Ring test for measuring soil hydraulic properties
Remarks and methodical innovations

Uwe Schindler¹, Wolfgang Durner² and Georg von Unold³

¹ Zalf Müncheberg, Institute of Landscape Hydrology
² Institute of GeoEcology, Braunschweig Technical University
³ UMS GmbH Munich

Content:
- Soil preparation
- Evaluating the results
- Methodical innovations of the Evaporation method
- Conclusions
Texture

Clay: 9.5%
Silt: 48.6%
Sand: 41.2%

Texture:
Clay: 9.5%
Silt: 48.6%
Sand: 41.2%

Slu acc. to German soil classification KA5

Grain diameter (um)

Values are interpolated

FutMon

Percent

0 10 20 30 40 50 60 70 80 90 100

1 10 100 1000 10000

!!

Workshop: Ring test for quantifying soil hydraulic properties, Warsaw, 12/13.10.2009
Dry bulk density _Soil preparation

Pressure distribution under load

Photo 1: Hydraulic compression system driven by the PTO of a tractor
Variation of dry bulk density

The variation is much greater than at any natural site!
Variation of water content measurements

Water content (% by Vol.)

Laboratories

Soil paste

Compacted soil

pF 4.2 ← pF 3

pF 2.5 ← pF 1

Hy

Variation is caused by different DBD’s

Water content (% by Vol.)
Water retention relationship

HYPROP and mean FutMon are comparable. Differences have to be investigated!

Slu (ULs) \(_{(KA5)}\) WC pF 4.2 = 11-12 % by vol
Water retention Relationship

Comparison FutMon versus HYPROP

ws and PWP are generally fixed values.
Evaporation method- Innovations

1. **Evaporation functions**-
   Weighing accuracy reduced
   JPNSS 2006

1. **New tensiometers**-
   Measurement extension 300 kPa
   SSSAJ 2009

1. **Bubble point extension**-
   Extension the range to 800 kPa
   JPNSS 2009

Properties:
- Water retention function
- Hydraulic conductivity function

Measurement range
- 0 – 800 kPa (pF 3.9)

Measurement time
- 3 (clay) to 8 days (sand and peat)
Conclusions – open questions

- HYPROP and mean FutMon were quite comparable. Differences have to be investigated!

- Natural undisturbed soils are better than artificial compaction for this ring test.

- For steady-state procedures: How is the water potential when steady-state is achieved? Which potential is charged?

- HYPROP: Dynamic effects have to be analyzed

- Do we have evaporative water loss (sand box) within the measurement time?

- A water potential of 1hPa is unrealistic for steady-state procedures, because the average gravitation potential is 2.5 hPa.
Thank you