Papua New Guinea

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Pacific-Australia Climate Change Science and Adaptation Planning program

International CLIMATE CHANGE ADAPTATION Initiative

Climate Variability and Projected Future Climate Change in PNG

Papua New Guinea's (PNG) area covers the region approximately bounded by the longitudes 141°E and 157°E and from the Equator to 12°S (Fig 1). PNG shares its predominant maritime border with six (6) other countries such as Australia, Indonesia, Solomon Islands, Palau, Nauru and Federated States of Micronesia.
Due to its location, PNG is vulnerable to extreme climate variability events related to the El Niño Southern Oscillation (ENSO) such as tropical cyclones, droughts, floods, and sea level rise.

Fig 1 : Map of Papua New Guinea.

Observed climate

Sites in PNG have very weak seasonal variations in temperature but a strong seasonal cycle in rainfall (Fig 2). This seasonality is most evident in a few locations such as Port Moresby; otherwise PNG experiences rainfall all year round with the wettest months being from November to April consistent with the West Pacific Monsoon. The Intertropical Convergence Zone and the South Pacific Convergence Zone, to a certain extent, also affect the climate of PNG.
The year to year variability in rainfall is high in PNG and much of this inter-annual variability is associated with ENSO. Generally, on average, PNG is drier during El Niño years and wetter during La Niña years.
There is a warming trend in both the annual and seasonal mean air temperatures (Fig 2). On average, PNG receives one tropical cyclone per season (Nov-Apr) and this is confined mainly to the south-eastern coasts of PNG.

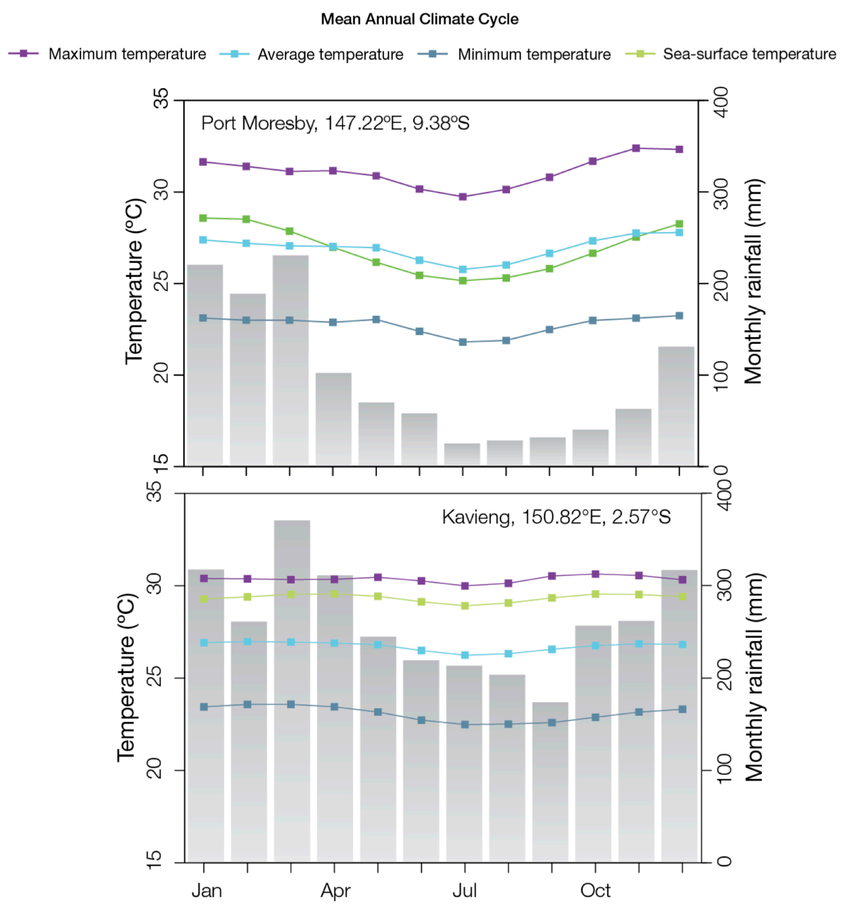


Fig 2: Mean annual cycle of rainfall (bars), monthly maximum, minimum and mean air temperature, and sea surface temperature.

