Optical Thickness Data: Fraser (FIFE)

Summary:

The Solar Transmissometer Aerosol Optical Thickness Data Set contains optical thickness data that provide a measure of the effect of aerosols on the attenuation of radiation through the atmosphere at 8 discrete wavelength bands throughout the visible and near IR portion of the electromagnetic spectrum. These data were collected using a ground-based solar transmissometer in June and July of 1987, and July and August of 1989, at two stations in the FIFE study area. These data are used to provide atmospheric correction of remotely sensed data using radiative transfer models and to study aerosol particle size distribution (see Halthore and Markham 1992; King et al. 1978). These data are also used to infer the optical clarity of the atmosphere.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Optical Thickness Data: Fraser (FIFE).
(Solar Transmissometer Aerosol Optical Thickness).

Data Set Introduction:

The Solar Transmissometer Aerosol Optical Thickness Data Set contains atmospheric pressure, ozone content, and aerosol optical thickness data at 8 wavelengths from 440 to 1030 nanometers (nm). These data are used to provide atmospheric correction of remotely sensed data using radiative transfer models and to study aerosol particle size distribution (see Halthore and Markham 1992; King et al. 1978). These data are also used to infer the optical clarity of the atmosphere.

Objective/Purpose:

The focus of these measurements of aerosol optical thickness was to enable an estimation of atmospheric effects on transmitted and reflected radiation. These estimates can then be used to develop correction schemes for aircraft and satellite radiometric data.

Summary of Parameters:

Atmospheric pressure, ozone content, and aerosol optical thickness at 8 wavelengths from 440 to 1030 nanometers (nm).

Discussion:

These optical thickness data provide a measure of the effect of aerosols on the attenuation of radiation through the atmosphere at 8 discrete wavelength bands throughout the visible and near IR portion of the electromagnetic spectrum. These data are used to provide atmospheric correction of remotely sensed data using radiative transfer models and to study aerosol particle size distribution (see Halthore and Markham 1992; King et al. 1978). These data are also used to infer the optical clarity of the atmosphere. These data were collected using a ground-based solar transmissometer in June and July of 1987, and July and August of 1989, at two stations in the FIFE study area.

Related Data Sets:

- NIPS and Reagan Sunphotometer Optical Thickness (Bruegge).
- Sunphotometer Optical Thickness Data from C130 Aircraft.
- Optical Thickness Calibration Reference.
- Aerosol Optical Thickness from GSFC.

FIS Data Base Table Name:

OPTICAL_THICK_FRASER_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Staff Science.

Title of Investigation:

Aerosol Optical Thickness Measurements During FIFE.

Contact Information:

Contact 1:
Dr. R.N. Halthore
NASA Goddard Sp. Fl. Ctr.
Greenbelt, MD
(301) 286-1094
halthore@ltpsun.gsfc.nasa.gov

Contact 2:
Mr. Brian L. Markham
NASA Goddard Sp. Fl. Ctr.
Greenbelt, MD
(301) 286-5240
Markham@highwire.gsfc.nasa.gov

Requested Form of Acknowledgment.

The aerosol optical thickness data were collected under the direction of the FIFE calibration scientist B. Markham and his staff at GSFC. The dedicated efforts of B. Markham and R. Halthore in the collection analysis and preparation of these data is greatly appreciated. Please cite the following papers in any work or publication using these data:

Halthore, R.N., B.L. Markham, R. Ferrare, and T.O. Aro. 1992. Aerosol optical properties over the mid-continental United States.

Geophys. Res. 97:18,769-18,778. Bruegge, C.J., R.N. Halthore. B.L. Markham, M. Spanner, and R. Wrigley. 1992a. Aerosol optical depth retrievals over the Konza Prairie. J. Geophys. Res. 97:18,743 18,758.

3. Theory of Measurements:

Aerosol optical thickness is highly variable in space and time, and an accurate estimate is made by measuring the direct solar radiance at the ground by the use of a calibrated sunphotometer. Solar radiation reaching the ground is attenuated by absorption and scattering by atmospheric molecules, as well as particles. Molecular scattering (Rayleigh scattering) is estimated by measuring the pressure. Molecular absorption is avoided by an appropriate choice of band passes.

