The Island Climate Update

25

8 October 2002

An overview of the present climate in the tropical South Pacific, with an outlook for the coming months, to assist in dissemination of climate information in the Pacific region.

Produced by the National Institute of Water and Atmospheric Research, New Zealand.

NIWA
Taihoro Nukurangi

Contributors

Australian Bureau of Meteorology

Meteo France

Fiji Met Service

European Centre for Medium Range Forecasting, ECMWF

NOAA Climate Prediction Centre

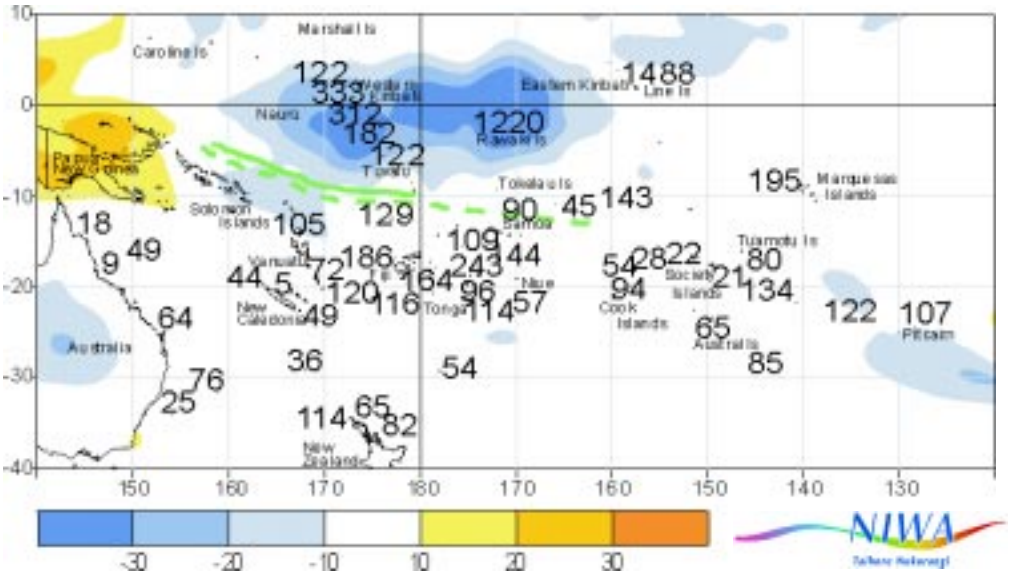
UK Meteorological Office

International Research Institute for Climate Prediction, IRICP

World Meteorological Organisation, WMO

September's climate

A large area of very enhanced convection, associated with the now well-established El Niño, persists in the central equatorial Pacific. This resulted in enhanced rainfall from Nauru across to Eastern Kiribati, with totals at least 200% of average over much of that region, and more than 1000% of average in some areas. Rainfall was also above average in parts of Vanuatu, Fiji, Tonga and the Marquesas Islands. The South Pacific Convergence Zone (SPCZ) was near its average location about and west of the date line, but had little activity further east. An area of divergence affected Indonesia, and extended over much of Papua New Guinea, and dry conditions extended from Australia across to New Caledonia. Willis Island, in the western Coral Sea, has now recorded 14 consecutive months with less than 75% of average rainfall. Rainfall was also below average from the Niue across to central French Polynesia. *More on Page 2*



Outgoing Long-wave Radiation (OLR) anomalies, in Wm^{-2} are represented by hatched areas, and rainfall percentage of average, shown by numbers. 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 September 2002 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.

ENSO and sea surface temperatures

A more persistent El Niño state is now apparent, with anomalous westerlies affecting equatorial regions about and west of the dateline. The 3-month Southern Oscillation Index (SOI) remains steady at -1.2, and positive equatorial sea surface temperature (SST) anomalies around Kiribati intensified. The El Niño is expected to persist into early 2003. *Details Page 2.*

The next three months (October to December 2002)

Above average rainfall is likely in both Western and Eastern Kiribati. Tuvalu and Tokelau are likely to experience average or above average rainfall. Below average or average rainfall is expected from Papua New Guinea across to the Southern Cook Islands including New Caledonia, Vanuatu and Fiji. *More on Page 3.*

