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Evaluation of erosion-rate models for numerical simulations of sediment transport GIANMARCO D'ALESSANDRO, UGO PIOMELLI, ZVI HANTSIS, Queen's University — This work investigates the performance of commonly used sediment transport models and high-resolution Navier-Stokes equations solution methods. Entrainment functions predict the average rate of transport of sediment eroded from a channel bed based on the average wall shear stress. However, as computational resources increase, eddy-resolving methods, in which a range of temporal and spatial scales is present, are becoming more widespread. In this work we show that the accuracy of various entrainment functions is compromised when applied instantaneously, as is necessary in Direct Numerical Simulation (DNS), and Large Eddy Simulation (LES). For small values of the wall shear stress (normalized by particle size and density ratio) the fine spatial and temporal resolution of wall-resolved simulations can yield overestimation of the sediment transport; methods that yield a more coarse-grained solution, such as wall-modeled large-eddy simulations, result in more accurate predictions. A short-time averaging of the velocity field is shown to improve the performance of the entrainment functions combined with eddy-resolving solution methods.

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