SE-590 Leaf Optical Prop. Data (FIFE)

Summary:

The SE-590 Leaf Level Spectral Observations from GSFC Data Set were acquired in situ with a Spectron SE590 spectroradiometer fitted with the 1 degree IFOV lens, and coupled with a LI-COR integrating sphere. The purpose in collecting SE590 leaf reflectance and transmittance data was to characterize the optical properties of the canopy components to gain a better understanding of how these optical properties contribute to canopy reflection and absorption of radiation. To measure the reflectance and transmittance of leaf surfaces an integrating sphere was used. The integrating sphere collected all of the radiation reflected from or transmitted through a surface.

These data are the average spectral optical properties (i.e., reflectance, transmittance) and the standard deviations for the three dominant species found on each of three sites: 916 (i.e., Big Bluestem, Indiangrass, and Switchgrass), 906 (i.e., Big Bluestem, Indiangrass, and Switchgrass), and 26 (i.e., Big Bluestem, Lovegrass and Dropseed) during late July and early August, 1989. The average spectral reflectance and transmittance represent the mean values for the adaxial (top) and abaxial (bottom) sides of 4 - 10 leaves for wavelengths between 400 - 1050 nm at approximately 3 nm intervals.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

SE-590 Leaf Optical Prop. Data (FIFE).
(SE-590 Leaf Level Spectral Observations from GSFC).

Data Set Introduction:

The SE-590 Leaf Level Spectral Observations from GSFC data are the average spectral optical properties (i.e., reflectance, transmittance) and the standard deviations for the three dominant species found on each of three sites: 916 (Big Bluestem, Indiangrass, and Switch grass), 906 (Big Bluestem, Indiangrass, and Switchgrass), and 26 (Big Bluestem, Lovegrass and Dropseed) during late July and early August, 1989.

Objective/Purpose:

The purpose in collecting SE590 leaf reflectance and transmittance data was to characterize the optical properties of the canopy components to gain a better understanding of how these optical properties contribute to canopy reflection and absorption of radiation.

Summary of Parameters:

Spectral reflectance and transmittance of leaves and wavelength.

Discussion:

Leaf-level spectral observations were acquired in situ with a Spectron SE590 spectroradiometer fitted with the 1 degree IFOV lens, and coupled with a LI-COR integrating sphere. This system was held in place by a tripod. For grass leaves, two leaves were abutted at their widest parts and held in place by tape in two places-above and below sphere's aperture. No gaps between leaves, or overlaps, were permitted; this was verified by examination of the transmitted beam (in Reflectance Mode) through the leaf onto a mirror before data acquisitions. All data were automatically corrected for dark current and corrected for stray light during processing. These data are the average spectral optical properties (reflectance, transmittance) for the three dominant species found on each of three sites: 916 (Big Bluestem, Indiangrass, and Switch grass), 906 (Big Bluestem, Indiangrass, and Switchgrass), and 26 (Big Bluestem, Lovegrass and Dropseed) during late July and early August, 1989. The average spectral reflectance and transmittance represent the mean values for the adaxial (top) and abaxial (bottom) sides of 4-10 leaves for wavelengths between 400-1050 nm at ~3 nm intervals. Also given are the standard deviations.

Related Data Sets:

- SE-590 Spectroradiometer Reflectance Factors from GSFC. This data set contains nadir SE590 spectrometer reflectances measurements from the Elizabeth Middleton at NASA

Goddard Space Flight Center. Leaf optical measurements complement these particular data sets, as they were acquired on the same sites and on the same day (+ or - 1 day)

- SE-590 Reflectance Factors and Radiances from UNL. This data set contains nadir and off nadir SE590 spectrometer radiances and reflectances measurements from the University of Nebraska group.
- SE-590 Reflectance Factors and Radiances Measured with a Helicopter. This data set contains reflectance measured with the helicopter mounted SE590 spectrometer.
- Surface Reflectance 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 Optical Properties from UNL. This data set contains leaf optical properties (reflectance and transmittance) for the MMR bands measured with the Nebraska Multiband Leaf Radiometer by the University of Nebraska group.
- 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 data.
- 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 Wand. This data set contains data from the LICOR LAI-2000 Plant Canopy Analyzer collected by the UNL group.
- Indirect Leaf Area Index Obtained from the KSU Light Wand. This data set contains data from the LICOR LAI-2000 Plant Canopy Analyzer collected by KSU staff science.

