Eddy Corr. Surface Flux: UNL (FIFE)

Summary:

Surface flux and micrometeorological measurements were collected at one site within the northwest quadrant near the center of the FIFE study area during all five of the Intensive Field Campaigns (four in 1987 and one in 1989). This site had historically been ungrazed but had recently been exposed to grazing. The station was capable of measuring the fluxes of net radiation, sensible heat and latent heat using an eddy correlation system. In addition, measurements of soil heat flux and several micrometeorological parameters were made.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Eddy Corr. Surface Flux: UNL (FIFE)
(Eddy Correlation Surface Flux Observations (UNL)).

Data Set Introduction:

Surface flux and micrometeorological measurements were collected at one site within the northwest quadrant near the center of the FIFE study area during all five of the Intensive Field Campaigns (four in 1987 and one in 1989).

Objective/Purpose:

The combined aim of the surface flux group was to use a network of ground based observing systems to measure fluxes of heat, water vapor and radiation at a number of points within the FIFE study area. The specific objectives were to:

1. Measure and analyze, employing the eddy correlation technique, the fluxes of sensible heat, latent heat, and momentum over the tallgrass prairie.
2. Estimate the aerodynamic characteristics (e.g., roughness parameter, zo; zero plane displacement, d; and the drag coefficient, Cd) of the prairie vegetation at various stages of growth and to develop functional relationships between these parameters and vegetation height, h.

Summary of Parameters:

Latent heat flux, net radiation, sensible heat flux, soil heat flux, incoming solar radiation, soil temperature, wind speed, air temperature, vapor pressure, frictional velocity, carbon dioxide flux.

Discussion:

Surface flux measurements were made at one site within the FIFE study area. These data were collected in 1987 and 1989. The station was capable of measuring the fluxes of net radiation, sensible heat and latent heat using an eddy correlation system. In addition, measurements of soil heat flux and several micrometeorological parameters were made.

The surface flux and micrometeorological measurements available in this data set were collected during all five of the Intensive Field Campaigns (four in 1987 and one in 1989). During the campaigns measurements were made every day. Between campaigns, data were not collected. These date were collected from a single location (station 16, sitegrid 4439) within the northwest quadrant near the center of the FIFE study area. This site had historically been ungrazed but had recently been exposed to grazing.

Related Data Sets:

- Eddy Correlation Surface Flux Observation (USGS).
- Eddy Correlation Surface Flux Observation (GSFC).
- Eddy Correlation Surface Flux Observation (UK).
- Eddy Correlation Surface Flux Observation (Argonne).
- Bowen Ratio Surface Flux Observation (GSFC).
- Bowen Ratio Surface Flux Observation (KSU).
- Bowen Ratio Surface Flux Observation (Fritschen).
- Bowen Ratio Surface Flux Observation (Smith).

- Bowen Ratio Surface Flux Observation (UNL).
- Bowen Ratio Surface Flux Observation (USGS).

FIS Data Base Table Name:

SURFACE_FLUX_30MIN_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Dr. Shashi B. Verma
University of Nebraska

Title of Investigation:

Measurement and Analysis of Latent and Sensible Heat Flux by Eddy Correlation and Aerodynamic Characteristics of Vegetation at the FIFE Test Site.

Contact Information:

Contact 1:
Dr. Shashi B. Verma
242 L.W. Chase Hall
Department of Agricultural Meteorology
University of Nebraska
Lincoln, NE 68583-0728
Tel: (402) 472-3679/6702
Email: verma@pldsg3.gsfc.nasa.gov

Requested Form of Acknowledgment.

The Eddy Correlation Surface Flux Observations (UNL) were collected by Dr. Shashi B. Verma.

3. Theory of Measurements:

Eddy correlation is micrometeorological technique for directly measuring turbulent fluxes in the surface layer of the atmospheric boundary layer. This method involves fewer assumptions than other methods.

The sensible heat flux is computed as the product of the volumetric heat capacity of air and the covariance between vertical wind velocity and air temperature fluctuations. Latent heat flux is calculated as the product of the latent heat of vaporization and the covariance between the vertical wind velocity and humidity fluctuations. An in-depth discussion of this technique and its theoretical basis can be found in Baldocchi et al. 1988, Businger 1986, Kanemasu et al. 1979, and Verma 1990.

