

The Island Climate Update

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

April's climate

- South Pacific Convergence Zone (SPCZ) further north than normal in the west
- Wet throughout southern Tonga, and parts of Fiji, with enhanced convection over Vanuatu and Tuvalu
- Suppressed convection and low rainfall over Eastern Kiribati, Tokelau, the Northern Cook Islands, Samoa, and the Marquesas Islands
- Warmer than normal in Samoa, Northern and Central French Polynesia, Tuvalu, Tonga, and Niue
- One tropical cyclone in April

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

- Neutral ENSO conditions currently prevail in the tropical Pacific
- Below average rainfall is expected over Eastern Kiribati
- Above average rainfall is likely over the Solomon Islands and the Southern Cook Islands



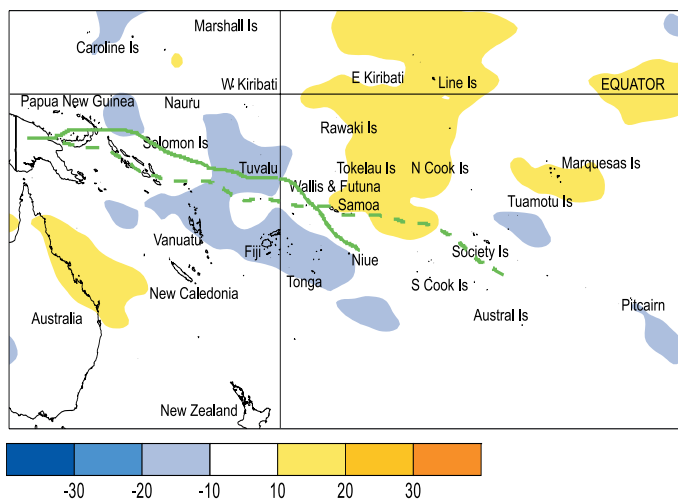
Climate developments in April 2007

The South Pacific Convergence Zone (SPCZ) was generally further north than usual, extending from Papua New Guinea to Tuvalu, and then towards Niue. A region of weakly enhanced convection occurred over Vanuatu, Tuvalu, Fiji, and Tonga. A region of weakly suppressed convection and low rainfall existed over parts of Eastern Kiribati, Tokelau, the Northern Cook Islands, Samoa, and the Marquesas Islands.

Rainfall was above average (at least 150% of normal) throughout southern Tonga, and at least 125% of normal in parts of Fiji. However, rainfall was low, (50% or less of normal) in much of Northern French Polynesia, and also below average (75% or less of normal) throughout much of New Caledonia.

April mean air temperatures were about 1.0 °C above average in Samoa, Northern French Polynesia, and 0.5 °C above average in Tuvalu, Tonga, Niue, Central French Polynesia.

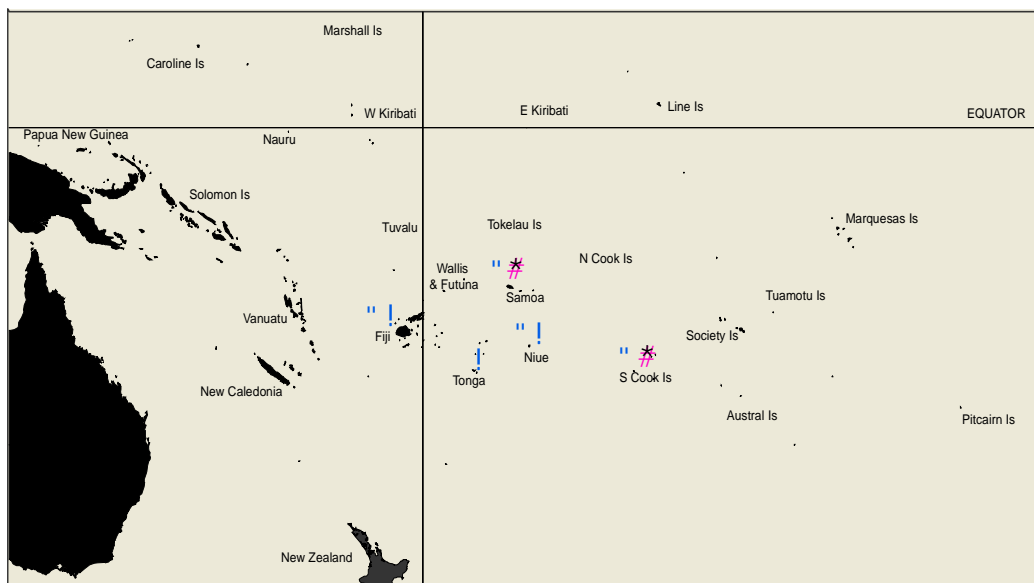
Tropical Southwest Pacific mean sea-level pressures were above average west of New Caledonia and Vanuatu, and near average over many Southwest Pacific Islands. Equatorial surface easterlies occurred in 97% of observations at Tarawa.



