National Aeronautics and Space Administration

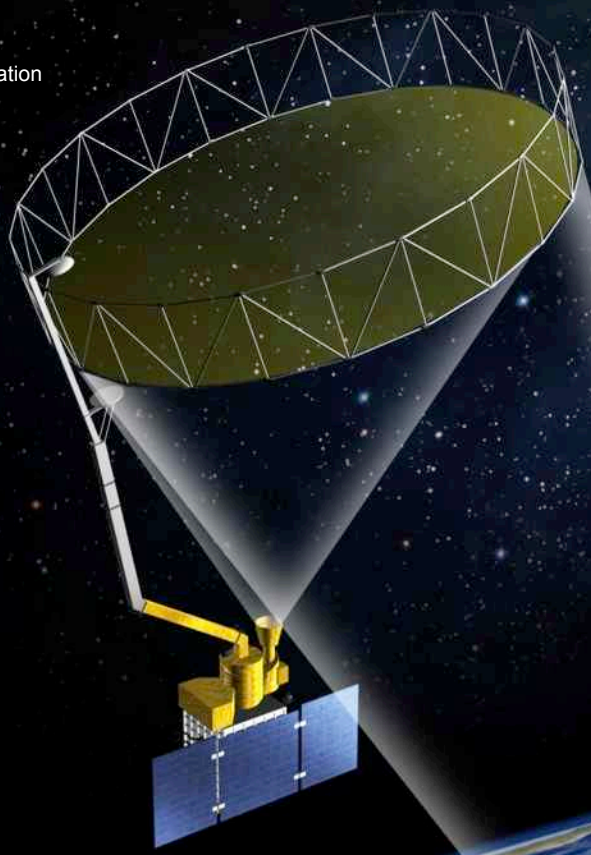
Jet Propulsion Laboratory
California Institute of Technology

Soil Moisture Active Passive Mission

SMAP

Cal/Val Partners

Tom Jackson, USDA



3rd Cal/Val Workshop

Nov. 14-16, 2012

L2-L4 Validation Methodologies

Methodology	Role	Constraints	Resolution
Core Validation Sites	Accurate estimates of products at matching scales for a limited set of conditions	• In situ sensor calibration • Limited number of sites	• In Situ Testbed • Cal/Val Partners
Sparse Networks	One point in the grid cell for a wide range of conditions	• In situ sensor calibration • Up-scaling • Limited number of sites	• In Situ Testbed • Scaling methods • Cal/Val Partners
Satellite Products	Estimates over a very wide range of conditions at matching scales	• Validation • Comparability • Continuity	• Validation studies • Distribution matching
Model Products	Estimates over a very wide range of conditions at matching scales	• Validation • Comparability	• Validation studies • Distribution matching
Field Campaigns	Detailed estimates for a very limited set of conditions	• Resources • Schedule conflicts	• Airborne simulators • Partnerships

SMAP Cal/Val Partners Program

- In situ observations are essential to SMAP Cal/Val
- There were only a few high quality resources available
- Increasing the number was constrained by
  - *The time and effort to establish a site*
  - *No $ to support these*
- Action: ROSES DCL
  - *No cost collaboration*
  - *Minimum standards*
  - *In situ data in exchange for early access to SMAP products*
- Based on responses
  - *Refined definitions*
  - *Missed some important resources*

SMAP Cal/Val Partners: Sites

- **Core Validation Sites**: In situ observing sites that provide well-characterized estimates of a L2-L4 product at a matching spatial scale, a direct benchmark reference for the products. Additional minimum criteria are:
  - *Provides calibration of the in situ sensors*
  - *Up-scaling strategy provided (implemented by Project)*
  - *Provides data in a timely manner*
  - *Long term commitment by the sponsor/host*
- **Contributing Validation Sites**: In situ observing sites that provide estimates of a L2-L4 product but do not meet all of the minimum criteria for a Core Validation Site. (i.e. sparse networks)
  - *Contributing Validation Sites are a supplemental resource (In assessing meeting mission requirements but important in Stage 2 Validation).*
  - *The baseline approach to using sparse networks is the triple-collocation technique. Efforts to improve this approach are desirable.*

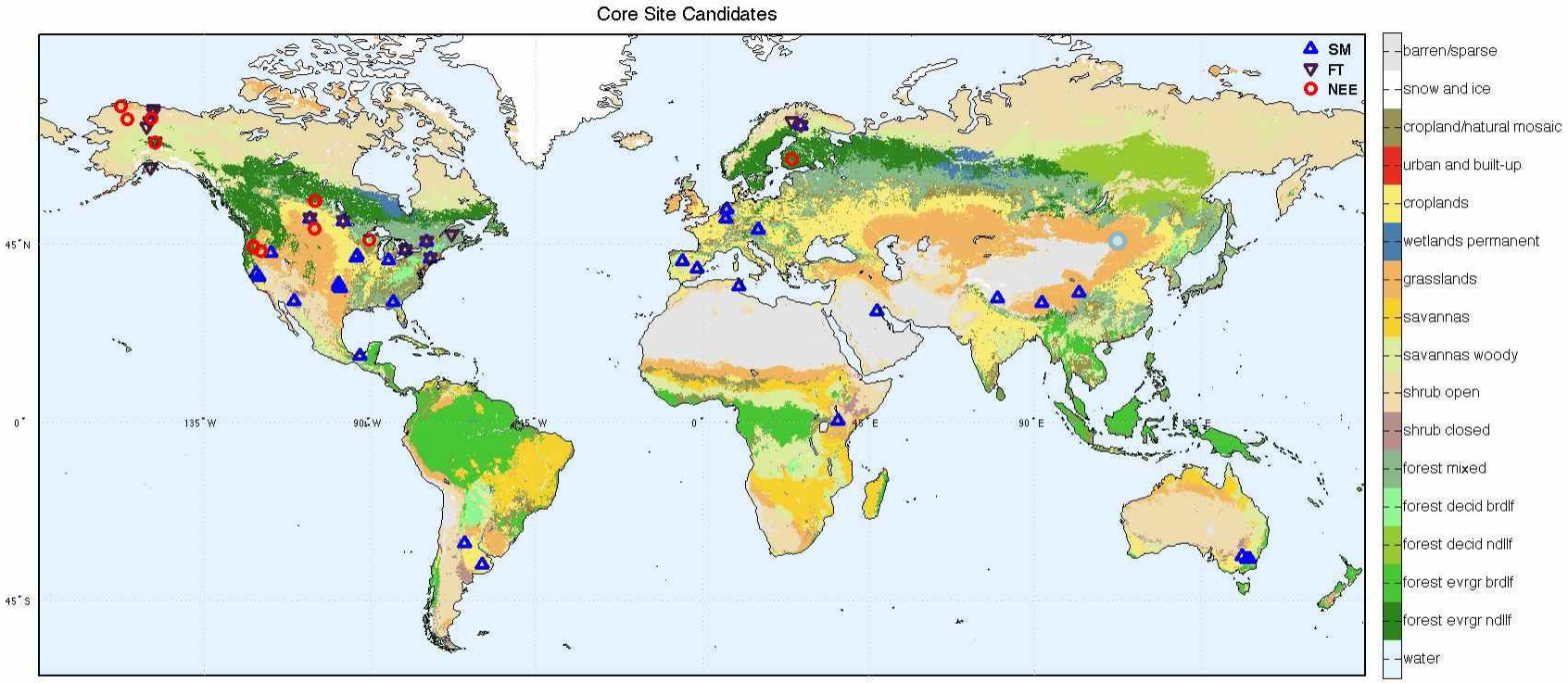
Soil Moisture Cal/Val Partner Work Plan

- Formalize agreements
- Rigorous evaluation of data quality
- Assessment of up-scaling
- Resolve data formatting issues
- Resolve data latency issues
- **Rehearsal campaigns**
- Final selection

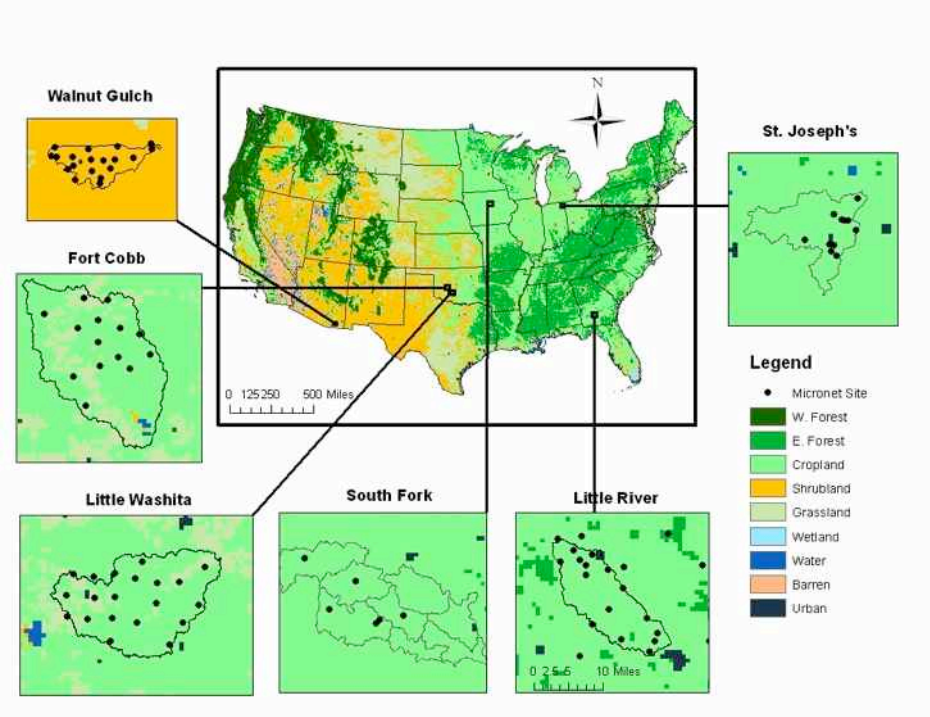
Soil Moisture Cal/Val Partner Discussions

- Update on status
  - *One slide from each Partner*
  - *Poster session after presentation*
  - *Roughly arranged to start with Core sites and end with Contributing sites (sparse networks)*
- Assessment of readiness and value to SMAP Cal/Val
- Suggestions from Cal/Val Working Group to the Cal/Val Partners or the SMAP Project