4. Equipment:

Sensor/Instrument Description:

Summary of Eddy Correlation System used by UNL:

- Vertical velocity sensor (path length): CSI sonic (10 cm)
- Temperature sensor (response time): 12-um Thermocouples (0.01 s)
- Moisture sensor (response time): ERC Lyman alpha (0.01 s)
- Sensor height above ground: 12.25 m
- Sampling rate: 20 Hz
- Duty cycle for 30 min averaging period: 100%

The eddy correlation instrument array included: a one-dimensional sonic anemometer, a rapid response CO2 sensor with a 0.2 m path length, and a Lyman alpha hygrometer with a 5 mm path length.

Details of instrument description can be found in Kim and Verma 1990a, Kim and Verma 1990b, and Verma 1990.

Collection Environment:

Ground-based.

Source/Platform:

The eddy correlation sensors were mounted on a horizontal boom at a height of 2.25 m in 1987 and 2.5 m in 1989, above the ground.

Source/Platform Mission Objectives:

These data were collected to measure fluxes of sensible and latent heat using the eddy correlation technique. Sampling, recording, and near real-time processing of the data were done with a microcomputer.

Key Variables:

Latent heat flux, net radiation, sensible heat flux, soil heat flux, solar radiation, photosynthetically active radiation, mean soil temperature, wind speed, mean air temperature, mean vapor pressure, friction velocity, carbon dioxide flux.

Principles of Operation:

Fast-response sensors were used to measure fluctuations of vertical wind speed, air temperature, and concentrations of water vapor and CO_2.

Detailed principles of operation can be found in Kaimal 1975, Fritschen and Gay 1979, Buck 1976, Bingham et al. 1978, and Campbell and Unsworth 1979.

Sensor/Instrument Measurement Geometry:

Eddy correlation sensors were mounted on a horizontal boom at a height of 2.25m above ground in 1987 and 2.5m above ground in 1989. The "footprint" of the surface sampled extended approximately 200 m upwind, depending on the atmospheric stability, and wind speed and wind direction.

Manufacturer of Sensor/Instrument:

Sonic anemometers:

Campbell Scientific
P. O. Box 551
Logan UT 84321

and

Kaijo Denki Co., Ltd.
No. 19.1 - Chrome Kanda-Nishikicho
Chiyoda-Ku, Tokyo 101, Japan.

Fine-wire thermocouple:

Campbell Scientific
P. O. Box 551
Logan, UT 84321.

CO_2 sensor:

Lawrence Livermore Laboratory
Livermore, CA.
(See Bingham et al. 1978.)

Lyman-alpha Hygrometer:

Atmospheric Instrumentation Research, Inc.
1880 South Flatiron Court
Boulder, CO 80301.

Soil heat transducer:

Radiation & Energy Balance Systems, Inc. (REBS)
P.O. Box 15512
Seattle, WA 98115-0512.

Pyranometer:

Eppley Laboratories
Newport, RI.

Net radiometer:
Radiation & Energy Balance Systems, Inc. (REBS)
P.O. Box 15512
Seattle, WA 98115-0512.
Quantum sensor:
LI-COR, Inc.
4421 Superior Street
P.O. Box 4425
Lincoln, NE 68504.
Psychrometer:
EnviroMet Instrument Company
90 Calle Encanto
Tucson, AZ 85716.
Cup anemometer:
Cayuga Development
Ithaca, NY.
Data logging system:
IBM.

Calibration:

- Sonic anemometer: supplied by the manufacturer.
- CO2 sensor: calibrated against known standard gases in the field.
- Lyman-alpha Hygrometer: calibrated in a chamber in which humidity could be controlled.
- Pyranometer: supplied by the manufacturer.
- Net radiometer: supplied by the manufacturer.
- Quantum sensor: supplied by the manufacturer.
- Soil heat transducer: supplied by the manufacturer.
- Psychrometer (RTDs): calibrated in a water bath.
- Cup anemometer: calibrated in a wind tunnel.

Specifications:

Not provided by the Principal Investigator.

Tolerance:

Not available at this revision.

