Number 72, September 2006

The Island Climate Update

August's climate

- South Pacific Convergence Zone (SPCZ) more active west of the Date Line
- Exceptionally high rainfall in parts of Niue
- Wet weather persists in the Southern Cook Islands and central French Polynesia
- Temperature: above average in Tonga and northern French Polynesia; below average in parts of New Caledonia

El Niño/Southern Oscillation (ENSO) and seasonal rainfall forecasts

- Weak warm ENSO event likely by the end of 2006
- Near or below average rainfall expected over New Caledonia and the Marquesas Islands
- Enhanced convection likely from the Solomon Islands to Western and Eastern Kiribati, and from the Southern Cook Islands eastwards to Pitcairn Island including Society and Austral Islands

Collaborators

Pacific Islands National Meteorological Services

Australian Bureau of Meteorology

Meteo France

NOAA National Weather Service

NOAA Climate Prediction Centre (CPC)

International Research Institute for Climate and Society

European Centre for Medium Range Weather Forecasts

UK Met Office

World Meteorological Organization

SOPAC

SPREP

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NIWA Taihoro Nukurangi

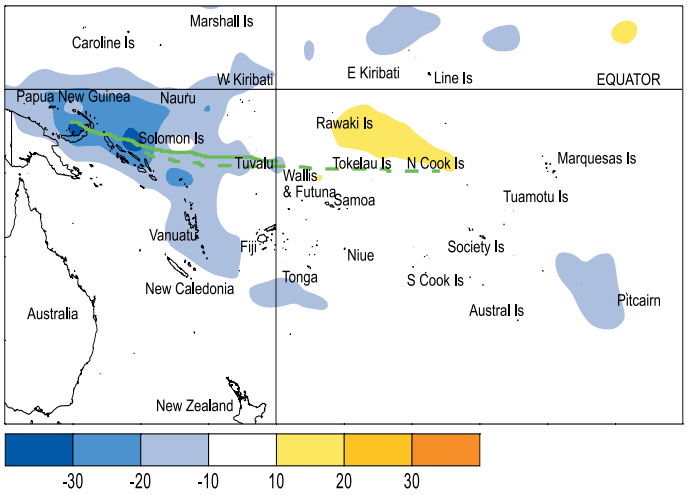
Climate developments in August 2006

During August, convection associated with the SPCZ has been concentrated in the region west of the Date Line; a pattern that has been evident since June 2006. This month much of the SPCZ activity occurred over the Solomon Islands. There were weak regions of enhanced convection over Vanuatu and Tuvalu. A region of weakly suppressed convection affected the Northern Cook Islands and region north of Tokelau.

Exceptionally high rainfall occurred in parts of Niue. Wet conditions persisted in the Southern Cook Islands and parts of central French Polynesia, where rainfall was 150 to 200% of average. Rainfall was near or above average in New Caledonia (much of the rainfall occurring at the start of August). There were 23 days with rainfall at Nausori Airport in Fiji. Rainfall was 75% or less of average throughout southern Tonga.

Mean air temperatures were about 1.0 ºC above average throughout much of Tonga, and about 0.5 ºC above average in northern French Polynesia. In contrast, they were about 0.5ºC or more below average in parts of New Caledonia,where it has been now been cooler than usual for three months.

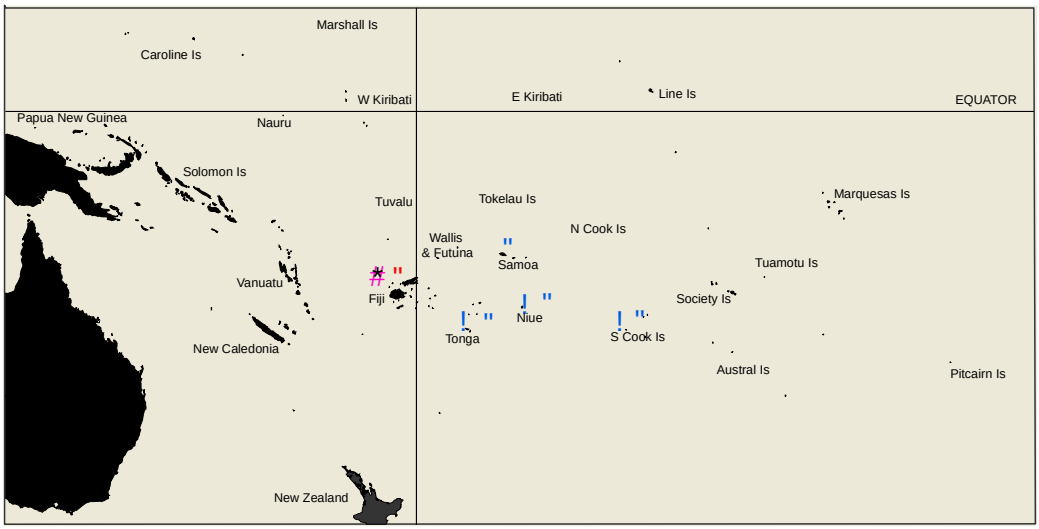
Tropical Southwest Pacific mean sea-level pressures were above average over Australia, but below average over much of the tropical region east of about Eastern Kiribati and Samoa. Equatorial surface westerlies occurred in 28% of observations at Tarawa, the highest frequency of occurrence there since 40% in February 2005.



