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# The Island Climate Update

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## July's climate

- South Pacific Convergence Zone (SPCZ) fairly in east inactive; suppressed convection persists along the equator
- Rainfall above average throughout much of Vanuatu; below average in parts of Southern French Polynesia, and over much of Kiribati and New Caledonia
- Much warmer than normal in Fiji, Tuvalu, Wallis and Futuna, and the Southern Cook Islands

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

- ENSO indicators continue to fluctuate with a 50% chance of a La Niña developing over coming months
- Samoa likely to experience above average rainfall
- Below average rainfall expected over Western and Eastern Kiribati and Tuvalu





## Climate developments in July 2007

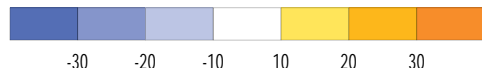
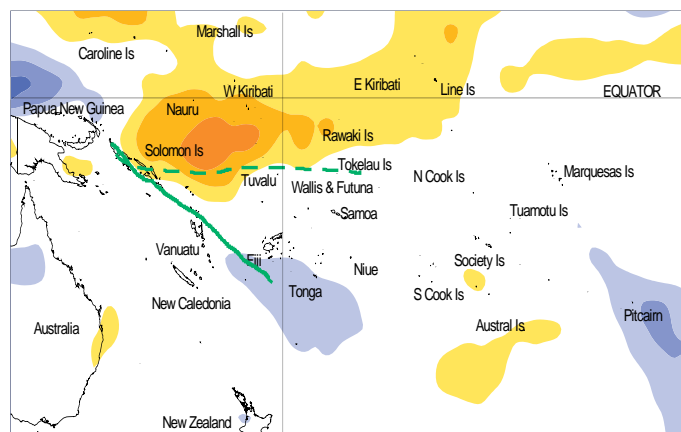
The South Pacific Convergence Zone (SPCZ) affected the Solomon Islands (closely linked to the monsoon trough north of Papua New Guinea) and Vanuatu, with little activity east of the Equator. Convergence was weakly enhanced south of Fiji and over New Zealand's North Island, due to frequent depressions in the Tasman Sea. An elongated region of suppressed convection persisted along the equator from the region north of the Solomon Islands across Western and Eastern Kiribati and further east (north of the Equator to South America).

Rainfall was about 300% of normal throughout much of Vanuatu. Several parts of Fiji experienced well above average July rainfall, with some significant rain towards the end of the month. Flood-producing rainfall occurred in parts of Vanuatu on 21 July. Rainfall was also well above normal in northern New Zealand, due to flood-producing rains on 10 July, some locations recording more than 400 mm for the month.

July rainfall was 50% or less of normal in parts of Southern French Polynesia, and also below normal over much of Kiribati and New Caledonia. It was extremely dry in parts of Queensland, Australia, some locations recording less than 1 mm for the month.

July mean air temperatures were 1.0 °C or more above normal in parts of Fiji (where there were some record high temperatures, including 33.6 °C measured on Viwa Island on 29 July), as well as parts of Tuvalu, Wallis & Futuna, and the Southern Cook Islands. It was also warmer than usual in Northern French Polynesia. Temperatures were near average in New Caledonia.

Tropical Southwest Pacific mean sea-level pressures were above average over Australia, and generally below average in the equatorial Southwest Pacific from Papua New Guinea to the region east of the Date Line as well as in the Tasman Sea (due to frequent cyclogenesis there).