Outgoing Long-wave Radiation (OLR) anomalies, in Wm^{-2} (blue equals high rainfall and yellow equals low rainfall). The April 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.

Country	Location	Rainfall (mm)	% of average	Comments
Fiji	Lakeba	523	254	Record high
Tonga	Lupepau'u	579	277	Extremely high

Soil moisture in April 2007



April 2007

- ! Dry
- ! Wet
- * Moderate

April 2006

- " Dry
- " Wet
- * Moderate

Estimated soil moisture conditions at the end of April 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 April 2007, Nadi, Hanan and Nuku'alofa soils were at field capacity (full) while Apia and Rarotonga soils were at moderate capacity.

El Niño/Southern Oscillation (ENSO)

Conditions in the tropical Pacific are currently neutral with the chances of La Niña developing remaining elevated.

The pattern of sea surface temperature (SSTs) anomalies is beginning to resemble La Niña conditions with colder than average waters in the far eastern Pacific and slightly warmer than average waters in the western Pacific. SSTs remain slightly above normal to the west of the Date Line, with below average SSTs extending from the South American coast to 130°W.

The NINO3 anomaly cooled to -0.1°C in April (February–April average around $+0.1^{\circ}\text{C}$) while the NINO4 anomaly was $+0.4^{\circ}\text{C}$ in April (February–April mean around $+0.5^{\circ}\text{C}$).

The Southern Oscillation Index (SOI) is still negative, but in the neutral range.

Subsurface data for April shows that negative anomalies in the top 150 metres between the Date Line and the South American coast continued over the last month and moved westwards.

The easterly trade winds during April have been near normal in the eastern Pacific, but slightly stronger than normal in the central and western Pacific.

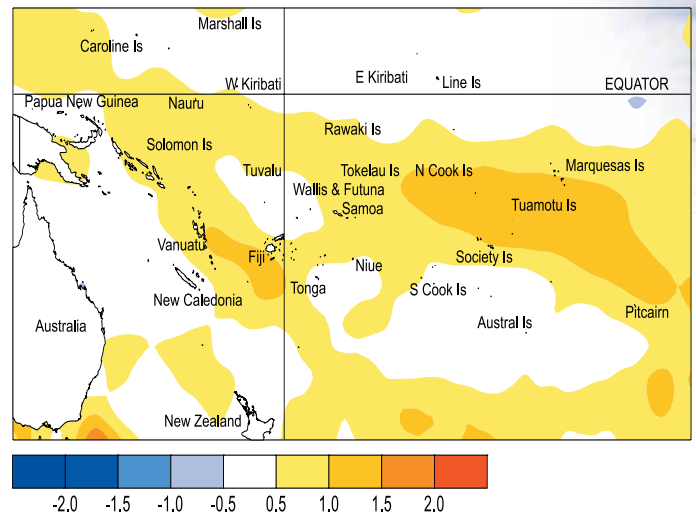
Outgoing longwave radiation and tropical rainfall anomalies for April indicate continued enhanced convection in the South Pacific Convergence Zone (SPCZ) and west of the Date Line and a double-ITCZ (Inter-Tropical Convergence Zone) structure east of the Date Line.