Outgoing Long-wave Radiation (OLR) anomalies, in Wm^{-2} (blue equals high rainfall and yellow equals low rainfall). The August 2006 position of the SPCZ, as identified from total rainfall, is indicated by the solid green line. The average position of the SPCZ is identified by the dashed green line..

Country	Location	Rainfall (mm)	% of average	Comments
Niue	Liku	305	272	Highest
Australia	Townsville	Nil	0	Lowest
Tonga	Salote Pilolevu Airport	19	19	Well below average
Tuvalu	Funafuti	466	201	Well above average

Soil moisture in August 2006



Estimated soil moisture conditions at the end of August 2006, using monthly rainfall data.

Estimates of soil moisture shown in the map (above) are based on monthly rainfall for one station in each country. Currently there are not many sites in the water balance model. It is planned to include more stations in the future.

The information displayed is based on a simple water balance technique to determine soil moisture levels. Addition of moisture to available water already in the soil comes from rainfall with losses via evapotranspiration. Monthly rainfall and evapotranspiration are used to determine the soil moisture level and its changes.

Please note that these soil moisture calculations are made at the end of the month. For practical purposes, generalisations were made about the available water capacity of the soils at each site.

At the end of August 2006, Apia, Hanan Airport, Fua'motu and Rarotonga were at field capacity (full). Nadi soil moisture levels were moderate.

El Niño/Southern Oscillation (ENSO)

Current atmospheric and oceanic conditions in the equatorial Pacific Ocean are consistent with a developing phase of warm ENSO event. Monitoring of the atmospheric and oceanic ENSO indicators over next few months will be critical in defining this event.

There has been continued warming in the upper layers of the equatorial Pacific Ocean over the past three months. Equatorial Pacific sea surface temperature (SST) anomalies are now positive across the whole basin, with anomalies in excess of +1°C in places. The NINO3 SST anomaly for August was around +0.6°C (+0.5°C for June–August) and NINO4 was around +0.9°C (+0.7°C for June–August).

Subsurface temperatures show a more coherent structure of warm anomalies this month from the Date Line eastward centred at about 100m depth. The 5-day subsurface temperature ending 30 August 2006 has a warm anomaly exceeding +3°C at 100m depth from 145-115°W.

The Southern Oscillation Index (SOI) has remained consistently negative during the past 3 months, with a value of –1.8 for August, and -1.1 for the June–August mean. There have been significant westerly wind anomalies along the Equator in July and August, west of the Date Line.

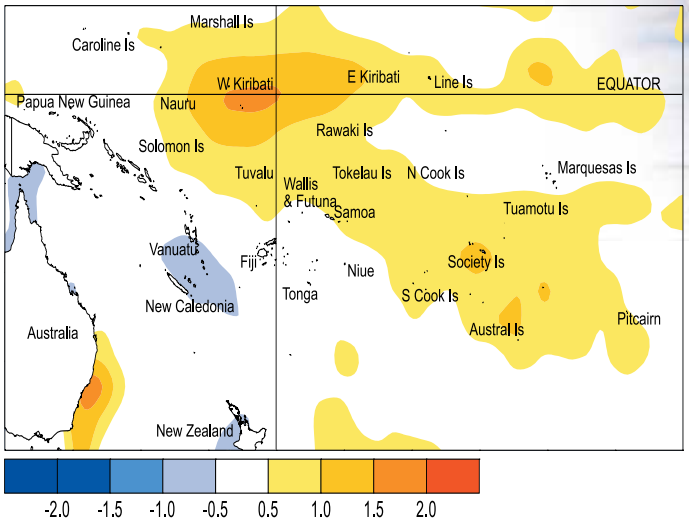
The Madden–Julian Oscillation (MJO) has not been very active of late, but the Australian Bureau of Meteorology suggests a gradual eastward movement of MJO-associated weather in the western Pacific in early September.

