



CICS-MD Science Meeting

November 29, 2016



NOAA Soil Moisture Operational Product System (SMOPS): Version 3.0

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Outline

- **What is SMOPS**
- **Objectives**
- **Methodology**
- **Version History**
- **Data Quality**
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What is SMOPS

<http://www.ospo.noaa.gov/Products/land/smops/index.html>

- The Soil Moisture Operational Products System (SMOPS) is one-stop shop for all available operational soil moisture products from different satellite sensors.
- SMOPS provides a blended soil moisture product that has improved spatial and temporal coverage.
- Operationally running at NOAA/NESDIS/OSPO.
- Updated with newly launched sensors.

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What is SMOPS

Major SMOPS External Output Description

Item	Description	Format	Projection	Spatial Coverage	Spatial Resolution	Data Latency	Main Purpose
SMOPS 6 Hour Product	SMOPS 6 hour Gridded Soil Moisture	GRIB2	Lat/Long	Global	0.25 degree (720x1440)	3 Hours	Operational
SMOPS Daily Product	SMOPS Daily Gridded Soil Moisture	GRIB2	Lat/Long	Global	0.25 degree (720x1440)	6 Hours	Operational
SMOPS Archive Product	SMOPS Daily Gridded Soil Moisture	netCDF4	Lat/Long	Global	0.25 degree (720x1440)	2 Days	Archive