The global sea surface height (SSH) anomaly shows a classic La Niña pattern with lower SSH anomalies from the Date Line east, surrounded by a horseshoe of higher SSH anomalies in the western Pacific. The Madden-Julian Oscillation is presently very weak, with no discernable phase.

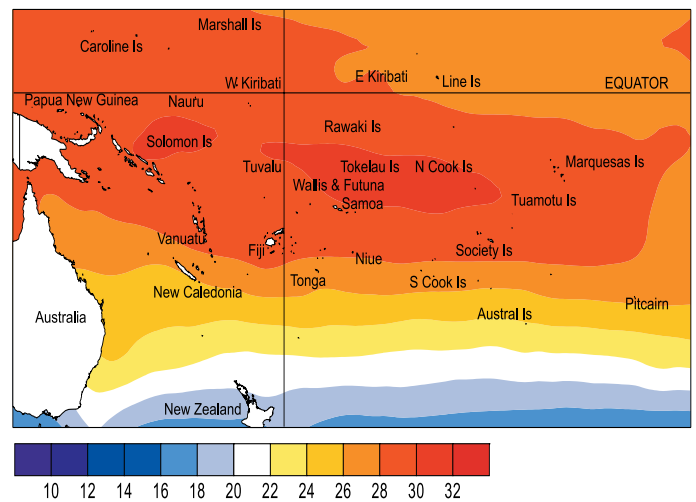
The dynamical models show a transition to La Niña conditions over the next 3 months, with this persisting for the remainder of the year, whilst the statistical models project neutral ENSO states for the next 6–9 months.

Forecast validation: February to April 2007

A large region of enhanced convection and above average rainfall was expected over Western and Eastern Kiribati, Tuvalu, Tokelau, Wallis and Futuna, and the Northern Cook Islands, with average or above average rainfall affecting the Solomon Islands, Vanuatu, Fiji, Tonga, Niue, and Samoa. This region was further south than expected. Suppressed convection and below average rainfall was expected over New Caledonia, with near or below average rainfall in Vanuatu, Fiji, Tonga, the Tuamotu and Marquesas Islands, and Pitcairn Island. Near average rainfall was expected elsewhere.



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



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

No model retains warm conditions during the remainder of the year. The NCEP synopsis suggests a transition from ENSO-neutral to La Niña conditions is possible within the next 2–3 months, while the IRI synthesis gives a probability of 50% for a La Niña by mid-year. The probability of El Niño conditions re-emerging during the forecast period remains at or below 5%.

A large region of enhanced convection and/or above average rainfall extended from the region northeast of Papua New Guinea southeast to the Southern Cook Islands, including the Solomon Islands, Vanuatu, Fiji, Tonga, Niue, and Samoa. This region was further south than expected. Suppressed convection or/or below average rainfall occurred over Eastern Kiribati, Tokelau, the Northern Cook Islands, and Northern French Polynesia, as well as New Caledonia. Rainfall was higher than expected in Vanuatu, Fiji, Tonga, and Niue, and lower than expected in Western and Eastern Kiribati, Tuvalu, and Tokelau. The 'hit' rate for the February–April 2007 rainfall outlook was about 50%.

Tropical cyclones

Tropical cyclone (TC) Cliff was the only named tropical cyclone to occur in the Southwest Pacific in April; there have been a total of six TCs so far this season, for the region east of 150°E. TC Cliff developed near northern Fiji and tracked southeast over 4-6 April, with maximum sustained wind speeds reaching 100 km/h. Some eastern parts of Fiji suffered minor wind damage and minor to moderate flooding.

