Number 91, April 2008

The Island Climate Update

March's climate

- South Pacific Convergence Zone (SPCZ) extends from Coral Sea towards New Caledonia and Vanuatu, and is displaced well southwest of normal.
- Suppressed convection exists from Western Kiribati to Eastern Kiribati and about the Equator with low rainfall, especially near Nauru.
- Below normal rainfall for several stations in Fiji, the Northern Cook Islands, and in parts of Australia, but very high rainfall in New Caledonia, and record high rainfall in Niue.

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

- The strong La Niña episode present in the Pacific has reached maturity, and is deteriorating. The event is expected to persist into the Southern Hemisphere winter.
- Average or below average rainfall is very likely along the equatorial Pacific from Western Kiribati to Eastern Kiribati, including Tuvalu, the Northern Cook Islands, Tuamotu, and the Marquesas. Near or below average rainfall is forecast for the Solomon Islands. Average rainfall is likely for Papua New Guinea, the Southern Cook Islands, the Society Islands, Pitcairn Island, and Samoa.
- Enhanced convection is likely to continue along a southwest displaced SPCZ, with average or above average rainfall for Vanuatu, New Caledonia, the Austral Islands, Fiji, and Niue.

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

MetService of New Zealand

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Climate developments in March 2008

The South Pacific Convergence Zone (SPCZ) extended from Vanuatu and New Caledonia eastward across Tonga and Fiji to the Southern Cook Islands, with an overall displaced position further south and west than normal for March. A large region of very suppressed convection persisted along the Equator extending from Western to Eastern Kiribati and included Tuvalu, the Northern Cook Islands, Tuamotu, and the Marquesas Islands. Rainfall was well below average in Nauru.

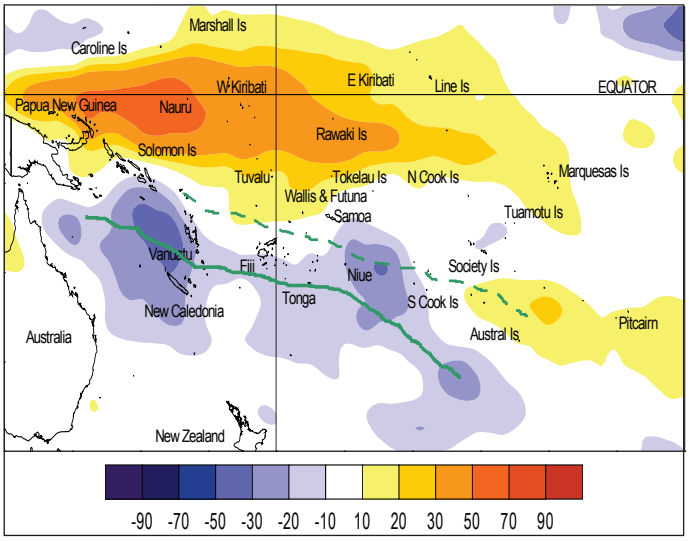
Rainfall was well above average in parts of New Caledonia, and Vanuatu as a result of a southwest-displaced SPCZ. New high monthly rainfall totals were recorded for Niue, while Aneityum, Vanuatu recorded one of the highest rainfall readings for March in the last six years (507.1 mm). New Caledonia also reported an east coast station average rainfall of 180 % from normal, with rainfall exceeding 1 meter in the mountains.

In contrast, March rainfall was near or below normal over much of Kiribati, French Polynesia, the Northern Cook Islands, the Austral Islands and the Marquesas. Rainfall has been below average for each of the past 10 months in Kiribati. Suva, Fiji experienced the third driest month ever recorded in the instrumental period, with monthly rainfall totals between 25 – 75% normal. A near-record low rainfall was also recorded at Townsville, Australia.

Country	Location	Rainfall (mm)	% of avg	Comments
Niue	Hanan Airport	364.3	174	Record high
Niue	Liku	368.1	161	Record high
Australia	Townsville	1.8	1	Extremely low
New Caledonia	La Roche	420.8	178	High
Fiji	Nausori	134.1	145	High

Australia also experienced heatwave conditions in March, with six consecutive days >39 ºC in Melbourne, and 15 consecutive days >35 ºC in Adelaide. March mean air temperatures were above average in New Zealand, and were 0.5 ºC or more above normal in New Caledonia and Fiji.

