

Notice to Data Users:
The documentation for this data set was provided solely by the Principal Investigator(s) and was not further developed, thoroughly reviewed, or edited by NSIDC. Thus, support for this data set may be limited.

SMEX04 San Miguel Watershed Soil Moisture Data: Sonora

Summary

This data set combines data for several parameters measured for the Soil Moisture Experiment 2004 (SMEX04) along a topographic transect in northern Sonora, Mexico. The parameters include gravimetric and volumetric soil moisture, soil temperature, air temperature, relative humidity, barometric pressure, and rainfall. In addition, we document landscape (soils, vegetation, topography) conditions at 30 transect sites and the daily weather observations.

This study was conducted during August 2004 in the San Miguel watershed in northern Sonora, Mexico. Data were collected along a topographic transect including several different ecosystems, using a variety of methods and sensors: manual soil samples for gravimetric data, theta probe for soil moisture, thermometers for temperature, and associated atmospheric measurements (barometer, hygrometer, thermometer).

Data are provided in ASCII text and Microsoft Excel files, and are available via FTP: (1) Soil moisture, temperature, hydrometeorological data, (2) Landscape characteristics, (3) Gravimetric soil moisture data, (4) Station Locations.

The Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) is a mission instrument launched aboard NASA's Aqua Satellite on 4 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:

Vivoni, E. R., Gutierrez-Jurado, H. A., Aragon, C. A., Rinehart, A. J., and R. L. Wyckoff. 2009. *SMEX04 San Miguel Watershed Soil Moisture Data: Sonora*. Boulder, Colorado USA: NASA DAAC at the National Snow and Ice Data Center.

Overview Table

Category	Description
<u>Data format</u>	MS Excel 2002, ASCII tab-delimited text
<u>Spatial coverage</u>	29°55' N to 29°59' N; 110°27' W to 110°37' W
<u>Temporal coverage</u>	3 August 2004 to 14 August 2004
<u>File naming convention</u>	'DailyData' designates daily measurements. 'GravimetricData' is gravimetric soil moisture 'SamplingIDS' is a GPS locations. 'LandscapeData' is the landscape descriptions.
<u>File size</u>	33 KB to 175 KB
<u>Parameter(s)</u>	Gravimetric soil moisture, volumetric soil moisture, soil and surface temperature, rainfall, air temperature, relative humidity, barometric pressure, landscape characteristics, GPS coordinates
<u>Procedures for obtaining data</u>	Data are available via FTP.

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1. Contacts and Acknowledgments:

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2. Detailed Data Description:

Format:

MS Excel 2002, ASCII tab-delimited text

File Naming Convention:

Four Excel files are included:
SMEX04SamplingIDs.xxx GPS coordinates of sites
SMEX04TransectDailyData.xxx Daily field site measurements
SMEX04TransectGravimetricData.xxx Gravimetric moisture data
SMEX04TransectLandscapeData.xxx Site landscape descriptions

ASCII text files contain the same data as Excel files. The data from SMEX04TransectDailyData.xls file is provided in two separate ASCII

text files: SMEX04TransectDailyData_SoilTemp.txt and SMEX04TransectDailyDate_SoilMoist_Hydro.txt.

File Size:

File sizes range from 33 KB to 175 KB.

Spatial Coverage:

Southernmost Latitude: 29°55' N
Northernmost Latitude: 29°59' N
Westernmost Longitude: 110°37' W
Easternmost Longitude: 110°27' W

Temporal Coverage:

3 August 2004 to 14 August 2004

Temporal Resolution:

Gravimetric and volumetric soil moisture, soil and surface temperature, rainfall, air temperature, relative humidity, barometric pressure data were collected daily.

Parameter or Variable:

Parameter Description:

Parameters in this data set include gravimetric and volumetric soil moisture, soil and surface temperature, rainfall, air temperature, relative humidity, barometric pressure data. The following table describes the units of measurement and sources of each parameter:

Parameter	Unit of Measurement	Sensor
Gravimetric soil moisture	grams of water per grams of dry soil*100%	manual soil collection
Soil temperature	Degrees Celsius	Temperature Probes
Surface temperature	Degrees Celsius	IRT
Soil moisture	Water Fraction Volume (m ³ /m ³)*100%	Theta Probes

Air temperature	Degrees Celsius	Thermometer
Relative humidity	Percent saturation (%)	Hygrometer
Barometric pressure	Millimeters of Hg (mercury)	Barometer
Rainfall	Centimeter of water	Event rain gauge

Parameter Range:

The following tables detail the column headings for each data file in the categories of gravimetric sampling, bulk density, soil temperature, and theta probe data.

