

Monthly Climate Bulletin

June 2024



ISSN: 2617-3557

Photo Credit: Molly Powers (SPC) Samoa Tide Gauge



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- The El Niño Southern Oscillation (ENSO) is currently neutral.
- The Madden-Julian Oscillation (MJO) is weak to moderate in strength in the eastern Indian Ocean.
- In June, the Intertropical Convergence Zone (ITCZ) was just north of the equator, and a well defined South Pacific Convergence Zone (SPCZ) extended east-southeast from PNG to the northern Cook Islands in the southern hemisphere.
- Sea surface temperatures (SSTs) for June 2024 were warmer than average across most of the tropical Pacific Ocean.
- The Coral bleaching Outlook to 21 July shows 'Alert Level 2' over most parts of Palau, south-west and southeast FSM, and northern PNG mainland and Islands.
- For July to September 2024 the models agree that above normal rainfall is likely or very likely for southern Palau, central RMI, most of PNG north of Milne Bay, most of Solomon Islands, northern Fiji, central and southern Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern Cook Islands, and northwest French Polynesia. In addition, the models agree that below normal rainfall is likely or very likely for Guam, CNMI, Nauru, Kiribati (central Gilbert, patches of Phoenix, and northern Line Is.), southeast French Polynesia, and Pitcairn Islands.
- The ACCESS-S weekly tropical cyclone outlook shows significantly increased risk over Palau, FSM, Guam, CNMI, Philippines and Japan for the week from 15 to 21 July, and an elevated risk over the Philippines, Guam and CNMI in the following week from 22 to 28 July.



EL NIÑO–SOUTHERN OSCILLATION

Neutral ENSO and IOD conditions continue

Click link to access [Climate Driver Update issued on 09 July 2024](#)

The El Niño-Southern Oscillation (ENSO) is currently neutral.

Sea surface temperatures (SSTs) in the central Pacific have been cooling since December 2023. This surface cooling is supported by a cooler than average sub-surface in the central and eastern Pacific. During June, the rate of cooling has decreased. Cloud and surface pressure patterns are currently ENSO-neutral.

Climate models suggest that SSTs in the central tropical Pacific are likely to continue to cool for at least the next 2 months. Four of 7 models suggest SSTs are likely to remain at neutral ENSO levels, and the remaining 3 suggest the possibility of SSTs at La Niña levels (below -0.8°C) from September. The Bureau's ENSO Outlook is at La Niña Watch due to early signs that an event may form in the Pacific Ocean later in the year. A La Niña Watch does not guarantee La Niña development, only that there is about an equal chance of either ENSO neutral or a La Niña developing. Early signs of La Niña have limited relevance to mainland Australia and are better reflections of conditions in the tropical Pacific.

While phenomena such as La Niña provide broad indications of the expected climate, the long-range forecast provides better guidance for local rainfall and temperature patterns.

Global sea surface temperatures (SSTs) have been the warmest on record for each month between April 2023 and June 2024. These global patterns of warmth differ to historical global patterns of sea surface temperatures associated with ENSO and IOD; therefore, future predictions based on historical SSTs during past ENSO or IOD events may not be reliable. Phenomena such as ENSO and the IOD are only broad indicators of the expected climate. The long-range forecast provides better guidance on local rainfall and temperature patterns.

The Indian Ocean Dipole (IOD) is currently neutral, with the latest weekly value close to zero. Predictability of the IOD is low at this time of year but improves through the winter months. The latest model outlooks indicate that the IOD will remain neutral until at least early spring.

The Southern Annular Mode (SAM) is currently neutral (as of 22 June). Forecasts indicate the index is expected to become positive during late June, before returning to neutral by early July.

The 30-, 60- and 90-day Southern Oscillation Index (SOI) values for the period ending 23 June 2024 were -8.0, -3.0 and -5.0, respectively. The SOI reflects neutral ENSO conditions.



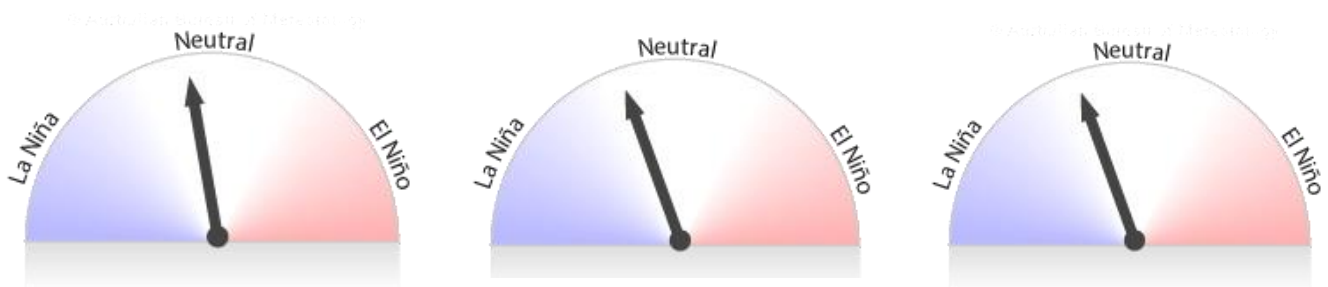


EL NIÑO–SOUTHERN OSCILLATION

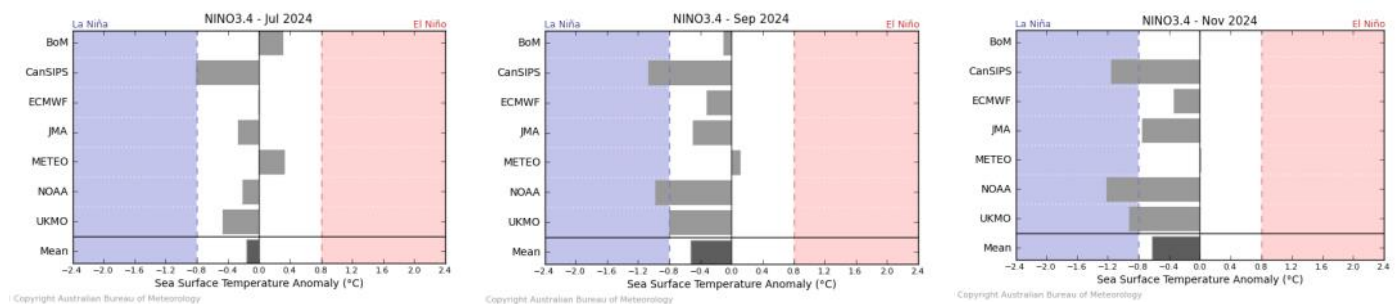
Neutral ENSO and IOD conditions continue

Click link to access [Climate Driver Update issued on 09 July 2024](#)

Bureau of Meteorology NINO3.4 ENSO Model Outlooks for July, September and November



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>

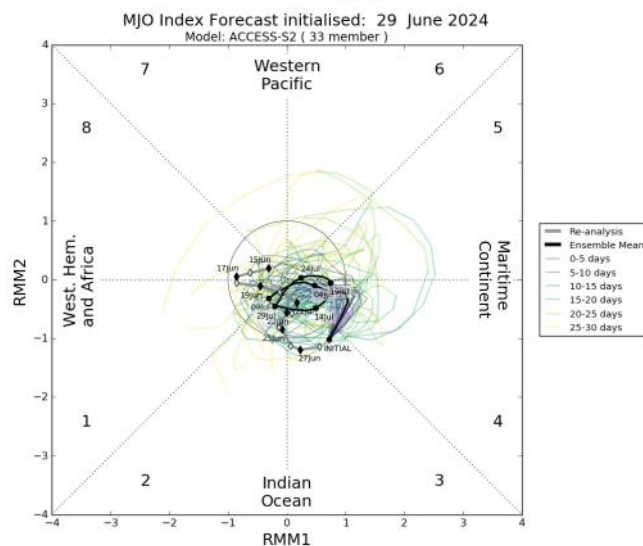
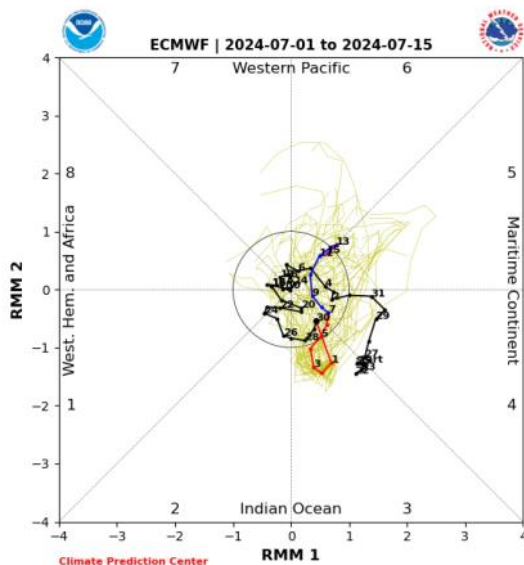
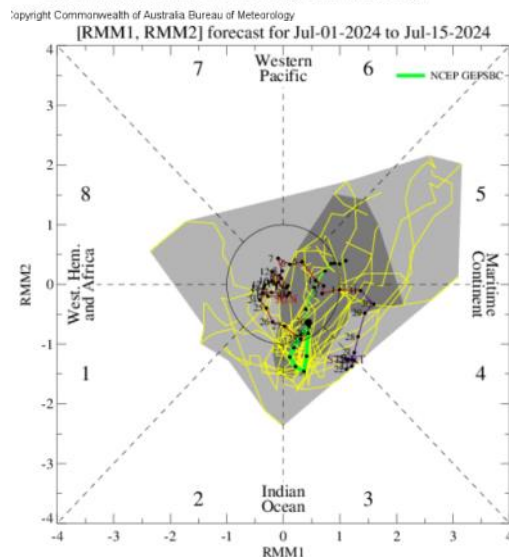
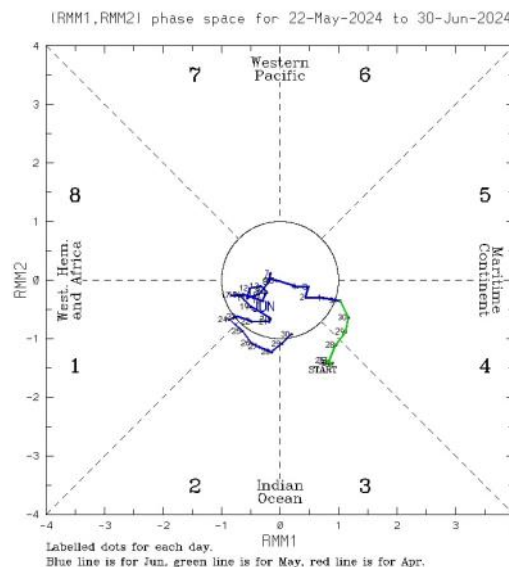
MADDEN–JULIAN OSCILLATION

Click link to access [➡ Tropical Climate Update](#) [Issued on Tuesday 09 July 2024]

The Madden-Julian Oscillation (MJO) has been generally weak in June.

