

Trend Analysis for Temperature and Rainfall Timeseries Over Micronesia Region to Enhance Climate Resilience

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Abstract

The islands of Micronesia are among the most climate-vulnerable regions in the world due to their geographic isolation, limited freshwater resources, and heavy reliance on seasonal rainfall. Understanding long-term climate trends is critical for developing adaptive strategies that build resilience against the growing threats of climate change. This study presents a comprehensive trend analysis of historical temperature and rainfall data across the Micronesia region, encompassing locations in Guam, the Commonwealth of the Northern Mariana Islands (CNMI), the Federated States of Micronesia (FSM), the Republic of the Marshall Islands (RMI), and the Republic of Palau. Utilizing historical datasets from local meteorological stations and global climate repositories (e.g., NOAA, CHIRPS), we analyze time series data spanning the past 40 to 70 years. Statistical techniques including the non-parametric Mann-Kendall trend test and Sen's slope estimator are applied to detect and quantify monotonic trends in annual and seasonal temperature and precipitation. Results reveal a significant upward trend in mean annual temperatures across all sites, with warming rates ranging between 0.12°C to 0.18°C per decade. Rainfall patterns exhibit greater spatial and temporal variability: while some islands show increasing annual precipitation, others display declining trends or more pronounced dry and wet seasons. These insights are crucial for informing climate-sensitive sectors such as agriculture, water management, and disaster preparedness. By identifying emerging patterns and potential climate extremes, this work supports the design of localized adaptation strategies and early warning systems. Ultimately, the study underscores the urgent need for climate-resilient planning and regional cooperation in addressing the disproportionate climate risks facing Pacific Island communities.

Keywords

Micronesia, climate resilience, trend analysis, Mann-Kendall, pacific islands.