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)

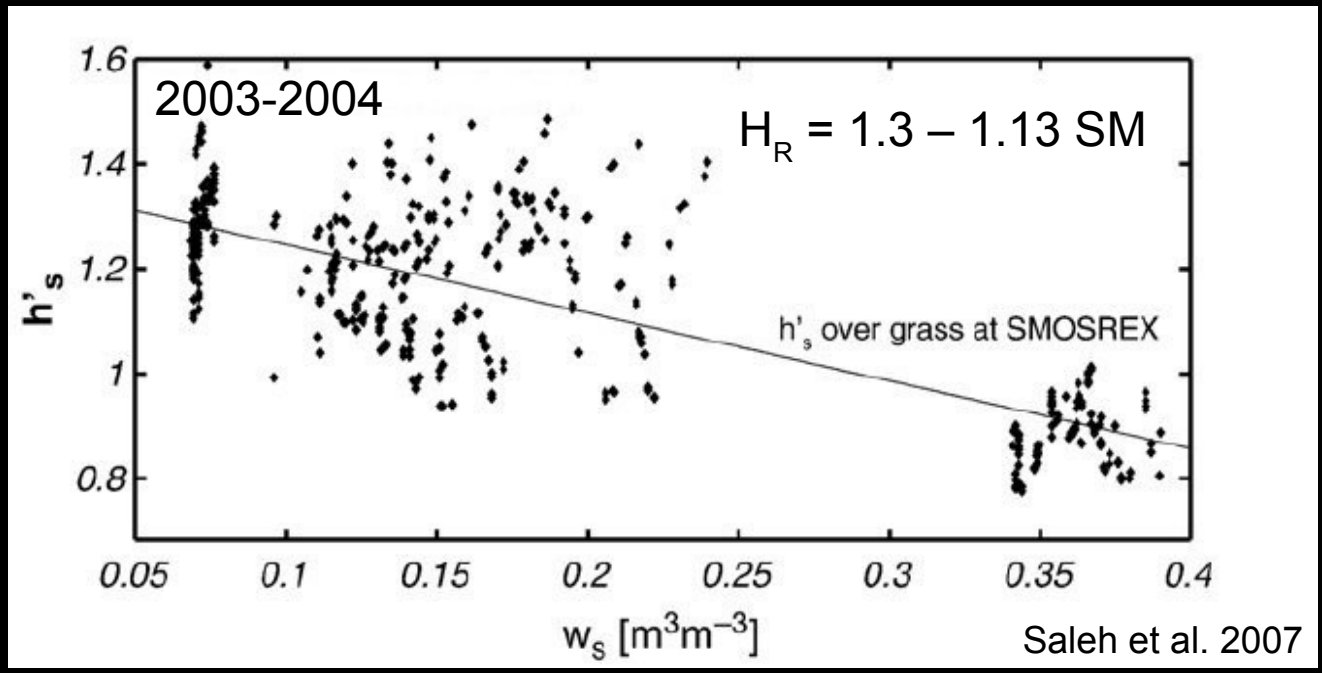
Allow '2-P' retrieval (τ , H_R)

Study of H_R dependency with *SM*

Calibration of H_R over fallow

Using *SM* in-situ data to calibrate H_R

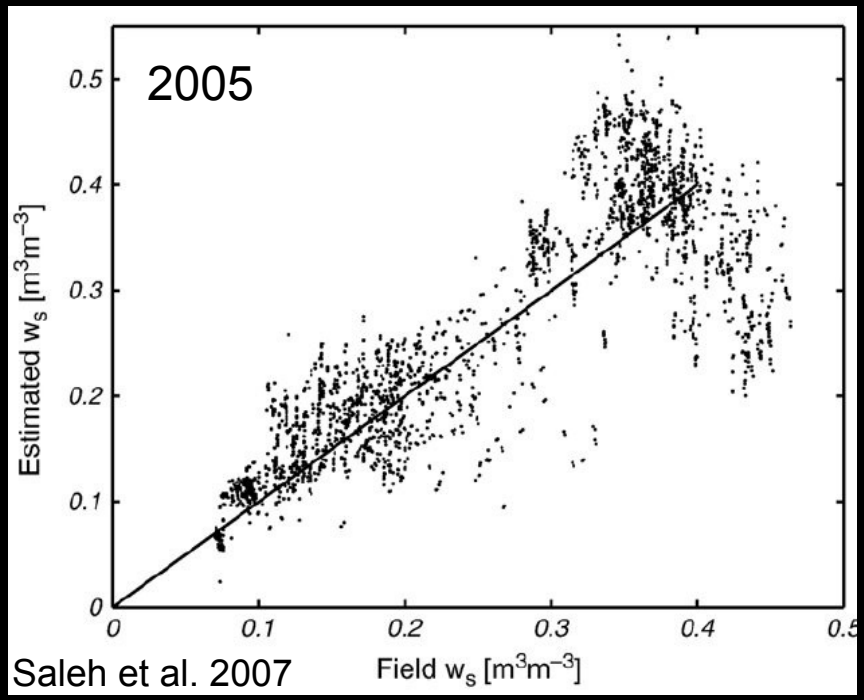
- (τ ,H_R) inversions with measured *SM*:
  - H_R can be calibrated with a linear dependency on *SM*



