Geophysical Research Abstracts
Vol. 13, EGU2011-2373, 2011
EGU General Assembly 2011

Energy balance measurements of forest floor interception in the Huewelerbach catchment, Luxembourg

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In a forest, evaporation is a major flux in the water and energy balance. Transpiration by trees is widely recognized as a significant flux, but there is less recognition for the significance of interception in forests. Forest interception consists of two components: interception by the canopy and interception by the forest floor. Previous research showed that both are considerable fluxes, as observed by Gerrits et al. (2010) in a beech plot in the Huewelerbach catchment in Luxembourg. In winter the canopy evaporated 7% of the rainfall, while the forest floor evaporated 20%. In summer it amounted to 15% and 20%, respectively. Hence the canopy evaporates less than the forest floor. Canopy interception has been measured by subtracting throughfall and stemflow from the gross rainfall, measured in the open field close to the plot. To measure forest floor interception, a special device has been developed consisting of two aluminum reservoirs mounted above each other. The upper reservoir is permeable and contains the forest floor. Evaporation from the forest floor can be measured by continuous weighing of both reservoirs.

To obtain more insight into the process of forest floor interception and its relation with energy fluxes within a forest, a 10 meter flux tower has been installed in the Huewelerbach. Wind, temperature and humidity are measured at 10 meter height and near the forest floor surface. Incoming short wave radiation below the canopy is measured next to the forest floor interception device. The phenology is monitored by measuring leaf area index (LAI) of the canopy using a light sensitivity device.

A one-dimensional vertical energy balance model, adapted from De Ridder and Schayes (1997), is used to investigate the radiative, sensible heat and evaporative fluxes at the forest floor. The model structure is composed of a vegetation layer and a forest floor layer. The focus of this research study is on the forest floor layer. Preliminary results for a limited period during summer period in 2008 show that the energy balance model compares favourably to the observations. However, it appears to somewhat underestimate forest floor evaporation. Continued data collection is required to improve understanding and model parameterization of forest floor hydrological processes.