The Island Climate Update

39

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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

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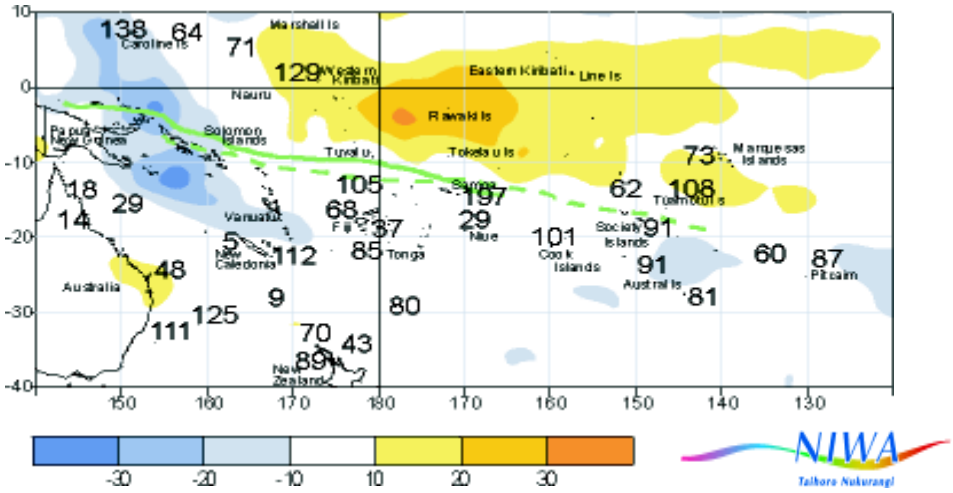
November's climate

Below average rainfall persisted over much of the equatorial Southwest Pacific, with suppressed convection over much of Western and Eastern Kiribati, Tokelau, and also parts of northern French Polynesia. Rainfall was also below average over the southern Coral Sea, and parts of New Caledonia, Fiji, and Niue. Low rainfall has persisted for many months in parts of Eastern Kiribati, and Fiji. The South Pacific Convergence Zone (SPCZ) extended east from north of Papua New Guinea to Samoa, being more active than usual over the Solomon Islands. Enhanced convection occurred from the Caroline Islands southeast to southern Vanuatu. Air temperatures were above average in Tuvalu and Tonga, and below average in New Caledonia and the Southern Cook Islands. There have been no tropical cyclones so far this season. ***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 November 2003 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

Even though the equatorial Pacific is in a neutral state, equatorial sea surface temperatures (SSTs) remain higher than normal, especially in the western Pacific. The Southern Oscillation Index (SOI) was -0.5 for November. Almost all global climate models indicate neutral conditions (with positive SST anomalies) through to early 2004. A number of models suggest a warm event developing for the southern hemisphere winter of 2004. ***Details Page 2***

The next three months December 2003 to February 2004

Enhanced convection is expected in the equatorial region extending from Western Kiribati southeast to Tuamotu Islands, including the Solomon Islands, Tuvalu, Tokelau and Wallis and Futuna, where rainfall is expected to be average or above average. Average or below average rainfall is likely for New Caledonia and the Marquesas Islands, while below average is forecast for Eastern Kiribati. Near average rainfall is most likely elsewhere in the region. ***More on Page 3***

SOPAC

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Nga Hoe Tuputupu-mai-tawhiti

SPREP

Climate developments in November 2003

Below average rainfall persists over much of the equatorial Southwest Pacific

Enhanced convection from the Caroline Islands to southern Vanuatu

High rainfall persists in Pitcairn Island

A large region of suppressed convection and generally below average rainfall encompassed much of Western and Eastern Kiribati, Tokelau, and parts of northern French Polynesia.

CLIMATE EXTREMES IN NOVEMBER 2003

Country	Location	Rainfall (mm)	% of average	Comments
Australia	Norfolk Island	6	9	Extremely low

Country	Location	Mean Air Temp (°C)	Dep. from Av	Comments
Tuvalu	Nanumea	29.3	+1.0	Well above average

Country	Location	Max Air Temp (°C)	Date	Comments
Fiji	Vunisea	32.5		New record

Rainfall was also below average (75% of average) over the southern Coral Sea, and parts of New Caledonia, Fiji, and Niue. November was the 9th consecutive month with below average rainfall in parts of Eastern Kiribati, and the 5th consecutive month with below average rainfall in parts of Fiji.

