Wind Profile Data: LIDAR - NOAA (FIFE)

Summary:

The aim of this wind profile study was to derive wind profiles and momentum fluxes from the National Oceanic and Atmospheric Administration (NOAA)/Wave Propagation Laboratory (WPL) Doppler LIDAR, and compare LIDAR and airborne measurements of mean wind, turbulent structure, momentum flux, and heat flux. Another objective was to compare profiles of mean wind and temperature obtained from aircraft, balloon sondes, and wind LIDAR. These data were collected at one location near the center of the FIFE study area but in the northwest quadrant. Data were acquired for a two week period during June and July 1987.

Pulsed Doppler LIDAR measures the radial (along-beam) velocity as a function of range using light-scattering particles in the air as tracers. When the LIDAR beam is directed straight upward and the backscattered return as a function of height is recorded, vertical aerosol profiles may be determined. Various pointing and scanning schemes permit measurement of a variety of mean and turbulent quantities based on assumptions about the flow.

The remote-sensing character of LIDAR offers the ability to measure flow parameters simultaneously at all the heights in a profile. The winds were obtained with the VAD (Velocity Azimuth Display) technique. The LIDAR only operates above 500 m, therefore the wind profile begins above the ground surface. Data in the planetary boundary layer are usually continuous, but gaps appear occasionally in profiles extending to several kilometers. Profiles were unsmoothed, and the LIDAR's short pulse made adjacent data points almost independent.

Table of Contents:

1. Data Set Overview:

Data Set Identification:

Wind Profile Data: LIDAR - NOAA (FIFE).
(NOAA Wind Profiles Using LIDAR).

Data Set Introduction:

This dataset contains wind profile data collected at one location near the center of the FIFE study area in the northwest quadrant. The data covers a two week period during June and July 1987.

Objective/Purpose:

The aim of this study was to derive wind profiles and momentum fluxes from the National Oceanic and Atmospheric Administration (NOAA)/Wave Propagation Laboratory (WPL) Doppler LIDAR, and compare LIDAR and airborne measurements of mean wind, turbulent structure, momentum flux, and heat flux. Another objective was to compare profiles of mean wind and temperature obtained from aircraft, balloon sondes, and wind LIDAR.

Summary of Parameters:

Wind speed and direction.

Discussion:

The deduced mean wind, its variance, as well as the momentum fluxes from a single Doppler LIDAR (Light Detection and Range) measurements, showed that the momentum fluxes appear to be a response to the mean wind. However, the diffusion process is not just "bottom up" (i.e., driven by surface friction) but also "top down". The assumption needed to derive the mean wind and its second moments is that the turbulence is horizontally homogeneous. This assumption is not too restrictive. However, a more severe restriction appears to be the range resolution of the LIDAR beam (about 150 m). For Planetary Boundary Layer (PBL) studies a more desirable resolution is 25 m. It appears that, improvements in the signal processing and shorter pulses may solve this problem.

The surface heat flux for July 11, 1987 (17:29-18:21 GMT) case is estimated to be 107 [Watts][meter^-2], a factor of 2 higher than airplane measurements, but is in agreement with the average estimate from the surface stations.

These data were collected at one location near the center of the FIFE study area but in the northwest quadrant. Data were acquired for a two week period during June and July 1987.

Related Data Sets:

- Detrended Boundary Layer Fluxes from the Twin Otter.
- Filtered Boundary Layer Fluxes from the Twin Otter.
- Raw Boundary Layer Fluxes from the Twin Otter.
- Detrended Atmospheric Turbulence Data from the NCAR King Air.
- Filtered Atmospheric Turbulence Data from the NCAR King Air.
- Raw Atmospheric Turbulence Data from the NCAR King Air.
- Detrended Boundary Layer Fluxes from the UW King Air.
- Filtered Boundary Layer Fluxes from the UW King Air.
- Raw Boundary Layer Fluxes from the UW King Air.
- Automatic Micrometeorological Observations.
- FIFE Standard Pressure Level Radiosonde Data.
- FIFE Radiosonde Data.
- Quick Look Boundary Layer Height.
- NOAA Regional Surface Data.
- FIFE Radiosonde Wind Profiles.

FIS Data Base Table Name:

WIND_PROFILE_LIDAR_DATA.

2. Investigator(s):

Investigator(s) Name and Title:

Dr. Tzvi Gal-Chen
University of Oklahoma

Dr. Wynn L. Eberhard
NOAA Wave Propagation Laboratory

Title of Investigation:

Estimations of Atmospheric Boundary Layer Fluxes and Other Turbulence Parameters from Doppler LIDAR Data.

