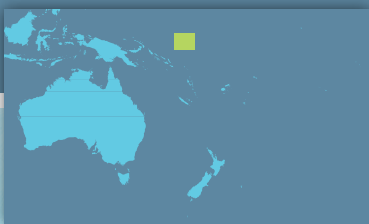


Pacific Climate Change Science Program



Current and future climate of **Nauru**



- > Nauru Department of Commerce, Industry and Environment
- > Australian Bureau of Meteorology
- > Commonwealth Scientific and Industrial Research Organisation (CSIRO)



Australian Government

Nauru's current climate

Nauru has consistent monthly average temperatures throughout the year which are strongly tied to the surrounding ocean temperature (Figure 1). The wet season usually starts in November and continues to April of the next year, while drier conditions occur from May to October.

Nauru's wet season is affected by the movement of the South Pacific Convergence Zone and the Intertropical Convergence Zone. These heavy bands of rainfall are caused by air rising over warm waters where winds converge, resulting in thunderstorm activity. They sit to the south and north of Nauru respectively (Figure 2).

Nauru's climate varies considerably from year to year due to the El Niño-Southern Oscillation. This is a natural

climate pattern that occurs across the tropical Pacific Ocean and affects weather around the world. There are two extreme phases of the El Niño-Southern Oscillation: El Niño and La Niña. There is also a neutral phase. In Nauru, El Niño events tend to bring warmer, wetter conditions than normal, while La Niña events are associated with a delayed onset of the wet season and drier than normal conditions, often resulting in an extended drought.

In some years Nauru's climate can be affected by the West Pacific Monsoon. This occurs when the persistent monsoon westerly winds reach as far east as western Kiribati. The West Pacific Monsoon is driven by large differences in temperature between the land and the ocean. It moves north to mainland Asia during the Northern Hemisphere summer and south to Australia in the Southern Hemisphere summer. The influence of the West Pacific Monsoon on Nauru generally varies with the phase and strength of the El Niño-Southern Oscillation and is usually associated with strong El Niño events.

extreme weather events

Being so close to the equator, Nauru does not experience tropical cyclones, although it is subject to strong winds and sea swells. The main climate extreme experienced by Nauru is drought, lasting as long as 36 months. Droughts usually occur during La Niña events when the surrounding sea temperature is lower, resulting in less cloud and rainfall. Prolonged droughts impact the underground fresh-water lens, resulting in water supply problems and severe stress on natural ecosystems.

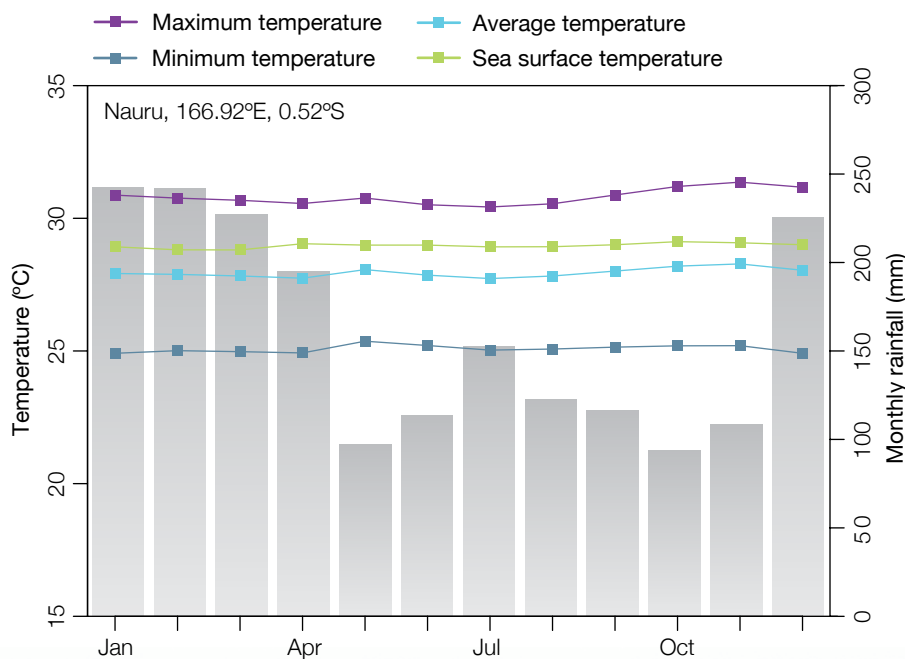


Figure 1: Seasonal rainfall and temperature at Nauru.

