Towards an Active/Passive Soil Moisture Algorithm for Aquarius/SAC-D

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Overview

- Radiometer Algorithm
- Radar Algorithm
- Radiometer/Radar Fusion

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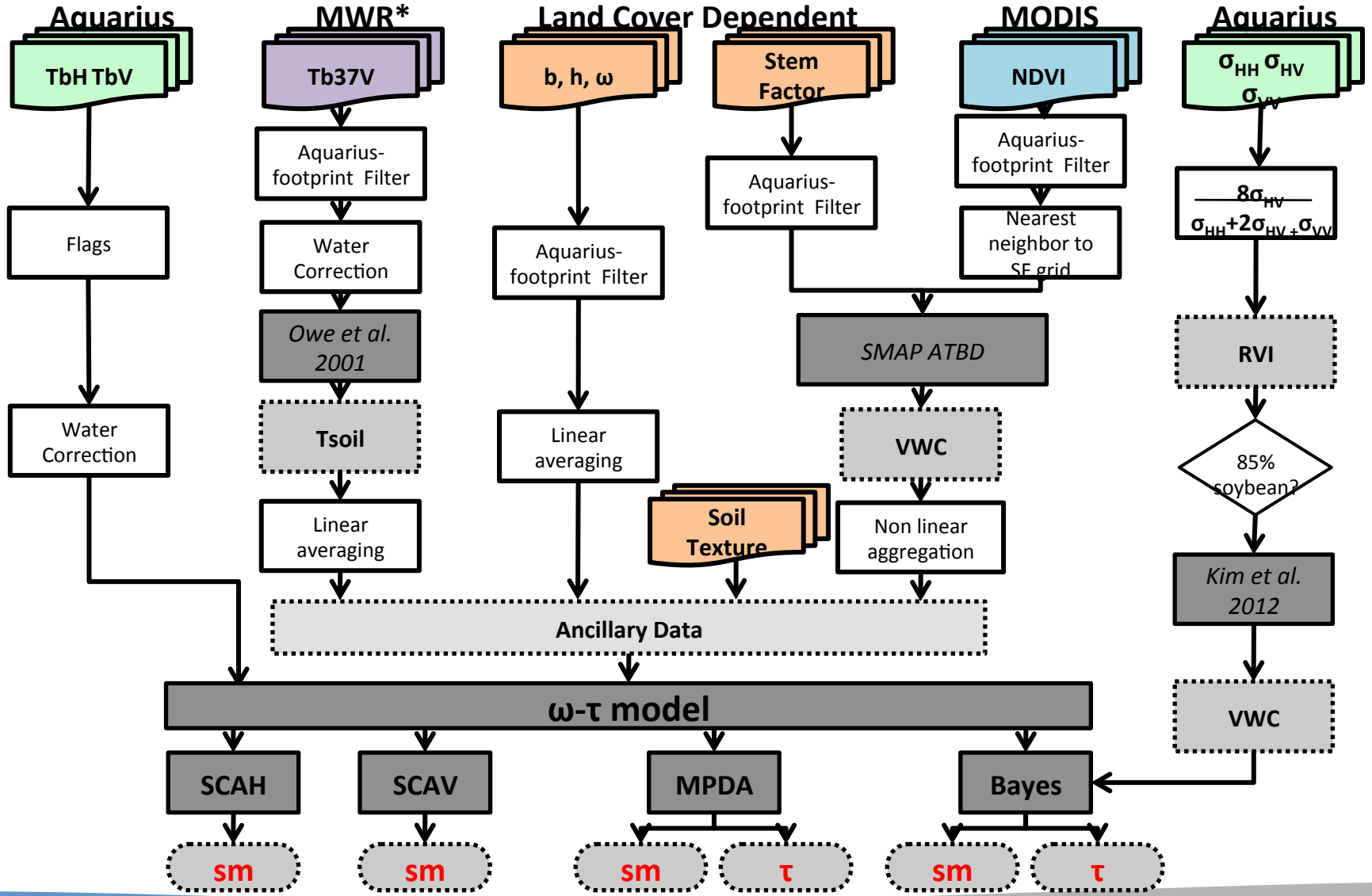
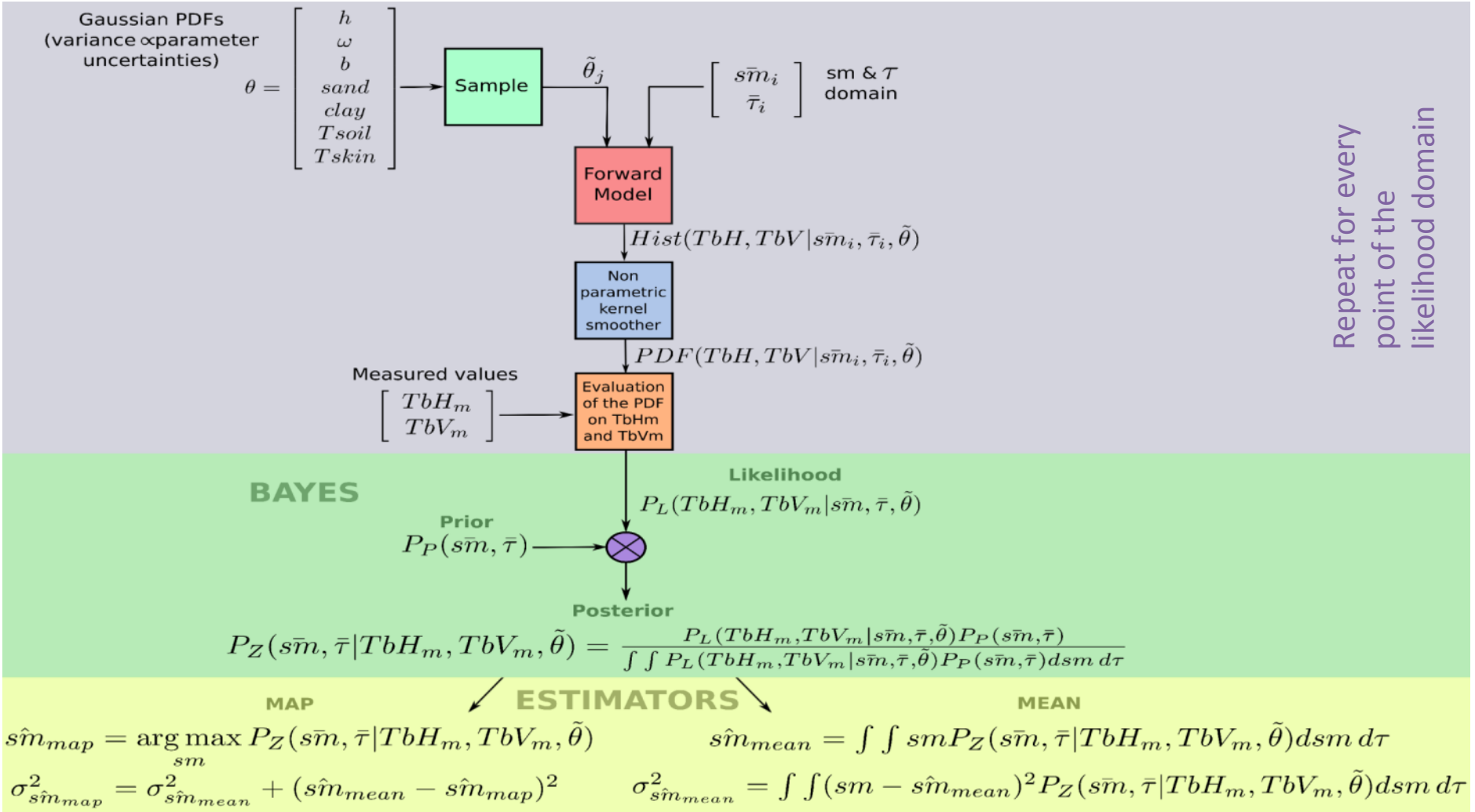
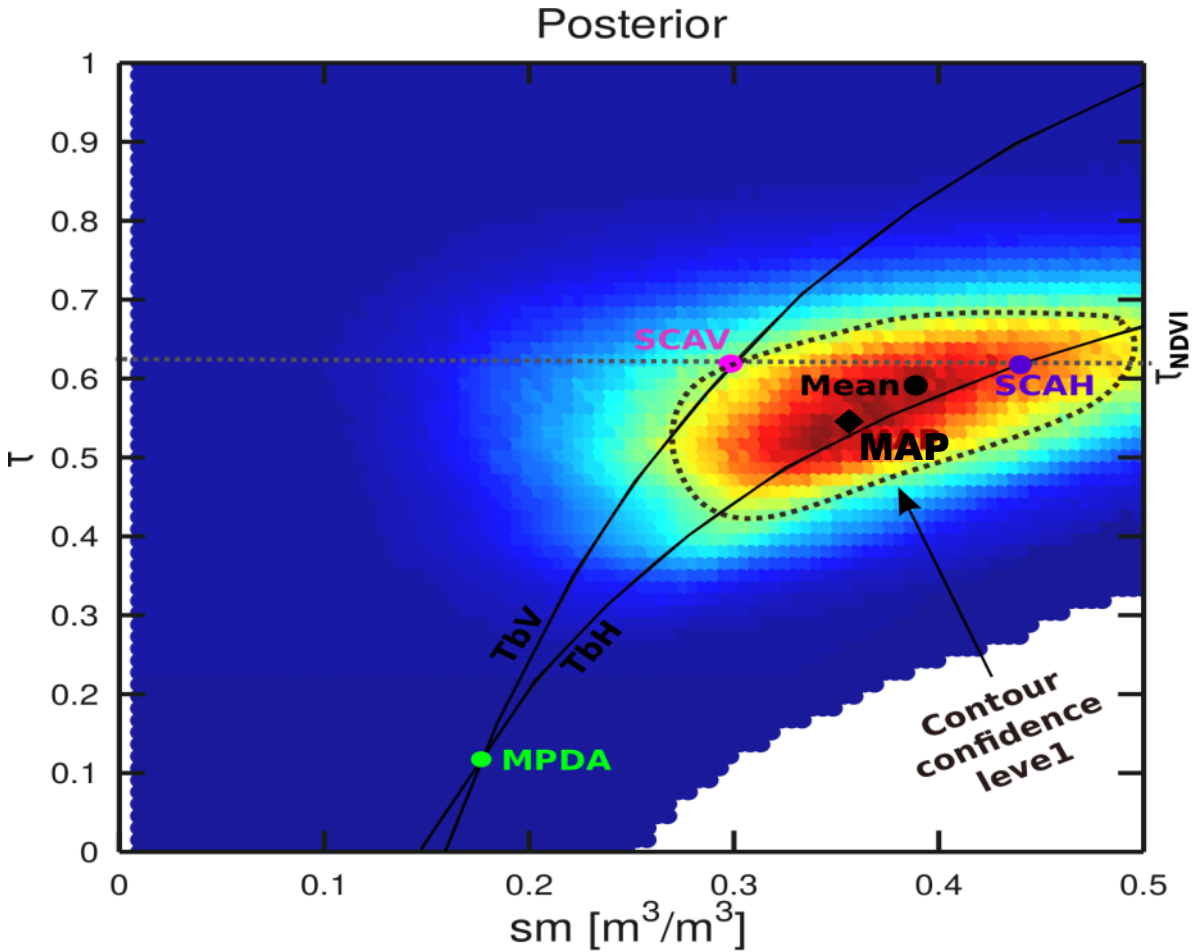
Radiometer algorithm: review of the existing algorithms and an introduction of the bayesian scheme