If **I** is the solar radiance at the surface,

I = (I_o / r^2) exp((-m * tau)_R + (-m tau)_oz + (-m * tau)_aer) * T_w

where **I_o** is the exo-atmospheric solar radiance, **r** is the Sun-Earth distance in Astronomical Units, **m** is the airmass, **tau** is the optical thickness, and sub- scripts **R**, **oz**, and **aer** refer to Rayleigh, ozone, and aerosol components of the total attenuation. **Tw** is the transmission due to water vapor attenuation. Since the instruments used by this group avoided the water absorption bands, **T_w** is assumed to be 1. The form of the above equation then becomes what is commonly known as the Beer-Lambert-Bouger law.

If **V** is voltage response of the sunphotometer,

ln(V) + (m * tau)_R + (m * tau)_oz = ln (V_o / R^2) - (m * tau)_aer.

Here, **V_o** is the calibration coefficient and is the fictitious response of the sunphotometer to exo-atmospheric solar radiance. By measuring surface pressure, **tau_R** can be accurately calculated. From climatology or from the TOMS (Total Ozone Mapping Spectrometer) aboard the Nimbus satellite, ozone column abundance can be obtained from which **tau_oz** can be calculated. Thus, in the above equation, all terms except **tau_aer** are known for each measurement of **V**.

4. Equipment:

Sensor/Instrument Description:

The eight-channel sunphotometer, named SXM-2 (Spinhirne, 1983), is a table-mounted automatic Sun-tracking transmissometer having wavelengths of 440, 522, 557, 613, 672, 781, 871, and 1030 nm with 10 nm full width at half maximum (FWHM). It was used on the ground. SXM-3 is identical to SXM-2 except that it is hand-held. SXM-3 was used in 1987, and SXM-2 was used in 1989.

Collection Environment:

Ground.

Source/Platform:

Ground.

Source/Platform Mission Objectives:

The primary reasons for collecting these data were two fold, 1) to measure atmospheric attenuation and hence estimate the aerosol optical thickness, and 2) to then use the aerosol optical thickness values in radiative transfer algorithms to estimate components of the radiation field at the ground or at the sensor.

Key Variables:

Aerosol optical thickness, surface atmospheric pressure, and ozone abundance.

Principles of Operation:

The SXM-3 is a hand-held sunphotometer used only in the 1987 field campaign. It has a peak hold feature, which enables the instrument to measure and hold the maximum voltage as the instrument is pointed toward the Sun. The detector is a silicon photodiode detector, which is kept at a constant temperature of 20 degrees C. It employs multiple gain settings allowing gain factors of 1, 10, 1000, and 10,000, thus enabling solar radiance, as well as sky radiance measurements with a viewing angle of approximately 1.3 degrees (Spinhirne and King, 1985).

In 1989, SXM-2, an automatic version of SXM-3, was used. SXM-2 has the same eight channels as SXM-3, but unlike SXM-3, it tracks the Sun automatically. The frequency of sampling for the SXM-2 can be varied from once every 0.5 min to once every 4 min. The SXM-3 detector is kept at a constant temperature of 25 degrees C.

Sensor/Instrument Measurement Geometry:

The field-of-view (FOV) for SXM-2 and SXM-3 are 0.8 and 1.3 degrees, respectively.

Manufacturer of Sensor/Instrument:

SXM-2 and SXM-3 were built at Goddard Space Flight Center, Greenbelt, Maryland.

Calibration:

Calibration was performed using the Langley plot method. This method has been discussed extensively in the literature (Shaw et al. 1973; See also the *Calibration Section* in the Optical Thickness Calibration Reference Guide Document.) In 1987, Langley plots were obtained for the SXM-3 on two relatively clear and stable days. In 1987, the derived optical thickness values did not agree with the instrument readings from the JPL Reagan sunphotometer. For that reason, the calibration obtained using the Langley plots was supplemented with the information obtained from the instrument intercomparisons performed in 1989. In 1989, the SXM-2 instrument was calibrated before and after the FIFE IFC in August at mountain sites. These data and the data from the intercomparisons of this instrument, the Reagan Sunphotometer (see the NIPS and Reagan Sunphotometer Optical Thickness (Bruegge) Data Set) and the C-130 airborne tracking sunphotometer (see Sunphotometer Optical Thickness Data from C130 Aircraft Data Set) were used to create a calibration for the SXM-2 in 1989.

Specifications:

See the *Sensor/Instrument Description Section*.

Tolerance:

The precision of SXM-2 and SXM-3 is quite good at 4 x 10E-4 in some channels. The accuracy is determined by the accuracy in calibration, which is estimated to be 1% translating to +/- 0.01 in aerosol optical thickness at 1 airmass.

