Effects of Soil Hydraulic Properties on the Spatial Variability of Soil Water Content

One of the most important elements in modeling subsurface water movement is the hydraulic property characteristics of the soil. Unfortunately, little or no data exist on these properties in most locations, other than a classification of soil type, which is not universally used; i.e., different organizations use different names for the same soil.

In a recent issue of Vadose Zone Journal, researchers quantified the impact of soil hydraulic properties on the soil water distribution at a field scale. The authors obtained soil water content distribution by deploying a sensor network in the Rollesbroich catchment in Germany, and the soil hydraulic properties were obtained using inverse modeling. HYDRUS 1-D software was used to solve the commonly used Richards equation, and it predicted soil water at 5-, 20-, and 50-cm depths. The simulated soil water distribution agreed with the observed soil water distribution at all depths with low root mean square error and high correlation coefficients.

The authors found that the pore size distribution parameter (from the well-known van Genuchten equation) and the saturated soil water content exerted a strong effect on the spatial variability of soil moisture distribution across their field, but the saturated hydraulic conductivity and shape parameter did not have the same influence. Topographic effects on the spatial distribution of soil moisture were not considered in this study.

This study has implications at larger scales where detailed measurements of soil properties may be difficult to obtain, which is the norm in most cases. The results are somewhat limited to the silt loam texture of the soil that characterized this field site, highlighting the need for future studies that span a greater range of soil types and hydraulic property variability at larger spatial scales. This will help scientists to properly quantify soil type and hydraulic properties for soil water movement. The absence of a detailed data set on soils makes such studies very important.


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