SMAP Core Validation Site Candidates



USDA-ARS Experimental Watersheds – M. H. Cosh
Arizona, Georgia, Indiana, Iowa, Oklahoma

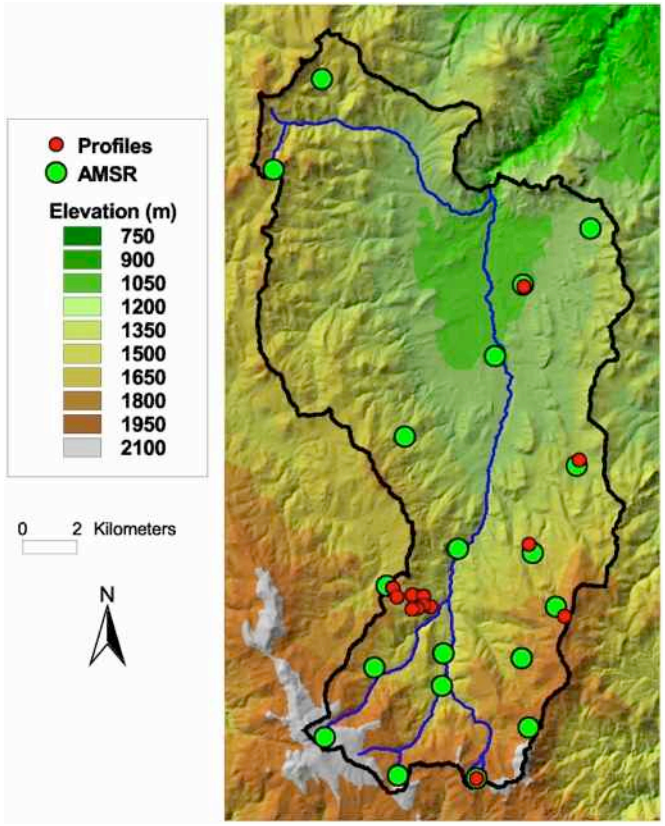


- Agricultural Research Watersheds
- SMAP Soil Moisture (surface and profile)
- Six domains
  - ✓ Walnut Gulch, AZ – 21
  - ✓ Little River, GA – 33
  - ✓ Little Washita, OK - 20
  - ✓ Fort Cobb, OK – 15
  - ✓ St. Joseph's, IN – 9
  - ✓ South Fork, IA – 15 (by mid 2013)
- Telemetry and FTP
- Latency: Daily to Monthly
- Status – Operating and Developing

Measurement	Method	Depths
Soil Moisture	Hydra	5 cm and various
Soil Temperature	Hydra	5 cm and various
Precipitation	Tipping Bucket	

AMSR-E and SMOS history

USDA-ARS Reynolds Creek Experimental Watershed
Mark Seyfried Idaho, USA

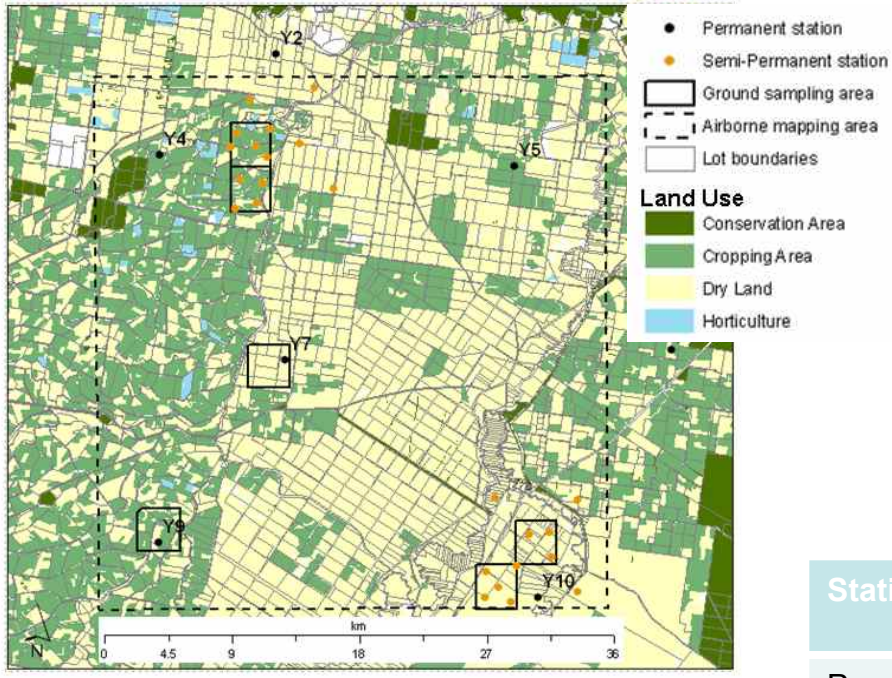


- Ecohydrology in Complex Terrain
- Soil moisture, surface and profile, Freeze-Thaw
- Radio-telemeter to ftp
- One day
- Operational

Measurement Type	Method	Depths
Soil moisture	Hydraprobe	multiple
Soil temperature	Hydraprobe	multiple
Snow depth	Sonic	
Water and CO2 Flux	Eddy covariance	

AMSR-E and SMOS history

SMAPEx - J.P. Walker
Yanco, NSW, Australia



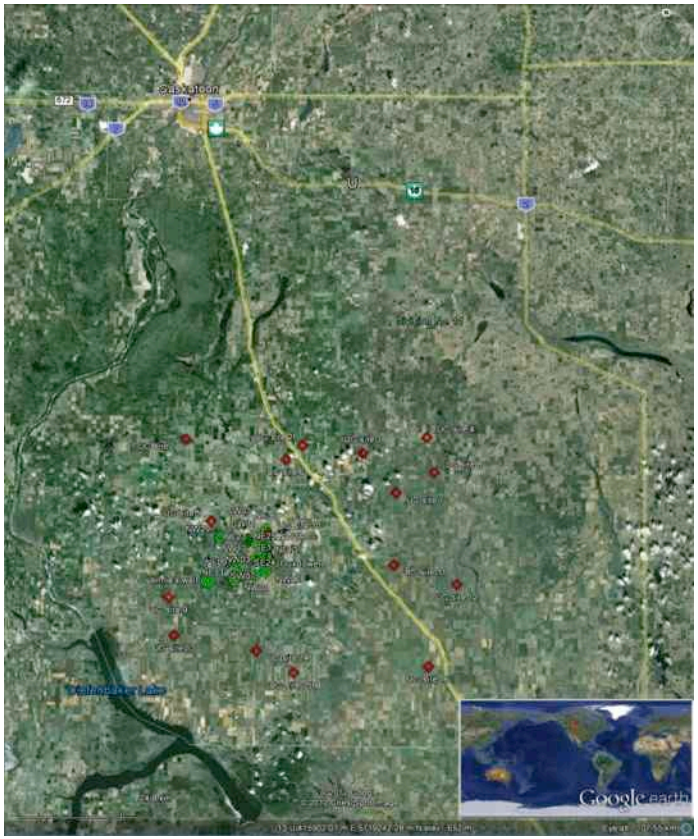
- Soil moisture
- L2_SM_A, L2_SM_P, L2_SM_A/P, L3_SM_A, L3_SM_P, L3_SM_A/P, L4_SM
- One domain
- Some manual, some telemetry
- Seasonal latency
- Ongoing since 2009, upgraded

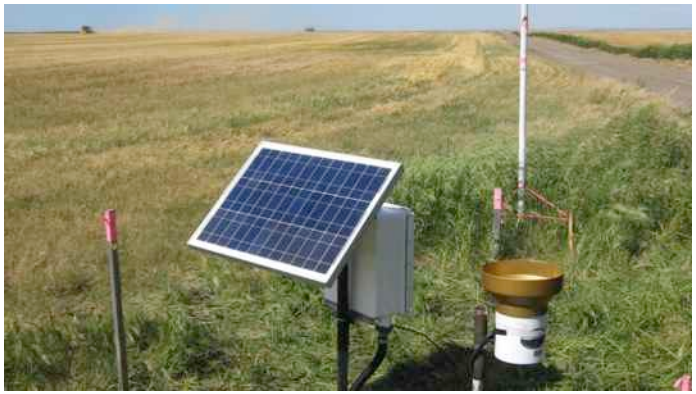
Station Type	Measurement Type	Method	Depths (cm)
Permanent	Rainfall	Raingauge	n/a
	Soil moist.	CS-616	0-30, 30-60, 60-90
	Soil temp.	T-107	3, 16
Semi-Permanent	Soil moist.	SDI-12	5
	Soil temp.	Unidata 6507A	1.5, 2.5, 5

- Smith, A. B. et al. (2012) The Murrumbidgee Soil Moisture Monitoring Network Data Set. Water Resources Research, vol. 48, W07701, doi: 10.1029/2012WR011976

AMSR-E and SMOS history

Kenaston Soil Moisture Mesonet Saskatchewan Canada
A. Berg (U of Guelph), B. Toth (Env Canada)

