Number 90, March 2008

The Island Climate Update

February's climate

- South Pacific Convergence Zone (SPCZ) extends from northeast of Australia towards New Caledonia and northeast of New Zealand, displaced well southwest of normal
- Suppressed convection exists from Western Kiribati to Eastern Kiribati and about the Equator with low rainfall, especially near Nauru
- Below normal rainfall for several stations in Samoa, but very high rainfall in New Caledonia, and one record high recorded in Tonga.

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

- The strong La Niña episode present in the Pacific has reached maturity, and the event is expected to persist into the Southern Hemisphere autumn
- Suppressed convection and average or below average rainfall is very likely along the equatorial Pacific encompassing the region from Western Kiribati to Eastern Kiribati, the Solomon Islands, the Society Islands, Tuamotu, and the Marquesas Islands. Near or below average rainfall is likely for the Northern Cook Islands and Wallis & Futuna, while average rainfall is likely for Samoa, Tonga, and Pitcairn Island.
- Enhanced convection is likely to continue along a southwest displaced SPCZ with average or above average rainfall for New Caledonia, the Southern Cook Islands, and the Austral Islands, while Papua New Guinea, Fiji, and Niue are expected to receive near or above average rainfall.

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

World Meteorological Organization

MetService of New Zealand

SOPAC

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Taihoro Nukurangi

Climate developments in February 2008

The South Pacific Convergence Zone (SPCZ) extended from northeastern Australia, over Vanuatu and New Caledonia, eastward of Tonga and northeast of New Zealand, with an overall displaced position much further south and west than normal for February. A large region of very suppressed convection persisted along the Equator extending from Western to Eastern Kiribati and the Tuamotu Islands, affecting the regions both north and south of the Equator, including the Northern Cook Islands, Tuvalu, and the Marquesas.

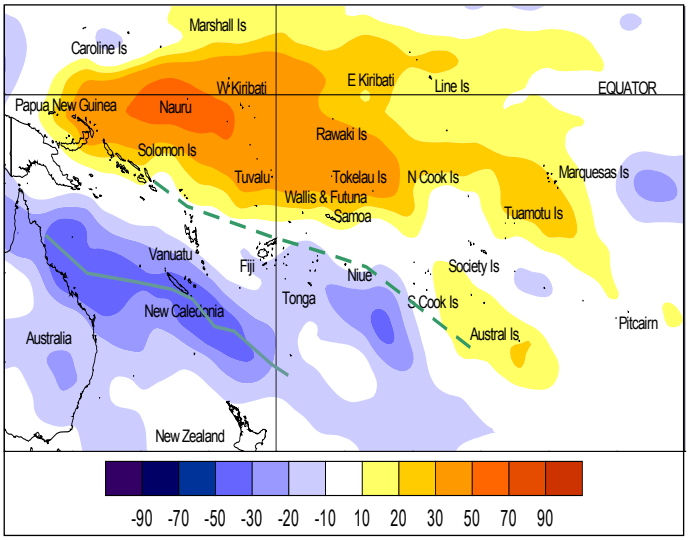
Rainfall was well above average in parts of Northern Australia, and also in parts of New Caledonia, northern New Zealand, Norfolk Island, and Tonga as a result of a southwest-displaced SPCZ. A new monthly rainfall total was recorded at Lupepau'u, Tonga (383.4mm). New Caledonia also reported a global station average rainfall of 169 % from normal, with a record monthly rainfall at Canala of 945 mm (347 % of normal) and a daily maximum of 279.6 mm on the 27th at that site.

In contrast February rainfall was near or below normal over much of Kiribati, French Polynesia, and parts of the Cook Islands, the Austral Islands and the Marquesas. Rainfall has been below average for each of the past 9 months in Kiribati, and above average during the past 5 months in Nadi, Fiji. Samoa also had multiple stations that recorded below normal rainfall for the month.