The SPCZ extended east from the north of Papua New Guinea to Samoa, being more active than usual over the Solomon Islands, and was displaced slightly north of its mean location. Enhanced convection occurred from the Caroline Islands southeast to southern Vanuatu. Apart from that region, there were only isolated areas where rainfall was at least 125% of average.

Air temperatures were at least 0.5ºC above average in Tuvalu and Tonga, and about 0.5ºC below average in New Caledonia and the Southern Cook Islands.

Surface westerlies were almost absent in November at Tarawa, Western Kiribati, where a high frequency of calm conditions occurred. Trade winds were stronger than average in New Caledonia.

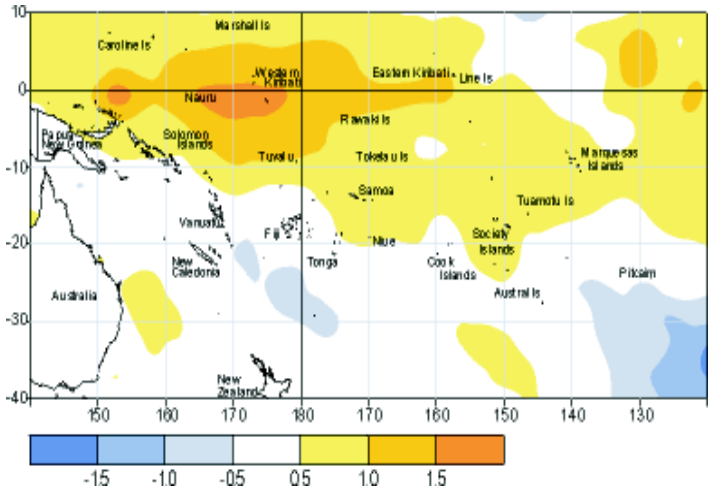
Warmer SSTs in western equatorial Pacific

Neutral ENSO state forecast till April 2004

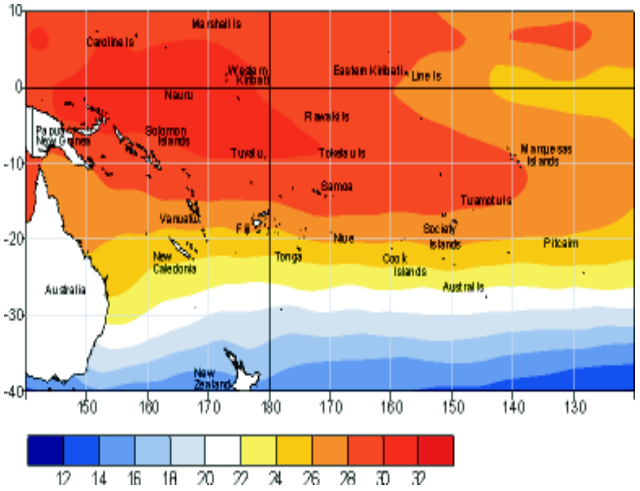
The Equatorial Pacific is in a neutral state, but equatorial SSTs remain higher than normal, especially just west of the Date Line.

The NINO3 SST anomaly for November is about +0.6°C and NINO4 is above +1.1°C (3-month means are +0.6°C and +0.9°C, respectively). Despite the relatively high SST anomalies, zonal winds have been near-normal in the Equatorial Pacific recently, after a period of westerly anomalies in the west. Subsurface ocean temperature anomalies show little change from October, being weakly positive above 100 m depth, and weakly negative in the 100 m below that.

Almost all models indicate neutral conditions (but positive SST anomalies) through to early 2004.