A number of models increase SST anomalies (NINO3.4) further to around +0.8°C or above by January 2007, but with an equally large group showing no warming trend, although with positive SST anomalies.

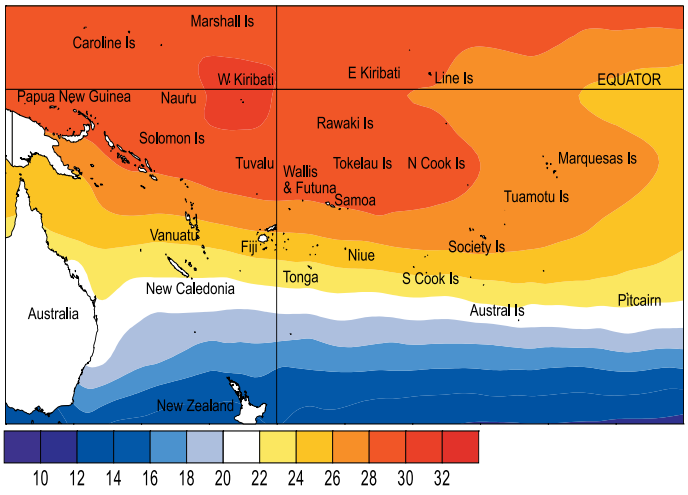
The UK Met Office and Scripps models are warm enough to qualify at the border of a weak El Niño for the coming season. Two of the models, ECMWF and NCEP/CFS, show substantially larger warming by the end of 2006 in their latest runs.

The NCEP synopsis is for weak El Niño conditions likely by the end of 2006.

The IRI (who have a higher threshold for an El Niño) indicate neutral ENSO conditions are favoured with a 60% likelihood



Sea surface temperature anomalies (°C) for August 2006.



Mean sea surface temperatures (°C) for August 2006.

for the remainder of 2006, and a 45% probability of El Niño by year-end. However, more recent model forecasts suggest that the probability of El Niño will be increased on the September outlook.

The Australian Bureau of Meteorology ENSO wrap-up (30-August) warns of an "increasing risk of an El Niño". They comment that most of the ENSO models will not have factored in the (warming) developments that have taken place during August, but also note that sustained warming from August is unusual climatologically, with El Niño events usually beginning to evolve between March and June.

Forecast validation: June to August 2006

A region of suppressed convection with below average rainfall was expected over Tuvalu, Tokelau, the Northern Cook Islands, and the Marquesas Islands. Near or below average rainfall was forecast for the Tuamotu Islands. A large region of enhanced convection and average or above average rainfall was expected to extend from Papua New Guinea southeast to the Austral Islands, including the Solomon Islands, Vanuatu, Samoa, Tonga, Niue, the Southern Cook Islands, and the Society Islands. Near average rainfall was expected elsewhere in the region.

Areas of enhanced convection or above average rainfall affected the region near Papua New Guinea and the Solomon Islands, as well the region from Niue to the Austral Islands, including the Southern Cook Islands and the Society Islands. Below average rainfall occurred over New Caledonia and the Northern Cook Islands. Rainfall was higher than expected in Tokelau and Northern French Polynesia, and lower than expected in New Caledonia and Vanuatu. Otherwise the overall rainfall anomaly pattern was similar to what was expected. The 'hit' rate for the June-August 2006 outlook was about 70%.

