

Monthly Climate Bulletin

September 2022



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Photo Credit: Molly Powers (SPC) Samoa Tide Gauge



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- La Niña is underway in the tropical Pacific and the Bureau's ENSO Outlook remains at La Niña.
- The negative Indian Ocean Dipole (IOD) event continues.
- The Madden-Julian Oscillation (MJO) was weak or indiscernible during the month of September and is forecast to strengthen over the Maritime Continent in the coming week.
- The Intertropical Convergence Zone (ITCZ) was active in the western and shifted north of its average September position, while the South Pacific Convergence Zone (SPCZ) was also active and shifted southwest over New Caledonia, southern Vanuatu, southern Fiji, southern Tonga and New Zealand.
- The SSTs for September 2022 were slightly cooler than average along the equator between 155°E and to the south American coast, with SSTs generally cooler than average along the rest of the equator across the Pacific.
- Coral bleaching status for 2 October 2022 shows 'Alert Level 2' over Bismarck Sea and 'Alert Level 1' over parts of Palau and PNG island. Patches of 'Warning' for Palau, western FSM, northern RMI and northern PNG while 'No Stress or Watch' for the rest of COSPPac partner countries.
- For October-December 2022, the models agree on above normal rainfall being favoured for much of Palau, Guam, CNMI, central RMI, most of PNG mainland, southern Solomon Islands, New Caledonia, Vanuatu, Fiji (excluding Rotuma), Tonga, Niue, southern Cook Islands, and southern French Polynesia. The models also agree that below normal rainfall is likely or very likely for northern PNG, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands, northern French Polynesia and Pitcairn Island.
- The ACCESS-S weekly tropical cyclone forecast model shows significant increased risk between 11 and 17 October for the northwest Pacific including the Philippines, the South China Sea region and south of Japan. There is also increased risk for the 19 to 25 October period.



EL NIÑO–SOUTHERN OSCILLATION

La Niña continues in the tropical Pacific

Click link to access [Climate Driver Update issued on 27 September 2022](#)

La Niña is underway in the tropical Pacific and the Bureau's ENSO Outlook remains at La Niña. La Niña increases the chance of above average rainfall for northern and eastern Australia, and Pacific countries in the west during spring and summer.

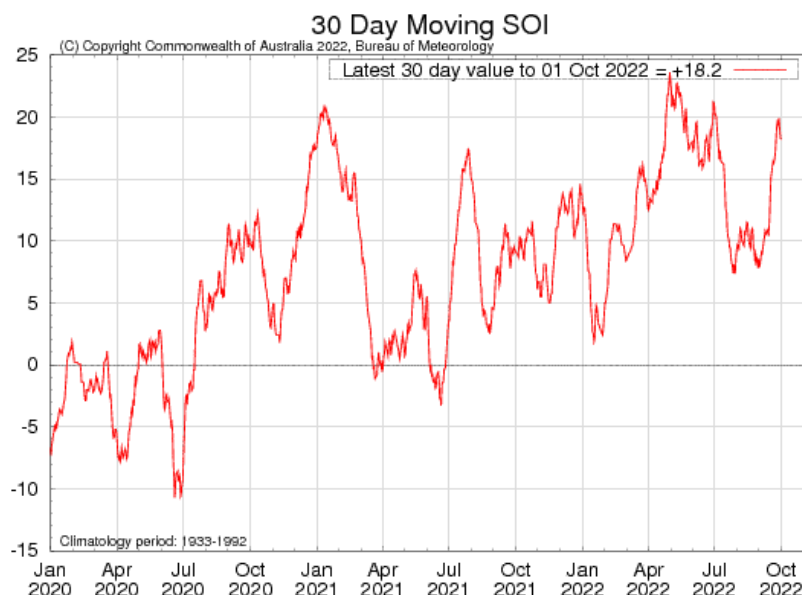
Both atmospheric and oceanic indicators of the El Niño-Southern Oscillation (ENSO) are consistent with an established La Niña, including tropical Pacific sea surface temperatures, the Southern Oscillation Index (SOI), trade wind strength, and equatorial cloudiness.

Models indicate the La Niña may peak during spring and return to neutral conditions early in 2023. Sea surface temperatures in the tropical Pacific have weakened a little compared to two weeks ago while the SOI has continued to rise and is currently well above La Niña thresholds.

The negative Indian Ocean Dipole (IOD) event continues. The IOD index has satisfied negative IOD thresholds (i.e. at or below -0.4 °C) since June. Models indicate that the negative IOD is likely to persist at least until late spring.

The Southern Annular Mode (SAM) is currently positive and is likely to remain generally positive throughout spring into early summer. During the spring months, positive SAM increases the chance of above average rainfall for parts of eastern New South Wales, eastern Victoria, and south-eastern Queensland, but has a drying influence for western Tasmania.

The 30-day Southern Oscillation Index (SOI) for the 30 days ending 25 September was +19.2. The 90-day SOI value was +11.5. Both the 30-day and 90-day SOI have risen slightly over the past fortnight.



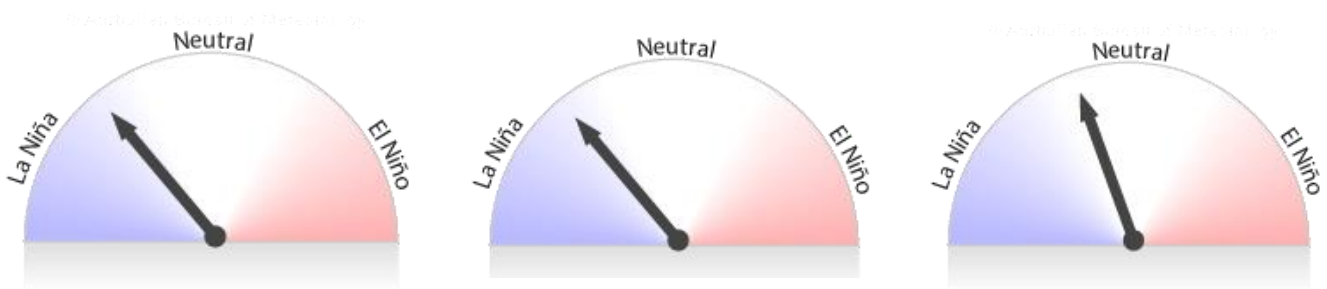


EL NIÑO–SOUTHERN OSCILLATION

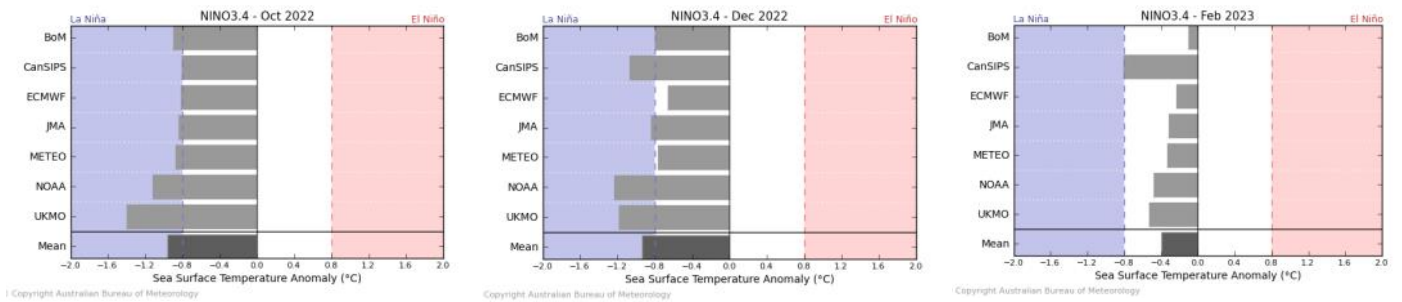
La Niña continues in the tropical Pacific

Click link to access [Climate Driver Update issued on 27 September 2022](#)

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



Bureau of Meteorology NINO3.4 International Model Outlooks



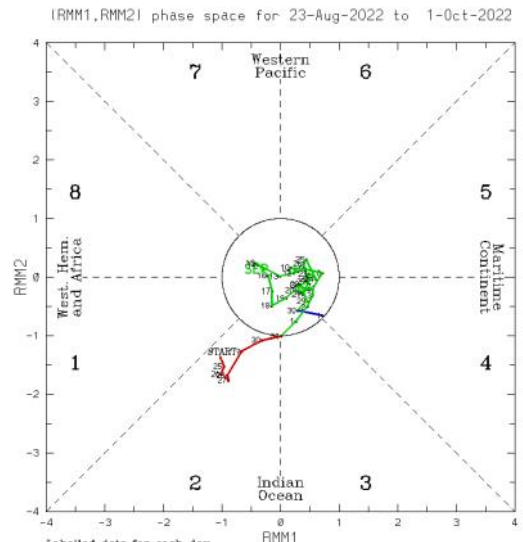
Bureau of Meteorology summary of international model outlooks for NINO3.4: <http://www.bom.gov.au/climate/model-summary/#tabs=Pacific-Ocean>

MADDEN–JULIAN OSCILLATION

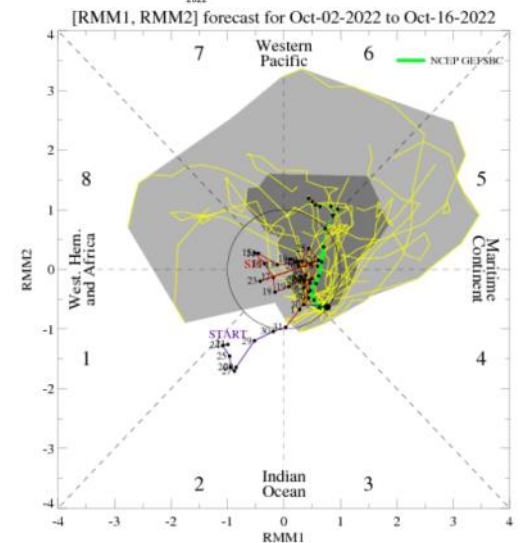
Click link to access [Tropical Climate Update](#) [Issued on Tuesday 04 October 2022]

The Madden-Julian Oscillation (MJO) was weak or indiscernible during the month of September. The Madden-Julian Oscillation (MJO) is forecast to strengthen over the Maritime Continent, to Australia's north, in the coming week.

