SMAP Algorithms and Cal/Val Workshop

Oxnard, CA, USA

June 9-11, 2009

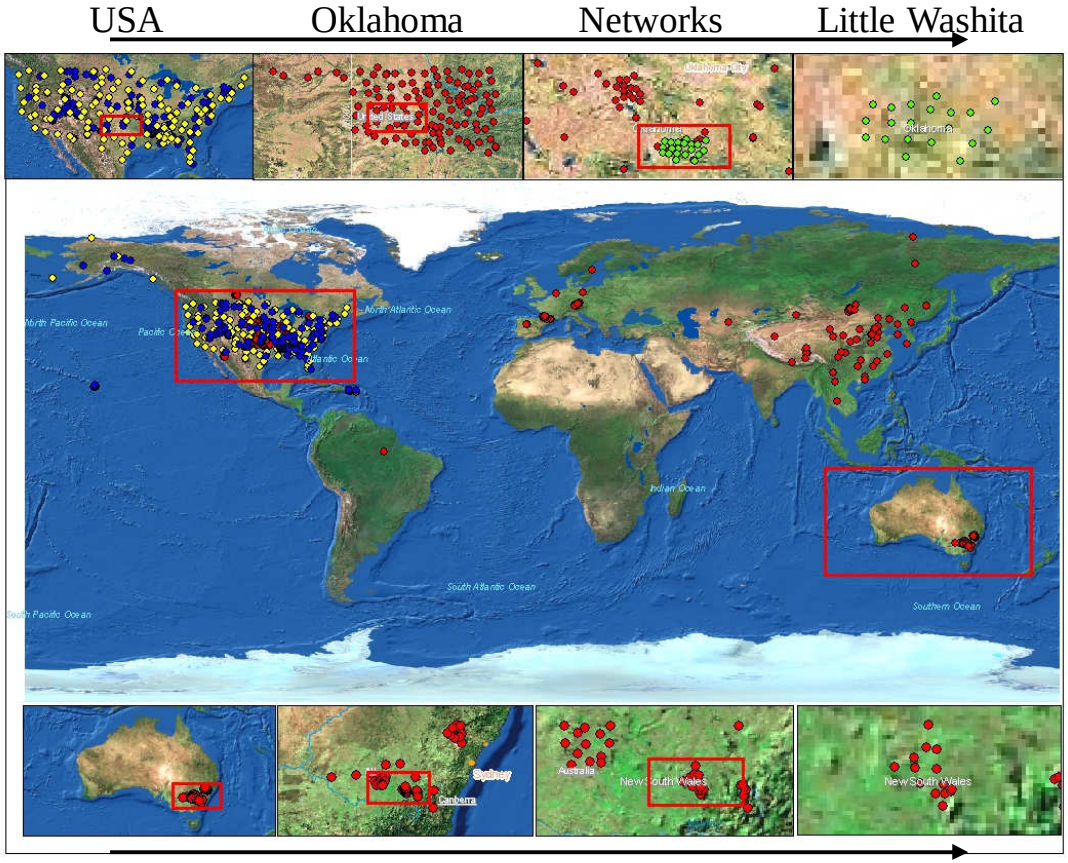
In Situ Network Data Acquisition and Integration in SMAP Validation

Overview

- Morning session will deal with the ground-based geophysical observations that will be used to validate the SMAP products.
- This is part of the process of establishing the necessary infrastructure for post-launch validation
  - Address USA first, international later
  - Integrating existing networks/measurement programs
  - Testbeds, standards
  - Scaling
  - Guidance on validation site design
- Suggestions on international cooperation/participation
  - Validation sites

Global In Situ Soil Moisture Validation Resources

- There are a substantial number of in situ soil moisture resources available for validation. These will be a core element of SMAP validation.
- Some regions (OK and NSW) have exceptional resources.
- However, there are issues that need to be addressed if these are to be of value to SMAP validation.
  - Continuity
  - Verification
  - Replication and Scaling
  - Coverage gaps
  - Infrastructure
  - Availability



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  - Integrating existing networks/measurement programs
  - Testbeds, standards
  - Scaling
  - Guidance on validation site design
- Suggestions on international cooperation/participation
  - Validation sites

Agenda

08:30-09:45 In Situ Network Data Acquisition and Integration Jackson

SM Networks	What's Available?	
	USDA NRCS SCAN	Schaeffer
	NOAA CRN	Wilson
	Oklahoma Mesonet	Basara
	USDA ARS Watersheds	Cosh
	COSMOS	Zreda
	GPS	Small
	Additional presentations (1 slide)	
FT(Met) Networks		Kimball/McDonald
Compatibility of Networks with Cal/Val Needs		Jackson
Proposal for Establishing an Insitu Testbed(s)		Cosh
Strategy for International Participation		Jackson

In Situ Network Data Acquisition and Integration in SMAP Validation

- Existing networks are a key resource for SMAP validation
  - No cost?
  - Open to cooperation
  - Independent verification programs
  - Typically; real time and public domain
- Review of some of the major resources

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Can these satisfy the validation requirements?

