SE-590 Ground Data: GSFC (FIFE)

Summary:

The SE-590 Spectroradiometer Reflectance Factors from GSFC Data Set contains spectral data collected with the Spectron SE-590 Spectral Radiometer at selected FIFE sites located primarily on the Konza Prairie. These measurements were acquired in conjunction with the Surface Reflectances measured by the PARABOLA bi-directional measurements. Ground SE-590 data were acquired in all four 1987 Intensive Field Campaigns and in the 1989 Intensive Field Campaign. The ground SE-590 data were collected at approximately every 10 degree change in solar zenith angle (SZA) to characterize diurnal variations and/or simultaneous observations acquired by helicopter, airplane, or satellite over flights. The data were collected as wavelength intensity values which were converted to spectral radiances with instrument and campaign-specific calibration coefficients.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

SE-590 Ground Data: GSFC (FIFE).
(SE-590 Spectroradiometer Reflectance Factors from GSFC).

Data Set Introduction:

The SE-590 Spectroradiometer Reflectance Factors from GSFC Data Set contains surface reflectance, wavelength, and viewing angle data. These data were acquired in all four 1987 Intensive Field Campaigns and in the 1989 Intensive Field Campaign.

Objective/Purpose:

The purpose in collecting the ground SE-590 data was to characterize diurnal variations and/or simultaneous observations acquired by helicopter, airplane, or satellite over flights.

Summary of Parameters:

Surface reflectance, wavelength, and viewing angle.

Discussion:

The Surface Radiation Measurement Team (SRB-3) collected spectral data with the Spectron SE-590 Spectral Radiometer at selected FIFE sites located primarily on the Konza Prairie. These measurements were acquired in conjunction with the Surface Reflectances Measured by the PARABOLA bi-directional measurements. The ground SE-590 data were collected at approximately every 10 degree change in solar zenith angle (SZA) to characterize diurnal variations and/or simultaneous observations acquired by helicopter, airplane, or satellite over flights. Ground SE-590 data were acquired in all four 1987 Intensive Field Campaigns and in the 1989 Intensive Field Campaign. The data were collected as wavelength intensity values which were converted to spectral radiances with instrument and campaign-specific calibration coefficients.

Related Data Sets:

- SE-590 Leaf Level Spectral Observations from GSFC. Leaf reflectance data collected with the SE-590 spectrometer by Elizabeth M. Middleton at NASA Goddard Space Flight Center.
- SE-590 Reflectance Factors and Radiances from UNL. This data set contains nadir and off nadir SE-590 spectrometer reflectances measurements from the University of Nebraska group.
- SE-590 Reflectance Factors and Radiances Measured from a Helicopter. This data set contains reflectance measured with the helicopter mounted SE-590 spectrometer.
- Surface Reflectances Measured by the PARABOLA. This data set contains Don Deerings PARABOLA data; sky and ground radiance values collected using a sphere-scanning radiometer. This data has been averaged to give equal intervals of viewing angles.
- Leaf Angle Data. This data set contains data on the orientation of leaves of 10 different species.
- Biophysical Properties of Vegetation. This data set contains measurements of leaf area index and biomass of difference canopy components.

- Vegetation Species and Cover Abundance. This data set contains the species composition data, by site and date.
- Vegetation Species Reference. Konza LTER species names, codes, types and other reference information.
- Leaf Area Index and PAR Determined from UNL Light Bar Measurements. This data set contains data from the light bar (LICOR LI-191SA) collected by University of Nebraska group. The variables collected were photosynthetically active radiation, Absorbed photosynthetically active radiation, Intercepted photosynthetically active radiation and Leaf Area Index.
- Leaf Area Index and PAR Determined from KSU Light Bar Measurements. This data set contains data from the light bar collected by the Kansas State University Staff Science. Leaf Area Index and photosynthetically active radiation above and below the canopy were measured.
- Indirect Leaf Area Index Obtained from the UNL Light Wands. These data sets contain data from the LICOR LAI-2000 Plant Canopy Analyzer collected by the UNL group.
- Indirect Leaf Area Index Obtained from the KSU Light Wands. These data sets contain data from the LICOR LAI-2000 Plant Canopy Analyzer collected by KSU staff science.

FIS Data Base Table Name:

SE590_GROUND_GSFC_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Dr. Elizabeth M. Middleton
NASA Goddard Space Flight Center

Title of Investigation:

Quantifying Reflectance Anisotropy of Photosynthetically Active Radiation in Grasslands.

