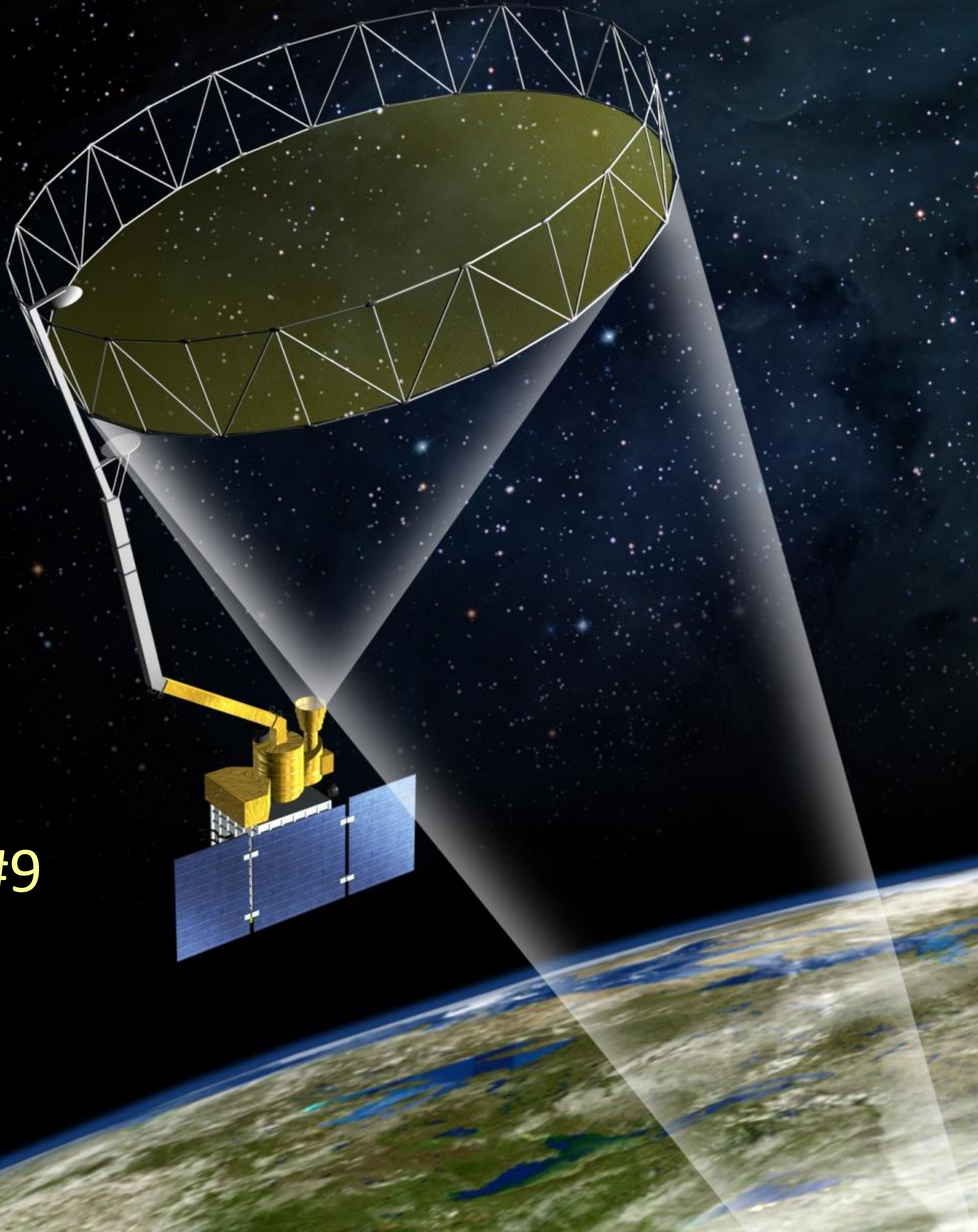
Science and Applications Update

Soil Moisture Active Passive Mission

SMAP



Dara Entekhabi (MIT)

Simon Yueh (JPL/CalTech)