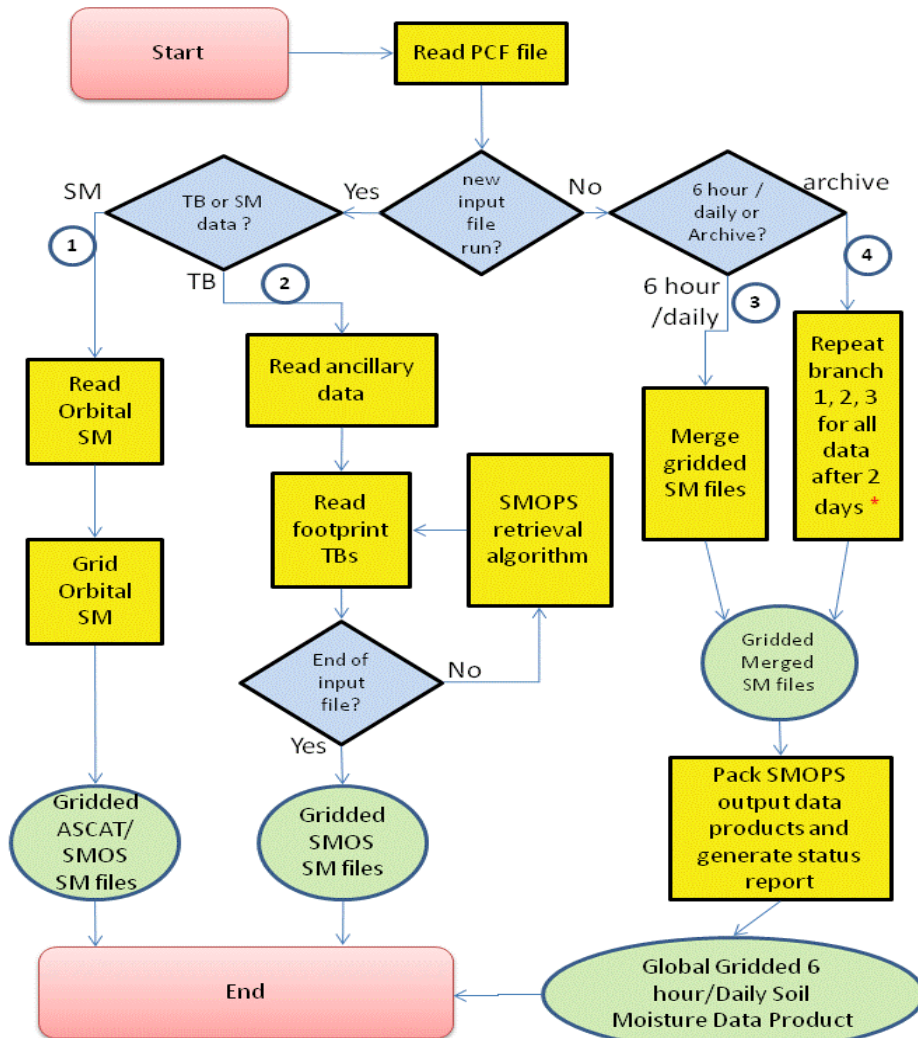
What is SMOPS

Layer #	Data Description	Units / Format	Data Type	Fill Value	Valid Range	Scale Factor
1	Blended Soil Moisture	%/%	2-byte signed integer	-9999	0 – 500	1000
2	NRT SMOS Soil Moisture	%/%	2-byte signed integer	-9999	0 – 500	1000
3	ESA SMOS Soil Moisture	%/%	2-byte signed integer	-9999	0 – 500	1000
4	ASCAT-A Soil Moisture	%/%	2-byte signed integer	-9999	0 – 1000	1000
5	ASCAT-B Soil Moisture	%/%	2-byte signed integer	-9999	0 – 1000	1000
6	AMSR2 Soil Moisture	%/%	2-byte signed integer	-9999	0 – 500	1000
7	GMI Soil Moisture	%/%	2-byte signed integer	-9999	0 – 500	1000
8	NRT SMAP Soil Moisture	%/%	2-byte signed integer	-9999	0 – 500	1000
9	SMAP Soil Moisture	%/%	2-byte signed integer	-9999	0 – 500	1000
10	SD of Blended SM	%/%	2-byte signed integer	-9999	0 – 500	1000

Objectives

- **Global soil moisture is one of the critical land surface initial conditions for numerical weather, climate, and hydrological predictions.**
- **Land surface soil moisture remote sensing provides a practical tool.**
- **A number of soil moisture products have been produced from different satellite sensors (SMOS, ASCAT-A/B, AMSR2, SMAP etc).**
- **Different data formats, projection and insufficient spatial and temporal coverage of soil moisture products from individual sensors.**
- **SMOPS is to:**
 1. **Provide an operational product that has decent spatial coverage and short enough latency for operational use.**
 2. **Provide a one-stop for most of the available operational soil moisture products.**
 3. **Provide a blended soil moisture layer that is merged from soil moisture retrievals from all available products.**

