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5 March 2004

The Island Climate Update

An overview of the present climate in the tropical South Pacific, with an outlook for the coming months

Contributors

Australian Bureau of Meteorology

Meteo France

Fiji Meteorological Service

Samoa Meteorological Service

NOAA National Weather Service

NOAA Climate Prediction Centre, CPC

International Research Institute for Climate Prediction, IRICP

European Centre for Medium Range Weather Forecasts, ECMWF

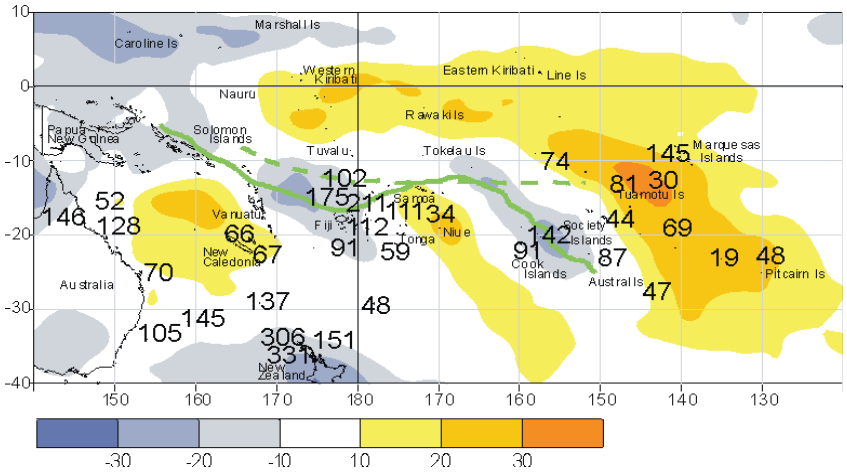
UK Met Office

World Meteorological Organisation, WMO

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

February's climate

- Tropical cyclone 'Ivy', the second this season, brought severe winds and heavy rainfall to parts of Vanuatu on the 25 - 26th of February.
- The South Pacific Convergence Zone (SPCZ) was located further south than usual in many areas, with above average rainfall over much of Fiji and the Southern Cook Islands.
- An extensive region of below average rainfall occurred from Western Kiribati to Pitcairn Island.



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 February 2004 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

- The February Southern Oscillation Index (SOI) was +0.7. The equatorial Pacific remains in a neutral El Niño Southern Oscillation (ENSO) state.
- Sea Surface Temperatures (SST) are well above average in the southwest Pacific.

The next three months March to May 2004

- Suppressed convection in the Eastern Pacific is likely to result in average or below average rainfall in the Tuamotu Islands and Pitcairn Island's region, and below average rainfall over the Marquesas Islands.
- Above average or average rainfall is expected over Western Kiribati, Vanuatu, the Wallis and Futuna Islands and the Society Islands.

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New Zealand Agency for International Development
Nga Hoe Tuputupu-mai-tawhiti

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Taihoro Nukurangi

Climate developments in February 2004

SPCZ was further south than usual

Above average rainfall in parts of Fiji, Vanuatu and the Southern Cook Islands

An extensive region of below average rainfall from Western Kiribati to Pitcairn Island

CLIMATE EXTREMES IN FEBRUARY 2004

Country	Location	Rainfall (mm)	% of average	Comments
Vanuatu	Bauerfield	621	238	Extremely High
Fiji	Udu Point	526	211	Well above average
New Zealand	Kaitaia	309	306	Highest
New Zealand	Auckland Airport	272	331	Highest
French Polynesia	Gambier, Rikitea	31	19	Lowest

Country	Location	Mean Temp (°C)	Dep from av	Comments
French Polynesia	Tahiti Faaa	28.1	+1.0	Extremely high
New Caledonia	Koumac	28.3	+1.5	Record high
New Caledonia	Ouanaham	27.7	+1.5	Record high
New Caledonia	La Tontouta	28.2	+1.7	Well above average
New Caledonia	Noumea	28.1	+1.7	Well above average

Country	Location	Max Temp (°C)	Date	Comments
Fiji	Vunisea	34.4	5th	New High
Fiji	Vatukoula	25.1	13th	New Low

