Abstract Submitted
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Large-eddy simulation of sand dune morphodynamics[1] ALI KHOSRONEJAD, FOTIS SOTIROPOULOS, St. Anthony Falls Lab. University of Minnesota, ST. ANTHONY FALLS LABORATORY, UNIVERSITY OF MINNESOTA TEAM — Sand dunes are natural features that form under complex interaction between turbulent flow and bed morphodynamics. We employ a fully-coupled 3D numerical model (Khosronejad and Sotiropoulos, 2014, Journal of Fluid Mechanics, 753:150-216) to perform high-resolution large-eddy simulations of turbulence and bed morphodynamics in a laboratory scale mobile-bed channel to investigate initiation, evolution and quasi-equilibrium of sand dunes (Venditti and Church, 2005, J. Geophysical Research, 110:F01009). We employ a curvilinear immersed boundary method along with convection-diffusion and bed-morphodynamics modules to simulate the suspended sediment and the bed-load transports respectively. The coupled simulation were carried out on a grid with more than 100 million grid nodes and simulated about 3 hours of physical time of dune evolution. The simulations provide the first complete description of sand dune formation and long-term evolution. The geometric characteristics of the simulated dunes are shown to be in excellent agreement with observed data obtained across a broad range of scales.

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