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Requested Form of Acknowledgment.

Please reference these publications:

Eberhard, W.L., R.E. Cupp and K.R. Healy. 1989. Doppler LIDAR measurement of profiles of turbulence and momentum flux. Journal of Atmospheric and Oceanic Technology. 6:809-819.

Gal-Chen, T., X. Mei, and W.L. Eberhard. 1992. Estimations of atmospheric boundary layer fluxes and other turbulence parameters from Doppler LIDAR data. Journal of Geophysical Research. 97:18409-18423.

3. Theory of Measurements:

Pulsed Doppler LIDAR measures the radial (along-beam) velocity as a function of range using light-scattering particles in the air as tracers. When the LIDAR beam is directed straight upward and the backscattered return as a function of height is recorded, vertical aerosol profiles may be determined. Various pointing and scanning schemes permit measurement of a variety of mean and turbulent quantities based on often-met assumptions about the flow.

The remote-sensing character of LIDAR offers the ability to measure flow parameters simultaneously at all the heights in a profile. Alternatively, the LIDAR scanning at lower elevation angles can probe flow characteristics over a large area or volume. The vertical profiles of momentum flux and turbulent intensity have been the object of experimental measurements to understand and model the dynamics of the atmosphere.

The winds were obtained with the VAD (Velocity Azimuth Display) technique, which is explained in most books treating Doppler radar, including Radar Observation of the Atmosphere by L.J. Battan (University of Chicago Press, 324 p). The LIDAR directly measures the radial (along-beam) component of the wind as a function of range. When scanning 360 degrees in azimuth at constant elevation angle in a horizontally homogeneous wind field, the radial component at a single range varies sinusoidally with azimuth. The phase of the sinusoid gives the wind direction, and the amplitude reveals the speed (modified by the known elevation angle). A least squares fit of a sinusoid to the data is applied to average out the effects of turbulence and random instrument uncertainties over the VAD circle.

The LIDAR only operates above 500 m, therefore the wind profile begins above the ground surface. The vertical spacing depends on range gate spacing and elevation angle, which the operators varied from one VAD to another. Maximum height was set by signal/noise limitations or blockage by clouds. Data were edited to remove spurious values. Data in the planetary boundary layer are usually continuous, but gaps appear occasionally in profiles extending to several kilometers. Profiles were unsmoothed, and the LIDAR's short pulse made adjacent data points almost independent.

4. Equipment:

Sensor/Instrument Description:

The NOAA's pulsed, coherent, carbon dioxide Doppler LIDAR, is a hybrid carbon dioxide laser transmitting at 10.59 micrometer wavelength (or any other selectable wavelength) by a hill-climbing servo, while the local oscillator (another carbon dioxide laser) is held 20 MHz below the hybrid with another servo loop. The Ultra-violet pre-ionized power laser is seeded by the hybrid and produces S-polarized pulses of about 0.4 microsecond duration (in the short-pulse mode used at FIFE) at a 1-20 Hz pulse repetition frequency. Post et al. (1981) had described the instrument in detail.

Collection Environment:

Ground.

Source/Platform:

The LIDAR is mounted in a trailer of a semi-truck with the scanner on the roof.

Source/Platform Mission Objectives:

The purpose of the semi-trailer-mounted carbon dioxide Doppler LIDAR system developed by NOAA was to measure atmospheric winds, turbulence, and energy backscatter, using aerosols as tracers.

Key Variables:

Wind speed and direction.

Principles of Operation:

The pulsed Doppler LIDAR measures the radial component of the air velocity (positive toward the LIDAR) as a function of range along the beam. The LIDAR performed a conical scan through a full circle in the azimuth plane at constant elevation angle, to obtain the radial component of the air velocity. Azimuth is measured clockwise from North at a specified time. The scan was repeated many times within a period long enough (typically 1 h) to sample a number of advecting eddies up to the largest scale of interest in the turbulent spectrum.

Energy is directed through a germanium wedged plate that acts as a transmit/receive (T/R) switch and into a ZnSe Fresno rhombi, which changes the polarization to circular. The beam then enters an 28 cm parabolic off-axis telescope. The telescope output is directed vertically through the roof (of the semi-trailer) to an azimuth/ elevation scanner.

