Geophysical Research Abstracts
Vol. 19, EGU2017-6151, 2017
EGU General Assembly 2017

Automated seismic detection of landslides at regional scales: a Random Forest based detection algorithm for Alaska and the Himalaya.

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Detection of landslide occurrences and measurement of their dynamics properties during run-out is a high research priority but a logistical and technical challenge. Seismology has started to help in several important ways. Taking advantage of the densification of global, regional and local networks of broadband seismic stations, recent advances now permit the seismic detection and location of landslides in near-real-time. This seismic detection could potentially greatly increase the spatio-temporal resolution at which we study landslides triggering, which is critical to better understand the influence of external forcings such as rainfalls and earthquakes. However, detecting automatically seismic signals generated by landslides still represents a challenge, especially for events with volumes below one millions of cubic meters. The low signal-to-noise ratio classically observed for landslide-generated seismic signals and the difficulty to discriminate these signals from those generated by regional earthquakes or anthropogenic and natural noises are some of the obstacles that have to be circumvented.
We present a new method for automatically constructing instrumental landslide catalogues from continuous seismic data. We developed a robust and versatile solution, which can be implemented in any context where a seismic detection of landslides or other mass movements is relevant. The method is based on a spectral detection of the seismic signals and the identification of the sources with a Random Forest algorithm. The spectral detection allows detecting signals with low signal-to-noise ratio, while the Random Forest algorithm achieve a high rate of positive identification of the seismic signals generated by landslides and other seismic sources. We present here the preliminary results of the application of this processing chain in two contexts: i) In Himalaya with the data acquired between 2002 and 2005 by the Hi-Climb network; ii) In Alaska using data recorded by the permanent regional network and the USArray, which is currently being deployed in this region. The landslide seismic catalogues are compared to geomorphological catalogues in terms of number of events and dates when possible.