Number 87, December 2007

The Island Climate Update

November's climate

- Active South Pacific Convergence Zone (SPCZ) extends from Papua New Guinea to Niue; further west than normal
- Tropical cyclone Guba brings high rainfall to Papua New Guinea; also wet in Vanuatu, Fiji, and Niue
- Suppressed convection persists over Kiribati, extending to Tokelau and the Northern Cook Islands
- Low rainfall over much of Kiribati, New Caledonia, and northern French Polynesia
- Above average temperatures in Western Kiribati, the south of Vanuatu, southern Tonga, American Samoa, and the Southern Cook Islands

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

- La Niña conditions have strengthened in the central and eastern equatorial Pacific and are expected to persist into the Southern Hemisphere autumn
- A large area of suppressed convection and below average rainfall is very likely over the equatorial Pacific including Kiribati, Tuvalu, Tokelau, Northern Cook Islands, and the Marquesas, Tuamotu, and Society Islands
- Enhanced convection is likely to continue along a southwest displaced SPCZ with above average rainfall from the Solomon Islands to southern French Polynesia, including Vanuatu, Wallis & Futuna, Tonga, Niue, and the Southern Cook 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

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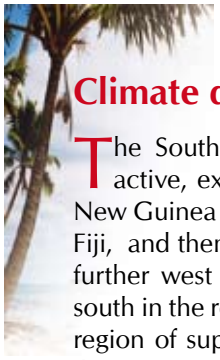


Climate developments in November 2007

The South Pacific Convergence Zone (SPCZ) was very active, extending from the monsoon trough over Papua New Guinea toward the Solomon Islands, the region north of Fiji, and then southeast over Niue. The SPCZ was displaced further west than normal for the time of year, and further south in the region east of the Date Line. A horseshoe shaped region of suppressed convection continued to persist along the Equator, although not as far west as in October, affecting Kiribati, and the region further east (north of the Equator) to the coast of South America, as well as Tokelau and the Northern Cook Islands.

Rainfall was extremely high in areas under the active SPCZ with over 200% or more of normal in parts of Vanuatu, Niue, and Fiji, and also above normal in the Solomon Islands, much of Tonga, and the Southern Cook Islands. Heavy rainfall and flooding occurred in parts of Papua New Guinea during the month associated with tropical cyclone Guba. In contrast November rainfall was 50% or less of normal over much of Kiribati, New Caledonia, and northern French Polynesia, western areas of New Caledonia being extremely dry. Rainfall was near normal in most other regions.

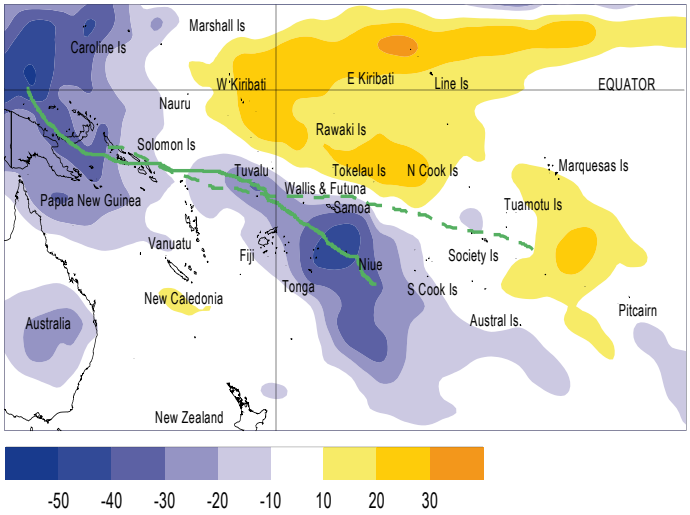
Rainfall has been below average for each of the past six months in both Western and Eastern Kiribati, and above average for the past five months in Vanuatu.

Country	Location	Rainfall (mm)	% of avg	Comments
Vanuatu	Lamap	371	288	Extremely high
Fiji	Nadi Airport	325	246	Record high
Fiji	Viwa Island	400	-	Record high
Fiji	Tokotoko	666	-	Record high
Niue	Hanan Airport	607	349	Extremely high
New Caledonia	Koumac	1	2	Extremely low
New Caledonia	La Tontouta	3	5	Extremely low

November mean air temperatures were about 1.0 ºC above normal in parts of Western Kiribati, the south of Vanuatu, southern Tonga, American Samoa, and the Southern Cook Islands, and about 0.5 ºC above normal in New Caledonia, Fiji, and Niue. Fiji was uncomfortably warm due to accompanying humid conditions.

