Blending Approaches for SMOPS

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SMOPS Project Team

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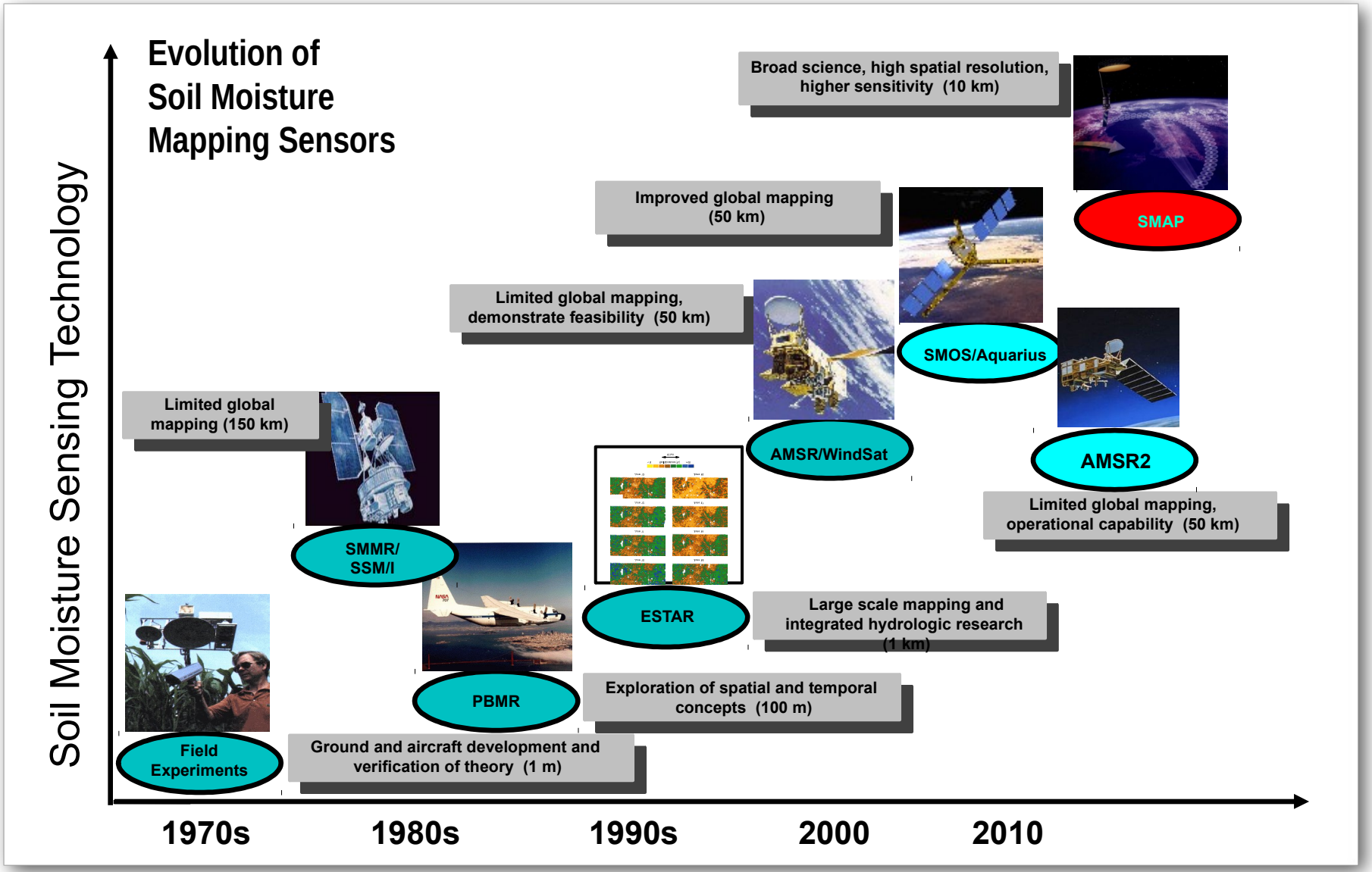
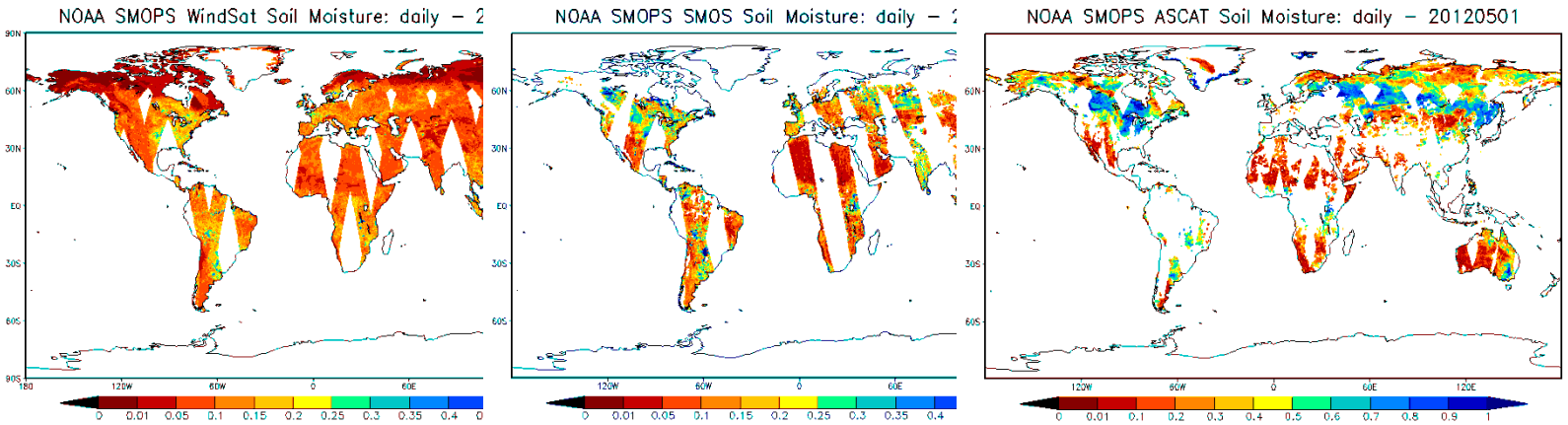
Outline

- Why SMOPS & Why Blending
- SMOPS Architecture and Blending Algorithms
  - CDF Matching to count satellite retrieval differences
  - Simple averaging for blending
  - TCEM-based weighting for blending
- Evaluation of the different blending method
- Summary and Path Forward

