Longwave Radiation Data: UNL (FIFE)

Summary:

The Incoming Longwave Radiation Data from UNL Data Set was collected as part of a study of thermal radiant energy from vegetative canopies. These data were collected during the growing season of 1987 and 1989. The data measurements were made at 13 stations within 12 sitegrids scattered throughout the FIFE study area.

Values for incoming longwave radiation were calculated using the radiometer chopper or detector temperature as a measure of air temperature. When determining surface temperatures from infrared thermometer measurements of the surface, the surface emissivity and the reflected component must be taken into account. The reflected component is dependent on the surface emissivity and the incoming longwave radiation.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Longwave Radiation Data: UNL (FIFE).
(Incoming Longwave Radiation Data from UNL).

Data Set Introduction:

The Incoming Longwave Radiation Data from UNL Data Set was collected as part of a study of thermal radiant energy from vegetative canopies. These data were collected during the growing season of 1987 and 1989. Values for incoming longwave radiation were calculated using the radiometer chopper or detector temperature as a measure of air temperature.

Objective/Purpose:

The objective was to determine the incoming longwave radiation as part of a study of thermal radiant energy from vegetative canopies.

Summary of Parameters:

Average estimated incoming longwave data using equation of Deacon (1970). The time period averaged ranged from a few minutes to 30 minutes.

Discussion:

Values for incoming longwave radiation were calculated for each Barnes Model 12-1000 Modular Multiband Radiometer (MMR) data record using the radiometer chopper or detector temperature as a measure of air temperature in the Deacon equation. See the Surface Reflectance Measured with a Mast-borne MMR document for more information. The equation is valid for clear daytime conditions (Deacon 1970). These measurements were made at 13 stations within 12 sitegrids scattered throughout the FIFE study area. About half of these stations were located in the northwest quadrant of the study area within the Konza Prairie Natural Research Area. These data were collected during the growing season of 1987 and 1989.

Related Data Sets:

- Surface Reflectance Measured with a Mast-borne MMR.
- Surface Temperature, Reflected and Emitted Radiation, and PAR from UNL.
- Leaf Area Index and PAR Determined from UNL Light Bar.
- Indirect Leaf Area Index Obtained from the UNL Light Wand.
- Mowing Experiment Biophysical Measurements.

FIS Data Base Table Name:

LONGWAVE_RADIATION_UNL_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Drs. Blaine L. Blad and Elizabeth A. Walter-Shea
University of Nebraska

Title of Investigation:

Measuring and Modeling Near-Surface Reflected and Emitted Radiation Fluxes at the FIFE Site.

Contact Information:

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Requested Form of Acknowledgment.

The Incoming Longwave Radiation Data from UNL data were collected under the direction of B.L. Blad and E.A. Walter-Shea at the University of Nebraska. The dedicated efforts of C.J. Hays and M.A. Mesarch in the collection and preparation of these data is particularly appreciated.

3. Theory of Measurements:

Thermal radiant energy (**Rb**) is composed of an emitted component (**e * a * Ts**4**) and a reflected component [**(1 - e)ILW**]:

Rb = a * Tirt4 = e * a * Ts**4 + (1 - e) ILW**

where:

e = surface emissivity [unitless]
Ts = surface temperature [degrees K]
ILW = incoming longwave radiation [W][m^-2]

a = Stefan-Boltzmann constant [W][m^-2][K^-4]
Tirt = infrared thermometer measurement of the surface [degrees K]

When determining surface temperatures from infrared thermometer measurements of the surface, the surface emissivity and the reflected component must be taken into account. The reflected component is dependent on the surface emissivity and the incoming longwave radiation. A typical incoming longwave radiation value is 300 [W][m^-2] (Fuchs and Tanner 1966; Chen and Zhang 1989). The emissivity of vegetation foliage is of the order of 0.98. Assuming typical values of incoming longwave radiation and surface emissivity and an infrared thermometer measurement of a vegetative surface of 299.5 degrees K, the surface temperature would be 300 degrees K. Correcting the infrared thermometer measurement for surface emissivity alone would yield a temperature of the surface of 301 degrees K (Fuchs 1990).

