Geophysical Research Abstracts
Vol. 15, EGU2013-2742, 2013
EGU General Assembly 2013

Microseismicity at two geothermal power plants at Landau and Insheim in the Upper Rhine Graben, Germany

Jörn Groos, Jens Zeiß, Michael Grund, and Joachim Ritter
Karlsruhe Institute of Technology (KIT), Geophysical Institute, Karlsruhe, Germany (joern.groos@kit.edu)

The Upper Rhine Graben in south-western Germany and especially the southern part of Rhineland-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 since Oct. 2012 near Insheim (∼4 km south-east of Landau). Further 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 below Landau (depth ∼3 km) and were felt within a radius of several kilometres (intensity up to V+). Furthermore, two felt earthquakes with magnitudes (ML) of 2.2 and 2.4 occurred during the stimulation of the reservoir near Insheim in April 2010. Therefore, a temporary seismic network was deployed and is continuously extended by the Geophysical Institute of the Karlsruhe Institute of Technology with 12 stations (surface and shallow borehole) of the KArlsruhe Broad Band Array KABBA. In total more than 35 stations are operated by four operators for the microseismic monitoring of the region around Landau.

The main challenge of the monitoring is the detection of the microseismic events with a magnitude ML below 1 due to the high seismic noise conditions in the densely populated Upper Rhine Graben. The application of established short-term to long-term average trigger algorithms is not feasible due to the large amount of transient signals caused by human activity (e.g. traffic). We apply an automated detection of microseismic events based on a combined cross-correlation and correlation coefficient analysis with known seismic events. The detected events are localized for absolute (HYPOSAT) and relative (hypoDD) hypocentres. Furthermore, we determine the peak ground velocities and vibration intensities after the German standard (DIN 4150-2 Structural vibration: human exposure to vibration in buildings) to evaluate the perceptibility of the shallow seismic events with ML<2.

Up to now (Dec. 2012) more than 600 microseismic events (-0.5 < ML < 2.7; 2009-2012) could be detected which are related to the geothermal reservoirs below Landau and Insheim. The events occurred during circulation (Landau, 2009-2012; Insheim since Oct. 2012) as well as stimulation (Insheim, April 2010). For both reservoirs we observe clusters of earthquakes with highly similar waveforms (correlation coefficient larger than 0.9) which indicate a repeated occurrence of microseismic events with similar focal mechanisms and hypocenters. At Landau the earthquakes are located north-west and close to the landing point of the injection well. The comparison of event magnitudes, measured peak ground velocities (PGV) and the obtained maximum vibration intensities indicates that shallow (2-4 km) seismic events as weak as ML ∼1.3-1.5 can be felt by the population in Landau.

This study is part of the research project MAGS (Microseismic Activity of Geothermal Systems) which is funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany (FKZ 0325191A-F) and supervised by Projektträger Jülich (PT-J).