

**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 Bulk Density and Rock Fraction Data: Sonora**

### **Summary**

The parameters for this data set include Sample Bulk Density, Soil Bulk Density, Gravimetric Soil Moisture, % Rock by Weight, and % Rock by Volume. Summary files containing field averages are provided for simplicity. This data set is part of the Soil Moisture Experiment 2004 (SMEX04). The SMEX studies are designed to evaluate, among other things, the accuracy of AMSR-E soil moisture data. The Mexico portion of SMEX04 was conducted during August 2004. Data are provided in ASCII text files.

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:**

Jackson, T. J., McKee, L. G., and V. Lakshmi. 2009. *SMEX04 Bulk Density and Rock Fraction Data: Sonora*. Boulder, Colorado USA: National Snow and Ice Data Center. Digital media.

## Overview Table

Category	Description
<u>Data format</u>	ASCII tab-delimited text files.
<u>Spatial coverage</u>	29.8° to 30.4° N, 110.2° to 110.7° W
<u>Temporal coverage</u>	4 August 2004 to 12 August 2004
<u>File naming convention</u>	'Raw' is a raw data file and 'Sum' is a summary data file.
<u>File size</u>	4 KB to 7 KB
<u>Parameter(s)</u>	Sample Bulk Density, Soil Bulk Density, Gravimetric Soil Moisture, % Rock by Weight, and % Rock by Volume
<u>Procedures for obtaining data</u>	Data are available via FTP.

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### 1. Contacts and Acknowledgments:

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## **Acknowledgements:**

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## **2. Detailed Data Description:**

### **Format:**

ASCII tab-delimited text files.

### **File Naming Convention:**

Raw data files contain the word RAW, and summary data files contain the word SUM. Summary data files contain the average of the 2 sampling sites at each field. Some files also contain a version number (such as V2 for version 2) if the file has been revised.

### **File Size:**

File sizes range from 4 KB to 7 KB.

### **Spatial Coverage:**

Southernmost Latitude: 29.8° N  
Northernmost Latitude: 30.4° N

Westernmost Longitude: 110.2° W  
Easternmost Longitude: 110.7° W

### **Temporal Coverage:**

4 August 2004 to 12 August 2004

### **Temporal Resolution:**

Data was collected on multiple days at multiple sites.

### **Parameter or Variable:**

#### **Parameter Description:**

Parameters in this data set are Gravimetric Soil Moisture, Sample Bulk Density, Soil Bulk Density, % Rock by Weight, and % Rock by Volume. The following table describes the units of measurement and sources of each parameter.

<b>Parameter</b>	<b>Unit of Measurement</b>	<b>Sensor</b>
Gravimetric Soil Moisture	%	Manual data collection
Sample Bulk Density	g/cm <sup>3</sup>	Manual data collection
Soil Bulk Density	g/cm <sup>3</sup>	Manual data collection
% Rock by Weight	%	Manual data collection
% Rock by Volume	%	Manual data collection

#### **Parameter Range:**

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

#### **Bulk Density and Rock Fraction Sampling**

'Raw\_ SMEX04\_ Mexico\_BD' – Raw Data Columns

<b>Column Heading</b>	<b>Description</b>
Field	Field location identification number
Date	Month/day/year

DOY	Day of year
Site	Number of site within field
Latitude	Decimal Degree, WGS84
Longitude	Decimal Degree, WGS84
UTM_Easting	WGS84, Zone 12, in meters
UTM_Northing	WGS84, Zone 12, in meters
Extracted Volume	Volume of soil extracted in mls
Sample Wet Weight	Wet weight of soil extracted in grams
Sample Dry Weight	Dry weight of soil extracted in grams
Gravimetric Soil Moisture	Grams of water per grams of dry soil
Sample Bulk Density	Bulk density of sample in g/cm <sup>3</sup>
Rocks Weight	Weight of Rocks (>2mm) in grams
Rocks Volume	Volume of Rocks (>2mm) in mls
Soil Bulk Density	Bulk density of soil (<2mm) in g/cm <sup>3</sup>
% Rock by Weight	% Rock (>2mm) by weight in the extracted sample
% Rock by Volume	% Rock (>2mm) by volume in the extracted sample
Notes	Sampling notes (if any)

