Comparing Theory and Practice of a Beerkan Infiltration Experiment in a Layered Soil

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**Abstract.** The use of the Haverkamp infiltration model to deduce hydrodynamic parameters of a saturated soil presupposes fully unconfined infiltration experiments (ring insertion depth, d=0) with a null ponded depth of water on the soil surface (H=0). In practice, a ring is inserted a short depth into the soil and a small positive head of water is established on the infiltration surface for at least a part of the run.

In this numerical investigation, the combined ring insertion and ponded depth of water effects on infiltration were tested for both a homogeneous and a layered soil. In particular, a 2 h infiltration process was simulated for homogeneous loamy-sand (LS) and silt-loam (SIL) soils and for layered soil profiles consisting of a 0.5, 1 and 3 cm thick SIL soil overlying a LS soil. A source with a radius of 5 cm and both the theoretical (d=H=0, d0H0) and a practical (d=H=1 cm, d1H1) setups were considered.

In comparison with the data obtained in accordance with theory, the d1H1 setup yielded i) a very similar cumulative infiltration at the end of the process, I2h, for the homogeneous LS soil (+1.2%) and a smaller I2h value for the homogeneous SIL soil (-10.2%); ii) a larger I2h value for a thin SIL soil layer overlying the LS soil (+15.6% and +4.1% for the 0.5 and 1 cm thick upper layer, respectively); and iii) a smaller I2h value in the case of a thicker SIL soil layer (3 cm: -9.1%). Similar results were obtained by considering the final infiltration rates. Therefore, in the case of a thin low-permeability upper soil layer, the practical experiment enhanced infiltration as compared with the theoretical experiment. As the thickness of the upper soil layer increased, the practical experiment induced a slower infiltration process than the theoretical one and the difference between the two setups approached the detected difference for the homogeneous SIL soil.

In conclusion, the thickness of the upper soil layer influences the difference between the theoretical and the practical experiment. For the investigated layered soil, the best correspondence between theory and practice should be expected to occur when the upper soil layer has a thickness falling in the 1 to 3 cm range. A wider investigation, including other soils, layered soil profiles, ring radii and antecedent soil water conditions is necessary to reach general conclusions.