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Inverse Modelling of Soil Water Dynamics in Heterogeneous Soil with Macropores

M. Dohnal (1), J. Dusek (1), T. Vogel (1), M. Cislerova (1), F. Dolezal (2)

(1) Czech Technical University in Prague, Prague, Czech Republic, (dohnalm@mat.fsv.cvut.cz), (2) Research Institute for Soil and Water Conservation, Prague, Czech Republic

Agricultural lands in foothill zones on acid crystalline rocks in Central Europe can be an important source of diffused nitrate pollution affecting the quality of both subsurface and surface waters. Field experiment established to optimise the drip irrigation and nitrogen fertilisation of potatoes was set up in Valecov in the Bohemo-Moravian highland region (total annual precipitation 660 mm and average annual temperature 7.2 °C). The soil is a deep loamy Planosol, underlain by weathered paragneiss. It has capacity to swell and shrink and contains numerous macropores (both desiccation cracks and biopores). Well equipped experimental site provides a broad variety of measurements (soil water pressure, lysimetric fluxes, water quality and meteorological data). An attempt is made to explain the major part of the measured spatial variability of soil water pressure by means of dual permeability modelling. S1D DUAL model was used to simulate seasonal soil water suction variations. Inverse modelling was applied in order to minimize the discrepancies between the model responses and observed pressure heads. Commercial software package PEST (Waterloo Hydrogeologic), based on the Levenberg-Marquardt algorithm, was used as a parameter estimator. It is concluded that the measurements of soil water pressure provide valuable information about the physical nature of water flow and retention in structured soils, and can help us to quantify parameters of dual permeability models. The research is funded by the Grant Agency of the Czech Republic, project No. 103/04/0663.