National Aeronautics and Space Administration

SMOS/SMAP Status and SM retrievals

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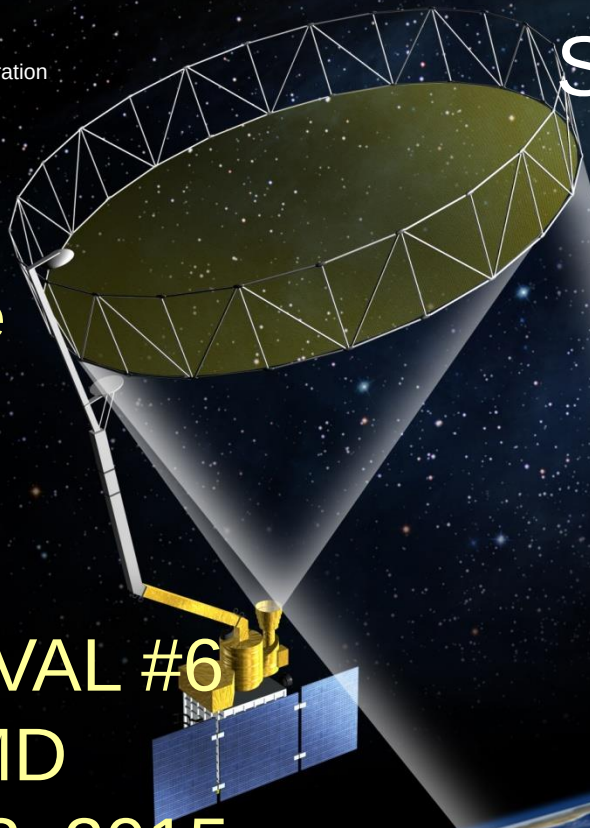
Yann Kerr
CESBIO

Soil Moisture Active Passive Mission

SMAP

SMAP CAL VAL #6
Columbia, MD
September 3, 2015

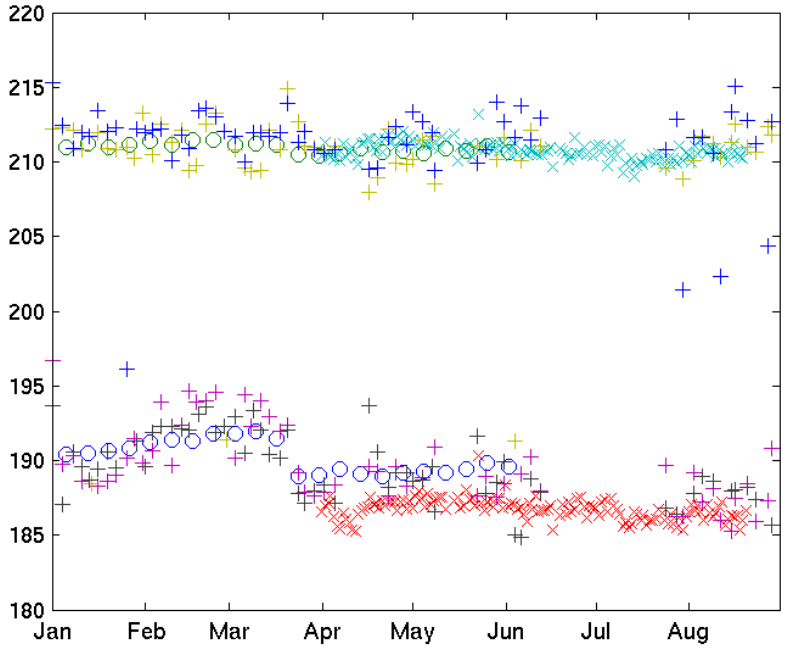


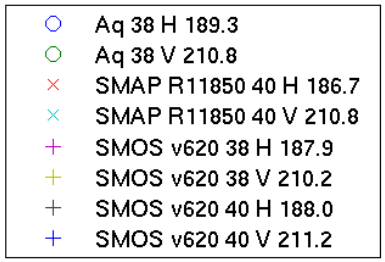
Introduction

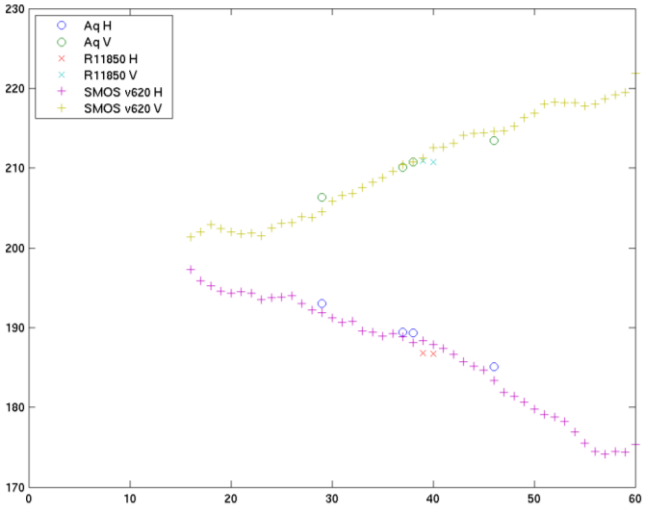
- Comparison at TB level are conducted over various surfaces
  - Based on near simultaneous, **iso geometry**
    - Land
    - Ocean
  - Ice core around Dome Concordia
- Latest versions of processing
  - SMOS v620,
  - SMAP T11850
  - Aquarius v4.0
- Compared TBs are ToA, without reflexion foreign source corrections (gal, sun, moon)

DomeC

- All instruments are processed to a common footprint centered on DomeC at 100km resolution, with Gaussian PSF.
- Comparison is done at Top of Atmosphere level
- Daily or angle bins averages are compared
  - Access to Dome C depends on orbital characteristics and swath coverage
- Latest versions include: SMOS v620, Aquarius v4.0 and SMAP R11850.

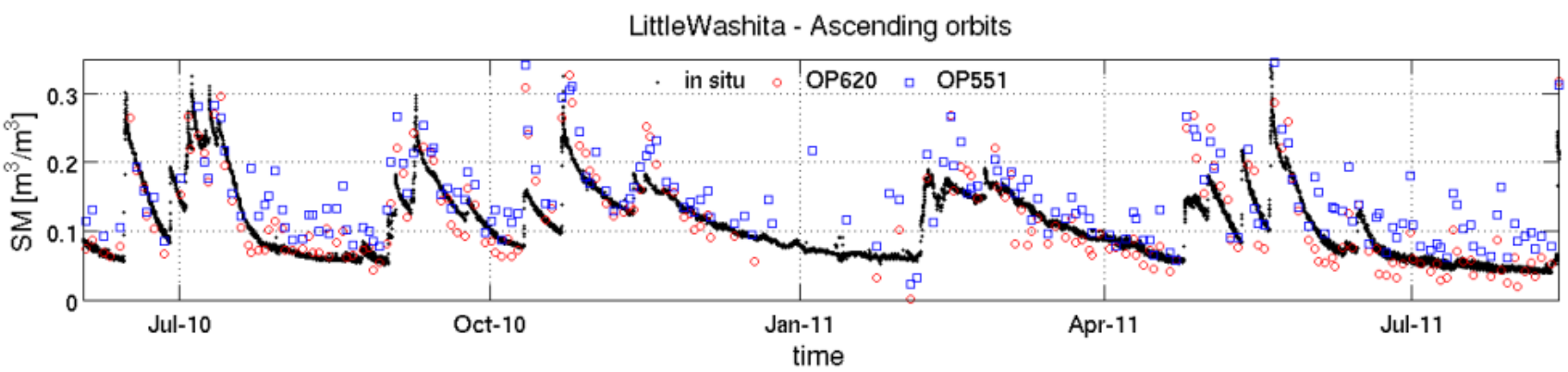




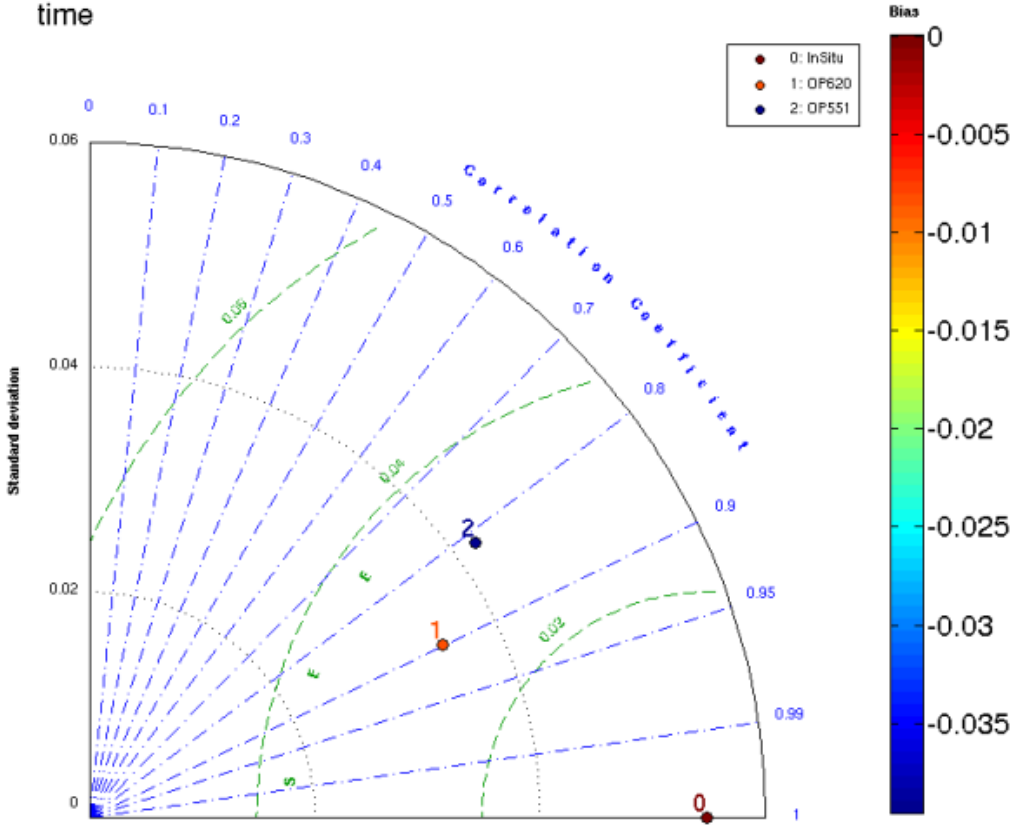


SMOS V 620 validation

- Improvements wrt v551



Series	ρ	μ	σ	RMSE	#kept
OP620	0.90	-0.008	0.035	0.036	200
OP551	0.81	-0.040	0.042	0.058	206