Ministry for the Environment and Territory

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New Zealand Agency for International Development
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SPREP

Climate developments in September 2002

CLIMATE EXTREMES IN SEPTEMBER 2002

Country	Location	Rainfall (mm)	% of average	Comments
Western Kiribati	Tarawa	377	333	Record High
Eastern Kiribati	Christmas Island	536	1488	Record High
Eastern Kiribati	Kanton Island	330	1220	Record High
Tonga	Lupepau'u	296	243	Well above average
Australia	Townsville Airport	1	9	Extremely Low
New Caledonia	Koumac	2	5	Extremely Low
French Polynesia	Tahiti - Faaa	11	21	Well below average

Country	Location	Max Air Temp (°C)	Date	Comments
Fiji	Rotuma	32.3	18th	Record High
French Polynesia	Hao	32.0		Record High

Country	Location	Min Air Temp (°C)	Date	Comments
Fiji	Rotuma	26.5	13th	Record High
French Polynesia	Borabora	19.2		Record High

Enhanced convection persists in the central equatorial Pacific

A large area of very enhanced convection, although less extensive than in August, persisted in the central equatorial Pacific during September. This was assisted by anomalous surface equatorial westerlies between 160°E and 180°E (occurring in 80% of observations at Tarawa, Western Kiribati; the highest frequency there since the middle of the last El Niño in October 1997). This convergence affected much of the region between 5°N and 5°S and 165°E and 165°W,enhancing rainfall from Nauru, across to Eastern Kiribati. Very anomalous September rainfall, more than 1000% of average was recorded in parts of Eastern Kiribati, and totals were at least 200% of average throughout much of Western Kiribati, as well as localised parts of Vanuatu, Tonga and the Marquesas Islands. Rainfall was at least 125% of average over much of Fiji. Tarawa has recorded 854 mm in the past two months.

The SPCZ was near its average location about and west of the date line, between the Solomon Islands and Tuvalu. However, it continued to be weak with little activity further east in the Southwest Pacific.

Convection was suppressed, with sunny conditions, over Indonesia, and extending to Papua New Guinea. Dry conditions extended from Australia across the Coral Sea to New Caledonia, with rainfall less than 50% of average in many areas. Rainfall was also below average from the Niue across to central French Polynesia.

Some new temperature extremes were recorded in Fiji and French Polynesia.

El Niño may persist into early 2003

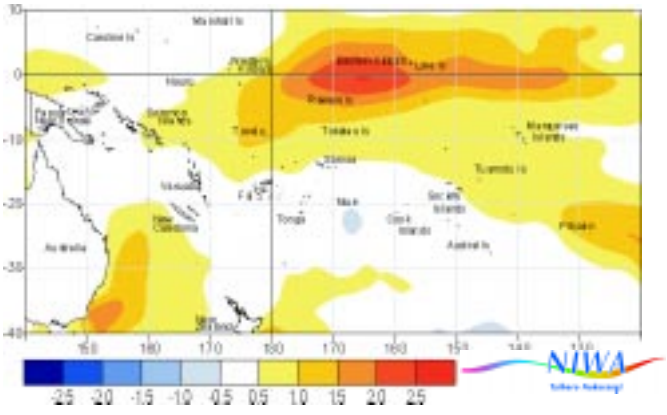
Further intensification of central equatorial SST anomalies

Central Pacific SST anomalies intensified further during September, with some areas around Kiribati more than 2.0°C above average, surface water temperatures being at least 30°C. The horseshoe like Pacific SST anomaly pattern has developed slightly since August, but at this stage is still surrounded by average SSTs rather than cooler than average waters. Above average (+0.9 to +1.2°C) equatorial SSTs continue in the NINO3 and NINO 4 regions, with positive subsurface SST anomalies (+3.0°C) evident across the equatorial Pacific east of the dateline, in the upper 150m.