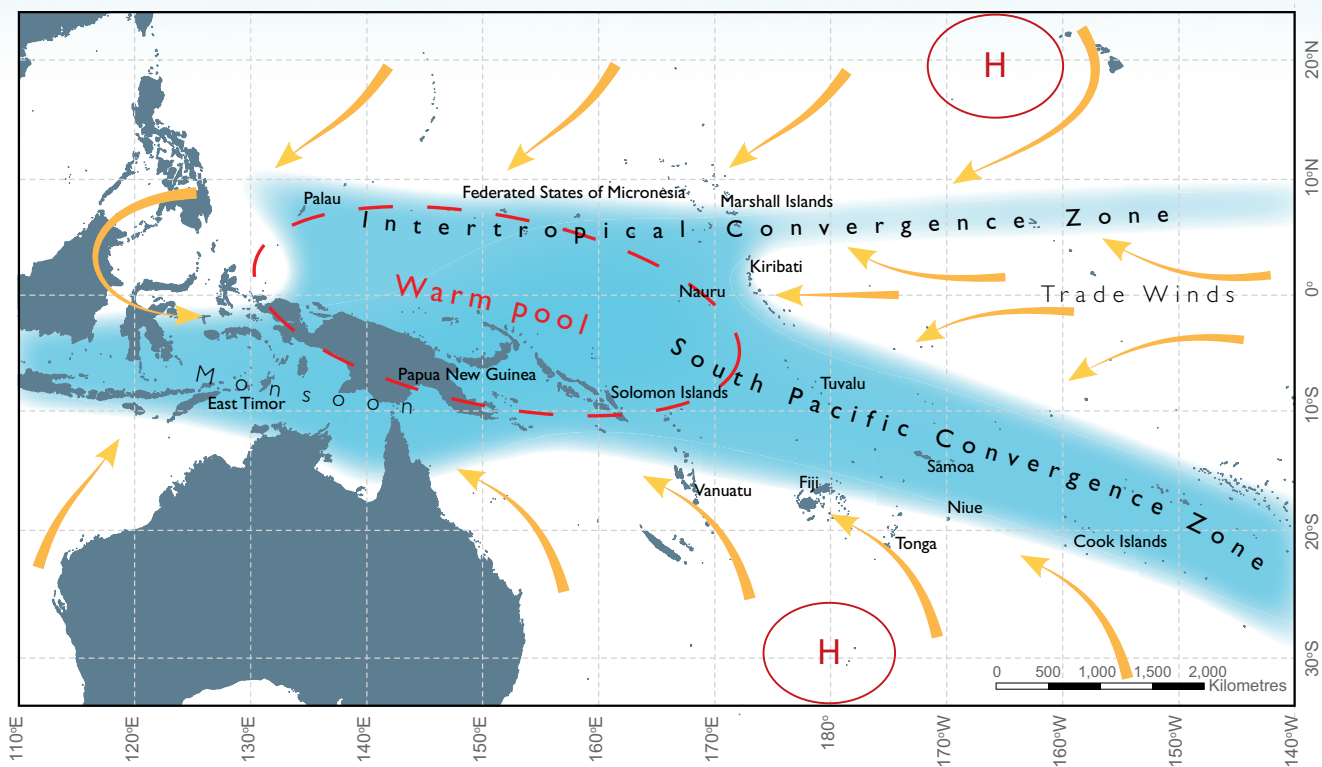


Figure 2: The average positions of the major climate features in November to April. The arrows show near surface winds, the blue shading represents the bands of rainfall convergence zones, the dashed oval shows the West Pacific Warm Pool and H represents typical positions of moving high pressure systems.