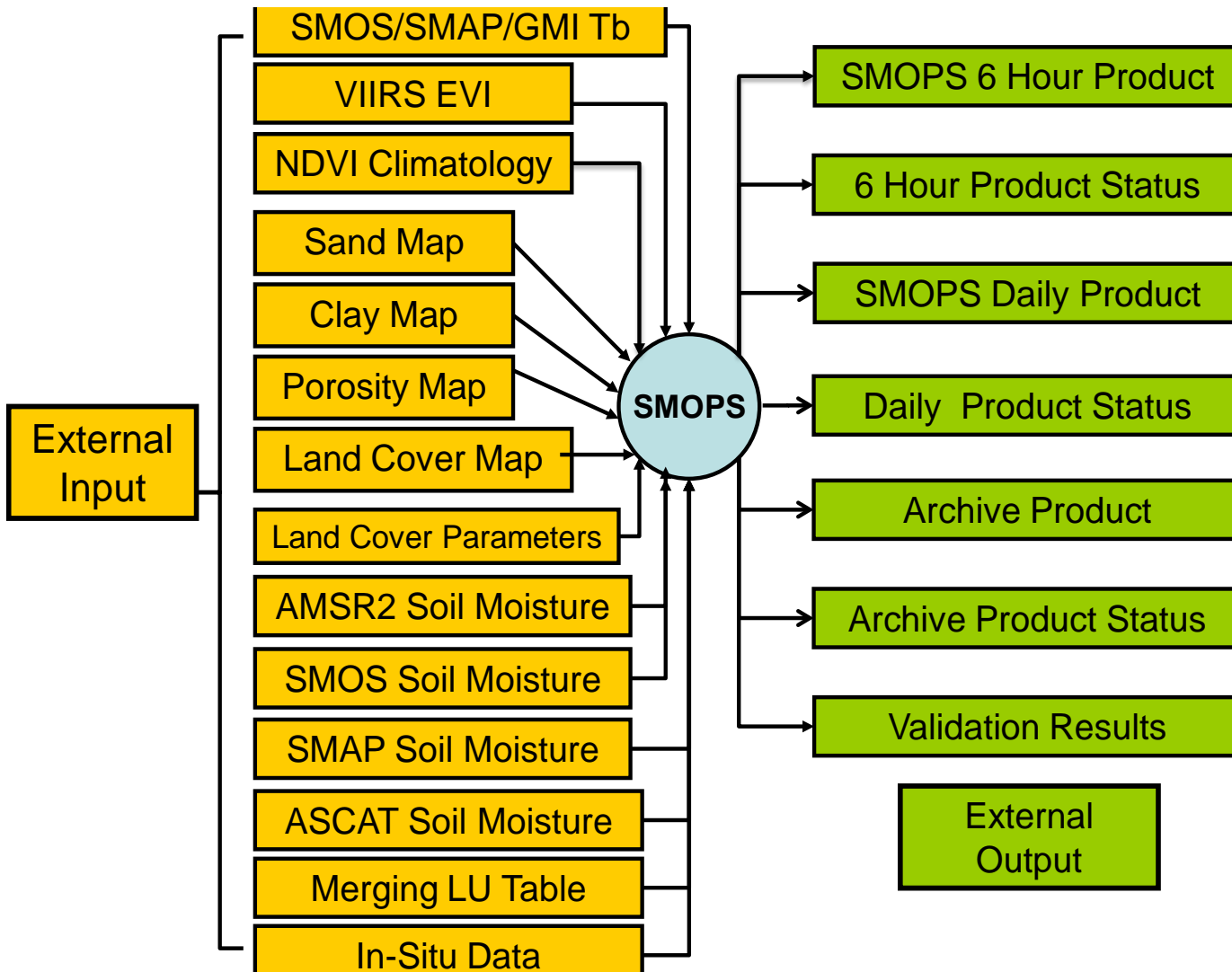
Methodology



* All data acquired within the 6 hour or whole day time period arrived in the past 48 hours

- Branch 1 is the SM Pre-Processing function
- Branch 2 is the Retrieval function
- Branch 3 is the Merging function
- Branch 4 is a reprocessing step for the Archive Product
 - » There is a possibility that the delivery of SM data from individual sensors acquired in the past 24 hours is delayed.
 - » If these data becomes available within the next day (i.e. the past 48 hours), another SMOPS archive run will be activated to generate the daily global soil moisture product for archiving.

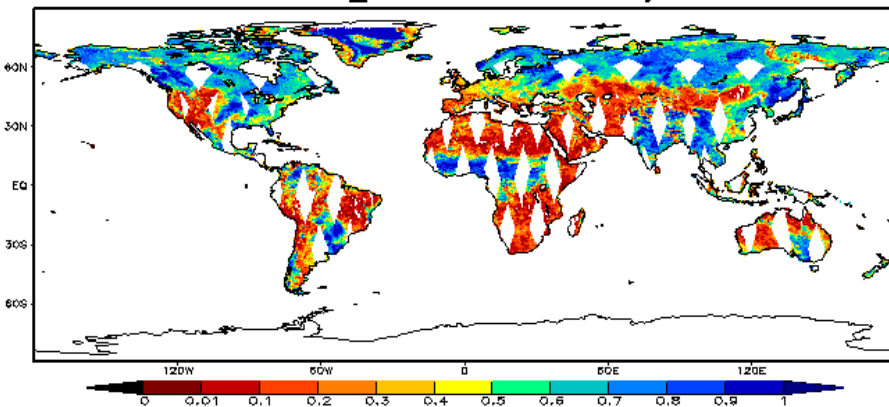
Methodology



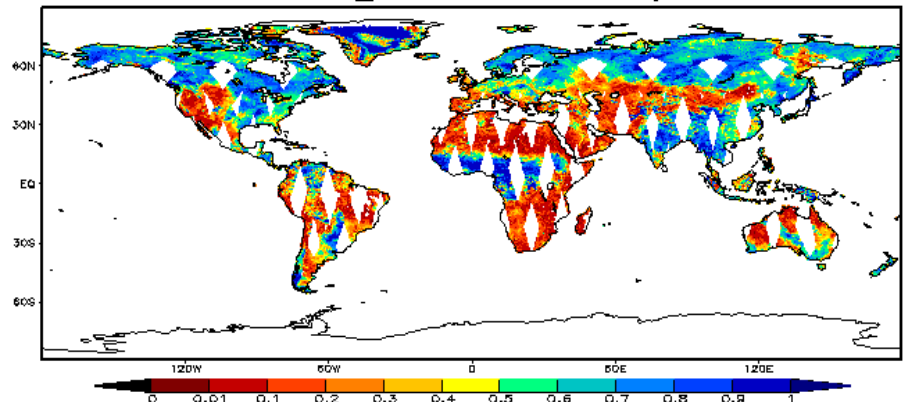
Methodology

- All microwave soil moisture remote sensing satellites, currently in space or to be launched in near future, do not have a full global coverage for every day. Each of these satellite sensors may not have observations or soil moisture retrievals for the day.
- The figure shows example maps of soil moisture retrieved from ASCAT. Significant gaps exist.

