COSMOS: COsmic-ray Soil Moisture Observing System

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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

[Graphs showing soil water content over depth for two dates: 23 July 2010 and 16 September 2010.]
Variations in soil moisture, 15 sites
Measuring soil moisture with cosmic rays

![Dry soil dataset](image1)

![Wet soil dataset](image2)

![Neutron flux vs. volumetric soil moisture content](image3)

![Fast and epithermal neutrons](image4)
COSMOS sites - 48 states (May 2011)
COSMOS data: SMAP-OK

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.ar4.usda.gov/

Installation Date: 2010-07-21
Network Affiliation: SMAP

Timezone (UTC): -6
Elevation (m): 325
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

Sunday, August 01, 2010
Wednesday, September 08, 2010
Saturday, October 16, 2010
Tuesday, November 23, 2010
Thursday, January 22, 2011
Friday, February 25, 2011
March 10, 2011
April 03, 2011

Sunday, April 24, 2011
COSMOS rover: Hawaii
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)
COSMOS - full network (preliminary plan)