The MJO is weak to moderate in strength in the eastern Indian Ocean (as at 7 July). Model forecasts suggest it is expected to remain weak for the coming fortnight. A weak MJO has little impact on tropical Pacific and Australian rainfall.

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



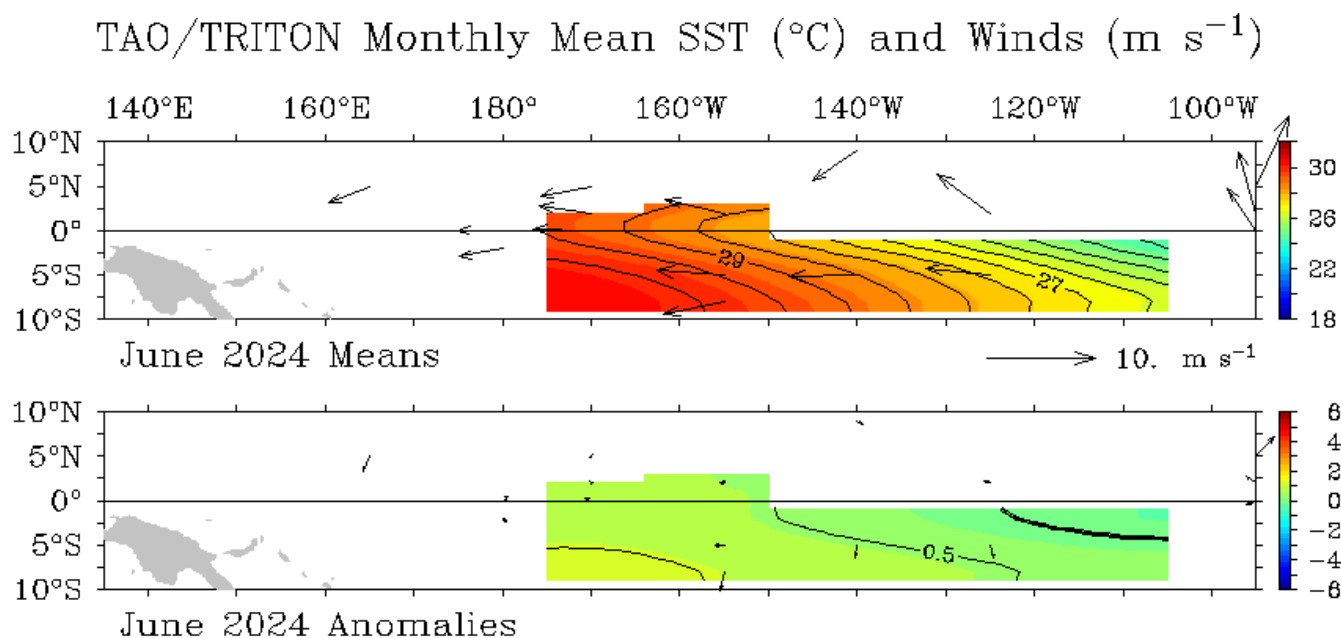
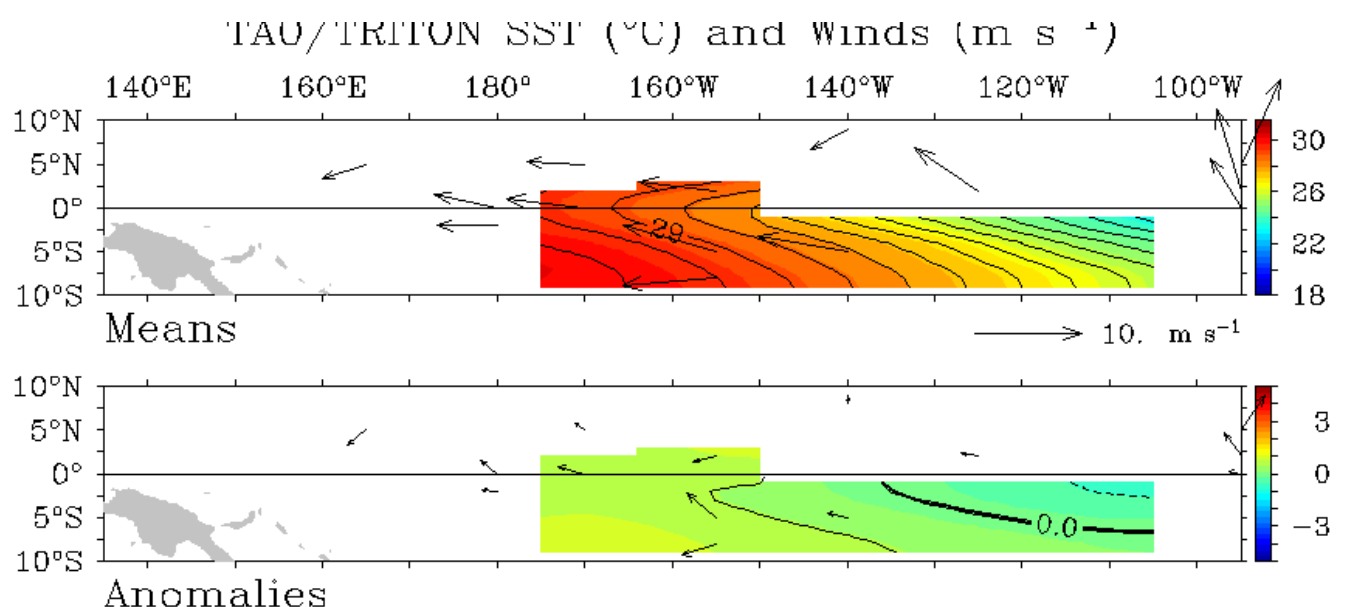
WIND



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

During June, the trade winds were generally close to normal over the equatorial Pacific. For the five days ending 30 June 2024, the trade winds were a little stronger than normal over most of the near-equatorial Pacific.

During El Niño events there is a sustained weakening, or even reversal, of the trade winds across much of the tropical Pacific, while during La Niña, there is a sustained strengthening of the trade winds.



CLOUD AND RAINFALL

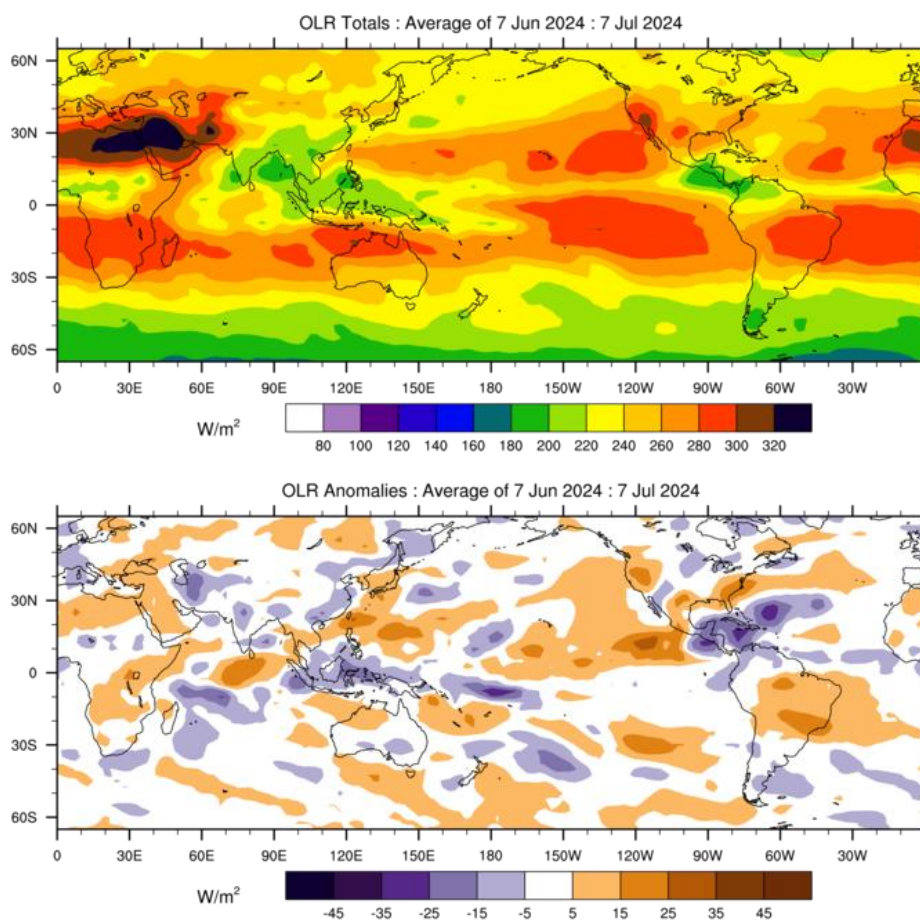
Click link to access [OLR](#)



The June 30-day OLR anomaly map shows a large region of low OLR (increased convection) that stretched east-southeastwards from the northern PNG mainland and PNG Islands in the west, to the northern Cook Islands in the east. This line of enhanced cloud cover can be used to estimate the position of the South Pacific Convergence Zone (SPCZ), which appeared to be shifted to the northeast. Areas of high OLR (decreased convection) were evident over FSM, Guam, CNMI, RMI, and Kiribati in the northern hemisphere. In the southern hemisphere, anomalously high OLR stretched from the southern Solomon Islands across New Caledonia, Vanuatu, and Fiji.