Aquarius
MWR*
Land Cover Dependent
MODIS
Aquarius
TbH TbV
Tb37V
b, h, ω
Stem Factor
NDVI
σHH σHV σVV
Aquarius-footprint Filter
Aquarius-footprint Filter
Aquarius-footprint Filter
Aquarius-footprint Filter
Nearest neighbor to SE grid
8σHV / σHH+2σHV+σVV
Flags
Water Correction
Owe et al. 2001
Tsoil
Linear averaging
Water Correction
Linear averaging
SMAP ATBD
VWC
Non linear aggregation
Soil Texture
RVI
85% soybean?
Kim et al. 2012
VWC
Ancillary Data
ω-τ model
SCAH
SCAV
MPDA
Bayes
sm
sm
sm
τ
sm
τ

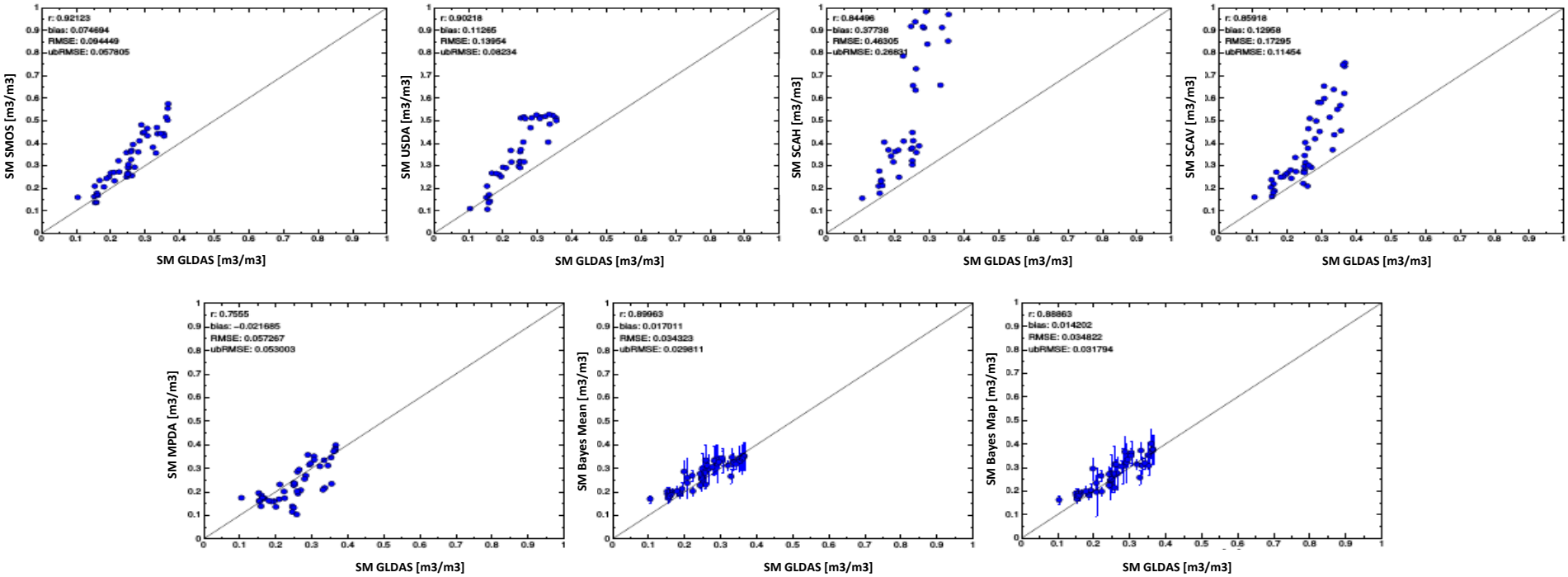
Bayesian Algorithm



Interpretation of retrieval algorithms



Retrieval Algorithms Comparison



[REF]: Bruscantini, C.A.; Grings, F.M.; Barber, M.; Carballo, F.; Perna, P.; "A Bayesian approach for soil moisture and optical depth retrieval: evaluation on Aquarius/SAC-D observations", Journal of Selected Topics in Applied Earth Observations and Remote Sensing. (undergoing review)