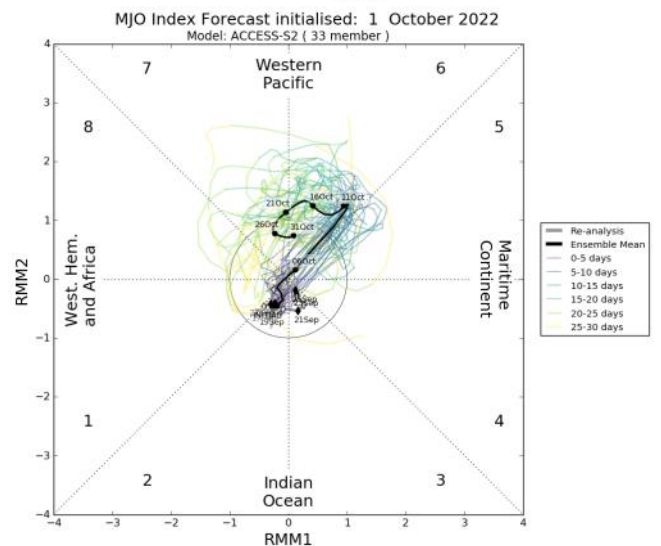
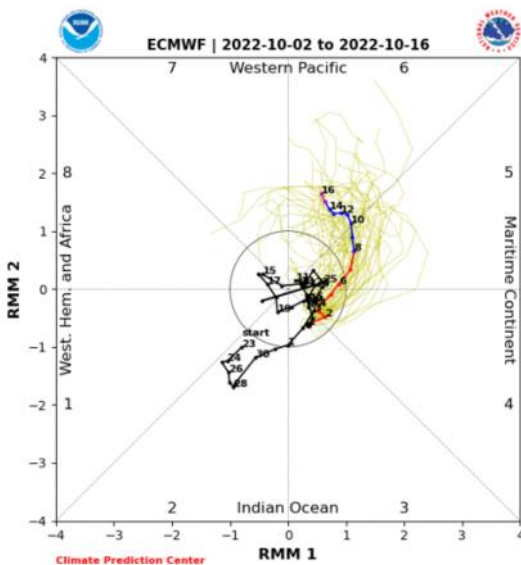
This is an abbreviated version of the Tropical Climate Update. Click on the *Weekly Tropical Update* for more information .

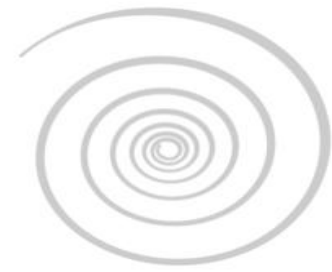


Labelled dots for each day.
Blue line is for Oct, green line is for Sep, red line is for Aug.
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MJO Index Forecast initialised: 1 October 2022
Model: ACCESS-S2 (33 member)



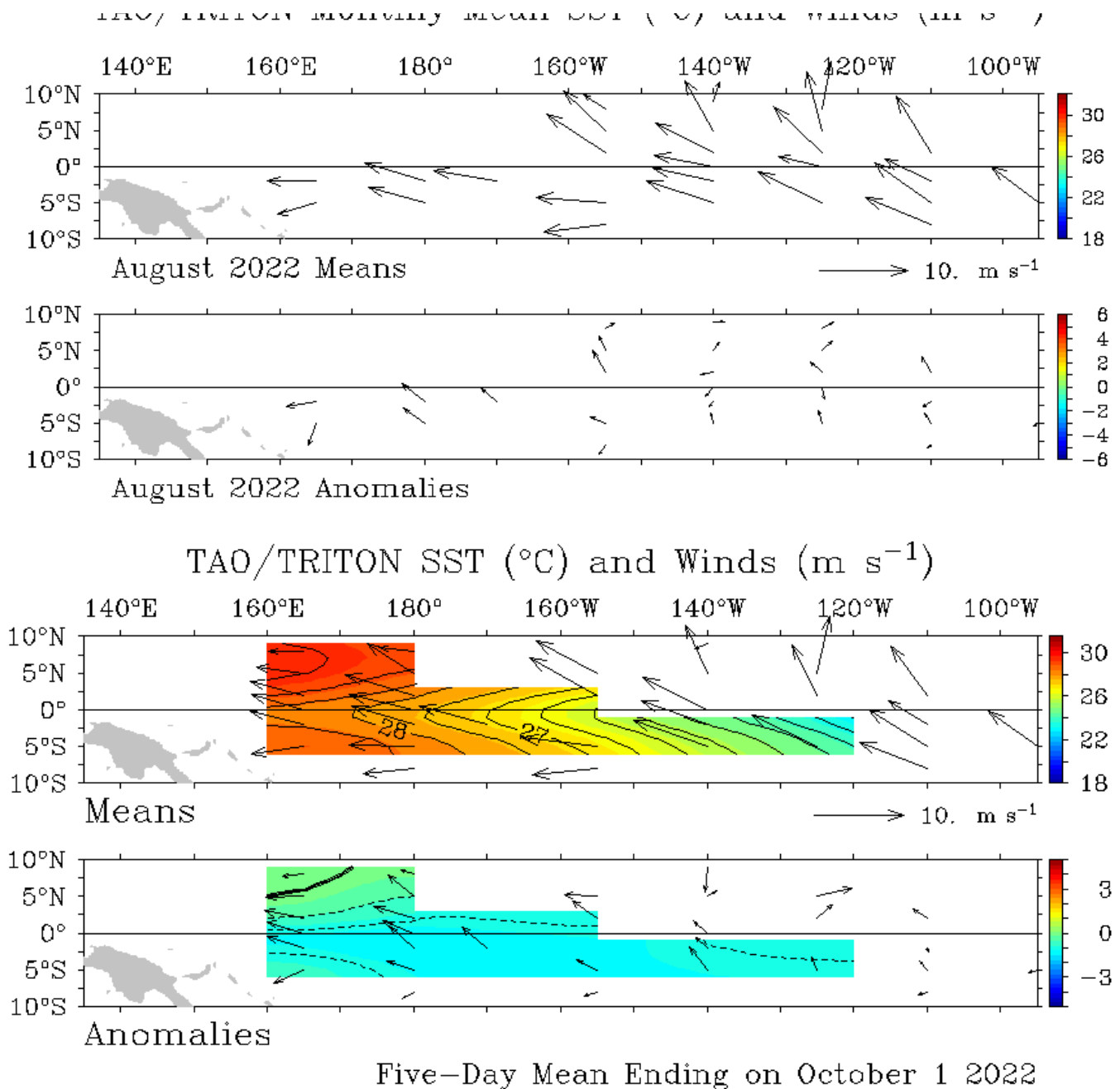


WIND

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

The trade winds were stronger than normal in the western and central equatorial Pacific over the five days ending 1 October.

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

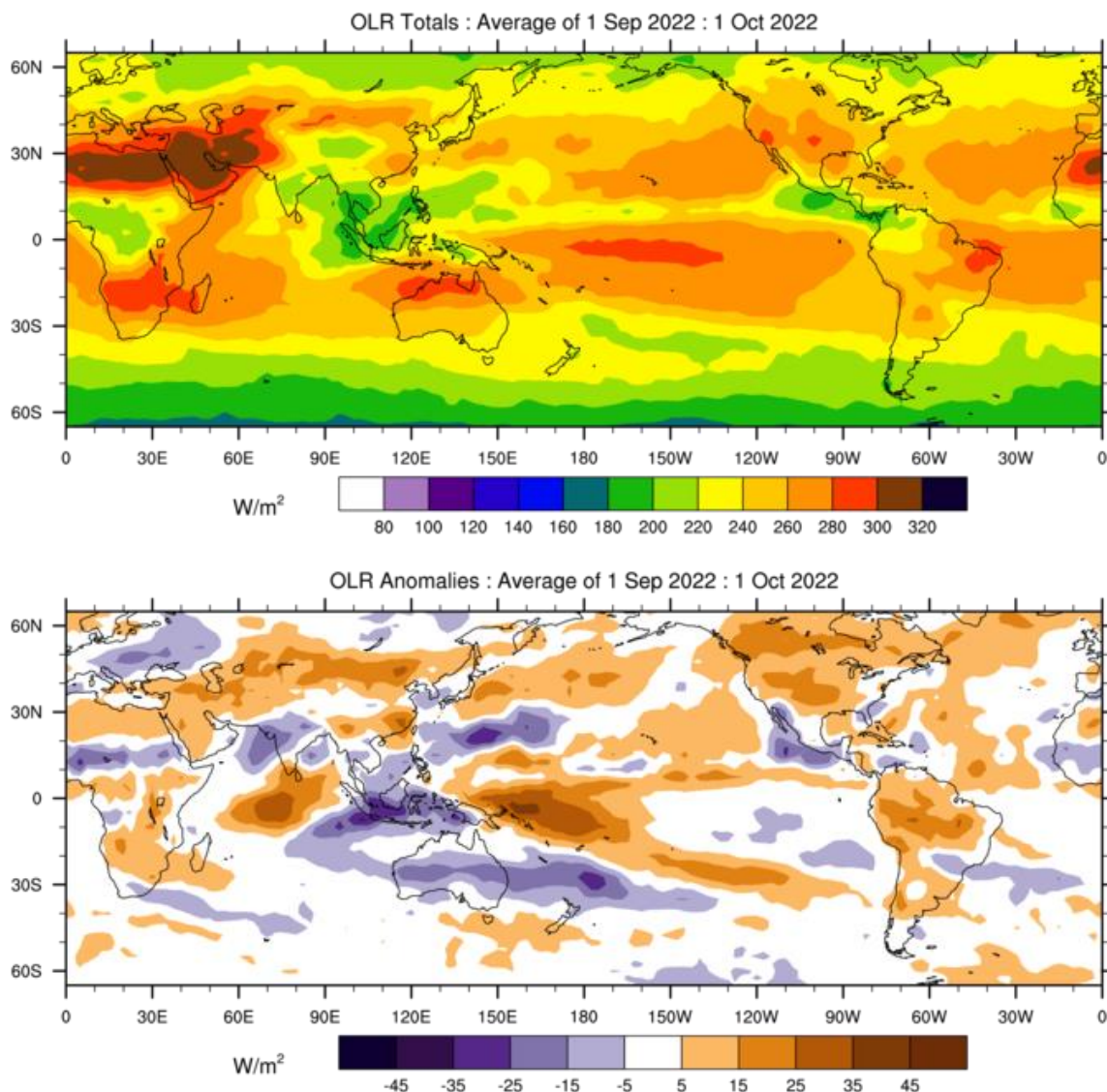
Click link to access [OLR](#)



The September 30-day OLR total and anomaly maps suggest the Intertropical Convergence Zone (ITCZ) was displaced north of its average September position and more active than normal east of the Date Line. The South Pacific Convergence Zone (SPCZ) was displaced south-west with a portion over New Caledonia, southern Vanuatu, southern Fiji, and southern Tonga.

