Geophysical Research Abstracts
Vol. 15, EGU2013-3185, 2013
EGU General Assembly 2013

Size-segregation in bedload transport: experiments at the particle scale and continuous modelling

Coraline Bel, Rorsman Kristina, and Philippe Frey

Irstea, Unité de recherche Erosion torrentielle, neige et avalanches, St. Martin d'Heres, France (coraline.bel@irstea.fr)

Sediment transport plays a major role in the stability and the morphology of stream channels and has major consequences for environmental sustainability and in flood alleviation. Bedload, i.e. the transport of sediment remaining in contact with the streambed, should be considered from a granular point of view, and take into account not only the grain-fluid but also the grain-grain interactions. On the streambed, the wide range of grain sizes leads to size-segregation, especially to armouring, i.e. the building of a coarser layer on the surface of the bed. Segregation is also studied in industrial contexts often for non-desirable effects. Depending on the size-ratio, fine grains infiltrate spontaneously in between the coarser grains (spontaneous percolation), or smaller grains fall into the pores opened dynamically (kinetic sieving). This research is about the kinetic sieving process. The aim of this investigation is to test, against our experimental data, a continuum theoretical model for the segregation of binary mixtures based on a kinematic approach (Gray and Chugunov 2006). First, experiments were carried out to measure the evolution of the concentration over space and time in a binary flowing mixture. During those experiments, spherical glass beads of diameter 4 mm and 6 mm were entrained by a turbulent and supercritical water flow, down a steep (10%) narrow flume with a mobile bed under bedload equilibrium conditions. Experimental results have been compared to the model requiring as input the normal profiles of bead velocity and the sediment rates. A reasonable agreement was found between experimental and modelled concentration profiles.

Gray, J. M. N. T., & Chugunov, V. A. (2006). Particle-size segregation and diffusive remixing in shallow granular avalanches. Journal of Fluid Mechanics, 569, 365–398.