SMEX05 Multispectral Radiometer Data: Iowa

Summary

This data set contains multispectral radiometer reflectance data collected over the Soil Moisture Experiment 2005 (SMEX05) area of Iowa, USA from 16 June 2005 through 08 July 2005. The total volume of this data set is approximately 1.5 megabytes. Data are provided in ASCII text and Excel formats, 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:

Jackson, Thomas J. and Lynn G. McKee. 2010. *SMEX05 Multispectral Radiometer Data: Iowa*. Boulder, Colorado USA: NASA DAAC at the National Snow and Ice Data Center.

Overview Table

Category	Description
Data Format	ASCII tab-delimited text Microsoft Excel spreadsheet files
Spatial Coverage	41.92º to 42.01º N, 93.58º to 93.92º W
Temporal Coverage	16 June 2005 - 08 July 2005

File naming Convention	Avg_SMEX05_MSR.txt and .xls Over_Raw_SMEX05_MSR.txt and .xls Over_Sum_SMEX05_MSR.txt and .xls Raw_SMEX05_MSR.txt and .xls Sum_SMEX05_MSR.txt and .xls
File Size	5 KB - 728 KB
Parameter(s)	Surface Reflectance
Procedures for Obtaining Data	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:

Each data set file is provided in ASCII tab-delimited text format and in Microsoft Excel spreadsheet format.

File Naming Convention:

Files are named as follows and are further described in Table 1:

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Avg_SMEX05_MSR.txt
Avg_SMEX05_MSR.xls
Over_Raw_SMEX05_MSR.txt
Over_Raw_SMEX05_MSR.xls
Over_Sum_SMEX05_MSR.txt
Over_Sum_SMEX05_MSR.xls
Raw_SMEX05_MSR.txt
Raw_SMEX05_MSR.xls
Sum_SMEX05_MSR.txt
Sum_SMEX05_MSR.xls
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Table 1. Description of File Name Variables

Variable	Description
Avg	Average data file; average data files consist of the averages for each sampling site at every field. There are no average data files for the overpass days.
Over	Overpass file
Raw	Raw data file
Sum	Summary data file; summary data files consist of the average of the sampling sites at each field.
SMEX05	Soil Moisture Experiment 2005
MSR	Multispectral Radiometer
.txt	ASCII tab-delimited text
.xls	Microsoft Excel file

File Size:

File sizes range from 5 KB to 728 KB.

Spatial Coverage:

Southernmost Latitude: 41.92º N
Northernmost Latitude: 42.01º N
Westernmost Longitude: 93.92º W
Easternmost Longitude: 93.58º W

Temporal Coverage:

Data span 16 June 2005 through 08 July 2005.

Temporal Resolution:

Data was collected on multiple days at multiple sites.

Parameter or Variable:

Parameter Description:

The parameter in this data set is Surface Reflectance measured in percent using a CropScan MSR-16R multispectral radiometer.

Parameter Range:

Tables 2, 3, and 4 detail the column headings for each data file in the raw, average, and sum categories of multispectral radiometer reflectance. Missing data are represented with -999.

Table 2. Raw_SMEX05_MSR – Raw Data Columns

Column Heading	Description
Field	Field location identification number
Site	Letter of site within field
Plot	Number of plot within site
SS	Number of subsample within plot
Crop	c=corn, sb=soybean, alf=alfalfa
Date	Month/day/year
DOY	Day of year
Time	Time of sampling in Central Daylight Time (CDT)
Latitude	Decimal Degree, WGS84

Longitude	Decimal Degree, WGS84
Northing	UTM northing, WGS84, Zone 15, in meters
Easting	UTM easting, WGS84, Zone 15, in meters
Wavelength	**Multispectral Radiometer Reflectance (%)**
485nm	% reflectance at 485nm
560nm	% reflectance at 560nm
650nm	% reflectance at 650nm
660nm	% reflectance at 660nm
830nm	% reflectance at 830nm
850nm	% reflectance at 850nm
1240nm	% reflectance at 1240nm
1640nm	% reflectance at 1640nm
1650nm	% reflectance at 1650nm
Site	Soil Moisture site, if collocated

Table 3. Avg_SMEX05_MSR – Average Data Columns

Field	Field location identification number
Site	Letter of site within field
Crop	c=corn, sb=soybean, Alf=alfalfa
Date	Month/day/year
DOY	Day of year
Time	Time of sampling in CST
Latitude	Decimal Degree, WGS84
Longitude	Decimal Degree, WGS84
Northing	UTM Northing, WGS84, Zone 15, in meters
Easting	UTM Easting, WGS84, Zone 15, in meters
Wavelength	**Multispectral Radiometer Reflectance (%)**
485nm – AVG	Avg of % reflectance at 485nm
485nm – STD	Std of % reflectance at 485nm
560nm – AVG	Avg of % reflectance at 560nm
560nm – STD	Std of % reflectance at 560nm
650nm – AVG	Avg of % reflectance at 650nm
650nm – STD	Std of % reflectance at 650nm
660nm – AVG	Avg of % reflectance at 660nm
660nm – STD	Std of % reflectance at 660nm
830nm – AVG	Avg of % reflectance at 830nm
830nm – STD	Std of % reflectance at 830nm
850nm – AVG	Avg of % reflectance at 850nm