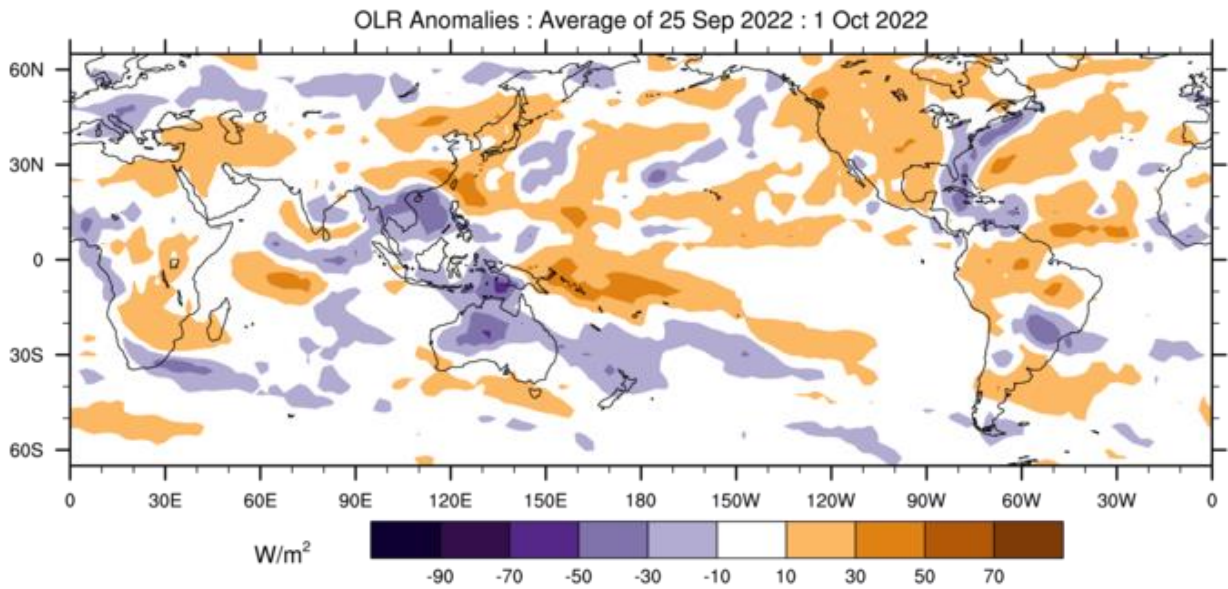
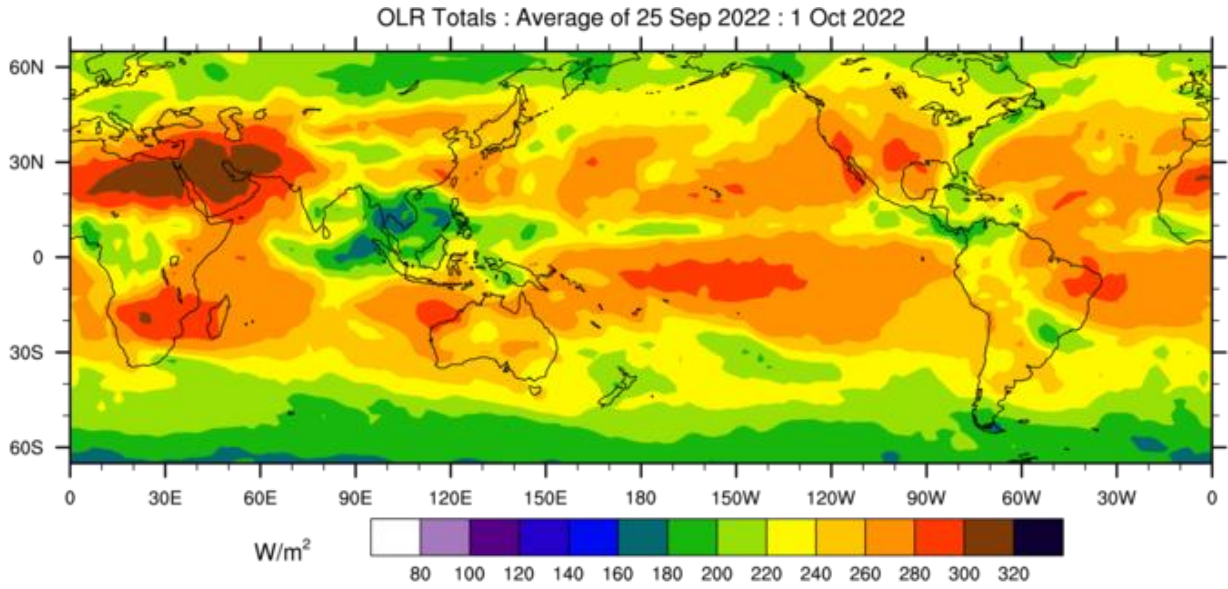
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

