Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06700, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06700
EGU General Assembly 2008

Polymer tensiometers: Comparing direct measurement of soil water potential in dry soils with TDR soil moisture readings converted with water retention curves

M.J. van der Ploeg (1), H.P.A. Gooren (1), C.W. Hoogendam (1), G. Bakker (1), C. Huiskes (2), L.K. Koopal (1), H. Kruidhof (2) and G.H. de Rooij (1)

(1) Wageningen University and Research Centre, (2) University of Twente (martine.vanderploeg@wur.nl)

In water scarce areas, plant growth and productivity can be severely hampered by irregular precipitation and overall water shortage. Although root water uptake is driven by potential gradients, measurement of soil water potentials was limited by the measurement range of water-filled tensiometers (-0.085 MPa). Other measurement techniques indirectly measure soil water pressure by converting soil moisture with the use of the water retention curve. In dry soil conditions, when the soil moisture measurements may become insensitive to small moisture variations, this conversion may lead to large errors. We developed a polymer tensiometer (POT) that is able to measure down to -2.0 MPa. The POT consists of a solid ceramic, a stainless steel cup and a pressure transducer. The ceramic consist of a support layer and a membrane with 2 nm pore-size to prevent polymer leakage. Between the ceramic membrane and the pressure transducer a tiny chamber is located, which contains the polymer solution. The polymer's osmotic potential strongly reduces the total water potential inside the polymer tensiometer, which causes build-up of osmotic pressure. Hence, the water in the polymer tensiometer cavitates at a much lower soil water potential than the essentially pure water in a conventional tensiometer. We tested 8 POTs in an experimental setup, where we compared pressure measurements with moisture measurements made by TDR, pressure from converted moisture measurements, and pressure

measurements by water-filled tensiometers. The experimental setup consisted of two evaporation boxes, one containing sand (97.6% sand, 1.6% silt, 0.8% clay), and one containing loam (42.8% sand, 38.8% silt, 18.4% clay). The uniformly repacked soils were saturated at the beginning of the experiment, then drained, and left to dry out. Results show that polymer tensiometers work comparable to the other instruments, polymer tensiometer and TDR data can be used to measure an in-situ water retention curve, and the comparison highlights the weaknesses of using converted soil water pressures.

This research is funded by the Dutch Technology Foundation (STW). Contributing companies are: ECO Ceramics BV (www.ecoceramics.nl), ENRIN (www.enrin.nl) and KELLER Meettechniek BV (www.keller-holland.nl)