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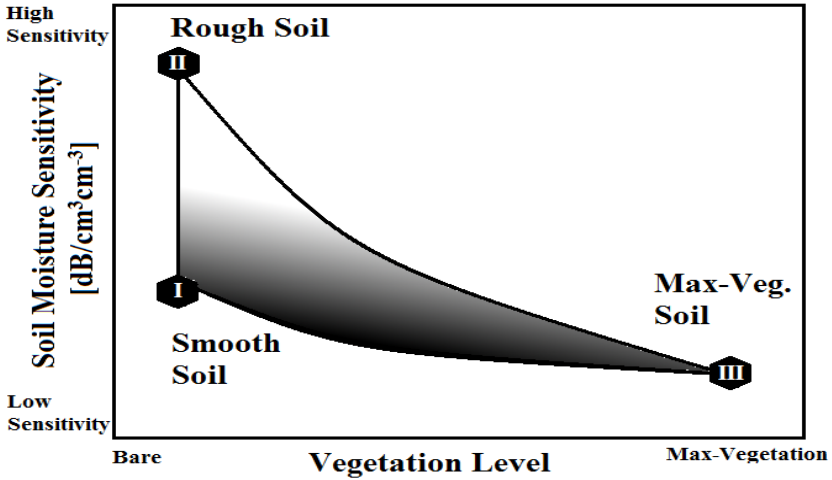
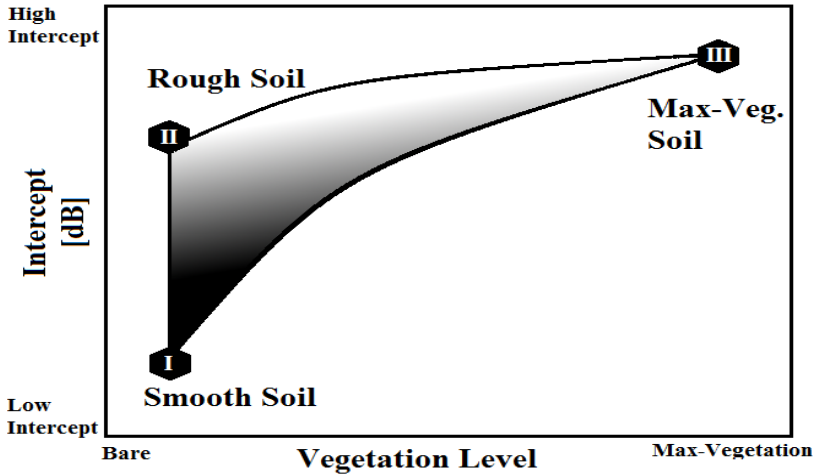
Radar algorithm: New radar-only algorithm

New radar-only algorithm: Conceptual model





$$\sigma_{VV}[dB] = Sensitivity * m_v^{\lambda} + Intercept$$

Sensitivity and Intercept dependence with vegetation (Radar Vegetation Index, RVI) and soil roughness (Radar Roughness Index, RRI).

Definition of three limiting cases:

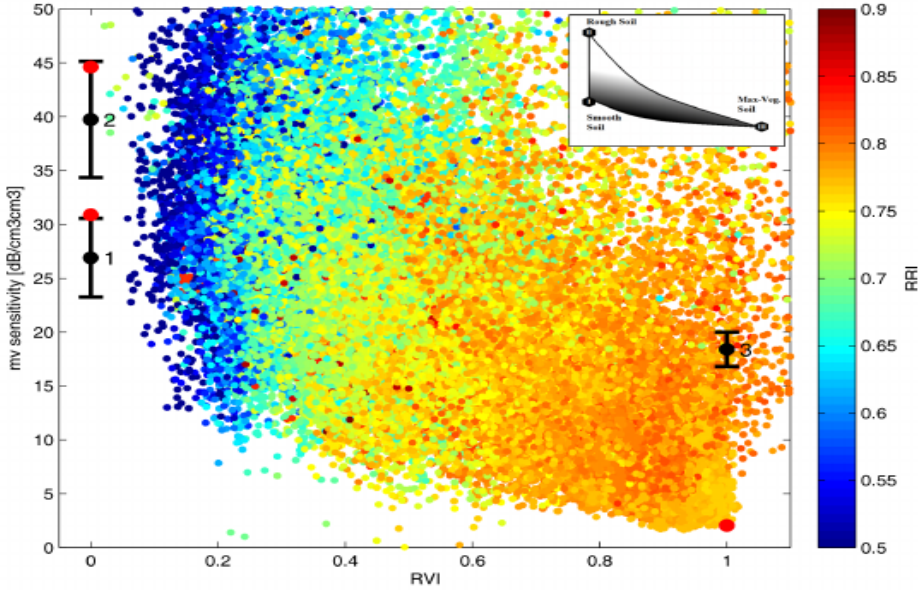
- Smooth bare soil (1)
- Rough bare soil (2)
- Maximum vegetation (3)

[REF]: Narvekar, P.S.; Entekhabi, D.; Kim, S.; Njoku, E.G.; , "Soil Moisture retrieval using L-band radar observations". (undergoing review).

