Optical Thickness Data: Staff (FIFE)

Summary:

Aerosol optical thickness in conjunction with an atmospheric model can provide estimates of atmospheric effects on transmitted and reflected solar radiation. These effects can then be used to correct aircraft and satellite radiometric data.

In FIFE, three sunphotometers were used to track the sun through a range of airmasses during the period of February 6, 1987 through October 31, 1989. The Aerosol Optical Thickness from GSFC Data Set were analyzed using the Langley technique. Rayleigh optical depth was subtracted, and aerosol, ozone, and water vapor abundance's simultaneously measured. In retrieving ozone a Junge aerosol model was assumed, thus the natural log of aerosol optical depth was linear with wavelength (Bruegge et al. 1992a&b). This approach allows measurement of aerosol, but is limited by the accuracy of the ozone data.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Optical Thickness Data: Staff (FIFE).
(Aerosol Optical Thickness from GSFC).

Data Set Introduction:

The Aerosol Optical Thickness from GSFC Data Set were collected from February 6, 1987 through October 31, 1989 at different locations within the FIFE study area. Aerosol optical thickness and surface atmospheric pressure were measured. In retrieving ozone a Junge aerosol model was assumed, thus the natural log of aerosol optical depth was linear with wavelength (Bruegge et al. 1992a&b). This approach allows measurement of aerosol, but is limited by the accuracy of the ozone data.

Objective/Purpose:

The purpose was to measure the aerosol optical thickness of the atmosphere. Aerosol optical thickness in conjunction with an atmospheric model can provide estimates of atmospheric effects on transmitted and reflected solar radiation. These effects can then be used to correct aircraft and satellite radiometric data.

Summary of Parameters:

Aerosol optical thickness, and surface atmospheric pressure.

Discussion:

In FIFE, three sunphotometers were used to track the sun through a range of airmasses. These data were analyzed using the Langley technique. Rayleigh optical depth was subtracted, and aerosol, ozone, and water vapor abundance's simultaneously measured. In retrieving ozone a Junge aerosol model was assumed, thus the natural log of aerosol optical depth was linear with wavelength (Bruegge et al. 1992a&b). This contrasts with other experimental approaches used by investigators in which an ozone abundance is assumed. This approach allows measurement of aerosol, but is limited by the accuracy of the ozone data. These data were collected from February 6, 1987 through October 31, 1989. These data were collected at different locations within the FIFE study area during this period.

Related Data Sets:

- Sunphotometer Optical Thickness Data from C130 Aircraft.
- Solar Transmissometer Aerosol Optical Thickness.
- NIPS and Reagan Sunphotometer Optical Thickness.
- Optical Thickness Calibration.

FIS Data Base Table Name:

OPTICAL_THICK_STAFF_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Brian L. Markham
NASA Goddard Space Flight Center

Title of Investigation:

Staff Science Aerosol Optical Thickness Measurements During FIFE.

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Requested Form of Acknowledgment.

The Aerosol Optical Thickness from GSFC data were collected for FIFE by B.L. Markham from Goddard Space Flight Center, A. Retta, G. Harbers, and L. Ballou from Kansas State University.

3. Theory of Measurements:

Sunphotometers or solar transmission meters have long been used to measure atmospheric transmission. The basic idea is that for time scales of a day, solar radiance **I_o** outside the atmosphere is constant in narrow bands (~10 nm) in the visible and near-infrared wavelengths, changes in radiance (**I**) measured at the ground by a sunphotometer are the result of changes in atmospheric radiance, and more importantly, transmission. Thus, applying Bouger's law of attenuation,

$$I = (I_o / r^2) * \exp((-m * \tau)_R - (m * \tau)_{oz} - (m * \tau)_{aer}) \quad [1]$$

where **I_o** is the solar radiance at one AU in a given band (the underscore refers to a subscript and a caret '^' refers to a superscript), **r** is the Earth/Sun distance at the time of observation in

Astronomical Unit (AU), **m** is the airmass, **tau** is the optical thickness, and subscripts **R**, **oz**, and **aer** refer to Rayleigh scattering, ozone absorption, and aerosol absorption and scattering as causes of attenuation. Note that water vapor is not included in this analysis, which refers to channels that avoid water bands. If the sunphotometer responds with a voltage **V** for an incident radiance **I** as in **I = KV**, where **K** is a constant, thus, implying linearity in the instrument response, Equation (1) becomes, after some manipulation,

$$(m * tau)_{aer} = \ln(V_o / r^2) - \ln V - (m * tau)_{oz} - (m * tau)_R \quad [2]$$

