Geophysical Research Abstracts
Vol. 16, EGU2014-8681, 2014
EGU General Assembly 2014

Macroscopic modeling of plant water uptake: soil and root resistances

Tomas Vogel, Jana Votrubova, Michal Dohnal, and Jaromir Dusek
Czech Technical University in Prague, Prague, Czech Republic (dohnalm@mat.fsv.cvut.cz)

The macroscopic physically-based plant root water uptake (RWU) model, based on water-potential-gradient formulation (Vogel et al., 2013), was used to simulate the observed soil-plant-atmosphere interactions at a forest site located in a temperate humid climate of central Europe and to gain an improved insight into the mutual interplay of RWU parameters that affects the soil water distribution in the root zone. In the applied RWU model, the uptake rates are directly proportional to the potential gradient and indirectly proportional to the local soil and root resistances to water flow. The RWU algorithm is implemented in a one-dimensional dual-continuum model of soil water flow based on Richards' equation. The RWU model is defined by four parameters (root length density distribution, average active root radius, radial root resistance, and the threshold value of the root xylem potential). In addition, soil resistance to water extraction by roots is related to soil hydraulic conductivity function and actual soil water content. The RWU model is capable of simulating both the compensatory root water uptake, in situations when reduced uptake from dry layers is compensated by increased uptake from wetter layers, and the root-mediated hydraulic redistribution of soil water, contributing to more natural soil moisture distribution throughout the root zone. The present study focusses on the sensitivity analysis of the combined soil water flow and RWU model responses in respect to variations of RWU model parameters.

Vogel T., M. Dohnal, J. Dusek, J. Votrubova, and M. Tesar. 2013. Macroscopic modeling of plant water uptake in a forest stand involving root-mediated soil-water redistribution. Vadose Zone Journal, 12, 10.2136/vzj2012.0154.