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Water fluxes in spruce tree SPA system - numerical modeling

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Improved quantitative understanding of processes controlling the transfer of water near the land surface, including soil-plant-atmosphere (SPA) interactions, is of major importance when solving a wide spectrum of problems arising in hydrology, climatology and other relevant disciplines of natural science. In this contribution, we limit ourselves to evaluation of responses to varying atmospheric forcing and subsequent modeling of the hydrological processes at the local scale. Sap flow monitoring using the method of heat flow imaging is carried out at an experimental station located in a forested mountainous area. Automated tensiometers and soil moisture sensors provide detailed picture about water flow dynamics in the soil profile. Water fluxes through the soil are analyzed by means of mathematical modeling of transient soil water movement. The numerical model is based on the Richards' equation with a sink term accounting for root water uptake. The sap flow measurements of the transpiration stream are compared with the predicted transpiration intensities, resulting from the analysis of the observed meteorological data and numerical simulation of soil water movement in the root zone. The potential evapotranspiration rates are alternatively determined using the Penman-Monteith and the "optimum canopy temperature" method.

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