



SMEX03 ThetaProbe Soil Moisture Data: Alabama, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

SMEX03 ThetaProbe Soil Moisture Data: Alabama, Version 1. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/DOBHLK9KEUOS>. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/NSIDC-0306>



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1 DETAILED DATA DESCRIPTION

1.1 Format

Data are provided as a Microsoft Excel file with three worksheets or as three separate text files. Each tab-delimited text file contains the same data as each individual worksheet of the Excel file.

The following tables detail the column headings for each of the three worksheets in the Excel file and the three text files. Refer to Table 1 for details on All_Samples_AL, Table 2 for details on Mean_mV_AL, and Table 3 and 4 for details on Mean_VWC_AL.

All_Samples_AL contains all voltage and volumetric water content (VWC) data collected:

Table 1 Column headings for All_Samples_AL

Column Heading	Description
Date	Date readings made (MM/DD/YY)
DOY	Day of Year
Site	Alabama site # (1-59)
Lat	Latitude of site (decimal degrees)
Long	Longitude of site (decimal degrees)
Sample	Sample # (1-3) at site
Time	Time of day in the format HH:MM
mV	ThetaProbe voltage reading (millivolts)
VWC	Volumetric water content (%) calculated using the generalized ThetaProbe calibration equation

Mean_mV_AL contains means of the 3 voltage readings taken at each site on each day:

Table 2 Column headings for Mean_mV_AL

Column Heading	Description
Date	Date reading was made
1, 2, 3, ..., 59	Mean ThetaProbe reading (millivolts) for Alabama site 1, 2, 3, ..., 59
All Site Mean	Mean of ThetaProbe readings (millivolts) for all sites for the day

Mean_VWC_AL contains two different tables. The top table contains means of the 3 VWC measurements at each site on each day:

Table 3 Column headings for the top half of Mean_VWC_AL

Column Heading	Description
Date	Date readings made
1, 2, 3, ..., 59	Mean VWC values for AL sites 1, 2, 3, ..., 59
All Site Mean	Mean of VWC values across sites for the day
# Sites Reporting	Number of sites (of 59 total) reporting for the day
Minimum	Minimum VWC across sites for the day
Maximum	Maximum VWC across sites for the day
Corn Mean, Soybeans Mean, etc.	Mean VWC for each landcover class for the day
Alpha Mean, Bravo Mean, etc.	Mean VWC for each sampling team for the day
Limestone Mean, Madison Mean, etc.	Mean VWC for each county for the day
EASE 1 Mean, EASE 2 Mean, etc.	Mean VWC for each EASE grid cell (1-10) for the day

The bottom table describes the areas sampled during this investigation. The column on the left hand side of the table lists the dates of each day of the investigation (6/22/03-7/2/03) in month/day/year format (mm/dd/yy). The rows along the top are described in the following table:

Table 4 Row headings for the bottom half of Mean_VWC_AL

Row Heading	Description
Landcover	Type of landcover investigated at the site (soybean, pasture, grassland, etc.,).
County	The county in which the investigation took place.
Team	Name of the team that visited the site.
EASE Grid Cell	EASE-Grid cell number (1-10).

For each site and date, a value of 1 means that the site was sampled on that day, and a value of 0 means that the site was not sampled that day.

1.2 File and Directory Structure

All files are located within the same directory on the FTP site.

1.3 File Naming Convention

The Excel file is named ThetaProbe_AL.xls and contains three worksheets. The text files have the same names as the individual worksheets of the Excel file, with the suffix .txt and are named as follows: All_Samples_AL.txt, Mean_VWC_AL.txt, and Mean_mV_AL.txt.

1.4 Spatial Coverage

Southernmost Latitude: 34.68° N

Northernmost Latitude: 35.16° N

Westernmost Longitude: 87.08° W

Eastermost Longitude: 85.78° W

1.4.1 Spatial Resolution

Three readings were taken at random locations within an approximate 1 m diameter circle at each site.

1.5 Temporal Coverage

Data was acquired from 22 June 2003 to 02 July 2003.

1.5.1 Temporal Resolution

ThetaProbe readings were taken daily between 11:00 a.m. and 3:00 p.m. central daylight time (CDT).

1.6 Parameter or Variable

1.6.1 Parameter Description

The parameters in this data set include raw voltage readings in millivolts (mV) and volumetric soil moisture (%).