P. O'Neill (GSFC)

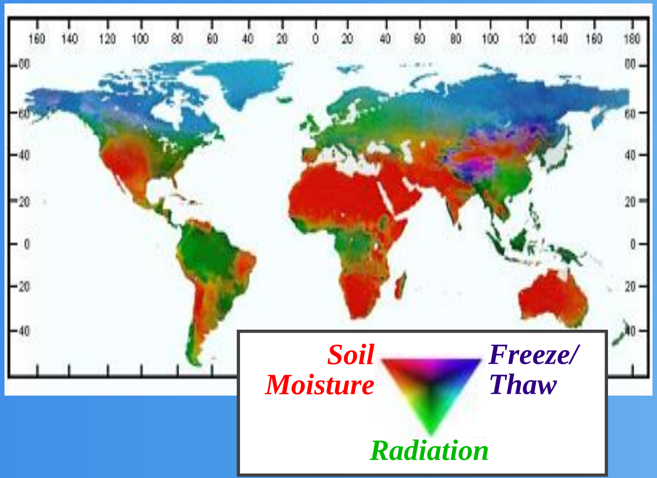
Cal/Val Workshop #9

October 22-23, 2018

SMAP Science and Application Returns

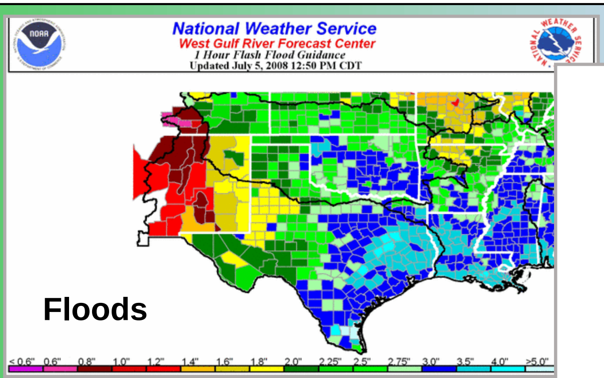
Science Returns

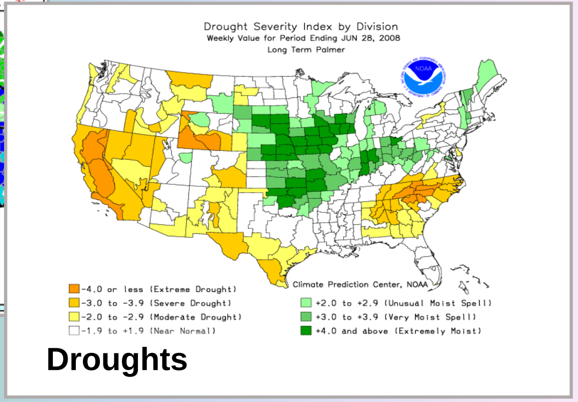
Soil Moisture *Links* the Global Land Water, Energy, and Carbon Cycles



1. Understand processes that link the terrestrial water, energy and carbon cycles;
2. Estimate global water and energy fluxes at the land surface;
3. Quantify net carbon flux in boreal landscapes;

Applications Returns





4. Enhance weather and climate forecast capability;

5. Develop improved flood prediction and drought monitoring capability.

L-band (~21 cm; All-Weather; Canopy Penetration; Sensing Depth)

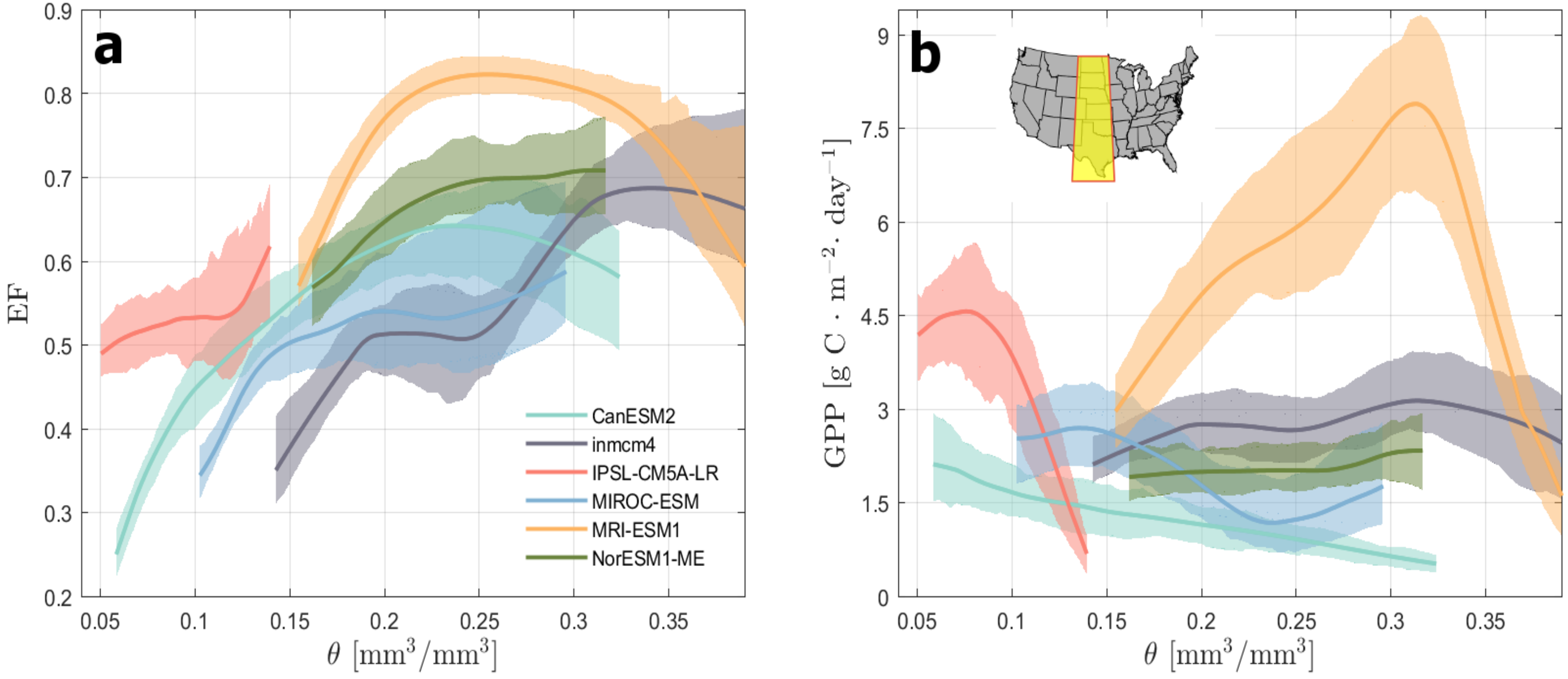
6m conically scanning (14 rpm) antenna for 1000 km swath

