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Throughfall and stemflow dynamics of different tree species and their implications for groundwater recharge

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Rainfall redistribution by forest canopies varies for different tree species and can play an important role for soil moisture patterns and groundwater recharge. A thorough understanding of these relationships will improve our ability to predict future impacts of climate and forest structural changes on the water balance of forest stands.
Throughfall was continuously measured at 7 sites with different dominant tree species and ages: young and old beech, young oak, and young and old pine. Within 2000 m^2-plots situated in the Müritz National Park (north-eastern Germany), trough-based throughfall monitoring systems with a total collecting area of 6.6 m^2 per site, and soil moisture, leaf wetness and sapflow sensors were installed. Stemflow was measured for 5-10 trees per site with a temporal resolution of 1 min.
To date at least one year of high temporal resolution data has been collected for each investigated site. This has allowed for deeper insights into the dynamics of throughfall and stemflow and their dependencies on tree species, age, season and other rainfall and forest characteristics.
The data set was used to parameterize and run the soil hydrological model HYDRUS-2D from single tree to forest stand scale to assess the effect of stemflow and throughfall patterns of different forest types on the dynamics and patterns of soil moisture. The spatial distribution of root water uptake turned out to be a critical point in the model set up with regard to the ability of the model to simulate observed soil moisture dynamics.
First results highlight the importance of concentrated water input by stemflow in beech stands, subsequent high infiltration rates around beech stems and the resulting high soil moisture contents for rapid groundwater recharge. For the other tree species stemflow plays a minor role and rainfall redistribution patterns are more determined by canopy gaps or ground vegetation.
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