Number 70, July 2006

The Island Climate Update

June's climate

- South Pacific Convergence Zone (SPCZ) active over Papua New Guinea and the Solomon Islands
- High rainfall occurred in central and southern Tonga and Niue
- Low rainfall throughout New Caledonia
- Temperature: below average in New Caledonia and northern Tonga; above average in French Polynesia

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

- The tropical Pacific remains in a neutral ENSO state
- Below average rainfall expected over Tuvalu and the Marquesas Islands
- An extensive region of near or above average rainfall expected from Papua New Guinea southeast to Pitcairn Island

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

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nzaid

NIWA Taihoro Nukurangi

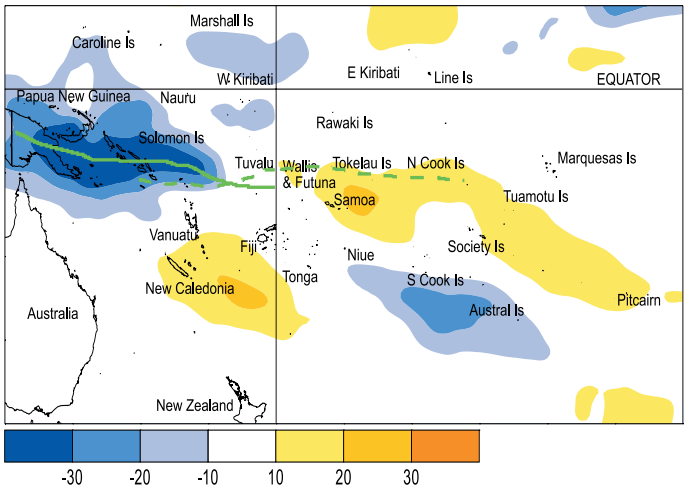
Climate developments in June 2006

During June, the SPCZ was displaced further north and west than average, with enhanced convection extending from Papua New Guinea east over the Solomon Islands and the seas north of Vanuatu. The SPCZ was rather inactive to the east of the Date Line. Enhanced convection also occurred southeast of the Southern Cook Islands. Rainfall was at least 200% of average in central and southern Tonga and Niue, at least 150% of average in parts of central French Polynesia, and near or above average over much of southern French Polynesia, as well as parts of Eastern Kiribati.

Regions of suppressed convection affected New Caledonia and Samoa. Rainfall was 50% or less of average over all of New Caledonia, and 75% or less in Samoa, the Southern Cook Islands, and parts of Viti Levu, Fiji.

Mean air temperatures were 1.0 ºC or more below average in parts of New Caledonia and northern Tonga, due to frequent cool southerly airflow. In contrast, they were 1.0 ºC or more above average in parts of central French Polynesia.

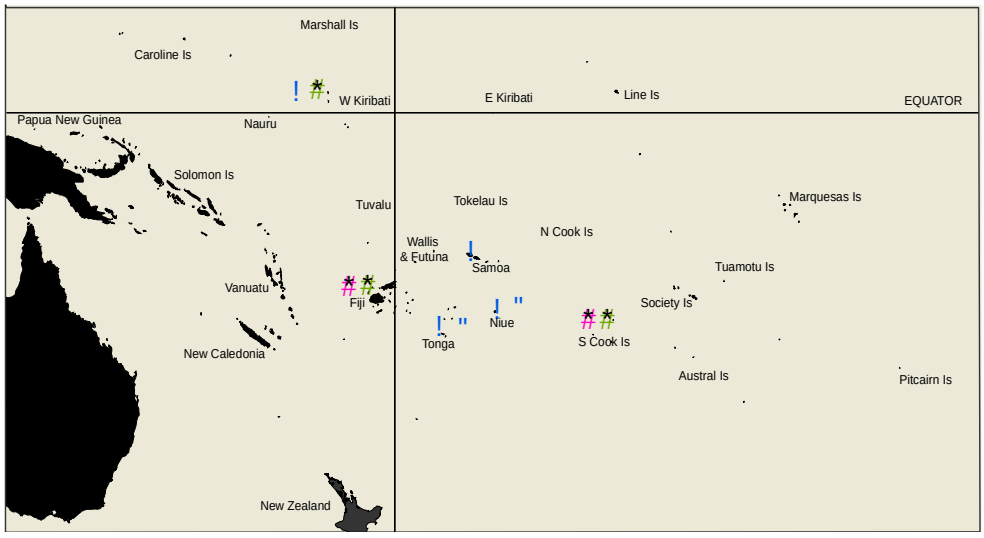
Tropical Southwest Pacific mean sea-level pressures were above average west of the Date Line, due to more frequent anticyclones south of Australia extending into the Tasman Sea. Pressures tended to be average in the east. Equatorial surface easterlies occurred in 78% of observations at Tarawa, a slight increase from May.



