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Transformation of the rainfall drop-size distribution and diameter-velocity relation by the maize canopy

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Interception of rainfall by crop canopies changes not only the amount of water reaching the soil, but also the velocity and size distribution of the drops that make their way to the ground. Consequently, understanding the mechanics of soil water recharge, or soil erosion under canopies requires knowledge of not only the partitioning of rainfall into stemflow, throughfall, and plant water storage, but relies also on our ability to measure and predict the sizes and velocities of hydrometeors under the plants. In order to measure the drop-size distribution and the velocity of the drops that constitute the throughfall, we installed two optical disdrometers; one under and one outside the maize canopy and collected data from 14 July 2009 to 28 August 2009, comprising 12 storms with more than 1 mm of rainfall, from which 10 events exceeded 10 mm of rain. By comparing the number of drops on each of the 440 diameter/velocity classes under and outside of the canopy, we were able to identify preferential drop sizes on the throughfall, i.e. classes of drop diameters with higher count under the canopy. The drop classes presenting higher counts under the canopy had diameters ranging from 3.25 mm to 5.75 mm with velocities between 1.4 m/s and 5 m/s. Using the method proposed by Wang and Pruppacher (1977) to calculate drop accelerations on still air, we were able to trace the origin of those drops to heights between 10 cm to 105 cm within the canopy, confirming that these drops constitute the indirect throughfall, i.e. they were intercepted, ran towards an edge of a leaf and detached finally reaching the ground. The capability to trace the detachment height of drops allows us to reconstruct the drop-size distribution at different levels of the canopy, giving us unique insight in the mechanics of interception, indirect throughfall formation and re-interception of rain drops by the maize canopy.