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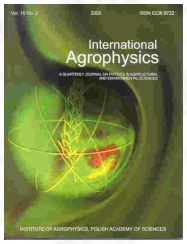

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Analysis of field tension disc infiltrometer data by parameter estimation

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abstract Using numerically generated data, we previously showed that it is theoretically possible to estimate the soil hydraulic functions from the cumulative infiltration curve measured with a tension disc infiltrometer at several consecutive tensions, provided that estimates of the initial and final water contents are available. In this study we used two field data sets to obtain the soil hydraulic functions by parameter estimation. Our inverse procedure combined the Levenberg-Marquardt nonlinear parameter optimization method with a numerical solution of the axisymmetric variably-saturated flow equation. We used a disc permeameter with a radius of 10 cm and applied consecutive tensions of-20, -10, and -3 cm. The average initial water content of the soil was 0.077 cm3cm"3 and the final water contents below the disc were approximately 0.24 and 0.27 cm3cm~3 for two runs. This is about 0.11 and 0.08 cm3cm"3 lower than the saturated water content as measured in the laboratory. The objective function for parameter estimation was defined in terms of the cumulative infiltration curve and the final water content. Al-:ernatively, we added into the objective function two /alues of the unsaturated conductivity obtained using kVooding's analytical solution. Unsaturated soil hydraulic :onductivities obtained using the inverse solution com-)ared closely with those resulting from Wooding's analy-;is. However, relatively large differences were found) etween retention parameters obtained with the inverse ;olution and those measured independently in the labora-ory. Simulations using soil hydraulic parameters deter-nined in the laboratory did not accurately reproduce the leld infiltration experiment.

keywords soil hydraulic properties, tension disc nfiltrometer, parameter estimation, numerical modeling