ENERGY BALANCE MEASUREMENTS OF FOREST FLOOR INTERCEPTION, HUEWELERBACH CATCHMENT, LUXEMBOURG

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Being frequently considered as a process of minor importance, interception is often neglected in hydrological models or considered as a constant (Savenije, 2004). However, observations and model studies indicate that interception has a distinct influence on the energy and water balance and therefore cannot be neglected (e.g., Fenicia (2008) and Zhang (2005)). Gathering more knowledge about the process is thus an important issue in hydrological sciences.

In the Huewelerbach catchment in Luxembourg interception is intensively measured in an experimental plot of 0.0596 ha (Figure 1). The plot is located in a 120 years old beech forest (*Fagus Sylvatica*) with a tree density of 168 trees per hectare. In the plot both canopy and forest floor interception are measured.

Canopy interception is measured by subtracting stemflow and throughfall from gross rainfall, which is measured in an open valley near the outlet of the catchment (see Figure 1). Throughfall is measured in two ways: by long gutters connected to tipping buckets and by manual rain gauges, which are equally distributed over the plot to capture the spatial heterogeneity of the throughfall. Stemflow is determined by a flexible tube wrapped around the trunk of the tree.

To measure interception from the forest floor a special device has been developed, which is depicted in Figure 2. The device consists of two aluminium basins, mounted above each other, and which has a surface area of 1 m^2. The upper basin contains the forest floor and is permeable (geotextile), so that water can infiltrate into the lower basin. The lower basis has a valve, which opens every day to avoid evaporation from the lower basin as much as possible. Using mass measurements of both reservoirs every five minutes with strain gauges, it is possible to determine evaporation from the forest floor when a water balance is calculated. Further details about the device can be found in Gerrits (2007).

A one-dimensional vertical model, adapted from de Ridder and Schayes (1997), is used to investigate the evaporative flux from the forest floor. The model is composed of a vegetation layer and a forest floor layer, and the required parameters are obtained from measurements on a 10 m tower, which is installed at the plot. In Figure 3 an overview of the setup is shown. To estimate the wind profile under the canopy, a wind sensor is installed at a height of 10 meter. The wind speed at the surface ($z = 0$ m) is assumed to be zero. Relative humidity and temperature are measured at two heights: at 10 meters and near the surface.

Furthermore, incoming short wave radiation is measured by two radiation sensors close to the forest floor interception device. Due to the high spatial heterogeneity of the canopy's density, we choose to use two

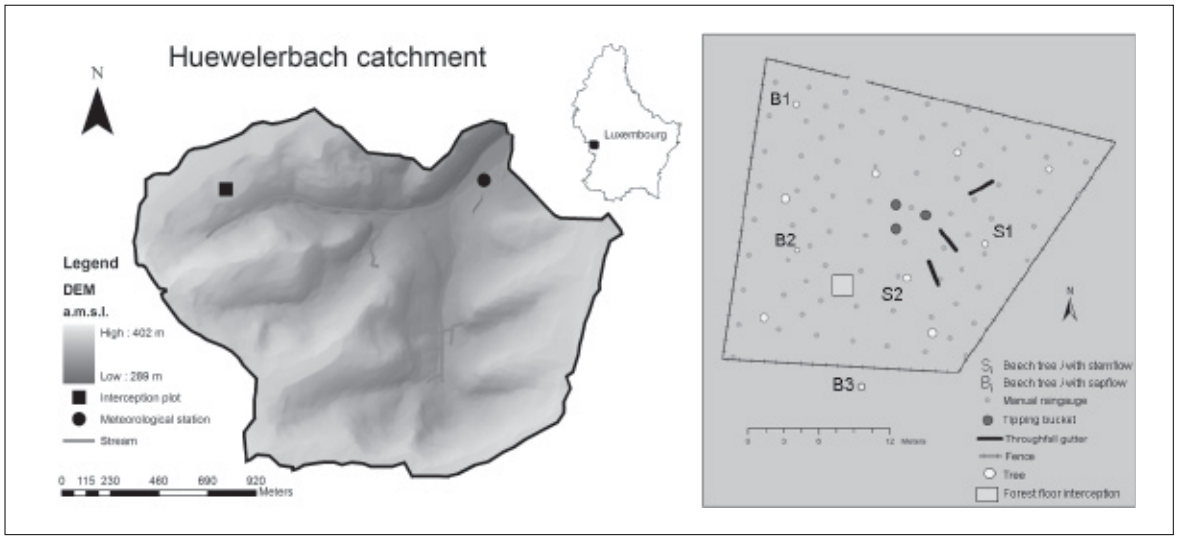

Figure 1. Location of the Huewelerbach catchment in Luxembourg (left) and the interception plot (right)

