

Temperature Profiles: Radiosonde (FIFE)

Summary:

The temperature profile data included in this data set was derived from the FIFE radiosonde data collected during the summer and fall of 1987 and the late summer of 1989 by Dr. Wilfred H. Brutsaert. These intensive radiosonde flights allowed the measurement of the atmospheric profiles of potential temperature and specific humidity. These data have been corrected for sensor delays, algorithm inconsistencies and have been interpolated to a set of standard pressure levels.

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1. Data Set Overview:

Data Set Identification:

Temperature Profiles: Radiosonde (FIFE)
(FIFE Temperature and Humidity Profiles).

Data Set Introduction:

This data set contains temperature and humidity profiles above the atmospheric boundary layer measured by means of radiosondes.

Objective/Purpose:

In this study temperature and humidity profiles above the atmospheric boundary layer were measured by means of radiosondes.

Summary of Parameters:

Potential temperature, specific humidity.

Discussion:

Intensive radiosonde flights, carried out by Dr. Wilfred H. Brutsaert during the summer and fall of 1987 and the late summer of 1989 have allowed the measurement of the atmospheric profiles of potential temperature and specific humidity. The temperature profile data, described in this document, was derived (corrected for sensor delays) from the FIFE radiosonde data collected during FIFE by Dr. Wilfred H. Brutsaert. These data have also been corrected for algorithm inconsistencies (see FIFE Radiosonde Wind Profiles) and have been interpolated to a set of standard pressure levels (see FIFE Standard Pressure Level Radiosonde Data). These other data sets are described separately.

Related Data Sets:

- [FIFE Radiosonde Data.](#)
 - This data set contains Dr. Brutsaert actual (raw) radiosonde observations.
- [FIFE Standard Pressure Level Radiosonde Data.](#)
 - This data set contains temperature and humidity values at standard levels (5 mb intervals) derived from Dr. Brutsaert raw radiosonde data.
- [FIFE Radiosonde Wind Profiles.](#)
 - This data set includes corrected wind velocity values derived from Dr. Brutsaert radiosonde measurements.

FIS Data Base Table Name:

TEMP_PROFILE_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Dr. Wilfred H. Brutsaert
School of Civil and Environmental Engineering

Title of Investigation:

Measurement and Analysis of Temperature Profiles Through the Atmospheric Boundary Layer.

Contact Information:

Contact 1:

Dr. Wilfred H. Brutsaert
Cornell University
Tel.: (607) 255-3676
Email: wbh@cornella.bitnet
whb@cornella.cit.cornell.edu (Internet)

Requested Form of Acknowledgment.

The FIFE Temperature and Humidity Profiles were measured by a team from Cornell University, directed by Prof. W. Brutsaert.

3. Theory of Measurements:

The original FIFE Radiosonde data collected by Dr. Brutsaert have been "improved" as follows. According to the manufacturer (AIR), the response of the pressure sensor is practically instantaneous, but the dry-bulb sensor and wet-bulb sensor have time constants of 3 and 12 seconds, respectively. Therefore, Dr. Brutsaert decided to shift all the data in time by an amount equal to the time constants to match with the pressure data. The height of the radiosonde was also re-calculated, by Dr. Brutsaert, from the pressure, temperature and humidity obtained from the original FIFE Radiosonde Data.

4. Equipment:

See the FIFE Radiosonde Data document for details on the instrumentation used to collect the original data used in this study.

5. Data Acquisition Methods:

The temperature profile data was calculated from FIFE Radiosonde Data, located on FIFE CD-ROM Volume 1.

6. Observations:

Not available.

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 temperature profile data were calculated from radiosonde data collected from balloon releases at the FIFE site listed below:

SITEGRID_ID	SN_ID	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEV
0928-RSB	102	4332188	710674	39 06 55	-96 33 48	342

For each flight the spatial coverage can be deduced from the horizontal distance and direction the sonde traveled from the launch site. This information is found in the FIFE Radiosonde Wind Profiles data set located on FIFE CD-ROM Volume 1.