For a measurement of voltage (**V**) at a known airmass all the terms on the right-hand side of Equation (2) are known, and therefore aerosol optical thickness can be estimated. Note that **V_o** is the calibration coefficient to be discussed in the *Calibration Section*, and Rayleigh and ozone optical thicknesses are calculated thus:

$$tau_R = (P / P_o) * [0.008569 * Lambda^{(-4)} * (1 + 0.0113 * Lambda^{-2} + 0.00013 * Lambda^{-4}) \quad [3]$$

with **p** as the measured surface pressure and **P_o** is the sea level pressure of 1.013 bars. The wavelength of observation (lambda) is in micrometers. Ozone optical thickness is estimated by multiplying the ozone column abundance in Dobson units (DU or matm-cm) obtained from climatological charts (i.e., the standard relationship between ozone abundance, latitude and time of year) by the absorption coefficients tabulated below:

Wavelength	Ozone Absorption Coefficients in [matm^-1][cm^-1]
441	3.36E-6
522	4.8E-5
557	9.73E-5
613	1.19E-4
671	4.55E-5
781	4.61E-6
872	6.17E-7
1030	0.0

For a description of the theory involved in water column abundance measurements in channels that include the 940 nm water vapor band, consult Bruegge et al. (1992b).

4. Equipment:

Sensor/Instrument Description:

The staff science sunphotometer measurements used hand-held (non-suntracking) 4-band radiometers with silicon detectors and temperature monitors.

Below is a listing of the instruments, center wavelengths and operators for the staff data collection period:

INSTR NAME ID NUM SERIAL NUM OPERATOR	CENTER WAVELENGTHS (nm)	50% BANDWIDTHS (nm)	DATES OF USE
EKO MS-120 (ID = 600) (S/N S83098.10) (A. RETTA/KSU)	500 675 875 945	5-6	2/1/87-8/7/87
RSMAS (ID = 322) (S/N 322) (A. RETTA, L.BALLOU/KSU)	380 500 875 945	~10 nm	3/5/87-7/11/87 12/1/87-10/31/89 2/8/88-9/26/88 6/15/89-10/31/89
RSMAS (ID = 304) (S/N 304) (G. HARBERS/KSU)	500 641 875 945	~10 nm	8/1/88-12/1/88

Collection Environment:

Ground.

Source/Platform:

Ground.

Source/Platform Mission Objectives:

The objective was to measure the attenuation of solar radiation by the atmosphere, and then to estimate the aerosol optical thickness using these data. These data are then used for calibration and correction of other measurements made with remote sensing instruments during FIFE.

Key Variables:

Vertical aerosol optical thickness.

Principles of Operation:

The instruments have silicon photodiode detectors. A peak sample and hold circuitry allowed the instruments to be hand-held during data collection since they do not track the Sun automatically. The peak hold feature also enables the instrument to measure and hold the maximum voltage as the instrument is pointed toward the Sun. The detectors are not temperature stabilized and have a small temperature sensitivity that is compensated for.

Sensor/Instrument Measurement Geometry:

The field-of-view (FOV) for these sunphotometers is about 2 degrees. The instrument is pointed directly at the Sun and therefore measures attenuation along this path.

Manufacturer of Sensor/Instrument:

Rosenthal School of Marine and Atmospheric Sciences (RSMAS)
University of Miami
4600 Richenbacken Causeway
Miami, Florida 33149-1098

EKO MS-120:
Made in Japan

Calibration:

Instruments were calibrated by Langley plots at mountain sites (e.g., Mauna Loa, Hawaii or Sunspot, New Mexico) or by comparison with calibrated instruments at various locations. The table below details the comparisons and the instrument calibration constants (V_o).

INSTRUMENT	DATE	METHOD	REFERENCE	INSTRUMENT CALIBRATION CONST. FOR CENTER WAVELENGTHS			
				1	2	3	4
600 (EKO)	10/86	LANGLEY	---	.446	1.065	.351	.447
	7/87	COMPARE	SXM-3	.476	1.030	.247	----
	10/26/87	COMPARE	302	.486	-----	.206	----
322 (RSMAS)	10/86	LANGLEY	-----	20.41	188.47	140.71	193.92
	7/87	COMPARE	SXM-3	22.8	196.2	144.7	------
	10/23/87	COMPARE	302	----	187.0	141.5	------
	11/88	LANGLEY	-----	----	177.4	135.5	------
304 (RSMAS)	Not known.						

Specifications:

See the *Sensor/Instrument Description Section*.

Tolerance:

Not known.

Frequency of Calibration:

Dates of calibration and comparison for the various instruments are tabulated in the *Calibration Section*.

Other Calibration Information:

None.

