



Measurement of rainfall distribution on a small catchment for the evaluation of canopy interception effects

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Variability of rainfall and throughfall is an essential characteristic of the water balance at spatial scales ranging from meters to hundreds of meters or even kilometers. The amount of throughfall is governed by the characteristics of the vegetation canopy and the involved interception and stemflow effects. In initial, developing ecosystems, distinct patterns of the growing vegetation (e.g. patchiness) supposedly govern the spatial distribution of water in the system, thereby initiating and supporting hydro-ecological feedback processes. Questions are i) is the spatial variability of vegetation relevant for the system as a whole, and ii) how does the distribution of the effective precipitation (i.e. the infiltration) change over time in dependency of vegetation succession?

We present the first results of a spatially distributed measurement approach of surface-near precipitation on the constructed catchment “Hühnerwasser” (“Chicken Creek”). The 6-ha site is located in the recultivation area of the lignite open-cast mine “Welzow-Süd” in Lower Lusatia, Brandenburg, Germany. Here, the free development of an initial ecosystem is investigated since September 2005. After eight years of succession, the spatial distribution of plant species is highly heterogeneous, and gains increasing influence on throughfall patterns, thus impacting the distribution of soil humidity and possibly even surface runoff.

For spatially distributed precipitation measurement, 47 tipping bucket rain gauges were installed in heights of 0.5 m and 1.0 m along two transects on the catchment. Rain gauge data were collected by a wireless sensor node network provided by the Sens4U joint research project. The transects run NW-SE and NE-SW and cover the range of plant communities presently existing in the ecosystem: locust copses, dense sallow thorn bushes and reeds, base herbaceous and medium-rise small-reed vegetation, and open areas covered by moss and lichens. The raw measurement data were temporally aggregated using a VBA script in order to characterize interception for various types of precipitation events on different time scales.

First results from the measurement period 17th July – 3rd September 2013 widely exhibit a good accordance with reference data from on-site weather stations for sites on open ground, while canopy sites show more heterogeneous values, either due to interception or due to canopy collection effects. However, it was found that the explanation of the differences between comparable sites requires an additional inclusion of other relevant parameters, e.g. wind speed and direction, screening effects, and specific canopy characteristics. Moreover, extreme precipitation events sometimes seemed to lead to incorrect measurements either by the sensor and / or node, which required supplementary quality controls of equipment and data.

Results from future long-term measurements on the “Hühnerwasser” catchment will be used to identify possible plant-soil feedback mechanisms and to parameterize models that simulate the behavior of initial eco-hydrological systems.