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Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Jeffrey A. Newcomer, Editors

Volume 2

BOREAS AFM-2 King Air 1994 Aircraft Flux and Moving Window Data

R.D. Kelly

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

June 2000

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Robert D. Kelly

Summary

The BOREAS AFM-2 team collected pass-by-pass fluxes (and many other statistics) for a large number of level (constant altitude), straight-line passes used in a variety of flight patterns. The data were collected by the University of Wyoming King Air in 1994 BOREAS IFCs 1-3. Most of these data were collected at 60-70 m above ground level, but a significant number of passes were also flown at various levels in the planetary boundary layer, up to about the inversion height. This documentation concerns only the data from the straight and level passes that are presented as original (over the NSA and SSA) and moving window values (over the Transect). Another archive of King Air data is also available, containing data from all the soundings flown by the King Air 1994 IFCs 1-3. The data are stored in tabular ASCII files.

Note that although there are less than 100 records in any data file, there are over 170 columns of data. Most spreadsheet software should be able to handle up to 256 columns of data.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS AFM-02 King Air 1994 Aircraft Flux and Moving Window Data

1.2 Data Set Introduction

The King Air was flown in a variety of flight patterns in the BOReal Ecosystem-Atmosphere Study (BOREAS) during 1994, but predominantly in various sequences of straight, constant-altitude passes for measurement of fluxes and flux profiles in the boundary layer above the BOREAS experiment sites. This document describes the contents of these "flux" archives, which also include statistical summaries of a large number of navigational, dynamic, and thermodynamic parameters.

The fluxes and statistics archived here are for passes or segments of passes between predefined waypoints, as part of various flight patterns (see Section 5). The shortest times for the regular flux data passes/segments are about 2 min, for which the spatial resolution is about 10 km. Included in these regular data are those from the grid patterns and the Candle Lake runs. The passes for the grid patterns (GS, GN) are 32 km in length. The Candle Lake (CS) runs were divided into two segments, one over the relatively homogeneous Old Aspen (OA) area surrounding the OA flux tower (east end of CL run), and the other over the area at the west end of the run dominated by black spruce. The moving window data for each long leg of the regional transects (RT) was segmented into 180-second segments, each overlapping the adjoining two segments by 50%.

1.3 Objective/Purpose

The Wyoming King Air is one of four flux aircraft flown in BOREAS. The primary objectives of its operation were to measure fluxes of sensible heat, latent heat (moisture), momentum, and carbon dioxide in the boundary layer. In addition, atmospheric dynamic, thermodynamic, and radiation data were collected, along with the standard aircraft parameters of position, altitude, heading, etc. These data will be used for estimates of surface fluxes, boundary layer budgets, and error analysis of flux measurements, and will be integrated with smaller and larger scale measurements from the project.

1.4 Summary of Parameters

The following is a list of variables for each "flux pass" by the King Air. Section 7 defines the variables and their origins in detail. Note: Those variables flagged (**) were not measured by the King Air.

VARIABLES:

- BOREAS aircraft i.d.
- Date
- BOREAS mission designator
- Mission number of day
- Pass number
- Segment number
- Run start time, GMT
- Starting latitude
- Starting longitude
- Starting BORIS grid E
- Starting BORIS grid N
- Run end time, GMT
- Ending latitude
- Ending longitude
- Ending BORIS grid E
- Ending BORIS grid N
- Aircraft heading
- Mean pressure altitude
- Mean radar altitude
- Mean wind direction
- Mean wind speed
- Air temperature
- Potential temperature
- Mixing ratio, H_20
- U, westerly wind component
- V, southerly wind component
- Static pressure
- Surface radiative temperature **
- Downwelling total radiation
- Upwelling total radiation

- Downwelling longwave radiation
- Upwelling longwave radiation
- Net radiation **
- Upwelling PAR **
- Downwelling PAR **
- Auxiliary radiation sensor **
- Greenness index **
- CO_2 concentration as mole CO_2 per mole dry air (also referred to as CO_2 molar mixing ratio. If it were given as just CO_2 mixing ratio, the units would be mass CO_2 per mass dry air).
- Ozone concentration **
- Methane concentration **
- Satellite simulator channels 1-4 **

Standard deviations of the following:

- Air temperature
- Potential temperature
- Mixing ratio, H_20
- U, westerly wind component
- V, southerly wind component
- Static pressure
- Surface radiative temperature **
- Downwelling total radiation
- Upwelling total radiation
- Downwelling longwave radiation
- Upwelling longwave radiation
- Net radiation **
- Upwelling PAR **
- Downwelling PAR **
- Auxiliary radiation sensor **
- Greenness index **
- CO_2 concentration (mole CO_2 per mole dry air)
- Ozone concentration **
- Methane concentration **
- Satellite simulator, channels 1-4 **

Linear trends of the following:

- Trend in air temp.
- Trend in potential temp.
- Trend in mixing ratio
- Trend in u
- Trend in v
- Trend in static pressure
- Trend in surface radiation temperature **
- Trend in downwelling total radiation **
- Trend in upwelling total radiation **
- Trend in downwelling longwave radiation **
- Trend in upwelling longwave radiation **
- Trend in greenness index **
- Trend in CO_2 concentration
- Trend in O_3 concentration **
- Trend in CH_4 concentration **

In various categories to follow, the following variables are referred to as the flux variables:

- Vertical gust, w
- Westerly wind component, u
- Southerly wind component, v
- Along wind component
- Crosswind component
- Potential temperature
- H_20 mixing ratio (mass H_2O per mass dry air)
- CO_2 mixing ratio (mass CO_2 per mass dry air)
- O_3 concentration **
- CH_4 concentration **

In various categories to follow, these variable pairs are referred to as the flux variable pairs:

- w, u
- w, v
- w, alongwind comp.
- w, crosswind comp.
- w, potential temp
- w, H_2O mixing ratio (mass H_2O per mass dry air)
- w, CO_2 mixing ratio (mass CO_2 per mass dry air)
- w, O_3 concentration **
- w, CH_4 concentration **
- Potential temperature, H_2O mixing ratio

List of fluxes:

- Momentum flux, south component
- Momentum flux, west component
- Momentum flux along mean wind
- Momentum flux across
- Sensible heat flux, H
- Latent heat flux, LE
- CO_2 flux
- Ozone flux **
- Ozone deposition velocity **
- Methane flux **

- Standard deviations for the raw flux variables
- Skewness for the raw flux variables
- Kurtosis for the raw flux variables
- Correlation coefficients for the raw flux variable pairs
- Fluxes using the raw data
- Constants used in the flux calculations (such as specific heats, latent heat)
- Standard deviations for the linearly detrended flux variables
- Skewness for the linearly detrended flux variables
- Kurtosis for the linearly detrended flux variables
- Correlation coefficients for the linearly detrended flux variable pairs
- Fluxes using the linearly detrended data

1.5 Discussion

The King Air was flown in all three BOREAS 1994 Intensive Field Campaigns (IFCs). The archived data were collected during straight and level flight lines over the BOREAS study areas and on regional runs between Southern Study Area (SSA) and Northern Study Area (NSA). A variety of flight patterns were used, including grids, L- patterns, profiling stacks, and soundings, which are described in more detail in Section 7. Two separate sets of data have been submitted to the BOREAS Information System (BORIS) archive: 1-second resolution listings of various variables from the soundings, and fluxes and statistics from the level flux runs. Variables in the latter category include pass-length averages and other statistics; momentum and scalar fluxes; and supporting meteorological, radiometric, and aircraft positional data. The high-rate data from which all these variables were computed were not submitted to BORIS. If required, they may be acquired from the University of Wyoming directly.

1.6 Related Data Sets

Related data sets include the 1994 King Air sounding data for BOREAS and the flux and/or sounding archives from the other three flux aircraft:

BOREAS AFM-01 NOAA/ATDD Long-EZ Aircraft Flux Data over the SSA
BOREAS AFM-02 Wyoming King Air 1994 Aircraft Sounding Data
BOREAS AFM-03 NCAR Electra 1994 Aircraft Flux and Moving Window Data
BOREAS AFM-03 NCAR Electra 1994 Aircraft Sounding Data
BOREAS AFM-04 Twin Otter Aircraft Flux Data
BOREAS AFM-04 Twin Otter Aircraft Sounding Data

2. Investigator(s)

2.1 Investigator(s) Name and Title

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2.2 Title of Investigation

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3. Theory of Measurements

A series of introductory monographs addressing the theory and practice of measuring atmospheric variables from a moving, aircraft platform may be found in Lenschow, 1986. An introduction to the general topic of eddy correlation fluxes may be found in Stull, 1988.

The aircraft uses gust sensors to measure the 3-D air motion relative to the aircraft and a combination of an inertial platform, accelerometers, and (more recently) satellite-based global positioning system (GPS) to measure the motion of the aircraft relative to Earth. These data are combined to determine aircraft position and the Earth-relative 3-D winds. Scalar quantities, including static pressure, temperature, water vapor mixing ratio, and CO_2 mixing ratio are also measured with fast-response, aircraft-mounted sensors. For each straight, level pass by the aircraft, the local means or trends are removed from each of the wind components and the scalar values, leaving the gust components u', v', w', T', r', etc., with which the eddy correlation fluxes are calculated.

4. Equipment

4.1 Sensor/Instrument Description

Table 4.1. University of Wyoming King Air Instruments

Variable	Instrument	Accuracy	Resolution
Hi-rate temperature	Rosemount housing, fast-response thermistor (design by Friehe, UCI)	0.50 C	0.01 C
Dewpoint temperature	Cambridge Model 1373C	1.0 C, >0 C	0.006 C
Water vapor mix ratio	LICOR 6262 IR spectrometer	1% of reading	0.001 g/kg
CO_2 mix ratio	LICOR 6262 IR spectrometer	+/-1ppm at .01 ppm	350 ppm
Magnetic heading	King KPI553/Sperry C14-43	1 degree	0.02 degree
Static pressure	Rosemount 1201FA1B1A	0.5 mb	0.06 mb
Static pressure	Rosemount 1501	0.5 mb	0.003 mb
Geometric Altitude	Stewart Warner APN159	1% reading	0.24 ft
Geometric Altitude	King KPA 405	3% <500 ft 6% > 500 ft	0.48 ft
Total pressure	Rosemount 831CPX	2 mb	0.005 mb
Azimuth VOR	King KNR615 VOR	1 degree	0.02 degree
Distance DME	King KNR705A DME	0.2 nautical miles	0.1 nautical mile
Latitude/longtitude	Tremble 2000 GPS	100 m	0.000172 degree
Latitude/longtitude	Honeywell Laseref SM	0.8 nm/hr drift	0.000172 degree
Ground velocity	Honeywell Laseref SM	13.5 ft/s	0.0039 kts
Vertical velocity	Honeywell Laseref SM	0.5 ft/s	0.03215 ft/min
Pitch/roll	Honeywell Laseref SM	0.05 degree	0.000172 degree
Platform heading	Honeywell Laseref SM	0.2 degree	0.000172 degree
Flow angle	Rosemount 858AJ/831CPX	0.2 degree	0.00375 degree
Vertical acceleration	Humphrey SA0905021	0.002 g	0.0001 g

Rate of climb	Rosemount 1241A4BCDE	1%, <15000 ft 2%, >25000 ft	0.004 m/s
Engine torque	--	--	0.2 ft-lbf
Liquid Water Content	In-house CSIRO hot wire	0.2 g/m^3	0.0003 g/m^3
Liquid Water Content	Bacharach LWH	0.2 g/m^3	0.0002 g/m^3
Cloud drops	PMS FSSP	3 micron	3 micron
Radiation:			
Upwelling Shortwave (0.3-3 microns)	Eppley Pyranometer	5 W/m^2	1 W/m^2
Downwelling Shortwave (0.3-3 microns)	Eppley Pyranometer	5 W/m^2	1 W/m^2
Upwelling IR (4-50 microns)	Eppley Pyrgeometer	15 W/m^2	1 W/m^2
Downwelling IR (4-50 microns)	Eppley Pyrgeometer	15 W/m^2	1 W/m^2

4.1.1 Collection Environment

The data were collected during each day's flights over a vertical and horizontal range with varying atmospheric conditions.

4.1.2 Source/Platform

Platform: Beechcraft Super King Air model 200T, twin-turboprop aircraft.

4.1.3 Source/Platform Mission Objectives

See Section 1.4.

4.1.4 Key Variables

See Sections 1.4, 1.5, and 7.3.

4.1.5 Principles of Operation

See Section 3.

4.1.6 Sensor/Instrument Measurement Geometry

The gust probe was mounted at the end of the aircraft nose boom, so that the gust probe tip was about 2 m ahead of the nose of the aircraft. The inertial reference system (IRS) and accelerometers were mounted close to the main wing spar (close to aircraft c.g.). A fast-response (Friehe-type) temperature probe was mounted below the nose of the aircraft, 1.29 m aft from the gust probe tip. Water vapor and CO_2 measurements were obtained with a LI-COR 6262 infrared absorption spectrometer. Air was drawn from the airstream above the aircraft cabin into a 12.7-mm i.d. tube that faced forward, about 0.3 m above the fuselage skin and 4.06 m aft of the gust probe tip. Airflow in the tube was maintained with a high-capacity vacuum pump at 60-70 SLPM (about 9 m/s), for Reynolds number about 50,000 (fully developed turbulent flow). At 1.52 m from the inlet, air was drawn from the center of the tube into the LI-COR through a short 6.4-mm i.d. tube, again by vacuum pump, at an average flow rate of 6-8 SLPM (also fully turbulent). As verified by flying the aircraft through a power-plant plume, there was a time delay of 0.3 s between the gust probe data and the LI-COR data. This delay was removed in the software at the time of data processing. The LI-COR 6262 was operated in absolute mode, in which the closed-path absorption in the sample chamber was simultaneously compared to the closed-path absorption in the reference chamber. Air in the reference chamber was circulated continuously through scrubbers that remove both water and CO_2, and was circulated at a flow rate of 2 SLPM. A Cambridge chilled-mirror dewpoint hygrometer mounted inside the cabin drew air from the vacuum pump-driven sample tube. All cloud and precipitation probes (PMS and liquid water content) were mounted near the wing tips, on both wings.

4.1.7 Manufacturer of Sensor/Instrument
See Table 4.1.

4.2 Calibration
Instruments were subject to calibration as follows:

- **Air temperature:** Used manufacturer's one-time calibration for Rosemount model 102, then compared Friehe-type probe against Rosemount.
- **Water vapor concentration:** Before each flight, the LI-COR H_2O channel was calibrated by flushing the chamber with a beam-filling gas of known H_2O concentration, generated with a LI-COR Model 610 Dew-Point generator, with accuracy +/-0.03 °C.
- **CO_2 concentration:** Before each flight, the LI-COR CO_2 channel was calibrated by flushing the chamber with a gas of known CO_2 concentration (Source: Scott Specialty, Longmont, Colo., concentration 403.5 ppm, accurate to 4%).
- **Static pressure and gust differential pressures:** The gust probe differential pressure sensors (for up-down and left-right angle of flow measurements) and absolute pressure sensor (gust probe total pressure) were calibrated at the beginning of each IFC, using the Rosemount 1501 (accurate to 0.5 mb).

4.2.1 Specifications
See Table 4.1.

4.2.1.1 Tolerance
None given.

4.2.2 Frequency of Calibration
See Section 4.2.

4.2.3 Other Calibration Information
None given.

5. Data Acquisition Methods

The straight-line, constant altitude passes used for the flux calculations were all part of several different flight patterns used throughout the 1994 BOREAS campaigns. What follows here is a brief description of those patterns, including the short, two-letter identifier used for communications, labeling data files, etc.

ID	Description (second letter denotes NSA or SSA)
CS	Candle Lake runs, SSA only, usually along path a-d.
FS,FN	Flights of two (intercomparison runs), various locations.
GS,GN	Grid patterns. Sequence of 9 evenly spaced, parallel flight lines, covering a 32 x 32 km square area (King Air), with lines oriented either east-west or north-south.
HS,HN	Stack patterns.
LS,LN	Transects of intermediate length (e.g. 100 km).
PS,PN	Budget box pattern (see Betts et al., 1990, Boundary Layer Meteorology, 50, 109-137.
RT	Regional transect. For King Air, route used in transit between NSA and SSA. Coincide with Electra RTs.
TS,TN	Site-specific run at a tower flux (TF) site.

Navigation waypoints used for flying the patterns:

Pt.	Lat.	Long.	
A	53° 32.0'N	106° 34.0'W	
C	53° 37.8'N	106° 11.4'W	(same as Prince Albert National Park (PANP)-OA)
G	53° 55.6'N	104° 59.7'W	
H	54° 07.0'N	104° 13.5'W	
K	54° 41.7'N	103° 47.5'W	
L	54° 57.3'N	101° 58.0'W	
M	55° 54.8'N	99° 07.5'W	
O	55° 53.2'N	98° 00.0'W	
P	60° 30.0'N	98° 00.0'W	
Q	60° 30.0'N	95° 30.0'W	
R	59° 00.0'N	95° 30.0'W	
CH	58° 44.5'N	94° 04.0'W	(Churchill airport)
a	53° 34.7'N	106° 23.8'W	
b	53° 42.8'N	105° 52.0'W	
c	53° 55.0'N	105° 04.0'W	
d	53° 59.0'N	104° 47.2'W	
f	53° 59.8'N	104° 43.5'W	
g	53° 32.0'N	104° 27.6'W	
h	53° 56.8'N	105° 20.5'W	
i	54° 03.7'N	104° 45.5'W	
j	53° 43.8'N	104° 34.0'W	
k	53° 35.8'N	106° 18.0'W	
m	54° 05.2'N	104° 50.5'W	
n	53° 32.2'N	104° 19.5'W	
s	53° 17.0'N	105° 43.0'W	
t	53° 38.0'N	105° 43.0'W	
u	53° 17.0'N	105° 32.0'W	
v	53° 43.0'N	105° 17.0'W	

Centers of north and south KA grids:

North	55° 52.5'N	98° 31.5'W
South	53° 51.5'N	104° 48.6'W

Other locations:

NOAA radar	55° 56.0'N	98° 36.8'W

6. Observations

6.1 Data Notes

None given.