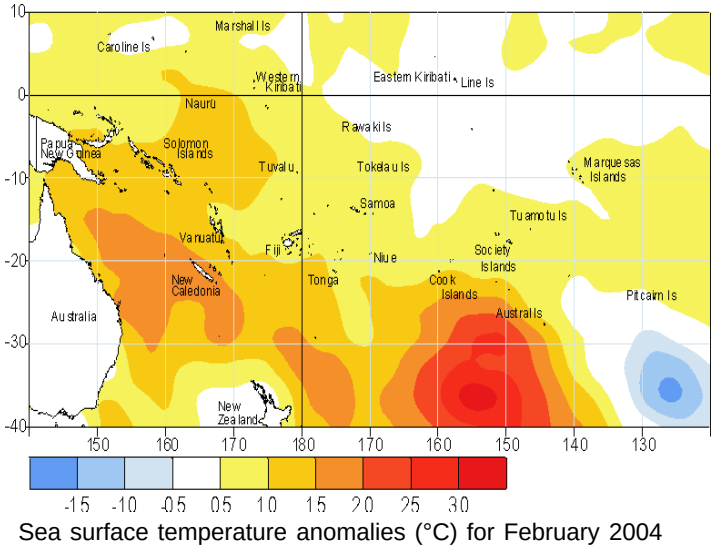
The Southwest Pacific OLR/rainfall anomaly pattern changed again, withthe February patterns almost opposite that of January. The SPCZ was located further south than usual in many areas, extending east-south-east from the Solomon Islands toward Fiji, across to Samoa, and over the Southern Cook Islands. Rainfall was above average over much of the SPCZ affected region, with anomalies exceeding 125% of normal over much of Fiji and in the Southern Cook Islands. There were 25 days with rainfall at both Rarotonga Airport and Bora Bora (Society Islands). February was also extremely wet with strong westerly winds over much of New Zealand's North Island, many sites recording their wettest and windiest February on record. High intensity rainfall occurred over parts of Vanuatu during the passage of tropical cyclone 'Ivy' (25-26th February), with Bauerfield recording 544 mm in 48 hours, and 115 mm in 12 hours.

A large region of suppressed convection and below average rainfall (generally 75% or less of normal) affected the region from Western Kiribati spreading southeast to the Tuamotu Islands and Pitcairn Island. Other smaller regions of suppressed convection and generally below average rainfall occurred over the southern Coral Sea and New Caledonia and Niue. February was the 12th consecutive month with below average rainfall in many parts of Eastern Kiribati. Mean air temperatures exceeded 1.5ºC above average in parts of New Caledonia and were 0.5-0.9ºC above average in French Polynesia.

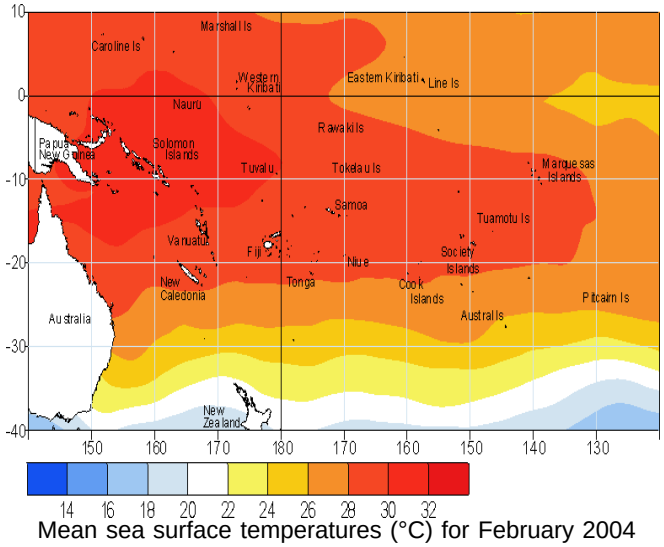
Western Pacific warmer than usual Average SSTs in NINO4

The equatorial Pacific remains in a neutral state. Equatorial SSTs have eased further, but are slightly higher than normal, especially in the west. The monthly SOI continues to fluctuate, associated with the Madden-Julian Oscillation (MJO). The mean SOI for February was +0.7, and +0.1 for December to February. The NINO3 SST anomaly for February was about +0.2°C and NINO4 about +0.6°C (December to February are +0.5°C and +0.8°C, respectively). The trade winds have been near normal apart from the MJO-related variability in the western Pacific.

