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Hydrogeophysical monitoring of water flows in a shallow landslide: the Laval infiltration test 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 4 days on an shallow landslide developed in black marls (Laval slide in the South French Alps). This shallow slide (of 3 to 4 m depth) is characterized by unsaturated conditions within most of the year, and the build up of positive pore pressures at the toe essentially during the winter and spring season. The objective of the experiments is to analyse the hydrological system and to quantify the partition between Darcian matrix flow and preferential fissure flows in the infiltration process. The rainfall experiment was conducted on a representative plot of about 120 m2 (7 x 14 m) for 4 days with a rainfall intensity of around 15 mm.h-1. The soil profile is in initial unsaturated conditions at the start of the 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 experiment 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 experiment. 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 comple-

mentary 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. Electrical resistivity data have been inverted in a time-slice approach with the RES2SINC software. Time variations of resistivity are observed during the rainfall test. These time variations, of around 20%, are organized according anomalies spreading widely at the surface and sinking to a deeper and restricted zone. These anomalies appear to be well correlated to water level and soil moisture variations. The seismic and electrical experiments have shown potentialities for studying both the structure and the water flows within the soil profile. Further works will be done to analyse these data with hydrological, hydrochemical, geomechanical and geomorphological observations and to model the hydrology of the landslide. A contribution to this work is presented by Travelletti et al. with a rainfall experiment conducted in nearby saturated conditions on the Super-Sauze mudslide.