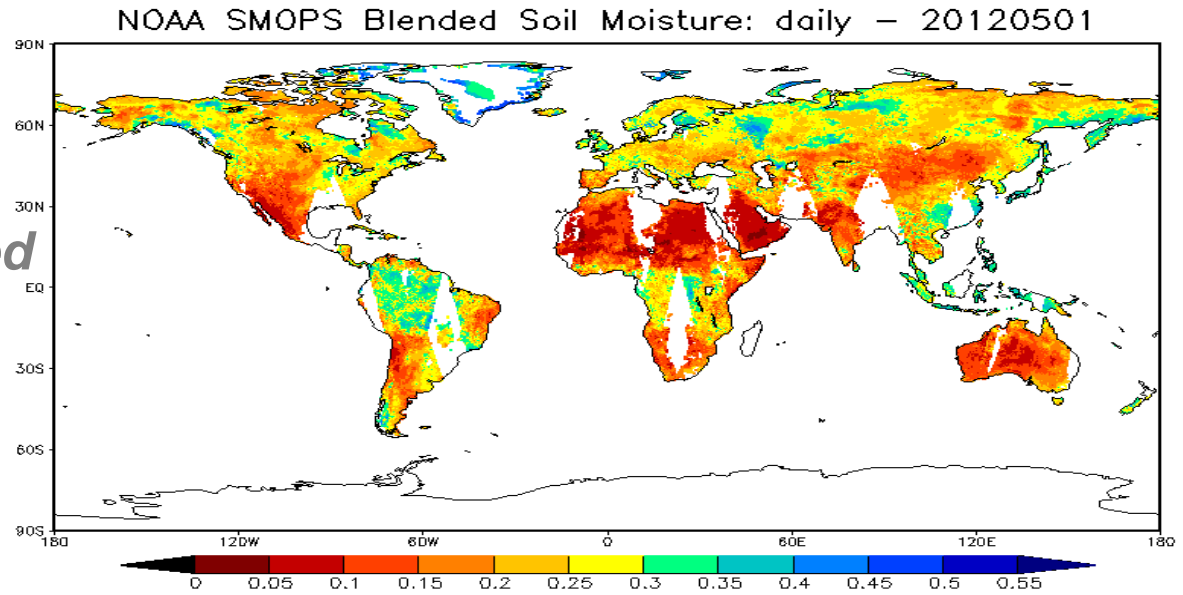
Why SMOPS & Blending



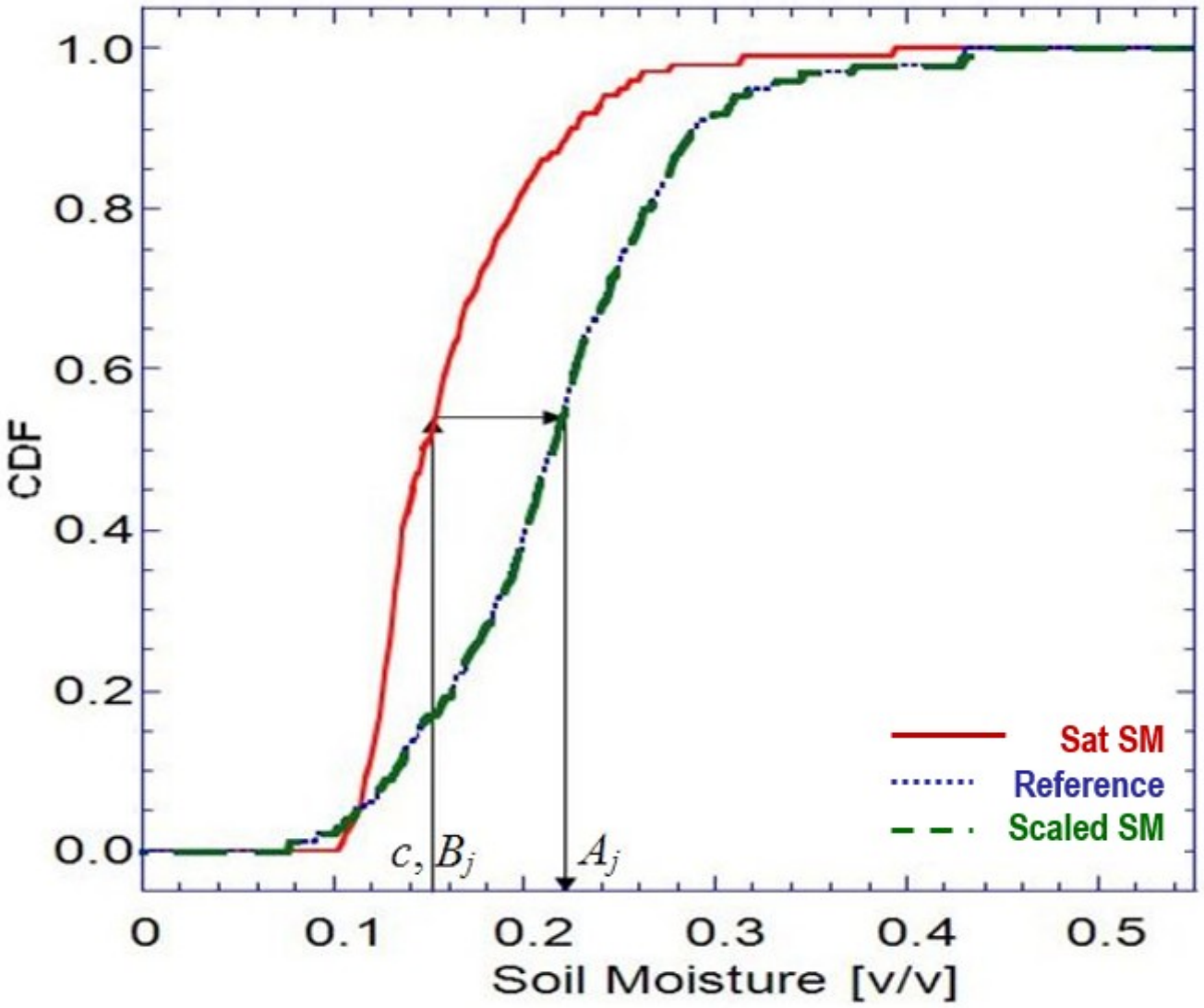
Why SMOPS & Blending



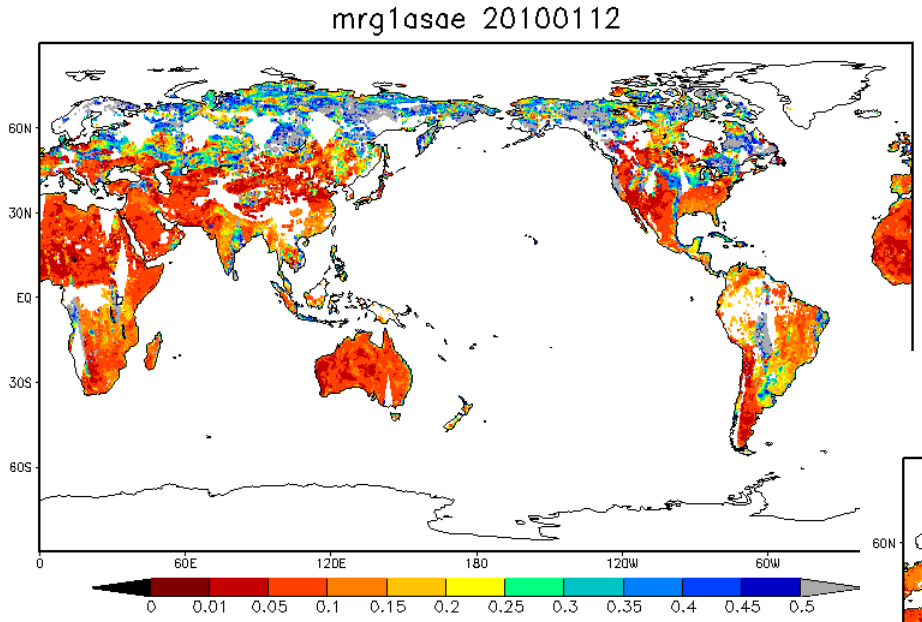
Blended

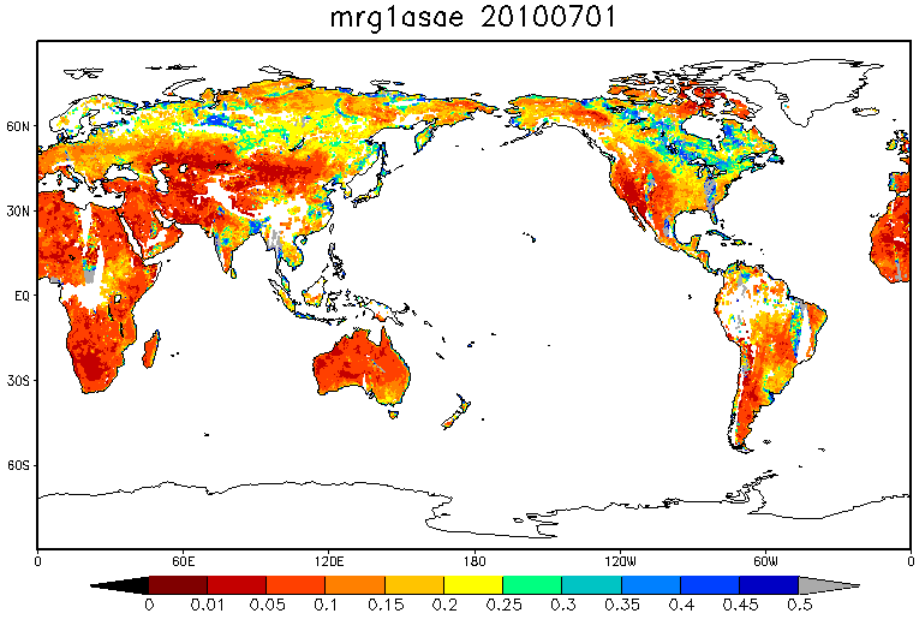


CDF Matching



Simple Average Blending





- Increased spatial coverage
- Multi retrieval variance could be used as error estimate

Weighted Average Blending

Triple Collocation Error Model (TCEM)

