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Numerical experiments to evaluate the effectiveness of a new method for scaling core-based hydraulic properties to the field

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The authors recently proposed a method for deriving the field hydraulic properties in the case when the only available information consists of laboratory hydraulic functions, along with a measurement of the maximum water content in the field. Specifically, the field hydraulic parameters were estimated by a scaling procedure accounting for the ratio between the total porosity estimated by the maximum water content in the laboratory and the partial porosity effectively involved in the field, as estimated by the field measured.

The scaling method was evaluated on four soils (three volcanic sandy loam soils and one silty clay loam soil) whose hydraulic properties were measured both in situ by a field internal drainage test and in the laboratory by the Wind method. Scaling-based hydraulic properties were also compared to those estimated by applying a simplified method based on the unit gradient water flow assumption where only water content measurements performed during the internal drainage test were of concern.

The hydraulic properties estimated by the scaling method were compared to the measured ones and to those from the unit gradient method in terms of output of Richards-based simulations.

The scaling method proved to be effective when applied to the three sandy loam soils. Concerning the silty clay loam soil, inappropriate results were observed due to an unacceptable scaled hydraulic conductivity estimation.