Global coverage every 2-3 days

CMIP5 Global Earth System Models

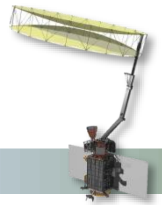
a) Evaporative fraction (EF) and surface soil moisture (θ)

b) Gross Primary Productivity (GPP) and surface soil moisture (θ)



Divergent parameterizations of linkages leads to wide spread of projections results and uncertainty.

Droughts and Floods



Home > services > national_water_model > NWM_Land_Analysis (MapServer) > Near-Surface Soil Moisture (% saturation)

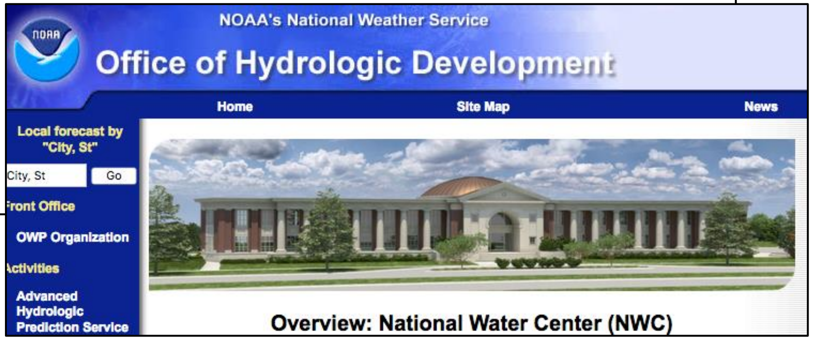
JSON

Layer: Near-Surface Soil Moisture (% saturation) (ID: 0)

Name: Near-Surface Soil Moisture (% saturation)

Display Field:

Type: Raster Layer



Jet Propulsion Laboratory
California Institute of Technology

Droughts and Floods

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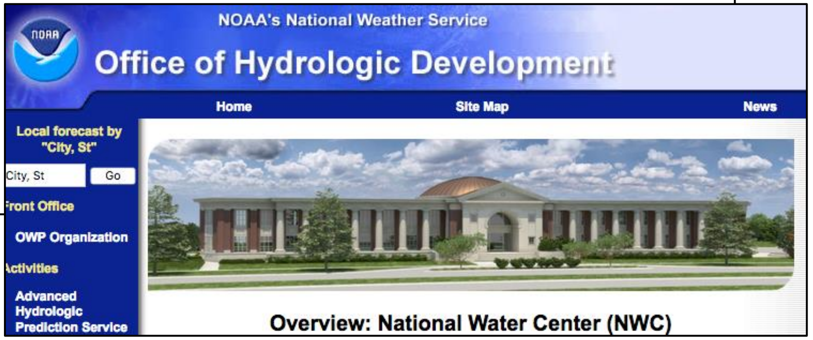


