

COSMOS: COsmic-ray Soil Moisture Observing System

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University of Arizona

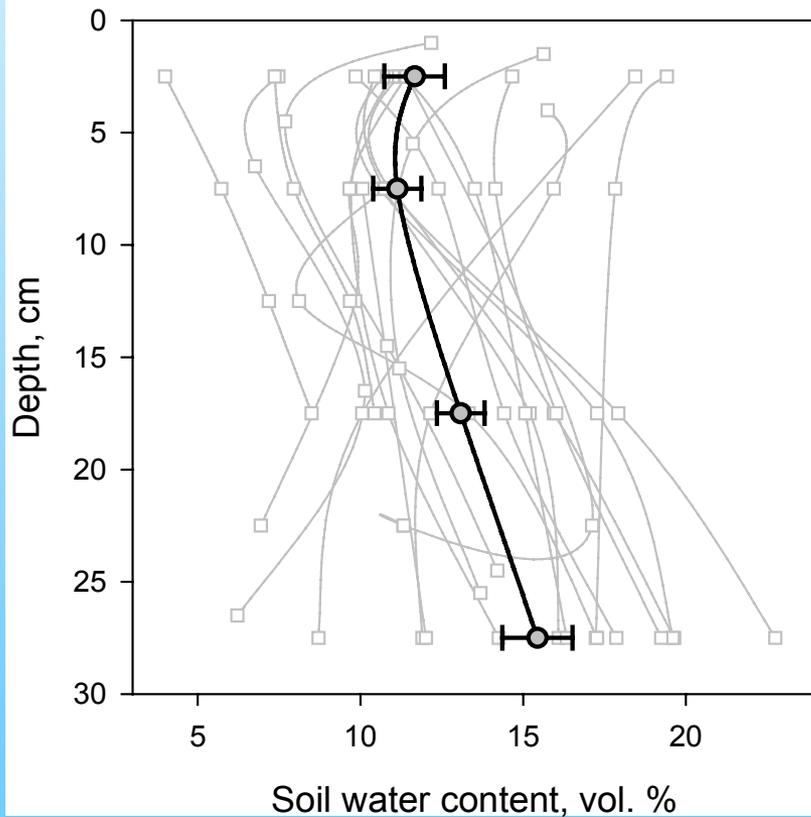
SMAP cal/val workshop, Oxnard, 4 May 2011

Some aspects of cal/val experiments and methods

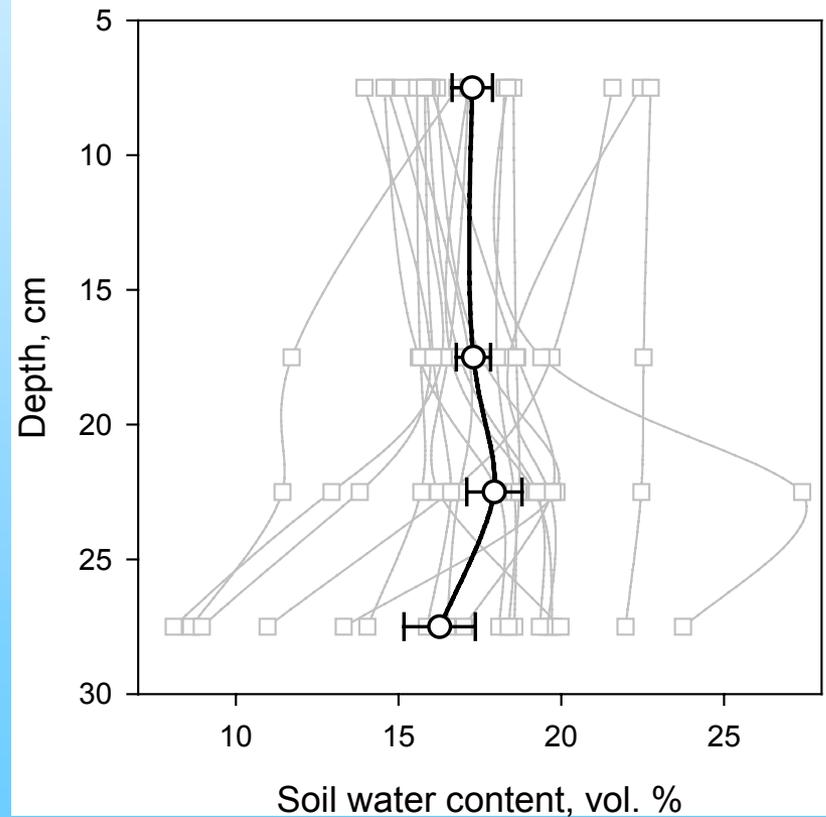
- (1) Representative of field conditions**
- (2) Long and well-calibrated time series**
- (3) Scalable to SMAP pixel size**
- (4) Low latency**
- (5) Roving surveys**

