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Geophysical and hydrological monitoring of water flows on an active mudslide in nearly saturated conditions: the Super-Sauze hydrogeophysical experiment.

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In order to better understand the factors controlling hydrological and mechanical processes of clay-rich landslides, an hillslope hydrology experiment has been performed during several days on an active mudslide (Super-Sauze mudslide in the South French Alps). This mudslide is characterized by nearly saturated conditions within most of the year, with groundwater levels located nearby the topographical surface. The landslide velocities are comprised between 0.005 m.day^{-1} to 0.3 m.day^{-1} in periods of crises.

The objective of the experiments is to analyse the hydrological system and to quantify the impacts of preferential flows in fissures on the groundwater variations. The rainfall experiment was conducted on a representative plot of about 120 m^2 (7 x 14 m) for 2 periods of 4 days with 2 different intensities (13 mm.h^{-1} for the first experiment, 18 mm.h^{-1} for the second experiment). Geophysical (electrical resistivity, P-wave velocity), hydrological (soil water content, soil suction, soil temperature, groundwater level, water discharge) and hydrochemical parameters (water quality, water conductivity) were observed before, during, and after the rainfall experiments at several locations

within the experiment plot.

The objective of this work is to present the results of the geophysical measurements. These measurements were performed with a 3 hours time resolution during the rain experiments. The acquisition system involved 48 channels seismic equipment featured by 40 Hz geophones and a handy-hammer source. Electrical equipment was constituted by 48 electrodes designed according to a Wenner-Schlumberger configuration.

The results can be considered in two complementary objectives. First, the structure and the mechanical behaviour of the mudslide can be described by using seismic first-breaks tomography. The distribution of P-wave velocities along a vertical section shows with a relatively good resolution the location of the bedrock (high velocity values) in depth, so that the overburden unstable materials (low velocity values) can be easily identified. On the other hand, no traveltime difference induced by the increasing saturation of the soil was observed, indicating that seismic wave propagation cannot be used alone to monitor water flows at the site scale.

Apparent resistivity data have been inverted in a time-slice approach with Res2DInv. Time variation of true resistivity up to - 20 Ω.m are observed during the rainfall test. The accuracy and confidence in depth of the resistivity are carefully evaluated. These time variations appear to be well correlated to water level and soil moisture variations.

This contribution is complementary to the work presented by Grandjean et al. on the Draix landslide experiment started in initial unsaturated conditions.