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# Unfrozen water content of permafrost during thawing by the capacitance technique

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## ABSTRACT

The capacitance method is portable, safe in terms of no radiation hazard, fast in terms of response time, and cheap, and has been widely used to measure the water content of unfrozen soils. However, it is sensitive to installation, salinity, temperature, bulk density, and clay content. Calibration for specific soil types of interest is essential for improved accuracy. This paper explores using the capacitance technique to measure the unfrozen water content of permafrost. It presents a detailed capacitance sensor calibration process, data, and regression equations for describing the relationship between volumetric water content and the sensor output. The subfreezing temperature effects on the sensor electronics response and on the relative permittivity or dielectric constant of water, ice, and oven-dry soil minerals are investigated. The obtained unfrozen water content results are used for

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