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Estimation of the water retention curve from the soil hydraulic conductivity and sorptivity in an upward infiltration process

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Determination of the saturated hydraulic conductivity, K_s, and the α and n parameters of the van Genuchten (1980) water retention curve, *θ(h),* are fundamental to fully understand and predict soil water distribution. This work presents a new procedure to estimate the soil hydraulic properties from the inverse analysis of a single cumulative upward infiltration curve followed by an overpressure step at the end of the wetting process. Firstly, K_s is calculated by the Darcy's law from the overpressure step. The soil sorptivity (S) is then estimated using the Haverkamp et al., (1994) equation. Next, a relationship between α and n, *f(*α*,n)*, is calculated from the estimated $S$and K_s. The α and n values are finally obtained by the inverse analysis of the experimental data after applying the *f(*α*,n)* relationship to the HYDRUS-1D model. The method was validated on theoretical synthetic curves for three different soils (sand, loam and clay), and subsequently tested on experimental sieved soils (sand, loam, clay loam and clay) of known hydraulic properties. A robust relationship was observed between the theoretical α and $n$values ($R^2 > 0.99$) of the different synthetic soils and those estimated from inverse analysis of the upward infiltration curve. Consistent results were also obtained for the experimental soils ($R^2 > 0.85$). These results demonstrated that this technique allowed accurate estimates of the soil hydraulic properties for a wide range of textures, including clay soils.