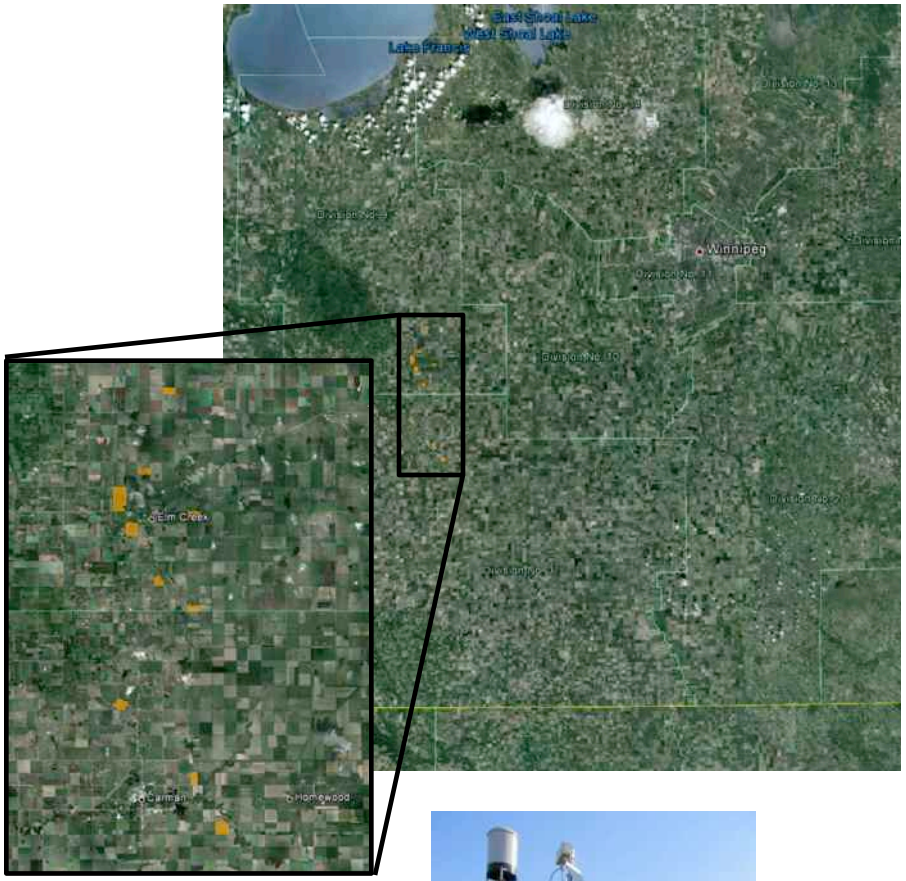




- Soil moisture and flux data to validate hydrological modelling and remote sensing products
- Surface to 50 cm soil moisture, precipitation, freeze thaw state, energy flux products
- Nested domain, 16 sites/60 km (U of G), 24 sites/10 km (EC)
- Manual – moving towards cell transmission for 10 km domain
- Variable – 48 hr to 2 weeks
- Active from thaw to freeze up, 2007 – current

Measurement Type	Method	Depths
Soil moisture	Logged Steven's Water Hydraprobe	5 cm (x2) 20 cm 50 cm
Precipitation	Logged TB3 tipping bucket	0.8 m
Full eddy correlation	Logged CS instrumentation,	One point in 10 km grid
Full met tower	Logged CS instrumentation,	One point in 10 km grid

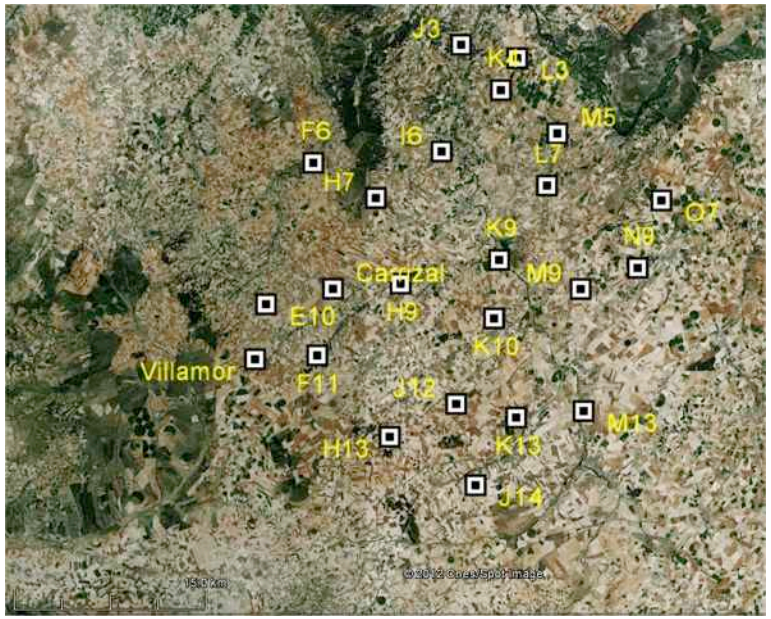
Brunkild Watershed Manitoba (Canada)
Dr. Heather McNairn (Agriculture and Agri-Food Canada)



- Regional and field level soil moisture
- Validation of SMAP surface and root zone soil moisture
- Currently 9 stations, with 3 replicate measurements down to rooting zone
- Adcon telemetry units transmit data to Ottawa
- Data is transmitted every 30 minutes
- Stations installed; calibration underway

Measurement Type	Method	Depths
Rainfall	tipping bucket rain gauge (Campbell Scientific 700)	
Soil moisture and temperature	Stephen's Hydra Probes	3 probes at each depth (5, 20, 50 and 100 cm); plus 3 inserted vertically at surface (0-6cm)
Soil temperature	Stephen's Hydra Probes	2 measurements at each depth

REMEDHUS- Dr. José Martínez-Fernández
University of Salamanca, Spain



- Primary focus of research at the site: hydrological processes
- SMAP Products to Validate: soil moisture
- Number of Domains and number of points in each: 1 domain; 23 points
- Method of Data Transmission: field to lab., cell phone; lab. to SMAP, Internet
- Expected Latency: routinely, monthly; immediately after specific experiments.
- Status: In operation

Measurement Type	Method	Depths
Soil moisture	HydraProbe, hourly	5 cm

AMSR-E and SMOS history

Valencia Anchor Station-Ernesto Lopez-Baeza
Caudete de las Fuentes, Valencia, Spain

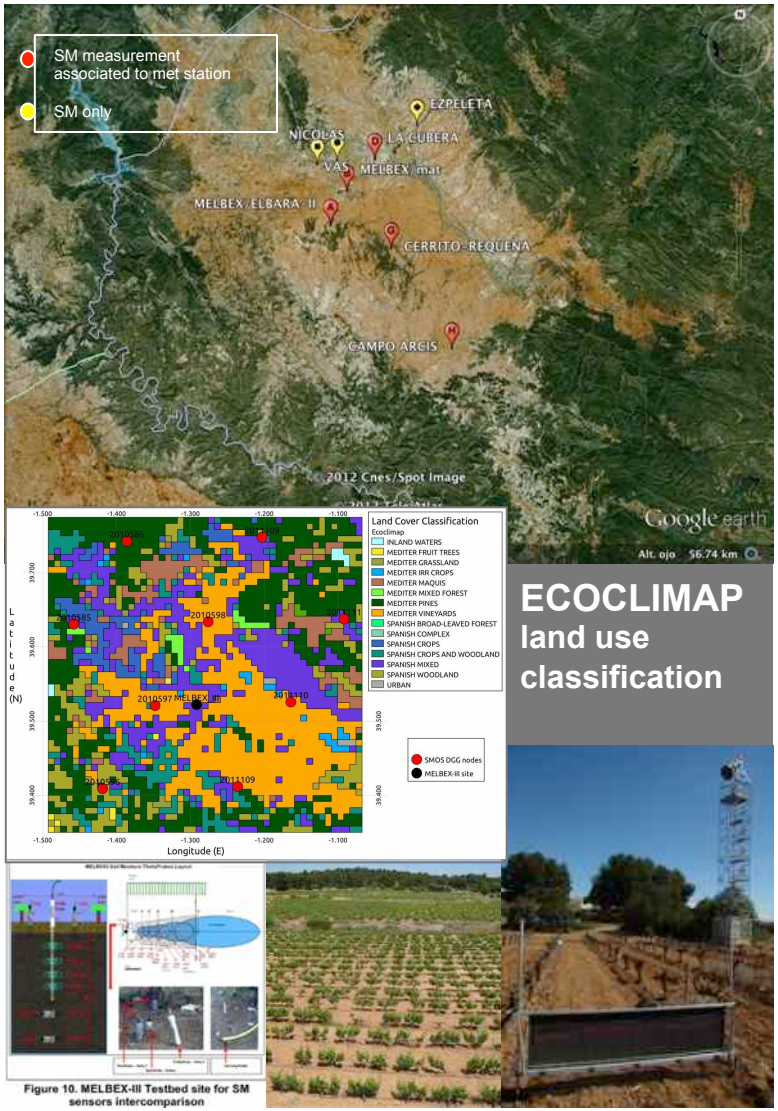


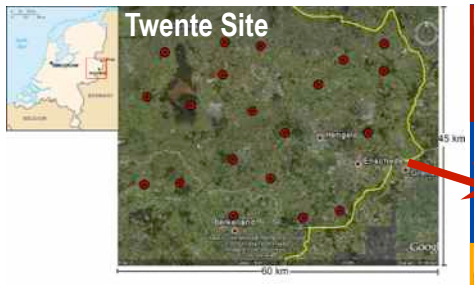
Figure 10. MELBEX-III Testbed site for SM sensors intercomparison

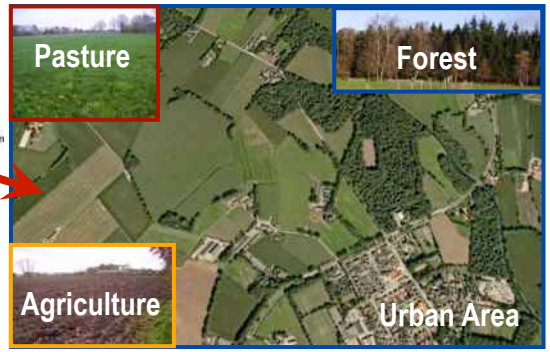
ECOCLIMAP land use classification

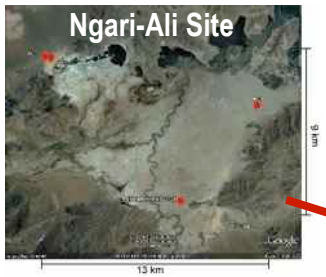
- Validation of SMOS (+SMAP) L1 & L2 land data & products
- Ground data for
  - L1B_TB, L1C_TB
  - L2_SM_A, L2_SM_P, L2_SM_A/P, L3_SM_A, L3_SM_P, L3_SM_A/P
  - L4_SM
- 8 (+ 1) Domains with different measuring points in each
- Data Transmission: manual download
- Expected Latency
- Status: operational