Saleh et al. 2007

Using *SM* in-situ data to calibrate H_R

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



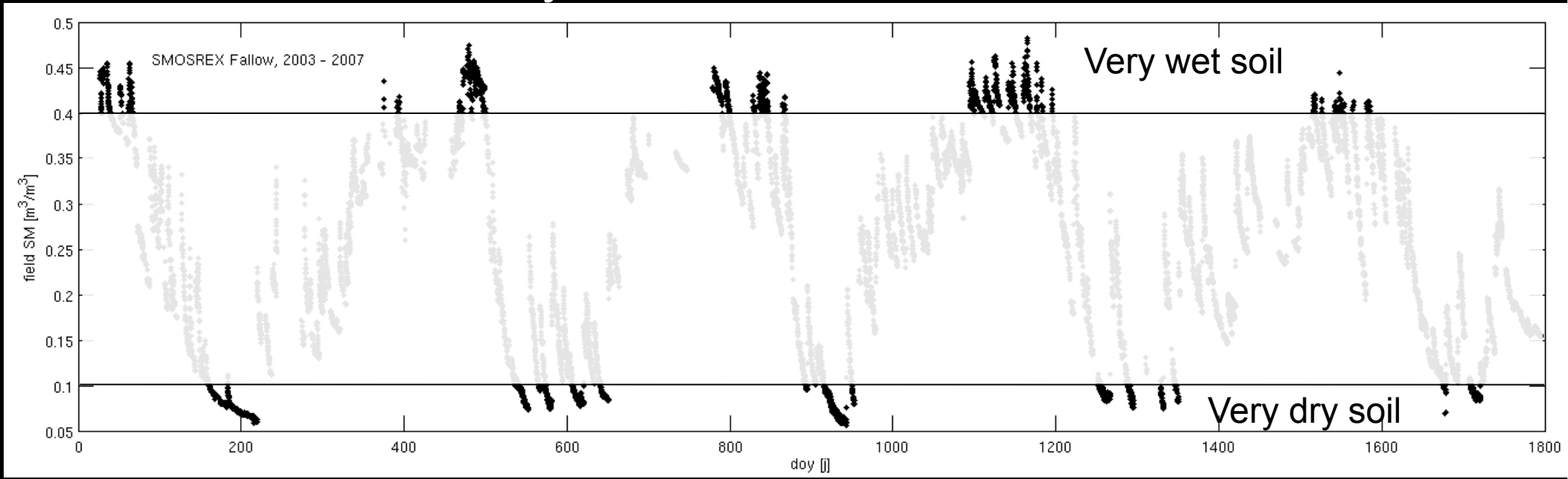