Contact Information:

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Requested Form of Acknowledgment.

The SE-590 Spectroradiometer Reflectance Factors from GSFC were collected by Dr. Elizabeth M. Middleton and her colleagues at NASA Goddard Space Flight Center.

3. Theory of Measurements:

Ground spectral radiances were acquired for grassland canopies and spectral irradiances were determined from radiation reflected from a barium sulfate reference panel. Radiances and irradiances were available at 252 wavelength channels that sampled the spectrum between 0.372 - 1.1 micrometers at unequal intervals of 0.002 - 0.003 micrometers. The true spectral resolution was 0.12 (O.10-0.15) micrometers. Due to decreased sensitivity of the instrument at extreme wavelengths, the data were retained for the interval 0.400 - 1.01 micrometers. Spectral reflectance was calculated as the ratio of the grassland radiance to the irradiance per spectral channel.

4. Equipment:

Sensor/Instrument Description:

The SE-590 was fitted with a 15 degree IFOV lens and mounted, along with another instrument (the PARABOLA, D. Deering, Code 923, NASA/GSFC) and a down-looking camera, on a large tripod-supported boom. The boom was elevated to position the instruments approximately 4.5 m above the surface in a relatively large area (50-70 [m^2]) that was judged to be as uniform and representative of the site as possible. The instruments were connected by cables to the respective recording units that were placed on elevated platforms behind the tripod/boom/instrument apparatus.

Collection Environment:

Ground-based.

Source/Platform:

The SE-590 was mounted 4.5 m above the surface on a large tripod-supported boom.

Source/Platform Mission Objectives:

To measure surface radiance.

Key Variables:

Surface radiances and reflectance factors from 0.372 to 1.1 micrometers at unequal intervals of 0.002 - 0.003 micro-meters.

Principles of Operation:

The SE-590 spectral detector head uses a defraction grating as the dispersive element; the spectrum is imaged onto a 256 element photodiode array. Each element integrates simultaneously acquiring the spectrum in a fraction of a second.

Sensor/Instrument Measurement Geometry:

The SE-590 was mounted on a tripod/boom apparatus 4.5 m above the ground. The SE-590 was fitted with a 15 degree IFOV lens All data were collected with the boom oriented normal to the solar principal plane (SPP). The azimuth orientation of the boom was adjusted before each sampling period to ensure that the data were acquired in the SPP. Typically 2 - 10 nadir observations were collected aligned in the SPP. These nadir SPP measurements were immediately followed by 2 or more additional nadir observations taken when the boom was rotated slightly to either side of the SPP.

Manufacturer of Sensor/Instrument:

Spectron Engineering, Inc.
255 Yuma Court
Denver, Colorado 80223
(303) 733-1060

Calibration:

During any given data collection time period, multiple observations with the SE-590 were made of the vegetated surface and of the barium sulfate reference panel. The reference scans were taken at the beginning and end of each sampling period since the boom had to be swung around 180 degrees to avoid trampling on the target vegetation surface.

Specifications:

The SE-590 was calibrated in house (GSFC) against several standards:

1. A 6 foot integrating sphere with 12 energy levels (0-142 [microvolts] [cm^-2][mm^-1[sr^-1], at 800 nm) was used to develop the 252 channel coefficients to convert the recorded "count" values to radiance [watts][m^-2][nm^-1][sr^-1]; 5 values per energy level for all 12 levels were determined at all 252 channels, and averaged values were used to calculate the calibration coefficients per channel using linear regression methods.
2. Two different sources (Mercury; Argon) were used to find the channels matching spectral calibration. The emission peaks which occur at known wavelengths (10 - 15) were utilized with assignment of other channels to wavelength by linear interpolation.

Calibration was conducted before both 1987 and 1989 FIFE field campaigns and checked for stability after the 1989 field acquisition.

Tolerance:

The true spectral resolution was 0.12 (0.10 - 0.15) micrometers.

Frequency of Calibration:

Daily stability checks were only performed during the IFC-5 period. A post-season wavelength and radiance calibration were performed at Goddard Space Flight Center.

Other Calibration Information:

Not available at this revision.

