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Landslide induced seismicity: near real-time detection and characterization using regional seismic networks

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Landslides are prominent geomorphological phenomena, causing every year a large number of damages and casualties. Monitoring strategies based on in-situ and remote sensing techniques have demonstrated their effectiveness to quantitatively evaluate landslide hazard at different spatial and temporal scales. In this context, recent studies have shown that broadband seismic networks may record the ground vibrations induced by distant landslide phenomena. By analyzing landslide-induced seismicity it is possible to obtain significant information on the source of the mass wasting, as well as on its dynamics.

In this work, we propose a new approach to detect, locate, and characterize rockslides in real-time, by considering waveforms acquired from broadband regional seismic networks (i.e. available in the European Integrated Data Archive, EIDA), and adapting algorithms originally developed for earthquake early warning.
In particular, we have exploited the detection and location algorithms implemented within the PRobabilistic and Evolutionary early warning SysTem (PRESTo, http://www.prestoews.org/).
The discrimination of signals generated by rockslides from other sources, such as natural and/or induced earthquakes, is performed by exploiting the ratio between local magnitudes (ML) and duration magnitudes (MD). Remarkably, we found that signals associated to rockslides show ML/MD<0.8, while by definition for earthquakes is ML/MD $\cong$ 1. In addition, we derived an empirical law between MD and rockslide volumes that allows obtaining a preliminary characterization of rockslide volumes within seconds from its occurrence. The key-points of this study are presented by testing the hypothesis on a recent rockslide event occurred in northern Italy, and discussing the potential evolution of the methodology for early warning and/or fast response purposes.