



WP 2.1 Decomposition of Icelandic seismicity: developed software and scientific results

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The complex spatio - temporal occurrence of earthquakes is usually visualized as a map of epicentres for a given period of time. Most seismicity patterns are described in this way in the literature. This simple space-time representation might not be sufficient to describe seismicity, however. Subtle (possibly precursory) patterns may be hidden by other more dominant patterns for example.

We use Principle Component Analysis (PCA) to decompose seismicity into it's eigen-patterns in order to separate the superimposed patterns. Within the PREPARED project we developed a software package which comprises the complete workflow of a PCA decomposition. This includes the import of earthquake catalogue data, spatial and temporal gridding as well as PCA and visualization. Additional capabilities to evaluate the decomposed constituents in terms of, e.g., significance and spatial coherency are included. As an alternative to PCA, seismicity may be decomposed into independent constituents using Independent Component Analysis (ICA).

Analysing Icelandic seismicity we show that the constituents of the PCA decomposition are physically significant. They can be attributed to various seismic sequences. Most important is the identification of background activity as the pattern common to all time periods. We demonstrate the usefulness of a PCA decomposition to reconstruct the seismicity in Iceland prior to the two $M_s=6.6$ earthquakes in June 2000. A concentration of earthquake sequences that exceed the background level can be observed in South Iceland after 1999. The Signal that directly preceded the 2000 events on a half yearly basis is a seismic sequence associated with the eruption of Hekla volcano in February 2000.