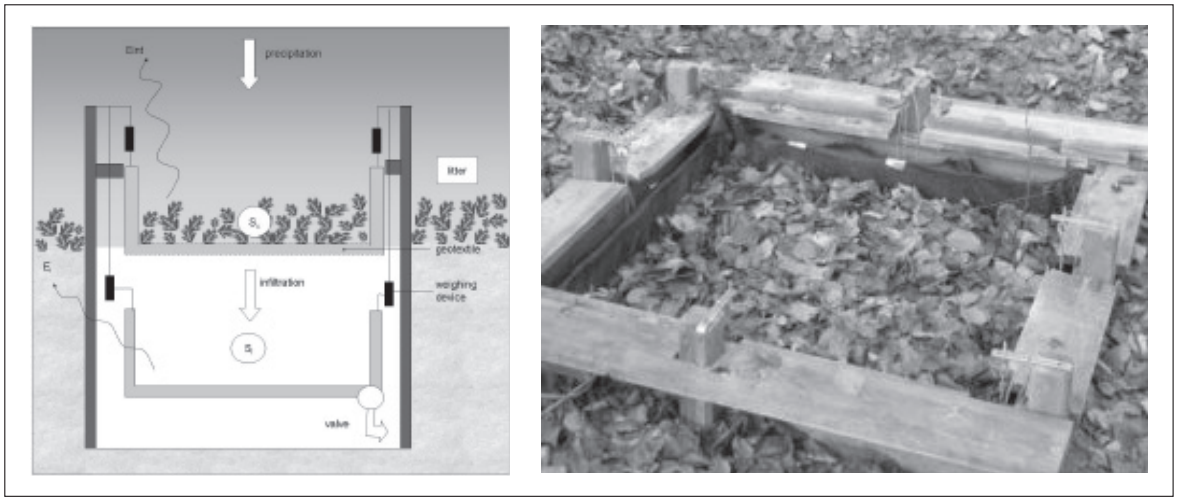

Figure 2. Schematic drawing (left) and picture of the forest floor device in the Huewelerbach catchment (right)

sensors instead of one. All the measurements are recorded every 5 minutes on an Onset Computer Corporation HOBO data logger. Moreover, the leaf area index (LAI) of the canopy is estimated with a fish-eye lens and a light sensitive resistance. The light intensity is successively converted to LAI values with the Beer-Lambert law.

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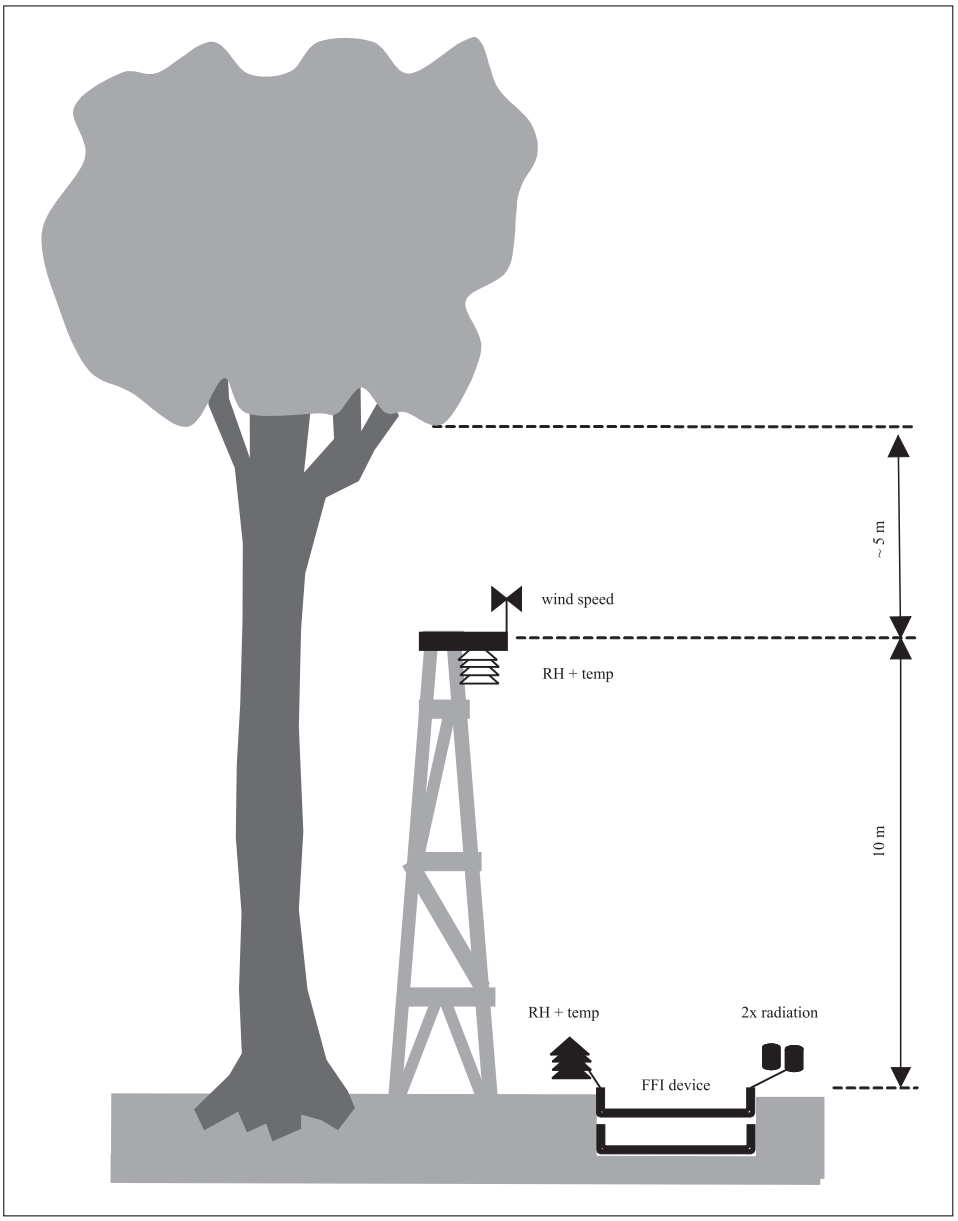

Figure 3. Overview of the measuring setup for the energy balance model (RH = relative humidity sensor; temp = temperature sensor; FFI device = forest floor interception device)

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