Geophysical Research Abstracts, Vol. 9, 06486, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06486

Effective hydraulic properties and temporal evolution of soil water content profiles of aggregated soils

A. Coppola(1), A. Comegna(2), A. Basile(3)

(1) Dept. for Agro-Forestry Systems Management (DITEC), Hydraulics Division, University of Basilicata, Potenza, Italy (acoppola@unibas.it)

(2) Dept. of Agricultural Engineering and Agronomy,University of Napoli Federico II, Napoli, Italy

(3) Institute for Mediterranean Agricultural and Forestry Systems (ISAFOM), National Research Council (CNR), Ercolano (Napoli), Italy

Water flow in natural porous media is significantly affected by the occurrence of a macroheterogeneity (due to the spatial variability of soil properties) and microheterogeneities (structural heterogeneities). The spatial variability is generally taken into account by extrapolating the theory for the nonlinear unsaturated flow process to a larger-scale. The microscale governing equation for water flow in soils (Richards' equation) is assumed to apply at any scale and the soil hydraulic properties to be used in this mean flow equation are macroscale-properties. This implies the problem of defining an aggregation rule to obtain the macroscale properties for large-scale simulations. In the stochastic approach, the hydraulic properties are treated as spatial random functions. The main assumption mostly adopted in this approach is that the randomness of soil hydraulic properties stems entirely from the stochastic nature of saturated hydraulic conductivity. Such a hypothesis has been actually verified for soils assumed to have a unimodal pore-size distribution. In fact, a very few studies can be found dealing with the impact of local heterogeneities on the effective soil water characteristics and the corresponding ensemble soil hydrological behavior. Accordingly, the problem treated here is twofold: 1) to use a large data set of hydraulic properties of an aggregated soil in order to characterize their spatial variation taking into account the effects of the soil structure; 2) to use these results to determine, in a Monte-Carlo simulation framework, if and how well a single set of hydraulic characteristics, specif-

ically taking into account the soil structure, can reproduce the observed temporal evolution of the ensemble soil water content profile. It will be shown that in structured soils effective characteristics are conditional to the soil hydraulic properties formulations. Bimodal hydraulic functions, explicitly including parameters accounting for soil micro-heterogeneities, proved successful to reproduce effectively the ensemble soil hydrological behavior. The results suggested that irrespective of the hydraulic properties formulation, reasonable effective properties could not be obtained when the randomness of soil water properties is attributed only to the saturated hydraulic conductivity.