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Highly-resolved numerical simulations of bed-load transport in a turbulent open-channel flow[1] BERNHARD VOWINCKEL, Mechanical Engineering, UCSB, Santa Barbara, USA, TOBIAS KEMPE, Institute of Fluid Mechanics, TU Dresden, Germany, VLADIMIR NIKORA, School of Engineering, The University of Aberdeen, Schotland, RAMANDEEP JAIN, JOCHEN FRÖHLICH, Institute of Fluid Mechanics, TU Dresden, Germany — The study presents the analysis of phase-resolving Direct Numerical Simulations of a horizontal turbulent open-channel flow laden with a large number of spherical particles. These particles have a mobility close to their threshold of incipient motion andare transported in bed-load mode. The coupling of the fluid phase with the particlesis realized by an Immersed Boundary Method. The Double-Averaging Methodology is applied for the first time convolutingthe data into a handy set of quantities averaged in time and space to describe the most prominent flow features.In addition, a systematic study elucidatesthe impact of mobility and sediment supply on the pattern formation of particle clusters ina very large computational domain. A detailed description of fluid quantities links the developed particle patterns to the enhancement of turbulence and to a modified hydraulic resistance. Conditional averaging isapplied toerosion events providingthe processes involved inincipient particle motion. Furthermore, the detection of moving particle clusters as well as their surrounding flow field is addressedby a a moving frameanalysis.

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