Most of the global climate models indicate neutral conditions during the 2004 autumn. Recent oceanic Kelvin wave activity and the general lack of predictability at this time of the year make longer-range ENSO outlooks difficult to predict.



Sea surface temperature anomalies (°C) for February 2004



Mean sea surface temperatures (°C) for February 2004

Forecast validation

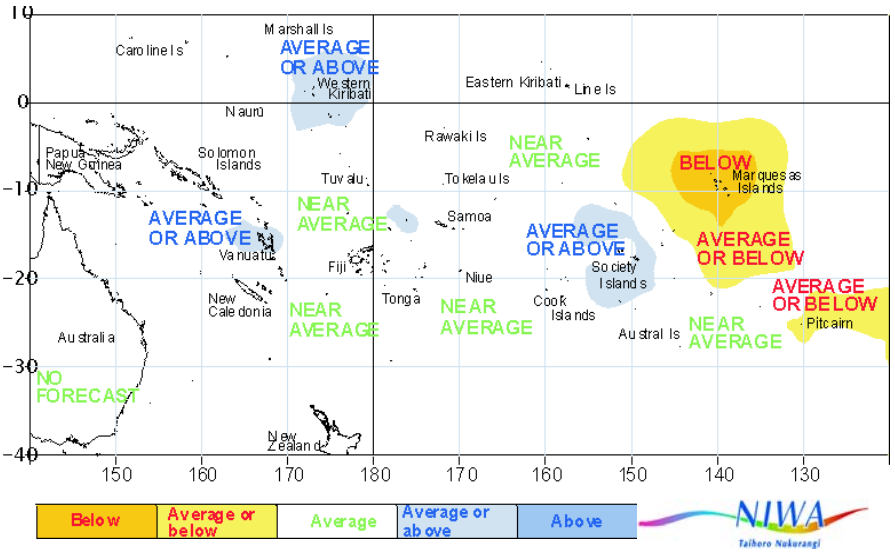
Forecast period: December 2003 to February 2004

Above average rainfall was expected for Western Kiribati with enhanced convection expected in the equatorial region extending from the Solomon Islands eastwards to Tokelau, Tuvalu and Wallis and Futuna. Below average rainfall was forecast for Eastern Kiribati, with average or below average rainfall in the Marquesas Islands.

Rainfall was lower than expected in Tonga, central and southern French Polynesia region. Rainfall was higher than forecast in the Marquesas Islands and Pitcairn Island, mixed over Vanuatu, and as forecast elsewhere. The overall 'hit rate' for the December 2003 to February 2004 rainfall outlook period was about 55%.

Rainfall outlook: March to May 2004

- **Enhanced convection in Western Kiribati, Vanuatu, the Wallis and Futuna, and the Society Islands**
- **Average or below average rainfall likely over the Tuamotu Islands and Pitcairn Island**
- **Below average rainfall is expected in the Marquesas Islands**

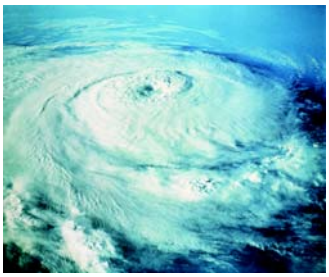


Rainfall outlook map for March to May 2004

Enhanced convection is expected in Western Kiribati, Vanuatu, Wallis and Futuna and the Society Islands, resulting in average or above rainfall around this region. Average or below average rainfall is expected in the Tuamotu Islands and Pitcairn Island region while suppressed convection is expected over the Marquesas Islands, where rainfall is likely to be below average.

Near average rainfall is likely elsewhere in the region. The model skills are low to moderate due to lack of predictability during this time of the year.

Tropical Cyclones



There have been only two tropical cyclones so far this season. Tropical cyclone 'Heta', affected Samoa, American Samoa and Tonga but devasted Niue in early January. Tropical cyclone 'Ivy' which formed west of Fiji on 22 February, brought damaging winds and high rainfall to parts of Vanuatu on 25-26 February. Maximum sustained winds near Ivy's centre were estimated to be as high as 205 km/h, with mean wind speeds of at least 130 km/h when it struck Vanuatu.

Ivy later tracked south to affect north eastern parts of northern New Zealand.