'Sum\_ SMEX04\_ Mexico\_BD' – Summary Data Columns

<b>Column Heading</b>	<b>Description</b>
Field	Site location identification number
Date	Month/day/year
DOY	Day of year
Latitude	Decimal Degree, WGS84
Longitude	Decimal Degree, WGS84

UTM_Easting	WGS84, Zone 12, in meters
UTM_Northing	WGS84, Zone 12, in meters
Gravimetric Soil Moisture	Grams of water per grams of dry soil
Sample Bulk Density	Bulk density of sample in g/cm <sup>3</sup>
Soil Bulk Density	Bulk density of soil (<2mm) in g/cm <sup>3</sup>
% Rock by Weight	% Rock (>2mm) by weight in the extracted sample
% Rock by Volume	% Rock (>2mm) by volume in the extracted sample

Missing data are represented with -999

## **Error Sources:**

### **Bulk Density:**

Hard and rocky soils can make accurate collection of bulk density samples difficult.

### **Rock Fraction:**

Human error can exist in sieving, weighing and measuring the volume.

## **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 which recognizes tab-delimited text files, such as MS Excel is recommended. A word-processing program or Web browser will also display the data.

### **Related Data Collections:**

See related information on the NSIDC [Soil Moisture Experiment \(SMEX\)](#) Web site.

## **4. Data Acquisition and Processing:**

### **Theory of Measurements:**

Bulk density is used to convert the gravimetric samples to volumetric soil moisture. A volume extraction technique was used.

### **Sampling:**

Only a brief summary is provided. Please see the experiment plan for details. In general, two samples per site were taken. Efforts were made to collocate the bulk density samples with the gravimetric soil moisture sampling points. In cases where these points could not be easily identified, approximations of location were made. See gravimetric soil moisture sampling dataset for information on the geographic coordinates. After selecting a location, vegetation is removed. A volume of surface soil is extracted to a specific depth (6 cm). The soil was dried at 100°C for 24 hours, then was sieved through a 2mm mesh sieve to separate the rock fraction.

### **Computing Sample Bulk Density:**

Using the volume extracted and the dry weight of the soil extracted, the bulk density is computed. The computation is as follows:

$$\text{Sample Bulk Density} = \text{dry weight soil} / \text{soil volume extracted}$$

### **Computing Gravimetric Soil Moisture:**

It is also possible to compute the soil moisture of the sample used for the bulk density:

$$\text{Gravimetric Soil Moisture} = (\text{wet weight} - \text{dry weight}) / \text{dry weight}$$

### **Computing Rock Fraction:**

Using the volume and weight of the rock fraction of the sample, the % rock by weight and the % rock by volume are calculated. The computations are as follows:

$$\% \text{ Rocks by Weight} = \text{weight of rocks} / \text{dry weight of sample}$$

*% Rocks by Volume = volume of rocks / volume of sample extracted*

### **Computing Soil Bulk Density:**

Using the volume and weight of the sample extracted and the volume and weight of the rocks, the soil bulk density can be calculated. The computations are as follows:

*Dry weight of soil = Dry weight of sample – weight of rocks*

*Volume of soil = Volume of sample extracted – volume of rocks*

*Soil Bulk Density = dry weight of soil / volume of soil*

### **Sensor or Instrument Description:**

#### **Bulk Density and Rock Fraction**

Samples were collected manually. In the laboratory they were weighed, dried at 100°C for 24 hours, and then weighed again. The samples were then sieved through a 2mm mesh sieve to separate the rock fraction.

### **5. References and Related Publications:**

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

### **6. Document Information:**

#### **Glossary and Acronyms:**

Please see the [EOSDIS Glossary of Terms](#) for a general list of terms.

#### **List of Acronyms**

Please see the [EOSDIS Acronyms](#) list for a general list of Acronyms. The following acronyms are used in this document:  
AMSR-E - Advanced Microwave Scanning Radiometer – Earth Observing System  
FTP – File transfer protocol

SMEX - Soil Moisture Experiment  
UTM - Universal Transverse Mercator

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