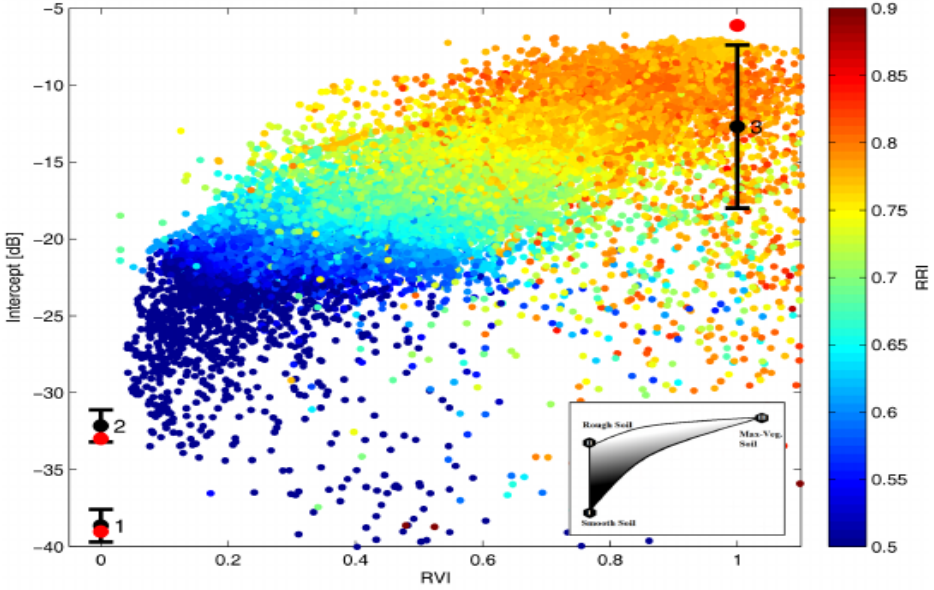
New radar-only algorithm: Sensitivity and Intercept analysis

