

Challenges of Forecasting Flooding on Coral Reef–Lined Coasts

Understanding Flooding on Reef-lined Island Coasts Workshop; Honolulu, Hawaii, 5–7 February 2018



Recent sea level rise in the central tropical Pacific Ocean increases wave-driven flooding hazards along coral reef–lined coasts, as shown here on Roi-Namur, an island in the Kwajalein Atoll in the Republic of the Marshall Islands, in March 2014. Attendees at a workshop earlier this year addressed how sea level rise, climate change, and impacts on coral reef health will exacerbate such flooding and threaten the sustainability of many tropical coastal communities. Photograph by Peter Swarzenski ([USGS](#))

By [Curt D. Storlazzi](#) © 16 May 2018

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Understanding wave-driven coastal flooding is a challenging scientific problem; the need for forecasts is becoming more urgent because of sea level rise, climate change, and ever-growing coastal populations. The tools developed for sandy shorelines are generally not applicable to coral reef-lined coasts with their complex bathymetry, hydrodynamically rough reef platforms, steep and poorly sorted beaches, and low coastal elevations. Advances in understanding and predicting flooding on coral reef-lined coasts thus require concerted efforts from a number of disciplines, including climatology, oceanography, geology, and ecology.

To encourage such multidisciplinary collaboration, a meeting earlier this year brought together more than 30 experts from 12 countries over 3 days. Attendees addressed the current state of knowledge of the factors controlling spatial extent, timing, and magnitude of flooding along tropical, coral reef-lined coasts (<https://eos.org/research-spotlights/modeling-ocean-waves-over-rocky-reefs>). The meeting focused on four research themes: sea level; wave climate; wave transformation, water levels, and coastal flooding; and coral reefs, sediment, and shorelines.

The overarching goal was for the participants to share advancements in their fields and lay out a pathway to provide forecasting tools for hazard risk reduction along tropical reef-lined coasts. The strength of the workshop was the comprehensive review and extended discussions of in situ and remote sensing observations, numerical models, and products for each of the research themes.

Three major topics emerged from this meeting:

The need for early-warning capabilities—on the order of days—to provide forecasts of flooding. Such short-term forecasts are dominated by tides, wind-generated waves, local wave setup, and barometric pressure. The goal is to reduce risks to life and assets by providing a timely warning.

The need to begin developing predicted scenarios of flooding that start a few decades into the future and focus on the time frame of decades. Such long-term projections are primarily governed by sea level rise, wind and wave climates, coral reef biogeomorphology (<http://www.biogeomorphology.org/introduction.html>) and sediment budgets, and anthropogenic impacts. The goal is to increase the resiliency of coastal communities by providing guidance to support climate adaptation planning.

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The greatest needs for developing early-warning systems and future scenarios include coral reef bathymetry (<https://eos.org/project-updates/new-insights-from-seafloor-mapping-of-a-hawaiian-marine-monument>) and island topography. These will require field observations to calibrate and validate numerical models of

[wave-driven flooding over coral reefs](https://pubs.er.usgs.gov/publication/70158670) (<https://pubs.er.usgs.gov/publication/70158670>); records from past flooding events to define local event thresholds; downscaled pressure and wind fields for more accurate future wave modeling; historic coastal change data, especially island vertical development; carbonate sediment budgets; and coral reef and island coring to understand how they have evolved over recent changes in sea level.

The meeting participants resolved to continue data and knowledge sharing and to begin a dialogue with regional and international bodies. A report of the workshop discussions, including the overview presentations and the expertise of the workshop participants, can be found [here](https://www.deltares.nl/en/news/understanding-flooding-reef-lined-island-coasts-uforic/) (<https://www.deltares.nl/en/news/understanding-flooding-reef-lined-island-coasts-uforic/>).

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