NOAA SMOPS ASCAT_A Soil Moisture: Daily — 20160830

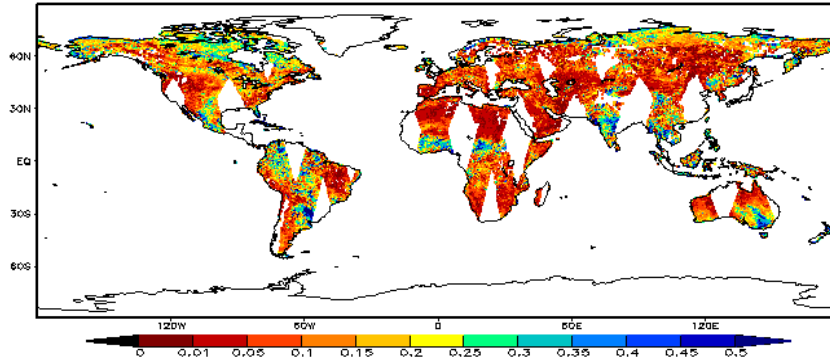


NOAA SMOPS ASCAT_B Soil Moisture: Daily — 20160829

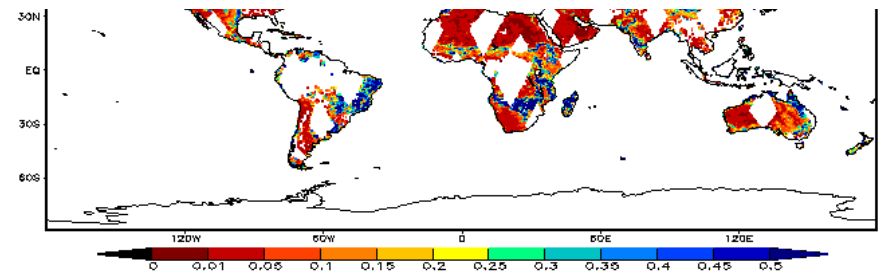
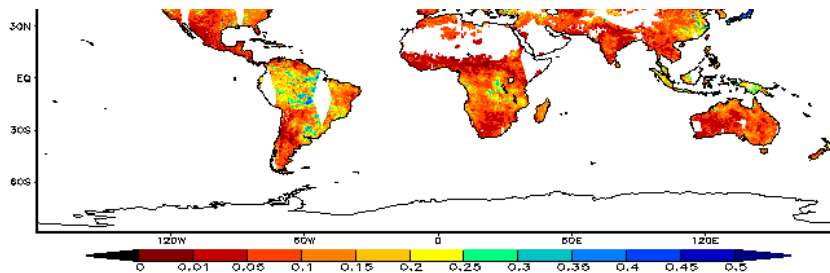
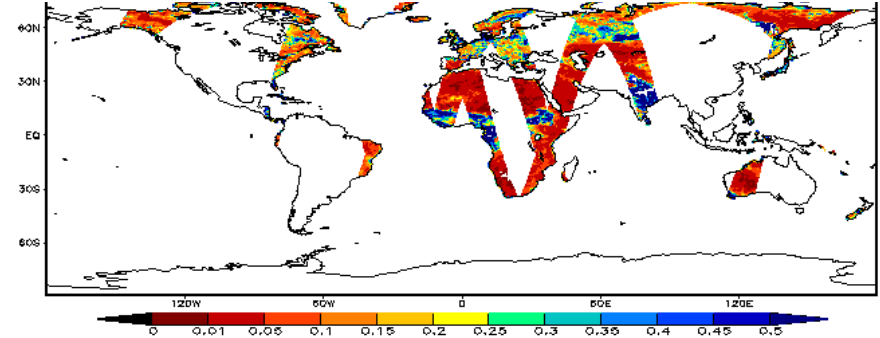
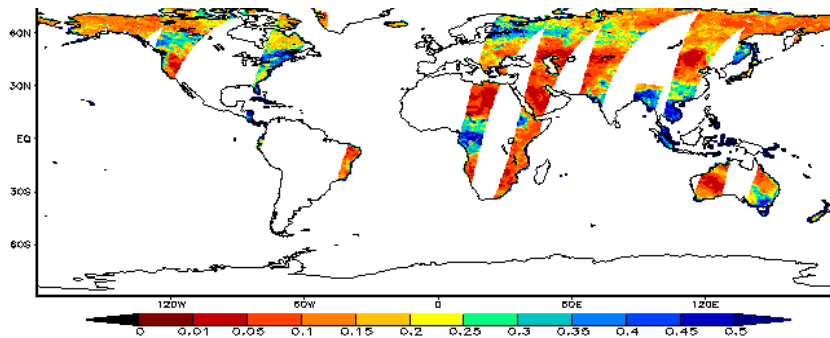
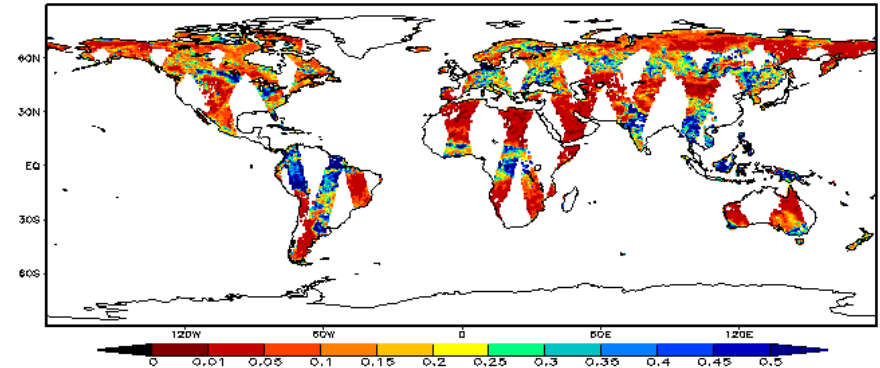