View overlooking Aiwo and Denigomodu districts.

Nauru's changing climate

Temperature and rainfall

Trends in temperature are difficult to present for Nauru because of inadequate data records. Based on nearby trends it is likely the average temperatures in Nauru have increased by around 0.15–0.25°C per decade since 1950. This is similar to the trend in sea surface temperature for the Nauru region which shows an increase of 0.15–0.20°C per decade since 1950. Data since 1950 show no clear trends in annual or seasonal rainfall (Figure 3), but over this period, there has been substantial variation in rainfall from year to year.

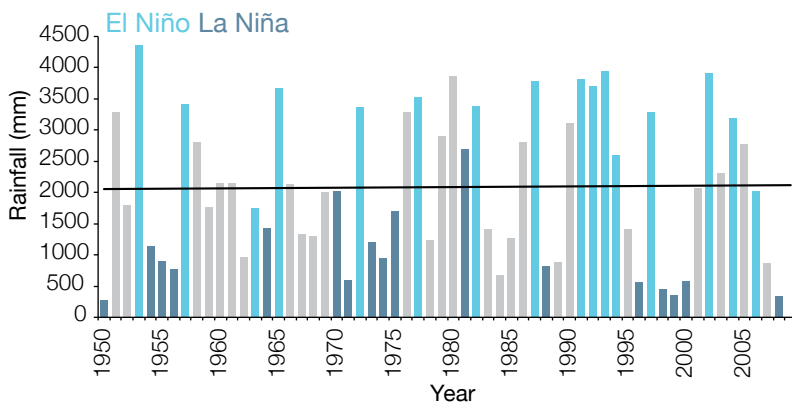


Figure 3: Annual rainfall for Nauru. Light blue bars indicate El Niño years, dark blue bars indicate La Niña years and the grey bars indicate neutral years.

Sea level has risen

As ocean water warms it expands causing the sea level to rise. The melting of glaciers and ice sheets also contribute to sea-level rise.

Instruments mounted on satellites and tide gauges are used to measure sea level. Satellite data indicate the sea level has risen near Nauru by about 5 mm per year since 1993. This is larger than the global average of 2.8–3.6 mm per year. This higher rate of rise may be related to natural fluctuations that take place year to year or decade to decade caused by phenomena such as the El Niño-Southern Oscillation. This variation in sea level can be seen in Figure 6 which includes the tide gauge record since 1974 and satellite data since 1993.

Ocean acidification has been increasing

About one quarter of the carbon dioxide emitted from human activities each year is absorbed by the oceans. As the extra carbon dioxide reacts with sea water it causes the ocean to become slightly more acidic. This impacts the growth of corals and organisms that construct their skeletons from carbonate minerals. These species are critical to the balance of tropical reef ecosystems. Data show that since the 18th century the level of ocean acidification has been slowly increasing in Nauru's waters.



Taking temperature observations at the Tropical Western Pacific Climate Research Station.



Buada lagoon.

Nauru's future climate

Climate impacts almost all aspects of life in Nauru. Understanding the possible future climate of Nauru is important so people and the government can plan for changes.

How do scientists develop climate projections?

Global climate models are the best tools for understanding future climate change. Climate models are mathematical representations of the climate system that require very powerful computers. They are based on the laws of physics and include information about the atmosphere, ocean, land and ice.

There are many different global climate models and they all represent the climate slightly differently. Scientists from the Pacific Climate Change Science Program (PCCSP) have evaluated 24 models from around the world and found that 18 best represent the climate of the western tropical Pacific region. These 18 models have been used to develop climate projections for Nauru.