Tropical Southwest Pacific mean sea-level pressures were below average over the Fiji-Tonga-Niue region. Higher than normal pressures occurred over the south Tasman Sea.

Equatorial surface easterlies remained persistent at Tarawa, occurring in about 95% of observations.



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 mean higher rainfalls. The November 2007 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.

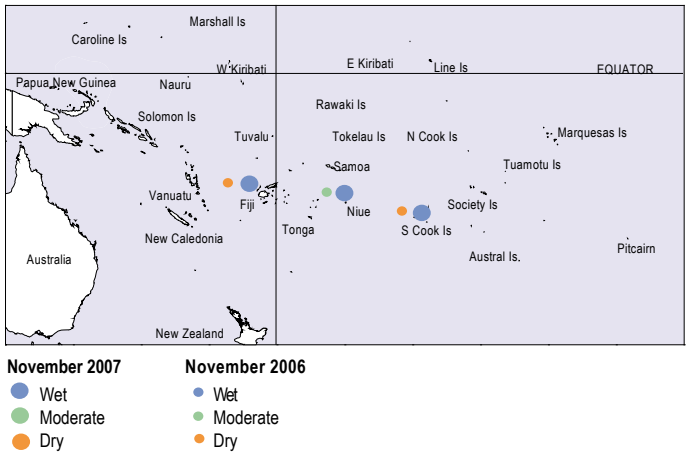
Soil moisture in November 2007

Estimates of soil moisture shown in the map 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 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.

Formerly dry soils in Rarotonga (Southern Cook Islands) were relieved during November 2007, soil moisture being replenished by the end of the month. Soils continued to be at field capacity for the time of year at Hanan (Niue), and were also moist at Nadi (Fiji).



Estimated soil moisture conditions at the end of November 2007, using monthly rainfall data.

El Niño/Southern Oscillation (ENSO)

La Niña conditions have strengthened in the central and eastern Pacific, and are expected to persist into the Southern Hemisphere autumn. For the first month since the La Niña event began, the Southern Oscillation Index (SOI) has shown a strong movement upwards, showing ocean-atmosphere coupling.

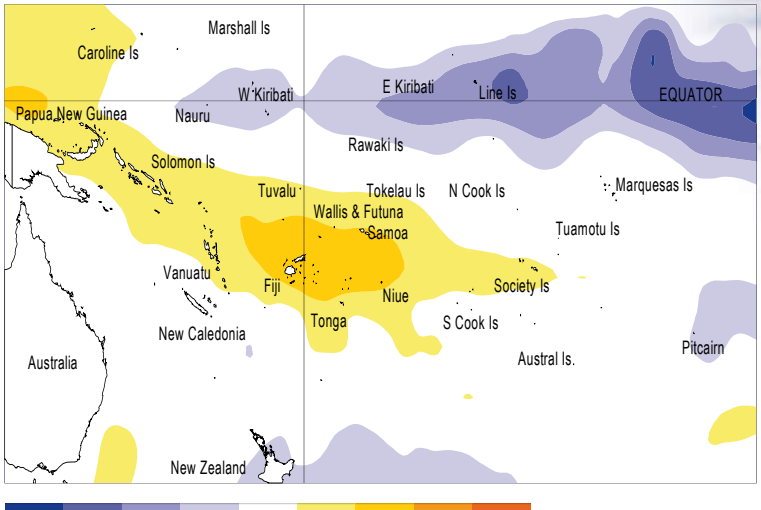
Below normal sea surface temperature (SST) anomalies intensified across the tropical Pacific from South America to west of the Date Line during November, while a warm 'horseshoe' extends into the extratropics of both hemispheres. The NINO3 anomaly was –1.6 °C for November (SON average –1.3 °C), while NINO4 strengthened to –0.8 °C (SON average –0.4 °C). Conversely, the subsurface temperature anomalies have weakened: the largest anomalies near 100 m depth over 140-120° W during November were about –2 °C (–4 °C in October).

