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Granular surface flows confined between flat, frictional walls: Simulations vs Experiments

We report discrete element method simulations of three-dimensional, gravity-driven flows of cohesionless granular media over an erodible bed, confined between two flat, frictional sidewalls. The role of the sidewalls is investigated by varying the gap width from 5 to 30 grain size (d). Two distinct flow regimes are identified: regime I, for flow angles smaller than a critical angle q_c , corresponding to dense flows, and regime II, for angles larger q_c characterized by strong depthwise variations of the volume fraction. Scaling laws for the shear rate, velocity, and mass flow rate are obtained, depending on the dimensionless parameters (h/W) and (W/d) . These scalings support the existence of the two regimes and are compared with experimental results.