Variations in soil moisture, circle, 200 m radius

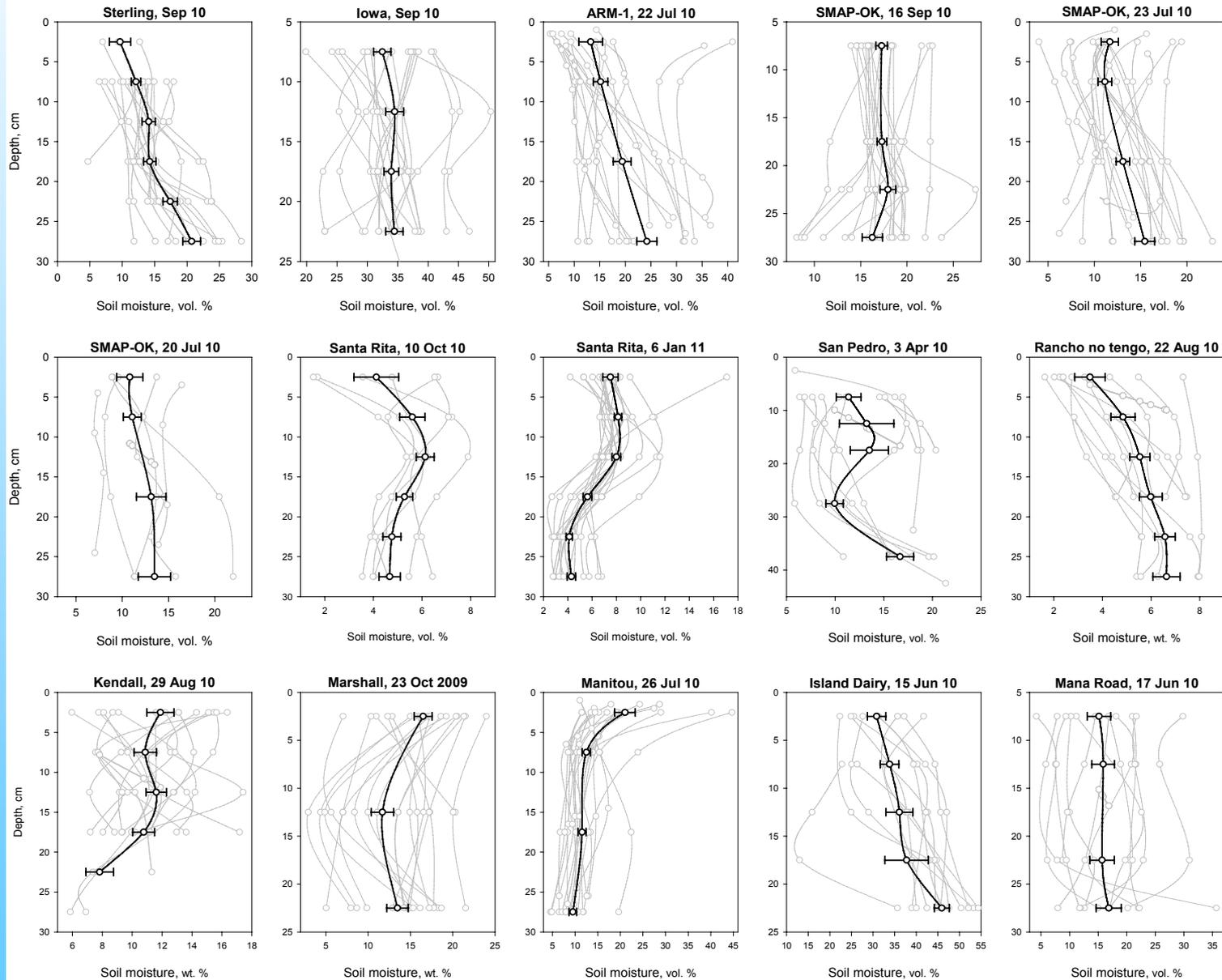
SMAP-OK
23 July 2010



