

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 Vegetation Data

Summary

This data set contains in situ data collected using a multispectral radiometer and a plant-canopy analyzer over the Soil Moisture Experiment 2004 (SMEX04) areas of Arizona, USA and Sonora, Mexico. The experiment was conducted 20 July 2004 to 24 August 2004. Sampling was performed on sites approximately 800 meters by 800 meters in size. The parameters for this data set include Leaf Area Index (LAI), Multispectral Radiometer Reflectance, wet biomass, dry biomass, water content, and site vegetation cover. The total volume for this data set is approximately 1.5 megabytes. Data are provided in Microsoft Excel files, 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, publisher: NSIDC, and digital media.

Hunt, E. R., and L. McKee. 2009. *SMEX04 Vegetation Data*. Boulder, Colorado USA: National Snow and Ice Data Center. Digital media.

Overview Table

Category	Description
<u>Data format</u>	Microsoft Excel files.
<u>Spatial coverage</u>	29.94° to 32.08° N, 109.72° W to 110.67° W

<u>Temporal coverage</u>	20 July 2004 to 24 August 2004
<u>File naming convention</u>	SMEX04_datatype.xls
<u>File size</u>	27 KB to 1060 KB
<u>Parameter(s)</u>	Leaf Area Index (LAI), Multispectral Radiometer Reflectance, wet biomass, dry biomass, water content, and site vegetation cover.
<u>Procedures for obtaining data</u>	Data are available via FTP.

Table of Contents

1. Contacts and Acknowledgments
2. Detailed Data Description
3. Data Access and Tools
4. Data Acquisition and Processing
5. References and Related Publications
6. Document Information

1. Contacts and Acknowledgments:

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Acknowledgements:

Many graduate students and volunteers worked to collect the field data. We would like to thank the Soil Moisture Experiment 2004 Science Team. We would also like to thank the National Aeronautics and Space Administration for their generous contributions to the study. This work was supported by the NASA Aqua AMSR, Terrestrial Hydrology and Global Water Cycle Programs.

2. Detailed Data Description:

Format:

Nine Microsoft Excel files.

File Naming Convention:

Files are named according to the following convention and are further described in Table 1:

SMEX04_datatype.xls

Table 1. Description of File Name Variables

Variable	Description
SMEX04	
datatype	CropScan LAI-2000_raw LAI-Hemispherical_raw Site_Coordinates Site_Definitions Site_cover Vegetation_Leaf_Dry_weight Vegetation_Leaf_Fresh_and_Dry_weight Vegetation_Leaf_Water_Content
.xls	Indicates a Microsoft Excel spreadsheet file

CropScan contains Multispectral Radiometer Reflectance data.

LAI-2000_raw and LAI-Hemispherical_raw contain the Leaf Area Index data measured by LAI-2000 instrument and fish eye Hemispherical photos only.

Vegetation_Leaf_Dry_weight, Vegetation_Leaf_Fresh_and_Dry_weight, and Vegetation_Leaf_Water_Content contain all leaf dry and fresh weight data.

Site files contain location, vegetation cover, and other site related information.

File Size:

File sizes range from 27 KB to 1060 KB.

Spatial Coverage:

Northernmost Latitude: 32.08° N
Southernmost Latitude: 29.94° N
Westernmost Longitude: 110.67° W
Easternmost Longitude: 109.72° W

Temporal Coverage:

20 July 2004 to 24 August 2004

Temporal Resolution:

Data were collected on multiple days at multiple sites.

Parameter or Variable:

Parameter Description:

Parameters in this data set are: Leaf Area Index (LAI), Multispectral Radiometer Reflectance, wet biomass, dry biomass, water content, and site vegetation cover. The following table describes the units of measurement and sources of each parameter.

Parameter	Unit of Measurement	Sensor
Leaf Area Index	m ² /m ²	1) LI-COR LAI-2000 2) Fish eye Hemispherical photos
Multispectral Radiometer Reflectance	%	CropScan MSR-16R
Wet Biomass	Grams	manual data collection
Dry Biomass	Grams	manual data collection
Water Content	Grams	manual data collection
Leaf Area	Cm ²	Digital photos

Parameter Range:

The following tables detail the column headings for each data file in the categories of vegetation sampling, and multispectral radiometer reflectance.

