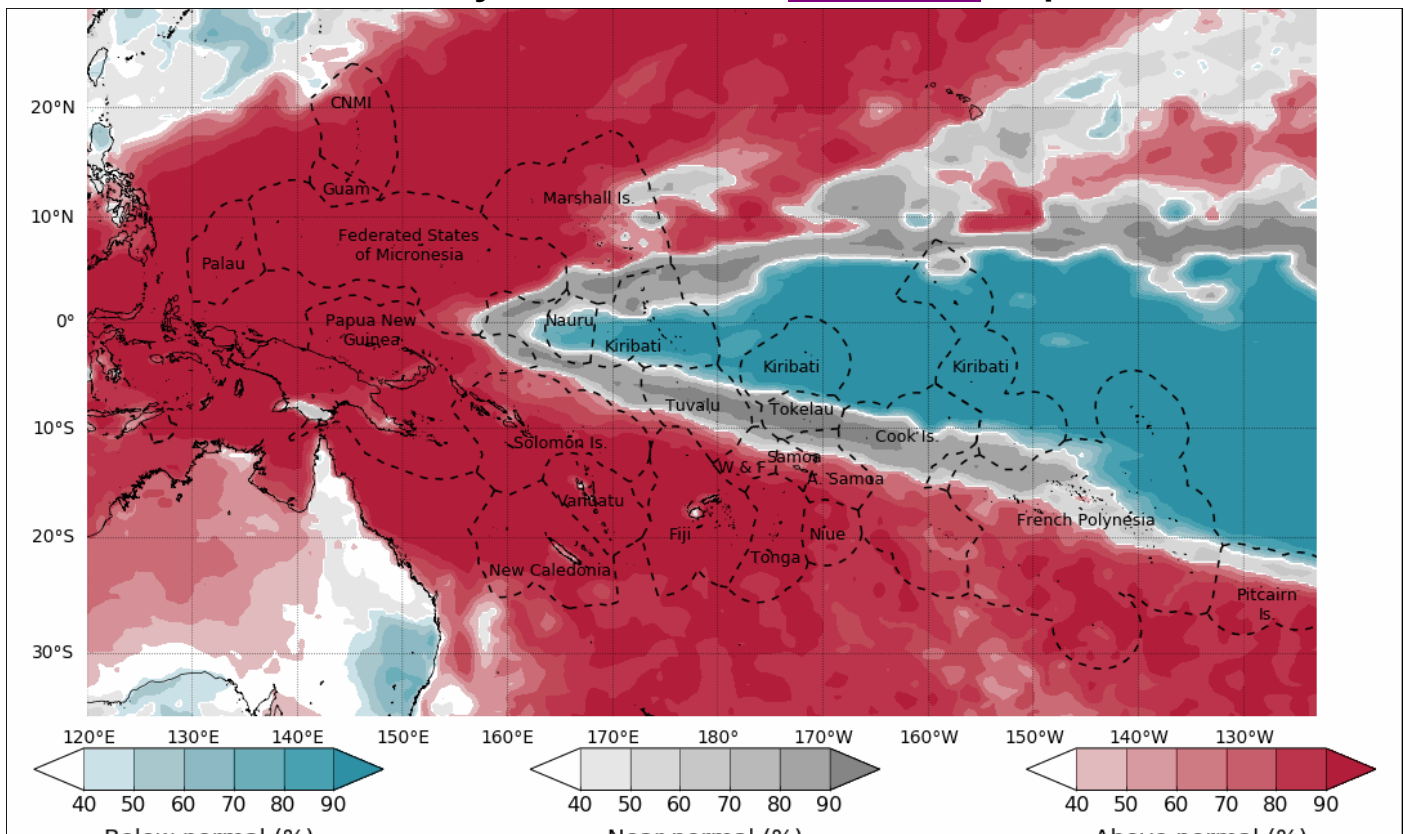
For December 2021-February 2022, the dynamical models (including SCOPIC) agree on above normal rainfall for Palau, Guam, CNMI, FSM, southern RMI, southeastern PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for northern PNG, northern RMI, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands, and the northern and central French Polynesia.

