

Monthly Climate Bulletin

September 2021



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Photo Credit: Philip Malsale subsistence fishing in Vanuatu



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SUMMARY

Issued 08 October 2021

- The El Niño Southern Oscillation (ENSO) is currently neutral. However, recent model outlooks and cooling in the tropical Pacific Ocean mean the Bureau's ENSO Outlook status is at La Niña WATCH.
- The Madden-Julian Oscillation (MJO) is currently weak, located over the western Maritime Continent with most models forecast its movement towards the eastern Maritime Continent in the coming fortnight.
- The Intertropical Convergence Zone (ITCZ) was active around the western and central Pacific, while the South Pacific Convergence Zone (SPCZ) was generally suppressed except for some activity between eastern PNG and western Solomon Islands.
- The sea surface temperature anomaly pattern in September 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 is '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 Palau, western FSM, southern PNG, southern Solomon Islands and Vanuatu.
- For October to December 2021, the dynamical models agree on above normal rainfall for Palau, FSM, central Marshall Islands, most of PNG and 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 and Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands, and the northern half of French Polynesia.

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EL NIÑO–SOUTHERN OSCILLATION

La Niña; negative Indian Ocean Dipole near its end

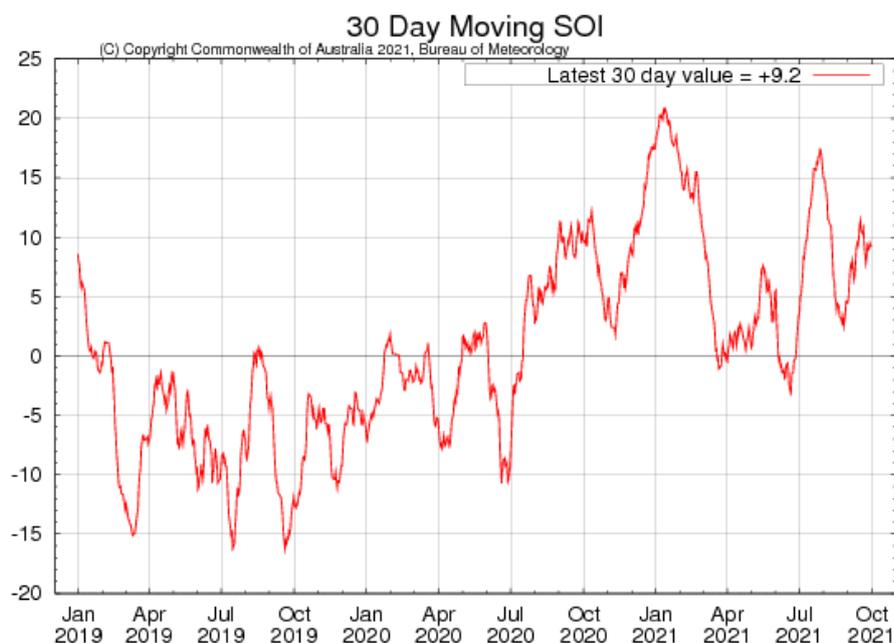
Click link to access [Climate Driver Update issued on 28 September 2021](#)

The El Niño Southern Oscillation (ENSO) is currently neutral. However, recent model outlooks and cooling in the tropical Pacific Ocean mean the Bureau's ENSO Outlook status is at La Niña WATCH. In the past when La Niña WATCH has been reached, a La Niña event has subsequently developed around 50% of the time; this is approximately double the normal likelihood. La Niña events increase the chances of above-average rainfall for northern and eastern Australia during spring and summer.

Most oceanic and atmospheric indicators of ENSO remain within the ENSO-neutral range. However, sea surface temperatures in the central tropical Pacific Ocean have cooled over the past two to three months, supported by cooler than average waters beneath the surface. Climate models continue this cooling trend over the coming months, with three of the seven models surveyed by the Bureau meeting La Niña criteria, while two additional models briefly touch La Niña thresholds.

The negative Indian Ocean Dipole (IOD) event has weakened, with latest IOD values falling shy of negative thresholds. Should these values persist, it is likely that the negative IOD is near its end. However, the pattern of sea surface temperatures in the Indian Ocean remains likely to influence Australian rainfall over the coming months. A negative IOD increases the chances of above-average spring rainfall for much of southern and eastern Australia.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 26 September was +9.3. The 90-day SOI value was +9.4. The 30-day SOI has maintained similar values over the past two weeks.



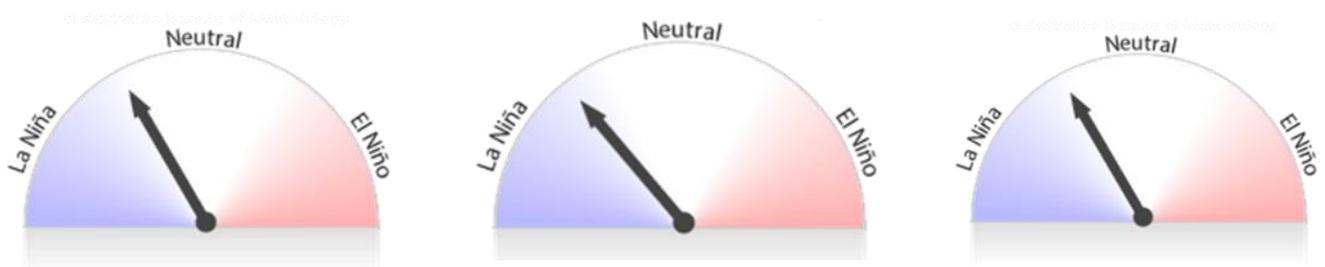


EL NIÑO–SOUTHERN OSCILLATION

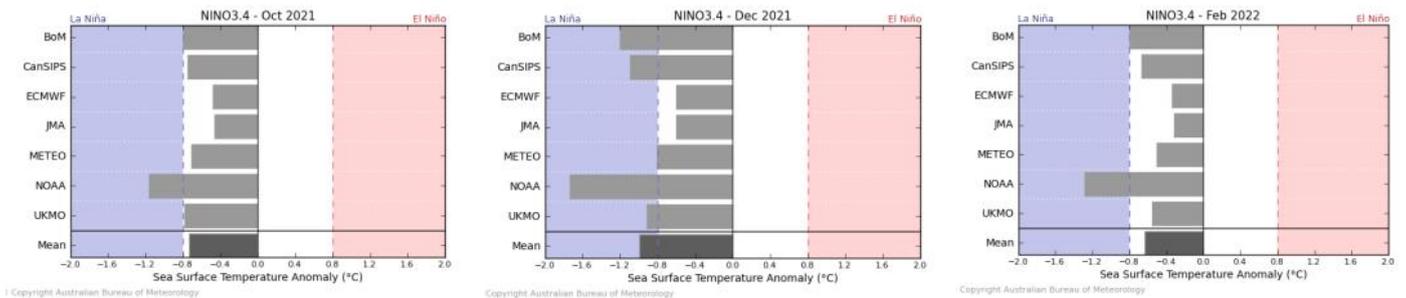
La Niña; negative Indian Ocean Dipole near its end

Click link to access [Climate Driver Update issued on 28 September 2021](#)

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



Bureau of Meteorology NINO3.4 International Model Outlooks



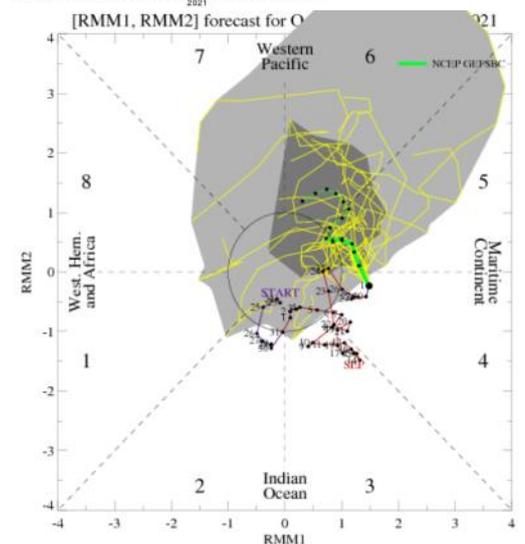
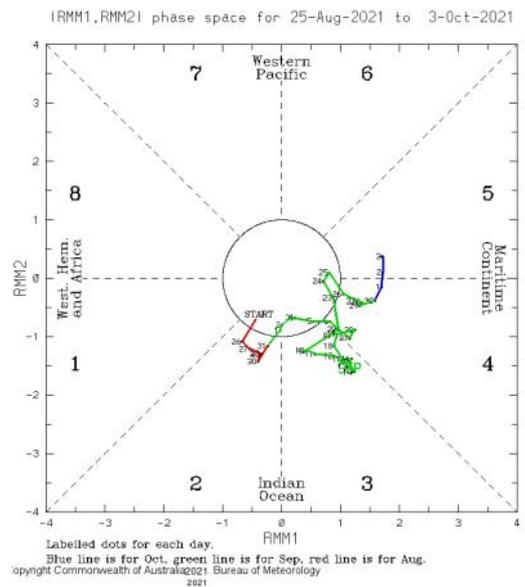
Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean>