4. Equipment:

Sensor/Instrument Description:

The Barnes Model 12-1000 Modular Multiband Radiometers have been described in the literature (Robinson et al. 1979 and Robinson et al. 1981). The Barnes Modular Multiband Radiometer (MMR) produces analog voltage responses to scene radiance in 8 spectral bands, and to the instrument chopper and detector temperatures. The 8 wavebands are approximately 0.45-0.52, 0.52-0.60, 0.63-0.69, 0.76-0.90, 1.15-1.30, 1.55-1.75, 2.08-2.35, 10.4-12.5 um. Wavebands 1-4 have silicon detectors, wavebands 5-7 have lead sulfide detectors and waveband 8 has a Lithium Tantalum trioxide detector. The MMR's dimensions are 26.4 cm by 20.5 cm by 22.2 cm and weighs 6.4 kg.

Collection Environment:

Ground-based.

Source/Platform:

Portable mast on the ground.

Source/Platform Mission Objectives:

The objective was to determine incoming longwave radiation.

Key Variables:

Average estimated incoming longwave radiation [W][m^-2] using equation of Deacon (1970). The time period averaged ranged from a few minutes to 30 minutes.

Principles of Operation:

Two thermistor circuits provide temperature information for the chopper area (chopper temperature) and instrument housing (detector temperature). The chopper temperature monitor circuitry utilizes a thermistor component providing linear voltage output as a function of temperature. The detector temperature monitor circuitry is adjusted to read thermistor resistance directly in volts. For more information see the Barnes Operation and Service Instruction Manual (Anonymous 1982b).

Sensor/Instrument Measurement Geometry:

The Barnes Model 12-1000 Modular Multiband Radiometer was mounted 2.2 m (50 degree view zenith angle) to 3.4 m (0 degree view zenith angle) above the soil surface.

Manufacturer of Sensor/Instrument:

Barnes Engineering Company
30 Commerce Road
Stamford, Connecticut 07904
(203) 348-5381

Calibration:

Pre-season and post-season calibrations were supplemented with daily stability checks using an Everest Model 100 calibration source. Calibration procedures and specifics can be found in Jackson et al. 1983 and Markham 1987.

Specifications:

Not applicable.

Tolerance:

The Barnes Model 12-1000 Modular Multiband Radiometer chopper temperature standard errors of estimates for the regression equations were always less then 0.1. The detector thermistor is a precision thermistor bead accurate to better than 0.1 degree C over a 0-70 degree temperature range (Anonymous 1982a).

Frequency of Calibration:

In 1987 and 1989 pre-season and post-season calibrations were performed. In 1988 only a post-season calibration was performed.

Other Calibration Information:

Chopper temperature coefficients.

1987 (Markham 1987):

Serial Number (SN) 103 (chopper thermistor malfunctioned)
SN 111 AC = 0.16091 BC = 14.508
SN 128 AC = 0.1573 BC = 13.727

1988:

SN 108 (chopper thermistor malfunctioned)

1989 (Markham 1989):

SN 114 AC = 0.1296 BC = 14.42

5. Data Acquisition Methods:

The MMR was mounted on a pointable portable mast at a height of 3.4 m above the soil surface at a view zenith angle of 0 degree. The mast allowed the sensor to view the same surface area regardless of the view zenith angle. Seven to 8 view zenith angles ranging from 0 to 50 degrees were measured at each plot. During IFC-1 in 1987 only one replication was recorded at each view zenith angle, otherwise three replications were recorded. A reference panel measurement was taken at intervals of less then 30 minutes (Blad et al. 1990). See the Surface Reflectance Measured with a Mast-borne MMR document for further information.

6. Observations:

Data Notes:

Not available.

