

Number 67, April 2006

# The Island Climate Update

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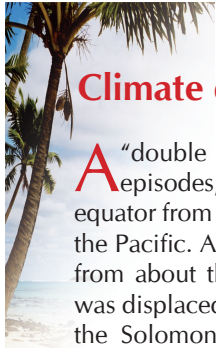
## March's climate

- Double Inter-Tropical Convergence Zone (ITCZ) evident in March; South Pacific Convergence Zone (SPCZ) much further south than average
- Suppressed convection over Western and Eastern Kiribati, extending towards Samoa
- Rainfall above average in the Southern Cook Islands and the Marquesas Islands; below average over much of Fiji, northern Tonga, and the Society Islands
- Much warmer than average in Fiji and French Polynesia
- Seven tropical cyclones so far this season

## El Niño/Southern Oscillation and seasonal rainfall forecasts

- The tropical Pacific continues to exhibit weak La Niña conditions
- Below average rainfall over Western Kiribati and Tuvalu
- Near or above average rainfall extending from Papua New Guinea southeastwards to Pitcairn Island





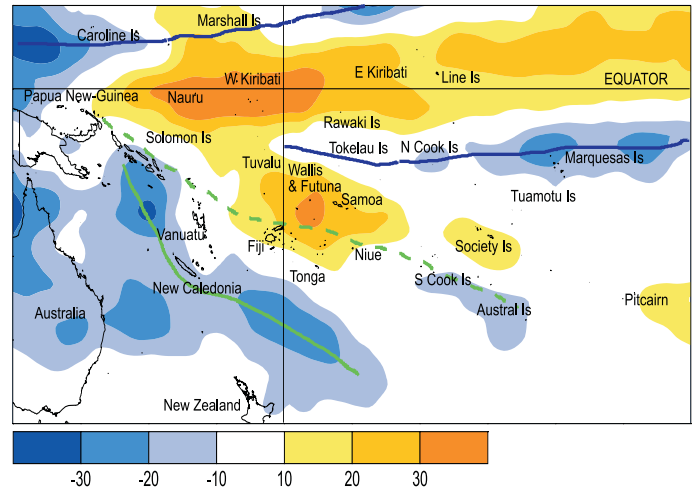
## Climate developments in March 2006

A “double ITCZ” structure, usually only seen during La Niña episodes, was evident in March. One region lay north of the equator from the Caroline Islands extending east across much of the Pacific. Another region extended east, south of the equator, from about the Date Line towards South America. The SPCZ was displaced much further south than average, extending from the Solomon Islands southeast toward New Caledonia, and south of Tonga. This pattern resulted in enhanced convection and/or above average rainfall over parts of the Caroline Islands, the eastern seaboard of Australia, the Solomon Islands, New Caledonia, the Northern Cook Islands, the Marquesas Islands, and the Austral Islands.

An elongated region of suppressed convection (more intense than in February) affected Nauru, Western and Eastern Kiribati, and along the equator east towards South America. Another branch of suppressed convection extended southeast from Tuvalu to Samoa, including Wallis and Futuna, Fiji, northern Tonga, and the Society Islands.

Rainfall was at least 125% of average in the Southern Cook Islands, the Marquesas Islands, and northern New Zealand. In contrast, March rainfall was less than 50% of average in parts of Fiji, northern Tonga, and the Society Islands.

Mean air temperatures were at least 1.0 °C above average in the southern Cook Islands, and more than 1.5 °C above average in parts of central and southern French Polynesia. Many Fiji locations measured record high mean daily maximum temperatures.

