Optical Thickness Cross-Calib. (FIFE)

Summary:

The objective of the Optical Thickness Calibration study was to compare aerosol optical thickness measurements derived from three different groups. These groups measured atmospheric transmission, in particular, the aerosol optical thickness, using at least three different instruments (e.g., a solar transmissometer SXM-2, a Reagan sunphotometer, and an airborne tracking sunphotometer) and three different analysis procedures.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Optical Thickness Cross-Calib. (FIFE)
(Optical Thickness Calibration).

Data Set Introduction:

The Optical Thickness Calibration Data Set contains Rayleigh, aerosol, ozone, and total optical thickness data obtained from three different groups. These groups measured atmospheric transmission, in particular, the aerosol optical thickness, using at least three different instruments (e.g., a solar transmissometer SXM-2, a Reagan sunphotometer, and an airborne tracking sunphotometer) and three different analysis procedures.

Objective/Purpose:

During the 1989 field campaign for FIFE there were three independent groups measuring atmospheric transmission, in particular, the aerosol optical thickness, using at least three different instruments and three different analysis procedures. The objective of this study was to collocate the instruments in space and time so that a comparison could be made of the aerosol optical thickness derived by the three groups.

Summary of Parameters:

Rayleigh, aerosol, ozone, and total optical thickness.

Discussion:

These data enable the intercalibration of the sunphotometers used in 1989 and therefore, the direct comparison of the data collected by these instruments. Measurements were taken with three instruments (Solar transmissometer SXM-2, Reagan sunphotometer, and Airborne Tracking Sunphotometer) positioned side by side on August 4, 1989. Only the SMX-2 and Reagan sunphotometer were used for measurements on August 6, 1989. Optical thickness was measured with each of the instruments.

Bruegge et al. (1992a) reported on the comparison study involving data acquired in the early afternoon of August 4, 1989 using the Reagan, SXM-2, and Airborne Tracking Sunphotometers (ATSP) at Manhattan Airport. When the data at 440 nm were compared for a 1-hour period, the aerosol optical depth was found to drop by about 0.01. All instruments followed the same temporal profile during periods of simultaneous measurements. Generally, the data were in agreement to within 0.005.

Related Data Sets:

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

FIS Data Base Table Name:

OPTICAL_THICK_CALIB_REF.

2. Investigator(s):

Investigator(s) Name and Title:

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NASA Goddard Space Flight Center/Hughes STX Corp.

Mr. Brian L. Markham
NASA Goddard Space Flight Center

Dr. Michael A. Spanner
NASA Ames Research Center

Title of Investigation:

Aerosol Optical Thickness Calibration.

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Requested Form of Acknowledgment.

The Optical Thickness Calibration data were obtained by C.J. Bruegge, R.N. Halthore, B.L. Markham, and M.A. Spanner.

3. Theory of Measurements:

Sunphotometers or solar transmissometers have long been used to measure atmospheric transmission. The basic idea is that since for time scales in order of a day, solar radiance **I_o** outside the atmosphere is a constant in narrow bands (approx. 10 nm) in the visible and near-infrared wavelengths, changes in radiance **I** measured at the ground by the 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** = solar radiance at one AU in a given band (the underscore refers to a subscript and a '^' refers to a superscript),
- **r** = Earth-Sun distance at the time of observation in Astronomical Units (AU),
- **m** = airmass of observation,
- **tau** = optical thickness,
- **R** = Rayleigh scattering as cause of attenuation
- **oz** = ozone absorption as cause of attenuation
- **aer** = aerosol absorption and scattering as cause of attenuation

Note: 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,

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

For a measurement of voltage **V** at a known airmass of **m** (= sec(theta), approximately where theta is the solar zenith angle), 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 thickness 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 or microns. 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 relation between ozone abundance, latitude and time of year) by the absorption coefficient tabulated below:

Wavelength (nm)	Ozone Absorption Coefficient in [matm^-1]	[cm^-1]

441	3.36E-6
522	4.8E-5
557	9.73E-5
613	1.19E-5
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, the reader should consult Bruegge et al. (1992b).

4. Equipment:

Sensor/Instrument Description:

Collection Environment:

Ground.

Source/Platform:

SXM-2 and Reagan sunphotometers were located on the ground, while the ATSP was in its usual location atop the C-130 aircraft parked nearby.

Source/Platform Mission Objectives:

The objective was to compare the measured aerosol or total optical thickness as measured by different groups.

Key Variables:

Aerosol optical thickness, pressure, total optical thickness, and optical thickness due to ozone absorption.

Principles of Operation:

Sunphotometers used in this study typically employ a silicon photodiode detector, which may be temperature controlled. A filter wheel having 6 - 10 bands throughout the visible and near-IR at preselected wavelengths that usually avoid water band absorption. Sometimes bands are specifically chosen to include water absorption to monitor water column abundance.