Poster session 4: Climate Modeling/ Early Warning	
07 Relationship of Soil moisture and Sand/dust storm events in Jing-Jin-Ji region of China	Lingchang An
08 Diagnosing the land-atmosphere coupling strength in CMIP5 using satellite-based soil moisture and evapotranspiration	Fangni Lei
09 An Overview of the NOAA National Water Model and Related Hydrologic and Agricultural Applications	Yuqiong Liu
10 Potential Application of Satellite Soil Moisture Data Products in National Water Model	Jifu Yin

The 5th SATELLITE SOIL MOISTURE VALIDATION AND APPLICATION WORKSHOP

SMAP Updated Post-launch Field Experiment Priorities

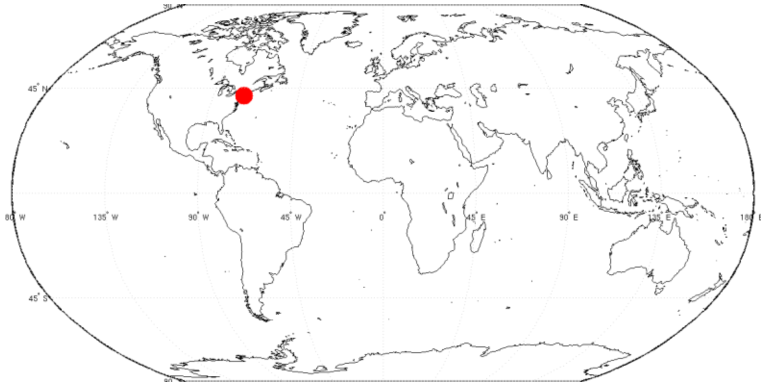
- Improved retrieval of soil moisture for biomes with high levels of vegetation

- Provide a basis for evaluating new disaggregation approaches (SMAP-Sentinel product)

Source: Andreas Colliander (JPL)

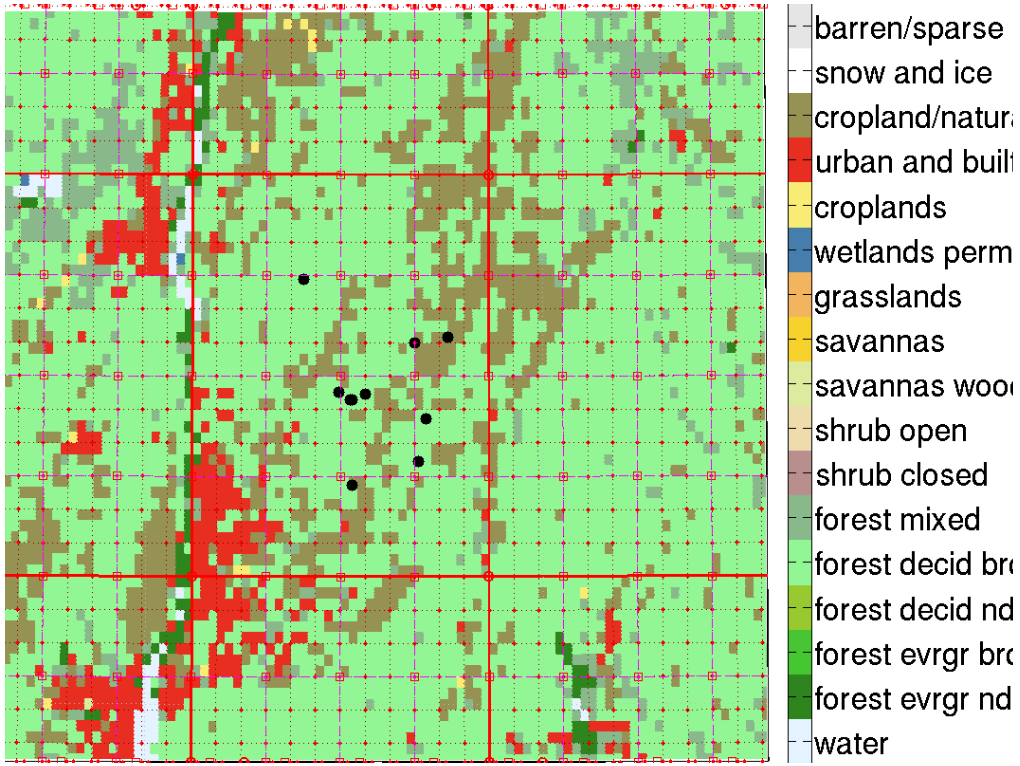
Millbrook (Candidate Pixel)

