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ASSESSING EXTREME STORM AND LONG TERM COASTAL CHANGE HAZARDS USING AIRBORNE LIDAR

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The emergence of airborne lidar as a cost effective mapping tool has revolutionized the assessment of storm and long-term coastal change hazards. In a few hours, a lidar system can survey a swath of coast a few hundred meters wide, a hundred kilometers long, with an elevation estimate acquired every one to two square meters. Vertical accuracies of these elevations are approximately 15 cm RMS. Although ground-based range finders can acquire higher accuracy elevations, it would take a traditional field party many months to years to duplicate the spatial coverage of a one- day lidar survey.

Since the 1997-98 El Nino storms that ravaged the west coast of the United States, the U.S. Geological Survey, with its partners at NASA, NOAA, and U.S. Army Corps of Engineers, have used airborne lidars to quantify magnitudes and spatial patterns of coastal change. The initial surveys were conducted before and after the 1997-98 El Nino winter and spanned two thirds of the shore from southern California to central Washington. These surveys were compared to detect change, such as the 14 m of sea cliff erosion at Pacifica, CA that undermined houses. Since that time, USGS with its partners have addressed hurricane impacts in the U.S. southeast, e.g. surveying before and after Hurricanes Isabel, Charlie, Ivan, Katrina, Gustav and Ike. The acquired elevation data are being used to test and develop models that predict coastal change during extreme events. Initial success has been obtained in predicting whether total water level, including storm surge, wave setup, and wave runup, exceeds various beach elevation thresholds, e.g. dune elevation, that when exceeded indicate the nature and relative magnitudes of change.

The same pre-storm data that are useful in establishing a baseline to detect storm-induced changes are also useful to compare to historical data acquired with traditional means to assess long-term changes of the nation's coasts. The USGS with our partners in other agencies and academia are preparing assessments of long-term shoreline changes throughout the U.S., including Hawaii and parts of Alaska. These assessments incorporate estimates of errors arising from comparing lidar data (referenced with GPS to the ellipsoid) to historical data that were based on visual estimates of shoreline position based on wet-dry lines or obtained at a known tide elevation. In close cooperation with the Corps of Engineers lidar mapping program, these long term change estimates will be updated periodically in the future and will serve as a foundation to assess the long term impacts on the nation's coasts of the anticipated acceleration in sea level rise.

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