MADDEN–JULIAN OSCILLATION

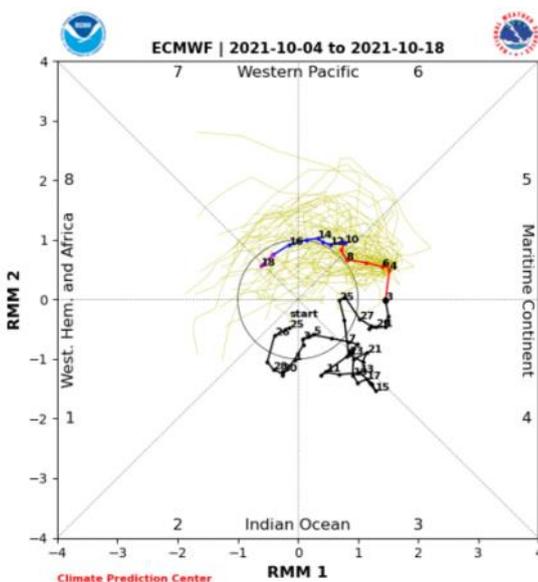
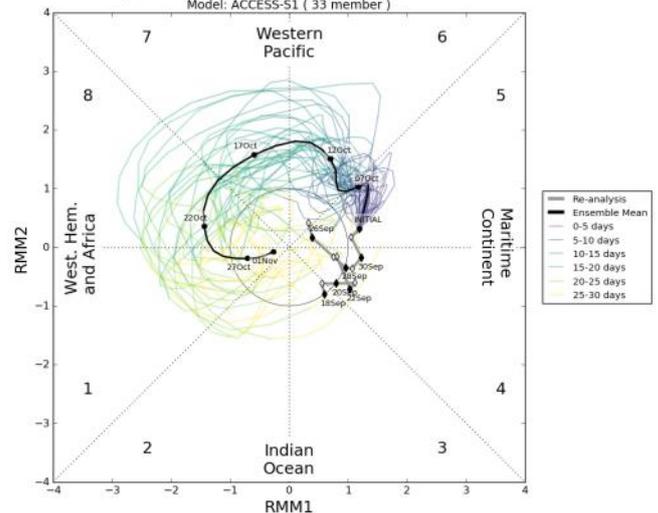
Click link to access [Tropical Climate Update](#) [Issued on Tuesday 04 October 2021]

During mid-September, a moderately strong pulse of Madden-Julian Oscillation (MJO) tracked across the Indian Ocean and weakened before strengthening towards the end of the month. The Madden-Julian Oscillation (MJO) is currently weak, located over the western Maritime Continent, north of Australia. Most models forecast movement of the MJO towards the eastern Maritime Continent in the coming fortnight, but there is some disagreement between models as to the strength of the MJO during that period. Some models suggest a moderate strengthening while others maintain a weak MJO. If the MJO strengthens over the Maritime Continent region, it would encourage enhanced rainfall over the tropics to the north of Australia and the western Pacific region.

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



MJO Index Forecast initialised: 2 October 2021
Model: ACCESS-S1 (33 member)



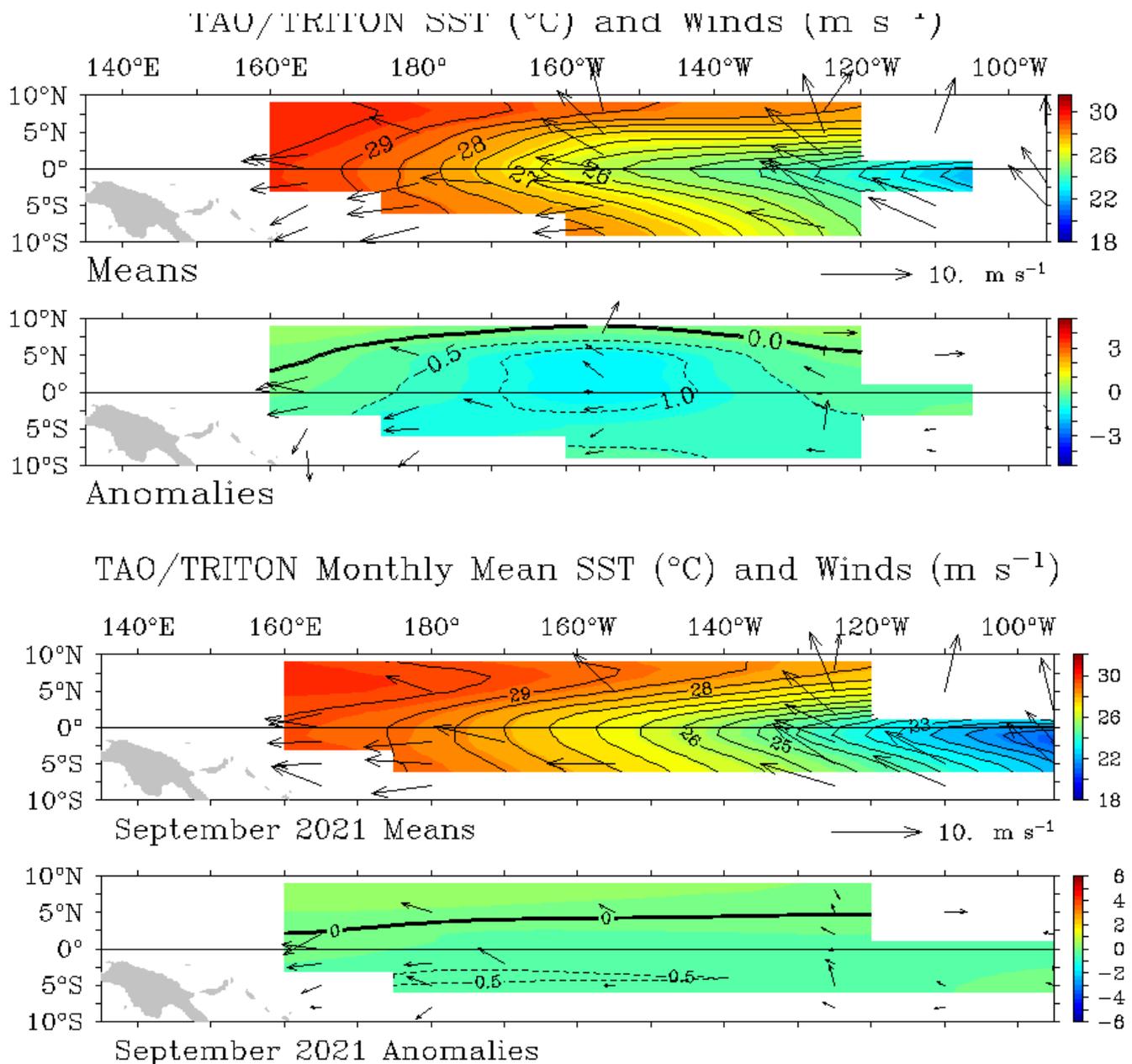


WIND

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

The trade winds in September 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

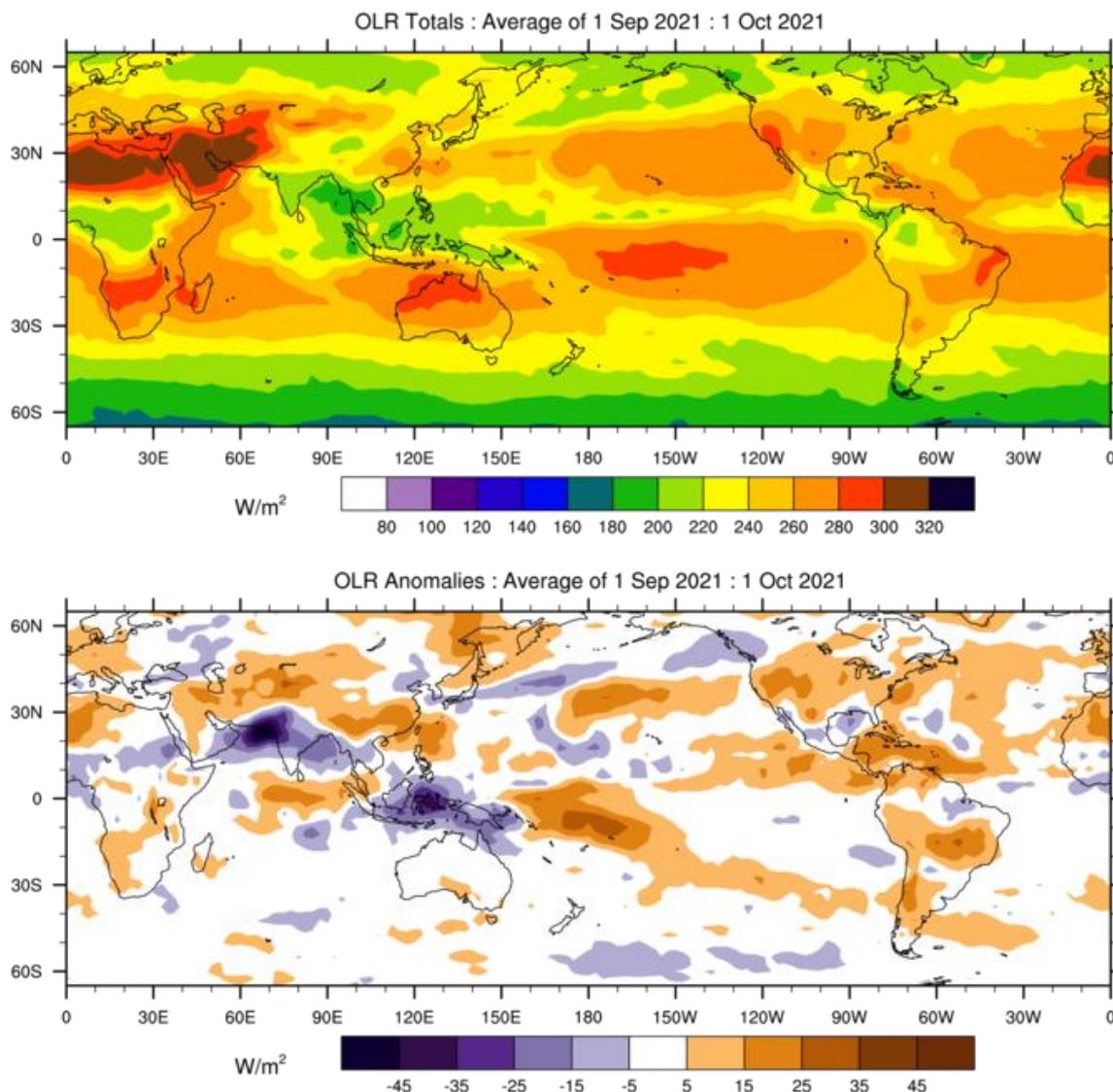
Click link to access [OLR](#)



