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Characteristics of the drop size distribution and rainfall erosivity of throughfall beneath a deciduous tree canopy

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Throughfall constitutes the majority of incident precipitation reaching the ground under any type of vegetation canopies. Its characteristics play a crucial role in understanding the sub-canopy hydrologic and erosional processes. The present study examines the drop size distribution (DSD) and erosivity of throughfall beneath the birch tree (*Betula pendula Roth.*) canopy during its leafed period using a Parsivel[1] optical disdrometer installed in the experimental plot in the city of Ljubljana, Slovenia. The momentum and kinetic energy of throughfall drops were used to express the impact of the tree canopy on the potential erosive power of throughfall on a soil surface which was computed from the measured raindrop size and velocity. The microstructures of open rainfall and throughfall were measured simultaneously by an optical disdrometer during the two separate precipitation events that occurred on August and September 2021 with an accumulated amount of 34.4 mm in 7.3 hours and 87.6 mm in 7.6 hours, respectively. On an event basis, the preliminary results show that the throughfall DSD for both events exhibits two contrasting modes (i.e. bimodal peaks) while open rainfall has only one which is attributed to the influence of canopy interception and storage. The total number of throughfall drops is higher compared to the open field condition but are smaller in size, comprising nearly 89% of the recorded drops are below 1 mm while only 0.23% are greater than 2.4 mm. Additionally, the median-volume drop diameter (D_{50}) of the throughfall is 1.31 mm for an extreme event (September 2021) and 0.98 mm for a medium-magnitude rainfall (August 2021) which is respectively, 70% and 79% lower than those in open precipitation. On the other hand, the raindrops from moderate and heavy precipitation have greater momentum to cause soil particle displacement with a corresponding value of 60.49 and107.83 kg m s^{-1} m^{-2} than the throughfall drops (40.99 and 87.49 kg m s^{-1} m^{-2}). Similarly, a throughfall kinetic energy of 91.96 and 187.77 J m^{-2} is respectively 64% and 82% lower than the energy loads of raindrops in the open environment. Owing to the effects of the birch tree canopy, the distribution of throughfall reduces the erosive potential of raindrops by approximately 36% and 18% for the two selected rainfall events during the leafed period. These results accentuate the importance of understanding the different characteristics of throughfall from the open rainfall which is necessary for the prediction of soil erosion processes in areas where this tree species is abundant in nature.

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