Field Notes:

1987:

- June 3 Site 40(1246-MRN) clear skies, measurement period: 2007-2059 GMT.
- June 4 Site 8(3129-MRN) clear skies, measurement periods: 1344-1417, 1443-1515, 1544-1610, 1810-1859, 1951-2047, 2055-2147 GMT.
- June 5 Site 18(4439-MRN) clear skies, measurement periods: 1534-1731, 1746- 1835 GMT. Site 32(4268-MRN) clear skies, measurement period 2035-2118 GMT.
- June 6 Site 26(8739-MRN) clear skies, measurement period: 1719-1757 GMT. Site 5(2123-MRN) slight haze, measurement period: 2111-2135 GMT.
- June 16 Site 42(1445-MRN) no notes.
- June 26 Site 18(4439-MRN) clear skies, measurement periods: 1506-1611, 1724-1751, 1810-1838, 1848-1911 GMT. Site 26(8739-MRN) clear skies then clouds moved in, measurement period: 2023-2038 GMT.
- June 27 Site 26(8739-MRN) clouds moved in measurements aborted, measurement period: 1750-1753 GMT.

- June 28 Site 32(4268-MRN) clear skies, measurement period: 2000-2104 GMT.
- July 1 Site 26(8739-MRN) cumulus, measurement periods: 1525-1559, 1723-
- 1801 GMT.
- July 6 Site 5(2123-MRN) increasing haze measurements aborted, measurement periods: 1439-1513, 1612-1703, 1752-1809 GMT.
- July 10 Site 28(6943-MRN) variable haze, measurement periods: 1401-1436, 1441-1515 GMT.
- July 11 Site 18(4439-MRN) slight haze, measurement periods: 1418-1518, 1546-1609 GMT. Site 42(1445-MRN) clear skies, measurement period 1719-1805 GMT. Site 40(1246-MRN) some haze and cirrus, measurement period: 2006-2047 GMT.
- July 14 Site 42(1445-MRN) some cirrus, measurement period: 1546-1705 GMT. Site 5 clear skies, measurement period: 2023-2104 GMT.
- July 15 Site 170(0939-MRN) clear skies, measurement period: 1715-2113 GMT.
- Aug. 7 Site 18(4439-MRN) slight haze, measurement period: 1726-1844 GMT. Site 28(6943-MRN) slight haze, measurement period: 2018-2058 GMT.
- Aug. 10 Site 32(4268-MRN) measurements aborted due to cirrus, measurement period: 1414-1432 GMT. Site 26(8739-MRN) slight haze, measurement period: 1738-1810 GMT. Site 32(4268-MRN) cumulus, very dry conditions, measurement period: 2051-2203 GMT.
- Aug. 11 Site 40(1246-MRN) clear skies, measurement period: 1355-1430 GMT. Site 42(1445-MRN) slight haze, measurement period: 1727-1809 GMT.
- Aug. 15 Site 18(4439-MRN) clear skies, measurement periods: 1444-1526, 1621-1715 GMT. Site 28(6943-MRN) clear skies, measurement periods: 1846-1917, 2006-2046 GMT.
- Aug. 16 Site 26(8739-MRN) slight haze, measurement period: 1617-1653 GMT. Site 29(0847-MRN) clear skies, measurement period: 2014-1046 GMT.
- Aug. 17 Site 18(4439-MRN) clear skies, measurement period: 1719-1843 GMT. Site 32(4268-MRN) clear skies, measurement period: 2019-2058 GMT.
- Aug. 19 Site 170(0939-MRN) measurements aborted due to clouds, measurement periods: 1628-1701, 1947-2025 GMT.
- Aug. 20 Site 29(0847-MRN) clear skies, measurement period: 1354-1430 GMT. Site 42(1445-MRN) clear skies, measurement periods: 1551-1632, 1720-1759 GMT. Site 40(1246-MRN) measurements aborted due to clouds, measurement period: 2114-2140 GMT.
- Oct. 6 Site 26(8739-MRN) no notes.
- Oct. 7 Site 18(4439-MRN) cirrus and haze, measurement periods: 1726-1754, 2048-2152 GMT.
- Oct. 9 Site 40(1246-MRN) cumulus and cirrus, measurement period 2016-2116 GMT.
- Oct. 11 Site 29(0847-MRN) clouds on horizon, measurement period 1520-1552 GMT. Site 42(1445-MRN) clear skies, measurement period 2004-2042 GMT.
- Oct. 12 Site 28(6943-MRN) clear skies, contrails, measurement period 1446-1523 GMT. Site 40(1246-MRN) cirrus and contrails, measurement period: 1803-1836 GMT. Site 18(4439-MRN) cirrus, measurement period 2118-2148 GMT.
- Oct. 13 Site 32(4268-MRN) cirrus, measurement period: 1426-1519 GMT. Site 18(4439-MRN) cirrus, measurement period: 1738-1755 GMT.

