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Modelling of landslide failure surface using SLBL: from analogue modelling to real scale rotational landslides

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Landslides are complex phenomena affected by many different processes and factors. The identification of the relative importance of these factors can be complicated, due to difficulties in accurately quantifying every parameter and in process repeatability.

In this study, we used laboratory scale experiments through a sandbox for creating artificial landslide slopes to compare and observe the deformation. We varied parameters such as slope inclination, water level or particles size to characterise the influence on slope stability. Deformation geometry is measured with a high resolution 3D digitizer (Konica Minolta Vivid 9i) at equal time intervals, which provides a series of point clouds with submillimetric accuracy representing the landslide slope surface evolution. This allowed then a visualisation of the landslide kinematic.

Based on the previous experiments, we first defined the real geometry of the failure surface combining image analysis through the glass panes of the sandbox and the point cloud obtained using the 3D digitizer. We then calculated the slope failure surface using the Sloping Local Base Level (SLBL) computational method. The parameter of this model (tolerance) was calibrated in order to minimize the RMS error between observations and the computed surface. Our results show good matches between the observed and simulated failure surfaces, proving the validity of SLBL method in estimating failure surfaces.

We then utilise the 3D datasets of a rotational landslide occurred in a river bank of the Sorge river (Vaud, Switzerland) first described by Jaboyedoff et al. (2009) in order to test if the previously defined parameter determines a computed surface which matches the observed failure surface. We looked then for similarities between the geometry of the simulated and the real landslide surface of failure.

Sandbox experiments provided a good understanding of failure mechanisms and dynamic of landslides. All these informations can be very useful in predicting real landslides evolution and helping adequate measures to be taken in order to reduce the risk they represent.