6.2 Field Notes

None given.

7. Data Description

7.1 Spatial Characteristics

Defined by flight pattern, leg length, etc. These values are contained in each archived set of numbers for each pass or segment.

7.1.1 Spatial Coverage

The majority of the data were collected over the BOREAS SSA and NSA.

The North American Datum of 1983 (NAD83) corner coordinates of the SSA are:

	Latitude	Longitude
Northwest	54.321° N	106.228° W
Northeast	54.225° N	104.237° W
Southwest	53.515° N	106.321° W
Southeast	53.420° N	104.368° W

The NAD83 corner coordinates of the NSA are:

	Latitude	Longitude
Northwest	56.249° N	98.825° W
Northeast	56.083° N	97.234° W
Southwest	55.542° N	99.045° W
Southeast	55.379° N	97.489° W

7.1.2 Spatial Coverage Map

Data were collected over the northern and southern study areas of BOREAS, and along a transect between them.

7.1.3 Spatial Resolution

The fluxes and statistics archived here are for passes or segments of passes between predefined waypoints, as part of various flight patterns (see Section 5). The shortest times for such passes/segments are about 2 min, i.e., about 10 km. Thus, the spatial resolution is about 10 km or greater. For the grid patterns (GS, GN), the passes are each 32 km in length. The Candle Lake (CS) runs were divided into two segments, one over the relatively homogeneous OA area surrounding the OA flux tower (east end of CL run), and the other over the area at the west end of the run dominated by black spruce. Each long leg of the regional transects (RT) was segmented into 180-second segments, each overlapping the adjoining two segments by 50%.

7.1.4 Projection

Not applicable.

7.1.5 Grid Description

Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

Times of data collection are given in the table below. See Section 5 for flight pattern descriptions.

Summary of UW King Air research flights for BOREAS 1994

Date	Start	End	Hrs	Weather	Description and comments
940525	1745	2000	2.9	5-10% sct cu	CS, 2 rts a-h, 300 agl FS, first a-h with FE
940526	1646	1905	3.0	ci, small % cu	GS, full rt, 300 agl
940531	1645	1929	3.6	cu incr 10-40% sharp jump Zi	FS, 300 agl with FT PS, using W,E ends FK grid at 200 agl, 2500 and 3400 msl FS, a-d, 300 agl, with FE
940601	630	1802	2.4	H, ci, cist sct cu < 1%	LS, j-i-h-i-j, 200 agl CS, one rt d-a-d, 200 agl
940604	1616	1919	3.8	clr then cu incr rapidly, end ovc	CS, mult passes 200 agl, 3000 msl FS, d-a, 200 agl, with FL
940606	1546	1809	3.1	cu < 5%	LS, mult h-i-j, 200 agl-2900 msl
940607	1447	1649	4.8	clr entire pattern	RT, a-h-k-l-m, 200 agl
	1649	1904		clr entire pattern	GN, full rt, all 300 agl, EW lines
940608	1520	1742	2.9	clr	LN, mult t-o at 200 agl, 2100 msl FN, m-o, 300 agl with FT
940610	1642	1901	3.0	sct ci, K all sky	GN, full rt, 200 agl, NS lines
940611	1646	1844	2.6	K, cu to 80%, RW-	RT, o-m-l-k-h-a, 200 agl
940720	1656	2044	4.4	H, K, cu 10-50%	CS, a-d, 300 agl to 4800 msl (co-ord with FE) FS, two a-d, 300 agl with FE
940721	1652	1905	3.0	clr?	GS, full rt, 200 agl, NS lines FS, one run SW of grid with FT
940723	1528	1800	3.2	clr, incr to 20% cu	CS, mult a-d at 200 agl, 3500 msl
940724	1655	1943	3.4	clr over site	GS, full rt, 200 agl, EW lines
940725	1519	1753	3.2	clr	CS, mult a-d at 200 agl, 3000 msl
940726	1628	1832	2.7	K, ci	RT, a-h-k-l-m-o, 200 agl
940727	1609	1909	4.3	K, altocu, cu	GN, full rt 200 agl, NS lines TN (mult) at radar, 500-1000 agl
940728	1620	1810	2.6	K, ci	HN(GN) time-centered m-o, 200 agl, 1800 and 2700 msl
940731	1550	1859	3.7	K, clr above	GN

Date	Start	End	Hrs	Weather	Description and comments
940831	1720	1938	2.9	K, cu <1 to 40%	GN, full rt, 200 agl, EW lines
940901	1550	1717	1.9	clr above K	FN, rt 200 agl, with FT FN, rt 200 agl, diff TAS than FT LN, o-m-o-m-o, 200 agl
940903	1548	1811	3.0	ci, K, cu 0-10%	GN, full rt, 200 agl, EW lines
940906	1605	1833	2.9	cu 20-80%	GN, full rt, 200 agl, NS lines
940908	1606	1823	2.8	acu, ci, cist, ci ovc	RT, o-m-l-k-h-a, 200 agl
940909	1940	2131	2.7	ci, cist thinning	CS, mult 200 agl-2600 msl, with FE FS, 300 agl, with FE
940912	1735	2004	3.6	cu incr 0-30%	CS, 3 rts, all 200 agl Test = 3 rt over OA area of CS
940913	1645	1905	3.4	clr, then cist and ci	GS, full rt, 200 agl, EW lines Test = wind "L" at 8500 msl
940916	1653	1914	4.8	clr	GS, full rt, NS lines, 200 agl
	1925	2053		clr then <5% cu	CS, d-a mult lvls, with FE FS, second a-d with FE, 600 agl
940917	1712	1902	2.4	clr, thin ci to W	FS, one end=a, 200 agl, with FT CS, a-d, two rts, 200 agl

Abbreviations used in weather notes in table:

cu	cumulus
st	status
ci	cirrus
sct	scattered
Zi	inversion height above ground
H	haze
K	smoke
cist	cirrostratus
clr	clear
ovc	overcast
RW-	light rain showers
acu	altocumulus

Abbreviations in flight descriptions:

rt	round trip
agl	above ground level (in feet)
msl	above mean sea level (in feet)
mult	multiple
TAS	true airspeed
lvl	level
wind	"L" "L" with one leg parallel to wind direction, flown as at least one round trip

7.2.2 Temporal Coverage Map

See Section 7.2.1.

7.2.3 Temporal Resolution

See Section 7.2.1. Also, each archived data entry contains the start and end times for the pass/segment being summarized.

7.3 Data Characteristics

7.3.1 Parameter/Variable

The parameters contained in the aircraft flux data over the NSA and SSA and moving window data from the Transect files on the CD-ROM are:

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          Column Name
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SPATIAL_COVERAGE
RUN_START_DATE
RUN_START_TIME
RUN_END_DATE
RUN_END_TIME
FLUX_MISSION_DESIGNATOR
FLUX_MISSION_NUM
FLUX_PASS_NUM
FLUX_SEGMENT_NUM
START_LATITUDE
START_LONGITUDE
END_LATITUDE
END_LONGITUDE
START_BOREAS_X
START_BOREAS_Y
END_BOREAS_X
END_BOREAS_Y
HEADING
MEAN_PRESS_ALTITUDE
MEAN_RADAR_ALTITUDE
MEAN_WIND_DIR
MEAN_WIND_SPEED
MEAN_AIR_TEMP
MEAN_POTNTL_TEMP
MEAN_H2O_MIX_RATIO
MEAN_U_COMPNT_WIND_VELOC
MEAN_V_COMPNT_WIND_VELOC
MEAN_STATIC_PRESS
MEAN_SURF_RAD_TEMP
MEAN_DOWN_TOTAL_RAD
MEAN_UP_TOTAL_RAD
MEAN_DOWN_LONGWAVE_RAD
MEAN_UP_LONGWAVE_RAD
MEAN_NET_RAD
MEAN_UP_PPFD
MEAN_DOWN_PPFD
MEAN_AUX_RAD
MEAN_GREEN_INDEX
MEAN_CO2_CONC
```

MEAN_O3_CONC
MEAN_CH4_CONC
MEAN_SAT_SIM_CH1
MEAN_SAT_SIM_CH2
MEAN_SAT_SIM_CH3
MEAN_SAT_SIM_CH4
SDEV_AIR_TEMP
SDEV_POTNTL_TEMP
SDEV_H2O_MIX_RATIO
SDEV_U_COMPNT_WIND_VELOC
SDEV_V_COMPNT_WIND_VELOC
SDEV_STATIC_PRESS
SDEV_SURF_RAD_TEMP
SDEV_DOWN_TOTAL_RAD
SDEV_UP_TOTAL_RAD
SDEV_DOWN_LONGWAVE_RAD
SDEV_UP_LONGWAVE_RAD
SDEV_NET_RAD
SDEV_UP_PPFD
SDEV_DOWN_PPFD
SDEV_AUX_RAD
SDEV_GREEN_INDEX
SDEV_CO2_CONC
SDEV_O3_CONC
SDEV_CH4_CONC
SDEV_SAT_SIM_CH1
SDEV_SAT_SIM_CH2
SDEV_SAT_SIM_CH3
SDEV_SAT_SIM_CH4
TREND_AIR_TEMP
TREND_POTNTL_TEMP
TREND_H2O_MIX_RATIO
TREND_U_COMPNT_WIND_VELOC
TREND_V_COMPNT_WIND_VELOC
TREND_STATIC_PRESS
TREND_SURF_RAD_TEMP
TREND_DOWN_TOTAL_RAD
TREND_UP_TOTAL_RAD
TREND_DOWN_LONGWAVE_RAD
TREND_UP_LONGWAVE_RAD
TREND_GREEN_INDEX
TREND_CO2_CONC
TREND_O3_CONC
TREND_CH4_CONC
SDEV_VERT_GUST_RAW
SDEV_U_COMPNT_WIND_VELOC_RAW
SDEV_V_COMPNT_WIND_VELOC_RAW
SDEV_ALONG_WIND_RAW
SDEV_CROSS_WIND_RAW
SDEV_POTNTL_TEMP_RAW
SDEV_H2O_MIX_RATIO_RAW
SDEV_CO2_MIX_RATIO_RAW
SDEV_O3_CONC_RAW
SDEV_CH4_CONC_RAW

SKEW_VERT_GUST_RAW
SKEW_U_COMPNT_WIND_VELOC_RAW
SKEW_V_COMPNT_WIND_VELOC_RAW
SKEW_ALONG_WIND_RAW
SKEW_CROSS_WIND_RAW
SKEW_POTNTL_TEMP_RAW
SKEW_H2O_MIX_RATIO_RAW
SKEW_CO2_MIX_RATIO
SKEW_O3_CONC_RAW
SKEW_CH4_CONC_RAW
KURT_VERT_GUST_RAW
KURT_U_COMPNT_WIND_VELOC_RAW
KURT_V_COMPNT_WIND_VELOC_RAW
KURT_ALONG_WIND_RAW
KURT_CROSS_WIND_RAW
KURT_POTNTL_TEMP_RAW
KURT_H2O_MIX_RATIO_RAW
KURT_CO2_MIX_RATIO_RAW
KURT_O3_CONC_RAW
KURT_CH4_CONC_RAW
CORC_VERT_U_WIND_COMPNT_RAW
CORC_VERT_V_WIND_COMPNT_RAW
CORC_VERT_ALONG_WIND_RAW
CORC_VERT_CROSS_WIND_RAW
CORC_VERT_POTNTL_TEMP_RAW
CORC_VERT_H2O_MIX_RATIO_RAW
CORC_VERT_CO2_MIX_RATIO_RAW
CORC_VERT_O3_CONC_RAW
CORC_VERT_CH4_CONC_RAW
CORC_POTNTL_H2O_MIX_RATIO_RAW
MMNTM_FLUX_V_WIND_COMPNT_RAW
MMNTM_FLUX_U_WIND_COMPNT_RAW
MMNTM_FLUX_ALONG_MEAN_WIND_RAW
MMNTM_FLUX_CROSS_MEAN_WIND_RAW
SENSIBLE_HEAT_FLUX_RAW
LATENT_HEAT_FLUX_RAW
CO2_FLUX_RAW
O3_FLUX_RAW
O3_DEPOSITION_VELOC_RAW
CH4_FLUX_RAW
AIR_DENSITY_CONSTANT
SPECIFIC_HEAT_CONSTANT
LATENT_HEAT_VAP_CONSTANT
DRY_AIR_GAS_CONSTANT
SDEV_VERT_GUST_DET
SDEV_U_COMPNT_WIND_VELOC_DET
SDEV_V_COMPNT_WIND_VELOC_DET
SDEV_ALONG_WIND_DET
SDEV_CROSS_WIND_DET
SDEV_POTNTL_TEMP_DET
SDEV_H2O_MIX_RATIO_DET
SDEV_CO2_MIX_RATIO
SDEV_O3_CONC_DET
SDEV_CH4_CONC_DET

SKEW_VERT_GUST_DET
SKEW_U_COMPNT_WIND_VELOC_DET
SKEW_V_COMPNT_WIND_VELOC_DET
SKEW_ALONG_WIND_DET
SKEW_CROSS_WIND_DET
SKEW_POTNTL_TEMP_DET
SKEW_H2O_MIX_RATIO_DET
SKEW_CO2_MIX_RATIO_DET
SKEW_O3_CONC_DET
SKEW_CH4_CONC_DET
KURT_VERT_GUST_DET
KURT_U_COMPNT_WIND_VELOC_DET
KURT_V_COMPNT_WIND_VELOC_DET
KURT_ALONG_WIND_DET
KURT_CROSS_WIND_DET
KURT_POTNTL_TEMP_DET
KURT_H2O_MIX_RATIO_DET
KURT_CO2_MIX_RATIO_DET
KURT_O3_CONC_DET
KURT_CH4_CONC_DET
CORC_VERT_U_WIND_COMPNT_DET
CORC_VERT_V_WIND_COMPNT_DET
CORC_VERT_ALONG_WIND_DET
CORC_VERT_CROSS_WIND_DET
CORC_VERT_POTNTL_TEMP_DET
CORC_VERT_H2O_MIX_RATIO_DET
CORC_VERT_CO2_MIX_RATIO_DET
CORC_VERT_O3_CONC_DET
CORC_VERT_CH4_CONC_DET
CORC_POTNTL_H2O_MIX_RATIO_DET
MMNTM_FLUX_U_WIND_COMPNT_DET
MMNTM_FLUX_V_WIND_COMPNT_DET
MMNTM_FLUX_ALONG_MEAN_WIND_DET
MMNTM_FLUX_CROSS_MEAN_WIND_DET
SENSIBLE_HEAT_FLUX_DET
LATENT_HEAT_FLUX_DET
CO2_FLUX_DET
O3_FLUX_DET
O3_DEPOSITION_VELOC_DET
CH4_FLUX_DET
CRTFCN_CODE
REVISION_DATE

7.3.2 Variable Description/Definition

The descriptions of the parameters contained in the aircraft flux data over the NSA and SSA and moving window data from the Transect files on the CD-ROM are:

Column Name	Description
SPATIAL_COVERAGE	The general term used to denote the spatial area over which the data were collected.
RUN_START_DATE	The date in GMT at the beginning of the segment (or pass if not segmented) in the form DD-MON-YY.
RUN_START_TIME	The time in GMT at the beginning of the segment (or pass if not segmented).
RUN_END_DATE	The date in GMT at the end of the segment (or pass if not segmented) in the form DD-MON-YY.
RUN_END_TIME	The time in GMT at the end of the segment (or pass if not segmented).
FLUX_MISSION_DESIGNATOR	The two-letter mission identifier used to identify the type of mission being flown, where GS or GN=grids and stacks, CS=Candle Lake runs, TS or TN=site-specific runs, RT=transects, LS or LN=mini- or meso-transects, PS or PN=Budget Box pattern, HS or HN=stacks and tees, FS or FN=flights of two for intercomparison, ZS=low-level routes, and XX=not standard.
FLUX_MISSION_NUM	The sequential number for all missions flown on a given day starting at 1.
FLUX_PASS_NUM	The sequential pass number within a mission starting at 1.
FLUX_SEGMENT_NUM	The segment number within the current pass starting at 1 or given as 0 if pass is not segmented.
START_LATITUDE	The NAD83 based latitude coordinate at the start of the measurement set.
START_LONGITUDE	The NAD83 based longitude coordinate at the start of the measurement set.
END_LATITUDE	The NAD83 based latitude coordinate at the end of the measurement set.
END_LONGITUDE	The NAD83 based longitude coordinate at the end of the measurement set.
START_BOREAS_X	The x component of the BOREAS grid coordinate at the start of the measurement set.
START_BOREAS_Y	The y component of the BOREAS grid coordinate at the start of the measurement set.
END_BOREAS_X	The x component of the BOREAS grid coordinate at the end of the measurement set.
END_BOREAS_Y	The y component of the BOREAS grid coordinate at the end of the measurement set.
HEADING	The aircraft heading.
MEAN_PRESS_ALTITUDE	The mean pressure altitude.
MEAN_RADAR_ALTITUDE	The mean radar altitude.
MEAN_WIND_DIR	The mean direction from which the wind was traveling, increasing in a clockwise direction from the north for the given time over the period defined by the start and end dates.

MEAN_WIND_SPEED	The mean wind speed for the given time over the period defined by the start and end dates.
MEAN_AIR_TEMP	The mean air temperature.
MEAN_POTNTL_TEMP	The mean potential temperature.
MEAN_H2O_MIX_RATIO	The mean water vapor mixing ratio.
MEAN_U_COMPNT_WIND_VELOC	The mean westerly vector component of the wind speed and wind direction.
MEAN_V_COMPNT_WIND_VELOC	The mean southerly vector component of the wind speed and wind direction.
MEAN_STATIC_PRESS	The mean static pressure.
MEAN_SURF_RAD_TEMP	The mean surface radiative temperature.
MEAN_DOWN_TOTAL_RAD	The mean downwelling total radiation.
MEAN_UP_TOTAL_RAD	The mean upwelling total radiation.
MEAN_DOWN_LONGWAVE_RAD	The mean downward longwave radiation.
MEAN_UP_LONGWAVE_RAD	The mean upwelling longwave radiation.
MEAN_NET_RAD	The mean net radiation.
MEAN_UP_PPFD	The mean upward photosynthetic photon flux density.
MEAN_DOWN_PPFD	The mean downward photosynthetic photon flux density.
MEAN_AUX_RAD	The mean measurement from the auxiliary radiation sensor.
MEAN_GREEN_INDEX	The mean greenness index.
MEAN_CO2_CONC	The mean carbon dioxide concentration.
MEAN_O3_CONC	The mean ozone concentration.
MEAN_CH4_CONC	The mean methane concentration.
MEAN_SAT_SIM_CH1	The mean channel 1 satellite simulator.
MEAN_SAT_SIM_CH2	The mean channel 2 satellite simulator.
MEAN_SAT_SIM_CH3	The mean channel 3 satellite simulator.
MEAN_SAT_SIM_CH4	The mean channel 4 satellite simulator.
SDEV_AIR_TEMP	The standard deviation of the air temperature.
SDEV_POTNTL_TEMP	The standard deviation of potential temperature.
SDEV_H2O_MIX_RATIO	The standard deviation of the water vapor mixing ratio.
SDEV_U_COMPNT_WIND_VELOC	The standard deviation of the westerly vector component of the wind speed and wind direction.
SDEV_V_COMPNT_WIND_VELOC	The standard deviation of the southerly vector component of the wind speed and wind direction.
SDEV_STATIC_PRESS	The standard deviation of the static pressure.
SDEV_SURF_RAD_TEMP	The standard deviation of the surface radiative temperature.
SDEV_DOWN_TOTAL_RAD	The standard deviation of downwelling total radiation.
SDEV_UP_TOTAL_RAD	The standard deviation of upwelling total radiation.
SDEV_DOWN_LONGWAVE_RAD	The standard deviation of the downward longwave radiation.
SDEV_UP_LONGWAVE_RAD	The standard deviation of upwelling longwave radiation.
SDEV_NET_RAD	The standard deviation of the mean net radiation.
SDEV_UP_PPFD	The standard deviation of the upward photosynthetic photon flux density.
SDEV_DOWN_PPFD	The standard deviation of the downward photosynthetic photon flux density.

SDEV_AUX_RAD	The standard deviation of the measurements from the auxiliary radiation sensor.
SDEV_GREEN_INDEX	The standard deviation of greenness index.
SDEV_CO2_CONC	The standard deviation of the CO2 concentration.
SDEV_O3_CONC	The standard deviation of the ozone concentration.
SDEV_CH4_CONC	The standard deviation of CH4 concentration.
SDEV_SAT_SIM_CH1	The standard deviation of the channel 1 satellite simulator values.
SDEV_SAT_SIM_CH2	The standard deviation of channel 2 satellite simulator values.
SDEV_SAT_SIM_CH3	The standard deviation of channel 3 satellite simulator values.
SDEV_SAT_SIM_CH4	The standard deviation of channel 4 satellite simulator values.
TREND_AIR_TEMP	The trend in air temperature.
TREND_POTNTL_TEMP	The trend in potential temperature.
TREND_H2O_MIX_RATIO	The trend in water vapor mixing ratio.
TREND_U_COMPNT_WIND_VELOC	The trend in the westerly vector component of the wind speed and wind direction.
TREND_V_COMPNT_WIND_VELOC	The trend in the southerly vector component of the wind speed and wind direction.
TREND_STATIC_PRESS	The trend in static pressure.
TREND_SURF_RAD_TEMP	The trend in surface radiative temperature.
TREND_DOWN_TOTAL_RAD	The trend in the downwelling total radiation.
TREND_UP_TOTAL_RAD	The trend in the upwelling total radiation.
TREND_DOWN_LONGWAVE_RAD	The trend in the downwelling longwave radiation.
TREND_UP_LONGWAVE_RAD	The trend in the upwelling longwave radiation.
TREND_GREEN_INDEX	The trend in the greenness index.
TREND_CO2_CONC	The trend in the carbon dioxide concentration.
TREND_O3_CONC	The trend in the ozone concentration.
TREND_CH4_CONC	The trend in the methane concentration.
SDEV_VERT_GUST_RAW	The standard deviation of the raw vertical gust.
SDEV_U_COMPNT_WIND_VELOC_RAW	The standard deviation of the raw westerly wind component.
SDEV_V_COMPNT_WIND_VELOC_RAW	The standard deviation of the raw southerly wind component.
SDEV_ALONG_WIND_RAW	The standard deviation of the raw along wind component.
SDEV_CROSS_WIND_RAW	The standard deviation of the raw cross wind component.
SDEV_POTNTL_TEMP_RAW	The standard deviation of the raw potential temperature.
SDEV_H2O_MIX_RATIO_RAW	The standard deviation of the raw water vapor mixing ratio.
SDEV_CO2_MIX_RATIO_RAW	The standard deviation of the raw carbon dioxide mixing ratio.
SDEV_O3_CONC_RAW	The standard deviation of the raw ozone concentration.
SDEV_CH4_CONC_RAW	The standard deviation of the raw methane concentration.
SKEW_VERT_GUST_RAW	The skewness of the raw vertical gust.
SKEW_U_COMPNT_WIND_VELOC_RAW	The skewness of the raw westerly wind component.
SKEW_V_COMPNT_WIND_VELOC_RAW	The skewness of the raw southerly wind component.

SKEW_ALONG_WIND_RAW	The skewness of the raw along wind component.
SKEW_CROSS_WIND_RAW	The skewness of the raw cross wind component.
SKEW_POTNTL_TEMP_RAW	The skewness of the raw potential temperature.
SKEW_H2O_MIX_RATIO_RAW	The skewness of the raw water vapor mixing ratio.
SKEW_CO2_MIX_RATIO	The skewness of the raw carbon dioxide mixing ratio.
SKEW_O3_CONC_RAW	The skewness of the raw ozone concentration.
SKEW_CH4_CONC_RAW	The skewness of the raw methane concentration.
KURT_VERT_GUST_RAW	The kurtosis of the raw vertical gust.
KURT_U_COMPNT_WIND_VELOC_RAW	The kurtosis of the raw westerly wind component.
KURT_V_COMPNT_WIND_VELOC_RAW	The kurtosis of the raw southerly wind component.
KURT_ALONG_WIND_RAW	The kurtosis of the raw along wind component.
KURT_CROSS_WIND_RAW	The kurtosis of the raw cross wind component.
KURT_POTNTL_TEMP_RAW	The kurtosis of the raw potential temperature.
KURT_H2O_MIX_RATIO_RAW	The kurtosis of the raw water vapor mixing ratio.
KURT_CO2_MIX_RATIO_RAW	The kurtosis of the raw carbon dioxide mixing ratio.
KURT_O3_CONC_RAW	The kurtosis of the raw ozone concentration.
KURT_CH4_CONC_RAW	The kurtosis of the raw methane concentration.
CORC_VERT_U_WIND_COMPNT_RAW	The correlation coefficient of the raw vertical gust/westerly wind component pair.
CORC_VERT_V_WIND_COMPNT_RAW	The correlation coefficient of the raw vertical gust/southerly wind component pair.
CORC_VERT_ALONG_WIND_RAW	The correlation coefficient of the raw vertical gust/along wind component pair.
CORC_VERT_CROSS_WIND_RAW	The correlation coefficient of the raw vertical gust/cross wind component pair.
CORC_VERT_POTNTL_TEMP_RAW	The correlation coefficient of the raw vertical gust/potential temperature pair.
CORC_VERT_H2O_MIX_RATIO_RAW	The correlation coefficient of the raw vertical gust/water vapor mixing ratio pair.
CORC_VERT_CO2_MIX_RATIO_RAW	The correlation coefficient of the raw vertical gust/carbon dioxide mixing ratio pair.
CORC_VERT_O3_CONC_RAW	The correlation coefficient of the raw vertical gust/ozone concentration pair.
CORC_VERT_CH4_CONC_RAW	The correlation coefficient of the vertical gust /methane concentration pair.
CORC_POTNTL_H2O_MIX_RATIO_RAW	The correlation coefficient of the raw potential temperature/water vapor mixing ratio pair.
MMNTM_FLUX_V_WIND_COMPNT_RAW	The momentum flux using the raw southerly wind component.
MMNTM_FLUX_U_WIND_COMPNT_RAW	The momentum flux using the raw westerly wind component.
MMNTM_FLUX_ALONG_MEAN_WIND_RAW	The momentum flux using the raw along mean wind component.
MMNTM_FLUX_CROSS_MEAN_WIND_RAW	The momentum flux using the raw across mean wind component.
SENSIBLE_HEAT_FLUX_RAW	The raw sensible heat flux.
LATENT_HEAT_FLUX_RAW	The raw latent heat flux.
CO2_FLUX_RAW	The raw carbon dioxide flux.
O3_FLUX_RAW	The raw ozone flux.
O3_DEPOSITION_VELOC_RAW	The raw ozone deposition velocity.
CH4_FLUX_RAW	The raw methane flux.
AIR_DENSITY_CONSTANT	The constant used for air density in the flux

	calculations.
SPECIFIC_HEAT_CONSTANT	The constant used for specific heat at constant pressure in the flux calculations.
LATENT_HEAT_VAP_CONSTANT	The constant used for latent heat of vaporization in the flux calculations.
DRY_AIR_GAS_CONSTANT	The dry air gas constant used in the flux calculations.
SDEV_VERT_GUST_DET	The standard deviation of the detrended vertical gust.
SDEV_U_COMPNT_WIND_VELOC_DET	The standard deviation of the detrended westerly wind component.
SDEV_V_COMPNT_WIND_VELOC_DET	The standard deviation of the detrended southerly wind component.
SDEV_ALONG_WIND_DET	The standard deviation of the detrended along wind component.
SDEV_CROSS_WIND_DET	The standard deviation of the detrended cross wind component.
SDEV_POTNTL_TEMP_DET	The standard deviation of the detrended potential temperature.
SDEV_H2O_MIX_RATIO_DET	The standard deviation of the detrended water vapor mixing ratio.
SDEV_CO2_MIX_RATIO	The standard deviation of the detrended carbon dioxide mixing ratio.
SDEV_O3_CONC_DET	The standard deviation of the detrended ozone concentration.
SDEV_CH4_CONC_DET	The standard deviation of the detrended methane concentration.
SKEW_VERT_GUST_DET	The skewness of the detrended vertical gust.
SKEW_U_COMPNT_WIND_VELOC_DET	The skewness of the detrended westerly wind component.
SKEW_V_COMPNT_WIND_VELOC_DET	The skewness of the detrended southerly wind component.
SKEW_ALONG_WIND_DET	The skewness of the detrended along wind component.
SKEW_CROSS_WIND_DET	The skewness of the detrended cross wind component.
SKEW_POTNTL_TEMP_DET	The skewness of the detrended potential temperature.
SKEW_H2O_MIX_RATIO_DET	The skewness of the detrended water vapor mixing ratio.
SKEW_CO2_MIX_RATIO_DET	The skewness of the detrended carbon dioxide mixing ratio.
SKEW_O3_CONC_DET	The skewness of the detrended ozone concentration.
SKEW_CH4_CONC_DET	The skewness of the detrended methane concentration.
KURT_VERT_GUST_DET	The kurtosis of the detrended vertical gust.
KURT_U_COMPNT_WIND_VELOC_DET	The kurtosis of the detrended westerly wind component.
KURT_V_COMPNT_WIND_VELOC_DET	The kurtosis of the detrended southerly wind component.
KURT_ALONG_WIND_DET	The kurtosis of the detrended along wind component.
KURT_CROSS_WIND_DET	The kurtosis of the detrended cross wind

	component.
KURT_POTNTL_TEMP_DET	The kurtosis of the detrended potential temperature.
KURT_H2O_MIX_RATIO_DET	The kurtosis of the detrended water vapor mixing ratio.
KURT_CO2_MIX_RATIO_DET	The kurtosis of the detrended carbon dioxide mixing ratio.
KURT_O3_CONC_DET	The kurtosis of the detrended ozone concentration.
KURT_CH4_CONC_DET	The kurtosis of the detrended methane concentration.
CORC_VERT_U_WIND_COMPNT_DET	The correlation coefficient of the detrended vertical gust/westerly wind component pair.
CORC_VERT_V_WIND_COMPNT_DET	The correlation coefficient of the detrended vertical gust/southerly wind component pair.
CORC_VERT_ALONG_WIND_DET	The correlation coefficient of the detrended vertical gust/along wind component pair.
CORC_VERT_CROSS_WIND_DET	The correlation coefficient of the detrended vertical gust/cross wind component pair.
CORC_VERT_POTNTL_TEMP_DET	The correlation coefficient of the detrended vertical gust/potential temperature pair.
CORC_VERT_H2O_MIX_RATIO_DET	The correlation coefficient of the detrended vertical gust/water vapor mixing ratio pair.
CORC_VERT_CO2_MIX_RATIO_DET	The correlation coefficient of the detrended vertical gust/carbon dioxide mixing ratio pair.
CORC_VERT_O3_CONC_DET	The correlation coefficient of the detrended vertical gust/ozone concentration pair.
CORC_VERT_CH4_CONC_DET	The correlation coefficient of the detrended vertical gust/methane concentration pair.
