



Lagrangian and Eulerian description of bed-load particle kinematics

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The motion of bed-load sediment particles transported by a flow can be analyzed within a Lagrangian or an Eulerian framework. In the former case, we consider the particles as individual objects in motion and we study their kinematic properties. The latter approach is instead referred to suitably chosen control volumes. Quantities describing sediment motion in the two frameworks are different, and the relationships among the two approaches are not straightforward. In this work, we intend to discuss the kinematic properties of sediment transport: first, a set of quantities is univocally defined; then, relationships among different representations are explored. Proof-of-concept results presented in the study are from a recent experiment involving weak bed-load sediment transport, where the moving particles were released over a fixed rough bed. The bulk flow velocity was 1.4 times the critical value for incipient particle motion, and particles were mostly moving by rolling and sliding, with limited saltation. The particle motion was filmed from the top and the measurements were conducted by image-based methods, obtaining extensive samples of virtually-instantaneous quantities.