Aquarius global observations

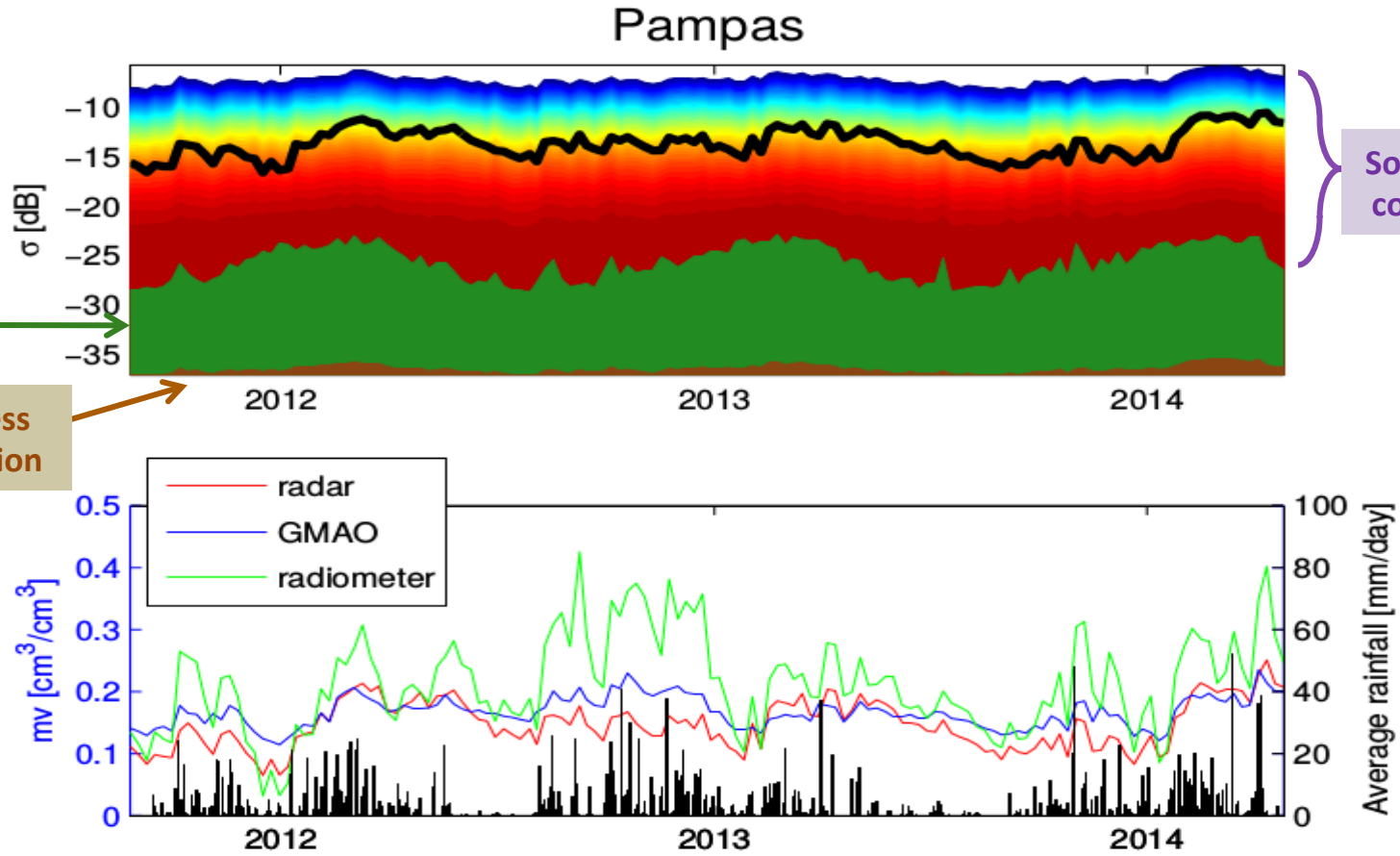
Sensitivity



Intercept



Vegetation and Roughness Contribution to Backscatter



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Radiometer/radar