Tropical Pacific rainfall – August 2006

Territory and station name	August 2006 rainfall total (mm)	August 2006 percent of average
Australia		
Cairns Airport	14.4	53
Townsville Airport	0.0	0
Brisbane Airport	25.6	43
Sydney Airport	86.6	79
Cook Islands		
Rarotonga EWS	181.2	166
Fiji		
Rotuma	182.6	88
Udu Point	68.1	80
Nadi	104.4	161
Nausori	112.0	76
Ono-I-Lau	65.2	55
French Polynesia		
Hiva Hoa, Atuona	166.0	118
Bora Bora Motu	92.2	174
Tahiti - Faa'a	91.8	187
Tuamotu, Takaroa	113.2	183
Gambier, Rikitea	272.8	164
Tubuai	91.4	67
Rapa	182.0	75
New Zealand		
Kaitaia	121.5	80
Whangarei Airport	128.6	93
Auckland Airport	99.2	92
Niue		
Liku	305.1	272
Hanan Airport	185.0	187

Territory and station name	August 2006 rainfall total (mm)	August 2006 percent of average
New Caledonia		
Ile Art, Belep	45.2	85
Koumac	35.4	107
Ouloup	63.6	82
Ouanaham	94.2	131
La Roche	98.2	121
La Tontouta	69.6	134
Noumea	49.0	75
Moue	145.6	164
North Tasman		
Lord Howe Island	131.4	93
Norfolk Island	93.4	76
Raoul Island	93.6	73
Samoa		
Faleolo	214.4	133
Apia	149.1	134
Tonga		
Lupepau'u	37.1	42
Salote Airport	18.8	19
Fua'amotu Airport	89.5	72
Queen Lavinia	208.5	178
Niuatoputapu	53.4	55
Nuku'alofa	72.7	62
Tuvalu		
Nanumea	344.1	148
Nui Island	169.2	77
Funafuti	465.5	201
Nuilakita	174.0	88

Rainfall totalling 200 percent or more is considered well above average. Totals of 40 percent or less are normally well below average. Highlighted values are new records.

Data are published as received and may be subject to change after undergoing quality control checks.

Tropical rainfall outlook: September to November 2006

Most of the seasonal rainfall forecast models are depicting rainfall patterns which are consitent with a weak warm ENSO event for the coming three months.

A large region of enhanced convection is expected to extend from Western Kiribati eastwards to Pitcairn Island including Eastern Kiribati, the Solomon Islands, Samoa, the Southern Cook Islands, Society, and Austral Islands.

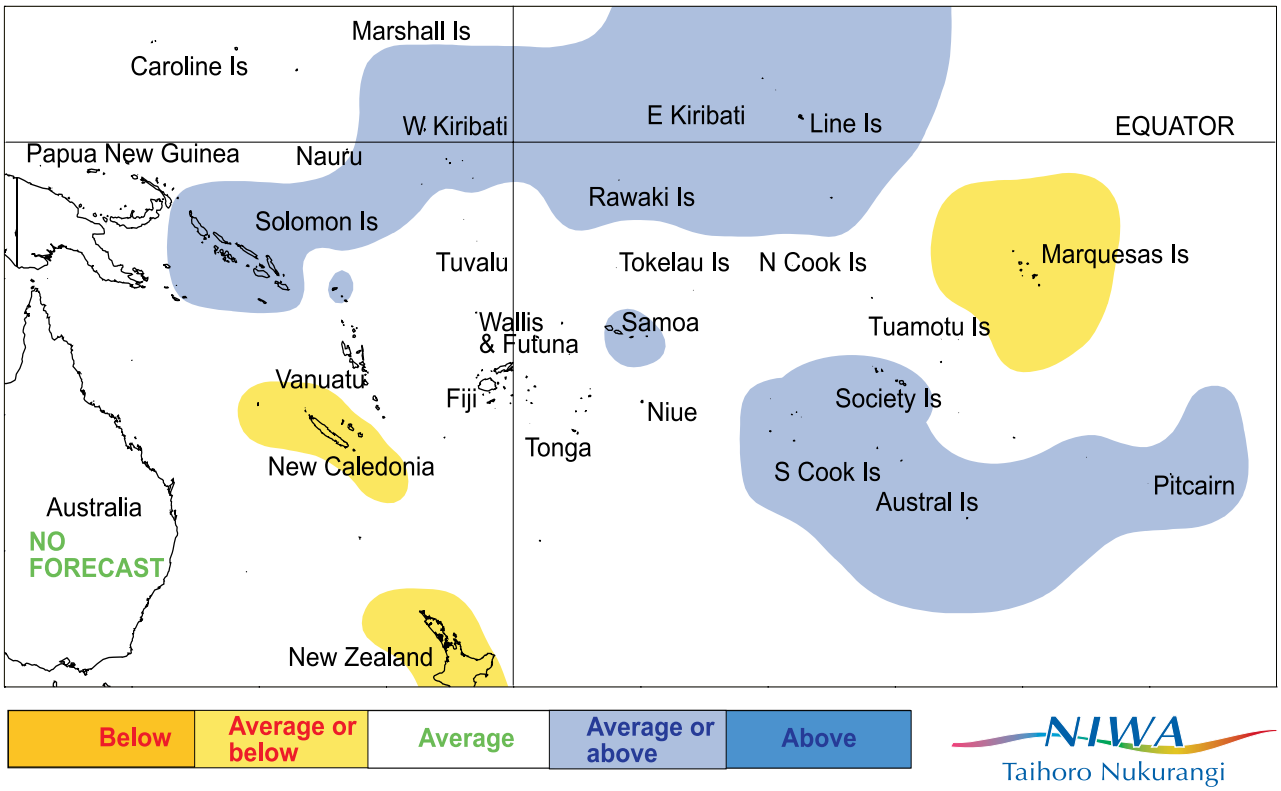
Suppressed convection with near or below average rainfall is likely over New Caledonia and the Marquesas Islands.