1.6.2 Sample Data Record

The following is a sample of the first five rows from the data file All_Samples_AL.txt:

Date	DOY	Site	Lat	Long	Sample	Time	mV	VWC
6/22/03	173	1	35.1114	-87.0021	1	12:55		22
6/22/03	173	1	35.1114	-87.0021	2	12:56		23.4

Date	DOY	Site	Lat	Long	Sample	Time	mV	VWC
6/22/03	173	1	35.1114	-87.0021	3	12:57		23.3
6/22/03	173	2	35.1254	-86.8723	1	11:24		37.6
6/22/03	173	2	35.1254	-86.8723	2	11:25		28.5

The following is a sample of the first five rows from the data file Mean_mV_AL.txt (only the first 6 and the last 5 columns are shown):

Date	Site -->	1	2	3	4	...	56	57	58	59	All Site Mean
6/22/03						...	486.33	866.00	881.33	661.50	600.83
6/23/03		381.67		825.00	410.67	...	387.67	893.00	833.00	677.67	548.80
6/24/03		249.33	224.33	798.00	491.33	...	362.00	811.00	882.00	608.00	519.54
6/25/03		251.67	280.00	638.33	267.67	...	423.00	821.67	814.00	591.33	476.01
6/26/03		399.33	437.00	615.33	302.00	...	376.67	715.00	804.00	455.67	484.46

The following is a sample of the first five rows of the top table from the data file Mean_VWC_AL.txt (not all columns are shown):

Date	Site -->	1	2	3	...	58	59	All Site Mean	# Sites Reporting	EASE 10 Mean
6/22/03		22.9	32.7	34.2	...	39.9	27.4	25.4	50	30.7
6/23/03		14.8		36.3	...	36.9	27.8	22.3	49	29.1
6/24/03		8.6	7.5	34.6	...	37.0	24.6	20.9	50	27.5
6/25/03		8.7	10.0	25.9	...	35.7	23.8	18.9	43	26.3
6/26/03		15.0	17.0	24.8	...	35.1	17.8	19.2	44	24.3

1.7 Error Sources

Some data values are missing due to equipment failure or transportation problems to the test sites. Depending on the type of equipment failure, data were sometimes able to be recovered. When the data logger had a downloading error, VWC was recovered from the field books; but the voltage readings were not recorded. In the case of a total logger failure or transportation issues, no data were obtained for that day. Data that were not collected or were lost are flagged as -9999, and data that were determined to be in error are flagged as -999.

VWC values reported here were calculated using the default calibration equation for mineral soils. See the ThetaProbe ML2x Principles of Operation and Applications document (PDF, 286 KB) for a discussion of calibration issues. In post-experiment analysis, it was found that for 12 sites at which reliable bulk density measurements were available, VWC values obtained using this calibration compared well with values obtained concurrently from gravimetric sampling. Therefore, the default calibration equation was applied for all sites.

2 DATA ACQUISITION AND PROCESSING

2.1 Theory of Measurements

Volumetric soil water content is expressed as a ratio of the volume of water present in a soil sample to the total volume of the sample and is a dimensionless parameter. The ThetaProbe measures this by responding to changes in the dielectric constant of the soil. For more information on the theory behind these measurements, please see the [ThetaProbe ML2x principles of operation and applications](#) document (PDF, 286 KB).

2.2 Data Acquisition Methods

The ML2 ThetaProbes have four separate 6 cm stainless steel rods which are inserted vertically into the soil. Each instrument was connected to a handheld data logger, which delivers the electrical pulse, detects the return signal, and converts the period to voltage between 0 V and about 1 V. For AMSR-E validation purposes, soil moisture was sampled each day between 11:00 a.m. and 3:00 p.m. CDT.

2.3 Derivation Techniques and Algorithms

The software provided by the ThetaProbe manufacturer calibrates the probes to soil moisture, calculating an estimate of volumetric water content according to Equation 1:

VWC =	$1.07 + 6.4V - 6.4V^2 + 4.7V^3 - a_0$	
	_____	(Equation 1)
	a_1	

where the coefficients a_0 and a_1 are 1.6 and 8.4 for mineral soils, respectively.

The resulting VWC estimates are provided in the data files. Three readings were taken at random locations within an approximate 1 m diameter circle at each site. Field averages of voltage and derived VWC were calculated by taking the arithmetic mean of the three values.

3 REFERENCES AND RELATED PUBLICATIONS

Miller, J. D. and G. J. Gaskin. ThetaProbe ML2x Principles of Operation and Applications. Macaulay Land Use Research Institute. <http://www.macaulay.ac.uk/MRCS/pdf/tprobe.pdf>, 286 KB.

The following Web site contains related information:

- [USDA Soil Moisture Experiments 2003](#): The United States Department of Agriculture's SMEX03 Web site provides in depth information on the science mission and goal of the SMEX project.

3.1 Related Data Collections

[AMSR-E/Aqua Data at NSIDC](#): AMSR-E standard products available at NSIDC.

4 CONTACTS AND ACKNOWLEDGMENTS

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5 DOCUMENT INFORMATION

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