Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AGE04-01 Room:101A Time:May 20 09:00-09:15

Development of a tensiometer-TDR coil probe for the measurement of soil-water retention curves on water-repellent soils

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Soil- water repellency accounts for influencing many of the key soil hydrological processes such as reduced infiltration, preferential flow and surface water flow. Water repellency- induced fingered flow can lead to considerable variations in water content in an initially water repellent soil. The precise and continuous measurement of hydraulic properties of water repellent soils is important for understanding soil-water interaction. Moreover, there is a need for small-scale, non destructive measurement techniques to obtain direct, high resolution measurement of soil-water content and water potential. To study the soil-water retention properties for hydrophobized sands and natural volcanic ash soil during repeated wetting and drying processes, a mini tensiometer-time domain reflectometry (T-TDR) coil probe was developed with dimensions of 6-mm diameter and 30-mm length. Seven mini T-TDR coil probes were developed and the performances were tested against Toyoura sand, hydrophobized sands and volcanic ash soil. Due to the poor performance of dielectric mixing models, a simple two-point calibration equation was proposed. The new mini T-TDR coil probe also provided reliable, simultaneous measurements of volumetric water content and soil-water potential (h) measurements when investigating the soil-water retention characteristics of hydrophobized sands and natural volcanic ash soils under repeated wetting and drying cycles.

Keywords: Mini T-TDR coil probe, soil-water retension, water repellency