Time-lapse monitoring of landfill leachate through time-domain induced polarization with temperature corrections

Thue Bording[1], Léa Lévy[1], Gianluca Fiandaca[2]

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

keywords: landfill, temperature correction, time-lapse

We present the results from a year-long geophysical monitoring setup from the now-defunct Pillemark landfill on the Danish island of Samsø. The landfill is located in the vicinity of a waterworks, and it is therefore of great concern that the underlying groundwater aquifer is not being contaminated. Samsø receives a massive influx of tourists in the summer months and as such the groundwater level in the aquifer fluctuates wildly during the year. Given varying hydraulic gradients, we expect that potential leaching would also be time varying. The field setup consisted of a 100 m profile installed permanently in a 30 cm deep trench, placed between the landfill and the waterwork and orthogonal to the regional groundwater flow direction. Geophysical data were collected daily, and temperatures were measured in a borehole nearby at different depths down to 8 m. Data acquisition was fully automatic by a computer system installed in the field.

In general the contact resistance was low, but increased after extended periods without rainfall. All datasets were inverted independently for outlier detection and removal, and then subsequently time-lapse inverted using an asymmetric generalized minimum support norm scheme, which includes modelling of temperature effects. The time-lapse inversions show changes in soil water content in the upper 5-8 m, but also a possible deeper plume having seasonal variations.

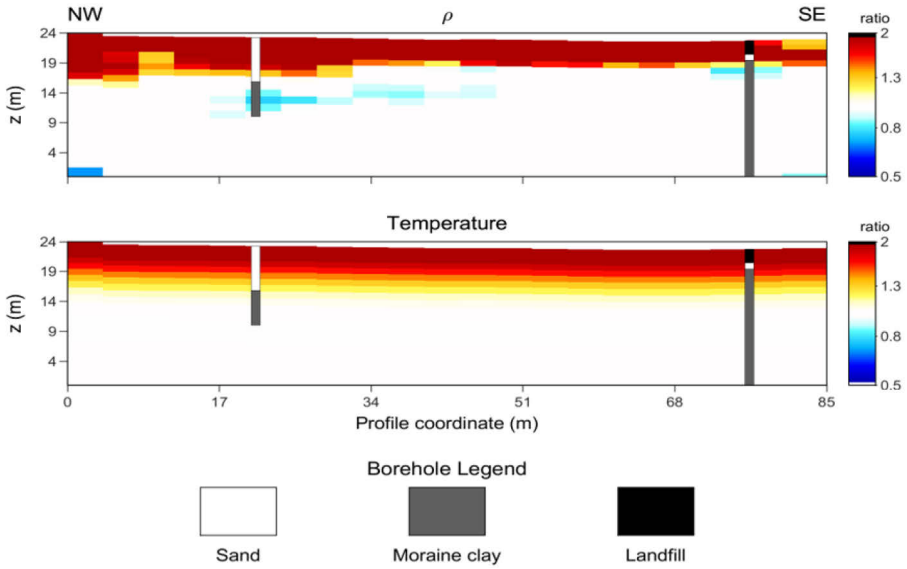

Figure caption: Results from time-lapse resistivity inversion, including temperature corrections, showing the resistivity changes 6 months after the beginning of monitoring. The ratio plot corresponds the dates September 9th (2016) versus March, 27th (2016) and illustrates seasonal variation in the top 8 m, as well as an inferred plume push at elevation 14 m, confirmed by water samples from a monitoring borehole 8 m away from the profile (orthogonally to the figure plane).