

Estimating soil hydraulic properties obtained from evaporation and multi-step outflow experiments

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Inverse modeling using data from transient experimental methods such as multistep outflow (MSO) method and evaporation (EVP) method are frequently used for estimating unsaturated soil hydraulic parameters. However, comparisons between different inverse results obtained from MSO and EVP methods are scarce in the literature, especially for organic-rich soils with low bulk density, e.g. Andosol. The objective of this study was to determine and compare unsaturated hydraulic properties of Andosol from data collected using both methods. Undisturbed soil core samples (5.0 cm in i.d. and 5.1 cm in height) were taken from soil at a depth of 0-5 cm. The packed soil samples were also used for the experiments. After the MSO method, the same soil core samples were saturated again for the EVP method. The MSO method yielded a set of pressure heads (h_{MSO}) or cumulative water outflow (Q_{MSO}) vs. time while the EVP method obtained a set of pressure heads (h_{EVP}) or cumulative water flux (V_{EVP}) vs. time. A one-dimensional model based on Richards' equation, HYDRUS-1D (ver.4.14), was then used to analyze data to estimate soil unsaturated hydraulic parameters. The unknown parameters were accomplished by minimizing the objective functions which described the differences between observed and estimated h_{MSO} , h_{EVP} , Q_{MSO} and V_{EVP} , respectively. The results could be important in determining the agreement of soil hydraulic parameters obtained from both experiments and provide more precise and accurate characterization of water and solute transport.