SMEX03 Regional Ground Soil Moisture Data: Georgia, Version 1

USER GUIDE

How to Cite These Data

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

Bosch, D., T. Jackson, V. Lakshmi, and J. Jacobs. 2006. *SMEX03 Regional Ground Soil Moisture Data: Georgia, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/Q3CPBEY9F4YP. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0288

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

1.1 Format

The data are in a tab-delimited ASCII text file. Missing data are represented with -999 in the data file. The column headings and the information in each column are described in the following table. See the Parameter or Variable section for more information about the parameters.

Column Heading in File	Description
Site ID	Site location identifier number
Date	Month/day/year
Crop_type	Type of land cover: peanuts double-row peanuts forest young pines strip-till cotton cotton pasture corn cucumbers
Sample_Time (EDT)	Sampling time in Eastern Daylight Time (EDT); most sampling is 5-10 minutes in duration
Latitude WGS84	Latitude of sample site in decimal degrees, World Geodetic System 1984 (WGS84)
Longitude WGS84	Longitude of sample site in decimal degrees, WGS84
Easting in m WGS84 Zone 17	Easting of sample site in meters, WGS84, Zone 17
Northing in m WGS84 Zone 17	Northing of sample site in meters, WGS84, Zone 17
TP_V row	Impedance probe (ThetaProbe) millivolt reading in V in row
TP_V 1/4 row	ThetaProbe millivolt reading in V at ¼ row
TP_V 1/2 row	ThetaProbe millivolt reading in V at ½ row
TP_gc row	ThetaProbe volumetric soil moisture (VSM) in m^3/m^3, from general calibration in row
TP_gc 1/4 row	ThetaProbe VSM in m^3/m^3 from general calibration at ¼ row
TP_gc 1/2 row	ThetaProbe VSM in m^3/m^3 from general calibration at ½ row
TP_ssc row	ThetaProbe VSM in m^3/m^3 from site-specific calibration in row
TP_ssc 1/4 row	ThetaProbe VSM in m^3/m^3 from site-specific calibration at ¼ row
TP_ssc 1/2 row	ThetaProbe VSM in m^3/m^3 from site-specific calibration at ½ row

Column Heading in File	Description
TP_V average	ThetaProbe volt reading, average
TP_V stdev	ThetaProbe volt reading, standard deviation
TP_gc average	ThetaProbe volumetric soil moisture from general calibration, average
TP_gc stdev	ThetaProbe volumetric soil moisture from general calibration, standard deviation
TP_ssc average	ThetaProbe volumetric soil moisture from site-specific calibration, average
TP_ssc stdev	ThetaProbe volumetric soil moisture from site-specific calibration, standard deviation
ST_C 1 cm	Soil temperature in degrees Celsius at 1 cm
ST_C 5 cm	Soil temperature in degrees Celsius at 5 cm
ST_C 10 cm	Soil temperature in degrees Celsius at 10 cm
Surf_Temp C	Surface temperature in degrees Celsius
Can_ID 0-1 cm	Soil can identifier for 0-1 cm sample
Can_Wgt 0-1 cm	Soil can weight for 0-1 cm sample
Wet_Wgt 0-1 cm	Wet weight of soil for 0-1 cm sample
Dry_Wgt 0-1 cm	Dry weight of soil for 0-1 cm sample
GSM 0-1 cm	Gravimetric soil moisture in g/g for 0-1 cm sample
BD 0-1 cm	Bulk density in g/cm^3 for 0-1 cm sample
VSM 0-1 cm	Volumetric soil moisture (calculated from sample) in m^3/m^3 for 0-1 cm sample
Can_ID 0-3 cm	Soil can identifier for 0-3 cm sample
Can_Wgt 0-3 cm	Soil can weight for 0-3 cm sample
Wet_Wgt 0-3 cm	Wet weight of soil for 0-3 cm sample
Dry_Wgt 0-3 cm	Dry weight of soil for 0-3 cm sample
GSM 0-3 cm	Gravimetric soil moisture in g/g for 0-3 cm sample
BD 0-3 cm	Bulk density in g/cm^3 for 0-3 cm sample
VSM 0-3 cm	Volumetric soil moisture (calculated from sample) in m^3/m^3 for 0-3 cm sample
Can_ID 3-6 cm	Soil can identifier for 3-6 cm sample
Can_Wgt 3-6 cm	Soil can weight for 3-6 cm sample
Wet_Wgt 3-6 cm	Wet weight of soil for 3-6 cm sample
Dry_Wgt 3-6 cm	Dry weight of soil for 3-6 cm sample

