SMEX04 Soil Moisture Network Data: Sonora

Summary

This data set combines data for several parameters measured for the Soil Moisture Experiment 2004 (SMEX04) in Sonora, Mexico. SMEX04 was conducted during August of 2004 to coincide with the North American Monsoon Experiment in the Southwestern U.S. and Northwestern Mexico. The parameters include volumetric soil moisture, soil temperature, voltage, and rainfall rate. Data provided span from June 1, 2004 through August 31st, 2004, where available. Data are provided in ASCII text files, and are available via FTP.

The Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) is a mission instrument launched aboard NASA's Aqua satellite on 04 May 2002. AMSR-E validation studies linked to SMEX are designed to evaluate the accuracy of AMSR-E soil moisture data. Specific validation objectives include: assessing and refining soil moisture algorithm performance; verifying soil moisture estimation accuracy; investigating the effects of vegetation, surface temperature, topography, and soil texture on soil moisture accuracy; and determining the regions that are useful for AMSR-E soil moisture measurements.

Citing These Data:

The following example shows how to cite the use of this data set in a publication. List the principal investigators, year of data set release, data set title, and publisher.

Vivoni, E. R., C. J. Watts, J. C. Rodríguez, and L. A. Méndez-Barroso. 2009. *SMEX04 Soil Moisture Network Data: Sonora*. Boulder, Colorado USA: NASA DAAC at the National Snow and Ice Data Center.

Overview Table

Category	Description
Data format	ASCII tab-delimited text
Spatial coverage	29.03° N to 31.28° N, 109.73° W to 111.07° W
Temporal coverage	01 June 2004 to 31 August 2004
File naming convention	Files are named according to the established site number for the Sonora region, e.g. Site130.txt.
File size	142 KB to 436 KB
Parameter(s)	Volumetric soil moisture, soil temperature, voltage, rainfall rate.
Procedures for obtaining data	Data are available via FTP.

Table of Contents

1. Contacts and Acknowledgments:

Investigator(s) Name and Title:

Enrique R. Vivoni, Luis Méndez-Barroso, Assistant Professor and Graduate Student, New Mexico Institute of Mining and Technology, Socorro, NM. Christopher J. Watts, Julio C. Rodríguez, Professor and Graduate Student, Universidad de Sonora, Mexico.

Technical Contact:

NSIDC User Services
National Snow and Ice Data Center
CIRES, 449 UCB
University of Colorado
Boulder, CO 80309-0449
phone: (303)492-6199

fax: (303)492-2468
form: <u>Contact NSIDC User Services</u>
e-mail: <u>nsidc@nsidc.org</u>

Acknowledgements:

2. Data Description:

Format:

Fifteen ASCII tab-delimited text files.

File Data Containing:

The files contain data from the Sonora sampling site that belongs to the SMEX04 (Soil Moisture Experiment 2004). Each file contains data from the Vitel Hy dra Probe sensor (installe d at 5cm dept h from surface) as well as rain gauges located in several sites within the 75-km by 50-km box region.

File Size:

File sizes range from 142 KB to 436 KB.

Spatial Coverage:

Southernmost Latitude: 29.028702 N
Northernmost Latitude: 31.283901 N
Westernmost Longitude: 111.074860 W
Easternmost Longitude: 109.732430 W

Spatial Location:

Site/File	Lat	Long	Northing	Easting	Elev

Site 130	30.04027462	-110.6735678	3323293	531471	724
Site 131	29.99078607	-110.6671155	3317811	532109	719
Site 132	29.96043451	-110.5201815	3314498	546296	905
Site 133	29.8767943	-110.5954312	3305202	539068	642
Site 134	30.21998856	-110.4611729	3343285	551854	1180
Site 135	30.25163068	-110.5176812	3346767	546401	1044
Site 136	30.31024863	-110.6712206	3353210	531611	991
Site 137	29.93708486	-110.2616813	3312043	571255	660
Site 138	30.04545177	-110.2671959	3324048	570646	722
Site 139	30.15901943	-110.2867319	3336621	568684	758
Site 140	30.29821866	-110.2567857	3352065	571467	1017
Site 143	30.33971155	-110.5550572	3356513	542767	960
Site 144	30.20158171	-110.6869169	3341164	530135	799
Site 146	29.97049566	-110.4704121	3315634	551093	1375
Site 147	30.04027462	-110.6735678	3323293	531471	724

Temporal Coverage:

File	Starting date	Ending date
Site 130	June 14 2004	August 31 2004
Site 131	June 14 2004	August 31 2004
Site 132	June 14 2004	August 31 2004
Site 133	June 14 2004	August 31 2004
Site 134	June 13 2004	August 31 2004
Site 135	June 22 2004	August 31 2004
Site 136	June 01 2004	August 31 2004
Site 137	June 26 2004	August 31 2004
Site 138	June 22 2004	August 31 2004
Site 139	June 22 2004	August 31 2004
Site 140	June 22 2004	August 31 2004
Site 143	June 13 2004	August 31 2004
Site 144	June 22 2004	August 31 2004
Site 146	June 14 2004	August 31 2004
Site 147	July 15 2004	August 31 2004

Temporal coverage varies due to the different installation times for the soil moisture sensors and rain gauges. Technical difficulties (e.g. battery power malfunction) also prevented sampling during particular days and at particular sites.

Day of the year (DOY) to date conversion:

The following table shows the equivalent dates of the previous table in days of the year 2004. In the data files, the date is shown as day of the year 2004.