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- Extensive comparison with
  - core sites
  - Sparse networks
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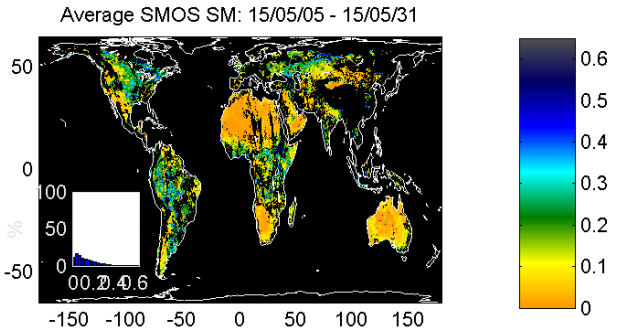
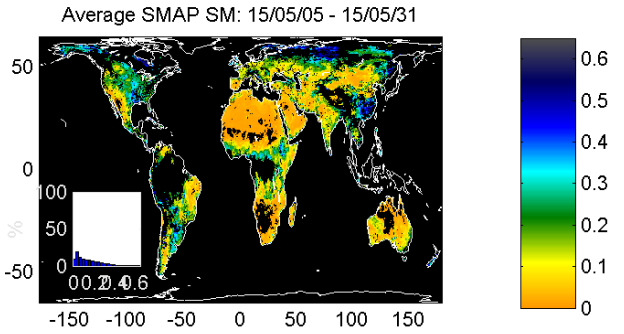
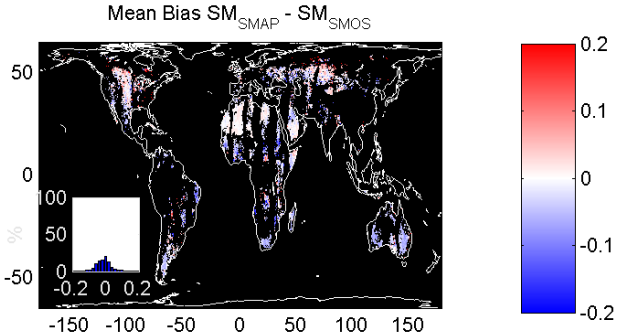
Soil moisture preliminary comparison

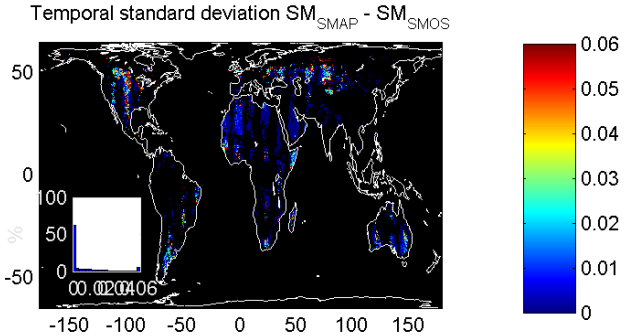
- Starting may 5, SMOS SM is produced using v620
  - Enhanced calibration and reconstruction at L1
  - Improved retrieval over forest with new parametrisation
  - Improved retrieval at low soil moisture with symmetrization of dielectric constant model
  - Reprocessing completed up until end 2014, bridging phase for early 2015 on its way.
- SMOS L3 filtered for RFI, nominal and forest only.
  - Issue with RFI filter ➔ one component (Snapshot Flag) wrong threshold (to aggressive!) Very few data to b corrected
  - SMAP L2_SM_P T11850
  - Dualpol
  - Filtered for surface (ice/snow, water bodies, frozen), ~~TB quality~~, retrieval quality
- Compare 1 month (may 5 to June 2)

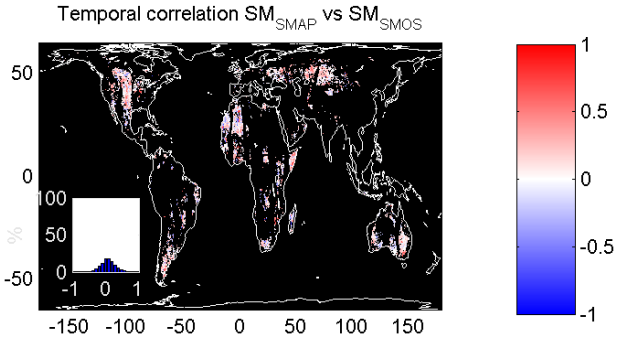

Average SMOS SM: 15/05/05 - 15/05/31
50
0
-50
%
100
50
0
0 0.2 0.4 0.6
-150 -100 -50 0 50 100 150
0.6
0.5
0.4
0.3
0.2
0.1
0

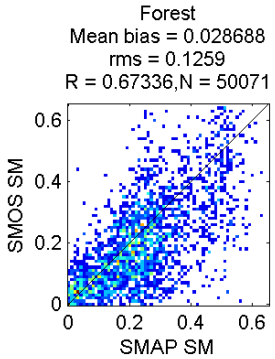
Option 3

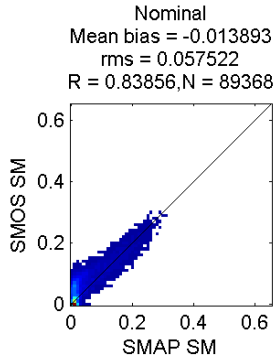

Average SMAP SM: 15/05/05 - 15/05/31
50
0
-50
%
100
50
0
0 0.2 0.4 0.6
-150 -100 -50 0 50 100 150
0.6
0.5
0.4
0.3
0.2
0.1
0

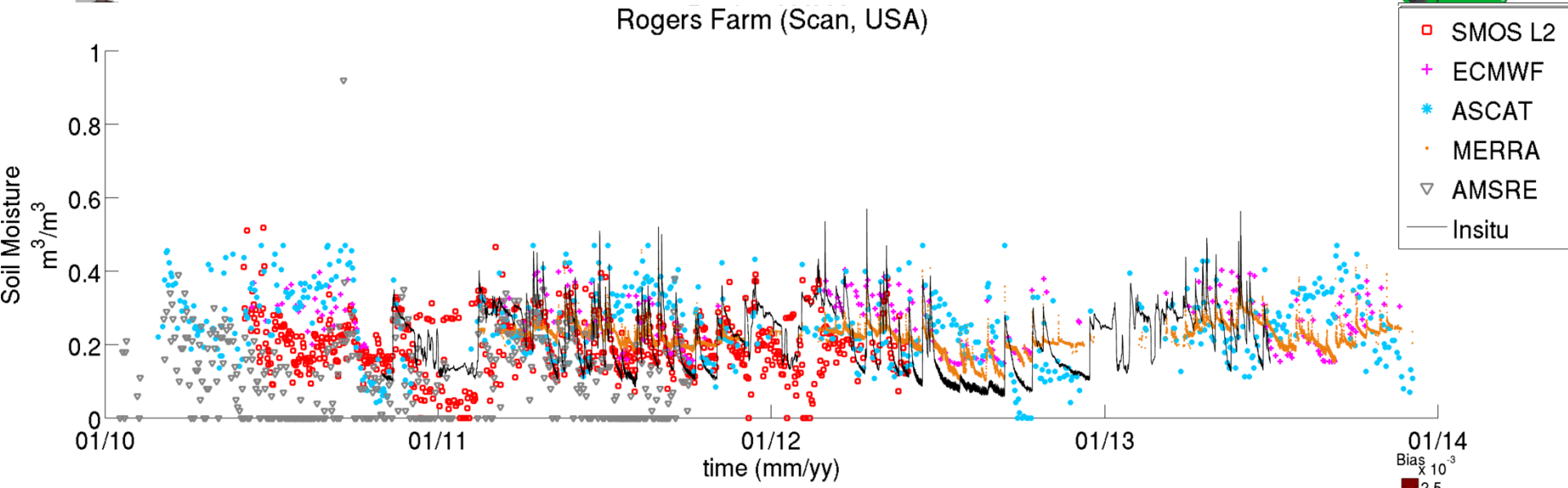

Mean Bias SMSMAP - SMSMOS
50
0
-50
%
100
50
0
-0.2 0 0.2
-150 -100 -50 0 50 100 150
0.2
0.1
0
-0.1
-0.2