Frequency of Calibration:

The responses of the instrument were monitored during the experiment period in 1989 by instrument intercomparison (see the Optical Thickness Calibration Reference Data Set and Aerosol Optical Thickness from GSFC Data Set) and calibration at Mountain top sites before and after FIFE. In 1987, Langley calibration was performed on 2 days and checked with prior calibrations. In the period between the 1987 and 1989 field campaigns, Langley plots used for calibration were obtained on 3 days. Finally, in 1989, instrument calibration was performed both before and after the August IFC at a mountain site and during the IFC via a comparison of the three instruments used to measure aerosol optical thickness.

Other Calibration Information:

None.

5. Data Acquisition Methods:

In 1987, data were acquired from the manual SXM-3 sunphotometer with the aid of an electronic data logger. Data were written to a cassette tape within the data logger. Of the 20 days of data, 11 days were either clouded or rained out.

In 1989, data were acquired throughout the day using a SXM-2. Date were logged directly on to a computer and then down-loaded for analysis. On some days, cloud cover did not allow continuous measurement of solar transmission.

6. Observations:

Data Notes:

Not available.

Field Notes:

Contact R.N. Halthore (see the *Contact Information Section*), if you wish to examine the field notes.

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:

In 1987, measurements were made at station 100 (sitegrid 1609-SPF) with SXM-3. In 1989, measurements were made at station 415 (sitegrid 3639-SPH) with SXM-2.

Spatial Coverage Map:

Not available.

Spatial Resolution:

These are point data. However, a single measurement represents the area of the FIFE study area.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

Measurements were made during daylight hours on 10 days from June 25, 1987 to July 14, 1987, and on 13 days from July 25, 1989 to August 12, 1989.

Temporal Coverage Map:

Not available.

Temporal Resolution:

The SXM-2 instrument cycles through a set of eight filters in about 20 seconds and the frequency of sampling can be varied from once every 4 minutes to once every 0.5 minutes. In 1987, the SXM-3 obtained data when possible approximately every 5 minutes. The number of spectra obtained each day ranges from 5 to 376.

Data Characteristics:

The SQL definition for this table is found in the OT_FRASR.TDF file located on the 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 number for the location of the observations.			
OBS_DATE The date on which the observation was made.	min = 25-JUN-87, max = 12-AUG-89		GSFC
OBS_TIME The time when the observation was made.	min = 4, max = 2356	[GMT]	GSFC
INSTR_ID The instrument which collected the image data.			
SURFACE_PRESS The surface pressure.	min = 1, max = 1	[millibars]	ANEROID SENSOR
ABUNDANCE_OF_OZONE The column abundance of ozone, reduced to STP.	min = 297, max = 348	[Dobson Units]	SUNPHOTOMETER

AEROSOL_OPTCL_THICK_440

The aerosol optical thickness for   min = .059,
SUNPHOTOMETER
a wavelength of 440.8 nm.   max = .697

AEROSOL_OPTCL_THICK_552
The aerosol optical thickness for   min = .051,
SUNPHOTOMETER
a wavelength of 552.2 nm.   max = .564

AEROSOL_OPTCL_THICK_557
The aerosol optical thickness for   min = .043,
SUNPHOTOMETER
a wavelength of 557.9 nm.   max = .512,
missing = -9.999

AEROSOL_OPTCL_THICK_612
The aerosol optical thickness for   min = .038,
SUNPHOTOMETER
a wavelength of 612.7 nm.   max = .471,
missing = -9.999

AEROSOL_OPTCL_THICK_672
The aerosol optical thickness for   min = .034,
SUNPHOTOMETER
a wavelength of 672.3 nm.   max = .443,
missing = -9.999

AEROSOL_OPTCL_THICK_781
The aerosol optical thickness for   min = .027,
SUNPHOTOMETER
a wavelength of 781.2 nm.   max = .389,
missing = -9.999

AEROSOL_OPTCL_THICK_872
The aerosol optical thickness for   min = .022,
SUNPHOTOMETER
a wavelength of 872.4 nm.   max = .351,
missing = -9.999

AEROSOL_OPTCL_THICK_1030
The aerosol optical thickness for   min = .021,
SUNPHOTOMETER
a wavelength of 1030.0 nm.   max = .485,
missing = -9.999

FIFE_DATA_CRTFCN_CODE   **
The FIFE Certification Code for   min = D,   FIS
the data, in the following format: max = E
CPI (Certified by PI), CPI-???

