Geophysical Research Abstracts,
Vol. 11, EGU2009-12749-1, 2009
EGU General Assembly 2009

A mechanicistic model to simulate unsaturated flow in a green roof system

A. Palla, I. Gnecco, L.G. Lanza, and P. La Barbera

DICAT (Dept. of Construction, Environmental and Territorial Engineering), University of Genova, Genoa, Italy
(anna.palla@dicat.unige.it / +39 010 3532481)

The growing interest in the evaluation of the environmental benefits by a green roof system bring to improve the understanding of the water flow through engineered porous media.

An experimental site was obtained to this aim by retrofitting an existing single-layer vegetated roof built in the sixties into a modern technological system fully equipped with sensors for on-site meteorological, hygrometric and flow rate measurements. The site is equipped with a meteorological station (for rain data, air temperature and humidity, solar radiation and air pressure), with 8 TDR probes and 12 thermocouples for continuous water content and soil temperature monitoring along two vertical profiles and with a hydraulic device for continuous subsurface-flow monitoring.

The SWMS -2D model that solves the Richards' equation for two-dimensional saturated-unsaturated water flow was used to simulate the hydraulic response of the experimental green roof. The model was calibrated and validated using rain events recorded at the experimental site. The calibration and validation strategy involved comparing predicted and measured outflow hydrographs and water content vertical profiles.

The sophistication of the model requires precise identification of the water retention curve and the soil hydraulic conductivity function. However, the investigated porous media - the engineered media used for green roof installations - present a complex soil matrix due to the presence of both macro porosity and internal porosity. The presence of macropores leads to spatial concentrations of water flow through unsaturated soil that will not be described by a Darcy approach. Although a wide range of models for the prediction of the retention curve and the hydraulic conductivity function are available for natural soil, only few experimental results about engineered porous media have been presented in the literature.
The influence of macropores on infiltration and subsurface flow was investigated in this work on the basis of experimental evidence and model results.

The difficulty in determining the retention curve and the hydraulic conductivity function is one of the major obstacle to overcome in case mechanicistic models are applied for quantitative evaluations.