

Soil hydraulic parameter estimation by evaporation method

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An evaporation method to estimate soil hydraulic properties, such as soil water retention curve and unsaturated hydraulic conductivity, has been receiving attention because of its simplicity and flexibility. Depending upon experimental setup, there are several approaches available for data analysis. In this study, a so-called simplified method and a more common but more involved inverse method were compared in terms of estimating soil hydraulic parameters. In the simplified method, soil water retention curve and unsaturated hydraulic conductivity were approximated by assuming that soil water pressure heads measured at two locations within the soil sample were linearly distributed. Parameter α and n which were used in the van Genuchten (VG) soil water retention model were determined by fitting it to the curve obtained by the simplified method. Unsaturated hydraulic conductivity function was then predicted by the van Genuchten-Maulen model with the obtained α and n . For the inverse method, the α and n parameters were directly optimized using a numerical analysis by fitting to measured pressure heads. In this study, Toyoura sand, Tottori dune sand, glass beads and silt were used. After soil water retention curves were determined using the simplified method, the VG parameters were estimated to predict unsaturated hydraulic conductivity. With the inverse method, the VG parameters were inversely estimated using HYDRUS-1D program. Results showed that the parameters estimated from both the simplified and inverse methods predicted unsaturated hydraulic conductivity well compared to that determined from the simplified method. On the other hand, those for Toyoura sand, Tottori dune sand and glass beads were not well predicted. In general, the unsaturated hydraulic conductivity in the wet region was overpredicted, while that in the dry region was underestimated when the simplified method was used. Overall, this study shows that the simplified method needs to be carefully used especially for coarse materials, such as sand and glass beads.

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