Methodology

NOAA SMOPS SMOS Soil Moisture: Daily - 20160830

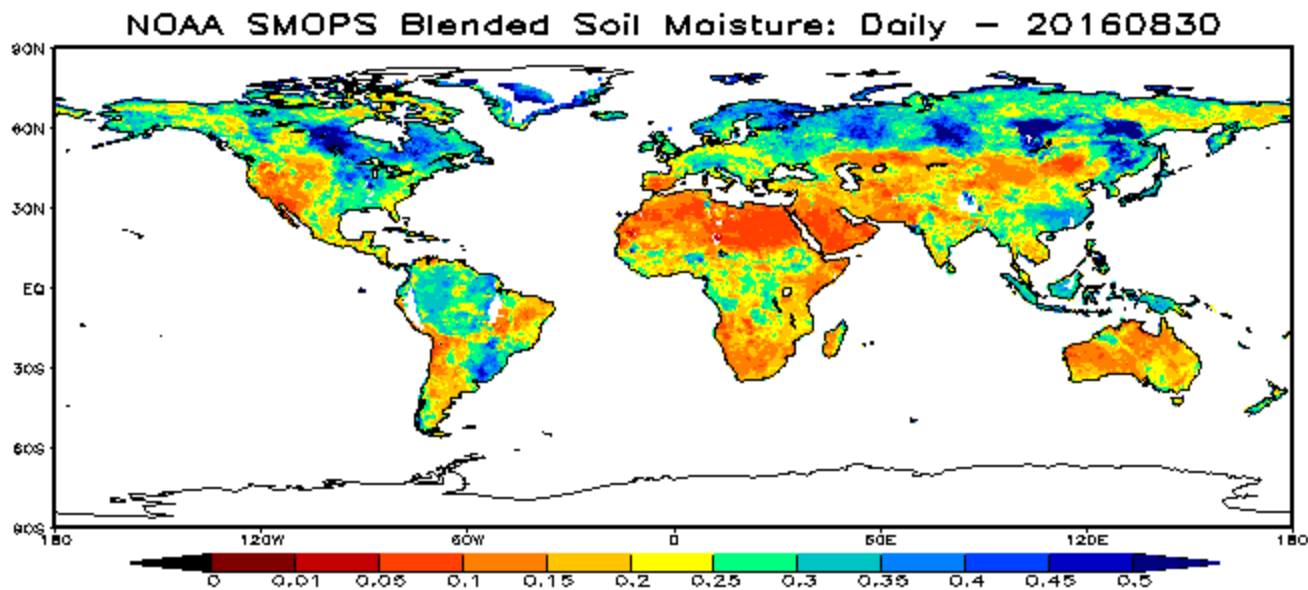


NOAA SMOPS NRT SMOS Soil Moisture: Daily - 20160830



Methodology

- To increase the spatial coverage of daily soil moisture retrievals, SMOPS provides a soil moisture data layer that merges all available satellite soil moisture retrievals in addition to the individual soil moisture retrievals from each of the available satellites.



