

Soil water content sensors from laboratory calibration to field monitoring: discrepancies and uncertainties

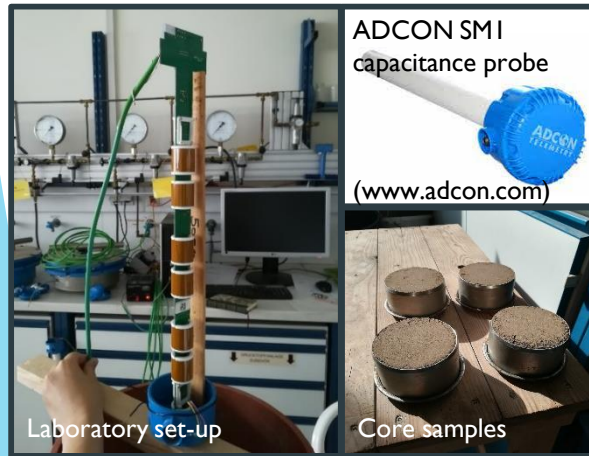
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Objectives

- Calibrate four multi-sensor capacitance probes in the laboratory.
- Evaluate the calibrated water content readings under natural conditions in an irrigated field by means of a modelling approach.

Methods

- Laboratory calibration



- Data processing

Calibration equation form:

$$\theta = aN^b$$

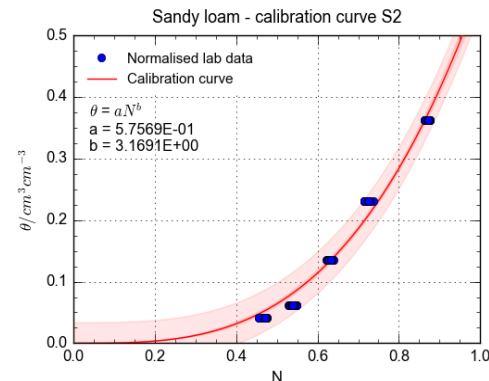
θ : volumetric water content in $\text{cm}^3\text{cm}^{-3}$,
 a and b : fitting parameters,
 N : normalised sensor readings.

$$N = \frac{R_a - R_s}{R_a - R_w}$$

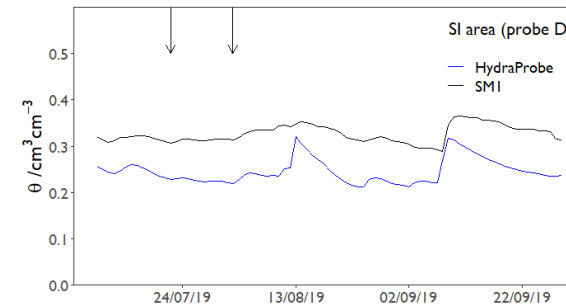
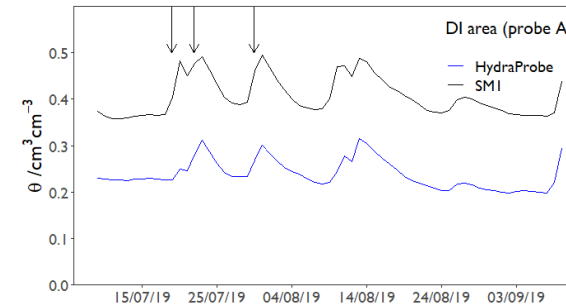
R_a, R_s and R_w : sensor readings in air, soil and water, respectively.

Results

- Sensor-specific calibration functions



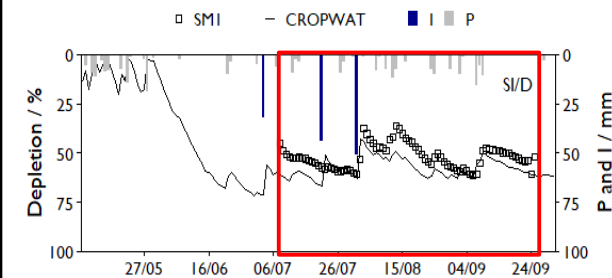
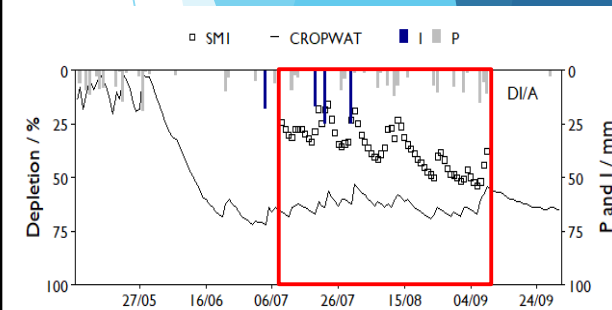
- SMI vs. HydraProbe (Stevens Water) in 20 cm depth



(Arrows indicate irrigation events)

- S2 precision: ± 0.4 SFU, CV = 1%
- S2 accuracy: MAE = $0.10 \text{ cm}^3 \text{ cm}^{-3}$

- Measured depletion vs. CROPWAT simulations



- Physical mechanisms
- Operational frequency
- pb and soil structure
- Compensation and Consolidation