

Climate extremes in the western tropical Pacific

Countries in the western tropical Pacific are particularly vulnerable to impacts from extremes in temperature, rainfall and sea-level rise, as well as tropical cyclones.

What are climate extremes?

Climate extremes are short-term weather or longer-term climatic events that are rare or uncommon in occurrence, and often excessively severe in impact.

Extreme events resulting from natural variability in large-scale climate processes, from season to season and year to year, can cause massive loss and damage to infrastructure, industry and environmental assets, and can impact on the health, safety and overall wellbeing of local communities. These large-scale processes include the El Niño Southern Oscillation (ENSO), the South Pacific Convergence Zone (SPCZ), the West Pacific Monsoon (WPM) and the Intertropical Convergence Zone (ITCZ). Longer-term variability and climate change compound these impacts, particularly in terms of increased vulnerability to natural, climate-related disasters.

What has happened in the past?

Temperature: There has been a trend toward more frequent hot days and warm nights, and fewer cool days and cool nights, as average air temperatures have increased significantly over the last 50 years.

Rainfall: Rainfall extremes are primarily influenced by year-to-year and decade-to-decade variability associated with ENSO and the intensity/location of other major climate features such as the SPCZ, ITCZ and WPM. As an example, La Niña events in recent years have been associated with severe drought in Tuvalu and floods in Fiji.

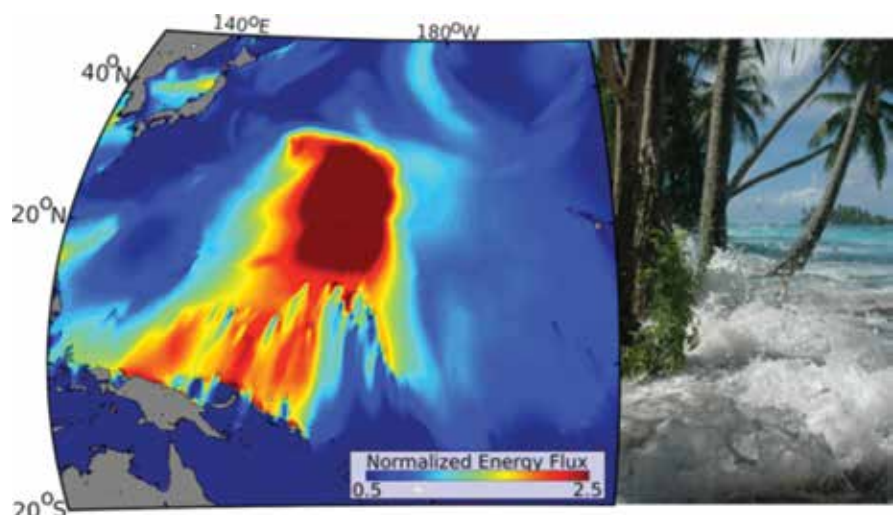
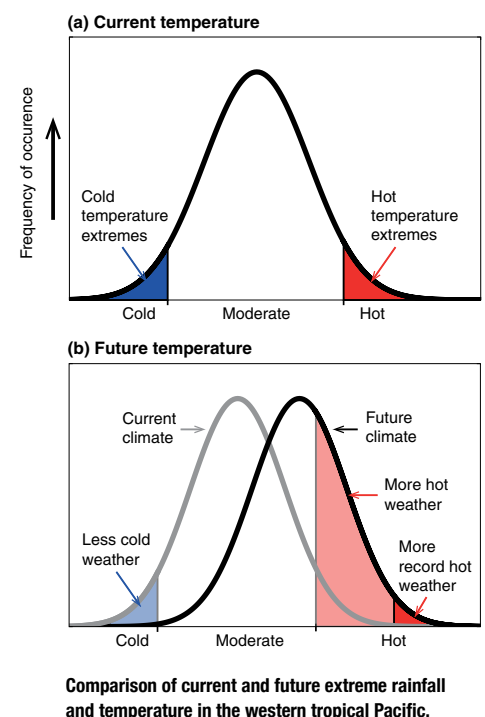
Tropical cyclones: On average, nine tropical cyclones occur in the western Pacific region between November and April each year, mostly between January and March. The greatest numbers of cyclones occur in the Vanuatu-New Caledonia region. The frequency and intensity of cyclones varies significantly from year to year, largely due to ENSO.