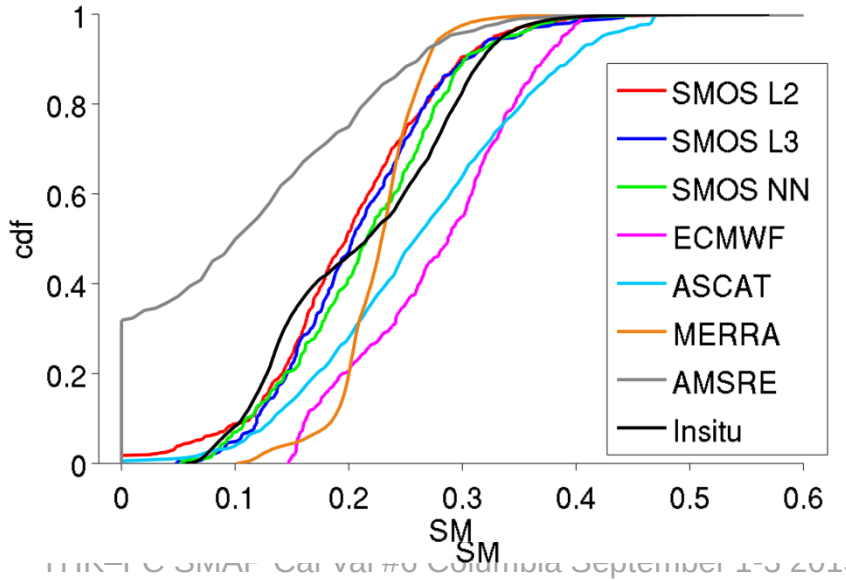

Temporal standard deviation SMSMAP - SMSMOS
50
0
-50
%
100
50
0
0 0.02 0.04 0.06
-150 -100 -50 0 50 100 150
0.06
0.05
0.04
0.03
0.02
0.01
0

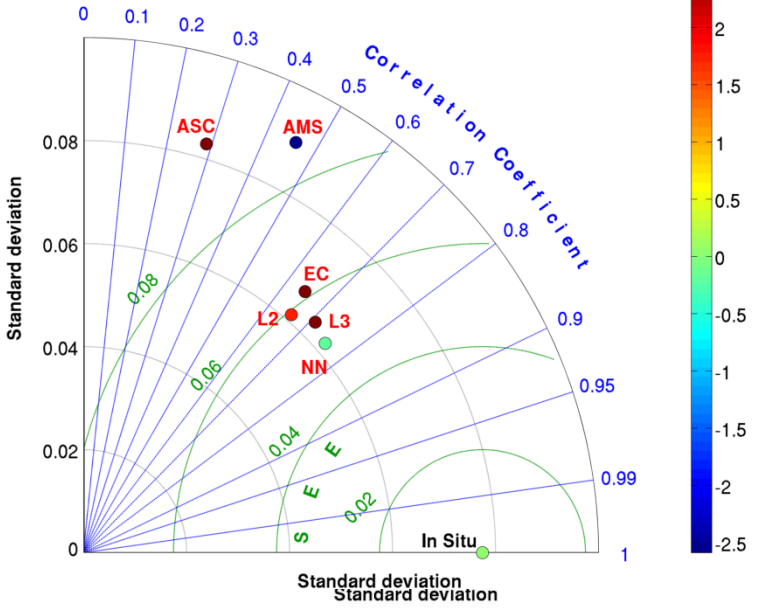

Temporal correlation SMSMAP vs SMSMOS
50
0
-50
%
100
50
0
-1 0 1
-150 -100 -50 0 50 100 150
1
0.5
0
-0.5
-1


Forest
Mean bias = 0.028688
rms = 0.1259
R = 0.67336,N = 50071
SMOS SM
SMAP SM
0
0.2
0.4
0.6


Nominal
Mean bias = -0.013893
rms = 0.057522
R = 0.83856,N = 89368
SMOS SM
SMAP SM
0
0.2
0.4
0.6


Rogers Farm (Scan, USA)
SMOS L2
ECMWF
ASCAT
MERRA
AMSRE
Insitu
Soil Moisture
m3/m3
1
0.8
0.6
0.4
0.2
0
01/10
01/11
01/12
01/13
01/14
time (mm/yy)


cdf
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
SM
SM
SMOS L2
SMOS L3
SMOS NN
ECMWF
ASCAT
MERRA
AMSRE
Insitu


Correlation Coefficient
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0.95
0.99
1
Standard deviation
0.08
0.06
0.04
0.02
0
ASC
AMS
EC
L2
L3
NN
In Situ
Standard deviation
Standard deviation
Bias
x 10-3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5

Comparison of different SMOSproducts

SM	Mean STDE	Mean R	Mean Bias
All network types : Sites 477, *Mean* N_{points} 120.2 Ascending			
SMOS-NN	0.063	0.56	-0.024
ECMWF	0.062	0.55	0.054
SMOS-L3	0.071	0.51	-0.018
Ocurrences of best statistics: *Total* N_{points} 57314.0 Ascending			
SMOS-NN	6	7	8
ECMWF	7	3	1
SMOS-L3	1	3	9
All network types : Sites 402, *Mean* N_{points} 156.6 descending			
SMOS-NN	0.066	0.52	-0.019
ECMWF	0.065	0.54	0.047
SMOS-L3	0.078	0.47	-0.014
Ocurrences of best statistics: *Total* N_{points} 62944.0 descending			
SMOS-NN	6	8	5
ECMWF	6	4	1
SMOS-L3	0	0	5

SMOS V 620 validation

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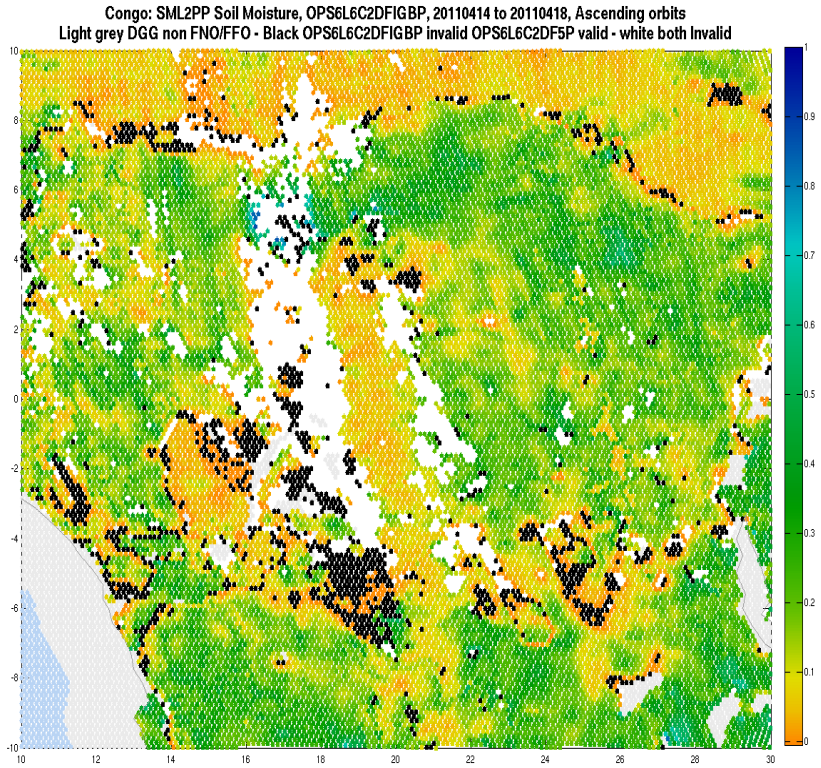
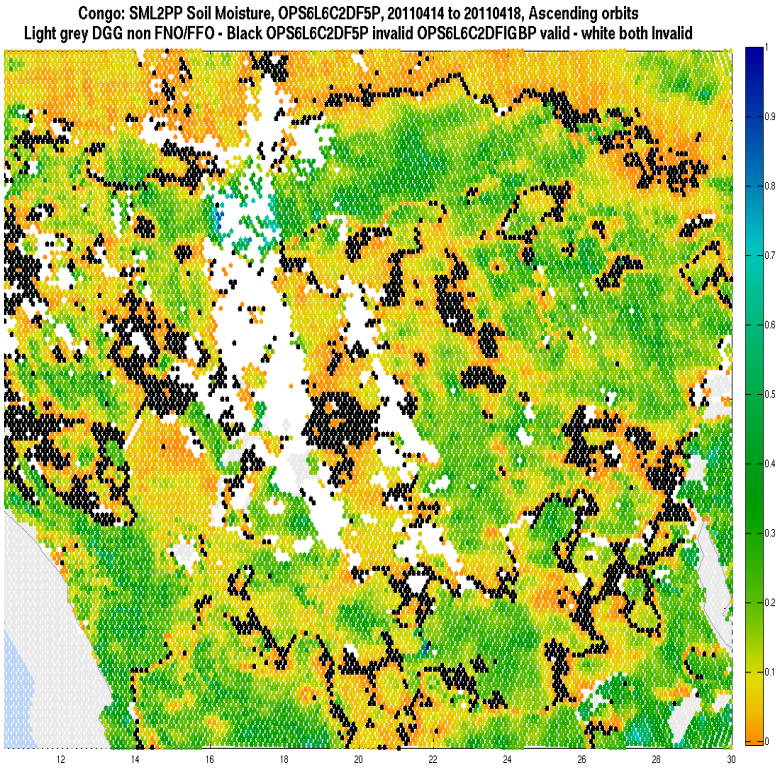
    - SMAp missing but
  - First comparisons with SMOS (see Rajat's , Steven's presentations!). François is also on it
  - Joint cal val site approach?
- Next points
  - Identification of a Land use map issue
  - Work with Forest
  - And for high latitudes
  - SM NRT at ECMWF
  - Common RFI product