The easterly trade winds were also strong and persistent during November over a wide longitude band centred on the Date Line. The SOI for November was +0.9 (+0.4 October), with the SON average of +0.5 (ASO average +0.1).

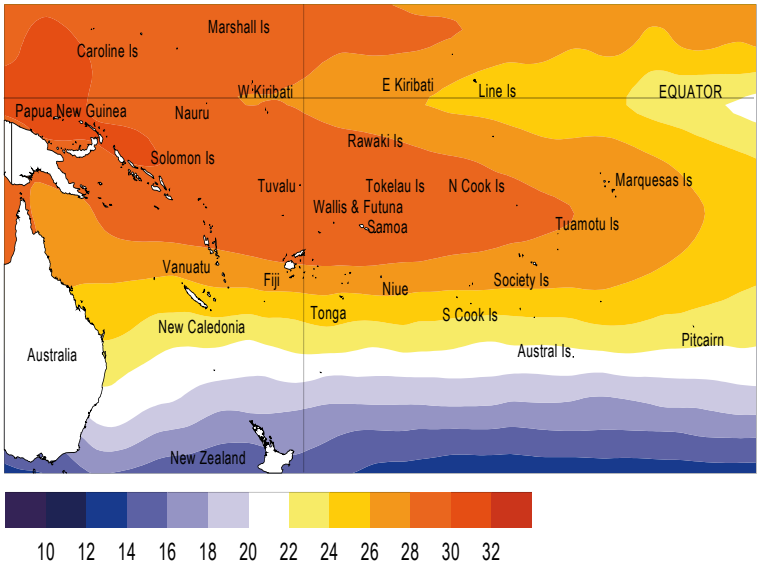
The trade winds remained enhanced both west and east of the Date Line.

Tropical OLR anomalies show suppressed convection in the equatorial region from the Date Line eastwards. Enhanced convection occurred over Indonesia, and the South Pacific Convergence Zone is prominent through Fiji, south of its normal position. The TRMM-based ENSO precipitation index was –1.06 in November, entering the moderate range for the first time during the current event. The Madden-Julian Oscillation has displayed a fairly regular periodicity of 40–50 days in recent months, and the next active phase could begin around mid December, and precede monsoon development over northern Australia.

All dynamical models except Scripps, and all statistical models clearly indicate existing La Niña conditions. Most models indicate La Niña conditions continuing through the southern summer and autumn, before easing to neutral conditions in winter 2008. The



Sea surface temperature anomalies (ºC) for November 2007



Mean sea surface temperatures (ºC) for November 2007

NCEP synopsis (of 8 November) suggests La Niña is approaching moderate strength (Niño3.4 index below –1.0 °C), and likely to continue into early 2008. The IRI synthesis gives more than a 90% probability of La Niña conditions continuing through the next three months.

Forecast validation: September to November 2007

A La Niña-like pattern, with a large region of enhanced convection was expected from Vanuatu southeast to the Southern Cook Islands, with average or above average rainfall from Papua New Guinea eastsoutheast to the Southern Cook Islands, including Solomon Islands, Vanuatu, New Caledonia, Fiji, Samoa, Tonga, and Niue. Suppressed convection with average or below average rainfall was expected over Western and Eastern Kiribati, Tuvalu and the Northern Cook Islands.

The rainfall outlook for the September–November 2007 period was similar to what was forecast, the 'hit' rate being almost 80%.

Suppressed convection and below average rainfall occurred as expected in the equatorial region about and east of the Date Line, extending to Tuvalu, the Northern Cook Islands, and the Marquesas Islands. Rainfall was above average as expected from Papua New Guinea to Niue. Rainfall was higher than expected in the Society Islands, and lower than expected in the Marquesas Islands.

