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Landslide micro-seismicity: description and classification of endogenous seismic sources

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In the last decade, numerous studies focused on the analysis of seismic waves generated by Earth surface processes such as, for instance, mass instabilities. At close distances, the installation of seismometers on unstable slopes demonstrated a variety of endogenous seismic signals suspected to be generated by slope deformation, weathering of the slope material or fluid circulation. The complexity of the underground structure, and its spatio-temporal variability (due to changes in the topography, variation of the water content, etc.) and the low magnitude of the sources (ML<0) are currently challenging to analyse the seismic signal with traditional seismological approaches. Moreover, despite a growing attention on these questions, the classification of the recorded seismic signals varies for each study. The latter prevents currently to establish a more robust interpretation of the processes generating the recorded seismic signals.

Taking profit of the growing number of instrumented slopes (mainly in the European Alps), we aim to propose a typology of the sources generated by landslides deformation. The possible mechanisms of the seismic sources are also discussed.

The datasets of 15 sites are gathered in the present study. The sites are representative of the various types of movement (i.e. slide, fall and topple, and flow) and rocks (i.e. consolidated to unconsolidated rocks). The seismic networks are similar enabling comparison of the recorded seismic signals. Different signal properties are taken into account such as the duration, the spectral content, the spectrogram shape and the polarization. The influence of the source to distance sensor and the source size are carefully discussed.

Finally, similar signals recorded at different sites present the same characteristics and the analysis of the several sites is pertinent to infer the different source(s) mechanism(s). The proposed typology aims to serve as a reference and framework for further comparisons of the endogenous micro-seismicity recorded on mass instabilities.