The September 30-day OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was active around the western and central Pacific and shifted north of its normal position, while the South Pacific Convergence Zone (SPCZ) was generally suppressed, with an active area around eastern PNG to western Solomon Islands.

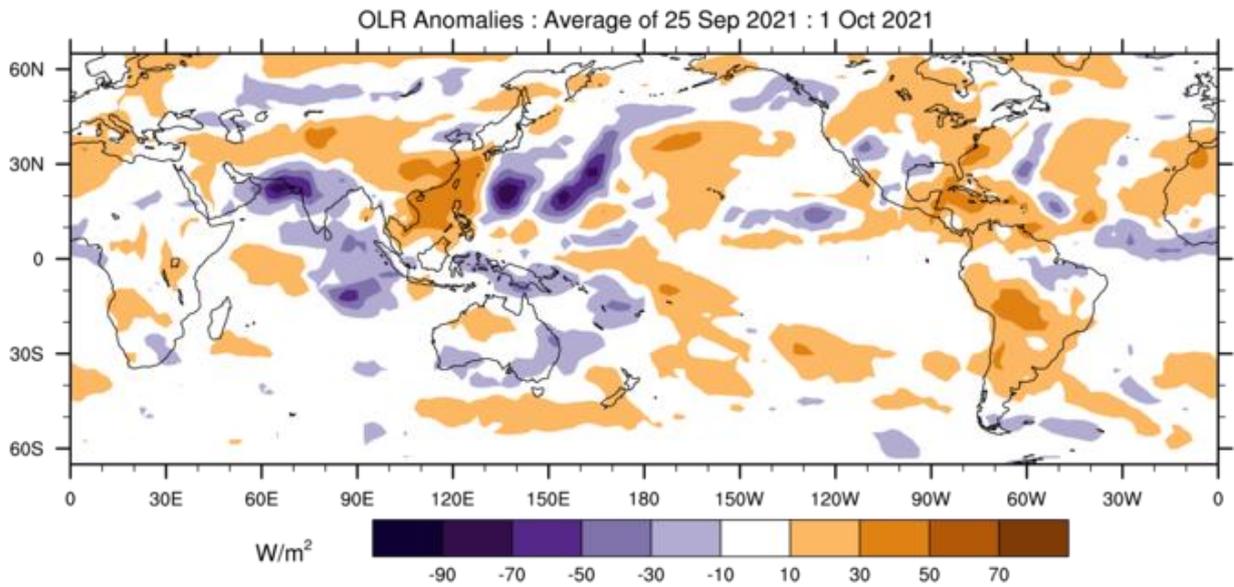
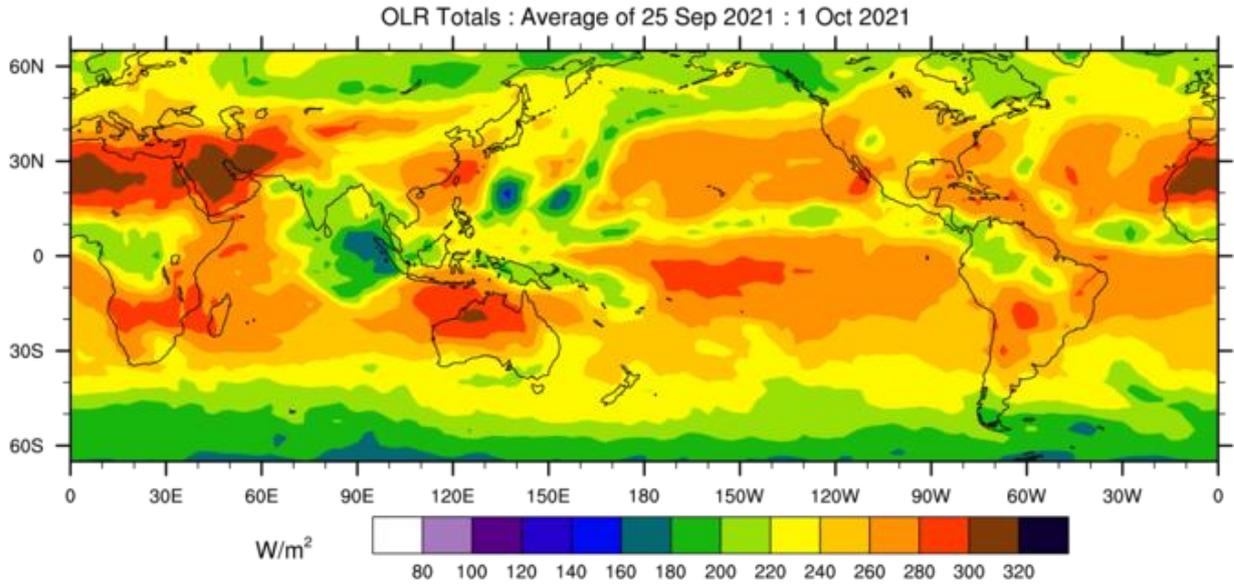
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