Impact of Land use map

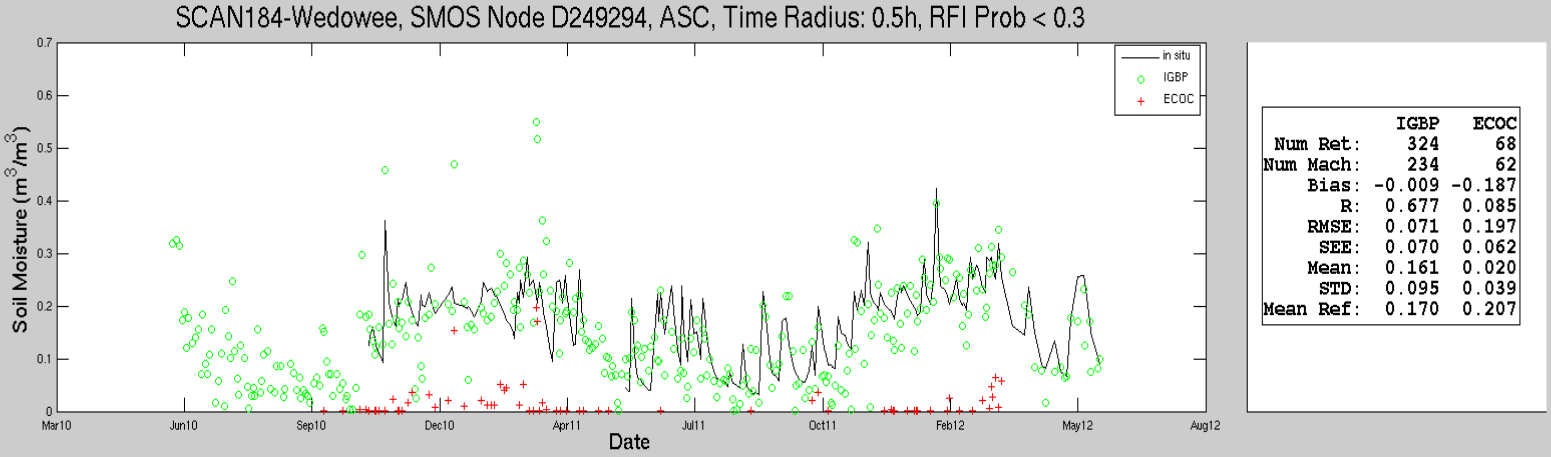
- IGBP SM



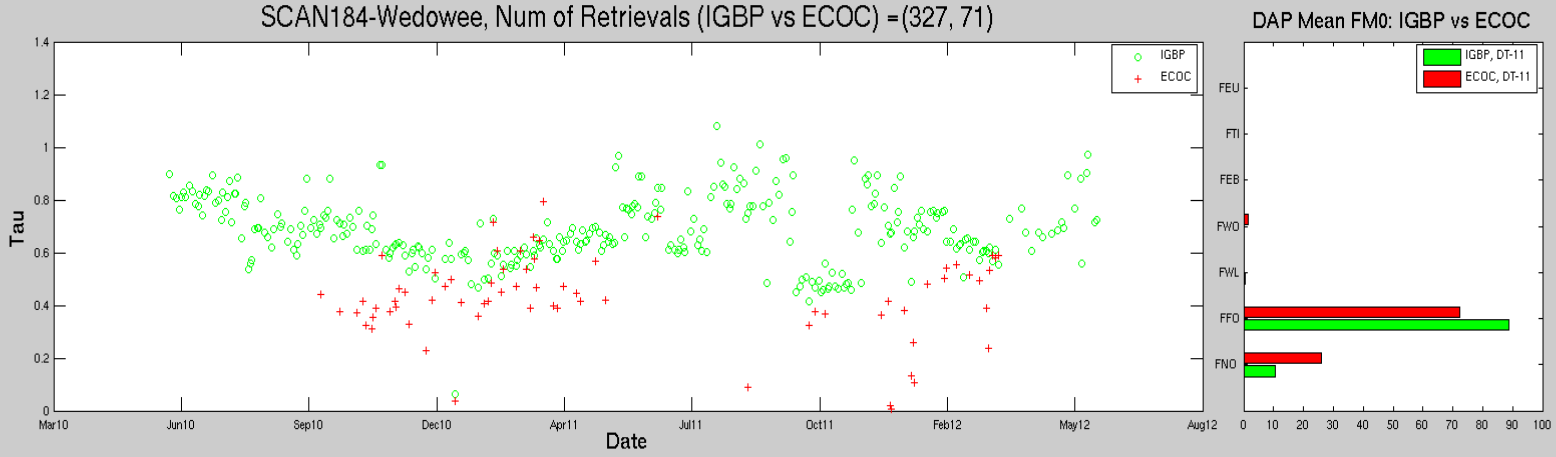
- ECOCLIMAP SM



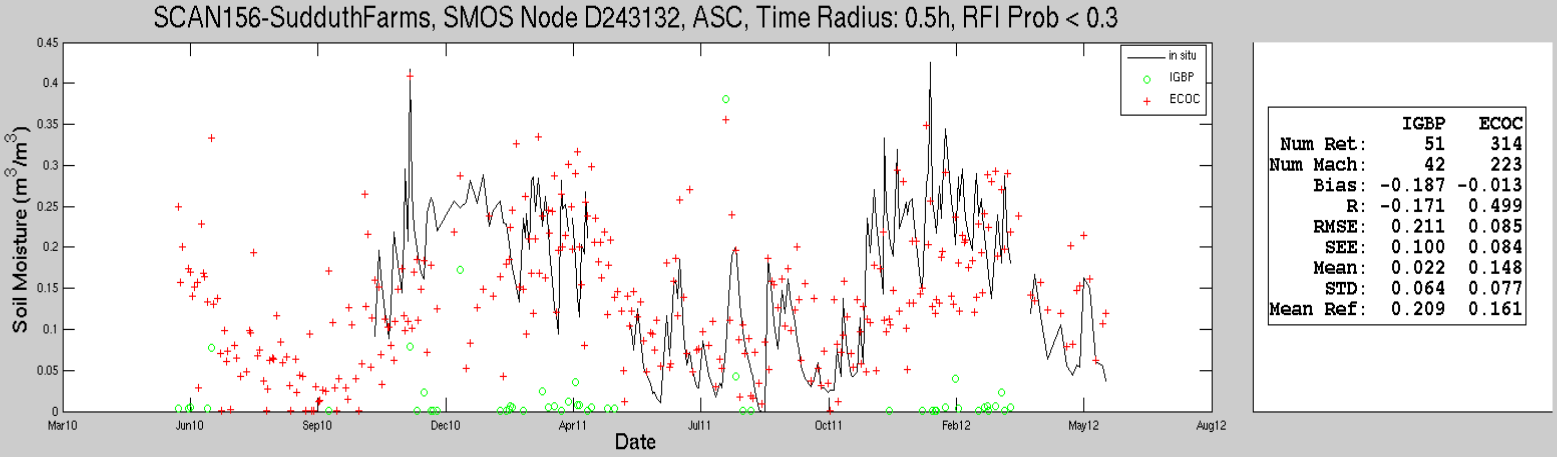
SCAN 184: Wedowee Site



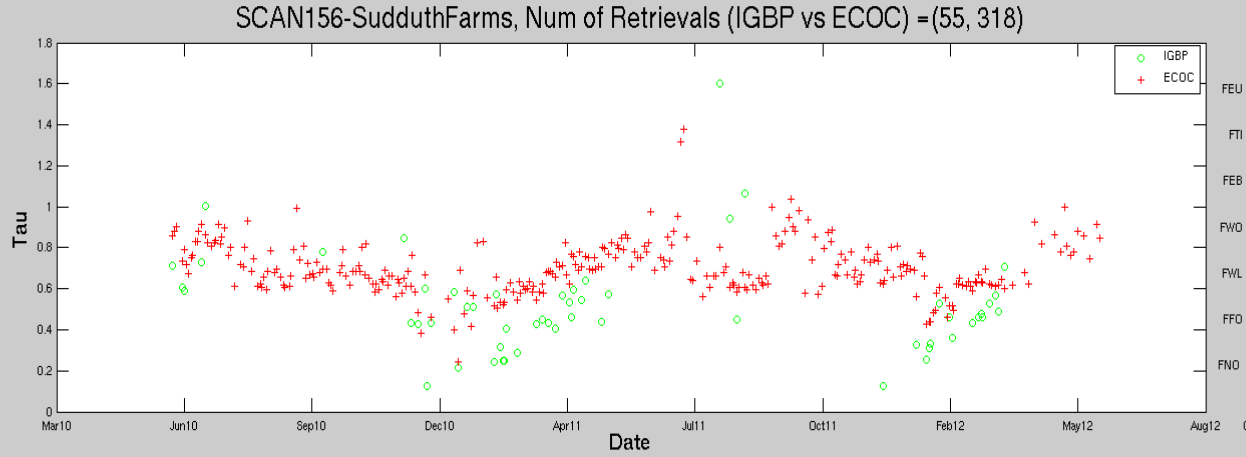
	IGBP	ECOC
Num Ret:	324	68
Num Mach:	234	62
Bias:	-0.009	-0.187
R:	0.677	0.085
RMSE:	0.071	0.197
SEE:	0.070	0.062
Mean:	0.161	0.020
STD:	0.095	0.039
Mean Ref:	0.170	0.207

