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Preliminary results of laboratory experiments on substratum roughness, grainsize and volume influence on the motion and spreading of large rock avalanches

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Large rock avalanches are rare but catastrophic events with unusual runout distance involving a great amount of granular material (>106 m3). They reach high velocities (up to ten meters per second) and can travel long distances and consequently cover area over 0.1 km2. These events are often really costly in term of human lives and infrastructures. In these days, the processes controlling the behaviour of such masses are not well understood and that is why laboratory experiments are important for the understanding of their unusual comportment.
The main objective of the research is to link the granular physics with the modelling of rock avalanches and to understand the effects of grain size, the runout and the lateral spreading of rock avalanches regarding the density of material and the apparent basal friction angle. This work presents the first steps of the laboratory campaign that consists into finding a convenient granular material, speaking of grain size and physical behaviour and testing it on simple slope geometry. The fact of modelling a debris avalanche and its spreading allows understanding the relationship between the roughness and the travel distance and also between the volume and the reach angle. It appears that the roughness of the substratum influence the spreading of the sliding mass. The relationship between the substratum and the runout distance is more complex. In fact, it appears that if the substratum is too rough, the distance diminishes, as well as if it is too smooth because the effect on the apparent friction decreases. For a better understanding of the sliding mass motion and its spreading, the experiments are recorded by a height speed precision camera and the deposit is scanned with a micro laser scanner Minolta in order to compare how the volume influence the behaviour of the sliding mass. Up to now our results do not enable to validate any previous model (Melosh or Bagnold).
A better understanding of the behaviour of these large rock avalanches can have significant implications for hazard assessment and risk management.