



Analysis of seismic noise at the International Geothermal Centre Bochum

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Passive seismic data can contain important information about the subsurface (e.g. velocity, thickness of sedimentary layers, geological structure), subsurface processes (e.g. microseismic events), and anthropogenic (e.g. highway) or natural events on the surface (e.g. wind, landslides). The aim of this analysis is to obtain a first characterization of the noise field at the geothermal site in Bochum. For this purpose we use two three-component broadband seismometers in the vicinity of the International Geothermal Centre and the Ruhr-University Bochum. Later on, the results from this first study will be used to build up a seismic array around the drilling site at the Geothermal Centre. To characterize the ambient seismic wavefield, we use several techniques (some are originally developed for hydrocarbon exploration in Saenger et al. 2009). These techniques are tested on the relatively noisy data influenced strongly by cultural noise. First, to prove the quality of the seismic stations, we estimate power spectral density (PSD) curves and probability density functions. To get a better knowledge about the noise level, we compare the curves with the new high and low noise model (Peterson, 1993). Second, we calculate the PSD-IZ values of the stations over time, where IZ stands for the integral of the vertical component. Third, we calculate different (using quiet data, noisy data and both) HVSRs (horizontal-to-vertical spectral ratios) to estimate characteristic frequencies at the site. And fourth, we perform a polarization analysis of the data over time to get typically values of the dip, azimuth, rectilinearity and the largest eigenvalue. We will use these tools as well for characterization of passive seismic data recorded in Mexico at a super-hot resource near Los Humeros. Our aim is, among others, to estimate the general noise level and to test the sensitivity of the seismic attributes described above to the geothermal reservoir at depth.

Peterson, J. et al. (1993), 'Observations and modelling of seismic background noise', U.S. Geological Survey Open-File Report pp. 93–322.

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