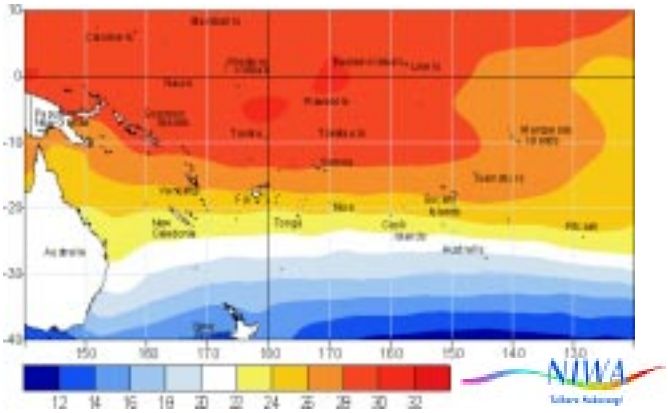
Warmer than average waters continued to affect the east coast of Australia and the region southwest of New Caledonia. The broad region of warmer than average SST between Kiribati to Pitcairn Island has now merged.

Anomalous equatorial westerlies are still affecting the region about and west of the dateline.

The present El Niño event is expected to last throughout the rest of the year, affecting the southwest Pacific wet season, into early 2003.



Sea surface temperature anomalies (°C) for September 2002



Mean sea surface temperatures (°C) for September 2002

Forecast validation

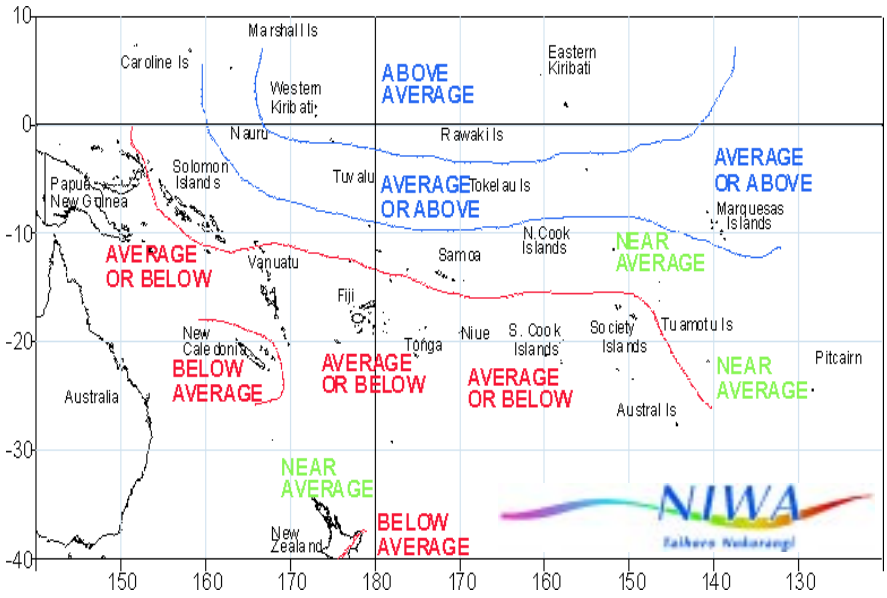
Forecast period:
July to September 2002

Rainfall was projected to be above average in Western and Eastern Kiribati, and average or above average in the Solomon Islands, Vanuatu and Tuvalu. A trend towards below average rainfall was expected in New Caledonia, Fiji, Samoa, Tokelau and the Marquesas Islands. Average rainfall was forecast for other areas.

The rainfall outlook was as expected for most countries near and west of the Equator. However, the region of above average rainfall extended further south than expected to affect Fiji, Tonga, Niue, parts of Samoa and the Marquesas Islands. Rainfall was lower than expected in Papua New Guinea, and from the Southern Cook Islands east to Pitcairn, including parts of the Austral Islands. The overall 'hit rate' for the July to September rainfall outlook was about 50%.

Rainfall outlook: October to December 2002

- Enhanced convection and above average rainfall in Western and Eastern Kiribati with above average or average rainfall in Tuvalu, Tokelau and the Marquesas Islands
- Below average or near average rainfall from Papua New Guinea southeast to the Society Islands
- Below average rainfall for New Caledonia



Rainfall outlook map for October to December 2002

The El Niño related region of enhanced convection, presently affecting Western and Eastern Kiribati is expected to persist over the October to December 2002 period, resulting in continued above average rainfall in that region, with average or above average rainfall likely in Tuvalu, Tokelau and the Marquesas Islands. Below average or average rainfall is expected from Papua New Guinea to the Society Islands, including Vanuatu, Fiji and Southern Cook Islands. Below average rainfall is expected for New Caledonia. Near average rainfall is likely elsewhere.