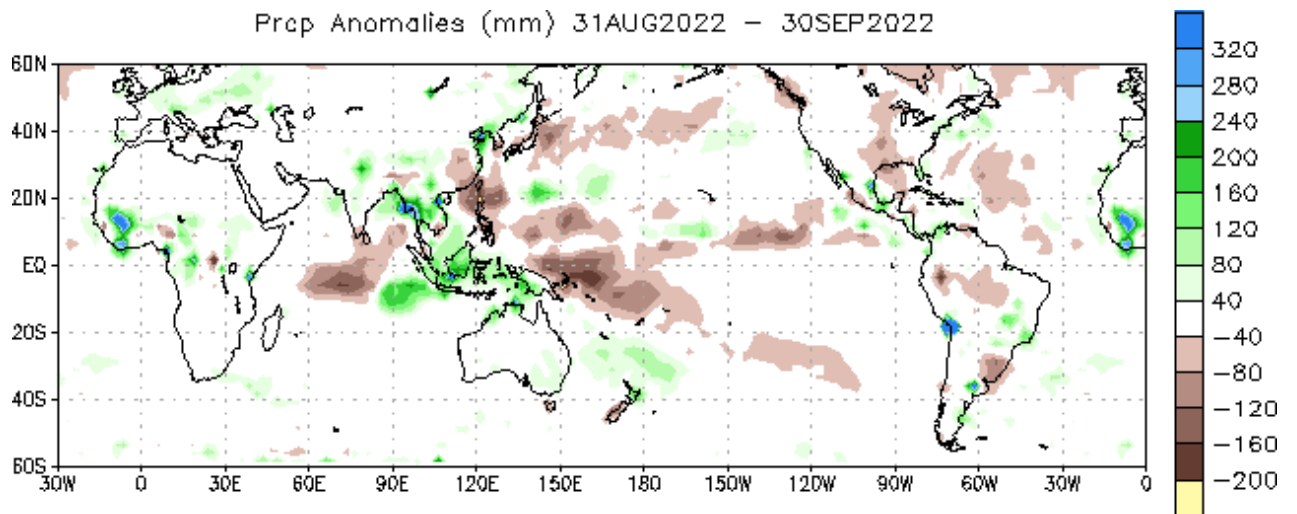


(C) Copyright Commonwealth of Australia 2022. Bureau of Meteorology

OLR Total and Anomalies, 7 Day OLR

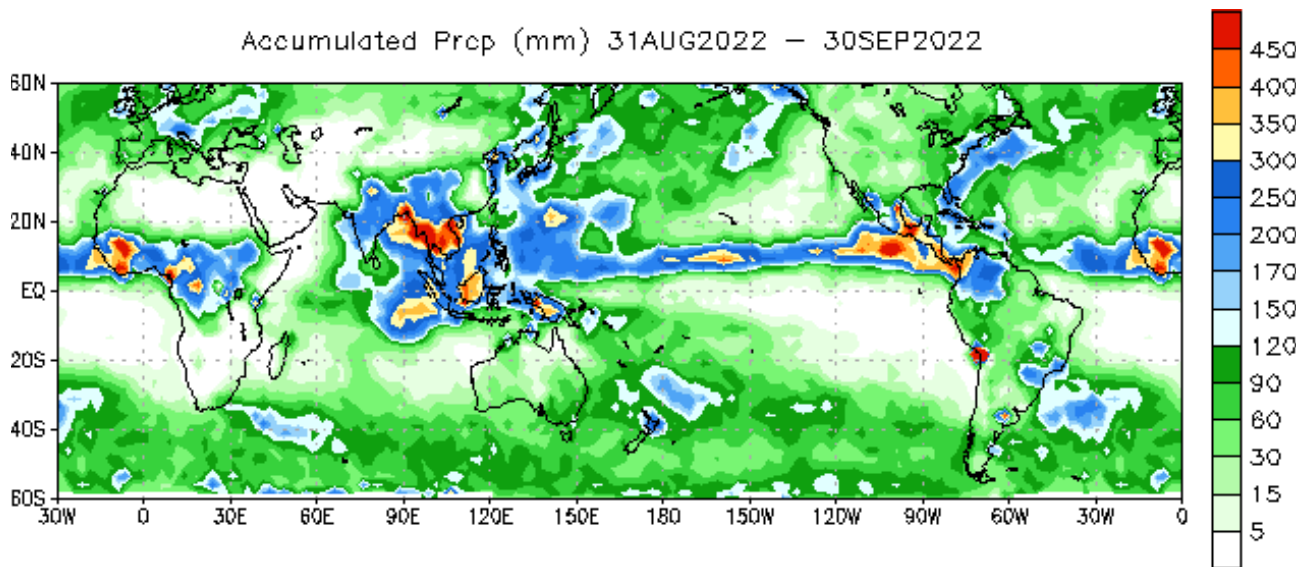


(C) Copyright Commonwealth of Australia 2022. Bureau of Meteorology

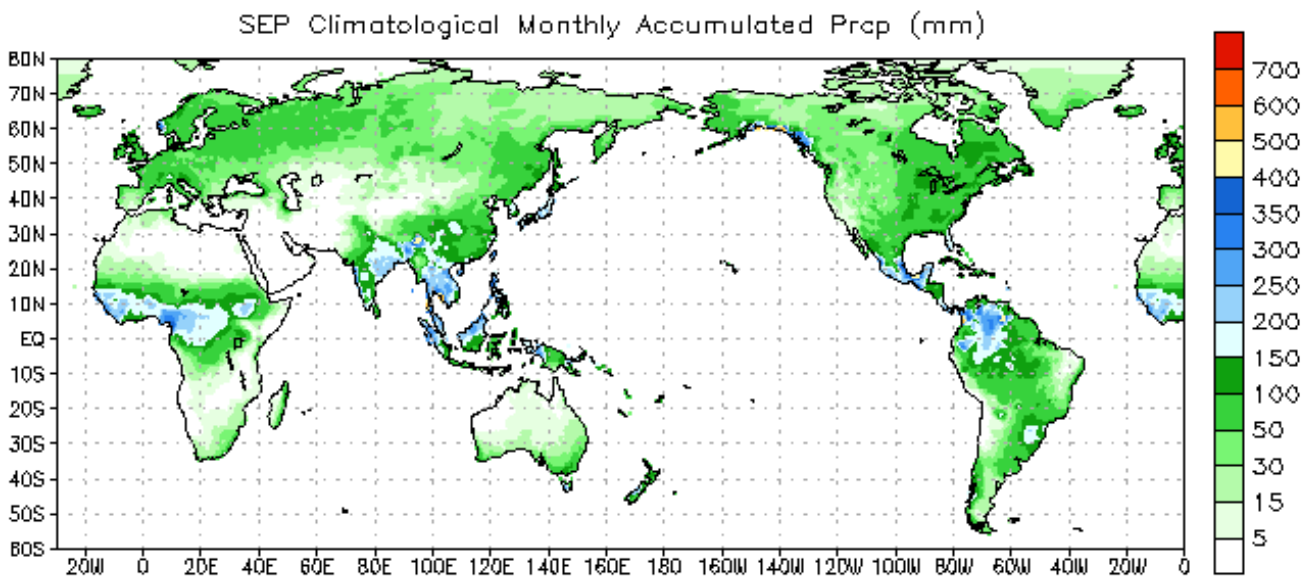


Data Source: NCEP CMAP Precipitation Climatology (1991-2020)

30-Day Rainfall Accumulated



Data Source: NCEP CMAP Precipitation



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

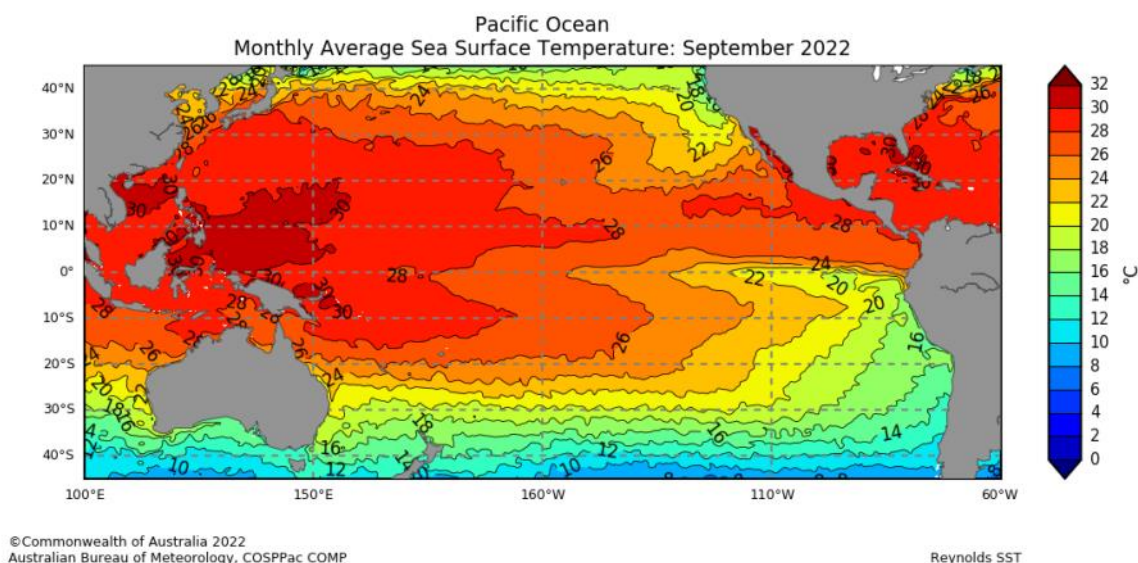


Click link to access [Pacific Community COSPPac Ocean Portal](#)

The SSTs for September 2022 were slightly cooler than average along the equator between 155°E and to the south American coast. SSTs were also slightly cooler than average over much of the tropical central and eastern Pacific south of the equator. Warm SST anomalies were present over much of the Maritime Continent and across most COSPPac countries, with the exception for Nauru, RMI, Tuvalu, northern Cook Islands and French Polynesia experiencing cooler SST anomalies. Compared to August, cool anomalies have strengthened over the eastern equatorial Pacific and extended further west.

The highest on record deciles for September, occurred in northern Palau, most of Papua New Guinea, Solomon Islands, northern New Caledonia, majority of Vanuatu, southern Fiji, parts of Tonga and Niue. Regions of very much above average (deciles 10) SSTs spanned across parts of Palau, western FSM, northern PNG, northern Solomon Islands, eastern Vanuatu, northern Fiji, most of Tonga, patches in Niue, southern Cook Islands, French Polynesia and Pitcairn Island. Regions of above average (deciles 8-9) SST for September occurred across majority of the COSPPac countries from eastern FSM to Pitcairn Island. In contrast, average (4-7) SSTs were observed in eastern FSM, most of RMI, far northern PNG, southern Tuvalu, Samoa, northern Niue, central Cook Islands and central French Polynesia. Below average (deciles 2-3) to very much below average (decile 1) occurred over far southeastern FSM, southern RMI, Nauru, Kiribati, northern Tuvalu, Tokelau, northern Cook Islands and central and northern French Polynesia. The lowest on record SSTs were observed over Phoenix Islands and central Line Islands of Kiribati and central French Polynesia.

