Monitoring of microseismic activity around the GeneSys deep geothermal drilling site, Hannover (Germany)

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In the framework of the GeneSys-project (Generated Geothermal Energy Systems) a borehole was drilled at the Geozentrum Hannover down to a depth of 3900 m. The aim of the project is to extract geothermal energy from one single borehole to heat the buildings of the Geozentrum. The borehole is drilled in mid-triassic sandstone formations of the Northern German Basin.

Collaterally to the drilling and the upcoming heat production phase BGR has installed a seismic network around the drilling hole to monitor and analyze possibly induced seismic micro-events, especially induced by the hydraulic fracturing activities which are planned in the beginning of 2011. Altogether, the network consists of 13 seismometers or geophones respectively. 5 geophones are installed in 100 m deep boreholes and build the inner circle of the network within a radius of approximately 1 km around the geothermal borehole. A second circle with a radius of 4 km is equipped with 1 Hz seismometers. Two additional geophones are installed in boreholes of 180m depth.

Due to the position of the borehole in direct vicinity to the major city of Hannover and several highways nearby the noise conditions are relatively bad for the detection of small seismic events. The noise conditions as well as the position of Hannover in a more or less aseismic area allows us to detect only a few seismic events up to now. These are for example a controlled detonation of an aircraft bomb in a distance of about 3 km or mining induced events of magnitude 3.5 - 4.0 in the Polish mining area. The only event which is directly connected to the geothermal project and we have detected so far, is the recording of the perforation shoot which took place at a depth of 3706 m on the 20th June 2010.

In the poster we present the design of the seismic monitoring system, the data flow as well as an automatic detector which is tested on the data streams to detect small events in case of difficult signal-to-noise conditions. Furthermore, we show some data examples, an estimation of the sensitivity of the network and we compare the conditions of the GeneSys-borehole with those of other geothermal projects in Germany.