Vegetation Sampling

‘SMEX04 LAI_2000_raw’ file

Column Heading	Description
Date	Month/day/year
Time	Time of sampling in MST
Site	Sampled Field Name
LAI	Leaf Area Index

‘SMEX04 Hemispherical_raw’ file

Column Heading	Description
Site Names	Field to be sampled
Average	Average LAI over all measurements in the field.
Date	Day/Month/year
Latitude	Decimal Degree, WGS84
Longitude	Decimal Degree, WGS84
LAI_ave	Average of Leaf Area Index

‘SMEX04 CropScan’ – Reflectance Data Columns

Column Heading	Description
Field	Field location identification number, AZ is an Arizona regional site, RG is a Walnut Gulch Watershed site, CP01 is a Chili Pepper field, KT01 is the Kendall Tank, WS01 is a White area used for calibration.
SS	Sub sample
Date	month/day/year
DOY	Day of year
Time	Time of sampling in CDT
Latitude	Decimal Degree, WGS84
Longitude	Decimal Degree, WGS84
UTM_Easting	WGS84, Zone 12, in meters

UTM_Northing	WGS84, Zone 12, in meters
	Multispectral Radiometer Reflectance (%)
485nm – AVG	Avg of % reflectance at 485nm
560nm - AVG	Avg of % reflectance at 560nm
650nm - AVG	Avg of % reflectance at 650nm
660nm - AVG	Avg of % reflectance at 660nm
830nm - AVG	Avg of % reflectance at 830nm
850nm - AVG	Avg of % reflectance at 850nm
1240nm - AVG	Avg of % reflectance at 1240nm
1640nm - AVG	Avg of % reflectance at 1640nm
1650nm - AVG	Avg of % reflectance at 1650nm

‘SMEX04 Site Coordinates’

Column Heading	Description
Feature Type	GPS feature type
Description	Description where the GPS measurement was taken
Date	Month/day/year
Hour	Time of the day
Original file Name	Original file Name
Height	Height
Vertical Accuracy	Vertical Accuracy
Horizontal Accuracy	Horizontal Accuracy
Lat	Latitude Decimal Degree, WGS84
Long	Longitude Decimal Degree, WGS84

‘SMEX04 Site Cover’ – the number land cover measurements in the sampled area

Column Heading	Description
Land Cover	Land cover type
Vegetation Type	The vegetation class the land cover type associated
Field	Sampled field name
Date	Month/day (2004)

‘SMEX04 Vegetation Leaf Dry weight’ – Dry weights of the leaf samples collected.

Column Heading	Description
Sample+bag	Sample weight (grams) with the bag
Bag	Bag weight
Dry Weight	The net dry weight of the sample
Date	Month/day/year

‘SMEX04 Vegetation Leaf Fresh and Dry weight’ – Fresh and Dry weights, and areas of the leaf samples collected.

Column Heading	Description
Site Names	Field Name the samples were collected
File Name	The digital picture name
Standard size	The square reference area that was placed in the pictures
Standard Pixel	Reference area in pixel number
Sample pixel	Sample leaf area in pixel number
Sample area	Sample Leaf area in cm ²
Fresh sample weight	Net Fresh weight (g) of the leaf samples
Dry sample	Net Dry weight (g) of the leaf samples
Fresh - Dry	Net water amount in the samples (g)

‘SMEX04 Vegetation Leaf Water Content’ – Average Field Data.

Column Heading	Description
Site Name	Field Name the samples were collected
Site Loc	The location of the fields. (AZ) refers to Arizona and (SO) refers to Sonora
Samp Date	Sampling Date (mon/day/year)
Coordinates	WGS84 degree latitude and longitude coordinates
Cover %	Average field land cover
LAI	Leaf Area Index

Error Sources:

Leaf Area Index:

Direct-beam radiation reflected into the sensor from upper leaves in the canopy can be confused with open sky, causing LAI to be underestimated. Samplers were instructed to sample with the sun to their backs, but occasionally direct sunlight may enter the sensor. The data were examined for this and for evidence of variable sky conditions during the measurement sequence. Also, hemispherical photos with automatic exposure settings underestimated LAI. This has been corrected with the calibration studies performed after the experiment.

Multispectral Radiometer:

The radiometer performs near-simultaneous inputs of incident as well as reflected irradiation. This allows useful measurements of percent reflectance to be obtained during cloudy conditions with incident irradiance levels down to approximately 300 watts per square meter. Measurements obtained with an incident irradiance level of less than 300 watts had to be discarded. One day it was too cloudy to take any multispectral radiometer measurements.

