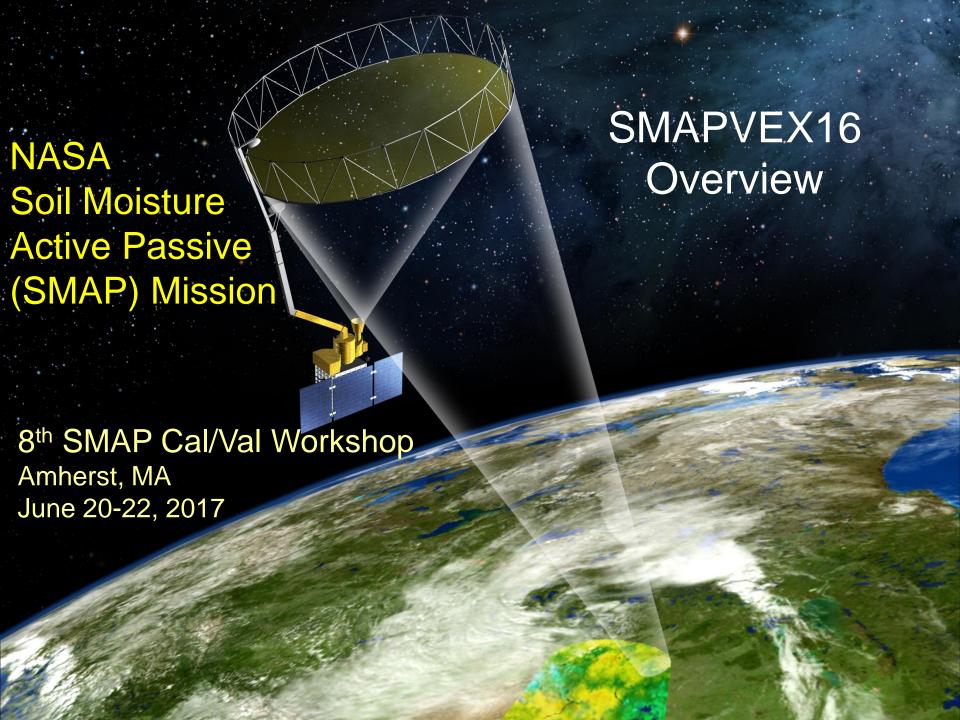


8th SMAP Cal/Val Workshop Agenda-Day 1



Session	Title	Authors
Opening		
8:00	Welcome	P. Siquera
8:15	Objectives	T. Jackson
8:30	NASA HQ and SUSMAP	J. Entin
8:45	Mission Status, New Products and Timeline	TH. You and S. Yueh
9:15	Science and Applications Update	D. Entekhabi and S. Yueh
9:45	Break	
Validating New	Products and Product Updates and Plans	
10:00	Recalibration and Validation of the SMAP L-band Radiometer	J. Peng, S. Misra, J. Piepmeier, E. Dinnat, T. Meissner, D. Le Vine, G. De Amici, S. Yueh
10:20	Soil Moisture Passive Product Enhancements	S. Chan, R. Bindlish, T. Jackson, P. O'Neill
10:40	Calibration and Validation of the SMAP and Sentinel based Active- Passive High Resolution Soil Moisture Product	N. Das, S. Kim, S. Dunbar, T. Jagdhuber and D. Entekhabi
11:20	L3 Freeze/Thaw Products and Cal/Val Activities Summary	X. Xu, C. Derksen, S. Dunbar, A. Colliander, Y. Kim, J. Kimball
11:40	Lunch	
12:45	L4_SM Product Updates	J. Kolassa and R. Reichle
13:00	SMAP Level 4 Carbon (L4C) Product Assessment, Status and Plans	S. Kimball, L.A. Jones, J. Glassy, R. Reichle
Field Experime		
13:15	SMAPVEX16 Overview	T. Jackson
13:20	Overview of SMAPVEX16-lowa Ground Operations	M. Cosh, A. Colliander, T. Jackson, J. Prueger, J. Hatfield, B. Hornbuckle, J. Judge, T. Franz, J. Qu, W. Krajewski, A. Fisher
13:40	Iowa Tower Radiometer	J. Judge et al.
14:00	Soil Surface Roughness Measurements During SMAPVEX16-IA	B. Hornbuckle, W. Eichinger, V. Wallace, V. Walker, E. Yildirim. M. Cosh
14:15	SMAPVEX16-MB Data and Analysis	M. Friesen, J. Powers, K. Gottfried, H. McNairn, A. Pacheco, A. Merzouki
14:45	PALS SMAPVEX16	A. Colliander, S. Misra, M. Cosh, T. Jackson, et al.
15:15	SMAPEx Overview	J. Walker, T. Jackson
15:30	Discussion	
15:45	Break	
Validation Stud	dies (Contributed)	
16:00	Water Contamination Correction for SMAP	J. Chaubell, S. Yueh, J. Peng
16:20	Soil moisture variability from hillslope to SMAP grid scale over Iowa	W. F. Krajewski, R. Mantilla, and N. Jadidoleslam
16:35	The hydrologic understory: soil moisture in the wetland habitat	C. Hatch, G. Davenport, M. Cosh, J. Koyen, C. Richardson, L. Winter, A. Hackman, B. Clement, and K. Ballantine
16:50	Enhancing the information content and utilization of SMAP products for agricultural applications	J. Bolten, S. Kumar, J. Santanello
17:05	Summary of the Day	





Post-launch Field Experiment Objectives



- Investigate and resolve anomalous observations and products
 - Agricultural CVS
 - Forests
- Improving up-scaling functions for CVS
- Provide a basis for evaluating new disaggregation approaches
- Contribution to a broader science/application objective
- Understand the effects and contribution of heterogeneity on coarser resolution retrievals
- Evaluate the impact of known RFI sources on retrieval
- Correlative analysis of L1 product calibration and heterogeneity effects



