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Comparison of empirical, semi-empirical and physically based models of soil hydraulic functions

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The study deals with the following soil hydraulic functions: Soil water retention function $h(\theta$p and unsaturated hydraulic conductivity $K(h)$, or $K(\theta$ps where θ is the soil water content and h is the pressure head. The analytical description of a curve passing experimental data sets of the soil hydraulic function is typical for the empirical expression of the function. Except of variables h, θ or K, h, eventually *K*, θ the function is charactzerized by fitting parameters only. If the measured data are described by the equation derived by the physical model without using fitting parameters we speak about a physically based model. There exist several transitional subtypes between empirical and physically based models denoted as semi-empirical. We tested 4 models of soil water retention function and 5 models of unsaturated conductivity using experimental data sets of loamy soils. All used soils are typical by their bi-modality of the soil porous system. The model efficiency was estimated by RMSE and RSE. The closest model data to experiments were obtained by the combination of empirical with physically based models, where the fitting parameters smoothed the difference between the rigidity of the physical model and the physical reality of the soil porous media. The „optimal“ model was nearer to the empirical function for soil water retention function. On the other hand side, the „optimal“ unsaturated conductivity function was obtained for a model closer to the physical model.

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