ESTIMATING BREAKER HEIGHTS IN THE SURF ZONE ALONG BEACHES WITH BROAD BOTTOM SLOPES

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Accurate surf zone breaker height forecasts are critical for planning purposes in the nearshore and coastal environment. Lifeguards, recreationists (surfers), emergency managers, coastal engineers, and nearshore researchers depend on the forecast breaker heights. Additionally, knowledge of the breaker heights can aid the development of critical thresholds for coastal flooding due to wave setup along a vulnerable portion or portions of a coastline and lead to more accurate rip current forecasts. Multiple rescues with occasional fatalities occur annually along the Florida Panhandle coast due to moderate to strong rip currents.

A Smart Tool was developed in the AWIPS Graphical Forecast Editor to calculate breaker heights using the significant wave height, direction, and period forecasts from the Simulating Waves Nearshore (SWAN) model. The SWAN model is a third generation wave model for deep, intermediate and depth-limited waters. The model is initialized at the boundaries of the computational grid with parametric spectra points from the operational Western North Atlantic WAVEWATCH III model. Topography of the region is derived from the 3-arc-second (~90 m resolution) gridded Coastal Relief Model from the National Geophysical Data Center (NGDC). The Smart Tool utilizes two second-degree polynomials that were empirically derived based on a regression analysis from four-years of data at surf beaches along the eastern Florida Panhandle coast. These calculations are based on very broad bottom slopes with low refraction and account for both the short-period and long-period energy.

Although significant wave heights from the SWAN model were used to calculate the expected breaker height in the surf zone, observations revealed a greater distribution of heights within the surf zone than those computed using the Smart Tool. To support the greater wave height distribution in the observations, a multiplication factor to the significant wave height was included based on the Rayleigh wave distribution. An additional Smart Tool was developed to calculate the most frequent, average, and highest one-tenth wave heights.

Those NWS forecast offices responsible for coastlines with similar bottom slopes could use this methodology to forecast the distribution of breaker heights in the surf zone. A planned implementation to quantify radiation stress and wave setup from breaking waves along the Florida Panhandle coast using the SWAN model is expected to further enhance coastal flooding and rip current forecasts due to breaking waves in the surf zone environment.