USA (New York)
Lat: 41.85, Lon: -73.62
PI: Marouane Temimi



2601-33-02

33-km ref pixel at Millbrook NY



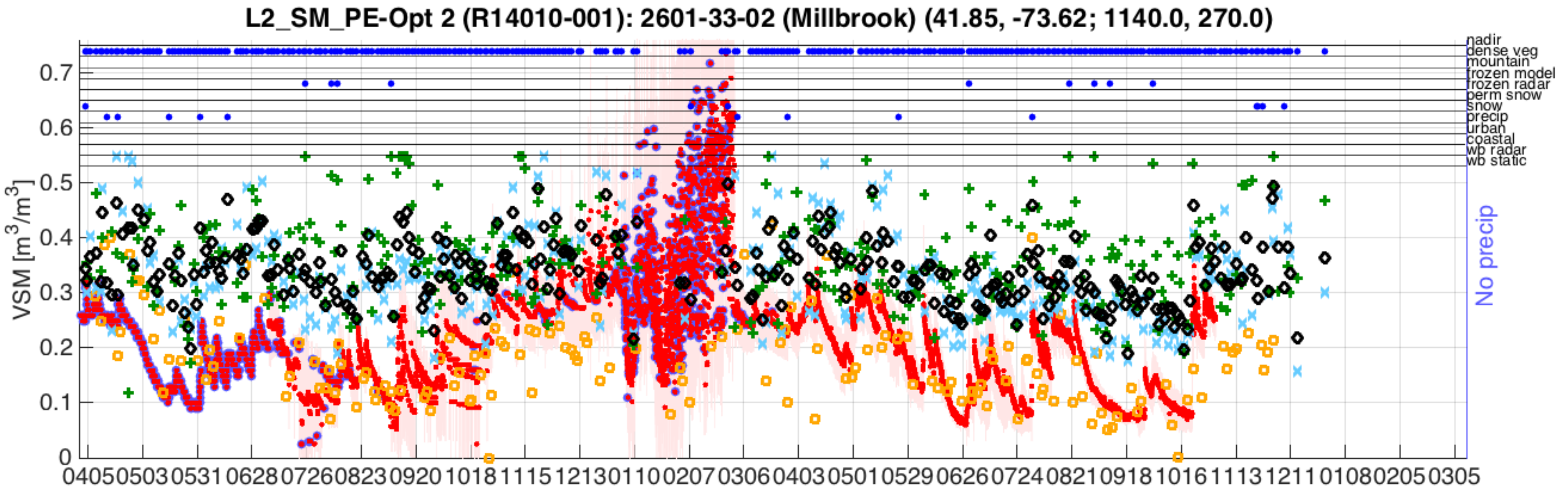
Climate class:
Cold (Dfa)

Dominant landcover:
Forest decid brdlf

Soil texture:
S-%: 44
C-%: 8
BD: 1.19

Source: Andreas Colliander (JPL)

Millbrook (Candidate Pixel)

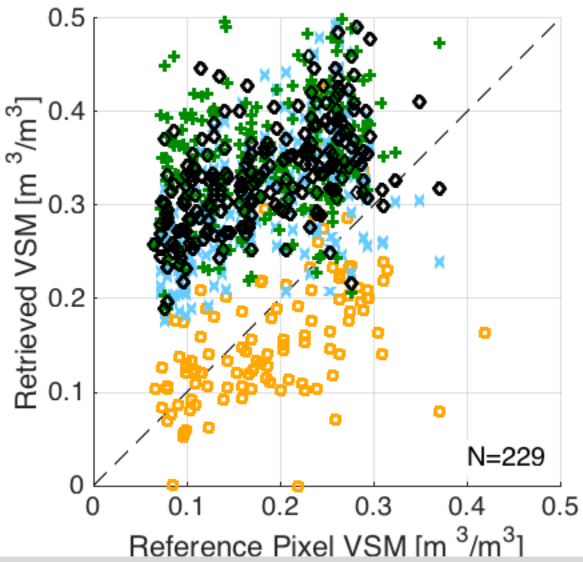


Retrieval Quality Flag Ignored

Alg	ubRMSE	Bias	RMSE	R
SCA-H	0.075	0.128	0.148	0.544
SCA-V	0.067	0.144	0.159	0.558
DCA	0.100	0.178	0.205	0.227
SMOS	0.077	-0.028	0.082	0.463
In Situ				

