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Evaluation of TDR water content measurements in large undisturbed soil sample

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The evaporation experiments were conducted on large undisturbed sample of coarse sandy loam soil from the experimental watersheds Liz (Šumava Mountains). The sample was carefully taken in plastic tube (internal dia. 189 mm and 250 mm height). The apparent dielectric constants were monitored at depths 75, 125 and 175 mm bellow the sample surface using the 7.5 cm long TDR probes connected to Campbell Scientific TDR100 reflectometer via multiplexor. Pressure heads were measured by microtensiometers in the same three depths. The total weight of the samples was continuously recorded during the course of experiments; therefore subsequent calculation of the volumetric water content changes was possible.
Volumetric water contents in each probe were calculated from apparent dielectric constants using Topp's equation, after the apparent dielectric constant readings were corrected for effect caused by the plastic sample container. Two methods were used to calculate the total volumetric water content from point TDR water content measurements. In first method the sample was divided into three vertical sections, while the uniform moisture distribution was assumed in each section. The second method assumed the semi-equillibrium state during the evaporation experiment. Then hydrostatic pressure distribution was assumed in each section and water content distribution was therefore approximated with van Genuchten's retention curve developed from measured pairs of pressure heads and TDR based water contents.
The total water contents measured by gravimetrically were compared with total TDR derived water contents. The results show that TDR measurements underestimated significantly the total water contents measured by gravimetric method. Additionally, the sample was scanned using computer tomography to inspect the spatial variability of the sample structure, which is believed to be possible source of the TDR measurement bias.

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