Near average rainfall is forecast for the rest of the countries in the region.

The forecast model skill is near moderate for most countries.

Island group	Rainfall outlook	Outlook confidence
Western Kiribati	15:40:45 (Near or above average)	Moderate
Eastern Kiribati	20:40:40 (Near or above average)	Moderate
Solomon Islands	15:40:45 (Near or above average)	Moderate
Samoa	20:40:40 (Near or above average)	Moderate
Southern Cook Islands	20:40:40 (Near or above average)	Moderate
Society Islands	20:40:40 (Near or above average)	Moderate
Austral Islands	20:40:40 (Near or above average)	Moderate
Pitcairn Island	20:40:40 (Near or above average)	Moderate
Papua New Guinea	25:45:30 (Near average)	Moderate
Vanuatu	25:45:30 (Near average)	Moderate
Tuvalu	35:40:25 (Near average)	Moderate
Wallis & Futuna	25:45:30 (Near average)	Moderate
Tokelau	30:45:25 (Near average)	Moderate
Northern Cook Islands	20:45:35 (Near average)	Moderate
Fiji	30:40:30 (Near average)	Moderate
Tonga	25:45:30 (Near average)	Moderate
Niue	25:45:30 (Near average)	Moderate
Tuamotu Islands	25:50:25 (Near average)	Low – moderate
New Caledonia	40:40:20 (Near or below average)	Moderate – high
Marquesas Islands	40:40:20 (Near or below average)	Moderate

NOTE: Rainfall estimates for Pacific Islands for the next three months are given in the table. The tercile probabilities (e.g., 20:30:50) are derived from the interpretation of several global climate models. They correspond to the odds of the observed rainfall being in the lowest (driest) one third of the rainfall distribution, the middle one third, or the highest (wettest) one third of the distribution. On the long-term average, rainfall is equally likely (33% chance) in any tercile.



Rainfall outlook map for September to November 2006.

Review of Recent Tropical Cyclone Climatological Research

Howard J. Diamond, NOAA/National Climatic Data Center and the University of Auckland

Averaged across all global ocean basins, the tropical cyclone (TC) season of 2005 saw an above normal (1981-2000 base) number of tropical storms, but fewer hurricanes/typhoons/cyclones (HTC) or major HTCs than average. Globally, 103 tropical storms (> 33 kt) were recorded, with 53 becoming HTCs, and just 28 attaining major/intense (> 95 kt) status, compared to an average of 97.25, 55, and 25.35 storms respectively (Diamond, 2006)[1]. While the Atlantic had its all time busiest season ever with 28 total storms, the other basins were characterized by near normal to below normal levels of activity. A question for all basins, including the Southwest Pacific, is, have TCs increased in number, accompanied by a possible increase in the intensity and duration of the storms? TCs require an ocean temperature of 26º C and above to sustain their formation, and increased global sea surface temperatures coupled with an increase in lower tropospheric water vapour, provide the necessary dynamic for increased intensity of TCs, (Trenberth, 2005). In essence, a new science has been created to assess whether TC activity has increased as a result global warming (Kerr, 2006), and some the results of studies on trends are now starting to be published (Klotzbach, 2006).

