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.

SMEX05 Soil Moisture Network Data: Iowa

Summary

This data set contains soil moisture network data collected over the Soil Moisture Experiment 2005 (SMEX05) area of Iowa, USA from 10 June 2005 through 03 July 2005. The total volume of this data set is approximately one megabyte. Data set parameters are soil temperature and volumetric soil moisture. Related measurements for soil salinity and soil water conductivity are included. Data are provided in ASCII tab-delimited text format and Microsoft Excel format, 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 version number, dates of the data you used (for example, September to October 2003), publisher: NSIDC, and digital media.

Cosh, Michael H. 2010. *SMEX05 Soil Moisture Network Data: Iowa*. Boulder, Colorado USA: National Snow and Ice Data Center. Digital media.

Overview Table

Category	Description
Data format	Microsoft Excel spreadsheet file ASCII
Spatial coverage	41.96679° to 42.44194° N, 93.29113° to 93.59537° W
Temporal coverage	10 June 2005 - 03 July 2005
File naming convention	Regional_Soil_Moisture_Network.xls Regional_Soil_Moisture_Network_IA49.txt Regional_Soil_Moisture_Network_WC31.txt
File size	1 MB
Parameter(s)	Soil Temperature Volumetric Soil Moisture Soil Salinity Soil Water Conductivity
Procedures for obtaining data	Data are available via FTP.

Table of Contents

1. Contacts and Acknowledgments:

Investigator(s) Name and Title:

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Acknowledgements:

Many graduate students and volunteers worked to collect the field data. The investigators would like to thank the Soil Moisture Experiment 2005 Science Team and the National Soil Tilth Laboratory for their assistance. The investigators would also like to

thank the Naval Research Laboratory and National Aeronautics and Space Administration (NASA) for their generous contributions to the study. This work was supported by the Naval Research Laboratory, NASA Aqua AMSR, Terrestrial Hydrology and Global Water Cycle Programs.

2. Detailed Data Description:

Format:

The data set is comprised of six tab-delimited ASCII text files, with a corresponding MS Excel file containing six data sheets.

File Naming Convention:

Regional_Soil_Moisture_Network_IA16.txt
Regional_Soil_Moisture_Network_IA29.txt
Regional_Soil_Moisture_Network_IA40.txt
Regional_Soil_Moisture_Network_IA45.txt
Regional_Soil_Moisture_Network_IA49.txt
Regional_Soil_Moisture_Network_WC31.txt

Each regional soil moisture data file is named according to site number as shown in Table 1.

Table 1. Description of File Name Variables

Variable	Description
Regional_Soil_Moisture_Network	Regional Soil Moisture Network
IA16	Iowa regional domain site 16
IA29	Iowa regional domain site 29
IA40	Iowa regional domain site 40
IA45	Iowa regional domain site 45
IA49	Iowa regional domain site 49
WC31	Walnut Creek watershed domain site 31
.txt	ASCII text file

The corresponding Excel file name is:
Regional_Soil_Moisture_Network.xls.

The Excel file contains six spreadsheets. Each sheet is named according to site number: IA16, IA29, IA40, IA45, IA49, WC31.

File Size:

The file size is approximately one MB.

Temporal Coverage:

Data span from 10 June 2005 through 03 July 2005.

Temporal Resolution:

Data were collected hourly.

Spatial Coverage:

Southernmost Latitude: 41.96679º N
Northernmost Latitude: 42.44194º N
Westernmost Longitude: 93.59537º W
Easternmost Longitude: 93.29113º W

Parameter or Variable:

Parameter Description:

Each data file contains the columns described in Table 2.

Table 2: Data Columns

Column Heading	Description
Year	Year
DOY	Day of Year
HHMM	Two-digit hour and two-digit minute of data record Central Standard Time
V1	Vitel Voltage 1
V2	Vitel Voltage 2
V3	Vitel Voltage 3
V4	Vitel Voltage 4
Temp	Temperature in Celsius (C) calculated from Vitel algorithm using Voltage 4

VSM	Soil moisture volumetric water content calculated by Vitel calibration
Er	Real Dielectric Constant
Ei	Imaginary Dielectric Constant
Er-corr	Real Dielectric Constant (Temperature Corrected)
Ei-corr	Imaginary Dielectric Content (Temperature Corrected)
NACL	Soil Salinity
Soil_Cond	Soil Conductivity
TcorSC	Soil Conductivity (Temperature Corrected)
Water_Cond	Soil Water Conductivity (Temperature Corrected)

3. Data Access and Tools:

Data Access:

Data are available via FTP at:
ftp://sidads.colorado.edu/pub/DATASETS/AVDM/data/soil_moisture/SMEX05/ground_soil_moisture/soil_moisture_network/

Software and Tools:

No special tools are required to view these data. A spreadsheet program that recognizes tab-delimited text files is recommended. A word-processing program or Web browser also will display the data.

