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# Estimation of Soil Hydraulic Properties from Numerical Inversion of Tension Disk Infiltrometer Data

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## ABSTRACT

**Many applications involving variably saturated flow and transport require estimates of the unsaturated soil hydraulic properties. Numerical inversion of cumulative infiltration data during transient flow, complemented with initial or final soil water content data, is an increasingly popular approach for estimating the hydraulic curves. In this study, we compared Mualem–van Genuchten (MVG) soil hydraulic parameters obtained from direct laboratory and in situ unsaturated hydraulic conductivity measurements with estimates using numerical inversion of tension infiltration data of four coarse- to medium-textured soils in Alentejo (Portugal). The laboratory methods used were suction tables, pressure plates, and the evaporation method as applied to undisturbed soil samples collected from the surface horizons of four different soil profiles. Field measurements were taken with a tension disk infiltrometer using consecutive supply pressure heads of −15, −6, −3, and 0 cm. Six MVG parameters (residual soil water content [$\theta_r$], saturated soil water content [$\theta_s$], empirical shape factors $\alpha$, $\eta$, and $\ell$, and saturated hydraulic conductivity [$K_s$]) were estimated from the field data by numerical inversion using the HYDRUS-2D software package, and compared with values estimated from the laboratory data. Macroporosity was also determined. The laboratory- and field-measured water retention curves were found to agree closely for most experiments as reflected by relatively high values of the coefficient of determination, the modified coefficient of efficiency, and the modified index of agreement (always >0.9949, 0.8412, and 0.8931, respectively). The unsaturated hydraulic conductivity curves were predicted less accurately, although good estimates of $K_s$ were obtained.**

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**Abbreviations:** MVG, Mualem–van Genuchten.