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Near-bed sediment transport by coherent structures in the turbulent flow past a surface-mounted cylinder.[1] CRISTIAN ESCAURIAZA, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, University of Minnesota — Fluctuations on the instantaneous hydrodynamic forces produced by coherent structures are responsible for the initiation of motion and transport of sediment particles in turbulent flows. The bed-load transport near the threshold of motion driven by these unsteady vortical structures is characterized by intermittent displacement events of varying magnitudes with particles saltating or sliding on the bed. In this study, we utilize a hybrid URANS/LES turbulence model to capture the large-scale coherent structures in the turbulent flow around a vertical cylinder mounted in a rectangular channel. We develop a Lagrangian model to carry out one-way coupling simulations of inertial particles near the bed and investigate the transport process by performing a detailed statistical analysis of the sediment flux. The quantitative description of the sediment dynamics will provide insights on the fundamental mechanisms of particle entrainment and transport, and clarify the role of the coherent structures in determining the time-scales of sediment motion for realistic flow conditions.

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Fotis Sotiropoulos
University of Minnesota

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