

# Pacific Islands Climate Change Cooperative



## Future wind and wave projections for US-affiliated Pacific islands

Continued warming of the global climate will affect many aspects of weather, including the strength and location of storms and winds. Winds create ocean waves, so any substantial changes in winds and storms will affect island shorelines. However, global climate models do not directly generate projections of wave height in specific regions of the vast Pacific Ocean, where very large swells generated by distant storms are of concern. Therefore, the [Pacific Islands Climate Change Cooperative](#) is supporting a project to investigate trends and variability, on an island and archipelago scale, of wind and wave qualities that are expected to respond to changes resulting from increasing global greenhouse gas emissions.

Waves are important to natural areas in a number of ways. Wave energy constrains marine species' distribution in the Pacific Ocean. Wave- and wind-driven processes drive inundation that results in coastal erosion as well as damage to infrastructure and freshwater supplies. These processes can also damage habitats needed by US federally protected species. Anticipating changes in wind and waves over time is therefore crucial to understanding not only the sustainability of existing infrastructure and natural and cultural resources, but also to planning for future investments and the viability of economic activities such as fishing and tourism.

### Management of US Pacific island assets will benefit 25 parks and refuges

The goal of this project is to provide a better understanding of potential climate change

impacts on 25 federally managed national parks, national historical parks, national wildlife refuges, and marine national monuments in the Pacific. Specifically, scientists will apply the Wavewatch III model to calculate the average and top 5% values for wave height, wave period (distance between waves), wave direction, wind speed and wind direction for these sites. Future projections (2026-2045 and 2085-2100 time periods) will



be based on global climate model scenarios for medium and high rates of greenhouse gas emissions. Historical (1996-2005) simulations will be used for assessing the accuracy of the model.

### The complexity of modeling waves

The Wavewatch III model incorporates the knowledge that properties such as water depth and current vary on time and space scales that are much larger than the variations within a single wave. Therefore, it includes calculations for deepwater wave growth and

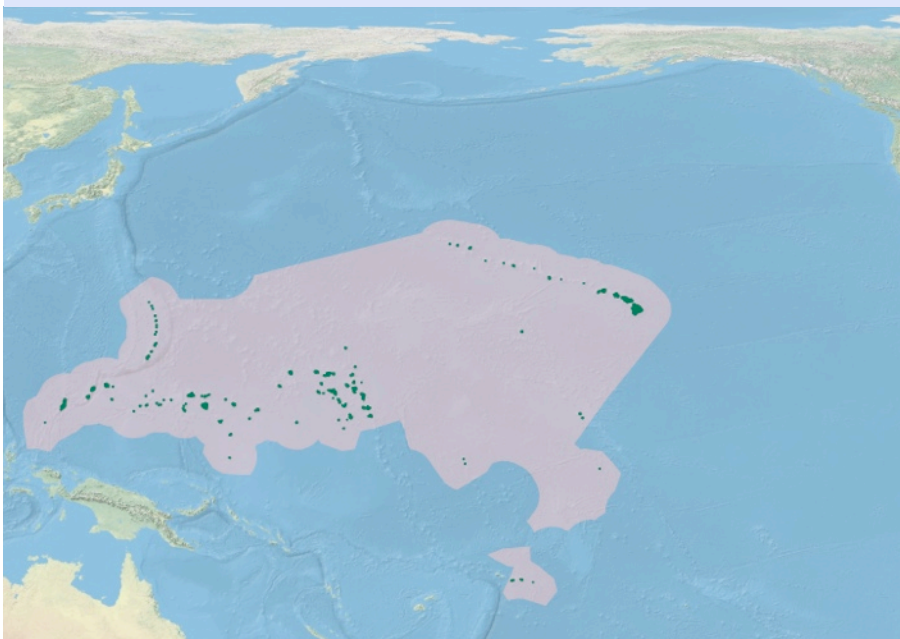
decay due to wind, interactions with other waves, dissipation, bottom friction, and surf-breaking. The goal is to understand overall wave climate trends, not the details of potential future modeled storm events. These trends can then be used as inputs to nearshore wave models to investigate impacts to natural and cultural resources and infrastructure. Furthermore, the data generated by this effort will be key in envisioning future transient sea level extremes on coasts and small islands, as winds and waves are the key processes driving extreme water levels and inundation.

This project will deliver average and extreme (top 5%) monthly statistics for wave height, wave period, wave direction, wind speed, and wind direction for each of the 25 study locations. This makes a total of 5 combinations of time frames and emission scenarios (one past, four future). The final peer-reviewed USGS report will be available online and maintained at the [USGS Publications Warehouse](https://pubs.usgs.gov/warehouse/).

For more details about this project, visit the PICCC projects page: [piccc.net/projects](https://piccc.net/projects).



The map below depicts the PICCC geography, which includes Hawai'i, American Sāmoa, Guam, the Northern Mariana Islands, the Marshall Islands, the Federated States of Micronesia, Palau and 4 Marine National Monuments.



## Principal Investigators

Dr. Curt D. Storlazzi and Dr. Li H. Erikson

\*[Pacific Coastal and Marine Science Center](https://www.pacificcoastcenter.org/), US Geological Survey

\*co-funder

## The Pacific Islands Climate Change Cooperative (PICCC) was

established in 2009 to assist those who manage native species, island ecosystems, and key cultural resources in adapting their management to climate change for the continuing benefit of the people of the Pacific Islands. The PICCC provides a range of services and tools to help managers in Hawai'i, the Mariana Islands, American Sāmoa, and other Pacific Island groups make informed decisions for conservation of natural and cultural resources including climate models at the scale of islands and archipelagos, ecological response models, and implementation and monitoring strategies for island species, resources, and communities. Our goal is to help managers reach explicit biological and cultural conservation objectives in the face of climate change and ongoing threats such as fire, land conversion, and invasive species.

### Contact:

Jeff Burgett

PICCC Science Coordinator

[jeff.burgett@piccc.net](mailto:jeff.burgett@piccc.net)

677 Ala Moana Blvd., Suite 320

Honolulu, HI 96813

Phone: 808-687-6175

Fax: 808-664-8510

Banner photo by Matthew Wingate, NOAA Photo Library; Wave at Laysan by Michelle Reynolds, USGS; East waves by Belindah, Flickr