Gemma Helicopter Data (FIFE)

Summary:

During the 1989 Intensive Field Campaign a Russian spectroradiometer, the Gemma, was used to collect visible and near infrared spectra of a variety of FIFE sites from a helicopter. Gemma measurements of selected study sites and laboratory measurements of a portable calibration light sphere were made.

The helicopter missions were designed to provide characterizations of each FIFE site while providing FIFE study area coverage, and to provide an intermediate scale of sampling between that of the surface measurements and the higher altitude aircraft and spacecraft multispectral imaging devices. The Gemma spectroradiometer was mounted on the helicopter to allow a comparison between it and the SE-590 spectroradiometer and Modular Multiband Radiometer (MMR) over a number of sites.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Gemma Helicopter Data (FIFE).
(High Spectral Resolution Measurements from the Russian Gemma Instrument).

Data Set Introduction:

The High Spectral Resolution Measurements from the Russian Gemma Instrument Data Set contains reflected spectral radiance and wavelength data.

Objective/Purpose:

The acquisition of multispectral radiometer data from FIFE sites using a helicopter platform.

Summary of Parameters:

Reflected radiance.

Discussion:

During the 1989 Intensive Field Campaign a Russian spectroradiometer, the Gemma, was used to collect visible and near infrared spectra of a variety of FIFE sites from a helicopter. Gemma measurements of selected study sites and laboratory measurements of a portable calibration light sphere were made.

Related Data Sets:

- SE-590 Reflectance Factors and Radiances Measured from a Helicopter. This data set contains SE-590 spectrometer reflectances measured in conjunction with the Gemma.
- 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 Spectroradiometer Reflectance Factors from GSFC. This data set contains nadir SE-590 spectrometer reflectances measurements from the Elizabeth Middleton at NASA Goddard Space Flight Center.
- Surface Reflectance Measured with a Helicopter-borne MMR. This data set contains site averaged reflected radiance and reflectance values from a Barnes MMR taken from a helicopter.
- Surface Radiant Temperature Measured with a Helicopter-borne Infrared Thermometer. This data set contains data from the Everest Infrared thermometer mounted on the helicopter.

FIS Data Base Table Name:

GEMMA_HELO_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

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Byelorussian State University

Igor K. Gorankov
Academy of Sciences of the USSR

Title of Investigation:

Spectropolarimetry Using Gemma Instrument.

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Requested Form of Acknowledgment.

The High Spectral Resolution Measurements from the Russian Gemma Instrument were collected by the FIFE helicopter crew for B.I. Belyaev and I.K. Gorankov of Byelorussian State University and Academy of Sciences of the USSR, respectively. The dedicated efforts of this team of pilots, mechanics, photographers and scientists are especially appreciated. The efforts of the following individuals are notable:

Helicopter crew: Charles Walthall, mission scientist; William Dykes, pilot; Charles Smith, mechanic and observer; Ed Bohles, mechanic and observer; Richard Huey, photographer; David Pierce, engineer; Douglas Young, engineer; Moon Kim, software development and data processing;

Frank Wood, system integration; US Army 82nd Medical Helicopter Unit, Ft. Riley, Kansas for on-site hanger space and helicopter technical support.

3. Theory of Measurements:

The helicopter missions were designed to provide 1) a rapid means of intensively, spectrally characterizing each FIFE site while providing FIFE study area coverage, and 2) to provide an intermediate scale of sampling between that of the surface measurements and the higher altitude aircraft and spacecraft multispectral imaging devices. The Gemma spectroradiometer was

mounted on the helicopter to allow a comparison between it and the SE-590 spectroradiometer and Modular Multiband Radiometer (MMR) over a number of sites.

