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Joint analysis of the seismic and geodetic signatures of the large and rapidly developing Pas de l'Ours landslide – Queyras, French Alps

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The "Pas de l'Ours" landslide, located in the Queyras valley (Southeast France) is undergoing a fast deformation since Spring 2017. This landslide is located 400m upstream of the village of Aiguilles and a sudden acceleration may provoke a landslide dam in the Guil river.
The landslide has developed in unconsolidated schists and moraines. The total moving mass is estimated at 17 million cubic meters, with a width of the unstable area of 1 km and a length of 600 m, which makes it currently one of the largest active landslides in the French Alps. Since April 2017, numerous rockfalls, mudflows and large deformation of the slope and the road at the foot of the landslide have been observed.
Several instruments have been deployed on site to monitor the landslide evolution. Among them a Ground-Based SAR able to measure the deformation field every 2 minutes and four broadband seismometers are operating since May 2017. The instruments monitored the end of the acceleration period in May/June 2017, the deceleration of the landslide in summer and transient peaks of acceleration linked to some rainfall events in Autumn.
We here present the results of the joint analysis of the two datasets. The displacement rate of the slope reaches a velocity of 1m.d-1 and decelerates progressively to a stabilization of the landslide at the beginning of July 2017. A catalogue of the seismic signals generated by the landslide is built using machine-learning techniques. After an automatic detection performed on the spectrogram energy, the classification is automatically achieved with the Random Forest algorithm trained on the first month of measure. The occurrence of the signal events is compared to the spatio-temporal evolution of the surface deformation. The number of micro-seismic events seems to decelerate with the displacement rate of the landslide.