TWO-PHASE SIMULATION OF A VARIABLE RATE INFILTRATION EXPERIMENT

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Variable rate infiltration experiments carried out in a sand column equipped with tensiomenters and TDR probes revealed that the retention curves obtained under static conditions cannot correctly represent the system dynamics under transient conditions. As a consequence, the observations cannot be numerically predicted by the commonly used Richard's equation. These results are observed also when the top portion of the soil never reaches full saturation during the experiment. These findings have important consequences, e.g. for the prediction of runoff production and hill-slope stability.

The discrepancy experimentally observed may be due to the impact of air flow on water pressure occuring under variable rainfall conditions. We numerically investigated this hypothesis using a two-phase air-water flow model. The numerical solver is based on a linear FEM-based pressure-pressure formulation where accurate mass balance is preserved by careful choice of spatial and temporal discretization of the nonlinear terms. The pressure-pressure formulation is chosen to ensure proper implementation of the pressure-based boundary conditions that need to be imposed at the top of the column under condition of infiltration in unsaturated soil. Simulation results and experimental observations are compared and discussed.