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Preliminary insights into the relationship between throughfall drop size and isotopic composition

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Even though throughfall is the dominant input of water to forests, many questions remain about the temporal fine-scale mechanisms controlling the redistribution of rainfall by forest canopies. Hydrologists must therefore combine different methods in novel way to achieve breakthroughs in our understanding of rainfall partitioning and its interactions with pre-event water storage on tree surfaces. Here, we apply a combination of isotopes (oxygen and hydrogen) and laser disdrometers to quantify the isotopic composition of free, splash, and release throughfall at the sub-event timescale. For individual events, isotopic differences between throughfall and open rainfall may indeed vary in magnitude and direction as a result of evaporation, exchange or selection processes.
Our working hypothesis is that relating the sub-event timescale throughfall measurements with that of drop size distribution and of isotopic variations will provide an unprecedented understanding of the throughfall generation process. Such an understanding would be required to fully and accurately track the transfer of moisture from the canopy to the forest floor.
This work performed in a Scots pine forest under Mediterranean conditions is based on the continuous (5min data) measurement of open rainfall and throughfall amounts (by means of tipping-buckets) and of drop size distributions (laser disdrometers) at the same two locations. In addition, rainfall and throughfall passing through the laser disdrometers and the tipping buckets are finally collected sequentially by means of automatic samplers. This presentation will show preliminary findings on the relationship between throughfall drop size and isotopic composition for several rainfall events of different magnitudes and intensities, helping to reveal how water moves through flowpaths and storage reservoirs in the canopy.