Mean Sea Surface Temperature

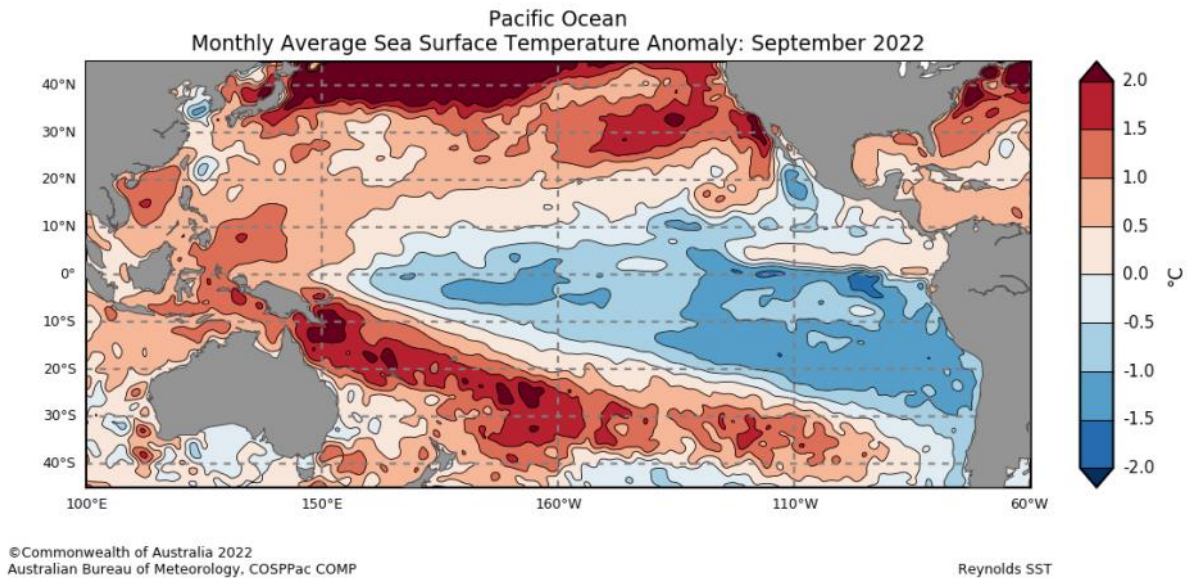


OCEAN CONDITIONS

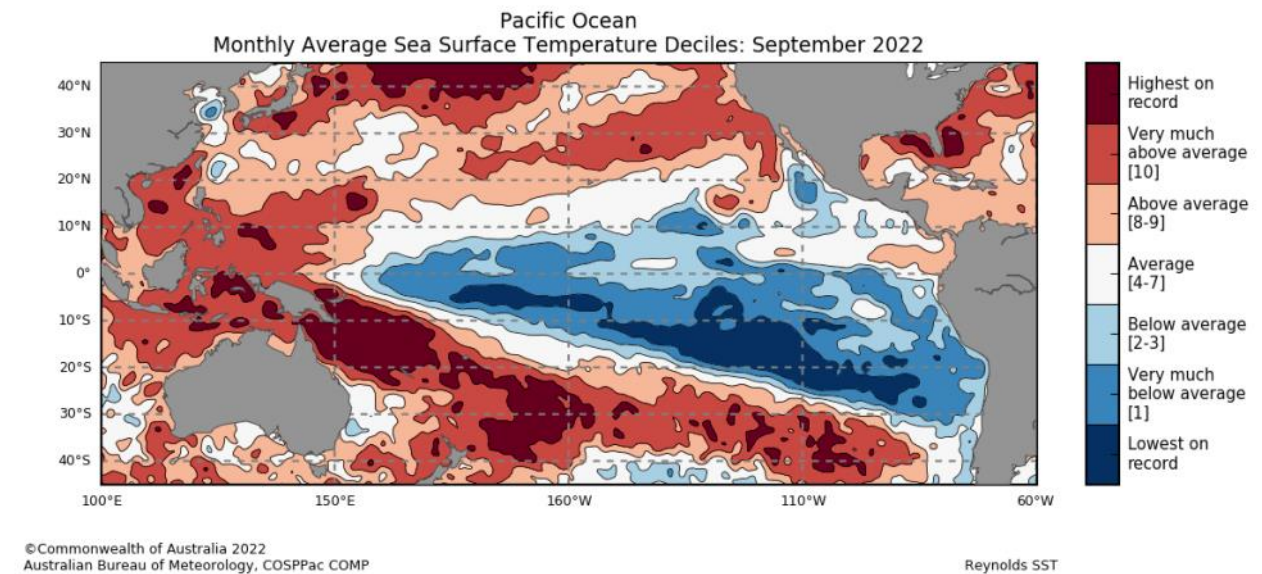
Click link to access [SEA SURFACE TEMPERATURE](#)



Anomalous Sea Surface Temperature



Sea Surface Temperatures Deciles



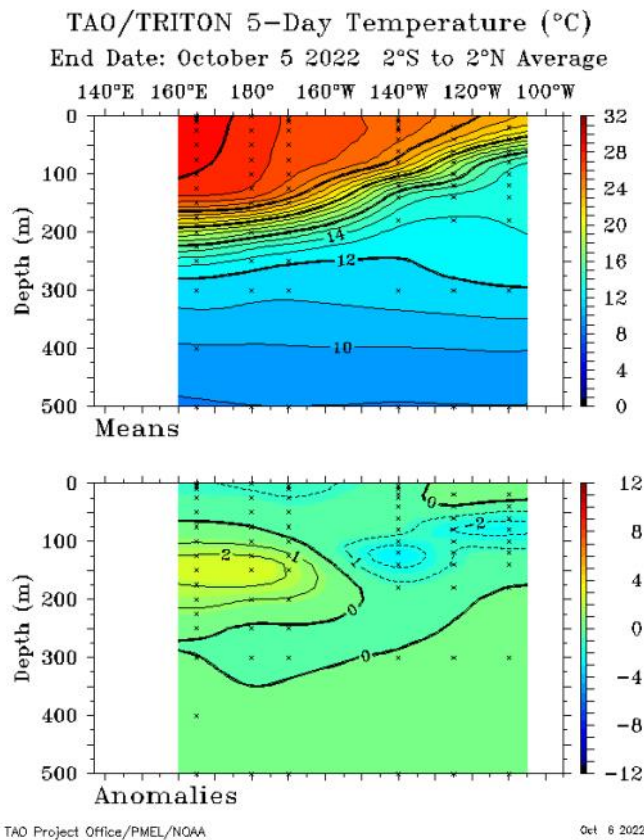
OCEAN CONDITIONS

SUB SURFACE

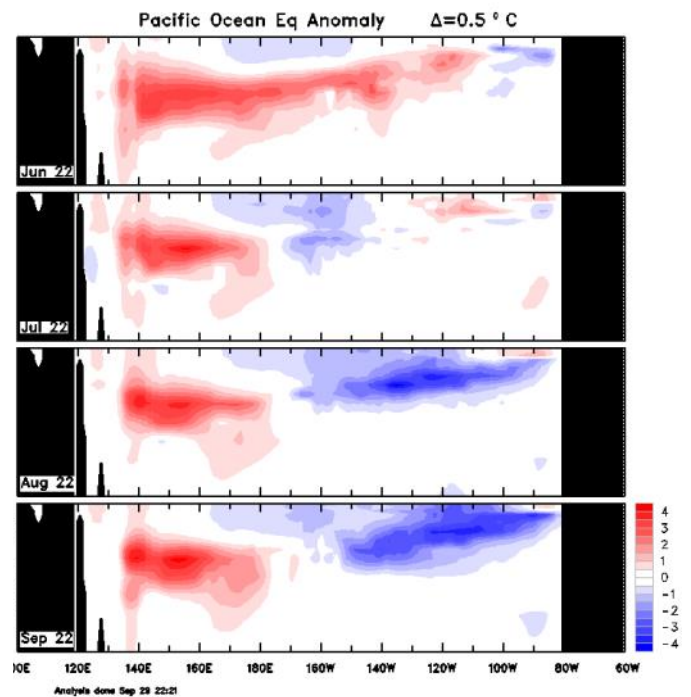


The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 22 September 2022) shows cool anomalies from the surface to around 150 m depth in the central to eastern equatorial Pacific. Warm anomalies persist between around 100 m and 250 m depth west of the International Date Line. Cool anomalies increased in the central to eastern equatorial Pacific sub-surface month-on-month until August with month-to-date September values being similar to those observed in August.

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

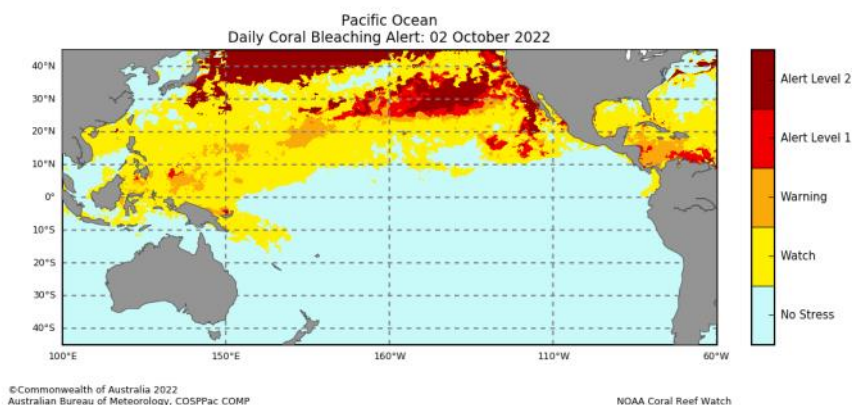
CORAL BLEACHING



The daily Coral Bleaching Alert for 2 October 2022 shows 'Alert Level 1' over parts of Palau and PNG island. Patches of 'Warning' for Palau, western FSM, northern RMI and northern PNG while 'No Stress or Watch' for the rest of COSPPac partner countries. The four weeks Coral Bleaching Outlook to 23rd October shows 'Alert Level 2' for Palau and part of northern PNG. 'Alert Level 1' for rest of Palau and western FSM. 'Warning' alert for most of FSM, Guam and northern PNG. 'No Stress or Watch' for the rest of COSPPac partner countries.

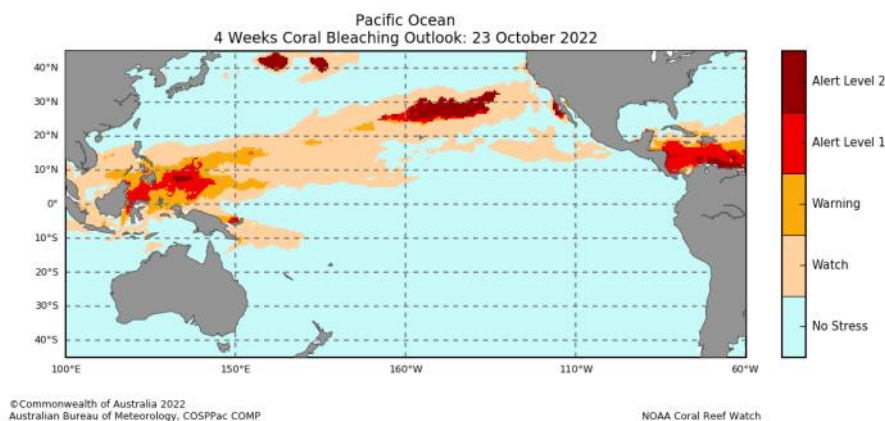
Daily Coral Bleaching Alert

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



4 Weeks Coral Bleaching Outlook

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



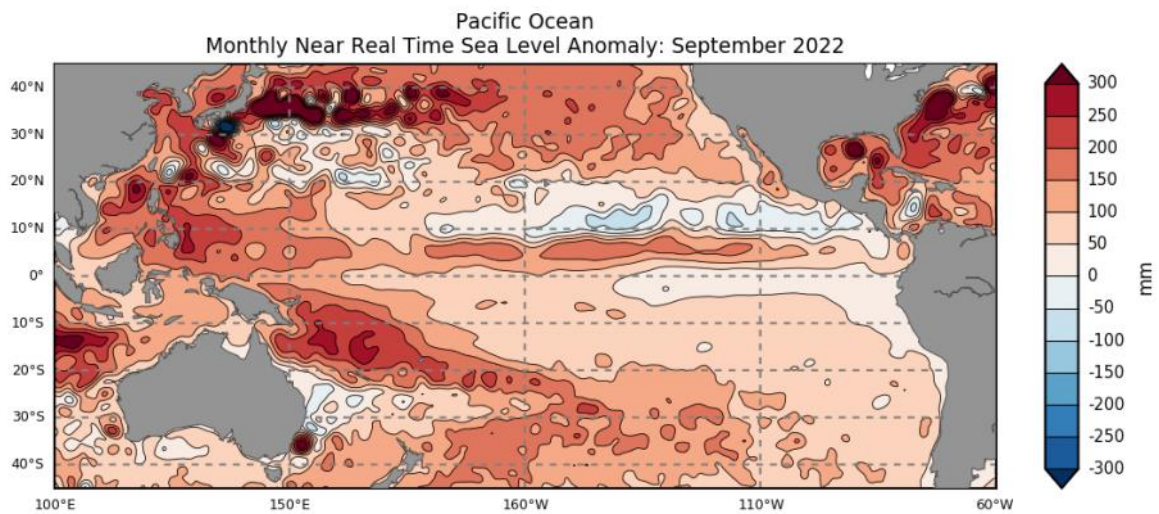
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea level was above normal for most of the COSPPac countries. Patches of the highest anomalies above 300mm were observed in northern New Caledonia, western Vanuatu, southern Tonga and southern Niue. Patches of anomalies of 200-300mm were observed part of Palau, western FSM, southeastern PNG, Solomon Islands, Vanuatu, parts of Fiji, Tonga, Niue and southern Cook Islands. Sea level of 100mm to 200mm were also observed for FSM, southern RMI, most of PNG, Patches of New Caledonia, Vanuatu, Fiji, Tuvalu, Tonga, Samoa, Niue, southern Cook Islands and French Polynesia. Anomalies of 50-100mm observed at most of COSPPac countries. Near normal to below normal sea levels were observed over parts of eastern Australia, southern New Caledonia and southern Tonga.

