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High-resolution geophysical and hydrological observations of surface and subsurface dynamics at the slow-moving Super-Sauze landslide (South French Alps)

Sabrina Rothmund (1,2), Marco Walter (1), Jean-Philippe Malet (2), and Manfred Joswig (1)

(1) Institute for Geophysics, Universität Stuttgart, Stuttgart, Germany (sabrina.rothmund@geophys.uni-stuttgart.de), (2) Institut de Physique du Globe de Strasbourg, CNRS UMR 7516, Université de Strasbourg, France

The Super-Sauze landslide (Southern French Alps) is completely water-saturated in spring after the snowmelt, and is drying out in the uppermost layer (2 m) in summer. The decrease of water saturation in the topsoil, the drainage of the groundwater table and the displacement rate (of nearly 0.01 to 0.04 $m.day^{-1}$) causes fissures development at the surface. These fissures, which are characterized by different specific orientation, distribution, opening and clogging, are very often located in the same parts of the landslide and their spatial pattern reflects the interactions between the rheology of the sliding material and the bedrock topography. These fissures have opposite effects on the dynamics of the landslide, either destabilizing by conducting rain water to the groundwater table or stabilizing by dissipating pore water pressures in extension zones.

The fissures can be detected and mapped in very high-resolution UAV-based aerial images. In addition, small impulsive signals in the subsurface caused by stress relief or fissure development can be detected by nanoseismic monitoring.

To better understand the mechanism underlying the landslide dynamics, the relationship of small fracture processes with slope movement, fissure developments and pore water pressure build-up has been investigated. For this purpose a multi-technique and high-resolution monitoring campaign was performed for eight weeks after the snowmelt from late May to late July 2010 over an area of about 10.000 m^2. The surface slope dynamics has been observed by UAV-based aerial images, ground-based optical images, terrestrial laser scanning (TLS), thermal infra-red images as well as permanent and non permanent DGPS. The subsurface dynamics has been monitored by nanoseismic monitoring for fracture processes and electrical resistivity tomography (ERT) for soil moisture analysis. Shallow piezometers provided information of the pore water pressure, and meteorological data were available.

In the middle of the monitoring period (15^{th}June 2010), a heavy-rain event caused many shallow landslides in the surrounding area. This rain event offers an interesting opportunity to examine the short-term extreme effects of rapid rain infiltration on the dynamics of the landslide. First results of surface deformation and water infiltration will be presented.