

The Island Climate Update

December's climate

- The South Pacific Convergence Zone (SPCZ) was displaced southwest of its normal position.
- Very suppressed convection near Western Kiribati and south of the Equator from Nauru east to northern French Polynesia.
- Above normal rainfall for few areas in the South Pacific, with a record high in the Southern Cook Islands.

El Niño/Southern Oscillation (ENSO), seasonal rainfall, and sea surface temperature forecasts

- La Niña-like conditions exist in the tropical Pacific. Many climate models project continuation of La Niña through to the end of summer 2009.
- Below normal rainfall is forecast for Western Kiribati, the Marquesas, Tuvalu, Tokelau, the Northern Cook Islands, and the Tuamotu archipelago.
- Above normal rainfall is expected for New Caledonia, Fiji, Vanuatu, Niue, Tonga, and the Southern Cook Islands.
- Normal to above normal SSTs are forecast for the southwestern half of the southwest Pacific region. Normal to below normal SSTs are forecast for the northeast half of the southwest Pacific.

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
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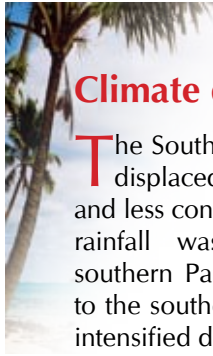
European Centre
for Medium Range
Weather Forecasts

UK Met Office

World Meteorological
Organization

MetService of
New Zealand





Climate developments in December 2008

The South Pacific Convergence Zone (SPCZ) activity was displaced south and west of normal during December, and less consolidated than last month. A region of enhanced rainfall was observed during December 2008 over southern Papua New Guinea and northeast Australia, and to the southeast of New Caledonia. Suppressed convection intensified during the month to the south of the Equator, and encompassed the region northeast of the Solomon Islands, Nauru, and Western Kiribati and extended across the southwest Pacific to central French Polynesia. The regional circulation for the month was characterised by more frequent high pressure across the South Pacific from east of Papua New Guinea to the Society Islands; and lower than normal pressure near northern New Zealand and Eastern Kiribati.

Rainfall was near normal or below normal for many countries in the southwest Pacific in December 2008. The exception occurred in a swath that extended from southern Vanuatu and west of Tonga southward through the Kermadec Islands, and enhanced rainfall was also localised in northern and central Australia. Lower than normal rainfall was recorded at many stations in French Polynesia, with Tahiti in the Society Islands receiving 106 mm of rainfall (30% of normal). Elsewhere in the eastern half of the southwest Pacific, the stations in the Tuamotu archipelago and the Austral Islands all recorded normal or below normal rainfall, except Tubuai, which received 354 mm (195% of normal).

Many stations in New Caledonia received well below normal rainfall (30–60%) during December. Vanuatu experienced a

Island Group	Location	Rainfall (mm)	% of avg	Comments
Southern Cook Islands	Rarotonga Airport	471	251	Record high
French Polynesia	Tubuai	354	195	Very high
Samoa	Afiamalu	751	129	Highest monthly total in the region
Tonga	Lupepau'u	27	21	Very low
Eastern Kiribati	Kanton	1	1	Very low

Soil moisture in December 2008

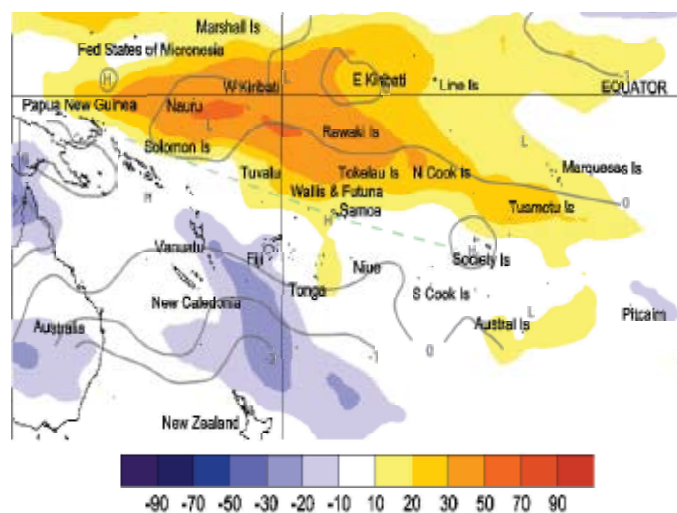
Estimates of soil moisture shown in the map (right) are based on monthly rainfall for one station in each country. Currently there are not many sites in the water balance model, but more stations will be included in the future.