Individual SM:

$$\psi_A = T + \mu$$
$$\psi_P = T + \omega$$
$$\psi_G = T + \rho$$

Assuming their error are not correlated:

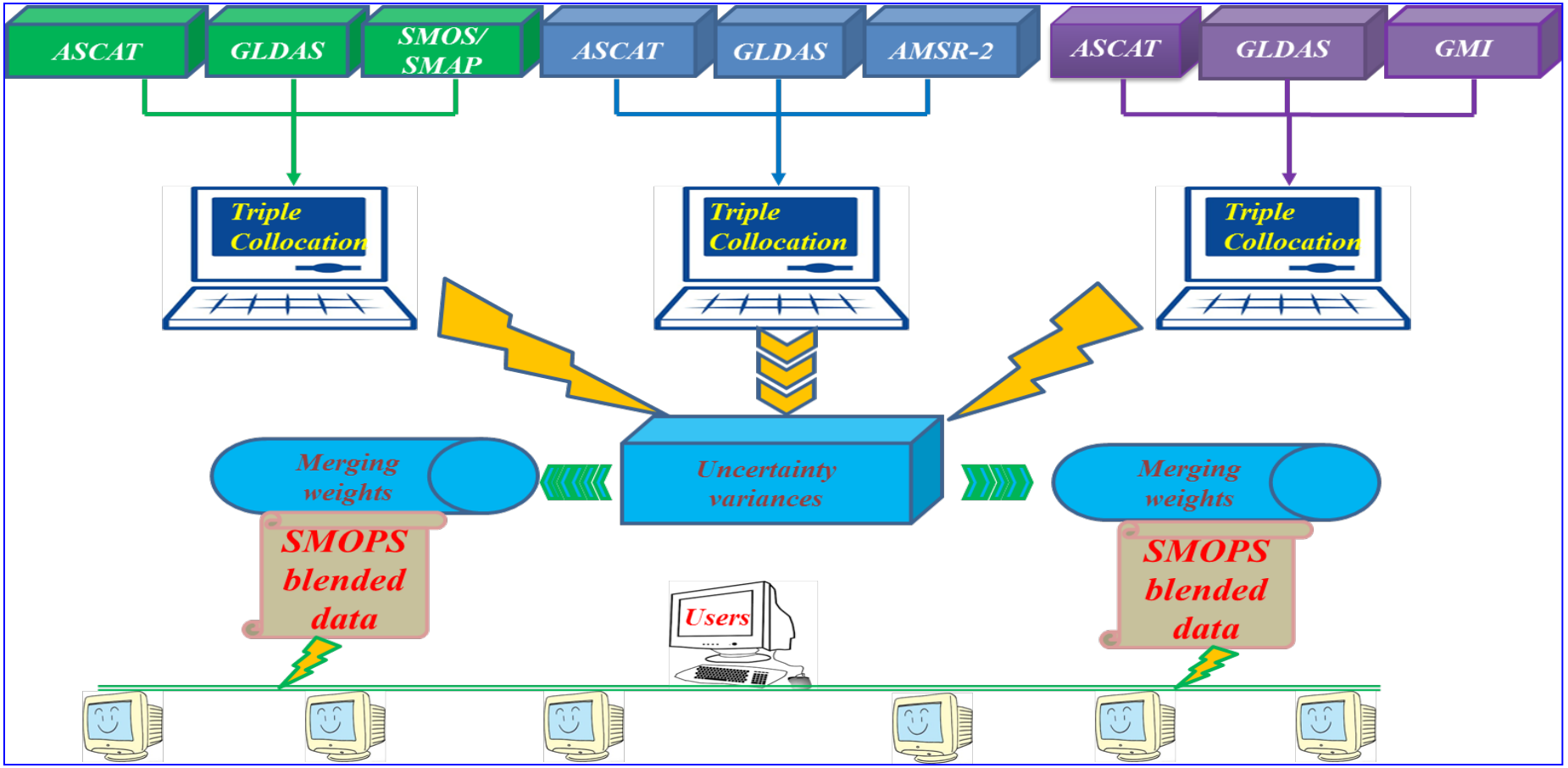
$$\mu\rho = 0, \mu\omega = 0, \omega\rho = 0$$

Then we get their relative RMSE as:

$$\xi_A = (\psi_A - \psi_P)(\psi_A - \psi_G) = \mu^2$$
$$\xi_P = (\psi_P - \psi_A)(\psi_P - \psi_G) = \omega^2$$
$$\xi_G = (\psi_G - \psi_A)(\psi_G - \psi_P) = \rho^2$$