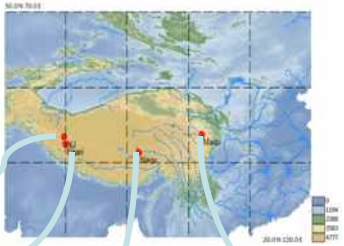
Measurement Type	Method	Depths (cm)
Delta-T ML2x	Capacitance Probe	5
Delta-T PR2/4	Capacitance Probe	10/20/30/40
Stevens Hydra Probe	Capacitance Probe	5 7,5
EnviroSCAN (IVIA) (2007-2011)	Capacitance Probe (dry & irrigated)	10/30/60/100
Surface Roughness	Roughness Profiler	
LAI	LICOR Sensor	
VWC	Dendrometer	

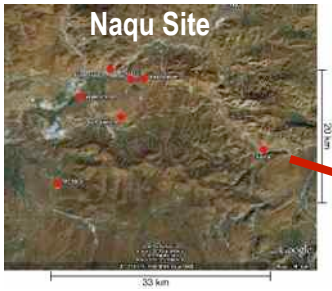
SMAP Eurasia Core Validation Site – **PI: Prof. Bob Su**
Twente, the Netherlands & Tibetan Plateau, China

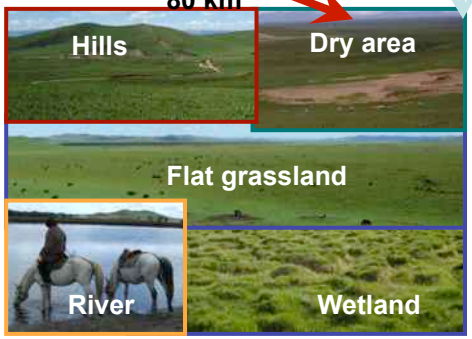












- **Research Focus:**
  Measuring, remote sensing and modeling the land surface states (soil moisture, temperature, vegetation) and heat fluxes (latent, sensible);
- **SMAP Products to Validate:**
  L2_SM radar/radiometer, L3/L4
- **Site Characteristics:**

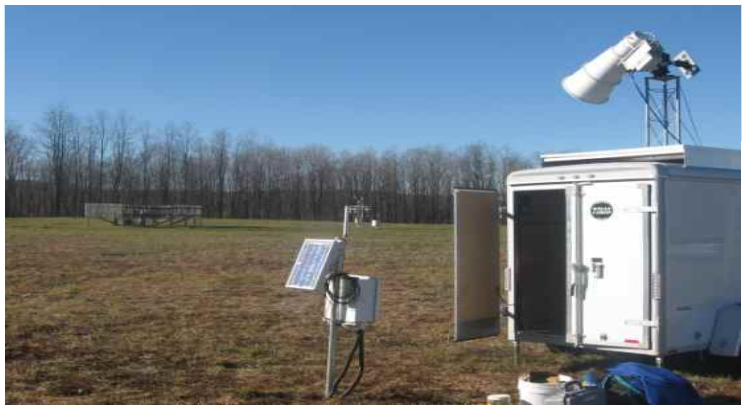
	Twente	Naqu	Maqu	Ngari
Nr. Domains	1	1	1	2
Nr. Points	22	7	20	20

- **Method of Data Transmission**
  Data can be downloaded through FTP site maintained by ITC-WRS.
- **Expected Latency:**
  For the Tibet-Obs sites, we expect to provide data before and after the monsoon seasons each year. This is related to the remoteness of the sites and the harsh environmental conditions. For the Twente site, monthly data can be provided.
- **Status:**
  All four SM/ST observation networks are operational.

	Twente	Naqu	Maqu	Ngari
Data Downloaded	Per 3 Mons.	Per Year	Per 3/6 Mons	Per Year
Calibration	Gravimetric	Gravimetric	Gravimetric	Gravimetric

Measurement Type	Method	Depths
Soil Moisture	ECH_2O (Capacitance probe) Type: EC-10 & EC-TM	Naqu Station -2.5, -7.5, -15, -30 , -60cm Maqu & Twente Station -5, -10, -20, -40, -80cm Ngari Station -5, -10, -20, -40, -60, -80cm
Soil Temperature		
Micrometeorological	AWS, PBL Tower	1.5, 2, 5, 6.5, 10, 14.0 m

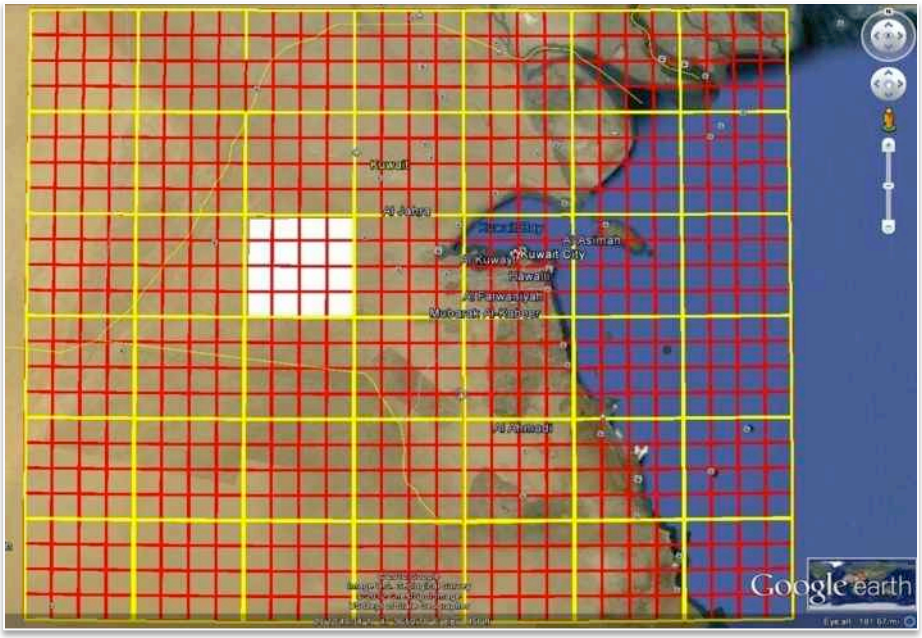
NOAA-CREST Soil moisture observation network-PI: M. Temimi Millbrook, NY and Caribou, ME



- Continuous brightness temperature observations in relations to dynamic changes in surface conditions including soil moisture and vegetation
- P, A, P/A soil moisture and freeze/thaw
- Six sites; two observations (6 probes) each
- L band: through Internet; soil moisture: cell phone antenna for one site
- L band in near real time; soil moisture: few days
- Operational

Measurement Type	Method	Depths
Soil moisture	Hydra Probes	2.5 cm
Soil moisture	Hydra Probes	5 cm
Soil moisture	Hydra Probes	10 cm

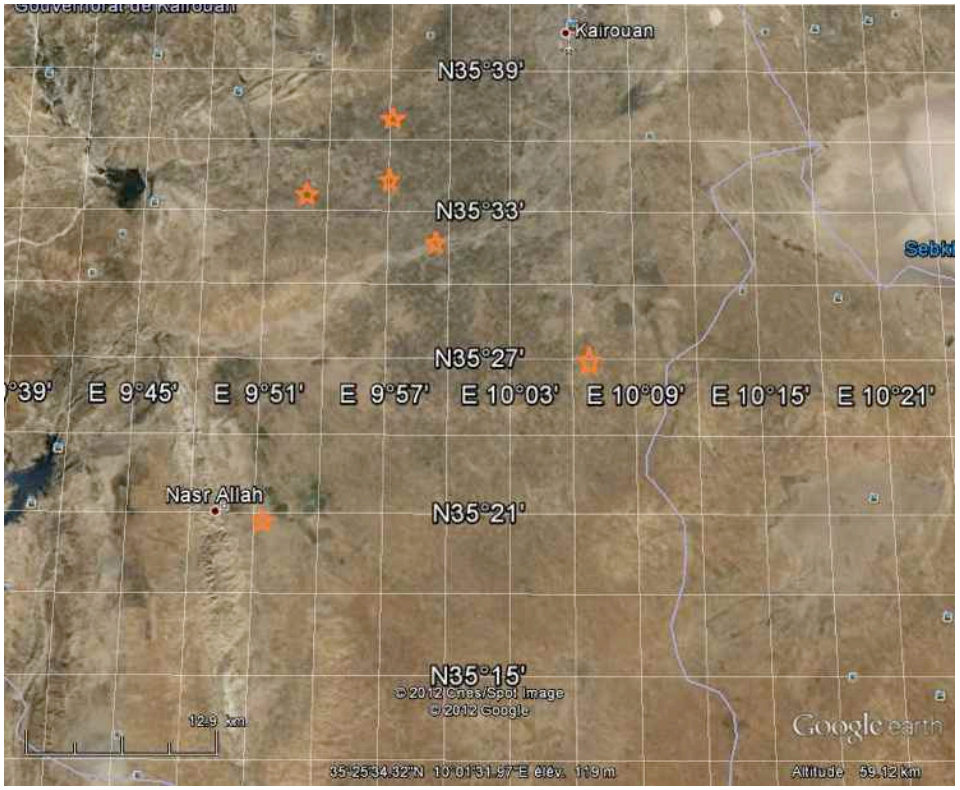
Test Site: Kuwait Desert - PI : Hala K Al Jassar
Location : Kuwait



- Primary focus of research: Measuring of Soil Moisture, Brightness Temperature, Surface Temperature, Surface Roughness, Backscattered Coefficients
- SMAP Product to validate: Soil Moisture products (with the resolutions of 3km,9km and 36km) required.
- Number of Domains: One domain under supervision with Points per area as below,
  - 10 points per 9 sq. km
  - 90 points per 81 sq. km
  - 1440 points per 1296 sq. km
- Data transmission via FTP,E-mail.
- Latency: Minimum of 3 days
- Status: Proposal Under Review by "Kuwait Foundation for the Advancement of Sciences" (KFAS)

Measurement Type	Method	Depths
Soil Moisture	Gravimetric	0-1.5 m
Soil Moisture	Time-Domain Reflectometer(TDR)	0-10 cm and 0-20 cm
Soil Moisture	Neutron -probe	0-1.5 m
Temperature	Soil thermometer	0-1.5 m