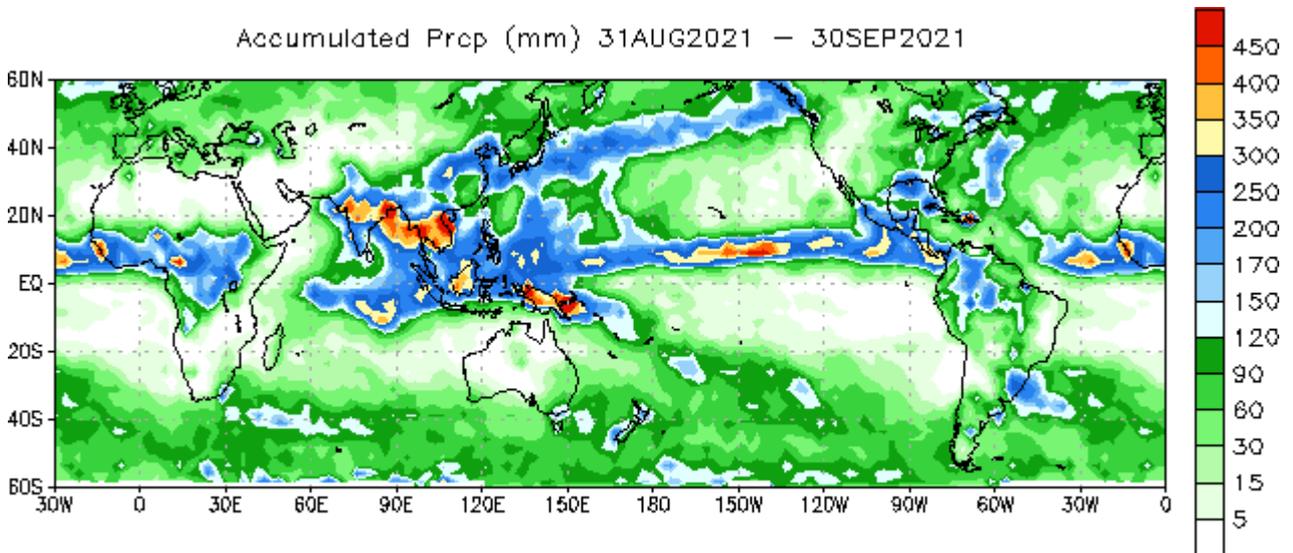


(C) Copyright Commonwealth of Australia 2021. Bureau of Meteorology

OLR Total and Anomalies, 7 Day OLR

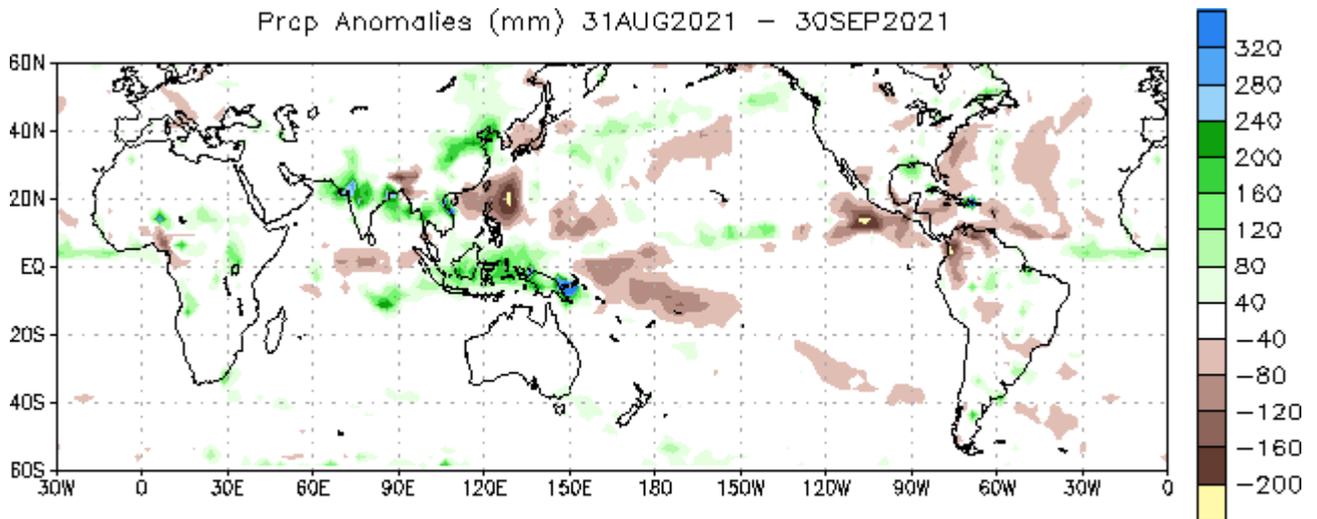


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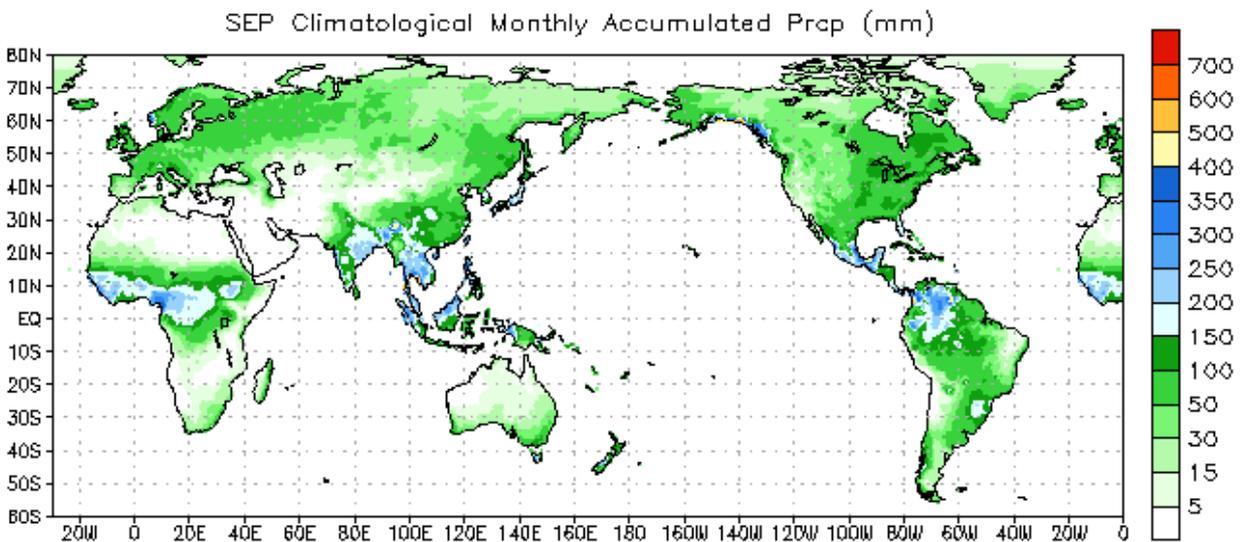


Data Source: NCEP CMAP Precipitation

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

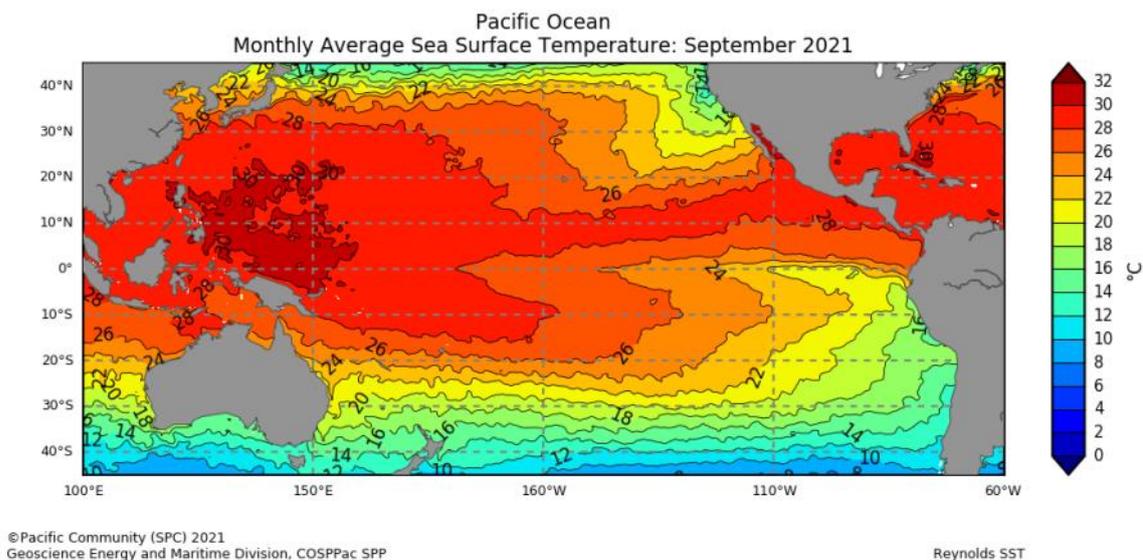


Click link to access [Pacific Community COSPPac Ocean Portal](#)

The SST map for September 2021 shows SSTs were warmer than average in the far western Pacific while cooler than average SSTs along the central and eastern equatorial Pacific towards the South America. 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, regions of above average (deciles 8-9) for September occurred across majority of the COSPPac countries from Palau to French Polynesia. 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. Regions of highest on record deciles occurred in eastern PNG, parts of Solomon Islands, Niue, southern Cook Islands and French Polynesia. In contrast, below average (deciles 2-3) SSTs were observed central and eastern Kiribati with patches of very much below average (decile 1) over the central Kiribati.

