ICNEM
International Conference on Nonlinear Elasticity in Materials

Contribution ID: **29** Type: **not specified**

Decennial Monitoring of the Séchilienne Landslide with Seismic Noise

Wednesday 16 July 2025 17:00 (15 minutes)

Landslides are difficult to predict and can therefore be a serious threat to populations and infrastructures. Understanding landslide processes and their precursor parameters is an important challenge for scientists and for public managers. Landslide monitoring is essential for determining the hazard associated with the unstable slopes. Computing seismic velocity changes from ambient seismic noise has been proven an effective tool for landslide monitoring. Before failure, a drop in rigidity in the landslide leads to a decrease in shear wave velocity, creating a potential precursory signal that can be retrieved by seismic interferometry (1).

An important step is distinguishing these precursory signals from environmental influences on seismic velocities, which are often observed. Seismic velocities can vary nonlinearly with stress and strain due to the behavior of fractured and unconsolidated slope materials. Small changes in external factors, such as groundwater level or temperature, can induce measurable changes in seismic velocity, potentially complicating the interpretation of precursory signals.

The Séchilienne landslide, located 25 km southeast of Grenoble, has been instrumented with broadband seismic stations since 2013 (2). We use this extensive dataset to compute relative seismic velocity changes from ambient seismic noise over a period of 10 years. We observe seasonal cycles (Figure 1) that could be caused by groundwater fluctuations inside the landslide. The seasonal cycles are best visible in low frequency ranges. Surface wave sensitivity kernels show these frequencies correspond to the lower part of the fractured layer of the landslide. No significant velocity drop was observed, which is coherent with no observed sudden acceleration within these 10 years.

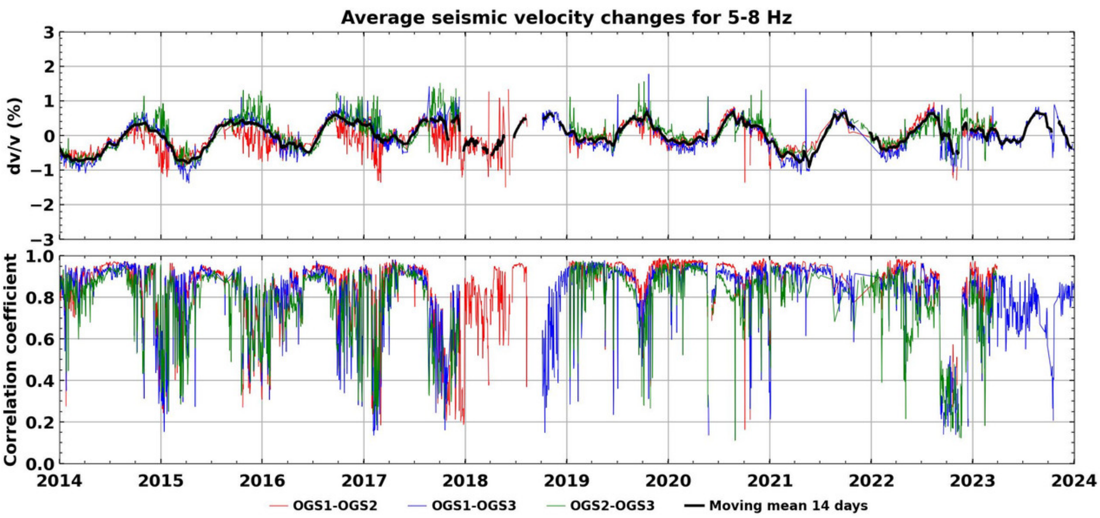

Figure 1: Relative seismic velocity curve between 5 and 8 Hz showing clear seasonal trends.

(1) Mainsant, G., E. Larose, C. Brönnimann, D. Jongmans, C. Michoud, and M. Jaboyedoff (2012), Ambient seismic noise monitoring of a clay landslide: Toward failure prediction, J. Geophys. Res., 117, F01030, doi:10.1029/2011JF002159.

(2) Seismic data have been acquired by the French National Landslide Observatory (OMIV), and are available at doi.org/10.15778/RESIF.FR and doi.org/10.15778/RESIF.MT

Primary author: WIENK, Imme (ISTerre (CNRS), University Grenoble Alpes, Grenoble, France)

Co-authors: GUILLEMOT, Antoine (Geolithe - Crolles - France); RADIGUET, Mathilde (ISTerre (CNRS), University Grenoble Alpes, Grenoble, France); HELMSTETTER, Agnès (ISTerre (CNRS), University Grenoble Alpes, Grenoble, France); LAROSE, Eric (ISTerre (CNRS), University Grenoble Alpes, Grenoble, France)

Presenter: WIENK, Imme (ISTerre (CNRS), University Grenoble Alpes, Grenoble, France)

Session Classification: Nonlinearity for environmental monitoring

Track Classification: Nonlinearity for environmental monitoring