Column Heading in File	Description
GSM 3-6 cm	Gravimetric soil moisture in g/g for 3-6 cm sample
BD 3-6 cm	Bulk density in g/cm^3 for 3-6 cm sample
VSM 3-6 cm	Volumetric soil moisture (calculated from sample) in m^3/m^3 for 3-6 cm sample
VSM 0-6 cm	Total volumetric soil moisture in m^3/m^3 for 0-6 cm
rain/irrig (mm)	Notes about amount of rain the previous night (if any); whether or not the field was irrigated, etc.

1.2 File Naming Convention

The single data file is named `GA_GVSM_Raw.txt`.

1.3 Spatial Coverage

Southernmost Latitude: 31.20º N

Northernmost Latitude: 31.82º N

Westernmost Longitude: 83.94º W

Easternmost Longitude: 83.43º W

1.4 Temporal Coverage

Data were collected from 23 June 2003 to 2 July 2003.

1.4.1 Temporal Resolution

Data were collected once daily at multiple sites. The sampling was conducted between 11:30 A.M. and 3:00 P.M. local time. Most sampling was 5 to 10 minutes in duration.

1.5 Parameter or Variable

1.5.1 Parameter Description

Parameters in this data set are gravimetric soil moisture (GSM), volumetric soil moisture (VSM), bulk density (BD), and surface and soil temperature. The following table describes the units of measurement and sources of each parameter.

Parameter	Units of Measurement	Source/Sensor(s)
Gravimetric soil moisture	Grams of water per grams of dry soil	Manual soil collection
Volumetric soil moisture	Cubic meters of water per cubic meters of dry soil	Manual soil collection and impedance probes (ThetaProbes)
Bulk density	Grams per cubic centimeter (g/cm^3)	Manual soil collection
Surface and soil temperature	Degrees Celsius	Infrared thermometers, temperature probes

1.5.2 Sample Data Record

The following sample illustrates the data. The first 12 data rows are shown; only the first 4 columns and last 4 columns of each row are shown (the column headings in the sample indicate the included columns). Missing data are represented with -999 or -99:99 in the data file.

Site ID	Date	Crop_type	Sample_Time (EDT)		...	BD 3-6 cm	VSM 3-6 cm	VSM 0-6 cm	rain/irrig (mm)
GA01	6/23/2003	peanuts	-99:99		...	1.479	0.12	0.115	nd
GA01	6/24/2003	peanuts	-99:99		...	1.386	0.101	0.08	0
GA01	6/25/2003	peanuts	-99:99		...	1.37	0.092	0.076	0
GA01	6/26/2003	peanuts	14:00		...	1.531	0.108	0.09	nd
GA01	6/27/2003	peanuts	13:35		...	1.609	0.102	0.075	0
GA01	6/28/2003	peanuts	13:50		...	1.279	0.091	0.057	0
GA01	6/29/2003	peanuts	13:18		...	1.395	0.09	0.091	1
GA01	6/30/2003	peanuts	13:32		...	1.382	0.087	0.089	3
GA01	7/1/2003	peanuts	13:38		...	1.487	0.099	0.098	5
GA01	7/2/2003	peanuts	13:43		...	1.425	0.139	0.139	21
GA02	6/23/2003	forest	11:50		...	1.547	0.094	0.104	nd
GA02	6/24/2003	forest	13:34		...	1.309	0.096	0.095	0

1.6 Error Sources

1.6.1 Impedance Probes

Impedance probes (ThetaProbes) were used for volumetric soil moisture sampling. For various reasons, including extremely dry conditions, severe weather restrictions, miscommunication among personnel, and cultivation, some sites were not sampled on particular days. Occasionally, a ThetaProbe 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 instrument was used. The site-specific calibration resulted in an average root mean square error of 0.02 m^3/m^3.

