Geophysical Research Abstracts
Vol. 20, EGU2018-13201, 2018
EGU General Assembly 2018

Seismic characterization of clay- block ruptures in the Harmalière landslide (French Western Alps)

Sylvain Fiolleau, Denis Jongmans, Grégory Bièvre, Agnès Helmstetter, Pascal Lacroix, and Laurent Baillet
Université Grenoble Alpes, ISTerre, France (sylvain.fiolleau@univ-grenoble-alpes.fr)

Many regions of the world are exposed to landslides in clay deposits, which pose major problems for land management and population safety. The activity of clayey landslides is complex, showing a succession of periods of inactivity and reactivation phases that can evolve into sudden acceleration and catastrophic slides and/or flows. The understanding of the processes controlling this activity thus requires the continuous monitoring of specific parameters. In late June 2016, the Harmalière clayey landslide (located 30 km south of the city of Grenoble, French Alps) was dramatically reactivated at the headscarp after a 35-year long period of continuous but limited activity. The total involved volume, which moved as sliding blocks of various sizes, was estimated to about 3 106 m^3. Several sensors, including seismometers and GNSS stations, were installed immediately at the rear of the main headscarp in early July 2016. They recorded two further rupture events with volumes of a few hundreds of cubic meters in late 2016 and 2 500 m^3 in early 2017. These permanent measurements were supplemented by geophysical and geotechnical data. Complementary records (seismology, meteorology, piezometry, etc.) were provided by data from a permanent observatory located a few hundred meters away in the neighbouring Avignonet landslide (RESIF 2006). The kinematics of the Harmalière landslide was further characterized by aerial LIDAR and correlation of Sentinel-2 satellite images.

This work aims to better understand the rupture mechanism of the sliding blocks at the head-scarp from this exceptional database, analysing the seismic records. For each rupture event, a three-component seismic sensor was located on the collapsed block. The spectral characteristics of the signals (amplitude, frequency, polarization) were analysed, as well as the seismic velocity deduced from noise cross-correlations with two sensors installed, on the block and a few meters away (first rupture). For the first rupture, the 4-month analysis showed a continuous increase in the block natural frequency (from 8 Hz to more than 9 Hz), which seems to be related to meteorological fluctuations. Just before the rupture, a drop in frequency and in the surface wave velocity variation ($\frac{dV}{V}$) between sensors was observed. For the second rupture, the relationship with meteorological fluctuations is also observed. However, the natural frequency evolution was more difficult to establish, probably because of the numerous small rupture events preceding the main rupture.