

Rossylynn Pulehetoa-Mitiepo and Robert Murray Togiamana, Niue Meteorology and Climate Change Department



# **Climate Projections for Niue**

### Introduction

Niue is the world's largest and highest single coral atoll situated in the Southwest Pacific Ocean at latitude 19.1°S and longitude 169.9°W (Figure 1). The land area is comprised of 259 km<sup>2</sup> with a lower terrace of 28 m and upper rim averaging 69 m above sea level. Fishing activity is undertaken within Niue's EEZ of approximately 450,000km<sup>2</sup>.

Since 1974, Niue became a self-governing state in free association with New Zealand. Niue has a population of 1,460 residents living in 14 village communities along the coastal areas. The Government emphasizes economic development in the tourism, fisheries and agriculture sectors with a vision "Niue Ke Monuina" - "A Prosperous Niue".



Figure 1: Map of Niue

# **Observed Climate**

Niue's climate is typically divided into a wet and a dry season. The wet season runs from November to April, which is also the Tropical Cyclone (TC) season. The warmest months are from February to March. The South Pacific Convergence Zone (SPCZ) is very active in the wet season, and is influenced by El Niño Southern Oscillation (ENSO). During La Niña years Niue usually receives above normal rainfall.

The dry season occurs from May to October with the coolest months being July to August. During the dry season, sub-tropical high pressure systems dominate Niue's climate as the SPCZ is displaced towards the equator. As a result the south-east trade winds are strongest at this time of year. El Niño brings Niue below average rainfall and may cause drought. Warming trends are evident in both annual and seasonal mean air temperatures at Hanan Airport for the period 1950-2009 (Figure 2).

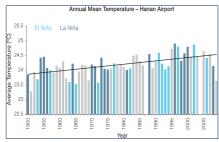


Figure 2. Annual mean air temperature (+0.11 °C per decade), Hanan Airport. Light blue, dark blue and grey bars denote El Niño, La Niña and neutral years respectively





Vibrant culture and lifestyle, natural resources and environment of Niue

### **Climate Projections**

Method: Climate projections were derived using the Coupled Model Intercomparison Project (CMIP3) models with 18 acceptable models. Projections are given for the A2(high), A1B(medium), and B1(low) emission scenarios, for three 20-year time periods centred on 2030, 2055 and 2090.

Surface air temperature and sea-surface temperature are projected to continue to increase over the course of the 21st century (Figure 3). There is very high confidence in this direction of change because warming is physically consistent with rising greenhouse gas concentrations.

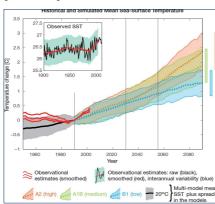


Figure 3. Historical and simulated future annual mean sea-surface temperature in the region surrounding Niue

Rainfall: Annual mean and wet season rainfall are projected to increase, consistent with a projected likely increase in the intensity of the SPCZ. There is moderate confidence in this projection due to the wide model range.

Tropical Cyclones: While changes in TCs are not known with high confidence, there is some evidence from models that TC frequency in the South Pacific will decrease, but that the proportion of very intense cyclones will increase.

Mean Sea Level and Ocean Acidification are projected to continue to rise over the course of the 21st century with a very high confidence.



Meteorology officers taking 9am climate observations at Hanan Airport Climate Station.

SUMMARY OF PROJECTIONS				
SEASONS & VARIABLES	2030	2055	2090	CONFIDENCE
Annual Surface air temperature ('C)	+0.6 ±0.4 +0.7 ±0.5 +0.7 ±0.4	+1.0 ±0.5 +1.3 ±0.6 +1.3 ±0.4	+1.3 ±0.6 +2.0 ±0.8 +2.5 ±0.7	Moderate
1-20-in-year event Maximum temperature ( <sup>'</sup> C)	N/A	+1.0 ±0.7 +1.4 ±0.6 +1.5 ±0.6	+1.2 ±0.7 +2.0 ±1.0 +2.6 ±1.4	Low
Annual Total rainfall (%)	+2 ±15 +1 ±12 +5 ±12	+2 ±11 +5 ±14 +6 ±13	+5 ±13 +5 ±13 +10 ±20	Moderate
Wet season rainfall (%) November - April	+3 ±15 +1 ±12 +5 ±13	+3 ±14 +6 ±15 +7 ±17	+6 ±19 +8 ±17 +14 ±20	Moderate
Dry season rainfall (%) May - October	+1 ±17 +3 ±21 +5 ±13	+0 ±13 +3 ±21 +5 ±17	+3 ±16 +2 ±22 +4 ±30	Low
Annual Sea-surface temperature ('C)	+0.6 ±0.3 +0.6 ±0.4 +0.7 ±0.4	+0.9 ±0.4 +1.1±0.5 +1.3±0.4	+1.3 ±0.4 +1.9 ±0.6 +2.4 ±0.6	Moderate
Annual Mean sea level (cm)	+10 (5-16) +10 (5-15) +10 (4-17)	+18 (10-27) +20 (10-30) +20 (10-30)	+32 (17-46) +38 (19-57) +40 (20-60)	Moderate

See BoM and CSIRO (2011) Climate Change in the Pacific: Scientific Assessment and New Research (Vol. 2: Country Reports) produced by the Pacific Climate Change Science Program, Section 1.7.2 for details of the method used to assign confidence levels to projections.

## **Possible Impacts of the Climate Projections on Niue**

Niue's marine and coastal ecosystems have cultural value, source of nutritious food, important for recreation and tourism, and they collectively comprise a significant share of the island's biodiversity. Increase in storm surge damage may impact on fisheries development through damage to and loss of boats and canoes, boat launching facilities, fuel facilities, and fish storage and processing facilities.

Niuean agriculture is sensitive to drought and cyclones. Cyclones pose major dangers to human health, causing mortality and injury, increasing the risk of post-event diseases through disruptions to water, sanitation and power services. Changes in the water supply system, including resetting the depth of pumps, ongoing investigations and monitoring of groundwater, the use of renewable energy to power pumps, and greater investments in rainwater harvesting can help reduce the vulnerability of Niue's water supply to climate change.



Southwest of Niue affected from high seas during Tropical Cyclone Cyril on Monday 6th February 2012.

Much of the material in this poster was obtained from BoM and CSIRO (2011) Climate Change in the Pacific: Scientific Assessment and New Research (Vol. 2: Country Reports) produced by the Pacific











