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Bartosz Zawilski, Franck Granouillac, Nicole Claverie, Baptiste Lemaire,
Aurore Brut, Tiphaine Tallec

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SOIL'S WATER CONTENT WORLD

Zawilski B. M., Granouillac F., Claverie N., Lemaire B., Brut A., Tallec T.

bartosz.zawilski@cnr.fr

Centre d'Etudes Spatiales de la BIOSphère

18 avenue Edouard Belin, 31400 Toulouse, FRANCE



Context & Objectives

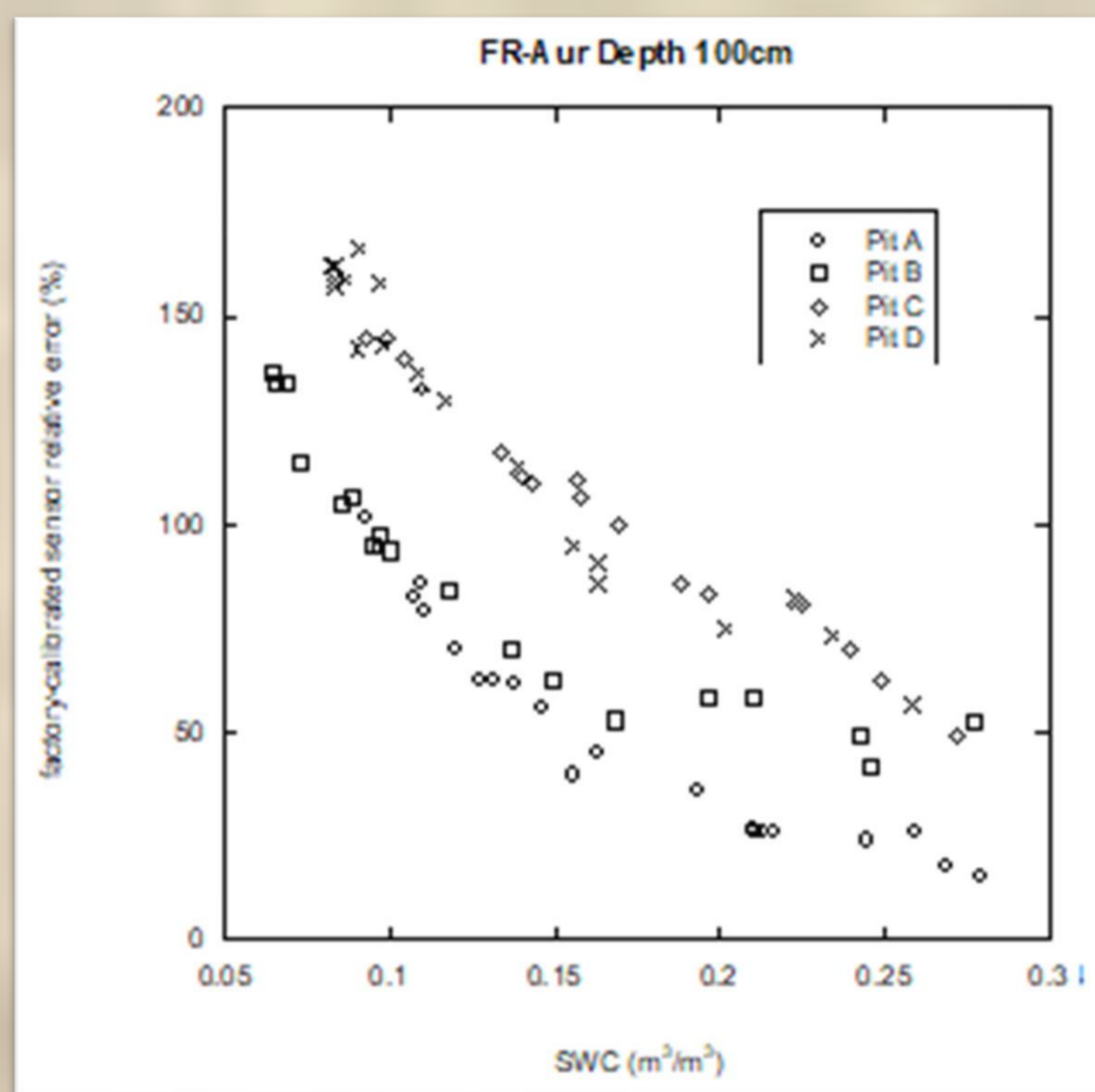
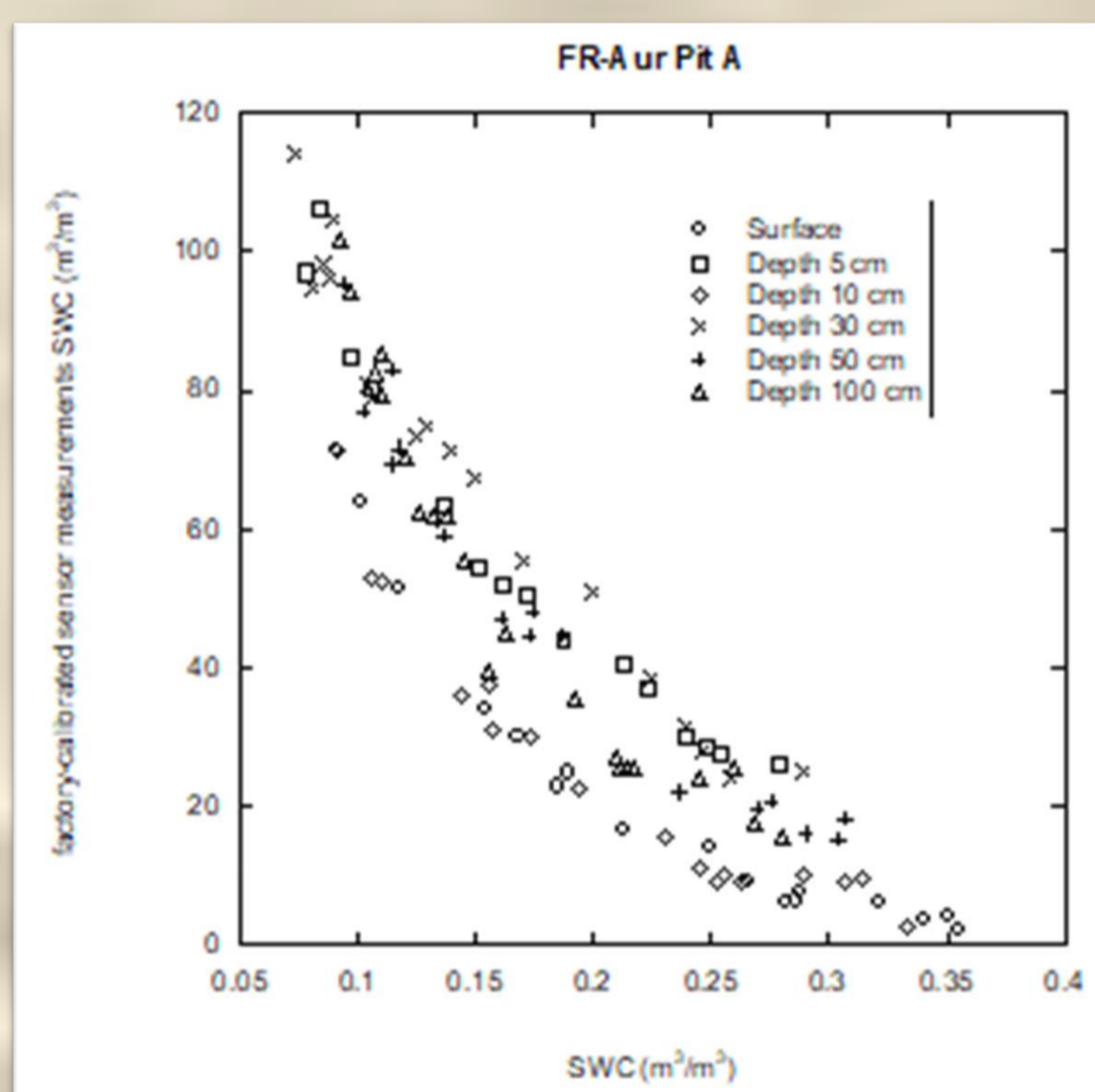
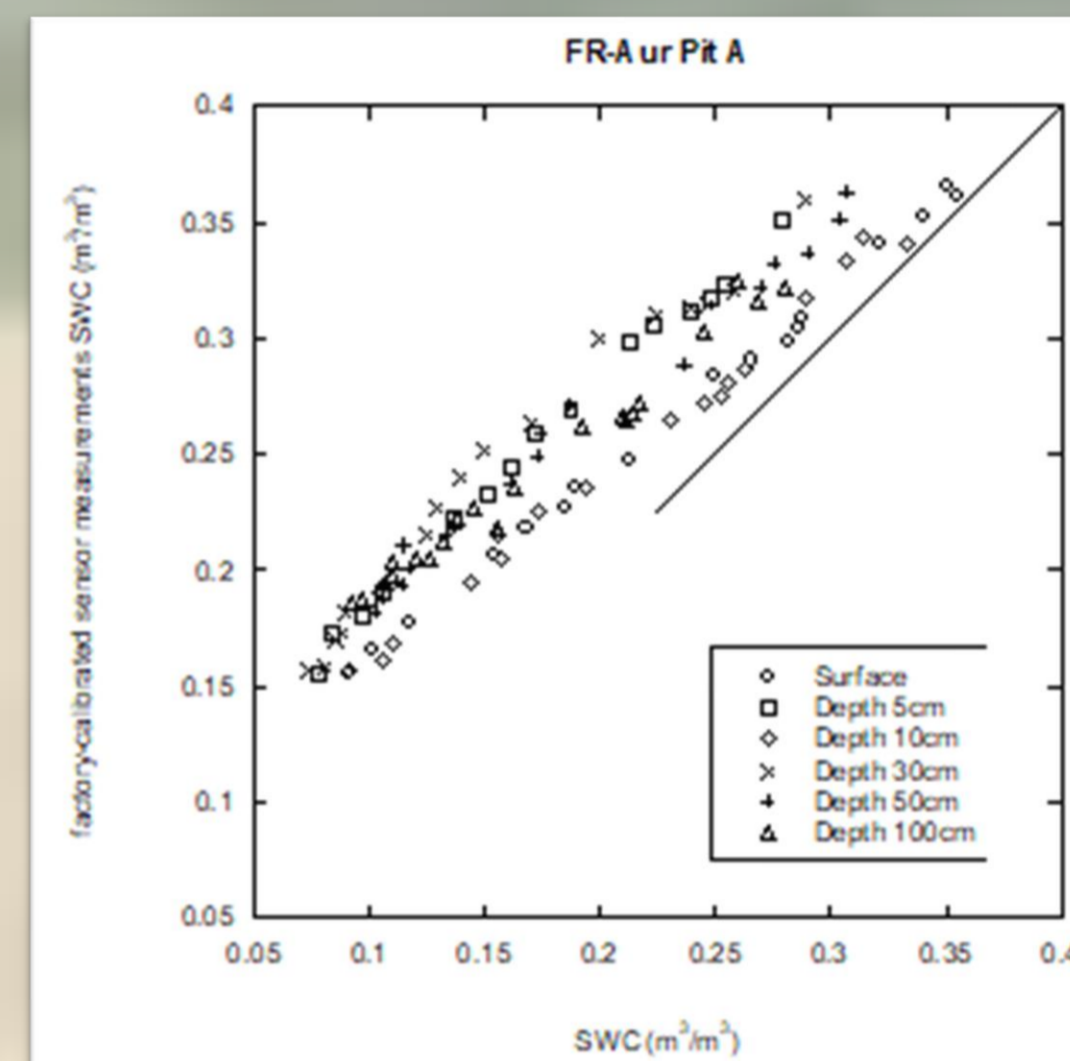
- In the context of global climate warming, soil water content (SWC) is monitored. ICOS mandatory measurements are achieved using TDR or FDR sensors (FDR, Stevens' HydraProbe on FR-Lam and FR-Aur). Two questions arise:
 - Are they as accurate as claimed by constructor?
 - Subsequently, how to calibrate the clayey soil?

