Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Fluid-driven transport of spherical sediment particles: from discrete simulations to continuum modeling QIONG ZHANG, KEN KAMRIN, Mechanical Engineering, Massachusetts Institute of Technology, ERIC DEAL, TAYLOR PERRON, EAPS, Massachusetts Institute of Technology, JEREMY VENDITTI, Simon Fraser University, SANTIAGO BENAVIDES, MATTHEW RUSHLOW, EAPS, Massachusetts Institute of Technology — Empirical bedload transport expressions commonly over- or underpredict sediment flux by more than a factor of two, even under controlled laboratory conditions. In this work, the Discrete Element Method and Lattice Boltzmann Method are coupled together to simulate 3D fluid-driven transport problems, in which the spherical sediment particles are fully resolved. After comparisons with flume experiments are made to test the numerical simulations, the grain-scale physics is studied, such as the flow field around individual particles and higher order descriptions of the granular motion. A more robust continuum model, unifying empirical models under various conditions and in different regimes, is further proposed based on the new grain-scale understanding of the mechanisms.

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Date submitted: 01 Aug 2019 Electronic form version 1.4