Forecast model skills are generally moderate, with the transition to the southern hemisphere wet season. However, the model skills are high for Kiribati.

Probabilities of rainfall departures from average

Broad-scale rainfall patterns and anomalies in the southern tropical Pacific area are estimated from the state of large-scale regional climate factors, such as La Niña or El Niño, their effect on the South Pacific and Tropical Convergence Zones, surface and sub-surface sea temperatures, and computer models of the global climate.

Rainfall estimates for the next three months for Pacific Islands are given in the adjacent 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.

The probabilities shown express the expected shift in the distribution from the long-term average, based on predictions of oceanic and atmospheric conditions. The amount of inter-model forecast consistency is indicated by the levels of confidence expressed in the table.

TROPICAL PACIFIC RAINFALL OUTLOOK
(OCTOBER - DECEMBER 2002)

Island Group	Rainfall Outlook	Confidence in the Outlook
Western Kiribati	15:20:65 (Above)	High
Eastern Kiribati	15:15:70 (Above)	High
Tuvalu	10:40:50 (Average or above average)	Moderate
Tokelau	10:50:40 (Average or above average)	Moderate
Marquesas Islands	20:40:40 (Average or above average)	Moderate
Solomon Islands	35:50:15 (Near average)	Moderate
Wallis & Futuna	25:50:25 (Near average)	Moderate
Samoa	25:50:25 (Near average)	Moderate
Northern Cook Islands	25:50:25 (Near average)	Moderate
Austral Island	30:50:20 (Near average)	Moderate
Pitcairn Island	20:50:30 (Near average)	Moderate
Papua New Guinea	35:45:20 (Average or below average)	Moderate
Vanuatu	40:40:20 (Average or below average)	Moderate
Fiji	40:40:20 (Average or below average)	Moderate
Tonga	40:40:20 (Average or below average)	Moderate
Niue	40:40:20 (Average or below averge)	Moderate
Southern Cook Islands	40:40:20 (Average or below average)	Moderate
Society Islands	40:40:20 (Average or below average)	Moderate
New Caledonia	60:30:10 (Below Average)	Moderate

Relative Influences of the Interdecadal Pacific Oscillation and ENSO on the South Pacific Convergence Zone

J A Renwick, M J Salinger, A B Mullan, C K Folland & A Gosai

This summary is based on recent work done by NIWA and the U.K. Met Office Hadley Centre (Folland et al 2002). The South Pacific Convergence Zone (SPCZ) is one of the most significant features of subtropical Southern Hemisphere climate (Kiladis et al., 1989; Vincent, 1994). It is characterized by a band of low-level convergence, cloudiness and precipitation in the western Pacific extending south eastwards towards French Polynesia. Its location varies in relation to both the Interdecadal Pacific Oscillation (IPO) and El Niño Southern Oscillation (ENSO). The SPCZ is a broad feature, and is associated with maxima of sea surface temperatures (SST), precipitation, cloudiness, low level convergence and a of minima out-going long-wave radiation (OLR).

The SPCZ is linked to the Inter-Tropical Convergence Zone (ITCZ) in the west over the Pacific warm pool and it is maintained by the interaction of the trade winds and disturbances in the mid-latitude westerlies in the east. The SPCZ tends to be most active during the southern hemisphere summer months (November- April). Trenberth (1976) showed that location of the SPCZ varies systematically with ENSO-related expansion and contraction of the western Pacific warm pool, moving northeast during El Niño events and southwest during La Niña events. The SPCZ also changes its mean locations with the polarity of the IPO, a ~15-30 year time scale fluctuation in SST and circulation across the whole of Pacific basin (ICU 21&23, Power et al., 1999). Variations in the mean location of the SPCZ are important for South Pacific climate, as precipitation can vary strongly with the movement (Salinger et al., 1995).