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. 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.

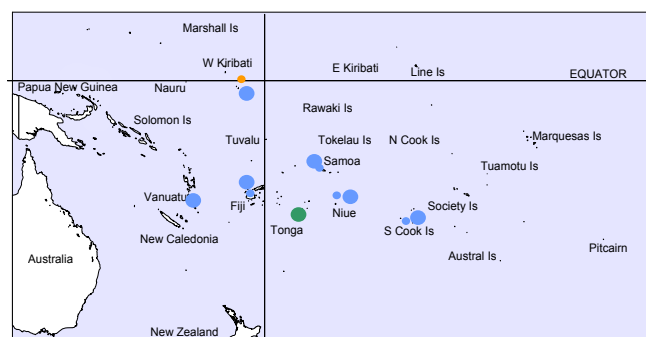
Nadi (Fiji), Hanan (Niue), Port Vila (Vanuatu), Rarotonga (Southern Cook Islands), and Apia (Samoa) project moist (at or near field capacity) soil moisture conditions. Soils are moderate for the time of year at Nuku'alofa (Tonga).

relatively dry month, with the northern part of the country recording near or below normal rainfall. The Solomon Islands also had a relatively dry month receiving 70–90% of normal rainfall, except at Auki, which received 456 mm of rain (159% of normal).

In Fiji, higher than normal rainfall occurred at Nadi Airport (271 mm; 152% of normal). In Samoa, abundant rainfall continued to fall in December, except at Maota. A regional high monthly rainfall total was recorded at Afiamalu, which received 751mm (129% of normal). In the western southwest Pacific, rainfall totals were near to above normal in central and eastern Australia.



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 result in higher rainfall. The December 2008 position of the South Pacific Convergence Zone (SPCZ) was contracted toward Papua New Guinea, was displaced southwest of its normal position, and less coherent than last month. The average position of the SPCZ is identified by the dashed green line, which is based on mean January rainfall for the South Pacific. Mean sea level (MSL) pressure anomalies (in hPa) are shown as grey lines.



December 2008 December 2007

- Wet
- Moderate
- Dry

Estimated soil moisture conditions at the end of December 2008, using monthly rainfall data. Soil moisture projections for individual Pacific Island countries are dependent on data availability at the time of publication.

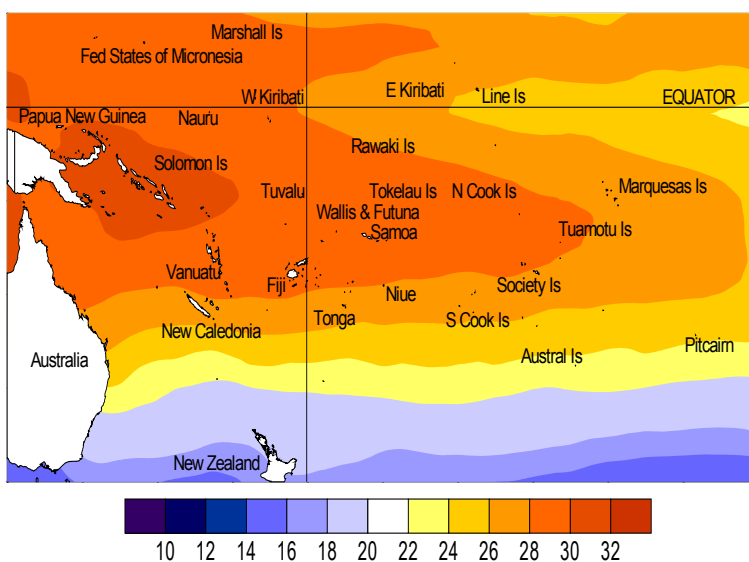
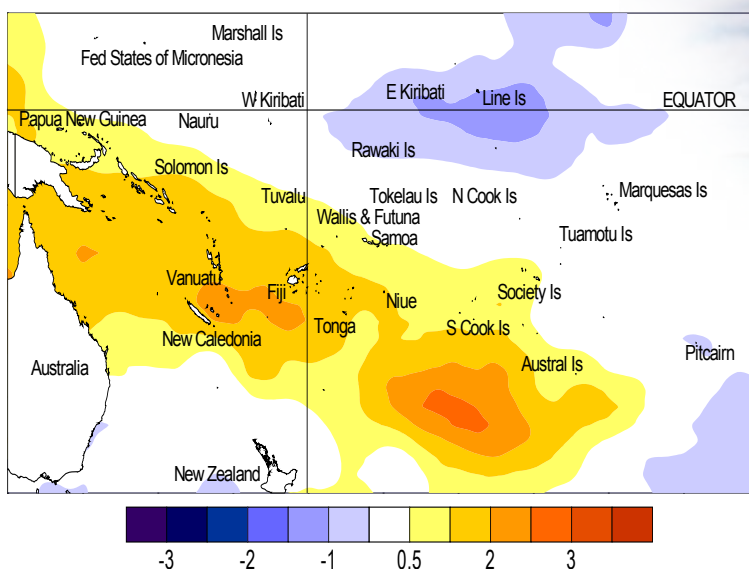
El Niño/Southern Oscillation (ENSO)