CORC_POTNTL_H2O_MIX_RATIO_DET	The correlation coefficient of the detrended potential temperature/water vapor mixing ratio pair.
MMNTM_FLUX_U_WIND_COMPNT_DET	The momentum flux using the detrended westerly wind component.
MMNTM_FLUX_V_WIND_COMPNT_DET	The momentum flux using the detrended southerly wind component.
MMNTM_FLUX_ALONG_MEAN_WIND_DET	The momentum flux using the detrended along mean wind component.
MMNTM_FLUX_CROSS_MEAN_WIND_DET	The momentum flux using the detrended across mean wind component.
SENSIBLE_HEAT_FLUX_DET	The detrended sensible heat flux.
LATENT_HEAT_FLUX_DET	The detrended latent heat flux.
CO2_FLUX_DET	The detrended carbon dioxide flux.
O3_FLUX_DET	The detrended ozone flux.
O3_DEPOSITION_VELOC_DET	The detrended ozone deposition velocity.
CH4_FLUX_DET	The detrended methane flux.
CRTFCN_CODE	The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable).
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.

7.3.3 Unit of Measurement

The measurement units for the parameters contained in the aircraft flux data over the NSA and SSA and moving window data from the Transect files on the CD-ROM are:

Column Name	Units
SPATIAL_COVERAGE	[none]
RUN_START_DATE	[DD-MON-YY]
RUN_START_TIME	[HHMMSS GMT]
RUN_END_DATE	[DD-MON-YY]
RUN_END_TIME	[HHMMSS GMT]
FLUX_MISSION_DESIGNATOR	[none]
FLUX_MISSION_NUM	[unitless]
FLUX_PASS_NUM	[unitless]
FLUX_SEGMENT_NUM	[unitless]
START_LATITUDE	[degrees]
START_LONGITUDE	[degrees]
END_LATITUDE	[degrees]
END_LONGITUDE	[degrees]
START_BOREAS_X	[kilometers]
START_BOREAS_Y	[kilometers]
END_BOREAS_X	[kilometers]
END_BOREAS_Y	[kilometers]
HEADING	[degrees]
MEAN_PRESS_ALTITUDE	[meters]
MEAN_RADAR_ALTITUDE	[meters]
MEAN_WIND_DIR	[degrees]
MEAN_WIND_SPEED	[meters][second^-1]
MEAN_AIR_TEMP	[degrees Celsius]
MEAN_POTNTL_TEMP	[degrees Kelvin]
MEAN_H2O_MIX_RATIO	[grams of water vapor][kilogram dry air^-1]
MEAN_U_COMPNT_WIND_VELOC	[meters][second^-1]
MEAN_V_COMPNT_WIND_VELOC	[meters][second^-1]
MEAN_STATIC_PRESS	[kiloPascals]
MEAN_SURF_RAD_TEMP	[degrees Celsius]
MEAN_DOWN_TOTAL_RAD	[Watts][meter^-2]
MEAN_UP_TOTAL_RAD	[Watts][meter^-2]
MEAN_DOWN_LONGWAVE_RAD	[Watts][meter^-2]
MEAN_UP_LONGWAVE_RAD	[Watts][meter^-2]
MEAN_NET_RAD	[Watts][meter^-2]
MEAN_UP_PPFD	[microEinsteins][meter^-2][second^-1]
MEAN_DOWN_PPFD	[microEinsteins][meter^-2][second^-1]
MEAN_AUX_RAD	[Watts][meter^-2]
MEAN_GREEN_INDEX	[unitless]
MEAN_CO2_CONC	[micromoles CO2][mole air^-1]
MEAN_O3_CONC	[nanomoles O3][mole air^-1]
MEAN_CH4_CONC	[nanomoles CH4][mole air^-1]
MEAN_SAT_SIM_CH1	[unitless]
MEAN_SAT_SIM_CH2	[unitless]
MEAN_SAT_SIM_CH3	[unitless]
MEAN_SAT_SIM_CH4	[unitless]
SDEV_AIR_TEMP	[degrees Celsius]
SDEV_POTNTL_TEMP	[degrees Kelvin]
SDEV_H2O_MIX_RATIO	[grams of water vapor][kilogram dry air^-1]

SDEV_U_COMPNT_WIND_VELOC	[meters][second^-1]
SDEV_V_COMPNT_WIND_VELOC	[meters][second^-1]
SDEV_STATIC_PRESS	[kiloPascals]
SDEV_SURF_RAD_TEMP	[degrees Celsius]
SDEV_DOWN_TOTAL_RAD	[Watts][meter^-2]
SDEV_UP_TOTAL_RAD	[Watts][meter^-2]
SDEV_DOWN_LONGWAVE_RAD	[Watts][meter^-2]
SDEV_UP_LONGWAVE_RAD	[Watts][meter^-2]
SDEV_NET_RAD	[Watts][meter^-2]
SDEV_UP_PPFD	[microEinsteins][meter^-2][second^-1]
SDEV_DOWN_PPFD	[microEinsteins][meter^-2][second^-1]
SDEV_AUX_RAD	[unitless]
SDEV_GREEN_INDEX	[unitless]
SDEV_CO2_CONC	[micromoles CO2][mole air^-1]
SDEV_O3_CONC	[nanomoles O3][mole air^-1]
SDEV_CH4_CONC	[nanomoles CH4][mole air^-1]
SDEV_SAT_SIM_CH1	[unitless]
SDEV_SAT_SIM_CH2	[unitless]
SDEV_SAT_SIM_CH3	[unitless]
SDEV_SAT_SIM_CH4	[unitless]
TREND_AIR_TEMP	[degrees Celsius][meter^-1]
TREND_POTNTL_TEMP	[degrees Kelvin][meter^-1]
TREND_H2O_MIX_RATIO	[grams of water vapor][kilogram dry air^-1][mete r^-1]
TREND_U_COMPNT_WIND_VELOC	[second^-1]
TREND_V_COMPNT_WIND_VELOC	[second^-1]
TREND_STATIC_PRESS	[kiloPascals][meter^-1]
TREND_SURF_RAD_TEMP	[degrees Celsius][meter^-1]
TREND_DOWN_TOTAL_RAD	[Watts][meter^-3]
TREND_UP_TOTAL_RAD	[Watts][meter^-3]
TREND_DOWN_LONGWAVE_RAD	[Watts][meter^-3]
TREND_UP_LONGWAVE_RAD	[Watts][meter^-3]
TREND_GREEN_INDEX	[meter^-1]
TREND_CO2_CONC	[micromoles CO2][mole air^-1][meter^-1]
TREND_O3_CONC	[nanomoles O3][mole air^-1][meter^-1]
TREND_CH4_CONC	[nanomoles CH4][mole air^-1][meter^-1]
SDEV_VERT_GUST_RAW	[meters][second^-1]
SDEV_U_COMPNT_WIND_VELOC_RAW	[meters][second^-1]
SDEV_V_COMPNT_WIND_VELOC_RAW	[meters][second^-1]
SDEV_ALONG_WIND_RAW	[meters][second^-1]
SDEV_CROSS_WIND_RAW	[meters][second^-1]
SDEV_POTNTL_TEMP_RAW	[degrees Kelvin]
SDEV_H2O_MIX_RATIO_RAW	[grams of water vapor][kilogram dry air^-1]
SDEV_CO2_MIX_RATIO_RAW	[unitless]
SDEV_O3_CONC_RAW	[nanomoles O3][mole air^-1]
SDEV_CH4_CONC_RAW	[nanomoles CH4][mole air^-1]
SKEW_VERT_GUST_RAW	[meters][second^-1]
SKEW_U_COMPNT_WIND_VELOC_RAW	[meters][second^-1]
SKEW_V_COMPNT_WIND_VELOC_RAW	[meters][second^-1]
SKEW_ALONG_WIND_RAW	[meters][second^-1]
SKEW_CROSS_WIND_RAW	[meters][second^-1]
SKEW_POTNTL_TEMP_RAW	[degrees Kelvin]
SKEW_H2O_MIX_RATIO_RAW	[grams of water vapor][kilogram dry air^-1]
SKEW_CO2_MIX_RATIO	[unitless]

SKEW_O3_CONC_RAW	[nanomoles O3][mole air^-1]
SKEW_CH4_CONC_RAW	[nanomoles CH4][mole air^-1]
KURT_VERT_GUST_RAW	[meters][second^-1]
KURT_U_COMPNT_WIND_VELOC_RAW	[meters][second^-1]
KURT_V_COMPNT_WIND_VELOC_RAW	[meters][second^-1]
KURT_ALONG_WIND_RAW	[meters][second^-1]
KURT_CROSS_WIND_RAW	[meters][second^-1]
KURT_POTNTL_TEMP_RAW	[degrees Kelvin]
KURT_H2O_MIX_RATIO_RAW	[grams of water vapor][kilogram dry air^-1]
KURT_CO2_MIX_RATIO_RAW	[unitless]
KURT_O3_CONC_RAW	[nanomoles O3][mole air^-1]
KURT_CH4_CONC_RAW	[nanomoles CH4][mole air^-1]
CORC_VERT_U_WIND_COMPNT_RAW	[meters^2][second^-2]
CORC_VERT_V_WIND_COMPNT_RAW	[meters^2][second^-2]
CORC_VERT_ALONG_WIND_RAW	[meters^2][second^-2]
CORC_VERT_CROSS_WIND_RAW	[meters^2][second^-2]
CORC_VERT_POTNTL_TEMP_RAW	[degrees Kelvin][meters][second^-1]
CORC_VERT_H2O_MIX_RATIO_RAW	[grams of water vapor][meters] [kilogram dry air^ -1][second^-1]
CORC_VERT_CO2_MIX_RATIO_RAW	[unitless]
CORC_VERT_O3_CONC_RAW	[nanomoles O3][meters][mole air^-1][second^-1]
CORC_VERT_CH4_CONC_RAW	[nanomoles CH4][meters][mole air^-1][second^-1]
CORC_POTNTL_H2O_MIX_RATIO_RAW	[grams of water vapor][degrees Kelvin] [kilogram dry air^-1]
MMNTM_FLUX_V_WIND_COMPNT_RAW	[Newtons][meter^-2]
MMNTM_FLUX_U_WIND_COMPNT_RAW	[Newtons][meter^-2]
MMNTM_FLUX_ALONG_MEAN_WIND_RAW	[Newtons][meter^-2]
MMNTM_FLUX_CROSS_MEAN_WIND_RAW	[Newtons][meter^-2]
SENSIBLE_HEAT_FLUX_RAW	[Watts][meter^-2]
LATENT_HEAT_FLUX_RAW	[Watts][meter^-2]
CO2_FLUX_RAW	[micromoles CO2][meter^-2][second^-1]
O3_FLUX_RAW	[nanomoles O3][meter^-2][second^-1]
O3_DEPOSITION_VELOC_RAW	[millimeters][second^-1]
CH4_FLUX_RAW	[nanomoles CH4][meter^-2][second^-1]
AIR_DENSITY_CONSTANT	[kilograms][meter^-3]
SPECIFIC_HEAT_CONSTANT	[Joules][kilogram^-1][degree Kelvin^-1]
LATENT_HEAT_VAP_CONSTANT	[Joules][kilogram^-1]
DRY_AIR_GAS_CONSTANT	[Joules][kilogram^-1][degree Kelvin^-1]
SDEV_VERT_GUST_DET	[meters][second^-1]
SDEV_U_COMPNT_WIND_VELOC_DET	[meters][second^-1]
SDEV_V_COMPNT_WIND_VELOC_DET	[meters][second^-1]
SDEV_ALONG_WIND_DET	[meters][second^-1]
SDEV_CROSS_WIND_DET	[meters][second^-1]
SDEV_POTNTL_TEMP_DET	[degrees Kelvin]
SDEV_H2O_MIX_RATIO_DET	[grams of water vapor][kilogram dry air^-1]
SDEV_CO2_MIX_RATIO	[unitless]
SDEV_O3_CONC_DET	[nanomoles O3][mole air^-1]
SDEV_CH4_CONC_DET	[nanomoles CH4][mole air^-1]
SKEW_VERT_GUST_DET	[meters][second^-1]
SKEW_U_COMPNT_WIND_VELOC_DET	[meters][second^-1]
SKEW_V_COMPNT_WIND_VELOC_DET	[meters][second^-1]
SKEW_ALONG_WIND_DET	[meters][second^-1]
SKEW_CROSS_WIND_DET	[meters][second^-1]
SKEW_POTNTL_TEMP_DET	[degrees Kelvin]

SKEW_H2O_MIX_RATIO_DET	[grams of water vapor][kilogram dry air^-1]
SKEW_CO2_MIX_RATIO_DET	[unitless]
SKEW_O3_CONC_DET	[nanomoles O3][mole air^-1]
SKEW_CH4_CONC_DET	[nanomoles CH4][mole air^-1]
KURT_VERT_GUST_DET	[meters][second^-1]
KURT_U_COMPNT_WIND_VELOC_DET	[meters][second^-1]
KURT_V_COMPNT_WIND_VELOC_DET	[meters][second^-1]
KURT_ALONG_WIND_DET	[meters][second^-1]
KURT_CROSS_WIND_DET	[meters][second^-1]
KURT_POTNTL_TEMP_DET	[degrees Kelvin]
KURT_H2O_MIX_RATIO_DET	[grams of water vapor][kilogram dry air^-1]
KURT_CO2_MIX_RATIO_DET	[unitless]
KURT_O3_CONC_DET	[nanomoles O3][mole air^-1]
KURT_CH4_CONC_DET	[nanomoles CH4][mole air^-1]
CORC_VERT_U_WIND_COMPNT_DET	[meters^2][second^-2]
CORC_VERT_V_WIND_COMPNT_DET	[meters^2][second^-2]
CORC_VERT_ALONG_WIND_DET	[meters^2][second^-2]
CORC_VERT_CROSS_WIND_DET	[meters^2][second^-2]
CORC_VERT_POTNTL_TEMP_DET	[degrees Kelvin][meters][second^-1]
CORC_VERT_H2O_MIX_RATIO_DET	[grams of water vapor][meters][kilogram dry air^-1][second^-1]
CORC_VERT_CO2_MIX_RATIO_DET	[unitless]
CORC_VERT_O3_CONC_DET	[nanomoles O3][meters][mole air^-1][second^-1]
CORC_VERT_CH4_CONC_DET	[nanomoles CH4][meters][mole air^-1][second^-1]
CORC_POTNTL_H2O_MIX_RATIO_DET	[grams of water vapor][degrees Kelvin][kilogram dry air^-1]
MMNTM_FLUX_U_WIND_COMPNT_DET	[Newtons][meter^-2]
MMNTM_FLUX_V_WIND_COMPNT_DET	[Newtons][meter^-2]
MMNTM_FLUX_ALONG_MEAN_WIND_DET	[Newtons][meter^-2]
MMNTM_FLUX_CROSS_MEAN_WIND_DET	[Newtons][meter^-2]
SENSIBLE_HEAT_FLUX_DET	[Watts][meter^-2]
LATENT_HEAT_FLUX_DET	[Watts][meter^-2]
CO2_FLUX_DET	[micromoles CO2][meter^-2][second^-1]
O3_FLUX_DET	[nanomoles O3][meter^-2][second^-1]
O3_DEPOSITION_VELOC_DET	[millimeters][second^-1]
CH4_FLUX_DET	[nanomoles CH4][meter^-2][second^-1]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

7.3.4 Data Source

The sources of the parameter values contained in both the aircraft flux data over the NSA and SSA and moving window data from the Transect on the CD-ROM are:

Column Name	Data Source
SPATIAL_COVERAGE	[Supplied by BORIS]
RUN_START_DATE	[Supplied by AFM-02]
RUN_START_TIME	[Supplied by AFM-02]
RUN_END_DATE	[Supplied by AFM-02]
RUN_END_TIME	[Supplied by AFM-02]
FLUX_MISSION_DESIGNATOR	[Supplied by AFM-02]
FLUX_MISSION_NUM	[Supplied by AFM-02]
FLUX_PASS_NUM	[Supplied by AFM-02]
FLUX_SEGMENT_NUM	[Supplied by AFM-02]
START_LATITUDE	[Supplied by AFM-02]
START_LONGITUDE	[Supplied by AFM-02]
END_LATITUDE	[Supplied by AFM-02]
END_LONGITUDE	[Supplied by AFM-02]
START_BOREAS_X	[Supplied by AFM-02]
START_BOREAS_Y	[Supplied by AFM-02]
END_BOREAS_X	[Supplied by AFM-02]
END_BOREAS_Y	[Supplied by AFM-02]
HEADING	[Supplied by AFM-02]
MEAN_PRESS_ALTITUDE	[Supplied by AFM-02]
MEAN_RADAR_ALTITUDE	[Supplied by AFM-02]
MEAN_WIND_DIR	[Supplied by AFM-02]
MEAN_WIND_SPEED	[Supplied by AFM-02]
MEAN_AIR_TEMP	[Supplied by AFM-02]
MEAN_POTNTL_TEMP	[Supplied by AFM-02]
MEAN_H2O_MIX_RATIO	[Supplied by AFM-02]
MEAN_U_COMPNT_WIND_VELOC	[Supplied by AFM-02]
MEAN_V_COMPNT_WIND_VELOC	[Supplied by AFM-02]
MEAN_STATIC_PRESS	[Supplied by AFM-02]
MEAN_SURF_RAD_TEMP	[Supplied by AFM-02]
MEAN_DOWN_TOTAL_RAD	[Supplied by AFM-02]
MEAN_UP_TOTAL_RAD	[Supplied by AFM-02]
MEAN_DOWN_LONGWAVE_RAD	[Supplied by AFM-02]
MEAN_UP_LONGWAVE_RAD	[Supplied by AFM-02]
MEAN_NET_RAD	[Supplied by AFM-02]
MEAN_UP_PPFD	[Supplied by AFM-02]
MEAN_DOWN_PPFD	[Supplied by AFM-02]
MEAN_AUX_RAD	[Supplied by AFM-02]
MEAN_GREEN_INDEX	[Supplied by AFM-02]
MEAN_CO2_CONC	[Supplied by AFM-02]
MEAN_O3_CONC	[Supplied by AFM-02]
MEAN_CH4_CONC	[Supplied by AFM-02]
MEAN_SAT_SIM_CH1	[Supplied by AFM-02]
MEAN_SAT_SIM_CH2	[Supplied by AFM-02]
MEAN_SAT_SIM_CH3	[Supplied by AFM-02]
MEAN_SAT_SIM_CH4	[Supplied by AFM-02]
SDEV_AIR_TEMP	[Supplied by AFM-02]
SDEV_POTNTL_TEMP	[Supplied by AFM-02]
SDEV_H2O_MIX_RATIO	[Supplied by AFM-02]

SDEV_U_COMPNT_WIND_VELOC [Supplied by AFM-02]
SDEV_V_COMPNT_WIND_VELOC [Supplied by AFM-02]
SDEV_STATIC_PRESS [Supplied by AFM-02]
SDEV_SURF_RAD_TEMP [Supplied by AFM-02]
SDEV_DOWN_TOTAL_RAD [Supplied by AFM-02]
SDEV_UP_TOTAL_RAD [Supplied by AFM-02]
SDEV_DOWN_LONGWAVE_RAD [Supplied by AFM-02]
SDEV_UP_LONGWAVE_RAD [Supplied by AFM-02]
SDEV_NET_RAD [Supplied by AFM-02]
SDEV_UP_PPFD [Supplied by AFM-02]
SDEV_DOWN_PPFD [Supplied by AFM-02]
SDEV_AUX_RAD [Supplied by AFM-02]
SDEV_GREEN_INDEX [Supplied by AFM-02]
SDEV_CO2_CONC [Supplied by AFM-02]
SDEV_O3_CONC [Supplied by AFM-02]
SDEV_CH4_CONC [Supplied by AFM-02]
SDEV_SAT_SIM_CH1 [Supplied by AFM-02]
SDEV_SAT_SIM_CH2 [Supplied by AFM-02]
SDEV_SAT_SIM_CH3 [Supplied by AFM-02]
SDEV_SAT_SIM_CH4 [Supplied by AFM-02]
TREND_AIR_TEMP [Supplied by AFM-02]
TREND_POTNTL_TEMP [Supplied by AFM-02]
TREND_H2O_MIX_RATIO [Supplied by AFM-02]
TREND_U_COMPNT_WIND_VELOC [Supplied by AFM-02]
TREND_V_COMPNT_WIND_VELOC [Supplied by AFM-02]
TREND_STATIC_PRESS [Supplied by AFM-02]
TREND_SURF_RAD_TEMP [Supplied by AFM-02]
TREND_DOWN_TOTAL_RAD [Supplied by AFM-02]
TREND_UP_TOTAL_RAD [Supplied by AFM-02]
TREND_DOWN_LONGWAVE_RAD [Supplied by AFM-02]
TREND_UP_LONGWAVE_RAD [Supplied by AFM-02]
TREND_GREEN_INDEX [Supplied by AFM-02]
TREND_CO2_CONC [Supplied by AFM-02]
TREND_O3_CONC [Supplied by AFM-02]
TREND_CH4_CONC [Supplied by AFM-02]
SDEV_VERT_GUST_RAW [Supplied by AFM-02]
SDEV_U_COMPNT_WIND_VELOC_RAW [Supplied by AFM-02]
SDEV_V_COMPNT_WIND_VELOC_RAW [Supplied by AFM-02]
SDEV_ALONG_WIND_RAW [Supplied by AFM-02]
SDEV_CROSS_WIND_RAW [Supplied by AFM-02]
SDEV_POTNTL_TEMP_RAW [Supplied by AFM-02]
SDEV_H2O_MIX_RATIO_RAW [Supplied by AFM-02]
SDEV_CO2_MIX_RATIO_RAW [Supplied by AFM-02]
SDEV_O3_CONC_RAW [Supplied by AFM-02]
SDEV_CH4_CONC_RAW [Supplied by AFM-02]
SKEW_VERT_GUST_RAW [Supplied by AFM-02]
SKEW_U_COMPNT_WIND_VELOC_RAW [Supplied by AFM-02]
SKEW_V_COMPNT_WIND_VELOC_RAW [Supplied by AFM-02]
SKEW_ALONG_WIND_RAW [Supplied by AFM-02]
SKEW_CROSS_WIND_RAW [Supplied by AFM-02]
SKEW_POTNTL_TEMP_RAW [Supplied by AFM-02]
SKEW_H2O_MIX_RATIO_RAW [Supplied by AFM-02]
SKEW_CO2_MIX_RATIO [Supplied by AFM-02]
SKEW_O3_CONC_RAW [Supplied by AFM-02]

SKEW_CH4_CONC_RAW [Supplied by AFM-02]
KURT_VERT_GUST_RAW [Supplied by AFM-02]
KURT_U_COMPNT_WIND_VELOC_RAW [Supplied by AFM-02]
KURT_V_COMPNT_WIND_VELOC_RAW [Supplied by AFM-02]
KURT_ALONG_WIND_RAW [Supplied by AFM-02]
KURT_CROSS_WIND_RAW [Supplied by AFM-02]
KURT_POTNTL_TEMP_RAW [Supplied by AFM-02]
KURT_H2O_MIX_RATIO_RAW [Supplied by AFM-02]
KURT_CO2_MIX_RATIO_RAW [Supplied by AFM-02]
KURT_O3_CONC_RAW [Supplied by AFM-02]
KURT_CH4_CONC_RAW [Supplied by AFM-02]
CORC_VERT_U_WIND_COMPNT_RAW [Supplied by AFM-02]
CORC_VERT_V_WIND_COMPNT_RAW [Supplied by AFM-02]
CORC_VERT_ALONG_WIND_RAW [Supplied by AFM-02]
CORC_VERT_CROSS_WIND_RAW [Supplied by AFM-02]
CORC_VERT_POTNTL_TEMP_RAW [Supplied by AFM-02]
CORC_VERT_H2O_MIX_RATIO_RAW [Supplied by AFM-02]
CORC_VERT_CO2_MIX_RATIO_RAW [Supplied by AFM-02]
CORC_VERT_O3_CONC_RAW [Supplied by AFM-02]
CORC_VERT_CH4_CONC_RAW [Supplied by AFM-02]
CORC_POTNTL_H2O_MIX_RATIO_RAW [Supplied by AFM-02]
MMNTM_FLUX_V_WIND_COMPNT_RAW [Supplied by AFM-02]
MMNTM_FLUX_U_WIND_COMPNT_RAW [Supplied by AFM-02]
MMNTM_FLUX_ALONG_MEAN_WIND_RAW [Supplied by AFM-02]
MMNTM_FLUX_CROSS_MEAN_WIND_RAW [Supplied by AFM-02]
SENSIBLE_HEAT_FLUX_RAW [Supplied by AFM-02]
LATENT_HEAT_FLUX_RAW [Supplied by AFM-02]
CO2_FLUX_RAW [Supplied by AFM-02]
O3_FLUX_RAW [Supplied by AFM-02]
O3_DEPOSITION_VELOC_RAW [Supplied by AFM-02]
CH4_FLUX_RAW [Supplied by AFM-02]
AIR_DENSITY_CONSTANT [Supplied by AFM-02]
SPECIFIC_HEAT_CONSTANT [Supplied by AFM-02]
LATENT_HEAT_VAP_CONSTANT [Supplied by AFM-02]
DRY_AIR_GAS_CONSTANT [Supplied by AFM-02]
SDEV_VERT_GUST_DET [Supplied by AFM-02]
SDEV_U_COMPNT_WIND_VELOC_DET [Supplied by AFM-02]
SDEV_V_COMPNT_WIND_VELOC_DET [Supplied by AFM-02]
SDEV_ALONG_WIND_DET [Supplied by AFM-02]
SDEV_CROSS_WIND_DET [Supplied by AFM-02]
SDEV_POTNTL_TEMP_DET [Supplied by AFM-02]
SDEV_H2O_MIX_RATIO_DET [Supplied by AFM-02]
SDEV_CO2_MIX_RATIO [Supplied by AFM-02]
SDEV_O3_CONC_DET [Supplied by AFM-02]
SDEV_CH4_CONC_DET [Supplied by AFM-02]
SKEW_VERT_GUST_DET [Supplied by AFM-02]
SKEW_U_COMPNT_WIND_VELOC_DET [Supplied by AFM-02]
SKEW_V_COMPNT_WIND_VELOC_DET [Supplied by AFM-02]
SKEW_ALONG_WIND_DET [Supplied by AFM-02]
SKEW_CROSS_WIND_DET [Supplied by AFM-02]
SKEW_POTNTL_TEMP_DET [Supplied by AFM-02]
SKEW_H2O_MIX_RATIO_DET [Supplied by AFM-02]
SKEW_CO2_MIX_RATIO_DET [Supplied by AFM-02]
SKEW_O3_CONC_DET [Supplied by AFM-02]

SKEW_CH4_CONC_DET	[Supplied by AFM-02]
KURT_VERT_GUST_DET	[Supplied by AFM-02]
KURT_U_COMPNT_WIND_VELOC_DET	[Supplied by AFM-02]
KURT_V_COMPNT_WIND_VELOC_DET	[Supplied by AFM-02]
KURT_ALONG_WIND_DET	[Supplied by AFM-02]
KURT_CROSS_WIND_DET	[Supplied by AFM-02]
KURT_POTNTL_TEMP_DET	[Supplied by AFM-02]
KURT_H2O_MIX_RATIO_DET	[Supplied by AFM-02]
KURT_CO2_MIX_RATIO_DET	[Supplied by AFM-02]
KURT_O3_CONC_DET	[Supplied by AFM-02]
KURT_CH4_CONC_DET	[Supplied by AFM-02]
CORC_VERT_U_WIND_COMPNT_DET	[Supplied by AFM-02]
CORC_VERT_V_WIND_COMPNT_DET	[Supplied by AFM-02]
CORC_VERT_ALONG_WIND_DET	[Supplied by AFM-02]
CORC_VERT_CROSS_WIND_DET	[Supplied by AFM-02]
CORC_VERT_POTNTL_TEMP_DET	[Supplied by AFM-02]
CORC_VERT_H2O_MIX_RATIO_DET	[Supplied by AFM-02]
CORC_VERT_CO2_MIX_RATIO_DET	[Supplied by AFM-02]
CORC_VERT_O3_CONC_DET	[Supplied by AFM-02]
CORC_VERT_CH4_CONC_DET	[Supplied by AFM-02]
CORC_POTNTL_H2O_MIX_RATIO_DET	[Supplied by AFM-02]
MMNTM_FLUX_U_WIND_COMPNT_DET	[Supplied by AFM-02]
MMNTM_FLUX_V_WIND_COMPNT_DET	[Supplied by AFM-02]
MMNTM_FLUX_ALONG_MEAN_WIND_DET	[Supplied by AFM-02]
MMNTM_FLUX_CROSS_MEAN_WIND_DET	[Supplied by AFM-02]
SENSIBLE_HEAT_FLUX_DET	[Supplied by AFM-02]
LATENT_HEAT_FLUX_DET	[Supplied by AFM-02]
CO2_FLUX_DET	[Supplied by AFM-02]
O3_FLUX_DET	[Supplied by AFM-02]
O3_DEPOSITION_VELOC_DET	[Supplied by AFM-02]
CH4_FLUX_DET	[Supplied by AFM-02]
CRTFCN_CODE	[Supplied by BORIS]
REVISION_DATE	[Supplied by BORIS]

7.3.5 Data Range

The following table gives information about the parameter values found in the aircraft flux data files on the CD-ROM.

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SPATIAL_COVERAGE	N/A	N/A	None	None	None	None
RUN_START_DATE	25-MAY-94	17-SEP-94	None	None	None	None
RUN_START_TIME	151842	211915	None	None	None	None
RUN_END_DATE	25-MAY-94	17-SEP-94	None	None	None	None
RUN_END_TIME	153123	213106	None	None	None	None
FLUX_MISSION_DESIGNATOR	CS	PS	None	None	None	None
FLUX_MISSION_NUM	1	3	None	None	None	None
FLUX_PASS_NUM	1	20	None	None	None	None
FLUX_SEGMENT_NUM	0	0	None	None	None	None
START_LATITUDE	53.54388	56.0204	None	None	None	None
START_LONGITUDE	-106.401	-97.9598	None	None	None	None
END_LATITUDE	53.56771	56.0234	None	None	None	None
END_LONGITUDE	-106.394	-97.9957	None	None	None	None
START_BOREAS_X	304.18	810.3	None	None	None	None
START_BOREAS_Y	293.16	630.89	None	None	None	None
END_BOREAS_X	304.59	807.95	None	None	None	None