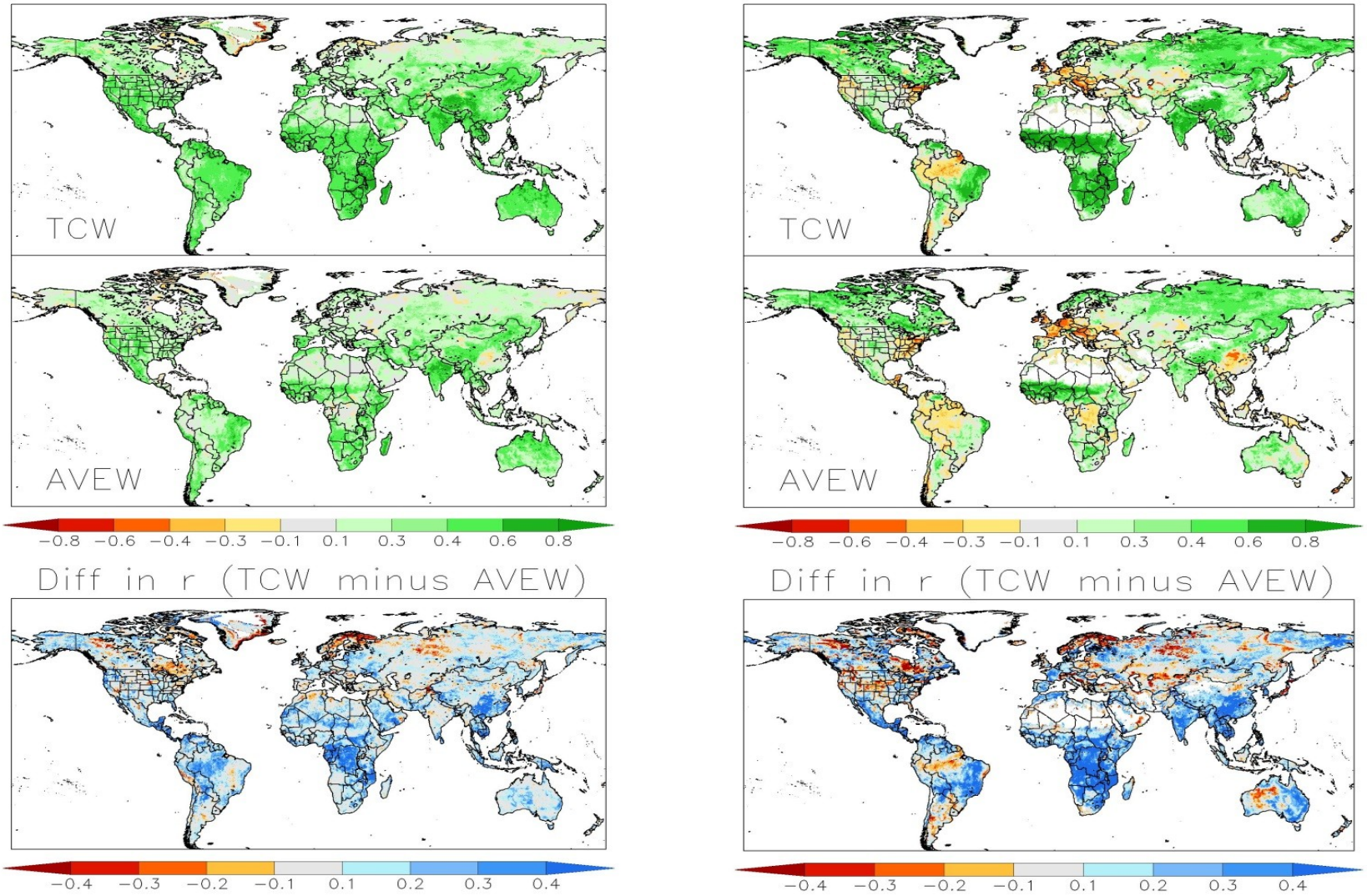
Weighted Average Blending

Triple Collocation Error Model for Blending



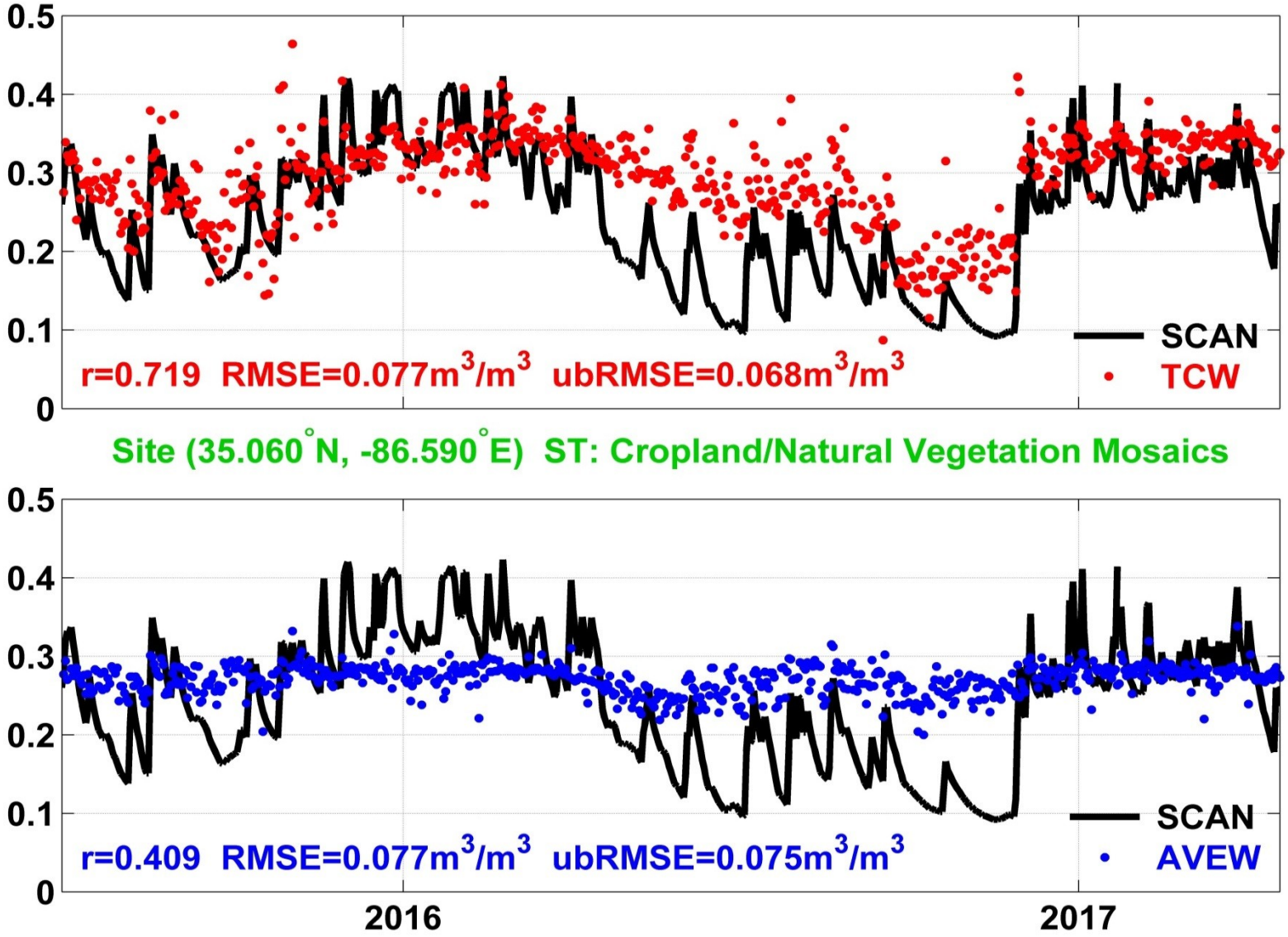
Flow chart describing the TCEM weights-based SMOPS blended SM product.