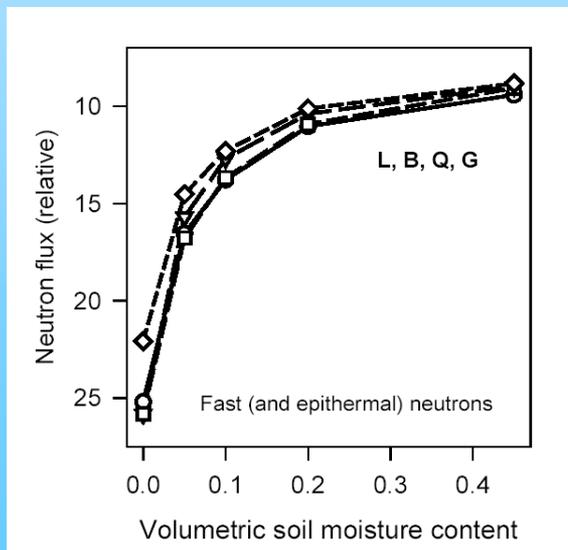
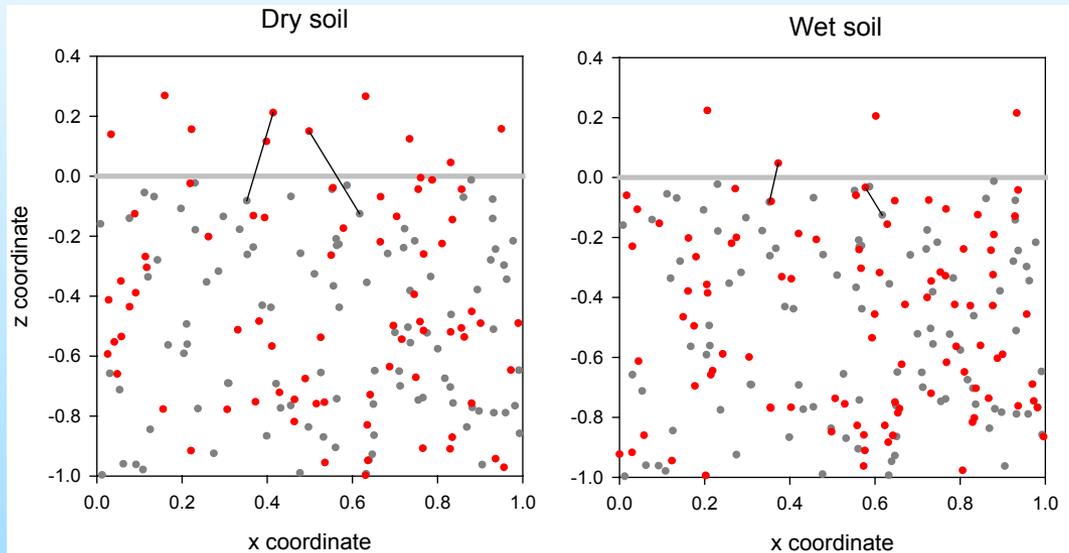
SMAP-OK
16 September 2010