Tropical Southwest Pacific mean sea-level pressures were below average in the north Tasman Sea and to the west of New Caledonia. This pressure pattern produced more north easterlies with abundant rain into northern New Zealand, and heavy rainfall in New Caledonia and parts of northeastern Australia.



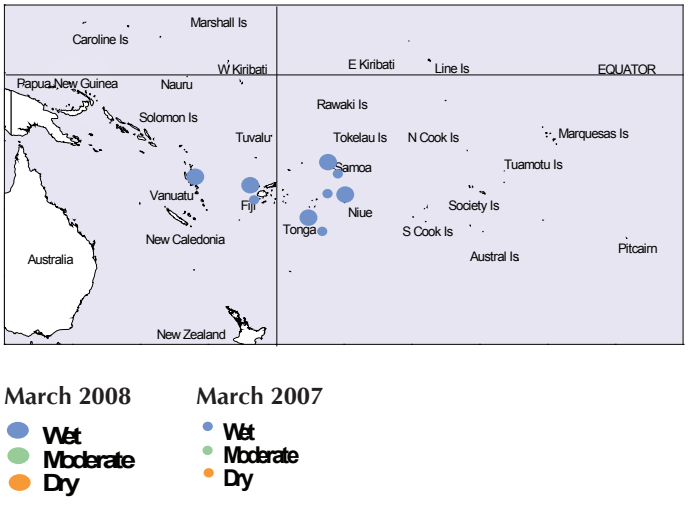
Outgoing Long-wave Radiation (OLR) anomalies, in Wm^2 are represented by hatched areas. High radiation levels (yellow) are typically associated with clearer skies and lower rainfall, while cloudy conditions lower the OLR (blue) and typically results in higher rainfalls. The March 2008 position of the South Pacific Convergence Zone (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.

Soil moisture in March 2008

Estimates of soil moisture shown in the map (right) are based on monthly rainfall for one station in each country. Currently there are not many sites in the water balance model, but 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 the 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 were made at the end of the month, and for practical purposes, generalisations were made about the available water capacity of the soils at each site.

French Polynesia reports important soil moisture deficits equal to or greater than – 50 % exist at multiple sites. Soils continued to be moist (at field capacity) for the time of year at Nadi (Fiji), Hanan Airport (Niue), and in Tonga.



Estimated soil moisture conditions at the end of March 2008, using monthly rainfall data.

El Niño/Southern Oscillation (ENSO)

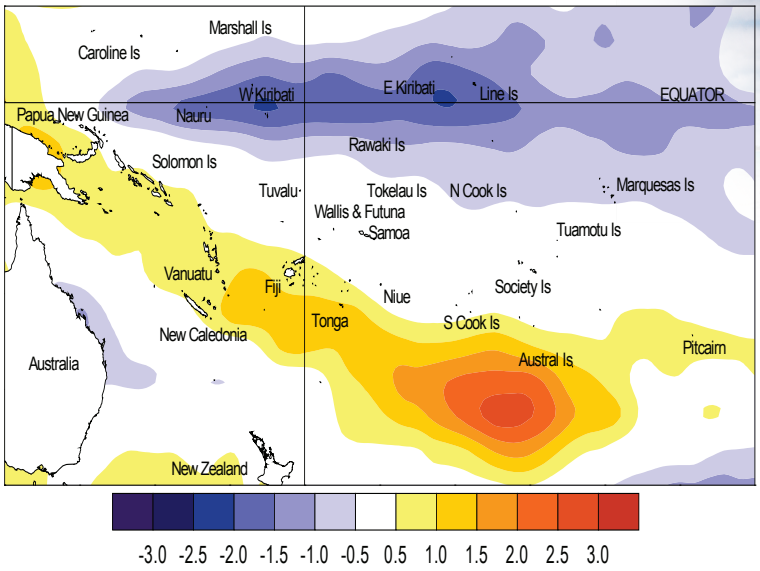
During March, the La Niña event that persisted from previous months has reached maturity, and is now showing signs of weakening. The Southern Oscillation Index (SOI) decreased markedly this past month, indicating deterioration of the event is underway.