Mean Sea Surface Temperature

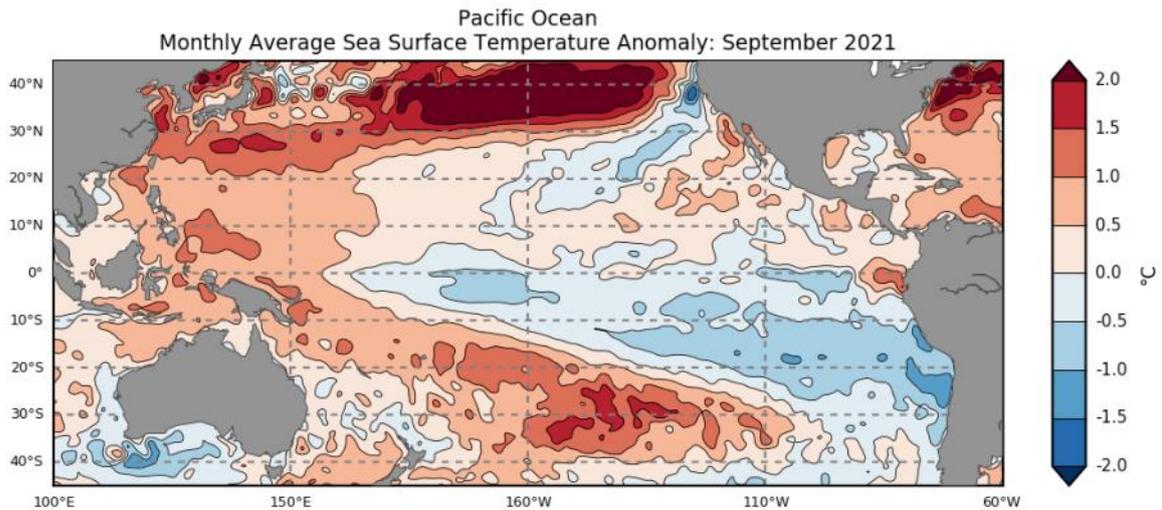


OCEAN CONDITIONS

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



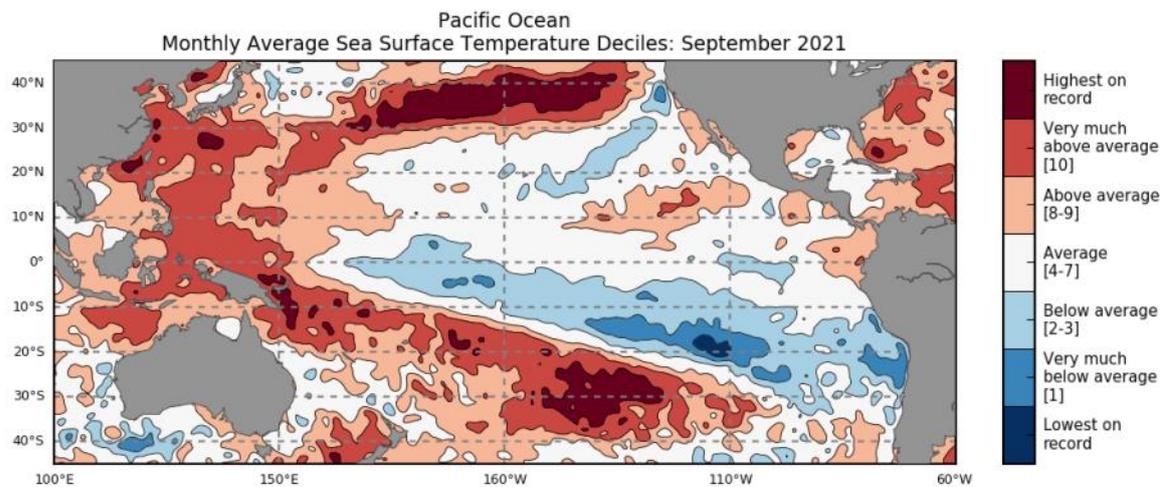
Anomalous Sea Surface Temperature



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

Reynolds SST

Sea Surface Temperatures Deciles



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Geoscience Energy and Maritime Division, COSPPac SPP

Reynolds SST

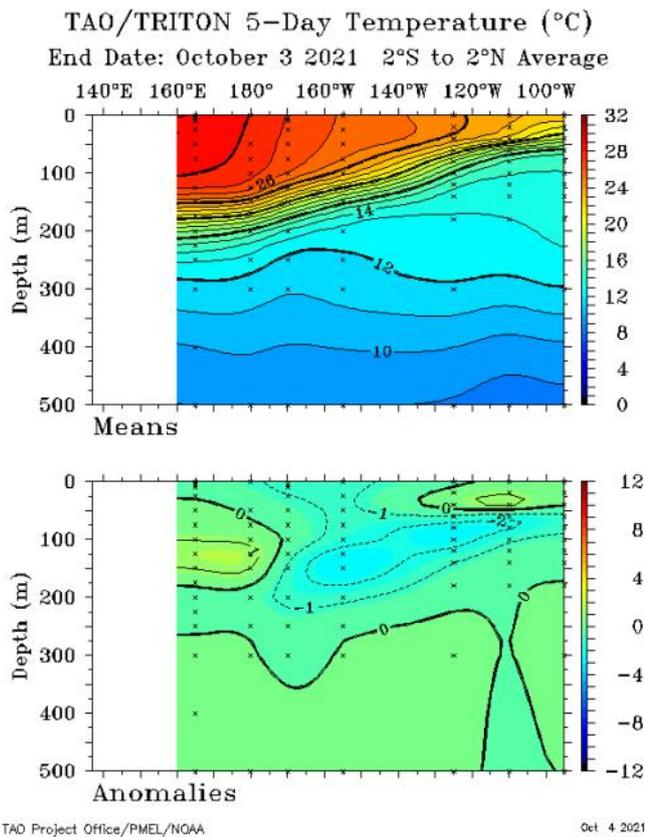
OCEAN CONDITIONS

SUB SURFACE

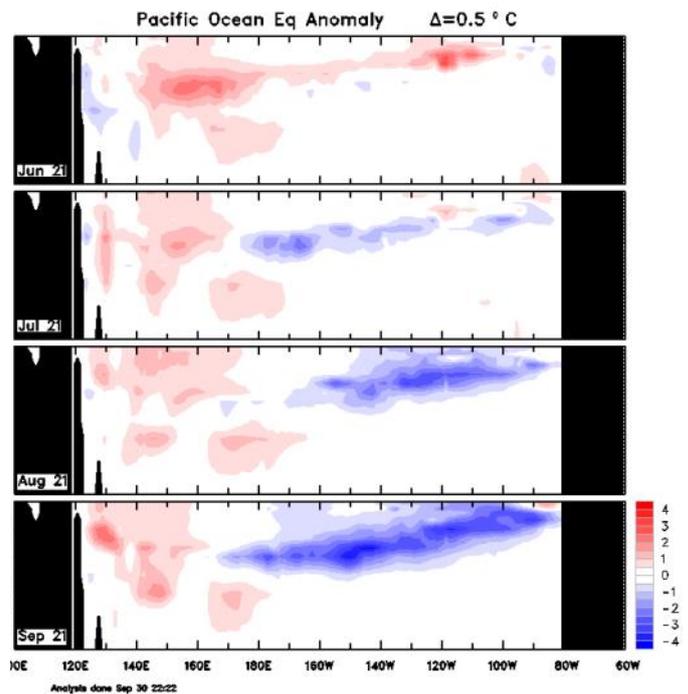


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 23 September) shows cool anomalies have developed in the sub-surface of the central to eastern equatorial Pacific over September to date. Waters were up to three degrees cooler than average across a large region, and reach up to four degrees cooler than average in the central equatorial Pacific around 150°W and 150 m depth. Weak 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

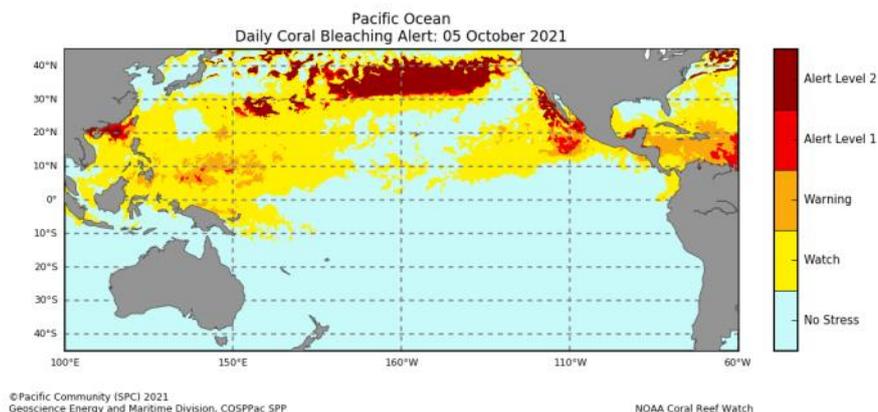
CORAL BLEACHING



The daily Coral Bleaching Alert for 05th October 2021 shows 'Warning' for parts of Palau, most of FSM, northern Marshall Islands and northern PNG. 'No Stress or Watch' for the rest of COSPPac partner countries. The four weeks Coral Bleaching Outlook to 30th October shows 'No Stress' for most of the countries with a 'Watch' and 'Warning' for northern and eastern PNG, western Solomon Islands, RMI, Rotuma, southern Tuvalu and Samoa. 'Alert level 1' for FSM, Palau and eastern PNG.