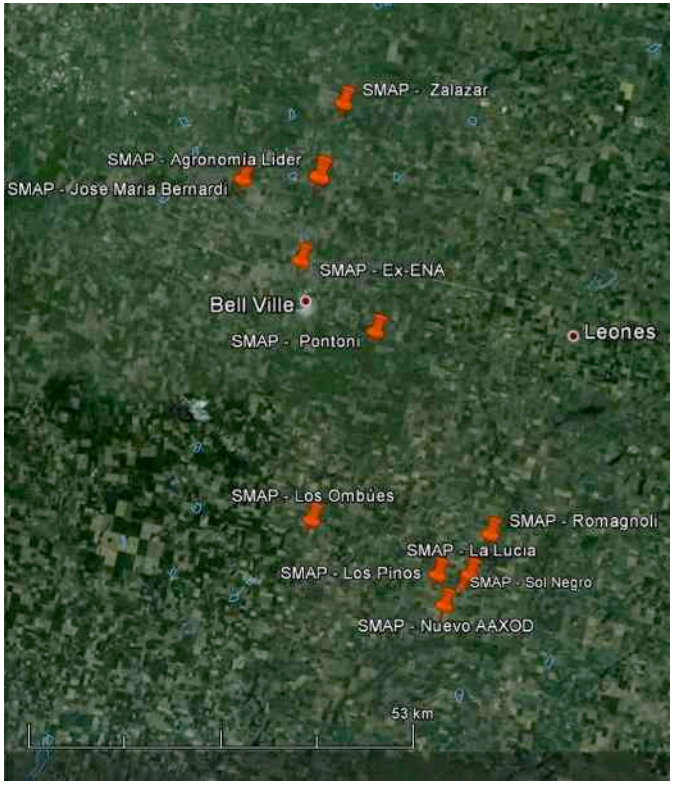
Merguellil-Mehrez Zribi
Tunisia, North Africa



- Hydrology, surface fluxes
- SMAP Products to Validate: radar, radiometer data, soil moisture Level2
- 1 site, a network with six thetaprobe points (others will be added)
- Method of Data Transmission: ?
- Expected Latency: one week
- Status: installation realized

Measurement Type	Method	Depths
moisture	Thetaprobe PR2 Gravimetric measurements	**5**, 20, **40**, 80, 120
temperature	thermostat	5, 40

Bell Ville – Marc Thibeault
Córdoba, Argentina

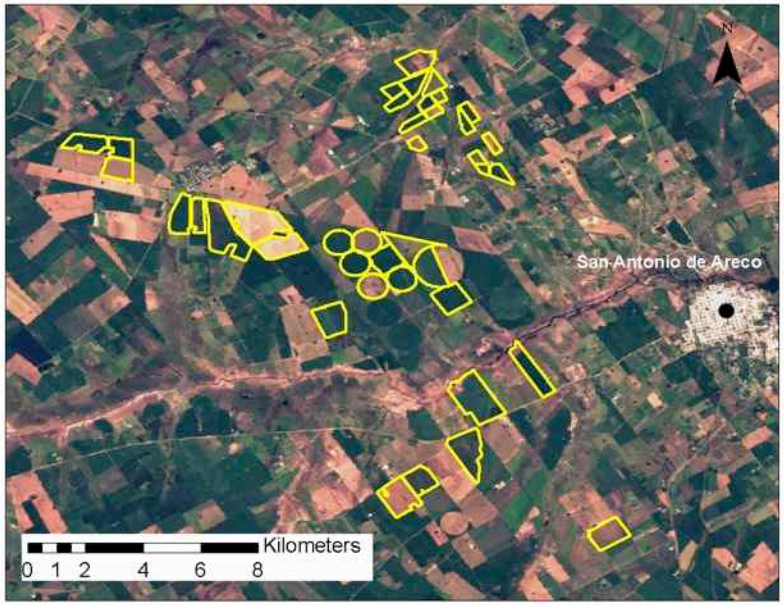


- Validation of Surface Soil Moisture with SAR
- L2_SM_A, L2_SM_P, L2_SM_AP and L3´s
- 3 Domains (3, 9 ,70 km) with ~ 9 points in each
- RTU + Cell Phone Network
- Expected Latency: < 1 day
- Status: in construction

Measurement Type	Method	Depths
FDR (HP II)	Automatic	5 cm
FDR (HP II)	Manual	5 cm*
Grav./Vol.	Manual	5 cm*

* Calibration purposes

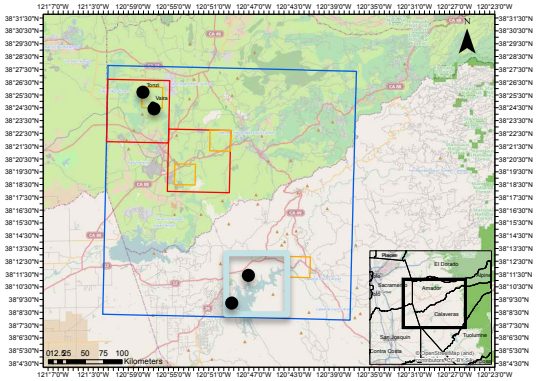
Areco (Rolling Pampas) - Haydee Karszenbaum (IAFE-INTA teams) Buenos Aires, Argentina



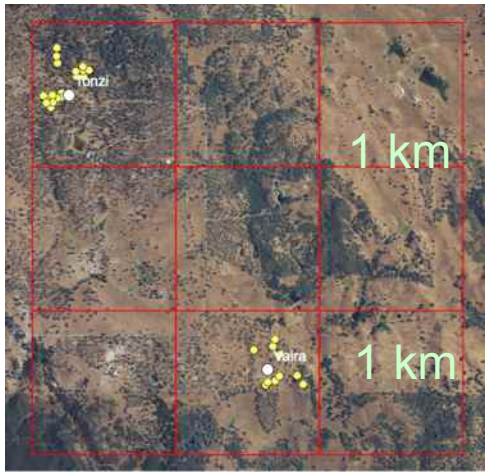
- Primary focus of research at the site: **Soil moisture algorithm developments from microwave imagery**.
- SMAP Products to Validate: **soil moisture.**
- Number of Domains and number of points in each: **TBD.**
- Method of Data Transmission: **GPRS.**
- Expected Latency: **~ 6 hs.**
- Status: **in progress.**
- Others: **JECAM site since 2010**

Measurement Type	Method	Depths
Soil moisture (continuous)	Dielectric probe (Hydra Probe II)	10 cm
Soil moisture (intensive)	Dielectric probe (Hydra Probe II)	10 cm
Soil moisture (intensive)	Gravimetric	10 cm
Soil roughness	2D Laser profiler	N/A
General atmospheric variables	several	N/A

SoilSCAPE – PI Mahta Moghaddam
California Central Valley (Tonzi Ranch +)



Overview of 36 km domain with current installation shown with black dots

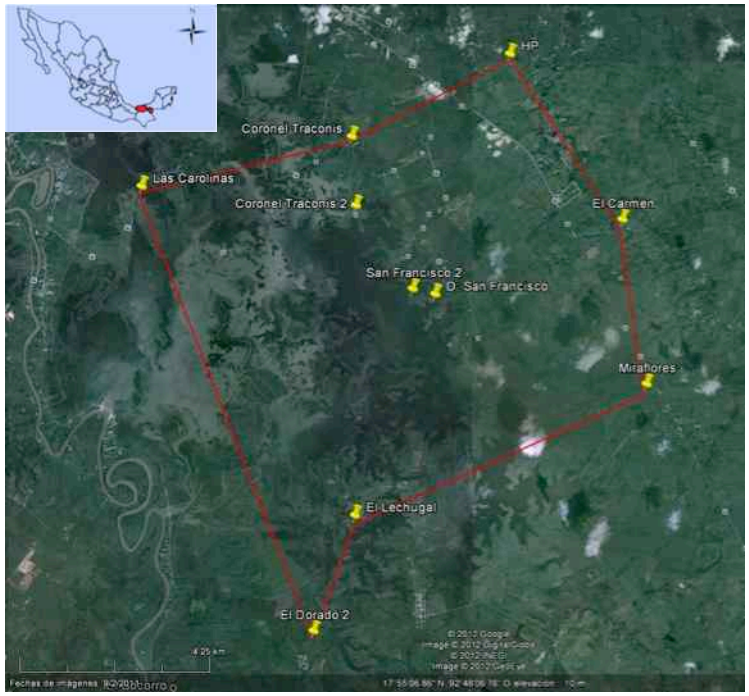


One of 3km grids

- Focus: Large scale wireless sensor network for validation of surface and root zone soil moisture retrievals
- SMAP Products to Validate: L2 (active, passive, joint) and L4 soil moisture
- 4-6 domains, 1km, 3km, 9km, 36km; 150 nodes total
- Method of Data Transmission: wireless over AT&T, T-Mobile, Verizon networks
- One hour typical max latency
- 50% installed; planned completion by 12/12; all installed nodes are active
- Soilscape.usc.edu/drupal

Measurement Type	Method	Depths
Soil moisture	Volumetric, EC-5	3 points to 30-50 cm
temperature	Planned at subset	shallowest

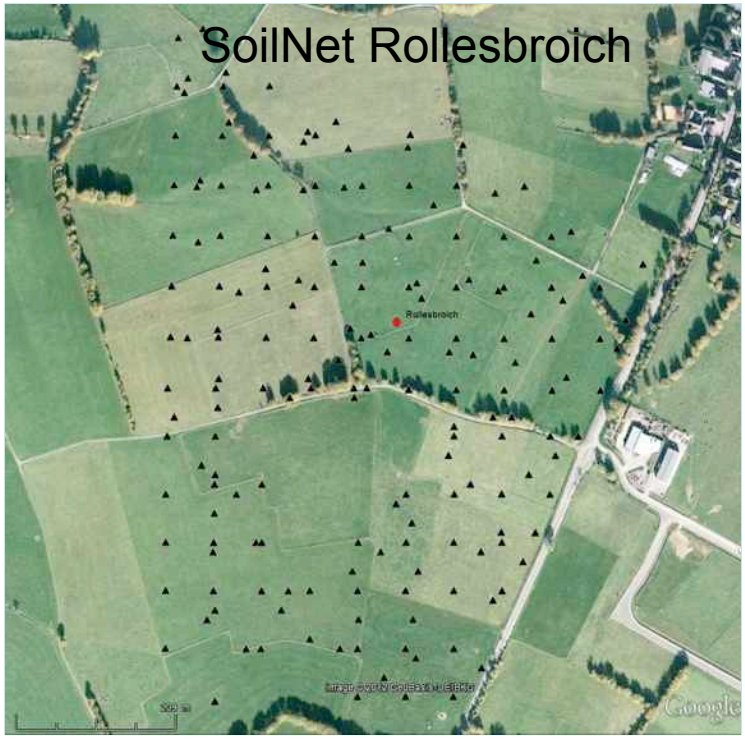
Zapotes' Basin – Judith Ramos
Tabasco, Mexico