Return signals pass through the system on a precise reverse path, and are changed to p-polarization on emerging from the Fresno rhombi. These signals are then reflected from the T/R switch onto the detector where heterodyne mixing with the local oscillator occurs. The 20 MHz offset in the local oscillator frequency permits discrimination between receding and approaching velocity components of scatterers.

Sensor/Instrument Measurement Geometry:

The system is capable of scanning through the roof of the trailer at an elevation of -5 degree to 90 degrees and an azimuth 0 degrees to 360 degrees, with a 0.1 degree accuracy.

Manufacturer of Sensor/Instrument:

NOAA/Wave Propagation Laboratory
Boulder, Colorado

Calibration:

Backscatter amplitude is calibrated by reference to signals from a sand-paper target of known reflectance. Doppler shift is calibrated by checking digitizer clock frequency and checked by return from a stationary target.

Specifications:

Wavelength Selectable, normally 10.6 micrometer. Pulse Energy 0.065 - 0.150 joules. Pulse Duration 0.4 micro sec, full width, half maximum. Pulse Repetition Frequency 1 - 20 Hz. Telescope Type Off-axis paraboloid. Telescope diameter 28 cm. Detector Hg:Cd:Te, liquid Nitrogen cooled. Digital Processing 15 MHz digitizing, efficient Doppler and intensity processing, recording on magnetic tapes.

Tolerance:

Velocity accuracy for each range gate (150 m in length) using a 3-beam average was typically 0.7 meters/second r.m.s when there is high signal-to-noise ratio (i.e., plentiful dust particles).

Frequency of Calibration:

Calibration was performed weekly.

Other Calibration Information:

None.

5. Data Acquisition Methods:

Data were normally acquired at a 20 Hz pulse rate with a 3 pulse average. Scanning modes were alternated among 3 methods, with usually an hour spent continuously on one method:

1. Conical or Velocity Azimuth Display (VAD) scans between 0 and 360 degree azimuth, in a succession of constant elevation angles of 15, 30, and 45, or 30, 45, and 60 degrees.
2. Over-the-top or Range Height Indicator (RHI) scans between 0 and 180 degree elevation angle, alternating between azimuths aligned along-wind and cross-wind.
3. Volume or roster scans with azimuth sweeps through 180 degrees centered near the mean wind direction, and about 15 steps in elevation angle from 0 to 40 degrees.

Signal was sampled at 15 MHz rate (10 m range interval) and processed in real time to 150 m range gate values of radial Doppler velocity and back-scatter intensity. These data and housekeeping information were recorded on magnetic tape for later analysis as described in Eberhard et al. (1989) and Gal-Chen et al. (1991).

6. Observations:

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:

The LIDAR operated from a relatively high vantage point in an area of gently rolling terrain approximately 12 km south of Manhattan, Kansas within the FIFE study area.

SITEGRID_ID	STATION_ID	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEVATION
3539-LIN	103	4327002	712810	39 04 05	-96 32 25	440

Spatial Coverage Map:

Not available.

Spatial Resolution:

These are point data. However, the full width at half maximum of the laser power was 0.37 microsecond, which is equivalent to a horizontal resolution of 55 m.

The processor's minimum gate size was considerably larger, so the along-beam (vertical) resolution of the LIDAR was slightly more than 150 m. Resolution transverse to the beam depended on scan rate and pulse rate because of the 3-pulse averaging. Transverse resolution was equal to or finer than the vertical resolution.

Projection:

Not available.

Grid Description:

Not available.

Temporal Characteristics:

Temporal Coverage:

The overall time period of data acquisition was from June 24, 1987 through July 11, 1987. Data were obtained on an episodic basis, during daylight hours.

Temporal Coverage Map:

Not available.

Temporal Resolution:

The profiles were obtained at irregular intervals. One VAD or RHI scan typically was accomplished in approximately 30 seconds to 2 minutes.

Data Characteristics:

