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Roughness calibration for the SMOS L-MEB model



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Why roughness calibration ?



- Principle : simultaneously retrieval of several surface parameters from multi-angular radiometric data with a least-squares iterative method
- Focused parameters:
 - Soil moisture (SM)
 - Vegetation optical thickness (τ)
 - Surface roughness (H_R) ←



The SMOREX experiment



- Both radiometric and in-situ measurements
 - LEWIS: L-band dual pol. radiometer
 - Incidence angle from 20° to 60°
 - 8 data sets every day
 - Ground installation:
 - Meteorology
 - Soil moisture and temperature profile
 - Biomass measurements, soil texture,...
- 2 surfaces: Bare soil and Fallow
- 6 years of data acquisition

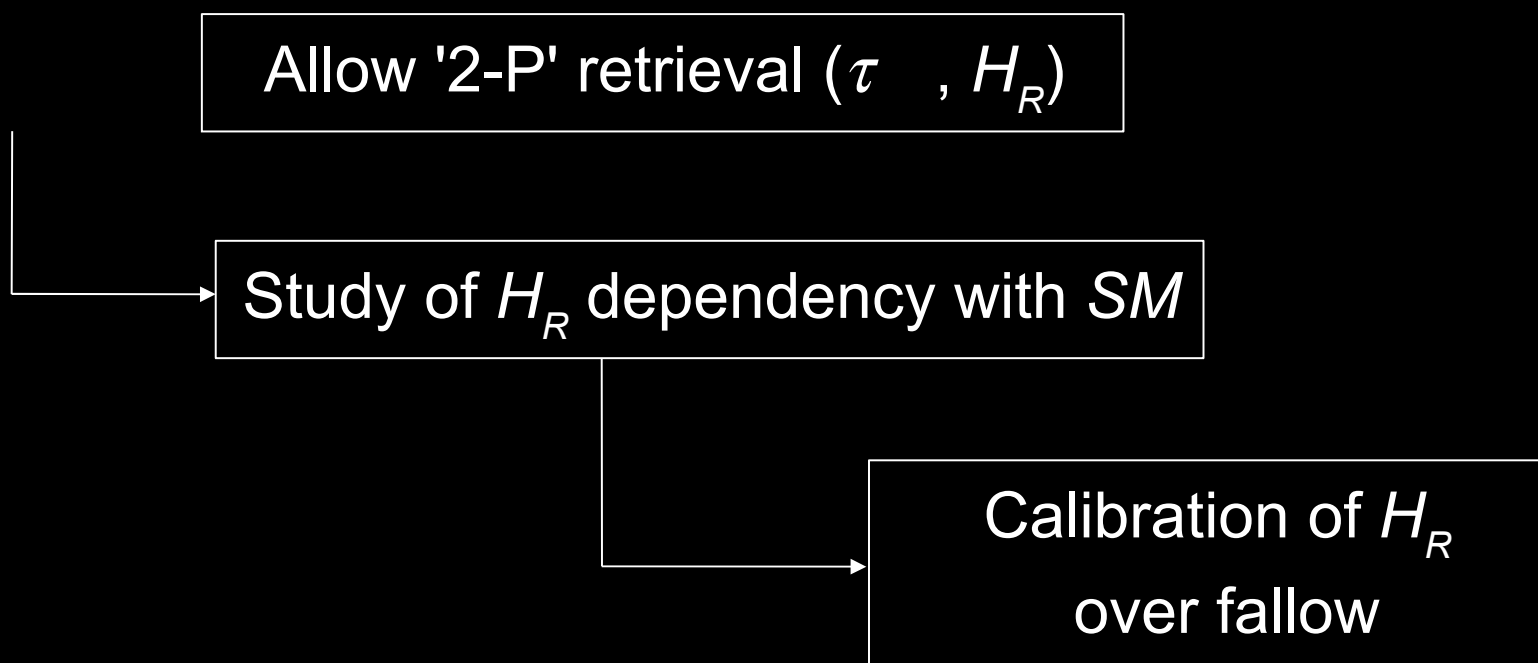




Using *SM* in-situ data to calibrate H_R



- *SM* in-situ measurements as input parameter in L-MEB to invert H_R
(Saleh et al. 2007)

