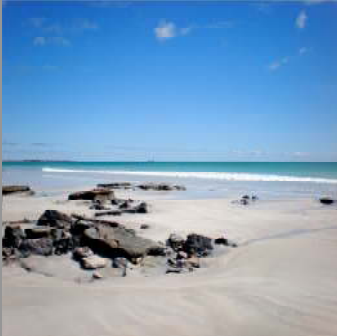




The Climate of the Pacific: Observations and projections



The terms defined

“Climate is the average atmospheric condition in a certain location near the surface of the Earth measured after a period of months to decades”. 1

Climate is usually defined as “average weather”.2

Weather is what is happening in the atmosphere at any given time. 2

The atmosphere is the envelope of gas surrounding the Earth. 2

1 World Meteorological Organization (WMO) Weather, climate and water science for youth www.wmo.int/youth/climate_en.html

2 World Meteorological Organization (WMO) Understanding Climate www.wmo.int/pages/themes/climate/understanding_climate.php

Is the climate changing?

Observation network

Globally, there is a network of stations used to observe weather conditions and collect data. This data has been stored and can help us understand patterns in climate. The climate records in Australia date back to 1900 with some records from the 19th Century also available. Data records in the Pacific Islands are not as long, however there is currently a project being undertaken to recover climate records in the Pacific (Pacific Islands - Climate Prediction Project www.bom.gov.au/climate/pi-cpp/data_rescue.shtml). There currently is a regional observing network established in the Pacific in 2000 (The Pacific Islands Global Climate Observing System <http://pi-gcos.org/>). We can also gain understanding of the past climate from computer models.

Pacific Climate observations

The Intergovernmental Panel on Climate Change (IPCC) describes the climate of the Pacific as:

"The climates of small islands in the central Pacific are influenced by several contributing factors such as trade wind regimes, the paired Hadley cells and Walker circulation, seasonally varying convergence zones such as the South Pacific Convergence Zone (SPCZ), semi-permanent sub-tropical high-pressure belts, and zonal westerlies to the south, with ENSO as the dominant mode of year-to-year variability. The Madden-Julian Oscillation (MJO) is a major mode of variability of the tropical atmosphere-ocean system of the Pacific on time-scales of 30 to 70 days, while the leading mode of variability with decadal time-scale is the Interdecadal Pacific Oscillation (IPO). A number of studies suggest that the influence of global warming could be a major factor in accentuating the current climate regimes and the changes from the normal that come with ENSO events." (IPCC www.ipcc.ch/publications_and_data/ar4/wg2/en/ch16s16-2-2.html)

In the tropics, cyclones and other extreme weather events, including storm surge, can cause losses to life and property.

Table 2.3. Reported Natural Disasters in the Pacific Islands (1950-2004)¹

Event	Number	Fatalities	Population Affected	Losses (millions 2004 US\$)
Windstorms	157	1,380	2,496,808	5,903.90
Droughts	10	0	629,580	137.00
Floods	8	40	246,644	94.80
Earthquakes	17	53	22,254	330.60
Others	15	274	21,520+	60.00

Source: CSIRO - Climate Change in the Asia/Pacific Region www.csiro.au/files/files/p9xj.pdf

Project Survival Pacific is an initiative of the Australian Youth Climate Coalition For more information see our website at <http://youthprojectsurvival.org>

The Climate of the Pacific: Observations and projections



The terms defined

"Climate is the average atmospheric condition in a certain location near the surface of the Earth measured after a period of months to decades". 1

Climate is usually defined as "average weather".2

Weather is what is happening in the atmosphere at any given time. 2

The atmosphere is the envelope of gas surrounding the Earth. 2

1 World Meteorological Organization (WMO) Weather, climate and water science for youth
www.wmo.int/youth/climate_en.html

2 World Meteorological Organization (WMO) Understanding Climate

www.wmo.int/pages/themes/climate/understanding_climate.php

Climate change-induced sea-level rise will exacerbate natural variability in sea level and local tides to affect coastal communities and ecosystems in the Asia/Pacific region.