Seasonal cropping pattern of coffee is disturbed as a result of a changing climate *Photo courtesy of NARI, Aiyura*

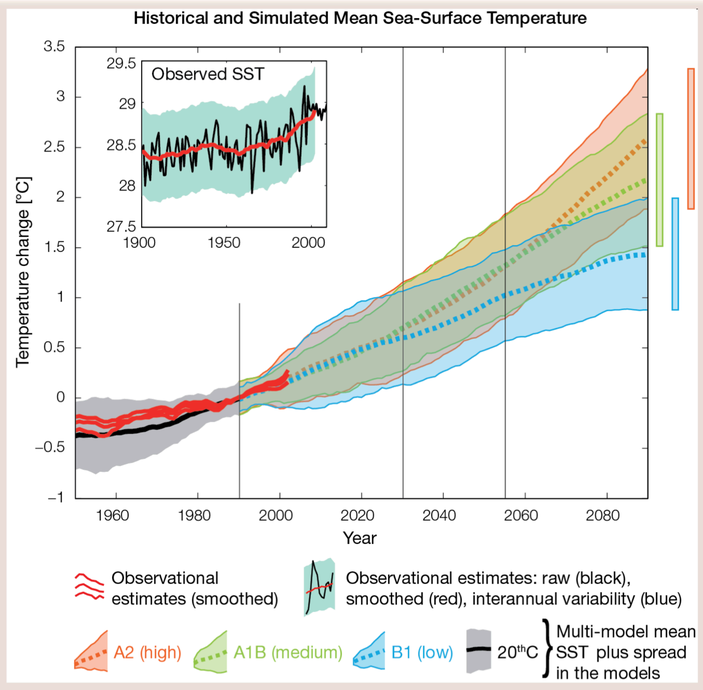
Increase of malaria incidences in the highlands as a result of warmer temperatures. *Photo courtesy of the OCCD.*

Coastal flooding is a serious problem for this coastal village in Port Moresby. *Photo courtesy of the OCCD.*

Climate projections

Climate projections have been derived from 18 global climate models (GCMs), from the CMIP3 database, for up to three emissions scenarios (B1-Low, A1B-Medium and A2-High) for three 20-year periods (2030, 2055 and 2090). These models were selected based on their ability to reproduce important features of the current climate so that these projections from the models are plausible representations of the future climate. This means there is not one single projected future for PNG, but rather a range of possible future outcomes.

These projections do not represent a value specific to any actual location such as a town or city; rather they refer to an average change over the broad geographical area.



*Historical climate (from 1950 onwards) and simulated historical and future climate for annual **mean sea surface temperature** in the region surrounding PNG, for the CMIP3 models.*

Rainfall Projections

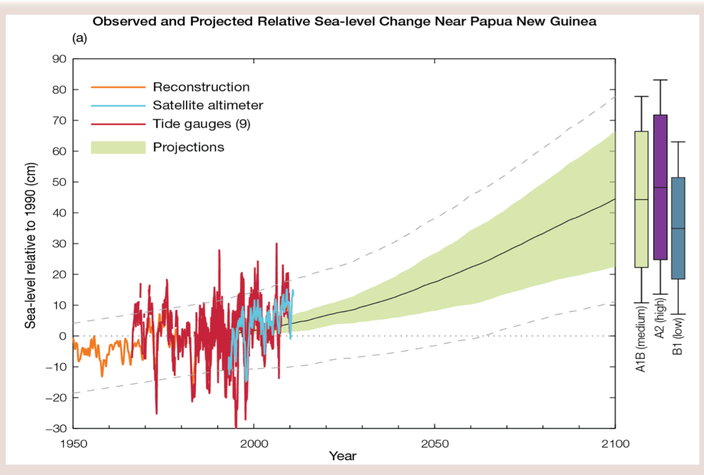
Wet Season (November-April), dry season (May-October) and annual rainfall is projected to increase over the course of the 21st century. There is *high* confidence in this direction of change because (a) physical arguments indicate that rainfall will increase in the equatorial Pacific in a warmer climate (IPCC); and (b) almost all of the CMIP3 models agree on this direction of change by 2090.