(CPI - questionable data).

LAST_REVISION_DATE
data, in the format (DD-MMM-YY).   max = 16-NOV-89

Footnote:

** 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 are "merged" from two separate receiving stations to eliminate transmission errors. CPI-??? Investigator thinks data item may be questionable.

Sample Data Record:

SITEGRID	STATION_ID	OBS_DATE	OBS_TIME	INSTR_ID	SURFACE_PRESS
3639-SPH	415	25-JUL-89	1403	SXM-2	963.6
3639-SPH	415	25-JUL-89	1403	SXM-2	963.6
3639-SPH	415	25-JUL-89	1404	SXM-2	963.6
3639-SPH	415	25-JUL-89	1404	SXM-2	963.6
3639-SPH	415	25-JUL-89	1404	SXM-2	963.6
3639-SPH	415	25-JUL-89	1405	SXM-2	963.6

ABUNDANCE_OF_OZONE	AEROSOL_OPTCL_THICK_440	AEROSOL_OPTCL_THICK_552
300	.438	.372
300	.428	.362
300	.428	.363
300	.43	.36
300	.422	.355
300	.422	.355

AEROSOL_OPTCL_THICK_557	AEROSOL_OPTCL_THICK_612	AEROSOL_OPTCL_THICK_672
.329	.285	.247
.321	.281	.242
.325	.284	.247
.319	.279	.241
.314	.273	.238
.316	.278	.241

AEROSOL_OPTCL_THICK_781	AEROSOL_OPTCL_THICK_872	AEROSOL_OPTCL_THICK_1030
.193	.158	.118
.187	.155	.117
.191	.158	.12
.187	.153	.117
.187	.154	.118
.186	.152	.117

