

Experimental study on granular debris flows

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Abstract

The present study starts with a review of the debris flow literature. An introduction into the phenomenon and its occurrence is followed by a presentation of different rheological models proposed in literature to describe the flow behaviour of both viscous and granular debris flows. The choice of an appropriate model depends on the debris flow type and on the posed task.

The experimental part of the study has been conducted in the laboratory of hydraulics and fluid mechanics of the Technical University of Catalonia (UPC). A mixture of well sorted gravel with a mean grain diameter of 7.9 mm and water is discharged suddenly at the upstream end of the metallic laboratory flume. At a distance of approximately 6 m downstream from the gate, the debris flow is filmed at a frequency of 1000 Hz. From the images, the velocity profiles are obtained by a pixel line correlation technique. The flow surface is detected based on the change in the colour spectrum of the images corresponding to the change of air to water. The obtained velocity profiles show that the granular debris flow surge may be best described by a Voellmy model with a predominant Coulomb friction term. The onset of turbulence can be observed by increasing the flume inclination from 15° to 20°.

Key words

Debris flows; saturated granular mixture; rheology; Voellmy model; image processing