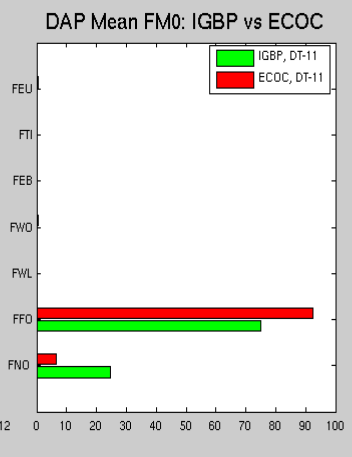


SCAN 156: Sudduth Farms Site

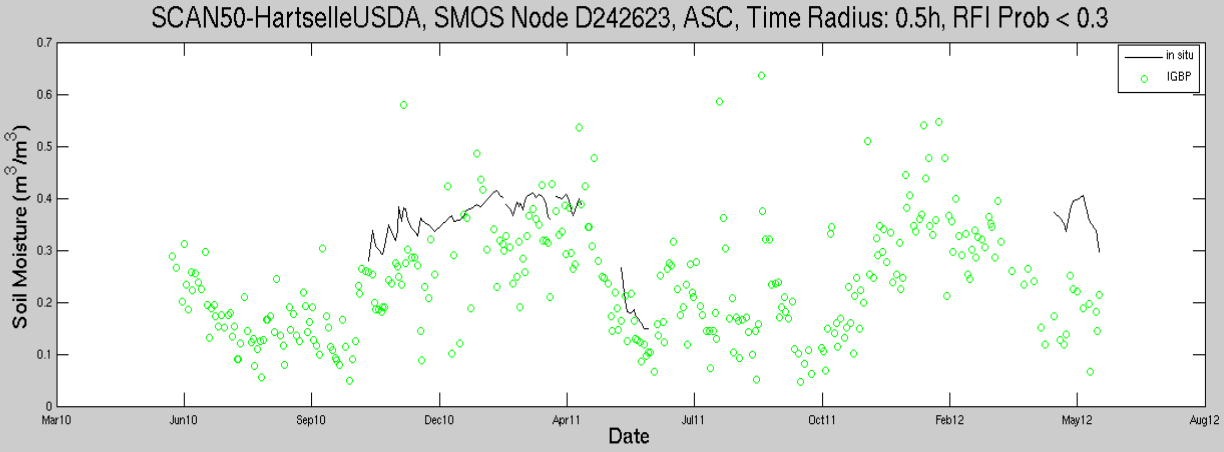


	IGBP	ECOC
Num Ret:	51	314
Num Mach:	42	223
Bias:	-0.187	-0.013
R:	-0.171	0.499
RMSE:	0.211	0.085
SEE:	0.100	0.084
Mean:	0.022	0.148
STD:	0.064	0.077
Mean Ref:	0.209	0.161

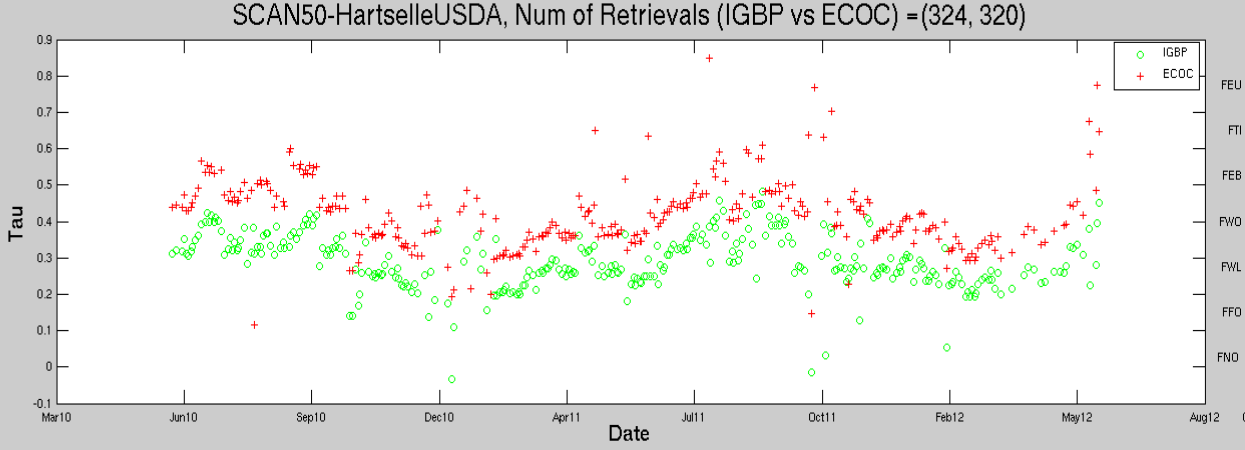


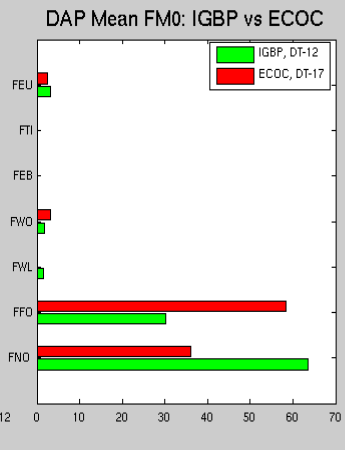


SCAN 50 Hartselle

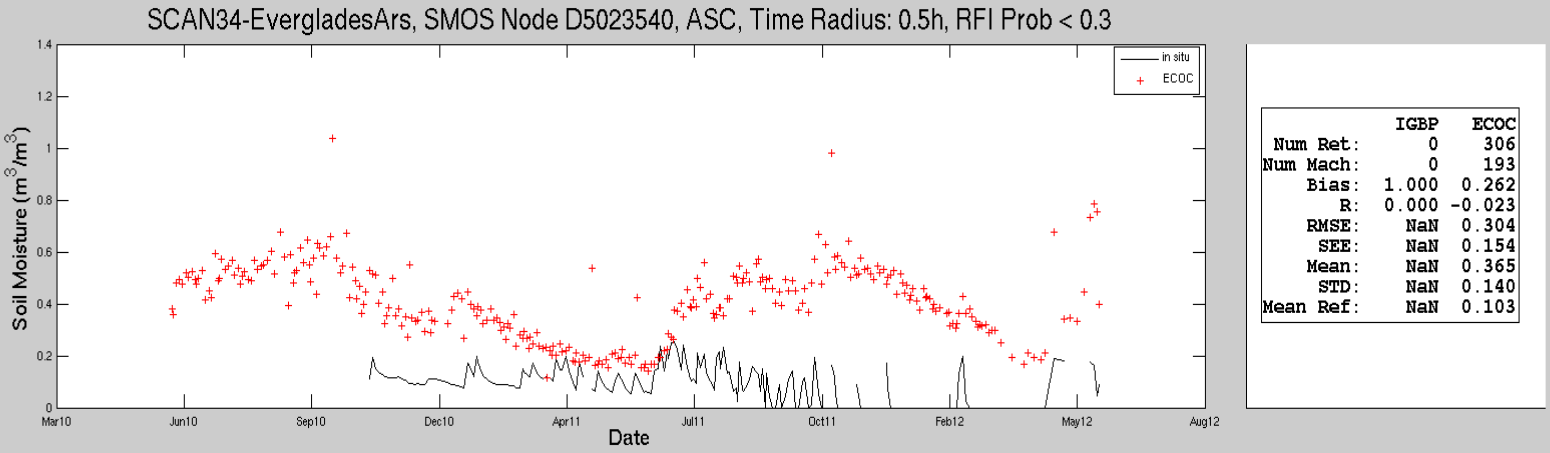


	IGBP	ECOC
Num Ret:	326	0
Num Mach:	95	0
Bias:	-0.087	1.000
R:	0.585	0.000
RMSE:	0.121	NaN
SEE:	0.084	NaN
Mean:	0.257	NaN
STD:	0.103	NaN
Mean Ref:	0.343	NaN