Sensor/Instrument Measurement Geometry:

Sunphotometers are designed to measure solar radiance at the ground surface, in a narrow viewing angle as determined by a baffled long tube. The narrow viewing angle, typically 1-2 degrees field of view ensures full coverage of the solar disk, while eliminating much of the sky radiance.

Manufacturer of Sensor/Instrument:

See the documents listed in the *Sensor/Instrument Description Section*.

Calibration:

Equation (2) in the *Theory of Measurements Section* can be written as the following:

$$\ln V + (m*\tau)_{oz} + (m*\tau)_R = \ln(V_o / R^2) - \tau_{aer} * m_{aer}. \quad (4)$$

In the above equation, the terms on the left-hand side can be plotted against **m_{aer}**, the aerosol airmass. If the aerosol optical thickness does not change during portions of the day when the airmass is changing the most (sunrise and sunset), such a plot would yield a straight line whose y-intercept would be a function of the required calibration coefficient: **$\ln(V_o/R^2)$**, and whose slope is **$-\tau_{aer}$**.

This is known as the Langley plot method of calibration. The requirement that **τ_{aer}** not change during measurements is most easily met at mountain sites, which are above the boundary layer and in the morning when convective motions have had not enough time set in. For a further discussion, see Halthore and Markham (1992).

In 1987 and 1989, all of the sunphotometers were calibrated using the Langley plot method (or a minor variant on the theme). The present effort, however, was conducted to perform another method of calibration-the intercomparison method. In this method, if there are two instruments (e.g., 1 and 2) of identical bands, situated side by side and measuring the aerosol optical thickness at the same time, the calibration coefficient of one of the instruments (e.g., 2) can be computed from equation (2) as:

$$(V_o)_2 = (V_o)_1 * (V_2 / V_1) \quad (5)$$

Where the subscripts **_1** and **_2** refer to the instruments 1 and 2 respectively. Instrument 1 is the reference instrument in this case. If the bands do not overlap, appropriate extrapolation/interpolation in wavelength for the optical thickness must be done and with the help of equation (2), **V_o** is determined.

The advantage of having three instruments is obvious. Aerosol optical thickness derived from three independent calibrations can be compared to have the following outcomes:

1. All three values agree. No correction for calibration is required.
2. Two values agree. The third instrument's calibration is adjusted to make its aerosol optical thickness agree with the other two.
3. None of the values agree. There is no positive outcome.

Further intercomparisons with other instruments better calibrated than the three used here must be done to resolve the differences.

In the data reported here, it can be seen that the aerosol optical thickness derived from the three instruments agreed to within the uncertainties of any one instrument.

Specifications:

Not available at this revision.

Tolerance:

Not available at this revision.

Frequency of Calibration:

The Langley plot method of calibration was performed at mountain sites before and after the 1989 IFC. Calibration check using the intercomparison method was done once during the 1989 IFC.

Other Calibration Information:

None.

5. Data Acquisition Methods:

Optical thickness data were collected simultaneously by the SXM-2, Reagan, and ATSP sunphotometers at the same site and times during the 1989 IFC. Surface pressure was measured with a high-accuracy barometer made by Atmospheric Instrumentation Research, Inc.

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:

All the data were acquired at a single location in Manhattan airport near the tarmac where the C130 aircraft was parked.

The sitegrid is XMH2-SPS with coordinates as follows:

- LATITUDE: 39 13 00
- LONGITUDE: -96 67 00

Spatial Coverage Map:

Not available.

Spatial Resolution:

This is point data. However, the data represent the optical thickness for distances of about 0.5 km from the instrument collecting the data.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

Data were collected on 2 days during the IFC. Measurements were made by all three investigators on August 4, 1989, but only two of the investigators collected data on August 6, 1989. Below are the dates and investigators for the measurements:

Investigators	Date
Halthore, Bruegge, Spanner	AUG-04-89
Halthore, Bruegge	AUG-06-89

Temporal Coverage Map:

Not available.

Temporal Resolution:

The spectra were taken by Spanner every minute on August 4, by Bruegge about every minute on the August 4 and 6 August, and by Halthore every minute on the August 4 , and three measurements on the August 6. There are 10 spectra on August 4 between 1843 and 1852 GMT which coincide in time for all three instruments.

Data Characteristics:

The SQL definition for this table is found in the OT_CALIB.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 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		[millibars]	

of the observation.	
SURFACE_TEMP The surface temperature during the observation.	[degrees Celsius]
SOLAR_ZEN_ANG The Solar Zenith Angle for this observation.	[degrees]
WAVLEN The wavelength at which the observation was made.	[nm]
OZONE_OPTCL_THICK The Ozone Optical Thickness of the atmosphere due to Ozone molecules in the air.	
RAYLEIGH_OPTCL_THICK The Rayleigh Optical Thickness, caused by molecular scattering.	
AEROSOL_OPTCL_THICK The Aerosol Optical Thickness, of colloidal particles suspended in the atmospheric column.	
TOTAL_OPTCL_THICK The Total Optical Thickness, on a vertical path from surface to space.	
MIE_CONSTANT_1 MIE_1 and MIE_2 are used to compute AEROSOL_OPTCL_THICK at arbitrary wavelengths.	
MIE_CONSTANT_2 MIE_1 and MIE_2 are used to compute AEROSOL_OPTICAL_THICK at arbitrary wavelengths.	
ABUNDANCE_OF_OZONE The column abundance of ozone, at standard temperature and pressure.	