4. Equipment:

Sensor/Instrument Description:

Gemma is a portable spectroradiometer based on a scanning monochrometer with optional provisions for measurement of polarization. The optical system module (MS-03) includes a polarization device that is placed in front of the monochrometer lens (designated as the MS- 02 STOKS module). A gap in the spectral data exists at 626 nm +/-1 nm due to an absorption line from the configuration of the monochrometer and therefore data is unavailable at this wavelength. The system has 396 channels in the spectral range of 0.409 to 0.804 micrometers and takes less than 1 second to complete a spectral scan. The gain is pre-set to accommodate radiance levels commonly found under field conditions. The focus of the lens system is variable between 80-200 mm yielding a field-of-view between 3.6 x 0.3 and 1.5 x 0.1 degrees. A microcomputer system (ACC-2) serves as the control unit and as the data logger for Gemma. This microcomputer system is also used to process the data. Data storage is via cassette tape.

Collection Environment:

Airborne.

Source/Platform:

During 1989 the Gemma was mounted on a plate on the port side of the NASA Bell UH-1B "Huey" helicopter (NASA 415). The instrument was fixed in a nadir-looking attitude for all of the helicopter flights. Because of logistical limitations and time restrictions, it was not possible to accurately adjust the optical alignment of Gemma to that of the SE-590 and the MMR.

Source/Platform Mission Objectives:

There were two type of helicopter optical system missions: H-1a and H-1b. The objective of the H-1a missions was to acquire spectral data of specific FIFE sites coincident with surface, atmospheric and satellite measurements. The objective for the H-1b missions was to acquire multispectral data of as many FIFE sites during the available flight time. All regular FIFE sites were measured from a hover. Some special sites were flown in a slow-flight transect mode.

The area for observations within a site differed for the three primary sites (906, 916 and 928) from the other FIFE sites. For the primary sites the area upwind of the flux tower or "WAB" area was outlined by crews on the surface with flags: the two edges and a center line directly into the wind were marked. Using these lines as guides, slow flight transects with an average of 8 observations per line were flown. Sampling of the other FIFE sites followed the 1987-type pattern of sampling. The sample area for these sites was a doughnut-like ring around the automated weather stations or over areas where surface radiance and biology measurements were

being conducted. The ring around the weather stations was 2-3 times the width of the weather station areas (the instruments were normally bounded by fences).

Key Variables:

Reflected spectral radiance and wavelength.

Principles of Operation:

The Gemma spectroradiometer based on a scanning monochrometer The system has 396 channels in the spectral range of 0.409 to 0.804 micrometers and takes less than 1 second to complete a spectral scan. A gap in the spectral data exists at 0.626 micrometers +/- 0.01 micrometers due to an absorption line from the configuration of the monochrometer and therefore data is unavailable at this wavelength.

Sensor/Instrument Measurement Geometry:

The Gemma was mounted on a plate on the port side of the helicopter and fixed at a nadir view. The focus of the lens system is variable between 80-200 mm yielding a field-of-view between 3.6 x 0.3 and 1.5 x 0.1 degrees. The helicopter collected data at an altitude of 330 m.

Manufacturer of Sensor/Instrument:

Built by engineers at White Russian State University, Minsk, CIS.

Calibration:

Spectral and radiometric calibration of Gemma is done at the Meteorological Complex for Spectrophotometric Testing at Byelorussian State University, Minsk, CIS (Antonov et al. 1989). A 600 mm illuminated integrating sphere that is calibrated in absolute values of radiance is used for radiometric calibration. A linear relationship between the instrument response and the radiance from the sphere is determined (Green et al. 1991).

The spectral and polarization features are calibrated using linear polarized light streams of equal intensity. One source is parallel, the other is perpendicular to the input slit. The total error of the system is less than 10 percent (Green et al. 1991). Processing of the spectra includes conversion of digital counts to radiance using equations from the radiometric calibration and the use of a non-linear median filter procedure for noise suppression (Huang 1981). When calculation of reflectance factors are desired, a well-characterized white "milk glass" reflectance standard is used as a target to provide estimates of irradiance.

The Gemma and SE-590 spectroradiometers were compared under controlled conditions through viewing the laboratory-based 30 cm integrating sphere. At the completion of the flight measurements, the SE-590 and Gemma were dismounted from the helicopter and taken to the laboratory where the integrating sphere was located. The inside of the sphere is coated with barium sulfate and is illuminated by four quartz-halogen lamps that are powered with a regulated

power supply. This sphere was used to provide a controlled source of illumination for periodic comparisons of MMRs during FIFE (Markham et al. 1988). Measurements of the different lamp levels were made using the two spectroradiometers by placing each instrument on a pedestal in front of the 12 cm sphere aperture and triggering the devices as the number of lamps were varied.