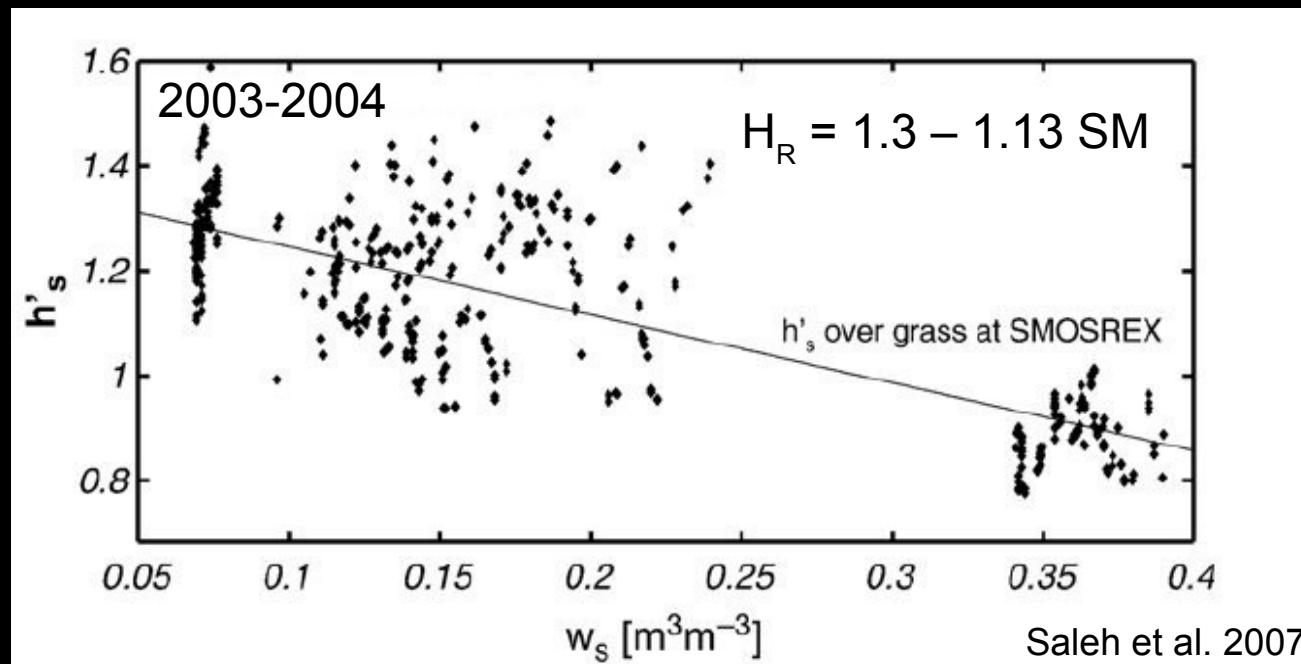




Using SM in-situ data to calibrate H_R



- (τ, H_R) inversions with measured SM :
 - H_R can be calibrated with a linear dependency on SM

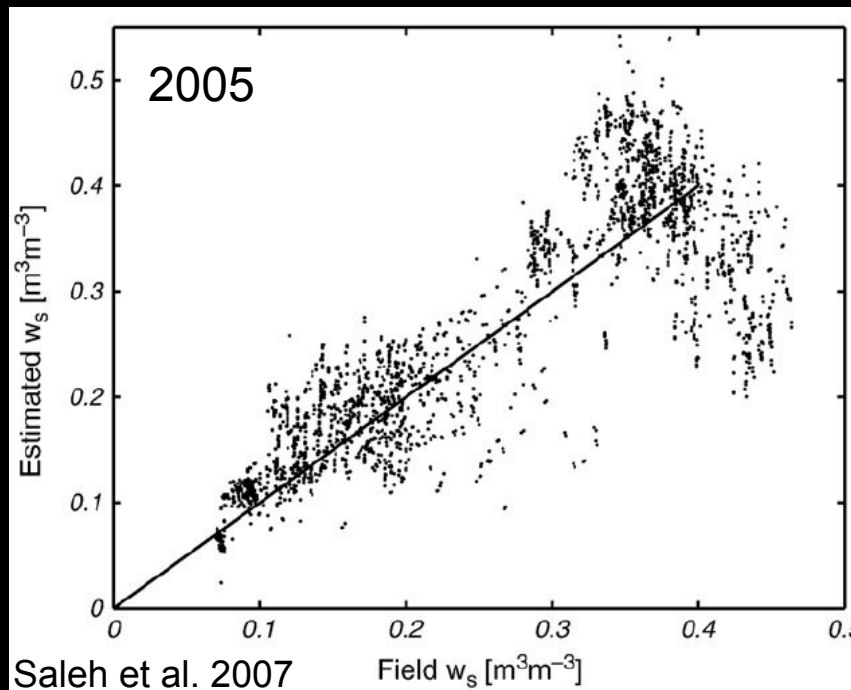




Using SM in-situ data to calibrate H_R



- (τ, SM) inversions with calibrated H_R :
 - Good correlation between retrieved and measured SM