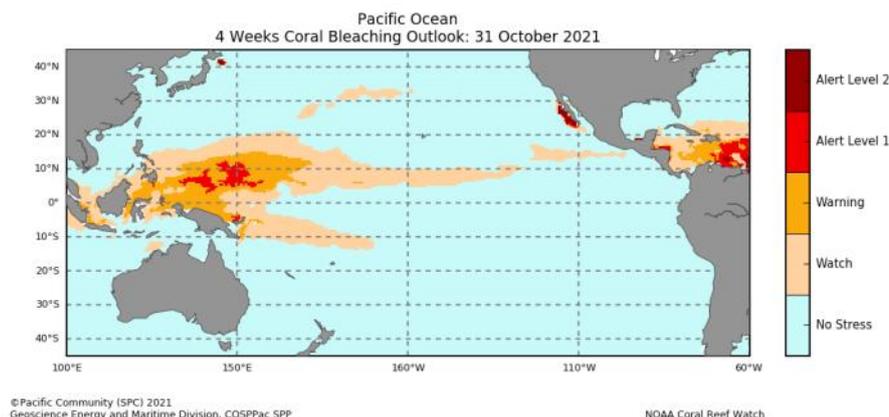
Daily Coral Bleaching Alert

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



4-Weeks Coral Bleaching Outlook

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



OCEAN CONDITIONS

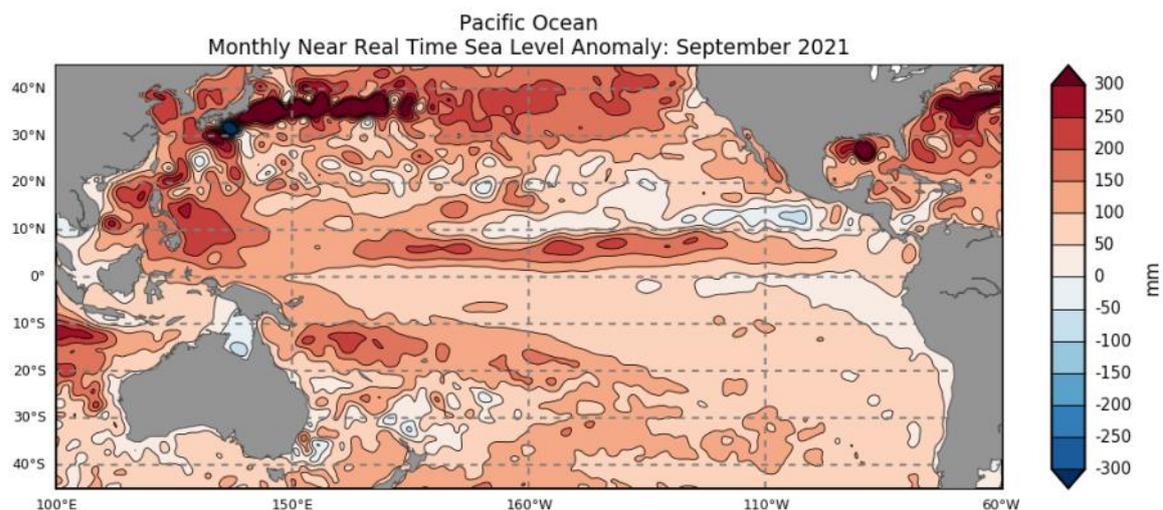
OCEAN SURFACE CURRENTS AND SEA LEVEL



Sea level was above normal for most of the COSPPac countries. The highest anomalies above +250mm were in the Palau, western FSM, southern PNG, southern Solomon Islands and Vanuatu. Patches of near normal to below normal Sea levels were observed further north and south of the COSPPac countries.

Monthly Sea Level Anomalies

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



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Geoscience Energy and Maritime Division, COSPPac SPP

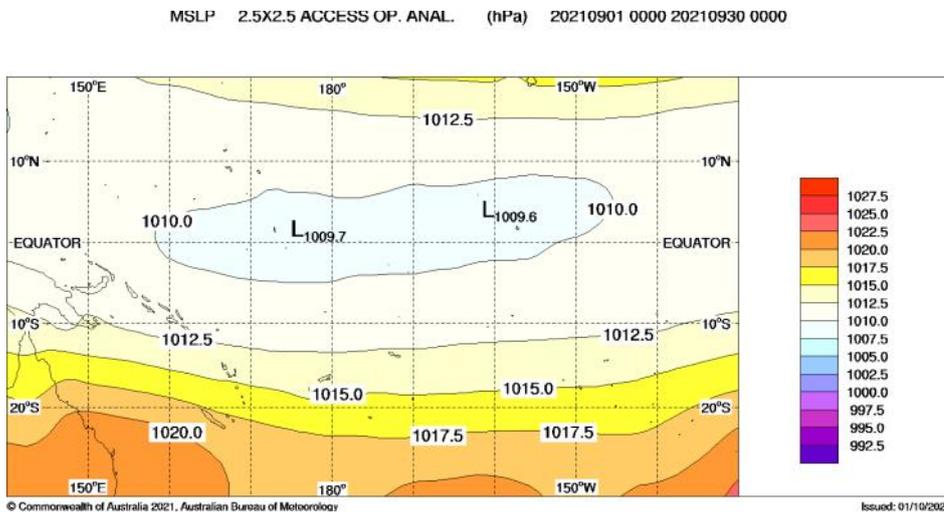
AVISO Ssalto/Duacs SLA

MEAN SEA LEVEL PRESSURE

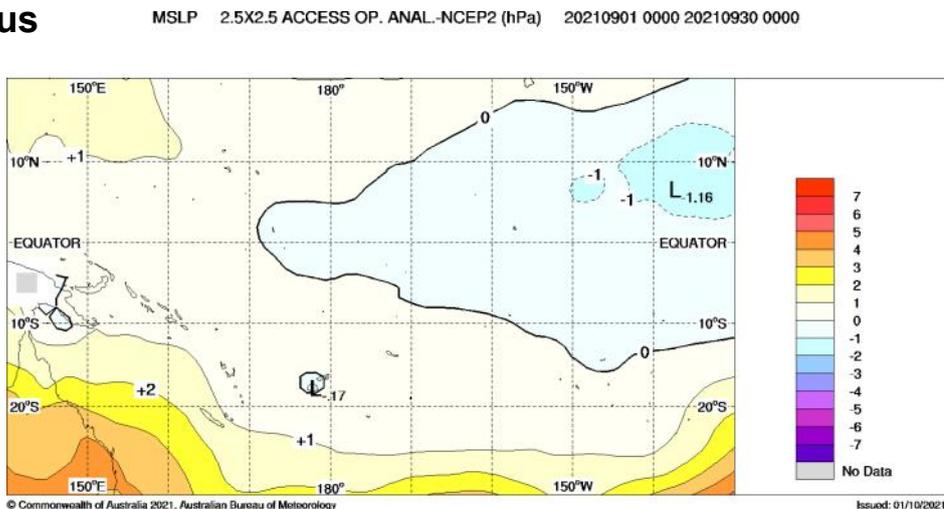
The September mean sea level pressure (MSLP) anomaly map shows positive anomalies over the Coral Sea region west of 165°W and over Australia. Negative anomalies were present over the eastern equatorial Pacific around 145°E.

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

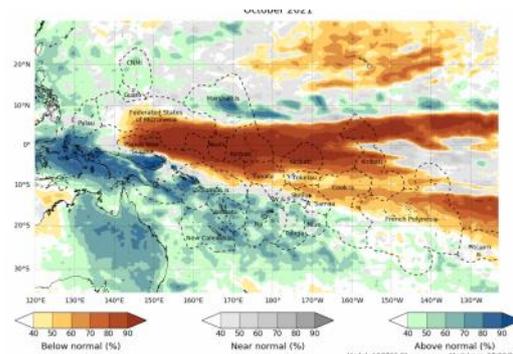
October—December 2021



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

The three-month rainfall outlook (October-December) shows a strong dry signal affecting northern PNG, Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands, northern French Polynesia and Pitcairn Island. In contrast, the models show an increased chance of wetter in Palau, most of FSM, most of 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 October to December favours below normal rainfall for the northeastern PNG Islands, 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, most of FSM, southern Marshall Islands, most of PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands.

The SCOPIC statistical model for October to December favours above normal rainfall for most of the COSPPac countries except for Kiribati, Tuvalu, Samoa and northern Cook Islands with normal rainfall.

The APEC Climate Centre multi-model for October to December favours below normal rainfall for northern Marshall Islands, northeastern 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, most of PNG, most of Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia.