SMAP L2SMP Validated Release Assessment

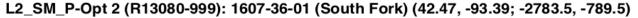


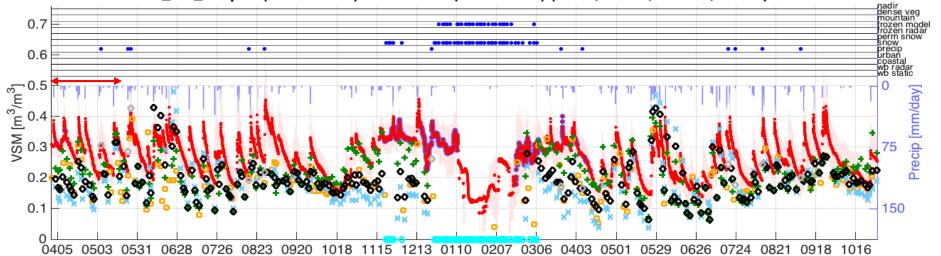
Core Validation Sites

CVC	ubF	RMSE (m ³	/m ³)	В	Bias (m³/m	³)	RI	MSE (m³/r	n ³)		R			N	
CVS	SCA-H	SCA-V	DCA	SCA-H	SCA-V	DCA	SCA-H	SCA-V	DCA	SCA-H	SCA-V	DCA	SCA-H	SCA-V	DCA
Reynolds Creek	0.041	0.041	0.055	-0.065	-0.030	-0.003	0.077	0.051	0.055	0.638	0.670	0.650	86	93	93
Walnut Gulch	0.026	0.028	0.041	-0.028	-0.006	0.015	0.038	0.028	0.043	0.587	0.688	0.674	86	101	97
TxSON	0.030	0.029	0.036	-0.061	-0.011	0.065	0.068	0.031	0.074	0.937	0.942	0.886	99	99	97
Fort Cobb	0.033	0.029	0.042	-0.069	-0.040	-0.003	0.076	0.049	0.042	0.870	0.883	0.815	137	137	137
Little Washita	0.024	0.020	0.040	-0.054	-0.018	0.034	0.059	0.027	0.052	0.915	0.940	0.884	149	149	148
South Fork	0.057	0.053	0.052	-0.078	-0.064	-0.047	0.097	0.083	0.070	0.494	0.515	0.515	104	107	107
Little River	0.038	0.028	0.033	0.057	0.095	0.152	0.068	0.099	0.155	0.895	0.924	0.831	157	157	157
Kenaston	0.037	0.026	0.039	-0.061	-0.035	0.008	0.071	0.043	0.040	0.661	0.774	0.584	76	76	76
Carman	0.084	0.058	0.055	-0.088	-0.085	-0.075	0.121	0.103	0.093	0.570	0.620	0.471	101	102	102
Monte Buey	0.072	0.056	0.045	0.004	0.013	-0.010	0.072	0.058	0.047	0.776	0.885	0.682	74	87	88
REMEDHUS	0.034	0.039	0.050	-0.031	-0.013	0.004	0.046	0.041	0.050	0.908	0.897	0.882	142	138	132
Twente	0.070	0.054	0.047	0.021	0.035	0.049	0.073	0.064	0.068	0.909	0.919	0.847	153	157	157
MAHASRI	0.030	0.037	0.034	-0.007	-0.008	-0.005	0.031	0.037	0.034	0.788	0.765	0.782	63	47	51
Yanco	0.040	0.037	0.038	-0.012	0.013	0.034	0.042	0.039	0.051	0.923	0.936	0.930	104	105	105
Kyeamba	0.056	0.054	0.043	-0.019	0.004	0.017	0.059	0.054	0.046	0.918	0.948	0.942	99	116	122
SMAP Average	0.045	0.039	0.043	-0.033	-0.010	0.016	0.067	0.054	0.061	0.786	0.820	0.758			
SMOS Average		0.048			-0.023			0.066			0.750				

South Fork (Core Pixel)









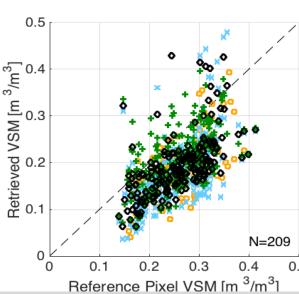
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- In Situ

Climate class: Cold (Dfa) Landcover: Croplands

Soil texture:

S-%: 37 C-%: 30

BD: 1.35



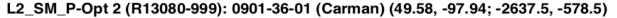
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- The range of soil moisture is similar
- 2016 retrievals are "better" than 2015

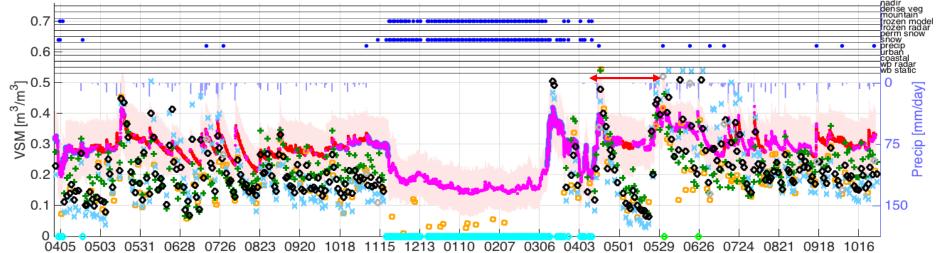
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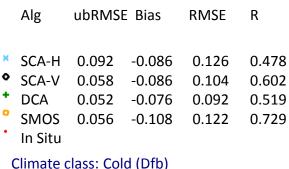
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Carman (Core Pixel)