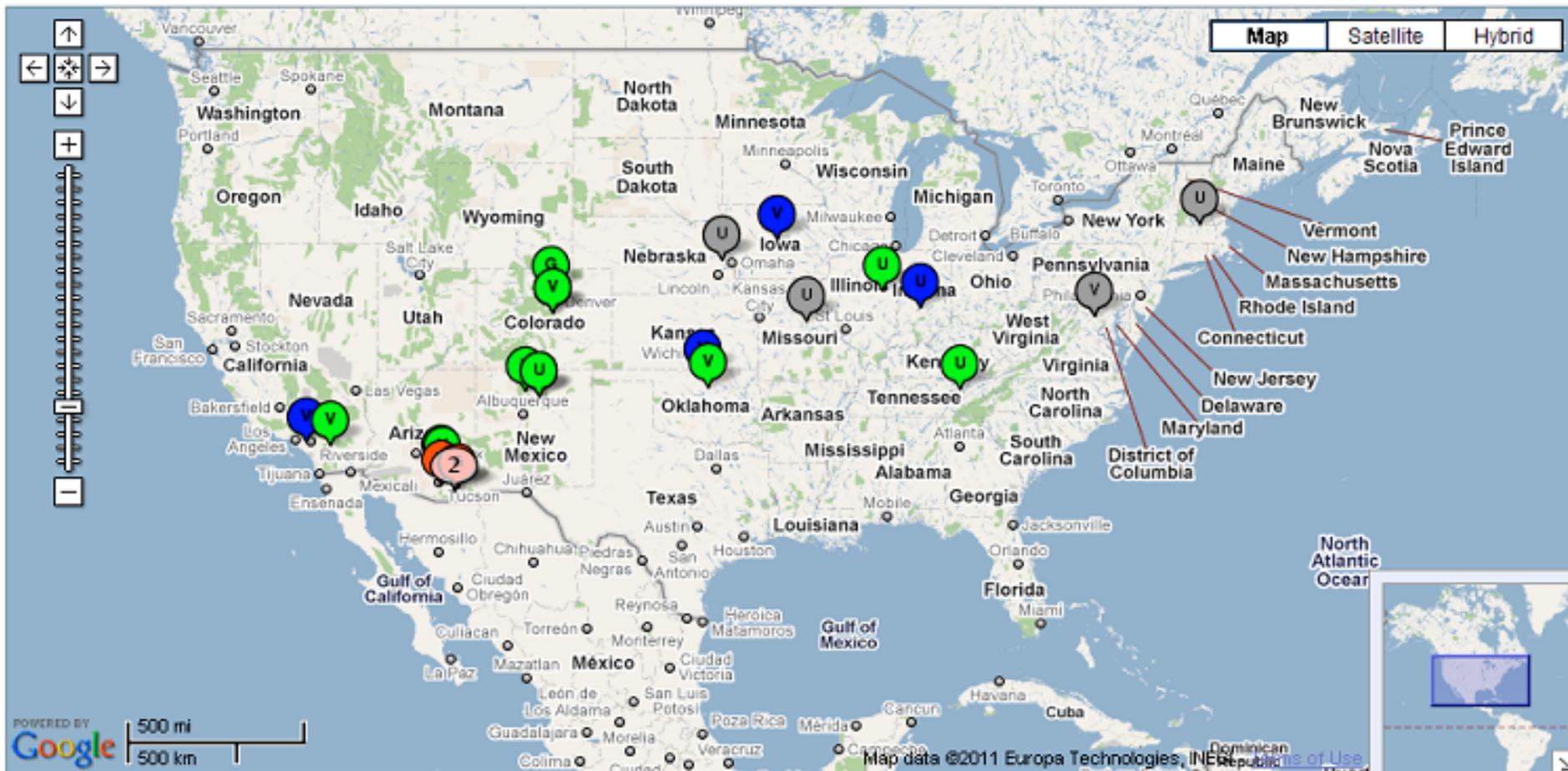
Variations in soil moisture, 15 sites



Measuring soil moisture with cosmic rays



COSMOS sites - 48 states (May 2011)

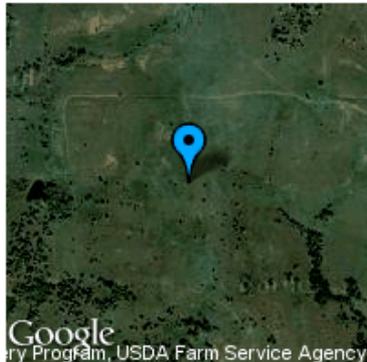


Soil Moisture (V=volumetric, G=gravimetric, U=uncalibrated)

- 0 - 05%
- 05 - 15%
- 15 - 25%
- 25 - 35%
- > 35%
- mixed

COSMOS data: SMAP-OK

SMAP-OK



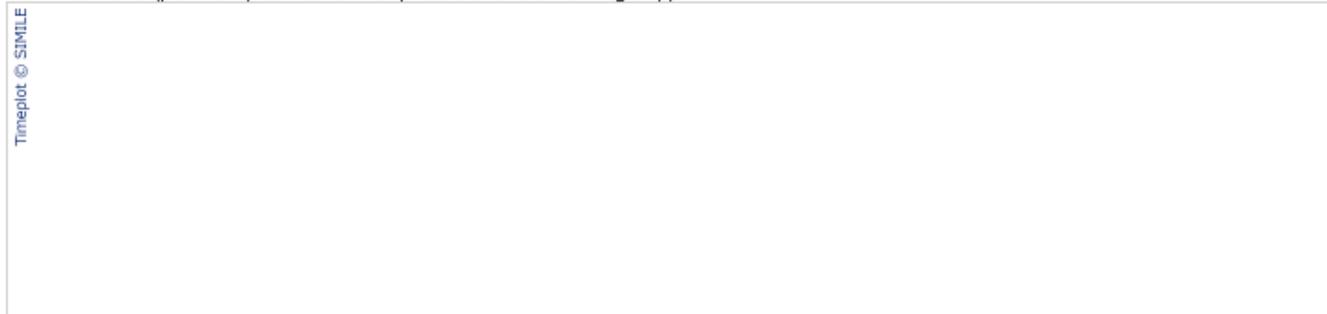
SMAP-OK. [Approx Footprint](#)

Pasture, sparse trees. COSMOS sensor part of the intercomparison of methods that can be used in the cal/val program for the SMAP (Soil Moisture Active Passive) satellite microwave mission.