5. Data Acquisition Methods:

The ground SE-590 data were collected at approximately every 10 degree change in solar zenith angle (SZA). Each SZA sampling period typically lasted 5 - 20 minutes, averaging 10 minutes duration. During any given data collection time period, multiple observations with the SE-590 were made of the vegetated surface and of the barium sulfate reference panel. The reference scans were taken at the beginning and end of each sampling period since the boom had to be swung around 180 degree to avoid trampling on the target vegetation surface. For the vegetation scans, typically 2 - 10 nadir (view zenith angle = 0) observations of the grassland were collected with the boom realigned in the SPP. These nadir SPP measurements were immediately followed by 2 or more additional nadir observations taken when the boom was rotated slightly to either side of the SPP, increasing spatial sampling (1 m separated each of the three surface sample centers).

6. Observations:

Data Notes:

Not available.

Field Notes:

Not available at this revision.

7. Data Description:

Spatial Characteristics:

The FIFE study area with areal extent of 15 km by 15 km, is located south of the Tuttle Reservoir and Kansas River, and about 10 km from Manhattan, Kansas, USA. The northwest corner of the area has UTM coordinates of 4,334,000 Northing and 705,000 Easting in UTM Zone 14.

Spatial Coverage:

These data were located at the following locations within the FIFE study area:

	SITEGRID	STN	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEV
1916-EMS	2	4330296	708270	39 05 56	-96 35 30	340	
2043-EMS	44	4330003	713536	39 05 42	-96 31 51	415	
2132-EMS	6	4329774	711336	39 05 36	-96 33 23	405	
2655-EMS	36	4328787	716070	39 05 00	-96 30 07	367	
2731-EMS	4	4328678	711110	39 05 01	-96 33 34	446	
3129-EMS	8	4327702	710711	39 04 30	-96 33 51	430	
3414-EMS	10	4327286	707854	39 04 19	-96 35 51	410	
4439-EMS	16	4325215	712794	39 03 07	-96 32 28	445	
4439-EMS	916	4325193	712773	39 03 06	-96 32 28	443	
8739-EMS	926	4316699	712845	38 58 31	-96 32 35	442	

	SITEGRID	SLOPE	ASPECT
1916-EMS			
2043-EMS			
2132-EMS			
2655-EMS			
2731-EMS			
3129-EMS			
3414-EMS			
4439-EMS			
4439-EMS	2	N	
8739-EMS	1	TOP	

Spatial Coverage Map:

Not available.

Spatial Resolution:

The SE-590 was fitted with a 15 degree IFOV lens.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

The data was collected during FIFE's five IFC's, covering the period from June 1, 1987 through August 11, 1989.

OBS_DATE	OBS_DATE	OBS_DATE
01-JUN-87	15-AUG-87	27-JUL-89
03-JUN-87	16-AUG-87	28-JUL-89
04-JUN-87	17-AUG-87	01-AUG-89
05-JUN-87	20-AUG-87	04-AUG-89
06-JUN-87	06-OCT-87	06-AUG-89
26-JUN-87	07-OCT-87	07-AUG-89
28-JUN-87	11-OCT-87	08-AUG-89
06-JUL-87	12-OCT-87	09-AUG-89
11-JUL-87	13-OCT-87	10-AUG-89
10-AUG-87	26-JUL-89	11-AUG-89
11-AUG-87		

Temporal Coverage Map:

Not available.

Temporal Resolution:

Each solar zenith angle sampling period typically lasted 5 - 20 minutes, averaging 10 minutes in duration.

Data Characteristics:

The SQL definition for this table is found in the SE_GSFC.TDF file located on FIFE CD-ROM Volume 1.

Parameter/Variable Name

Parameter/Variable Description **Range** **Units** **Source**

SITEGRID_ID
This is a FIS grid location code.
Site grid codes (SSEE-III) give
the south (SS) and east (EE) cell
number in a 100 x 100 array of