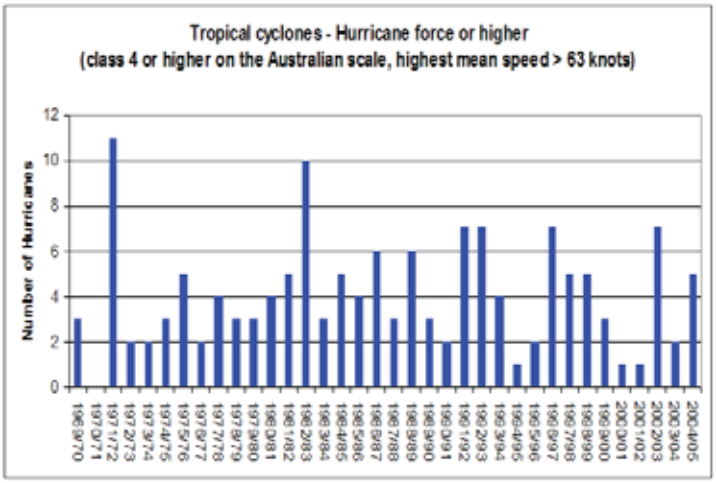


Figure 1. Tropical Cylone intensity in the South West Pacific

It is possible that an increase in TC frequency and intensity may be occurring (Webster, et al., 2005); and TCs may be more destructive due to possible increases in storm life (Emanuel, 2005). A few examples in the Southwest Pacific include the 2005 season in which five TCs struck the Cook Islands, and the very severe events of TC Waka which struck Tonga in 2002 and TC Heta which struck Niue in 2004. However, for the Southwest Pacific there is no discernible increase in frequency or intensity over the period of satellite monitoring (1970 – 2006). Another factor to consider is the quality of the data itself, and recent TC activity may be equal or even greater to that during the last active period in the mid-20th Century (Landsea, 2005). Determining trends in TC intensity is more complicated simply because there are many possible metrics of intensity (e.g., maximum potential intensity, average intensity, average storm lifetime, average wind speed, maximum sustained wind speed, maximum wind gust, accumulated cyclone energy, power dissipation), that have not been closely studied from the standpoint of historical trends due to data limitations (Pielke, 2005).

Two distinct, active, and intense schools of thought have emerged related to TC climatology, and for lack of a better nomenclature I have named them after the most prominent authors of papers representing each school of thought. The Emanuel/Trenberth/Webster school focuses primarily on how global warming, as manifested in increased Sea Surface Temperatures, over the past few decades has modified or increased the intensity of TCs. While, the Gray/Landsea/Pielke school, attributes natural variability associated with TCs independent of global warming, along the dearth of reliable historic global or basin scale data to explain the present situation.

The number of storms as well as the number of strong Category 4/5 storms[2] appears to be on the increase. However, there is also greatly improved monitoring and satellite data analyses over the past few years. Re-analyses of older satellite data from the 1960s and 1970s shows that past TCs in the Indian Ocean for example, were categorised at a lower level, and would now be upgraded, thus boosting levels of extreme TCs in the 1970s and 1980s to those levels seen more recently (Landsea, et. al., 2006). The 28 TCs in the Atlantic in 2005 was an all-time record, breaking the previous mark of 21 set in 1933. However, without any satellite data it is very possible that there may have been more than 21 storms in 1933, as well as in some other years before the period of satellite coverage, but they likely were just not identified. As such, it is interesting to note that the 28th storm of the 2005 Atlantic season was not discovered until April 2006 (6 months after it occurred) by a reanalysis of the satellite data from the season. It will be interesting to see how this research progresses, and what affect the results will have on the Southwest Pacific; the author will continue to monitor and provide updates on new developments as appropriate.

1 See http://www.ncdc.noaa.gov/oa/usgcos/ICUReferences.pdf
2 See http://www.ncdc.noaa.gov/oa/usgcos/Saffir-Simpson.pdf

The Island Climate Update

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Sources of South Pacific rainfall data
This bulletin is a multi-national project, with important collaboration from the following Meteorological Services:

American Samoa, Australia, Cook Islands, Fiji, French Polynesia, Kiribati, New Caledonia, New Zealand, Niue, Papua New Guinea, Pitcairn Island, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu

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This summary is prepared as soon as possible following the end of the month, once the data and information are received from the Pacific Island National Meteorological Services (NMHS). Delays in data collection and communication occasionally arise. While every effort is made to verify observational data, NIWA does not guarantee the accuracy and reliability of the analysis and forecast information presented, and accepts no liability for any losses incurred through the use of this bulletin and its content.

Requests for Pacific Island climate data should be directed to the Meteorological Services concerned.