KEYNOTE LECTURE: Recent developments using ERT-derived temperature for monitoring and characterizing aquifers

Nguyen Frederic[1], Lesparre Nolwenn, Klepikova Maria, Alain Dassargues, Jef Caers, Andreas Kemna, Hermans Thomas

(1) University of Liège, Belgium

Groundwater temperature may be of use as a state variable proxy for aquifer heat storage, highlighting preferential flow paths, or contaminant remediation monitoring. However, its estimation often relies on scarce temperature data collected in boreholes. Electrical resistivity monitoring may provide more exhaustive spatial information of the bulk properties of interest than samples from boreholes. One advantage of the bulk resistivity-temperature relationship is its relative simplicity: the fractional change is often found to be around 0.02 per degree centigrade, and represents mainly the variation of electrical resistivity due to the viscosity effect. However, in presence of chemical and kinetics effects, the variation may also depend on the duration of the test and may neglect reactions occurring between the pore water and the solid matrix. Such effects are not expected to be important for low temperature systems (<30 °C), at least for short experiments. In this contribution, we use different field experiments, from 2D to 3D, under natural and forced flow conditions to review developments for ERT to map and monitor the temperature distribution within aquifers, to characterize aquifers in terms of heterogeneity and to better understand processes. We show how temperature time-series measurements might be used to constrain the ERT inverse problem in space and time and how combined ERT-derived and direct estimation of temperature may be used together with hydrogeological modelling to provide predictions of the groundwater temperature field.