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SLOWMOVE - A numerical model for the propagation of slow-moving landslides: a spatially distributed 2.5D approach and its application to the analysis of the Super-Sauze landslide (French Alps).

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Process-based models are common tools for understanding and forecasting landslide behaviour. The objective of this study is to describe the implementation of the dynamic SLOWMOVE model in 2.5 dimensions using the GIS scripting language PCRaster. This environment provides visualization of the results through map animations and time series, and a user-friendly interface. The model performance is evaluated on multi-temporal datasets of landslide displacements for the period of summer 2009.
The Super-Sauze landslide is triggered in Callovo-Oxfordian black marls and is composed of a silty-sand matrix mixed with moraine debris. It extends over a horizontal distance of 850 m with an average 25° slope. The total volume is estimated at 750,000 m3 and creeping velocities range from 0.01 to 0.40 m day-1. The complex paleo-topography covered by the landslide is made by successions of crests and gullies which play an essential role in the behavior by creating sections with distinct kinematical, mechanical and hydrological characteristics. Observational data showed that the velocity rates are mainly controlled by changes in excess pore water pressure.
The SLOWMOVE model has been implemented in 2.5D in order to take into account of complex basal topography represented through a DEM. The landslide is treated as a one-phase material, whose behavior is controlled by rheological properties following a Coulomb-viscous model. SLOWMOVE 2.5D is based on a two dimensional finite difference solution (2D Eulerian space with Cartesian coordinates) of the Saint Venant equations that are derived from a depth-integration of the Navier-Stokes equations of fluid motion. Important assumptions in the model are that: (1) the inertia term in the equation of motion can be cancelled without a significant effect in the velocity field; (2) the acceleration due to internal pressure is controlled by strain; (3) undrained loading generates excess pore water pressure.