Country	Location	Rainfall (mm)	% of avg	Comments
Tonga	Lupepau'u	383.4	176	Record high
Kiribatii	Kanton Island	0.3		Extremely low
Australia	Willis Island	533.8	270	Very high
New Caledonia	Canala	945	347	Record high
New Caledonia	Poindimie	729.8	206	Very high

February mean air temperatures above average in New Zealand, and were 0.5 ºC or more above normal in New Caledonia, Samoa, and Tonga.

Tropical Southwest Pacific mean sea-level pressures were below average in the north Tasman Sea and to the west of New Caledonia. This pressure pattern produced more north easterlies with abundant rain into northern New Zealand, and heavy rainfall in New Caledonia and parts of northeastern 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 results in higher rainfalls. The February 2008 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.

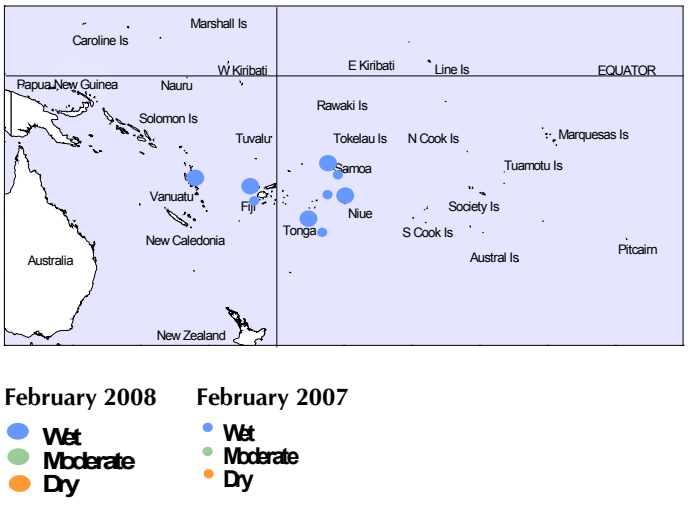
Soil moisture in February 2008

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 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.

Soils continued to be moist (at field capacity) for the time of year at Nadi (Fiji), Hanan Airport (Niue), Apia (Samoa), and in Tonga.



Estimated soil moisture conditions at the end of February 2008, using monthly rainfall data.

El Niño/Southern Oscillation (ENSO)

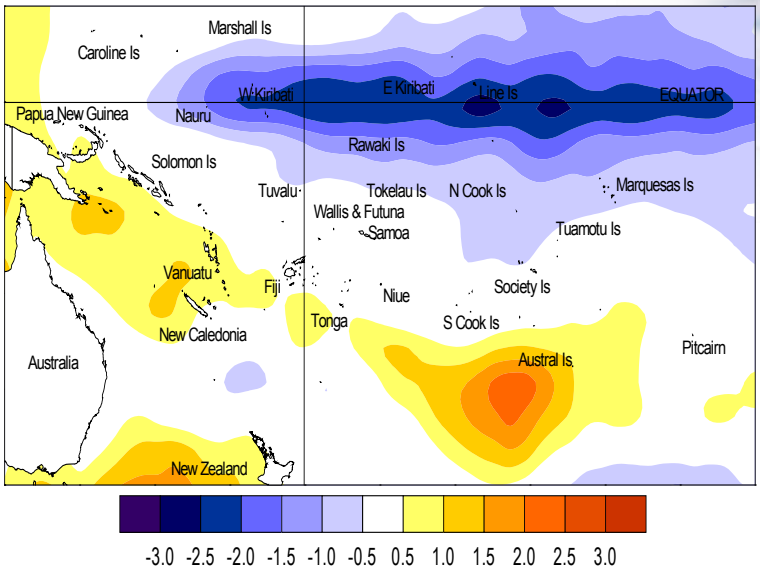
During February, the La Niña event that persisted from previous months has reached maturity. and conditions continued to spread into the western tropical Pacific. The Southern Oscillation Index (SOI) continued its strong movement upwards, indicating a further strengthening of the ocean-atmosphere coupling.

