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Future Wave and Wind Effects on Pacific Islands

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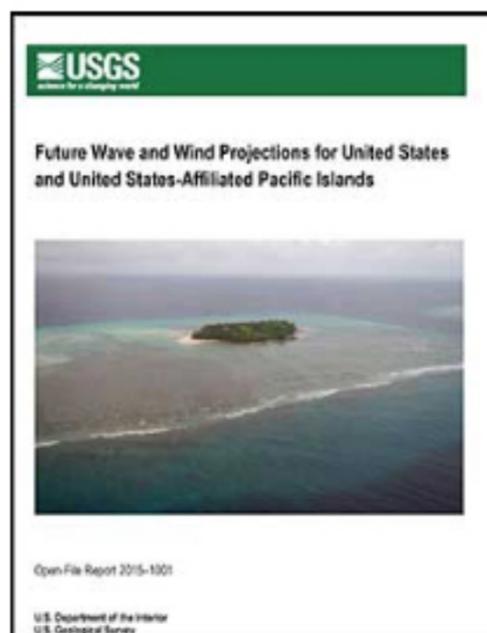
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[Open-File Report 2015-1001](#): Future Wave and Wind Projections for United States and United States-Affiliated Pacific Islands.

SANTA CRUZ, Calif. — According to a new report released by the U.S. Geological Survey, climate changes during the 21st century are expected to alter the highest waves and strongest winds across U.S. and U.S.-affiliated Pacific Islands. The detailed calculations provided in the report will be useful for managers developing coastal resilience plans or ecosystem restoration efforts, and for engineers designing future infrastructure.

Information on changes in waves and winds under global climate change is crucial to understanding the sustainability of existing infrastructure and natural and cultural resources, as well as to planning for future investments such as renewable wind and wave energy for islands, or for understanding the viability of coastal-related economic activities such as fishing and tourism. Wave- and wind-driven processes drive flooding and inundation of coastal land, potentially resulting in damage to islands' infrastructure, fresh-water supplies, and natural resources, and harming federally protected species such as nesting seabirds. Such impacts may only be exacerbated in the future with projected trends in sea-level rise.

"With little to no publicly available historical wind and wave data for most of the U.S.-affiliated Pacific islands, and no future projections of waves and winds for different climate scenarios, there was a great science and management need to understand how waves and wind might change in future climates," said Curt Storlazzi, USGS oceanographer and lead author of the study.

Scientists from USGS and the University of California, Santa Cruz, ran four global climate models (developed for the Intergovernmental Panel on Climate Change), using them to drive a global-wave model to look at the projected changes in wave heights, wave periods, and wave directions, and wind speed and wind direction on three Hawaiian Islands and 22 other locations on U.S.-affiliated islands in the Pacific Ocean. Modeling results project that wind and wave patterns will change over the years throughout the century, and also over certain months and seasons within each year.

"Natural resource managers, communities, and engineers will all benefit by being able to prepare for the shifts in inundation risk shown by this study. This work shows that the degree of change we see will depend on how greenhouse-gas emissions change," said Jeff Burgett, Science Coordinator for the Pacific Islands Climate Change Cooperative.

Scientists first ran the models for the years 1976 – 2005 and compared them to the few available historical instrumental data in order to make sure the models were functioning properly, then ran them for the different future time spans (2026 – 2045 and 2085 – 2100) for two different climatic scenarios — increasing greenhouse-gas concentrations until mid century, followed by reduced emissions (known as scenario RCP4.5), and unfettered growth of emissions (scenario RCP8.5).

The spatial patterns and trends are mostly similar between the two different greenhouse gas concentration scenarios (scenario RCP4.5 and scenario RCP8.5), although the results of the study reveal some differences among islands. The magnitude and spatial extent of the trends are generally greater for the higher-emissions scenario (RCP8.5).

In general, extreme wave heights (the top five percent) are projected to increase from now until mid 21st century and then decrease toward the end of the 21st century. Peak wave periods (another measure of intensity) increase east of the International Date Line and are forecast to decrease west of the International Date Line. In equatorial Micronesia, extreme waves and winds are projected to undergo substantial (greater than 20 degrees) shifts in direction.

The full [USGS Open-File Report 2015-1001](#), "Future Wave and Wind Projections for United States and United States-Affiliated Pacific Islands," by Curt D. Storlazzi, James B. Shope, Li H. Erikson, Christie A. Hegermiller, and Patrick L. Barnard is available [online](#). This research was supported by the [Pacific Islands Climate Change Cooperative](#).