Geophysical Research Abstracts
Vol. 16, EGU2014-8842, 2014
EGU General Assembly 2014

Stemflow affects spatial soil moisture fields differently in summer and winter

Anke Hildebrandt (1), Jan Friesen (2), and Simon Kögler (3)

(1) Friedrich Schiller University Jena, Institute of Geoscience, Jena, Germany (hildebra@alum.mit.edu, +49 341 235451973), (2) (2) Helmholtz Centre for Environmental Research – UFZ, Department Computational Hydrosystems, Permoserstr. 15, Leipzig, Germany, (3) (3) Helmholtz Centre for Environmental Research – UFZ, Department Monitoring and Exploration Technologies, Permoserstr. 15, Leipzig, Germany

Stemflow is only a minor component of net precipitation, but because it acts as a point input, it has the potential to strongly shape the soil moisture patterns below trees and induce vertical fluxes as well as groundwater recharge. However, there is little research on the evolution of soil moisture patterns around trees over prolonged periods of time.

In this paper we investigate in a beech dominated forest in central Germany the dynamics of surface soil moisture in proximal (<70 cm) and distant (70-350cm) regions from beech trunks. The site belongs to the Terrestrial Environmental Observatories (TERENO), Harz/Central German Lowland Observatory. We measured soil water content using a wireless sensor network (SoilNet) at over 130 locations. The measurement points were arranged in circles of increasing radius around the tree trunks. Data were collected over a nine months period, including 10 weeks of intensive event based throughfall and stemflow monitoring.

During the growing season, water content near the tree trunks was almost always lower compared to greater distance from the tree, which may be related to both lower root water uptake and higher throughfall in regions with thinner crowns at mid-distance between trees. During the growing season, soil water content near the beech trees only exceeded levels at greater distance during few rain events with substantial stemflow (15-20% of rain). However, during the wintertime, soil moisture near the trees was higher than at greater distances, in particular in response to rain events after leaf senescence. The variance of soil moisture at tree-distant locations is highest at intermediate mean moisture levels, while variance is low at both very high and very low mean soil water content. No such pattern is evident for the region near the trees, where both the highest and lowest variances occur at intermediate soil water contents.

Our results indicate that the areas near tree trunks are a source of substantial spatial variation in the soil moisture field below trees. The elevated soil moisture in fall and early winter suggests a strong role of stemflow for shaping soil moisture patterns during mild winter periods.