Saleh et al. 2007

H_R = 1.3 – 1.13 *SM*

RMSE = 0.057 $m^3.m^{-3}$

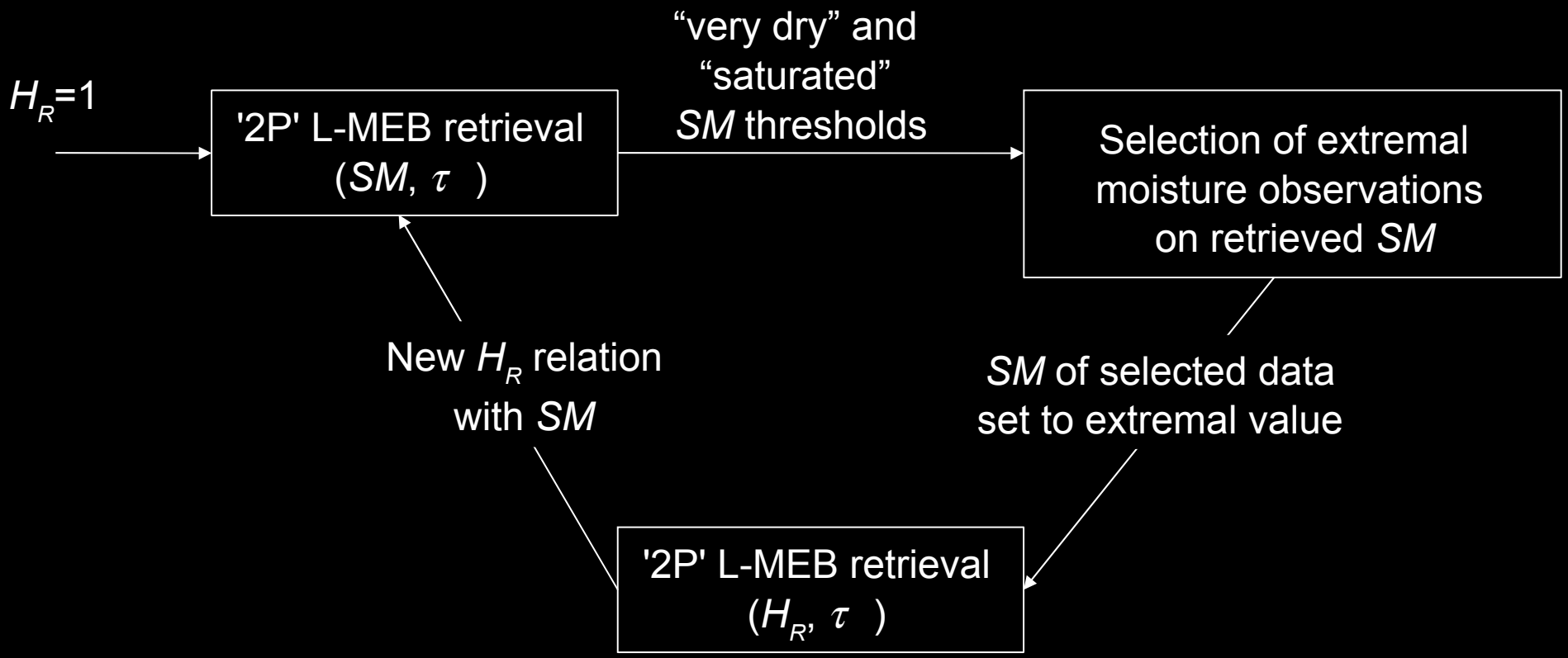
Roughness calibration without *SM* in-situ data