Spatial Coverage Map:

Not available.

Spatial Resolution:

Resolution for the measurements are around 15 to 20 meters.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

The data were collected during FIFE's five IFC's, covering the period from May 26, 1987 through August 12, 1989.

	IFC#	Dates
IFC-1	05/26/87	- 06/06/87
IFC-2	06/25/87	- 07/11/87

IFC-3 08/06/87 - 08/21/87
 IFC-4 10/05/87 - 10/16/87
 IFC-5 24/07/89 - 12/08/89

Temporal Coverage Map:

Not available.

Temporal Resolution:

The soundings were made at 2 to 3 hour intervals, depending on weather conditions.

Data Characteristics:

The SQL definition for this table is found in the TEMP_PRO.TDF file located on FIFE CD-ROM Volume 1.

Parameter/Variable Name

Parameter/Variable Description Source	Range	Units
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SITEGRID_ID
 This is a FIS grid location code.
 FIS
 Site grid codes (SSEE-III) give the south (SS) and east (EE) cell number in a 100 x 100 array of 200 m square cells. The last 3 characters (III) are an instrument identifier.

STATION_ID The station ID designating the location of the observations.	min = 102, max = 102	
--	-------------------------	--

OBS_DATE The date of the observations. CORNELL max = 12-AUG-89	min = 26-MAY-87, UNIVERSITY	
---	--------------------------------	--

START_TIME The time that this radiosonde flight CORNELL	min = 30,	[GMT]
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was started.
UNIVERSITY
missing = -9999

max = 2355,

FLIGHT_NUM
This is the flight number of the
FIS
radiosonde balloon flight where the
data was recorded.

POTNTL_TEMP
The potential temperature at the
CORNELL
observation height; the temperature
UNIVERSITY
an air sample attains if reduced to
1000 millibars pressure without any
external heat exchange

min = -.01, [degrees
max = 503.54 Kelvin]

SPECIFIC_HUMID
The specific humidity at the
ANEROID
observation height.
SENSOR

min = -7.41, [grams]
max = 79.82 [kg^-1]

HEIGHT_ABV_MEAN_SEA_LVL
The height above mean sea level for
ANEROID
each observation.
SENSOR

min = 309.62, [meters]
max = 3321

FIFE_DATA_CRTFCN_CODE
The FIFE Certification Code for the
FIS
data, in the following format:
CPI (Certified by PI),
CPI-??? (CPI - questionable data).

*
CPI - checked
by primary
investigator

LAST_REVISION_DATE
in the format (DD-MMM-YY).
max = 02-NOV-90

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 is "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	START_TIME	FLIGHT_NUM	POTNTL_TEMP
0928-RSB	102	26-MAY-87	1549	3	300.640
0928-RSB	102	26-MAY-87	1549	3	300.520
0928-RSB	102	26-MAY-87	1549	3	300.470
0928-RSB	102	26-MAY-87	1549	3	300.420
SPECIFIC_HUMID	HEIGHT_ABV_MEAN_SEA_LVL	FIFE_DATA_CRTFCN_CODE			
12.670	354.0000	CPI			
12.660	370.0000	CPI			
12.630	387.0000	CPI			
12.570	400.0000	CPI			
LAST_REVISION_DATE					
02-NOV-90					
02-NOV-90					
02-NOV-90					
02-NOV-90					

8. Data Organization:

Data Granularity:

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:

Dr. Brutsaert, shifted the dry-bulb temperature and wet-bulb temperature data (see the [Theory of Measurements Section](#)) in time by an amount equal to the time constants (3 and 12 seconds for dry-bulb temperature and wet-bulb temperature, respectively) to match with the pressure data. In other words, the dry-bulb temperature measured during cycle $(i + 1)$, i.e., $Td(i + 1)$ and the wet-bulb temperature measured two cycles later, i.e., $Tw(i + 3)$ were both assigned to the pressure $p(i)$ of the i -th cycle. The height of the sonde was re-calculated from the pressure, temperature (obtained from the FIFE Radiosonde Data) and humidity (derived from the shifted dry-bulb temperature and wet-bulb temperature data). It should be noted that these "improved" heights, as listed in the FIFE Temperature and Humidity Profiles, are not very different (except for the conversion from height above ground level to height above sea level) from those listed in the original FIFE Radiosonde Data so that it should be easy to recover the original pressures (which are not listed here) from the original FIFE Radiosonde Data.