SMOPS Version History

- **Version 1.0 went operational: September, 2012**
- **Version 1.1: June, 2013 (SMOS data format change)**
- **Version 1.2: Feb., 2015 (Added ASCAT-B)**
- **Version 1.3: May, 2015 (SMOS data format change)**
- **Version 2.0: October, 2016 (Added AMSR2 and NRT SMOS)**
- **Version 3.0: Update with SMAP and GMI (System Readiness Review completed)**

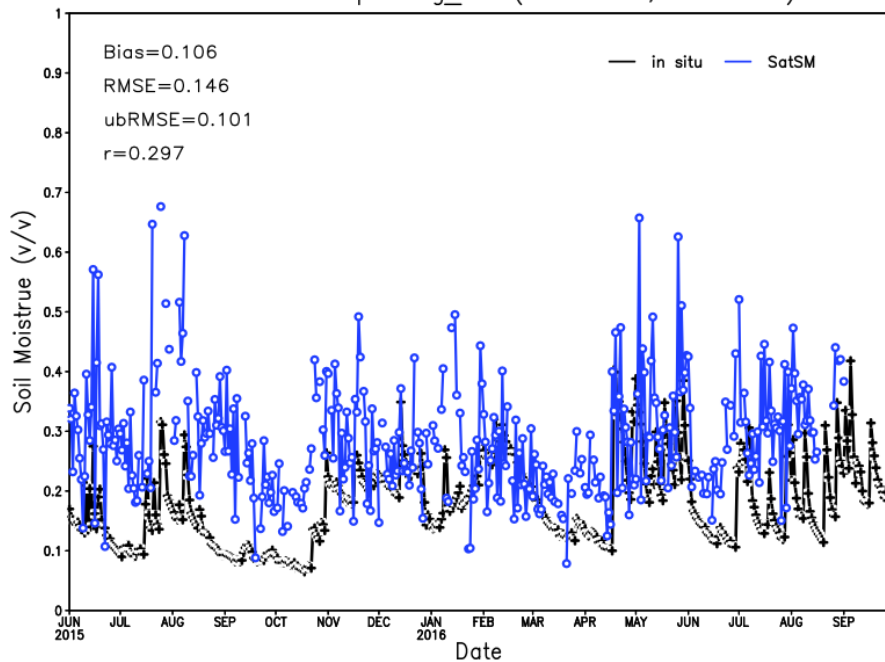
SMOPS Version History

Soil Moisture Product	SMOPS Version 1.3	SMOPS Version 2.0	SMOPS Version 3.0
SMOPS Blended	√ (1)	√ (1)	√ (1)
NOAA AMSR-E	√ (2)	×	×
NRT SMOS	×	√ (2)	√ (2)
ESA SMOS	√ (3)	√ (3)	√ (3)
EUMETSAT ASCAT-A	√ (4)	√ (4)	√ (4)
EUMETSAT ASCAT-B	√ (5)	√ (5)	√ (5)
NOAA WindSat	√ (6)	×	×
NOAA AMSR2	×	√ (6)	√ (6)
GMI	×	×	√ (7)
NRT SMAP	×	×	√ (8)
NASA SMAP	×	×	√ (9)

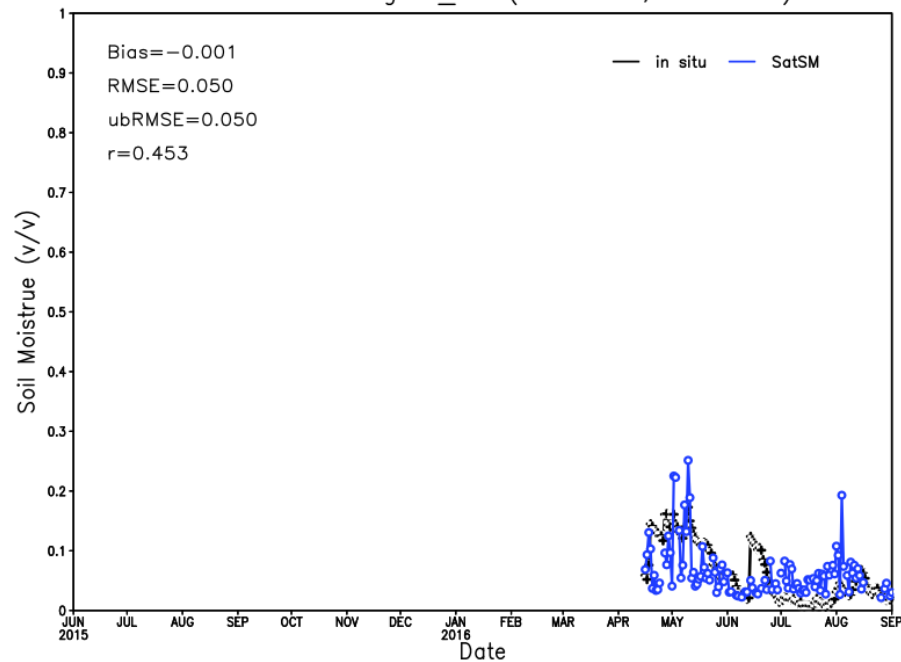
SMOPS Data Quality

GPM/GMI

GMISM @ Phillipsburg_KS (39.790, -99.330)



