Geophysical Research Abstracts
Vol. 12, EGU2010-7973-1, 2010
EGU General Assembly 2010

Modelling the water balance of an inclined mature beech stand

Michael Janott (1), Sebastian Bittner (1), Sebastian Gayler (1), Eckart Priesack (1), and Jutta Holst (2)

(1) Institute for Soil Ecology, Helmholtz-Zentrum München, Neuherberg, Germany
(michael.janott@helmholtz-muenchen.de), (2) Meteorological Institute, Albert-Ludwigs-University of Freiburg, Germany

We developed a xylem water transport model for European beech (Fagus sylvatica L.) to scale up organ based processes to the tree level and to quantify their influence on the whole tree transpiration and the water uptake from the soil.
To better consider the root-soil interaction a finite element tree crown hydro-dynamics model was extended and further developed based on the 1D porous media equation by including in addition to the explicit 3D architectural representation of the tree crown a corresponding 3D characterisation of the root system. Subsequently this 1D xylem water flow model was coupled to a soil water flow model also derived from the 1D porous media equation.
The model was tested using data of a 80 – 90 years old beech stand on a steep NE-slope on Rendzic Leptosol derived from limestone (Weißjura) located close to Tuttlingen, SW-Germany. The above-ground tree architecture of a representative mature beech tree was recorded by a laser scanner and digitized. The root architecture was estimated by applying a virtual root generator since detailed information on root distribution was not available due to the restricted accessibility of roots in soil. Input of measured meteorological and soil data in combination with plant specific parameters from literature enable the appropriate simulation of transpiration and soil water contents.
In conclusion, the 1D porous media approach provided a computationally efficient method to simulate water flow in a soil-plant system as represented by mature beech trees. The model is able to reproduce main mechanisms of plant hydro-dynamics including sap flow and root water uptake from soil.