DCIP monitoring installation at Vomb MAR

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A DCIP system has been installed in and around an infiltration pond within the Vomb managed aquifer recharge (MAR) plant in southern Sweden. The objective is to monitor the water saturation and transport under the infiltration pond to create a better understanding of the infiltration process, to form a base for optimised operation of the water works. Another objective is to assess the possibility to monitor the growth of biofilm in the sand filter.

The installation includes in total 416 electrodes divided between 3 lines with 128 to 160 each (Figure 1a). The electrodes consist of 10 cm x 10 cm stainless steel plates that were buried in trenches at 0.4 m depth and connected alternatingly to two parallel cables that are separated by around 0.7 m (Figure 1b). The instrumentation is based on an ABEM Terrameter LS2, a 16x32 relay switch with built-in lightning protection and PC control via network. Furthermore, sensors for water conductivity, level and temperature were installed.

Measurements are taken using 100% duty cycle IP (Olsson et al. 2015) with 4 s pulses, and data are saved as full waveform with a data rate of 3750 Hz to allow advanced signal processing (Olsson et al. 2016). A roll-along approach has been implemented, in which selected subsets of the electrode spreads are connected to the instrument in a sequence. Multiple gradient array adapted for separated spreads is used for the measurements, plus pseudo pole-dipole array using the farthest electrode in the other end of the spread as "remote" electrode. Reciprocal measurements are made for 10 % of the data to allow quantification of observation errors. In total around 16 000 datapoints are measured daily. Data are transferred via SFTP to a server for processing, archiving, etc.

A background series measured before water filling of the pond started shows electrode contact resistances that are mostly in the range 5-10 kΩ. Preliminary inversion of the apparent resistivity and integral chargeability data, without accounting for the burial depth of the electrodes, results in excellent data fit with mean residuals below 1 %. The sandy sediments above the groundwater level stand out with resistivities above 1 kΩm, which drops to a few hundred Ωm in the saturated zone (Figure 1c). The gradually decreasing resistivity with depth reflects changes in grain size of the sediments. In the southern end the line is close to the neighbouring water filled infiltration pond which is reflected by a steep increase in the level of the interface to lower resistivity associated with higher groundwater level. The chargeability is rather low (Figure 1d).

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