Blending Method Comparison

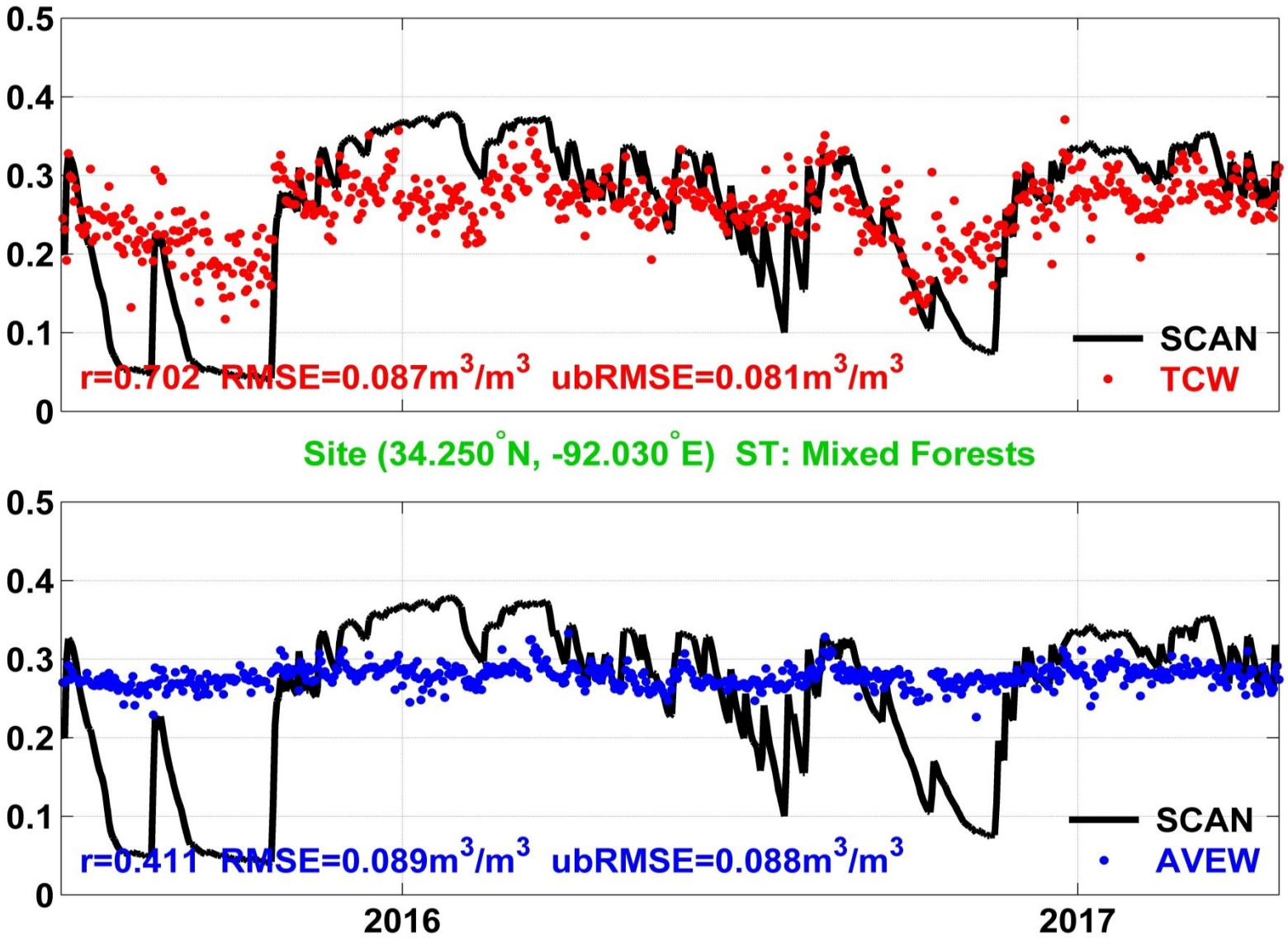


GLDAS precip-based (left) and MODIS EVI-based (right) correlations over 1 April 2015-30 June 2018 period. EVI data lags SM data by 8 days.