Specifications:

Observations of the four lamp levels from the laboratory-based portable integrating sphere provided an increase in overall radiance with an increase in lamp levels. The SE-590 spectra showed less noise, while the Gemma data had a noticeable amount of detail that increased with increasing lamp levels. The standard deviation of the SE-590 was small, while the standard deviation for Gemma increased from lamp levels 1 to 3 and then decreased at lamp level 4, suggesting that the Gemma had saturated at that light level. The SE-590 uses a procedure to determine an appropriate gain setting for every observation, while the gain setting on Gemma is fixed for the expected range of illumination conditions. For the illuminating sphere lamp comparisons, it was determined later that the radiance level from the integrating sphere lamps would seldom, if ever, be encountered under field conditions. This created problems with Gemma as the gain settings were for field conditions. Some error in comparing the Gemma and SE-590 was also introduced from the different physical configuration of the devices as they sit in the port, as each instrument has a different view into the sphere of which a part is then re-reflected to the sensor.

Tolerance:

The sensitivity of Gemma appears to be somewhat higher than that of the SE-590 in the visible wavelengths while the SE-590 appears to provide a signal with lower noise. The SE-590 uses a procedure to determine an appropriate gain setting for a target, while the gain setting on Gemma is fixed for an expected range of field conditions. The differences in sensitivity between the two devices is such that reflectances calculated from the two different devices (using each device for its corresponding irradiance measurement), may be similar as the amplitude differences would cancel each other out.

Frequency of Calibration:

At the completion of the flight measurements, the SE-590 and Gemma were dismounted from the helicopter and taken to the laboratory where the integrating sphere was located. This sphere was used to provide a controlled source of illumination for periodic comparisons of MMRs during FIFE (Markham et al. 1988).

Other Calibration Information:

Not available at this revision.

5. Data Acquisition Methods:

The NASA Bell UH-1B helicopter optical remote sensing system for 1989 supported a data acquisition system consisting of a SE-590, MMR, Everest infrared thermometer, Gemma, a color video camera, and one 35 mm flight research camera loaded with color film. Controller units for all the optical devices are rack-mounted inside the helicopter and are wired such that a single switch closure triggers all devices except Gemma, which was operated independently. Coordination of simultaneous triggering of the spectroradiometers was executed by verbal and visual signals between operators. The switch closure also activates an audible tone which is recorded on one of the two audio tracks of a Beta-format video recording system. The other audio track of the VCR was used to record cabin intercom conversations among the helicopter crew. Note that the 35 mm camera and Gemma were secured in a nadir-looking configuration. The video camera was mounted on the pointable platform with the other radiometric instruments.

6. Observations:

Data Notes:

Not available.

Field Notes:

No atmospheric corrections have been made.

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:

The number and spatial distribution of the sites covered on each mission varied. The purpose of the helicopter mission was to collect data over many of the sites. These data were collected from the 13 locations listed below. The three primary sites (2133-GEM, 4439-GEM, 8739-GEM) were measured on every mission to assure continuity.

SITEGRID	STN	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEV
1478-BRS	938	4331223	720664	39 06 15	-96 26 53	375
1916-BRK	902	4330282	708259	39 05 55	-96 35 30	351
1942-BRL	944	4330133	713414	39 05 46	-96 31 56	422
2123-SAM	905	4329866	709506	39 05 41	-96 34 39	405
2133-ECA	906	4329726	711604	39 05 34	-96 33 12	443
2330-BRK	908	4329314	711066	39 05 22	-96 33 35	424
2655-BRL	936	4328787	716070	39 05 00	-96 30 07	367

3317-BRK	910	4327395	708485	39 04 22	-96 35 24	427
4439-ECV	916	4325193	712773	39 03 06	-96 32 28	443
6735-BRL	913	4320652	712073	39 00 40	-96 33 03	385
6912-BRL	924	4320111	707336	39 00 26	-96 36 20	397
8739-ECB	926	4316699	712845	38 58 31	-96 32 35	442
XETL-SPH	999	4340743	708712	39 11 34	-96 35 00	325