Below normal sea surface temperatures (SSTs) extend across most of the equatorial Pacific, with anomalies of –2.0 °C or lower over the central equatorial region (Date Line to 120 °W, approximately). The warm "horseshoe" is in evidence in the extra-tropics of both hemispheres but remains patchy in the Southern Hemisphere. The NINO3 anomaly was around –1.5 °C in February (December-February average of 1.3 °C) and NINO4 was around –1.6°C (December - February average –1.0°C). In the equatorial subsurface Pacific ocean, a strong east-west dipole is evident in the temperature anomalies, with the thermocline near the surface everywhere east of 120 °W while the 0–300m heat content increases west of the Date Line.

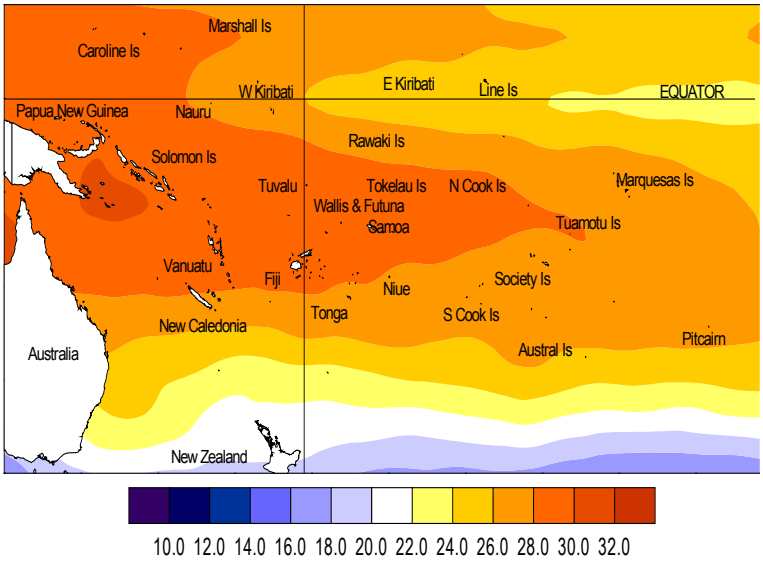
The easterly trade winds have remained enhanced in February across much of the tropical Pacific, though they have weakened recently near the South American coast. The SOI continues to rise and was near +2.1 in February (DJF average +1.7). This is the highest February SOI value on record for the data set which starts in 1871.

OLR anomalies show an east-west dipole with enhanced convection over Indonesia and suppressed convection from the Solomon Islands to east of the Date Line. The region of enhanced convection that was in the western Pacific has continued to shift westward during the past month. The SPCZ is still prominent but is shifted well to the southwest of its normal position.

The TRMM ENSO precipitation index was –1.3 in February, strengthening from a value of –0.4 in January. The Madden-Julian Oscillation is very weak at present.



Sea surface temperature anomalies (ºC) for February 2008



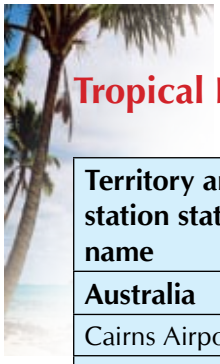
Mean sea surface temperatures (ºC) for February 2008

All models now indicate La Niña conditions, though some weaken to nearer a neutral state during autumn. Most models indicate La Niña conditions easing to neutral by the end of austral winter. The NCEP forecast indicates La Niña is likely to continue through April–June (though weaker). The IRI synthesis (20 February) suggests strong but weakening La Niña conditions through April (95% chance) with the probability of neutral conditions rising to 50% after June 2008.