FIS Data Base Table Name:

SE590_LEAF_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:

Contact 1:
Dr. Elizabeth Middleton
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Requested Form of Acknowledgment.

The SE-590 Leaf Level Spectral Observations from GSFC were collected by Dr. Elizabeth M. Middleton and her colleagues at NASA Goddard Space Flight Center. Their contribution of these data is particularly appreciated.

3. Theory of Measurements:

To measure reflectance and transmittance of leaf surfaces an integrating sphere is used. The integrating sphere collects all of the radiation reflected from or transmitted through a surface. In the LI-COR 1800-12 integrating sphere the sample is held to the outside of the sphere, with a small section of the sample acting as part of the sphere wall. The interior of the sphere is coated with barium sulfate to make a uniform diffuse reflector. In this type of sphere the sensor, in this case an SE590, does not directly observe the sample. The field-of-view of the sensor is on a section of the sphere wall.

To calculate reflectance a comparison is made of the wall illumination caused by a beam of radiation reflected by the sample material to that reflected from the reference material. The LI-COR 1800-12 uses the same illumination source for both cases. The light source is moved between ports to illuminate the sample and reference material. Under ideal conditions the sample reflectance Rs is given by:

$$\mathbf{Rs = Is / Ir}$$

Where **Is** is the output when the sample is illuminated and **Ir** is the reference output. In reality other factors must be considered. First, the reference material is not a perfect reflector, and

second, not all of the incoming radiation beam hits the sample or reference, some radiation is scattered off of the sphere walls without hitting the target. Taking these factors into account the reflectance is given by:

Rs = ((Is - Id) * Rr) / (Ir - Id)

Where **Rr** is the reflectance of the reference material and **Id** is the radiation scattered without hitting the target. **Id** can be determined by illuminating the sample port with no sample in it such that no external radiation can enter. Thus the only radiation illuminating the sample wall will be internally scattered. Transmittance is calculated by comparing the wall illumination from radiation passed through the sample to the illumination caused by radiation that did not pass through the sample. For diffusive samples, the transmittance **Ts** is:

Ts = (Is * Rr) / Ir

Where **Rr** is the reflectance of the reference material, **Is** the output when the sample is illuminated and **Ir** is the output when the reference material is illuminated.

4. Equipment:

Sensor/Instrument Description:

The Spectron Engineering SE590 is a portable battery operated spectroradiometer consisting of a CE500 data analyzer/logger controller, CE390 spectral detector head and an external battery charger/power supply. The CE500 is a self contained microprocessor based controller which processes the signal from the head, amplifying and digitizing it with 12 bit resolution. For each spectral scan, the controller actuates the CE390 shutter, measures and stores the dark current, calculates optimum integration time, acquires the spectrum and automatically subtracts the noise for all 256 spectral elements. A series of scans can be taken and automatically averaged. The spectrum is stored in a double precision register which saves the entire 12-bit binary spectra until it is transmitted through the RS-232C port. The 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. The interconnect cable from the spectral head to the controller couples the spectral signals to the controller, timing and control signals to the head. A shutter in the head, operated by the controller closes the light path for dark current measurements. For further information consult the SE590 operating manual.

The SE590 was fitted with a 1 degree IFOV lens and attached to the observation port of the LI-COR 1800-12 Integrating Sphere. This system was held in place by a tripod. The sphere has five ports in it. The sample port is 1.45 cm in diameter, the observation port is 0.64 cm in diameter. There are three entrance ports, one each for reflectance, reference, and transmittance. The reference ample disk uses pressed barium sulfate powder and the sphere has an internal coating of barium sulfate. The sphere is illuminated using a 6 volt, 10 watt glass-halogen lamp with a spot diameter of 1.14 cm and stray light amount less than 0.5%. For grass leaves, which are too narrow for a single leaf to cover the sample port, two leaves were abutted at their widest parts and held in place by tape in two places (i.e., above and below sphere's aperture).