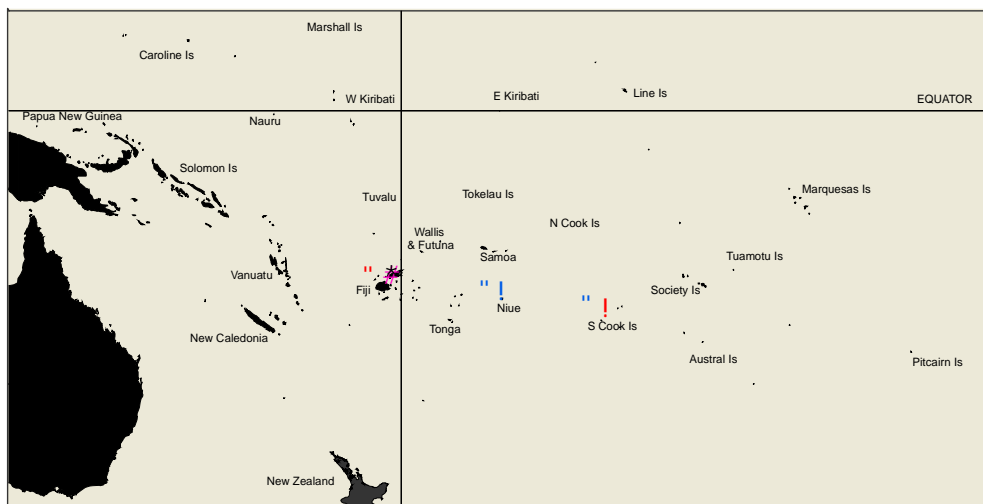


Outgoing Long-wave Radiation (OLR) anomalies, in  $Wm^{-2}$  (blue equals high rainfall and yellow equals low rainfall). The July 2007 position of the SPCZ, as identified from total rainfall, is indicated by the solid green line. The average position of the SPCZ is identified by the dashed green line.

Equatorial surface easterlies were steady, occurring in about 85% of observations at Tarawa, similar to that of June.

Country	Location	Rainfall (mm)	% of average	Comments
Vanuatu	Pekoa	233	275	Well above average
Vanuatu	Lamap	273	288	Well above average
New Zealand	Whangarei Airport	456	282	Extremely high
Australia	Townsville Airport	< 1	1	Extremely low
Australia	Brisbane Airport	1	1	Extremely low
New Caledonia	Ile Art	17	14	Well below average
Cook Islands	Rarotonga EWS	14	14	Record low
French Polynesia	Tubuai	36	25	Extremely low

## Soil moisture in July 2007



### July 2007

- ! Dry
- ! Wet
- ⊗ Moderate

### July 2006

- !! Dry
- !! Wet
- ⊗ Moderate

Estimated soil moisture conditions at the end of July 2007, using monthly rainfall data.

Estimates of soil moisture shown in the map (above) are based on monthly rainfall for one station in each country. Currently there are not many sites in the water balance model. 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 available water already in the soil comes from rainfall, and 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 are made at the end of the month. For practical purposes, generalisations were made about the available water capacity of the soils at each site.

At the end of July 2007, Rarotonga soils were dry, Nadi soils were at moderate capacity and Hanan soils were at field capacity.

## El Niño/Southern Oscillation (ENSO)

Conditions in the tropical Pacific are currently neutral, but with an incipient La Niña state.

Sea surface temperature (SSTs) anomalies in the equatorial Pacific have become more strongly negative east of 140°W during July, but the monthly anomaly field shows only a weak La Niña pattern, with a 'cold tongue' evident near the South American coast and a partial 'warm horseshoe' in the extratropics of both hemispheres (also evident in SSH anomalies).

The NINO3 anomaly was around  $-0.4\text{ }^{\circ}\text{C}$  in July (May–July average  $-0.3$ ) and the NINO4 anomaly was  $+0.3\text{ }^{\circ}\text{C}$  (May–July mean also  $+0.3\text{ }^{\circ}\text{C}$ ).

Equatorial zonal wind anomalies have been variable in July and the Southern Oscillation Index (SOI) fell to  $-0.4$ , suggesting no clear atmosphere-ocean coupling as yet.

Tropical OLR anomalies show an east-west dipole from the Indonesian region to near the Date Line, somewhat suggestive of a La Niña convective anomaly and the TRMM-based ENSO precipitation index is  $-1.6$ , also suggestive of La Niña.

Equatorial subsurface temperatures for July showed a significant negative anomaly in the top 150 metres in the eastern Pacific, although this feature appeared quite weak in the last few days of the month.

The amplitude of the Madden-Julian Oscillation is currently very weak.