5. Data Acquisition Methods:

Data were recorded by hand. A data collection record consists of start time, start instrument temperature, detector voltages for each channel, stop detector temperature and stop time. For each sequence of measurements, barometric pressure and sky conditions were recorded.

6. Observations:

Data Notes:

Not available.

Field Notes:

None.

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:

Staff optical thickness data were obtained at the following locations within the FIFE study area.

SITEGRID	STN	NORTHING	EASTING	LATITUDE	LONGITUDE
0847-SP3	29	4332344	714439	39 06 57	-96 31 11
1609-SP2, SP3, SP4	100	4330786	706889	39 06 13	-96 36 27
1715-SP3, SP4	101	4330580	708020	39 06 05	-96 35 40
2133-SP3	906	4329726	711604	39 05 34	-96 33 12
2915-SP3	12	4328167	708028	39 04 47	-96 35 42
3317-SP3	910	4327395	708485	39 04 22	-96 35 24
4439-SP3, SP4	16	4325215	712794	39 03 07	-96 32 28
6735-SP3	13	4320652	712073	39 00 40	-96 33 03
XETL-SP2, SP3, SP3	999	4340743	708712	39 11 34	-96 35 00
4439-SP3	916				

SITEGRID	ELEV	SLOPE	ASPECT
0847-SP3	418		
1609-SP2, SP3, SP4	332		
1715-SP3, SP4			
2133-SP3	443	1	TOP
2915-SP3	415		

3317-SP3	427	15	W
4439-SP3, SP4	445		
6735-SP3	385		
XETL-SP2, SP3, SP3	325		

At each site the following instruments and instrument operators were used to collect the data:

INSTR	SITEGRID	STATION_ID	OPERATOR
304	1609-SP2, XETL-SP2	100, 999	GALEN HARBERS
322	4439-SP3, 1609-SP3	16, 100, 101, 999	AMARRE RETTA
	1715-SP3, XETL-SP3		
322	2915-SP3, 6735-SP3	12, 13, 16, 29, 100, 906,	GALEN HARBERS
	4439-SP3, 0847-SP3	910, 916, 999	
	1609-SP3, 2133-SP3		
	3317-SP3, 4439-SP3		
	XETL-SP3		
322			LARRY BALLOU
600	4439-SP4, 1609-SP4	16, 100, 101, 999	AMARRE RETTA
	1715-SP4, XETL-SP4		

Spatial Coverage Map:

Not available.

Spatial Resolution:

These are point data and represent the atmospheric path from the observer to the Sun. Spatial resolution is not well defined for measurements made using a sunphotometer.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

Measurements were made from February 6, 1987 through October 31, 1989. The various times of data collection by the different instruments are listed below:

Instrument ID	Date
600	06-FEB-87 to 07-AUG-87
304	06-AUG-88 to 01-DEC-88
322	06-MAR-87 to 31-OCT-89

Temporal Coverage Map:

Not available.

Temporal Resolution:

Typically, 3-5 measurements were made per instrument during a satellite overpass. Readings were generally made more frequently during the aircraft overflights in the IFC's. Measurements were made almost daily in March 1987, April 1987, June 1987, July 1987, August 1988, and July 1989. Measurements were intermittent during other months within this period of coverage.

Data Characteristics:

The SQL definition for this table is found in the OT_STAFF.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 the east (EE) cell number in a 100 x 100 array of 200 m square cells. The last 3 characters (III) are an instrument			
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 time that the observation was taken, in GMT. The format is HHMM.		[GMT]	
INSTR_ID The code name for the instrument			

used to make the observations.

SURFACE_PRESS
The surface pressure at the time of the observation. [millibars]

SOLAR_ZEN_ANG
The Solar Zenith Angle for this observation. [degrees]

ANGSTROM_WAVLEN_EXP
The Angstrom Wavelength Exponent. If AWE is close to 0 then atmospheric particles are large. If AWE is close to 3, the particles are small.

WAVLEN
The wavelength at which the observation was made. [nm]

OZONE_OPTCL_THICK
The Ozone Optical Thickness, caused by ozone particles in the air.

RAYLEIGH_OPTCL_THICK
The Rayleigh Optical Thickness, caused by molecular scattering.

AEROSOL_OPTCL_THICK
The Aerosol Optical Thickness, caused by colloidal particles suspended in the air.

TOTAL_OPTCL_THICK
The Total Optical Thickness, on a vertical path from surface to space.

WEATHER
A comment on the weather conditions at the time of the observation.