Tropical Pacific rainfall – April 2007

Territory and station name	April 2007 rainfall total (mm)	April 2007 percent of average
Australia		
Cairns Airport	70.0	37
Townsville Airport	4.8	8
Brisbane Airport	12.4	14
Sydney Airport	108.8	111
Cook Islands		
Penrhyn	47.0	23
Rarotonga Airport	73.1	35
Rarotonga EWS	51.6	24
Fiji		
Rotuma	300.2	102
Udu Point	340.5	123
Nadi	200.3	125
Nausori	326.8	92
Ono-I-Lau	178.4	114
French Polynesia		
Hiva Hoa, Atuona	63.0	36
Bora Bora Motu	95.4	52
Tahiti - Faa'a	53.0	46
Tuamotu, Takaroa	150.4	126
Gambier, Rikitea	218.5	145
Tubuai	54.4	30
Rapa	150.2	65
Niue		
Hanan	268.1	119
Liku	234.3	124
Tonga		
Queen Lavinia	183.5	73
Niutoputapu	142.8	55
Nuku'alofa	242.6	147
Lupepau'u	578.5	277
Salote Airport	309.0	163
Fua'amotu Airport	287.4	181

Territory and station name	April 2007 rainfall total (mm)	April 2007 percent of average
New Zealand		
Kaitia	80.0	84
Whangarei Airport	40.0	34
Auckland Airport	59.0	62
New Caledonia		
Ile Art, Belep	137.0	51
Koumac	33.2	51
Ouloup	64.4	67
Ouanaham	136.8	107
Poindimie	146.8	60
La Roche	39.0	29
La Tontouta	44.4	73
Noumea	90.3	88
Moue	95.2	77
North Tasman		
Lord Howe Island	147.2	91
Norfolk Island	47.0	34
Raoul Island	58.7	58
Tuvalu		
Nanumea	215.4	90
Funafuti	344.5	128
Nuilakita	232.4	96

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: May to July 2007

Enhanced convection is likely over the Solomon Islands and the Southern Cook Islands, where rainfall is expected to be above average.

Near or above average rainfall is expected from Papua New Guinea southeastwards to the Pitcairn Island, including Wallis and Futuna, Samoa, the Northern Cook Islands, Society Islands, Austral Islands, and Tuamotu Islands.

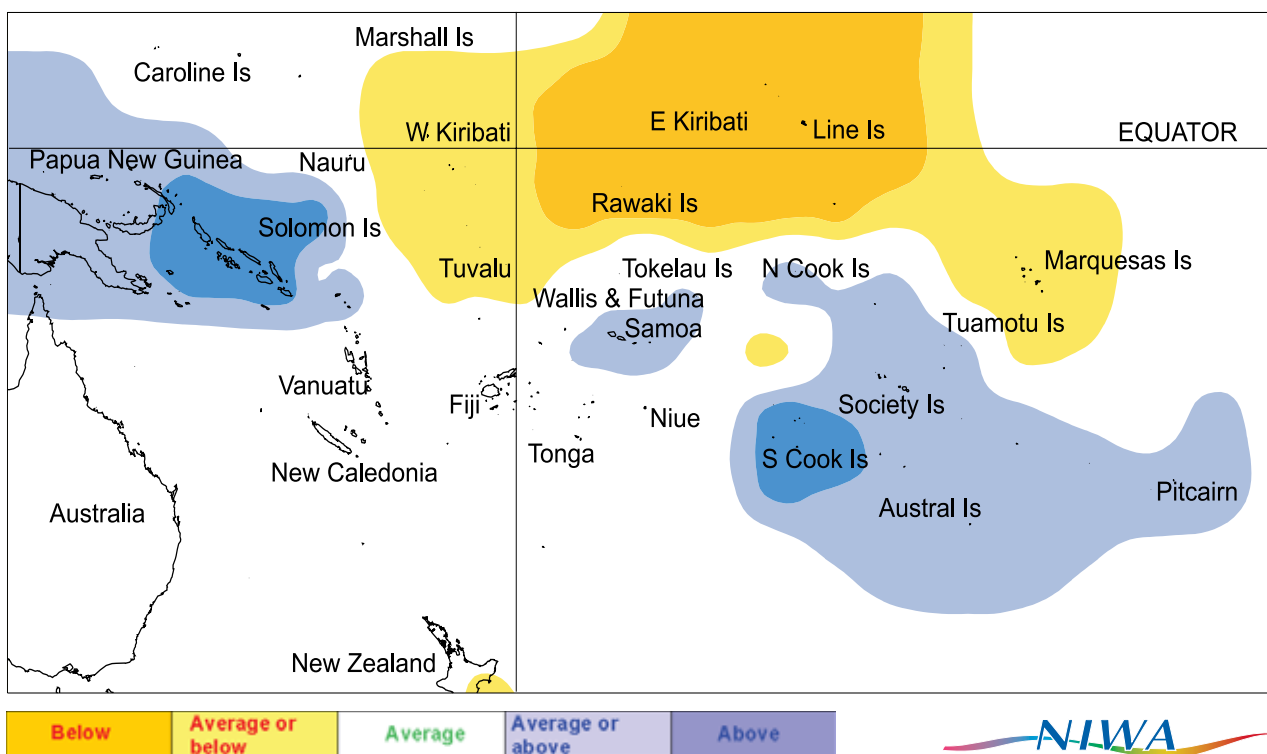
Suppressed convection is expected over Eastern Kiribati, where rainfall is likely to be below average. Near or below average rainfall is expected over Western Kiribati, Tuvalu and the Marquesas Islands.

