Near-saturated hydraulic conductivity: database development, meta-analysis and pedotransfer functions

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Near-saturated hydraulic conductivity exerts a critical control on water flow and solute transport through the vadose zone, yet very little is known concerning how it is influenced by various soil properties and site factors and attributes. Starting from the 1980's, tension infiltrometers or disc permeameters have become an increasingly popular method to measure near-saturated hydraulic conductivity in undisturbed soil. In this presentation, we describe the development and organization of a large database of tension infiltrometer measurements (n>700) collated from the published literature. The raw datasets were standardized and summarized using a modified Kozeny-Carman model of near-saturated hydraulic conductivity (Jarvis, N.J. 2008. Near-saturated hydraulic properties of macroporous soils. Vadose Zone Journal, 7, 1302-1310). This model was found to accurately describe near-saturated conductivity for this large dataset (92% of cases had R^2 values larger than 0.9). We will show the results of some initial analyses of the dataset, which show how hydraulic conductivity at pressure heads of -1 and -10 cm, as well as the slope of the near-saturated conductivity function, are affected by: i.) the choice of method to convert unconfined 3D infiltration to hydraulic conductivity, and ii.) interactions between soil properties such as texture and bulk density and site attributes such as land use and climate. We will also present some initial attempts to develop pedotransfer functions for parameters describing near-saturated hydraulic conductivity using the technique of random forests.