The SQL definition for this table is found in the WIND_LID.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 east (EE) cell number in a 100 x 100 array of 200 m square cells. The last 3 characters (III) are an instrument identifier.			FIS
STATION_ID The station ID designating the location of the observations.	min = 102, max = 103		FIS
OBS_DATE The date of the observations. max = 15-JUL-87	min = 25-MAY-87,		FIS
OBS_TIME The time that this LIDAR shot was FIS done and the data recorded. missing = -9999	min = 30, max = 2355,	[GMT]	
LIDAR_BEAM_ELEV_ANG The elevation of the lidar beam from horizontal.	min = 3, max = 45	[degrees]	FIS
LIDAR_BEAM_ZEN_ANG The number of degrees from the zenith of the LIDAR beam.	min = 45, max = 87	[degrees]	FIS
HEIGHT_ABV_MEAN_SEA_LVL The height above mean sea level for each observation.	min = 340, max = 11397.32	[meters]	FIS
WIND_SPEED The speed of the wind. max = 360 [sec^-1]	min = 0,	[meters]	FIS
WIND_DIR The direction from which the wind is blowing, measured in degrees from north.	min = .026, max = 359.924	[degrees]	FIS
FIFE_DATA_CRTFCN_CODE The FIFE Certification Code for the data, in the following format: CPI (Certified by PI), CPI-??? (CPI - questionable data).	** CPI - checked by primary investigator		FIS

```
LAST_REVISION_DATE
data, in the format (DD-MMM-YY).       max = 26-JUL-90
```

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_ID	STATION_ID	OBS_DATE	OBS_TIME	LIDAR_BEAM_ELEV_ANG
3539-LIN	103	24-JUN-87	1853	45
3539-LIN	103	24-JUN-87	1853	45
3539-LIN	103	24-JUN-87	1853	45
3539-LIN	103	24-JUN-87	1853	45

LIDAR_BEAM_ZEN_ANG	HEIGHT_ABV_MEAN_SEA_LVL	WIND_SPEED	WIND_DIR
45	1072.1530	4.0970	195.9190
45	1493.5870	3.8320	195.6780
45	1704.3060	4.8570	189.5030
45	1915.0230	3.7010	189.3320

FIFE_DATA_CRTFCN_CODE	LAST_REVISION_DATE
CPI	24-MAY-90
CPI	24-MAY-90
CPI	24-MAY-90
CPI	24-MAY-90

8. Data Organization:

Data Granularity:

This data set contains point data. However, the full width at half maximum of the laser power was 0.37 microsecond, which is equivalent to a horizontal resolution of 55 m. The along-beam (vertical) resolution of the LIDAR was slightly more than 150 m. Resolution transverse to the beam depended on scan rate and pulse rate because of the 3-pulse averaging. Transverse resolution was equal to or finer than the vertical resolution.

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:

Eberhard et al. (1989) derived the vertical profile of mean wind at three levels by applying the conventional VAD technique of Browning and Wexler (1968) to each scan. Secondly, they calculated the variance of measured radial wind velocities as a function of azimuth by rotating the azimuthal coordinate to a pointing direction (theta) parallel to the horizontal mean wind vector.

Finally, using the statistical form of the Navier-Stokes equations which was described in detail by Gal-Chen et al. (1992), the surface heat flux was derived as the residual balance between the vertical gradient of the vertical velocity and the kinetic energy dissipated.

Data Processing Sequence:

Processing Steps:

1. Obtain average wind profile.
2. Calculate variance of measured radial wind velocity.
3. Derive surface heat flux.

Processing Changes:

None.

Calculations:

Special Corrections/Adjustments:

The energy and frequency of the outgoing pulse were monitored by mixing a reflection of the transmitted pulse from an optical element with a beam split from the local oscillator. The processor acquired data from this pulse monitor during the first two range gates and then switched to the signal detector. Atmospheric velocities were corrected for any frequency offset as detected by this pulse monitor.

Calculated Variables:

Not available.

Graphs and Plots:

None.

10. Errors:

Sources of Error:

Any constant bias in LIDAR measurements is inconsequential in the turbulence analysis because the turbulence quantities are computed relative to the measured average coefficients: A(0), which includes the effects of vertical wind and divergence; A(1), which is the northerly component of horizontal wind multiplied by the constant elevation angle.

The LIDAR measurements also suffer from random errors, in part caused by imperfect frequency control, which is common with all coherent systems using many randomly moving scatterers as targets.

Quality Assessment:

Data Validation by Source:

An unsolved issue was the stability of the reference frequency (against which the frequency of the returned pulse must be compared). This can lead to biases which, at present, can be partially corrected by manual inspection of the data and the detection of "outliers".

Confidence Level/Accuracy Judgment:

Errors were less than expected for these types of measurements.

Measurement Error for Parameters:

The r.m.s. accuracy of individual radial velocity measurements is +/-0.7 [m^2][s^-2]. This should result in experimental errors in the momentum flux of the order of 6.25 x 10E-2 [m^2][s^-2], well below the typical values which lie in the range of -0.2 [m^2] [s^-2] to -2.5 [m^2][s^-2].

