Geophysical Research Abstracts
Vol. 12, EGU2010-12552-1, 2010
EGU General Assembly 2010

New hydrogeophysical methods examined at the test-site Schillerslage

Raphael Dlugosch, Raphael Holland, Julia Holzhauer, Thomas Günther, and Ugur Yaramanci
Leibniz Institute for Applied Geophysics, Hannover, Germany (Raphael.Dlugosch@liag-hannover.de)

Hydrogeophysical methods have proved to yield valuable information to characterise aquifers. However, in order to obtain reliable hydraulic properties such as porosity and hydraulic conductivity (kf), new methods need to be applied and improved. Among them, spectral induced polarisation (SIP) and magnetic resonance sounding (MRS) are promising, since the data are directly related to pore geometry and therefore storage properties. However, they are susceptible to noise and need methodological improvements.
These methods are evaluated at the new LIAG test site Schillerslage. The subsurface consists of two shallow quaternary aquifers (1-12m and 16-22m depth) separated by a till layer over cretaceous marls as typical in northern Germany. The subsurface structure was investigated by GPR and seismic surveys as well as drilling and borehole geophysics. Kf and porosity values are obtained by pumping tests to access field scale properties; lab kf measurements and grain size analyses to yield these parameters on a small scale.
Laboratory NMR and SIP measurements on core samples can be directly compared to hydrological data. Both methods provide relaxation spectra that are connected to the pore size distribution. With these pore size estimations coarse and fine grained parts of the aquifer can qualitatively be distinguished. For quantification, different approaches for estimating hydraulic conductivity from relaxation times and measured SIP phases are applied. All values are in similar order of the magnitude compared to the directly measured. However, variations of unidentified origin occur too.
Field measurements using MRS and SIP soundings have been carried out in the vicinity of the main borehole. Their inversion reveals the expected general layering. However, there is significant ambiguity in the inversion results that can only be diminished by additional information as known layer boundaries. The calculated porosities are 20-30% by SIP and 25-33% by NMR for the upper aquifer. The kf values range between 1e-6 and 1e-4 m/s for both methods. These results are comparable to the lab results, but still exhibit uncertainties. This is particularly important for SIP, where the phase information is dominated by till and marl. For both methods, spectral approaches inverting the data set as a whole are superior and yield additional knowledge on the pore geometry of the aquifers.
In conclusion, a combined approach of different field data is able to predict hydraulic properties comparable to boreholes. In case of moderate noise conditions, SIP and MRS measurements can be routinely applied. However, a joint interpretation or inversion of different data and existing information is required.