	SITEGRID	SLOPE	ASPECT
1478-BRS	2		N
1916-BRK	2		N
1942-BRL	1		TOP
2123-SAM	1		TOP
2133-ECA	1		TOP
2330-BRK	5		E
2655-BRL	4		E
3317-BRK	15		W
4439-ECV	2		N
6735-BRL	1		BOTTOM
6912-BRL	2		N
8739-ECB	1		TOP
XETL-SPH			

Spatial Coverage Map:

Not available.

Spatial Resolution:

The focus of the lens system is variable between 80-200 mm yielding a field-of-view between 3.6 x 0.3 and 1.5 x 0.1 degrees. The helicopter collected data at an altitude of 330 m.

6.3 Temporal Characteristics.

Missions were dependent on the availability of clear sky conditions. Every site was not observed on every flight.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

Missions were dependent on the availability of clear sky conditions. Data were collected on August 4, 8 and 12, 1989. Measurements were made between 1400 and 2102 GMT.

Temporal Coverage Map:

Not available.

Temporal Resolution:

Observation time over each site was 2 to 5 minutes during which an average of 20 measurements were made.

Data Characteristics:

The SQL definition for this table is found in the GEM_HELO.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 (EESS-III) give the east (EE) and south (SS) 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).

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]
ALTITUDE The helicopter altitude above ground level.	[meters]
OBS_TYPE A description of the area observed, FULL is the entire site, SRB is the same area as the ground surface radiance observations, WAB is the area upwind of the flux tower, SMT is a transect.	
MISSION_ID The mission identification for the helicopter flight.	
WAVLEN The wavelength at which the observation was made.	[micrometers]
RADNC The average reflected spectral radiance. [ster^-1] [micrometer^-1]	[Watts] [meter^-2]
RADNC_SDEV	

```
The standard deviation of the                                   [Watts]
radiance.                                                       [meter^-2]
[ster^-1]
[micrometer^-1]
```

```
COMMENTS
The comments provide information
on the field-of-view of the
Gemma in meters on the ground.
The field of view varies with the
use of different optics in the
instrument.
```

```
FIFE_DATA_CRTFCN_CODE                                *
The FIFE Data 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_CRTFCND_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 are "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
1478-GEM	938	08-AUG-89	2034	11	0
1478-GEM	938	08-AUG-89	2034	11	0
1478-GEM	938	08-AUG-89	2034	11	0
1478-GEM	938	08-AUG-89	2034	11	0

VIEW_ZEN_ANG	SOLAR_AZIM_ANG	SOLAR_ZEN_ANG	ALTITUDE	OBS_TYPE
0	237.95	35.1	305	FULL
0	237.95	35.1	305	FULL
0	237.95	35.1	305	FULL
0	237.95	35.1	305	FULL

MISSION_ID	WAVLEN	RADNC	RADNC_SDEV