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:

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_ID	STATION_ID	OBS_DATE	OBS_TIME	INSTR_ID	SURFACE_PRESS
XMH2-SPH	417	04-AUG-89	1841	SMX-2	963.60
XMH2-SPH	417	04-AUG-89	1841	SMX-2	963.60
XMH2-SPH	417	04-AUG-89	1841	SMX-2	963.60
XMH2-SPH	417	04-AUG-89	1841	SMX-2	963.60

SURFACE_TEMP	SOLAR_ZEN_ANG	WAVLEN	OZONE_OPTCL_THICK	RAYLEIGH_OPTCL_THICK
440.0				
552.0				
557.0				
612.0				

AEROSOL_OPTCL_THICK	TOTAL_OPTCL_THICK	MIE_CONSTANT_1	MIE_CONSTANT_2
.1580			
.1340			
.1170			
.1020			

ABUNDANCE_OF_OZONE	WEATHER	FIFE_DATA_CRTFCN_CODE
300.00		CPI
300.00		CPI

```
300.00                                      CPI
300.00                                      CPI
    LAST_REVISION_DATE
------------------
14-JUL-93
14-JUL-93
14-JUL-93
14-JUL-93
```

8. Data Organization:

Data Granularity:

This is point data acquired at a single location at the Manhattan airport. Data were collected on 2 days during the IFC. The data represent the optical thickness for distances of about 0.5 km from the instrument collecting the data.

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

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 and **tau** is derived from the other instruments. 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*).

Data Processing Sequence:

Processing Steps:

Morning data runs were used to produce Langley plots.

Processing Changes:

None.

Calculations:

Special Corrections/Adjustments:

None.

Calculated Variables:

- Voltage response of the instrument.
- Aerosol optical thickness derived from a voltage measurement.

Graphs and Plots:

None.

10. Errors:

Sources of Error:

Errors can arise during measurement or 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 our 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 major source of variation and hence uncertainty arises due to inadequate temperature compensation for the response. Furthermore, for sunphotometer 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 contribute to absolute errors in the measurements of aerosol optical thickness.

Quality Assessment:

Data Validation by Source:

Not available at this revision.

Confidence Level/Accuracy Judgment:

All the 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) per airmass.

Measurement Error for Parameters:

See the *Confidence Level/Accuracy Judgment Section*.

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:

```
      Parameter            Sitegrid   Stn  Date       Instrmnt  Description of problem
---------------------  --------   ---  --------  --------  ---------------------------
SURFACE_PRESS          XMH2-SPH   417  4-AUG-89  SMX-2     272 values have 0.96
SURFACE_TEMP           XMH2-SPB   416  4-AUG-89  REAGAN    Only 2 values, 40 & 28
SOLAR_ZEN_ANG                                    C-130     Only records for C-130
OZONE_OPTCL_THICK      XMH2-SPB   416  6-AUG-89  REAGAN    6 values greater than 0.041
AEROSOL_OPTCL_THICK    XMH2-SPB   416  4-AUG-89  REAGAN    4 values greater than 0.55
6-AUG-89  REAGAN    6 values greater than 0.597
TOTAL_OPTCL_THICK                      4-AUG-89  C-130     274 values greater than 1.4
```

Usage Guidance:

The purpose of the data in this data set is to give an idea of the discrepancies between the values of different instruments when they are collocated in space and time. This hopefully will assist an investigator in assessing the quality of the measurements during the rest of the IFCs.

Any Other Relevant Information about the Study:

None.

12. Application of the Data Set:

The Optical Thickness Calibration Data Set can be used to study the discrepancies between the aerosol optical thickness measurement values of different instruments when the instruments are collocated in space and time.

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:

Optical Thickness Calibration data are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

\DATA\OPTCAL\OT_CALIB\ydddMULT.OT

Note: capital letters indicate fixed values that appear on the CD-ROM exactly as shown here, lowercase indicates characters (values) that change for each path and file.

The format used for the filenames is: *ydddMULT.sfx*, where *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 .OT for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

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., 97:18743-18758.

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., 97:18759-18768.

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., 97:18731-18742.

Halthore, R.N., B.L. Markham, R. Ferrare and O. Aro. 1992. Aerosol optical properties over the mid-continental United States. J. Geophys. Res., 97:18769-18778.

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.

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:

ATSP Airborne Tracking Sunphotometer 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 ISLSCP International Satellite Land Surface Climatology Project ORNL Oak Ridge National Laboratory 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.

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