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Automatic processing of induced events in the geothermal reservoirs Landau and Insheim, Germany

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Induced events can be a risk to local infrastructure that need to be understood and evaluated. They represent also a chance to learn more about the reservoir behavior and characteristics. Prior to the analysis, the waveform data must be processed consistently and accurately to avoid erroneous interpretations.
In the framework of the MAGS2 project an automatic off-line event detection and a phase onset time determination algorithm are applied to induced seismic events in geothermal systems in Landau and Insheim, Germany.

The off-line detection algorithm works based on a cross-correlation of continuous data taken from the local seismic network with master events. It distinguishes events between different reservoirs and within the individual reservoirs. Furthermore, it provides a location and magnitude estimation.

Data from 2007 to 2014 are processed and compared with other detections using the SeisComp3 cross correlation detector and a STA/LTA detector. The detected events are analyzed concerning spatial or temporal clustering. Furthermore the number of events are compared to the existing detection lists.

The automatic phase picking algorithm combines an AR-AIC approach with a cost function to find precise P1- and S1-phase onset times which can be used for localization and tomography studies. 800 induced events are processed, determining 5000 P1- and 6000 S1-picks. The phase onset times show a high precision with mean residuals to manual phase picks of 0s (P1) to 0.04s (S1) and standard deviations below $\pm$0.05s.
The received automatic picks are applied to relocate a selected number of events to evaluate influences on the location precision.