$$H_R = 1.3 - 1.13 SM$$

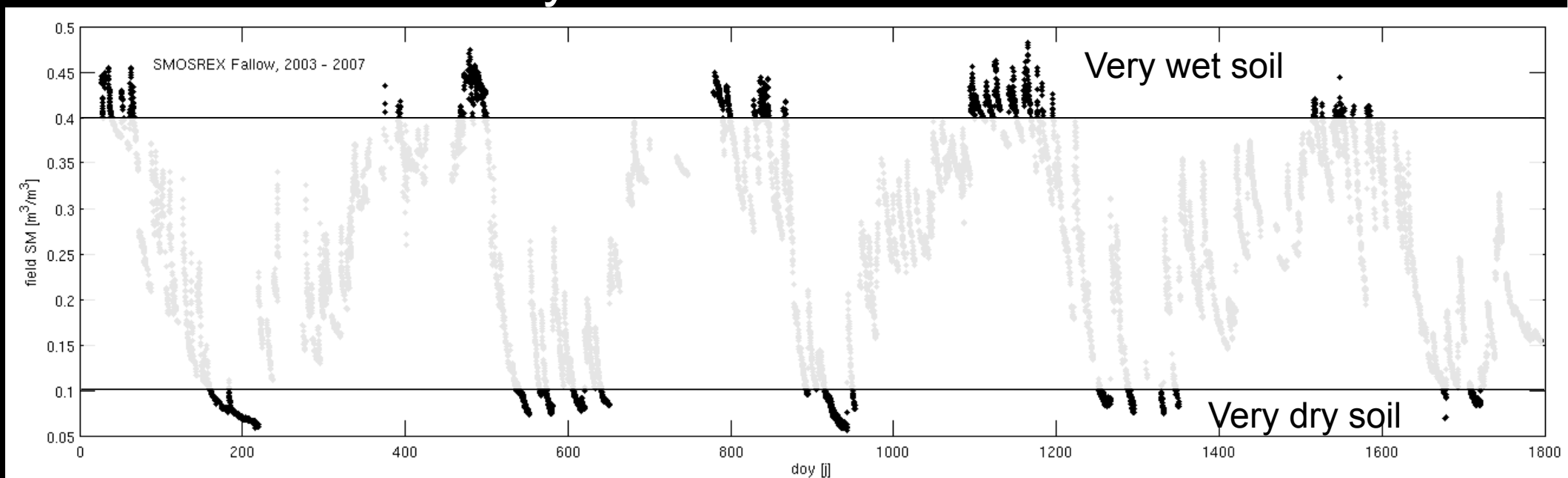
$$RMSE = 0.057 m^3 \cdot m^{-3}$$



Roughness calibration without *SM* in-situ data



- Calibrate H_R without on-field measurements
- Solution: using of observations where *SM* is theoretically known \rightarrow Theoretical *SM* values as L-MEB input param.
- How to select dry and wet observations ?