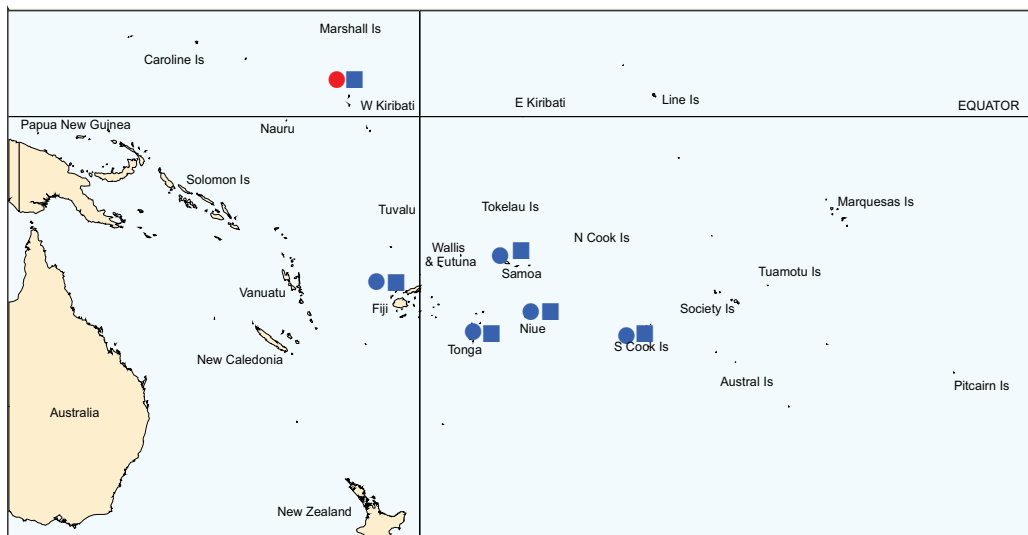


Outgoing Long-wave Radiation (OLR) anomalies, in  $Wm^{-2}$  (blue equals high rainfall and yellow equals low rainfall). The March 2006 position of the SPCZ, as identified from total rainfall, is indicated by the solid green line. The average position of the SPCZ is identified by the dashed green line.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

Southwest Pacific mean sea-level pressures tended above average between 15-25° S over much of the Southwest Pacific. Equatorial surface easterlies continued to be very persistent along the Equator, occurring in 98% of observations at Tarawa.

Country	Location	Monthly Rainfall (mm)	% of average	Comments
Tonga	Mata'aho Airport	67	23	Well below normal
Fiji	Monasavu	239	35	Record low

## Soil moisture in March 2006



Estimated soil moisture conditions at the end of March 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 occurs by rainfall with losses via evapotranspiration. Monthly rainfall and evapotranspiration is 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 March, above average soil moisture occurred at Nadi, Apia, Nuku'alofa, Hanan, and Rarotonga. Soils were drier than normal at Tarawa. For the same month last year, soils were generally wetter at Tarawa. All the other sites had similar soil conditions at the same time last year.

## El Niño/Southern Oscillation (ENSO)

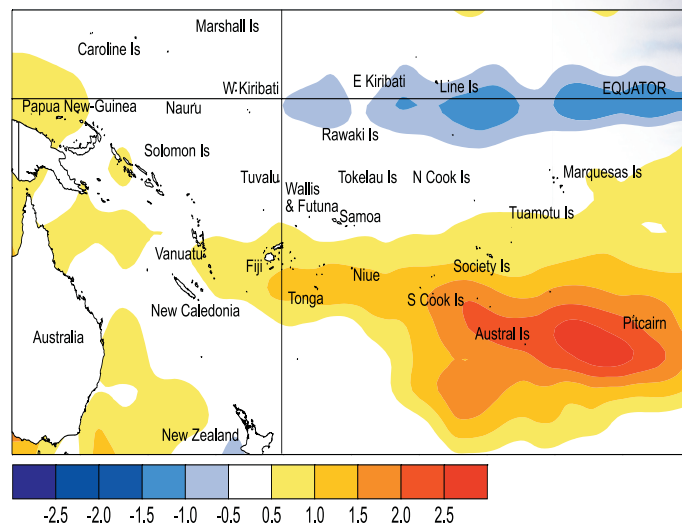
The tropical Pacific continues to exhibit weak La Niña conditions, with negative sea surface temperature (SST) anomalies along the equator east of the Date Line, and generally enhanced trade winds.

For March, the NINO3 SST anomaly was around  $0.4^{\circ}\text{C}$  ( $-0.4^{\circ}\text{C}$  for January–March) and NINO4 was also around  $-0.4^{\circ}\text{C}$  ( $-0.5^{\circ}\text{C}$  for January–March). The region of strongest negative SST anomalies has retreated eastwards in March and has weakened slightly.