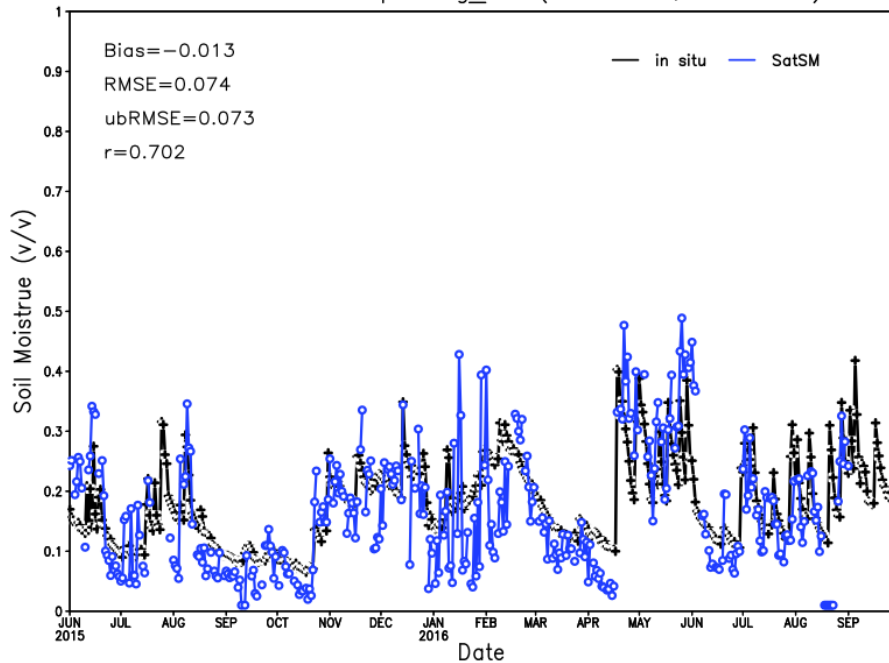
GMISM @ Torrington_WY (42.070, -104.130)



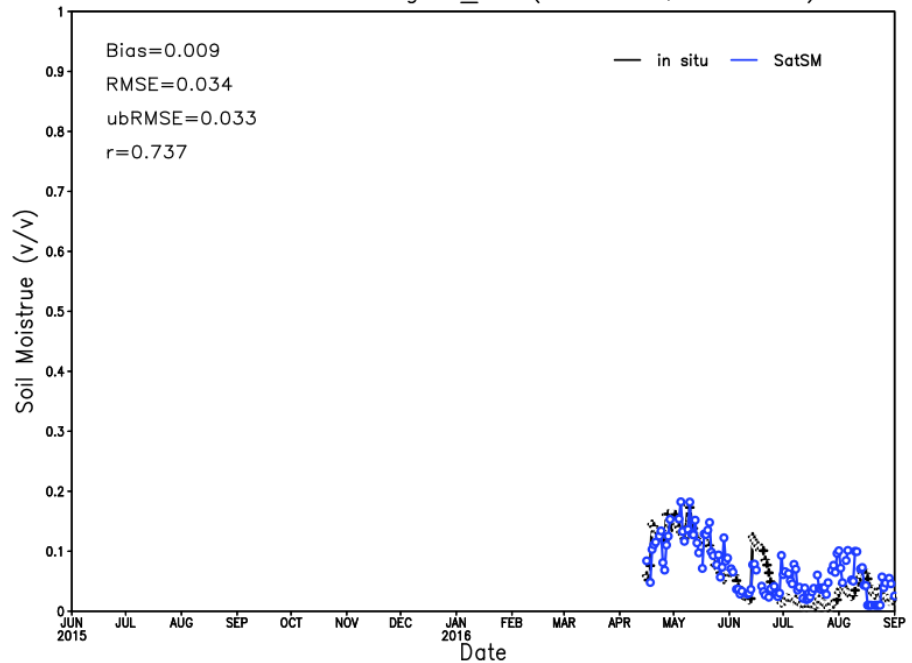
SMOPS Data Quality

SMAP

NSMAPSM @ Phillipsburg_KS (39.790, -99.330)



