



## Soil water diffusivity obtained from visual inspection experiment and comparison with $\gamma$ -ray measurements

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### ABSTRACT

Diffusivity is one of the main soil hydraulic properties. It is a critical parameter for the prediction of water transport within the vadose zone. The aim of this paper was to establish the soil water diffusivity of a soil sample using transformed soil moisture profile. Whisler et al. proposed a method, which requires knowledge of the complete soil moisture profile at fixed distances on the soil column. This article uses this method, which is more appropriate nowadays according to the available measuring instruments, for verification purposes. Our laboratory developed a visual method during horizontal experiment, which is simple and takes into consideration profile length observations, sorptivity, initial and final moisture content in order to calculate diffusivity. The method is based on the utilization of a complex empirical function either with four or three constants to generate the transformed soil moisture profile by treating the process as an optimization problem. The required conditions to compute the constants of the empirical function are: (a) the analytically computed sorptivity should agree with the experimental one and (b) the beginning and the end of the transformed soil moisture profile should agree with the final and the initial water content correspondingly. Once an analytic function for the transformed soil moisture profile is determined, then diffusivity is calculated analytically. Integral continuity is preserved throughout the process. The regenerated profiles, which were determined with the visual method, were verified with measured data points from  $\gamma$ -ray measurements during the horizontal absorption experiment and the results were very satisfactory.

*Keywords:* Diffusivity; Sorptivity; Soil water properties; Soil moisture profile; Horizontal absorption

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