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Influence of iron minerals on the determination of soil water content using dielectric techniques

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Abstract

Measurement of soil moisture content based on changes in dielectric constant has become a standard approach in recent years. Time domain reflectrometry (TDR), in particular, has gained rapid acceptance as a technique for measuring soil moisture that can be used in a wide range of applications. The capacitance soil moisture probe has been demonstrated also to have a large number of potential uses. One factor that dielectric soil moisture determining techniques have in common is the need for calibration. The capacitance probe needs to be calibrated for each soil type, and recent research has shown that it is advisable for the same strategy to be adopted with time domain reflectometers. Results presented show the influence that iron minerals such as magnetite, haematite and goethite can have on the calibration of time domain reflectometers and capacitance probes. Magnetite shows the greatest effect by causing an uncertainty of up to 60% in the estimation of volumetric water content in the presence of 15% magnetite.

1. Introduction

Although moisture content has long been known to affect the dielectric constant of the soil (Smith-Rose, 1933; Thomas, 1966; Hoekstra and Delaney, 1974), it is only in recent years that equipment suitable for routine measurement of soil dielectric constant has become available. Dielectric techniques include time domain reflectometry (TDR) and the Institute of Hydrology (IH) capacitance probe (Dean et al., 1987; Robinson and Dean, 1993). Compared with the more traditional methods of measuring soil water content such as the destructive gravimetric soil sampling or the use of the neutron probe, dielectric techniques have the advantage of being suited to auto-

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