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Large-scale physical modeling and numerical simulation of coastal sand dune morphodynamics

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Two-dimensional large-scale laboratory experiments (1:4 geometric scale model) were conducted to investigate the morphodynamics of coastal sand dune and underwater sand bar in cross-shore direction. Silica sands with the median diameter of 0.2 mm were used to make the simplified dune and beach profiles in the wave flume. The flume dimension is 100m long, 3m deep, and 2m wide and a piston type wave generator was installed in the flume. Prior to the experiment, numerical model simulations were performed by using CSHORE and XBeach to predict dune erosion and underwater sediment transport and to determine the optimal location of instruments. Capacitance type wave gages were installed to measure the water surface elevation. Acoustic Doppler Velocimeters (ADVs), an Acoustic Doppler Velocity Profilers (ADVP), and electromagnetic velocimeters were mounted on the movable cart to investigate the vertical profile of water particle velocity. Colored sands were also placed in the different cross-shore location to track the underwater sediment movement. The stereo cameras were installed to investigate the morphological change of sand dune. The wave condition includes the entire event of a single storm and recovery event. This synoptic data set can be used for numerical verification in terms of dune erosion, onshore and offshore sediment transport, and sand bar movement. The presentation includes numerical modeling results and the preliminary results of the laboratory experiments.