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 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	INSTR_ID	SURFACE_PRESS
XETL-SP3	999	06-MAR-87	1954	322	-9.00
XETL-SP3	999	06-MAR-87	1954	322	-9.00
XETL-SP3	999	06-MAR-87	1954	322	-9.00
XETL-SP3	999	06-MAR-87	1954	322	-9.00

SOLAR_ZEN_ANG	ANGSTROM_WAVLEN_EXP	WAVLEN	OZONE_OPTCL_THICK
54.750	.959	380.0	.0000
54.750	.959	500.0	.0110
54.750	.959	875.0	.0000
54.750	.959	945.0	.0000

RAYLEIGH_OPTCL_THICK	AEROSOL_OPTCL_THICK	TOTAL_OPTCL_THICK
.4280	.0790	.5070
.1380	.0830	.2310
.0140	.0490	.0630
.0100	.3470	.3570

WEATHER	FIFE_DATA_CRTFCN_CODE	LAST_REVISION_DATE
CLEAR	CPI	03-AUG-88
CLEAR	CPI	03-AUG-88
CLEAR	CPI	03-AUG-88
CLEAR	CPI	03-AUG-88

8. Data Organization:

Data Granularity:

This data set contains point data. Measurements were made from February 6, 1987 through October 31, 1989. Measurements were made almost daily in March 1987, April 1987, June 1987, July 1987, August 1988, and July 1989. Measurements were intermittent during other months within this period of coverage.

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:

The voltage response of the instrument (**V**) to a radiance (**L**) at the ground can be written as a function of the exoatmospheric solar radiance response **V(o)** through the Bouger's Law:

V = (V(o) / r^2) * e^(-m * tau)

where:

tau = the total optical thickness
m = the air mass
r = Earth/Sun distance in Astronomical Unit (AU)

If changes in **tau** are negligible during an air mass change, such as during mornings at a mountain site, a plot of Ln **V** versus **m** gives as the y intercept the required exoatmospheric radiance response ln **V(o)**. The latter is the well-known Langley plot method of calibration.

The aerosol optical thickness derived from a voltage measurement using the above equation is compared for each instrument. Of the three instruments, if data from two agreed and the other did not, the latter could be calibrated using:

V(o) = (V * r^2) * e^(m * tau)

where all the quantities on the right-hand side of the equation are known. This is the intercomparison method. If none of the instruments agreed, then, aerosol optical thickness derived from the most reliable instrument/calibration is used to calibrate the other two. In the data set presented here, the derived aerosol optical thickness values all agreed to within the uncertainties of the measurements (see the *Confidence Level/Accuracy Judgment Section*).

The following instrument calibration constants for individual wavelengths were used for each instrument:

```
            Instrument ID   Date       Instrument Calibration Constants +
by Band
-------------    -------    --------------------------------
1       2      3     4
600*            2/1/87     .460    1.065  .330   ---
8/24/87    .480    1.010  .222   ---
322             1987        22.83  196.2  144.7  ---
1988-89     22.8   177.4  135.5  ---
304             ALL         52.7    58.4   71.3  146.9
```

- Linearly interpolated for other dates.
- See chart in the *Sensor/Instrument Description Section* for wavelengths of Bands 1-4 for each instrument.

Data Processing Sequence:

Processing Steps:

Not applicable.

Processing Changes:

None.

Calculations:

Special Corrections/Adjustments:

None.

Calculated Variables:

- Voltage response of the instrument

- Aerosol optical thickness

Graphs and Plots:

None.

10. Errors:

Sources of Error:

Errors can arise during measurement and calibration. During calibration, a requirement of the Langley plot method is that the atmospheric optical thickness remains constant during the period of maximum airmass change. At mountain sites, this requirement is usually met on clear days, but not always. The effect of varying atmospheric conditions is reflected in the quality of the Langley plots (see Halthore and Markham 1992).

The calibration coefficient, which is the y-intercept in Langley plots, can be obtained to a consistency better than 1% and we take this as the uncertainty in out measurements. A 1 % uncertainty in **V_o** translates to an uncertainty in the aerosol optical thickness of 0.01 at airmass of 1. The equation is:

Delta(tau_aerosol) = (1 / m)((Delta V_o) / V_o)

Uncertainties in the Rayleigh optical thickness and ozone optical thickness are negligible for the conditions encountered in FIFE.

For sunphotometers that do not employ constant temperature detectors, a source of variation at some wavelength, and hence uncertainty arises due to inadequate temperature compensation for the response. Furthermore, for sunphotometers that do not employ auto-tracking or peak hold features, another major source of uncertainty arises due to imperfect pointing. For measurements reported here, these are not expected to significantly contribute to absolute errors in the measurements of aerosol optical thickness.