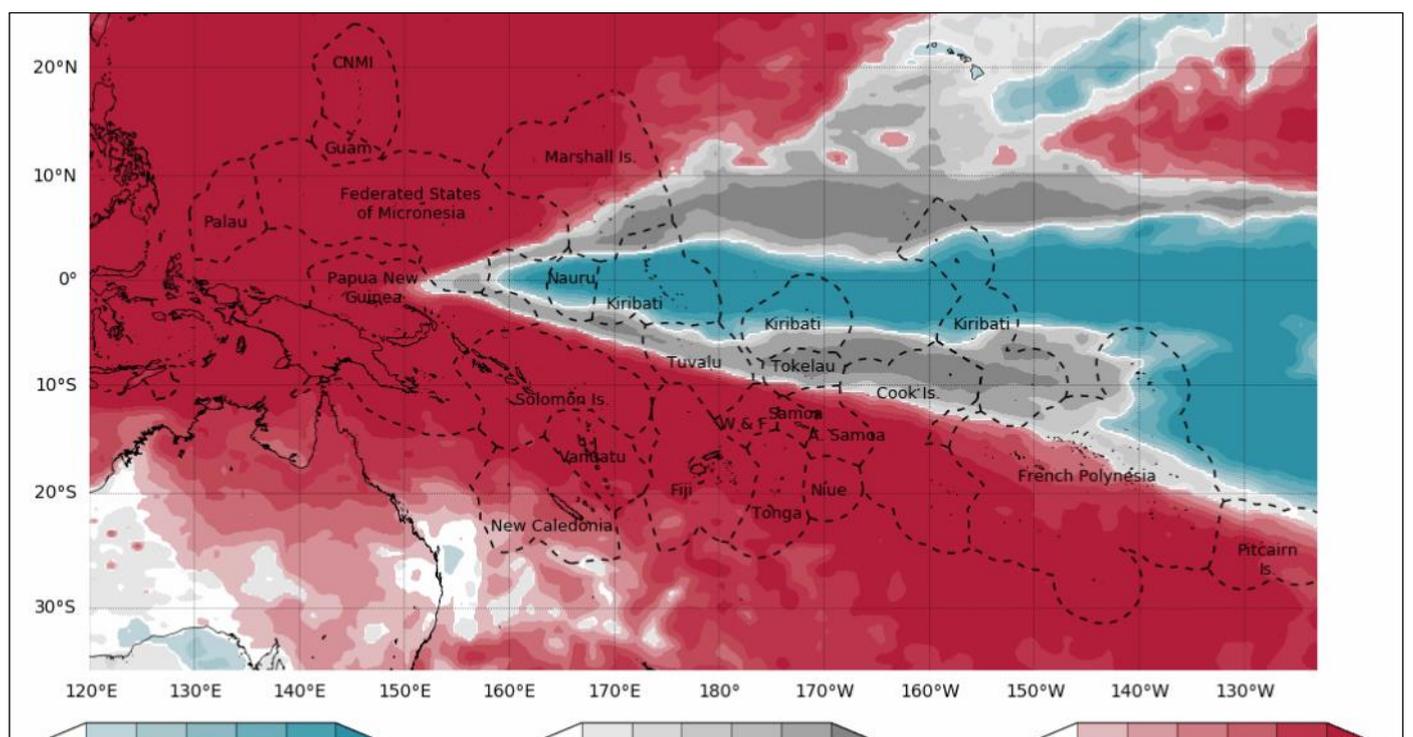
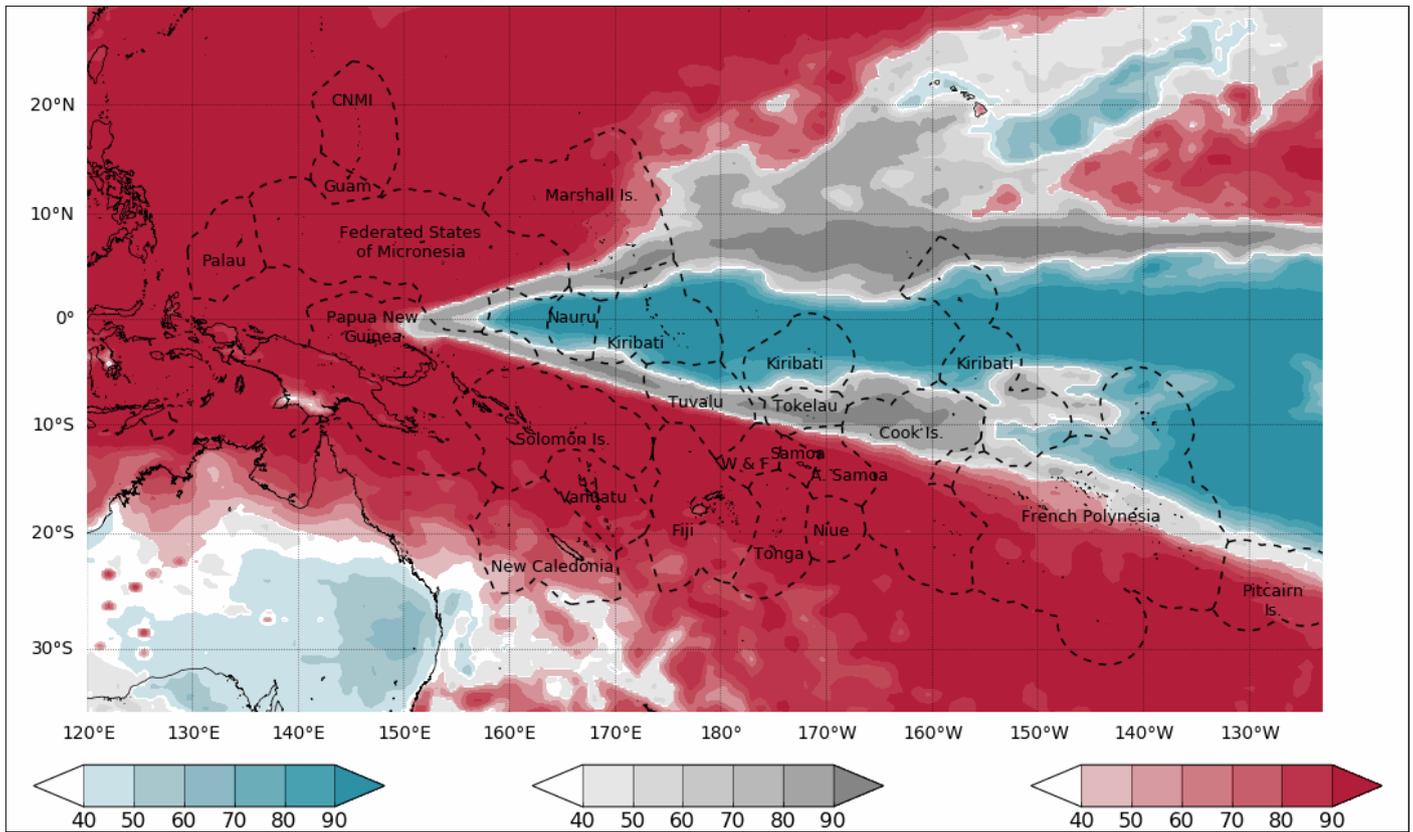
For October to December 2021, the dynamical models agree on above normal rainfall for Palau, FSM, central Marshall Islands, most of PNG and Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southern French Polynesia. The models also agree on below normal rainfall for northern PNG and Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern and central Cook Islands, and the northern half of French Polynesia.

SEASONAL TEMPERATURE OUTLOOK

October—December 2021



Monthly Tmax and Tmin **ACCESS-S** Maps



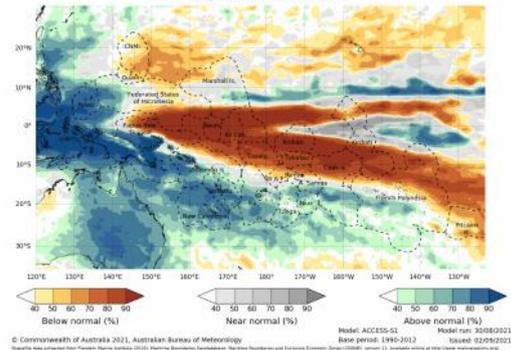
SEASONAL RAINFALL OUTLOOK

October—December 2021

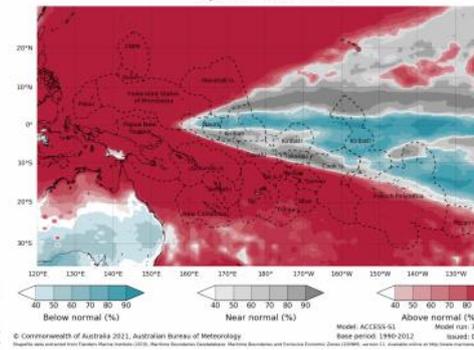


Seasonal ACCESS-S maps

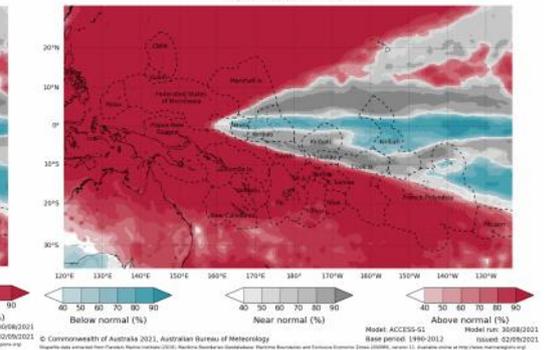
Tercile rainfall probabilities for September to November 2021



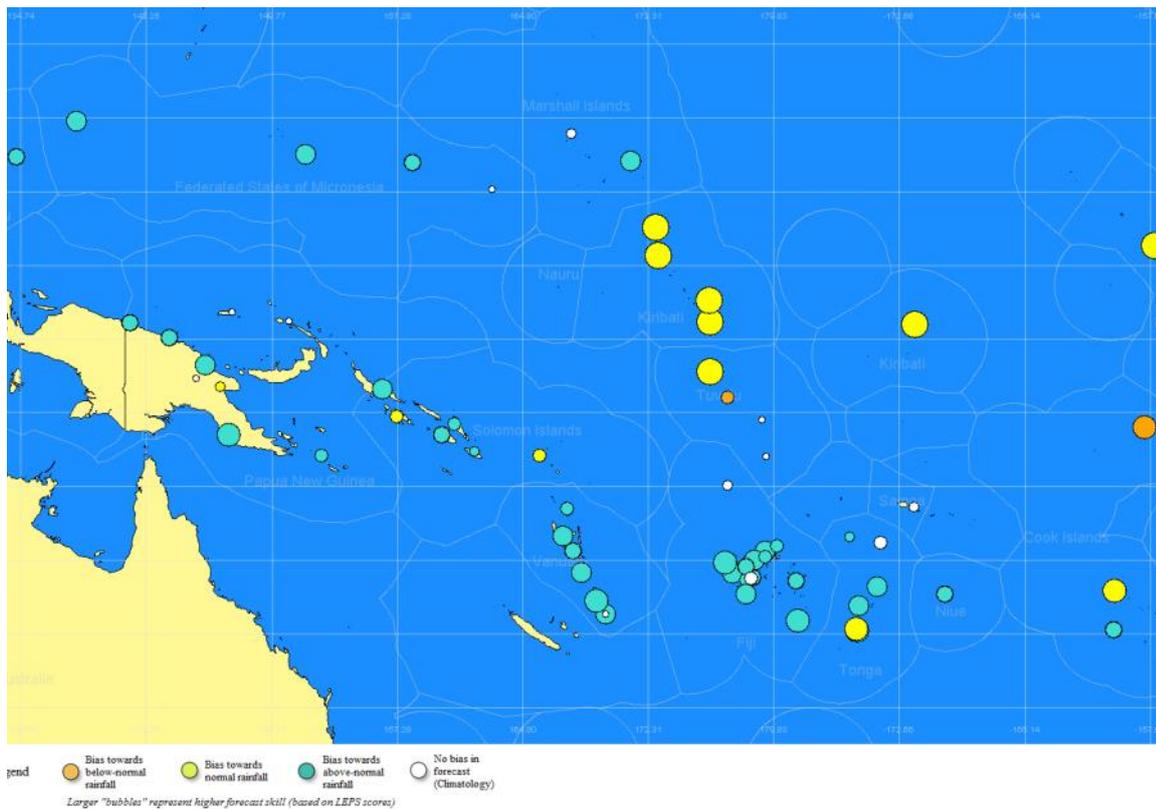
Tercile maximum temperature probabilities for September to November 2021