- Soil , vegetation and atmospheric measurements
- L4-SMAP Soil moisture
- 2 Domains of 9km cell and 2 domains of 3km cell, with 9 points in each
- Manual (Datalogger)
- TDR 20 min and FDR a week
- Working 1 domain of 9 km cell

Measurement Type	Method	Depths
Soil moisture	Gravimetric and FDR	0- max depth
Soil moisture	TDR, wireless	0-2.5,5,10,20,30
Soil temperature	probes	0-2.5,5,10,20,30
Soil, and Vegetation	Texture, roughness, geometry	

TERENO Rur/Eifel Observatory
Carsten Montzka, Juelich (Germany)



- Primary focus: Soil moisture variability
- SMAP SSM Product Validation
- 2 SoilNet domains with 185 and 150 nodes, 7 Cosmic Ray stations, ground-based and airborne radar/radiometer
- Transmission: GPRS, Satellite
- Expected Latency: < 2h
- Operational status

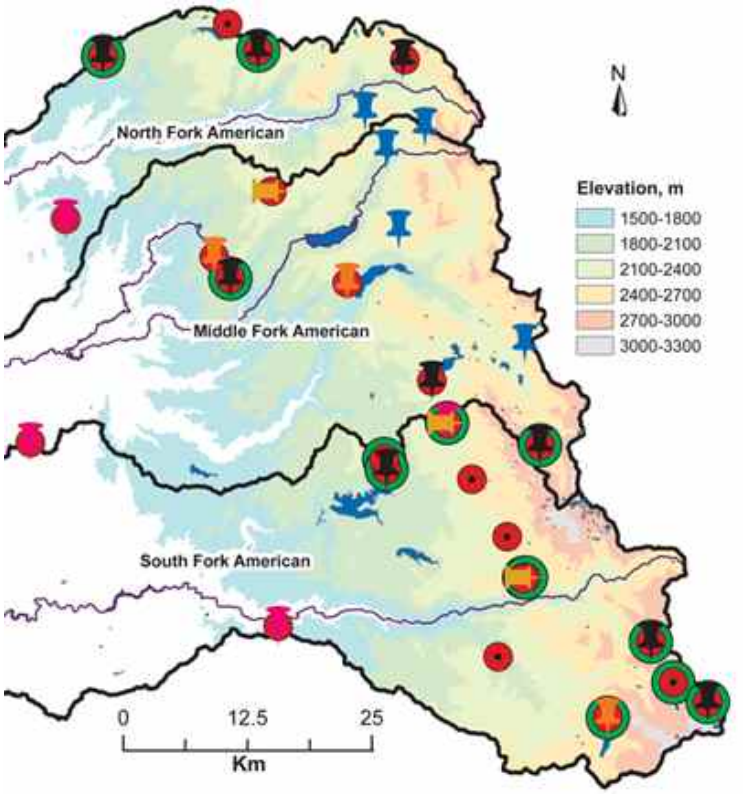
Meas. Type	Method	Depths
Soil Moisture	Capacity	5, 20, 50 cm
Soil Moisture	Cosm. Ray	~ Root zone
Soil Temp.	Digital T	5, 20, 50 cm

Hydrologic Open Air Laboratory
Petzenkirchen Catchment, Austria

- *Focus of research*: SM remote sensing (spatial scaling, diurnal variation), nutrient pathways, sediment transport, evapotranspiration
- *Products to validate*: L2 SM_A, SM_A/P
- 1 Domain (6.4 ha), 36 points
- *Data Transmission*: ZigBee Wireless network → **ISMN**
- *Latency*: NRT
- *Status*: installation starting February/ March

Measurement Type	Method	Depths
Soil moisture and temperature	SPADE	0.05, 0.10, 0.20, 0.50
Soil Moisture for calibration	Handheld TDR and Gravimetric sampling	0.05, 0.10, 0.20, 0.50
Precipitation	Pluvio	Surface

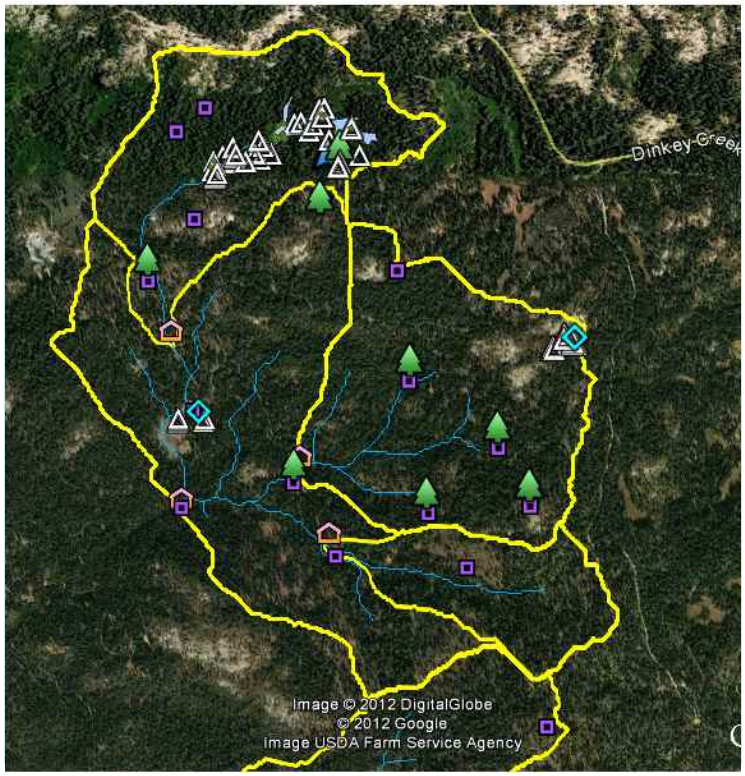
American River basin – R. Bales & J. Hopmans
Central Sierra Nevada



- Water balance research
- Soil moisture
- 20 sets, each with 10 nodes in 2000 km^2 area
- Some cell phone telemetry, some manual data download
- Expected latency very good
- Status: 3 sets of nodes operational, others under construction

Measurement Type	Method	Depths
VWC	Decagon	10-90 cm

Southern Sierra CZO – J. Hopmans & R. Bales
South of Shaver Lake



- Critical zone processes, hydrology
- Soil moisture, water balance
- 50 soil moisture nodes in 2 km^2 area
- Some cell phone telemetry, some manual data download
- Latency very good
- Status – operational 5 yr

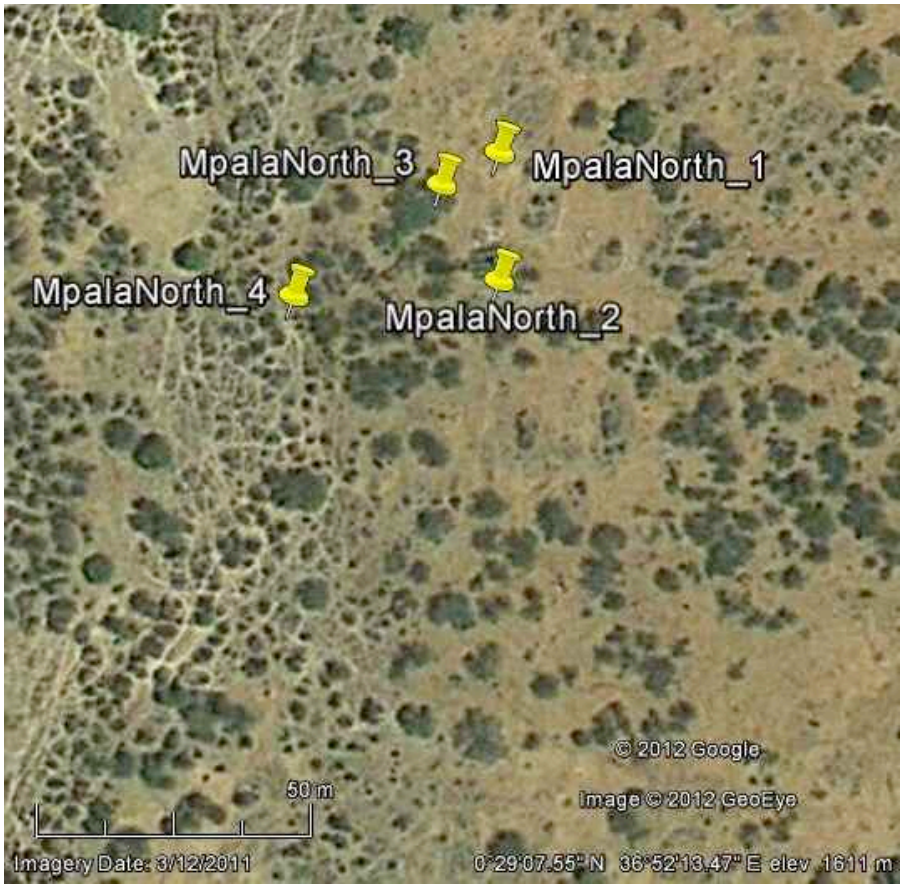
Measurement Type	Method	Depths
VWC	Decagon	10-90 cm

Sodankylä-Pallas Supersite - Jouni Pulliainen
Sodankylä, Northern Finland

- Surface-atmosphere interactions
- Freeze/thaw, soil moisture
- 13 automatic soil moisture / temperature loggers each having 5 to 10 sensors; about 10 frost tubes; CO_2 and CH_4 fluxes; etc.
- Data transmission via internet and modems and manual (frost tubes)
- Expected Latency: stations with solar panels and batteries – data sent once per day (modem), internet connected near real time
- Operational

Measurement Type	Method	Depths (cm)
Soil moisture	Decagon 5TE	5,10,20,40,80
Soil moisture	Theta probe	2,10;5,10,20,40,80
Soil temperature	Thermistors	2,5,10,20,40,80
Soil freeze state	Frost tubes	0 – 200 cm
Greenhouse gases	Flux meas.	Net flux