Day of the year	Date
153	June 01 2004

165	June 13 2004
166	June 14 2004
174	June 22 2004
178	June 26 2004
192	July 15 2004
244	August 31 2004

Temporal Resolution:

Volumetric soil moisture, surface temperature, voltage readings from the Vitel Hydra Probe sensor and pr ecipitation data were registered every 20 minutes. Some rea dings were collecte d every 3 0 minutes at site 130 and 131. At site 137, the voltage values were very l ow, and as a result, soil temperature could not be estimated.

Parameter or Variable:

Parameter Description:

Parameters in this data set include volumetric soil moisture, voltage, soil temperature and precipitation. The following table describes the units of measurement and sources of each parameter.

Parameter	Unit of measurement	Sensor
Voltages	mV (Millivolts)	Vitel Hydra Probe
Soil Temperature	Degrees Celsius	Vitel Hydra Probe
Soil Moisture	Percentage of volumetric soil moisture	Vitel Hydra Probe
Precipitation Inches		Rain gauge

Each parameter in the data files with a dash (-) indicates no data specified.

Parameter Range:

The following tables detail the column headings for each data file.

Column Header	Description
SITE	Describes the site ID
DEPTH	The actual depth where the sensor is located
SOIL	The soil type found in the site of sampling 1= Sand

	2= Silt
	3= Clay
YEAR	Year where the variables where collected
DOY	Day of the year 2004
HOUR-RG	Hour of the day
MIN	Minute of an hour
V1	Voltage of vitel channel 1
V2	Voltage of vitel channel 2
V3	Voltage of vitel channel 3
V4	Voltage of vitel channel 4
STEMP Soil	temperature
%VSM	Volumetric Soil Moisture
DOY-RG	Day of the year for rain gauge
HOUR	Hour for rain gauge
PRP Precipitati	on

3. Data Access and Tools:

Data Access:

Data are available via FTP.

Software and Tools:

No special tools are required to view these data. Any text reader or web browser is suitable.

Related Data Collections:

See related information on the Soil Moisture Experiment (SMEX) Web site:
http://nsidc.org/data/amsr_validation/soil_moisture/index.html

4. Data Acquisition and Processing:

Vitel Hydra Probe:

Soil moisture and temperature for the surface layer were measured using Vitel Type A Hydra Probes (HP). This probe is compatible with Campbell CR-10 data loggers. The temperature output voltage never exceeds 2.5 V. The probe determines soil moisture by making a high frequency (50-MHz) complex dielectric constant measurement which simultaneously resolves the capacitive and conductive parts of a soil's electrical response. The capacitive part of the response is most indicative of soil moisture, while the conductive part reflects mostly soil salinity. Temperature is determined from a calibrated thermistor incorporated into the probe head.

The HP has three main structural components: a multiconductor cable, a probe head, and sensing tines. The probes were installed horizontally in the soil, with the center tine at a depth of 5 cm.

The measured raw electrical parameters determined by the HP are the real and imaginary dielectric constants. These two parameters serve to fully characterize the electrical response of the soil (at the frequency of operation, 50 MHz). These are both dimensionless quantities. Because both the real and imaginary dielectric constants will vary somewhat with temperature, a temperature correction using the measured soil temperature is applied to produce temperature corrected values for the real and imaginary dielectric constant. The temperature correction amounts to calculating what the dielectric constants should be at 25°C.

The installation technique aims to minimize disruption to the site as much as possible so that the probe measurement reflects the "undisturbed site" as much as possible.
   o Dig an access hole. This should be as small as possible.
   o After digging the access hol e, a secti on of the wall should be made relatively flat. A spatula works well for this.
   o The probe should then be ca   refully inserted into the prepared hole section. The   probe should be placed into the soil without any side to si de motion which causes soil compression and ai r gaps be tween the tines and leads to subsequent measurement inaccu racies. The probe should be inserted far enough that   the plane formed where the tines join the probe head is flush with the soil surface.
   o After placing the probe, the access hole should be refilled.
   o For a near soil surface installation, one should avoid routing the cable from th   e pr obe head directly to the surface. A horizontal cabl   e run of 20 cm between the

probe head and the vertical cable orientation in near   soil surface installations is recommended.

Data Processing:

The output data from a Vitel Hydra Probe consists of a time stamp and four voltages (labeled V1-V4 in data distribution). These voltages are converted to estimate the soil moisture and soil temperature through a program provided by Stevens-Vitel. See the Stevens-Vitel Web site (http://www.stevenswater.com/) for the Hydra.exe or hyd-file.exe program. These programs require the four voltages (V1-V4) and a soil classification (Sand=1, Silt=2, and Clay=3). The quality control of this data was limited to removing samples for which the program returned erroneous data because of corrupted voltages. The corrupted voltages may be a result of several causes, including for example faulty installation, lightening strikes, and rodent impact. Erroneous samples were removed from the data. The data is not continuous for every Hydra Probe due to sensor problems. The classification of each soil was based on available databases and is indicated in each data file under the Soil column.

5. References and Related Publications:

Please see the SMEX04 site to access data:
http://nsidc.org/data/amsr_validation/soil_moisture/smex04/index.html

6. Document Information:

List of Acronyms

The following acronyms are used in this document:
AMSR-E - Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E)
FTP – File transfer protocol.
VSM –Volumetric Based Soil Moisture
PRP – Precipitation rate
RG – Rain gauge
SMEX – Soil Moisture Experiment
DOY – Day of Year
UTM - Universal Transverse Mercator
STEMP – Soil Temperature

Document Creation Date:

13 February 2006