Below normal sea surface temperatures (SSTs) extend across most of the equatorial Pacific, with anomalies of –1.0 °C or lower over the central equatorial region (Date Line to 120 °W, approximately). The oceanic component of La Niña has lost strength over the last few weeks as indicated by the weakening of the cold anomalies and the strengthening of a significant warm anomaly along the South American Coast. The NINO3 anomaly has weakened to –0.4 °C in March (down from –1.5 °C in February) and NINO4 was –1.4 °C (down from –1.6 °C). In the equatorial subsurface Pacific Ocean, the east-west dipole is still evident in the temperature anomalies but the cold pool near the South American coast has contracted considerably since last month due to the presence of warmer surface waters along the South American coast. The 0–300m heat content west of the Date Line has increased further since February.

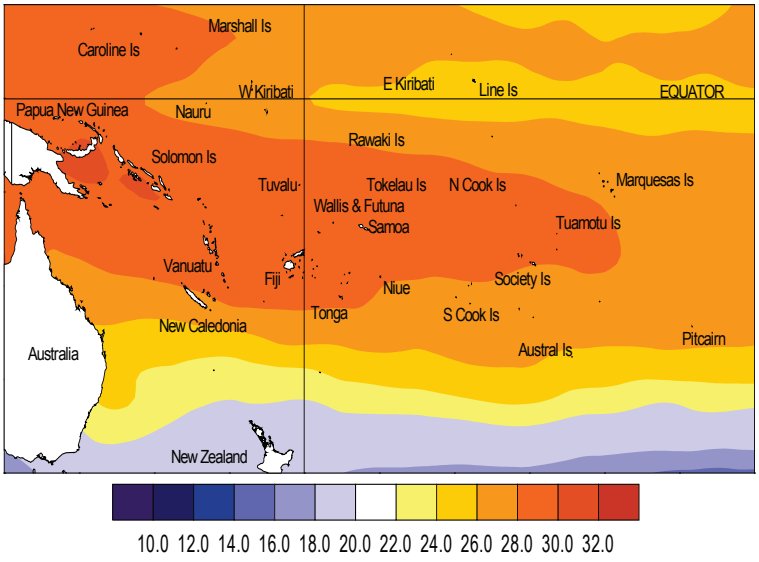
The trade winds have remained enhanced in March west of the Date Line along the equatorial Pacific, and have all but disappeared near the South American coast. The SOI dropped during March to +1.1 (down from +2.1 in February).

OLR anomalies show an east-west dipole with enhanced convection over Indonesia and suppressed convection from the near Papua New Guinea to east of the Date Line. The region of enhanced convection that was in the western Pacific has continued to shift westward and intensified during the past month. The SPCZ has shifted well to the southwest of its normal position.

The TRMM ENSO precipitation index was –1.3 in March. A moderate MJO episode is evident near Indonesia and is expected to spread into the equatorial Pacific in mid-to-late April.



Sea surface temperature anomalies (ºC) for March 2008



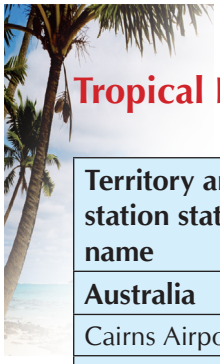
Mean sea surface temperatures (ºC) for March 2008

Most models indicate La Niña conditions easing to neutral by the end of austral winter. The NCEP discussion (of 6 March) indicates La Niña is likely to continue through April–June (though "weaker"). Some of the models suggest La Niña could continue into spring. The IRI synthesis (19 March) suggests a weakening of La Niña conditions during 2008 and a 50% chance of neutral conditions towards the latter part of 2008.

