Simulation of water regime in heterogeneous soil with macropores

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The objective of the long term study has been to simulate and analyze the water regime of the soil profile in the experimental area in Valecov, Czech Republic, for the vegetation season 2004. On the experimental area there is a research project in progress with the aim to optimize the drip irrigation and nitrogen fertilization of potatoes. As a part of the project the soil water pressures in depths of 45 and 75 cm have been measured. The soil profile, composed of Cambisols with high ratio of clay particles, exhibits fast preferential flow caused by macropores and parent rock heterogeneities. The simulation of the soil water suction field was done by means of S_1D_DUAL code, based on the dual-permeability approach. Both domains are governed by Richard's equations, the communication between them is ensured by the transfer term. In order to simplify the description of spatial variability the scaling was applied. The model input parameters were determined inversely with application of parameter estimation software PEST. Levenberg-Marquardt method was used to optimize parameters in the least-square sense. The comparison of results of the simulations of the both, single and dual domain approaches, demonstrates the significance of preferential pathways on the water regime. In dual domain approach the simulated hydraulic heads exhibit fast reactions on significant precipitation events. On the other hand, low rainfall intensities do not remarkable affect the water regime of the middle layers of the soil horizon. Irrigation water thus flows faster through the macropores and reaches higher depths. This effect has to be taken into account when optimizing the drip irrigation and nitrogen fertilization. The research has been carried out within the project GACR 103/04/0663.