END_BOREAS_Y	295.77	631.28	None	None	None	None
HEADING	1.2	359.9	None	None	None	None
MEAN_PRESS_ALTITUDE	220.1	1551.4	None	None	None	None
MEAN_RADAR_ALTITUDE	57.4	762.7	None	None	None	None
MEAN_WIND_DIR	1.4	356.9	None	None	None	None
MEAN_WIND_SPEED	1.38	12.85	None	None	None	None
MEAN_AIR_TEMP	10.85	25.88	None	None	None	None
MEAN_POTNTL_TEMP	287.13	302.88	None	None	None	None
MEAN_H2O_MIX_RATIO	3.4	11.22	None	None	None	None
MEAN_U_COMPNT_WIND_VELOC	-7.86	11.82	None	None	None	None
MEAN_V_COMPNT_WIND_VELOC	-7.48	9.05	None	None	None	None
MEAN_STATIC_PRESS	84.02	98.71	None	None	None	None
MEAN_SURF_RAD_TEMP			-999	None	None	None
MEAN_DOWN_TOTAL_RAD	173.9	927.3	None	None	None	None
MEAN_UP_TOTAL_RAD	22.8	110.1	None	None	None	None
MEAN_DOWN_LONGWAVE_RAD			-999	None	None	None
MEAN_UP_LONGWAVE_RAD			-999	None	None	None
MEAN_NET_RAD			-999	None	None	None
MEAN_UP_PPFD			-999	None	None	None
MEAN_DOWN_PPFD			None	None	None	None
MEAN_AUX_RAD	1	1	-999	None	None	None
MEAN_GREEN_INDEX			None	None	None	None
MEAN_CO2_CONC	339.8	363.8	-999	None	None	None
MEAN_O3_CONC			-999	None	None	None
MEAN_CH4_CONC			-999	None	None	None
MEAN_SAT_SIM_CH1						

MEAN_SAT_SIM_CH2			-999	None	None	None
MEAN_SAT_SIM_CH3			-999	None	None	None
MEAN_SAT_SIM_CH4			-999	None	None	None
SDEV_AIR_TEMP	.11	.82	None	None	None	None
SDEV_POTNTL_TEMP	.12	.82	None	None	None	None
SDEV_H2O_MIX_RATIO	.07	.78	None	None	None	None
SDEV_U_COMPNT_WIND_VELOC	.68	2.3	None	None	None	None
SDEV_V_COMPNT_WIND_VELOC	.73	2.3	None	None	None	None
SDEV_STATIC_PRESS	.02	.98	None	None	None	None
SDEV_SURF_RAD_TEMP			-999	None	None	None
SDEV_DOWN_TOTAL_RAD	9	384.9	None	None	None	None
SDEV_UP_TOTAL_RAD	2.3	43.5	None	None	None	None
SDEV_DOWN_LONGWAVE_RAD			-999	None	None	None
SDEV_UP_LONGWAVE_RAD			-999	None	None	None
SDEV_NET_RAD			-999	None	None	None
SDEV_UP_PPFD			-999	None	None	None
SDEV_DOWN_PPFD			-999	None	None	None
SDEV_AUX_RAD	1	1	None	None	None	None
SDEV_GREEN_INDEX			-999	None	None	None
SDEV_CO2_CONC	.3	4.3	None	None	None	None
SDEV_O3_CONC			-999	None	None	None
SDEV_CH4_CONC			-999	None	None	None
SDEV_SAT_SIM_CH1			-999	None	None	None
SDEV_SAT_SIM_CH2			-999	None	None	None
SDEV_SAT_SIM_CH3			-999	None	None	None
SDEV_SAT_SIM_CH4			-999	None	None	None
TREND_AIR_TEMP	-.000071	.0000763	None	None	None	None
TREND_POTNTL_TEMP	-.0000623	.0000644	None	None	None	None
TREND_H2O_MIX_RATIO	-.0000537	.0000462	None	None	None	None
TREND_U_COMPNT_WIND_VELOC	-.000188	.000143	None	None	None	None
TREND_V_COMPNT_WIND_VELOC	-.0002	.000116	None	None	None	None
TREND_STATIC_PRESS	-.0000462	.0000761	None	None	None	None
TREND_SURF_RAD_TEMP	1	1	None	None	None	None
TREND_DOWN_TOTAL_RAD	-.0251	.017	None	None	None	None
TREND_UP_TOTAL_RAD	-.0023	.00162	None	None	None	None
TREND_DOWN_LONGWAVE_RAD			-999	None	None	None
TREND_UP_LONGWAVE_RAD			-999	None	None	None
TREND_GREEN_INDEX	1	1	None	None	None	None
TREND_CO2_CONC	-.000263	.000403	None	None	None	None
TREND_O3_CONC	1	1	None	None	None	None
TREND_CH4_CONC	1	1	None	None	None	None
SDEV_VERT_GUST_RAW	.45	1.81	None	None	None	None
SDEV_U_COMPNT_WIND_VELOC_RAW	.68	2.3	None	None	None	None
SDEV_V_COMPNT_WIND_VELOC_RAW	.73	2.3	None	None	None	None
SDEV_ALONG_WIND_RAW	.78	2.26	None	None	None	None

SDEV_CROSS_WIND_RAW	.68	2.28	None	None	None	None
SDEV_POTNTL_TEMP_RAW	.12	.82	None	None	None	None
SDEV_H2O_MIX_RATIO_RAW	.07	.78	None	None	None	None
SDEV_CO2_MIX_RATIO_RAW	.3	4.3	None	None	None	None
SDEV_O3_CONC_RAW			-999	None	None	None
SDEV_CH4_CONC_RAW			-999	None	None	None
SKEW_VERT_GUST_RAW	.09	1.05	None	None	None	None
SKEW_U_COMPNT_WIND_VELOC_RAW	-.86	1.02	None	None	None	None
SKEW_V_COMPNT_WIND_VELOC_RAW	-.65	.7	None	None	None	None
SKEW_ALONG_WIND_RAW	-.82	.76	None	None	None	None
SKEW_CROSS_WIND_RAW	-.93	.62	None	None	None	None
SKEW_POTNTL_TEMP_RAW	-.95	1.51	None	None	None	None
SKEW_H2O_MIX_RATIO_RAW	-3.46	1.12	None	None	None	None
SKEW_CO2_MIX_RATIO	-1.56	2.09	None	None	None	None
SKEW_O3_CONC_RAW			-999	None	None	None
SKEW_CH4_CONC_RAW			-999	None	None	None
KURT_VERT_GUST_RAW	2.51	6.53	None	None	None	None
KURT_U_COMPNT_WIND_VELOC_RAW	2.1	5.24	None	None	None	None
KURT_V_COMPNT_WIND_VELOC_RAW	2.06	3.86	None	None	None	None
KURT_ALONG_WIND_RAW	2.06	4.5	None	None	None	None
KURT_CROSS_WIND_RAW	2.12	4.72	None	None	None	None
KURT_POTNTL_TEMP_RAW	1.55	7.06	None	None	None	None
KURT_H2O_MIX_RATIO_RAW	1.83	16.99	None	None	None	None
KURT_CO2_MIX_RATIO_RAW	1.53	11.96	None	None	None	None
KURT_O3_CONC_RAW			-999	None	None	None
KURT_CH4_CONC_RAW			-999	None	None	None
CORC_VERT_U_WIND_COMPNT_RAW	-.47	.43	None	None	None	None
CORC_VERT_V_WIND_COMPNT_RAW	-.41	.45	None	None	None	None
CORC_VERT_ALONG_WIND_RAW	-.47	.09	None	None	None	None
CORC_VERT_CROSS_WIND_RAW	-.17	.25	None	None	None	None
CORC_VERT_POTNTL_TEMP_RAW	-.15	.61	None	None	None	None
CORC_VERT_H2O_MIX_RATIO_RAW	.02	.52	None	None	None	None
CORC_VERT_CO2_MIX_RATIO_RAW	-.46	.18	None	None	None	None
CORC_VERT_O3_CONC_RAW			-999	None	None	None
CORC_VERT_CH4_CONC_RAW			-999	None	None	None
CORC_POTNTL_H2O_MIX_	-.85	.81	None	None	None	None

RATIO_RAW						
MMNTM_FLUX_V_WIND_COMPNT_RAW	-1.2803	.8603	None	None	None	None
MMNTM_FLUX_U_WIND_COMPNT_RAW	-1.1843	1.0847	None	None	None	None
MMNTM_FLUX_ALONG_MEAN_WIND_RAW	-1.3963	.1887	None	None	None	None
MMNTM_FLUX_CROSS_MEAN_WIND_RAW	-.3462	.7368	None	None	None	None
SENSIBLE_HEAT_FLUX_RAW	-44.6	319.2	None	None	None	None
LATENT_HEAT_FLUX_RAW	29.1	744.6	None	None	None	None
CO2_FLUX_RAW	-15.593	6.369	None	None	None	None
O3_FLUX_RAW			-999	None	None	None
O3_DEPOSITION_VELOC_RAW			-999	None	None	None
CH4_FLUX_RAW			-999	None	None	None
AIR_DENSITY_CONSTANT	1.025	1.199	None	None	None	None
SPECIFIC_HEAT_CONSTANT	1010.7	1025.1	None	None	None	None
LATENT_HEAT_VAP_CONSTANT	2440248	2473379	None	None	None	None
DRY_AIR_GAS_CONSTANT	287.04	287.04	None	None	None	None
SDEV_VERT_GUST_DET	.45	1.81	None	None	None	None
SDEV_U_COMPNT_WIND_VELOC_DET	.56	2.22	None	None	None	None
SDEV_V_COMPNT_WIND_VELOC_DET	.57	2.29	None	None	None	None
SDEV_ALONG_WIND_DET	.68	2.13	None	None	None	None
SDEV_CROSS_WIND_DET	.57	2.27	None	None	None	None
SDEV_POTNTL_TEMP_DET	.06	.54	None	None	None	None
SDEV_H2O_MIX_RATIO_DET	.07	.76	None	None	None	None
SDEV_CO2_MIX_RATIO	.2	4.1	None	None	None	None
SDEV_O3_CONC_DET			-999	None	None	None
SDEV_CH4_CONC_DET	999.9	999.9	None	None	None	None
SKEW_VERT_GUST_DET	.09	1.13	None	None	None	None
SKEW_U_COMPNT_WIND_VELOC_DET	-.89	1.09	None	None	None	None
SKEW_V_COMPNT_WIND_VELOC_DET	-.54	.79	None	None	None	None
SKEW_ALONG_WIND_DET	-.82	.6	None	None	None	None
SKEW_CROSS_WIND_DET	-1.01	.71	None	None	None	None
SKEW_POTNTL_TEMP_DET	-.79	1.95	None	None	None	None
SKEW_H2O_MIX_RATIO_DET	-2.74	.98	None	None	None	None
SKEW_CO2_MIX_RATIO_DET	-1.56	2.06	None	None	None	None
SKEW_O3_CONC_DET			-999	None	None	None
SKEW_CH4_CONC_DET	999.99	999.99	None	None	None	None
KURT_VERT_GUST_DET	2.52	6.49	None	None	None	None
KURT_U_COMPNT_WIND_VELOC_DET	2.18	5.36	None	None	None	None
KURT_V_COMPNT_WIND_	2.07	4.35	None	None	None	None

VELOC_DET						
KURT_ALONG_WIND_DET	1.99	5.31	None	None	None	None
KURT_CROSS_WIND_DET	2.08	5.05	None	None	None	None
KURT_POTNTL_TEMP_DET	1.6	9.82	None	None	None	None
KURT_H2O_MIX_RATIO_ DET	1.98	13.2	None	None	None	None
KURT_CO2_MIX_RATIO_ DET	1.65	11.96	None	None	None	None
KURT_O3_CONC_DET			-999	None	None	None
KURT_CH4_CONC_DET			-999	None	None	None
CORC_VERT_U_WIND_ COMPNT_DET	-.47	.46	None	None	None	None
CORC_VERT_V_WIND_ COMPNT_DET	-.43	.45	None	None	None	None
CORC_VERT_ALONG_WIND_ DET	-.48	.08	None	None	None	None
CORC_VERT_CROSS_WIND_ DET	-.16	.26	None	None	None	None
CORC_VERT_POTNTL_ TEMP_DET	-.18	.63	None	None	None	None
CORC_VERT_H2O_MIX_ RATIO_DET	.01	.58	None	None	None	None
CORC_VERT_CO2_MIX_ RATIO_DET	-.48	.15	None	None	None	None
CORC_VERT_O3_CONC_ DET			-999	None	None	None
CORC_VERT_CH4_CONC_ DET			-999	None	None	None
CORC_POTNTL_H2O_MIX_ RATIO_DET	-.83	.82	None	None	None	None
MMNTM_FLUX_U_WIND_ COMPNT_DET	-1.2942	.8537	None	None	None	None
MMNTM_FLUX_V_WIND_ COMPNT_DET	-1.2026	1.1114	None	None	None	None
MMNTM_FLUX_ALONG_ MEAN_WIND_DET	-1.3942	.1698	None	None	None	None
MMNTM_FLUX_CROSS_ MEAN_WIND_DET	-.3097	.7129	None	None	None	None
SENSIBLE_HEAT_FLUX_ DET	-49.8	316	None	None	None	None
LATENT_HEAT_FLUX_DET	13.3	679.7	None	None	None	None
CO2_FLUX_DET	-15.007	4.238	None	None	None	None
O3_FLUX_DET			-999	None	None	None
O3_DEPOSITION_VELOC_ DET			-999	None	None	None
CH4_FLUX_DET	999.99	999.99	None	None	None	None
CRTFCN_CODE	CPI	CPI	None	None	None	None
REVISION_DATE	12-JUN-96	12-JUN-96	None	None	None	None

The following table gives information about the parameter values found in the moving window data files on the CD-ROM.

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SPATIAL_COVERAGE	N/A	N/A	None	None	None	None
RUN_START_DATE	07-JUN-94	08-SEP-94	None	None	None	None
RUN_START_TIME	144730	182900	None	None	None	None
RUN_END_DATE	07-JUN-94	08-SEP-94	None	None	None	None
RUN_END_TIME	145030	183200	None	None	None	None
FLUX_MISSION_ DESIGNATOR	RT	RT	None	None	None	None
FLUX_MISSION_NUM	1	1	None	None	None	None
FLUX_PASS_NUM	1	5	None	None	None	None
FLUX_SEGMENT_NUM	1	29	None	None	None	None
START_LATITUDE	53.5741	55.91817	None	None	None	None
START_LONGITUDE	-106.418	-98.1254	None	None	None	None
END_LATITUDE	53.5905	55.91434	None	None	None	None
END_LONGITUDE	-106.343	-98.0052	None	None	None	None
START_BOREAS_X	303.11	800.14	None	None	None	None
START_BOREAS_Y	296.34	618.33	None	None	None	None
END_BOREAS_X	307.88	807.33	None	None	None	None
END_BOREAS_Y	298.48	619.74	None	None	None	None
HEADING	23	282.4	None	None	None	None
MEAN_PRESS_ALTITUDE	264.4	691	None	None	None	None
MEAN_RADAR_ALTITUDE	57.8	106	None	None	None	None
MEAN_WIND_DIR	102.2	339.9	None	None	None	None
MEAN_WIND_SPEED	1.29	8.19	None	None	None	None
MEAN_AIR_TEMP	10.41	24.25	None	None	None	None
MEAN_POTNTL_TEMP	285.27	299.61	None	None	None	None
MEAN_H2O_MIX_RATIO	3.64	9.34	None	None	None	None
MEAN_U_COMPNT_WIND_ VELOC	-6.95	3.59	None	None	None	None
MEAN_V_COMPNT_WIND_ VELOC	-4.96	7.14	None	None	None	None
MEAN_STATIC_PRESS	93.29	98.19	None	None	None	None
MEAN_SURF_RAD_TEMP			-999	None	None	None
MEAN_DOWN_TOTAL_RAD	427.3	802.4	None	None	None	None
MEAN_UP_TOTAL_RAD	40.5	106.1	None	None	None	None
MEAN_DOWN_LONGWAVE_ RAD			-999	None	None	None
MEAN_UP_LONGWAVE_RAD			-999	None	None	None
MEAN_NET_RAD			-999	None	None	None
MEAN_UP_PPFD			-999	None	None	None
MEAN_DOWN_PPFD			-999	None	None	None
MEAN_AUX_RAD	1	1	None	None	None	None
MEAN_GREEN_INDEX			-999	None	None	None
MEAN_CO2_CONC	336.6	357.5	None	None	None	None
MEAN_O3_CONC			-999	None	None	None
MEAN_CH4_CONC			-999	None	None	None
MEAN_SAT_SIM_CH1			-999	None	None	None
MEAN_SAT_SIM_CH2			-999	None	None	None

MEAN_SAT_SIM_CH3			-999	None	None	None
MEAN_SAT_SIM_CH4			-999	None	None	None
SDEV_AIR_TEMP	.13	.98	None	None	None	None
SDEV_POTNTL_TEMP	.14	1.07	None	None	None	None
SDEV_H2O_MIX_RATIO	.05	.67	None	None	None	None
SDEV_U_COMPNT_WIND_VELOC	.63	1.83	None	None	None	None
SDEV_V_COMPNT_WIND_VELOC	.68	1.87	None	None	None	None
SDEV_STATIC_PRESS	.05	.44	None	None	None	None
SDEV_SURF_RAD_TEMP			-999	None	None	None
SDEV_DOWN_TOTAL_RAD	10.7	124.7	None	None	None	None
SDEV_UP_TOTAL_RAD	3.9	27.5	None	None	None	None
SDEV_DOWN_LONGWAVE_RAD			-999	None	None	None
SDEV_UP_LONGWAVE_RAD			-999	None	None	None
SDEV_NET_RAD			-999	None	None	None
SDEV_UP_PPFD			-999	None	None	None
SDEV_DOWN_PPFD			-999	None	None	None
SDEV_AUX_RAD	1	1	None	None	None	None
SDEV_GREEN_INDEX			-999	None	None	None
SDEV_CO2_CONC	.3	6	None	None	None	None
SDEV_O3_CONC			-999	None	None	None
SDEV_CH4_CONC			-999	None	None	None
SDEV_SAT_SIM_CH1			-999	None	None	None
SDEV_SAT_SIM_CH2			-999	None	None	None
SDEV_SAT_SIM_CH3			-999	None	None	None
SDEV_SAT_SIM_CH4			-999	None	None	None
TREND_AIR_TEMP	-.000132	.000208	None	None	None	None
TREND_POTNTL_TEMP	-.00017	.000225	None	None	None	None
TREND_H2O_MIX_RATIO	-.0000734	.0000762	None	None	None	None
TREND_U_COMPNT_WIND_VELOC	-.00023	.0003	None	None	None	None
TREND_V_COMPNT_WIND_VELOC	-.000348	.000281	None	None	None	None
TREND_STATIC_PRESS	-.0000643	.0000741	None	None	None	None
TREND_SURF_RAD_TEMP	1	1	None	None	None	None
TREND_DOWN_TOTAL_RAD	-.0114	.0209	None	None	None	None
TREND_UP_TOTAL_RAD	-.00497	.00417	None	None	None	None
TREND_DOWN_LONGWAVE_RAD			-999	None	None	None
TREND_UP_LONGWAVE_RAD			-999	None	None	None
TREND_GREEN_INDEX	1	1	None	None	None	None
TREND_CO2_CONC	-.00138	.000687	None	None	None	None
TREND_O3_CONC	1	1	None	None	None	None
TREND_CH4_CONC	1	1	None	None	None	None
SDEV_VERT_GUST_RAW	.4	1.2	None	None	None	None
SDEV_U_COMPNT_WIND_VELOC_RAW	.63	1.83	None	None	None	None
SDEV_V_COMPNT_WIND_VELOC_RAW	.68	1.87	None	None	None	None
SDEV_ALONG_WIND_RAW	.6	1.7	None	None	None	None
SDEV_CROSS_WIND_RAW	.62	1.93	None	None	None	None

SDEV_POTNTL_TEMP_RAW	.14	1.07	None	None	None	None
SDEV_H2O_MIX_RATIO_RAW	.05	.67	None	None	None	None
SDEV_CO2_MIX_RATIO_RAW	.3	6	None	None	None	None
SDEV_O3_CONC_RAW			-999	None	None	None
SDEV_CH4_CONC_RAW			-999	None	None	None
SKEW_VERT_GUST_RAW	.03	1.55	None	None	None	None
SKEW_U_COMPNT_WIND_VELOC_RAW	-.87	1.11	None	None	None	None
SKEW_V_COMPNT_WIND_VELOC_RAW	-1.52	.87	None	None	None	None
SKEW_ALONG_WIND_RAW	-1.38	.42	None	None	None	None
SKEW_CROSS_WIND_RAW	-1.32	.83	None	None	None	None
SKEW_POTNTL_TEMP_RAW	-1.68	1.97	None	None	None	None
SKEW_H2O_MIX_RATIO_RAW	-1.04	1.5	None	None	None	None
SKEW_CO2_MIX_RATIO	-1.83	3.34	None	None	None	None
SKEW_O3_CONC_RAW			-999	None	None	None
SKEW_CH4_CONC_RAW			-999	None	None	None
KURT_VERT_GUST_RAW	2.51	10.55	None	None	None	None
KURT_U_COMPNT_WIND_VELOC_RAW	1.73	4.71	None	None	None	None
KURT_V_COMPNT_WIND_VELOC_RAW	1.99	5.28	None	None	None	None
KURT_ALONG_WIND_RAW	1.85	5.36	None	None	None	None
KURT_CROSS_WIND_RAW	1.99	4.48	None	None	None	None
KURT_POTNTL_TEMP_RAW	1.38	30.63	None	None	None	None
KURT_H2O_MIX_RATIO_RAW	1.57	8.46	None	None	None	None
KURT_CO2_MIX_RATIO_RAW	1.59	36.21	None	None	None	None
KURT_O3_CONC_RAW			-999	None	None	None
KURT_CH4_CONC_RAW			-999	None	None	None
CORC_VERT_U_WIND_COMPNT_RAW	-.4	.48	None	None	None	None
CORC_VERT_V_WIND_COMPNT_RAW	-.45	.34	None	None	None	None
CORC_VERT_ALONG_WIND_RAW	-.55	.1	None	None	None	None
CORC_VERT_CROSS_WIND_RAW	-.19	.2	None	None	None	None
CORC_VERT_POTNTL_TEMP_RAW	-.03	.64	None	None	None	None
CORC_VERT_H2O_MIX_RATIO_RAW	.02	.59	None	None	None	None
CORC_VERT_CO2_MIX_RATIO_RAW	-.51	.06	None	None	None	None
CORC_VERT_O3_CONC_RAW			-999	None	None	None
CORC_VERT_CH4_CONC_RAW			-999	None	None	None
CORC_POTNTL_H2O_MIX_RATIO_RAW	-.65	.9	None	None	None	None

MMNTM_FLUX_V_WIND_COMPNT_RAW	-.4309	.7251	None	None	None	None
MMNTM_FLUX_U_WIND_COMPNT_RAW	-.7727	.6204	None	None	None	None
MMNTM_FLUX_ALONG_MEAN_WIND_RAW	-.925	.1891	None	None	None	None
MMNTM_FLUX_CROSS_MEAN_WIND_RAW	-.311	.2071	None	None	None	None
SENSIBLE_HEAT_FLUX_RAW	-7.1	255.8	None	None	None	None
LATENT_HEAT_FLUX_RAW	14.5	435	None	None	None	None
CO2_FLUX_RAW	-23.756	7.29	None	None	None	None
O3_FLUX_RAW			-999	None	None	None
O3_DEPOSITION_VELOC_RAW			-999	None	None	None
CH4_FLUX_RAW			-999	None	None	None
AIR_DENSITY_CONSTANT	1.117	1.201	None	None	None	None
SPECIFIC_HEAT_CONSTANT	1011.1	1021.7	None	None	None	None
LATENT_HEAT_VAP_CONSTANT	2443673	2475066	None	None	None	None
DRY_AIR_GAS_CONSTANT	287.04	287.04	None	None	None	None
SDEV_VERT_GUST_DET	.4	1.2	None	None	None	None
SDEV_U_COMPNT_WIND_VELOC_DET	.61	1.77	None	None	None	None
SDEV_V_COMPNT_WIND_VELOC_DET	.58	1.82	None	None	None	None
SDEV_ALONG_WIND_DET	.48	1.7	None	None	None	None
SDEV_CROSS_WIND_DET	.62	1.76	None	None	None	None
SDEV_POTNTL_TEMP_DET	.12	.51	None	None	None	None
SDEV_H2O_MIX_RATIO_DET	.05	.67	None	None	None	None
SDEV_CO2_MIX_RATIO	.3	2	None	None	None	None
SDEV_O3_CONC_DET			-999	None	None	None
SDEV_CH4_CONC_DET	999.9	999.9	None	None	None	None
SKEW_VERT_GUST_DET	.04	1.04	None	None	None	None
SKEW_U_COMPNT_WIND_VELOC_DET	-.53	1.02	None	None	None	None
SKEW_V_COMPNT_WIND_VELOC_DET	-.96	.79	None	None	None	None
SKEW_ALONG_WIND_DET	-1.37	.33	None	None	None	None
SKEW_CROSS_WIND_DET	-.64	.93	None	None	None	None
SKEW_POTNTL_TEMP_DET	-3.08	1.96	None	None	None	None
SKEW_H2O_MIX_RATIO_DET	-1	2.01	None	None	None	None
SKEW_CO2_MIX_RATIO_DET	-1.82	3.74	None	None	None	None
SKEW_O3_CONC_DET			-999	None	None	None
SKEW_CH4_CONC_DET	999.99	999.99	None	None	None	None
KURT_VERT_GUST_DET	2.52	10.37	None	None	None	None
KURT_U_COMPNT_WIND_VELOC_DET	2.01	4.71	None	None	None	None
KURT_V_COMPNT_WIND_VELOC_DET	1.85	5.84	None	None	None	None

KURT_ALONG_WIND_DET	2.13	5.46	None	None	None	None
KURT_CROSS_WIND_DET	1.81	4.45	None	None	None	None
KURT_POTNTL_TEMP_DET	2.07	55.43	None	None	None	None
KURT_H2O_MIX_RATIO_DET	1.96	9.35	None	None	None	None
KURT_CO2_MIX_RATIO_DET	1.6	40.06	None	None	None	None
KURT_O3_CONC_DET			-999	None	None	None
KURT_CH4_CONC_DET			-999	None	None	None
CORC_VERT_U_WIND_COMPNT_DET	-.39	.48	None	None	None	None
CORC_VERT_V_WIND_COMPNT_DET	-.46	.35	None	None	None	None
CORC_VERT_ALONG_WIND_DET	-.56	.04	None	None	None	None
CORC_VERT_CROSS_WIND_DET	-.16	.19	None	None	None	None
CORC_VERT_POTNTL_TEMP_DET	.01	.65	None	None	None	None
CORC_VERT_H2O_MIX_RATIO_DET	.04	.6	None	None	None	None
CORC_VERT_CO2_MIX_RATIO_DET	-.51	.06	None	None	None	None
CORC_VERT_O3_CONC_DET			-999	None	None	None
CORC_VERT_CH4_CONC_DET			-999	None	None	None
CORC_POTNTL_H2O_MIX_RATIO_DET	-.74	.92	None	None	None	None
MMNTM_FLUX_U_WIND_COMPNT_DET	-.3971	.7054	None	None	None	None
MMNTM_FLUX_V_WIND_COMPNT_DET	-.7781	.6219	None	None	None	None
MMNTM_FLUX_ALONG_MEAN_WIND_DET	-.9214	.0209	None	None	None	None
MMNTM_FLUX_CROSS_MEAN_WIND_DET	-.2782	.2095	None	None	None	None
SENSIBLE_HEAT_FLUX_DET	1.4	253.7	None	None	None	None
LATENT_HEAT_FLUX_DET	23.1	447.6	None	None	None	None
CO2_FLUX_DET	-15.428	2.122	None	None	None	None
O3_FLUX_DET			-999	None	None	None
O3_DEPOSITION_VELOC_DET			-999	None	None	None
CH4_FLUX_DET	999.99	999.99	None	None	None	None
CRTFCN_CODE	CPI	CPI	None	None	None	None
REVISION_DATE	12-JUN-96	12-JUN-96	None	None	None	None

Minimum Data Value -- The minimum value found in the column.
Maximum Data Value -- The maximum value found in the column.
Missng Data Value -- The value that indicates missing data. This is used to indicate that an attempt was made to determine the parameter value, but the attempt was unsuccessful.
Unrel Data Value -- The value that indicates unreliable data. This is used