The statement: $(i + 1)$, i.e., $Td(i + 1)$ and the wet-bulb temperature measured two cycles later, i.e., $Tw(i + 3)$, Probably should be: $Td(i + 3)$ and the wet-bulb temperature measured two cycles later, i.e., $Tw(i + 12)$.

Data Processing Sequence:

Processing Steps:

1. Pressure, temperature, dry-bulb temperature and wet-bulb temperature data were obtained from original FIFE Radiosonde Data.
2. Corrections for sensor delays were made (see the [Derivation Techniques and Algorithms Section](#) for details)
3. The height of radiosonde instrument was re-calculated (see the [Derivation Techniques and Algorithms Section](#) for details)

Processing Changes:

Not available at this revision.

Calculations:**Special Corrections/Adjustments:**

Not available at this revision.

Calculated Variables:

Not available.

Graphs and Plots:

None.

10. Errors:**Sources of Error:**

Not available at this revision.

Quality Assessment:**Data Validation by Source:**

Not available at this revision.

Confidence Level/Accuracy Judgment:

Not available at this revision.

Measurement Error for Parameters:

Not available at this revision.

Additional Quality Assessments:

FIS staff applied a general 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. In some cases, histograms were examined to determine whether outliers were consistent with the shape of the data distribution. Inconsistencies and problems found in the QA check are described 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:

As of the revision data of this document, the following discrepancies or errors in the data have been reported:

Results of the FIS staff quality assessments:

- On June 27, 1987 and August 15, 1987 some observation time values are -9999. There are data in the records with -9999 obs_time values, however, FIS did not receive a time for the records and therefore entered -9999.
- The August 15, 1987 flight with OBS_TIME '-9999' has extreme values for POTENTIAL TEMPERATURE (700's) and SPECIFIC HUMIDITY 970'S).

There are negative humidity values on the following dates, times and heights:

OBS_DATE	OBS_TIME	HEIGHT_ABV_MEAN_SEA_LVL
03-JUN-87	2001	3118 to 3165
04-JUN-87	2132	2744.41 to 2810.09
25-JUN-87	1846	3163 to 3309
01-JUL-87	1528	3019
20-AUG-87	2249	1576.83

For more information on known problems with the data see the FIFE Radiosonde Data document.

Usage Guidance:

Use in the study of the atmospheric boundary layer.

Any Other Relevant Information about the Study:

In the FIFE Temperature and Humidity Profiles data set the temperature is given as virtual potential temperature in Kelvin and the specific humidity is in [g][kgE-1]. The potential temperature can be readily obtained by subtracting $[0.61 \cdot 10E-3q]$ (where q is the specific humidity as listed in the FIFE Temperature and Humidity Profiles data set table in [g][kgE-1]) from the listed virtual potential temperature. The actual temperature can then be calculated from the potential temperature by means of the usual relationship on the basis of pressure.

12. Application of the Data Set:

The FIFE Temperature and Humidity Profile data set radiosonde data can be used to infer inversion heights.

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 will be 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 FIFE Temperature and Humidity Profiles are available on FIFE CD-ROM Volume 1. The CD-ROM file name is as follows:

```
\DATA\ATMOS\TEMPPROF\YyyMmm\yddNnnn.TPS
```

Where *yy* is the last two digits of the year (e.g. Y87 = 1987), *mm* is the month of the year (e.g. M12 = December). Note: capital letters indicate fixed values that appear on the CD-ROM exactly as shown here, lower case indicates characters (values) that change for each path and file.

