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Water injection in a landslide: real time hydrochemical and geophysical study

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Temporal analysis of landslides triggering factors highlights parameters intervening on instability at various time scales. Thus, geology and faults are factors of predisposition and it is common to see large slips located on faults zones and guided by these structures. However, these structures are not motionless, since the end of the glacial age, toppling movements are led by these structures, playing an important part on slope destabilisations. Toppling movements, accentuated by water action on the massive or by ground vibrations can cause great landslides. We propose here to study during time the relations between hydrology and structure of an unstable slope in order to determine causes and mechanisms leading to destabilization. We have as studied site, an active part of the La Clapière landslide (Alpes Maritimes, France) on which we study both hydrochemical and geophysical survey.

A first study highlights the geometrical relations existing between the groundwater flowpaths of the slope and its structure. It also showed that water contained in the massive has several origins and is spatially distributed through different ways: in the form of drains and perched watertable. However, these results did not inform clearly about the dynamics of the slope. We thus kept our study protocol while proceeding to a forced water injection in the slope and to a real time measurements follow-up.

The purpose of this injection is first, to confirm the drainage modes within the massive and second, to evaluate water action in this slope destabilization.

The obtained results show clearly that slope response to a hydraulic solicitation is double:

- A fast response characterized by an effective drainage in ruptures and fault zones: the massive is difficult to saturate by cause of a great difference in permeability between slipped masses and shearing zones

- A shifted response consecutive to the rainwater drainage by the overall slope: results in a deep water flow guided by tectonical discontinuities of the massive. This contribution is able to saturate the massive, contributing to the toppling phenomenon and consequently to the evolution of the surface slide movement.