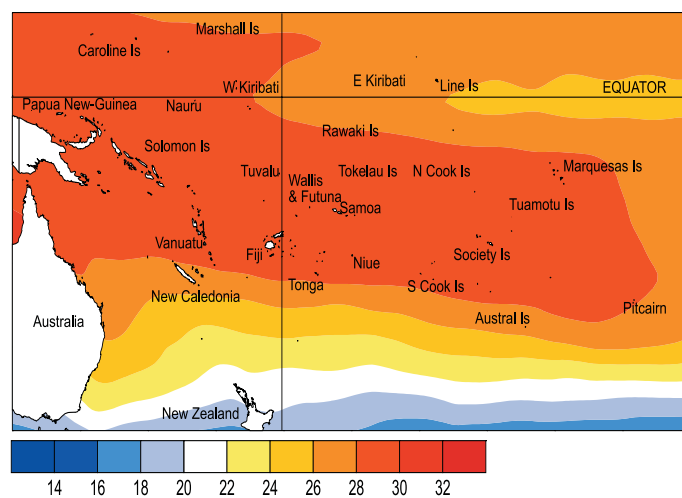
A region of significant negative temperature anomalies ( $-2^{\circ}\text{C}$  or more) is still present at the sub-surface in the eastern Equatorial Pacific. The Southern Oscillation Index (SOI) was  $+1.3$  for March but the 3-month mean is still less than  $+1$ .

Patterns of convection in March were consistent with La Niña conditions: a strong enhancement over Indonesia and northern Australia (with tropical cyclone activity both east and west of the Australian coast), and a suggestion that the SPCZ was displaced southwards; convection was suppressed near the Date Line and a “double ITCZ” structure was evident east of the Date Line. The Madden Jullian Oscillation (MJO) is weak at present.

All model predictions are in the neutral range (mostly on the cool side of neutral) for April–June. Several models suggest warming in the NINO3.4 region later in the year, with one or two predicting El Niño conditions by late 2006. However, there is considerable spread in many sets of model forecasts. The latest NCEP/CPC statement (released 6 April) calls for La Niña conditions during the next 1–3 months. The IRICP summary gives a 53% chance of La Niña conditions through May, reducing to 25% by mid year.



Sea surface temperature anomalies ( $^{\circ}\text{C}$ ) for March 2006.



Mean sea surface temperatures ( $^{\circ}\text{C}$ ) for March 2006.

## Tropical cyclones

There have been seven tropical cyclones to date in the Southwest Pacific (including the region west of latitude  $150^{\circ}\text{E}$ ). Tropical cyclones in March were Larry (18th–20th) and Wati (19th–24th). Larry, the most severe this season, originated in the Coral Sea, and was very destructive on the Queensland coast of Australia, being reported as the worst tropical cyclone to hit the region in 30 years, with estimated maximum sustained wind speeds of 185 km/h. Gusts to 290 km/h were reported. The Innisfail area, between Cairns and Townsville, was severely affected, high winds producing extensive damage to crops (especially sugar cane and bananas) and property. There was also flooding, and several injuries. ‘Wati’ affected the open-water region west of Vanuatu, with estimated maximum wind speeds to 150 km/h, and then tracked into the Tasman Sea, bringing high rainfall to northern New Zealand.

There is on average one tropical cyclone occurrence in April. The May issue of the ICU will provide an update on information relating to any occurrences of tropical cyclones in the region.

## Forecast validation: January to March 2006

Suppressed convection with below average rainfall was expected in the equatorial region of Western and Eastern Kiribati, with near or below average rainfall from Tuvalu east to the Marquesas Islands, including Tokelau, the Northern Cook Islands, and the Tuamotu Islands. A large region of near or above average rainfall was expected from Vanuatu southeast to Pitcairn Island including Samoa, Fiji, Tonga, Niue, the Society Islands, the Austral Islands, and the Southern Cook Islands. Near average rainfall was expected elsewhere in the region.