```
                    to indicate an attempt was made to determine the
                    parameter value, but the value was deemed to be
                    unreliable by the analysis personnel.
Below Detect Limit -- The value that indicates parameter values below the
                    instruments detection limits.  This is used to
                    indicate that an attempt was made to determine the
                    parameter value, but the analysis personnel determined
                    that the parameter value was below the detection
                    limit of the instrumentation.
Data Not Cllctd    -- This value indicates that no attempt was made to
                    determine the parameter value.  This usually
                    indicates that BORIS combined several similar but
                    not identical data sets into the same data base table
                    but this particular science team did not
                    measure that parameter.

Blank -- Indicates that blank spaces are used to denote that type of value.
N/A   -- Indicates that the value is not applicable to the respective column.
None  -- Indicates that no values of that sort were found in the column.
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7.4 Sample Data Record

The following are wrapped versions of data record from a sample aircraft flux data file on the CD-ROM:

```
SPATIAL_COVERAGE,RUN_START_DATE,RUN_START_TIME,RUN_END_DATE,RUN_END_TIME,
FLUX_MISSION_DESIGNATOR,FLUX_MISSION_NUM,FLUX_PASS_NUM,FLUX_SEGMENT_NUM,
START_LATITUDE,START_LONGITUDE,END_LATITUDE,END_LONGITUDE,START_BOREAS_X,
START_BOREAS_Y,END_BOREAS_X,END_BOREAS_Y,HEADING,MEAN_PRESS_ALTITUDE,
MEAN_RADAR_ALTITUDE,MEAN_WIND_DIR,MEAN_WIND_SPEED,MEAN_AIR_TEMP,MEAN_POTNTL_TEMP,
MEAN_H2O_MIX_RATIO,MEAN_U_COMPNT_WIND_VELOC,MEAN_V_COMPNT_WIND_VELOC,
MEAN_STATIC_PRESS,MEAN_SURF_RAD_TEMP,MEAN_DOWN_TOTAL_RAD,MEAN_UP_TOTAL_RAD,
MEAN_DOWN_LONGWAVE_RAD,MEAN_UP_LONGWAVE_RAD,MEAN_NET_RAD,MEAN_UP_PPFD,
MEAN_DOWN_PPFD,MEAN_AUX_RAD,MEAN_GREEN_INDEX,MEAN_CO2_CONC,MEAN_O3_CONC,
MEAN_CH4_CONC,MEAN_SAT_SIM_CH1,MEAN_SAT_SIM_CH2,MEAN_SAT_SIM_CH3,
MEAN_SAT_SIM_CH4,SDEV_AIR_TEMP,SDEV_POTNTL_TEMP,SDEV_H2O_MIX_RATIO,
SDEV_U_COMPNT_WIND_VELOC,SDEV_V_COMPNT_WIND_VELOC,SDEV_STATIC_PRESS,
SDEV_SURF_RAD_TEMP,SDEV_DOWN_TOTAL_RAD,SDEV_UP_TOTAL_RAD,SDEV_DOWN_LONGWAVE_RAD,
SDEV_UP_LONGWAVE_RAD,SDEV_NET_RAD,SDEV_UP_PPFD,SDEV_DOWN_PPFD,SDEV_AUX_RAD,
SDEV_GREEN_INDEX,SDEV_CO2_CONC,SDEV_O3_CONC,SDEV_CH4_CONC,SDEV_SAT_SIM_CH1,
SDEV_SAT_SIM_CH2,SDEV_SAT_SIM_CH3,SDEV_SAT_SIM_CH4,TREND_AIR_TEMP,
TREND_POTNTL_TEMP,TREND_H2O_MIX_RATIO,TREND_U_COMPNT_WIND_VELOC,
TREND_V_COMPNT_WIND_VELOC,TREND_STATIC_PRESS,TREND_SURF_RAD_TEMP,
TREND_DOWN_TOTAL_RAD,TREND_UP_TOTAL_RAD,TREND_DOWN_LONGWAVE_RAD,
TREND_UP_LONGWAVE_RAD,TREND_GREEN_INDEX,TREND_CO2_CONC,TREND_O3_CONC,
TREND_CH4_CONC,SDEV_VERT_GUST_RAW,SDEV_U_COMPNT_WIND_VELOC_RAW,
SDEV_V_COMPNT_WIND_VELOC_RAW,SDEV_ALONG_WIND_RAW,SDEV_CROSS_WIND_RAW,
SDEV_POTNTL_TEMP_RAW,SDEV_H2O_MIX_RATIO_RAW,SDEV_CO2_MIX_RATIO_RAW,
SDEV_O3_CONC_RAW,SDEV_CH4_CONC_RAW,SKEW_VERT_GUST_RAW,
SKEW_U_COMPNT_WIND_VELOC_RAW,SKEW_V_COMPNT_WIND_VELOC_RAW,SKEW_ALONG_WIND_RAW,
SKEW_CROSS_WIND_RAW,SKEW_POTNTL_TEMP_RAW,SKEW_H2O_MIX_RATIO_RAW,
SKEW_CO2_MIX_RATIO,SKEW_O3_CONC_RAW,SKEW_CH4_CONC_RAW,KURT_VERT_GUST_RAW,
KURT_U_COMPNT_WIND_VELOC_RAW,KURT_V_COMPNT_WIND_VELOC_RAW,KURT_ALONG_WIND_RAW,
```

