35

Geoelectric measurements as an efficient monitoring strategy for shallow geothermic reservoirs

Firmbach Linda[1], Schelenz Sophie[1], Vienken Thomas[1], Kolditz Olaf[1], Dietrich Peter[1]

[1]*Helmholtz-Zentrum für Umweltforschung GmbH – UFZ, Germany*

In the context of the national energy transformation the utilization of the near surface underground as thermal reservoir gains increasing importance, particularly with regard to the periodic availability of renewable energies, e.g. of wind and solar. With the growing number of shallow geothermal systems being used in the last two decades, discussions arise about potential negative consequences for groundwater and subsurface environment. Up to now, no consistent economic, political or environmental legislation for utilization of geothermal reservoirs exists (Hähnlein et al. 2012). It is generally stipulated that running geothermal plants may not influence the groundwater regime of neighbouring plots. Conversely, there is still no protocol agreement for a reliable large scale monitoring of geothermal systems. Currently, local temperature measurements carried out in the thermal exchangers themselves are the only monitoring data routinely acquired. Such single point measurements do not allow for a realistic assessment of the effect of geothermal reservoir utilization on groundwater and subsurface environment.

Geoelectric measurements could provide spatially continuous information about geothermal reservoir. Temperature-dependence of electrical resistivity may enable the utilization of geoelectric measurements for time and cost efficient geothermal monitoring. The main challenge would be to find the most simple and adequate electrode configurations and arrangements. In order to validate geoelectric measurements as efficient monitoring method, we conduct different experiments. First, the correlation between the temperature and the electrical resistivity shall be analysed on laboratory scale, taking additional influencing parameters e.g., porosity and water content, into account. Knowing the mutual dependencies between these parameters, we can consequently describe the real correlation between the temperature and the electrical resistivity. When monitoring shallow geothermal plants in the field, additional hydrological features of the underground need to be known. Here, we use data predicted by numerical simulations based on the open source software OpenGeoSys for each field site. These parameters can be used in a forward modelling to find the best fitting electrode arrangement and configuration for each field situation.