Forecast validation: December 2007 to February 2008

A La Niña like pattern was expected, with a large region of suppressed convection along the equator from Kiribati, including Tuvalu, Tokelau, and Northern Cook Islands, and the Marquesas, Tuamotu, and Society Islands. Near average or below average rainfall was expected for Pitcairn Island. Enhanced convection was anticipated along a southwest-displaced SPCZ extending from Papua New Guinea through the Solomon Islands, Vanuatu, and New Caledonia eastward across Fiji, Wallis & Futuna, Niue, the Southern Cook and Austral Islands, with average or above average rainfall expected in this region.

The rainfall outlook for the December 2007– February 2008 period was very similar to what was forecast, the 'hit' rate being 73%. Rainfall was lower than expected in Vanuatu and the Solomon Islands.



Tropical Pacific rainfall – February 2008

Territory and station station name	February 2008 rainfall total (mm)	February 2008 percent of average
Australia		
Cairns Airport	535.6	117
Townsville Airport	560.4	192
Brisbane Airport	216.8	126
Sydney Airport	258.4	244
Cook Islands		
Penrhyn	99.4	29
Aitutaki	124.6	
Rarotonga Airport	276.6	137
Rarotonga EWS	203.2	101
Fiji		
Rotuma Island	163.9	51
Udu Point	190.5	77
Nadi Airport	528.6	181
Nausori	185.4	69
French Polynesia		
Hiva Hoa, Atuona	26.6	17
Bora Bora	123.2	52
Tahiti – Faa'a	55.6	26
Tuamotu, Takaroa	122	63
Gambier, Rikitea	183.8	105
Tubuai	140.4	70
Rapa	47.6	26
Kiribati		
Tarawa		
Kanton	0.3	
New Zealand		
Kaitaia	46	56
Whangarei Airport	82.2	98
Auckland Airport	15	22
New Caledonia		
Ile Art, Belep	432	262
Koumac	284	187
Ouloup	254.6	128
Ouanaham	296	122
Poindimie	729.8	206
La Roche	231.6	109
La Tontouta	254.8	187
Noumea	158.8	128
Moue	248	138

Territory and station station name	February 2008 rainfall total (mm)	February 2008 percent of average
Niue		
Hanan Airport	269	114
Liku	143.5	58
North Tasman		
Lord Howe Island	90	78
Norfolk Island	225	278
Raoul Island	192	130
Samoa		
Apia	206.2	56
Faleolo Airport	187.8	50
Nafanua	206.5	
Afimalu	244.5	
Maota	201.2	
Tonga		
Niuafoo'o		
Mata'aho Airport	113	44
Lupepau'u	383.4	176
Salote Airport	267.1	138
Nuku'alofa	358.4	171
Fua'motu Airport	420	190
Tuvalu		
Nanumea	169.7	48
Nui Island	303.9	72
Funafuti	643.5	167
Nuilakita*	697.1	185
Vanuatu		
Sola	463.9	133
Pekoa	197.6	63
Lamap	110.5	43
Port Vila	282.4	106
Tanna/Whitegrass	115.9	
Bauerfield	83.3	39
Aneityum	68.2	23

