Laboratory granular landslides.

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A main objective in landslide research is to predict how far they will travel. A well-known feature first reported by Albert Heim in 1932 [1] is the positive correlation between landslide volume and landslide runout, so that larger landslides can travel many times further than one can naively predict using the energy balance between initial potential energy and frictional dissipation (cf. Fig.1). Different mechanisms have been suggested [2],[3]. An obstacle for these explanations is that it is difficult to test them by a systematic and independent study of the parameters for naturally occurring landslides.

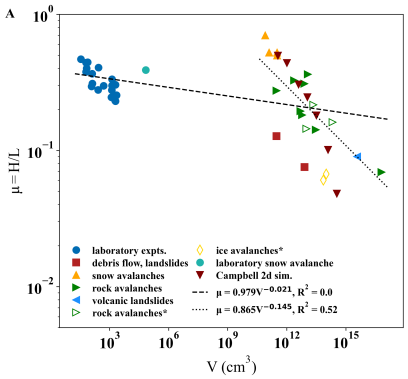

Figure 1. Comparison of experiments with field data using the usual normalized runout (the ratio between the travel distance and the initial height of the mass) showing the scale separation in the landslide size.

We used a simplified geometry for granular landslide laboratory experiments and focus on the maximum travel distance, the landslide runout, that is of primary interest for hazard management. Despite the apparent scale separation, we first managed to reproduce the decrease in friction with the landslide size observed in nature for large landslide sizes. Then by taking part of the relative simplicity of our set-up, we study the influence of substrate roughness and initial mass height. Our results suggest that a decrease in the apparent friction still occurs for rough sliding slopes or different dropping heights albeit with a shift in the critical landslide size needed to make this appear. The versatility of the set-up enables us to study the motion of the mass and particularly the non-trivial relations between the flow thickness, the speed of the landslide front and the landslide size. These results provide scaling laws that might be useful to test the validity of proposed mechanisms for the increase in mobility.

Références

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