Frequency of Calibration:

- The CO2 sensor was calibrated at least twice daily.
- Hygrometers were calibrated at least once a month.
- Cup anemometers were calibrated in a wind tunnel before the field experiment.
- Resistance thermometer devices were calibrated before and after the field experiment.

Other Calibration Information:

None.

5. Data Acquisition Methods:

Signals from the eddy correlation sensors were lowpass filtered with 8-pole Butterworth active filter (12.5 Hz cutoff frequency) and sampled at 20 Hz. These signals were recorded on an IBM PC microcomputer. Data were averaged on a half-hourly basis.

6. Observations:

Data Notes:

Not available.

Field Notes:

Fluxes toward the surface are positive and fluxes away from the surface are negative.

Measurements of mean horizontal wind speed, mean air temperature, and mean vapor pressure were made at 2.25 m above ground in 1987 and at 2.5 m above ground in 1989.

7. Data Description:

Spatial Characteristics:

The FIFE study area, with areal extent of 15 km by 15 km, is located south of the Tuttle Reservoir and Kansas River, and about 10 km from Manhattan, Kansas, USA. The northwest corner of the area has UTM coordinates of 4,334,000 Northing and 705,000 Easting in UTM Zone 14.

Spatial Coverage:

The data was obtained at the following location within the FIFE study area:

SITEGRID	STN	LATITUDE	LONGITUDE	NORTHING	EASTING	ELEV	SLOPE	ASPECT
4439-ECV	16	39 03 07	-96 32 28	4325215	712794	445		
4439-ECV	916	39 03 06	-96 32 28	4325193	712773	443	2	N

This site is located in the northwest quadrant near the center of the study area.

Spatial Coverage Map:

Not available.

Spatial Resolution:

These are point data. However, the "footprint" of the surface sampled in 1987 and 1989 extended approximately 200 m upwind, depending on the atmospheric stability, and wind speed and wind direction. Further details can be found in Hicks 1989, Leclerc and Thurtell 1990 and Schuepp et al. 1990.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

The overall time range for these data is May 28, 1987 - August 13, 1989. During that period, data were collected only during the five Intensive Field Campaigns.

IFC1: May 28 - June 6, 1987

IFC2: June 26 - July 11, 1987

IFC3: July 23 - August 21, 1987

IFC4: October 4 - October 15, 1987

IFC5: July 11 - August 13, 1989

There are 68 days of data in this data set.

Temporal Coverage Map:

Not available.

Temporal Resolution:

The data values are 30 minute averages. During the five IFC's data were collected almost daily.

Data Characteristics:

The SQL definition for this table is found in the SF_30MIN.TDF file located on FIFE CD-ROM Volume 1. The following chart lists only those variables that are contained in the data set described in this document.

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).			
OBS_TIME The time that the observation was taken, in GMT. The format is HHMM.		[GMT]	
LATENT_HEAT_FLUX The latent heat flux, the flux of the energy due to the evaporation of water.		[Watts] [meter^-2]	
NET_RADTN The net radiation, including both downward and upward energy.		[Watts] [meter^-2]	
SENSIBLE_HEAT_FLUX The sensible heat flux, the flux of the energy due to temperature differences.		[Watts] [meter^-2]	

SOIL_HEAT_FLUX The surface soil heat flux, the flux of energy into the soil.	[Watts] [meter^-2]
SOLAR_RADTN_DOWN The downward (incoming) solar radiation.	[Watts] [meter^-2]
PAR_DOWN The downward (incoming) photo-synthetically active radiation (PAR).	[Watts] [meter^-2]
SOIL_TEMP_0_TO_25MM The soil temperature recorded somewhere between 0 and 25 mm in depth. This is an average value from 0 to 5 cm, same as in the column SOIL_TEMP_25MM_TO_5CM.	[degrees Celsius]
SOIL_TEMP_25MM_TO_5CM The soil temperature recorded somewhere between 25 mm and 5 cm in depth. This is an average value from 0 to 5 cm, same as in the column SOIL_TEMP_0_TO_25MM.	[degrees Celsius]
WIND_SPEED The average wind speed in this 30 minutes.	[meters] [sec^-1]
AIR_TEMP_MEAN The mean air temperature in this 30 minutes.	[degrees Celsius]
VAPOR_PRESS_MEAN The mean vapor pressure in this 30 minutes.	[kiloPascals]
FRICTION_VELOC The friction velocity. [sec^-1]	[meters]
CO2_FLUX The carbon dioxide flux. [meter^-2] [sec^-1]	[mg]

```
FIFE_DATA_CRTFCN_CODE
The FIFE Certification Code           *
for the data, in the format:
CGR (Certified by Group), CPI
(Certified by PI), CPI-???
CPI - questionable data).
```

```
LAST_REVISION_DATE
data, in the format (DD-MMM-YY).
```