Tercile minimum temperature probabilities for September to November 2021



SCOPIC



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

SEASONAL RAINFALL OUTLOOK

October—December 2021



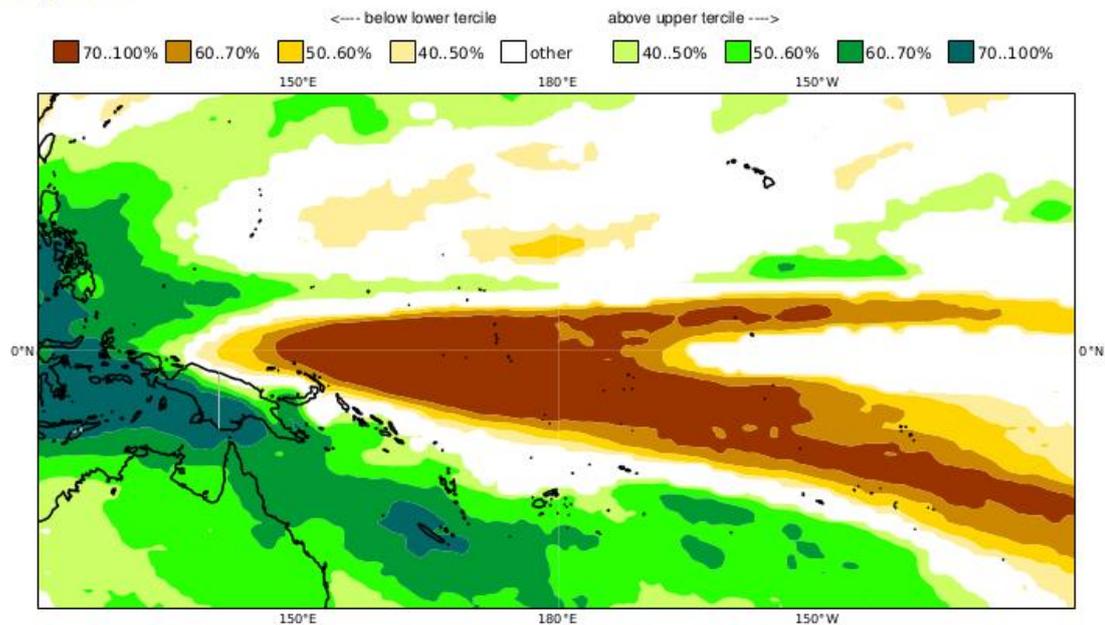
Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

OND 2021

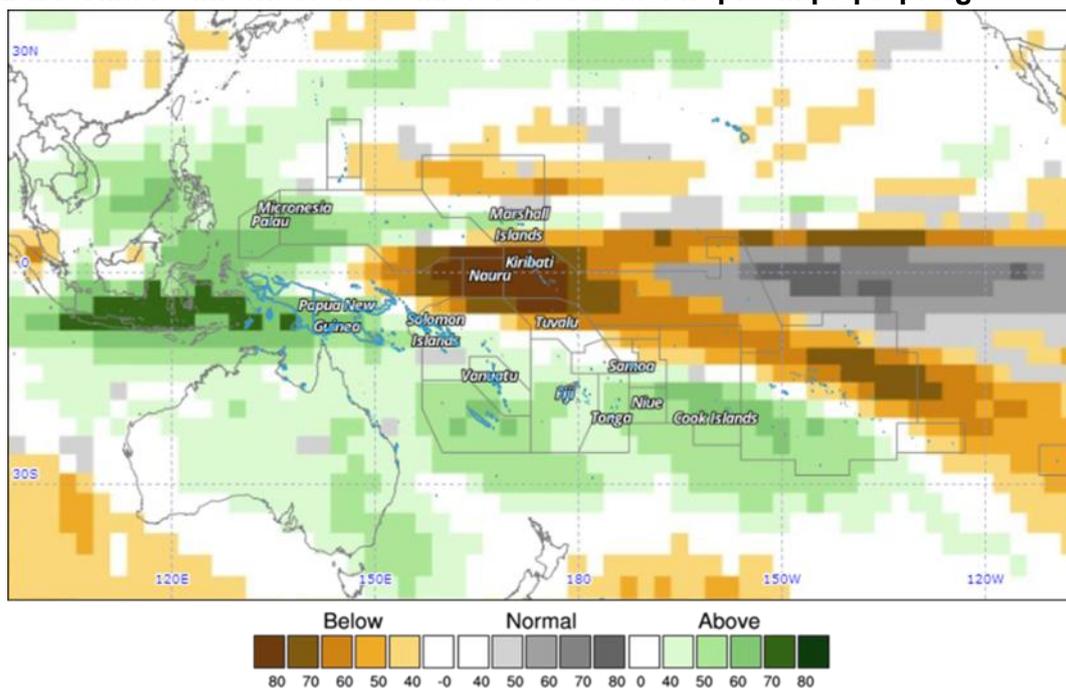
Nominal forecast start: 01/09/21

Unweighted mean



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

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



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

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

Generated using CLIK® (2021-10-6)

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TROPICAL CYCLONE

2020/2021 Season

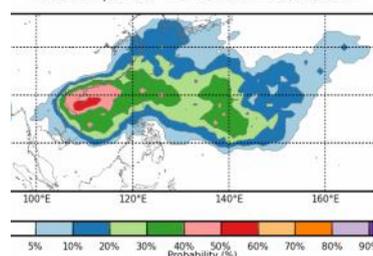


In the southwest Pacific, the tropical cyclone season 2020-21 ended on the 30th April, 2021. The outlook for the season was normal or slightly below normal Tropical Cyclone activity. Seven named TCs formed east of the longitude of the tip of Cape York, Australia. The long-term seasonal average for the southwest Pacific is nine. Three cyclones reached severe Category 3-5 status, including Yasa, one of the most intense TCs on record in the basin. TC activity in the Western North Pacific occurs year round. With ENSO-Neutral, near-normal to below normal numbers of TCs are anticipated.

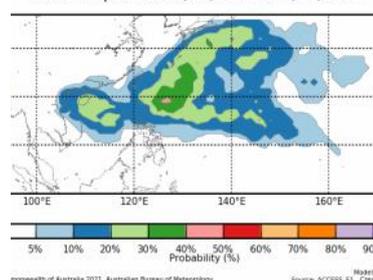
The weekly tropical cyclone forecast from the ACCESS-S model shows significant risk in the weeks beginning 12 October and ending 25 October 2021 for the northwest Pacific, especially in areas around northern Philippines and the China sea region.

ACCESS-S Weekly Forecasts –Northwest Pacific

Tropical Cyclone probabilities in the Northern Pac
Forecast period: 12/10/2021 - 18/10/2021

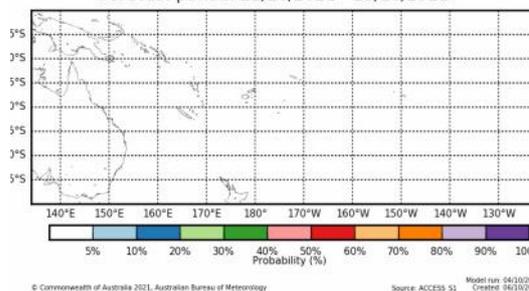


Tropical Cyclone probabilities in the Northern Pac
Forecast period: 19/10/2021 - 25/10/2021

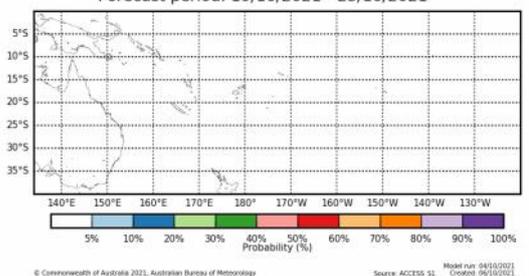


ACCESS-S Weekly Forecasts –Southwest Pacific

Tropical Cyclone probabilities in the South Pacific
Forecast period: 12/10/2021 - 18/10/2021



Tropical Cyclone probabilities in the South Pacific
Forecast period: 19/10/2021 - 25/10/2021



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.

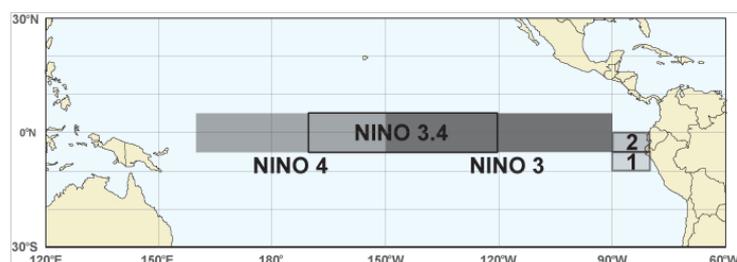
20 degrees Celsius Isotherm Depth

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