Related Data Collections:

For related data collections, please see the AMSR-E Validation Data - Soil Moisture Data Web site:
http://nsidc.org/data/amsr_validation/soil_moisture/index.html

4. Data Acquisition and Processing:

Theory of Measurements:

Soil moisture and temperature for the surface layer were measured using Vitel Type A Hydra Probes (HP) shown in Figure 1. This version is compatible with Campbell CR-10 data loggers. The temperature output voltage never exceeds 2.5 Volts.

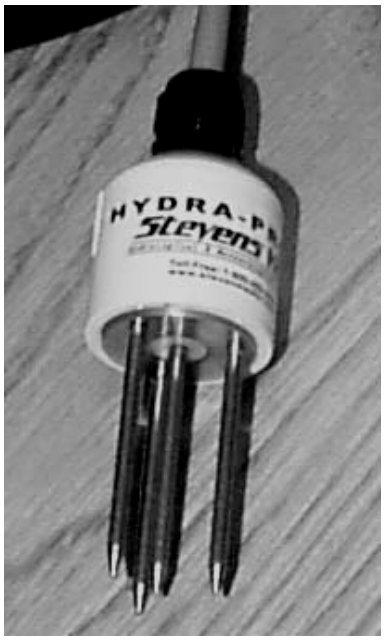

Figure 1. Hydra Probe

The HP soil moisture probe determines soil moisture and salinity by making a high frequency (50 MHz) complex dielectric constant measurement which simultaneously resolves the capacitive and conductive parts of a soil 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 five centimeters.

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 50 MHz frequency of operation. 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 is made by calculating what the dielectric constants should be at 25^{o} C.

The output data from an HP consists of a time stamp and four voltages V1-V4, which are converted to estimate the soil moisture and soil temperature through a program provided by Stevens Water Monitoring Systems, Inc. The program requires the four voltages and a soil classification of sand=1, silt=2, and clay=3. The quality control of these data was limited to removing samples for which the program returned erroneous data because of corrupted voltages. These voltages may be a result of several things, including faulty installation, lightning strikes, and rodent impact. Erroneous samples were removed. Therefore the data are not continuous for every HP.

As a soil becomes wet, the low dielectric constant component, air, is replaced by water with its much higher dielectric constant. As a soil becomes wet the capacitive response, which depends upon the real dielectric constant, increases steadily. The dielectric constant measurement can be directly related to soil moisture through the use of appropriate calibration curves.

The dielectric constant of moist soil has a small but significant dependence on soil temperature. The soil temperature measurement that the Hydra probe makes can be used to remove most of the temperature effects.

The installation technique described below was used to minimize disruption to the site as much as possible. This allowed the probe measurement to reflect the "undisturbed site" as much as possible.

- Dig an access hole. This should be as small as possible.
- After digging the access hole, a section of the hole wall should be made relatively flat. A spatula works well for this.
- The probe should then be carefully inserted into the prepared hole section. The probe should be placed into the soil without any side to side motion. Side to side motion results in soil compression and air gaps between the tines and lead to subsequent measurement inaccuracies. The probe should be inserted far enough that the plane formed where the tines join the probe head is flush with the soil surface.
- After placing the probe in the soil, the access hole should be refilled.
- For a near-soil-surface installation, avoid routing the cable from the probe head directly to the surface. A horizontal cable run of 20 cm between the probe head and the beginning of a vertical cable orientation in near-soil-surface installations is recommended.
- Avoid putting undue mechanical stress on the probe.
- Do not allow the tines to be bent as this will distort the probe data.
- Pulling on the cable to remove the probe from soil is not recommended.
- Moderate scratches or nicks to the stainless steel tines or the PVC probe head housing will not affect the performance of the probe.

5. References and Related Publications:

Refer to the USDA SMEX05 Web site for in-depth information on the science mission and goal of the SMEX project: http://www.ars.usda.gov/Research/docs.htm?docid=8996

6. Document Information:

List of Acronyms and Abbreviations:

AMSR-E - Advanced Microwave Scanning Radiometer – Earth Observing System
C - Celsius
FTP - File transfer protocol
HP - Hydra Probe
IA - Iowa
MHz - Megahertz
NASA - National Aeronautics and Space Administration
SMEX05 - Soil Moisture Experiment 2005
USDA ARS - United States Department of Agriculture Agricultural Research Service
V - Voltage
VSM - Volumetric Soil Moisture
WC - Walnut Creek watershed

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