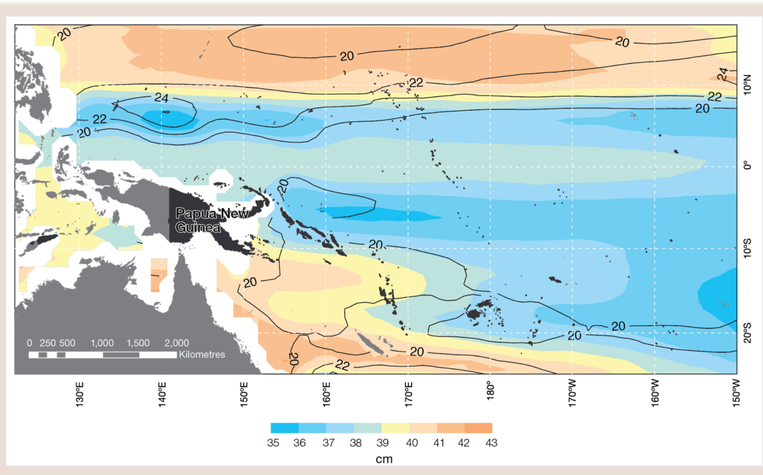
Summary of other Projections

- Surface air temperatures are projected to continue to increase (*very high confidence*).
- The intensity and frequency of days of extreme heat are projected to increase (*very high confidence*).
- The intensity and frequency of days of extreme rainfall are projected to increase (*high confidence*).
- The incidence of drought is projected to decrease (*moderate confidence*).
- Tropical cyclone numbers are projected to decline in the South West Pacific basin (*moderate confidence*).
- Ocean acidification is projected to continue (*very high confidence*).
- Mean sea level rise is projected to continue (*very high confidence*).

Variable	Season	2030	2055	2090	Confidence
Surface air temperature (°C)	Annual	+0.7 ± 0.4 +0.8 ± 0.4 +0.7 ± 0.3	+1.1 ± 0.5 +1.5 ± 0.5 +1.5 ± 0.4	+1.6 ± 0.6 +2.4 ± 0.8 +2.8 ± 0.6	High
Maximum temperature (°C)	1-in-20-year event	N/A	+1.0 ± 0.9 +1.4 ± 0.9 +1.5 ± 0.7	+1.3 ± 1.0 +2.2 ± 1.3 +2.7 ± 1.5	Low
Minimum temperature (°C)	1-in-20-year event	N/A	+1.4 ± 1.8 +1.7 ± 2.0 +1.6 ± 1.8	+1.8 ± 1.8 +2.4 ± 1.9 +2.6 ± 2.1	Low
Total rainfall (%)*	Annual	+3 ± 13 +3 ± 13 +5 ± 9	+8 ± 13 +7 ± 17 +7 ± 13	+11 ± 13 +15 ± 20 +15 ± 21	Moderate
Wet season rainfall (%)*	November-April	+4 ± 12 +5 ± 11 +6 ± 10	+10 ± 13 +9 ± 17 +8 ± 12	+12 ± 12 +16 ± 18 +15 ± 20	Moderate
Dry season rainfall (%)*	May-October	+1 ± 15 +1 ± 16 +4 ± 12	+7 ± 16 +5 ± 20 +6 ± 17	+10 ± 16 +15 ± 24 +15 ± 26	Moderate
Sea-surface temperature (°C)	Annual	+0.6 ± 0.5 +0.7 ± 0.4 +0.7 ± 0.5	+1.0 ± 0.5 +1.3 ± 0.5 +1.3 ± 0.5	+1.4 ± 0.6 +2.2 ± 0.7 +2.6 ± 0.7	High
Aragonite saturation state (Ωar)	Annual maximum	+3.5 ± 0.1 +3.4 ± 0.1 +3.4 ± 0.1	+3.2 ± 0.1 +3.0 ± 0.1 +3.0 ± 0.1	+3.1 ± 0.1 +2.7 ± 0.2 +2.5 ± 0.1	Moderate
Mean sea level (cm)	Annual	+9 (4–14) +10 (5–14) +10 (4–15)	+18 (10–26) +20 (9–30) +20 (10–29)	+31 (17–46) +39 (20–58) +41 (22–60)	Moderate

Projected change in the annual and seasonal mean climate for Papua New Guinea, under the B1 (low; blue), A1B (medium; green) and A2 (high; purple) emissions scenarios. Values represent the multi-model mean change ± twice the inter-model standard deviation. Numbers for aragonite saturation represent actual rather than projected changes.





*Observed and projected relative **sea-level change** near PNG. (a) For one observational location. (b) The projections (in cm) for the A1B scenario in the PNG region for the average over 2081–2100 relative to 1981–2000 are indicated by the shading, with the estimated uncertainty in the projections indicated by the contours (in cm).*

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