Quality Assessment:

Data Validation by Source:

The Principal Investigator checked the data.

Confidence Level/Accuracy Judgment:

1987:

The most useful channels on these instruments for aerosol optical thickness are 500 nm, 641 nm, 675 nm and 875 nm.

1988, 1989:

The 380 nm channel on instrument number 322 had a weak signal and thus, low sensitivity. Precision is in the order of 1 part in 100. The 945 nm channels must include water vapor and should not be used to measure aerosol optical thickness.

Measurement Error for Parameters:

No quantitative assessment was made, see the *Confidence Level/Accuracy Judgment Section*.

Additional Quality Assessments:

FIS staff applied a general Quality Assessment (QA) procedure to the data to identify inconsistencies and problems for potential users. As a general procedure, the FIS QA consisted of examining the maximum, minimum, average, and standard deviation for each numerical field in the data table. An attempt was made to find an explanation for unexpected high or low values, values outside of the normal physical range for a variable, or standard deviations that appeared inconsistent with the mean. In some cases, histograms were examined to determine whether outliers were consistent with the shape of the data distribution.

The discrepancies, which were identified, are reported as problems in the *Known Problems with the Data Section*.

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:

Instrument number 600, particularly the 875 nm channel degraded significantly over its 6 months of use. Instrument number 322 had some loose packing material that intermittently interfered with its optical path, potentially either increasing or decreasing its response. Also the calibrations for instrument number 322 in Kansas were about 3-4% higher than the pre- and post- season calibrations. This may be a temperature or a contamination problem. This difference amounts to 0.03-0.04 in aerosol optical depth. The 641 nm channel on instrument number 304 was occasionally out of bounds, apparently due to a filter non-uniformity. Aerosol optical thickness in the 641 nm channel should be between the values for the 500 and 870 nm channels.

Usage Guidance:

For the early 1987 period (2/1/87 - 8/7/87), it is suggested that the data from instruments numbered 322 and 600 be used in combination. If the processed 322 and 600, 500 nm channels aerosol optical depths agree to within +/- 0.02 then the 322 data at 500 nm and 875 nm are usable. The 380 channel on instrument number 322 had a weak signal and should not be used. The 945 channels on all instruments are water vapor channels. This has not been taken into consideration in processing the data, so the derived optical depths are not valid aerosol optical depths.

Generally, the values should be considered valid if the three measurements are made over a short timeframe, and are within 0.01 aerosol optical thickness.

Any Other Relevant Information about the Study:

None.

12. Application of the Data Set:

Aerosol optical thickness in conjunction with an atmospheric model can provide estimates of atmospheric effects on transmitted and reflected solar radiation. These effects can then be used to correct aircraft and satellite radiometric data.

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 Aerosol Optical Thickness from GSFC data are available on FIFE CD-ROM Volume 1. The CD-ROM file name is as follows:

\DATA\OPTICAL\OT_STAFF\GRIDxxxx\YyyMmm\ydddgrid.OTS or
\DATA\OPTICAL\OT_STAFF\GRIDxxxx\Yyyyy\ydddgrid.OTS

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., Y87 = 1987), *yyyy* are the four digits for the century and year (e.g., Y1987 = 1987), and *mm* is the month of the year (e.g., M12 = December). 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). The filename extension (*.sfx*), identifies the data set content for the file (see the *Data Characteristics Section*) and is equal to .OTS for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

Not available at this revision.

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Bruegge, C.J., R.N. Halthore, B.L. Markham, M. Spanner and R. Wrigley. 1992. Aerosol optical depth retrievals over the Konza Prairie. J. Geophys. Res. 97:18743-18758

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Shaw, G.E., J.A. Reagan, and B.M. Herman. 1973. Investigations of atmospheric extinction using direct solar radiation measurements made with a multiple wavelength radiometer. J. Appl. Meteorol. 12:374-380.

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:

CD-ROM Compact Disk-Read Only Memory DAAC Distributed Active Archive Center EOSDIS Earth Observing System Data and Information System FIFE First ISLSCP Field Experiment FIS FIFE Information System FOV Field of View ISLSCP International Satellite Land Surface Climatology Project ORNL Oak Ridge National Laboratory PAMS Portable Automatic Mesonet Station TOMS Total Ozone Mapping Spectrometer URL Uniform Resource Locator UTM Universal Transverse Mercator

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

20. Document Information:

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Warning: This document has not been checked for technical or editorial accuracy by the FIFE Information Scientist. There may be inconsistencies with other documents, technical or editorial errors that were inadvertently introduced when the document was compiled or references to preliminary data that were not included on the final CD-ROM.

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.

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