850nm – STD	Std of % reflectance at 850nm
1240nm – AVG	Avg of % reflectance at 1240nm
1240nm – STD	Std of % reflectance at 1240nm
1640nm – AVG	Avg of % reflectance at 1640nm
1640nm – STD	Std of % reflectance at 1640nm
1650nm – AVG	Avg of % reflectance at 1650nm
1650nm – STD	Std of % reflectance at 1650nm
SM Site	Soil Moisture site, if collocated

Table 4. Sum_SMEX05_MSR – Summary Data Columns

Field	Field location identification number
Crop	c=corn, sb=soybean, alf=alfalfa
Date	Month/day/year
DOY	Day of year
Time	Time of sampling in CST
Latitude	Decimal Degree, WGS84
Longitude	Decimal Degree, WGS84
Northing	UTM Northing, WGS84, Zone 15, in meters
Easting	UTM Easting, WGS84, Zone 15, in meters
Wavelength	**Multispectral Radiometer Reflectance (%)**
485nm – AVG	Avg of % reflectance at 485nm
485nm – STD	Std of % reflectance at 485nm
560nm – AVG	Avg of % reflectance at 560nm
560nm – STD	Std of % reflectance at 560nm
650nm – AVG	Avg of % reflectance at 650nm
650nm – STD	Std of % reflectance at 650nm
660nm – AVG	Avg of % reflectance at 660nm
660nm – STD	Std of % reflectance at 660nm
830nm – AVG	Avg of % reflectance at 830nm
830nm – STD	Std of % reflectance at 830nm
850nm – AVG	Avg of % reflectance at 850nm
850nm – STD	Std of % reflectance at 850nm
1240nm – AVG	Avg of % reflectance at 1240nm
1240nm – STD	Std of % reflectance at 1240nm
1640nm – AVG	Avg of % reflectance at 1640nm
1640nm – STD	Std of % reflectance at 1640nm
1650nm – AVG	Avg of % reflectance at 1650nm
1650nm – STD	Std of % reflectance at 1650nm

Notes	Notes, if collected

Error Sources:

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 were discarded. Some days or parts of days, it was too cloudy to take any multispectral radiometer measurements.

3. Data Access and Tools:

Data Access:

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

Software and Tools:

No special tools are required to view these data. A spreadsheet program which recognizes tab-delimited text files is recommended. Also, a word-processing program or Web browser 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:

Surface reflectance data are valuable in developing methods to estimate the vegetation water content and other canopy variables. Observations made concurrent with biomass sampling provide the essential information

needed for larger scale mapping with satellite observations. In addition, reflectance measurements made concurrent with satellite overpasses allow the validation of reflectance estimates based upon correction algorithms.

Field Sampling:

Reflectance measurements were collected at every Walnut Creek Watershed field at least once during the field campaign. The sampling was conducted between 09:00 and 16:00 local time.

Four sites in each of the fields were sampled. Every effort was made to make each site location coincide with the soil moisture sampling point. At each site, five parallel transects centering on the soil sampling point were sampled. The following sampling scheme was used for field sampling: Take a reading every five meters for 25 meters. Repeat, for a total of five replications located one meter/row apart.

Overpass Sampling:

Each land use type, such as corn and soybeans, was characterized by transect sampling. Reflectance measurements were collected at representative sites. A parking lot and a lake were also sampled for calibration purposes. This was done weekly to coincide with the Landsat and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) overpasses.

The following sampling scheme was used for transect sampling: Take a reading every five meters for 25 meters, walk 75 meters, continue until you have gone 400 meters. Walk over 100 meters. Do another 400 meter transect heading back in the direction that you started. Only one transect was sampled at WC22 on 22 June 2005 due to an instrument problem. On 08 July 2005, the alfalfa field was being harvested at the time of sampling, so additional samples were taken of the harvested area.

Sensor or Instrument Description:

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 Analog/Digital (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 Moderate Resolution Imaging Spectroradiometer (MODIS) instruments. Channels were chosen to provide Normalized Difference Vegetation Index (NDVI) as well as a variety of vegetation water content indices under consideration.

For more information, see the CropScan MSR:
www.cropscan.com/msr.html

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

A/D - Analog/Digital
AMSR-E - Advanced Microwave Scanning Radiometer – Earth Observing System
ASCII - American Standard Code for Information Interchange
ASTER - Advanced Spaceborne Thermal Emission and Reflection Radiometer
AVG - Average of percent reflectance
CDT - Central Daylight Time
DLC - Data Logger Controller
FTP - File transfer protocol
MODIS - Moderate Resolution Imaging Spectroradiometer
MSR - Multispectral Radiometer
NASA - National Aeronautics and Space Administration
nm - nanometers
NVDI - Normalized Difference Vegetation Index

SMEX05 - Soil Moisture Experiment 2005
STD - Standard Deviation
Terra MODIS - Moderate Resolution Imaging Spectroradiometer instrument on Terra satellite
TM5 - Thematic Mapper Instrument on Landsat 5 satellite
USDA ARS - United States Department of Agriculture Agricultural Research Service
UTM - Universal Transverse Mercator
WGS84 - World Geodetic System 1984

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