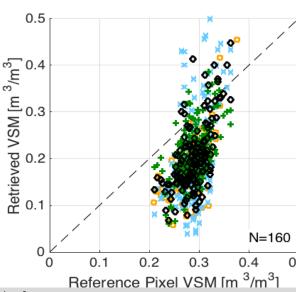




Landcover: Croplands

Soil texture:

S-%: 26 C-%: 34 BD: 1.18



The May 2016 time period is very interesting. Need further verification of what rainfall actually occurred

situ obs

SMAP has an

SMOS also has an

is larger for SMAP

during this period.

similar behavior

algorithms

underestimation bias for all

underestimation bias and

During drydowns, SMAP

decreases faster than the in

The range of soil moisture

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SMAPVEX16 Design



- Two agricultural CVS (Independent teams)
 - South Fork, IA (Collaboration with OCO-2 and GPM)
 - Carman, MB (Collaboration with Radarsat)
- Two IOPs at each CVS
 - Early season and high biomass
 - Total: 8 weeks
- Different focus crops
 - IA: Corn and Soybeans
 - MB: Wheat and Canola
- Enhanced observations
 - SMAP aircraft simulator: PALS
 - Tower-based microwave radiometers
 - Ground-based soil moisture
 - Surface roughness and vegetation measurements
 - Precipitation





SMAPVEX16 IOPs and SMAP Overpasses



	М						S	
	16	17	18	19	20	21	22	
	23	24	25	26	27	28	29	01115
IA IOP1	30	31	June 1	2	3	4	5	SMAP no PALS
145.165.4	6	7	8	9	10	11	12	SMAP and PALS
MB IOP1	13	14	15	16	17	18	19	PALS no SMAP
	20	21	22	23	24	25	26	Olvin ti
	27	28	29	30	July 1	2	3	
	4	5	6	7	8	9	10	
MB IOP2	11	12	13	14	15	16	17	
	18	19	20	21	22	23	24	
	25	26	27	28	29	30	31	
	August 1	2	3	4	5	6	7	
IA IOP2	8	9	10	11	12	13	14	
	15	16	17	18	19	20	21	TJJ–8

Resolving Anomalous SMAP Retrievals: XXXXXXXXX

Source of Error	Resolve/Investigate	Expectation	Status of Assessment



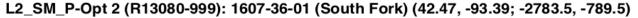
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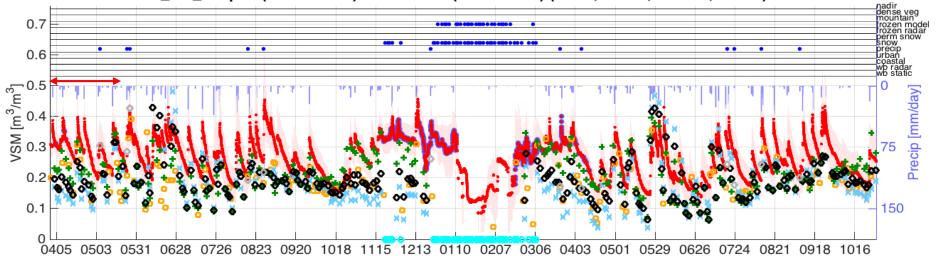


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	lies (Contributed)	
16:00	Water Contamination Correction for SMAP	J. Chaubell, S. Yueh, J. Peng
16:20	Evaluation of seven satellite-based soil moisture products using the CRN and COSMOS Networks	S. Stillman and X. Zeng
16:35	Modeling And Soil Moisture Retrieval With L-Band Synthetic Aperture Radar Data Through Dielectric Changes In Soil Moisture And Vegetation Over Shrublands	S. Kim, M. Arii
16:50	Enhancing the information content and utilization of SMAP products for agricultural applications	J. Bolten, S. Kumar, J. Santanello
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	· •	

South Fork (Core Pixel)









- SCA-H 0.061 -0.0770.585 0.098 SCA-V 0.054 -0.066 0.085 0.612
 - 0.058 -0.050 0.551 DCA 0.077 SMOS 0.050 -0.075 0.090 0.626
- In Situ

Climate class: Cold (Dfa) Landcover: Croplands

Soil texture:

S-%: 37 C-%: 30 BD: 1.35

0.5 Retrieved VSM [m ³/m³] N=209 0.1 0.3 Reference Pixel VSM [m 3/m3]

- SMAP has an underestimation bias for all algorithms
- SMOS also has an underestimation bias and similar behavior
- During drydowns, SMAP and in situ decrease at about the same rate
- The range of soil moisture is similar
- 2016 retrievals are "better" than 2015

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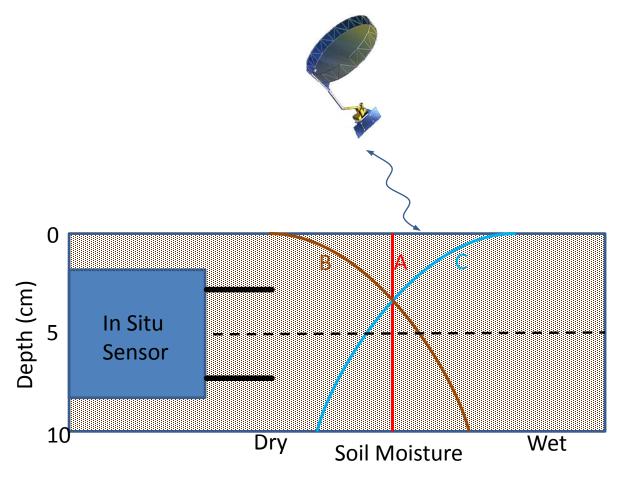
Resolving Anomalous SMAP Retrievals: South Fork