Climate class: Cold (Dfa)
Landcover: Forest decid brdlf

Soil texture:
S-%: 44
C-%: 8
BD: 1.19



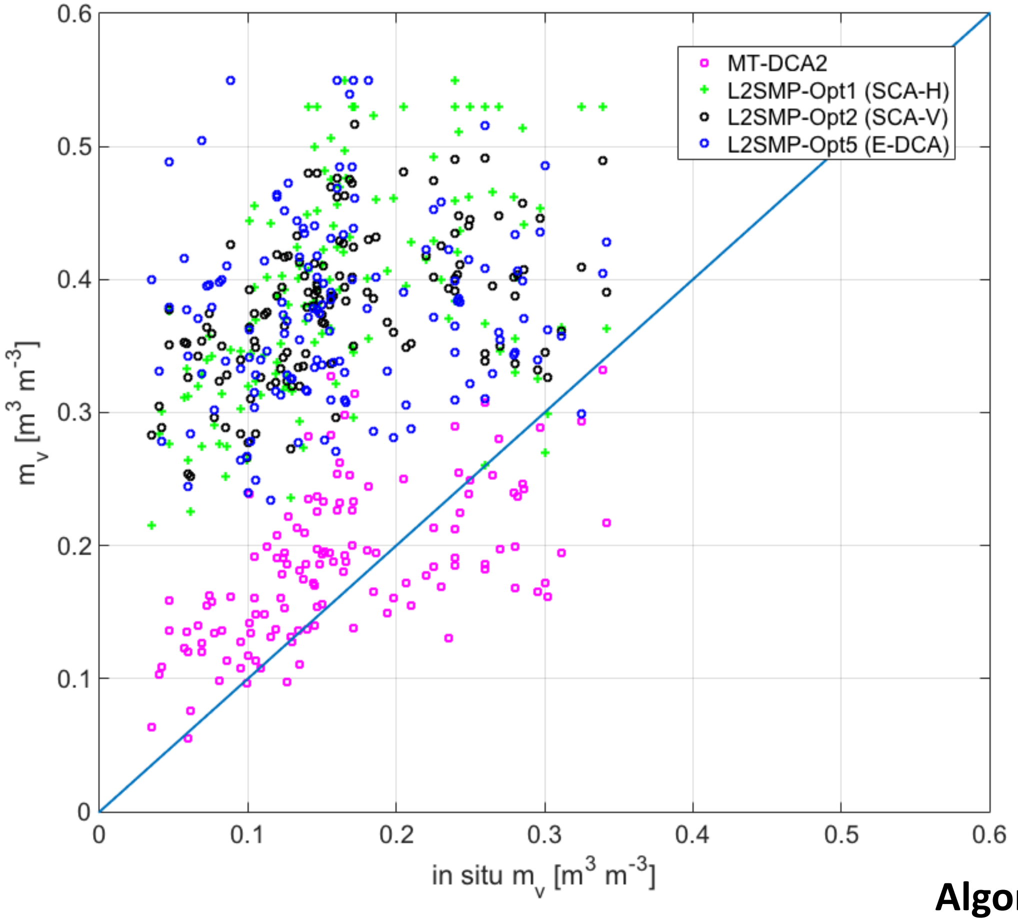
Added Note:

Notice all SMAP L2SMP algorithms have large positive bias. SMOS performs with much lower bias.

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]

Source: A. Colliander (JPL)

Comparison of Algorithms at Forested Millbrook, NY Core Site



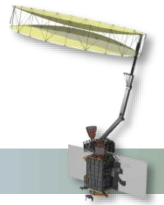
- All L2SMP algorithms (single-channel V and H as well as dual-channel) have large bias (greater than 0.2) in Millbrook forested site
- The MT-DCA2 algorithm bias is 0.025.
- The ubRMSE and correlation are also significantly improved.
- The L2SMP implementation of the two-channels algorithm has considerable more noise (does not adequately take into account DoI).