Collection Environment:

Ground-based.

Source/Platform:

The SE590 was attached to the observation port of the LI-COR integrating sphere. Both were mounted on a tripod. The measurements were made in situ, utilizing battery power supplied by a 12v deep cycle battery.

Source/Platform Mission Objectives:

To measure leaf reflectance and transmittance in situ.

Key Variables:

Leaf reflectance and transmittance from 0.372 to 1.1 micro meters at unequal intervals of 0.002 - 0.003 micro meters.

Principles of Operation:

The SE590 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. The integrating sphere collects all of the radiation reflected from or transmitted through a surface and the SE590 measures the illumination of the wall of the integration sphere. To calculate leaf reflectance a comparison of the wall illumination caused by a beam of radiation reflected by the sample material to that reflected from the reference material. Leaf transmittance is calculated by comparing the wall illumination from radiation passed through the sample to the illumination caused by radiation that did not pass through the sample.

Sensor/Instrument Measurement Geometry:

The SE590 was fitted with a 1 degree IFOV lens and attached to the observation port of the LI-COR 1800-12 Integrating Sphere. This system was held in place by a tripod. There are three entrance ports on the sphere, one each for reflectance, reference, and transmittance. Depending which type of measurement is being made these ports are filled by the lamp, a white plug, or a hollow black cover. The lamp is a 6 volt, 10 watt glass-halogen amp. The reference port has a disk of pressed barium sulfate powder covering it.

For grass leaves, which are too narrow for a single leaf to cover the sample port, two leaves were abutted at their widest parts and held in place by tape in two places-above and below sample port. No gaps between leaves, or overlaps, were permitted; this was verified by examination of the transmitted beam (in Reflectance Mode) through the leaf onto a mirror before data acquisitions.

Manufacturer of Sensor/Instrument:

SE590:

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

Integrating sphere:

LI-COR, inc.
4421 Superior Street
P.O. Box 4425
Lincoln, Nebraska 68504-0425 USA
(402) 467-3576

Calibration:

The SE590 was calibrated in house (GSFC) against several standards:

1. A 6 foot integrating sphere with 12 energy levels (0 - 142 micro[w][cmE-2][mmE-1[srE-1], at 800 nm) was used to develop the 252 channel coefficients to convert the recorded "count" values to radiance [w][m E-2][nm E-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.

Specifications:

Each SE590 has a unique wavelength associated with each of its 252 bands. The wavelength channels sample the spectrum between 0.372 - 1.1 micro meters at unequal intervals of 0.002 - 0.003 micro meters.

Tolerance:

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

Frequency of Calibration:

Daily stability checks were performed during the IFC5 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:

Relatively uniform areas (100 m E2) were identified at each of 3 sites (i.e., 916, 906, 926) for acquisition of canopy reflectance from a tripod/boom platform using the PARABOLA and SE590 radiometers. In the adjacent areas individual plants were randomly selected of the 3 dominant species on each site. Measurements were made on the uppermost fully expanded leaf or leaf pair; leaves were left attached to the plant during measurements. On site 916, these tagged leaves were resampled by the University of Nebraska group (Blad, Walter-shea, et al.). Measurements were initiated on the same day that canopy reflectance data were acquired, and completed on the next/or subsequent day. The same SE590 radiometer (green unit) was used for both canopy-level and leaf-level measurements.

6. Observations:

Data Notes:

Not available.

Field Notes:

None.

