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# Particle velocity profiles in bedload transport on steep slopes

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Physical processes ruling bedload transport and more generally coarse-particle/fluid systems are poorly known, impairing our ability to compute local and even bulk quantities such as the sediment flux in rivers. One reason is that granular interactions have not been thoroughly investigated. This paper focuses on vertical particle velocity profiles.
One-size and two-size mixtures of coarse spherical glass beads entrained by a shallow turbulent water flow were studied in a two-dimensional steep channel with a mobile bed. The particle diameters were 4 and 6 mm, the channel width 6.5 mm and the channel inclination was typically 10%. The water flow rate and the solid discharge were kept constant at the upstream entrance. They were adjusted to obtain bed load equilibrium, that is, neither bed degradation nor aggradation over sufficiently long time intervals. Flows were filmed from the side by a high-speed camera. Using image processing algorithms made it possible to determine the position, velocity and trajectory of a very large number of spherical particles thanks to a PTV algorithm (particle tracking velocimetry).
Mean vertical particle velocity profiles are characterized by an exponential tail at the interface between the quasi-stationary bed and the bedload layer, a linear increase up to the top of this layer where a logarithmic level-off corresponding to the saltating particles occurs. These results are comparable to experimental velocity profiles from the literature on dry and wet granular free surface flows.