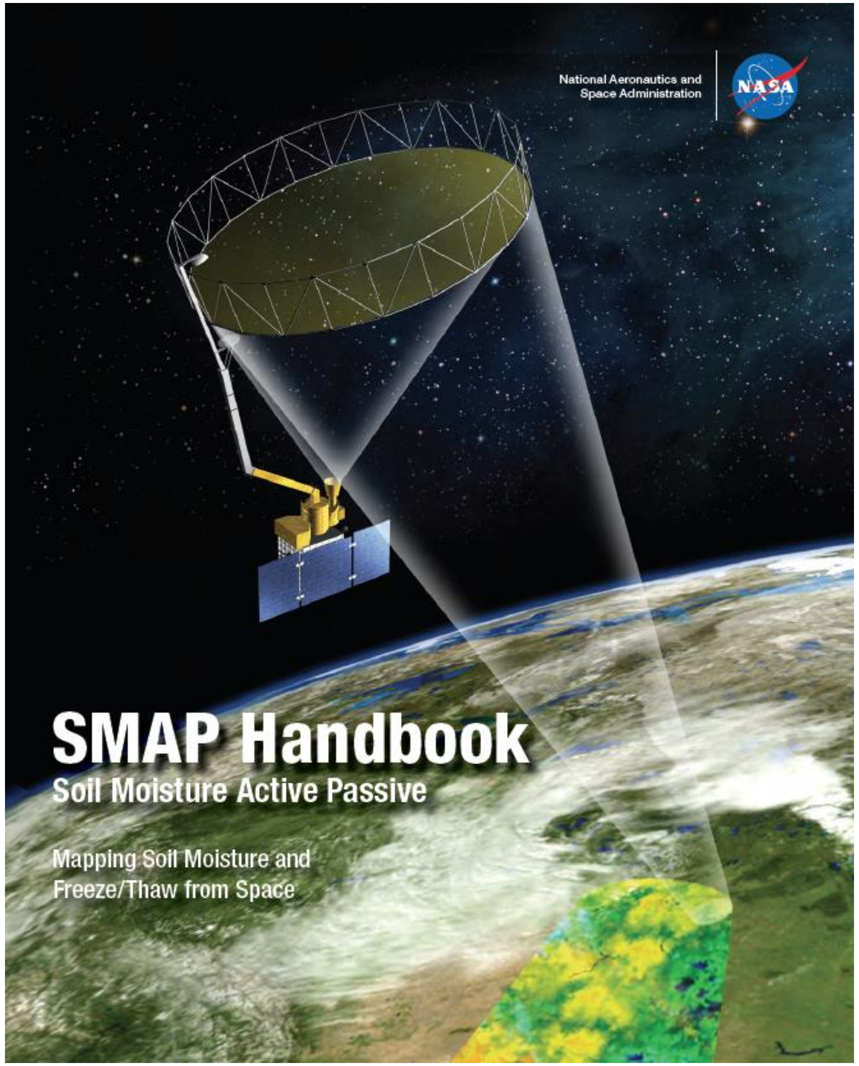
Algorithm	ubRMSE	Bias	RMSE	R (pValue)
L2SMP-Opt1 (SCA-H)	0.079	0.229	0.241	0.47 (8.3e-09)
L2SMP-Opt2 (SCA-V)	0.068	0.218	0.228	0.46 (2.3e-08)
L2SMP-Opt5 (E-DCA)	0.093	0.212	0.233	0.13 (1.4e-1)
MT-DCA2 (MIT Alg.)	0.061	0.025	0.065	0.59 (2.1e-13)

Source: Andrew Feldman (MIT)
Konings, Piles, Das, Entekhabi, 2017: *RSE*

Jet Propulsion Laboratory
California Institute of Technology

SMAP Mission Concept





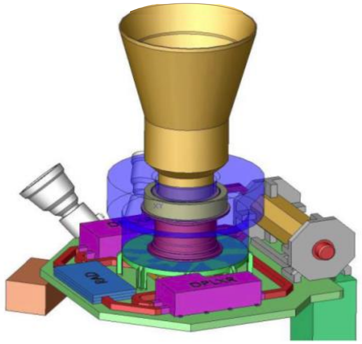
L-band unfocused SAR and radiometer system, offset-fed 6 meters light-weight deployable mesh reflector. Shared feed for:

- 1.4 GHz Radiometer at 40 km (-3 dB) H, V, 3rd and 4th Stokes
- 1.2 GHz Radar 1-3 km (30% nadir gap) HH, VV and HV (Failed; 2 Months of Data)

Conical scan, fixed incidence angle at 40°

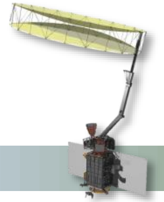
Contiguous 1000 km swath 2-3 days revisit

Sun-synchronous 6am/6pm orbit (680 km)