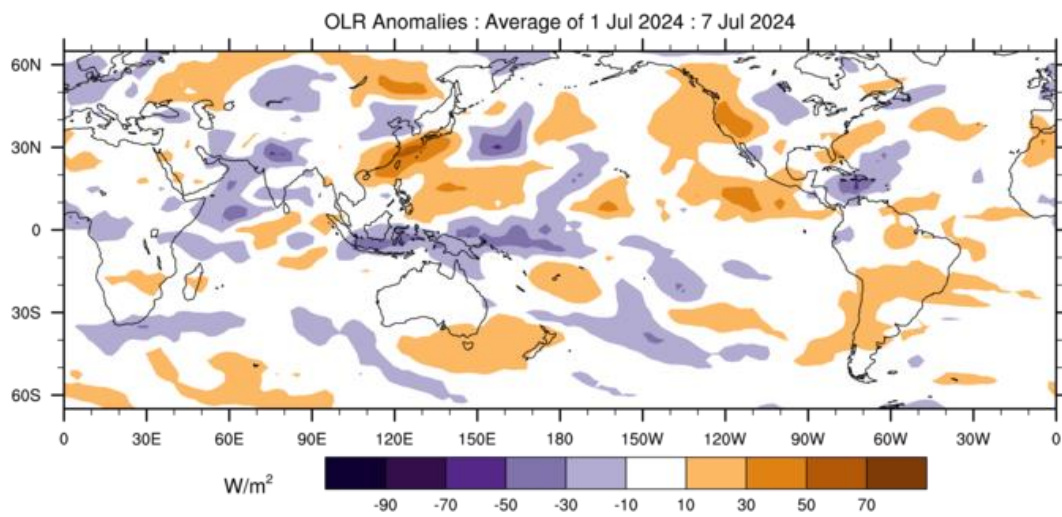
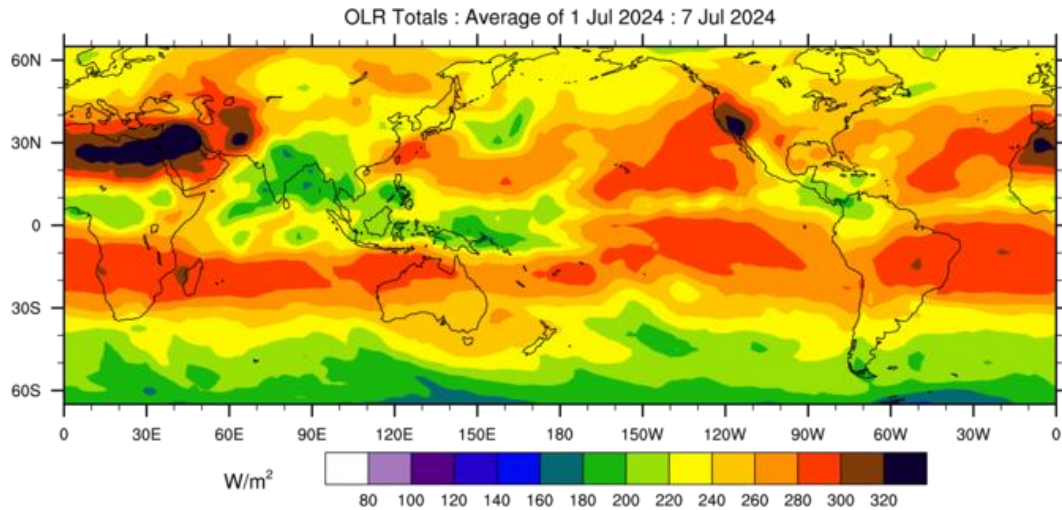
Note: Global maps of OLR below highlight regions experiencing increased or decreased cloudiness. The top panel is the total OLR in Watts per square metre (W/m^2) and the bottom panel is the anomaly (current minus the 1979-1998 climate average), in W/m^2 . In the bottom panel, negative values (blue shading)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

