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Assessing the Use of Capacitance Sensors for Estimating Diurnal Variation in Evaporation.

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Sub-daily estimates of evaporation, E, were obtained from diurnal changes in vertically integrated soil moisture content, θ, above the zero-flux-plane. θ was obtained with various types of capacitance sensors installed in a bare soil, a rapeseed plot and a maize field. These sensors comprised Theta probes (TP), Profile probes (PP), ECH_2O probes (EP) and Aquaflex sensors (AF). First, the output of these sensors was compared with θ obtained with the gravimetric and neutron probe method. The absolute values of θ as measured by the various capacitance sensors differed considerably. Furthermore, the output of the sensors (apart from the AF probes) was found to be affected by temperature, which would result in an anomalous course of diurnal E(see also Verhoef et al., 2006, JoH 321:147-162). Also, θ-data were subject to noise which required smoothing to ensure a physically realistic variation in E. Smoothed values of θ were temperature-corrected using field and laboratory-based correction equations. It was found that a considerable difference existed between both corrections procedures, and correction factors strongly depended on θ. As this resulted in an overly complicated correction procedure, which furthermore gave unreliable E-values, it was decided to use a constant correction factor for each capacitance probe.

For the bare soil, only θ profiles obtained with TP and AF produced reliable E values. By contrast, under a canopy all sensor types yielded satisfactory E-values. This was most likely caused by reduced amplitudes of soil temperatures and the fact that the dimensions of most sensors do not allow installation in the top few cm of soil, which is the layer from which most evaporation would occur in a bare soil. We conclude that more research needs to be done on the performance of these sensors.