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Analogue modelling of rock avalanches and structural analysis of the deposits

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Rock avalanches are catastrophic events in which granular masses of rock debris flow at high speeds, commonly with unusual runout. A great volume of material (>106 m3) is involved and the flowing mass can reach velocities up to ten meters per second. Rock avalanches can travel long distances on the order of kilometres and covering an area over 0.1 km2. These are extremely destructive and uncontrollable events. Due to the rarity of these events, analogue modelling plays a fundamental role in the understanding of the behaviour such events. The main objective of this research is to link the granular physics with the modelling of rock avalanches.
Firstly, we attempt to model the debris avalanche and its spreading on a slope with different substratum to understand the relationship between the volume and the reach angle, or Fahrböschung, i.e. angle of the line joining the top of the scar and the end of the deposit. For a better understanding of the sliding mass motion and its spreading, the deposit is scanned with a micro Lidar Minolta. The different datasets are compared in order to see how the grainsize and volume influence a debris avalanche. In a general way, the travel distance is greater with coarse material and varies between 32° for the coarser grainsize and 37° for the finer one. It is interesting to note that the highest Fahrböschung, 41°, is reached for the highest slope angle (60°) and varies between 32 and 34.5° for a slope of 40°.
Secondly, a detailed structural analysis of the deposit is performed in order to understand how the sliding mass stops. Several authors (e.g. Shea and van Wyk de Vries (2008)) highlighted that faults and folds are present in rock avalanches deposits and reproduced these features in analogue modelling. Our experiments are recorded by a height speed precision camera to see the development of these structures during the flowing of the mass.
The most important impacts of this study is a better understanding of the effects of grainsize, substratum and material type on the behaviour of rock avalanches regarding the density of material and basal friction angle. If the behaviour of those debris avalanches is better understood, the prediction and the risk assessment for such events will be better constrained.