Abstract Submitted
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Effect of Relative Submergence on the Flow Structure in the Wake of Wall-Mounted Spherical Obstacle[1] SEYED HAJIMIRZAIE, ACHILLEAS TSAKIRIS, JAMES BUCHHOLZ, ATHANASIOS PAPANICOLAOU, The University of Iowa — To understand the flow around submerged boulders in open channels, a study of a spherical obstacle on a rough bed in shallow open channel is conducted. In steep mountain streams, relative submergence (d/H, d being flow depth and H obstacle height) is introduced. In this study, through the use of PIV and thermal anemometry, the flow field surrounding a wall-mounted sphere with diameter D=5cm in two different relative submergences has been investigated on a smooth plate as a boundary layer (BL) as well as on a rough bed in shallow open channel flow. Flow patterns (velocity, vorticity) in the streamwise symmetry plane are different between the open channel and BL flow. Streamwise features are observed in the mean wakes of the sphere. In high relative submergence, an upwash (base structure) is observed in the wake of sphere in open channel flow but not in BL tests. The horseshoe vortex is not observed in the wake of the sphere in either case. Dye visualization, spectral analysis and cross-correlation show in $d/H \leq 1$, the wake in both cases has the appearance of a Karman vortex street, while in $d/H > 1$, the wakes are quite symmetric. A weak dominant shedding frequency is observed in BL experiments with a Strouhal number of $St = fsD/U \approx 0.35$.

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