Although the LIDAR suffered non-trivial instrumental error in the velocity measurements (approximately 0.4 [m^2][s^-2] variance), the self-cancellation inherent in the method made the effect on the flux parameters negligible.

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 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, that 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:

- The investigators reported that a small fraction of the data was lost due to offset in recording position angles.
- The FIS staff quality assessment detected no errors or problems in these data.

Usage Guidance:

The variance due to instrumental error must be subtracted to determine wind vectors, so the LIDAR error must be determined accurately to avoid bias in the intensities. The main source of uncertainty in all turbulence parameters was the limited number of samples of the large eddies. This was the case in spite of averaging for 1 h, covering an area by scanning in azimuth, and having rapid advection of eddies by 15 [m][s^-1] average winds. Doppler radars using this Velocity Azimuth Display technique can also apply this method to estimate the uncertainty in their flux and turbulence measurements.

Any Other Relevant Information about the Study:

During IFC-2 the pulsed Doppler LIDAR performed conical scans to measure the vertical profile of the horizontal wind which were then used to plan data acquisition for turbulence measurements.

The profiles were obtained at irregular intervals. The LIDAR site was at 39 degrees 4 minutes 5 seconds north latitude and 96 degrees 32 minutes 21 seconds west longitude, which is near the intersection of highways I-70 and K-177; elevation was 446 m AGL. Winds were given in meteorological convention: 0 degrees from North and 90 degrees from East. Heights were in meters MSL.

Some wind profiles not included in the CD-ROM are available (from Gal-Chen and Eberhard) for other times (between mid-morning and late afternoon) when the LIDAR engaged in intensive scanning for turbulence properties. These data sets are temporally intensive, typically with one wind profile per minute.

Some of the lost data were recoverable, and were restored and processed.

12. Application of the Data Set:

This data set can be used to compare LIDAR and airborne measurements of mean wind, turbulent structure, momentum flux, and heat flux. This dataset can also be used to compare the profiles of mean wind and temperature obtained from aircraft, balloon sondes, and wind LIDAR.

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 NOAA Wind Profiles Using LIDAR data are available on FIFE CD-ROM Volume 1. The CD-ROM file name is as follows:

\DATA\ATMOS\WIND_LID\ydddgrid.WPL

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 (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 .WPL for this data set.

17. References:

Satellite/Instrument/Data Processing Documentation.

Post, M.J., and R.E. Cupp. 1990. Optimizing a pulsed Doppler LIDAR. Appl. Opt. 29:4145-4158.

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Eberhard, W.L., R.M. Hardesty, and T. Gal-Chen. 1987. Turbulence Measurements in the Convective Boundary Layer with a Short-pulse CO2 Doppler LIDAR. Technical Digest. Topical Meeting on Laser and Optical Remote Sensing. Opt. Soc. Amer. Washington. 350-353.

Gal-Chen, T., X. Mei, and W.L. Eberhard. 1992. Estimations of atmospheric boundary layer fluxes and other turbulence parameters from Doppler LIDAR data. J. Geophys. Res. 97:18409-18423.

Gal-Chen, T., and R.A. Kropfli. 1984. Buoyancy and pressure perturbations derived from dual-Doppler radar observations of the planetary boundary layer: applications for matching models with observations. J. Atmos. Sci. 41:3007-3020.

Hall, F.F. Jr., R.M. Huffaker, R.M. Hardesty, M.E. Jackson, T.R. Lawrence, M.J. Post, R.A. Richter, and B.F. Weber. 1984. Wind Measurement Accuracy of the NOAA Pulsed Infrared Doppler LIDAR Applied Optics. Vol. 23. 2503-2506.

Kropfli, R.A. 1986. Single Doppler radar measurements of turbulence profiles in the convective boundary layer. J. Atmos. Oceanic Technol. 3:305-313.

Sellers, P.J., F.G. Hall, G. Asrar, D.E. Strebel, and R.E. Murphy. 1988. The First ISLSCP Field Experiment (FIFE). Bull. Am. Meteor. Soc. 69:22-27.

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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:

AGL Above Ground Level 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 RHI Range Height Indicator IFOV Instantaneous Field-of-View ISLSCP International Satellite Land Surface Climatology Project LIDAR Light Detection and Range MSL Mean Sea Level NOAA National Oceanic and Atmospheric Administration ONRL Oak Ridge National Laboratory RMS Root Mean Square SQL Structured Query Language URL Uniform Resource Locator UTM Universal Transverse Mercator VAD Velocity Azimuth Display WPL Wave Propagation Laboratory

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

20. Document Information:

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