Sea surface temperature anomalies (°C) for November 2003



Mean sea surface temperatures (°C) for November 2003

Forecast validation

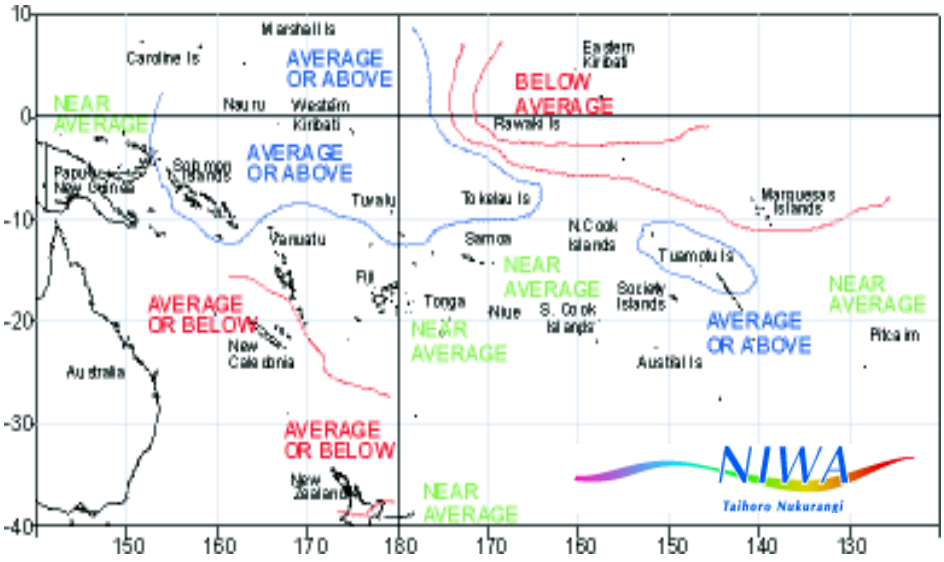
Forecast period: September to November 2003

Average or above average rainfall was expected in Papua New Guinea, but suppressed convection in equatorial regions was expected to result in average or below average rainfall in Western and Eastern Kiribati and the Marquesas Islands. Rainfall was also expected to be average or below average in Tuvalu and Fiji. Average rainfall was expected elsewhere in the region.

Observed rainfall was above average over northern regions of both Papua New Guinea and the Solomon Islands. Totals were below average in an extensive region from the Coral Sea to Fiji and across to the Cook Islands, as well as throughout Western and Eastern Kiribati, and in New Caledonia. Mixed rainfall patterns occurred over Fiji. Rainfall was near average on most other islands. Over Tuvalu, the SPCZ remained weaker than average. Rainfall was lower than expected in the Austral Islands.

Rainfall outlook: December 2003 to February 2004

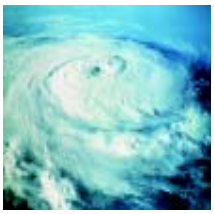
- **Average or above average from Western Kiribati southeast to the Tuamotu Islands**
- **Trending below average in New Caledonia, Eastern Kiribati and the Marquesas Islands**



Rainfall outlook map for December 2003 to February 2004

Enhanced convection is expected in the equatorial region just west of the Date Line, resulting in average or above average rainfall from Western Kiribati across to the Tuamotu Islands, including the Solomon Islands, Tuvalu, Tokelau and Wallis and Futuna. Average or below average rainfall is forecast for New Caledonia and the Marquesas Islands. Rainfall is expected to be below average in Eastern Kiribati.

Near average rainfall is likely elsewhere in the region. Seasonal forecast model skills are expected to range from moderate to high for the coming three months as the wet season commences.



Tropical Cyclones

There has been a slow start to the cyclone season. Of the 32 seasons for which we have satellite observations, in only 40% of years have there been no tropical cyclones by mid December. In 22% of years, the first tropical cyclone does not occur until January.

There is on average one occurrence in our region of the Pacific during December and two in January. Late starts of tropical cyclone season tend to coincide with Neutral or La Niña ENSO conditions.

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 (DECEMBER 2003 - FEBRUARY 2004)

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

Defining ENSO Events

Dr Brett Mullan, NIWA

Given the very wide interest in the climate impacts of El Niño-Southern Oscillation (ENSO), it is perhaps surprising that there is no universally accepted definition of an ENSO event. There is certainly ***qualitative*** agreement on typical characteristics associated with El Niño and La Niña periods. El Niños are characterised by warmer than normal sea surface temperatures (SSTs) across much of the central and eastern tropical Pacific, weaker easterly trade winds, higher than normal pressures over Indonesia, and an eastward shift in rainfall into the central tropical Pacific. La Niña anomalies are the opposite. Improved observations now allow important sub-surface oceanographic features to be identified too: for example, El Niños have higher than normal sub-surface temperatures in the eastern tropical Pacific, and a deeper thermocline (the boundary between warm well-mixed surface waters and colder deep water).

