SEDIMENT TRANSPORT DRIVEN BY WAVE-BREAKING-INDUCED TURBULENT COHERENT STRUCTURES - A NUMERICAL INVESTIGATION

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**Abstract:** At sandy beaches, it is common to observe a large plume of suspended sand under the passage of breaking waves. It is clear that from the more quantitatively laboratory observations, these suspended plumes are associated with wave-breaking induced turbulent coherent structures impinging onto the seabed. In this study, a series of 3D Large-eddy simulations are carried out to study the turbulent flow structures and bed signatures as these eddies approach the bed. Three types of wave-breaking processes, including a spilling solitary wave in the surf zone, and plunging periodic waves in the surf and inner-surf zones, are studied. Simulation results reveal that regardless of the shape of coherent structures, they can induce significant bottom shear stress and near bed turbulence. More importantly, these coherent structures can induce (locally) large gradient and temporal change of dynamic pressure. The former can drive momentary bed failure and the latter may induce substantial upward-directed pore pressure gradient and reduce bed shear strength. Motivated by these findings, detailed multiphase Eulerian and Euler-Lagrangian modeling studies are carried out to investigate the dynamics of momentary bed failure of and the onset of significant mobilization of sediment bed due to large upward-directed pore pressure gradient. Preliminary results from the multiphase Eulerian model show that momentary bed failure in sheet flow condition can mobilize a layer of sediment with much larger thickness comparing to that of pure sheet flow. Consequently, shear instabilities can be triggered and billows resulted from such instability can maintain a high erosion depth and large amount of transport. The threshold for the occurrence of momentary bed failure is significantly reduced as sheet flow transport is more intense.