FIFE_DATA_CRTFCN_CODE	LAST_REVISION_DATE
CPI	16-NOV-89

```
CPI                       16-NOV-89
CPI                       16-NOV-89
CPI                       16-NOV-89
CPI                       16-NOV-89
CPI                       16-NOV-89
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8. Data Organization:

Data Granularity:

This data set contains point data. However, a single measurement represents the area of the FIFE study area. The SXM-2 instrument has a frequency of sampling that can be varied from once every 4 minutes to once every 0.5 minutes. In 1987, the SXM-3 obtained data when possible approximately every 5 minutes. The number of spectra obtained each day ranges from 5 to 376.

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, and principal investigator name. 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.) 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:

From pressure values, obtain the Rayleigh optical thickness:

(Hansen and Travis, 1974)

$$tau\_R = (p / p0) (0.008569 / L^4) (1 - 0.0113 / L^2 - 0.00013 / L^4)$$

where:

p is the measured surface pressure,
p0 is pressure at sea level, and
L is the wavelength in micrometers.

The ozone optical thickness is obtained by multiplying the column abundance in Dobson units ([matm][cm]) with the absorption coefficient given in the following table for a particular wavelength and dividing by 1000.

Ozone Absorption Coefficients

Wavelength [nm]	Absorption Coefficient [atm^-1][cm^-1]
368	6.18 E-4
380	3.22 E-4
441	3.36 E-3
500	3.28 E-2
522	4.80 E-2
551	9.73 E-2
613	1.19 E-1
640	2.89 E-2
671	4.55 E-2
781	4.61 E-3
872	6.17 E-4
945	0.00 E-0
1030	0.00 E-0

Data Processing Sequence:

Processing Steps:

To get the total optical thickness, first, the formulae given in the above section is used to compute the Rayleigh optical thickness. Second, compute the ozone optical thickness (if any), and third, add them to the aerosol optical thickness.

Processing Changes:

None.

Calculations:

Special Corrections/Adjustments:

None.

Calculated Variables:

- Total optical thickness,
- Rayleigh optical thickness, and
- Ozone optical thickness.

Graphs and Plots:

None.

10. Errors:

Sources of Error:

Errors can arise (1) while calibrating and (2) while measuring. 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 our measurements. A 1% uncertainty in **V_o** (calibration coefficient) translates to an absolute 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 major source of variation and hence uncertainty may arise 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. Neither of these two sources of error are applicable in this case.

Quality Assessment:

Data Validation by Source:

The FIFE calibration scientist (B. Markham) and staff at GSFC believe their data to be of good quality.

Confidence Level/Accuracy Judgment:

All these data submitted to FIFE have an uncertainty of 1% in the calibration, which translates to an absolute uncertainty in aerosol optical thickness of (0.01)/m where **m** is the airmass.

Measurement Error for Parameters:

Not applicable.

Additional Quality Assessments:

FIS staff applied a general Quality Assessment (QA) procedure to these 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).
- 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:

discrepancies or errors in the data have been reported:

- All values for SURFACE_PRESSURE hover around 1.
- All values for aerosol optical thickness on August 12, 1989 are suspicious and should be used with caution.

- Values for the ABUNDANCE_OF_OZONE are constant throughout the day and were higher than expected on 3 days, July 1, 1987, July 13, 1987 and July 14, 1987 (ozone values of 324, 325, and 348 respectively.)

For 1987 data, the optical thickness for the 1030 nm channel did not agree with similar measurements using the sunphotometer (see NIPS and Reagan Sunphotometer Optical Thickness (Bruegge)). The problem may be with either instrument.

Usage Guidance:

The derived aerosol optical thicknesses can be used to correct remotely sensed data for atmospheric effect in conjunction with a reliable radiative transfer model, and they can be used to derive aerosol size distribution (Halthore et al. 1992; Markham et al. 1992).

Any Other Relevant Information about the Study:

None.

12. Application of the Data Set:

These data can be used to provide atmospheric correction of remotely sensed data using radiative transfer models and to study aerosol particle size distribution (see Halthore and Markham 1992; King et al. 1978). These data are also used to infer the optical clarity of the atmosphere.

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:

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

\DATA\OPTICAL\OT_FRASR\GRIDxxxx\YyyMmm\ydddgrid.OTF

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), *mm* is the month of the year (e.g., M12 = December), and *ddd* is the day of the year, (e.g., 061 = sixty-first day in the year). Note: capital letters indicate fixed values that appear on the CD-ROM exactly as shown here, lower case indicates characters (values) that change for each path and file.

The format used for the filenames is: *ydddgrid.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. The filename extension (.*sfx*), identifies the data set content for the file (see the *Data Characteristics Section*) and is equal to .OTF for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

Spinhirne, J.D. 1983. El Chichon eruption cloud: Latitudinal variation of the spectral optical thickness for October 1982. Geophys. Lett. 10:881-884.

Bruegge, C.J., R.N. Halthore, B.L. Markham, M. Spanner and R. Wrigley. 1992a. Aerosol optical depth retrievals over the Konza Prairie. J. Geophys. Res. 97:18,743-18,758.

Journal Articles and Study Reports.

Bruegge, C.J., J.E. Conel, R.O. Green, J.S. Margolis, G. Toon and R.G. Holm. 1992b. Water-vapor column abundance retrievals. J. Geophys. Res. 97:18,759-18,768.

Fraser, R.S., R.A. Ferrare, Y.J. Kaufman, S. Mattoo. 1989. Algorithm for atmospheric corrections of aircraft and satellite imagery. J. Int. Remote Sens. 13:541-557.

Halthore, R.N., and B.L. Markham. 1992. Overview of Atmospheric Correction and radiometric calibration efforts during FIFE. J. Geophys. Res. 97:18,731-18,742.

Halthore,R.N., B.L.Markham, R.Ferrare and O.Aro. 1992. Aerosol optical properties over the mid-continental United States. J. Geophy. Res. 97:18,769-18,778.

King, M.D., and D.M. Bryne. 1976. A method for inferring total ozone content from spectral variation of total optical depth obtained with a solar radiometer. J. Atmos. Sci. 33:2242-2251.

King, M., D. Bryne, B. Herman, and J. Reagan. 1978. Aerosol size distributions obtained by inversion of spectral optical depth measurements. J. Atmos. Sci. 35:2153-2167.

Markham, B.L., R.N. Halthore, and S.J. Goetz. 1992. Surface reflectance retrieval from satellite and aircraft sensors during FIFE. J. Geophys. Res. 97:18,785-18,795.

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.

Spinhirn, J.D., and M.D. King. 1985. Latitudinal variation of spectral optical thickness and columnar size distribution of the El Chichon stratospheric aerosol layer. J. Geophys. Res. 90:10,607-10,619.

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:

BPI Byte per inch CCT Computer Compatible Tape 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 FWHM Full Width Half Maximum IFC Intensive Field Campaign ISLSCP International Satellite Land Surface Climatology Project JPL Jet Propulsion Laboratory 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.

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Document Curator:

DAAC Staff

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