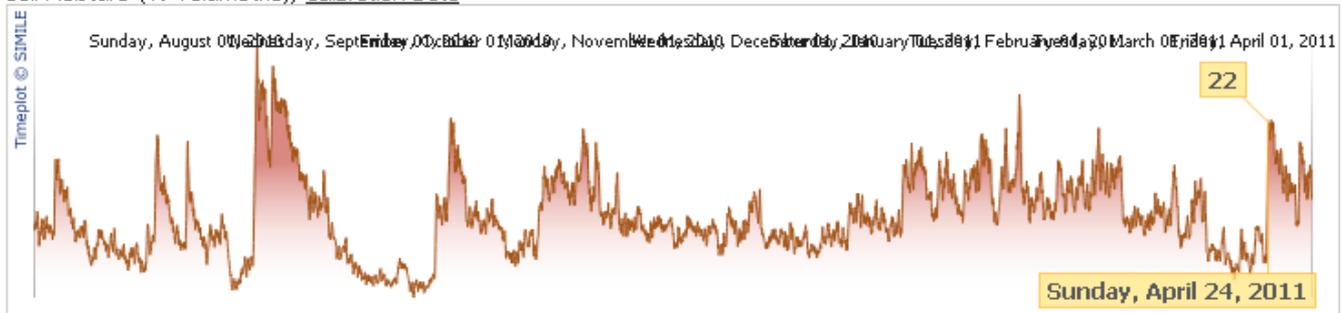
<http://www.ars.usda.gov/>

Installation Date:	2010-07-21
Network Affiliation:	SMAP
Timezone (UTC):	-6
Elevation (m):	326
Pressure (mb):	975
Cutoff Rigidity (GV):	3.27
Max Count Rate (/hour):	2754

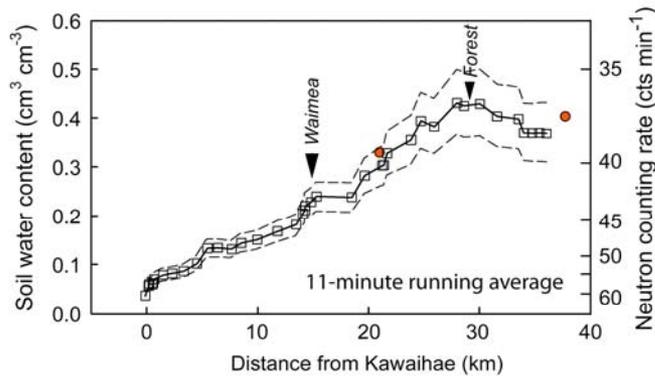
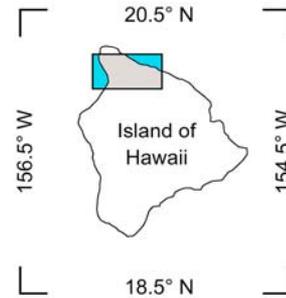
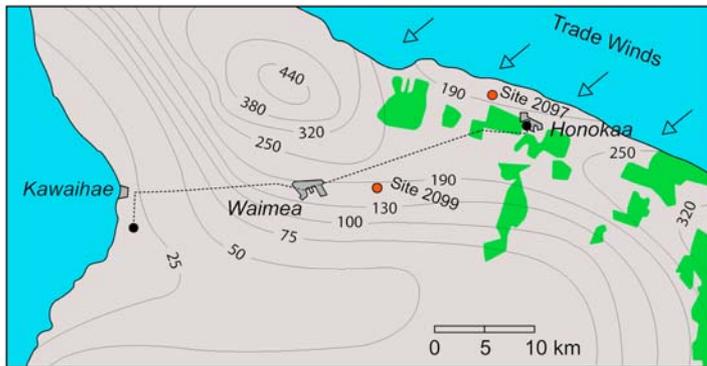
Fast Neutrons (per hour, corrected for pressure and cutoff rigidity)



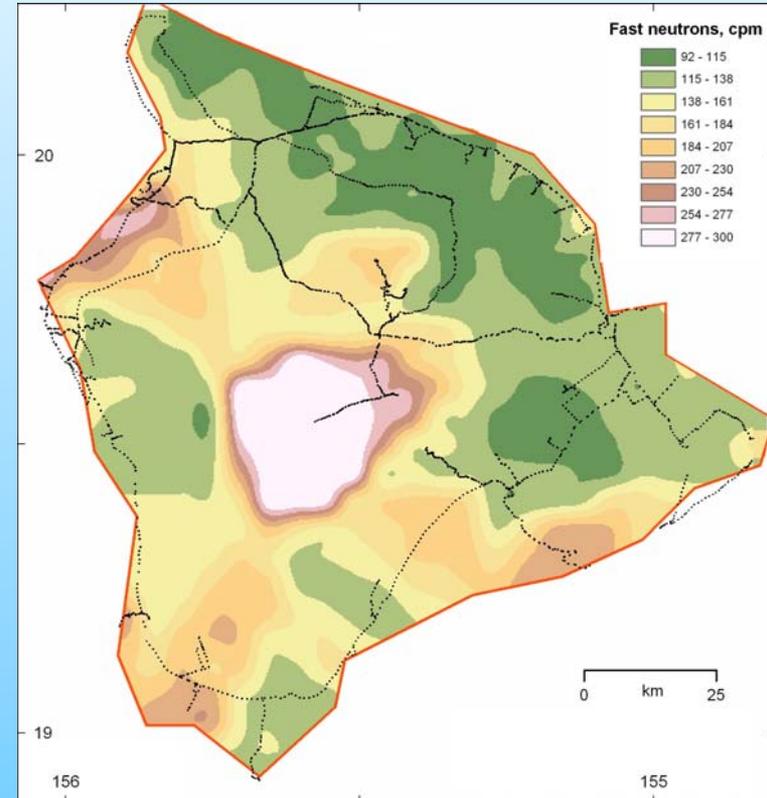
Soil Moisture (% Volumetric), Calibration Data