OLR Total and Anomalies, 30 Day OLR

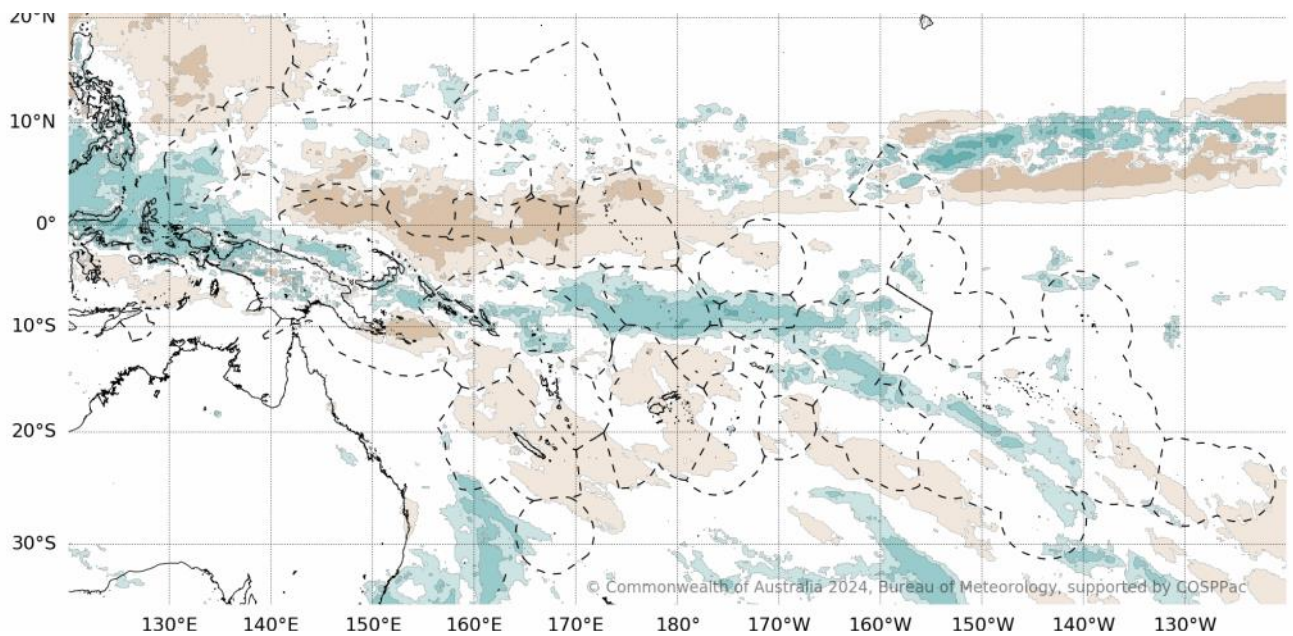


(C) Copyright Commonwealth of Australia 2024. Bureau of Meteorology

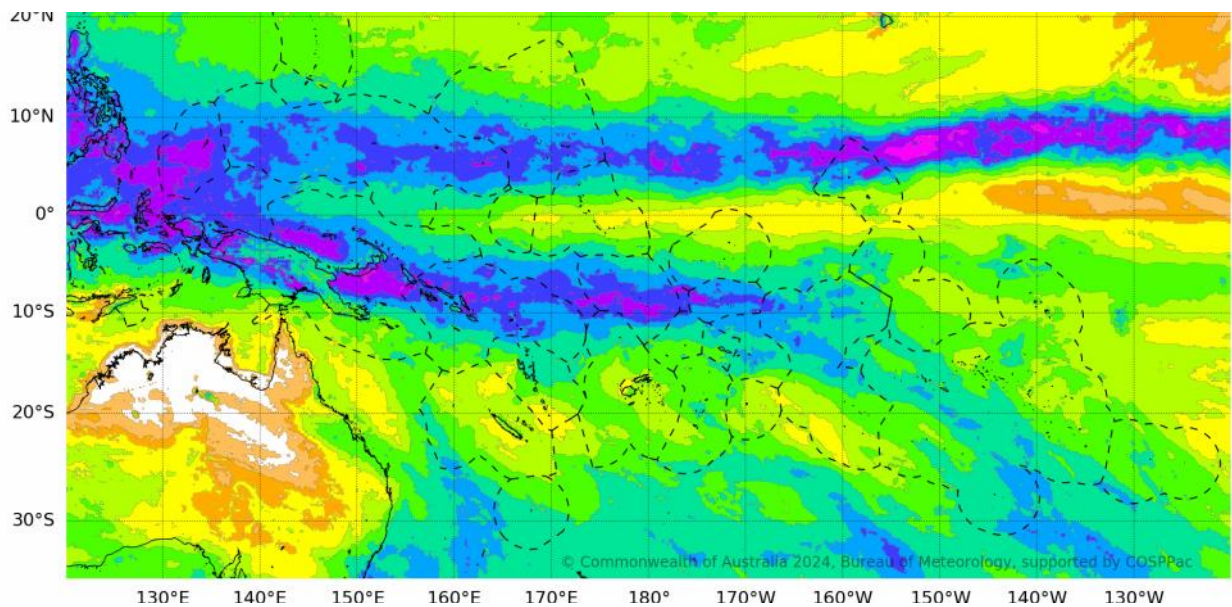
OLR Total and Anomalies, 7 Day OLR



(C) Copyright Commonwealth of Australia 2024. Bureau of Meteorology



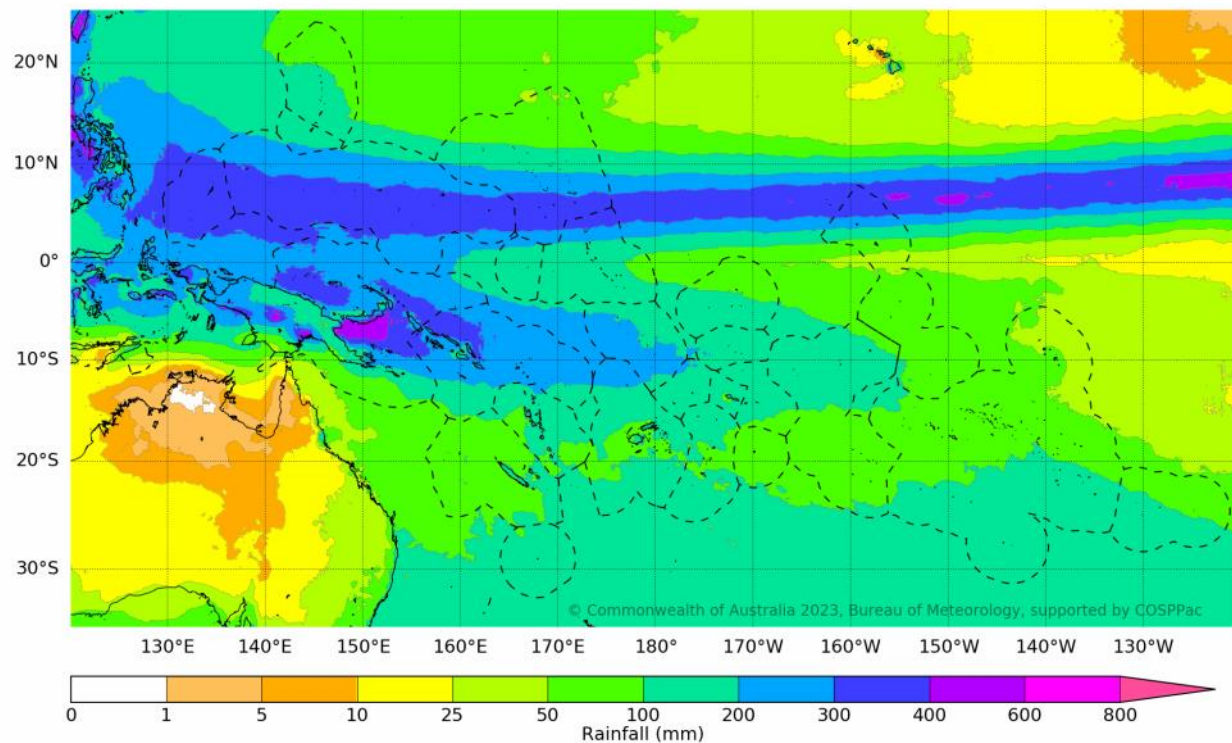
30-Day Rainfall Accumulated



Base period: 1980-2021
Data source: MSWEP

Monthly climatology for June

Issued: 08/12/2023



Dashed EEZ shapefile data extracted from Flanders Marine Institute (2019), Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at <http://www.marineregions.org/>.

Global and Pacific ACCESS-S outlook and Pacific Climate Monitoring - ACCESS-S precipitation:

<http://access-s.clide.cloud/>

OCEAN CONDITIONS

SEA SURFACE TEMPERATURE

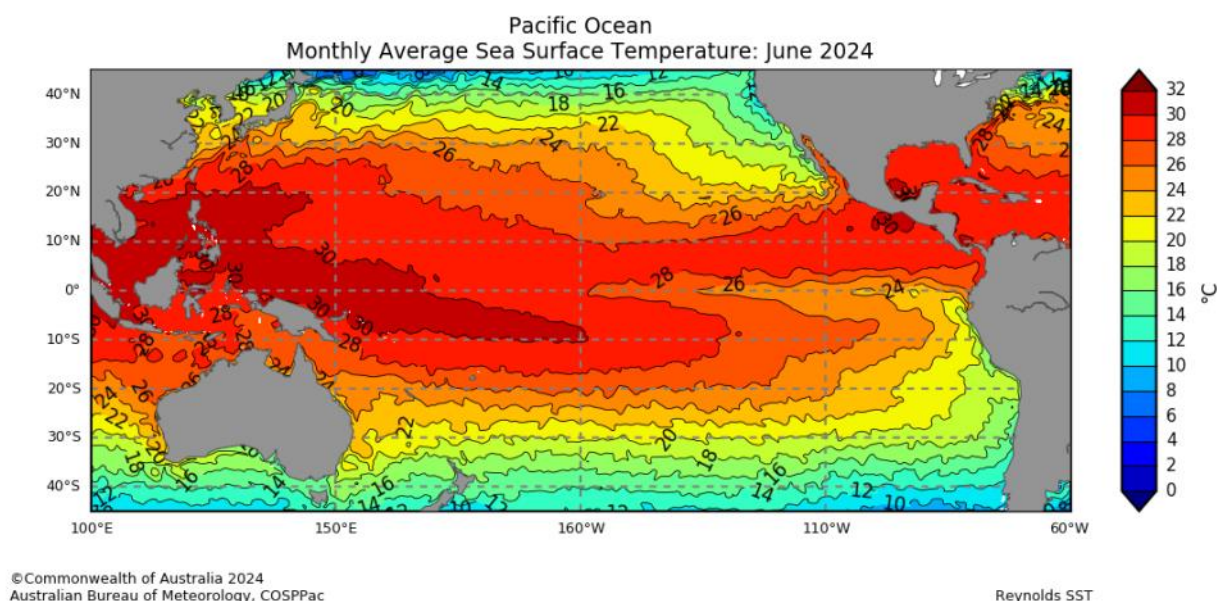


Click link to access [Pacific Community COSPPac Ocean Portal](#)

Sea surface temperatures (SSTs) for June 2024 were up to 1.2 °C warmer across most of the tropical Pacific Ocean. SSTs were up to 2 °C cooler than average in the equatorial Pacific east of 140°W and along parts of the South American coast.

Warm SST anomalies of up to 2 °C above average were evident around most of Australia, increasing to up to 3 °C to the south-west of the mainland and south-east of Tasmania. A small strip of SSTs was up to 2 °C cooler than average along the South Australian coast, likely due to enhanced upwelling. Warm anomalies persist to the north of Maritime Continent.

Highest-on-record June SSTs occurred in Palau, extending southeastward over southwest and south-east FSM, northeast PNG's EEZ, northern Solomon Islands, Nauru, parts of Kiribati (southwest Gilbert, and southern Phoenix), Tuvalu, Tokelau, Wallis and Futuna, Samoa, northern American Samoa, and northern Cook Islands. The SSTs in decile 10 (very much above average) stretched east-northeastwards from Palau, FSM to Marshall Islands. Another band stretched from east-southeastwards from PNG to northern French Polynesia. Above average (8-9) decile were observed for majority of the Pacific Island Countries, spanning east-north-eastward from northern FSM, northern most RMI, and east-south-eastwards from southeast PNG, southern Solomon Islands, northern Vanuatu to southern Cook Islands. Another band of above average (8-9) decile occurred over Kiribati (central Gilbert, northern Phoenix and most parts of Line Islands). Average SSTs (4-7) for June were observed in New Caledonia, southern Fiji, southern Tonga, southern Cook Islands and southern French Polynesia. Patches of decile 2-3 (below average) were observed in northwest New Caledonia, southern French Polynesia, and Pitcairn Islands.

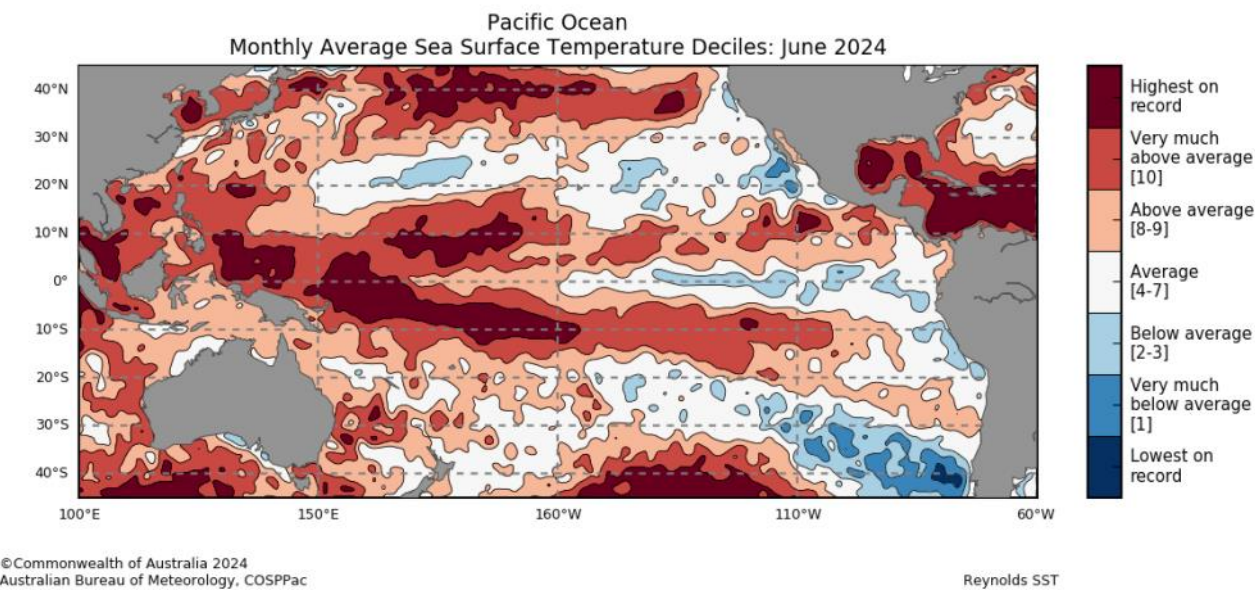
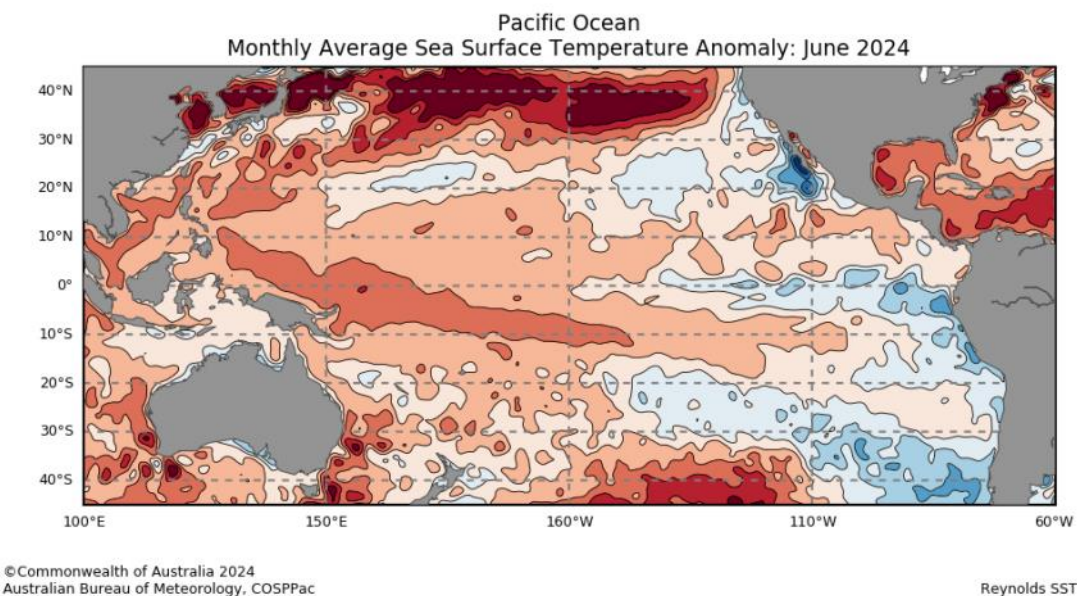


