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Uncertainty related to the estimation of saturated hydraulic conductivity from parameters of soil water retention function

Paolo Nasta (1), Joseph Pollacco (2), Bynayak Mohanty (2), and Nunzio Romano (1)

(1) Department of Agricultural Engineering, University of Naples Federico II, Portici (Naples), Italy (nunzio.romano@unina.it, +39-081-2539412), (2) Department of Biological and Agricultural Engineering, Texas A&M University, College Station, TX, USA

In the last decades there is a growing interest in retrieving effective soil hydraulic parameters at large scales estimated by inverse modelling from remote sensing measurements. This approach, albeit requires less effort to collect input information, is however affected by large uncertainty due to non-uniqueness of the inverse solution. Therefore, it is advisable to reduce the number of parameters to be optimized and tighten their physical range introducing mathematical relationships for the water retention parameters. In this study, a simple and physically sound method is presented to predict saturated hydraulic conductivity, Ks from the parameters describing the soil water retention analytical relation. The method is based on the empirical identification of the air-entry value head, hAEV from the scale and shape parameters of the water retention function. We assume that the maximum pore-radius (correspondent to the air entry value head through the Young-Laplace capillarity law) determines the threshold value above which the saturation condition is satisfied. Subsequently saturated hydraulic conductivity is calculated by physically-based relationships obtained by combining the Hagen-Poiseuille with Darcy's laws. The retention relations proposed by van Genuchten (1980) and Kosugi (1996) are used to validate the proposed method and they are compared when defining physical meaning of the retention parameters because related to the corresponding pore-size distribution. Even though the proposed method does not require preliminary calibrations, it is valid under specific assumptions and at present restricted only to soil with coarser texture. However, it turns out to be useful to define the prediction uncertainty of Ks related to the corresponding water retention parametric range.