200 m square cells. The last 3 characters (III) are an instrument identifier.	
STATION_ID The station ID designating the location of the observations.	
OBS_DATE The date of the observations, in the format (DD-MMM-YY).	
OBS_TIME The start time of the observation in GMT. The format is (HHMM).	[GMT]
NUM_OBS The number of observations averaged together.	
VIEW_AZIM_ANG The view azimuth angle. With North=0, East=90	[degrees from North]
VIEW_ZEN_ANG The view zenith angle of the observations. With a nadir view=0	[degrees]
SOLAR_AZIM_ANG The solar azimuth angle. With North=0, East=90	[degrees from North]
SOLAR_ZEN_ANG The solar zenith angle.	[degrees]
WAVLEN The wavelength at which the observation was made.	[microns]
REFL The average percent reflectance. These reflectance values take into account the anisotropy of the calibration panel.	[percent]
REFL_UNCORR	

```
The average percent reflectance.                              [percent]
These reflectance values DO NOT
take into account the anisotropy
of the calibration panel.
```

```
REFL_SDEV
The standard deviation of the                                 [percent]
reported reflectances.
```

```
COMMENTS
Any comments describing the data.
```

```
FIFE_DATA_CRTFCN_CODE
The FIFE Certification Code for          *
the data, in the following format:
CPI (Certified by PI), CPI-???
(CPI - questionable data).
```

```
LAST_REVISION_DATE
data, in the format (DD-MMM-YY).
```

Footnote:

Decode the FIFE_DATA_CRTFCN_CODE field as follows:

The primary certification codes are: EXM Example or Test data (not for release) PRE Preliminary (unchecked, use at your own risk) CPI Checked by Principal Investigator (reviewed for quality) CGR Checked by a group and reconciled (data comparisons and cross checks)

The certification code modifiers are: PRE-NFP Preliminary - Not for publication, at the request of investigator. CPI-MRG PAMS data that is "merged" from two separate receiving stations to eliminate transmission errors. CPI-??? Investigator thinks data item may be questionable.

Sample Data Record:

SITEGRID_ID	STATION_ID	OBS_DATE	OBS_TIME	NUM_OBS	VIEW_AZIM_ANG
2133-EMS	906	04-AUG-89	1736	5	0
2133-EMS	906	04-AUG-89	1736	5	0
2133-EMS	906	04-AUG-89	1736	5	0
2133-EMS	906	04-AUG-89	1736	5	0

VIEW_ZEN_ANG	SOLAR_AZIM_ANG	SOLAR_ZEN_ANG	WAVLEN	REFL
0	148.85	24.56	.402	2.55
0	148.85	24.56	.405	2.54
0	148.85	24.56	.407	2.53
0	148.85	24.56	.41	2.53

REFL_UNCORR	REFL_SDEV	COMMENTS

.11
.09
.05
.02

FIFE_DATA_CRTFCN_CODE	LAST_REVISION_DATE
CPI	08-OCT-92
CPI	08-OCT-92
CPI	08-OCT-92
CPI	08-OCT-92

8. Data Organization:

Data Granularity:

The ground SE-590 data were collected at approximately every 10 degree change in solar zenith angle (SZA). Each SZA sampling period typically lasted 5 - 20 min, averaging 10 min duration.

A general description of data granularity as it applies to the IMS appears in the EOSDIS Glossary.

Data Format:

The CD-ROM file format consists of numerical and character fields of varying length separated by commas. The character fields are enclosed with a single apostrophe. There are no spaces between the fields. Each file begins with five header records. Header records contain the following information: Record 1 Name of this file, its table name, number of records in this file, path and name of the document that describes the data in this file, and name of principal investigator for these data. Record 2 Path and filename of the previous data set, and path and filename of the next data set. (Path and filenames for files that contain another set of data taken at the same site on the same day.) Record 3 Path and filename of the previous site, and path and filename of the next site. (Path and filenames for files of the same data set taken on the same day for the previous and next sites (sequentially numbered by SITEGRID_ID)). Record 4 Path and filename of the previous date, and path and filename of the next date. (Path and filenames for files of the same data set taken at the same site for the previous and next date.) Record 5 Column names for the data within the file, delimited by commas. Record 6 Data records begin.

Each field represents one of the attributes listed in the chart in the *Data Characteristics Section* and described in detail in the TDF file. These fields are in the same order as in the chart.

9. Data Manipulations:

Formulae:

Derivation Techniques and Algorithms:

Spectral radiances measured over the reference panel were corrected for the known non-lambertian characteristics of the specific panel utilized. These non-Lambertian characteristics

were determined by the University of Arizona personnel, in Arizona under clear skies, using a nadir-looking Barnes MMR instrument. The reference panel was rotated (during measurements) to manipulate the solar incidence angles in each MMR band, as compared to the nadir incidence angle. From these, coefficients were generated for each MMR band. The calculated values were found to be similar for all visible bands and the NIR band, and differences were less than the measurements error. Therefore, one anisotropic factor (0>anisotropic factor>1) was chosen to represent the full SE-590 spectrum. The calculated anisotropic factors at the measurement incident angles were linearly interpolated at 1 degree intervals. A look-up table was generated with 2 variables: solar zenith angle and the associated anisotropic factor. A different table was required for each reference panel used in the 1987 and 1989 field campaigns. The solar zenith angle in the SE-590 header was used to determine the appropriate anisotropic factor in the look-up table for use with a SE-590 reference spectrum.