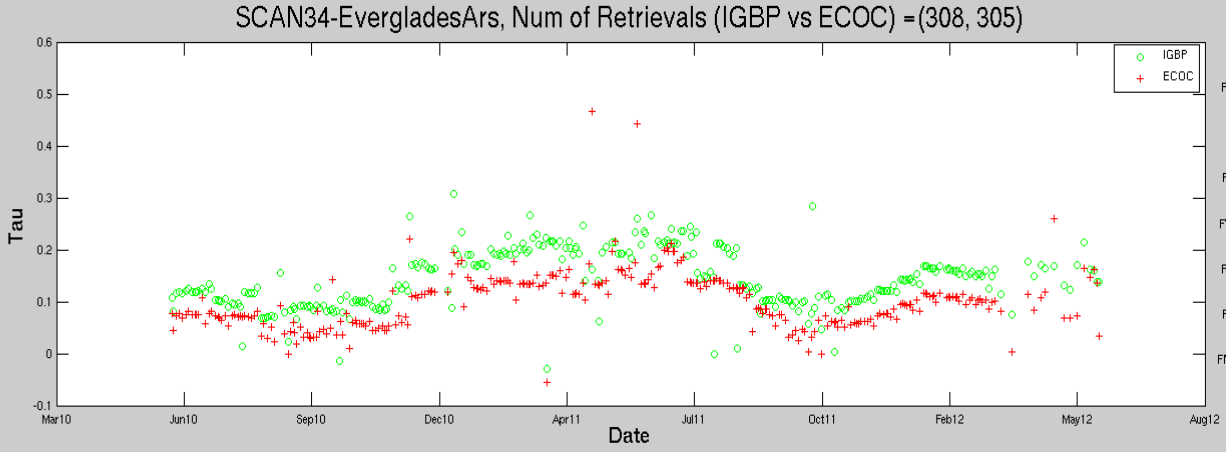


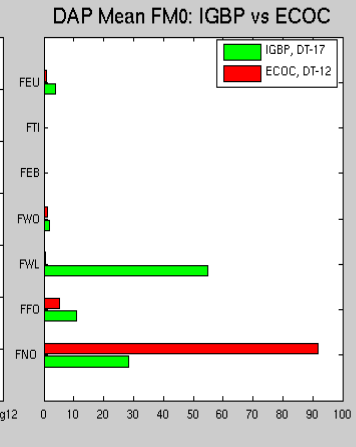


SCAN 34: Everglades

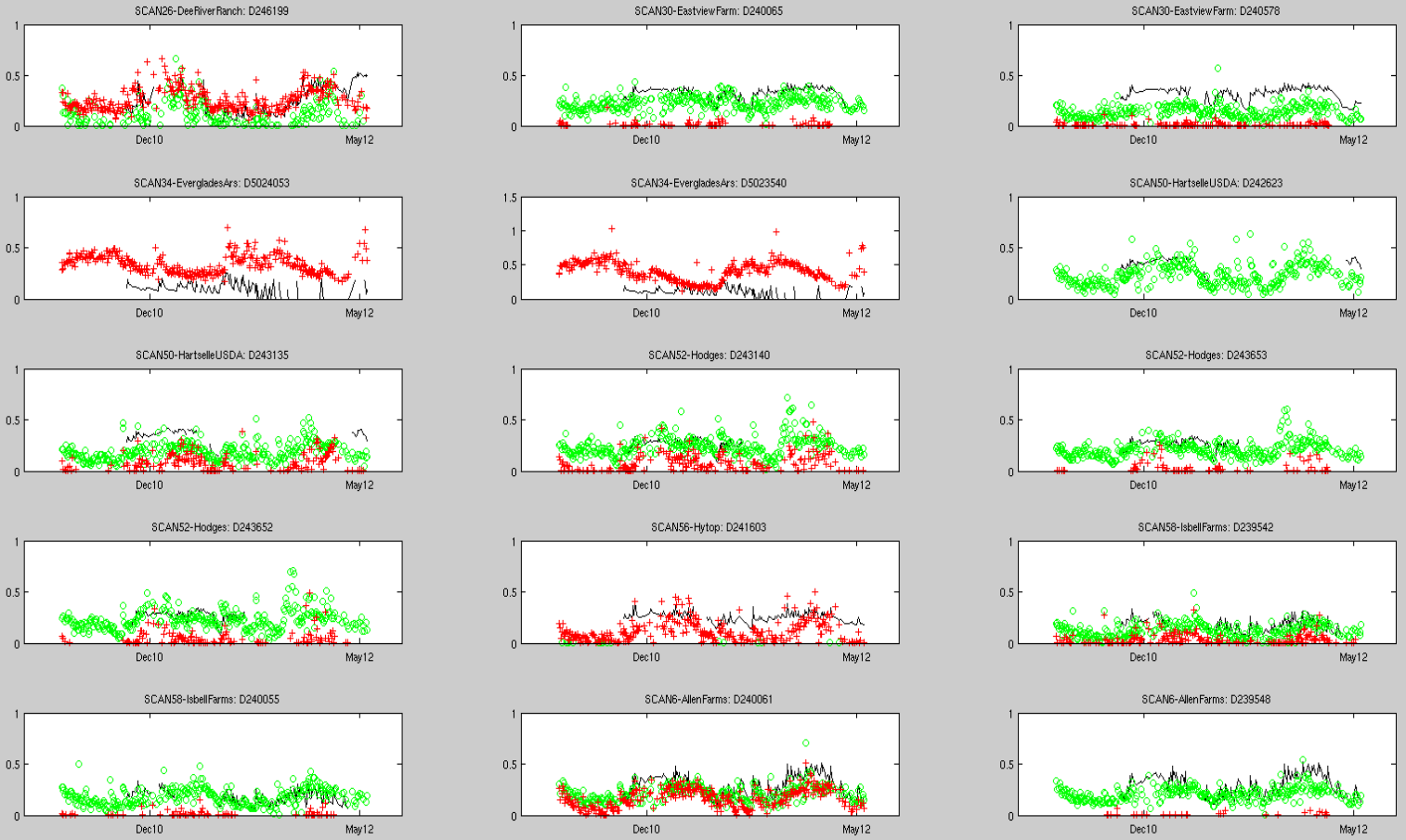


	IGBP	ECOC
Num Ret:	0	306
Num Mach:	0	193
Bias:	1.000	0.262
R:	0.000	-0.023
RMSE:	NaN	0.304
SEE:	NaN	0.154
Mean:	NaN	0.365
STD:	NaN	0.140
Mean Ref:	NaN	0.103





SCAN: Sites where SM significantly differ (diff of abs Bias or R > 0.1)(3)



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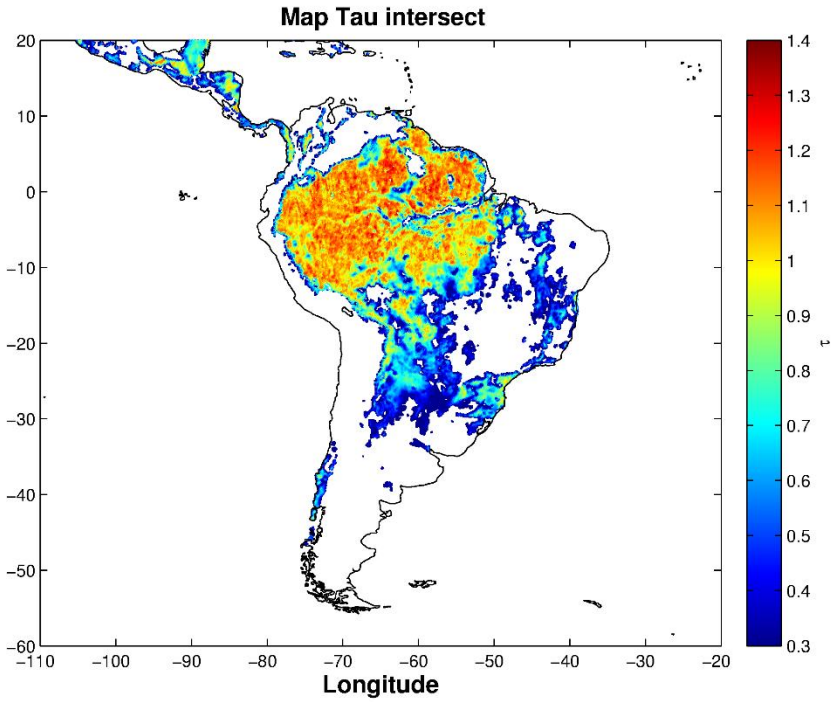
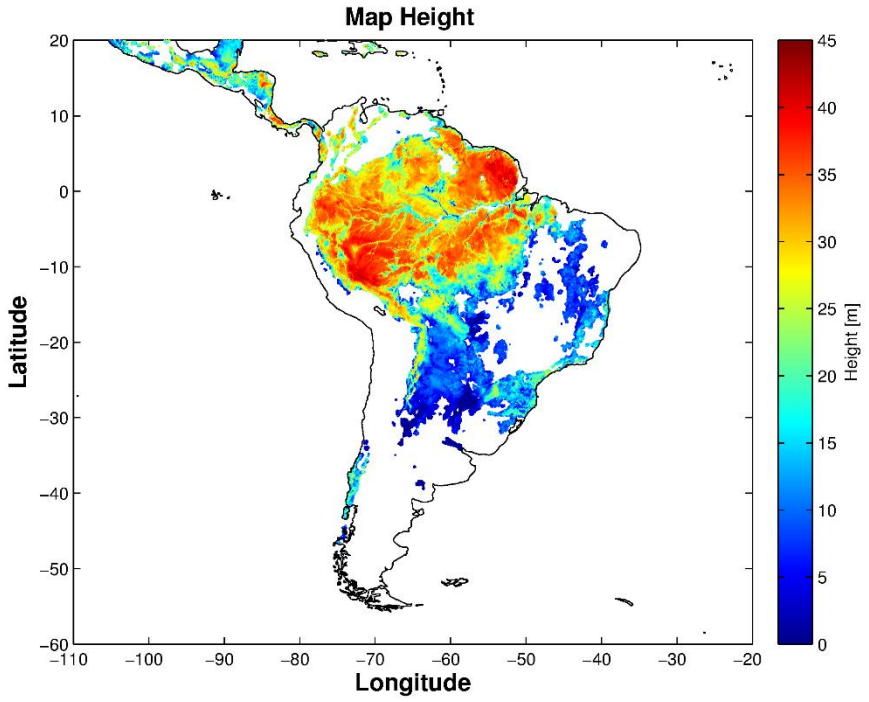
Height from **GLAS LIDAR** (Simard et al.) filtered for **RMSE< 5m**