Areas of enhanced convection and above average rainfall affected the Solomon Islands, Samoa, parts of Fiji, Tonga, Southern Cook Islands, Niue, and the Austral Islands. Suppressed convection or below average rainfall occurred over Western and Eastern Kiribati, Vanuatu, Tuvalu, the Northern Cook Islands, and Tuamotu Islands. Rainfall was higher than expected in the Solomon Islands, and lower than forecast in Vanuatu. The overall rainfall outcome was similar to what was expected, with a very high ‘hit’ rate for the January–March 2006 outlook of about 80%.

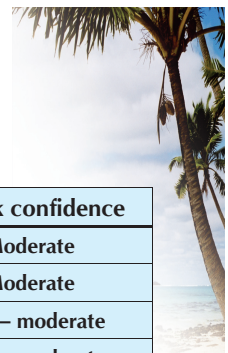
## Tropical Pacific rainfall – March 2006

Territory and station name	March 2006 rainfall total (mm)	March 2006 percent of average
<b>Australia</b>		
Cairns Airport	588.6	131
Townsville Airport	161.6	78
Brisbane Airport	76.0	55
Sydney Airport	30.6	24
<b>Cook Islands</b>		
Penrhyn	283.4	92
Aitutaki	97.6	50
Rarotonga Airport	246.4	145
Rarotonga EWS	216.4	127
<b>Fiji</b>		
Rotuma	223.9	61
Udu Point	164.2	51
Nadi	189.6	56
Nausori	224.8	59
Ono-I-Lau	79.9	32
<b>French Polynesia</b>		
Hiva Hoa, Atuona	326.2	168
Tahiti - Faa'a	59.4	33
Tuamotu, Takaroa	154.8	111
Gambier, Rikitea	72.2	43
Tubuai	208.2	124
Rapa	278.4	103
<b>Niue</b>		
Hanan Airport	233.9	113
<b>New Zealand</b>		
Kaitaia	172.2	227
Whangarei Airport	198.0	156
Auckland Airport	64.0	78

Territory and station name	March 2006 rainfall total (mm)	March 2006 percent of average
<b>New Caledonia</b>		
Ile Art, Belep	196.0	91
Koumac	136.6	96
Ouloup	204.4	93
Ouanaham	169.8	72
Poindimie	401.6	100
La Roche	96.4	47
La Tontouta	114.8	88
Noumea	85.2	58
Moue	134.2	66
<b>North Tasman</b>		
Lord Howe Island	57.4	46
Norfolk Island	118.0	107
Raoul Island	130.0	80
<b>Samoa</b>		
Apia	139.5	39
<b>Tonga</b>		
Queen Lavinia	158.9	52
Mata'aho Airport	67.3	23
Nuku'alofa	199.4	97
Lupepau'u	108.2	36
Salote Airport	66.9	29
Fua'amotu Airport	136.5	73
<b>Tuvalu</b>		
Nui Island	172.5	48
Funafuti	407.3	108
Nuilakita	278.1	75

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: April to June 2006

ENSO indicators in the equatorial Pacific are showing weakening La Niña conditions for the coming months. Global climate models are echoing this in the coming three month rainfall forecast patterns.

