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Contribution to prediction of Landslides from seismic wave analysis - Locating, monitoring, and characterizing the main events recorded by seismic stations in Colombia.

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In the Medellin Valley of the Colombian Andes have occurred a lot of landslides and down-hill mass-movements in general, with variable magnitudes. Between 1880 and 2007 6750 events have been recorded, from which 35% are mass movements, and the most populated municipalities in the Valley are the ones that concentrate most of the damage, e.g. Medellin, with 72% of the events and 2'223.660 inhabitants **(Aristizabal & Gomez, 2007)**.

Prediction of mass movements has been a topic of study for several decades; it is necessary to study the mechanisms that trigger them, such as intense and/or prolonged rainfall, rapid melting of snow and/or permafrost, earthquakes, volcanoes, as well as a variety of anthropic activities that trigger this natural processes. Seismology could be a tool to understand and monitor these phenomena; recent studies have shown that the mechanics of these slope processes is such that they have a distinctly different spectral signature to that of earthquakes, meaning that very large events can be detected using global-scale broadband seismic networks; this provides the possibility of the remote detection of large phenomena **(Deparis, 2008; Kao, 2012; Coviello, 2015; Feng, 2016)**. The analysis of seismicity induced by a mass movement may provide significant information about their type, dynamics, volumes and velocity of the event **(Brodsky, 2003; Deparis, 2008; Helmstetter, 2010)**. However, our understanding of the seismic signal of large landslides remains poor, the studies of using broadband seismic recordings to trace the evolution of slope processes events in time and space, and strategies for automatic detection and characterization within an operational and real-time framework, are still challenging, there exist some hypotheses that could open a research path in this direction, e.g. measurements of basal friction for dynamical predictions of landslides **(Brodsky, 2003)**, and controlled experiments that capture the emitted seismic waves in order to study and distinguish between different landslide phases: pre-, during and post-failure **(Yfantis, 2013)**.

The RSNC (National Seismological Network of Colombia from its Spanish acronym) run by the Colombian Geological Survey, is part of the National System for Disaster Prevention and Attention; there has been seismic monitoring since 1993, and currently there are nearly 50 broad band stations operating in Colombian territory. Using a list of landslides in Colombia and their time of occurrence, it could be possible to establish what stations could record information about the event and use them to study the record's behavior pre-, during and post-event. This could be the first step on a research process to contribute in to the study of detection, location, classification, characterization and prediction of landslides in Colombia; the objective is to use this information for the first time, trying to evaluate how many large events occur in average per year, when and where they happen, and aiming for a practical application of a well-developed system that can give early landslide warnings.

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