1989:

- June 15 Site 966(2437-MRN), few cumulus clouds near sun for first measurement period then clear skies, measurement periods: 1500-1600, 1730- 1930, and 2100-2230 GMT.
- July 14 Site 966(2437-MRN), clear skies for first measurement period, cumulus aborted second measurement period, measurement periods: 1430-1530 and 1600-1620 GMT.
- July 26 Site 916(4439-MRN), few clouds on horizon, measurement periods: 1400-1425 and 1425-1455 GMT.
- July 27 Site 916(4439-MRN), cumulus clouds, measurement period 1430-1530 GMT.
- July 28 Site 916(4439-MRN) clear skies except for cumulus during last measurement period, measurement periods: 1400-1430, 1500-1530, 1630-1715, 1800-1900 GMT.
- Aug. 4 Site 916(4439-MRN), clear skies, measurement periods: 1400-1500, 1700-1800, 1930-2000 GMT.
- Aug. 6 Site 906(2133-MRN), clear skies, measurement periods: 1430-1500, 1600-1630, 1800-1840, 1930-2000, 2045-2100 GMT.
- Aug. 7 Site 906(2133-MRN), cumulus during first measurement period, then clear skies, measurement periods: 1730-1300 and 1930-2000 GMT.
- Aug. 8 Site 916(4439-MRN), clear skies, measurement periods: 1415-1510, 1620-1745, 2010-2030, 2110-2135 GMT.
- Aug. 9 Site 966(2437-MRN), clear skies for first measurement period, then cumulus, measurement periods: 1530-1630 and 1730-1840 GMT.
- Aug. 10 Site 906(2133-MRN) no notes.
- Aug. 11 Site 916(4439-MRN), lots of cumulus clouds, measurement period 2150-2230 GMT.

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:

Measurements for this data set were made at the following locations:

SITEGRID	STN	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEV
0847-MRN	29	4332344	714439	39 06 57	-96 31 11	418
1246-MRN	40	4331666	714212	39 06 35	-96 31 21	365
1445-MRN	42	4331160	714090	39 06 19	-96 31 27	400
1916-MRN	70	4330296	708263	39 05 56	-96 35 30	340

2123-MRN	5	4329866	709506	39 05 41	-96 34 39	405
2133-MRN	906	4329726	711604	39 05 34	-96 33 12	443
2437-MRN	966	4329150	712375	39 05 15	-96 32 41	
3129-MRN	8	4327702	710711	39 04 30	-96 33 51	430
4268-MRN	32	4325626	718579	39 03 15	-96 28 27	445
4439-MRN	18	4325218	712792	39 03 07	-96 32 28	445
4439-MRN	916	4325193	712773	39 03 06	-96 32 28	443
6943-MRN	28	4320147	713500	39 00 22	-96 32 04	415
8739-MRN	26	4316699	712845	38 58 31	-96 32 35	442