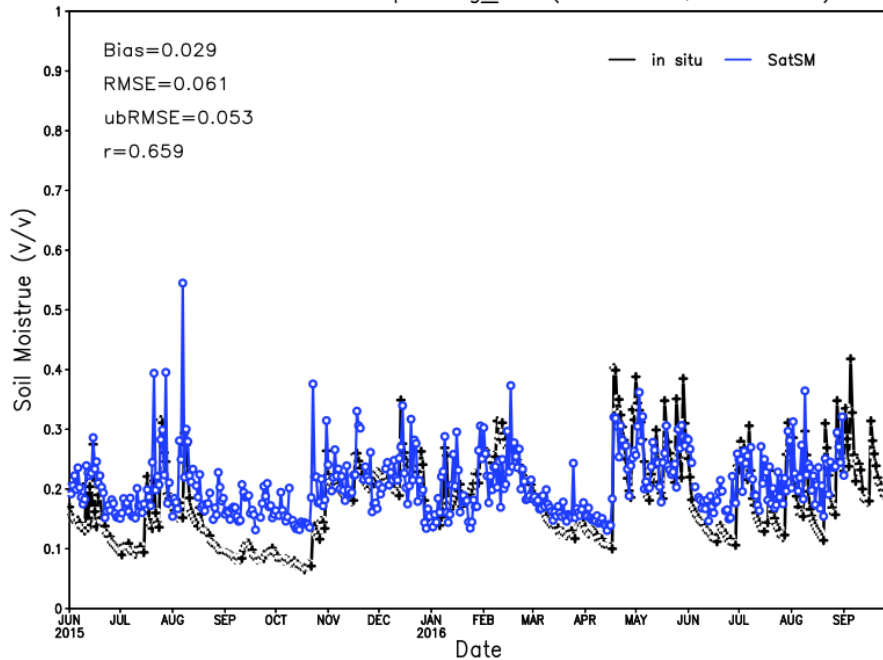
NSMAPSM @ Torrington_WY (42.070, -104.130)



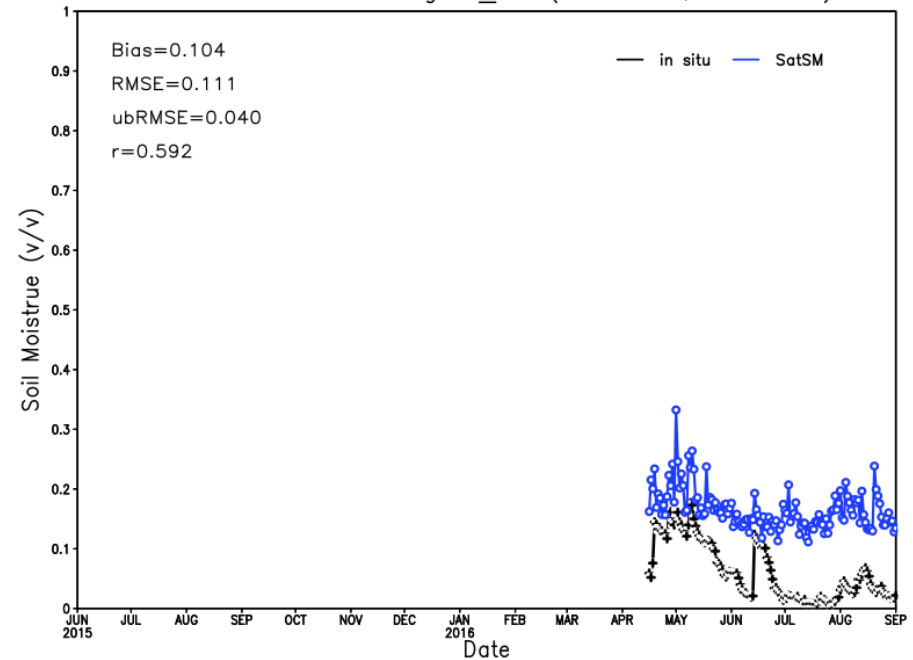
SMOPS Data Quality

Blended

BLENDEDSM @ Phillipsburg_KS (39.790, -99.330)



BLENDEDSM @ Torrington_WY (42.070, -104.130)



Next steps

- **To improve data quality from individual sensors**
- **To update CDFs for blended product regularly**
- **To use different weights in blending based on the performance of individual sensors**

Thank you!