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Estimates of root water uptake from soil moisture profile dynamics

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Measuring evapotranspiration (ET) in-situ remains a challenging task, despite the variety of techniques that are available at different scales. One approach to estimate actual ET is to infer root water uptake (RWU) of plants from measurements of changes in volumetric soil water content. However, the temporal dynamics of this process and the limitations of the method are not well-known.

In this study we examine soil moisture profiles within the main rooting zone of the top two metres, continuously measured with TDR probes with a depth resolution of 20 cm, at two beech forest sites in the same catchment but with contrasting geology and soils. With the help of an automated detection algorithm we can identify magnitude, timing and different phases of RWU. We compare the calculated RWU dynamics with xylem sap velocity dynamics measured in nearby beech trees.

Results show differences between the sites with respect to depth distribution and magnitude of RWU, but also concerning the performance of the detection algorithm. The comparison of calculated RWU and sap velocity dynamics show generally good agreement at ideal radiation days. However, this relation varies widely, both seasonally and within the soil profile.