3. Data Access and Tools:

Data Access:

Data are available via FTP.

Software and Tools:

These data are viewable using Microsoft Excel.

Related Data Collections:

For related data collections, please see AMSR-E Validation:
http://nsidc.org/data/amsr_validation/.

4. Data Acquisition and Processing:

Theory of Measurements:

The goal of vegetation sampling is to generate the vegetation products used to estimate surface soil moisture from passive microwave radiometers. Sampling was designed to coincide with satellite overpasses, such as Thematic Mapper (TM5) and Terra-MODIS, which can be used to estimate vegetation water content on the regional scale.

Section Sampling:

Sampling was performed on sites approximately a quarter section (0.8 km by 0.8 km) in size. The sampling was concentrated in the Arizona and Sonora watershed, but several locations outside of these study areas were also sampled. Sampling consisted of recording vegetation height and plants density, collecting vegetation biomass samples, and taking reflectance and LAI measurements. Three locations in each of the sites were sampled. Every effort was made to have these three locations coincide with soil moisture sampling points. The sampling was conducted between 09:00 and 15:00 local time.

Computing Areal Water Content:

The following steps were used to compute areal water content:

- Determine by manual collection the water content for a known number of plants, convert to a per area basis
- Multiply the water content per area by the measured Leaf Area Index to get the average water content.

Sensor or Instrument Description:

Vegetation Moisture

Samples were collected manually. In the laboratory they were weighed, dried at 60°C for 48 to 96 hours, and then weighed again.

Leaf Area Index Sensors

Investigators used LiCor LAI-2000 plant canopy analyzers to measure leaf area index (LAI) using an indirect non-contact method based on light transmittance through the canopy. The LAI-2000 calculates LAI from radiation measurements made with a "fish-eye" optical sensor (148° field-of-view). Measurements made above and below the canopy are used to determine canopy light interception at 5 angles.

Measurements are made by positioning the optical sensor and pressing a button, which sends the data to the data logger. Multiple below-canopy readings are taken so that LAI calculations are based on a large sample of the foliage canopy. After collecting above-canopy and below-canopy measurements, the control data logger performs all

calculations and the results are available for immediate inspection. For more information see: http://www.licor.com/env/Products/AreaMeters/lai2000/2000_intro.jsp

The hemispherical photographs were acquired using a Nikon Coolpix 5400 digital camera with an 8-mm focal-length lens. A tripod, compass, and bubble level were used to mount the camera horizontally about 25 mm off the ground, with the top of the camera always facing north. The resulting digital photographs were analyzed with HemiView Canopy Analysis Software, Version 2.1 SR1 (Delta-T Devices, Ltd., Cambridge, U.K.).

Multispectral Radiometer

Investigators used MSR-16R Multispectral radiometers manufactured by CropScan to measure reflectance. The CropScan Multispectral Radiometer (MSR) is an inexpensive instrument that has up-and-down-looking detectors and the ability to measure sunlight at different wavelengths. The CropScan multispectral radiometer systems consist of a radiometer, data logger controller (DLC) or A/D converter, terminal, telescoping support pole, connecting cables and operating software. The radiometer uses silicon or germanium photodiodes as light transducers. Matched sets of the transducers with filters to select wavelength bands are oriented in the radiometer housing to measure incident and reflected irradiation. In this experiment the wavelengths measured were: 485, 560, 650, 660, 830, 850, 1240, 1640, 1650 nm. These bands provide data for selected channels of the Landsat Thematic Mapper and MODIS instruments. Channels were chosen to provide NDVI as well as a variety of vegetation water content indices under consideration. For more information see: www.cropscan.com/msr.html

5. References and Related Publications:

Please see the National Snow and Ice Data Center SMEX04 Data Web site for more information and to access data: http://nsidc.org/data/amr_validation/soil_moisture/.

6. Document Information:

List of Acronyms

The following acronyms are used in this document:

AMSR-E - Advanced Microwave Scanning Radiometer – Earth Observing System

AVG – Average

FTP – File transfer protocol

LAI – Leaf Area Index

LW – Little Washita Watershed

MSR – Multispectral Radiometer

SMEX - Soil Moisture Experiment

STD – Standard Deviation

Terra MODIS – Moderate Resolution Imaging Spectroradiometer instrument on Terra satellite

TM5 – Thematic Mapper Instrument on Landsat 5 satellite

UTM - Universal Transverse Mercator

Document Creation Date:

10 May 2009