

Fractures in cohesive granular media

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Among the deadliest avalanches, so-called slab avalanches are triggered by multifracturing of the snowpack and then propagate rapidly as they flow (Fig. 1 left). Predicting their behavior is difficult and relies mainly on empirical observations. To improve our understanding of this phenomenon, it is essential to investigate the physics at the grain scale and the cohesive forces at play. This project focuses on fractures in a cohesive granular material using both experiments and theoretical models. In particular, we will address the following questions:

- How do fractures form within a cohesive granular material?
- How do their shape and density depend on the properties of the material?

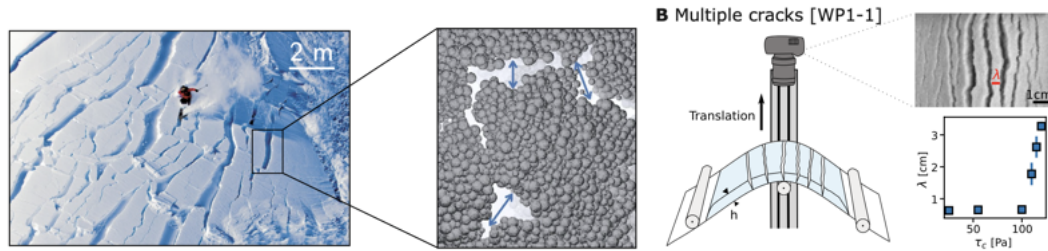


Figure 1: Left. Example of fractured flows: slab avalanche triggered by a skier. Mount Cook National Park, New Zealand. Mark Gollub, New Zealand Geographic 117. Right. Sketch of the 3-points bending experiment. Evolution of the wavelength as a function of cohesion.

To address these questions, the main objective of the internship will be to perform experimental test to characterize the behavior (critical stress, toughness) of an innovative cohesive granular material with tunable cohesion that has been recently synthesized.

The strategy will be to (1) adapt classical fracture mechanics tests (three-point bending, CT specimen) to the specificities of the cohesive granular material, and (2) characterize the formation of fractures in a layer of grains with fixed thickness and cohesion (Fig. 1 right), confronting theoretical approaches with experimental data. The characteristic wavelength of the fractures can be determined through a stability analysis with a damage model. This project combines several topics: fracture mechanics, damage mechanics, and granular media.

Candidate profile: curious, resourceful, and interested in both designing new experiments, theory, and/or numerical simulations.