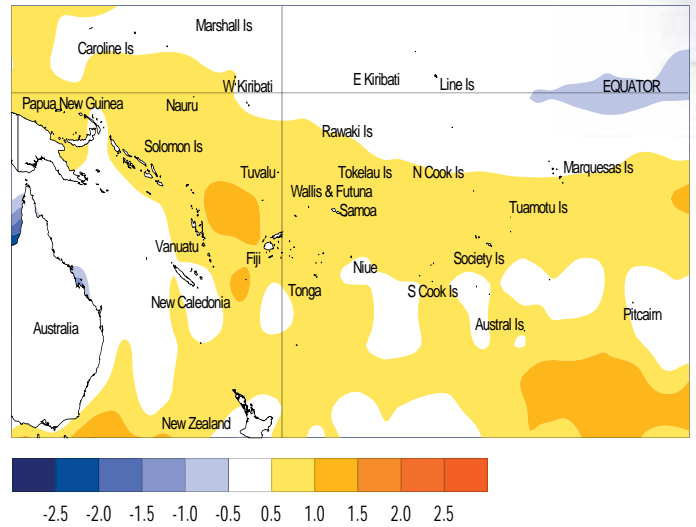
There has been a general weakening in ENSO forecasts since June, though around half the dynamical models still show apparent La Niña conditions through the rest of 2007.

The Scripps model indicates a warm event developing during the southern summer and autumn, but differs from the other models

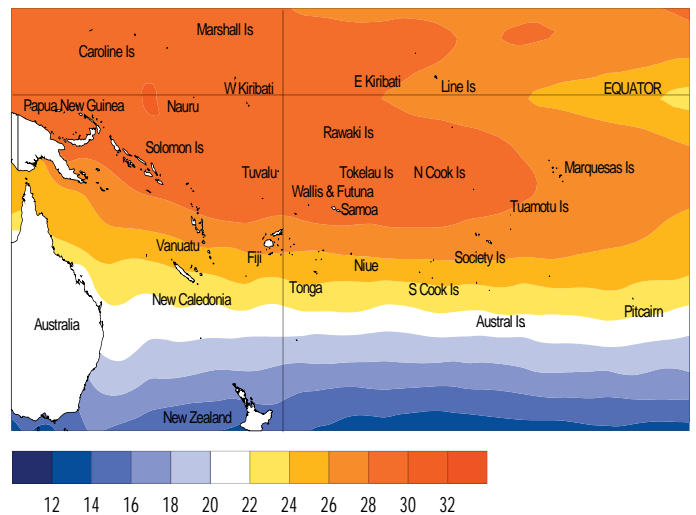
The NCEP synopsis suggests ENSO-neutral conditions at first with a 50% chance of La Niña conditions during spring.

## Forecast validation: May to July 2007

Enhanced convection and above average rainfall was expected over the Solomon Islands and also the Southern Cook Islands, with near or above average rainfall in Papua New Guinea, Wallis and Futuna, Samoa, the Northern Cook Islands, central and southern French Polynesia, and Pitcairn Island. Suppressed convection and below average rainfall was expected over Eastern Kiribati, with near or below average rainfall in Western Kiribati, Tuvalu, and the Marquesas Islands. Near average rainfall was expected elsewhere in the region.



Sea surface temperature anomalies ( $^{\circ}\text{C}$ ) for July 2007.



Mean sea surface temperatures ( $^{\circ}\text{C}$ ) for July 2007

The IRI synthesis continues to give a probability of 55% for a La Niña by November. The probability of El Niño conditions re-emerging during the forecast period remains below 10%.



