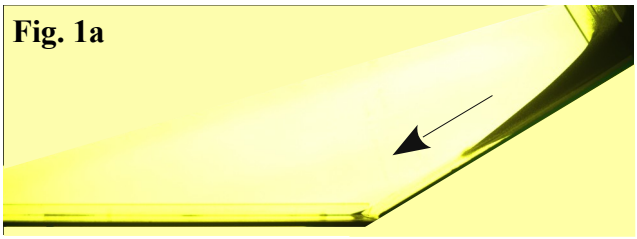
Master 2 Internship

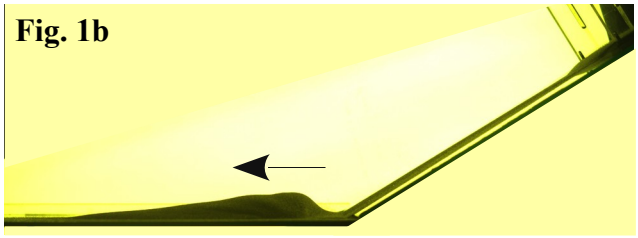
Title: Earthquakes and landslides: the effect of oscillations on granular rheology

Supervisor(s): Rory Cerbus

Email(s): rory.cerbus@u-bordeaux.fr

Project:





Landslides, the violent motion of large masses of debris, rock or snow, are an ever-present danger in mountainous regions the world over (Fig. 2). After the landslide material falls, it will run out some distance horizontally until the energy it gained from falling is dissipated. It is important to accurately estimate this distance to mitigate danger to people and property, and yet doing so has proven to be unexpectedly difficult. A recent theory suggests that landslides can runout very far because of self-induced oscillations. Here we ask whether external oscillations will have the same effect. Since many landslides are triggered by oscillations (earthquakes) this question is very pertinent to geological flows. We will be exploring answers to this question using granular flow, the flow of small particles like sand, which is a frequently used laboratory analog of landslides. The rheology of granular flow, how the flow responds to pressure and stresses, is nontrivial. The above-mentioned theory suggests that oscillations will make the flow behave like a non-Newtonian (Bingham) fluid, like toothpaste or mayonnaise. This provides a quantitative framework for making predictions, but the central question remains: will oscillations make a landslide travel further? Surprisingly, preliminary experiments with a rough setup suggest the opposite. Controlled experiments (see Fig. 1) with larger masses and independently controlled oscillation frequency and amplitude are needed to answer this question of importance to both granular and geological flows.