Tropical Pacific rainfall – November 2007

Territory and station station name	November 2007 rainfall total (mm)	November 2007 percent of average
Australia		
Cairns Airport	77.4	80
Townsville Airport	121.6	199
Brisbane Airport	63.4	65
Sydney Airport	104.6	126
Cook Islands		
Penrhyn	76.0	34
Aitutaki	185.8	141
Rarotonga Airport	270.5	199
Rarotonga EWS	252.0	185
Fiji		
Rotuma Island	435.3	154
Udu Point	334.0	164
Nadi Airport	325.2	246
Nausori	402.6	164
French Polynesia		
Hiva Hoa, Atuona	40.4	43
Bora Bora	86.0	47
Tahiti – Faa'a	102.0	79
Tuamotu, Takaroa	57.6	27
Gambier, Rikitea	241.2	105
Tubuai	119.6	92
Rapa	234.0	135
Kiribati		
Tarawa*	44.4	34
Kanton*	0.0	0
New Zealand		
Kaitaia	105.8	104
Whangarei Airport	84.4	95
Auckland Airport	44.4	53
New Caledonia		
Ile Art, Belep	67.8	62
Koumac	1.0	2
Ouloup	28.0	29
Ouanaham	56.6	52
Poindimie	45.4	24
La Roche	64.4	56
La Tontouta	2.8	5
Noumea	14.2	24
Moue	35.2	35

Territory and station station name	November 2007 rainfall total (mm)	November 2007 percent of average
Niue		
Hanan Airport	607.1	349
Liku	593.2	388
North Tasman		
Lord Howe Island	50.4	43
Norfolk Island	26.8	39
Raoul Island	219.6	226
Samoa		
Apia	198.3	75
Faleolo Airport	136.2	59
Nafanua	256.0	-
Afimalu	534.3	-
Maota	374.4	-
Tonga		
Mata'aho Airport	26.8	14
Lupepau'u	268.4	188
Salote Airport	141.3	124
Nuku'alofa		
Fua'motu Airport	149.2	149
Tuvalu		
Nanumea*	64.2	37
Nui Island*	119.8	45
Funafuti*	259.7	110
Nuilakita*	314.6	113
Vanuatu		
Sola	647.2	202
Pekoa	433.7	221
Lamap	371.0	288
Port Vila	216.0	140
Tanna/Whitegrass	181.0	-
Bauerfield	200.4	132
Aneityum	292.4	196

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: December 2007 to February 2008

Typical La Niña rainfall patterns are very likely to continue with a large area of suppressed convection along the equator from Kiribati, including Tuvalu, Tokelau, the Northern Cook Islands, and the Marquesas, Tuamotu, and Society Islands.

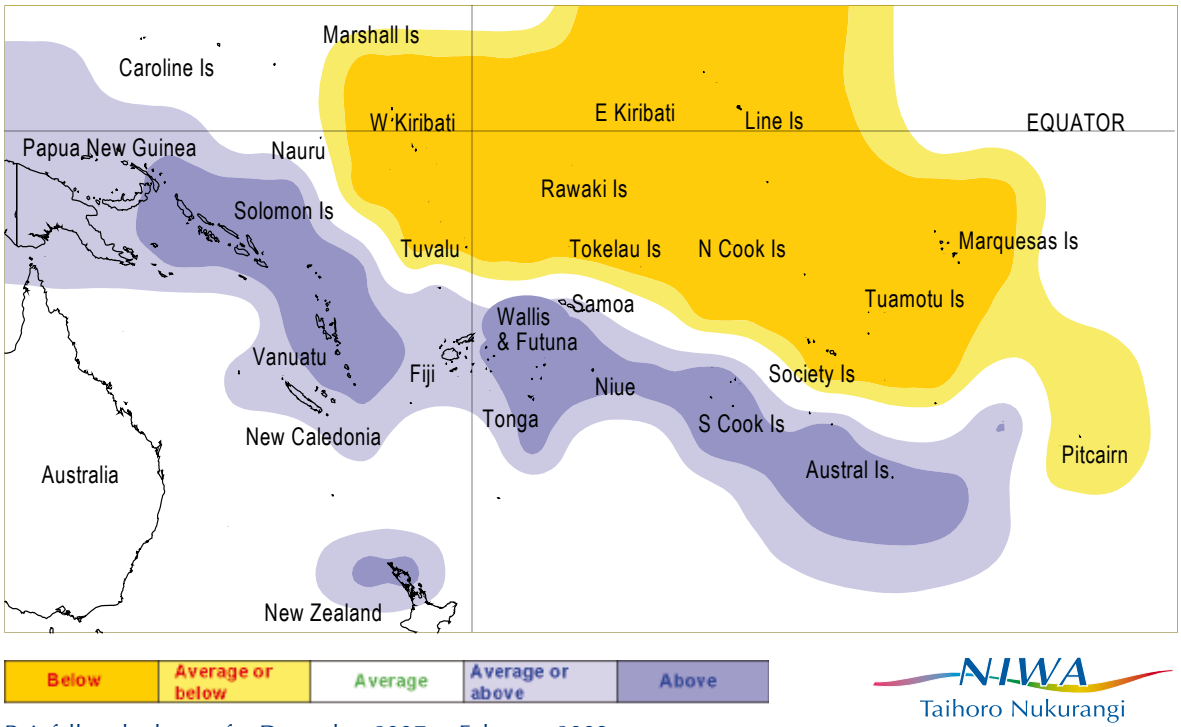
Near or below average rainfall is expected for Pitcairn Island.

