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Automated detection of microseismic events in the Upper Rhine valley near the city of Landau/South Palatinate

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The Upper Rhine valley in south-western Germany and especially the southern part of Rheinland-Palatinate is one of the regions with the highest potential for deep geothermal power generation in Germany. One geothermal power plant is operated since 2007 in the city of Landau and a second power plant will get operational in 2012 near Insheim (~4 km south-east of Landau). Furthermore, several geothermal power plants are currently projected in this region. In 2009 two earthquakes with magnitudes (ML) of 2.4 and 2.7 occurred in direct vicinity of the geothermal reservoir in Landau and were felt in a radius of several kilometers (intensity up to V+). Furthermore, two earthquakes with magnitudes (ML) of 2.2 and 2.4 occurred during the stimulation of the reservoir near Insheim in April 2010 and were also felt by most of the local inhabitants. After the unexpected strong seismicity in 2009 a temporary seismic network was deployed and is continuously extended by the Geophysical Institute of the Karlsruhe Institute of Technology to improve the microseismic monitoring of the region around Landau. The network consists currently of 12 surface stations of the KARlsruhe Broad Band Array (KABBA) and will be extended by two shallow borehole stations in 2012. Main challenge of the monitoring is the detection of microseismic events with a magnitude (ML) below 1 due to the high seismic noise conditions in the densely populated Upper Rhine valley. The application of established short term/long term average trigger algorithms is not feasible due to the large amount of transient signals caused by human activity (e.g. traffic). We present our procedure for the automated detection of microseismic events based on a combined cross-correlation and correlation coefficient analysis with known seismic events. Up to now several hundred microseismic events (ML>-0.5) could be detected which are related to the geothermal reservoirs below Landau and Insheim. For both reservoirs we observe clusters of earthquakes with highly similar waveforms (correlation coefficient larger than 0.9) which indicates a repeated occurrence of microseismic events with similar focal mechanisms and hypocenters. The next step in the analysis is the absolute and relative localisation of the detected microseismic events with a magnitude (ML) below one. This study is part of the research project MAGS (Microseismic Activity of Geothermal Systems) and funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany due to an enactment of the German Federal Parliament (Bundestag).