SMAP Validation

- Based on SMAP mission requirements and product Algorithm Theoretical Basis Documents (ATBDs)
  - Pre-launch: Address ATBD identified priorities, improve algorithms and products, and establish infrastructure necessary for post-launch
  - Post-launch: *Demonstrate that the science requirements have been met* and improve algorithms and products over the mission life

SMAP Soil Moisture Level 1 Requirements

- The baseline science mission shall provide estimates of soil moisture in the *top 5 cm* of soil with an error of no greater than *0.04* m^3/m^3 volumetric (one sigma) at *10 km* spatial resolution and 3-day average intervals over the global land area excluding regions of snow and ice, frozen ground, mountainous topography, open water, urban areas, and vegetation with water content greater than 5 kg m-2 (averaged over the spatial resolution scale)
- Level 2 requirements expand this to include the L3 SM 40 km and L4 SM
- Should also consider the L3 SM 3 km internal product.

A Soil Moisture Validation Resource Should:

- Provide the equivalent of volumetric soil moisture obtained using the gravimetric method (verified)
- Establish that it provides a measure of the 0-5 cm layer
- Provide observations concurrent with the satellite measurement
- Represent the 10 km product area
  - Also consider 40 km and 3 km scales
- Robust data set (conditions, sites)
- Additional constraints
  - Data must be available in a timely manner in order to allow continuous assessments during the validation phase of the mission
  - All data must be available to other investigators and ideally within the public domain.

Compatibility of Networks with Cal/Val Needs

	SCAN	CRN	OK	USDA ARS	COSMOS	GPS			
Verified to gravimetric									
Measure-ment depth									
Concurrent									
10 km scale									
Latency									
Availability									
Geographic diversity									
40 km scale									
3 km scale									

Compatibility of Networks with Cal/Val Needs

	SCAN	CRN	OK	USDA ARS	COSMOS	GPS			
Verified to gravimetric	Y/N	Y	Y/N	Y	Y	N			
Measure-ment depth (0-5 cm)	Y	Y	Y	Y	N	Y			
Root-zone (1 m)	Y	Y	60 cm	Y	Y/N	N			
Concurrent	Y	Y	Y	Y	Y	Y			
10 km scale	N	N	N	Y	N	N			
No Latency issues	Y	Y	Y	Y	Y	Y			
Availability	Y	Y	Y/N	Y	Y	Y			
Geographic diversity (?)	Y	Y	Y	Y	Y	Y			
40 km scale	Y/N	N	Y	Y	N	N			
3 km scale	N	N	N	N	N	N			
Soil charac. Availability	Y	Y	Y	Y/N	Y	Y			
Met availability	Y	Y	Y	Y	N	Y			

In Situ Network Data Acquisition and Integration in SMAP Validation

- Existing networks are a key resource for SMAP validation
  - No cost?
  - Open to cooperation
  - Independent verification programs
  - Typically; real time and public domain
- Review of some of the major resources
- Issues
  - Most are sparse requiring point to footprint scaling
  - Reconciling measurement techniques (units, depths)
  - Verification versus gravimetric

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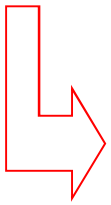
Dealing with measurement depths and techniques



In Situ Testbeds

- Different techniques, depths, spatial scales…..can we contribute to making them compatible and getting the most out of these resources.

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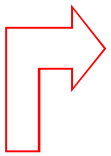