The probability for tropical cyclones to occur in March remains high, as March is normally one of the most active months for tropical cyclones. Another MJO pulse, which might occur between mid and late March, combined with well above average SSTs in the Coral Sea could assist in further tropical cyclone development in the region.

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 (MARCH - MAY 2004)

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

Pacific Island Weather and the MJO

Dr Mike Revell, NIWA

The Madden-Julian Oscillation (MJO) is the major mode of variability of the tropical atmosphere-ocean system on time scales of 30 to 70 days. The MJO organizes convection into an eastward-propagating envelope of smaller-scale disturbances. This envelope moves eastward at between 5 and 10 ms^{-1} on average, generally forming in the tropical Indian Ocean and dissipating over the central Pacific. It is generally most active during the southern hemisphere summer and autumn. This convective disturbance generates atmospheric circulation anomalies throughout the tropics and extra-tropics, causing active and break periods in the Asian and Australian monsoons and possibly playing a role in initiating and modulating El Niño events. Although the MJO is sporadic, once a disturbance is initiated there is a reasonably good measure of predictability associated with its evolution.

Early theories for the MJO viewed it as an eastward propagating, equatorially confined gravity wave in the atmosphere. The natural propagation speeds for such waves in the atmosphere seem considerably faster than the observed speed of the MJO, particularly when it is at its most intense over the warmer waters of the Indian and western Pacific oceans. More recent work suggests that in this latter region an ocean–atmosphere coupled mechanism may apply. Variations in cloudiness and low level winds associated with the MJO appear to induce changes in sea surface temperature (SST) to the east and west of the convection. These changes in SST then feed back on the atmosphere affecting the eastward propagation of the convection. This mechanism is schematically represented in Fig. 1. If this coupling is important it would help explain why current long range forecast models with prescribed SST at the lower boundary are not able to accurately reproduce the MJO.

At NIWA we are currently conducting research to establish whether or not the MJO has a predictable effect on the weather in the South Pacific between 10 days and a season ahead. Using satellite observations of outgoing longwave radiation (OLR), which is reduced in regions of high, cold cloud tops associated with deep convection, we have derived an index for the MJO. This index, in conjunction with streamfunction patterns at 200hPa, will be compared with radiosonde, surface and European Center for Medium-Range Weather Forecasting (ECWMF) reanalysis weather data in the South Pacific region, using simple statistical relationships to determine lag correlations. If we can establish any of these correlations are statistically significant then we will attempt to forecast the influence of the MJO. We do not expect the results to be dramatic (because many other factors influence the weather) but it may be possible to indicate average rain, wind or temperatures slightly above or below normal for the next month.

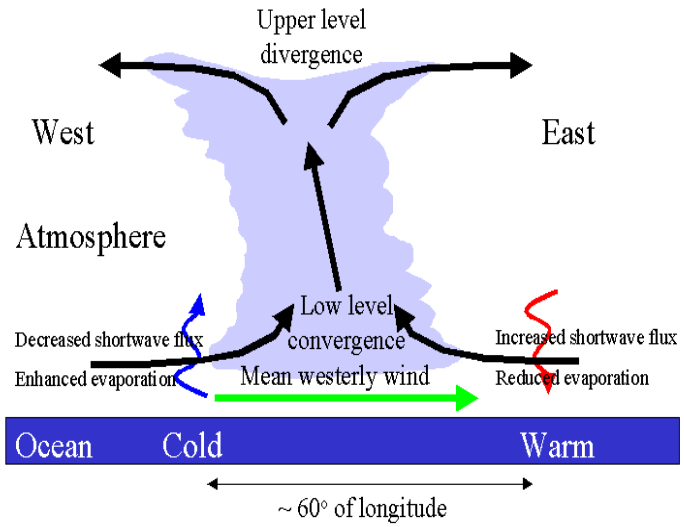


Figure 1. A simple schematic representation of the coupling between atmosphere and ocean of the MJO. The plot shows a cross section along the equator. The blue cloud represents the convective region of the MJO (which propagates to the east) and the black arrows indicate the circulation anomalies associated with it. The green arrow indicates the low level mean wind in the Indian and West Pacific Oceans. The red and blue curvy arrows represent surface flux anomalies.

The Island Climate Update

Visit The Island Climate Update website at: www.niwa.co.nz/NCC/ICU/.
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
Assistant Editor: **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
Climatologist: **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

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

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

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