Table 3.4. Recent Trends in Sea-Level Rise in Pacific Island Nations⁸⁵

Nation	Year of Gauge Installation	Trend (mm/year)
Cook Islands	1993	+2.5
Fiji	1992	+2.5
Federated States of Micronesia	2001	+21.4
Kiribati	1992	+5.7
Marshall Islands	1993	+5.2
Nauru	1993	+7.1
Papua New Guinea	1994	+8.1
Samoa	1993	+6.9
Solomon Islands	1994	+6.8
Tonga	1993	+8.0
Tuvalu	1993	+6.4
Vanuatu	1993	+3.1

Source: CSIRO - Climate Change in the Asia/Pacific Region www.csiro.au/files/files/p9xj.pdf

"A coordinated sea level monitoring effort has been under way in the Pacific Islands since the early 1990s (Table 3.4). Data through June 2006 reflect highly variable trends in sea levels throughout the Pacific Islands, with rates as low as 2.5mm/year around the Cook Islands or as high as 21.4 mm/year in the Federated States of Micronesia. Short-term variability in lunar tides, storm activity, as well as the effects of the El Niño Southern Oscillation (e.g., El Niño and La Niña events) may contribute to anomalously high or low tides in various regions. For example, during February of 2005, King Tides were responsible for damage to Pacific Islands such as Kiribati. Meanwhile the strong 1997/98 El Niño event contributed to anomalously low sea levels throughout the Pacific Islands."

Taken from the Climate Change in the Asia/Pacific Region report from the Australian Commonwealth Scientific and Research Organisation (CSIRO) which examined recent trends in sea-level rise in the Pacific.
(www.csiro.au/files/files/p9xj.pdf)

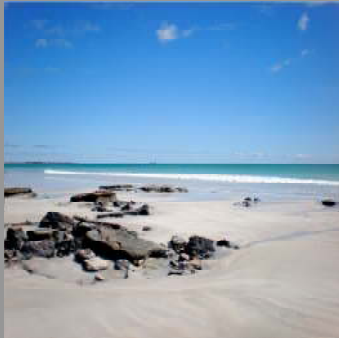
Observations of climate change in the Pacific were documented and summarised in the Third Assessment Report of the IPCC (2001):

"Analyses conducted by the New Zealand Meteorological Services reveal that, since 1920, temperature has risen by 0.6-0.7°C in Noumea (New Caledonia) and Rarotonga (Cook Islands), which is greater than the mean global increase. Based on data from 34 stations in the Pacific from about 160°E and mostly south of the equator, surface air temperatures have increased by 0.3-0.8°C during the 20th century, with the greatest increase in the zone southwest of the SPCZ. This is well in excess of global rates of warming. Further recent work undertaken by the New Zealand Institute of Water and Atmospheric Research (NIWA) shows a noticeable change in aspects of the South Pacific climate since the mid-1970s. For instance, western Kiribati, the northern Cook Islands, Tokelau, and northern French Polynesia have become wetter, whereas New Caledonia, Fiji, and Tonga have become drier. Meanwhile, Samoa, eastern Kiribati, Tokelau, and northeast French Polynesia have become cloudier, with warmer nighttime temperatures; New Caledonia, Fiji, Tonga, the southern Cook islands, and southwest French Polynesia and Tuvalu have become warmer and sunnier. It also might be noted that in the Pacific generally, observed changes in temperature and cloudiness appear to be closely influenced by the pattern of ENSO events."
(IPCC www.grida.no/publications/other/ipcc_tar/)

Project Survival Pacific is an initiative of the Australian Youth Climate Coalition
For more information see our website at <http://youthprojectsurvival.org>



The Climate of the Pacific: Observations and projections



The terms defined

“Climate is the average atmospheric condition in a certain location near the surface of the Earth measured after a period of months to decades”. 1

Climate is usually defined as “average weather”.2

Weather is what is happening in the atmosphere at any given time. 2

The atmosphere is the envelope of gas surrounding the Earth. 2

1 World Meteorological Organization (WMO) Weather, climate and water science for youth www.wmo.int/youth/climate_en.html

2 World Meteorological Organization (WMO) Understanding Climate www.wmo.int/pages/themes/climate/understanding_climate.php

What changes are likely?

Pacific Climate projections

The IPCC has projected a gradual warming of both sea-surface temperatures and air temperatures in all small island regions and across all seasons and have cautioned that temperature changes could be higher than the most recent projections. Projections from the IPCC (www.ipcc.ch/publications_and_data/ar4/wg2/en/ch16s16-3.html#16-3-1) are presented below:

Table 16.1. Projected increase in air temperature (°C) by region, relative to the 1961–1990 period.