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KURT_CROSS_WIND_RAW,KURT_POTNTL_TEMP_RAW,KURT_H2O_MIX_RATIO_RAW,
KURT_CO2_MIX_RATIO_RAW,KURT_O3_CONC_RAW,KURT_CH4_CONC_RAW,
CORC_VERT_U_WIND_COMPNT_RAW,CORC_VERT_V_WIND_COMPNT_RAW,
CORC_VERT_ALONG_WIND_RAW,CORC_VERT_CROSS_WIND_RAW,CORC_VERT_POTNTL_TEMP_RAW,
CORC_VERT_H2O_MIX_RATIO_RAW,CORC_VERT_CO2_MIX_RATIO_RAW,CORC_VERT_O3_CONC_RAW,
CORC_VERT_CH4_CONC_RAW,CORC_POTNTL_H2O_MIX_RATIO_RAW,
MMNTM_FLUX_V_WIND_COMPNT_RAW,MMNTM_FLUX_U_WIND_COMPNT_RAW,
MMNTM_FLUX_ALONG_MEAN_WIND_RAW,MMNTM_FLUX_CROSS_MEAN_WIND_RAW,
SENSIBLE_HEAT_FLUX_RAW,LATENT_HEAT_FLUX_RAW,CO2_FLUX_RAW,O3_FLUX_RAW,
O3_DEPOSITION_VELOC_RAW,CH4_FLUX_RAW,AIR_DENSITY_CONSTANT,
SPECIFIC_HEAT_CONSTANT,LATENT_HEAT_VAP_CONSTANT,DRY_AIR_GAS_CONSTANT,
SDEV_VERT_GUST_DET,SDEV_U_COMPNT_WIND_VELOC_DET,SDEV_V_COMPNT_WIND_VELOC_DET,
SDEV_ALONG_WIND_DET,SDEV_CROSS_WIND_DET,SDEV_POTNTL_TEMP_DET,
SDEV_H2O_MIX_RATIO_DET,SDEV_CO2_MIX_RATIO,SDEV_O3_CONC_DET,SDEV_CH4_CONC_DET,
SKEW_VERT_GUST_DET,SKEW_U_COMPNT_WIND_VELOC_DET,SKEW_V_COMPNT_WIND_VELOC_DET,
SKEW_ALONG_WIND_DET,SKEW_CROSS_WIND_DET,SKEW_POTNTL_TEMP_DET,
SKEW_H2O_MIX_RATIO_DET,SKEW_CO2_MIX_RATIO_DET,SKEW_O3_CONC_DET,
SKEW_CH4_CONC_DET,KURT_VERT_GUST_DET,KURT_U_COMPNT_WIND_VELOC_DET,
KURT_V_COMPNT_WIND_VELOC_DET,KURT_ALONG_WIND_DET,KURT_CROSS_WIND_DET,
KURT_POTNTL_TEMP_DET,KURT_H2O_MIX_RATIO_DET,KURT_CO2_MIX_RATIO_DET,
KURT_O3_CONC_DET,KURT_CH4_CONC_DET,CORC_VERT_U_WIND_COMPNT_DET,
CORC_VERT_V_WIND_COMPNT_DET,CORC_VERT_ALONG_WIND_DET,CORC_VERT_CROSS_WIND_DET,
CORC_VERT_POTNTL_TEMP_DET,CORC_VERT_H2O_MIX_RATIO_DET,
CORC_VERT_CO2_MIX_RATIO_DET,CORC_VERT_O3_CONC_DET,CORC_VERT_CH4_CONC_DET,
CORC_POTNTL_H2O_MIX_RATIO_DET,MMNTM_FLUX_U_WIND_COMPNT_DET,
MMNTM_FLUX_V_WIND_COMPNT_DET,MMNTM_FLUX_ALONG_MEAN_WIND_DET,
MMNTM_FLUX_CROSS_MEAN_WIND_DET,SENSIBLE_HEAT_FLUX_DET,LATENT_HEAT_FLUX_DET,
CO2_FLUX_DET,O3_FLUX_DET,O3_DEPOSITION_VELOC_DET,CH4_FLUX_DET,CRTFCN_CODE,
REVISION_DATE
'SSA',01-JUN-94,171221,01-JUN-94,171812,'CS',2,1,0,53.97977,-104.784,53.88426,
-105.195,406.88,349.72,380.92,336.8,244.5,555.2,68.7,137.4,5.85,18.27,295.88,
4.02,-3.64,4.07,94.83,-999.0,843.6,79.4,-999.0,-999.0,-999.0,-999.0,-999.0,1.0,
-999.0,354.0,-999.0,-999.0,-999.0,-999.0,-999.0,-999.0,.31,.32,.12,1.84,2.19,.14,
-999.0,33.2,11.4,-999.0,-999.0,-999.0,-999.0,-999.0,1.0,-999.0,.3,-999.0,-999.0,
-999.0,-999.0,-999.0,-999.0,-.0000004,.00000286,-.00000722,-.0000304,.0000958,
-.00000367,1.0,.000905,-.0000915,-999.0,-999.0,1.0,.000013,1.0,1.0,1.12,1.84,
2.19,2.02,2.03,.32,.12,.3,-999.0,-999.0,.33,-.09,.03,.18,.34,.89,.15,-.14,
-999.0,-999.0,3.55,3.08,2.36,2.5,3.4,3.28,2.91,3.51,-999.0,-999.0,.16,-.13,-.2,
-.02,.43,.34,-.09,-999.0,-999.0,.55,.3822,-.3476,-.5139,-.0533,180.1,126.0,
-1.152,-999.0,-999.0,-999.0,1.133,1011.8,2457548,287.04,1.12,1.82,2.04,1.87,
2.0,.32,.1,.3,-999.0,999.9,.33,-.24,.27,.48,.19,.92,.27,-.27,-999.0,999.99,
3.56,3.25,2.76,3.2,3.06,3.3,3.09,3.82,-999.0,-999.0,.17,-.15,-.23,-.01,.43,
.41,-.11,-999.0,-999.0,.69,.3939,-.3844,-.5491,-.0375,179.0,132.8,-1.324,
-999.0,-999.0,999.99,'CPI',12-JUN-96
'SSA',01-JUN-94,172232,01-JUN-94,173527,'CS',2,2,0,53.80465,-105.5,53.58083,
-106.394,361.68,326.33,304.59,297.18,242.0,550.5,71.5,141.2,7.38,18.31,295.87,
4.09,-4.33,5.52,94.89,-999.0,817.7,94.2,-999.0,-999.0,-999.0,-999.0,-999.0,1.0,
-999.0,355.1,-999.0,-999.0,-999.0,-999.0,-999.0,-999.0,.39,.38,.27,2.08,2.3,.3,
-999.0,106.9,22.2,-999.0,-999.0,-999.0,-999.0,-999.0,1.0,-999.0,.8,-999.0,
-999.0,-999.0,-999.0,-999.0,-999.0,-.00000626,.00000547,.00000141,-.0000393,
-.0000114,-.0000133,1.0,.00212,.000552,-999.0,-999.0,1.0,-.0000124,1.0,1.0,
1.32,2.08,2.3,2.13,2.25,.38,.27,.8,-999.0,-999.0,.48,-.1,-.1,-.15,.04,.59,.01,
.49,-999.0,-999.0,3.44,2.81,2.54,2.65,2.85,2.83,2.99,3.38,-999.0,-999.0,.18,
-.24,-.32,.02,.38,.25,-.12,-999.0,-999.0,.22,.5635,-.8401,-1.0088,.0744,220.5,
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248.7,-4.654,-999.0,-999.0,-999.0,1.133,1012.0,2457025,287.04,1.32,1.95,2.29,
2.11,2.13,.37,.27,.7,-999.0,999.9,.46,.05,-.11,-.2,.04,.6,0.0,.52,-999.0,999.99,
3.42,3.0,2.54,2.69,2.9,2.97,2.95,3.22,-999.0,-999.0,.21,-.24,-.33,.01,.38,.24,
-.11,-999.0,-999.0,.2,.6142,-.8254,-1.0285,.0254,213.3,244.2,-4.102,-999.0,
-999.0,999.99,'CPI',12-JUN-96
```

The following are wrapped versions of data record from a sample moving window data file on the CD-ROM:

