Rainfall Destabilization of a Clay-Rich Slope (Avignonet OMIV observatory) : hectometric analog of a sliding interface

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Abstract

The Avignonet landslide is an active clay landslide near Grenoble, France, and therefore one of the monitored site of OMIV observatory. Previous geophysical investigation, including borehole drilling and surface geophysics proved that the landslide deformation is accommodated by several localized shear zones. The shallowest shear zone is about 5 m deep and extends over 100 m.

Several sensors monitor the landslide. They record several precursors prior to a major disturbance of the landslide in autumn 2012, that affects all sensors in the landslide for several months. After major rainfalls, the two piezometers located near the 5 m deep interface got larger impulsional response to rainfall. The moderate rainfalls of Oct 26th caused the hydraulic head both reached a plateau before experiencing a sudden change, triggered by the small rainfall of Oct 31st. It's not the bigger rainfall that induced the disturbance. It was not the first rainfall neither.

Other sensors suggest that the destabilization of the landslide was progressive. Spontaneous potential sensors regularly spaced within the 100 m wide sensors begin to separate after Oct 28th, suggesting a landslide wide precursor. Repeated microseismic events, of high frequency, suggesting a local origin, are more frequent. Their occurrence peaks after the small rainfall of Oct 29th and again on Oct 31st, before the rainfall that triggered the disturbance. They stop at the same time as sudden change in piezometric data.

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Despite the lack of displacement sensor, it is assumed that the 5 m deep shear zone slipped on Oct 31st, since it affects the piezometer sampling this interface. The data shows a progressive path towards destabilization. Especially, triggering of the landslide disturbances is associated to the cumulative effect of seismic activity and rainfall, even minor. This suggests a hydromechanical process.