Source of Error	Resolve/Investigate	Expectation	Status of Assessment
Calibration of in situ probes	Conduct gravimetric/bulk density sampling and compare to probe estimates	If there is a calibration bias it could affect results.	Data were collected.
Bias in SMAP top-down versus <i>in situ</i> at depth	Profile sampling and vertical vs. horizontal probe measurements	Overestimation after rain, potential underestimation otherwise.	Need to compare the 0-5 to at 5 cm measurements collected. Also layer samples at tower site.
Upscaling approach	Compare to a dense set of samples from field campaigns, etc. Compare alternative upscaling methods.	Since some of this has been done previously, not expected to be a major factor.	Data were collected. Reviewing 2014 study also.
Soil texture	Sensitivity analysis and review dc vs. SM relationships	Clay soils can have lower dielectric constants for a given SM due to bound water. Underestimating clay fraction can lead to underestimating SM.	
Dielectric model	Review alternative methods	Different models produce varying SM for a dielectric constant. For Hallikainen, underestimating the clay fraction underestimates SM	
Soil emission model	All use Fresnel, which assumes uniform properties over the contributing depth	A modeling exercise could be conducted. However, no operational solution is likely (if this was the cause).	
Surface roughness characterization	Do the conditions change significantly over time? Collect roughness data.	Underestimating roughness effects would underestimate SM. There is an obvious seasonal element at SF not being incorporated.	Data were collected.
VWC (NDVI) climatology vs. actual	Compile data sets for comparison. Climatology, actual MODIS, field-based products.	Underestimating VWC (NDVI) would underestimate SM.	
b parameter (or omega)	b values are based on limited experimental data sets	Changing these to match a specific site (no)?	
Alternative tau estimates	Look at DCA and SMOS tau vs. climatology tau	Underestimating tau would underestimate SM. DCA tau is puzzling. Compensates for roughness in Spring/Fall.	
Vegetation model	The current model is a simplification. However, it is difficult to implement more complex approaches. Compare SMAP and SMOS parameters and retrievals.		
Spatial heterogeneity	Compare to PALS	Not expected to be a major factor.	Data were collected
RFI	Review data for potential issues	RFI would lead to underestimates of SM	
Assuming Ts=Tv	Sensitivity analyses, any field obs?		
Source of T data	Compare alternative products; ECMWF, Ka-band Is there a bias?		
Temperature normalization model		Underestimating Ts will underestimate SM	

What Would "fix" the South Fork Soil Moisture Retrievals

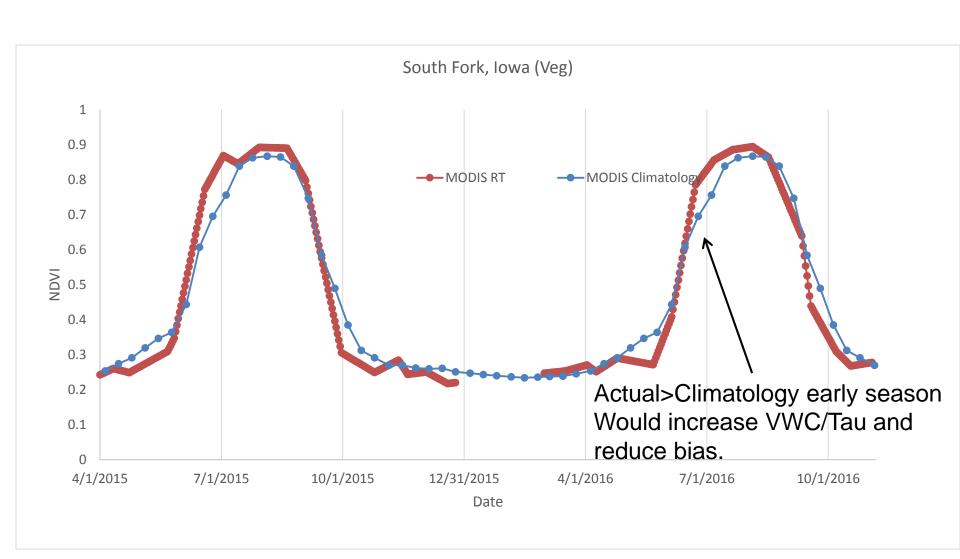
- Decrease estimates of in situ soil moisture
 - Calibration or scaling
- Increase surface roughness
- Introduce seasonal soil roughness
- Increase tau (VWC/NDVI or b) (Omega?)
 - ***note "tau" values during bare soil conditions!
- Use a surface biased in situ observation or shallower depth
- Decrease clay fraction
- Decrease physical temperature

Top-down Versus at Depth Measurements

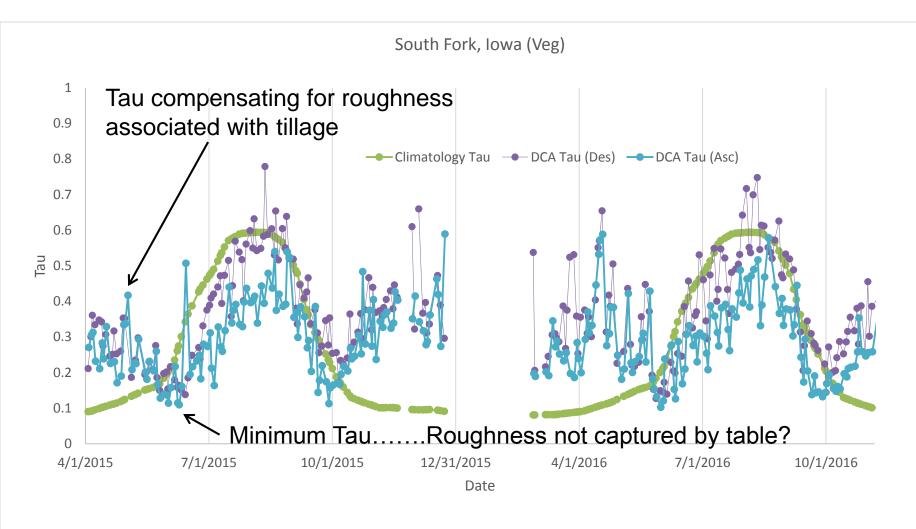


- A. Uniform soil moisture with depth: OK!
- B. Dry down: Satellite may underestimate vs. in situ
- C. Recent rain/irrigation: Satellite may overestimate vs. in situ