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: March to May 2008

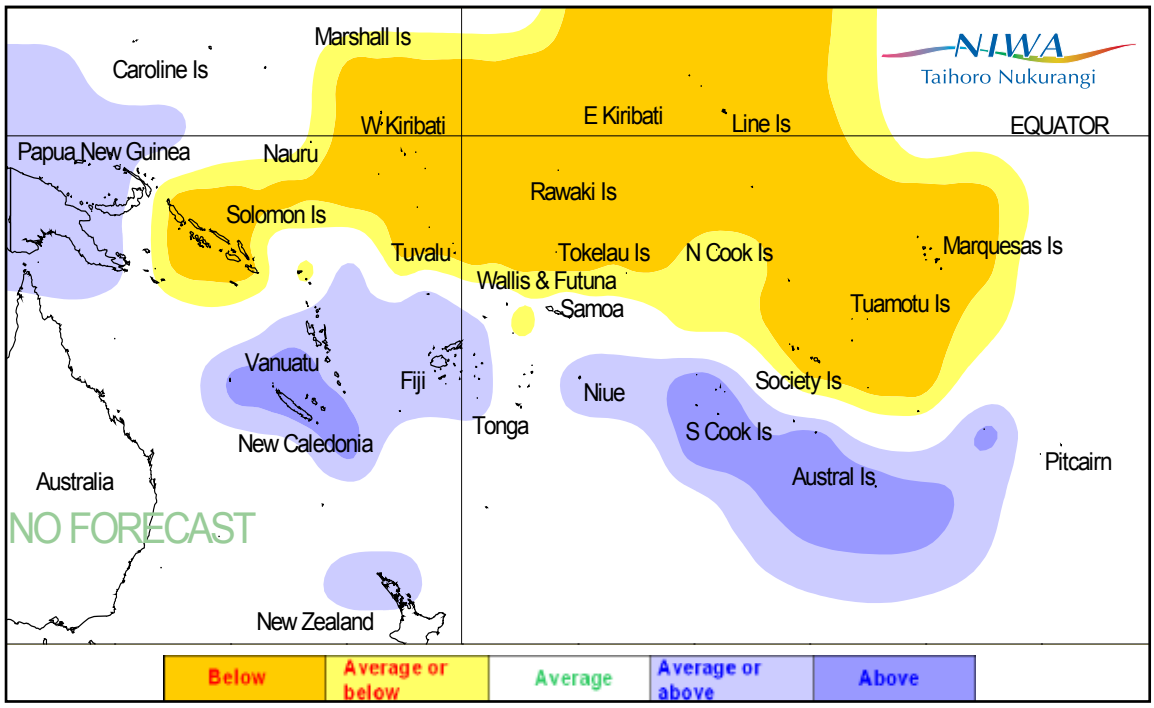
La Niña conditions are still very likely to influence rainfall patterns during this period, with a large area of suppressed convection very likely along the equatorial Pacific from Western Kiribati to Eastern Kiribati, including the Solomon Islands, Tuvalu, the Society Islands, Tuamotu, and the Marquesas Islands. Near or below average rainfall is likely for the Northern Cook Islands and Wallis & Futuna, while average rainfall is likely for Samoa, Tonga, and Pitcairn Island.

Enhanced convection with above average rainfall is likely in New Caledonia, the Southern Cook Islands, and the Austral Islands, while Papua New Guinea, Vanuatu, Fiji, and Niue are expected to receive near or above average rainfall.

The confidence in the forecast model skill for this seasonal outlook is moderate to moderately high for most Pacific Island countries. In the past, the average region-wide hit rate for forecasts issued in March is 63%, 3% higher than the long term average for all months combined.

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.

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



Rainfall outlook map for March to May 2008

Tropical cyclones

One tropical cyclone (TC) affected the South Pacific region in February. TC Gene formed on the 27 January northeast of Fiji and tracked southwest toward New Caledonia, reaching Category 3 strength. Maximum sustained winds of 100 knots were reached late on 31 January. TC Gene subsequently swung to the southeast and deteriorated along a southeast exit path into the extra-tropics on 1 February. There was only one other major depression that developed in the South Pacific during the month, but it did not develop into a cyclone. March is normally an active month for tropical cyclones, and the development of mature La Niña conditions at present will continue to influence tropical cyclones in several parts of the South Pacific region.

Climate change impacts on Pacific tuna fisheries

Dr. Andrew Lorrey, National Institute of Water and Atmospheric Research, New Zealand

Climate change will likely affect Pacific Ocean fisheries through raising ocean surface temperatures and through increased inter-annual climate variability. Direct impacts of climate change are anticipated to affect the distribution of key commercial fish species in the Pacific, as well as their abundance and catchability, including tuna.

