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Geophysical methods in a study of the infiltration process in clay soil

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Within the framework of the research of preferential flow in clay-loam soil at Valecov site in Bohemo-Moravian highland, field ponded infiltration experiment monitored by TDR and resistivity tomography was conducted. TDR measurements were done using Tektronix 1502C cable tester connected to three steel electrodes 1-m long installed vertically in the centre of the infiltration ring. The water content changes were evaluated using the soil-specific calibration curve. The TDR readings were taken before, during, and after the infiltration test. TDR method was able to detect slow water content increase throughout the infiltration; however, it was not able to detect all the water added to the soil right from the start of the experiment. The resistivity tomography was performed using ARES system (GF Instruments), employing Schlumberger method. Measurements were taken for a set of lines covering 4 m by 4 m area around the infiltration ring. Electrode span was 40 cm. The same measurements were conducted both before and during the infiltration experiment. The resistivity distribution was reconstructed using RES3DINV software (Geotomo Software). The results imply that the measuring technique in its present state is not suitable for the clay soil. The outputs of the geophysical methods were found inconclusive. That could be related to the structure and the hydraulic functioning of the soil. At the end of the infiltration experiment, a dye tracer (Brilliant Blue) and excavation was used to visualize the flow paths in the soil profile. The tracer was found to infiltrate about 4 times deeper than predicted based on the tracer volume, assuming flow in fully saturated soil. The tracer distribution implied that the flow takes place through a fine network of inter-aggregate voids, bypassing most of the soil volume. The findings from the field measurements were validated in laboratory experiments using 6.5-l undisturbed samples of the soil. The study was supported by research grants GACR 103/04/0663 and AVCR AV0Z20600510.