Outgoing Long-wave Radiation (OLR) anomalies, in Wm^{-2} (blue equals high rainfall and yellow equals low rainfall). The June 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
Fiji	Ono-i-Lau	260	296	Well above average
Niue	Hanan Airport	201	223	Well above average
Tonga	Fua'amotu Airport	359	355	Record high
New Caledonia	Moue	41	31	Record low

Soil moisture in June 2006



Estimated soil moisture conditions at the end of June 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.

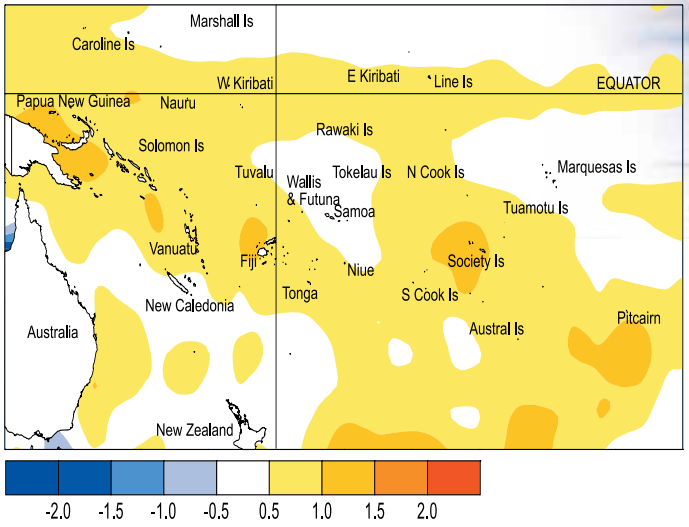
At the end of June 2006, Tarawa, Apia, Fua'amotu, and Hanan Airport were at field capacity (full). Nadi and Rarotonga soils were at soil moisture capacities, typical for the time of the year.

El Niño/Southern Oscillation (ENSO)

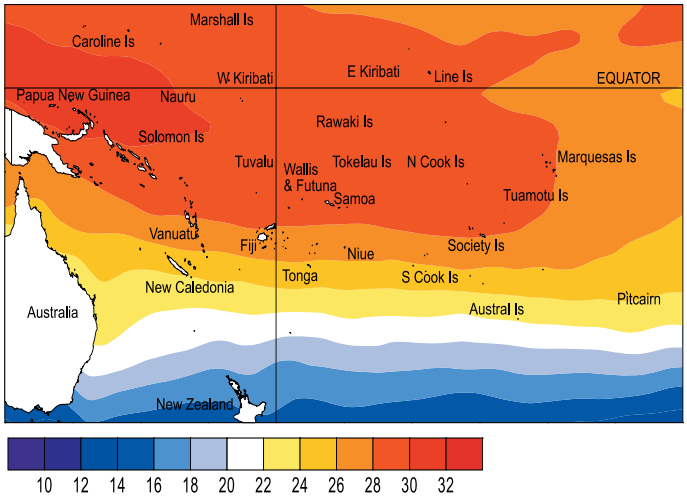
The tropical Pacific is in a neutral state. Equatorial Pacific sea surface temperature anomalies have risen almost 1°C in the past 3–4 months and are now positive across most of the basin, except in the far east. The NINO3 SST anomaly for June was about +0.3°C (+0.2°C for April–June) and NINO4 was about +0.6°C (+0.3°C for April–June), both having warmed from a near zero anomaly in April 2006.