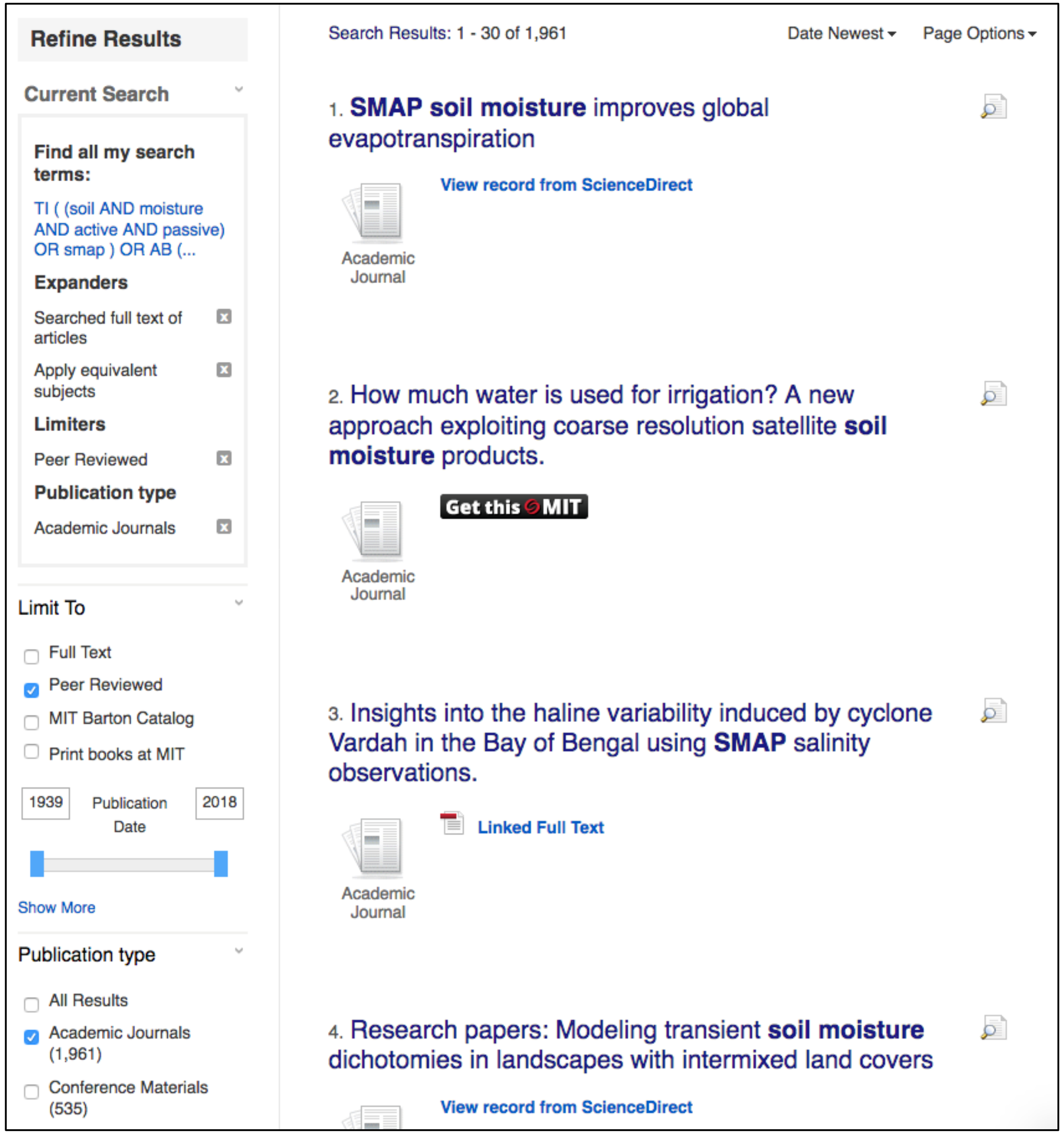


Electronic Version at http://smap.jpl.nasa.gov/Imperative/

Print Version Available (182 Pages): smap_science@jpl.nasa.gov



New Handbook (Electronic)



Update (Replace Chapters) SMAP Handbook with:

1. Comprehensive bibliography of peer-reviewed journal articles on SMAP (Title, Abstract, Reference)

2. One-page science highlight (one publication) with figure and extended caption

3. Update with new products and their technical specifications

Poster Session

Afternoon 2: New Directions in Soil Moisture Validation and Observation [POSTERS with 5 min talks] (Chair: D. Entekhabi)

16:05	Multi-scale L-band freeze/thaw retrieval in boreal forest	A. Roy
16:10	Dielectric characterization of vegetation	A. Mavrovic
16:15	BERMS soil moisture network	A. Berg
16:20	NMM3D forest modeling	H. Huang
16:25	Evaluating the SMAP and SMOS soil moisture values together with the results obtained from four land surface models	F. Lahoud
16:30	Temporal and spatial mismatch effect between SMAP and SMOS soil moisture	N. Yang
16:35	Validation strategy for high resolution soil moisture product	A. Balenzano
16:40	A non-stationary geostatistical framework for soil moisture prediction in the presence of surface heterogeneity	B. Mohanty
16:45	Evaluating the sensitivity of surface soil moisture dynamics to soil profile layering schemes	P. Shellito
16:50	An in-situ data based model to downscale radiometric satellite soil moisture products	I.-Y. Yeo
16:55	Standardizing short-term satellite soil moisture datasets	R. Leeper

2 Slides

Title: *[add title here]*

Authors: *[add authors list with abbreviated affiliation (optional)]*

Description:

[Add text here;

Limited to 75 words]

Graphic
[Caption limited to 12 words]

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Description:

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Graphic
[Caption limited to 12 words]

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