## Tropical Pacific rainfall – July 2007

Territory and station name	July 2007 rainfall total (mm)	July 2007 percent of average
<b>Australia</b>		
Cairns Airport	21.8	75
Townsville Airport	0.2	1
Brisbane Airport	0.8	1
Sydney Airport	35.2	28
<b>Cook Islands</b>		
Penrhyn	149.6	108
Rarotonga Airport	17.4	17
Rarotonga EWS	14.4	14
<b>Fiji</b>		
Rotuma	207.2	89
Udu Point	125.3	141
Nadi	69.5	154
Nausori	158.2	134
Ono-I-Lau	155.8	169
<b>French Polynesia</b>		
Hiva Hoa, Atuona	128.8	83
Bora Bora Motu	40.0	53
Tahiti - Faa'a	30.0	57
Tuamotu, Takaroa	157.2	195
Gambier, Rikitea	135.0	87
Tubuai	35.6	25
Rapa	96.8	38
<b>Niue</b>		
Hanan	167.3	143
Liku	128.7	101

Territory and station name	July 2007 rainfall total (mm)	July 2007 percent of average
<b>New Zealand</b>		
Kaitia	284.0	171
Whangarei Airport	456.2	282
Auckland Airport	167.8	128
<b>New Caledonia</b>		
Ile Art, Belep	17.0	12
Koumac	21.0	40
Ouloup	29.8	33
Ouanaham	47.9	47
Poindimie	24.8	19
La Roche	85.8	87
Noumea	64.0	91
Moue	67.0	79
<b>North Tasman</b>		
Lord Howe Island	156.4	84
Norfolk Island	100.6	68
Raoul Island	171.8	102
<b>Vanuatu</b>		
Sola	392.5	161
Pekoa	233.4	275
Lamap	273.2	288
Port Vila	185.1	272
Tanna/Whitegrass	169.9	
Aneityum	221.6	207

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: August to October 2007

Enhanced convection is likely over Samoa where rainfall is expected to be above average.

A large region of near or above average rainfall is likely from Papua New Guinea east southeastwards to the Austral Islands including, the Solomon Islands, Vanuatu, New Caledonia, Wallis and Futuna, the Northern and Southern Cook Islands, Fiji, Tonga, Niue, and the Society Islands.

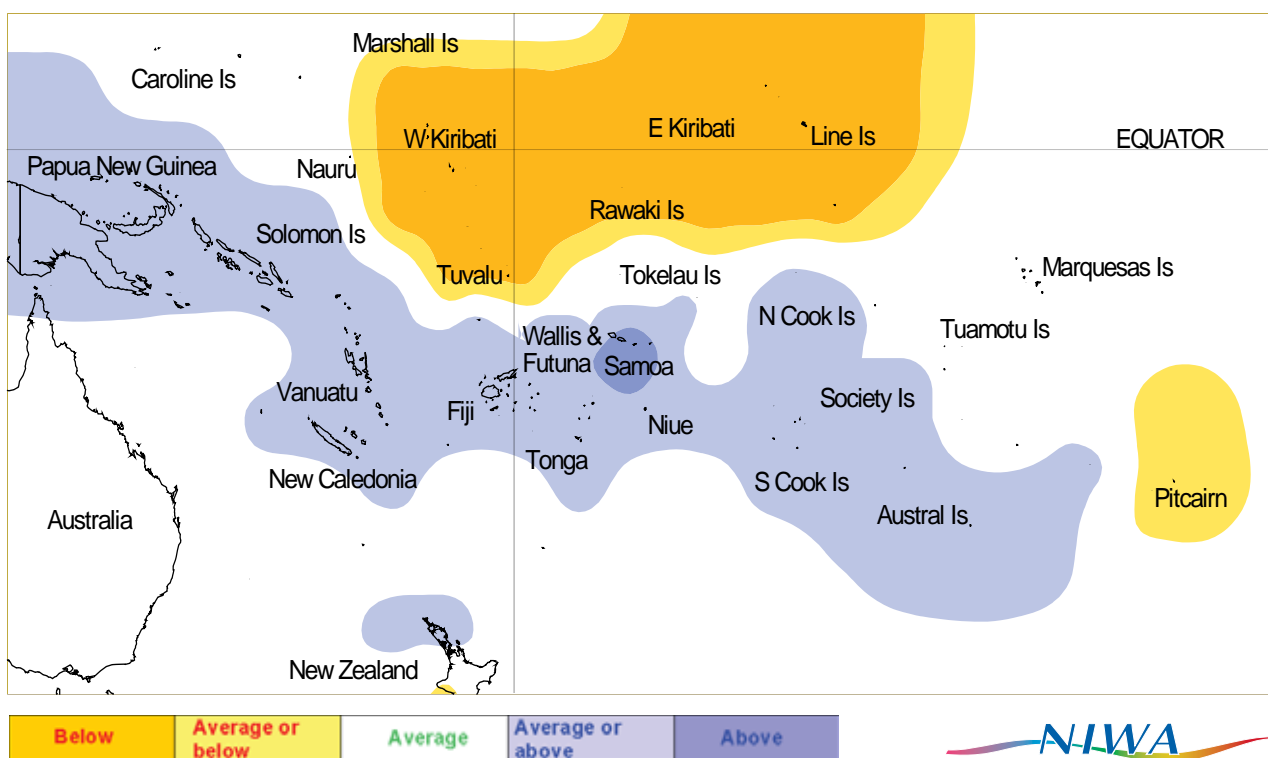
Suppressed convection is likely over Western and Eastern Kiribati, and Tuvalu, where rainfall is expected to be below average.