fusion: physically-based synergy

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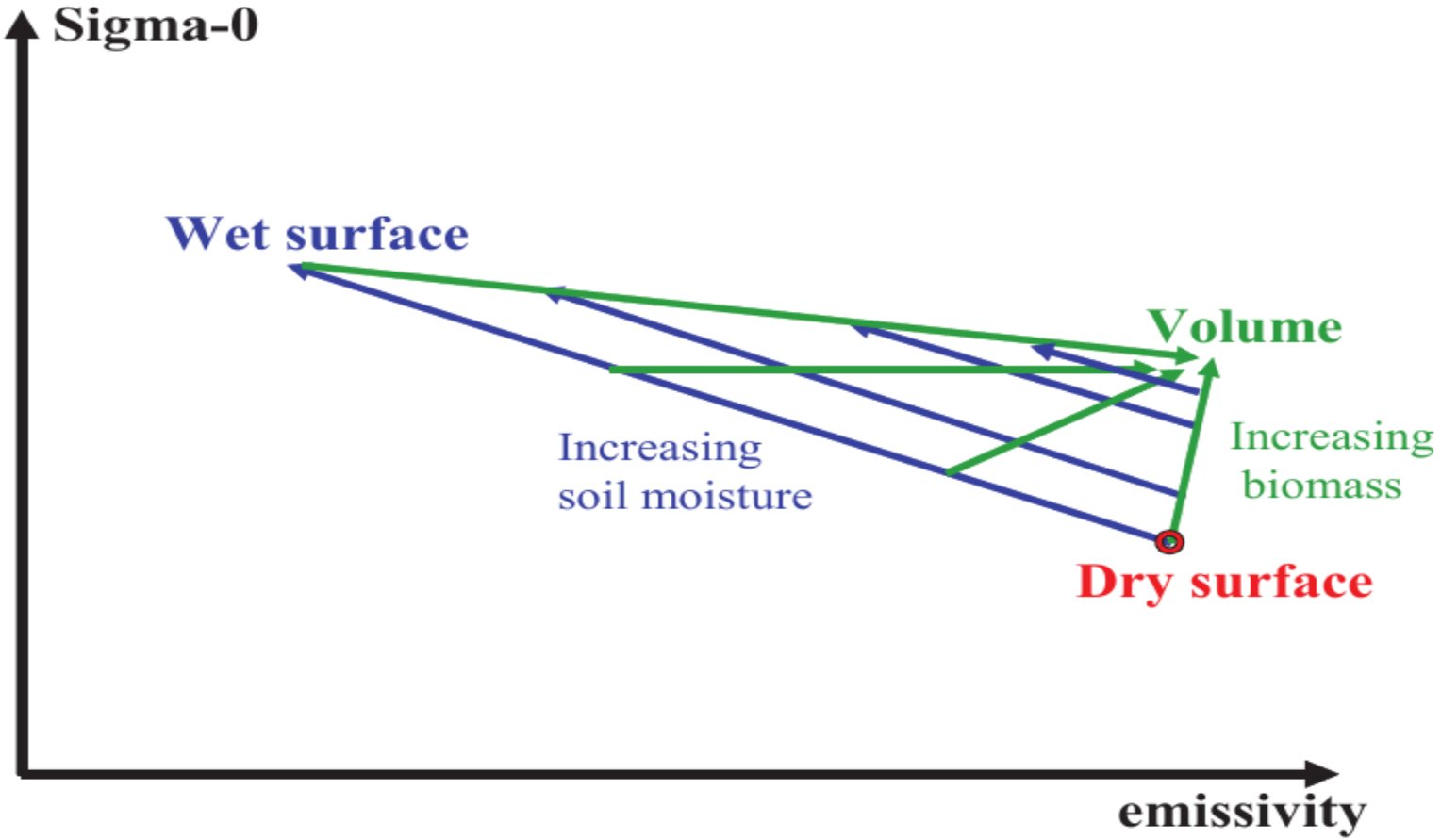
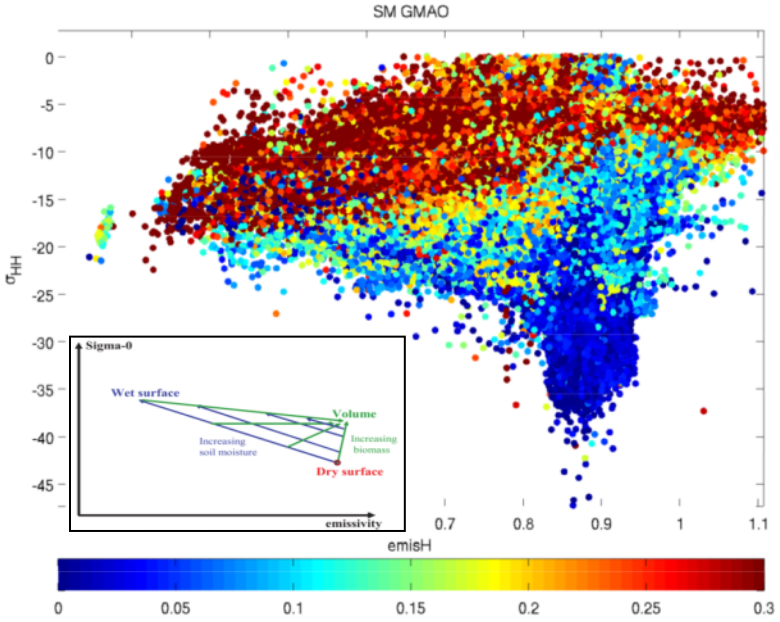
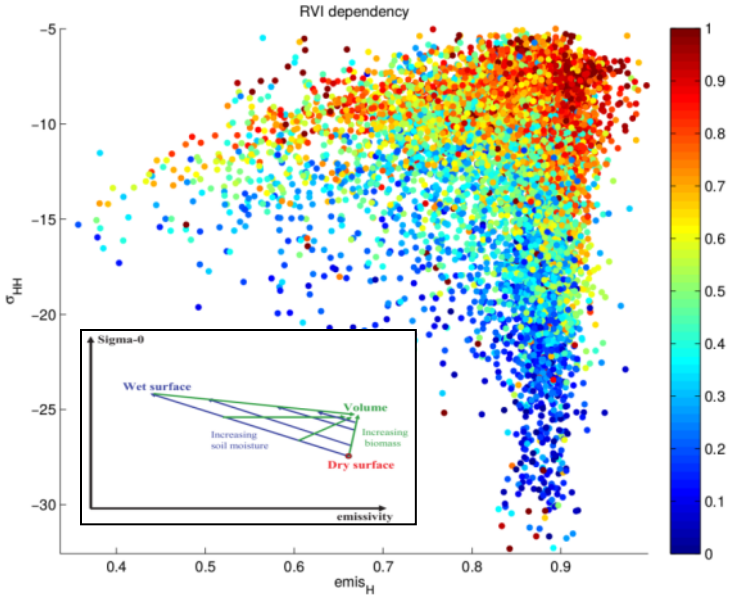