```
890616B        .409       6.346      4.885
890616B        .41        9.946      3.915
890616B        .411      10.196      3.964
890616B        .412       9.127      3.517
     COMMENTS                              FIFE_DATA_CRTFCN_CODE
-----------------------------------    ----------------------
FOV=19 X 1.5 M                            CPI
FOV=19 X 1.5 M                            CPI
FOV=19 X 1.5 M                            CPI
FOV=19 X 1.5 M                            CPI
     LAST_REVISION_DATE
------------------
04-OCT-90
04-OCT-90
04-OCT-90
04-OCT-90
```

8. Data Organization:

Data Granularity:

An average of 20 measurements were made during the observation time over each site (i.e., 2 to 5 minutes).

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:

For a discussion of the algorithms used to analyze these data refer to Markham et al. (1988) and Markham (1989).

Data Processing Sequence:

Processing of the spectra includes conversion of digital counts to radiance using equations from the radiometric calibration and the use of a non-linear median filter procedure for noise suppression (Huang 1981).

Processing Steps:

See references in the *Derivation Techniques and Algorithms Section*.

Processing Changes:

Not applicable.

Calculations:

Special Corrections/Adjustments:

Not applicable.

Calculated Variables:

Not available.

Graphs and Plots:

None.

10. Errors:

Sources of Error:

There is some debate on the amount of atmosphere in the pathlength between the helicopter and the surface. Recent inquiries have revealed absolute reflectance differences of up to 1 percent in the visible bands when at-sensor helicopter MMR radiances were corrected for atmospheric path length (of 300 m AGL) and processed for reflectance when using an atmospheric model. This has not been fully investigated and is still under investigation at the time of this writing.

The heterogeneity of the study site can also affect the measurements. This has been shown to be a potential problem when comparing airborne radiometric measurements to surface radiometric measurements.

Quality Assessment:

Gemma data were compared with SE-590 and MMR data. Differences between data from the two spectroradiometers can be attributed to several factors: spectral bandwidths, gain/sensitivity, and calibration sources. Greater standard deviations are commonly found in data reported from high spectral resolution systems. Fewer photons reach the sensor during the integration time for each wavelength resulting in a higher noise level. Degradation of the finer resolution Gemma data to that of the MMR provided more comparable values than that of the SE-590 because of reduced integration errors inherent in the use of finer resolution data .

The sensitivity of Gemma appears to be somewhat higher than that of the SE-590 in the visible wavelengths while the SE-590 appears to provide a signal with lower noise.

Data Validation by Source:

The spectra from the Gemma and SE-590 spectroradiometers were qualitatively similar and when integrated to broader band channels quantitatively compared well with radiances obtained with the broad band measurements of the well characterized MMR. The sensitivity of Gemma appears to be greater than that of the SE-590 and produces a higher value for a given level of field target radiance. The SE-590 produces a signal containing a lower level of noise and therefore spectra more consistent with data found in the literature.

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:

Due to differences in alignment and field-of-view, the Gemma was not viewing exactly the same area as the other instruments on the helicopter. It is assumed that the averaging of several observations has minimized these differences. Precise locations of the observations used to calculate a site average may not coincide with the exact locations of surface-based measurements.

Usage Guidance:

Note that the Gemma data provides radiance values only. The data has not been corrected for the effects of the atmosphere beneath the helicopter.

Any Other Relevant Information about the Study:

Not available.

12. Application of the Data Set:

The data set provides characterizations of each FIFE site while providing FIFE study area coverage, and provides an intermediate scale of sampling between that of the surface measurements and the higher altitude aircraft and spacecraft multispectral imaging devices.

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 High Spectral Resolution Measurements from the Russian Gemma Instrument data are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

\DATA\SUR_REFL\GEM_HELO\GRIDxxxx\ydddgrid.GHs

Where *xxxx* is the four digit code for the location within the FIFE site grid. 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.sfx*, 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), and *ddd* is the day of the year (e.g., 061 = sixty-first day in the year), and *s* is the sequential number of this spectra for that date and location. There are one to five spectra. The filename extension (.*sfx*), identifies the data set content for the file (see the *Data Characteristics Section*) and is equal to .GH1, .GH2, .GH3, .GH4, or .GH5 for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

Not available.

Journal Articles and Study Reports.

Antonov, B.S., B.I. Belyaev, A.A. Bogdanov, L.I. Kiselevsky and P.V. Komar. 1989. The meteorological complex for spectrophotometric apparatus testing in diapason 0.35-2.5 mcm (in Russian). Proceedings From Statistical Methods and Data Processing Methods for Remote Sensing of the Environment. (Minsk Univ.). pp. 75-76.

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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:

AGL Above Ground Level CIS Commonwealth of Independent States DAAC Distributed Active Archive Center EOSDIS Earth Observing System Data and Information System FIFE First ISLSCP Field Experiment FIS FIFE Information System IFC Intensive Field Campaign ISLSCP International Satellite Land Surface Climatology Project MMR Modular Multiband Radiometer (8 channel radiometer) ORNL Oak Ridge National Laboratory SE-590 Spectron Engineering 590 spectroradiometer URL Uniform Resource Locator WAB Wind Aligned Blob

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

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