Relations between the SPCZ, ENSO and the IPO were analysed using an SPCZ Position Index (SPI; Suva minus Apia pressure difference), the Southern Oscillation Index (SOI) and an IPO index calculated from the SST pattern in Fig 1. When the IPO is in its negative phase, and in a La Niña, the mean position of the SPCZ is displaced to the southwest. During the positive IPO, and in an El Niño, the SPCZ is displaced northeast.

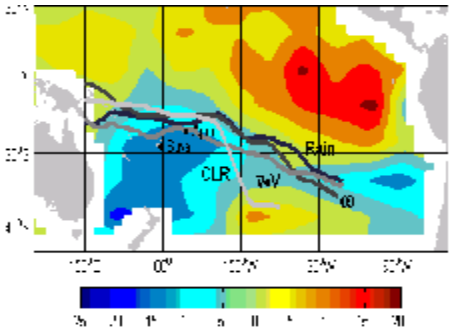


Figure 1. The SPCZ and its relationship to the pattern of the IPO. The mean Nov-Apr location of the SPCZ during 1958-1998 is shown by four different indicies: Maxima in rainfall (Rain), maxima in low-level convergence ($\nabla \cdot V$), maxima in 500 hPa vertical motion (ω) and minima in outgoing long-wave radiation (OLR). The background shading shows the IPO pattern in SST anomalies. The contour interval is 0.05°C.

Analysis of variance confirms that the SPI was significantly related both to the state of the IPO and SOI during 1891-2000.

Figure 2 shows changes in 10m divergence related to ENSO and the IPO. The top panel shows the mean pattern of Nov-Apr divergence during 1958-1998. The middle panel shows that El Niño events lead to a north-eastward movement of the SPCZ, relative to a cool La Niña event, and there is a tendency for blending of the ITCZ and the SPCZ in the central equatorial Pacific. The bottom panel shows analogous behaviour of the SPCZ in the warm phase of the IPO (1978-1998), resulting in a northward shift compared to the cool phase (1958-1977).

Therefore, it is demonstrated that both ENSO and the IPO influence the SPCZ quasi-independently. Spatial patterns of decadal trends in recent climate in the South Pacific are strongly affected by the SPCZ, especially the IPO-related changes in the mid 1970s (Folland et al., 1997; Salinger et al., 1995; Salinger et al 2001).

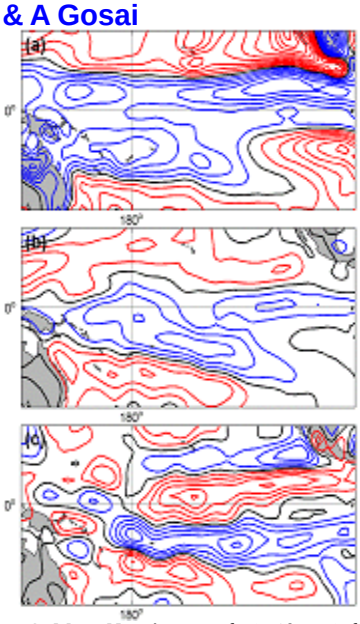


Figure 2. Mean Nov-Apr reanalysis 10m wind divergence for (a) all 1958-1998, (b) El Niño minus La Niña, (c) positive IPO minus negative IPO.

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The Island Climate Update

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Your comments and ideas about The Island Climate Update are welcome. Please contact:
The Editor: **Dr Jim Salinger**, NIWA, Private Bag 109 695, Newmarket, Auckland, New Zealand.
E-mail: j.salinger@niwa.co.nz Telephone: int + 64 9 375 2053 Facsimile: int +64 9 375 2051
For Comments: **Ashmita Gosai,** NIWA, Private Bag 109 695, Newmarket, Auckland, New Zealand
E-mail: a.gosai@niwa.co.nz Telephone: int + 64 9 375 4506 Facsimile: int + 64 9 375 2051
Technical Services: **Stuart Burgess**, NIWA, PO Box 14-901, Wellington, New Zealand.
E-mail: s.burgess@niwa.co.nz Telephone: int + 64 4 386 0300 Facsimile: int +64 4 386 0341
Design: **Alan Porteous**

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 Samoa Solomon Islands Tokelau Tonga Tuvalu Vanuatu

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

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