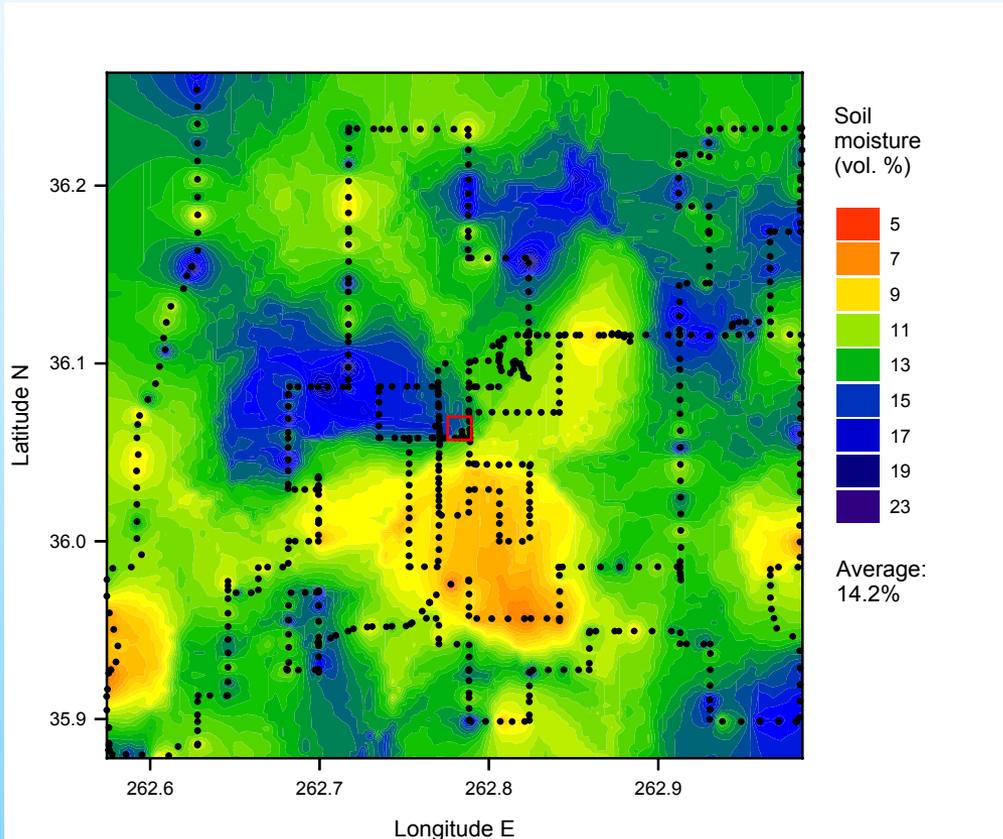
COSMOS rover: Hawaii



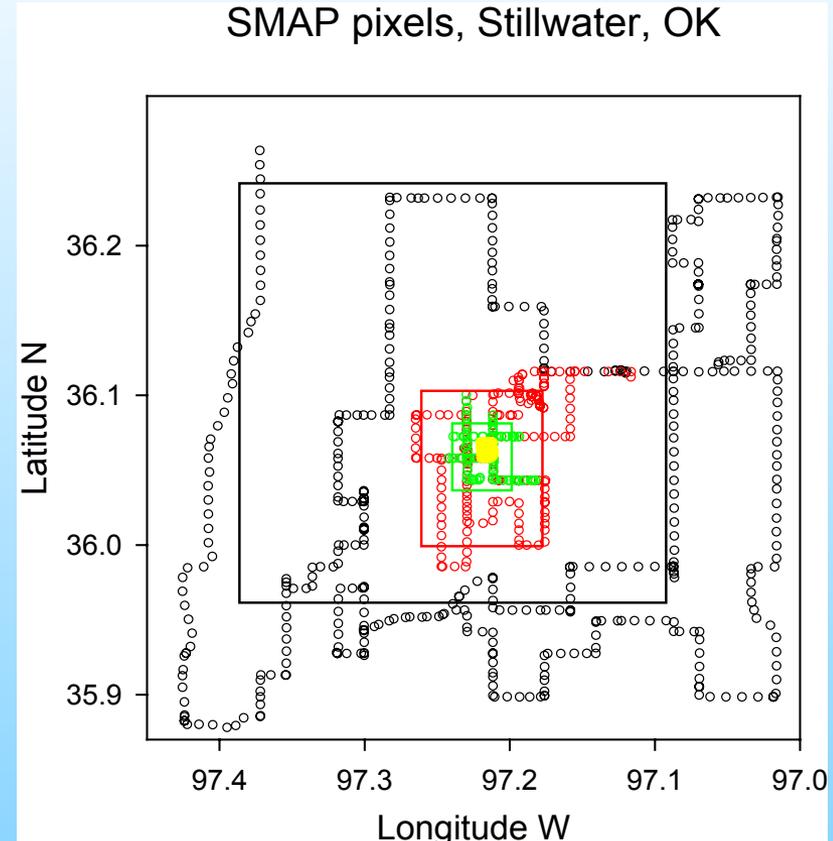
- Survey end point
- SCAN site
- ⋯ Survey route
- Annual precipitation (cm)
- Dense Forest
- Urbanized Zone