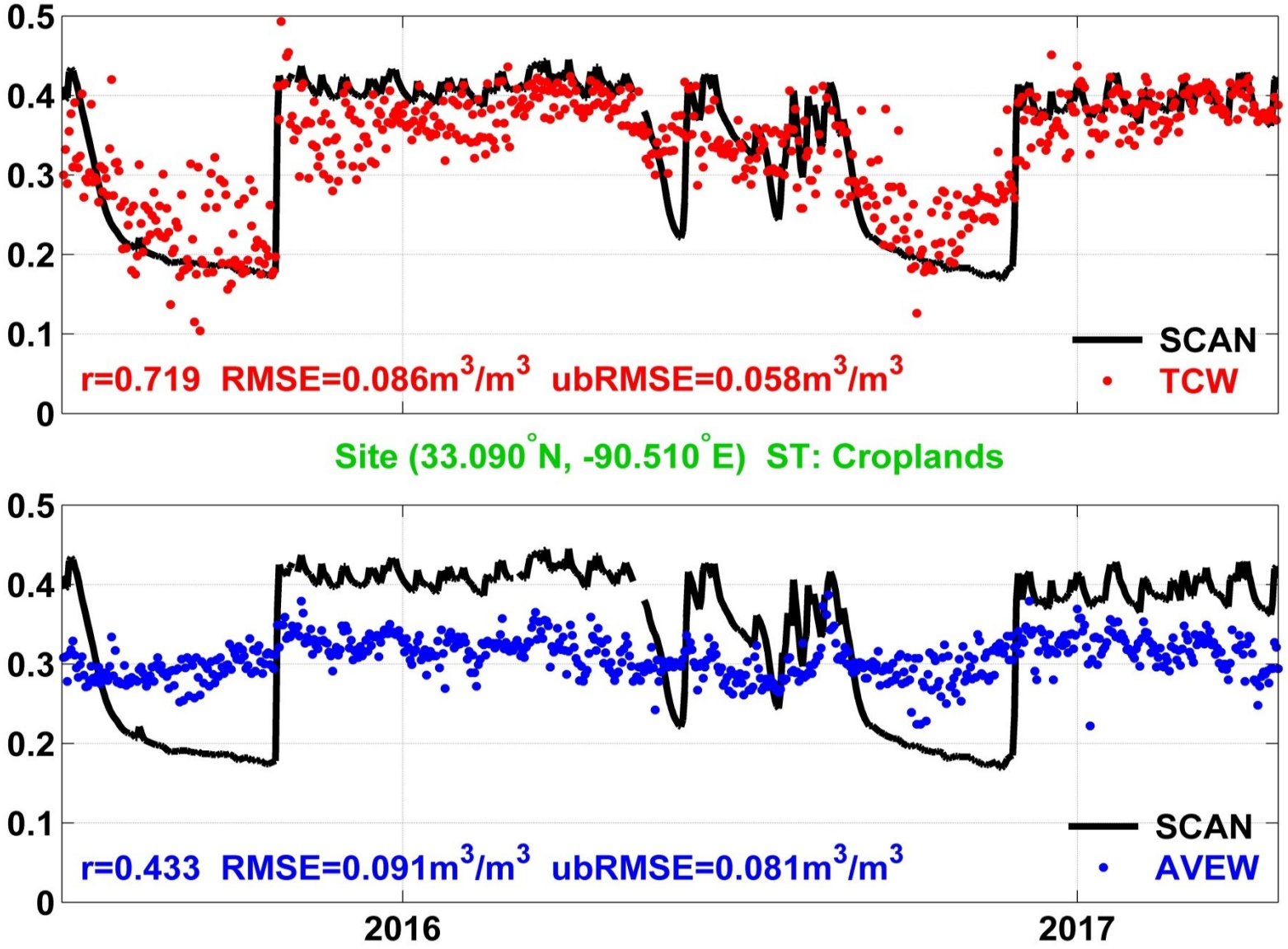
Blending Method Comparison



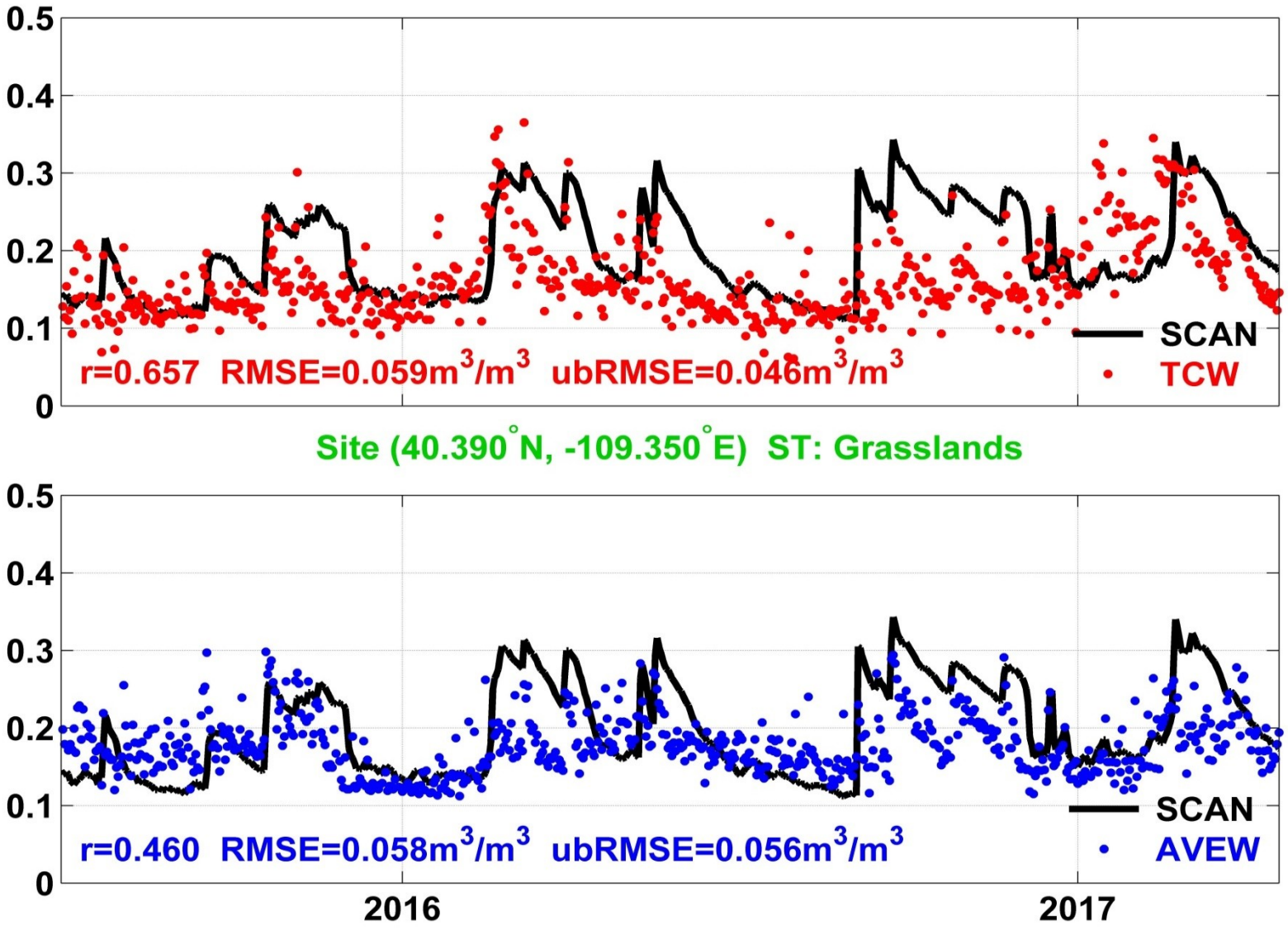
Blending Method Comparison



Blending Method Comparison



Blending Method Comparison



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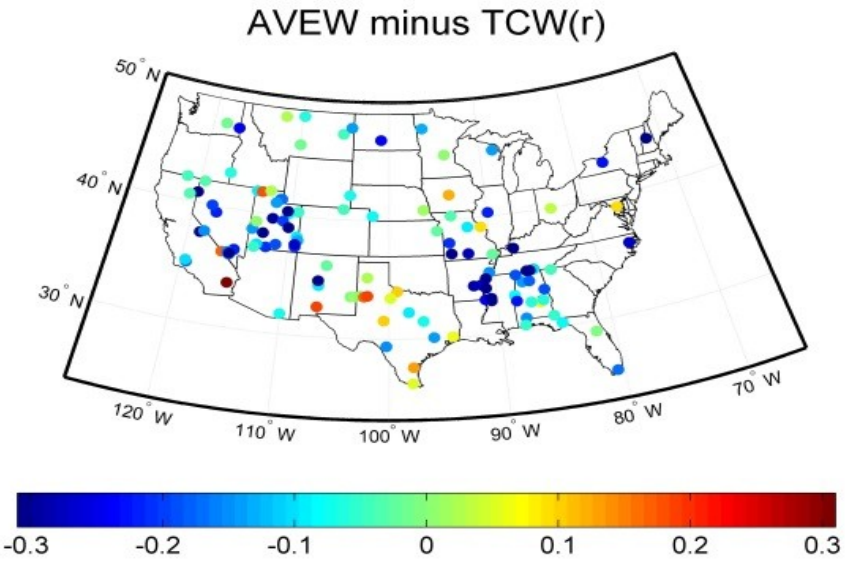
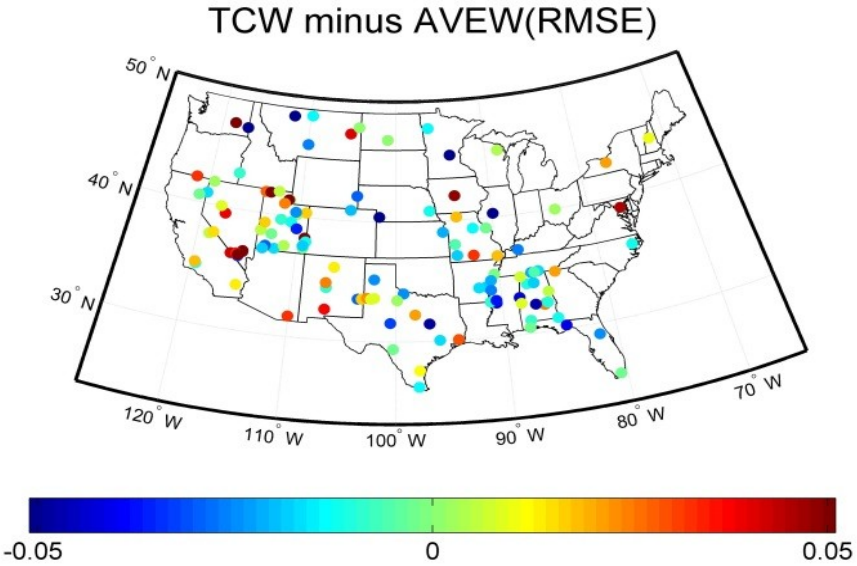
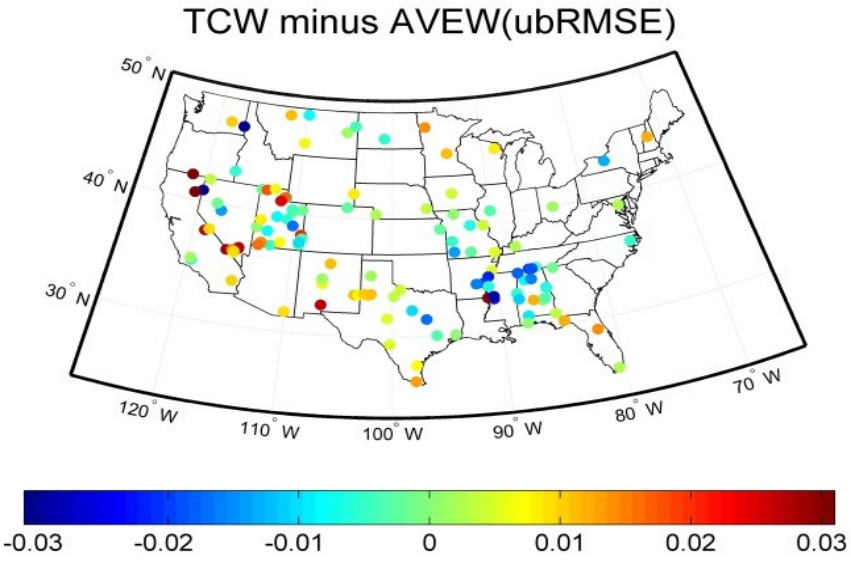
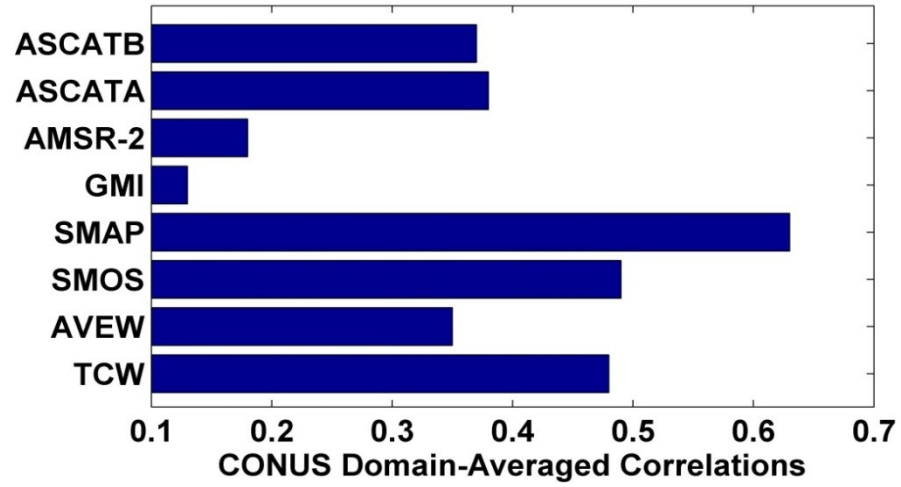


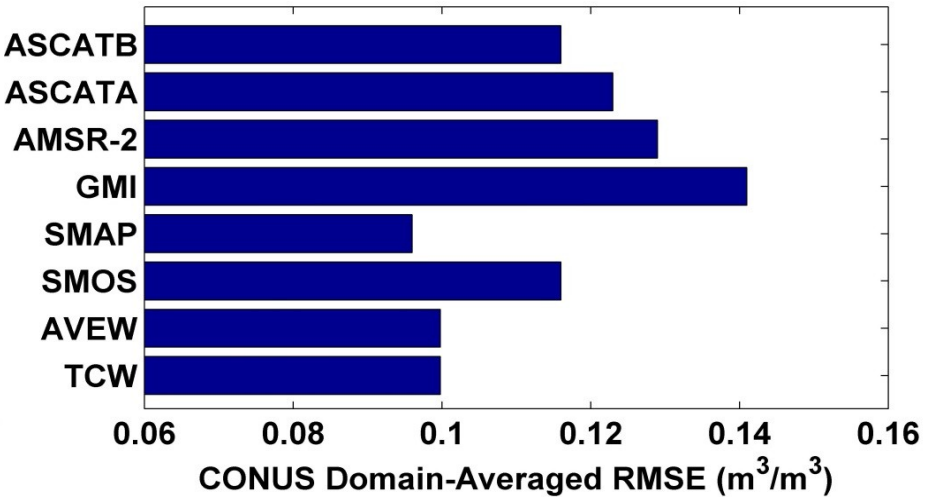


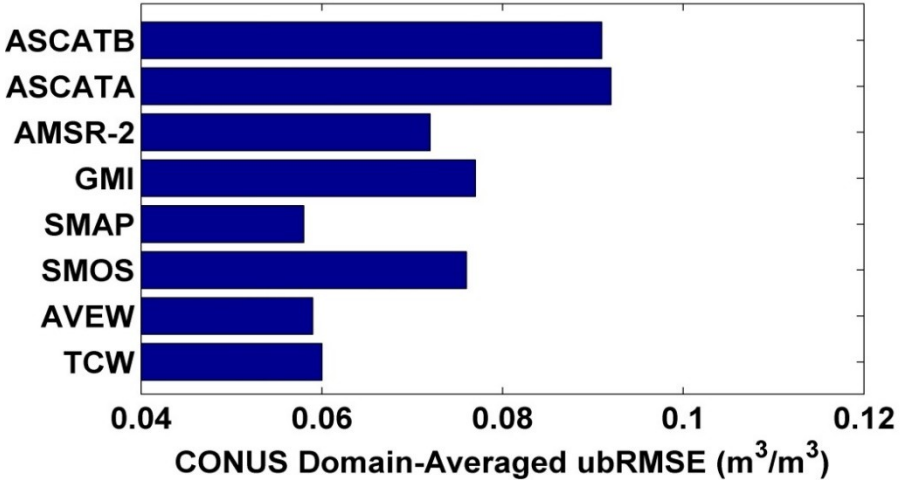


With Respect to the SCAN SM measurements for 10 cm soil layer, *differences in (a) correlations (r), (b) RMSE, and (c) ubRMSE* between AVEW and the scaled TCW SMOPS blended SM data over 1 April 2015-June 30 2017 period. **Site in blue color denotes improvement.**

Blending Method Comparison







CONUS domain-averaged (a) correlations, (b) RMSE and (c) ubRMSE for each of the 6 individual satellite SM retrievals with respect to the 5 cm SCAN SM measurements and both SMOPS blended SM datasets against to the SCAN SM measurements over 1 April 2015-June 30 2017 period.

STAR - SMCD - EMB - Soil Moisture Project - Daily Maps - Mozilla Firefox

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http://www.orbit2.nesdis.noaa.gov/smcd/emb/soilmoisture/DailyMaps.php

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Soil Moisture Daily Maps

To display maps, please select a data type, region, year, month, and date, and then click 'Refresh'.

Use the "<" and ">" buttons to step ahead or backward through the images. Soil moisture is expressed in Volumetric Soil Moisture Content [m^3 water/m^3 soil] (see Documents for details).

