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Scaling of sediment erosion rates for unsteady, nonequilibrium flows[1] KEN KIGER, KYLE CORFMAN, RAHUL MULINTI, University of Maryland — Traditional approaches to sediment transport are typically based on assumptions of fully developed, equilibrium conditions. Many flows, however, are dominated by the presence of intermittent, coherent large-scale structures, which may not satisfy such assumptions. The current study examines the erosion rates produced by a strongly forced air jet impinging on a mobile bed of fine glass beads. A parametric study is conducted using a range of mean flow and forcing conditions to elucidate the role of the dominant structure on the transport process. The evolution of the bed surface is compared to single-phase PIV measurements. The results show that the use of the time-averaged stress on the bed cannot be used to effectively predict the location or magnitude of erosion. Instead, it is shown that the erosion rate can be related to the location and magnitude of the periodic stress produced by the vortex interacting with the bed. After an initial transient, the erosion for all cases was observed to proceed at a relatively constant rate. The net removal rate was found to correlate closely to the unsteady stress produced by the periodic structures, and predicted the erosion rate for all of the conditions studied when scaled by the integral of the excess wall stress raised to the power 1.2.

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