Comparison of Actual and Climatology NDVI for South Fork



Comparison of Retrieved and Climatology Tau for South Fork



Combining Tau and h

Schmugge, T. J., Jackson, T. J. Kustas, W. R. and Wang, J. R. Passive microwave remote sensing of soil moisture: Results from HAPEX, FIFE and MONSOON 90. ISPRS Journal of Photogrammetry and Remote Sensing, 47:127-143. 1992.

Making a series of assumptions and rearranging terms, it was shown that roughness (h) and tau could potentially be combined into a single parameter.

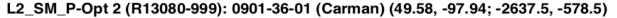
$$T_B = T_S (1 + (\epsilon_S - 1)e^{-(\tau + h)})$$

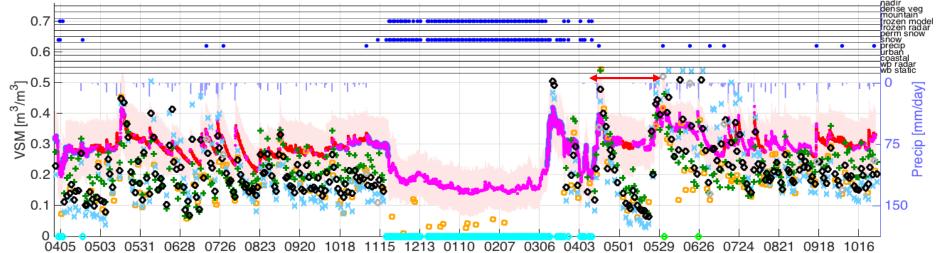
What Next (SF)?

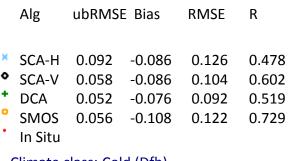
- Set up an infrastructure to quantitatively assess the impact of making changes to parameters on the performance metrics.
- Some sources of error are associated with the in situ data. If these can be verified then it is reasonable to make the corrects. This of course only applies to the site.
 - Calibration, Scaling
- Other errors are the result of parameterization and model structure. Any changes would require that they either are global or can be supported by additional information.

Carman (Core Pixel)





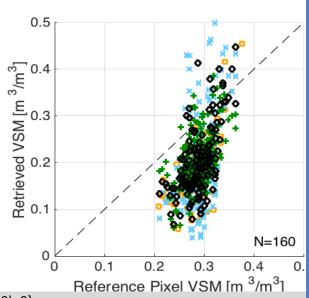




Climate class: Cold (Dfb) Landcover: Croplands

Soil texture: S-%: 26

C-%: 34 BD: 1.18



- SMAP has an underestimation bias for all algorithms
- SMOS also has an underestimation bias and similar behavior
- During drydowns, SMAP decreases faster than the in situ obs
- The range of soil moisture is larger for SMAP
- The May 2016 time period is very interesting. Need further verification of what rainfall actually occurred during this period.

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Resolving Anomalous SMAP Retrievals: Carman

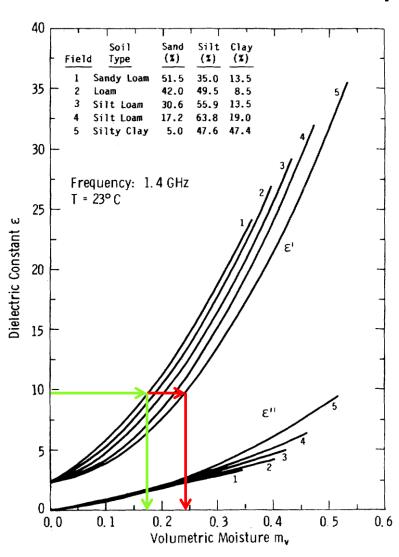
Source of Error	Resolve/Investigate	Expectation	Status of Assessment
Calibration of in situ probes	Conduct gravimetric/bulk density sampling and compare to probe estimates	If there is a calibration bias it could affect results.	It does not look like this is contributing factor.
Bias in SMAP top-down versus <i>in</i> situ at depth	Profile sampling and vertical vs. horizontal probe measurements	Overestimation after rain, potential underestimation otherwise.	Need to compare the 0-5 to at 5 cm measurements collected.
Upscaling approach	Compare to a dense set of samples from field campaigns, etc. Compare alternative upscaling methods.		Comparison of RISMA network to ~45 temporary station (both vertical probes) showed a small underestimation bias for RISMA. This does not explain the SMAP bias.
Soil texture	Sensitivity analysis and review dc vs. SM relationships	Clay soils can have lower dielectric constants for a given SM due to bound water. Underestimating clay fraction can lead to underestimating SM.	S. Chan to make some runs.
Dielectric model	Review alternative methods	Different models produce varying SM For Hallikainen, underestimating the clay fraction underestimates SM	No action yet.
Soil emission model	All use Fresnel, which assumes uniform properties over the contributing depth	A modeling exercise could be conducted. However, no operational solution is likely (if this was the cause).	No action expected.
Surface roughness characterization	Do the conditions change significantly over time? Collect roughness data.	Underestimating roughness effects would underestimate SM	Data collected.
VWC (NDVI) climatology vs. actual	Compile data sets for comparison. Climatology, actual MODIS, field-based products.	Underestimating VWC would underestimate SM	A. Pacheco and R. Bindlish plots. Actual <estimate. bias.<="" does="" explain="" not="" smap="" td="" the="" this=""></estimate.>
b parameter	b values are based on limited experimental data sets	Changing these to match a specific site (no)?	
Alternative tau estimates	Look at DCA and SMOS tau vs, climatology tau	Underestimating tau would underestimate SM. DCA tau is puzzling. Compensates for roughness in Spring/Fall.	R. Bindlish 2015 plots, 2016 requested.
Vegetation model	The current model is a simplification. However, it is difficult to implement more complex approaches Compare SMAP and SMOS parameters and retrievals		No action yet.
Spatial heterogeneity	Compare to PALS	Not expected to be a major factor.	Data were collected
RFI	Review data for potential issues	RFI would lead to underestimates of SM	No action expected.
Assuming Ts=Tv	Sensitivity analyses	Not expected to be a major factor.	No action yet.
Source of T data	Compare alternative products; ECMWF, Ka-band Is there a bias?		No action yet.
Temperature normalization model		Underestimating Ts will underestimate SM	No action yet.