COSMOS rover - Stillwater, Oklahoma



One scale: 36 x 36 km



Neutron intensity and water content at four scales:

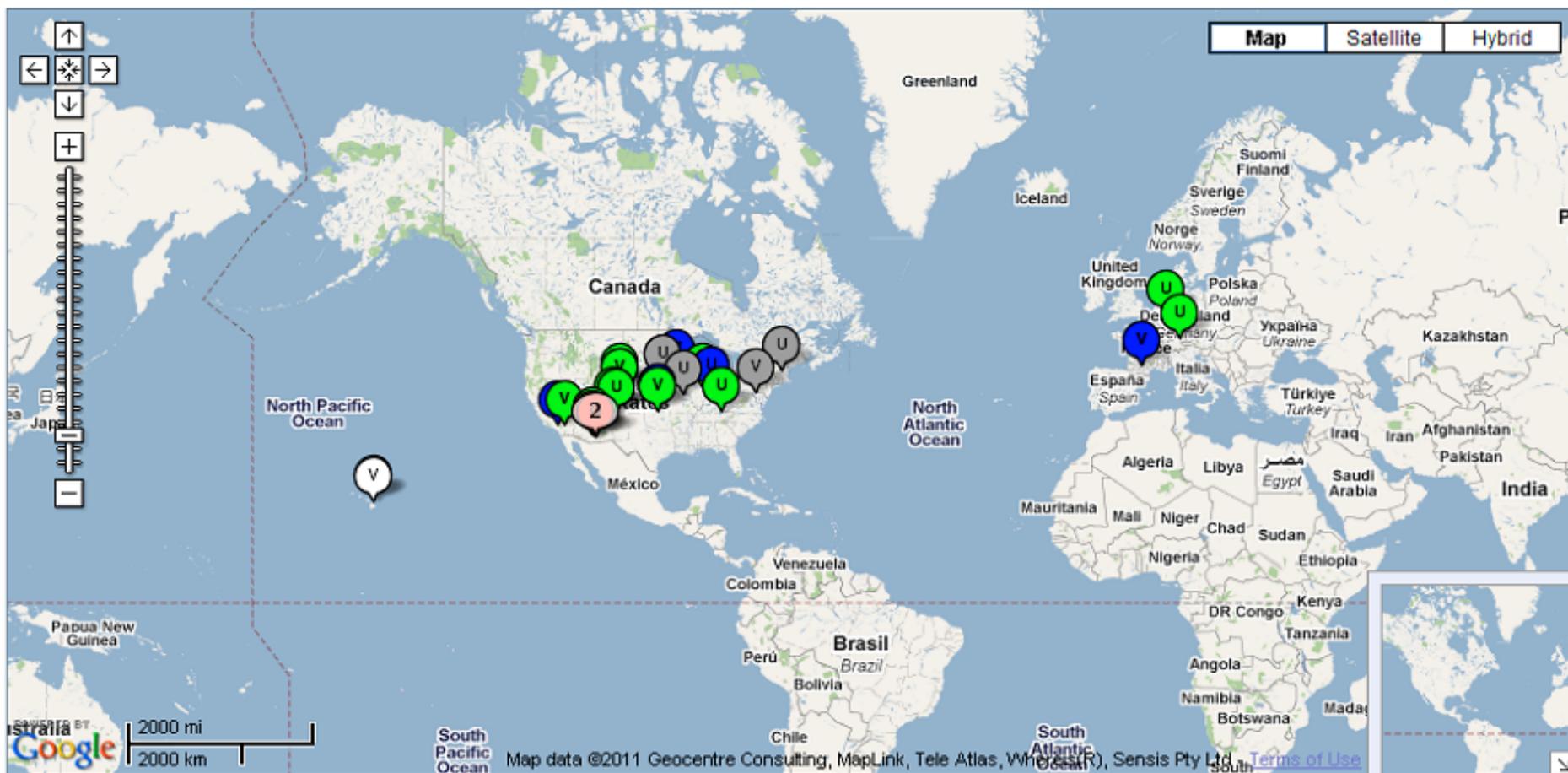
36 km x 36 km: 206 cpm, 14%

9 km x 9 km: 206 cpm, 14%

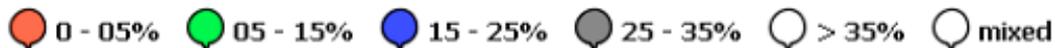
3 km x 3 km: 199 cpm, 15%