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



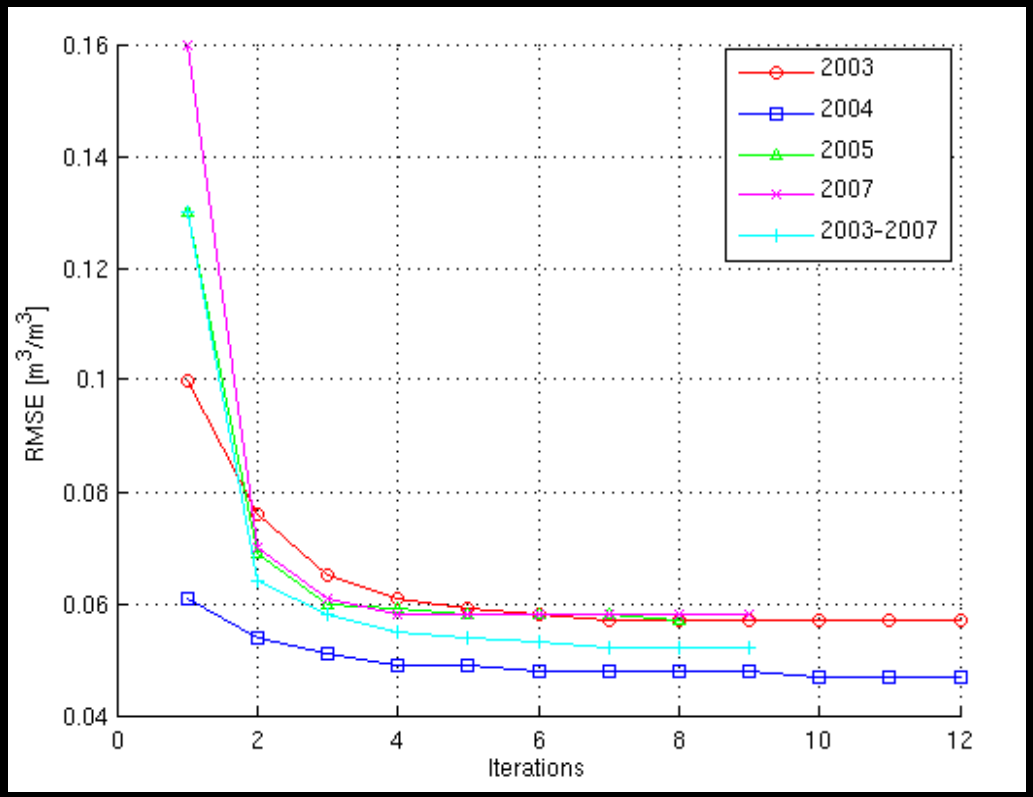
Iterative scheme for sub-sets selection

- 2P-2P retrieval iterative method



Roughness calibration with 2P-2P iterative method

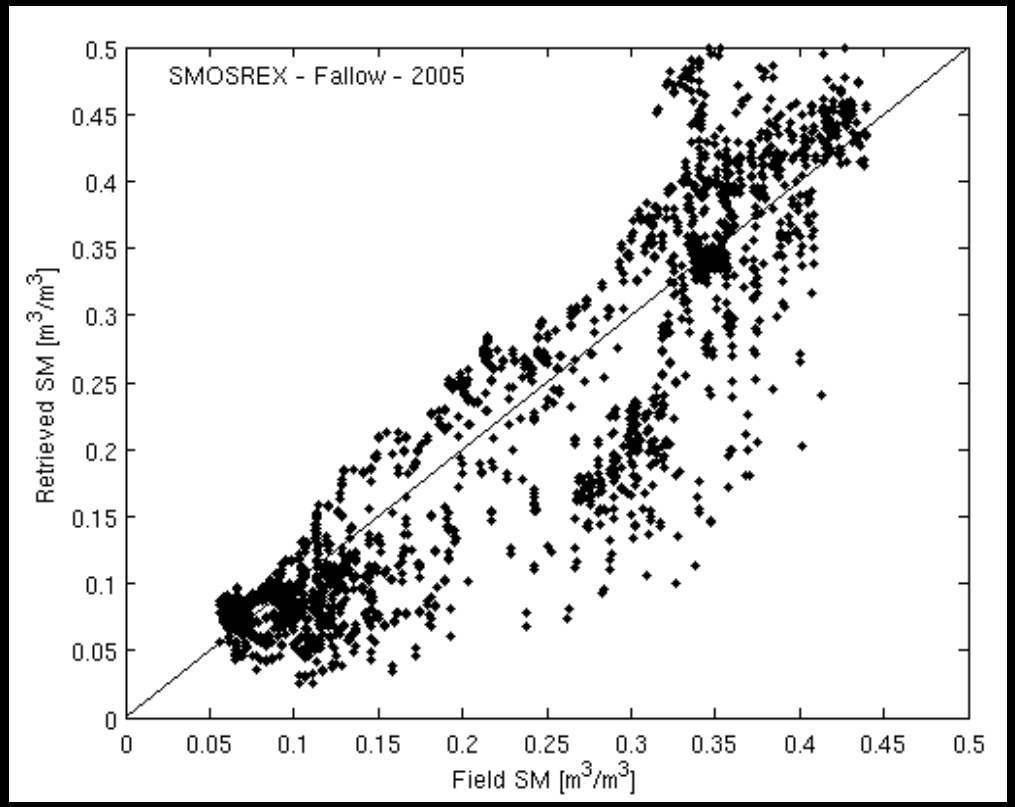
- Convergence lead to an improvement of the *SM* retrieval



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

$H_R = 1.33 - 1.2\ SM$

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

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 theorical 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