OCEAN CONDITIONS

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



Anomalous Sea Surface Temperature



OCEAN CONDITIONS

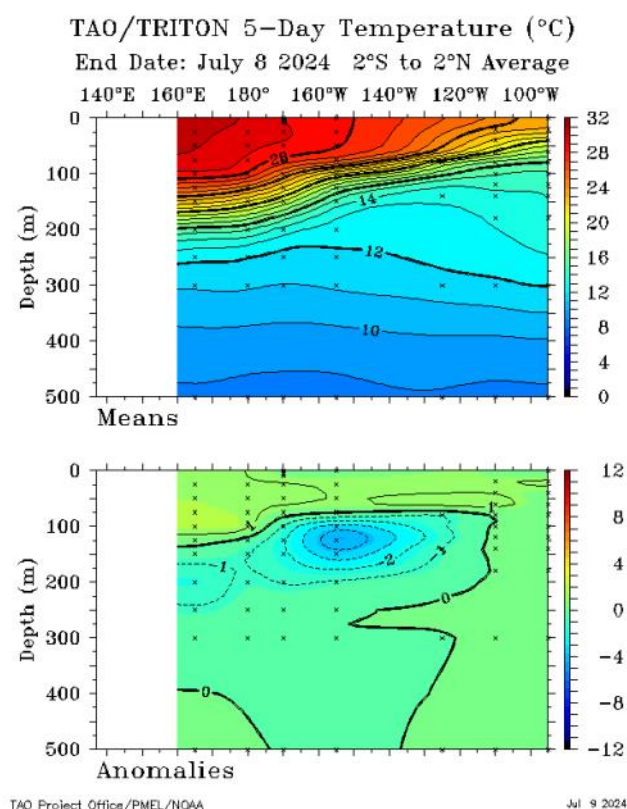
SUB SURFACE



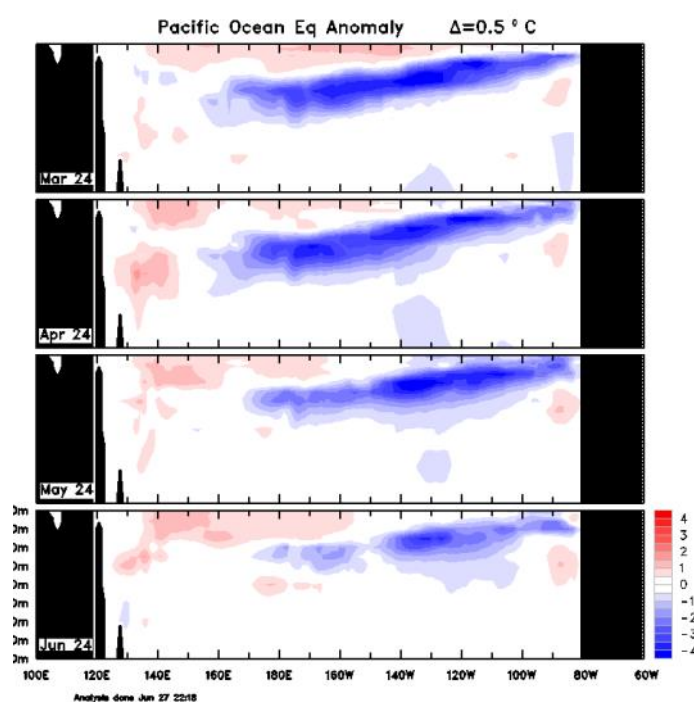
The four-month sequence of equatorial Pacific sub-surface temperature anomalies (to 27 June 2024) shows the persistence of cool anomalies in the eastern Pacific. For June, these anomalies were up to 3 °C cooler than average east of 170°E, being coolest around 150°W at 50-150 m depth. In the top 100 m of the central and western equatorial Pacific (between 130°E and 155°W) there are anomalies of up to 1 °C warmer than average.

In June, the magnitude and extent of cool anomalies decreased, compared to those in March, April and May. Warm anomalies in the western Pacific decreased in extent and magnitude between March and May but increased in June.

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

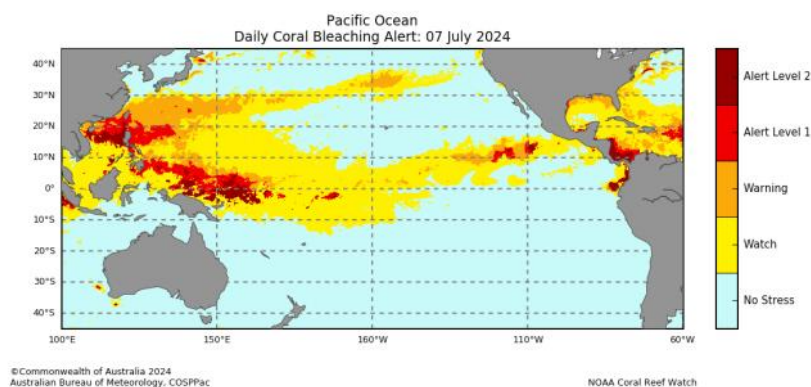
CORAL BLEACHING



The daily Coral Bleaching Alert status for 07 July 2024 shows an area of 'Alert Level 2' over parts of northern PNG's mainland, northeastern PNG's EEZ, and southeast FSM. 'Alert Level 1' over parts of central Palau, southern FSM, northern PNG, central Nauru, and Kiribati (southwest Gilbert and northern Phoenix Is.). 'Warning' status over central FSM, northern Nauru, and patches in Kiribati (northern Gilbert Is., and northern Line Is.). 'Watch' or 'No stress' for the rest of the countries. The four-week Coral Bleaching Outlook to 21 July shows 'Alert Level 2' over most parts of Palau, southwest and southeast FSM, and northern PNG mainland and Islands. 'Alert Level 1' rating stretches southeastwards from Palau, southern FSM, northern PNG, northern most Solomon Islands' EEZ, Nauru, and Kiribati (northern and southwest Gilbert Is.) 'Warning' extends from northern FSM, southern RMI, and Kiribati (northern Gilbert). 'Watch' or 'No Stress' over the rest of the countries.

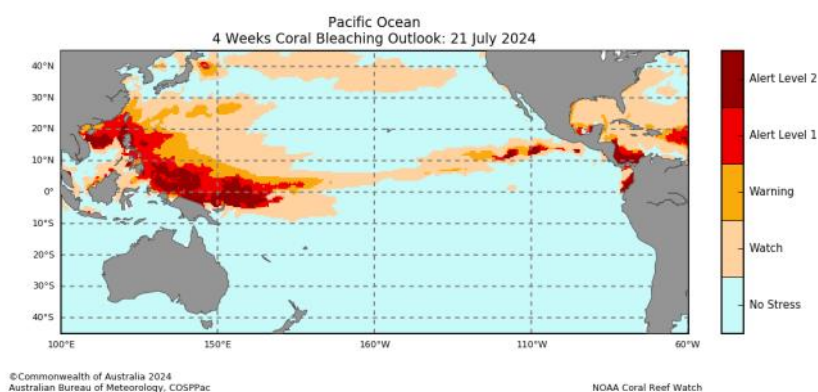
Daily Coral Bleaching Alert

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



4 Weeks Coral Bleaching Outlook

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



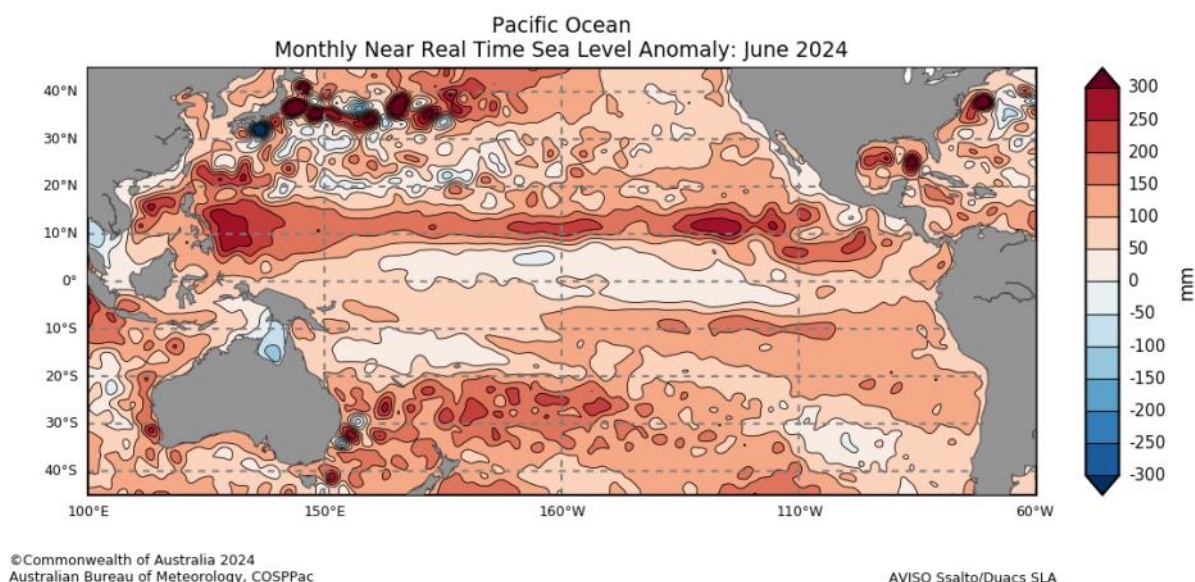
OCEAN CONDITIONS

OCEAN SURFACE CURRENTS AND SEA LEVEL

Sea levels observed in June were above normal over most COSPPac countries. Patches of anomalies from +200 to +300 mm were observed over northern Palau, along the southeastern Australian coast, and southern New Caledonia's EEZ. Anomalies of up to +250 were observed over most of Palau, northern FSM, northern RMI, with patches over parts of southern Fiji, southern Tonga, and southern French Polynesia. However, near-normal anomalies were observed in southern part of Marshall Islands, Kiribati Islands (northern half of Gilbert Islands, northern most Phoenix Islands, and northern half of Line Islands), southeastern PNG, southern Solomon Islands, parts of Vanuatu, northern half of Fiji, northern Tonga, and part of southern Cook Islands. The rest of the region were observed with anomalies between +50 and +100mm.

