Rainfall interception of urban trees: event characteristics and tree morphological traits

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Abstract

The rapid expansion of impermeable surfaces in cities has a major impact on urban hydrology. Infiltration of rainwater is reduced and water runs off faster with higher runoff peaks. Urban trees as stormwater management tools are becoming more relevant to reduce flood risks in addition to other ecosystem services. An in-situ field experiment to measure throughfall on Norway maple (*Acer platanoides*) and small-leaved lime (*Tilia cordata*) was conducted to determine the interception of solitary urban trees with different degrees of surface sealing in the city of Freiburg, Germany. The relationships between rainfall characteristics, tree morphological traits, and the interception behavior were investigated with eight trees per species. 76 recorded rainfall events were evaluated from April to September 2021. Average interception values were higher for small-leaved lime (70.3 $\pm$ 6.6%) than for Norway maple (54.8 $\pm$ 10.3%) and hence much higher than in a typical forested environment. The average interception loss of all recorded events was 2.58 $\pm$ 0.60 mm for Norway maple and 3.73 $\pm$ 0.29 mm for small-leaved lime. For both tree species, significant linear correlations were found between the relative interception and other factors like rainfall depths, the leaf area index (LAI), and the plant area index (PAI) (adj.$R^2 > 0.45$). In contrast to Norway maple, small-leaved lime also showed significant relationships of several tree morphological parameters with the interception (adj.$R^2 > 0.43$). LAI, which also effects the interception, of both tree species significantly decreased with the degree of surface sealing. Our results provide a better understanding of the interception process of solitary trees for different urban sites and allows to parameterize interception based on measurable properties. However, further field experiments with various tree species need to be conducted to obtain a larger database for typical parameters in models and to support urban planners in managing stormwater runoff.

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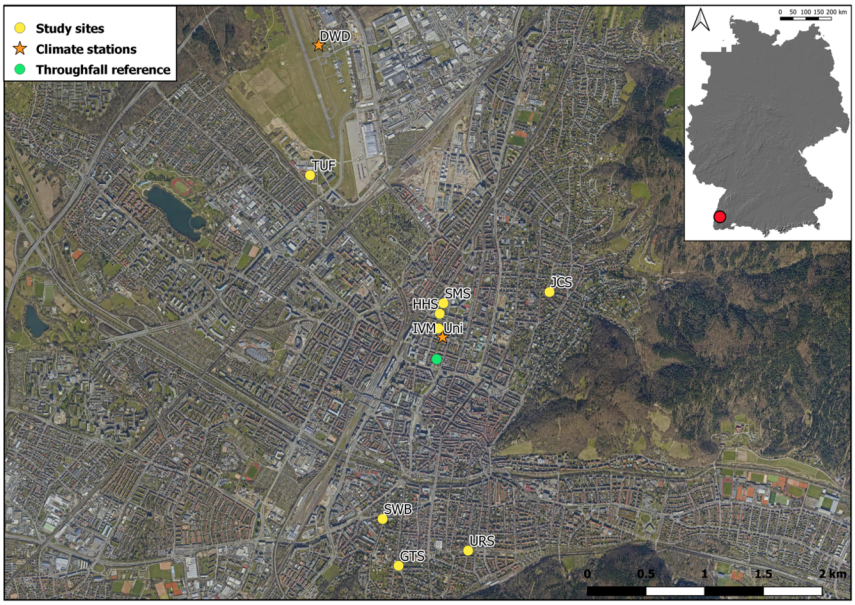

