The coral reefs surrounding Guam and the Commonwealth of the Northern Mariana Islands (CNMI) in western Micronesia are among the world’s most diverse, and they are vital to the islands’ culture and economy as well as ecology. However, these reefs are threatened by ocean warming and other effects of the changing global climate. Research is needed both to project future coral bleaching and to provide local-scale vulnerability information that resource managers can use in conservation planning.

This project used climate models to create projections of increases in sea temperatures for coral reef areas in Micronesia and abroad. The results suggest that projected sea temperature increases will cause coral bleaching to occur annually in Guam and CNMI by the early 2040s, if current greenhouse gas emissions growth continues. Coral reefs are expected to change dramatically once annual severe bleaching (ASB) occurs, resulting in loss of biodiversity and ecosystem goods and services. Importantly, the...
projections reveal that coral reef futures with respect to exposure to temperatures that cause coral bleaching, vary greatly on local scales (10s of km). Reefs that are projected to experience ASB significantly later than others within the same country/territory represent conservation priorities.

We have developed a wide variety of outreach materials for use at the local, national, and international levels. Brochures, map images and data available are online at https://nccwsc.usgs.gov/display-project/4f8c650ae4b0546c0c397b48/551eda81e4b027f0aee3ba05. These products are already being used by a variety of organizations to inform conservation and management planning, aiding managers in identifying and targeting actions where they will most reduce reef vulnerability to climate change, for example at https://coralreefwatch.noaa.gov/climate/projections/downscaled_bleaching_4km/index.php as well as part of the UN Environment Live Maps (http://uneplive.unep.org/).

**Quick Summary**

- As coral reef areas become more affected by changing environmental conditions, detailed information about local-scale vulnerability can help managers make the best management decisions to support reef resilience.
- We developed downscaled climate model projections of the timing of annual severe coral bleaching at local scales. Locations projected to experience ASB decades later than others are conservation priorities.
- Our results and output materials, including publications, workshop and project reports, and coral bleaching onset web maps are being widely used locally, nationally, and internationally to determine management plans and priorities.

![Projected timing of the onset of annual severe bleaching (ASB) under emissions scenario RCP8.5 for U.S. coral reefs.](image-url)