GPS Coordinates

"SMEX04SamplingIDs.xxx" – GPS Coordinate Columns

Column Heading	Description
Site ID	Identification for sites 1 through 30
Point ID	Point within each site (box corners) A through D
X	Easting/Longitude UTM Zone 13, in meters
Y	Northing/Latitude UTM Zone 13, in meters
Z	Altitude, in meters
Photo ID	ID of associated site photos (not provided)

"SMEX04TransectDailyData.xxx" – Daily Measurement Columns. A separate Excel spreadsheet for each day (August 3 – 14, 2004)

Site ID	Identification for sites 1 through 30
Time	Time of day (local MST)
IRT	Surface temperature using IRT in degrees C
Soil Temperature, 1cm	Soil temperature using thermometer at 1 cm depth in C (for each Point A through E)
Soil Temperature, 5cm	Soil temperature using thermometer at 5 cm depth in C (for each Point A through E)
Soil Temperature, 10cm	Soil temperature using thermometer at 10 cm depth in C (for each Point A through E)
Soil Moisture, %	Theta Probe Soil Moisture, % (for each Point A

	through E)
Soil Moisture, mv	Theta Probe Soil Moisture, millivolts (mv) (for each Point A through E)
Barom Pressure	Barometric Pressure in mmHG
Humidity Relative	Humidity in %
Air Temperature	Air Temperature in C and F
Rain Gauge	Event Rainfall in cm of water reading from small scale (sm) and large scale (lg) on gauge.
Weather Observations	Weather observations during sampling (classified as primary and secondary)

Missing data are represented by N/A

"SMEX04TransectGravimetricData.xxx" – Daily Measurement Columns. A separate spreadsheet for each day (Aug 3 – 14, 2004)

Column Heading	Description
Site ID	Identification for sites 1 through 30
Moist weight	Moist sample weight in grams (for samples at 0-3 cm and 3-6 cm)
Dry weight	Dry sample weight in grams (at 0-3 cm and 3-6 cm)
Can weight	Can weight in grams (at 0-3 cm and at 3-6 cm)
Soil Moisture	Percent (%) soil moisture computed as: $(\text{Moist Weight} - \text{Dry Weight}) / (\text{Dry Weight} - \text{Can Weight})$ (at 0-3 cm and at 3-6 cm)

Missing data not presented or left blank

"SMEX04TransectLandscapeData.xxx " – Site Description Columns.

Site ID	Identification for sites 1 through 30
Landscape	General landscape description
Landform Landform	description
Microfeature	Microfeature description
Vegetation Common Name	Vegetation common name
Vegetation Ground Cover	Estimated percent ground cover

Vegetation Field Notes	Field notes on vegetation
Erosion Kind	Observed erosion and type
Erosion Degree	Degree of observed erosion
Hillslope Profile Position	Description of hillslope position
Drainage	Type of drainage and proximity
Parent Material	Geologic parent material
Land Cover	Land cover description with dominant vegetation
Bedrock	Bare rock or bedrock (Y/N)
Curvature	Slope curvature description.
Aspect	Estimated slope aspect.
Slope Estimated	slope.
Slope complexity	Slope complexity description

Missing data are represented by N/A

Error Sources:

Theta Probe

For various reasons, including extremely dry conditions, severe weather restrictions, and extreme rock fraction some sites were not sampled on particular days. Occasionally, a probe rod was broken because of very hard and dry soil conditions. When possible, the broken rod was replaced. When it was not possible to replace the rod, a new theta probe was used.

3. Data Access and Tools:

Data Access:

Data are available via FTP.

Software and Tools:

No special tools are required to view these data. A spreadsheet program such as MS Excel is recommended and/or any Web browser/text editor.

4. Data Acquisition and Processing:

Theory of Measurements:

Sampling Technique

A scoop tool was used to retrieve approximately the top 6 cm of soil at each site.

Sensor or Instrument Description:

Gravimetric

Gravimetric samples were collected manually. In the laboratory they were weighed, dried, then weighed again.

Theta Probes

Investigators used theta probes to measure surface volumetric soil moisture. The probes were Type ML2 manually-operated impedance instruments manufactured by Delta-T Devices, Ltd. The theta probes have 4 separate 6-cm stainless steel rods inserted vertically into the soil. Each instrument was connected to a handheld reader, which delivers the electrical pulse, detects the return signal, and converts the period to voltage between 0 V and about 1 V. Transect surface soil moisture was sampled each day (9:00AM-4:00PM) during the experiment.

The software provided by the probe manufacturer calibrates the theta probes by calculating an estimate of volumetric soil moisture according to the following equation:

$$\text{Theta} = (1.07 + 6.4 * V - 6.4 * V^2 + 4.7 * V^3 - a_0) / a_1$$

where a_0 and a_1 are 1.6 and 8.4, respectively. These estimates are provided in the data files.

Processing Steps:

Gravimetric Processing

Researchers weighed the wet soil obtained in the field, heated the soil in an oven to dry it, then weighed the dry soil.

5. References and Related Publications:

Please see the [SMEX04](#) site for more information and to access data.

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.

gc - generalized calibration

GSM - Gravimetric Soil Moisture

GVSM - Gravimetrically-based Volumetric Based Soil Moisture

IRT - Infrared Thermometer

SMEX - Soil Moisture Experiment

ssc - site specific calibration

TP - Theta Probe

UTM - Universal Transverse Mercator

VSM - Volumetric Soil Moisture

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