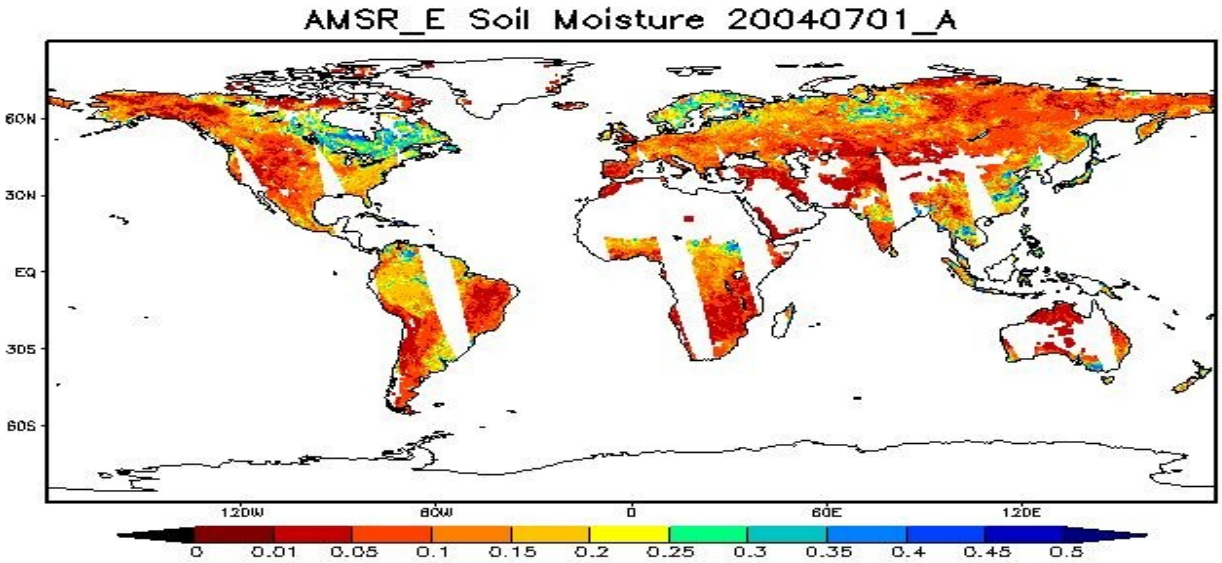
Data type	Region	Year	Month	Day	
NOAA-AMSR-E	Global	< 2004 >	< 7 >	< 1 >	Refresh Map

Regions:

- Global, North America, South America, Africa, Eurasia, Australasia, Asia, CONUS, China, India, South Africa.

Data Types:

- **NOAA-AMSR-E**
  NOAA Soil Moisture from AMSR-E: Land surface soil moisture retrieved from AMSR-E X-band brightness temperature (TB10H) observations using the Single- Channel-Retrieval (SCR) algorithm.
- **NOAA-WindSat**
  NOAA Soil Moisture from WindSat: Land surface soil moisture retrieved from Navel Research Lab's (NRL) WindSat X-band brightness temperature (TB10H) observations using the Single-Channel-Retrieval (SCR) algorithm.
- **NOAA-TMI**
  NOAA Soil Moisture from TMI: Land surface soil moisture retrieved from the X-band brightness temperature

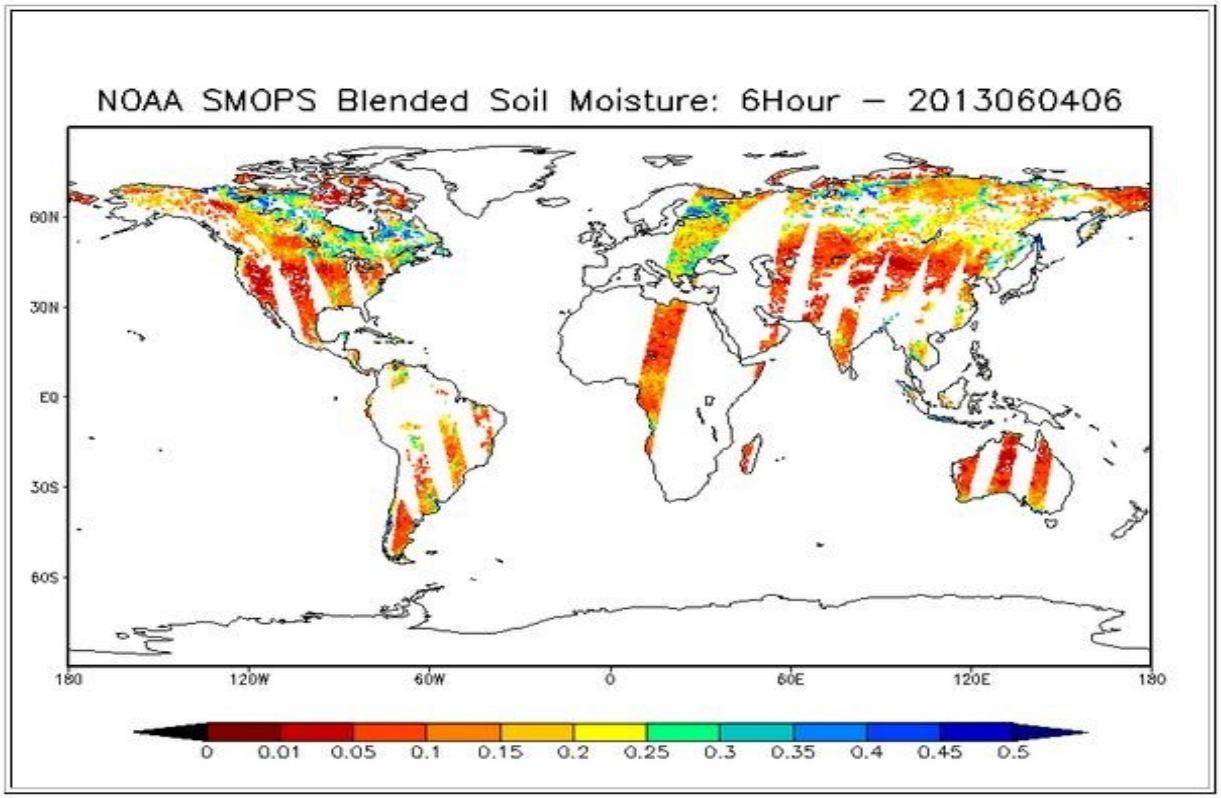


Done

Soil Moisture Products - 6 Hour

Start | Stop | << | NOAA_SMOPS_Blended_SoilMoistur | >>

Start: May 28 2013 End: Jun 4 2013 Reload



SMOPS Home

Algorithm Description

Satellites/Sensors:
ASCAT | SMOS | WindSat | AMSR-E

Product Animation:
Daily | 6-hourly

Validation:
In Situ | Time Series

Monitoring:
Product | Time Series | Processing | Timeliness

Test Data

Documents

IPT Members

Links

Summary & Path Forward

- *Many satellite soil moisture data products have been available while NWS users requested a combined data layer for their application convenience*
- *Using CDF match algorithm, SMOPS unified individual satellite retrievals to a common global satellite data climatology before blending them together*
- *Current operational SMOPS uses simple average as the blended SM data layer*
- *A testing indicates that weighted averaging using the TCEM-based relative RMSE of individual sensor retrievals may generate better blended products*
- *Upgrading SMOPS using the weighted averaging is to be explored with further evaluation and resources assessment*

Thanks!

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