Geophysical Research Abstracts
Vol. 16, EGU2014-4241-2, 2014
EGU General Assembly 2014

Measurement and modelling of sap flow in maize plants

Florian Heinlein, Christian Biernath, Peter Hoffmann, Christian Klein, Christoph Thieme, and Eckart Priesack
Institute of Soil Ecology, Helmholtz Zentrum München - German Research Center for Environmental Health, Neuherberg, Germany (florian.heinlein@helmholtz-muenchen.de)

Climate change as well as the changing composition of the atmosphere will have an impact on future yield of agricultural plants. In order to better estimate these impacts new, mechanistic plant growth models are needed. These models should be able to dynamically reproduce the plants' reactions to modified climate state variables like temperature, atmospheric CO_2-concentration and water availability. In particular, to better describe the crop response to more strongly changing water availability the simulation of plant-internal water and solute transport processes in xylem and phloem needs to be improved.

Our existing water transport model consists of two coupled 1-D Richards equations to calculate water transport in the soil and in the plants. This model has already been successfully applied to single *Fagus sylvatica* L. trees. At present it is adapted to agricultural plants such as maize.

To simulate the water transport within the plants a representation of the flow paths, i.e. the plant architecture, is required. Aboveground plant structures are obtained from terrestrial laser scan (TLS) measurements at different development stages. These TLSs have been executed at the lysimeter facilities of Helmholtz Zentrum München and at the TERENO (Terrestrial Environmental Observatories) research farm Scheyern. Additionally, an L-system model is used to simulate aboveground and belowground plant architectures.

In a further step, the quality of the explicit water flow model has to be tested using measurements. The Heat-Ratio-Method has been employed to directly measure sap flow in larger maize plants during a two-months-period in summer 2013 with a resolution of 10 minutes and thus, the plants' transpiration can be assessed. Water losses from the soil are determined by measuring the weight of lysimeters. From this evapotranspiration can be calculated.

Transpiration and evapotranspiration are also simulated by application of the modelling system Expert-N. This framework allows for the combination of different models and sub-models to simulate water, heat, nitrogen and carbon dynamics as well as crop management and plant growth. A comparison between measured and modeled transpiration and evapotranspiration is presented and discussed.