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# Inverting for centroid moment tensors for volcanic and induced seismic events

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Long period seismic signals (lp-events) may be important indicators of fluid or magma movement within a volcano. Their analysis is vital for the monitoring of an active volcanic region towards the estimation of the eruption hazard or volcanic unrest. We have built a tool to include such an analysis as a package in the newly developed multi method volcano early warning system (Project 'Exupéry').
In order to be suitable for such an early warning system, the method has to be operating reliably and automatically in (near-) real-time. Based on experiences with fast analysis applications for tectonic events, which have already proven to be functional, we have set up an algorithm, which is optimised with regard to the work on local volcanic seismic data.

In the case an lp-event is identified by the detection and classification package of the fast response system, an algebraic inversion combined with a grid search over possible source points is carried out, yielding a full centroid moment tensor solution with source location and time.
The inversion is based on a set of Green's functions (GFs), which take into account both the local or regional seismic velocity model and information about the topography. The GFs are calculated beforehand and are stored within a database, allowing a very fast data processing. Since the resulting solution is highly depending on the quality of the GFs, an optimal adjustment of the GFs set is a vital point in the setup of the program. Therefore the comparison of several one- and three-dimensional GFs is discussed.

Although mainly designed and suited for the use on volcanic seismic data within the early warning system, the modular structure of the tool enables autonomous use for different applications. For example it can be used to study induced seismic events at a regional scale, if suitable GFs are available. The flexibility of the autonomously working tool is shown by presenting results of applications on local volcanoseismic data and on regional seismic data for an induced earthquake respectively.