The thermocline has deepened significantly since March from about 150°W eastwards, and weak positive temperature anomalies exist at all longitudes in the top 100 m. The Southern Oscillation Index (SOI) was –0.7 in June, showing little change from May, with the April–June mean at +0.0. The trade winds were close to their normal strength across the Pacific in June. The NASA ENSO precipitation index for June was –1.1, which is indicative of a La Niña-like convection pattern, caused by southward displacement of the northern branch of the ITCZ, and higher precipitation over New Guinea and eastern Indonesia.

Some global ENSO forecast models suggest the recent warming will continue, with three predicting a weak El Niño state by late 2006. Moat models, however, are predicting continued neutral conditions. The NCEP synopsis is for neutral conditions during July–September, and an uncertain outlook for the remainder of the year. The IRI now indicates neutral ENSO conditions are favoured for the remainder of 2006.



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



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

Madden-Julian Oscillation (MJO) and Subtropical highs

The Madden-Julian Oscillation (MJO), an eastward progression of both enhanced and suppressed tropical rainfall cycling at 30 – 60 days, is an equatorial travelling pattern of anomalous convection. The MJO has been fairly weak, but has been showing a regular 30-day periodicity recently. Over recent months, convection increased again in mid June in the central Indian Ocean, and is expected to affect the western Pacific in the first week of July.

The Subtropical High pressure belt and those of the migratory anticyclones in the south west Pacific normally lies to the south of most island groups at 29°S. In June, west of the Date Line, it was further south than normal and particularly strong, being centred over southeastern Australia. This dominated climate patterns in the North Tasman/Coral Sea regions. East of the Date Line it was further north than normal and weaker.

Forecast validation: April to June 2006

Suppressed convection with below average rainfall was expected over Western Kiribati and Tuvalu, with near or below average rainfall in Eastern Kiribati and Tokelau. Regions of near or above average rainfall were expected from Papua New Guinea southeast to Pitcairn Island including Vanuatu, Wallis and Futuna, Tonga, Niue, the Southern Cook Islands, and the Austral Islands. Near average rainfall was expected elsewhere.

Areas of enhanced convection or above average rainfall affected the region near Papua New Guinea, and also Tonga and Niue. Suppressed convection or below average rainfall occurred over Western Kiribati, Tuvalu, and Samoa. Rainfall was higher than expected in Western Kiribati, otherwise the overall rainfall anomaly pattern was similar to what was expected. The 'hit' rate for the April–June 2006 outlook was about 70%.

Tropical Pacific rainfall – June 2006

Territory and station name	June 2006 rainfall total (mm)	June 2006 percent of average
Australia		
Cairns Airport	93.0	194
Townsville Airport	10.2	51
Brisbane Airport	59.4	84
Sydney Airport	186.4	148
Cook Islands		
Rarotonga Airport	62.9	56
Penrhyn	88.4	62
Fiji		
Rotuma	400.4	174
Udu Point	120.5	104
Nadi	39.9	61
Nausori	94.6	63
Ono-I-Lau	260.3	296
French Polynesia		
Bora Bora Motu	94.4	103
Tahiti - Faa'a	97.8	153
Tuamotu, Takaroa	29.4	33
Gambier, Rikitea	110.4	68
Tubuai	142.8	123
Rapa	234.2	117
Kiribati		
Christmas Island	111.6	116
Butaritari	279.4	105
Tarawa	184.0	114
Kanton Island	136.2	138
New Zealand		
Kaitaia	110.9	74
Whangarei Airport	97.2	59
Auckland Airport	101.2	87

