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Microseismic monitoring in the northern Upper-Rhine Graben

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The seismicity of the Upper-Rhine Graben and its seismic hazard have recently attracted new attention due to the potential of this region for geothermal power generation. Detailed knowledge of the natural seismicity is necessary to determine active fault zones and stress conditions within the crust. It also provides important background information for the estimation of possible induced seismicity. The relationship between natural and induced seismicity is the focus of the project SiMoN (Seismic Monitoring of the Northern Upper-Rhine Graben), which is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). One goal of the project is an improved characterization of the natural seismicity within the region, well in advance of any planned drilling activities. A recently installed network consisting of 12 seismic broad-band stations is designed to provide the necessary data base and, in a second step, to monitor the planned heat-mining activities. The data will be used to correlate geological, tectonic and hydraulic boundary conditions with the possible induced seismicity and, thus, provide constraints on triggering mechanisms. The network covers an area of approximately 30 km by 30 km and is located in the northern Upper-Rhine Graben south of the Taunus Mountains within the densely populated Rhine-Main region. We also show results from a pilot study to the SiMoN project which helped to identify suitable station sites and from which first conclusions on the local micro-seismic activity were drawn. 12 seismic stations were operated between November 2010 and September 2011. During this period, a total of 41 events were located, of which about 14 events occurred within the immediate vicinity of the network. The detection threshold was a local magnitude of approximately 1.0; earthquakes within a magnitude range of 0.9 to 4.4 were recorded. The majority of the epicenters are located to the northwest of the study area, as well as in the Wiesbaden/Taunus area and on the eastern graben shoulder. The seismicity extends to a depth of 21 km with a pronounced maximum in the range between 10-15 km. The associated fault-plane solutions show predominantly strike-slip mechanisms.