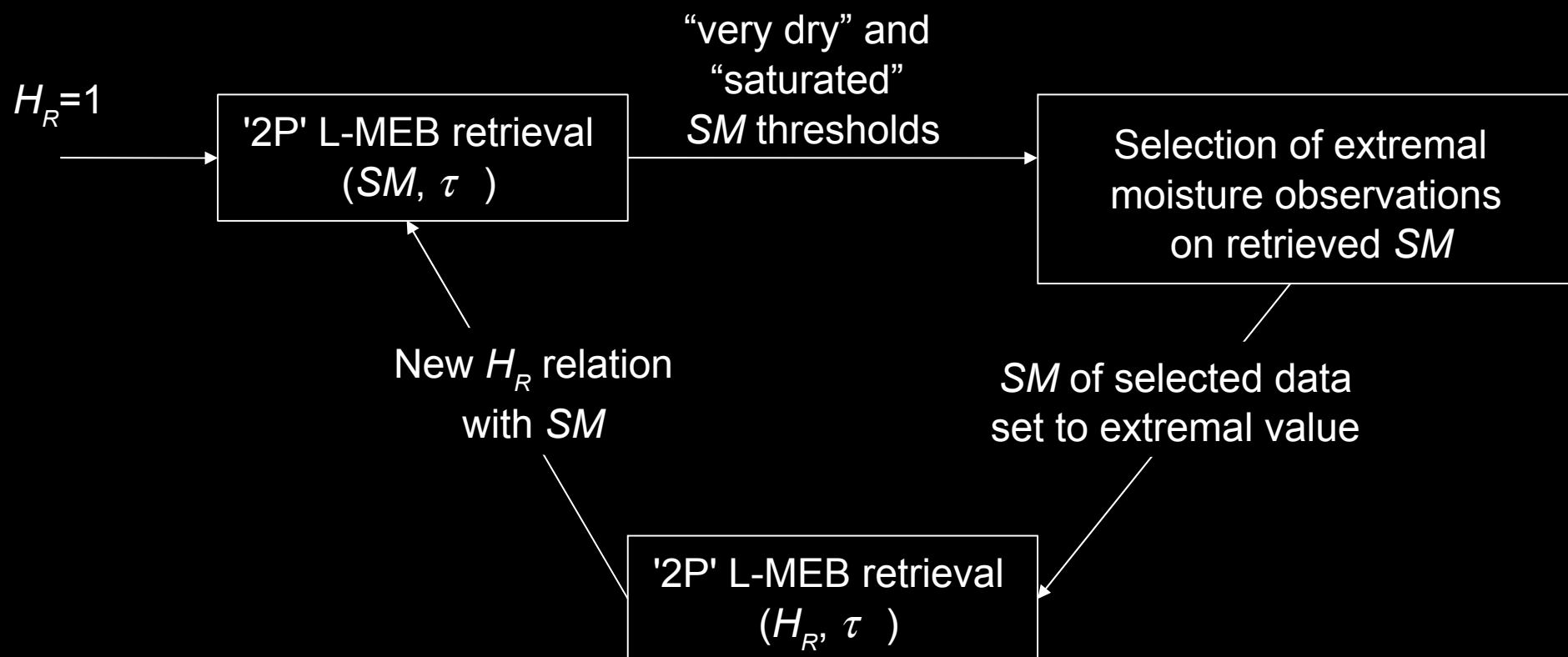




Iterative scheme for sub-sets selection



- 2P-2P retrieval iterative method

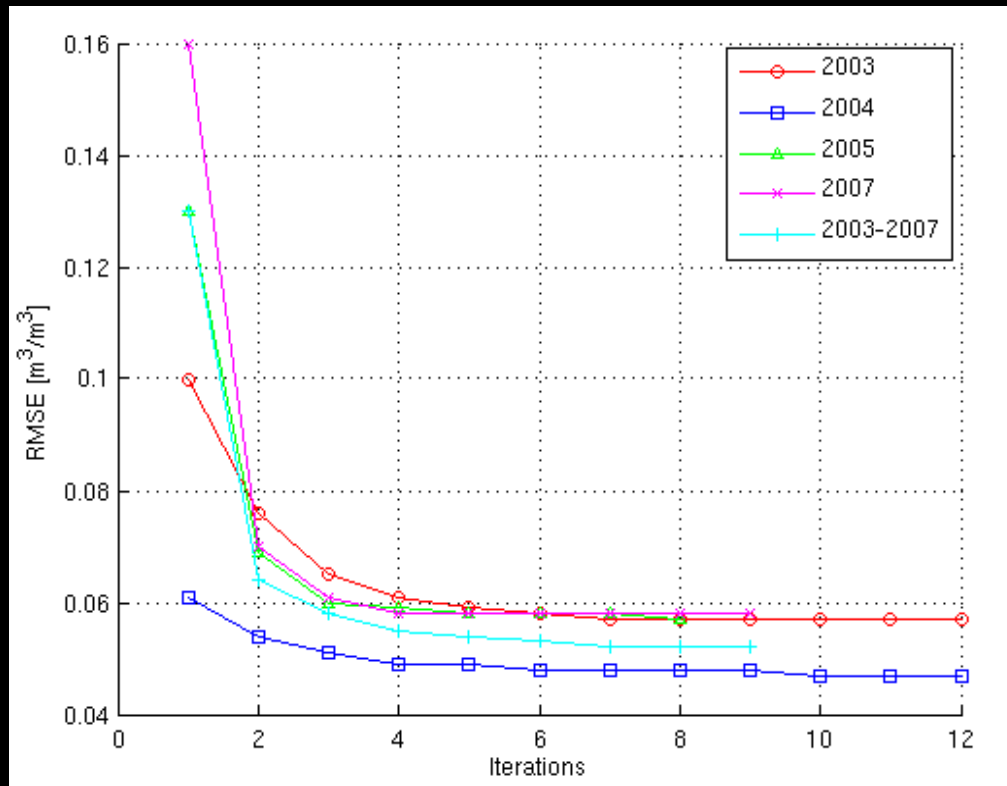




Roughness calibration with 2P-2P iterative method



- Convergence lead to an improvement of the *SM* retrieval



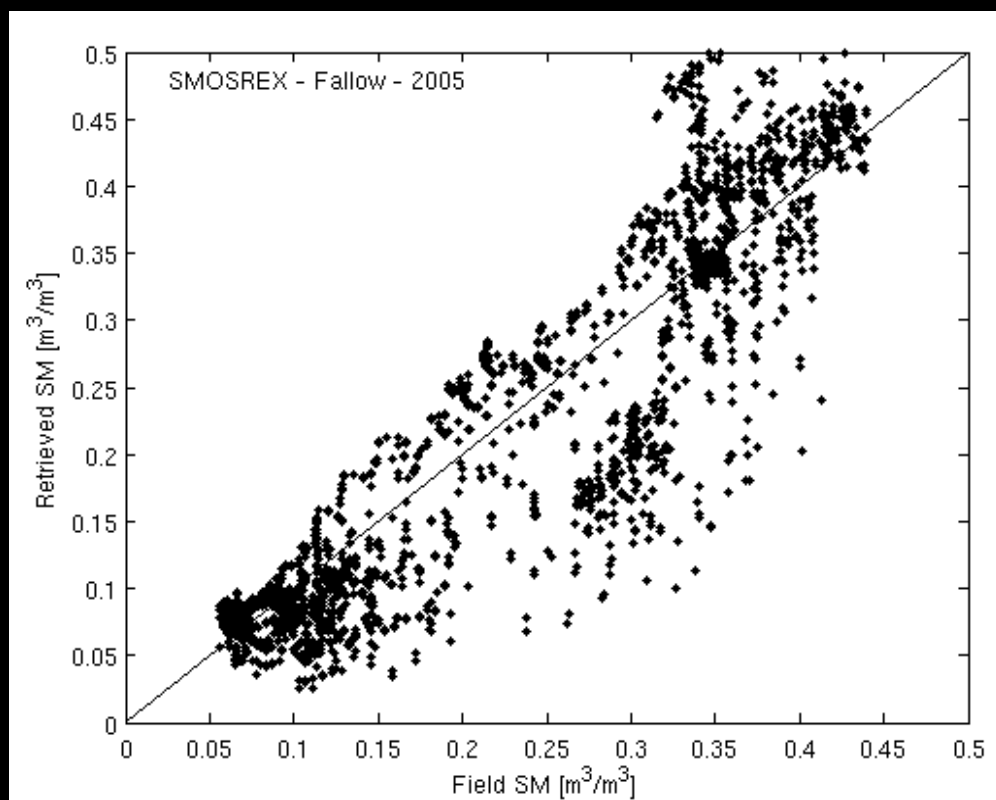
But no
convergence
for 2006...



Roughness calibration with 2P-2P iterative method



- (SM, τ) retrievals with H_R calibrated with 2P-2P iterative method



2005
Fallow

$$H_R = 1.33 - 1.2 SM$$

$$\text{RMSE} = 0.058 \text{ m}^3.\text{m}^{-3}$$



Roughness calibration with 2P-2P iterative method



- 2P-2P iterative method results for 2003 to 2007 SMOSREX data sets

	Saleh et al. 07 calibration	Iterative methode
2003	0.043	0.057
2004	0.052	0.048
2005	0.055	0.058
2006	0.039	X
2007	0.070	0.058
2003-2004	0.044	0.053
2003-2007	0.055	0.052

RMSE of SM retrievals over SMOSREX fallow



Conclusion



- Surface roughness can be calibrated without any soil moisture measurements by using theoretical estimations for period of extremal of soil moisture
- Results are almost as good as calibration done with *SM* on-field measurements
 - Effective calibration method for experiments extended in time (like SMOS)
- Improvements on initial conditions, sub-sets selection and convergence are in progress