Based on J. Powers Slides

- If the RISMA network is calibrated and the upscaling is correct then the errors lie in the retrieval/validation process.
- Examine
 - Clay fraction and dielectric mixing model
 - Vertical vs. horizontal probes

Impact of Soil Texture on Dielectric Constant-Soil Moisture Relationships

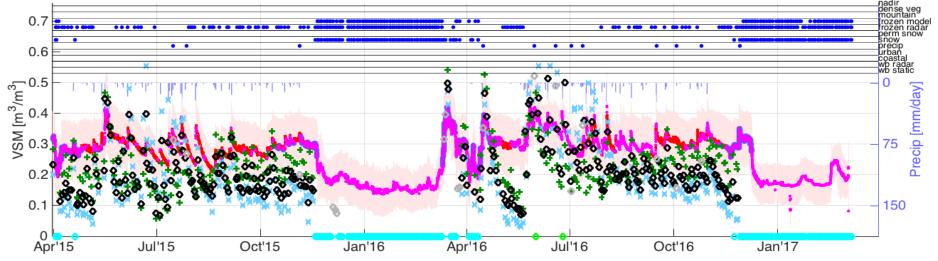
- If the algorithm
 "retrieves" the
 dielectric constant and
 then uses the soil
 texture to estimate soil
 moisture, the soil
 moisture will be
 smaller for a sand than
 a clay.
- If there is an underestimation bias for soil moisture, decreasing the clay content would improve retrievals.



M. T. Hallikainen, F. T. Ulaby, M. C. Dobson, M. A. El-rayes, and L. Wu. 1985. Microwave Dielectric Behavior of Wet Soil-Part 1: Empirical Models and Experimental Observations. IEEE Transactions on Geoscience and Remote Sensing. GE-23: 25-34, DOI: 0.1109/TGRS.1985.289497

Carman (Core Pixel)





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+	SCA-V	0.055	-0.090	0.130 0.105 0.091	0.599

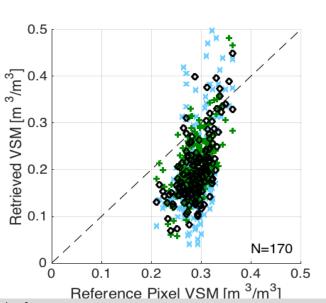
ubRMSE Risc

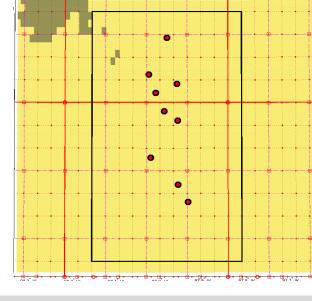
Climate class: Cold (Dfb) Landcover: Croplands

Soil texture:

S-%: 30 C-%: 31 BD: 1.18

ΛΙσ





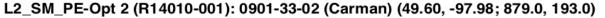
Black: Use recommended [Retrieval Quality Flag bit(0)=0] Gray: Retrieval attempted and succeeded but use not recommended [bit(0)=1, bit(1)=0, bit(2)=0] Green: Retrieval attempted but failed [bit(0)=1, bit(1)=0, bit(2)=1] Cyan: Retrieval not attempted [bit(0)=1, bit(1)=1] This document has been reviewed and determined a

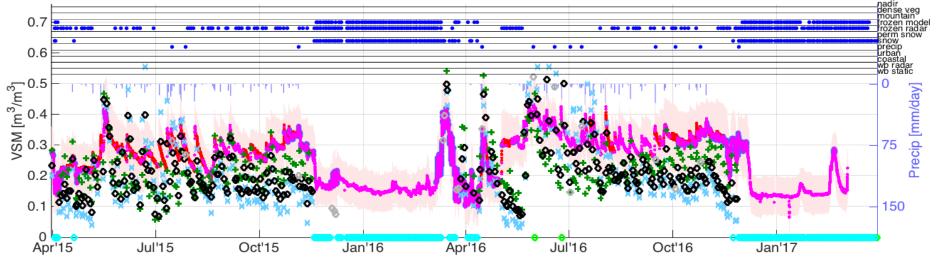
BIVICE

D

Carman (Candidate Pixel)







* SCA-H 0.095 -0.086 0.128 0.324 • SCA-V 0.068 -0.081 0.106 0.416 • DCA 0.071 -0.061 0.094 0.357 • In Situ		Aig	UDINIVISI	L Dias	IVIVIOL	IX
	۰ +	SCA-V DCA	0.068	-0.081	0.106	0.416

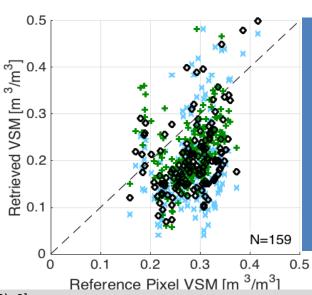
ubRMSE Risc

Climate class: Cold (Dfb) Landcover: Croplands

Soil texture: S-%: 30

C-%: 31 BD: 1.18

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- The range of in situ soil moisture increases when we use the vertical probe data (as opposed to the horizontal).
- Bias improves a bit but all other metrics degrade.
 - Results might support using a shallower depth for validation.