Monthly Sea Level Anomalies

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

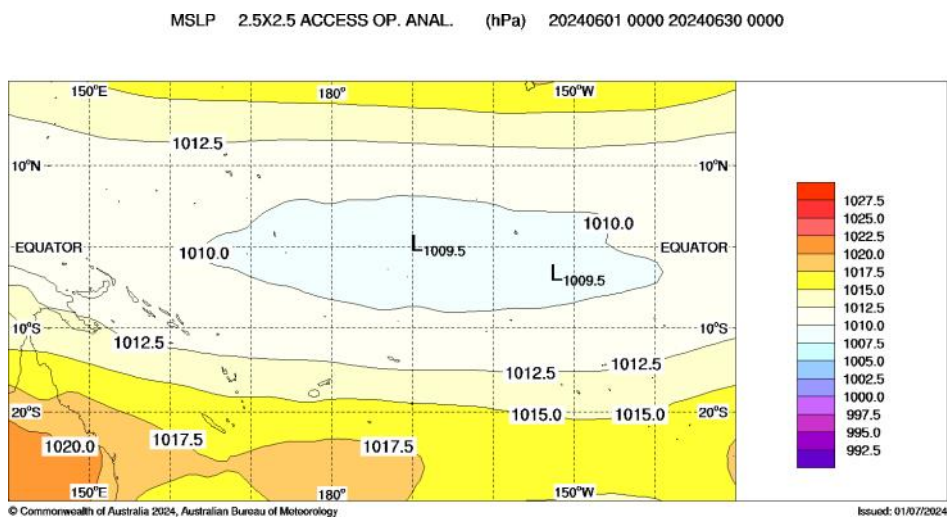


MEAN SEA LEVEL PRESSURE

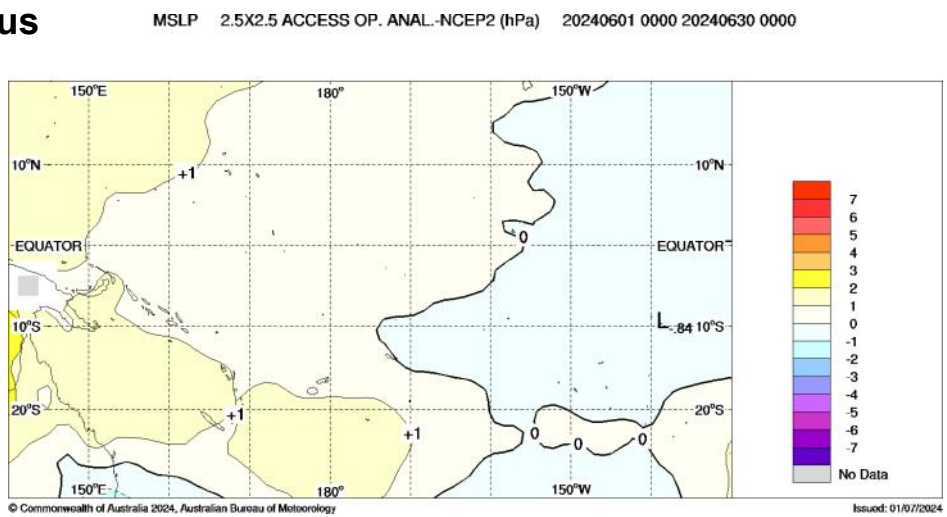
The June mean sea level pressure (MSLP) anomaly map displays positive anomalies of 1 hPa or greater over Palau, FSM, PNG, New Caledonia, Vanuatu, southern Fiji, and Tonga. Negative anomalies were observed over the tropical Pacific east of 160°W.

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

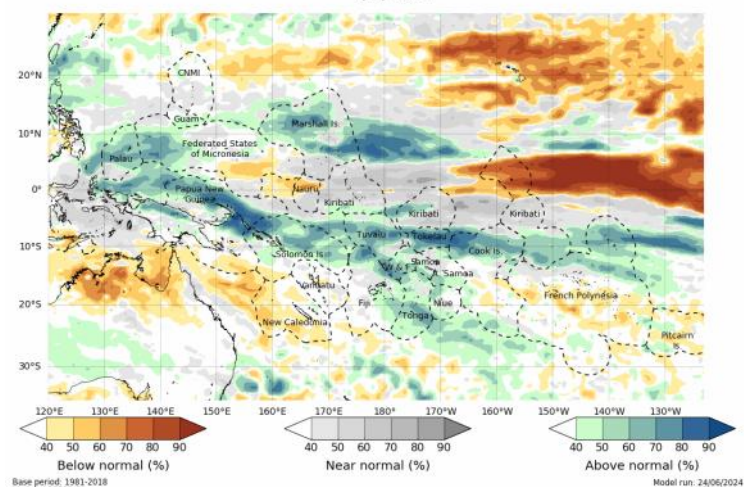
July—September 2024



The ACCESS-S model forecast for July 2024, shows above normal rainfall is likely or very likely for most of Palau, western FSM, most of Guam, northern and central RMI, northeastern PNG, Solomon Islands, Kiribati (far southwest Gilbert, central Phoenix, and southern Line Islands), northern and eastern Fiji, most of Tonga, Tuvalu, Tokelau, Wallis and Futuna, southern Samoa, southern American Samoa, northern and far southern Cook Islands, and northern French Polynesia. Below normal rainfall is likely or very likely for eastern FSM, northern Nauru, most of New Caledonia, Kiribati (northern Line Islands), central French Polynesia, and patches over Pitcairn Islands. .

The ACCESS-S three-month rainfall outlook (July to September 2024) is very similar to the July outlook, but with a stronger wet signal from Palau and western FSM extending southeast to the Cook Islands and northern French Polynesia. The below normal rainfall region in the southern hemisphere is weaker than in the monthly outlook, but it is stronger and more extensive in the northern hemisphere affecting CNMI, southeast FSM, Nauru, and Kiribati.

Monthly [ACCESS-S](#) Maps



The Copernicus multi-model outlook for July to September 2024 is very similar to the ACCESS-S outlook, but with a stronger equatorial dry signal from northern PNG islands, Nauru to Kiribati (Gilbert Is., northern Phoenix Is., and northern Line Is.). Another below normal rainfall region is predicted over Palau, northern FSM, Guam, CNMI and the northern fringes of RMI. The above normal rainfall signal is located a little further south in Copernicus compared with ACCESS-S.

The APEC Climate Centre multi-model outlook (July to September 2024) is similar to the other two models, but with a slightly weaker wet signal in the southern hemisphere.