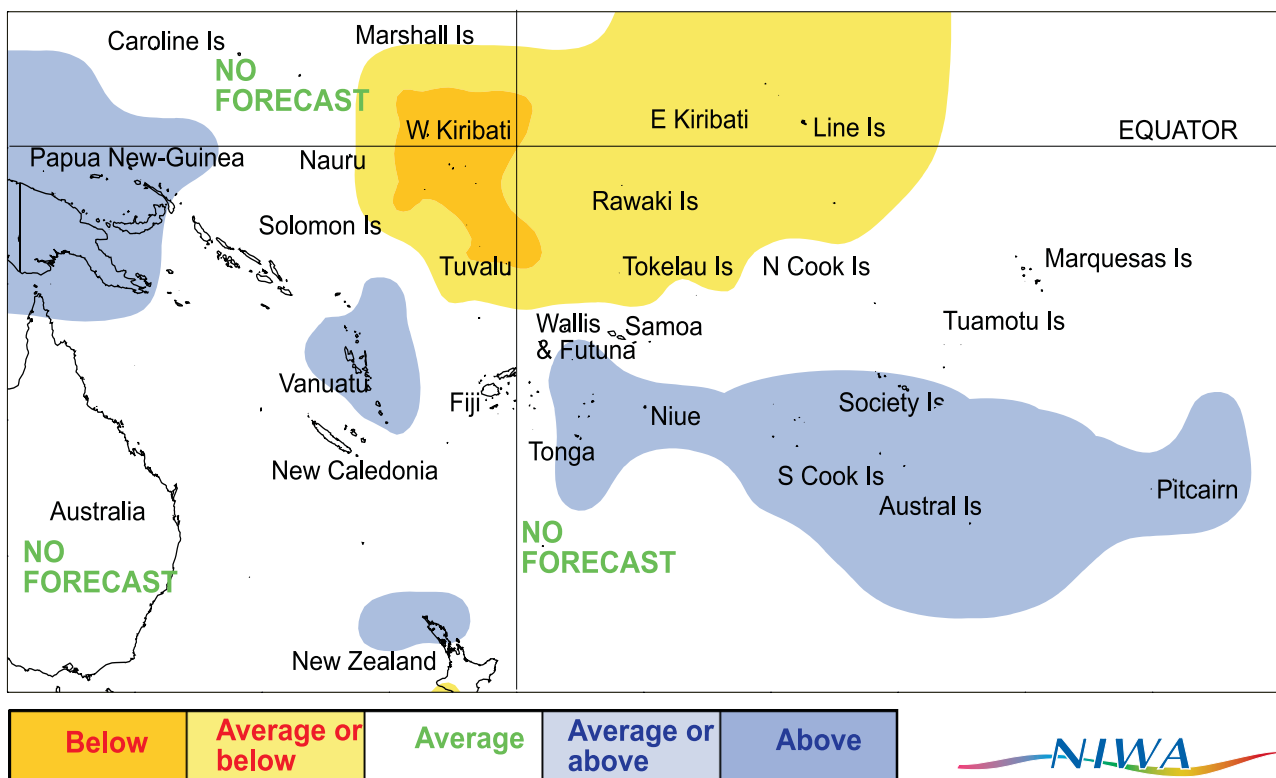
Suppressed convection is expected in the equatorial region around the Date Line where rainfall is expected to be below average for Western Kiribati and Tuvalu. Near or below average rainfall is likely over Eastern Kiribati and Tokelau.

A large region of enhanced convection with near or above average rainfall is expected from Papua New Guinea southeastwards to Pitcairn Island, including Vanuatu, Wallis & Futuna, Tonga, Niue, the Southern Cook Islands, as well as Society and Austral Islands.

Near average rainfall is likely elsewhere in the region. As this is the transition period from the wet to dry season, the forecast model skills are expected to be low or moderate for most countries in the region.

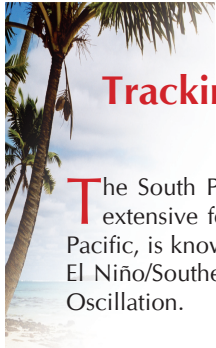
Island group	Rainfall outlook	Outlook confidence
Papua New Guinea	15:45:40 (Near or above average)	Moderate
Vanuatu	15:40:45 (Near or above average)	Moderate
Wallis & Futuna	15:45:40 (Near or above average)	Low – moderate
Tonga	20:40:40 (Near or above average)	Low – moderate
Niue	20:40:40 (Near or above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





# Tracking the South Pacific Convergence Zone: the SPCZ Position Index (SPI)

Dr J Salinger, NIWA

The South Pacific Convergence Zone (SPCZ), one of the most extensive features of the atmospheric circulation in the South Pacific, is known to vary its location according to the phase of the El Niño/Southern Oscillation (ENSO) and the Interdecadal Pacific Oscillation.

The SPCZ is characterised by a semi-permanent band of enhanced cloudiness and precipitation. Its position can be seen in remote sensing imagery via lower than normal outgoing long-wave radiation (OLR) anomalies, or higher rainfall. It originates from the west Pacific warm pool in the Indonesian region and trends southeast towards French Polynesia. West of the Date Line it is linked to the ITCZ over the western Pacific warm pool. To the east, it is maintained by the interaction of easterly trade winds and the disturbances in the mid-latitude westerlies emanating from the Australasian region. It is most active during the November–April season (wet season) in the Southwest Pacific.

