



Capability of two commercial moisture probes to measure dielectric permittivities over the complete range from air to water

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Capacitance and time domain reflectometry (TDR) probes are frequently used for measurements of the volumetric soil water content. The measurement concept is based on the correlation between volumetric water content and dielectric permittivity (ϵ). While considerable effort has been made to accurately measure ϵ in the typical range of mineral soils (< 40), little attention has been paid to the capability of moisture probes to measure high ϵ (>40), typical for highly porous media like organic soils.

Here we evaluated the capability of two moisture probe types (TRIME-PICO 64, GS3) to measure ϵ over the range from 1 to 80. In case of the TRIME probes, different equations to calculate ϵ from transit times were tested. For both probes, uncertainties increased with increasing ϵ . However, for the TRIME probes, acceptable results could only be achieved by extensive calibration on a set of reference solutions. We also tested the performance for different electrical conductivities of the reference solutions. Accuracy of ϵ values was unaffected by increasing conductivities for the TRIME probes, but decreased for the GS3. The GS3 probes, however, were able to determine electric conductivities accurately, while TRIME probes failed for electrical conductivity although indicated differently by the manufacturer.