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Significance and interest of dense seismic arrays for understanding the mechanics of clayey landslides: a test case of 150 nodes at Super-Sauze landslide

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Clayey landslides present various seismic sources generated by the slope deformation (rockfall, slidequakes, tremors, fluid transfers). However, the characterization of the micro-seismicity and the construction of advanced catalogs (classification of the seismic source, time, and location) are complex for such objects because of the variety of recorded signals, the low signal to noise ratios, the highly attenuating medium, and the small size of the object that limits the picking of the P and S-waves. A full understanding of the seismic sources is hence often difficult because of the few number of seismometers, the large distance source-to-sensor (> 50m) and because of the lack of a continous spatially distributed record of the slope deformation.

Recent progress in the geophysical instrumentation allowed the deployment of a dense network of 150 ZLand nodes (Tesla Corp.) combined with a Ground-Based InSAR sensor (IDS, IBIS-FM) for a period of ca. 2 months at the Super-Sauze clayey landslide (South French Alps). The Zland nodes are vertical wireless seismometers with 12 days autonomy. Three nodes were co-located at 50 locations in the most active part of the landslide and above the main scarp with a sensor-to-sensor distance of ca. 50m and a sample frequency of 400Hz. The Ground-Based InSAR sensor was installed in front of the landslide at a distance of ca. 800m and acquired an image every 15 minutes. The seismic events are detected automatically based on their spectrogram content with Signal-to-Noise Ratio (SNR) larger than 1.5 and automatically classified using the Random Forest algorithm. The landslide endogenous sources are then located by optimization of the inter-trace correlation of the first arrivals.

This experiment aims to document the deformation of the landslide by combining surface and in depth information and provides a new insight into the seismic sources interpretation. The spatial distribution of the deformation is compared to the location of the endogenous seismic events in order to analyze seismic vs. aseismic deformation.