1.6.2 Bulk Density

The coring tool extracts a known volume of soil that is used to compute a bulk density. There is potential for compaction with this tool, which results in higher bulk densities when compared to other methods. For the 0-1 cm sample, and for the other sample depths when dry moisture conditions prevented using the coring tool, a 13 cm x 10 cm x 2 cm rectangular shaped scoop tool was used to retrieve the soil sample. This tool does not allow for a bulk density estimate, so the average bulk density from all coring tool samples was used for computation of volumetric soil moisture. Also, the bulk density of the 0-3 cm sample was considered less reliable than the 3-6 cm sample; therefore, the 3-6 cm bulk density was used for all calculations. The bulk density for all 0-1 cm samples was assumed to be 1.5 g/cm^3.

2 DATA ACQUISITION AND PROCESSING

2.1 Theory of Measurements

This regional soil moisture site is within a single Aqua satellite passive microwave footprint (approximately 50 km), and measurements were taken around the time of the AMSR-E/Aqua overpass (13:30 local time). The goal of soil moisture sampling in these regional sites is to provide a reliable estimate of volumetric soil moisture and variance within the AMSR-E footprint.

2.1.1 Sampling

Sampling was performed on sites approximately one quarter section (0.8 km by 0.8 km) in size. A grid of 49 individual sites was sampled, covering approximately 50 km by 75 km. One location in each of the sites was sampled. The sampling was conducted between 11:30 A.M. and 3:00 P.M. local time.

Volunteers used a coring tool to extract a single soil moisture sample of the 0-3 cm and 3-6 cm soil layers. Surface samples of the 0-1 cm soil were taken with a rectangular shaped scoop tool.

For volumetric soil moisture sampling, the primary measurement was the 0-6 cm dielectric constant at a single location in each site using impedance probes. The dielectric constant is converted to volumetric soil moisture using a calibration equation.

2.1.2 Computing Bulk Density and Soil Moisture

In the laboratory, samples were weighed, dried, and then weighed again. Gravimetric soil moisture (GSM) was computed as:

GSM = (wet weight - dry weight) / dry weight

The bulk density (BD) was determined by dividing the dry soil mass by the volume of the sample (3 cm cylinder of sample length). The bulk density for all 0-1 cm samples was assumed to be 1.5 g/cm3.

Volumetric soil moisture (VSM) was computed as:

VSM = GSM * BD

Note: For the 0-3 cm samples, the 3-6 cm bulk density was used due to the unreliability of the 0-3 cm samples.

2.2 Data Acquisition Methods

2.2.1 Manual Soil Collection

Samples were collected manually in the field using coring tools, rectangular shaped scoop tools, and soil cans.

2.2.2 Infrared Thermometer (Pyrometer) and Temperature Probe

The surface temperature was sampled using handheld infrared thermometers, which are OMEGA OS643-LS Infrared Pyrometers. The instrument has an emissivity of 0.95, accuracy of ± 3%, and temperature range of 0 to 260°C (32 to 500°F). Refer to OMEGA Engineering for more information.

Soil temperature was obtained using a temperature probe inserted to depths of 1 cm, 5 cm, and 10 cm. Several different temperature probes were used, but all have a metal rod, plastic top, and digital readout.

