Contribution of continuous waveform processing to induced seismicity realtime monitoring during geothermal stimulation at Geldinganes, Iceland.

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At Geldinganes Island, Reykjavik, Iceland a hydraulic stimulation was recently conducted to enhance the productivity of an existing hydrothermal well. An experimental cyclic soft stimulation concept was applied. Seismic risk was assessed with an appropriate monitoring network which was set up and operated before, during, and for some time after the stimulation activities. An advanced traffic light system was developed and operated for the first time in this setup.

A crucial element in such traffic light systems is the real-time monitoring of background and induced seismicity. During the experiment, real-time seismograms from the monitoring network were streamed over the internet to three different institutions (ISOR, ETHZ and GFZ), where they were analysed independently, with different combinations and setups of automatic, semi-automatic and manual methods. Both, classic pick based approaches and modern full-waveform methods were applied. Locations, magnitudes, and centroid moment tensor solutions were determined.

Many things can go wrong in real-time or near-real-time processing of seismic data. Sensor failures, transmission failures, timing issues, processing hardware failures, computational limitations, software bugs and human error, just to name a few. In a temporary network the challenges are additionally salted by the need to validate sensor responses, orientations, gain factors and site conditions in a short time frame between station setup and beginning of the experiment. Furthermore, tuning of advanced analysis methods can be difficult without example events at hand.

In this contribution, we would like to share our lessons learned in near-real-time processing of
data from a heterogeneous temporary seismic network.