Geophysical Research Abstracts
Vol. 17, EGU2015-12285-1, 2015
EGU General Assembly 2015

Centrifuge modelling of granular flows

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A common characteristic of mass flows like debris flows, rock avalanches and mudflows is that gravity is their main driving force. Gravity defines the intensity and duration of the main interactions between particles and their surrounding media (particle-particle, particle-fluid, fluid-fluid). At the same time, gravity delimits the occurrence of phase separation, inverse segregation, and mass consolidation, among other phenomena. Therefore, in the understanding of the flow physics it is important to account for the scaling of gravity in scaled models.

In this research, a centrifuge model is developed to model free surface granular flows down an incline at controlled gravity conditions. Gravity is controlled by the action of an induced inertial acceleration field resulting from the rotation of the model in a geotechnical centrifuge. The characteristics of the induced inertial acceleration field during flow are discussed and validated via experimental data. Flow heights, velocity fields, basal pressure and impact forces are measured for a range of channel inclinations and gravity conditions.

Preliminary results enlighten the flow characteristics at variable gravity conditions and open a discussion on the simulation of large scale processes at a laboratory scale. Further analysis on the flow physics brings valuable information for the validation of granular flows rheology.