Geophysical Research Abstracts,
Vol. 10, EGU2008-A-08428, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-08428
EGU General Assembly 2008

The Use of a Hysteresis Model for the Upscaling of Soil Hydraulic parameters

S. Ferraris (1), F.M. Calderón Vega (1), D. Canone (1), M. Previati (1), I. Bevilacqua (1), R. Haverkamp (1)

(1) DEIAFA sez. Idraulica Agraria, University of Turin, Torino, Italy

e-mail: stefano.ferraris@unito.it / Fax: +39-011-6708619;

Soil water transport in the vadose zone is generally calculated by solving the Richards (1931) transfer equation. The solution of this partial differential equation crucially depends on soil characteristic data classically expressed through the soil texture dependent shape parameters and the structure related normalizing parameters. A sound data provision strategy may well take advantage of indirect evaluations from more easily accessible field data as a partial substitute for time consuming experimental procedures. Pedo-transfer functions (PTFs) that make use of relations between soil hydraulic shape parameters and soil textural information with a low underlying spatial variability are good alternatives. However, the validity of using PTFs for the prediction of soil structure dependent parameters is questionable.

The aim of this study is to develop a robust inverse procedure for the determination of the structure dependent soil parameters from infiltration and/or exfiltration flow data using a simple but reliable hysteresis model able to relate both processes through a unifying framework. Testing and validation was carried out on infiltration data collected at the experimental site (900 m^2) of the Agricultural Faculty of the "Università degli Studi di Torino" at Grugliasco (Italy). Local scale exfiltration data were calculated from simultaneously monitored soil water content and soil water pressure profiles using automatic TDR and tensiometer devices. Even though the entire measurement campaign lasted for many years (> 10), the data chosen for this study are from the spring 2007. For the purposes of testing, the soil hydraulic shape parameters were considered to be known.

The results showed that the introduction of the hysteresis model was an advantage rather than disadvantage, as its physically based constraints improved considerably the robustness of the inverse procedure; for all test cases, a unique solution was obtained. The procedure enabled to give a handle in estimating the wetting and/or drying history when expressed in terms of the scanning order of the water retention curves of the wetting and/or drying family. The normalizing water content and soil water pressure system parameters of the individual scanning curves calculated by the inverse procedure from both infiltration and exfiltration flow data, gave very good agreement with the experimentally determined system parameters.

The convincing results obtained so far for local scale infiltration-exfiltration data, opens a broad avenue for determining equivalent field scale soil characteristic system parameters by inversing evapotranspiration flux data measured at field scales.