Black: Use recommended [Retrieval Quality Flag bit(0)=0] Gray: Retrieval attempted and succeeded but use not recommended [bit(0)=1, bit(1)=0, bit(2)=0] Green: Retrieval attempted but failed [bit(0)=1, bit(1)=0, bit(2)=1] Cyan: Retrieval not attempted [bit(0)=1, bit(1)=1] This document has been reviewed and determined a

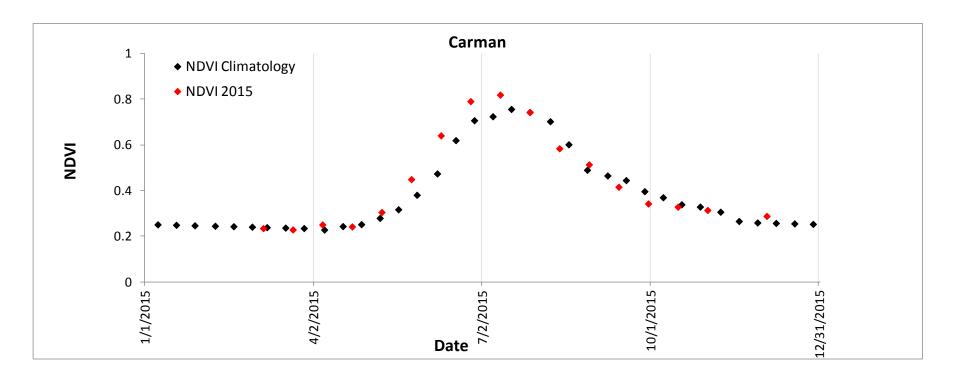
DIVICE

This document has been reviewed and determined not to contain export controlled technical data.

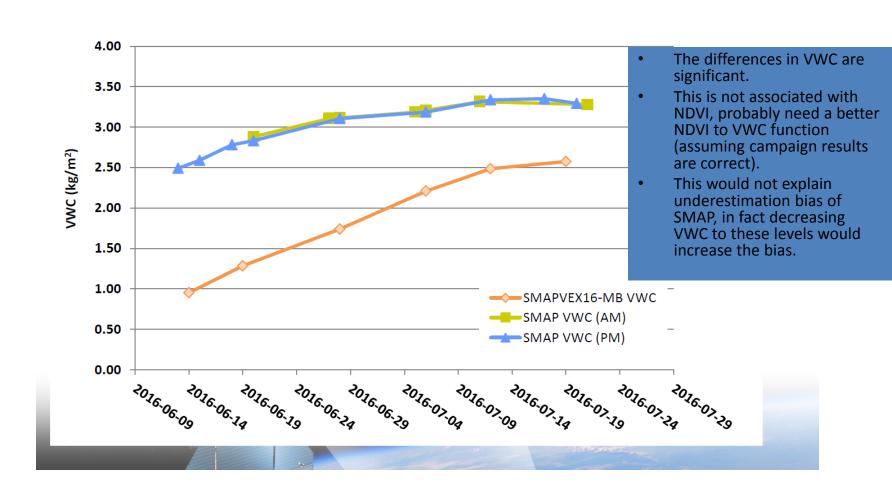
Resolving Anomalous SMAP Retrievals: Carman

Source of Error	Resolve/Investigate	Expectation	Status of Assessment
Calibration of in situ probes	Conduct gravimetric/bulk density sampling and compare to probe estimates	If there is a calibration bias it could affect results.	It does not look like this is contributing factor.
Bias in SMAP top-down versus <i>in</i> situ at depth	Profile sampling and vertical vs. horizontal probe measurements	Overestimation after rain, potential underestimation otherwise.	Need to compare the 0-5 to at 5 cm measurements collected.
Upscaling approach	Compare to a dense set of samples from field campaigns, etc. Compare alternative upscaling methods.		Comparison of RISMA network to ~45 temporary station (both vertical probes) showed a small underestimation bias for RISMA. This does not explain the SMAP bias.
Soil texture	Sensitivity analysis and review dc vs. SM relationships	Clay soils can have lower dielectric constants for a given SM due to bound water. Underestimating clay fraction can lead to underestimating SM.	S. Chan to make some runs.
Dielectric model	Review alternative methods	Different models produce varying SM For Hallikainen, underestimating the clay fraction underestimates SM	No action yet.
Soil emission model	All use Fresnel, which assumes uniform properties over the contributing depth	A modeling exercise could be conducted. However, no operational solution is likely (if this was the cause).	No action expected.
Surface roughness characterization	Do the conditions change significantly over time? Collect roughness data.	Underestimating roughness effects would underestimate SM	Data collected.
VWC (NDVI) climatology vs. actual	Compile data sets for comparison. Climatology, actual MODIS, field-based products.	Underestimating VWC would underestimate SM	A. Pacheco and R. Bindlish plots. Actual <estimate. bias.<="" does="" explain="" not="" smap="" td="" the="" this=""></estimate.>
b parameter	b values are based on limited experimental data sets	Changing these to match a specific site (no)?	
Alternative tau estimates	Look at DCA and SMOS tau vs, climatology tau	Underestimating tau would underestimate SM. DCA tau is puzzling. Compensates for roughness in Spring/Fall.	R. Bindlish 2015 plots, 2016 requested.
Vegetation model	The current model is a simplification. However, it is difficult to implement more complex approaches Compare SMAP and SMOS parameters and retrievals		No action yet.
Spatial heterogeneity	Compare to PALS	Not expected to be a major factor.	Data were collected
RFI	Review data for potential issues	RFI would lead to underestimates of SM	No action expected.
Assuming Ts=Tv	Sensitivity analyses	Not expected to be a major factor.	No action yet.
Source of T data	Compare alternative products; ECMWF, Ka-band Is there a bias?		No action yet.
Temperature normalization model		Underestimating Ts will underestimate SM	No action yet.