Forecast validation: January to March 2008

A La Niña-like pattern was expected, with a large region of suppressed convection along the equator from Western Kiribati, including Tuvalu the Northern Cook Islands, the Marquesas, Tuamotu, and the Society Islands. Near average or below average rainfall was expected for the Solomon Islands and Tokelau. Enhanced convection was anticipated along a southwest-displaced SPCZ extending from Vanuatu and New Caledonia eastward across Fiji, Wallis & Futuna, Niue, Pitcairn Island, and the Southern Cook and Austral Islands, where average or above average rainfall was expected.

The rainfall outlook for the January– March 2008 period was very similar to what was forecast, the 'hit' rate being 68%. Rainfall was lower than expected in northern New Zealand, and Tokelau, and higher than expected in Samoa.



Tropical Pacific rainfall – March 2008

Territory and station station name	March 2008 rainfall total (mm)	March 2008 percent of average
Australia		
Cairns Airport	793.2	177
Townsville Airport	1.8	1
Brisbane Airport	41.8	30
Sydney Airport	63.4	49
Cook Islands		
Penrhyn	217.4	70
Aitutaki	63	32
Rarotonga Airport	253.3	149
Rarotonga EWS		
Fiji		
Rotuma Island	173.1	47
Udu Point	82.7	26
Nadi Airport	258.3	76
Nausori	134.1	35
French Polynesia		
Hiva Hoa, Atuona	90	46
Bora Bora	114.2	64
Tahiti – Faa'a	56.4	32
Tuamotu, Takaroa	127.4	91
Gambier, Rikitea	175	104
Tubuai	82.6	49
Rapa	100.8	37
Kiribati		
Tarawa		
Kanton*	7.8	
New Zealand		
Kaitaia	113.3	149
Whangarei Airport	67	53
Auckland Airport	31	38
New Caledonia		
Ile Art, Belep	348.2	149
Koumac	359	238
Ouloup	139.6	70
Ouanaham	462.4	193
Poindimie	576.2	144
La Roche	420.8	178
La Tontouta	211.4	159
Noumea	343	230
Moue	441.2	201

Territory and station station name	March 2008 rainfall total (mm)	March 2008 percent of average
Niue		
Hanan Airport	364.3	174
Liku	368.1	161
North Tasman		
Lord Howe Island	77.8	63
Norfolk Island	77.8	71
Raoul Island*	52.4	
Samoa		
Apia	494.9	139
Faleolo Airport	145.2	55
Nafanua	603	
Afiamalu	444.4	
Maota	146.7	
Tonga		
Niuafoo'o	166.2	55
Mata'aho Airport	96.1	32
Lupepau'u	229.6	77
Salote Airport	317.3	139
Nuku'alofa	312	151
Fua'motu Airport	273.5	147
Tuvalu		
Nanumea		
Nui Island	254.4	72
Funafuti	271.6	72
Nuilakita*		
Vanuatu		
Sola	199.7	49
Pekoa	203.9	60
Lamap	213.3	76
Port Vila	284.8	87
Tanna/Whitegrass	284.8	
Bauerfield	351.9	111
Aneityum	507.1	150

Rainfall totalling 200% or more is considered well above average. Totals of 40% 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. * denotes synoptic values.

