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Determination of the soil hydraulic properties by simultaneous analysis of soil water cumulative infiltration and transient soil water content

D. Moret (1), Z. Saâdi (2) and R. Haverkamp (2)

(1) Departamento de Suelo y Agua, Estación Experimental de Aula Dei, Consejo Superior de Investigaciones Científicas (CSIC), Avda. Montañana 1005, 50059 - Zaragoza, Spain, (e-mail: david@eead.csic.es / Fax: +34 976 71 61 45), (2) Laboratoire d'Études des Transferts en Hydrologie et Environnement (LTHE), 1025, rue de la piscine, Domaine Universitaire, 38 400 - Saint Martin d'Hères, France.

The determination of soil hydraulic properties is of paramount importance in many scientific fields such as agronomy, hydrology and environmental science. This work presents a method for the determination of the soil water retention and hydraulic conductivity curves parameters by contrasting the modeled soil water cumulative infiltration and transient soil water content (both derived from analytical solutions of the Richards flow equation for dry initial soil conditions) to measured data. Three different subtracts were studied, two sands of different texture and a 2-mm sieved loam soil, which were uniformly packed in a 30 cm internal diameter and 25 cm height plastic column. The initial soil water content was less than 0.05 m^3m^{-3}. A four-rods 10 cm long TDR probe assembled by three external wires, which delimited a circle of 10 cm internal diameter, and an inner conductor were vertically inserted in the soil. The column was saturated through the top with distilled water using a tension disc infiltrometer with a base radius of 40 mm, which was placed in the center of the three external wires of the TDR probe. The soil water cumulative infiltration was automatically measured every 5 seconds from the water level drop of the infiltrometer water supply reservoir by using a pressure transducer connected to a datalogger. The transient soil water content was monitored every 30 seconds by the four-wires TDR probe. The soil water content at saturation corresponded to that measured by the TDR probe at the end of the infiltration process. The parameters for the soil water retention and hydraulic conductivity functions were calculated by looking for the best fit between

experimental and modeled cumulative infiltration and transient soil water content. The estimated soil hydraulic parameters where within the range of the values for the corresponding subtracts. The correlations between the experimental and modeled data were excellent, which demonstrates that it is possible to determine the soil hydraulic properties with a single infiltration process. However, more advances are expected to adapt this method to field soils.