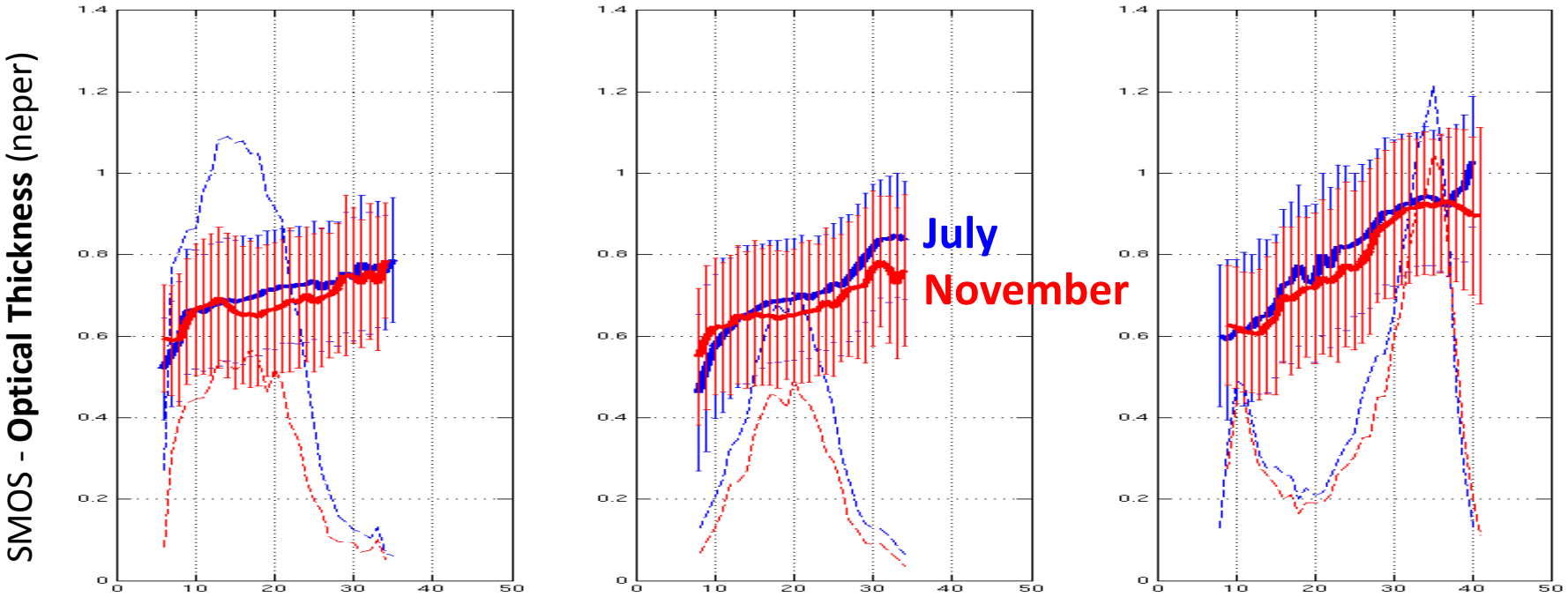
Map Tau Intersect 2011



GLAS Lidar Height

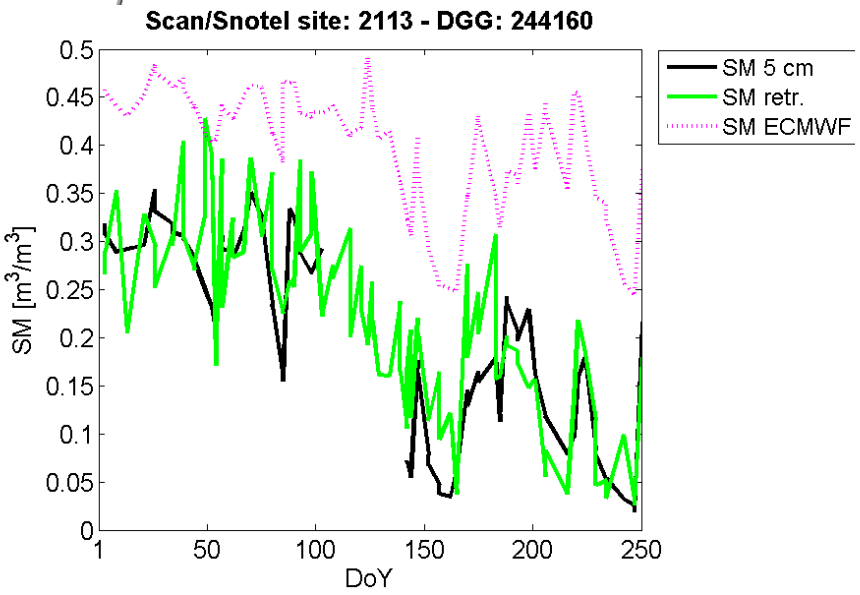


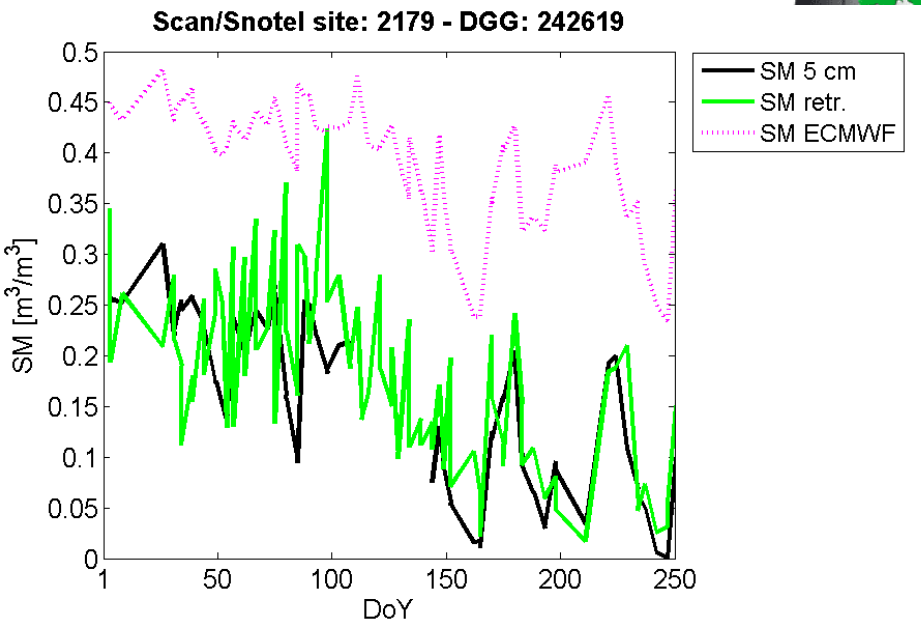
Optical thickness over forests

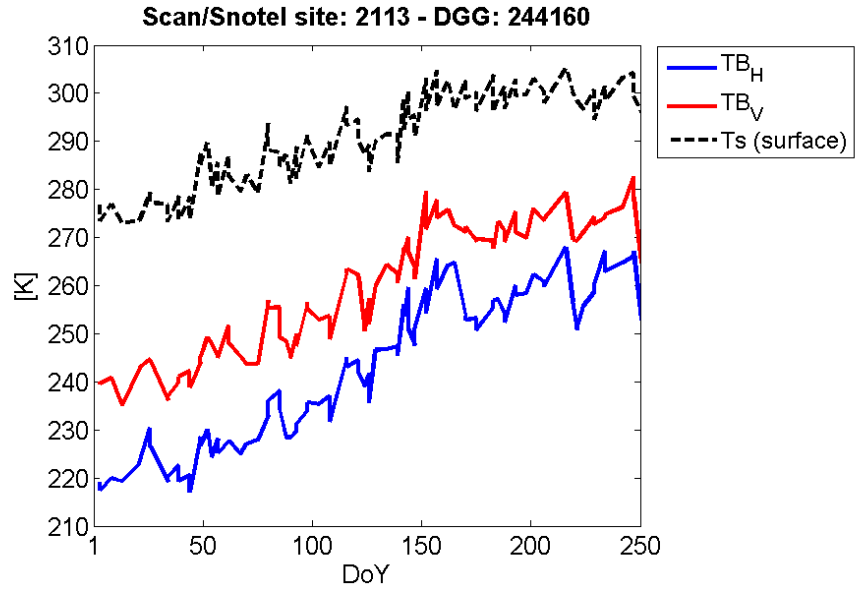


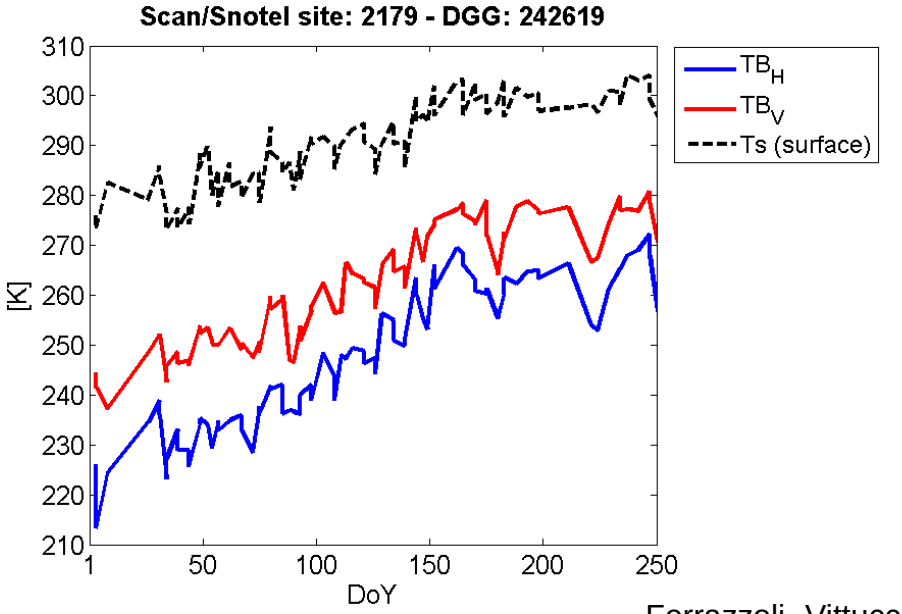
Rahmoune, R., Ferrazzoli, P., Singh, Y., Kerr, Y., Richaume, P., Al Bitar, A. SMOS Retrieval Results Over Forests: Comparisons With Independent Measurements. J-STARS ,2014