In practice, the spectral irradiance (**I(lambda)**) was estimated from the measured spectral radiance of the reference panel (**P(lambda)**), the known solar zenith angle (**THETA**), and the anisotropic factor at that **THETA (F(THETA))** [From the look-up table] as:

I(lambda) = P(lambda) / F(THETA)

This provided and improved estimate of total irradiance which was then utilized in the calculation of percent spectral reflectance for the grassland canopy at each THETA. This was the ratio of the upwelling spectral radiance (**L(lambda)**) to the downwelling spectral irradiance (**I(lambda)**), or

% Reflectance(lambda,THETA) = (L(lambda) / I(lambda)) (THETA) .100

L(lambda) was directly determined from observations made with the SE-590 over the grassland surface from its position at the end of the tripod-boom.

Data Processing Sequence:

Processing Steps:

In 1987, the data were originally recorded on magnetic tape in microcassettes and transferred via computer interface to floppy diskettes. Each scan consisted of a header which included date, time, scan sequence number, etc. and a string of 252 digital count values for each wavelength sampled (0.372 - 1.011 fm). The data were carefully examined scan by scan to evaluate data quality and to validate each one relative to the field data log sheets. Data were processed on a 286 or 386 desk-top computer using SE-590 processing and analysis software developed by Moon Kim (Code 923, NASA/GSFC). Data files were segmented into smaller files corresponding to SZA sampling periods. For "Canopy-Level" data, the processing program followed these steps:

1. The compressed digital format was read and "count values" were converted to a linear string of numbers;
2. A user-specified wavelength calibration file was incorporated to convert these values to radiances [Watts][m^-2][sr^-1][nm^-1];

3. The average SZA associated with the sampling period was determined from the header information and user-provided location and time type (e.g., daylight standard time) information;
4. The measured radiances for the reference panel were corrected for angular anisotropy using a look-up table (in 5 degree of SZA intervals) constructed from laboratory measurements;
5. Percent spectral reflectance was computed as the ratio (X100) at each channel of the average surface radiance to the average panel estimate of irradiance, for each SZA sampling period; and
6. Output files for radiance and reflectance information were made. Subsequent processing was accomplished by importing these files into LOTUS SYMPHONY.

Processing Changes:

Not available at this revision.

Calculations:

Special Corrections/Adjustments:

Not available at this revision.

Calculated Variables:

- Spectral irradiance, and
- Percent spectral reflectance.

Graphs and Plots:

Not available at this revision.

10. Errors:

Sources of Error:

Not available at this revision.

Quality Assessment:

Data Validation by Source:

Due to decreased sensitivity of the instrument at extreme wavelengths, the data were retained only for the interval 0.400 - 1.01 nm.

Confidence Level/Accuracy Judgment:

Not available at this revision.

Measurement Error for Parameters:

Not available at this revision.

Additional Quality Assessments:

Not available at this revision.

Data Verification by Data Center:

The data verification performed by the ORNL DAAC deals with the quality of the data format, media, and readability. The ORNL DAAC does not make an assessment of the quality of the data itself except during the course of performing other QA procedures as described below.

The FIFE data were transferred to the ORNL DAAC via CD-ROM. These CD-ROMs are distributed by the ORNL DAAC unmodified as a set or in individual volumes, as requested. In addition, the DAAC has incorporated each of the 98 FIFE tabular datasets from the CD-ROMs into its online data holdings. Incorporation of these data involved the following steps:

- Copying the entire FIFE Volume 1, maintaining the directory structure on the CD-ROM;
- Using data files, documentation, and SQL code provided on the CD-ROM to create a database in Statistical Analysis System (SAS); and
- Creating transfer files to transfer the SAS metadata database to Sybase tables.

