

# **In-situ monitoring, stability calculations and thermo-hydraulic modelling of a shallow landslide in Cercs (Catalan Pre-Pyrenees)**

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## **ABSTRACT**

The shallow translational landslide investigated in this study is located next to the village Cercs, which belongs to the Berguedà region of Catalonia. It involves a volume of about 250 m<sup>3</sup> at a natural slope of 10 to 15°. The slope failure includes the colluvium layer of about 0.5 m thickness and a few decimetres of the weathered bedrock. The bedrock consists of argillites classified as inorganic clay of high plasticity.

The monitoring set up includes a meteorological station that measures the precipitation, air temperature, relative air humidity and atmospheric pressure at a 5 minutes scan rate. In addition, various devices are installed in the shallow slide recording every 15 minutes soil moisture (4 sensors), pore water pressure (3), soil water potential (2), soil temperature (5) and displacement (1). Herein, we present time series covering the records between January 2015 and April 2019.

A back-analysis was performed applying the numerical program CODE\_BRIGHT. The 1D and 2D thermo-hydraulic modelling of four years (2015-2018) showed satisfactory correlations with the monitoring data. In particular soil temperature and volumetric water content could precisely be simulated. Finally, stability calculations were carried out: first by applying standard limit equilibrium method and then by using a simplified 1D infinite slope approach incorporating the results of the numerical modelling. The results indicated that the factor of safety was higher than 1.0 during the entire observation period, which is supported by the measurements of the extensometer that has not recorded any significant displacement.