

Identification of Material Laws in Unsaturated Fluid Flow from Column Experiments. 2. Applications

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The simultaneous identification of the soil moisture characteristic and the unsaturated hydraulic conductivity function from a single column outflow experiment is possible by inverse modeling, if cumulative outflow data and tensiometric measurements are used in the inverse procedure. It has been shown in the past that the identification is unique, if the assumed hydraulic model (generally Richards equation) is correct and if the parametric expressions of the soil hydraulic functions (e.g., van Genuchten/Mualem) are adequate to represent shapes of the "true" hydraulic properties. However, many soils are structured and have secondary pores systems that are not well described by simple-shaped hydraulic functions. We show a methodology that approximates both the soil moisture characteristic and the unsaturated hydraulic conductivity function from piece-wise spline interpolations.

The flexibility of the approximations is stepwise enhanced by increasing the numbers of freedom of the interpolation functions until the improvement of the fit of simulated vs. observed data is no longer significant. By this, the final flexibility of the hydraulic functions depends on the experimental data, and is not fixed to a certain functional expression that is set prior to the inverse analysis. We apply this methodology to some example data which shows that it has a tremendous potential to become a very powerful tool for the identification of soil hydraulic properties.