During December, La Niña conditions were re-established in the equatorial Pacific Ocean, with the tropical Pacific atmosphere exhibiting moderate to strong La Niña characteristics. The SOI has remained persistently positive with a December value of +1.3 (OND mean +1.4), and easterly trade winds have remained strong during December about and west of the Date Line.

SST anomalies in December were below average across the equatorial Pacific: The NINO3 anomaly for December was -0.2°C (3-month mean $+0.0^{\circ}\text{C}$), and the NINO4 anomaly was -0.5°C (OND mean 0.2°C). A warmer 'horseshoe' has also formed in the subtropics. Equatorial subsurface temperature anomalies are now below average east of the Date Line, with a -4°C anomaly centred near 140°W below 100 m.

Tropical Pacific precipitation patterns continue a La Niña signal, with the TRMM ENSO precipitation index at -1.3 for December. OLR anomalies show extremely suppressed equatorial convection about and west of the Date Line for December as a whole, with enhanced convection over the maritime continent and northern Australia. A convective pulse associated with the MJO was present east of Indonesia during early January, but this is predicted to dissipate by mid January as the convective region approaches the Date Line. Thus, the evidence suggests a redevelopment of a La Niña.

Several climate models assessed by NIWA indicate cool SST anomalies for the late summer period and La Niña conditions. However, the majority indicate neutral conditions developing during autumn 2009. The NCEP draft discussion of 6 January indicates La Niña conditions are likely to continue into the Northern Hemisphere spring of 2009. The IRI summary of 17 December projects a 50–55% probability of ENSO-neutral conditions persisting



over the coming season, and 45–50% for weak La Niña conditions.

Tropical Cyclone Guidance

Conditions in the tropical Pacific are likely to affect the chances of tropical cyclone (TC) activity for several countries between January and May 2009. There is an increased risk of TC occurrence for countries west of the Date Line, including Vanuatu, the Solomon Islands, and New Zealand, and a slight risk increase for New Caledonia. Reduced risk is expected for Samoa, Tonga, and Niue. For more information go to <http://www.niwasience.co.nz/news/mr/2009/2009-01-09>

Forecast validation: October to December 2008

A large region of suppressed convection was forecast to encompass the Solomon Islands, and a region extending southeast from Tuvalu to Pitcairn Island, including Tokelau, Wallis & Futuna, Samoa, the Northern Cook Islands, and most of French Polynesia, with average or below, or below average rainfall for those countries. Enhanced convection and above average rainfall was forecast for Papua New Guinea, Vanuatu, Eastern Kiribati, Tonga, and the Southern Cook Islands. Near or above average rainfall was forecast for Fiji, Niue, New Caledonia. No precipitation guidance was offered for the Austral Islands or the Society Islands.

