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Defining Coastal Storm and Quantifying Storms Applying Coastal Storm Impulse Parameter

Nader Mahmoudpour
CDM Smith, 3201 Jermantown Road, Suite 400, Fairfax, VA 22030

What defines a storm condition and what would initiate a "storm" has not been uniquely defined among scientists and engineers. Parameters that have been used to define a storm condition can be mentioned as wind speed, beach erosion and storm hydrodynamics parameters such as wave height and water levels. Some of the parameters are storm consequential such as beach erosion and some are not directly related to the storm hydrodynamics such as wind speed. For the purpose of the presentation, the different storm conditions based on wave height, water levels, wind speed and beach erosion will be discussed and assessed. However, it sounds more scientifically to have the storm definition based on the hydrodynamic parameters such as wave height, water level and storm duration. Once the storm condition is defined and storm has initiated, the severity of the storm would be a question to forecast and evaluate the hazard and analyze the risk in order to determine the appropriate responses. The correlation of storm damages to the meteorological and hydrodynamics parameters can be defined as a storm scale, storm index or storm parameter and it is needed to simplify the complexity of variation involved developing the scale for risk analysis and response management. A newly introduced Coastal Storm Impulse (COSI) parameter quantifies storms into one number for a specific location and storm event. The COSI parameter is based on the conservation of linear, horizontal momentum to combine storm surge, wave dynamics, and currents over the storm duration. The COSI parameter applies the principle of conservation of momentum to physically combine the hydrodynamic variables per unit width of shoreline. This total momentum is then integrated over the duration of the storm to determine the storm's impulse to the coast. The COSI parameter employs the mean, time-averaged nonlinear (Fourier) wave momentum flux, over the wave period added to the horizontal storm surge momentum above the Mean High Water (MHW) integrated over the storm duration. The COSI parameter methodology has been applied to a 10-year data set from 1994 to 2003 at US Army Corps of Engineers, Field Research Facility (FRF) located on the Atlantic Ocean in Duck, North Carolina. The storm duration was taken as the length of time (hours) that the spectral significant wave heights were equal or greater than 1.6 meters for at least a 12 hour, continuous period. Wave heights were measured in 8 meters water depth and water levels measured at the NOAA/NOS tide gauge at the end of the FRF pier. The 10-year data set were analyzed applying the aforementioned storm criteria and produced 148 coastal events including Hurricanes and Northeasters. The results of this analysis and application of the COSI parameter to determine "Extra Ordinary" storms in Federal Projects for the Gulf of Mexico, 2012 hurricane season will be discussed at the time of presentation.