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Downhole geophysical and hydrogeochemical observatories to monitor water content variations and water-rock interactions in a rainfall-induced landslide.

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The Pégairolles-de-l'Escalette landslide is located in the central part of Languedoc Region (Southern France). It corresponds to a deep-seated landslide (> 50 m of thickness) with a slow slip displacement (3-4 mm/year). Considering a relatively simple geological context and a landslide mainly controlled by slope hydrology, this site constitutes a preferential natural observatory to study the impact of large rain events on slope kinematics.
This work is based on a complete and original instrumentation deployed in two nearby boreholes since 2012. The landslide is investigated down to 60 m depth by two in situ permanent observatories for a geophysical (electrical resistivity and deformation) and an hydrogeochemical monitoring (pressure, pH, temperature, electrical conductivity, fluid sampling) to better understand the role of fluids in the slope instability.
The data recorded during the five years of investigations point out the relevance of the downhole monitoring to progress towards a better understanding of internal landslide processes in relation with climate forcing. The database helps characterizing the active slip zones in the underground as well as the seasonal dynamics of the different hydrogeological units within the slope. The observatories recorded heavy rainfall events that are characterized by both electrical resistivity and geochemical changes down hole suggesting different time responses of the system to the meteorological solicitations.
Because the long-term goal of this project is to use this downhole database to produce calibrated models of the internal processes, we also performed petrophysical experiments on core samples. In particular, we performed resistivity-saturation measurements in order to characterize the effect of both water content variations and water-rock interactions on the geophysical data.