341-6 Quantification of Soil Water Evaporation Using TDR-Microlysimetery.

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Soil water evaporation is conventionally measured using microlysimeters by evaluating the daily change in mass. Daily removal is laborious and replacement immediately after irrigation events is impractical because of field wetness which leads to delays and an underestimation of evaporation. Irrigation, precipitation and evaporation depth can be estimated using microlysimeters instrumented with time-domain reflectometry (TDR) probes. However, there are uncertainties in the use of TDR to estimate changes in stored soil water. During and immediately following irrigation and precipitation events, physical non-equilibrium of water flow may result in errors in the estimation of soil water mass within the microlysimeter. Diurnal oscillations and vertical gradients in soil temperature may also increase errors in permittivity-based measurements of soil water. We evaluated errors in the change in soil water content as determined using microlysimeters instrumented with TDR probes. Twelve microlysimeters (0.15 m length × 0.15 m dia. rigid Sch 40 polyvinyl chloride) were extracted using a hydraulic profiling probe. Each microlysimeter was instrumented with a 150 mm trifilar TDR probe inserted vertically from the bottom and thermocouples installed through the sidewall at 20, 60, and 120 mm depths. Water contents were estimated using a temperature dependent complex permittivity soil model. Errors in TDR-based estimates in water content changes were assessed by determining the change in microlysimeter mass. In the laboratory, 33 mm of water was applied to each microlysimeter using a multi-drip emitter at a flow rate of 129 mm h^{-1}. Following each water application, microlysimeters were sealed and permitted to equilibrate overnight and then placed in the field to permit evaporation for three days. Following water applications, changes in TDR soil water depth were small (<0.3 mm) throughout the equilibration period except for one replicate microlysimeter that declined by 10 mm in three hours. Errors in soil water content estimation after 2 hours of equilibration were less than 0.025 m^3 m^{-3}. Differences in mass-based and TDR-based estimates of evaporation averaged 1.5 mm (± 1.5 mm SD) for a cumulative three-day evaporative loss of 27 mm. However, a two to three hour equilibration time may be required following irrigation or intense precipitation events to accurately assess soil water content changes using TDR-microlysimetry.

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