Monthly Sea Level Anomalies

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



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Australian Bureau of Meteorology, COSPPac COMP

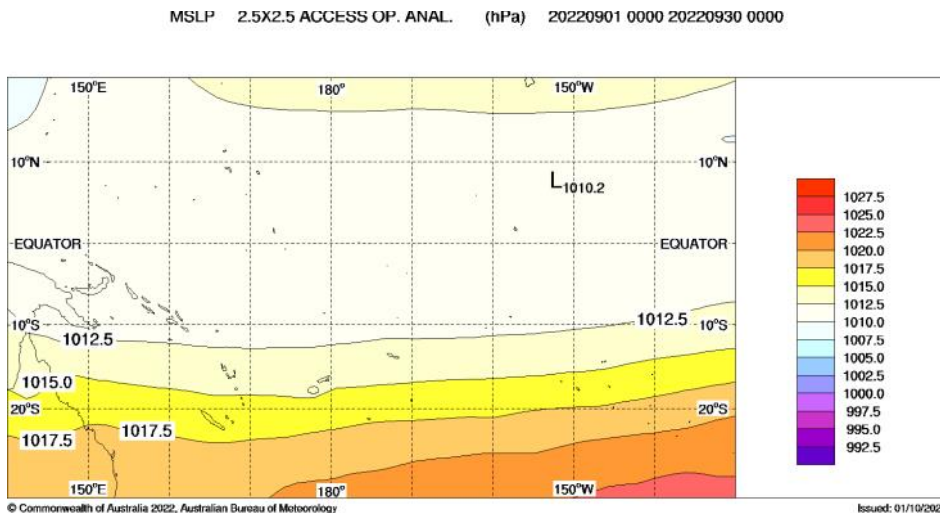
AVISO Ssalto/Duacs SLA

MEAN SEA LEVEL PRESSURE

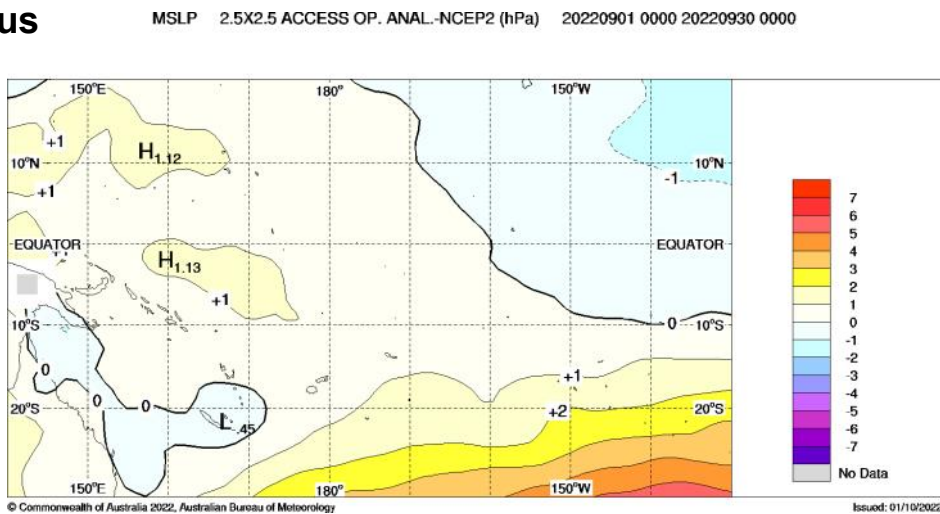
The September mean sea level pressure (MSLP) anomaly map shows mostly positive anomalies of +1 or greater over FSM, RMI, Nauru, Tonga and further south, and north Pacific over Guam and CNMI.

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

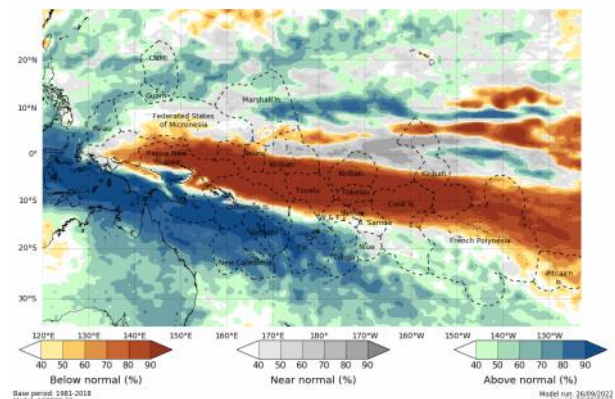
October—December 2022



The ACCESS-S model forecast for October 2022, favours below normal rainfall for central FSM, northern PNG plus Momase region and some of the PNG Islands, southern RMI, northern Solomon Islands, Nauru, most of Kiribati, Tuvalu, Rotuma (Fiji Islands), Wallis and Futuna, Tokelau, Samoa, American Samoa, northern and central Cook Islands and French Polynesia and Pitcairn. Above normal rainfall is likely or very likely for Palau, CNMI, Guam, eastern RMI, most of PNG, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands and French Polynesia.

The three-month rainfall outlook (October-December 2022) favours below normal rainfall for northern PNG plus Momase region and the PNG Islands, southern RMI, northern Solomon Islands, Nauru, most of Kiribati, Tuvalu, Rotuma (Fiji Islands), Wallis and Futuna, Tokelau, Samoa, American Samoa, northern and central Cook Islands and French Polynesia and Pitcairn. Above normal rainfall is likely or very likely for Palau, CNMI, Guam, northern FSM, northern and central RMI, most of PNG, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands and French Polynesia.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for October-December 2022 favours below normal rainfall for PNG Islands, southern RMI, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern and central Cook Islands, French Polynesia and Pitcairn Island. Above normal rainfall is likely or very likely for Palau, Guam, CNMI, central Marshall Islands, western and southern PNG, New Caledonia, Vanuatu, Fiji, Tonga, Niue and southern Cook Islands and French Polynesia.

The APEC Climate Centre multi-model for October-December 2022 favours below normal rainfall for northern RMI, PNG Islands, western and northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, Samoa, American Samoa, northern Cook Islands, northern French Polynesia and Pitcairn Island. Above normal rainfall is likely or very likely for Palau, western FSM, southern RMI, PNG mainland and Milne Bay region, southern Solomon Islands, New Caledonia, Vanuatu, Fiji, Tonga, Niue, southern Cook Islands and southwest French Polynesia.