Suggestions needed

Global In Situ Soil Moisture Validation Resources

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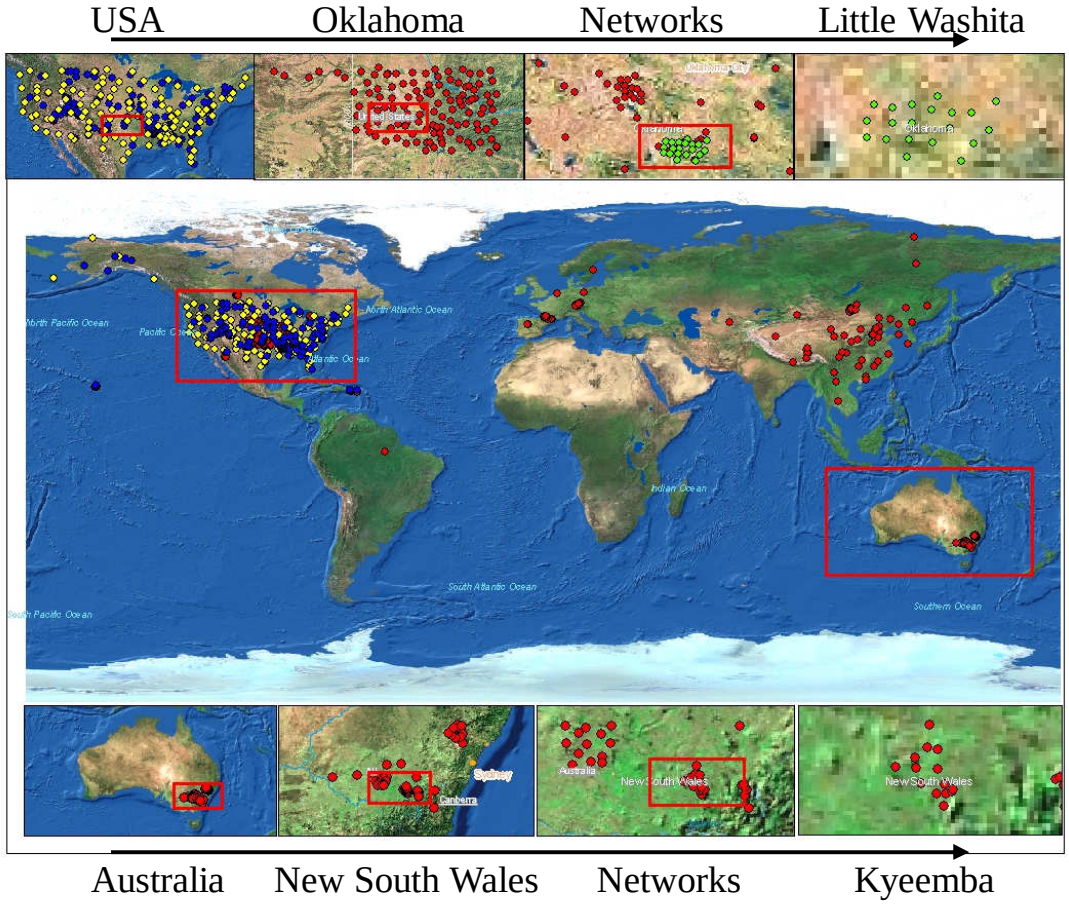
- Some regions (OK and NSW) have exceptional resources.
- However, there are issues that need to be addressed if these are to be of value to SMAP validation.
  - Continuity and follow through
  - Verification
  - Replication
  - Scaling
  - Coverage gaps
  - Infrastructure



International Participation in SMAP Cal/Val

- Why?
- Historic approach: Cal/Val Announcement of Opportunity
- Formal Partnerships and other Special Circumstances

International Participation in SMAP Cal/Val

- Why?
  - Adds to diversity of geographic/climate conditions
  - No cost
  - Seasonal considerations and/or unique resources
- Historic approach: Cal/Val Announcement of Opportunity
- Formal Partnerships and other Special Circumstances

International Participation in SMAP Cal/Val

- Why?
- Historic approach: Cal/Val Announcement of Opportunity
  - No funding
  - Access to satellite products during C/V phase in exchange for validation studies and providing all data to an archive
  - A possible timeline
    - AO: June 2010
    - Selection: January 2011
    - Coordination and Planning Workshop: April 2011
    - Status and Demonstration Workshop: September 2012
    - Post-Launch Validation Workshop: January 2014
- Formal Partnerships and other Special Circumstances

International Participation in SMAP Cal/Val

- Why?
- Historic approach: Cal/Val Announcement of Opportunity
- Formal Partnerships and other Special Circumstances
  - SMAP Project Partners
    - Canada (in situ data, field experiments)
    - ……
  - Complementary Satellite Programs (We want these data sets!)
    - SMOS
    - Aquarius
    - GCOM-W
    - SAOCOM …..

International Participation in SMAP Cal/Val

- High Priority Candidates
  - Compatible with validation requirements, parallel programs, partnerships with formal commitments, strength of supporting program
  - Canada, Australia, SMOS Core Sites (Valencia, Danube), Mongolia (GCOM-W), …….
- Next Priority Candidates
  - Data sparse regions, would require more significant efforts to use in validation, some level of common interest
  - Africa, Argentina, Brazil, Asia Water Cycle, …..
- Low Priority Candidates
  - High latency, sparse, unverified, no infrastructure support

Methodologies for Scaling

- There are numerous in situ networks throughout the world that provide point observations of soil moisture and temperature
- Cannot compare a point observation of soil moisture (FT may be more forgiving) to a footprint without addressing scaling
- There are several methodologies that might be employed
- Near term action actions should include:
  - Exploring and refining the basic methodologies
  - Conducting intercomparisons
  - Implementing supplemental measurement programs as needed

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09:45-11:15	Methodologies for scaling	Famiglietti
	Methods	
	Replication and Variability	Famiglietti
10:00	Break	
10:15	Methodologies for scaling (cont.)	
	Temporal Stability	Cosh
	Enhanced Temporal Stability	Mohanty
	Model Enhanced Approaches	Crow
	Additional presentations (1 slide)	
	Research Priorities	Famiglietti/Jackson

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