



Particle velocity and concentration profiles in bedload transport

Philippe Frey

Irstea, Unité de recherche Erosion torrentielle, neige et avalanches, St. Martin d'Hères, France (philippe.frey@irstea.fr)

Bedload, the part of sediment transport remaining in contact with the bed, should be considered from a granular point of view, and take into account not only the grain-fluid but also the grain-grain interactions. This paper presents particle velocity and concentration normal profiles. One-size and two-size mixtures of coarse spherical glass beads entrained by a shallow turbulent water flow were analysed 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 constant water flow and sediment rates 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 particle tracking algorithms made it possible to determine the position, velocity and trajectory of a very large number of particles. Mean streamwise particle velocity profiles are characterized by an exponential tail at the interface between the stationary bed and the bedload layer, a linear increase up to the top of this layer where saltating particle velocities exhibit a logarithmic shape. Those results are comparable to experimental velocity profiles given in the literature on dry and fluid-mediated granular free surface flows.