Enhanced convection is likely to continue along a SPCZ displaced southwest, from the Solomon Islands through to the Austral Islands in French Polynesia. Included in the above average rainfall are Vanuatu, Wallis & Futuna, Tonga, Niue, and the Southern Cook Islands. Near or above average rainfall is expected in Papua New Guinea, New Caledonia, Fiji, and Samoa.

The confidence in the forecast model skill for this seasonal outlook is moderate to high for all Pacific Island countries. In the past, the average region-wide hit rate for forecasts issued in November has been 66%, 6% higher than the long term average for all months combined.

Island Group	Rainfall Outlook	Outlook confidence
Tonga	20:25:55 (Above)	High
Niue	20:25:55 (Above)	High
Vanuatu	20:30:50 (Above)	High
Southern Cook Islands	20:30:50 (Above)	High
Solomon Islands	25:30:45 (Above)	High
Wallis & Futuna	20:35:45 (Above)	High
Austral Islands	20:35:45 (Above)	High
Papua New Guinea	20:40:40 (Near or Above)	Moderate – high
New Caledonia	20:40:40 (Near or Above)	Moderate – high
Fiji	20:40:40 (Near or Above)	Moderate – high
Samoa	20:40:40 (Near or Above)	Moderate – high
Pitcairn Island	40:40:20 (Near or Below)	Moderate – high
Society Islands	40:35:25 (Below)	Moderate
Tokelau	45:30:25 (Below)	High
Northern Cook Islands	45:30:25 (Below)	High
Tuamotu Island	45:30:25 (Below)	High
Tuvalu	50:30:20 (Below)	High
Marquesas Islands	55:25:20 (Below)	High
Western Kiribati	60:25:15 (Below)	High
Eastern Kiribati	50:30:20 (Below)	High

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.

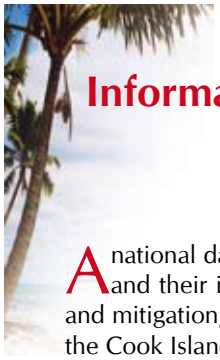


Rainfall outlook map for December 2007 to February 2008

Tropical cyclones

Tropical cyclone Guba, the first this season, occurred just over and south of Papua New Guinea between 13–19 November, with estimated maximum sustained wind speeds on 16 November of 139 km/h (category 1 on the Saffir-Simpson scale). Severe flooding was reported in parts of Papua New Guinea.

The La Niña conditions presently affecting the Pacific are still likely to influence tropical cyclones in several parts of the South Pacific this season, with a lower rate of occurrence expected in islands east of the Date Line, but with variable risk elsewhere; all islands should remain vigilant.



Information sources for a national database of historical tropical cyclone impacts: an example from the Cook Islands

Dr. Fes de Scally, University of British Columbia-Okanagan, Canada

A national database of historically occurring tropical cyclones and their impacts is an important tool for disaster planning and mitigation, and the recent completion of such a database in the Cook Islands can serve as a template for other Pacific Island nations. Many sources of written information were used which are scattered in libraries and repositories around the world. The cyclone database covers the period of European settlement, which in the Cook Islands extends back to the 1820s.

