

## Viscoplastic flows

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Actually little is known on the physical processes involved in avalanches or debris flows. We tackle this difficult issue by carrying out idealized experiments, where we focus on the motion of highly time-dependent flows of non-Newtonian fluids. The objective is to test various propositions of governing equations experimentally and numerically.

Experiments involve unleashing a finite volume of fluid down an inclined plane. For now, we use a simple viscoplastic material (viscoplastic gel called Carbopol), whose physical properties approach those of natural materials very roughly. The motion of the surge can be tracked using image processing techniques: we project fringes onto the free surface, which are deformed as a result of the bulk motion. Relating deformation and flow depth makes it possible to obtain a three-dimensional map of the surge.

In parallel, we extend a three-dimensional Navier-Stokes solver to numerically model the surge motion. The material considered in the simulations is a Herschel-Bulkley fluid. In order to compare the numerical results with our experimental data, we use the rheological parameters of the Carbopol gel, which were obtained independently using a rheometer. The key problem in these numerical simulations is the treatment of the yield stress as well as the boundary conditions at the front (contact line). In this talk, we present our preliminary results on the flow structure within the leading edge.