The format used for the filenames is: *ydddNnnn.sfx*, where *y* is the last digit of the year (e.g. 7 = 1987, and 9 = 1989), *ddd* is the day of the year (e.g. 061 = sixty-first day in the year), and *nnn* is the flight number (ranges from 002 - 450). The file extension, (*.sfx*), identifies the data set content for the file and is equal to *.TPS* for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

ADAS Operating Manual, AIR, Inc. Boulder CO.

Journal Articles and Study Reports.

Brutsaert, W., M. Sugita and L.J. Fritschen. 1990. Inner region humidity characteristics of the neutral boundary layer over prairie terrain. *Water Resour. Res.* 26:2931-21936.

Brutsaert, W. and M. Sugita. 1990. The extent of the unstable Monin-Obukhov layer for temperature and humidity above complex hilly grassland. *Boundary-Layer Meteor.* 51:383-400.

Brutsaert, W. and M. Sugita. 1991. A bulk similarity approach in the atmospheric boundary layer using radiometric skin temperature to determine regional surface fluxes. *Boundary-Layer Meteor.* 55:1-23.

Brutsaert, W. and M. Sugita. 1992. Self-preservation in the diurnal evolution of the surface energy budget to determine daily evaporation. *Jour. Geophys. Res.* 97:18,377-18,382.

Brutsaert, W. and M. Sugita. 1992. Regional surface fluxes under non-uniform and patchy soil moisture conditions during drying. *Water Resour. Res.* 28:1669-1674.

Sugita, M. and W. Brutsaert. 1990. Wind velocity measurements in the neutral boundary layer above hilly prairie. *Jour. Geophys. Res. (Atmos.)*. 95(D6):7617-7624.

Sugita, M. and W. Brutsaert. 1990. How similar are temperature and humidity profiles in the unstable boundary layer? *Jour. Appl. Meteor.* 29:489-497.

Sugita, M. and W. Brutsaert. 1990. Regional surface fluxes from remotely sensed skin temperature and lower boundary layer measurements. *Water Resour. Res.* 26:2937-2944.

Sugita, M. and W. Brutsaert. 1991. Daily evaporation over a region from lower boundary layer profiles measured with radiosonde. *Water Resour. Res.* 27:747-752.

Sugita, M. and W. Brutsaert. 1992. Landsat surface temperatures and radiosoundings to obtain regional surface fluxes of heat and water vapor. *Water Resour. Res.* 28:1675-1679.

Sugita, M. and W. Brutsaert. 1992. The stability functions in the bulk similarity formulation for the unstable boundary layer. *Boundary-Layer Meteor.* 61:65-80.

Archive/DBMS Usage Documentation.

The Collected Data of the First ISLSCP Field Experiment is archived at the EOS Distributed Active Archive Center (DAAC) at Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee (see the [Data Center Identification Section](#) above). 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:

ABL Atmospheric Boundary Layer ASL Above Sea Level AGL Above Ground Level BPI Byte per inch CD-ROM Compact Disk-Read Only Memory DAAC Distributed Active Archive Center EOS Earth Observing System EOSDIS EOS Data and Information System. FIFE First ISLSCP Field Experiment FIS FIFE Information System GMT Greenwich Mean Time IFC Intensive Field Campaign ISLSCP International Satellite Land Surface Climatology Project Mbps Megabyte per second NOAA National Oceanic and Atmospheric Administration ORNL Oak Ridge National Laboratory TDF Table Definition File URL Uniform Resource Locator UTM Universal Transverse Mercator

A general list of acronyms for the DAAC is available at [Acronyms](#).

20. Document Information:

April 22, 1994 (citation revised on October 10, 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:

February 18, 1996.

Document ID:

ORNL-FIFE_TEMP_PRO.

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Document Curator:

[DAAC Staff](#)

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