NATIONAL ASSESSMENT OF HURRICANE-INDUCED COASTAL EROSION HAZARDS IN PUERTO RICO

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Storms are one of the main causes of coastal erosion, causing substantial property and infrastructure losses in coastal communities. Coastal erosion is particularly damaging in underrepresented communities that are unable to meet building and zoning regulations due to limited resources [Lam, 2014]. The United States Geological Survey (USGS) has developed a probabilistic assessment of hurricane-induced coastal erosion for sandy coastlines along the eastern United States and the Gulf of Mexico. However, the current USGS product incorporates an empirical equation with inputs of beach slope and deep-water wave height and period [Stockdon, 2006] to predict the wave runup. Though this is appropriate for open coast sandy beaches, it is not valid for the rocky and reef lined coasts of Puerto Rico due to their complex bathymetries, steep slopes, and large bottom roughness.

To expand this tool to Puerto Rico, the USGS has created 1-dimensional XBeach [Roelvink, 2009] models around the island. These models use the actual complex bathymetry and topography and include spatially variable bottom roughness determined by bottom type and coral cover. The models were forced with water levels and wave parameters of hurricane scenarios modeled by The University of Puerto Rico at Mayagüez (UPRM) which included maximum surge and wave height [Benitez, 2015]. Model results allow calculation of the probability of dune collision, overwash and inundation (pCOI) around the island (figure 1) for each hurricane category scenario. The pCOI compares total water level, including 2 percent exceedance wave runup, at each transect to the elevation and alongshore variability in the dune and cliff features. Results showed that for a category 1 hurricane 95%, 12% and 2% of the island will be exposed to collision, overwash and inundation, respectively. Whereas a category 5 hurricane showed 100%, 47% and 23% of the island will be exposed to collision, overwash and inundation, respectively.

This effort provides a tool that could be beneficial to emergency managers in Puerto Rico, where communities are particularly vulnerable to the often-severe storms impacting the island. The development of this coastal hazard assessment will serve as a first step to provide residents of Puerto Rico with the necessary tools to understand coastal erosion risks around the island.

Figure 1 - Probability of hurricane-induced coastal erosion hazards for category 1 storm can be accessed through the USGS Coastal Chane Hazards Portal.

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