Tropical rainfall outlook: April to June 2008

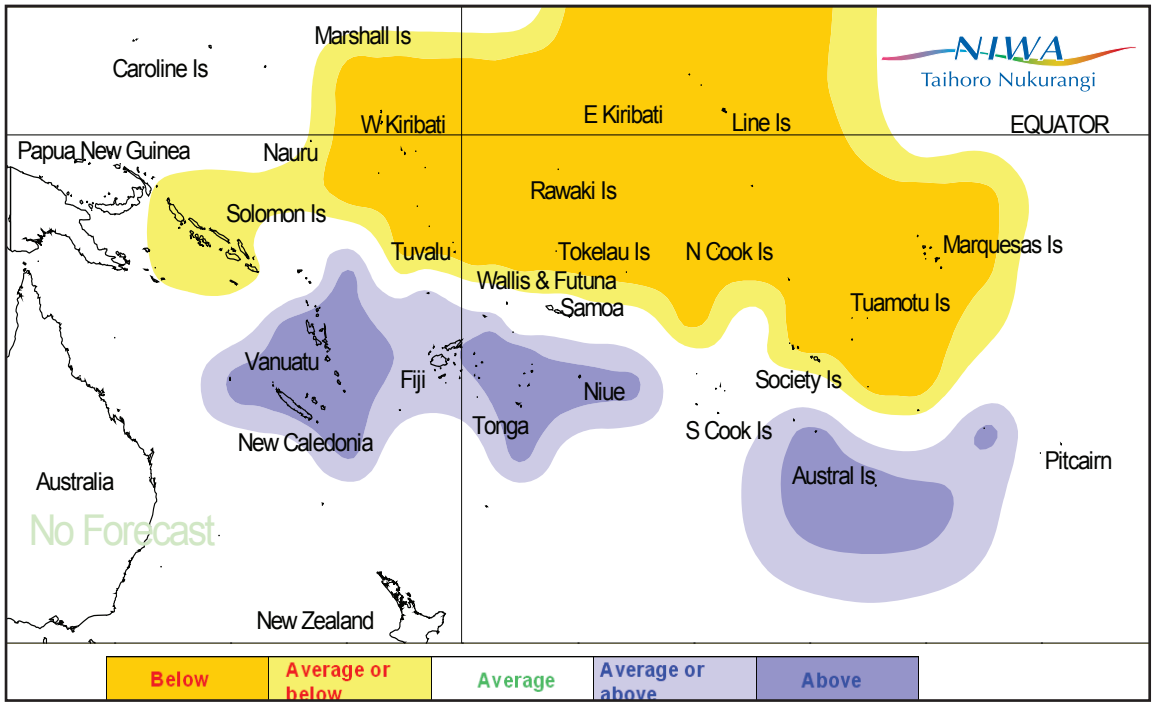
La Niña conditions are still very likely to influence rainfall patterns during this period. A large area of suppressed convection is very likely along the equatorial Pacific from Western Kiribati to Eastern Kiribati, including Tuvalu, the Northern Cook Islands, Tuamotu, and the Marquesas Islands. Near or below average rainfall is likely for the Solomon Islands, while average rainfall is likely for Papua New Guinea, the Southern Cook Islands, the Society Islands, Pitcairn Island, and Samoa.

Enhanced convection is likely from Vanuatu through to the Austral Islands of French Polynesia, including New Caledonia, Fiji, and Niue, which are expected to receive near or above average rainfall.

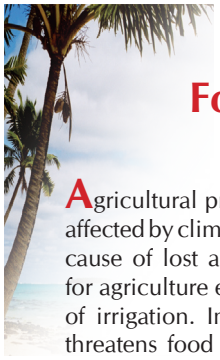
The confidence in the forecast model skill for this seasonal outlook is moderate to moderately high for most Pacific Island countries. In the past, the average region-wide hit rate for forecasts issued in April is 55%, 5% lower than the long term average for all months combined.

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 outputs 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.

Island Group	Rainfall Outlook	Outlook confidence
Vanuatu	10:25:65 (Above)	Moderate-High
Niue	15:30:55 (Above)	Moderate-High
Tonga	15:30:55 (Above)	Moderate-High
New Caledonia	15:35:50 (Above)	Moderate-High
Austral Islands	15:35:50 (Above)	Moderate-High
Fiji	15:40:45 (Near or Above)	Moderate-High
Papua New Guinea	30:35:35 (Near normal)	Moderate-High
Cook Islands (Southern)	35:35:30 (Near normal)	Moderate
Society Islands	30:40:30 (Near normal)	Moderate-High
Pitcairn Island	35:35:30 (Near normal)	Moderate-High
Samoa	35:35:30 (Near normal)	Moderate-High
Wallis & Futuna	40:35:25 (Near normal)	Moderate-High
Solomon Islands	45:30:25 (Near or Below)	Moderate
Cook Islands (Northern)	50:30:20 (Below)	Moderate
Tokelau	50:30:20 (Below)	Moderate
Tuamotu Islands	50:30:20 (Below)	Moderate-High
Kiribati (Eastern)	55:25:20 (Below)	Moderate
Kiribati (Western)	55:25:20 (Below)	Moderate
Marquesas	55:25:20 (Below)	Moderate
Tuvalu	55:30:15 (Below)	Moderate-High