7. Data Description:

Spatial Characteristics:

Individual leaves or pairs of leaves were measured for the three dominant species at the three FIFE supersites. 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:

This is point data collected at the following locations within the FIFE study area:

SITEGRID	STN	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEV
2133-SEL	906	4329726	711604	39 05 34	-96 33 12	443
4439-SEL	916	4325193	712773	39 03 06	-96 32 28	443
8739-SEL	926	4316699	712845	38 58 31	-96 32 35	442

SITEGRID	SLOPE	ASPECT
2133-SEL	1	TOP

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4439-SEL     2     N
8739-SEL     1     TOP
```

Spatial Coverage Map:

Not available.

Spatial Resolution:

Individual leaves.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

The data were collected during IFC-5 (07/24/89 - 08/12/89), observations collected over several days were averaged together. Data were collected at sitegrid 2133-SEL from August 4 to 10, 1989, sitegrid 4439-SEL from August 2 to 7, 1989, and at sitegrid 8739-SEL from August 5 to 7, 1989.

Temporal Coverage Map:

Not available.

Temporal Resolution:

The data are averages of several measurements collected over several days.

Data Characteristics:

The SQL definition for this table is found in the SE_LEAF.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.			
START_DATE The start date of the observations, in the format (DD-MMM-YY).			
END_DATE The ending date of the observations, in the format (DD-MMM-YY).			
SPECIES_NAME The common name of the plant being measured.			
LTER_SPECIES_CODE The LTER species code (see VEG_SPECIES_REF) for the species of the leaf measured.			
NUM_OBS The number of observations made.			
WAVLEN The wavelength at which the observation was made.		[microns]	
LEAF_REFL The mean percent reflectance of the leaves.		[percent]	
SDEV_REFL			

The standard deviation of the reflectance measurements.	[percent]

LEAF_TRNSMTNC The mean percent transmittance of the leaves.	[percent]

SDEV_TRNSMTNC The standard deviation of the transmittance measurements.	[percent]

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).

Note:

Valid levels

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	START_DATE	END_DATE	SPECIES_NAME
2133-SEL	906	04-AUG-89	10-AUG-89	BIG BLUESTEM
2133-SEL	906	04-AUG-89	10-AUG-89	BIG BLUESTEM
2133-SEL	906	04-AUG-89	10-AUG-89	BIG BLUESTEM
2133-SEL	906	04-AUG-89	10-AUG-89	BIG BLUESTEM

LTER_SPECIES_CODE	NUM_OBS	WAVLEN	LEAF_REFL	SDEV_REFL	LEAF_TRNSMTNC
2	10	.3996	11.10	.80	7.90
2	10	.4021	11.00	.70	7.30
2	10	.4046	10.60	.80	6.60
2	10	.4073	10.40	1.10	6.30

SDEV_TRNSMTNC	FIFE_DATA_CRTFCN_CODE	LAST_REVISION_DATE
.80	CPI	01-SEP-93

```
.70                 CPI                 01-SEP-93
.80                 CPI                 01-SEP-93
.60                 CPI                 01-SEP-93
```

8. Data Organization:

Data Granularity:

Individual leaves or pairs of leaves were measured for the three dominant species at the three FIFE supersites. The data set contains point data collected during IFC-5 (07/24/89 - 08/12/89). The data are averages of several measurements collected over several days.

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 Section 8.2 and described in detail in the TDF file (see Section 8.1). These fields are in the same order as in the chart.

9. Data Manipulations:

Formulae:

Not available at this revision.

Derivation Techniques and Algorithms:

Not available at this revision.

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 SE590 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 (W m2 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:

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 fm.

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.

Usage Guidance:

Not available.

Any Other Relevant Information about the Study:

Not available.

12. Application of the Data Set:

This data set can be used to gain a better understanding of how the optical properties of canopy components contribute to canopy reflection and absorption of radiation

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 Leaf Level Spectral Observations from GSFC are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

\DATA\SUR_REFL\SE5_LEAF\1989grid.Lss

The format used for the filenames is: *1989grid.Lss*, where *grid* is the four-number code for the location within the FIFE site grid and *ss* is the two digit LTER code for the species from which the spectra were collected. The content of each file is described in Section 8.2.

17. References:

Satellite/Instrument/Data Processing Documentation.

Spectron Engineering, Inc. Operating Manual: SE590 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.

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reflectances measured by different instruments at the FIFE site. J. Geophys. Res. 97:18,887-18,903.

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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 IPAR Intercepted Photosynthetically Active Radiation SLSCP International Satellite Land Surface Climotology Project KSU Kansas State University LAI Leaf Area Index MMR Modular Multiband Radiometer ORNL Oak Ridge National Laboratory 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.

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