Cross-borehole complex geo-electrical monitoring of treatment zone installation in an urban area: Case study from Farum, Denmark

Léa Lévy[1], Thue Bording[1], Anders V. Christiansen[1], Gianluca Fiandaca[2], Rasmus Thalund-Hansen[3], Line Madsen[1], Poul L. Bjerg[3]

(1) HydroGeophysics Group, Department of Geoscience, Aarhus University, Aarhus, Denmark
(2) Department of Earth Sciences "Ardito Desio", University of Milano, Milan, Italy
(3) Technical University of Denmark, Lyngby, Denmark

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We show the results from a pilot project on remediation of groundwater contaminated by chlorinated solvents. The remedial agent used to mitigate the contamination, consists of zero-valent-iron (ZVI) and microbial culture, and was injected in 7 wells in the depth range 13-20 m. Cross-borehole resistivity and time-domain induced polarization (IP) data were measured between nine electrode boreholes installed in the depth range 10-20 m. Seven rounds of data acquisition were carried out between July 2019 and June 2020, including four rounds after injection (August 2019).

We show how cross-borehole geophysical monitoring help evaluate the temporal and spatial distribution of the remediation cloud, composed of two main electrical conductors: ions in pore water, and connected solid iron particles that have yet to be dissolved. We critically discuss our results in light of groundwater and sediments analyses, conducted in parallel.

We also show how IP-based hydraulic conductivity predictions, validated through a comparison with hydraulic conductivity estimations based on numerous grain size analyses, could potentially have helped optimize the injection of remediation agent before-hand.

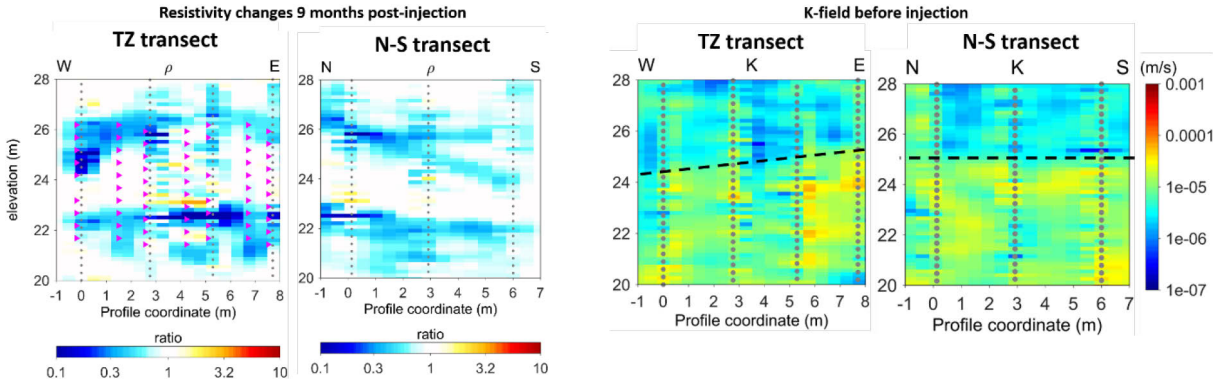

Figure caption: Left and center left panels show time-lapse inversion of resistivity, illustrating changes related to the remediation cloud spreading. Left: transect along the treatment zone (TZ). Center-left: transect perpendicular to the TZ (north-south). Right and center-right panels show hydraulic conductivity field derived from IP Inversion at the same two transects, based on inversion of data measured before injection. A lithological boundary between sandy till and meltwater sands, inferred from the DCIP inversion is emphasized with black broken line.