Territory and station name	June 2006 rainfall total (mm)	June 2006 percent of average
New Caledonia		
Ile Art, Belep	49.0	41
Koumac	23.4	33
Ouloup	55.6	42
Ouanaham	57.2	38
Poindimie	59.0	30
La Roche	51.2	33
La Tontouta	20.6	25
Noumea	37.6	32
Moue	41.2	31
Niue		
Hanan Airport	201.0	223
North Tasman		
Lord Howe Island	117.2	64
Norfolk Island	198.4	130
Raoul Island	85.2	50
Samoa		
Faleolo	50.8	55
Apia	91.8	69
Tonga		
Queen Lavinia	154.1	140
Lupepau'u	194.7	155
Salote Airport	161.5	202
Fua'amotu Airport	358.7	355
Tuvalu		
Nui Island	155.4	78
Funafuti	199.6	93
Nuilakita	196.7	102

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: July to September 2006

An extensive region of enhanced convection is expected from Papua New Guinea southeast to Pitcairn Island, including the Solomon Islands, Vanuatu, Wallis and Futuna, Fiji, Tonga, Niue, the Southern Cook Islands, and the Society, Austral, and Tumotu Islands.

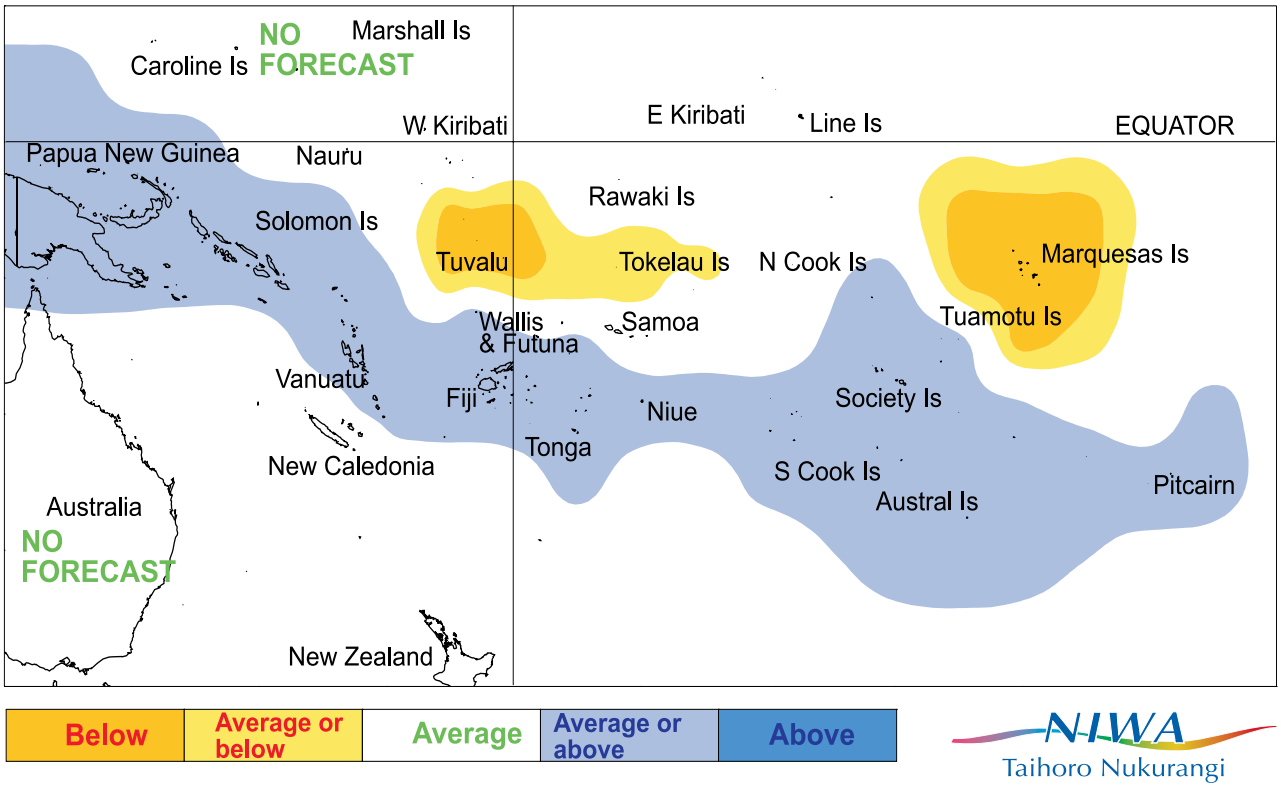
Suppressed convection is expected over Tuvalu and the Marquesas Islands, where rainfall is likely to be below average. Tokelau is expected to experience near or below average rainfall.