Footnotes:

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

** There are several missing value indicators in each column. The values may be positive or negative 9.9, 9.99, 99.99, 999, 999.99, 9999 or 99999.99.

Sample Data Record:

The following sample record contains all the fields in the surface flux record but only these fields that are described here (reported by S.B. Verma) contain data.

SITEGRID_ID	STATION_ID	OBS_DATE	OBS_TIME	LATENT_HEAT_FLUX
4439-ECV	16	17-AUG-87	1645	-355
4439-ECV	16	17-AUG-87	1715	-310
4439-ECV	16	17-AUG-87	1745	-368
4439-ECV	16	17-AUG-87	1815	-392

NET_RADTN	SENSIBLE_HEAT_FLUX	SOIL_HEAT_FLUX	DIFFUSE_SOLAR_RADTN_DOWN
526	-151	-50	
557	-110	-55	
578	-121	-56	
588	-113	-53	

SOLAR_RADTN_DOWN	SOLAR_RADTN_UP	SOLAR_RADTN_NET	SOLAR_RADTN_DOWN_SDEV

```
827
875
901
917
SOLAR_RADTN_UP_SDEV    PAR_DOWN     PAR_UP     SURF_ALBEDO
-------------------    ----------   ---------  -----------
1739
1823
1875
1902
LONGWAVE_RADTN_DOWN   LONGWAVE_RADTN_UP   LONGWAVE_RADTN_NET
-------------------   -----------------   ------------------
BB_TEMP_LONGWAVE_DOWN   BB_TEMP_LONGWAVE_UP   TOTAL_RADTN_DOWN
---------------------   -------------------   ----------------
TOTAL_RADTN_UP   SOIL_HEAT_FLUX_0_TO_5CM   SOIL_HEAT_FLUX_5_TO_10CM
--------------   -----------------------   ------------------------
SOIL_HEAT_FLUX_10_TO_20CM   HEAT_STORAGE   SOIL_WATER_POTNTL_0_TO_5CM
-------------------------   ------------   --------------------------
SOIL_WATER_POTNTL_5_TO_20CM   SURF_RADIANT_TEMP   SURF_RADIANT_TEMP_SDEV
---------------------------   -----------------   ----------------------
SOIL_TEMP_0_TO_25MM   SOIL_TEMP_25MM_TO_5CM   SOIL_TEMP_5_TO_10CM
-------------------   ---------------------   -------------------
25.2                  25.2
25.7                  25.7
26.2                  26.2
26.7                  26.7
SOIL_TEMP_10_TO_20CM   SOIL_TEMP_20_TO_50CM    RAINFALL    BOWEN_RATIO
--------------------   --------------------   ----------   -----------
WIND_SPEED   WIND_DIR    WIND_SPEED_MIN   WIND_SPEED_MAX   WIND_SPEED_SDEV
----------  ----------   --------------   --------------   ---------------
2.4
2.3
2.3
3.1
WIND_DIR_SDEV   TIME_WIND_SPEED_MIN   TIME_WIND_SPEED_MAX
-------------   -------------------   -------------------
TIME_WIND_DIR_MIN   TIME_WIND_DIR_MAX   WIND_SPEED_HOR_MEAN
-----------------   -----------------   -------------------
WIND_SPEED_LAT_MEAN   WIND_SPEED_VERT_MEAN   WIND_SPEED_HOR_SDEV
-------------------   --------------------   -------------------
WIND_SPEED_LAT_SDEV   WIND_SPEED_VERT_SDEV   AIR_TEMP_LOW   AIR_TEMP_HIGH
-------------------   --------------------   ------------   -------------
AIR_TEMP_OTHER   AIR_TEMP_MEAN   AIR_TEMP_MEAN_SDEV   AIR_TEMP_OTHER_SDEV
--------------   -------------   ------------------   -------------------
29.9
30.6
30.7
31.1
DELTA_TEMP   WET_BULB_TEMP_LOW   WET_BULB_TEMP_HIGH   VAPOR_PRESS_LOW
----------  -----------------   ------------------   ---------------
VAPOR_PRESS_HIGH   VAPOR_PRESS_MEAN   VAPOR_PRESS_SDEV   REL_HUMID_LOW
----------------   ----------------   ----------------  -------------
2.2
1.9
1.9
1.8
REL_HUMID_HIGH   REL_HUMID_SDEV   SURF_AIR_PRESS   FRICTION_VELOC
```

```
--------------   --------------   --------------   --------------
 W_T_MEAN     W_E_MEAN    CO2_CONTENT   OZONE_CONTENT   CO2_CONTENT_SDEV
----------   ----------   -----------   -------------   ----------------
OZONE_CONTENT_SDEV    CO2_FLUX    OZONE_FLUX   FIFE_DATA_CRTFCN_CODE
------------------   ----------   ----------   ---------------------
-9999                                CPI
.55                             CPI
.5                              CPI
.47                             CPI
LAST_REVISION_DATE
------------------
27-OCT-93
27-OCT-93
27-OCT-93
27-OCT-93
```