The rainfall outlook for the October–December 2008 period was very good compared to our forecast, although this is calculated for 17 island groups (two islands had a forecast of 'climatology', which is unscorable and two did not report values). The global station 'hit' rate was 71%, 7% higher than average for forecasts made during October and 10% higher than the average for all months combined. Rainfall totals were slightly overestimated for parts of Samoa, Vanuatu, the Southern Cook Islands, and Fiji.

Forecast statistics compiled over the last nine years indicate the multi-model ensemble strike rate will continue to have good skill throughout the summer.

Tropical Pacific rainfall – December 2008

Territory and station name	December 2008 rainfall total (mm)	December 2008 percent of average
Australia		
Cairns Airport	197	107
Townsville Airport	179	137
Brisbane Airport	63	50
Sydney Airport	54	71
Cook Islands		
Penrhyn	83	26
Aitutaki	304	145
Rarotonga Airport	471	251
Fiji		
Rotuma Island	138	48
Udu Point	309	117
Nadi Airport	271	152
Nausori	239	90
French Polynesia		
Hiva Hoa, Atuona	58	58
Bora Bora	150	55
Tahiti – Faa'a	106	30
Tuamotu, Takaroa	105	48
Gambier, Rikitea	216	104
Tubuai	354	195
Rapa	112	53
Kiribati		
Tarawa	194	92
Kanton	1	1
New Zealand		
Kaitaia	83	86
Whangarei Airport	139	153
Auckland Airport	101	122
New Caledonia		
Ile Art, Belep	109	83
Koumac	135	135
Ouloup	35	25
Ouanaham	78	45
Poindimie	93	41
La Roche	81	45
La Tontouta	85	116
Noumea	50	63
Moue	83	56

Territory and station name	December 2008 rainfall total (mm)	December 2008 percent of average
Niue		
Hanan Airport	149	88
Liku	188	116
North Tasman		
Lord Howe Island	88	73
Norfolk Island	80	98
Raoul Island	142	105
Samoa		
Faleolo Airport	393	152
Apia	365	99
Nafanua	N/A	N/A
Afiamalu	751	129
Maota	276	56
Solomon Islands		
Taro	143	69
Munda	218	78
Auki	456	159
Honiara	N/A	N/A
Henderson	222	106
Kira Kira	214	70
Santa Cruz, Lata	360	97
Tonga		
Niuafu'ou	N/A	N/A
Mata'aho Airport	85	32
Lupepau'u	67	27
Salote Airport	139	90
Nuku'alofa	80	49
Fua'amotu Airport	84	53
Tuvalu		
Nanumea	N/A	N/A
Nui Island	N/A	N/A
Funafuti	N/A	N/A
Nuilakita	N/A	N/A
Vanuatu		
Sola	213	55
Pekoa	241	89
Lamap	104	67
Port Vila	197	104
Tanna/Whitegrass	255	N/A
Aneityum	264	156

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. N/A denotes data unavailability at the time of publishing, and * denotes synoptic values.

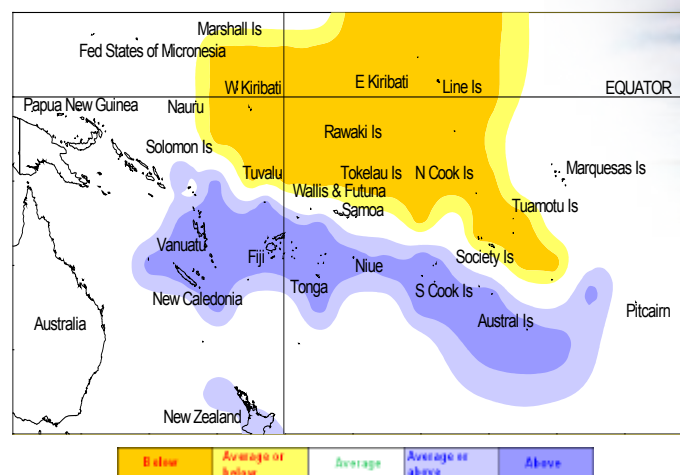
Tropical rainfall and SST outlook: January to March 2009

During the January–March 2009 forecast period, a region of suppressed convection is likely to encompass the central and eastern Southwest Pacific, extending from Western Kiribati to Eastern Kiribati, including Tuvalu, Tokelau, the Northern Cook Islands, and the Tuamotu archipelago. Below normal rainfall is expected. Near-to-below normal rainfall is expected for Samoa.

