



Current and Projected Future Climates of the Marshall Islands

1. Introduction

Marshall Islands is located near the equator in the central North Pacific Ocean between 4–14°N and 160–173°E. It consists of 29 low lying atolls (e.g., Fig. 1a) and 5 low elevated islands with a total land area of 70 square miles (181km²). The atolls and islands lie in two parallel chains: Ralik (Sunshine) to the east and Ratak (Sunset) to the west (Fig. 1b). The capital is in Majuro on the Ratak Island. Majuro and Kwajalein are the two most populated atolls, with close to 70% of the total national population of 53,158. In this poster, we examine some current climate variables of the Marshall Islands and their projected future changes due to global warming.



Fig. 3 Pictures showing impact of some extreme events in the Marshall Islands: an example of a coastal inundation during high storm surges (left), a case of a flooding event in the Kili Island (middle), and an example of a coastal erosion in an atoll (right).

3. Annual climate variability and trend

Year-to-year climate of the Marshall Islands is modulated by the El Niño Southern Oscillation (ENSO) phenomenon with La Niña, for example, bringing more rainfall than El Niño (e.g., Fig. 4a). A declining trend in rainfall is noticed in the Marshall Islands over the past years. On the other hand, a substantial positive trend in the mean air temperature is found over the Marshall Islands (e.g., Fig. 4b); both trends are statistically significant at the 95% level.

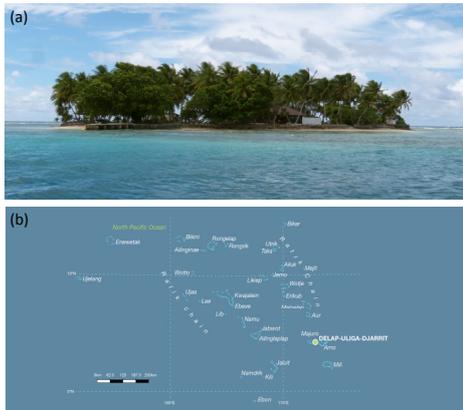


Fig. 1 (a) An inlet in the Marshall Islands, and (b) the map of the Marshall Islands showing the island chains – Ralik and Ratak.

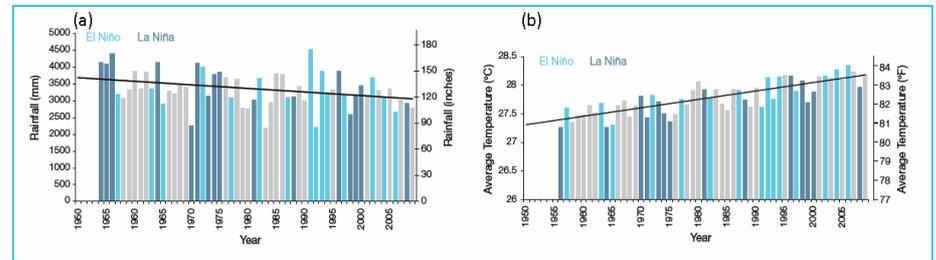


Fig. 4 (a) Annual rainfall, and (b) annual temperature variability for Majuro. Light blue, dark blue and grey bars denote El Niño, La Niña and neutral years respectively. Solid dark lines indicate annual trends.

2. Seasonal climatology

Air temperatures in the Marshall Islands remain nearly constant year-round because the amount of solar radiation does not vary significantly throughout the year (e.g., Fig. 2). Both Majuro and Kwajalein have a dry season from around December to April and a wet season from May to November. The difference between the seasons is more marked at Kwajalein where the driest months (January to March) receive, on average, relatively less rainfall than the wettest months (September–October). The main driver of rainfall is the Intertropical Convergence Zone, ITCZ, which is strongest and furthest North for the wet season.

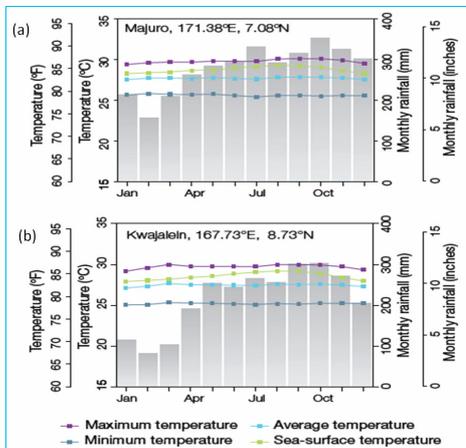


Fig. 2 Mean annual cycle of rainfall (grey bars) and daily minimum and maximum air temperatures, as well as the sea surface temperature, for (a) Majuro and (b) Kwajalein.

4. Future climate projections

The 21st century climate projections for the Marshall Islands are derived using the 18 Global Climate Model data obtained from the International Coupled Model Inter-Comparison Project phase 3 (CMIP3) experiments. Results presented are based on three greenhouse emissions scenarios, B1 (low), A1B (medium), and A2 (high).

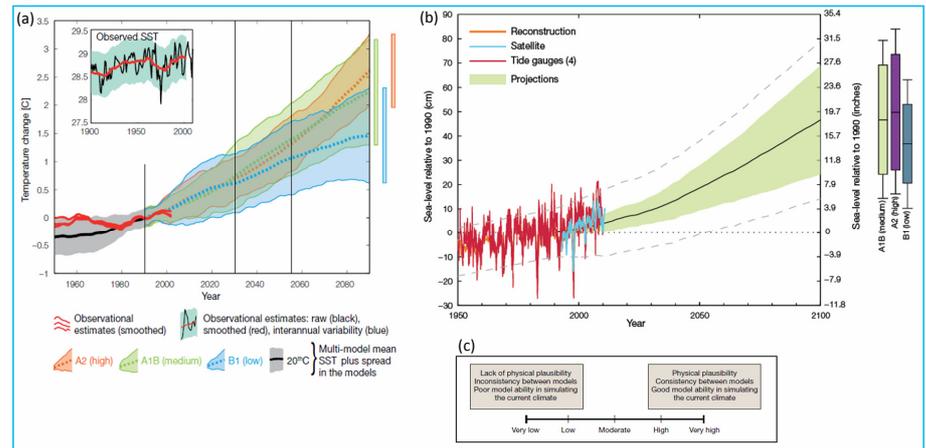


Fig. 5 (a) Historical and simulated mean sea surface temperature for southern Marshall Islands, (b) observed and projected relative sea-level change near the Marshall Islands, and (c) a description of confidence intervals for climate projections.

Summary of projections for the Marshall Islands

- Surface air and SSTs are projected to continue to increase (very high confidence; e.g., Fig. 5a);
- Annual and seasonal mean rainfall is projected to increase (high confidence).
- The frequency of days of extreme heat and rainfall are projected to increase (very high confidence).
- Tropical cyclone numbers are projected to decline (moderate confidence).
- Mean sea-level rise is projected to continue to rise (very high confidence; e.g., Fig. 5b).

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Further information:

- > Contact: Nover Juria > Phone: (692) 247-3214 > Email: nover.juria@noaa.gov
- > Web: www.pfh.noaa.gov/majuro/
- > Contact: Ned Lobwji > Phone: (692)625-7944 > Email: nedlobwji@gmail.com
- > Web: www.biomi.org

www.pacificclimatechangescience.org