Rainfall outlook map for April to June 2008



Food security, health, and climate change in the South Pacific

Dr. Jon Barnett, Australian Research Council Fellow, University of Melbourne

Agricultural production in Pacific Islands is likely to be adversely affected by climate change in several ways. Cyclones are a significant cause of lost agricultural production. Drought presents problems for agriculture everywhere in the region, particularly given the lack of irrigation. Increased risk of flooding in river catchments also threatens food production. Increasingly extreme rainfall, coupled with ongoing deforestation and longer dry spells, may all impact on soil fertility. Effects of climate change on critical infrastructure may also undermine both subsistence and commercial agriculture. Storm and cyclone damage to equipment for processing and storing food, and to roads, rail and vehicles, can upset the effective supply of food and goods to markets, and thus threaten the livelihoods of rural growers. Large-scale economic changes can also undermine food production.

Changes in agriculture practice

Traditionally Pacific Island communities have grown multiple crops, an agricultural practice that gave resilience to the food supply as not all crops were affected by specific hazards such as droughts or cyclones. However, greater penetration of international markets and development assistance of various kinds, as well as increased urbanisation (and some decreases in security of land tenure) have weakened the diversity and intensity of local production in many areas. Shifts towards modern agricultural economies and more affluent industrial societies have failed to deliver the resilient agricultural and food systems which developed countries enjoy. If anything, they have weakened traditional agricultural systems. Repeated efforts to develop monocultural cash crops, combined with the effects of the cash economy and penetration of markets by often cheaper but less healthy foods, have weakened the diversity and intensity of local production in many places. This has caused greater dependence on the market for food, less resilience of food supply to hazards (given low incomes and relatively high food prices), and a 'nutrition transition' associated with increased rates of obesity and cardiovascular disease in the region.

Health effects

In most Pacific Island countries people are relatively healthy. But there are problems of under-nutrition in parts of Melanesia and some of the more remote islands in several countries. Diarrhoea and other waterborne diseases such as cholera are serious problems in some islands and in urban areas. Incidences of ciguatera (fish poisoning) appear to be increasing. Climate change may extend the spread of malaria and dengue fever as factors that encourage the breeding of mosquitoes that carry these diseases are influenced by climate. Warming in Papua New Guinea, for example, is likely to cause a contraction of the cooler malaria-free zone in the highlands. Heat stress, and increased injuries and deaths from extreme events are other likely results. With health services in most Pacific Island countries already ill equipped and struggling to cope with existing health problems, it's unlikely there will be capacity to adequately respond to any increased health burden caused by climate change.

A food market in Niue, October 2006 (Photo: Jon Barnett).

What does the future hold?

Many rural Pacific Islanders combine selling products or labour for cash, and gardening, fishing and sometimes hunting, to meet their food needs. Such diversity of livelihood assures a degree of food security, and helps explain why in even the poorest communities severe disasters do not result in mass mortality. But climate change may cause chronic and or sporadic contractions in the food people are able to access through agriculture, fisheries, and in the marketplace, which may create other ongoing, transitory food problems. Thus, through impacts on food production, the ability of countries to import food, the ability of households to purchase food, and its effect on human health, climate change puts at risk the very basic and universal need of South Pacific peoples to have access to sufficient, safe, and nutritious food at all times.

Excerpts for this article were sourced from "Food security and climate change in the South Pacific", by Dr. Jon Barnett, published in the Winter 2007 issue of *Pacific Ecologist.* The full article can be read at *www.pacificecologist.org/archive/14/food-security-climate-change.pdf*

The Island Climate Update

Cover Photo: Wendy St George, NIWA

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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, Wallis and Futuna**

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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.