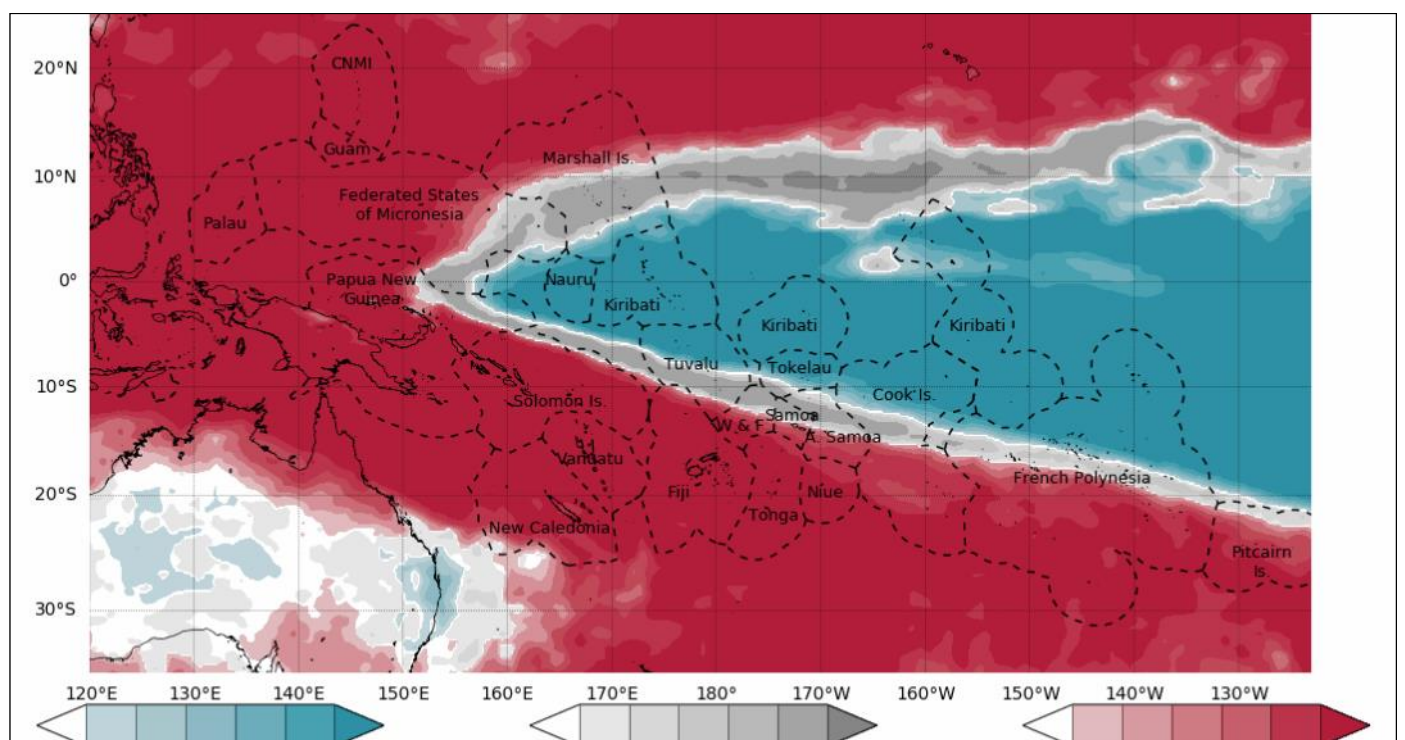
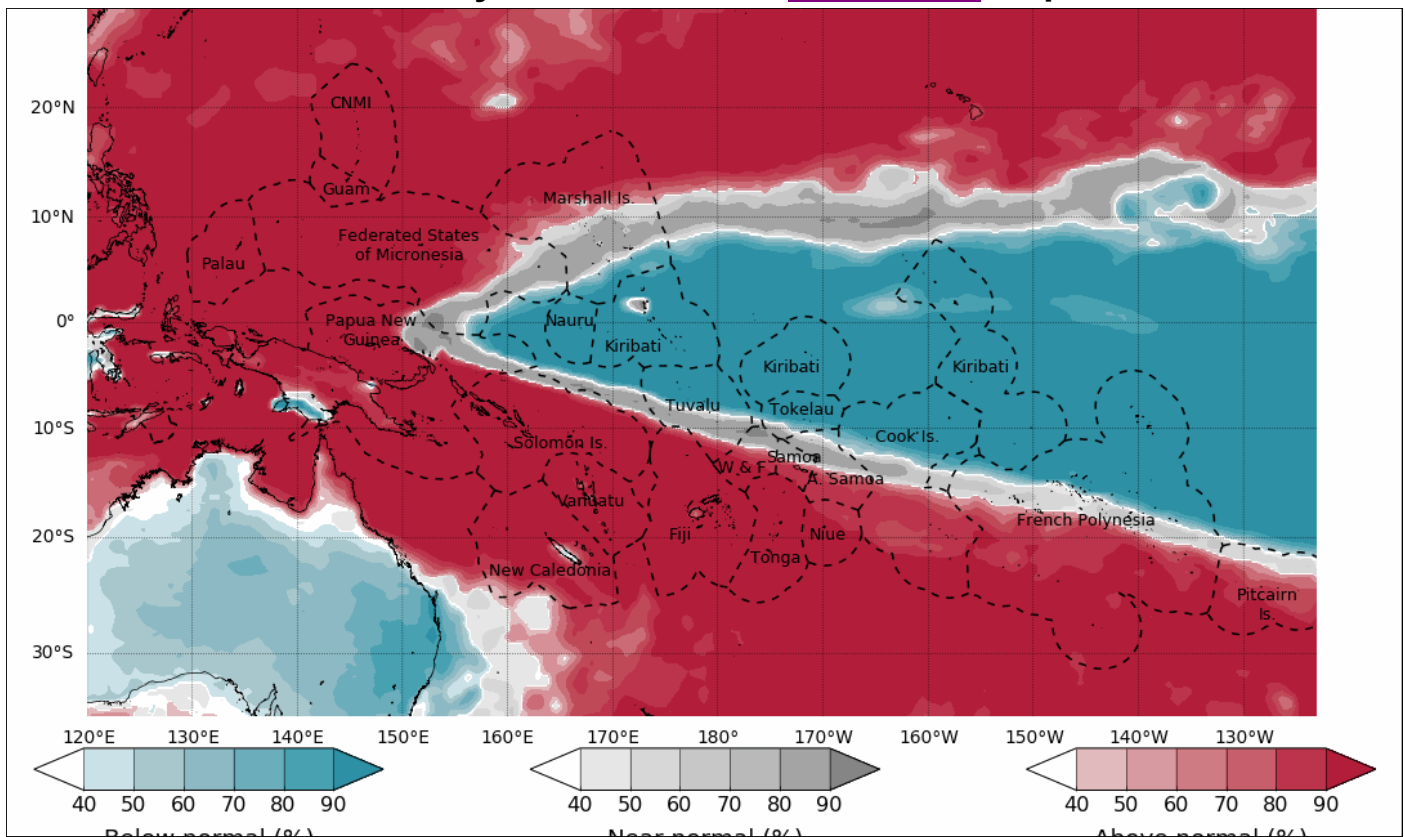
For October-December 2022, the models agree on above normal rainfall being favoured for much of Palau, Guam, CNMI, central RMI, most of PNG mainland, southern Solomon Islands, New Caledonia, Vanuatu, Fiji (excluding Rotuma), Tonga, Niue, southern Cook Islands, and southern French Polynesia. The models also agree that below normal rainfall is likely or very likely for northern PNG, northern Solomon Islands, Nauru, Kiribati, Tuvalu, Tokelau, northern Cook Islands, northern French Polynesia and Pitcairn Island.

SEASONAL TEMPERATURE OUTLOOK

October—December 2022



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



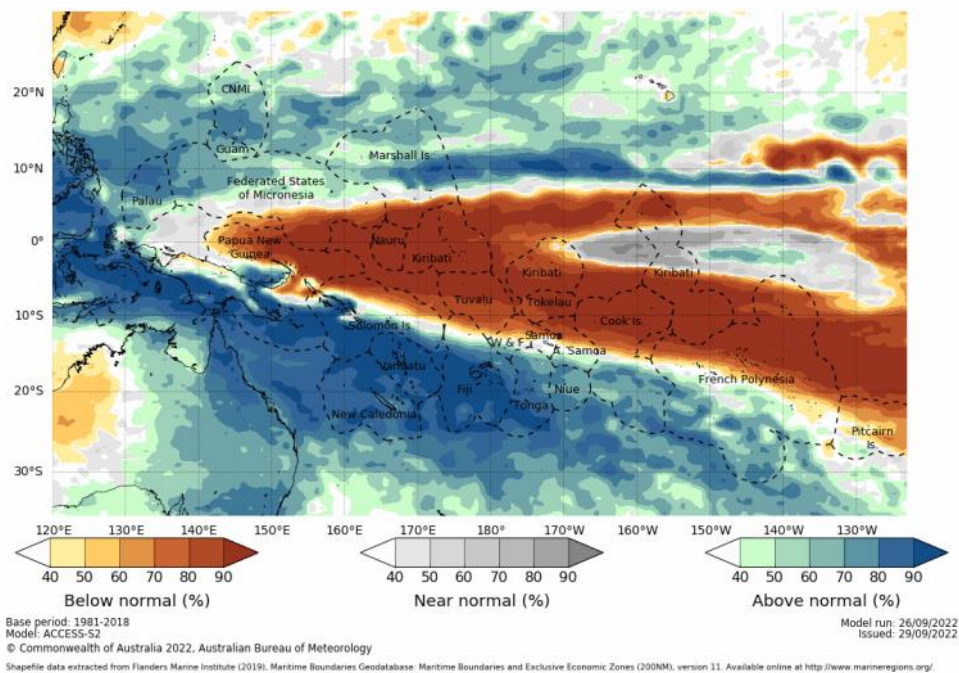
SEASONAL RAINFALL OUTLOOK

October—December 2022

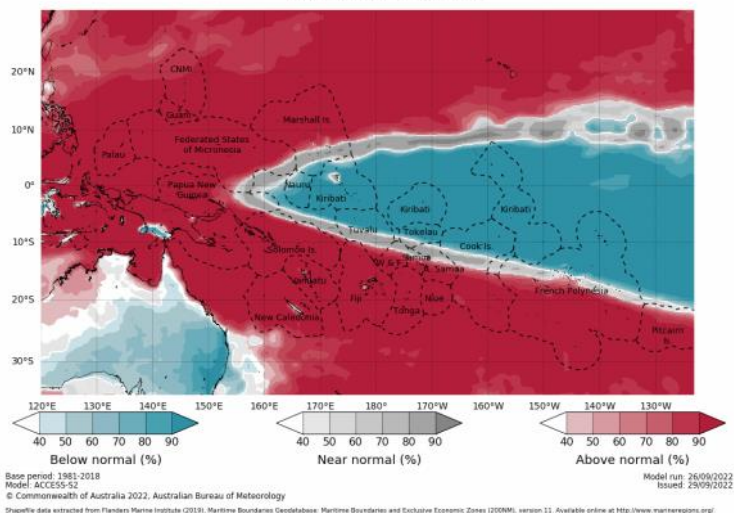


Seasonal ACCESS-S maps

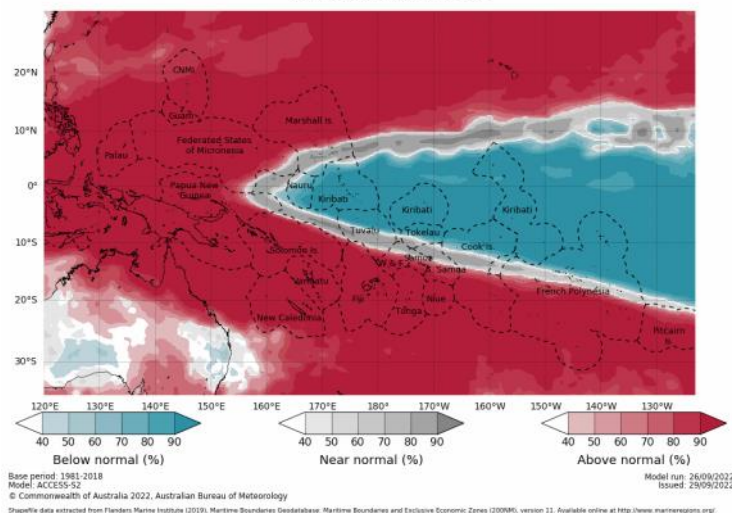
Tercile rainfall probabilities for October to December 2022



