Abstract

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Enhancement of Cross-Shore Profile Evolution Models for Sustainable Coastal Design

Results obtained from the validation of a cross-shore profile evolution model, Uniform Beach Sediment Transport-Time-Averaged Cross-Shore (UNIBEST-TC), were examined and further analyzed to reveal the reasons for the discrepancy between the model predictions of the field data at the surf zone of the Duck Beach in North Carolina, USA. The UNIBEST model was developed to predict the main cross shore parameters of wave height, direction, cross shore and long shore currents. However, the results of the model predictions are generally satisfactory for wave height and direction but not satisfactory for the remaining parameters. This research is focused on exploring the discrepancy between the model predictions and the field data of the Duck site, and conducting further analyses to recommend model refinements. The discrepancy is partially attributed due to the fact that the measured values, were taken close to the seabed, while the predicted values are the depth-averaged velocity. Further examination indicated that UNIBEST-TC model runs consider the RMS of the wave height spectrum with a constant gamma-value from the offshore wave spectrum at 8.0m depth. To confirm this argument, a Wavelet Analysis was applied to the time series of wave height and longshore current velocity parameters at the Duck site. The significant wave height ranged between 0.6m and 4.0m while the frequencies ranged between 0.08 to 0.2Hz at 8.0m water depth. Four cases corresponding to events of both high water level and low water level at Duck site were considered in this study. The results show that linear and non-linear interaction between wave height and longshore current occur over the range of frequencies embracing the low frequency band of infragravity (0.001- 0.02Hz) waves band and short incident wave band (0.05-0.10Hz). The current results highlight the necessity of incorporating interaction terms between wave - wave and wave-current in the development of cross shore and longshore model formulations.