Near or below average rainfall is likely over Pitcairn Island. Rainfall is expected to be near average over Tokelau, Tuamotu, and the Marquesas Islands.

The confidence in the forecast model skill is generally moderate this seasonal outlook.

Island group	Rainfall outlook	Outlook confidence
Samoa	20:35:45 (Above)	Moderate
Papua New Guinea	20:40:40 (Near or above)	Moderate
Solomon Islands	20:40:40 (Near or above)	Moderate
Vanuatu	20:40:40 (Near or above)	Moderate
New Caledonia	25:35:40 (Near or above)	Low
Wallis & Futuna	20:40:40 (Near or above)	Moderate
Northern Cook Islands	20:40:40 (Near or above)	Moderate
Fiji	20:40:40 (Near or above)	Moderate
Tonga	20:40:40 (Near or above)	Moderate
Niue	20:40:40 (Near or above)	Moderate
Southern Cook Islands	20:40:40 (Near or above)	Moderate
Society Islands	20:40:40 (Near or above)	Moderate
Austral Islands	20:40:40 (Near or above)	Moderate
Tokelau	30:40:30 (Near average)	Moderate
Tuamotu Islands	30:40:30 (Near average)	Moderate
Marquesas Islands	35:40:25 (Near average)	Moderate
Pitcairn Islands	40:40:20 (Near or below)	Moderate
Western Kiribati	45:35:20 (Below)	Moderate
Eastern Kiribati	40:35:25 (Below)	Moderate
Tuvalu	45:35:10 (Below)	Moderate

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 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.



Rainfall outlook map for August to October 2007

# The Pacific Convergence Zones in 2006

Dr Brett Mullan, NIWA

Three convergence zones can be identified in the Pacific: the Intertropical Convergence Zone (ITCZ) in the Northern Hemisphere at around 5–10°N; its Southern Hemisphere counterpart, denoted separately here as SITCZ; and the South Pacific Convergence Zone (SPCZ) that extends diagonally from around Solomon Islands (10°S, 160°E) to near 30°S, 140°W. The southern ITCZ (SITCZ) only occasionally extends eastwards of about 160°W, and west of this point often merges with the SPCZ, making it difficult to separate the two features in the southwestern Pacific.

The year 2006 saw a weak La Niña event end in the first few months, followed by the development of a moderate El Niño that peaked at the end of the year. La Niña conditions in March–April are known to promote the appearance of a 'double ITCZ' (Lietzke et al., 2001; Zhang, 2001), and Figure 1 shows a striking example of this. The SITCZ convection for March 2006 is continuous from 85°W to west of the Date Line, is stronger than a rather broken northern ITCZ, and shows a clear separation from a weak SPCZ further south.