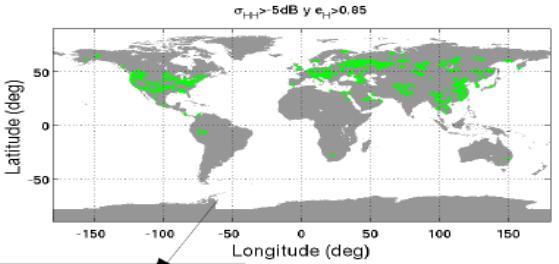
[REF]: P. Ferrazzoli and L. Guerriero, "Synergy of active and passive signatures to decouple soil and vegetation effects", Microrad 2010.

Aquarius Observed Triangles (global observations)

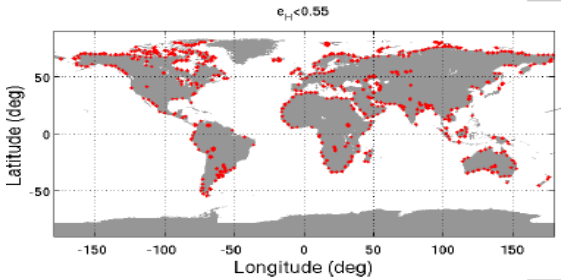




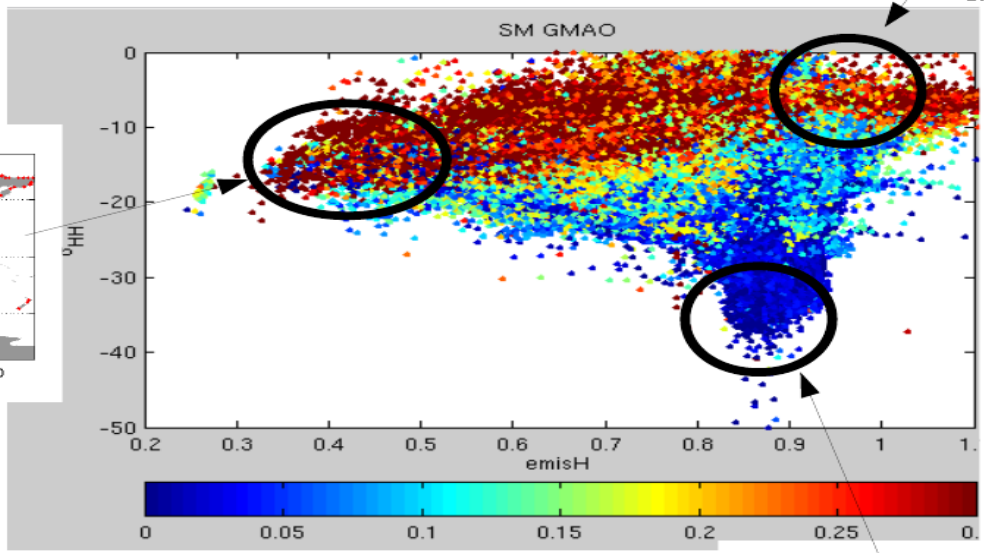
Triangle Edges Location



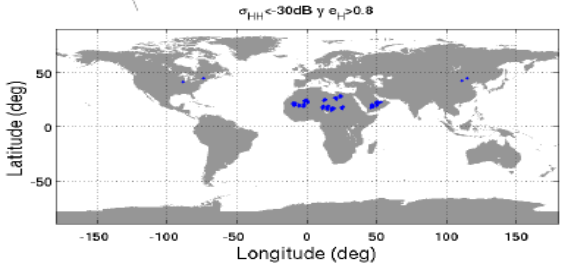
possible RFI



coastal areas

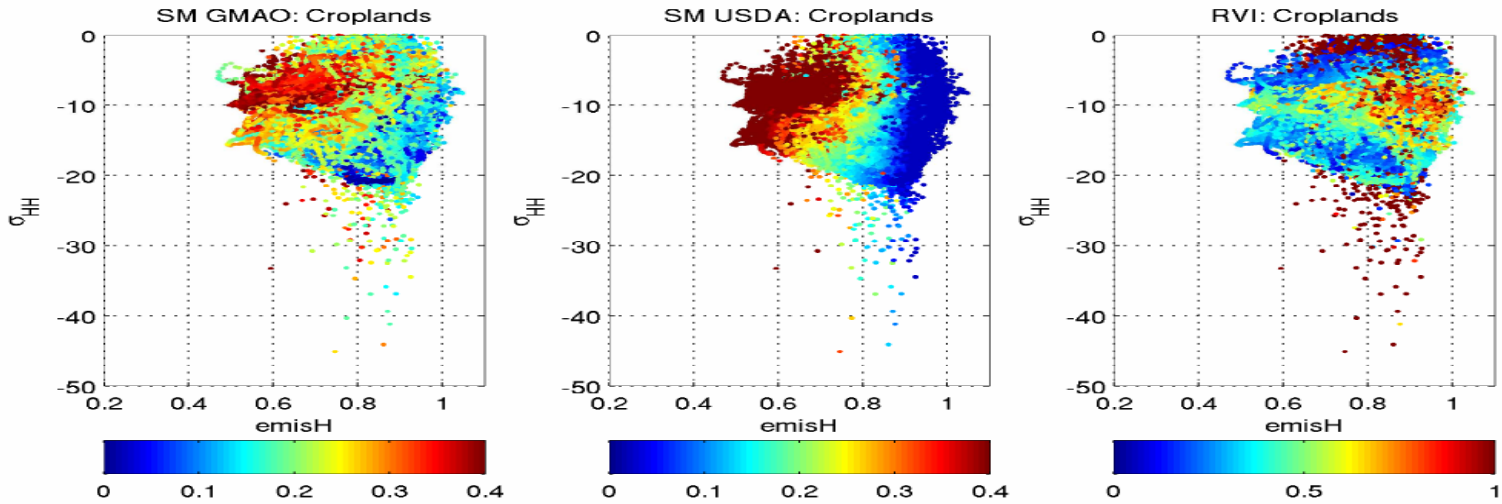


deserts



Aquarius Triangles by Land Covers

Croplands



Summary

✓More than 3 years have passed since Aquarius/SAC-D mission was launched. On December 2013, Aquarius official soil moisture maps were released worldwide provided by NASA NSIDC webpage. Only Aquarius H-pol radiometer observations are used at this time.

✓More recently, efforts were made towards exploiting all Aquarius available sources of information (radar/radiometer). In this context, active/passive fusion constitutes a new contribution for soil moisture retrieval. This work addresses models and observations related to active/passive fusion.

✓Although Aquarius soil moisture monitoring might be somehow unattractive for final-user applications, its collocated radar and radiometer instruments give a unique opportunity for space-borne active/passive fusion retrieval development, of special interest for forthcoming SMAP (Soil Moisture Active Passive) mission.

✓This presentation shows the latest collaborative efforts (IAFE/MIT/Tor Vergata) towards an active/passive algorithm.