Tercile maximum temperature probabilities for October to December 2022



Tercile minimum temperature probabilities for October to December 2022



About ACCESS-S <http://access-s.clide.cloud/>

SEASONAL RAINFALL OUTLOOK

October—December 2022



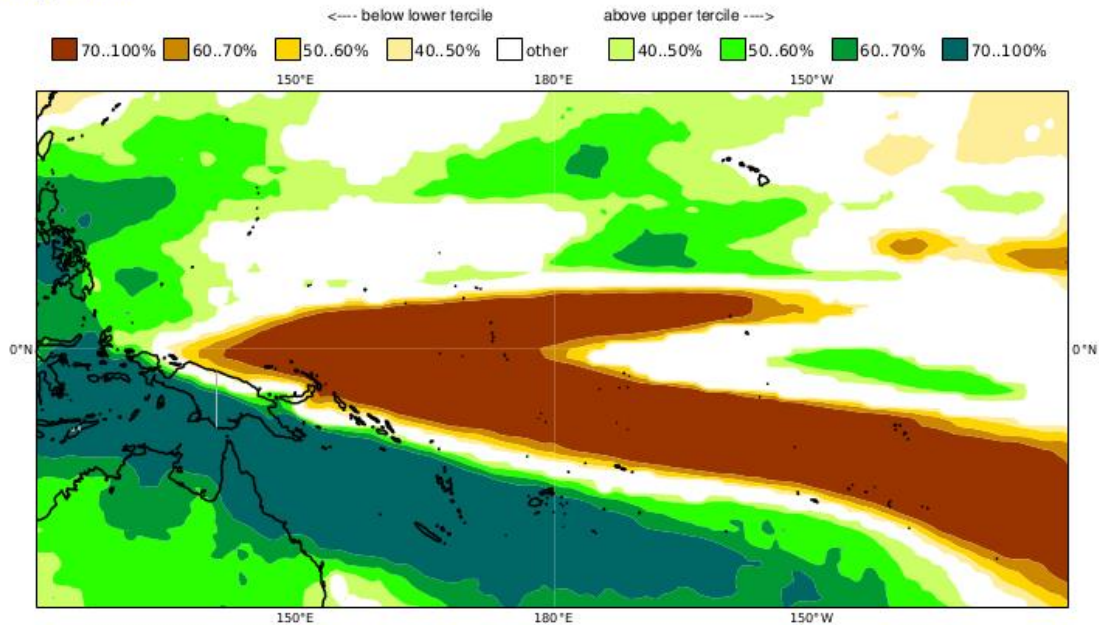
Copernicus (C3S multi-system)-Rainfall

Prob(most likely category of precipitation)

OND 2022

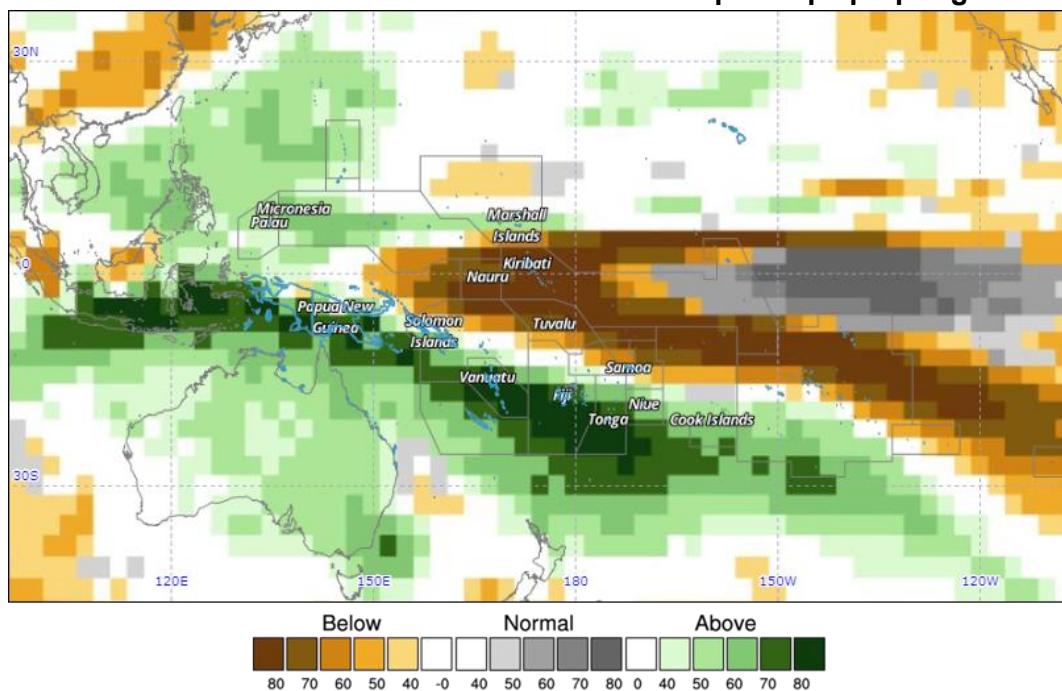
Nominal forecast start: 01/09/22

Unweighted mean



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

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



Year: 2022, Season: OND, Lead Month: 3, Method: GAUS

Model: APCC, CWB, MSC, NASA, NCEP

Generated using CLIK® (2022-10-6)

© APEC Climate Center

TROPICAL CYCLONE

2021/2022 Season

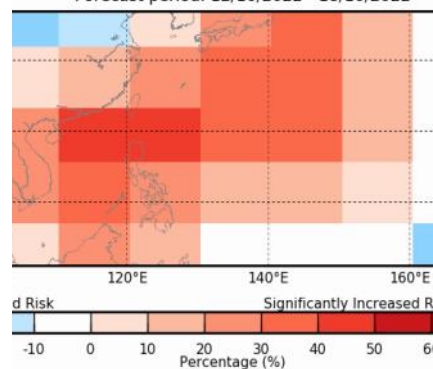


The southwest Pacific, 2021-22 tropical cyclone season ended on 30th April 2022. Seven named TCs (Ruby, Seth, Cody, Dovi, Tiffany, Eva and Fili) formed from east of the longitude of the tip of Cape York, Australia. Two cyclones reached category three status, including Dovi and Coby. TC activity in the Western North Pacific occurs year-around, and with the resurgence of at least a borderline La Niña conditions, a preliminary cyclone outlook for the northwest Pacific is for near-average seasonal activity.

It's 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).

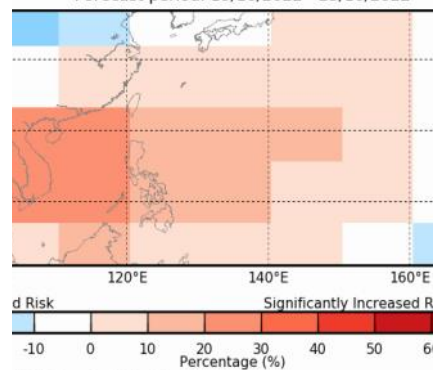
The weekly tropical cyclone forecast from the ACCESS-S model shows significant increased risk between 11 and 17 October for the northwest Pacific including the Philippines, the South China Sea region and south of Japan. There is also increased risk for the 19 to 25 October period.

ACCESS-S Weekly Forecasts –Northwest Pacific
 Difference from normal chance of Tropical Cyclone's in the Northwest Pacific
 Forecast period: 12/10/2022 - 18/10/2022



Probability in overlapping 15 x 20 degree boxes
 Model: ACCESS_S2 Model Run: 04/30/2022
 Issue: 122, Australian Bureau of Meteorology

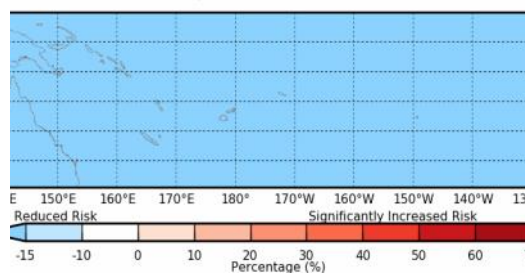
ACCESS-S Weekly Forecasts –Northwest Pacific
 Difference from normal chance of Tropical Cyclone's in the Northwest Pacific
 Forecast period: 19/10/2022 - 25/10/2022



Probability in overlapping 15 x 20 degree boxes
 Model: ACCESS_S2 Model Run: 04/30/2022
 Issue: 122, Australian Bureau of Meteorology

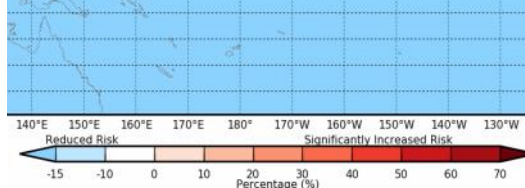
ACCESS-S Weekly Forecasts –Southwest Pacific

Difference from normal chance of Tropical Cyclone's in the Southwest Pacific
 Forecast period: 12/10/2022 - 18/10/2022



Probability in overlapping 15 x 20 degree boxes
 Model: ACCESS_S2 Model Run: 04/30/2022
 Issue: 122, Australian Bureau of Meteorology

Difference from normal chance of Tropical Cyclone's in the Southwest Pacific
 Forecast period: 19/10/2022 - 25/10/2022



Probability in overlapping 15 x 20 degree boxes
 Model: ACCESS_S2 Model Run: 04/30/2022 Issue: 122, Australian Bureau of Meteorology

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.

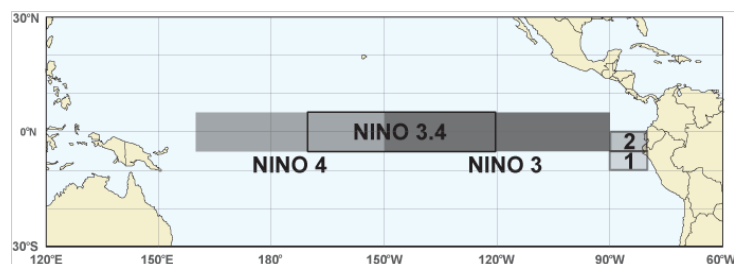
20 degrees Celsius Isotherm Depth

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