SEASONAL TEMPERATURE OUTLOOK

December 2021—February 2022



Monthly Tmax and Tmin ACCESS-S Maps



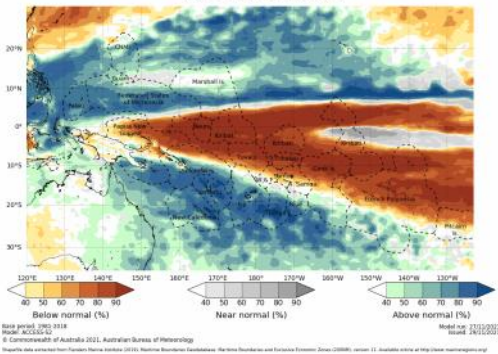
SEASONAL RAINFALL OUTLOOK

December 2021—February 2022

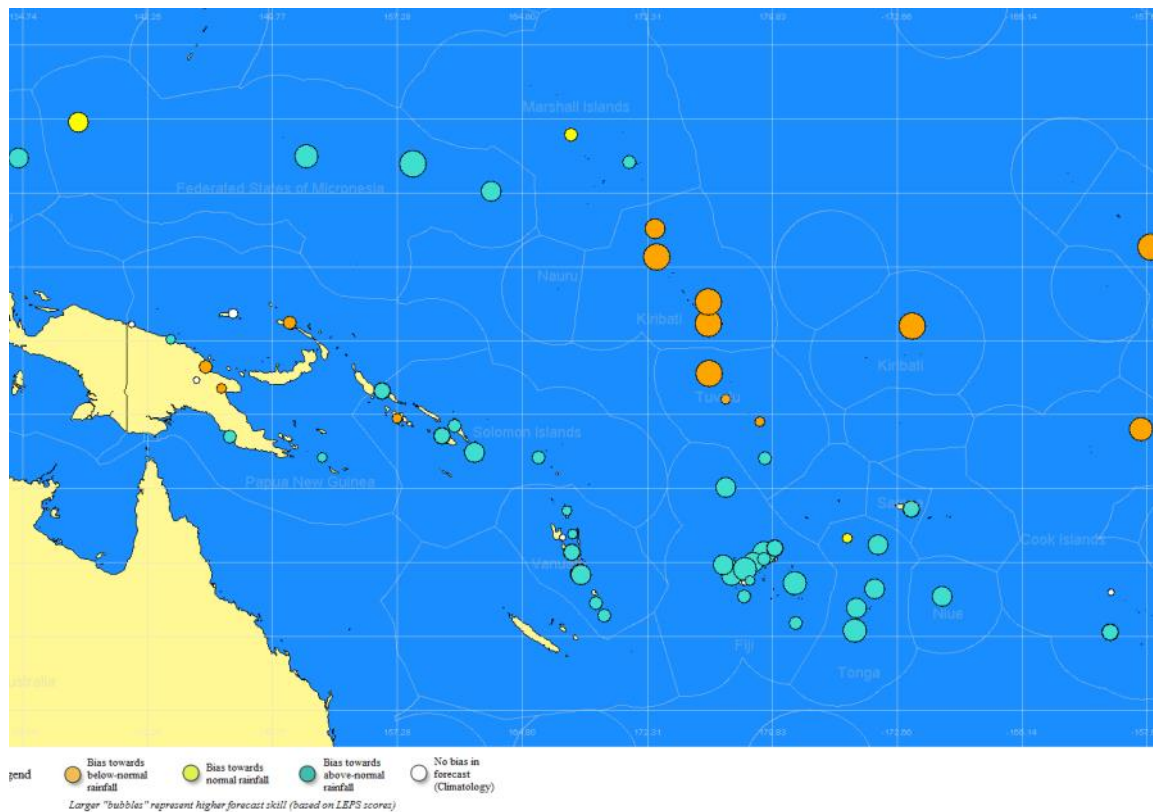
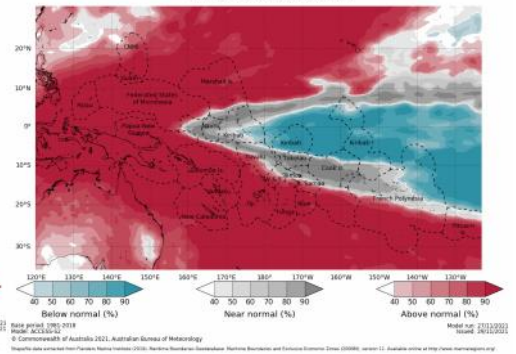
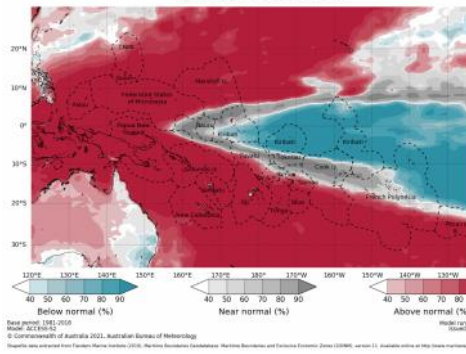


