Abstract Submitted
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Turbulent Flow in the Vicinity of Retaining Walls: Conditions at the Early Stages of Local Scour Development[1] NASSER HEYDARI, PANAYIOTIS DIPLAS, Department of Civil and Environmental Engineering, Lehigh University, Bethlehem, PA, J. NATHAN KUTZ, Department of Applied Mathematics, University of Washington, Seattle, WA — Turbulent flow characteristics corresponding to the initial stages of local scour development are investigated in the vicinity of a retaining wall structure. Data collection is performed using a volumetric particle image velocimetry to measure the three-dimensional velocity fields. Time-averaged flow topology, turbulence statistics, and instantaneous fields are examined. Furthermore, proper orthogonal decomposition (POD) and dynamic mode decomposition (DMD) tools are applied to further understand the underlying features of the large-scale coherent structures around the obstruction. The results indicate that a horseshoe vortex (HV) system develops over the channel bank at the upstream face of the obstruction. It follows the sloping junction line towards the toe of the channel bank and then bends in the direction of the flow. It was indicated that turbulent kinetic energy (TKE) inside the HV system and bed shear stress values in the mean flow are more pronounced near the leading edge of the protrusion where the flow acceleration is the strongest. Consistently, the leading POD and DMD modes indicate that the HV captures a significant portion of the TKE content. They also confirm the aperiodic behavior of the HV system.

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