Predicting Subsurface Soil Water Profile in Sand

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Abstract

Electromagnetic (EM) wave methods are used in many civil engineering applications for non-destructive investigations such as locating reinforcing steel and voids in concrete. In order to predict accurate relative permittivity for a soil, the water content of the soil must be known. The objective of the research project reported in this thesis was to choose a method to predict the water content of a soil and to quantify the accuracy of the method.

The focus of the larger project is on the Earth's near subsurface, 0 to about 1 m below ground surface. This depth is often characterized by alternately wet (saturated) to dry pores within the soil and is referred to as the vadose zone. A computer code was selected to be used to predict the soil water along a vertical profile in the vadose zone. The results of the predicted soil water were then compared to the measured water profile for the sand column.

The code was used to predict the soil water profile during draining (drying or dewatering) of the sand column. The sand had a saturated hydraulic conductivity of 0.04 cm/second which is a high hydraulic conductivity and leads to rapid drainage of water from the column of sand. The saturated volumetric water content of the sand was 0.35 \ and the residual volumetric water content was 0.05. After the sand was saturated with water, the water source was removed and the water in the pores of the sand was allowed to drain. The 160 cm column of sand drained to nearly the residual volumetric water content within 15 to 30 minutes. After two hours of drainage, the column of sand was essentially at the residual volumetric water content throughout the entire column.