1 km x 1 km: 209 cpm, 13%

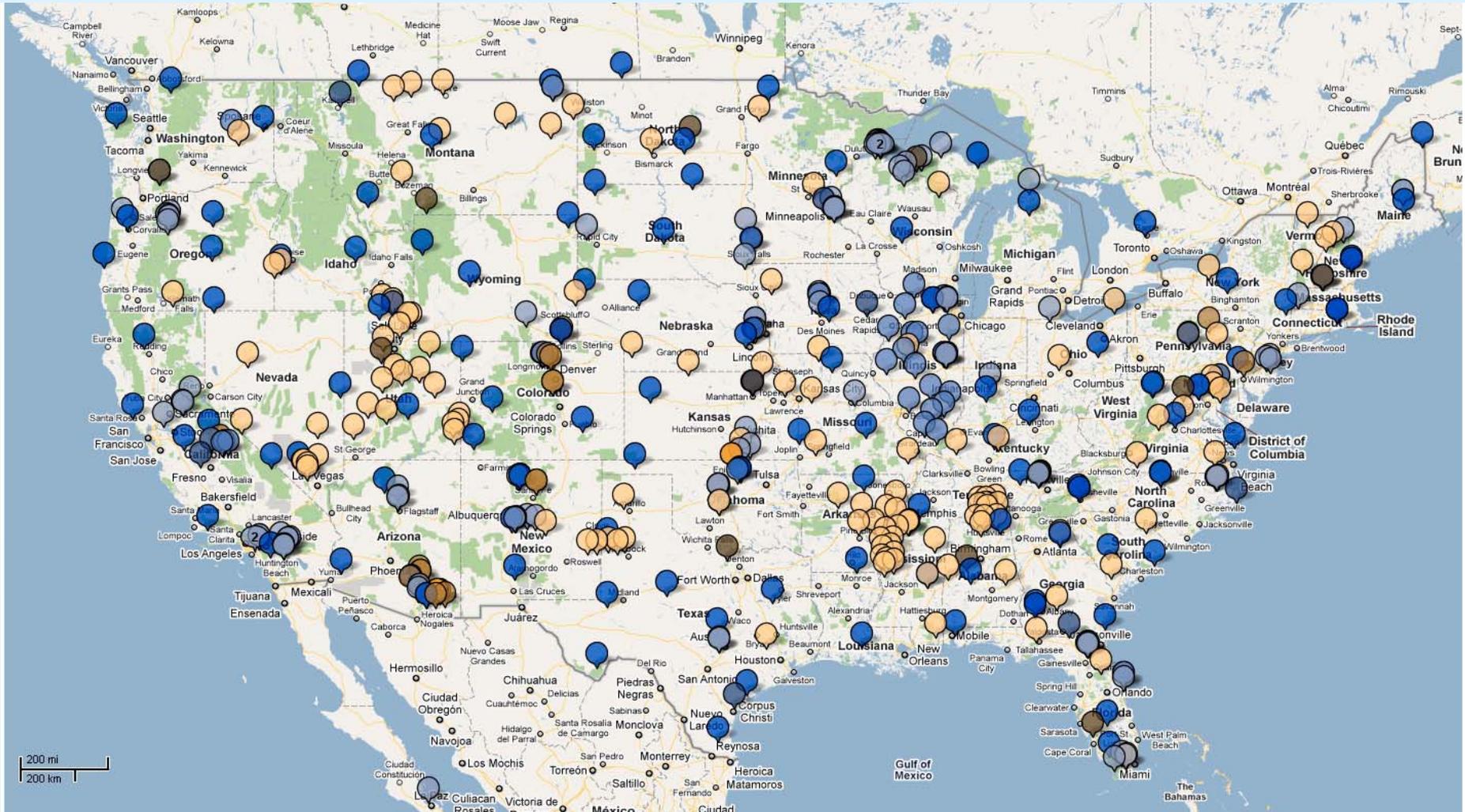
COSMOS - expanded (May 2011)



Soil Moisture (V=volumetric, G=gravimetric, U=uncalibrated)



COSMOS - full network (preliminary plan)



- ARM
- Ameriflux
- COSMOS
- CRN
- CZO
- Iowa State University
- NEON
- SCAN
- SMAP
- SOI
- WATERS