Sea level: Natural sea level changes due to tides, weather and climate variability can be quite large at any one time compared to sea-level rise as a result of climate change alone. Global-average sea level has risen 19 cm since 1901, primarily due to thermal expansion of water as the oceans warm, and melting of glaciers, ice caps and ice sheets on land with increased run-off to the sea.

What might happen in the future?

Temperature: Scientists are very confident that the intensity and frequency of extreme heat will continue to increase for the rest of the 21st century. Events that are considered a heat wave in the current climate are projected to become longer.

Rainfall: Almost all Pacific island countries are projected to get more rainfall and fewer droughts, with some showing little change. Longer-term projections of extreme rainfall days differ for each Pacific island country, but scientists are



High-energy, Pacific storm-driven extreme wave event (left) which impacted the islands of six Pacific nations including Takuu Atoll, Papua New Guinea (right), December 2008. (Photo: Jeffrey Holdaway, On the Level Productions).

confident that they will be more intense and more frequent over the entire region. Over the course of the 21st century, the change is likely to be slightly greater in some countries like Fiji and Niue, and also countries in the west such as Palau, Papua New Guinea and the Solomon Islands. However, longer-term changes in ENSO are still uncertain. For example, an increase in the frequency or intensity of El Niño in future could lead to an increase in drought in some countries, despite the overall increase in mean rainfall across the region.

Tropical cyclones: Scientists are confident that over the course of the 21st century tropical cyclones will become less frequent in the Pacific region, but more intense.

Sea level: Extreme sea level events will happen more often as the effects of natural variability are compounded by long-term sea-level rise due to climate change. This includes coastal flooding that occurs in association with tropical cyclones and other high energy, low-pressure storms that generate extreme winds and oceanic swells.

What are some of the impacts?

Temperature: Very hot days and long hot spells lead to heat stress which in turn poses threats to the health and wellbeing of local communities. Extreme temperatures in association with dry periods contribute to drought conditions, posing a risk to water security for domestic, industrial and agricultural purposes. High temperatures also increase energy demand for domestic and industrial cooling, posing a risk for energy security.

Rainfall: Flooding and erosion caused by extreme rainfall events can damage infrastructure, roads, agricultural land and human settlements. Flooding of rivers can combine with high sea levels from natural tidal fluctuations and/or storm surges to increase the impact of coastal inundation and erosion.

Tropical cyclones: Tropical cyclones are potentially life threatening to local communities and can cause a great deal of loss and damage to industry, infrastructure and natural resources. This damage can incur massive social, economic and environmental costs.

Sea level: Coastal flooding and erosion from combined storm surges and high tides could become more frequent in the future. This could directly impact on the health and wellbeing of coastal communities through potential injury and loss of life, and loss and damage to coastal resources, industry and infrastructure. In the longer-term, these events could cause saltwater contamination of freshwater aquifers, surface water storages and agricultural soils, and also the loss of culturally significant sites.

Building resilience for a more sustainable future

Climate extremes are only some of many challenges that climate variability and change present to local communities in the western tropical Pacific. Adaptation is essential to enhance the resilience of the most vulnerable communities in the face of potential climate impacts.

The timely provision of reliable scientific understanding and evidence to inform decision-making will enable more effective and efficient adaptation planning: an essential requirement for securing sustainable development in the region.



Damage caused by Tropical Cyclone Evan in Apia, Samoa, December 2012.
(Photo: Meteorology Division, Samoa Ministry of Natural Resources & Environment)



Storm-surge waves driven by Tropical Cyclone Cyril, overtopping Alofi wharf, Niue, February 2012.

Other fact sheets in the series include:

- Sea-level rise in the western tropical Pacific
- Climate variability and climate change in the western tropical Pacific
- Large-scale climate features in the western tropical Pacific
- Ocean acidification in the western tropical Pacific



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