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Inner Surf/Swash Zone Morphodynamic Numerical Model Simulation of an Accreting Ridge during Low-Energy Wave Conditions

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The inner surf/swash zone of a coastal beach is characterized as an intermittently wet and dry zone in the nearshore that often develops a variety of morphological features including intertidal bars and ridge-runnel (RR) systems. The cross-shore morphodynamic numerical model CSHORE is used to simulate the beach recovery observed during a field experiment carried out at South Bethany Beach, Delaware, a nourished, high-gradient meso-tidal sandy beach along the U. S. Coast. The field campaign was conducted from February 12 to February 25, 2014 to measure bed profile morphology change and sediment characteristics along with detailed hydrodynamic forcing parameters at six cross-shore stations, closely spaced over approximately 50 m in the inner surf and swash zone. On February 13, 2014 a Nor'easter eroded significant portions of the beach leading to formation of a pronounced RR system on the beach face that subsequently accreted in the recovery process after the storm. Bed profile changes, surf and swash velocity profiles, water free surface elevation and suspended sediment concentrations recorded during the recovery at the cross-shore measuring locations on the seaward face of the accreting ridge are compared with CSHORE simulation results.

During post-storm recovery, CSHORE demonstrates shoreward migration of the ridge and slight accretion on the beach face by the end of the simulation period on February 25, 2014. This trend was also observed in the field, where accretion at the ridge crest was up to $\sim$1.0 m with respect to the post-storm profile. The CSHORE parameters critical to improving model performance in reproducing measured morphodynamics and hydrodynamics during the ridge accretion process are examined and calibrated. Initial results show promise in using this type of efficient, process-based model to reproduce morphological evolution and depth-averaged hydrodynamics as a result of the complex surf and swash zone dynamics associated with beach accretion and RR system mobilization.