Each distinct type of data (i.e. "data set" on the CD-ROM), is accompanied by a documentation file (i.e., .doc file) and a data format/structure definition file (i.e., .tdf file). The data format files on the CD-ROM are Oracle SQL commands (e.g., "create table") that can be used to set up a relational database table structure. This file provides column/variable names, character/numeric type, length, and format, and labels/comments. These SQL commands were converted to SAS code and were used to create SAS data sets and subsequently to input data files directly from the CD-ROM into a SAS dataset. During this process, file names and directory paths were captured and metadata was extracted to the extent possible electronically. No files were found to be corrupted or unreadable during the conversion process.

Additional Quality Assurance procedures were performed as follows:

- Statistical operations were performed to calculate minimum and maximum values for all numeric fields and to create a listing of all values of the character fields. During this process, it was determined that various conventions were used to represent missing values. (Note: no modifications were made to any data by the DAAC). In most cases, missing value identification conventions were discussed in the accompanying .doc file. Based on a visual check of the minimum and maximum values, no glaring errors or holes were identified that might indicate errors introduced during CD-ROM mastering by the FIFE project or data ingest by the DAAC.

- Some minor inconsistencies and typographical errors were identified in some of the character fields and column labels, however, no modifications were made to the data by the DAAC.
- Some conversions of ASCII data were necessary to move the data from a DOS platform to a UNIX platform. Standard operating system conversion utilities were used (e.g., dos2unix).
- Much of the metadata required for archival is imbedded in the narrative documentation accompanying the data sets and extracted manually by DAAC staff who have read the .doc files provided on the CD-ROM and have hand entered this information into the metadata database maintained by the DAAC. QA procedures have been performed on these metadata to identify and eliminate typographical errors and inconsistencies in naming conventions, to ensure that all required metadata is present, and to ensure the accuracy of file names and paths for retrieval.
- Data requested for distribution to users are checked to verify that files copied from disk to other media remain uncorrupted.

As errors are discovered in the online tabular data by investigators, users, or DAAC staff, corrections are made in cooperation with the principal investigators. These corrections are then distributed to users. CD-ROM data are corrected when re-mastering occurs for replenishment of CD-ROM stock.

11. Notes:

Limitations of the Data:

Not available.

Known Problems with the Data:

Not available at this revision.

Usage Guidance:

Not available at this revision.

Any Other Relevant Information about the Study:

Noot available at this revision

12. Application of the Data Set:

This data set can be utilized to characterize diurnal variations and/or simultaneous observations acquired by helicopter, airplane, or satellite over flights.

13. Future Modifications and Plans:

The FIFE field campaigns were held in 1987 and 1989 and there are no plans for new data collection. Field work continues near the FIFE site at the Long-Term Ecological Research (LTER) Network Konza research site (i.e., LTER continues to monitor the site). The FIFE investigators are continuing to analyze and model the data from the field campaigns to produce new data products.

14. Software:

Software to access the data set is available on the all volumes of the FIFE CD-ROM set. For a detailed description of the available software see the *Software Description Document*.

15. Data Access:

Contact Information:

ORNL DAAC User Services
Oak Ridge National Laboratory

Telephone: (865) 241-3952
FAX: (865) 574-4665

Email: ornldaac@ornl.gov

Data Center Identification:

ORNL Distributed Active Archive Center
Oak Ridge National Laboratory
USA

Telephone: (865) 241-3952
FAX: (865) 574-4665

Email: ornldaac@ornl.gov

Procedures for Obtaining Data:

Users may place requests by telephone, electronic mail, or FAX. Data is also available via the World Wide Web at http://daac.ornl.gov.

Data Center Status/Plans:

FIFE data are available from the ORNL DAAC. Please contact the ORNL DAAC User Services Office for the most current information about these data.

16. Output Products and Availability:

The SE-590 Spectroradiometer Reflectance Factors from GSFC are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

\DATA\SUR_REFL\SE5_GSFC\GRIDxxxx\yyddd\ydddgrid.Gnn

Where *xxxx* is the four digit code for the location within the FIFE site grid, *yy* is the last two digits of the year (e.g., 87 = 1987), and *ddd* is the day of the year (e.g., 061 = sixty-first day in the year). Note: capital letters indicate fixed values that appear on the CD-ROM exactly as shown here, lower case indicates characters (values) that change for each path and file.

