



Grain-scale modeling and splash parametrization for aeolian sand transport

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The collision of a spherical grain with a granular bed is commonly parametrized by the splash function, which provides the velocity of the rebounding grain and the velocity distribution and number of ejected grains. Starting from elementary geometric considerations and physical principles, like momentum conservation and energy dissipation in inelastic pair collisions, we derive a rebound parametrization for the collision of a spherical grain with a granular bed. Combined with a recently proposed energy-splitting model [Ho et al., Phys. Rev. E 85, 052301 (2012)] that predicts how the impact energy is distributed among the bed grains, this yields a coarse-grained but complete characterization of the splash as a function of the impact velocity and the impactor-bed grain-size ratio. The predicted mean values of the rebound angle, total and vertical restitution, ejection speed, and number of ejected grains are in excellent agreement with experimental literature data and with our own discrete-element computer simulations. We extract a set of analytical asymptotic relations for shallow impact geometries, which can readily be used in coarse-grained analytical modeling or computer simulations of geophysical particle-laden flows.