OBJECTIVES: Check the SWC sensors accuracy and calibrations needs. Calibrate the clayey soil.



Soil water content sensors accuracy

- FDR Stevens SWC sensors are well-suitable for the FR-Lam and FR-Aur clayey soil. The embedded transfer function $f(\epsilon)$, between the sensed dielectric permittivity and the SWC, is claimed adapted but is it the case?
- After a preliminary check, it appears that all the sensor locations need to be recalibrated to find the correct transfer function $f(\epsilon)$.



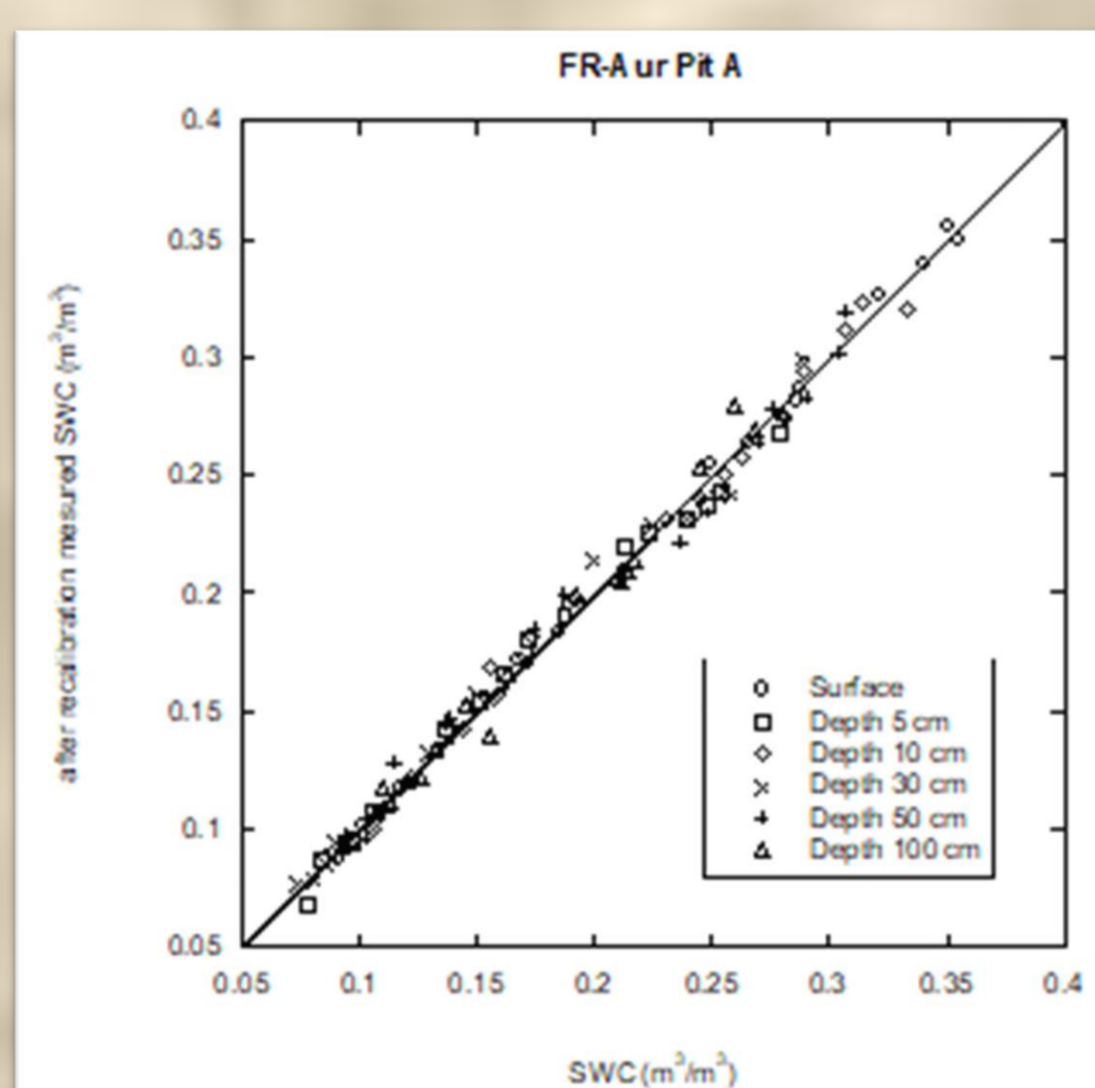
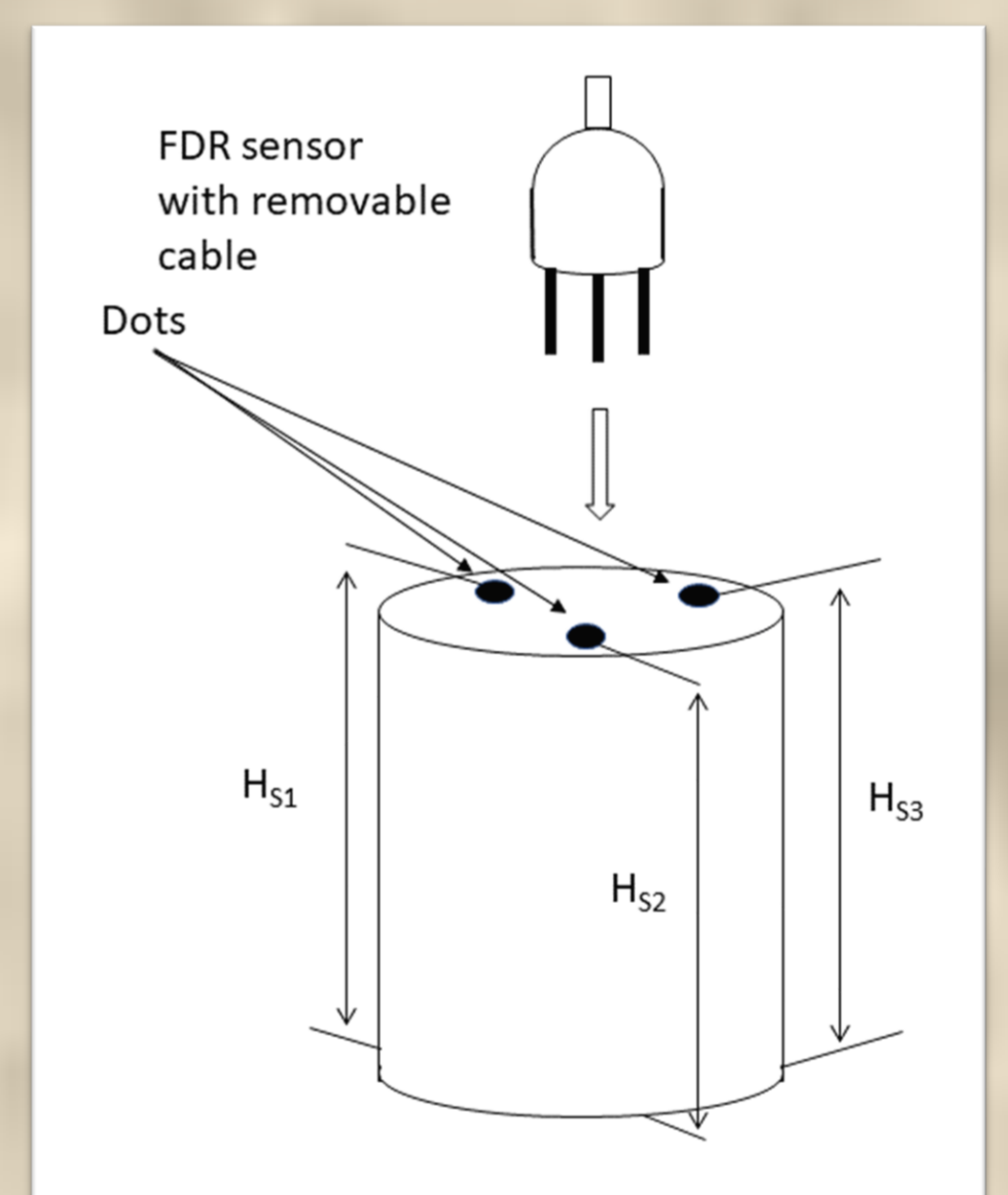
Measurements check

