Abstract

The El Niño event of 2015-2016 was one of the strongest El Niños to occur in the last 53 years in the Pacific Northwest – second only to the 1982-1983 and 1997-1998 events. All three events were associated with elevated water levels along the Columbia River beaches and southwest Washington coast resulting in increased erosion and scarping. In a study completed in 2016 we used sea surface temperature, precipitation anomalies, observed hourly tide levels and the Hedges and Maze (2014) Run-up model (using Regional average parameters) to identify coastal beaches at risk to increased erosion by the El Niño event.

In this study LIDAR data published by NOAA's Ocean Service for July 2014 and April 2016 are used to identify beaches that actually experienced scarping during the 2015-2016 El Niño. To accomplish this I developed several GIS based models to extract from the LIDAR data and compare them with the predicted at risk beaches and identified an accuracy assessment. The risk analysis and run-up model were run using specific mid-beach slopes estimated from the 2014 LIDAR for each transect. It was found that the model based on Regional parameters provided a good first order estimate of risk, but that a user defined parameter of the mid-beach slope (B) was required. The run-up model was derived (B) from the use of the beach slope as a measure of protection. The sea level rise was the user defined parameter. The severity of the 2014 El Niño was greatest on beaches with mid-beach slopes <3% and 10 to 20 m lower run-ups than those that experienced significant beach scarping.

Conclusions

The vulnerability of the northwest Oregon and southwest Washington coast to extreme wave events is associated with regional slope conditions and wave conditions. As such the use of "Regional Average" beach slopes should be discouraged and site specific values are needed. This combined approach will provide comparable results when comparing the risk and severity of major storms. The development of user defined parameter of mid-beach slope (B) resulted in significantly improved erosion risk mapping for our study area (e.g., only 50% of the trinsects identified by the "Regional Average" beach slope approach predicted the site of 'future' erosion now available for most of our LIDAR derived 1 x 1 m DEMs are used. In the United States Analysis of the 2014 and 2016 LIDAR data derived a location dataset of "New Scarps", also identified by previous storm activity. These scarps were digitized and used to create an envelope or polygon. This envelope was used to clip the transects that were clipped by the average high water line and erosion reference feature in 2015, so the transect length approximated the horizontal run-up for each transect this El Nino induced elevation anomaly was added to the calculated vertical run-up. The mean beach slope for the study area, derived from the 2016 LIDAR slope raster, was 3.07%. During Fall-Winter of the 2015-2016 El Niño the number of hours that the observed tide exceeded the predicted tide and the exceedance was 7.44 sec. in 2014 2016 the tidal excursion was as low as 3.44 sec. in 2014 compared to 1974 in 2016.

References