Tuna fisheries in the Pacific

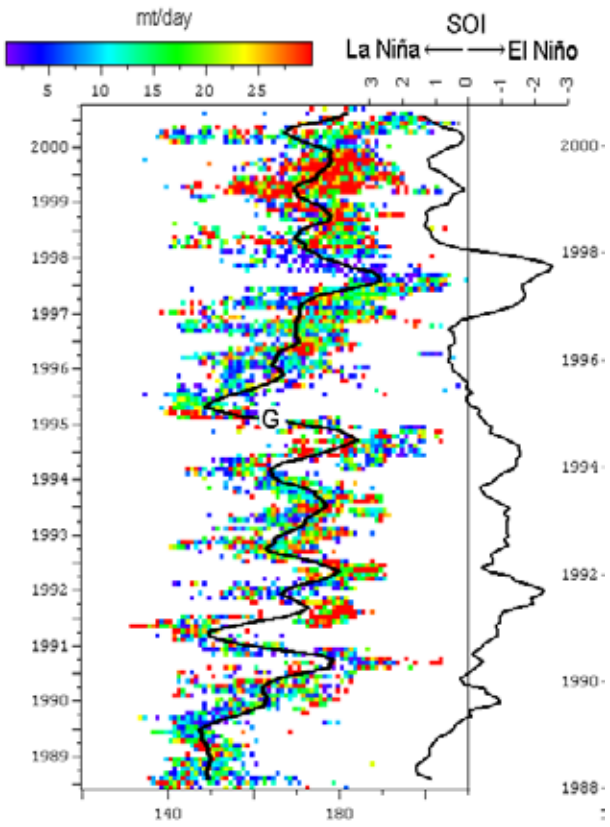
Nearly 70% of the world's tuna harvest comes from the Pacific Ocean. At present, 3.2 million tonnes are harvested from this region, and the catch is comprised mostly of skipjack tuna. Catches are highest in the western equatorial Pacific warm pool, which is characterised by low production rates and comprise the warmest surface waters of the world's oceans. This warm pool is fundamental to the El Niño-Southern Oscillation (ENSO) and the Earth's climate in general.

Changes in primary productivity

A decline in central and eastern Pacific primary productivity due to increased stratification between warm surface waters and colder deep water would reduce upwelling. This would result in a spatial redistribution of tuna resources to higher latitudes and toward the western equatorial Pacific. A decline in bigeye and adult yellowfin tuna populations might occur as a result of changes in primary productivity with possible impacts on the species targeted by longline fishing fleets. With an increased demand for sashimi and high quality fish world-wide, pressure on yellowfin tuna is expected to rise to compensate for decreased catch of bigeye tuna, and could potentially lead to an unsustainable population if the fish stocks are not well managed. However, the productivity rise anticipated for the western Pacific might help offset this pressure, and a catch of one million tonnes of skipjack tuna per year is deemed sustainable. Central Pacific countries like Kiribati that have a high dependence on tuna fishing makes them and their domestic fishing fleets most vulnerable to the climate change impacts on fish populations that may occur in the near future.

Future climate change and tuna fishing

Large uncertainties about the changes in western equatorial Pacific productivity mean there are many questions about climate change impacts on spawning migrations for tuna as well as the connections these fisheries have with extra-tropical regions.



Correlation of ENSO (illustrated by the SOI) variations to skipjack tuna catch rate (metric tonnes per day) and catch location indicates displacements in tuna populations are related to the eastern edge of the western Pacific warm pool movements.

Current research programmes like the Oceanic Fisheries and Climate Change Project (OFCCP) are underway to critically assess climate change impacts on oceanic tuna stocks with the aim of predicting short- to long-term population variations that will occur with global warming and increased climate variability. It is anticipated that this will help us understand how greenhouse warming will affect the abundance and productivity of commercially exploited species and fisheries at both the oceanic and global scale.

Information for this article was sourced from the Secretariat of the Pacific Communities Oceanic Fisheries Programme (New Caledonia) and The World Bank.

The Island Climate Update

Cover Photo: Wendy St George, NIWA

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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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