Examples: FFO>80%, South East, trends for 2011





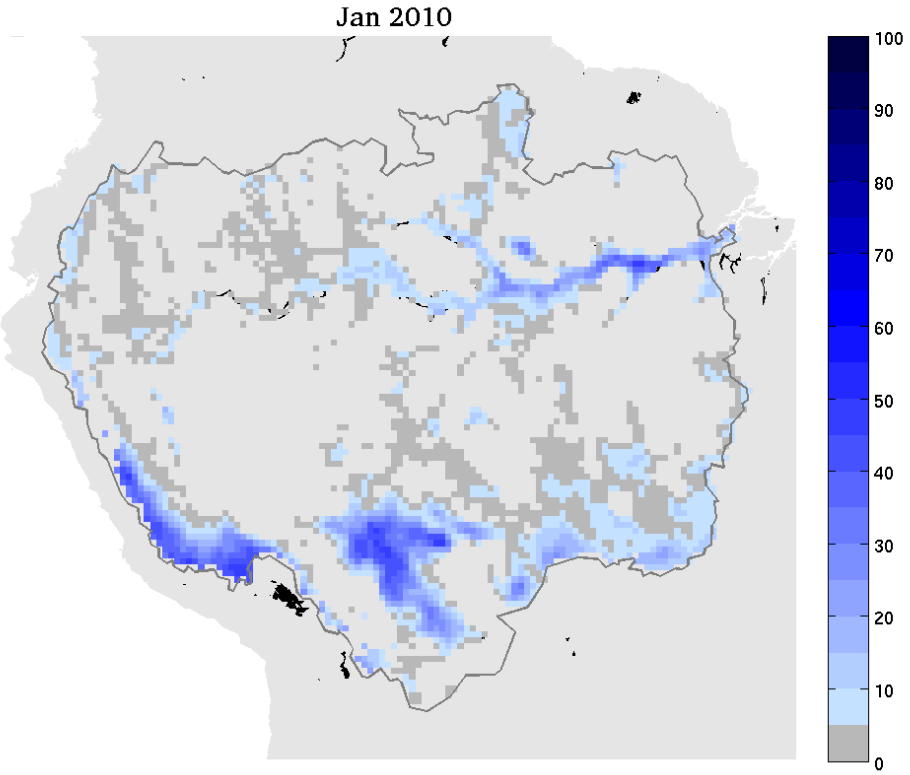


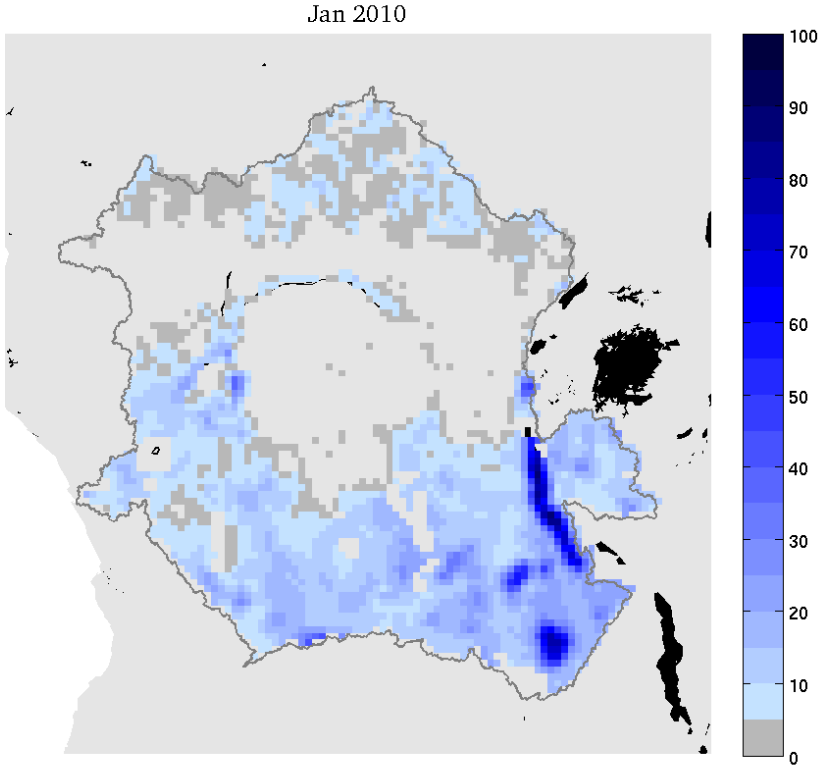


Ferrazzoli- Vittucci

SWaF: SMOS Water Fraction in tropical watersheds

Results

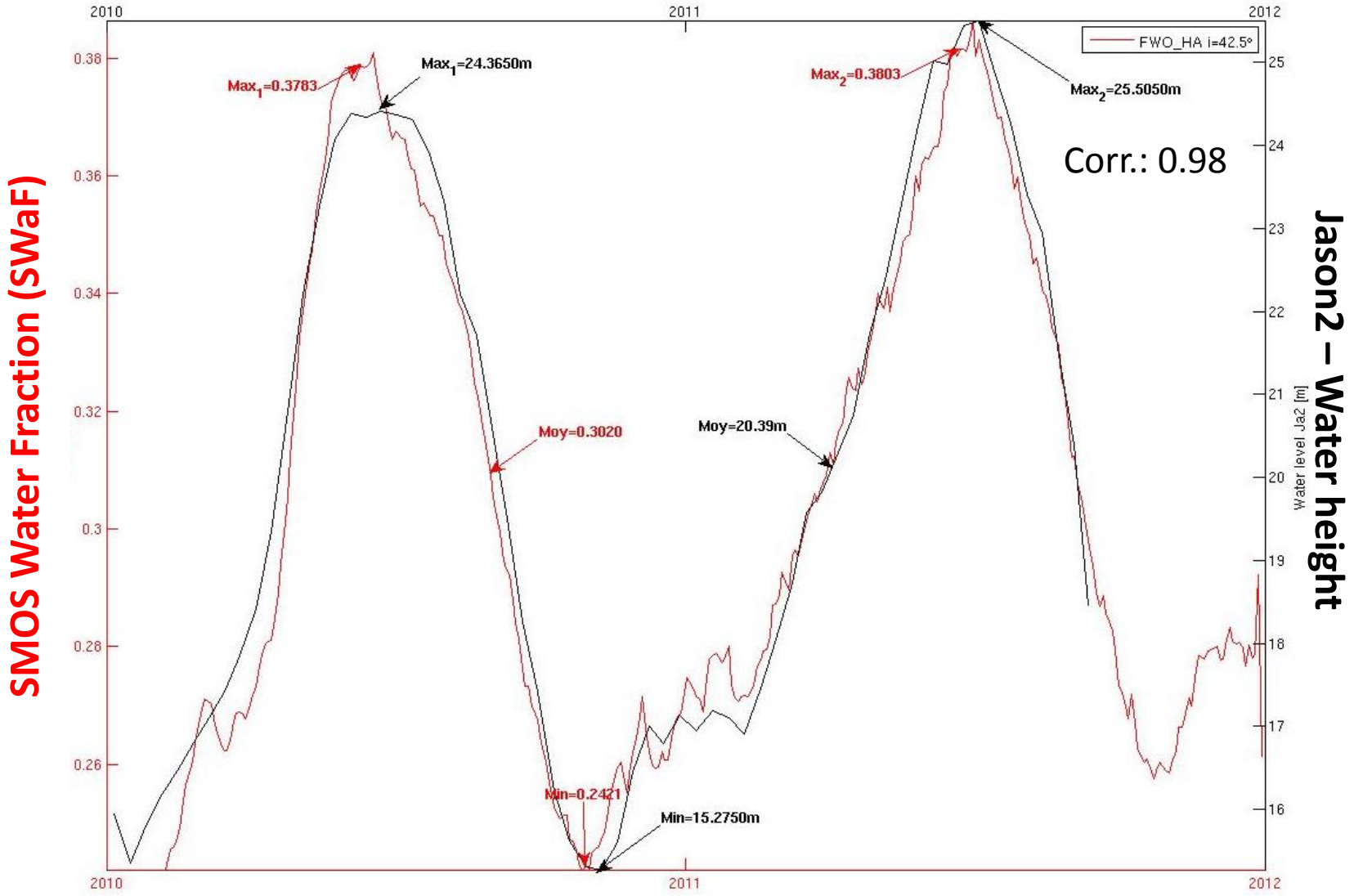




Al Bitar A., Parrens M., Wigneron J.P., Cote R., Cretraux J.-F., Selma C., Kerr Y. H., Water fraction in tropical watersheds from SMOS L-band radiometer, *in prep.*

SMOS Water Fraction & Jason2 Water Height

Results :



Jason2 river height from Hydroweb Legos (J.F. Creteaux)

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- Extensive comparison with
  - core sites
  - Sparse networks
    - Some issues
  - Other satellites (SCAT, AMSR)
    - SMAp missing but
  - First comparisons with SMOS (see Rajat's , Steven's presentations!). François is also on it
  - Joint cal val site approach?
- Next points
  - Identification of a Land use map issue
  - Work with Forest
  - And for high latitudes
  - SM NRT at ECMWF
  - Common RFI product