Geophysical Research Abstracts, Vol. 9, 10385, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10385

Determination of matrix and macropore flow characteristics (using tracer infiltration profiles and inverse modeling in SWAP)

N.L.M. van Schaik (1), R.F.A. Hendriks (2), J.C. van Dam (2)

(1) Utrecht University, (2) Wageningen University and Research Centre
(l.vanschaik@geo.uu.nl)

Preferential flow is rapid flow of water and solutes along certain pathways leaving a large part of the porous media relatively dry. Preferential flow influences infiltration, runoff, soil moisture distribution, and subsurface stormflow. The mechanisms of preferential flow are widely recognized to be threshold dependent. An important threshold for macropore flow initiation is the infiltration capacity of the matrix. As long as the matrix infiltration capacity is not reached, the net precipitation will infiltrate into the matrix, but as soon as the infiltration capacity is reached the water will start ponding and infiltration to macropores will start.

Most infiltration measurements however are overall measurements of combined matrix and macropore infiltration. Therefore it is important to determine the matrix and the preferential flow characteristics separately. To this purpose 18 rainfall experiments with dye-tracer (2.25 m^2 surface area, 44 mm/h) were performed in a 1 km^2 catchment in a semi-arid wooded rangeland (Extremadura, Spain). The inner $1m^2$ of the tracer experiment was excavated and three vertical infiltration profiles were prepared and photographed. The vertical infiltration profiles resulted in percentages of stained area versus depth. On the tracer infiltration profiles in most cases a clear distinction could be made between the homogeneous infiltration front and preferential flow areas. For the 18 locations also the initial moisture content, infiltration and runoff, soil physical characteristics (porosity, bulk density, (un)saturated conductivity), soil texture, vegetation and slope were determined.

Using these measurements a two-step inverse modeling is performed with the physically based SWAP (Soil Water Atmosphere Plant) model to derive the matrix and

preferential flow characteristics. In the first step the homogeneous infiltration front is used to derive the matrix properties. In the second step the macropore parameters of the SWAP model are determined using the measured depth and width of deeper infiltration patterns (preferential flow paths). The results for the 18 different rainfall simulations will give spatial information on the threshold values of infiltration capacity of the soil matrix and of the macropores, which is of great importance