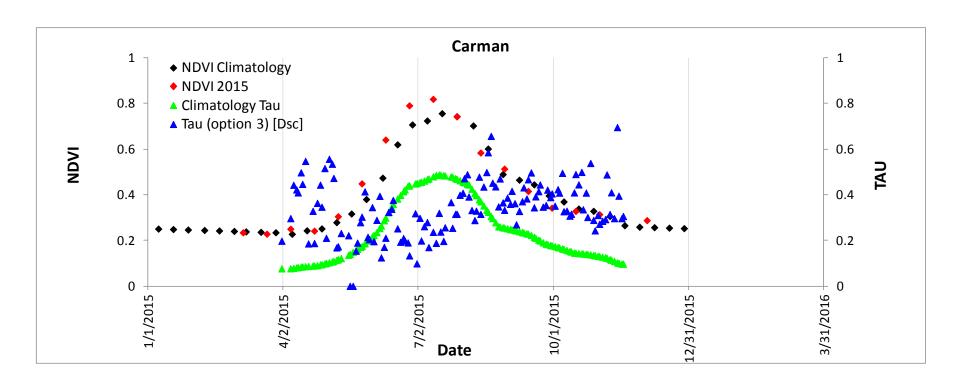
Comparison of Actual and NDVI Climatology for 2015 (Carman)



Comparison of SMAPVEX16-MB VWC and SMAP Climatology-based Estimates (From Anna Pacheco)



Comparison of Actual and NDVI and Tau Climatology for 2015 (Carman)



 What's happening with the DCA retrieved VWC???

What Would "fix" the Carman Soil Moisture Retrievals

- Increase surface roughness
- Increase tau (VWC/NDVI or b) (Omega?)
- Use a surface biased in situ observation or shallower depth
- Decrease clay fraction
- Decrease physical temperature

SMAPVEX16 Plans and Schedule

- Data archive
- Paper(s)



8th SMAP Cal/Val Workshop Agenda-Day 1



Session	Title	Authors
Opening		
8:00	Welcome	P. Siguera
8:15	Objectives	T. Jackson
8:30	NASA HQ and SUSMAP	J. Entin
8:45	Mission Status, New Products and Timeline	TH. You and S. Yueh
9:15	Science and Applications Update	D. Entekhabi and S. Yueh
9:45	Break	
	Products and Product Updates and Plans	
10:00	Recalibration and Validation of the SMAP L-band Radiometer	J. Peng, S. Misra, J. Piepmeier, E. Dinnat, T. Meissner, D. Le Vine, G. De Amici, S. Yueh
10:20	Soil Moisture Passive Product Enhancements	S. Chan, R. Bindlish, T. Jackson, P. O'Neill
10:40	Calibration and Validation of the SMAP and Sentinel based Active- Passive High Resolution Soil Moisture Product	N. Das, S. Kim, S. Dunbar, T. Jagdhuber and D. Entekhabi
11:20	L3 Freeze/Thaw Products and Cal/Val Activities Summary	X. Xu, C. Derksen, S. Dunbar, A. Colliander, Y. Kim, J. Kimball
11:40	Lunch	
12:45	L4_SM Product Updates	J. Kolassa and R. Reichle
13:00	SMAP Level 4 Carbon (L4C) Product Assessment, Status and Plans	S. Kimball, L.A. Jones, J. Glassy, R. Reichle
Field Experime		
13:15	SMAPVEX16 Overview	T. Jackson
13:20	Overview of SMAPVEX16-lowa Ground Operations	M. Cosh, A. Colliander, T. Jackson, J. Prueger, J. Hatfield, B. Hornbuckle, J. Judge, T. Franz, J. Qu, W. Krajewski, A. Fisher
13:40	Iowa Tower Radiometer	J. Judge et al.
14:00	Soil Surface Roughness Measurements During SMAPVEX16-IA	B. Hornbuckle, W. Eichinger, V. Wallace, V. Walker, E. Yildirim. M. Cosh
14:15	SMAPVEX16-MB Data and Analysis	M. Friesen, J. Powers, K. Gottfried, H. McNairn, A. Pacheco, A. Merzouki
14:45	PALS SMAPVEX16	A. Colliander, S. Misra, M. Cosh, T. Jackson, et al.
15:15	SMAPEx Overview	J. Walker, T. Jackson
15:30	Discussion	
15:45	Break	
Validation Stud	dies (Contributed)	
16:00	Water Contamination Correction for SMAP	J. Chaubell, S. Yueh, J. Peng
16:20	Soil moisture variability from hillslope to SMAP grid scale over Iowa	W. F. Krajewski, R. Mantilla, and N. Jadidoleslam
16:35	The hydrologic understory: soil moisture in the wetland habitat	C. Hatch, G. Davenport, M. Cosh, J. Koyen, C. Richardson, L. Winter, A. Hackman, B. Clement, and K. Ballantine
16:50	Enhancing the information content and utilization of SMAP products for agricultural applications	J. Bolten, S. Kumar, J. Santanello
17:05	Summary of the Day	