However, when it comes to a ***quantitative*** definition of ENSO, and an unambiguous list of past events, there is no single agreed approach. ENSO events have been identified most commonly using either the Southern Oscillation Index (SOI) or an index of tropical Pacific SST anomaly, usually for either the Nino3 region (5°N-5°S, 90°W-150°W) or the Nino3.4 region (5°N-5°S, 120°W-170°W). Other researchers have suggested bivariate indices (eg, both SOI and SST), and even multivariate indices (by including rainfall and wind anomalies, for example).

Any quantitative definition of an ENSO event requires choices to be made about: (i) What index to use (eg, SOI or Nino3.4) and what smoothing to apply (eg, 3- or 5-month running means); (ii)What threshold value to use (eg, ±1.0 for SOI, ±0.4°C for Nino3.4); (iii)What persistence to require (eg, at least 6 months); (iv)Whether to allow short-lived exceptions (eg, index dips below threshold for one or two months within an ENSO sequence).

Figure shows time series of both the SOI (normalised Tahiti minus Darwin pressure difference) and Nino3.4 (using Reynolds SST, 1982-2002, concatenated to UKMO HadISST1.1, and normalised relative to 1971-2000). Visually the curves seem almost mirror images of each other, although the correlation coefficient is only –0.89. There are differences in the detail, such as the 1977/78 El Niño being much stronger in the SOI data.

There is a recent initiative by NOAA to obtain international agreement on an operational definition of El Niño and La Niña events. Although a number of the typical ENSO characteristics (above) could be incorporated, NOAA has chosen to use the simple Nino3.4 index with minimum smoothing in time. (http://www.noaanews.noaa.gov/stories/s2095.htm) For research purposes, the use of an SST index (Nino3.4) is now the most common method for defining ENSO, at least for events from about 1950 and later. The SOI is still preferred for events earlier in the historical record. The Table below lists ENSO seasons based on the Nino3.4 5-month running mean SST exceeding ±0.4°C for at least 6 consecutive months (a definition that is gaining acceptance).

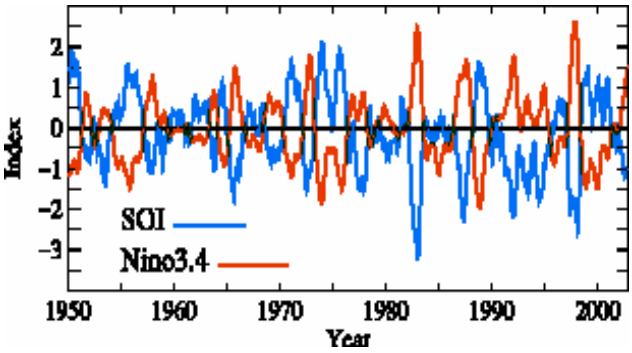


Figure: Five-month running mean of Southern Oscillation Index (SOI) and Nino3.4 SST anomaly, Jan-1950 to Dec-2002.

Event	Season	Years (century number omitted)
El Nino	Dec-Feb	52, **58**, 64, 66, 69, 70, **73**, 77, **78, 83, 87,** 88, **92,** 95, **98**, 03
	Mar-May	**53, 66,** 69, **77, 83, 87, 91, 92, 93, 97, 98**
	Jun-Aug	51, 53, 57, 63, **65,** 69, **72, 77, 82, 87,** 91, **93, 94, 97, 02**
	Sep-Nov	51, 57, **63, 65,** 69, **72,** 76, **77, 82,** 86, 87, **91, 94, 97,** 02
La Nina	Dec-Feb	**50, 51,** 55, **56,** 57, 65, **71, 74, 76,** 84, 85, **89,** 96, **99, 00,** 01
	Mar-May	**50,** 55, **56, 71, 74, 75,** 85, **89, 99, 00**
	Jun-Aug	**50**, 54, **55, 56,** 64, 71, **73,** 74, **75,** 88, **98,** 99
	Sep-Nov	**50,** 54, **55,** 56, 64, **70, 71, 73,** 74, **75,** 83, 84, **88,** 95, **98,** 99, **00**

Table: ENSO seasons (eg, "52" is 1952, associated with the January year), based on Nino3.4 index as defined in text. Bolded years also have the seasonal mean SOI exceeding ±1.0. The italicised 1953 El Niño does not quite reach the SST threshold, but is commonly accepted as an El Niño event in the literature.

The Island Climate Update

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

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

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