- Using the factory-embedded coefficients, the SWC measurements are erroneous (lower is the real SWC and higher is the relative error).
- In the same pit, depending on the depth, the coefficients change.
- In the same depth depending on the pit location the coefficients change.

Clayey soil calibration protocol

- Undisturbed soil samples collection at each planned sensor emplacement (two samples by emplacement) using an extruder.
- Soil sample SWC and dimensions measurement during a **slow drying**.
- Parallel soil sample weighting including the inserted but disconnected SWC sensor.
- Once naturally dried, the soil sample is oven dried at 105°C for 48h.
- The weighting of the oven-dried sample and then real SWC determination during drying with the measured weights. Gravimetric SWC measurements transformation into volumetric ones using the soil sample dimensions measurement.

Zawilski, B. M. et al. <https://doi.org/10.5194/gi-2022-8>, in review, 2022.



After soil calibration

- Recalculated coefficient allows reconstruction of a proper transfer function $f(\epsilon)$ for each considered sensor emplacement.

Conclusion

- Clayey soil is one of the most difficult soils to work with. The transfer function between soil dielectric permittivity and the SWC $f(\epsilon)$ are highly localization dependents. A special soil calibration protocol should be used to check both, the weight and the dimensions of a drying soil sample.
- SWC measurements after soil-specific calibration seem to be accurate enough for ICOS.

Acknowledgments

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