Near average rainfall is likely for the rest of the countries in the region.

The skill of the rainfall forecast models are low to moderate for this time of the year.

Island group	Rainfall outlook	Outlook confidence
Solomon Islands	30:35:45 (Above average)	Moderate
Southern Cook Islands	20:30:50 (Above average)	Moderate
Papua New Guinea	15:45:40 (Near or above average)	Moderate
Wallis and Futuna	20:40:40 (Near or above average)	Moderate
Samoa	20:40:40 (Near or above average)	Low – moderate
Northern Cook Islands	20:40:40 (Near or above average)	Moderate
Society Islands	20:40:40 (Near or above average)	Moderate
Austral Islands	20:40:40 (Near or above average)	Moderate
Tuamotu Islands	20:40:40 (Near or above average)	Moderate
Pitcairn Island	20:40:40 (Near or above average)	Moderate
Vanuatu	20:45:35 (Near average)	Moderate
New Caledonia	35:35:30 (Near average)	Low – moderate
Tokelau	30:45:35 (Near average)	Low – moderate
Fiji	35:35:30 (Near average)	Low – moderate
Tonga	30:40:30 (Near average)	Low – moderate
Niue	30:40:30 (Near average)	Low – moderate
Western Kiribati	40:40:20 (Near or below average)	Moderate
Tuvalu	40:40:20 (Near or below average)	Moderate
Marquesas Islands	40:40:20 (Near or below average)	Moderate
Eastern Kiribati	50:20:30 (Below average)	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 May to July 2007



Climate Change: the Intergovernmental Panel on Climate Change 4th Assessment Report – The South Pacific

Pene Lefale¹, Michele Hollis² and Jim Salinger³

This article highlights some of the key findings from the Small Islands chapter, released in April 2007, of Working Group II of the Intergovernmental Panel on Climate Change (IPCC), which includes material on the Pacific.

Working Group II identifies small islands, including those in the South Pacific, as one of four regions of the world likely to be especially affected by climate change. (The other three regions are the Arctic, Africa, and Asian megadeltas).