The future climate will be determined by a combination of natural and human factors. As we do not know what the future holds, we need to consider a range of possible future conditions, or scenarios, in climate models. The

Intergovernmental Panel on Climate Change (IPCC) developed a series of plausible scenarios based on a set of assumptions about future population changes, economic development and technological advances. For example, the A1B (or medium) emissions scenario envisages global population peaking mid-century and declining thereafter, very rapid economic growth, and rapid introduction of new and more efficient technologies. Greenhouse gas and aerosol emissions scenarios are used in climate modelling to provide projections that represent a range of possible futures.

The climate projections for Nauru are based on three IPCC emissions scenarios: low (B1), medium (A1B) and high (A2), for time periods around 2030, 2055 and 2090 (Figure 4). Since individual models give different results, the projections are presented as a range of values.

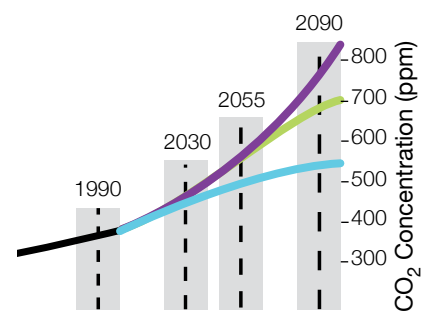


Figure 4: Carbon dioxide (CO₂) concentrations (parts per million, ppm) associated with three IPCC emissions scenarios: low emissions (B1 – blue), medium emissions (A1B – green) and high emissions (A2 – purple). The PCCSP has analysed climate model results for periods centred on 1990, 2030, 2055 and 2090 (shaded).



Children swimming in Anibare boat harbour.

Nauru's future climate

This is a summary of climate projections for Nauru. For further information refer to Volume 2 of *Climate Change in the Pacific: Scientific Assessment and New Research*, and the web-based climate projections tool – *Pacific Climate Futures* (available at www.pacificclimatefutures.net).

Temperatures will continue to increase

Projections for all emissions scenarios indicate that the annual average air temperature and sea surface temperature will increase in the future in Nauru (Table 1). By 2030, under a high emissions scenario, this increase in temperature is projected to be in the range of 0.3–1.3°C.

More very hot days

Increases in average temperatures will also result in a rise in the number of hot days and warm nights, and a decline in cooler weather.

Table 1: Projected annual average air temperature changes for Nauru for three emissions scenarios and three time periods. Values represent 90% of the range of the models and changes are relative to the average of the period 1980–1999.

	2030 (°C)	2055 (°C)	2090 (°C)
Low emissions scenario	0.2–1.2	0.7–1.9	0.9–2.5
Medium emissions scenario	0.2–1.4	0.9–2.3	1.7–3.5
High emissions scenario	0.3–1.3	1.0–2.2	2.2–3.8

Changing rainfall patterns

Almost all of the global climate models project an increase in average annual and seasonal rainfall over the course of the 21st century. Projected increases are consistent with the expected intensification of the South Pacific Convergence Zone, the West Pacific Monsoon and Intertropical Convergence Zone. However, there is some uncertainty in the rainfall projections and not all models show consistent results. Droughts are projected to become less frequent throughout this century.

More extreme rainfall days

Model projections show extreme rainfall days are likely to occur more often.



Canoes on the beach in Nauru.

Sea level will continue to rise

Sea level is expected to continue to rise in Nauru (Table 2 and Figure 5). By 2030, under a high emissions scenario, this rise in sea level is projected to be in the range of 4-14 cm. The sea-level rise combined with natural year-to-year changes will increase the impact of storm surges and coastal flooding. As there is still much to learn, particularly how large ice sheets such as Antarctica and Greenland contribute to sea-level rise, scientists warn larger rises than currently predicted could be possible.