Mpala North- Kelly Caylor
Laikipia, Kenya



- Long-term flux tower aimed at establishing an ecohydrological framework for understanding land degradation in semi-arid savannas
- 4 points at 5 depths each
- Data relayed via cell modem
- Data transmitted daily
- Ongoing since 2010
- Second domain
  - ✓ Kenya Long-term Exclosure Experiment studying effects of herbivory on tree community structure
  - ✓ 3 points at 2depths each
  - ✓ Data downloaded via direct connection to computer
  - ✓ Data transmitted weekly
  - ✓ Soil moisture observations ongoing since 2010

Measurement Type	Method	Depths
Soil moisture	TDR Probe	5, 10, 20, 30, 100cm
Soil temperature	Thermocouple	5, 20 cm
Rain gauge	Tipping bucket	

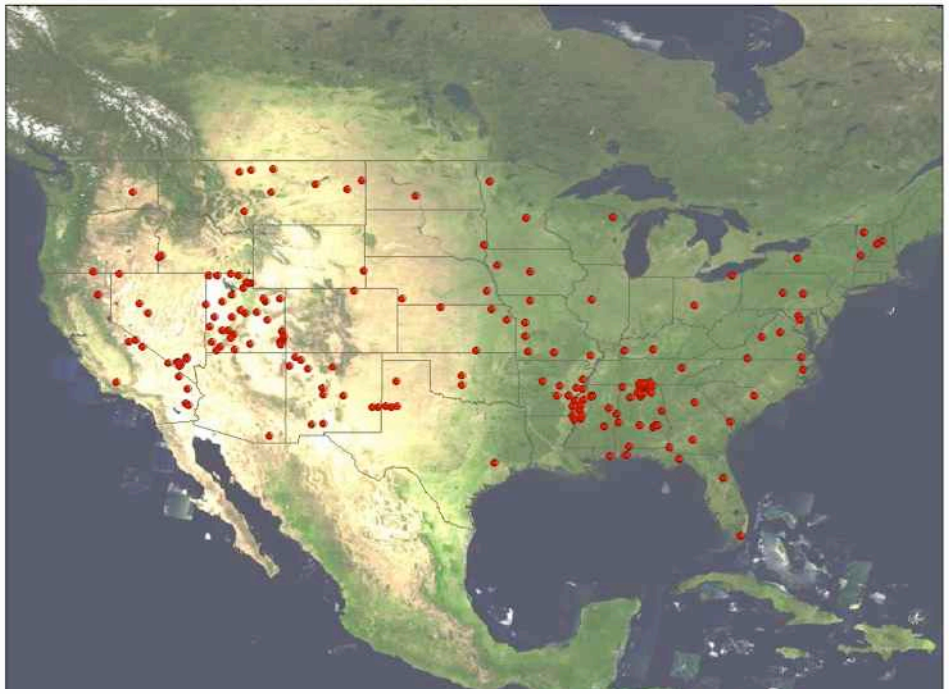
SMOSMANIA - JC Calvet (Meteo-France)
Southern France

- Validation of soil moisture products
- Sparse network of 21 stations
- GSM Data Transmission
- Latency ~1 day to 1 month
- Since 2007

Measurement Type	Method	Depths
Soil moisture	ThetaProbe	5-10-20-30 cm
Soil temperature	PT100	5-10-20-30 cm

SMOS history

USDA-NRCS-Soil Climate Analysis Network – D. Harms Continental U.S.

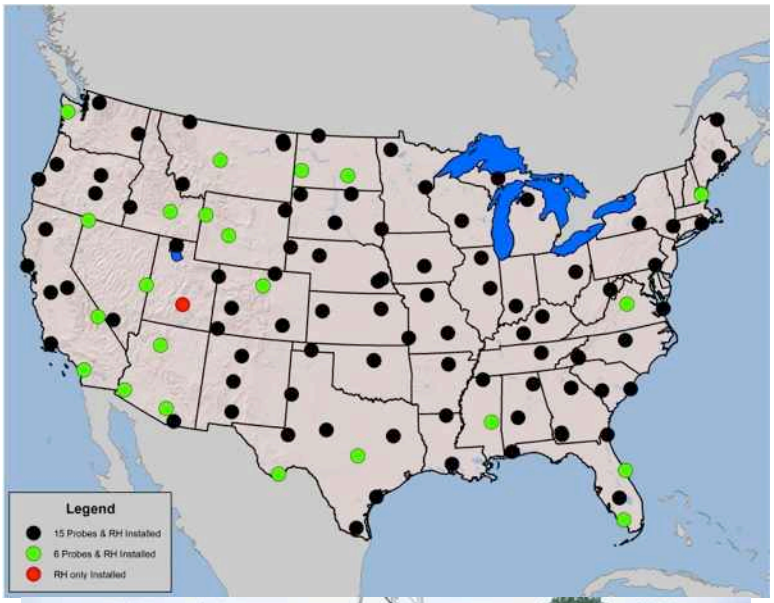


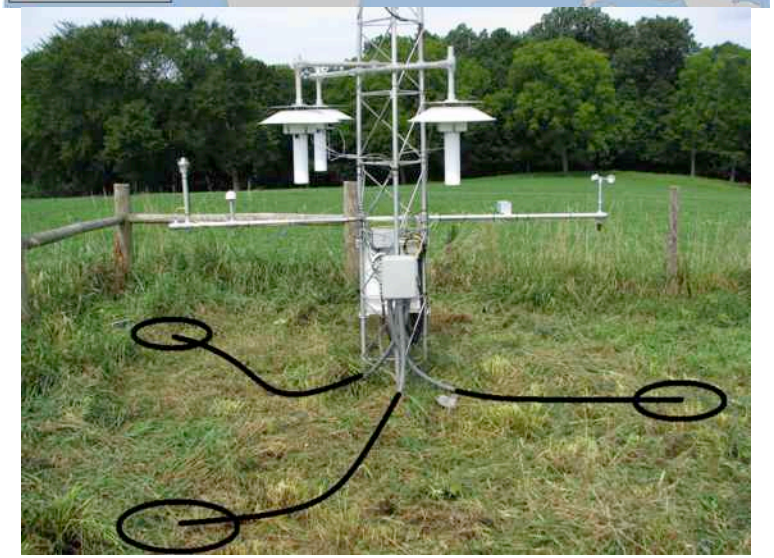
- Natural Resource Conservation Service monitoring
- SMAP Soil Moisture (surface and profile)
- CONUS - 181
- Telemetry and FTP
- Hourly
- Status – Operating and Developing

Measurement	Method	Depths
Soil Moisture	Hydra	5, 10, 20, 50, and 100 cm
Soil Temperature	Hydra	5, 10, 20, 50, and 100 cm
Precipitation	Tipping Bucket	-

AMSR-E and SMOS history

U.S. Climate Reference Network – M. A. Palecki and J.E. Bell, NCDC
National Sparse Network with Redundant Measurements

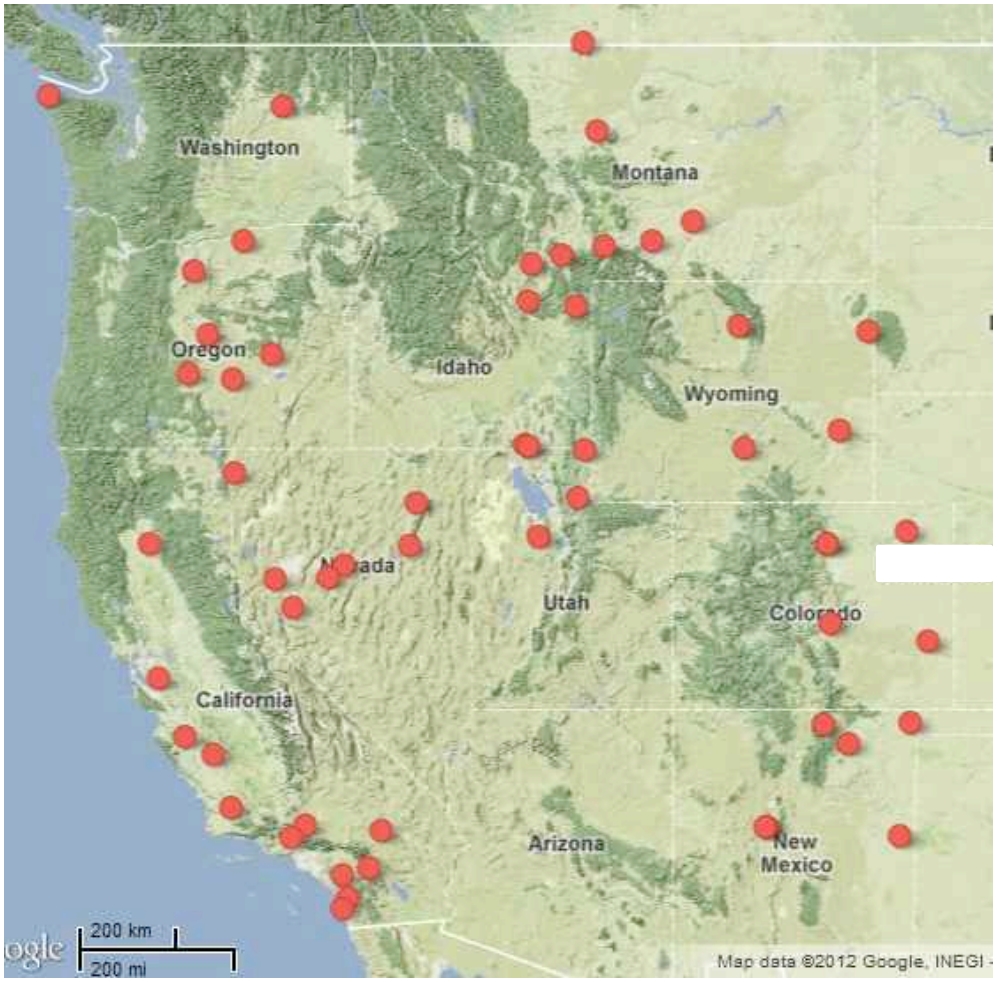




- USCRN observes climate change
- Soil Moisture/Temperature Product Validation with sparse network
- 114 sites, 20 field calibrated in FY13
- Satellite to NCDC, Internet to SMAP
- 2-3 hours
- Instruments in place, communication in place, gravimetric sampling of subset planned for FY13