8. Data Organization:

Data Granularity:

These are point data. The data values are 30 minute averages. During the five IFC's data were collected almost daily.

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 begin 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:

The eddy correlation method provides a relatively direct means of measuring fluxes, without the need for assumptions regarding diffusivities and without making assumption about the nature of the surface cover (Verma,1990). The vertical flux of a transported entity at a point is obtained by correlating the fluctuations in the concentration of that entity with the fluctuations in the vertical wind speed. For example, the fluxes of sensible heat (H), latent heat (Lambda (E)) and carbon dioxide flux (F (c)) over horizontally homogeneous surface under "steady-state" conditions are given by:

Sensible heat flux, **H = - (rho * C(p) * w' * T')**

Latent heat flux, **Lambda (E) = - (Lambda * w' * rho(v)')**

Carbon dioxide flux, **F(c) = - (w' * rho(c)')**

where:

w is the vertical velocity,
T is the potential air temperature,
rho(v) is the absolute humidity,
rho(c) is the carbon dioxide concentration,
rho is the air density,
C(p) is the specific heat of air at constant pressure, and
Lambda is the latent heat of vaporization.

The overbars indicate time averages, and the primes denote deviations from the mean. Fluxes to the surface are positive and fluxes away from the surface are negative in sign.

Data Processing Sequence:

Processing Steps:

Means, variances, and covariances were computed on a real time basis in the field. These calculations were updated later to incorporate sensor calibrations. For further details, see Verma (1990).

Processing Changes:

None.

Calculations:

Special Corrections/Adjustments:

Computational adjustments were made to compensate for spatial separation of sensors and limited frequency responses of sensors (Moore 1986). In addition, corrections were also applied to account for the variation in air density due to simultaneous transfers of latent and sensible heat fluxes (Webb et al. 1980).

Calculated Variables:

Fluxes of sensible heat (H), latent heat (Lambda (E)) and carbon dioxide flux.

Graphs and Plots:

None.

10. Errors:

Sources of Error:

Not provided by Principal Investigator.

Quality Assessment:

It was recognized early in the study that standardization of "constants" (e.g., physical constants of the air, psychrometric constant, etc.), methods of computation, integration and reporting time, etc. were necessary. These were agreed upon in planning sessions. Preliminary data sets were compared among stations and instruments from different manufacturers for estimating net radiation, soil heat flux, water vapor density, temperature, solar radiation, and wind speed, it was necessary to have confidence that differences in observations were due to site differences and not due to instrumentation.

Data Validation by Source:

The Hydrological Sciences Branch at NASA Goddard Space Flight Center was given the responsibility to compare flux data from all flux stations. This served two purposes: 1) as a data quality check, and 2) as a preliminary analysis of site differences.

