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A theoretical analysis to estimate the hydraulic properties of a loam soil from a capillary-evaporation process

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The determination of the water retention curve (WRC) parameters and the hydraulic conductivity (K) is of paramount importance in many scientific fields such as hydrology or environmental science. Their direct characterization, however, is typically cumbersome and time consuming. This work analyze the viability to estimate the α and n Van Genuchten (VG) WRC parameters and K from following processes: a capillary wetting process at saturation, an evaporation process and a capillary wetting at saturation followed by an evaporation process. The theoretical analysis was carried out on a 5 cm high and 5 cm diameter cylinder filled with loam soil using numerically generated data with the HYDRUS 2D code. The error maps for the above mentioned processes and the n-K, α-n and K-α planes were generated from the RMSE calculated between the original and the simulated cumulative curves. The deviation (%) between the optimal and original hydraulic parameters was also calculated. Results showed that the capillary plus evaporation method applied on the n-K and α-n planes was the unique process that allowed a unique and well defined minimum. For this last case, the deviation for the α and n parameter were 6'67 and 0'88%, respectively. Taking into account that K can be easy measured from the same soil cylinder by means of Darcy's law, we conclude the capillary + evaporation process can be a simple and effective alternative to estimate the WRC parameters. To this end, the hysteresis phenomena due to the wetting-evaporation process should be taking into account.