A more typical two convergence zone pattern is seen in the rainfall rate for December 2006 (Figure 1, lower panel). A prominent ITCZ is particularly active east of the Date Line, and the SPCZ is bowed northwards near 150°W, both features characteristic of El Niño conditions. For the year as a whole, the TRMM rainfall data suggests that rainfall was close to the 1999–2005 average over much of the tropical Pacific, with the exception of enhanced convection in the SITCZ region (Figure 2).

Rainfall in the ITCZ is higher in the second six months of the year, and this climatological pattern was accentuated during 2006. Rainfall was lower than normal in February (particularly), and higher than normal in October through December 2006. This transition was also apparent in island rainfall records for the year. South of the Equator, rainfall in specific island groups was affected by the ENSO modulation of the South Pacific Convergence Zone. The SPCZ was further south than usual from January through May, as expected with La Niña, and further north than usual in at least some months at the end of 2006 (e.g., December). As noted above, precipitation in the SITCZ region, which occurs mainly February through April, was enhanced during 2006.

Data sets made use of in preparation of this section were the 0.25 degree resolution rainfall data from TRMM (3B-43 product), and NCEP-NCAR reanalysis data. The section also drew on the University of Hawaii PEAC Pacific ENSO Update (<http://www.soest.hawaii.edu/MET/Enso/peu/update.html>), NCEP climate summary information ([http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/bulletin/](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/bulletin/)), and the NIWA Island Climate Update (<http://www.niwascience.co.nz/ncc/icu>).

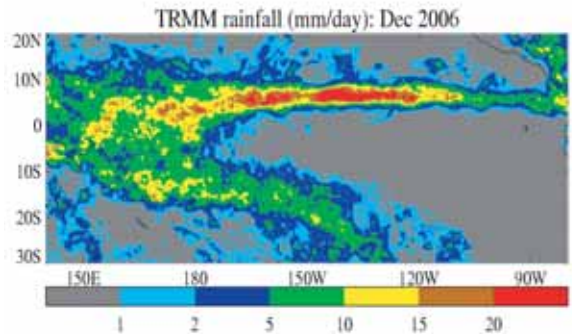
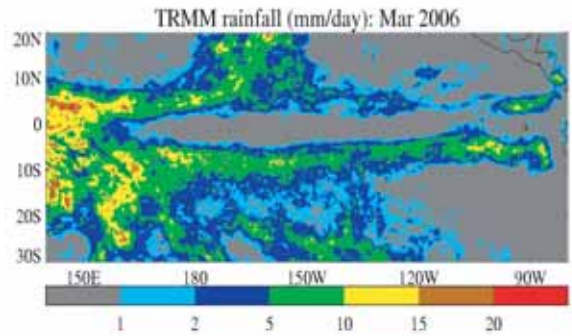


Figure 1: Average rainfall rate (mm/day) from TRMM 0.25 degree analysis for months of March (upper panel) and December (lower panel) 2006. Contours at uneven spacing of 1, 2, 5, 10, 15, 20 mm/day.

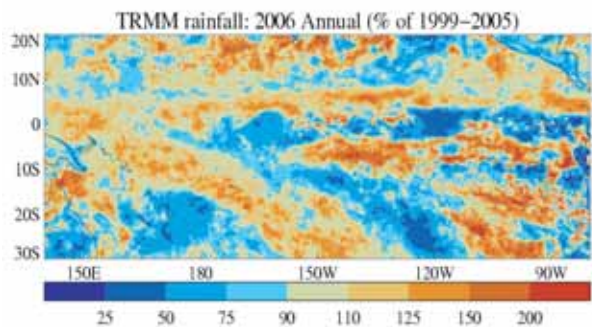


Figure 2: Annual average rainfall rate from TRMM 0.25 degree analysis for 2006, as a percentage of the 1999–2005 climatology.

## References

- Lietzke, C., E., Deser, C., and Vonder Harr, T.H., 2001. Evolutionary structure of the eastern Pacific double ITCZ based on satellite moisture profile retrievals. *J. Climate*, 14: 743–751.
- Zhang, C. (2001), Double ITCZs. *J. Geophys. Res.*, 106(D11): 11,785–11,792.

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## The Island Climate Update

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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**