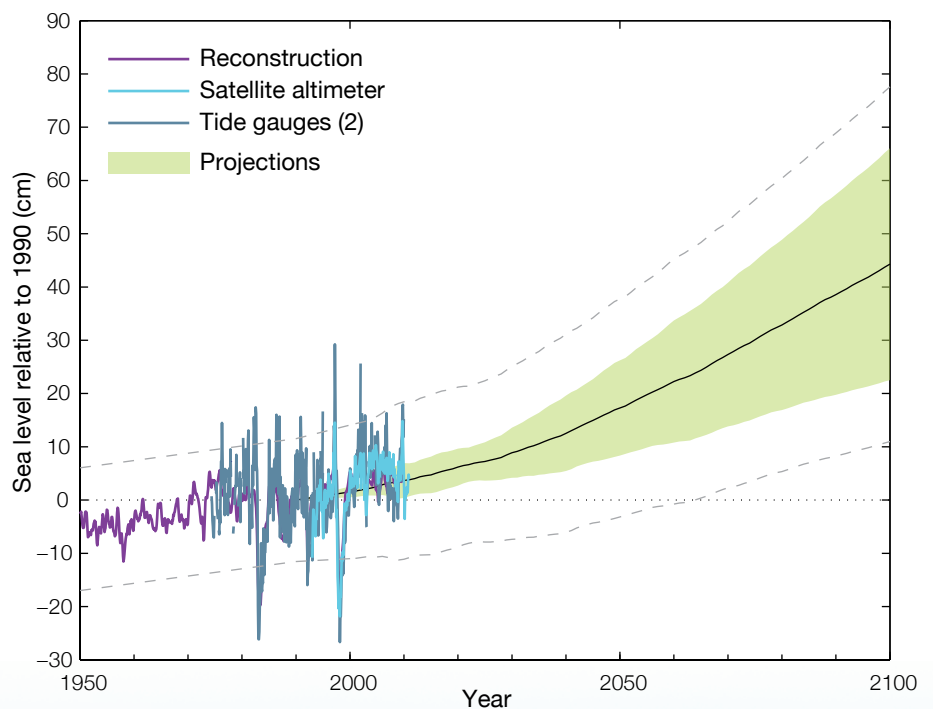
Figure 5: Observed and projected relative sea-level change near Nauru. The observed sea-level records are indicated in dark blue (relative tide-gauge observations) and light blue (the satellite record since 1993). Reconstructed estimates of sea level near Nauru (since 1950) are shown in purple. The projections for the A1B (medium) emissions scenario (representing 90% of the range of models) are shown by the shaded green region from 1990 to 2100. The dashed lines are an estimate of 90% of the range of natural year-to-year variability in sea level.

Table 2: Sea-level rise projections for Nauru for three emissions scenarios and three time periods. Values represent 90% of the range of the models and changes are relative to the average of the period 1980-1999.

	2030 (cm)	2055 (cm)	2090 (cm)
Low emissions scenario	4-13	9-25	17-45
Medium emissions scenario	4-14	10-30	20-57
High emissions scenario	4-14	10-29	21-60

Ocean acidification will continue

Under all three emissions scenarios (low, medium and high) the acidity level of sea waters in the Nauru region will continue to increase over the 21st century, with the greatest change under the high emissions scenario. The impact of increased acidification on the health of reef ecosystems is likely to be compounded by other stressors including coral bleaching, storm damage and fishing pressure.



Changes in Nauru's climate

- > Temperatures have warmed and will continue to warm with more very hot days in the future.
- > Rainfall shows no clear trend since 1950. Rainfall is generally projected to increase over this century with more extreme rainfall days and less droughts.
- > Sea level near Nauru has risen and will continue to rise throughout this century.
- > Ocean acidification has been increasing in Nauru's waters. It will continue to increase and threaten coral reef ecosystems.

The content of this brochure is the result of a collaborative effort between the Nauru Department of Commerce, Industry and Environment and the Pacific Climate Change Science Program – a component of the Australian Government's International Climate Change Adaptation Initiative. This information and research conducted by the Pacific Climate Change Science Program builds on the findings of the 2007 IPCC Fourth Assessment Report. For more detailed information on the climate of Nauru and the Pacific see: *Climate Change in the Pacific: Scientific Assessment and New Research. Volume 1: Regional Overview. Volume 2: Country Reports*. Available from November 2011.

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