Measurement Type	Method	Depths (cm)
Soil Moisture	Coaxial Impedance Dielectric	5,10,20,50,100
Soil Temperature	Thermistor	5,10,20,50,100
Meteorological Variables (air T, prec, surface T, global solar	Platinum resistance thermometer, weighing bucket, IR, pyranometer	150 Above Ground

GPS Reflections: NSF Plate Boundary Observatory Network
Eric Small and Kristine Larson, CU Boulder



- Estimate hydrologic variables from GPS multipath
- Surface soil moisture
- 60 active sites (40 more soon)
- Data available online
- Daily updates

NEON
United States

- **Research focus:** Climate change, land use & invasive species impacts on natural resources and biodiversity
- **SMAP Products to Validate**: Soil moisture, Freeze/thaw, & NEE
- 60 sites, 5 soil moisture profiles per site, 8 measurements per profile
- **Data Transmission**: Hard-wired network
- **Latency**: ~30 mins (automated QA/QC)
- **Status**: Under construction, expected completion 2017

Measurement Type	Method	Depths
Soil water content	*In-situ* capacitance probe	0-2 m (8 depths by soil horizon)
Soil temperature	*In-situ* PRT	0-2 m (8 depths by soil horizon)

Soil Moisture Cal/Val Partner Discussions

- Update on status
  - *One slide from each Partner*
  - *Poster session after presentation*
  - *Roughly arranged to start with Core sites and end with Contributing sites (sparse networks)*
- **Assessment of readiness and value to SMAP Cal/Val**
- **Suggestions from Cal/Val Working Group to the Cal/Val Partners or the SMAP Project**

Status of SMAP SM Cal/Val Partners

Name **(Slide)**	Location	Acknow-ledged	Answered Questions	Answered Survey	Type	Assessment of Status	Comments
Cosh	USA (6)	Y	Y	Y	2	3	Includes the 3 established sites (status 3) and 3 newer sites (status 2).
Seyfried	Idaho	Y	Y	Y	2	3	Established site
Moghaddam	California	Y	Y	Y	2	1	Currently being installed.
Hopmans	California	Y	-	Y	2/3	2/0	Collection of sites in California. None are 5 cm. Closer to a Type 3 than 2.
Termini	NY, ME	Y	Y	Y	3	2	Several points in a small area with a microwave radiometer
Small	USA	Y	Y	Y	3	2	A subset of the network will be CV at GPS footprint scale.
Palecki	USA	Y	-	-	3	2	Funding issues; will CV a subset at site scale
Harms	USA	Y			3	3	New POC, being updated
Hernandez	Mexico	Y	Y	Y	3	2	Some new sensors that are still at Status 1
McNairn	Manitoba	Y	Y	Y	2	2	Will benefit from SMAPVEX12
Berg	Saskatchewan	Y	Y	Y	2	3	Two networks with slightly different issues. More work is planned.
Thibeault	Argentina	Y	Y	Y	2/3	2	Looks promising with additional work planned.
Karszenbaum	Argentina	Y	Y	-	2	0	Issues; still working out support/ likely to have schedule problems
Walker	Australia	Y	Y	Y	2	3	ISMN
Fernandez	Spain	Y	Y	Y	2	3	Financial support issues (ISMN) will limit involvement.
Calvet	France	Y	Y	Y	3	3	Switching from research to operational
Lopez-Baeza	Spain	Y	Y	Y	2	3	Will collaborate
Dorigo	Austria	Y	Y	Y	2	0	Small site with plans to use additional sites to scale up
Montzka	Germany	Y	Y	Y	2/3	3	8 locations; 2 are dense networks over 1 km and 6 are cosmic ray
Su	Netherlands	Y	Y	Y	2	3	4 sites, all covering ~40 km, 3 in China
Rautainen	Finland	Y	Y	Y	3	3	Mix of approaches, primary site is next to a river.
Zribi	Tunisia	Y	Y	Y	3	3	Currently supporting ASCAT
Caylor	Kenya	Y	Y	Y	3	2	Acknowledged but did not provide requested info.
Jassar	Kuwait	Y	Y	-	3	0	Waiting on funding.

Type: 1-Intensive field sampling, 2-Dense network at footprint scale, 3-Single sites/points
Status: 0-Planning, 1-Installing, 2-CV ongoing, 3-Ready for integration

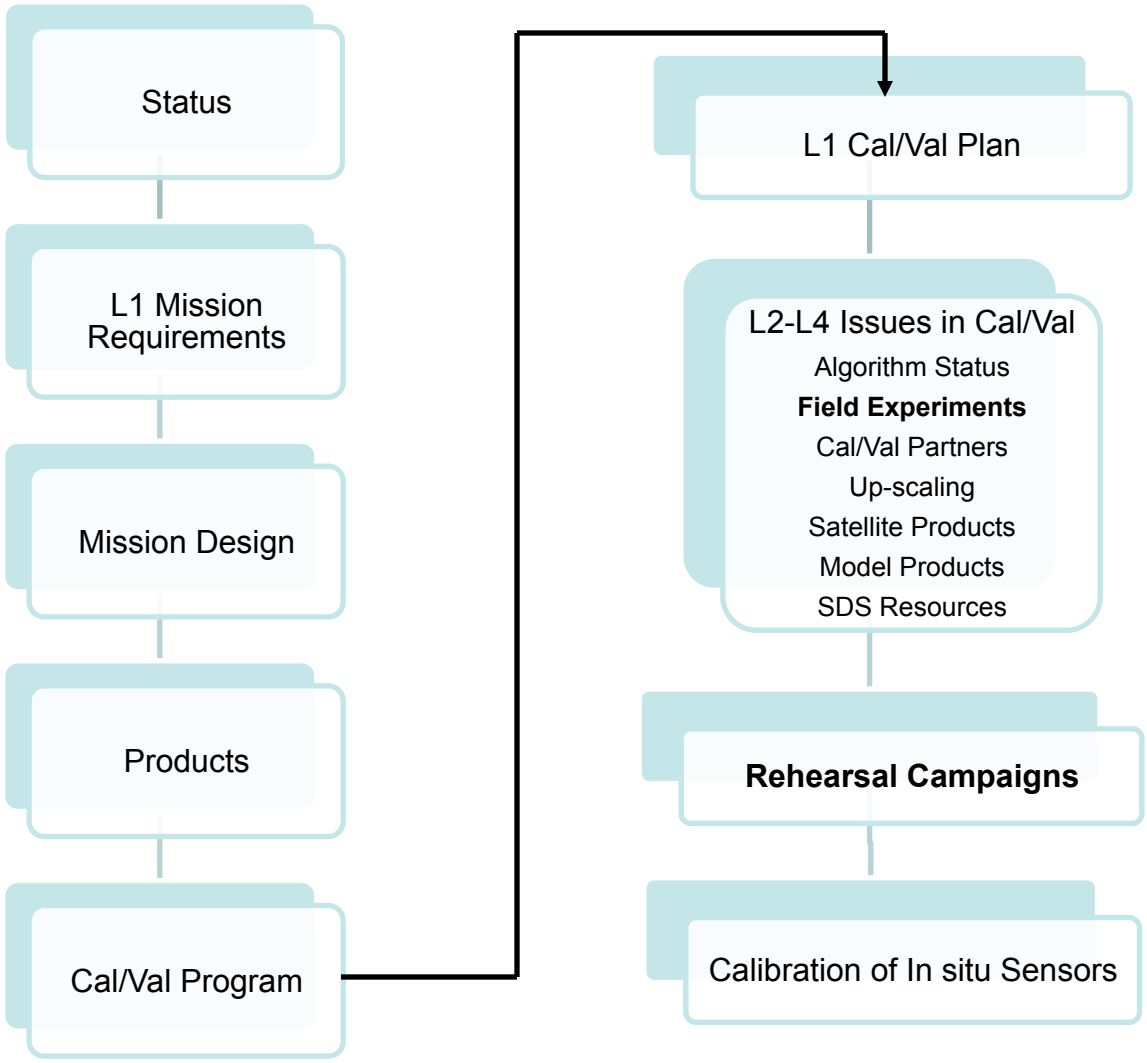
New/Potential SMAP SM Cal/Val Partners

Name **(Slide)**	Location	Acknow-ledged	Answered Questions	Answered Survey	Type	Assessment of Status	Comments
COSMOS	USA	Y			3	3	Agreed to collaborate (M. Zareda)
NEON	USA	Y			3	1	Agreed to collaborate (E. Ayres)
Koike	Mongolia				2	3	Data would likely be available but download would be in late summer. I. Kaihotsu indicated that this must be resolved with Koike.
Chung	Vietnam	Y				0	Aircraft-based radiometer
Kim	S. Korea	Y				0	Agreed to explore the development of a program

SMAP Cal/Val Partners-Recent Activities

- Ongoing efforts to formally engage more Partners.
- Recent soil moisture additions
  - *Valencia, Spain*
  - *NEON*
  - *COSMOS*
- L3 Freeze/Thaw is working to add sites
- L4 NEE has identified sites and is making progress in agreements
- The Phase 1 Rehearsal will play an important role in resolving the delivery process and assessing the quality of these resources.

Workshop Overview



Cal/Val Workshop Agenda-Day 2

Thursday (November 15)		
0815	Cal/Val Partners Status Report	Jackson
0915	Posters and Break	
	Implementing Sparse Networks in Validation	*Crow (Lead)*
1000	Sparse Network Up-Scaling	Crow
1030	Discussion: How to Implement in Validation?	Crow
	Satellite Validation Updates	*Njoku (Lead)*
1045	SMOS	Kerr/Walker
1100	SAOCOM	Thibeault
1115	Aquarius	Le Vine
1130	Satellite Products in SMAP Validation	Bindlish
1215	*Lunch*	
1315	Model-based Products in Validation	Reichle
1400	SMAP SDS Resources for Data Product Validation	Weiss/Cruz/Cuddy
1445	Break	
1500	***Validation Rehearsal Discussion and Planning***	***Jackson (Lead)***
1700	*End*	