The format used for the filenames is: *ydddgrid.Gnn*, where *grid* is the four-number code for the location within the FIFE site grid, *y* is the last digit of the year (e.g., 7 = 1987, and 9 = 1989), *ddd* is the day of the year, and *nn* is the number of spectra during a day, when all the spectra are ordered chronologically and all spectra for a minute are in the same file. The content of each file is described in the *Data Characteristics Section*.

17. References:

Satellite/Instrument/Data Processing Documentation.

Anonymous. Spectron Engineering, Inc. Operating Manual: SE-590 field-portable data-logging spectroradiometer. Spectron Engineering. Denver, CO 80223.

Journal Articles and Study Reports.

Deering, D.W., and E.M. Middleton. 1990. Spectral bi-directional reflectance and effects on vegetation indices for a prairie grassland. Symposium on FIFE. First ISLSCP Field Experiment. American Meteorological Society. Boston, Mass. pp. 71-76.

Deering, D.W., T.F. Eck, and J. Otterman. 1990. Bi-directional reflectances of selected desert surfaces and their three parameter soil characterization. J. Agric For. Meteorol. 52:71-93.

Deering, D.W., E.M. Middleton, J.R. Irons, B.L. Blad, E.A. Walter-Shea, C.J. Hayes, C.L. Walthall, T.F. Eck, S.P. Ahmad, and B.P. Banerjee. 1992. Prairie grassland bi-directional reflectances measured by different instruments at the FIFE site. J. Geophys. Res. 97:18,887-18,903.

Frouin, R. and E.M. Middleton. 1990. A differential absorption technique to estimate atmospheric total water vapor amounts. Symposium on FIFE. First ISLSCP Field Experiment. American Meteorological Society. Boston, Mass. pp. 135-139.

Mesarch, M.A., E.A. Walter-Shea, B.L. Blad, C.J. Hays, and E.M. Middleton. 1993. Comparing biophysical properties of the Streletskaya steppe reserve and the Konza prairie. Remote Sens. Environ. (submitted 4/93).

Middleton, E.M., D.W. Deering and S.P. Ahmad. 1987. Surface anisotropy and hemispheric reflectance for a semiarid ecosystem. Remote Sens. Environ. 23:193-212.

Middleton, E.M. 1990. Diurnal change in the vegetation index for tallgrass prairie. Proc. IGARSS '90. pp. 1013-1016.

Middleton, E.M. 1991. Solar zenith angle effects on vegetation indicies and estimates of canopy variables in tallgrass prairie. Remote Sens. Environ. 38:45-62.

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Archive/DBMS Usage Documentation.

Contact the EOS Distributed Active Archive Center (DAAC) at Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee (see the *Data Center Identification Section*). Documentation about using the archive and/or online access to the data at the ORNL DAAC is not available at this revision.

18. Glossary of Terms:

A general glossary for the DAAC is located at Glossary.

19. List of Acronyms:

APAR Absorbed Photosynthetically Active Radiation DAAC Distributed Active Archive Center EOSDIS Earth Observing System Data and information System FIFE First ISLSCP Field Experiment FIS FIFE Information System IFOV Instantaneous Field-of-View IPAR Intercepted Photosynthetically Active Radiation ISLSCP International Satellite Land Surface Climatology Project LAI Leaf Area Index MMR Modular Multiband Radiometer ORNL Oak Ridge National Laboratory PARABOLA Portable Apparatus for Rapid Acquisitions of Bi-directional Observations of Land and Atmosphere SPP Solar Principal Plane SZA Solar Zenith Angle UNL University of Nebraska-Lincoln URL Uniform Resource Locator WAB Wind Aligned Blob

A general list of acronyms for the DAAC is available at Acronyms.

20. Document Information:

May 4, 1994 (citation revised on October 16, 2002).

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Previous versions of this document have been reviewed by the Principal Investigator, the person who transmitted the data to FIS, a FIS staff member, or a FIFE scientist generally familiar with the data.

Document Review Date:

August 14, 1996.

Document ID:

ORNL-FIFE_SE_GSFC.

Citation:

Cite this data set as follows:

Middleton, E. M. 1994. SE-590 Ground Data: GSFC (FIFE). Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/81.

Also published in D. E. Strebel, D. R. Landis, K. F. Huemmrich, and B. W. Meeson (eds.), Collected Data of the First ISLSCP Field Experiment, Vol. 1: Surface Observations and Non-Image Data Sets. CD-ROM. National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland, U.S.A. (available from http://www.daac.ornl.gov).

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