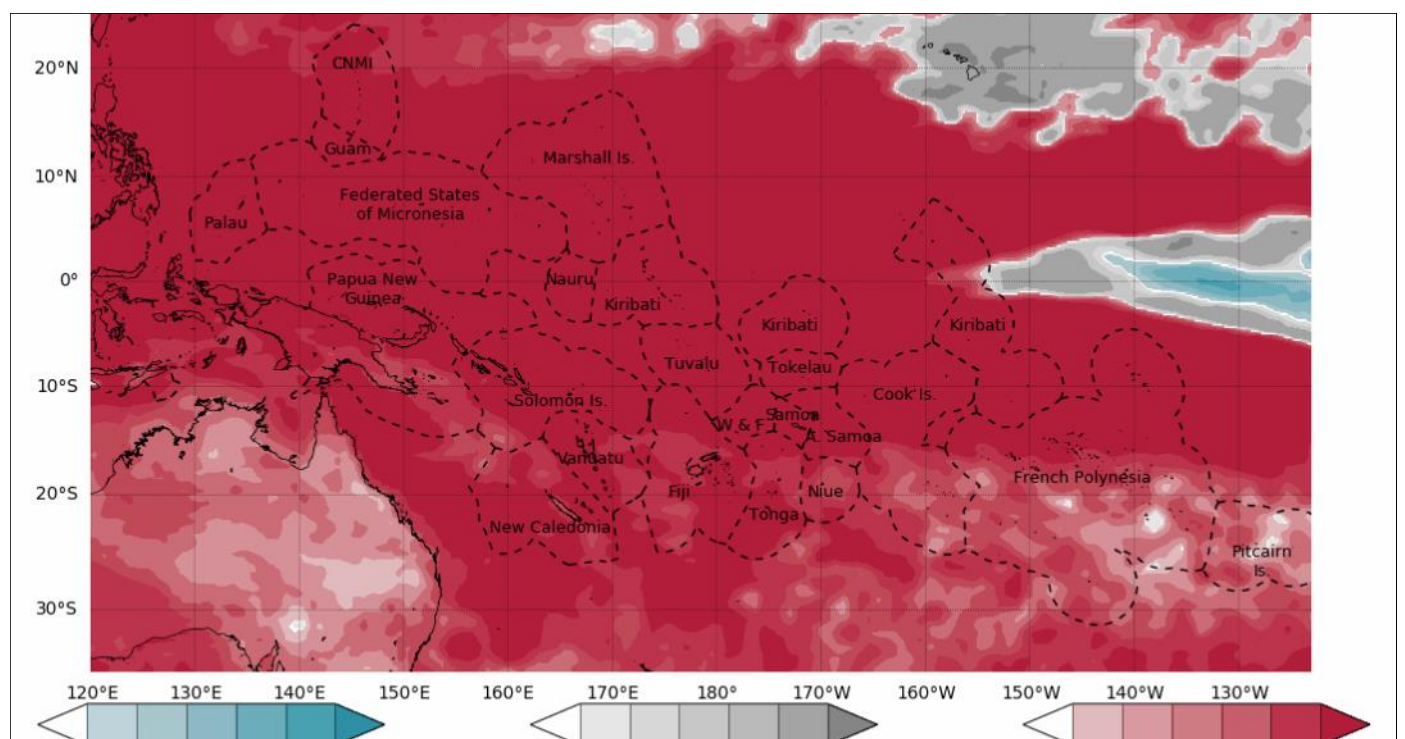
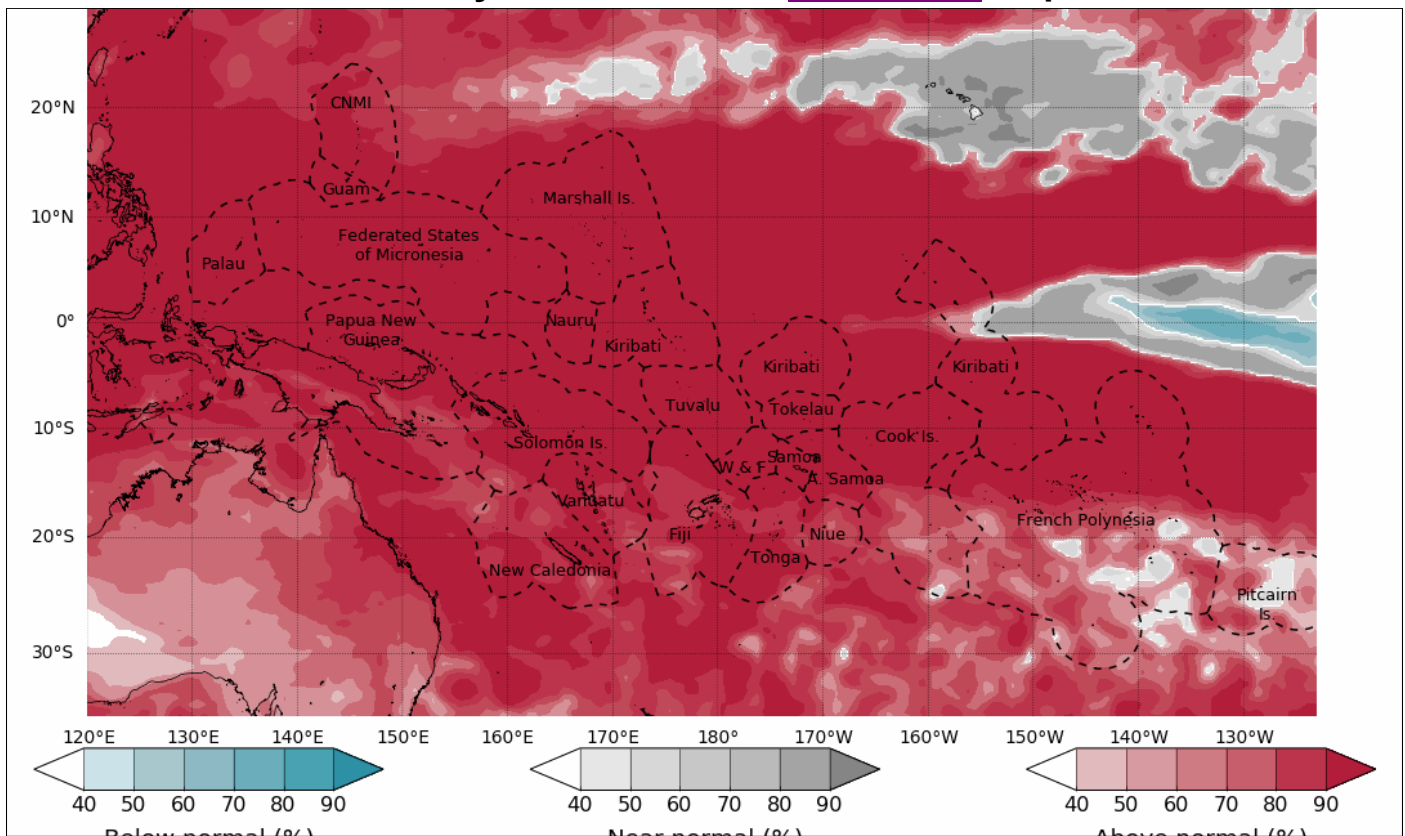
For July to September 2024 the models agree that above normal rainfall is likely or very likely for southern Palau, central RMI, most of PNG north of Milne Bay, most of Solomon Islands, northern Fiji, central and Tuvalu, Tokelau, Wallis and Futuna, Samoa, American Samoa, northern Cook Islands, and northwest French Polynesia. In addition, the models agree that below normal rainfall is likely or very likely for Guam, CNMI, northern Nauru, Kiribati (central Gilbert, patches of Phoenix, and northern Line Is.), southeast French Polynesia, and Pitcairn Islands.

SEASONAL TEMPERATURE OUTLOOK

July—September 2024



Monthly Tmax and Tmin [ACCESS-S](#) Maps



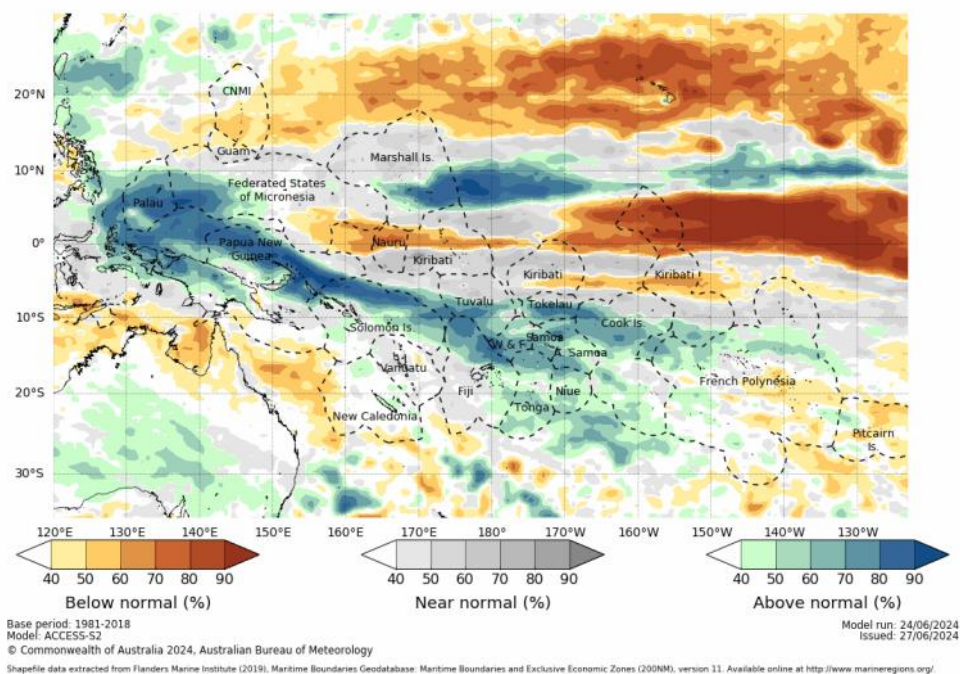
SEASONAL RAINFALL OUTLOOK

July—September 2024

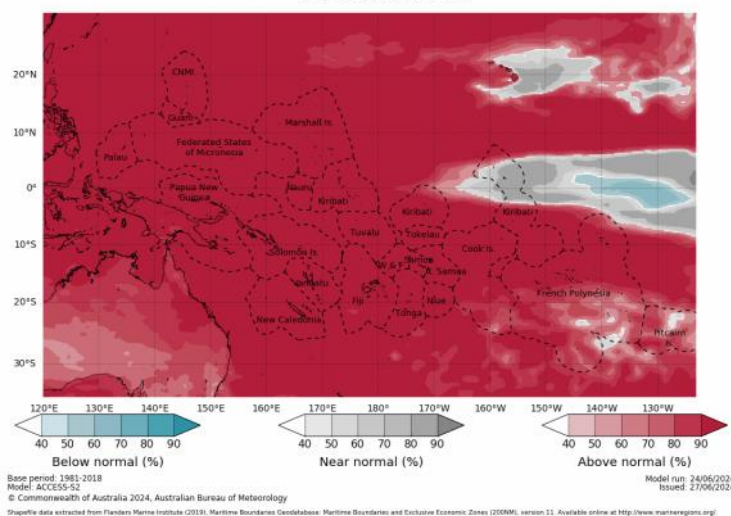


Seasonal ACCESS-S maps

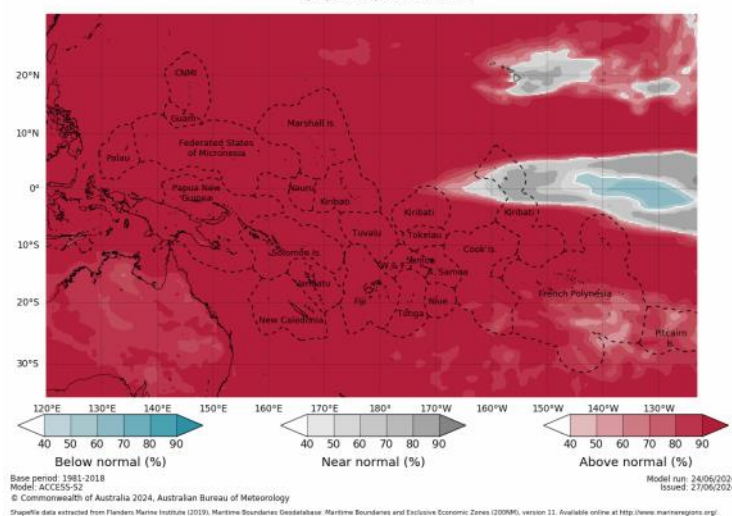
Tercile rainfall probabilities for
July to September 2024