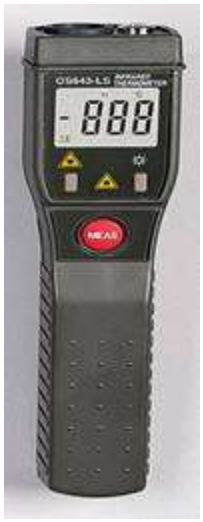

Figure 1. OS643-LS
Infrared Pyrometer

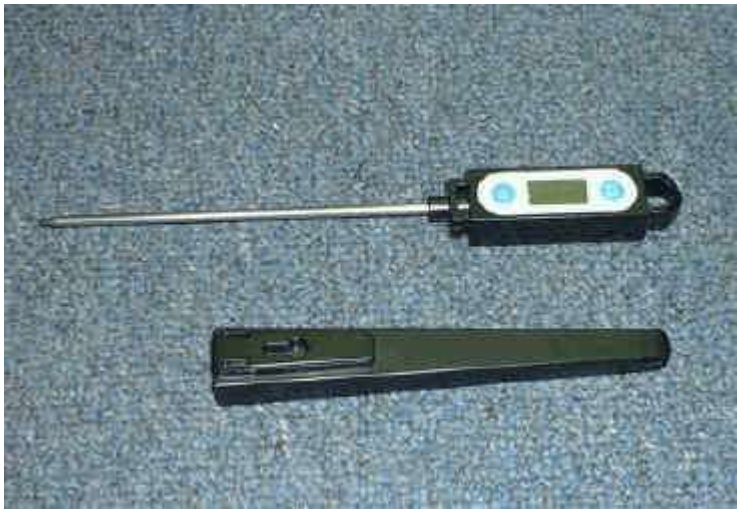

Figure 2. Temperature Probe

2.2.3 Impedance Probes (ThetaProbes)

Investigators used impedance probes to measure surface volumetric soil moisture. The probes were Type ML2 ThetaProbe manually-operated impedance instruments manufactured by Delta-T Devices, Ltd. The ThetaProbes have four separate 6 cm stainless steel rods that were inserted vertically into the soil. Each instrument was connected to a handheld reader that delivers the electrical pulse, detects the return signal, and converts the period to voltage between 0 and about 1 V.

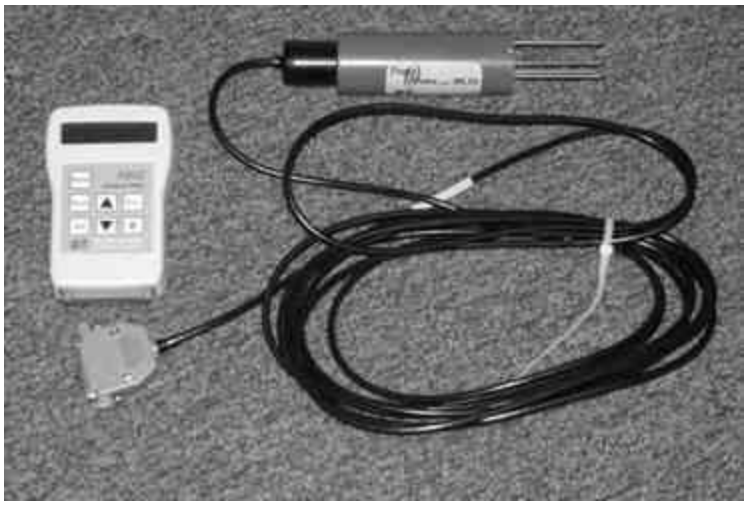

Figure 3. ML2 ThetaProbe

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

$$\text{Theta} = \frac{1.07 + 6.4V - 6.4V^2 + 4.7V^3 - a_0}{a_1}$$

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

Researchers also performed site-specific calibration for each field of sampling. Probe voltage readings from a row sampling point were compared to the volumetric soil moisture measured at the same point. A regression relationship was developed and new volumetric soil moisture values were estimated.

For several sites (GA01, GA08, GA09, GA24), recalibration of the probes was inappropriate because of the small dynamic range of the moisture values. For these sites, the general calibration coefficients were used for the site-specific calibration.

3 REFERENCES AND RELATED PUBLICATIONS

Please see the AMSR-E Web site to access data.

4 CONTACTS AND ACKNOWLEDGMENTS

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5 DOCUMENT INFORMATION

5.1 Publication Date

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5.2 Date Last Updated

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