Printed meteorological reports

Information in early reports has found its way into later reports, notably S.S. Visher's two classic 1925 reports which cover the period 1789 to 1923. Subsequent reports published by the New Zealand Meteorological Service and NIWA include those by (years of record in parentheses) I.S. Kerr in 1976 (1939–69 with 'notable storms' back to 1900 included), C.G. Revell in 1981 (1969–79), C. Thompson and others in 1992 (1979–89), and R. Basher and others in 1992 (1831–1989). A World Meteorological Organization report by J. Maunder in 1995 (1900–93) summarises the exhaustive work of Kerr as well as the later reports. Other cyclone inventories for the Southwest Pacific include those by J.W. Hutchings in 1953 (1940–51), J.F. Gabites in 1956 and 1963 (1952–56), J.L. Giovanelli in 1963, and Giovanelli and J. Robert in 1964 (1947–62). Detailed reports for individual cyclones were produced by the Fiji Meteorological Service (FMS) from 1979–98, and less detailed seasonal cyclone summaries 1994/95–2001/02. The reports since the 1999/2000 season are on the FMS website. NIWA holds a tropical cyclone database which is updated annually. Except for the Kerr and FMS reports a significant limitation of the above reports is that they provide mainly cyclone track and – in the satellite era – intensity data, with few if any insights into cyclones' impacts.

Printed non-meteorological sources

In the Cook Islands the earliest written accounts of cyclones are provided by London Missionary Society priests in the 1820s. Their published memoirs and books contain many references to 19th century cyclone calamities, although observations are usually confined to an individual's home island. As an example, Aaron Buzacott's accounts of the December 1831 and March 1846 cyclones at Rarotonga rival, in detail and insights, Robert Louis Stevenson's well known account of the March 1889 cyclone at Apia, Samoa.

During British and New Zealand administration of the Cook Islands, cyclone impacts are reported extensively in the annual reports of the Cook Islands Administration. These can be found in the Appendices to the Journals of the House of Representatives of New Zealand archived in New Zealand, but this reporting ceased with independence in 1965. Major cyclone calamities are reported in great detail, while the effects of even minor cyclones, such as drops in crop exports and costs of infrastructure repair, are noted. The Cook Islands database contains extensive detail about cyclone impacts starting in 1891. Local and regional print media such as the Cook Islands News and Pacific Islands Monthly provide much detail about historical cyclone impacts, with reporting by the latter going back to about 1930. An enormous variety of scientific papers and other publications, in some cases dating back to the early 20th century, provide valuable information about major cyclone calamities in the Cook Islands.

Online sources

Websites containing cyclone track and intensity data have proliferated in recent years, but for Southwest Pacific cyclones the generally short period of record (7–13 years) in them limits their use for historical analyses. Websites which contain longer records include those of the U.S. Navy's Joint Typhoon Warning Centre with archives of 'best track' data back to 1945 and annual cyclone reports back to 1959 – although for the Southwest Pacific the latter are available only since 1985; the U.S. Navy's Global Tropical Cyclone Atlas Version 1.0 extending back to 1860 – access to which requires a security certificate; and a database of the United Nations Environment Programme which contains data from several meteorological agencies back to 1980.

A major limitation of the online sources described above is their lack of information on cyclone impacts: to our knowledge only two provide this – the U.S. Navy's Global Tropical Cyclone Atlas occasionally contains brief historical narratives, while the Australia Severe Weather website summarises significant impacts for cyclones after 1997.

Lead author, **A History of Tropical Cyclones and Their Impacts in the Cook Islands**, Cook Islands Meteorological Service, 2006, 377 p. Citations and website addresses for information sources in this article are available by emailing: **fes.descally@ubc.ca.**
http://www.wmo.int/pages/prog/wcp/ccl/opags/opag3/et3.3/et3.3_members_tors.htm

The Island Climate Update

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Your comments and ideas about The Island Climate Update are welcome. Please contact:
Project Director: Dr Jim Salinger, NIWA, Private Bag 109 695, Newmarket, Auckland, New Zealand. E-mail: j.salinger@niwa.co.nz

Editors:
Jim Salinger Email: j.salinger@niwa.co.nz
Stuart Burgess Email: s.burgess@niwa.co.nz

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

Acknowledgements

This bulletin is produced by NIWA and made possible with financial support from the New Zealand Agency for International Development (NZAID), with additional support from the Pacific Islands Applied Geosciences Commission (SOPAC) and the Secretariat for the Pacific Regional Environmental Programme (SPREP).

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.