Tercile maximum temperature probabilities for
July to September 2024



Tercile minimum temperature probabilities for
July to September 2024



'About ACCESS-S <http://access-s.climatecloud/>

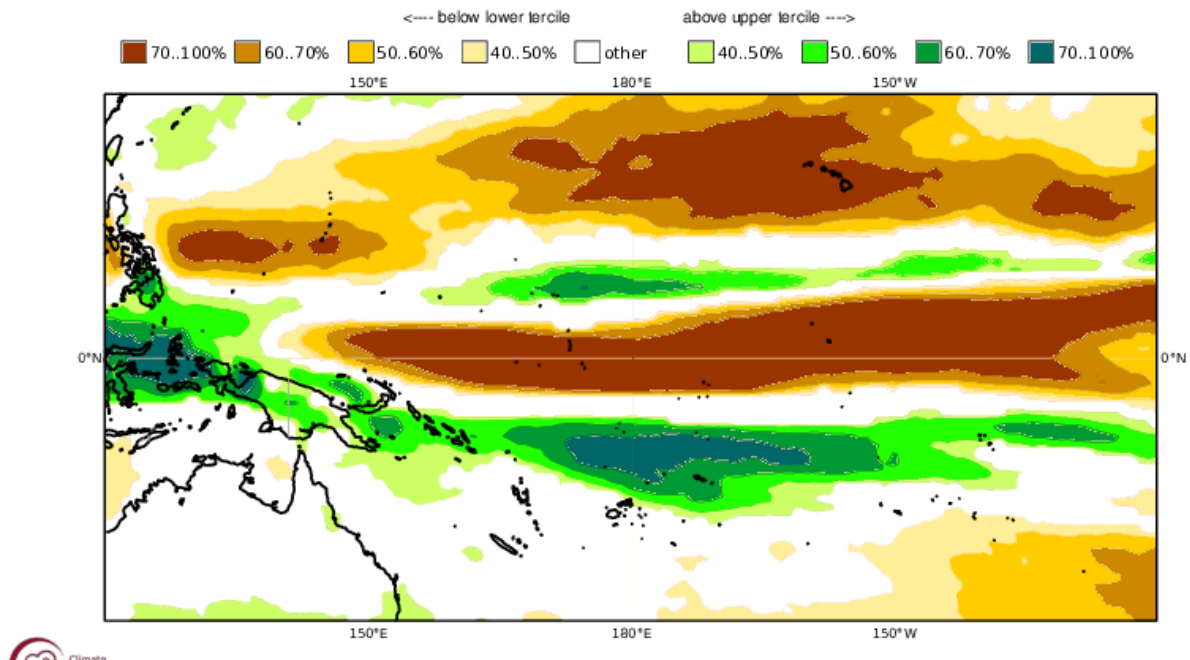
SEASONAL RAINFALL OUTLOOK

July—September 2024



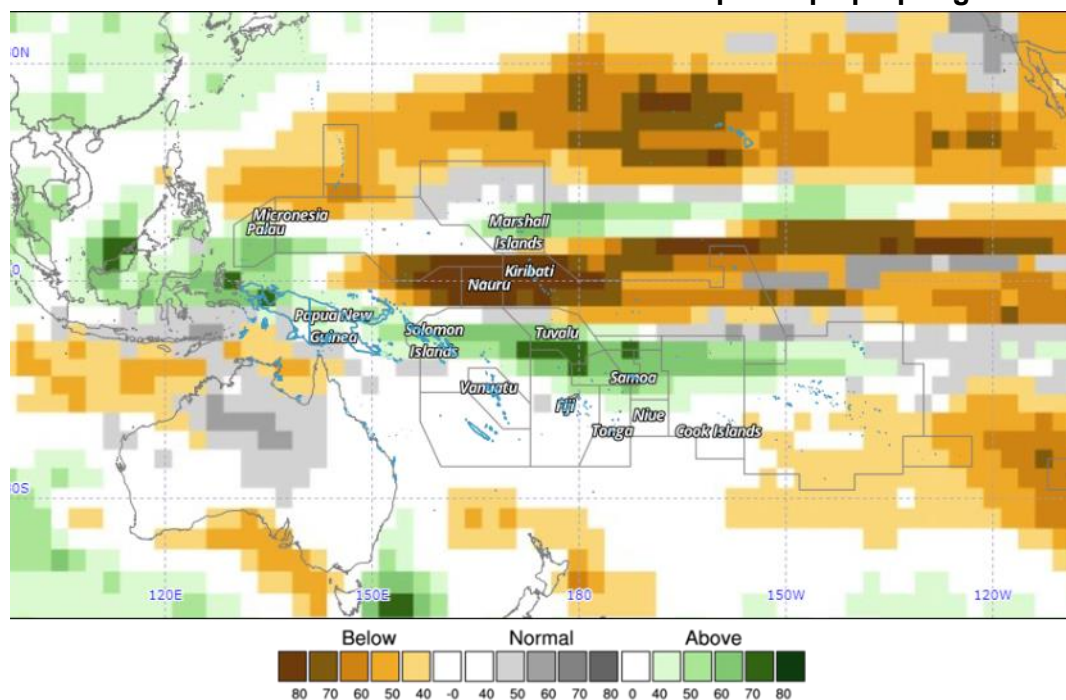
Copernicus (C3S multi-system)-Rainfall
 Prob(most likely category of precipitation)
 Nominal forecast start: 01/06/24
 Unweighted mean

JAS 2024



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

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



Year: 2024, Season: JAS, Lead Month: 3, Method: GAUS
 Model: BOM, CMCC, CWB, MSC, NASA, NCEP, PNU
 Generated using CLIKE (2024-7-11)

© APEC Climate Center

TROPICAL CYCLONE

2023/2024 Season



The northwest Pacific tropical cyclone season is year-round, with most cyclones occurring between May and December. In the WNP, the genesis and track of TCs show a relationship with the ENSO cycle: activity typically shifts eastward during El Niño and westward during La Niña. In the southwest Pacific, the 2023-24 tropical cyclone season officially started on 1 November 2023. Seven TCs (four severe) formed in the BOM forecast area (east of the tip of Cape York) with one of the seven occurring in the pre-season month of October 2023. This is below the long term (1981/82-present) average of nine in terms of total numbers. The long-term average for severe Category 3-5 events is four. Nine occurred in the NIWA seasonal outlook area (east of Darwin, five severe). The official season ended on 30 April 2024. There were fewer TCs than forecast in the eastern SW Pacific basin (east of 165 °E), while the western part of the basin experienced normal to reduced activity, as predicted. In the SW Pacific basin there has been a declining trend in the total number and severe TCs since 1981/82. The most recent season is consistent with trend. In 2023, the TC pattern in the WNP was unconventional for an El Niño year. TC activity was well below normal with a distribution that did not follow expectations for an El Niño year.

It's important to remember that history shows that tropical cyclones can happen outside the normal cyclone season, and 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, especially if the system is slow-moving. Communities should remain vigilant, and follow forecast information provided by their National Meteorological and Hydrological Service (NMHS).

The weekly tropical cyclone forecasts from the ACCESS-S model shows significantly increased risk over Palau, FSM, Guam, CNMI, Philippines and Japan for the week from 15 to 21 July, and an elevated risk over the Philippines, Guam and CNMI in the following week from 22 to 28 July.

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>

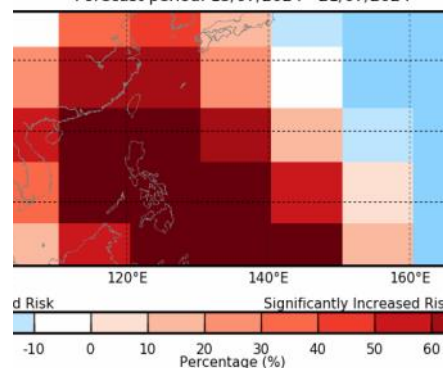
ECMWF Rain (Public charts) - Long range forecast: <http://www.ecmwf.int/en/forecasts/charts/seasonal/rain-public-charts-long-range-forecast>

POAMA Pacific Seasonal Prediction Portal: <http://poama.bom.gov.au/experimental/pasap/index.shtml>

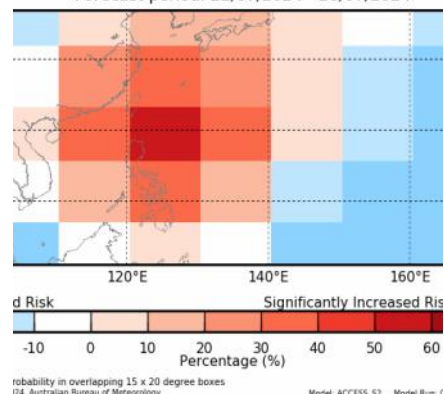
APEC Climate Center (APCC): <http://www.apcc21.org/eng/service/6mon/>

ACCESS-S Weekly Forecasts –Northwest Pacific

from normal chance of Tropical Cyclone's in the Nor
Forecast period: 15/07/2024 - 21/07/2024



from normal chance of Tropical Cyclone's in the Nor
Forecast period: 22/07/2024 - 28/07/2024



ACCESS-S Weekly Forecasts –Southwest Pacific

OUT OF SEASON

brated Tropical Cyclone outlc
are for November to April

OUT OF SEASON

alibrated Tropical Cyclone outlool
are for November to April

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.

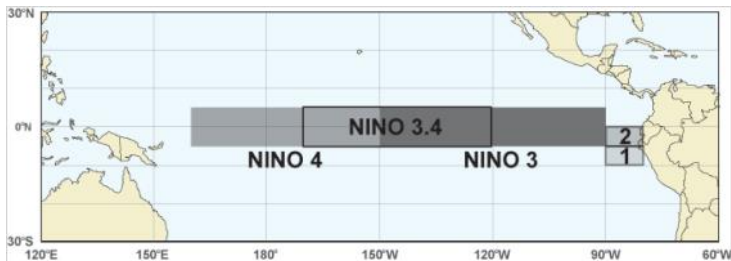
20 degrees Celsius Isotherm Depth

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