Seasonal ACCESS-S maps

Tercile rainfall probabilities for December 2021 to February 2022



Tercile maximum temperature probabilities for December 2021 to February 2022



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

SEASONAL RAINFALL OUTLOOK

December 2021—February 2022



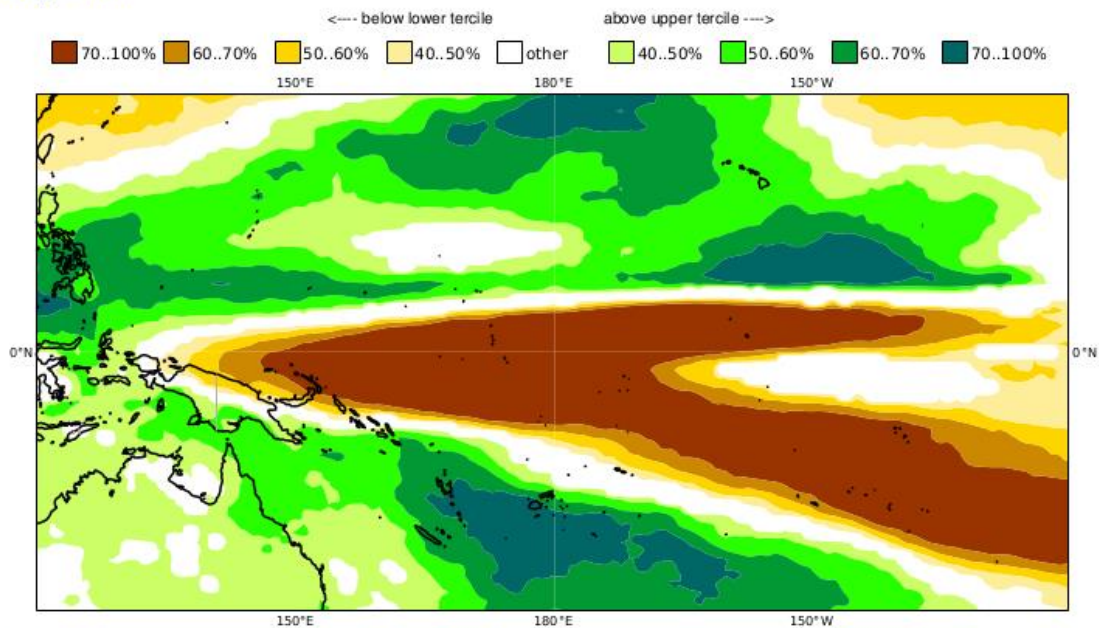
Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

Nominal forecast start: 01/11/21

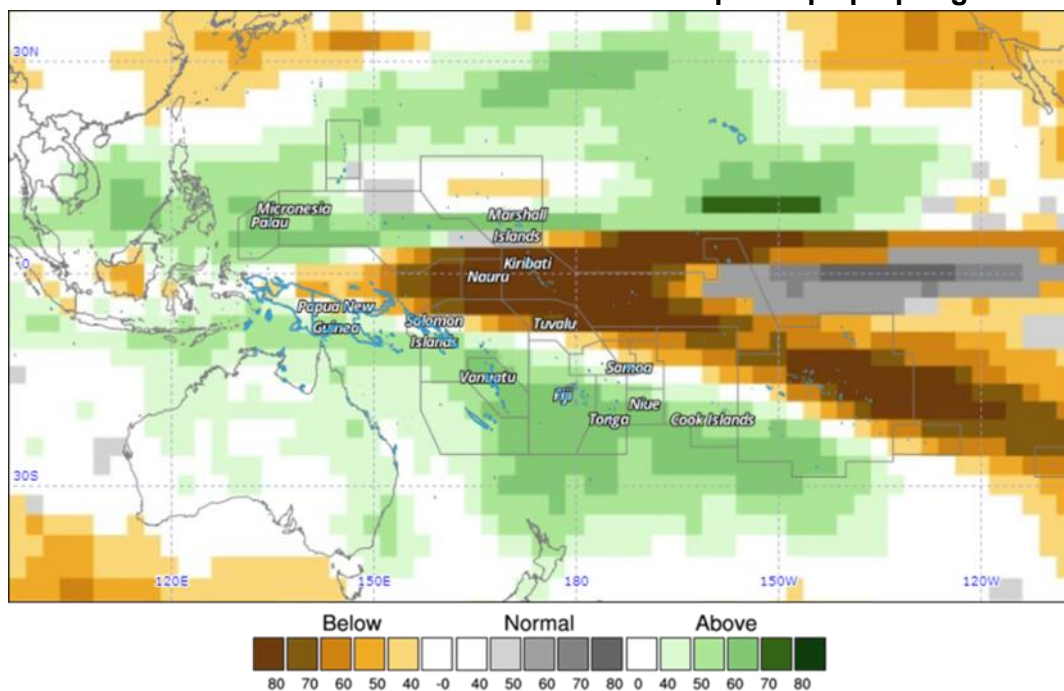
Unweighted mean

DJF 2021/22



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

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



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

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

Generated using CLIK® (2021-12-3)