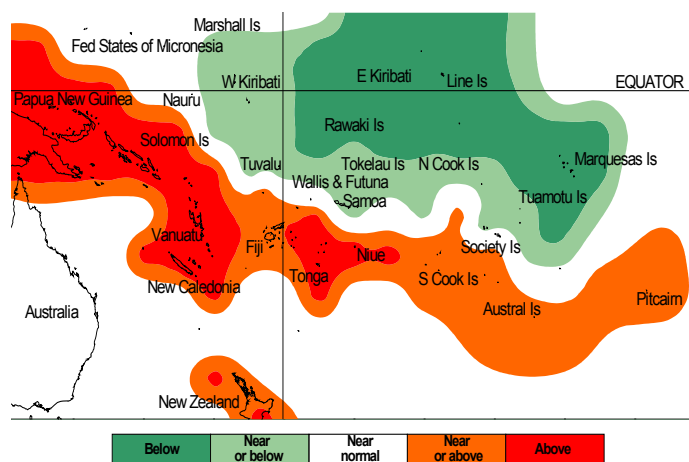
Enhanced convection is expected to extend southeast from Vanuatu and New Caledonia, to the Austral Islands, including Tonga, Fiji, Wallis & Futuna, and Niue, with above average rainfall projected. No precipitation guidance is offered for Pitcairn Island, Papua New Guinea, the Solomon Islands, the Marquesas, or the Society Islands for the three-month forecast period.

SSTs are expected to be above normal in a band extending from near Papua New Guinea, southeast to Vanuatu and New Caledonia, including the Solomon Islands, and above normal SSTs are also expected for Niue and Tonga. Near-to-above normal SSTs are forecast for Fiji, the Southern Cook Islands, the Society Islands, the Austral Islands, and Pitcairn Island. Below normal SSTs are forecast for the northeastern sector of French Polynesia, including the Tuamotu archipelago and the Society Islands, Tuvalu, Tokelau, and Eastern Kiribati. Western Kiribati is projected to have normal-to-below normal SSTs.

The confidence in the forecast model skill for this seasonal rainfall outlook is moderately high for most Pacific Island countries. In the past, the average region-wide hit rate for forecasts issued in January is 56%, 5% lower than the long-term average for all months combined. The SST forecast confidence is moderate-to-high for this period.



Rainfall outlook map for January to March 2009



SST outlook map for January to March 2009

NOTE: Rainfall and sea surface temperature estimates for Pacific Islands for the next three months are given in the tables below. The tercile probabilities (e.g., 20:30:50) are derived from the averages of several global climate models. They correspond to the odds of the observed rainfall or sea surface temperatures being in the lowest one third of the distribution, the middle one third, or the highest one third of the distribution. For the long term average, it is equally likely (33% chance) that conditions in any of the three terciles will occur. *If conditions are climatology, we expect an equal chance of the rainfall being in any tercile.

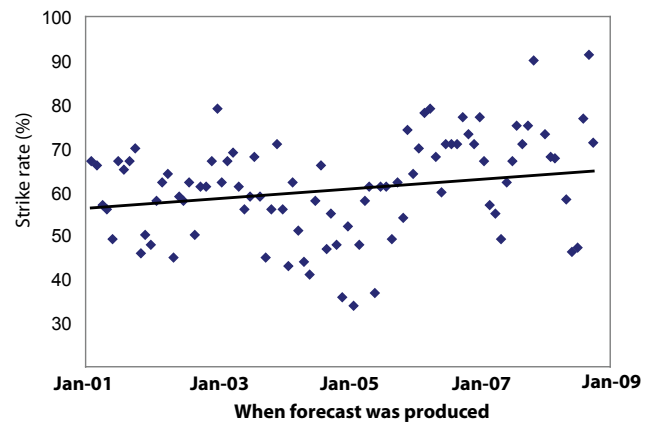
Island Group	Rainfall Outlook	Outlook confidence	Island Group	SST Outlook	Outlook confidence
Tonga	20:30:50 (Above)	Moderate-High	New Caledonia	20:35:45 (Above)	Moderate
Vanuatu	20:30:50 (Above)	Moderate-High	Niue	20:35:45 (Above)	Moderate
Wallis & Futuna	20:30:50 (Above)	Moderate-High	Papua New Guinea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