Rainfall over Western and Eastern Kiribati, New Caledonia, Samoa, and the Northern Cook Islands is expected to be near average.

The model skills are expected to be moderate during the dry season.

Island group	Rainfall outlook	Outlook confidence
Papua New Guinea	20:40:40 (Near or above average)	Moderate
Solomon Islands	15:40:45 (Near or above average)	Moderate
Vanuatu	20:40:40 (Near or above average)	Moderate
Wallis & Futuna	20:40:40 (Near or above average)	Moderate
Fiji	20:40:40 (Near or above average)	Moderate
Tonga	20:40:40 (Near or above average)	Moderate
Niue	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
Tuamotu Islands	20:40:40 (Near or above average)	Moderate
Pitcairn Island	20:40:40 (Near or above average)	Moderate
Western Kiribati	30:40:30 (Near average)	Moderate
Eastern Kiribati	20:45:35 (Near average)	Moderate
New Caledonia	30:40:30 (Near average)	Moderate
Samoa	25:50:25 (Near average)	Moderate
Northern Cook Islands	25:50:25 (Near average)	Moderate
Tokelau	40:40:20 (Near or below average)	Moderate
Tuvalu	45:30:25 (Below average)	Moderate
Marquesas Islands	50:30:20 (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 July to September 2006.

The Pacific Convergence Zones: 2005 and early 2006

A B Mullan, NIWA

Prominent maxima and minima in rainfall, cloudiness, and outgoing long-wave radiation are associated with the Pacific Intertropical Convergence Zone (ITCZ) and the South Pacific Convergence Zone (SPCZ). The Pacific ITCZ has its main branch in the northern hemisphere at around 5–10°N, where it is strongest in June–August. There is a branch of the ITCZ south of the equator, near 5°S, which is prominent in December-February near Australia, sometimes referred to as the 'monsoonal trough'. Convection frequently extends northwards across the equator in Indonesian region. The southern ITCZ rarely extends east of about 160°W, except in March and April when it can reach 90°W.

Near the Date Line, the southern ITCZ merges with the SPCZ which trends southeastward across the South Pacific to subtropical latitudes. The SPCZ is most active in the austral summer (December–February) and is located in a region of strong sea surface temperature (SST) gradient south of the maximum SSTs. On the other hand, the ITCZ is located near the axis of maximum SSTs.

The tropical convergence zones are now monitored routinely by satellite. A particularly useful data set, that is providing climatologists with new insights into tropical convection, is the Tropical Rainfall Measuring Mission (TRMM) rainfall data, available from January 1998 onwards on a 0.25° latitude-longitude grid (http://disc.sci.gsfc.nasa.gov/data/datapool/TRMM/01_Data_Products/02_Gridded/index.html)

In 2005, the year began with the tropical Pacific in a weak El Niño state and ended in a weak La Niña state. February 2005 was particularly unusual in terms of the convergence zones. The northern ITCZ was very weak west of the Date Line, with the islands of Micronesia experiencing very low rainfall. At the same time, the SPCZ was extremely active from about 160°E to 160°W, in association with more extensive equatorial westerlies and several tropical cyclones (Figure 1). There was concern at the time that this rainfall anomaly pattern might persist with the development of an El Niño event, but this did not eventuate. TRMM rainfall data suggest the northern ITCZ was continuous (in the monthly mean) right across the Pacific from 140°E to 90°W in almost all months of the year apart from February. It lay slightly equatorward of its normal location from May to August. In June and August–September, the northern ITCZ was particularly active in the far eastern tropical Pacific between 120°W and 90°W (Figure 1).