Small islands share many similar characteristics that enhance their vulnerability and reduce their resilience to climate change. These include small size, prone to natural disasters and climate extremes, limited resource base, large populations for the area they occupy (with high growth rates and densities), poorly developed infrastructure, extremely open economies, and low adaptive capacity. More details can be found at: <http://www.ipcc.ch/>

Climate change already observed

- Annual and seasonal ocean surface and island air temperature increase of 0.6 –1.0°C since 1910 throughout a large part of the region southwest of the South Pacific Convergence Zone
- Significantly fewer cool days and cold nights, particularly in years after the onset of El Niño.
- Analyses of satellite and tide gauge data show a maximum rate of sea level rise in the central and eastern Pacific, spreading north and south around the subtropics of the Pacific Ocean near 90°E, mostly between 2.0–2.5 mm/year, peaking at over 3 mm/year for the period 1950–2000.

Future climate projections

- Increased seasonal surface air temperature ranging from 0.45 to 3.11°C, relative to the baseline period of 1961–1990, by 2100.
- Projected changes in rainfall range from -14.0 to +14.6% by 2100 for the South Pacific, with more frequent heavy rainfall events.
- Projected globally averaged sea level rise at the end of the 21st century relative to 1980–1999 for the six SRES scenarios ranges from 0.19 to 0.58 mm/yr. Models indicate a geographical variation of sea level rise.
- The number of intense cyclones is likely to increase, though the total number of tropical cyclones overall may decrease on a global scale.

Future Impacts

Sea level rise

Sea level rise is likely to exacerbate inundation, storm surge, erosion, and other coastal hazards, thus threatening vital infrastructure, settlements, and facilities. Some studies suggest sea level rise could lead to possible reduction in island size, particularly in the Pacific, whilst others show a few islands are morphologically resilient and are expected to persist.

Port facilities at Suva, Fiji, and Apia, Samoa, are likely to experience overtopping, damage to wharves, and flooding of the hinterland following a 0.5 m rise in sea level combined with waves associated with a 1-in-50 year cyclone.

International airports on small islands are mostly sited on or within a few

kilometres of the coast, and the main, and often only, road network runs along the coast. Under sea level rise scenarios, many of them are likely to be at serious risk.

Coral reefs, fisheries, and other marine-based resources

The impact of climate change is likely to be severe here. Fisheries make an important contribution to the GDP of many small island states. Changes in the occurrence and intensity of El Niño and La Niña events are likely to severely impact on commercial and artisanal fisheries. The following factors are very likely to affect the health of coral reefs and other marine ecosystems which sustain small island fisheries:

- increasing sea surface temperature and sea level
- increased turbidity, nutrient loading, and chemical pollution
- damage from tropical cyclones
- possible decreases in growth rates due to ocean acidification

Such impacts will exacerbate non-climate change stresses on coastal systems. It is likely that these changes would in turn negatively affect the attraction of small islands as premier tourism destinations.

Pressure on water resources

There is strong evidence that under most climate change scenarios, water resources are likely to seriously be compromised. Many islands in tropical regions are likely to experience increased water stress. Under all IPCC SRES scenarios, a 10% reduction in average rainfall by 2050 would lead to a 20% reduction in the size of the freshwater lens on Tarawa Atoll, Kiribati. Reduced rainfall coupled with sea level rise would compound this threat.

Human health effects

There is growing concern that climate change is likely to adversely affect human health. Many small islands are located in regions whose weather and climate are already conducive to the transmission of diseases such as malaria, dengue, filariasis, and food–water-borne diseases. Increasing temperatures and decreasing water availability are likely to increase burdens of diarrhoeal and other infectious diseases on some islands.

Economic impact

Without adaptation, by 2050, agricultural economic costs from climate change are likely to reach between 2–3% of 2002 GDP on high terrain islands (e.g., Fiji) and 17–18% of 2002 GDP on low terrain islands (e.g., Kiribati). These figures are for mid-range climate change scenarios.

Costs & benefits of adaptation

Studies so far suggest that adaptation options for small island states are likely to be limited and the costs high relative to GDP. Despite this, “exploratory research” indicates prudent adaptation strategies can generate other benefits as well. For example, the use of waste-to-energy and other renewable energy systems can promote sustainable development, while strengthening resilience to climate change.

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The Island Climate Update

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Sources of South Pacific rainfall data

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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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