



# Independent State of Samoa

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# Observed Climate Variability and Change and Projected Climate for The Independent State of Samoa

Samoa, a Least Developed Country, inherits high vulnerability to natural disasters. These natural disasters include tropical cyclones, prolonged periods of drought, extreme flooding, pests and sudden outbreak of diseases, storm surges and sea level rise.

Climate change and sea level rise are serious concerns given that 70% of Samoa's population and infrastructure are located on low-lying coastal areas. The changing climate conditions and sea level rise put significant strain on people's livelihoods and erode their capabilities to deal with extreme climate events that breach their regular coping ranges.

Better understanding of climate science is seen as crucial and urgently needed for Samoa to adapt and plan for the future. 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 Climate Change Science Program.

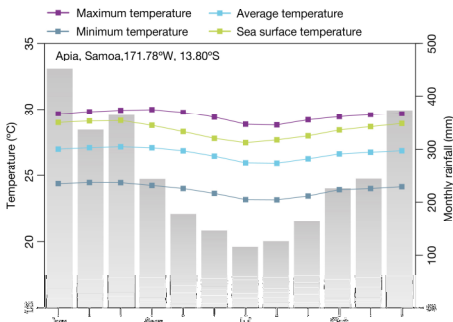


Figure 1. Mean annual cycle of rainfall (grey bars) and daily maximum, minimum and mean air temperatures at Apia, and local sea-surface temperatures derived from the HadSST dataset.

### Observed climate

The Climate of Samoa is tropical. There are only very small seasonal temperature differences in Samoa (Figure 1).

- The coolest month of the year is July. The warmest month is March, which is about 1°C warmer than July.
- Positive trends are evident in both annual and seasonal mean air temperatures at Apia for the period 1950–2009.
- There is significant year-to-year variability in rainfall observed in Samoa. This is influenced by the El Niño-Southern Oscillation (ENSO). The impact of ENSO is more significant in the wet season (Figure 2).

Climate feature/index	Dry season (May-October)			Wet season (November-April)		
	Tmin	Tmax	Rain	Tmin	Tmax	Rain
ENSO Niño3.4			-0.38	0.67	0.68	-0.46
Southern Oscillation Index			-0.24	0.30	-0.56	0.54
Interdecadal Pacific Oscillation Index			-0.23			
Southern Annular Mode Index						
ENSO Modoki Index	0.30	0.29		0.60	0.59	-0.20
Number of years of data	78	75	108	78	77	108

Figure 2. Correlation coefficients between indices of key large-scale patterns of climate variability and minimum and maximum temperatures (Tmin and Tmax) and rainfall at Apia. Significant correlations (95% level) are shown.

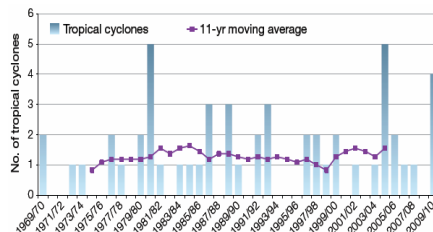


Figure 3. Tropical Cyclones passing within 400km of Apia per season. The purple line shows the 11-year moving average.

- Annual and seasonal rainfall trends for Apia for the period 1950–2009 are not statistically significant.
- Between the 1969/1970 and 2009/10 seasons, the centre of 52 tropical cyclones passed within approximately 400 km of Apia. This represents an average of 10 cyclones per decade (Figure 3).
- Water temperatures in around Samoa declined from the 1950s to about 1980. This was followed by a period of warming (approximately 0.08°C per decade for 1970–present).
- The sea-level rise near Samoa measured by satellite altimeters since 1993 is about 4 mm per year, slightly larger than the global average of 3.2 ± 0.4 mm per year.
- The aragonite saturation state has declined from about 4.5 in the late 18th century to an observed value of about 4.1 ± 0.1 by 2000.

### Climate projections

The climate projections for Samoa have been derived from up to 18 global climate models.

These models were selected based on their ability to reproduce important features of the current climate.

### SUMMARY OF PROJECTIONS

#### RAINFALL (ANNUAL, WET and DRY SEASON)

- Total annual rainfall is projected to increase over the course of the 21st century.
- Wet season (November to April) rainfall is projected to increase due to the intensification of the South Pacific Convergence Zone (SPCZ).
- Little change is projected in dry season rainfall (May to October).

#### AIR TEMPERATURE

- Surface air temperature and sea surface temperature is projected to continue to increase over the course of the century. (Figure 4).

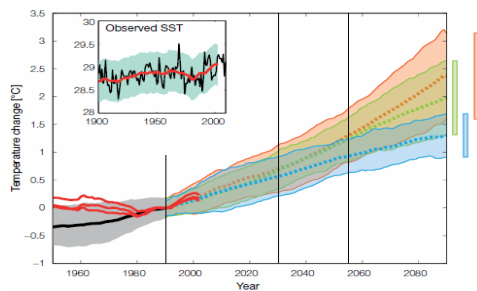


Figure 4. Historical and Simulated Mean Sea Surface Temperature

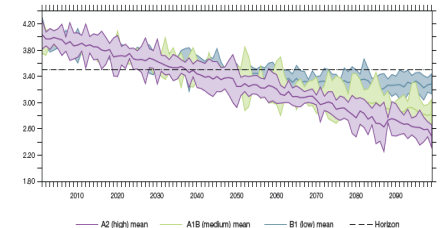


Figure 5. Maximum Annual Aragonite Saturation State - Samoa

### OCEAN ACIDIFICATION

- The acidification of the ocean will continue to increase as the rate of ocean acidification is driven primarily by the increasing oceanic uptake of carbon dioxide, in response to rising atmospheric carbon dioxide concentrations (Figure 5).

### SEA LEVEL

- Mean sea level is projected to continue to rise in response to increasing ocean and atmospheric temperatures, due to thermal expansion of the water and the melting of glaciers and ice caps (Figure 6).

### TROPICAL CYCLONES

- Tropical cyclone numbers are projected to decline in the south-east Pacific Ocean basin (0–40°S, 170°E–130°W).

### EXTREME TEMPERATURES and RAINFALL

- The intensity and frequency of days of extreme heat are projected to increase.

### DROUGHT

- Little change is projected in the incidence of drought over the course of the 21st century.

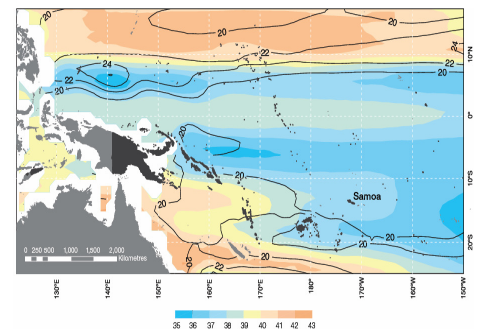


Figure 6. Sea Level projections (in cm) for the A1B emissions scenario in the Samoa region for the average over 2081–2100 relative to 1981–2000 are indicated by the shading

### Potential impacts of projected climate may include –

- Accelerated coastal erosion of beaches including traditional coastal lands and infrastructure;
- Increased number of climate-related diseases;
- Loss of biodiversity and degradation of natural resources (such as land, water, forestry, fisheries);
- Increased number of pests, invasive species and diseases;
- Decreased agricultural production and salt water intrusion of coastal springs; and,
- Lost revenue as a result of impacts on tourism sector.