SITEGRID	SLOPE	ASPECT
0847-MRN		
1246-MRN		
1445-MRN		
1916-MRN		
2123-MRN		
2133-MRN	1	TOP
2437-MRN		
3129-MRN		
4268-MRN		
4439-MRN		
4439-MRN	2	N
6943-MRN		
8739-MRN		

In 1987 measurement plots generally encircled the AMS station located at the site. In 1989 measurement plots were located northeast of the Wind Aligned Blob (WAB) site (Sellers et al. 1989). Topography files containing the northing and easting of the plots at each site, except for site 18 (SITEGRID=4439-MRN) in 1987 and site 966 (SITEGRID=2437-MRN) in 1989, are available in the GRABBAG section of FIFE CD-ROM Volume 1 in the UNL directory, in files UNL_PLOT.T87 and UNL_PLOT.T89. These files also include the slope, aspect, soil depth, species and vegetative height of the plots.

Spatial Coverage Map:

Not available.

Spatial Resolution:

These were point data. The IFOV of the MMR varied with the view zenith angle as the mast was adjusted from 0 to 50 degrees.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

Data were collected during two periods: June 3 through October 13, 1987 and June 15 through August 11, 1989. During these periods 28 days of data were collected in 1987 and 12 days of data in 1989.

The measurement time ranged from 1346 to 2220 GMT. Measurements were not continuously made over this range but were in discrete measurement periods.

Temporal Coverage Map:

Not available.

Temporal Resolution:

The estimated longwave data were averaged over a time period between reference panel measurements that ranged from a few to 30 minutes.

Data Characteristics:

The SQL definition for this table is found in the LONG_RAD.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 identifier.

STATION_ID
The station ID designating the location of the observations.

OBS_DATE
The date of the observations, in
the format (DD-mmm-YY).

START_TIME
The starting time of the [GMT]
observations in the format (HHMM)
in GMT.

END_TIME
The ending time of the [GMT]
observations in the format (HHMM)
in GMT.

LONGWAVE_RADTN_DOWN
The average downward (incoming) [Watts]
longwave radiation for the time [meter^-2]
period.

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 which is "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	START_TIME	END_TIME	LONGWAVE_RADTN_DOWN
1246-MRL	40	03-JUN-87	2019	2034	364.8
3129-MRL	8	04-JUN-87	1351	1403	341.7
4439-MRL	18	05-JUN-87	1700	1701	374.1

```
4268-MRL        32        05-JUN-87       2105         2116              386.8
8739-MRL        26        06-JUN-87       1719         1735              377.3
     FIFE_DATA_CRTFCN_CODE   LAST_REVISION_DATE
---------------------   ------------------
CPI                 10-MAR-89
CPI                 10-MAR-89
CPI                 10-MAR-89
CPI                 10-MAR-89
CPI                 10-MAR-89
```

8. Data Organization:

Data Granularity:

The data set contains point data collected during two periods: June 3 through October 13, 1987 and June 15 through August 11, 1989. During these periods 28 days of data were collected in 1987 and 12 days of data in 1989. The data measurements were made at 13 stations within 12 sitegrids scattered throughout the FIFE study area. Measurements were not made continuously but were in discrete measurement periods.

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:

Average estimated incoming longwave data was calculated using the equation of Deacon (1970).

air = (V9 - AC) * BC [1]

where:

air = air temperature [degrees C]
V9 = MMR response (volts) of the chopper thermistor
AC, BC = calibration coefficients

or, (see the *Processing Steps Section* for an explanation)

air = ln(V10 - 1.9316) Y / 9 - 0.04446) [2]

where:

air = air temperature [degrees C]
V10 = MMR response (volts) of the detector thermistor

ILW=(((air6) * 5.31E - 14) * 10.) - ((0.035) * (elev / 1000.) * (a * air**4))) [3]**

where:

a = Stefan-Boltzmann constant [W][m^-2][K^-4]
air = air temperature [degrees K]
ILW = incoming longwave [W][m^-2]
elev = elevation of each site [m]

Data Processing Sequence:

Processing Steps:

Air temperatures were calculated for each Barnes Model 12-1000 Modular multiband Radiometer (MMR) data record using equation 1 or 2. Equation 1 is preferred but if the chopper thermistor was not functioning then Equation 2 was used. Values for incoming longwave radiation were calculated for each air temperature using Equation 3. This equation is valid for clear daytime conditions (Deacon 1970). The incoming longwave radiation values were averaged over the time period between reference panel measurements.