Confidence Level/Accuracy Judgment:

The following are the best estimates of accuracy for a single flux estimate:

- Net radiation +/- 4 to 7%
- Soil heat flux +/- 30%
- Latent heat flux +/- 15 to 20 % or +/-30 [W][m^-2], whichever is larger
- Sensible heat flux +/- 15 to 20 % or +/-30 [W][m^-2], whichever is larger

None of these estimates addresses the variability of flux estimates from site-to-site.

Measurement Error for Parameters:

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

Additional Quality Assessments:

Several of the key surface flux parameters have undergone extensive intercomparison and examination for spikes in the data. Details of these analyses are described in the Surface Flux Baseline 1992 document on FIFE CD-ROM Volume 1.

FIS staff applied a general Quality Assessment (QA) procedure to some of the fields in this data set 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 numerical field. 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:

Different missing value indicators are used within each column. They can be positive or negative 9.9, 9.99, 99.99, 999.99, 9999 or 99999.99.

The missing value indicators in the following field may have been inadvertently converted to 1000. Use these data with caution.

Name	Name
DIFFUSE_SOLAR_RADTN_DOWN	TOTAL_RADTN_DOWN
SOLAR_RADTN_DOWN	TOTAL_RADTN_UP
SOLAR_RADTN_UP	HEAT_STORAGE
SOLAR_RADTN_NET	RAINFALL
SOLAR_RADTN_DOWN_SDEV	WIND_DIR_MIN
SOLAR_RADTN_UP_SDEV	WIND_DIR_MAX
LONGWAVE_RADTN_DOWN	CO2_CONTENT
LONGWAVE_RADTN_UP	O3_CONTENT
LONGWAVE_RADTN_NET	CO2_STDEV
BB_TEMP_LONGWAVE_DOWN	O3_STDEV
BB_TEMP_LONGWAVE_UP	

Usage Guidance:

Caution should be exercised when using flux data near dawn and dusk since these are periods of unsteady conditions. In addition, nighttime data should be used with caution.

Any Other Relevant Information about the Study:

Not available at this revision.

12. Application of the Data Set:

This data set can be used to estimate the aerodynamic characteristics (e.g., roughness parameter, zero plane displacement, and the drag coefficient) of the prairie vegetation at various stages of growth and to develop functional relationships between these parameters and vegetation height.

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:

Eddy Correlation Surface Flux Observations (UNL) data are available on FIFE CD-ROM Volume 1. The CD-ROM filename is as follows:

\DATA\SUR_FLUX\30_MIN\GRIDxxxx\YyyMmm\ydddgrid.ECV or
\DATA\SUR_FLUX\30_MIN\GRIDxxxx\Yyyyy\ydddgrid.ECV

Where *xxxx* is the four digit code for the location within the FIFE site grid, *yy* is the last two digits of the year (e.g., Y87 = 1987), *yyyy* is the four digits of the century and year (e.g., Y1987 = 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 .ECV 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:

BPI Byte per inch BREB Bowen Ratio Energy Balance CCT Computer Compatible Tape CD-ROM Compact Disk (optical), Read-Only Memory CSI Campbell Scientific Instrument DAAC Distributive Active Archive Center EOSDIS Earth Observation System Data and Information System ERC Electromagnetic Research Corp. FIFE First ISLSCP Field Experiment FIS FIFE Information System ISLSCP International Satellite Land Surface Climatology Project ORNL Oak Ridge National Laboratory PAMS Portable Automatic Mesonet Station REBS Radiation and Energy Balance Systems UNL University of Nebraska, Lincoln URL Uniform Resource Locator UTM Universal Transverse Mercator

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

20. Document Information:

April 28, 1994 (citation revised on October 15, 2002).

This document has been reviewed by the FIFE Information Scientist to eliminate technical and editorial inaccuracies. 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. It is believed that the document accurately describes the data as collected and archived on the FIFE CD-ROM series.

Document Review Date:

October 25, 1996.

Document ID:

ORNL-FIFE_SF30_ECV.

Citation:

Cite this data set as follows:

Verma, S. B. 1994. Eddy Corr[elation]. Surface Flux: 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/33. 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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