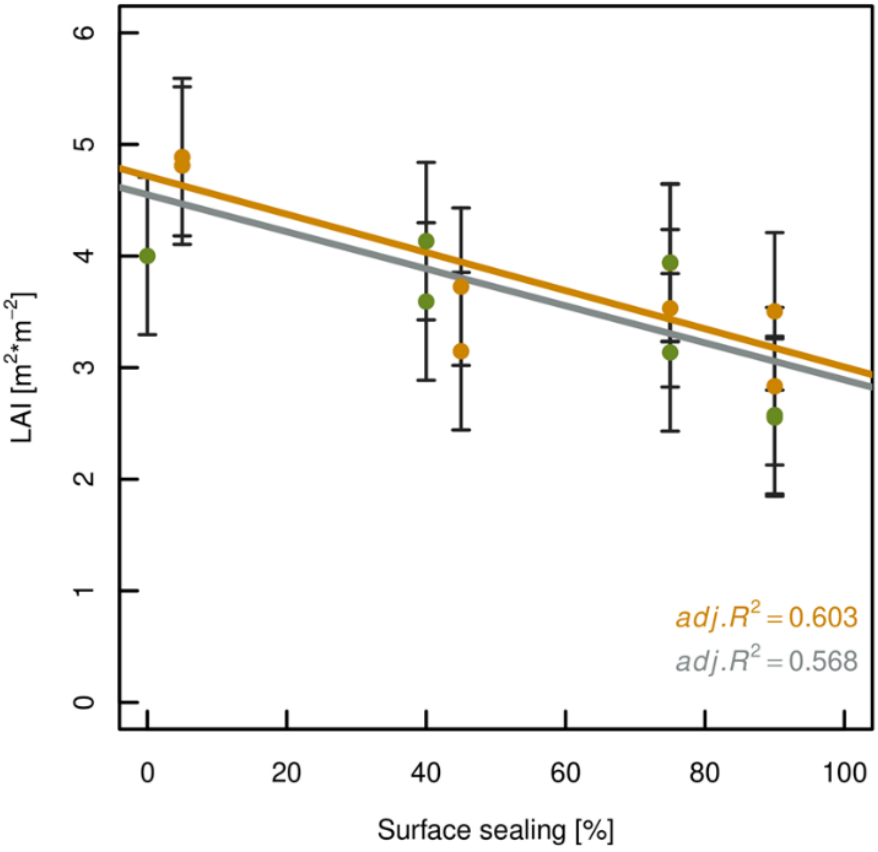

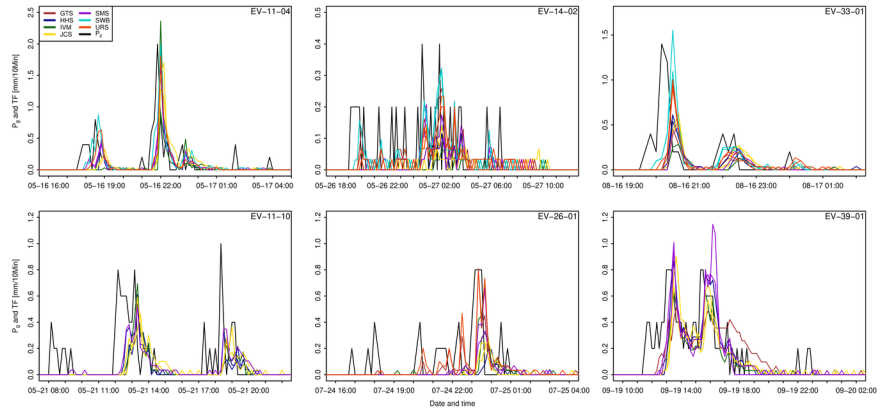

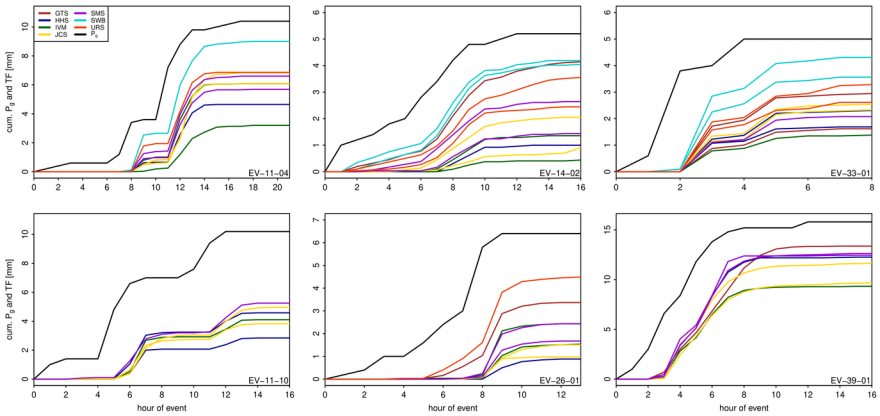

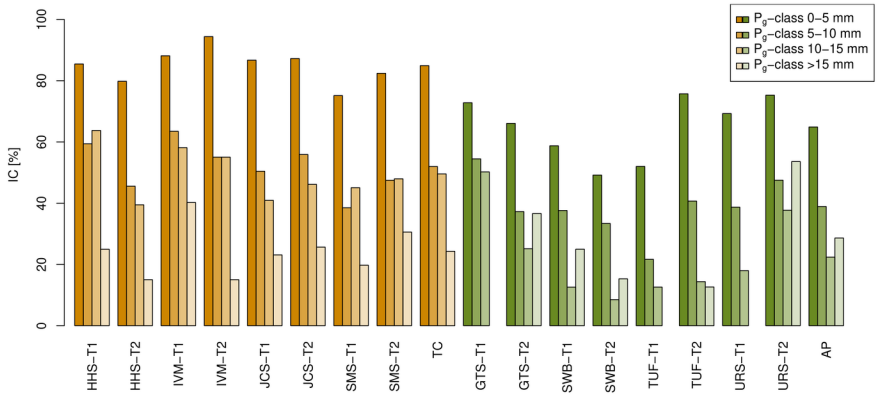

