



## **Automatic classification of mass movement seismicity at Illgraben, Switzerland**

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In mountainous areas, mass movements such as rockfalls, rock avalanches and debris flows constitute a risk to properties and human life. Over recent years, seismology has evolved into a standard tool to study temporal and spatial variability of such events. Increasing data volumes and the demand for near real-time monitoring call for automated techniques to detect and classify seismic signals generated by mass movements.

Here, we make use of seismic data recorded by a network of eight stations at the Illgraben catchment in Switzerland. The Illgraben catchment is one of the most active mass wasting sites in the European Alps, with numerous rock-slope failure events and several debris flows per year. Due to the variety of source mechanisms generating the recorded seismic signals, an automatic classification is crucial for a rigorous study of mass wasting.

We apply the random forest algorithm (RF), a supervised machine learning algorithm, to perform the classification task. RF is based on a majority vote of several decision trees and was chosen because of its efficiency and straightforward implementation. For the classification problem, we define four different classes, including rock avalanches and earthquakes. The training and test set consist of a manually picked seismic event catalog with several hundreds of events per class. To train the classifier, each seismic signal is represented by a dozen of features in the time as well as the frequency domain. The inclusion of network attributes (e.g. arrival time differences between the stations), improved the classification accuracy to over 90%. The trained model was used to create a complete event catalog of two seismic deployments in 2017 and 2018. The catalogs allow correlation of the mass movement activity with meteorological conditions to obtain an insight into triggering mechanisms. With some modifications, our classification method may be suitable for continuous near real-time monitoring.