Geophysical Research Abstracts, Vol. 9, 01845, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01845


# Crop root parameters in vertical profiles for modeling of soil water uptake at macroscale

**M. Himmelbauer** (1) and V. Novák (2)

(1) Department of Water, Atmosphere, and Environment, Institute of Hydraulics and Rural Water Management, BOKU - University of Natural Resources and Applied Life Sciences, Vienna, Austria

(2) Institute of Hydrology, Slovak Academy of Sciences, Bratislava, Slovak Republic (novak@uh.savba.sk / Fax: ++421 2 44259404 / Phone ++421 2 49268279)

An essential part of the simulation models, describing transport of water in soil – plant – atmosphere (SPAC) system is the root extraction sub-model. Its importance is given in distribution of transpiration rate along the root zone in the soil via so called water extraction (sink) term. Most mathematical models of water transport in SPAC use one-dimensional Richards' governing equation, describing water flow in vertical direction. Root water uptake is represented by a sink term. To characterize this term in its complexity is a difficult task. Especially, qualitative properties of root systems in relation to conductivity are not entirely parameterized until now. For that reason, easily measurable root parameters such as root (mass or length) density distributions along the soil profile are commonly used assuming identical uptake capabilities of roots despite their topology, diameter, age etc.

This contribution presents results of measurements on morphological parameters of root systems needed for macro scale modeling of root water uptake. Root mass-, root length- and root surface area density distributions were assessed for different agricultural plants, i.e. spring barley (*Hordeum vulgare L.*), winter rye *(Secale cereale L.*) and maize (*Zea mais, L.*) grown under equivalent environmental conditions.

Results showed that at early stages of plant ontogenesis, the relative vertical distributions of the root dry mass-, root length- and root surface area densities can be expressed by the exponential type of functions for the crops under study (spring barley, winter rye and maize). There were no significant differences between the shapes of their profiles. Hence, these root parameters can be expressed in the root uptake models by similar distribution functions.

Important outcomes are the estimated linear relationships between the dry mass density of roots and other root parameters measured using image analyzing, i.e. specific length and surface area of three studied root systems. Statistically highly significant correlations between dry mass, length and surface area of the roots densities were established, which is essential for alternative expressions of the root parameters profiles. Thus, the root dry mass density, which is easier to obtain, can be used for estimation of the root distribution function in the sink term in the case of lack of root length and root surface area measurements.