Region	2010–2039	2040–2069	2040–2069
Mediterranean	0.60 to 2.19	0.81 to 3.85	1.20 to 7.07
Caribbean	0.48 to 1.06	0.79 to 2.45	0.94 to 4.18
Indian Ocean	0.51 to 0.98	0.84 to 2.10	1.05 to 3.77
Northern Pacific	0.49 to 1.13	0.81 to 2.48	1.00 to 4.17
Southern Pacific	0.45 to 0.82	0.80 to 1.79	0.99 to 3.11

Table 16.2. Projected change in precipitation (%) by region, relative to the 1961–1990 period.

Region	2010–2039	2040–2069	2040–2069
Mediterranean	-35.6 to +55.1	-52.6 to +38.3	-61.0 to +6.2
Caribbean	-14.2 to +13.7	-36.3 to +34.2	-49.3 to +28.9
Indian Ocean	-5.4 to +6.0	-6.9 to +12.4	-9.8 to +14.7
Northern Pacific	-6.3 to +9.1	-19.2 to +21.3	-2.7 to +25.8
Southern Pacific	-3.9 to +3.4	-8.23 to +6.7	-14.0 to +14.6

Source: IPCC www.ipcc.ch/publications_and_data/ar4/wg2/en/ch16s16-3.html#16-3-1

More projections are also available for seasons from the CSIRO report: Climate Change in the Asia/Pacific Region available at www.csiro.au/files/files/p9xj.pdf.



The Climate of the Pacific: Observations and projections



The terms defined

“Climate is the average atmospheric condition in a certain location near the surface of the Earth measured after a period of months to decades”.¹

Climate is usually defined as “average weather”.²

Weather is what is happening in the atmosphere at any given time. ²

The atmosphere is the envelope of gas surrounding the Earth. ²

¹ World Meteorological Organization (WMO) Weather, climate and water science for youth www.wmo.int/youth/climate_en.html

² World Meteorological Organization (WMO) Understanding Climate www.wmo.int/pages/themes/climate/understanding_climate.php

Extreme events may also change with a warmer climate

Tropical cyclones, storms and extreme winds may change in frequency or intensity in the future.

"Globally, the World Meteorological Organisation has reported that extreme events are on the rise as a result of anthropogenic perturbation of the climate system, and climate models indicate the potential for increases in extremes of temperature, precipitation, droughts, storms, and floods. For example, modelling for Pohnpei, the Federated States of Micronesia and Rarotonga, Cook Islands suggests a shortening of return periods for extreme winds and rainfall as the world warms. Furthermore, modelling studies consistently find that tropical cyclone intensities increase in response to higher sea surface temperatures, meaning the potential for long-term increases in average cyclone intensities in the Asia/pacific region in the decades ahead. Nevertheless, specific knowledge regarding the magnitude or frequency of climate extremes remains limited." Source: (CSIRO - Climate Change in the Asia/Pacific Region www.csiro.au/files/files/p9xj.pdf)

Future Impacts

Some other impacts may impact the Pacific in future, which may not have been risks in the past are listed in the table below.

Region* and system at risk	Changed parameters	Impacts and vulnerability
6. Pacific and Mediterranean: Siam weed (Chromolaena odorata)	Increase in moisture, cold, heat and dry stress	Pacific islands at risk of invasion by Siam weed.
7. Pacific small islands: Coastal erosion, water resources and human settlement	Changes in temperature and rainfall, and sea-level rise	Accelerated coastal erosion, saline intrusion into freshwater lenses and increased flooding from the sea cause large effects on human settlements. Less rainfall coupled with accelerated sea-level rise compound the threat on water resources; a 10% reduction in average rainfall by 2050 is likely to correspond to a 20% reduction in the size of the freshwater lens on Tarawa Atoll, Kiribati.

Source: IPCC Climate Change 2007: Working Group II www.ipcc.ch/publications_and_data/ar4/wg2/en/ch16s16-4.html

Project Survival Pacific is an initiative of the Australian Youth Climate Coalition For more information see our website at <http://youthprojectsurvival.org>