The Centennial Issue of the Island Climate Update: Progress and success resulting from a multi-model ensemble forecast

Andrew Lorrey, Jim Salinger, and James Renwick (NIWA)

The strength of the Island Climate Update (ICU) forecast is drawn from two primary sources: a regional discussion about local climate information by Pacific Island Meteorological Services members each month, and external input from international research organisations which produce forecasts and interpretations of global climate diagnostics. The discussion in the ICU monthly teleconference and the collection of climate models compose the backbone of the ICU three-month forecast. There are more than ten climate models that are used to generate the rainfall outlook for the South Pacific. In 2008, an additional ensemble of SST forecasts, which include six models, were added to the ICU to provide an additional layer of information that could be useful for planning purposes.

The capability of the ICU multi-model ensemble rainfall forecasts have been tracked for more than eight years now, and there are statistical data indicating when the technique has had good 'skill', or the ability to provide accurate climate projections. It is very clear that the ICU has good skill for a majority of the year, and not surprising that the strongest forecast periods are during spring and summer, as well as mid-winter. The period of least skill is during mid-to-late autumn, which corresponds to the time when deterioration of ENSO events typically happens, and as a result the associated strong (as well as predictable) regional climate patterns that accompany these events are diminished.

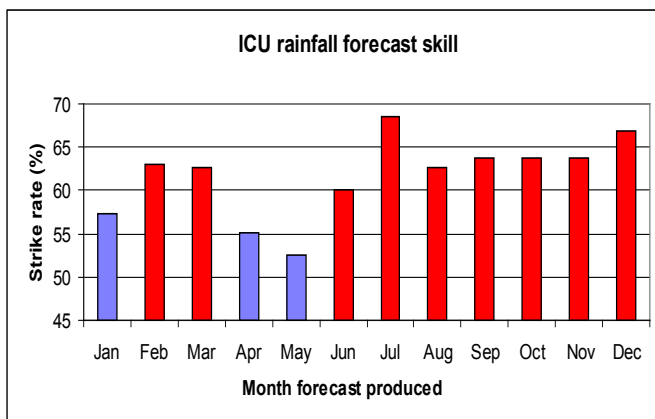


Long term trend in ICU strike rate, January 2001-present

Many of the island groups in the South Pacific have important spatial contrasts in their rainfall patterns. East-west as well as north-south differences in precipitation anomalies are often observed from month to month. The ICU forecast strike rate statistics indicate that the use of the multi-model ensemble approach to provide an overall rainfall forecast for each island group is, however, better than a coin toss. This suggests the multi-model ensemble approach has value complementary to local forecast information generated by Pacific Island Meteorological Services.

Moreover, the long-term trend in the ICU data indicates that the average strike rate has gradually increased by nearly 10% over the last eight years, at an average rate of about +1% each year. Since the ICU inception in 2000, the practice has been to include additional models that cover the South Pacific region as they come on-line. These additions, along with continual improvements made to models already in use, have likely improved the skill of the regional-scale multi-model ensemble forecast. Key highlights were achieving a global strike rate for the South Pacific of 90% (August-October 2007) and 91% (September-November 2008).

Beginning in 2008, a detailed compilation of the strikerates for the individual global climate models that are used in the ICU was initiated. This was done to assist Pacific Island Meteorological Services in their search for and refinement of the collection of models that could be used for island-specific forecasts. Future training sessions, selection of specific models, and discussions about the multi-model ensemble are anticipated to increase the skill of this powerful approach to regional climate forecasting.



Monthly average strike rate statistics for the ICU (January 2001-October 2008)

Visit The Island Climate Update at:

www.niwascience.co.nz/ncc/icu

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, Wallis and Futuna.**

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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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The Island
Climate Update

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