Where it is located is of great importance as those areas directly underneath often receive much above average precipitation, whilst locations well away can receive much lower than normal precipitation. The location of the SPCZ between the Date Line and the longitude of French Polynesia is known to vary systematically with ENSO-related expansions and contractions of the west Pacific warm pool, and moves northeast during El Niño events and southwest during La Niña events. It also varies with the phase of the Interdecadal Pacific Oscillation (IPO). Variations in the mean location of the SPCZ are important for South Pacific climate, as precipitation can vary strongly with the movement. Since 1958 there are plenty of observations and data to enable the seasonal positioning of the mean November to April location from NCEP re-analysis data.

Low-level convergence has been used to define the mean SPCZ location at each longitude over the period 1958–1998. To obtain a comparable century-long time series for the SPCZ, high quality station mean sea-level pressure (MSLP) data from South Pacific island sites were used as a proxy index of the SPCZ position. Two stations were used: Suva in Fiji and Apia in Samoa, as these lie on opposite sides of the mean SPCZ location. The SPCZ position index (SPI) was calculated as the normalised November–April difference in MSLP between Suva and Apia (Figure 1) based on the period 1961–90. It defines the latitude of the SPCZ between longitudes 180 and 170°W.

Relations between the SPCZ, ENSO, and the IPO were analysed using the SPI, the Southern Oscillation Index (SOI), and an IPO ,

index. When the IPO is in its negative phase, and in a La Niña, the SPI is negative the mean position of the SPCZ is displaced to the southwest towards Suva. During the positive IPO, and in an El Niño, the SPI is positive and the SPCZ is displaced northeast.

Comparisons between Figure 1 and Figure 2 show clearly that when the IPO is in its negative phase, the SPI is negative indicating that the mean position of the SPCZ is displaced to the southwest. During the positive IPO, the SPI is positive indicating that the SPCZ is displaced northeast. Similarly in a La Niña, the mean position of the SPCZ is displaced to the southwest and in an El Niño, the SPCZ is displaced northeast. The SPI is a good index of the SPCZ location.

Trends show that the largest displacement in the SPCZ towards Suva occurred in the mid 1910s, with a run of years showing the largest displacements toward Apia in the early 1940s. Generally the November–April SPI shows the last two IPO phases clearly with displacement toward Suva 1946–1976, and movement toward Apia 1977–1998. Movement of this particularly sensitive section of the SPCZ have occurred in phase of those of the IPO over the 20th century.

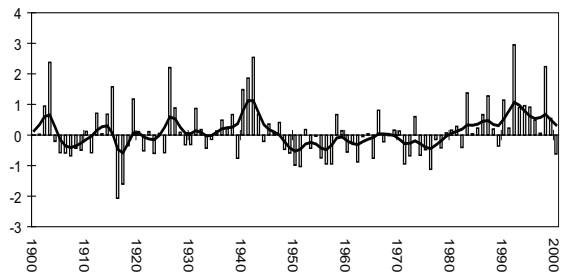


Figure 1. SPCZ Position Index (SPI; normalised Suva minus Apia pressure difference), November - April. Positive values indicate displacement toward Apia and negative values toward Suva.

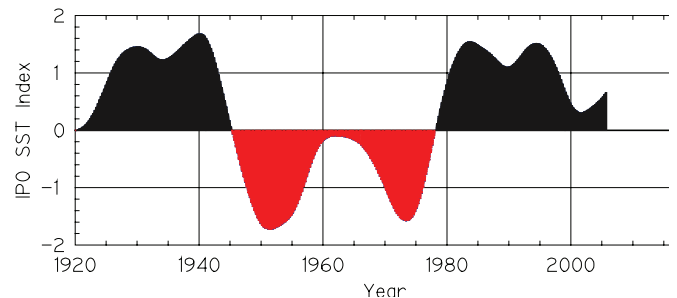


Figure 2. Phases of the Interdecadal Pacific Oscillation 1920–2005 based on the Hadley Centre IPO index.



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Your comments and ideas about The Island Climate Update are welcome. Please contact:

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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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Wendy St George,  
NIWA

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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.

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