Processing Changes:

None.

Calculations:

Special Corrections/Adjustments:

None.

Calculated Variables:

- Air temperature, and
- Average incoming longwave radiation.

Graphs and Plots:

None.

10. Errors:

Sources of Error:

Air temperature estimated from the Barnes Model 12-1000 Modular Multiband Radiometer chopper or detector thermistor response.

Quality Assessment:

Data Validation by Source:

Comparisons of the estimated incoming longwave radiation were made with data from the AMS of a nearby site.

Confidence Level/Accuracy Judgment:

On days with variable cloud conditions the data should be used with caution. The AMS incoming solar radiation data at the site or nearby site should be consulted. On clear days the measurements fall within the errors that were discussed in previous sections.

Measurement Error for Parameters:

Comparisons of the estimated incoming longwave with measured pyrgeometer incoming longwave (AMS data) show mean bias errors of 29.74, 25.49 and 10.52 [W][m^-2] for 1987, 1988, and 1989 respectively.

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, histog-rams 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:

None.

Usage Guidance:

Before using this data the incoming radiation from the AMS station at the site or nearby site should be checked for possible cloud-induced errors.

Any Other Relevant Information about the Study:

None.

12. Application of the Data Set:

Not available.

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 Incoming Longwave Radiation Data from UNL are available on FIFE CD-ROM Volume 1. The CD-ROM file name is as follows:

\DATA\SUR_REFL\UNL_LONG\Yyyyy\yyyygrid.LWR

Where *yyyy* are the four digits of the century and year (e.g., Y1987 = 1987). 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: *yyyygrid.sfx*, where *grid* is the four-number code for the location within the FIFE site grid, and *yyyy* are the four digits of the century and year (e.g., 1987, 1989). The filename extension (.*sfx*), identifies the data set content for the file (see the *Data Characteristics Section*) and is equal to .LWR for this data set.

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Archive/DBMS Usage Documentation.

Contact the EOS Distributed Active Archive Center (DAAC) at Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee (see the *Data Center Identification Section*). Documentation about using the archive and/or online access to the data at the ORNL DAAC is not available at this revision.

18. Glossary of Terms:

A general glossary for the DAAC is located at Glossary.

19. List of Acronyms:

AMS Automatic Meteorological Station 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 IFC Intensive Field Campaign IFOV Instantaneous Field-of-View ILW Incoming Longwave IPAR Incoming Photosynthetically Active Radiation IRT Infrared Thermometer ISLSCP International Satellite Land Surface Climatology Project MMR Modular Multiband Radiometer ORNL Oak Ridge National Laboratory PAR Photosynthetically Active Radiation SN Serial Number UNL University of Nebraska - Lincoln URL Uniform Resource Locator UTM Universal Transverse Mercator WAB Wind Aligned Blob

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

20. Document Information:

May 11, 1994i (citation revised on October 16, 2002).

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.

Document Review Date:

July 23, 1996.

Document ID:

ORNL-FIFE_LONG_RAD.

Citation:

Cite this data set as follows:

Blad, B. L., and E. A. Walter-Shea. 1994. Longwave Radiation Data: UNL (FIFE). Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/49. Also published in D. E. Strebel, D. R. Landis, K. F. Huemmrich, and B. W. Meeson (eds.), Collected Data of the First ISLSCP Field Experiment, Vol. 1: Surface Observations and Non-Image Data Sets. CD-ROM. National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland, U.S.A. (available from http://www.daac.ornl.gov).

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