Stemflow and canopy structure: revelations from the NIED large-scale rainfall simulator

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Stemflow plays an important role in both the hydrologic and elemental cycling of forest ecosystems. Although the amount of stemflow is relatively minor compared with the amount of throughfall, significantly concentrated inputs of stemflow water around tree bases have notable effects on near-trunk water dynamics and soils. Thus, the main factors controlling the amount of stemflow should be well understood. However, our knowledge of stemflow generation still has gaps because stemflow yields are affected by a myriad of interacting factors- the amount and the intensity of rainfall, and by differences in canopy structure among and within species, including leaf type, branch angle, and trunk lean, among other factors. In order to better understand the factors controlling stemflow funneling ratios among trees with differing canopy structures, we used the large-scale rainfall simulator at the National Research Institute for Earth Science and Disaster Resilience (NIED) with planted trees to measure stemflow under an artificially controlled environment with six different rainfall intensities (15, 20, 30, 40, 50, and 100 mm/h). Test tree species were *Cryptomeria japonica* D. Don (Japanese cedar), *Chamaecyparis obtusa* (Siebold & Zucc.) Endl. (Japanese cypress), and *Zelkova serrata* Thunb. (Japanese zelkova). We measured the detailed canopy projection areas for both foliated and defoliated conditions, branch number, and trunk lean via LiDAR and manual measurement techniques. Under controlled meteorological conditions, funneling ratios showed complex and different trends with respect to canopy structure. Hence, we used a Bayesian framework to obtain the relative influence of various canopy structural metrics. The preliminary results revealed that diameter at breast height and total amount of biomass were the two most influential factors affecting the funneling ratio among six test trees under foliated conditions. On the other hand, the differences in funneling ratios among defoliated six trees were mainly controlled by branch angle. Because raindrops directly contact with the surfaces of branches and stem without leaves, branch angle would have a relatively large influence on stemflow generation. These findings will contribute to better understanding the rainfall interception process, especially for its seasonality and dependency on tree species.

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