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Shallow Water Lidar System in Measuring Erosion Rate of Coarse-Grained Materials

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Abstract : Erosion rate of soils during a levee or dam overtopping event is a major component in risk assessment evaluation of breach time and downstream consequences. The mechanism and evolution of dam or levee breach caused by overtopping erosion is a complicated process and difficult to measure during overflow due to accessibility and quickly changing conditions. In this paper, the results of a flume erosion tests are presented and discussed. The tests are conducted on a coarse-grained material with a median grain size D50 of 5 mm in a 1-m (3-ft) wide flume under varying flow rates. Each test is performed by compacting the soil mix r to its near optimum moisture and dry density as determined from standard Proctor test in a box embedded in the flume floor. The box measures 0.45 m wide x 1.2 m long x 0.25 m deep. The material is tested several times at varying hydraulic loading to determine the erosion rate after equal time intervals. The water depth, velocity are measured at each hydraulic loading, and the acting bed shear is calculated. A shallow water lidar (SWL) system was utilized to record the progress of soil erodibility and water depth along the scanned profiles of the tested box. SWL is a non-contact system that transmits laser pulses from above the water and records the time-delay between top and bottom reflections. Results from the SWL scans are compared with before and after manual measurements to determine the erosion rate of the soil mix and other erosion parameters.

Keywords : coarse-grained materials, erosion rate, LIDAR system, soil erosion
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