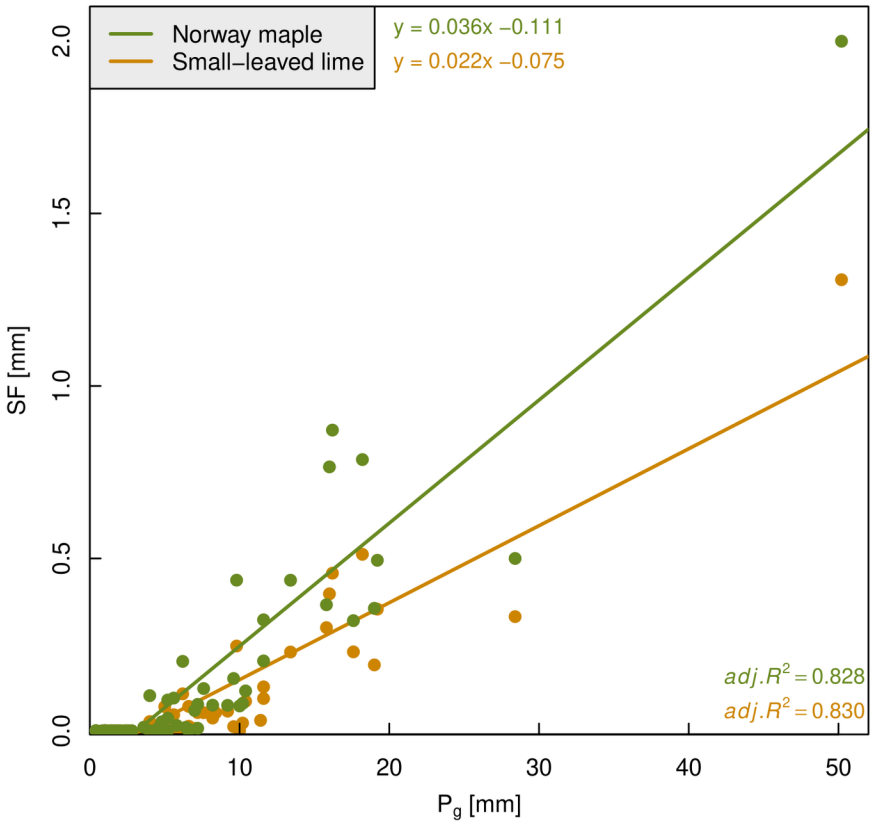

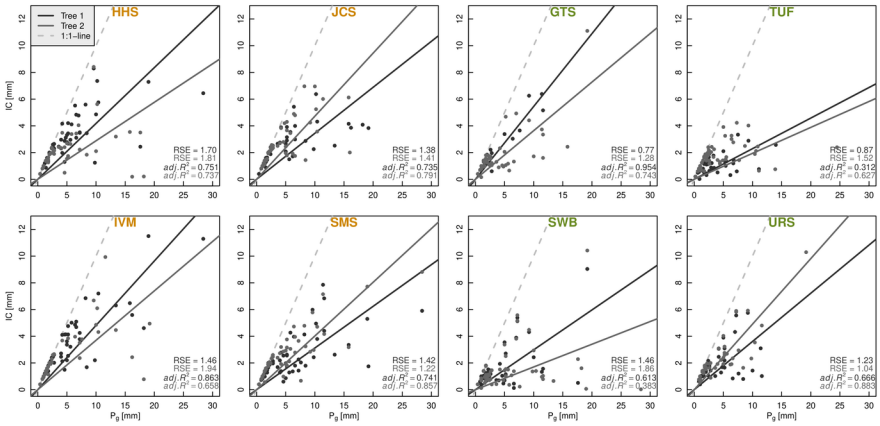

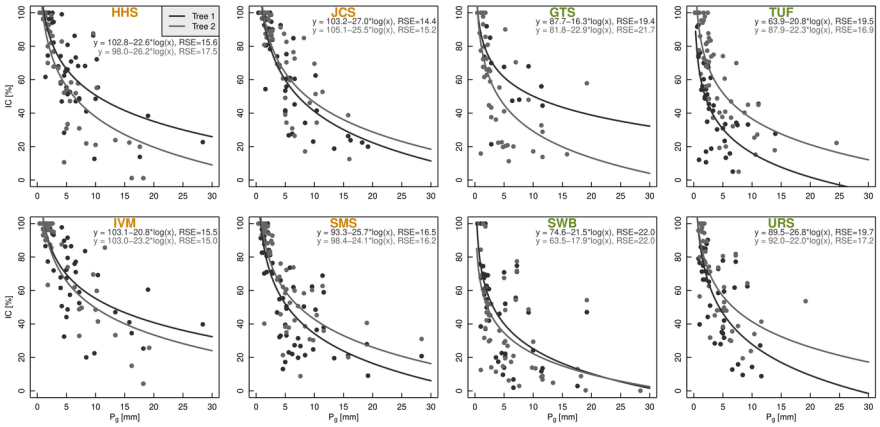

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