© 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 significant increased risk in the weeks beginning 12 December and ending 25 December 2021 for the northwest Pacific, especially in areas around Philippines. There is also increased risks for the southwest Pacific region especially for PNG, Solomon Islands, New Caledonia, Vanuatu, Fiji and New Zealand for weeks beginning 12 December and ending 18 December.

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>

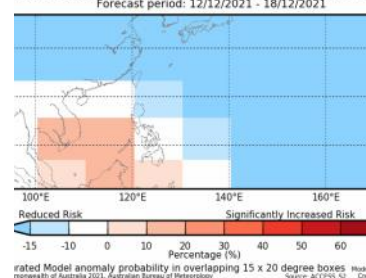
NASA GMAO GEOS-5: <http://gmao.gsfc.nasa.gov/research/ocean/>

NOAA CFSv2: <http://www.cpc.ncep.noaa.gov/products/CFSv2/CFSv2seasonal.shtml>

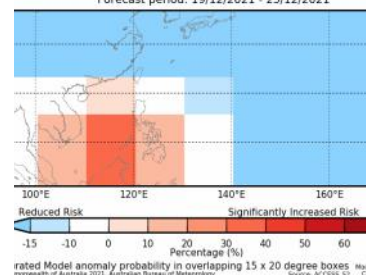
IRI for Climate and Society: <http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/>

ACCESS-S Weekly Forecasts –Northwest Pacific

Difference from normal chance of Tropical Cyclone's in the Northern
Forecast period: 12/12/2021 - 18/12/2021

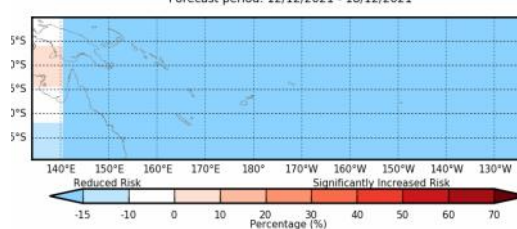


Difference from normal chance of Tropical Cyclone's in the Northern
Forecast period: 19/12/2021 - 25/12/2021



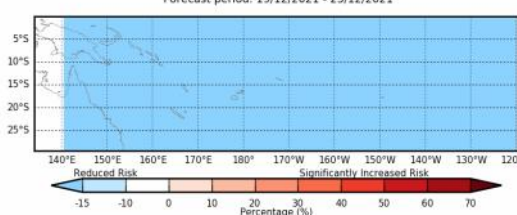
ACCESS-S Weekly Forecasts –Southwest Pacific

Difference from normal chance of Tropical Cyclone's in the South Pacific
Forecast period: 12/12/2021 - 18/12/2021



Calibrated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2021, Australian Bureau of Meteorology Source: ACCESS_S2 Model run: 04/12/2021 Created: 04/12/2021

Difference from normal chance of Tropical Cyclone's in the South Pacific
Forecast period: 19/12/2021 - 25/12/2021



Calibrated Model anomaly probability in overlapping 15 x 20 degree boxes
© Commonwealth of Australia 2021, Australian Bureau of Meteorology Source: ACCESS_S2 Model run: 04/12/2021 Created: 04/12/2021

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.

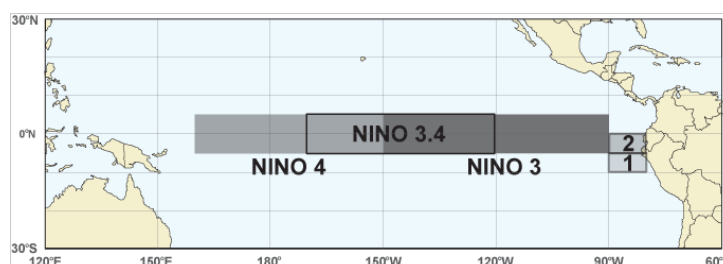
20 degrees Celsius Isotherm Depth

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