For the year as a whole, the TRMM rainfall data suggest that rainfall was slightly above the 1998–2004 average in the northern ITCZ, and also in the southern ITCZ and SPCZ to about 160°W.

In 2006, March and April are particularly interesting because a marked double ITCZ was present (Figure 2). The southern branch of the ITCZ, east of about 160°W, is a feature of the austral autumn, but is really only prominent in La Niña years, such as 1999–2001. The conditions necessary for the formation of a double ITCZ appear to be (a) a general region of low-level wind convergence with a warm sea surface in the deep tropics which occurs every year during March and April, and (b) a narrow sea surface equatorial cold tongue, which is strongest during La Niña years. Colder conditions along the equator at about 140–100°W enhance the SST meridional gradient associated with the southern off-equatorial SST maximum. See http://www.gsfc.nasa.gov/topstory/20020711itczworks.html, for further reading on the double ITCZ.

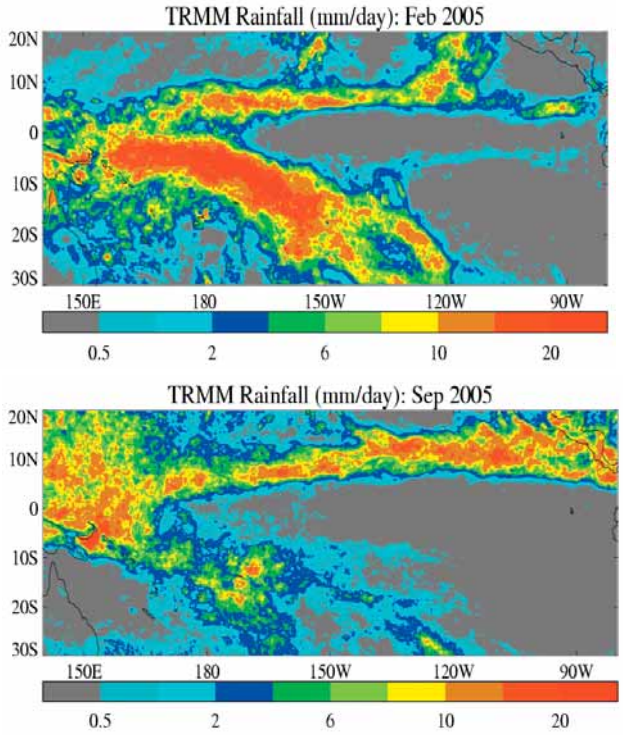


Figure 1: Average rainfall rate (mm/day) from TRMM 0.25 degree analysis for months of February (upper) and September (lower) 2005. Contours at uneven of 0.5, 1, 2, 4, 6, 8, 10, 15, and 20 mm/day.

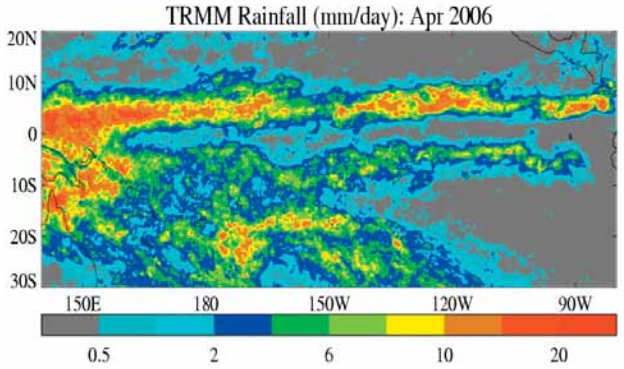


Figure 2: Average rainfall rate (mm/day) for April 2006. The convection pattern clearly shows a double ITCZ straddling the equator, along with the South Pacific Convergence Zone.

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

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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.