The Theory of Time Domain Reflectometry and its Implications for the Design of Probes to Measure Soil Water. (S01-knight221234-Oral)

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Abstract:

Time domain reflectometry (TDR) is a method used by electrical engineers to locate defects in transmission lines. The method was adapted by Clarke Topp to give soil water content from measurements of the speed of an electromagnetic wave in the soil, which depends strongly on the dielectric constant. Transmission lines are designed to be uniform with ideal properties, and the theory and practice of the transmission of electromagnetic waves in such ideal systems is well understood. However, soils are not ideal dielectric media. Some TDR probes are designed to have elements of known dielectric properties carrying some of the signal and affecting its speed. Field soils have spatially variable properties, and the water content may vary over the length and width of a TDR probe. It is important to know how the volume of soil sampled by a probe depends on the probe design. In some cases simplified solutions of Maxwell's equations can be found and analysed, in other cases numerical solutions or empirical calibrations must be performed. Some of the challenges involved in modeling non ideal TDR systems will be described, together with some of the successes.

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