```
SPATIAL_COVERAGE,RUN_START_DATE,RUN_START_TIME,RUN_END_DATE,RUN_END_TIME,
FLUX_MISSION_DESIGNATOR,FLUX_MISSION_NUM,FLUX_PASS_NUM,FLUX_SEGMENT_NUM,
START_LATITUDE,START_LONGITUDE,END_LATITUDE,END_LONGITUDE,START_BOREAS_X,
START_BOREAS_Y,END_BOREAS_X,END_BOREAS_Y,HEADING,MEAN_PRESS_ALTITUDE,
MEAN_RADAR_ALTITUDE,MEAN_WIND_DIR,MEAN_WIND_SPEED,MEAN_AIR_TEMP,
MEAN_POTNTL_TEMP,MEAN_H2O_MIX_RATIO,MEAN_U_COMPNT_WIND_VELOC,
MEAN_V_COMPNT_WIND_VELOC,MEAN_STATIC_PRESS,MEAN_SURF_RAD_TEMP,
MEAN_DOWN_TOTAL_RAD,MEAN_UP_TOTAL_RAD,MEAN_DOWN_LONGWAVE_RAD,
MEAN_UP_LONGWAVE_RAD,MEAN_NET_RAD,MEAN_UP_PPFD,MEAN_DOWN_PPFD,
MEAN_AUX_RAD,MEAN_GREEN_INDEX,MEAN_CO2_CONC,MEAN_O3_CONC,MEAN_CH4_CONC,
MEAN_SAT_SIM_CH1,MEAN_SAT_SIM_CH2,MEAN_SAT_SIM_CH3,MEAN_SAT_SIM_CH4,
SDEV_AIR_TEMP,SDEV_POTNTL_TEMP,SDEV_H2O_MIX_RATIO,SDEV_U_COMPNT_WIND_VELOC,
SDEV_V_COMPNT_WIND_VELOC,SDEV_STATIC_PRESS,SDEV_SURF_RAD_TEMP,
SDEV_DOWN_TOTAL_RAD,SDEV_UP_TOTAL_RAD,SDEV_DOWN_LONGWAVE_RAD,
SDEV_UP_LONGWAVE_RAD,SDEV_NET_RAD,SDEV_UP_PPFD,SDEV_DOWN_PPFD,
SDEV_AUX_RAD,SDEV_GREEN_INDEX,SDEV_CO2_CONC,SDEV_O3_CONC,
SDEV_CH4_CONC,SDEV_SAT_SIM_CH1,SDEV_SAT_SIM_CH2,SDEV_SAT_SIM_CH3,
SDEV_SAT_SIM_CH4,TREND_AIR_TEMP,TREND_POTNTL_TEMP,TREND_H2O_MIX_RATIO,
TREND_U_COMPNT_WIND_VELOC,TREND_V_COMPNT_WIND_VELOC,TREND_STATIC_PRESS,
TREND_SURF_RAD_TEMP,TREND_DOWN_TOTAL_RAD,TREND_UP_TOTAL_RAD,
TREND_DOWN_LONGWAVE_RAD,TREND_UP_LONGWAVE_RAD,TREND_GREEN_INDEX,
TREND_CO2_CONC,TREND_O3_CONC,TREND_CH4_CONC,SDEV_VERT_GUST_RAW,
SDEV_U_COMPNT_WIND_VELOC_RAW,SDEV_V_COMPNT_WIND_VELOC_RAW,
SDEV_ALONG_WIND_RAW,SDEV_CROSS_WIND_RAW,SDEV_POTNTL_TEMP_RAW,
SDEV_H2O_MIX_RATIO_RAW,SDEV_CO2_MIX_RATIO_RAW,SDEV_O3_CONC_RAW,
SDEV_CH4_CONC_RAW,SKEW_VERT_GUST_RAW,SKEW_U_COMPNT_WIND_VELOC_RAW,
SKEW_V_COMPNT_WIND_VELOC_RAW,SKEW_ALONG_WIND_RAW,SKEW_CROSS_WIND_RAW,
SKEW_POTNTL_TEMP_RAW,SKEW_H2O_MIX_RATIO_RAW,SKEW_CO2_MIX_RATIO,
SKEW_O3_CONC_RAW,SKEW_CH4_CONC_RAW,KURT_VERT_GUST_RAW,
KURT_U_COMPNT_WIND_VELOC_RAW,KURT_V_COMPNT_WIND_VELOC_RAW,
KURT_ALONG_WIND_RAW,KURT_CROSS_WIND_RAW,KURT_POTNTL_TEMP_RAW,
KURT_H2O_MIX_RATIO_RAW,KURT_CO2_MIX_RATIO_RAW,KURT_O3_CONC_RAW,
KURT_CH4_CONC_RAW,CORC_VERT_U_WIND_COMPNT_RAW,CORC_VERT_V_WIND_COMPNT_RAW,
CORC_VERT_ALONG_WIND_RAW,CORC_VERT_CROSS_WIND_RAW,
CORC_VERT_POTNTL_TEMP_RAW,CORC_VERT_H2O_MIX_RATIO_RAW,
CORC_VERT_CO2_MIX_RATIO_RAW,CORC_VERT_O3_CONC_RAW,CORC_VERT_CH4_CONC_RAW,
CORC_POTNTL_H2O_MIX_RATIO_RAW,MMNTM_FLUX_V_WIND_COMPNT_RAW,
MMNTM_FLUX_U_WIND_COMPNT_RAW,MMNTM_FLUX_ALONG_MEAN_WIND_RAW,
MMNTM_FLUX_CROSS_MEAN_WIND_RAW,SENSIBLE_HEAT_FLUX_RAW,LATENT_HEAT_FLUX_RAW,
CO2_FLUX_RAW,O3_FLUX_RAW,O3_DEPOSITION_VELOC_RAW,CH4_FLUX_RAW,
AIR_DENSITY_CONSTANT,SPECIFIC_HEAT_CONSTANT,LATENT_HEAT_VAP_CONSTANT,
DRY_AIR_GAS_CONSTANT,SDEV_VERT_GUST_DET,SDEV_U_COMPNT_WIND_VELOC_DET,
SDEV_V_COMPNT_WIND_VELOC_DET,SDEV_ALONG_WIND_DET,SDEV_CROSS_WIND_DET,
SDEV_POTNTL_TEMP_DET,SDEV_H2O_MIX_RATIO_DET,SDEV_CO2_MIX_RATIO,
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SDEV_O3_CONC_DET,SDEV_CH4_CONC_DET,SKEW_VERT_GUST_DET,
SKEW_U_COMPNT_WIND_VELOC_DET,SKEW_V_COMPNT_WIND_VELOC_DET,
SKEW_ALONG_WIND_DET,SKEW_CROSS_WIND_DET,SKEW_POTNTL_TEMP_DET,
SKEW_H2O_MIX_RATIO_DET,SKEW_CO2_MIX_RATIO_DET,SKEW_O3_CONC_DET,
SKEW_CH4_CONC_DET,KURT_VERT_GUST_DET,KURT_U_COMPNT_WIND_VELOC_DET,
KURT_V_COMPNT_WIND_VELOC_DET,KURT_ALONG_WIND_DET,KURT_CROSS_WIND_DET,
KURT_POTNTL_TEMP_DET,KURT_H2O_MIX_RATIO_DET,KURT_CO2_MIX_RATIO_DET,
KURT_O3_CONC_DET,KURT_CH4_CONC_DET,CORC_VERT_U_WIND_COMPNT_DET,
CORC_VERT_V_WIND_COMPNT_DET,CORC_VERT_ALONG_WIND_DET,
CORC_VERT_CROSS_WIND_DET,CORC_VERT_POTNTL_TEMP_DET,
CORC_VERT_H2O_MIX_RATIO_DET,CORC_VERT_CO2_MIX_RATIO_DET,
CORC_VERT_O3_CONC_DET,CORC_VERT_CH4_CONC_DET,CORC_POTNTL_H2O_MIX_RATIO_DET,
MMNTM_FLUX_U_WIND_COMPNT_DET,MMNTM_FLUX_V_WIND_COMPNT_DET,
MMNTM_FLUX_ALONG_MEAN_WIND_DET,MMNTM_FLUX_CROSS_MEAN_WIND_DET,
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```

8. Data Organization

8.1 Data Granularity

The smallest orderable data set available is one file of flux runs during a day. Note that although there are less than 100 records in any data file, there are over 170 columns of data. Most spreadsheet software should be able to handle up to 256 columns of data.

8.2 Data Format(s)

The Compact Disk-Read-Only Memory (CD-ROM) files contain American Standard Code for Information Interchange (ASCII) numerical and character fields of varying length separated by commas. The character fields are enclosed with single apostrophe marks. There are no spaces between the fields.

Each data file on the CD-ROM has four header lines of Hyper-Text Markup Language (HTML) code at the top. When viewed with a Web browser, this code displays header information (data set title, location, date, acknowledgments, etc.) and a series of HTML links to associated data files and related data sets. Line 5 of each data file is a list of the column names, and line 6 and following lines contain the actual data.

9. Data Manipulations

9.1 Formulae

Constants used in flux calculations:

The specific heat of air (Cp) is calculated as a function of the average water vapor mixing ratio, ignoring the pressure-dependent isobaric residual (Smithsonian Meteorological Tables, p. 339). In equation form, Cp=Cp0 + b*rbar, where Cp0=1004.42 J/kgK, b=1845.98, and rbar is the average water vapor mixing ratio, in units of g/g of kg/kg.

The latent heat of vaporization, Lv, is calculated as a function of the average temperature, Tbar, as Lv=Lv0 + c*Tbar, where Lv0=3.15209e06 J/kg, and c=-2382.9 for Tbar in Kelvin. These values were obtained by a least-squares fit to values tabulated in the Smithsonian Meteorological Tables, p. 343).

Formulas used for the various eddy covariance fluxes:

In these expressions, the angle brackets <> denote an average over the length of the time series.

Sensible heat flux:

Sensible heat flux, H, calculated as H=(density of moist air)*(Specific heat of air at constant pressure)*<w'*theta'>. Here w is the vertical air motion component (updraft), and theta is the air potential temperature. Resulting units: W/m^2.

Latent heat flux:

Latent heat flux, E, calculated as E=(density of moist air)*Lv*<w'r'>, where r is the water vapor mixing ratio. Resulting units: W/m^2.

Carbon dioxide flux:

Carbon dioxide flux, A, calculated as A=(density of dry air)*<w'C'>, where C is the CO_2 concentration expressed as mixing ratio (mass CO_2 per mass dry air). The units from this calculation would be mass CO_2/m^2 s. By BORIS convention, however, the archived units are converted to micromole $CO_2/m^2/s$.

Momentum fluxes:
The various vertical fluxes of horizontal momentum are calculated as (density of moist air)*<w'vel'>, giving units of kg/ms^2, where vel is u, v, unat, or vnat. Here, (u,v) is the horizontal wind vector in east-west and north-south coordinates, while (unat,vnat) is the vector of along- and cross-wind components of the horizontal wind, with unat parallel to the pass-average wind direction.

9.1.1 Derivation Techniques and Algorithms
Not applicable.

9.2 Data Processing Sequence

9.2.1 Processing Steps
As listed in Section 7.3, there are two basic categories of numbers (statistics and fluxes) in the archived values for each pass. The first category (groups 3, 4, and 6-10) are statistics and fluxes based on the "raw" data, i.e., on the time series data as they were recorded and processed. The second category (groups 12-16) are "detrended." In these cases the linear trends were removed by calculating an equal-weight least-squares line fit (y=mx+b) for each variable, then subtracting that line from the original series. Group 5 contains the linear trends (the slopes, or m values) from those least-squares fits. The fluxes for the first category ("raw") are based on the covariance values w's', where w'=w-wmean, s=s'-smean, wmean is the simple arithmetic average of w, and smean is the simple arithmetic average of the scalar s. The second category "detrended" fluxes are based on w's' where w'=w-(fitted line for w) and s'=s-(fitted line for s).

9.2.2 Processing Changes
None.

9.3 Calculations
See Section 9.1.

9.3.1 Special Corrections/Adjustments
Time lag between CO_2/H_2O measurements and gust probe: Due to the geometry of the instrument locations (see Section 4.1.6), there is a significant lag between measurements by the LI-COR device (water vapor and carbon dioxide) and the 3-D winds. Based on instrument placement, external airflow velocities, and internal (sampling tubes) flow velocities, the lag was predicted to be 0.3 sec. In contrast, the distance between the gust probe tip and the Friehe temperature probe causes negligible lag between the temperature and wind measurements. Thus, the lag between the temperature and LI-COR measurements should be equivalent to that between the wind and LI-COR measurements. The predicted temperature-LI-COR lag (0.3 sec) was verified by flying the plane several times through the plume from a local power plant, at distances close enough to the source that changes in temperature, water vapor, and CO_2 were very abrupt at the plume edges. Thus, prior to any other calculations, the LI-COR data are shifted 0.3 sec, to bring those data in sync with the remainder of the data.

9.3.2 Calculated Variables
See lists of variables in Sections 1.4, 7.1, and 7.3.

9.4 Graphs and Plots
Not applicable.

10. Errors

10.1 Sources of Error

As with any time-series measurements, there are uncertainties in the values of the resulting measured and derived quantities simply due to the limits of the sampling techniques. Each archived flux and statistic is a single sample, or single realization, of the measurement, and thus has a higher level of uncertainty than if multiple measurements were possible.

Sampling limits:

As detailed by Lenschow and Stankov (1986, J. Atmos. Sci., 43, 1198-1209), substantial uncertainties are present in single-pass measurements of fluxes. Even to reduce such uncertainties below the 10% range, for example, would require a single aircraft pass to be very long (distance), in fact, so long that other uncertainties would result from 1) having the BL characteristics change with time and 2) having the flight track pass over changing surface characteristics. The most direct technique available with aircraft to address this problem is to make repeated, shorter passes along the same track or at least along similar tracks. The fluxes and statistics from the individual passes may then be combined to at least reduce the standard error of each measurement. This strategy was incorporated into many of the King Air flight patterns.

Instrument limits:

See Section 11.2.

10.2 Quality Assessment

An extensive intercomparison of the BOREAS flux aircraft is given in Dobosy et al., 1994. In that text, King Air measurements, including means and variances of all the flux variables, as well as the fluxes themselves, are compared with corresponding values from the Canadian NRC Twin Otter and the NCAR Electra, for multiple wing-to-wing passes at various times during the 1994 experiment. As of this writing, these comparisons are the best available assessments of the overall data quality for the King Air, at least in comparison with similarly instrumented platforms.

10.2.1 Data Validation by Source

None given.

10.2.2 Confidence Level/Accuracy Judgment

None given.

10.2.3 Measurement Error for Parameters

None given.

10.2.4 Additional Quality Assessments

None given.

10.2.5 Data Verification by Data Center

Data were examined for general consistency and clarity.

11. Notes

11.1 Limitations of the Data

For each pass or segment of a pass, the statistics and fluxes are archived for time series with simple arithmetic means removed and then again for time series with simple linear trends removed. The first set ("demeaned") thus represents the original, raw data with no filtering applied. The second set (detrended) also represents unfiltered data, having only the linear trends removed. In order to apply more complicated, nonlinear detrending or filtering methods, the original data must be obtained.

11.2 Known Problems with the Data

Vertical velocity measurements: Spectral density plots of vertical velocity (w) generally show a fairly well defined inertial subrange, with -5/3 slope out to about 9 Hz, at which point the effects of the anti-aliasing low-pass filter are evident. Many of the w spectral plots do, however, show a slight "bulge" above the -5/3 line in the range 0.1-1 Hz. As of this writing (09-Jul-1996) we believe this is an artifact of the postflight calculations. Examples of these spectra can be seen in Dobosy et al., 1997.

High-rate H_2O measurements (LI-COR 6262): The LI-COR 6262 response is described by the manufacturer as being a 90% response to step-function changes in concentration in 0.1 s. The combination of this characteristic, any along-flow mixing in the sample tubes, and the anti-aliasing filter are evident in the spectral density plots for H_2O mixing ratio. These plots generally show an inertial subrange (slope -5/3) out to about 2 Hz, at which point the response drops sharply. At 2 Hz, the SNR is usually about 20 dB. Implications of this response for the flux calculations are that the H_2O fluxes are being resolved only to about 2 Hz (about 40 m for typical research airspeeds).

CO_2 measurements (LI-COR 6262): The response characteristics for CO_2 are generally the same as for H_2O, except that the SNR at 2 Hz is usually 10 dB or less. As with CO_2, these figures imply that the CO_2 fluxes are being resolved only to about 2 Hz (about 40 m for typical research airspeeds).

11.3 Usage Guidance

Note that although there are less than 100 records in any data file, there are over 170 columns of data. Most spreadsheet software should be able to handle up to 256 columns of data.

11.4 Other Relevant Information

None given.

12. Application of the Data Set

These data can be used to obtain study area and regional scale estimates of the various fluxes.

13. Future Modifications and Plans

None given.

14. Software

14.1 Software Description

Not applicable.

14.2 Software Access

Not applicable.

15. Data Access

The King Air 1994 aircraft flux and moving window data are available from the Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

15.1 Contact Information

For BOREAS data and documentation please contact:

ORNL DAAC User Services
Oak Ridge National Laboratory
P.O. Box 2008 MS-6407
Oak Ridge, TN 37831-6407
Phone: (423) 241-3952
Fax: (423) 574-4665
E-mail: ornldaac@ornl.gov or ornl@eos.nasa.gov

15.2 Data Center Identification

Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics http://www-eosdis.ornl.gov/ [Internet Link].

15.3 Procedures for Obtaining Data

Users may obtain data directly through the ORNL DAAC online search and order system [http://www-eosdis.ornl.gov/] and the anonymous FTP site [ftp://www-eosdis.ornl.gov/data/] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

15.4 Data Center Status/Plans

The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

16. Output Products and Availability

16.1 Tape Products

Not applicable.

16.2 Film Products

Not applicable.

16.3 Other Products

These data are available on the BOREAS CD-ROM series.

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

See references listed in Section 17.2.

17.2 Journal Articles and Study Reports

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17.3 Archive/DBMS Usage Documentation

None given.

18. Glossary of Terms and abbreviations

Abbreviations used in weather notes:

cu	cumulus
st	status
ci	cirrus
sct	scattered
Zi	inversion height above ground
H	haze
K	smoke
cist	cirrostratus
clr	clear
ovc	overcast
RW-	light rain showers
acu	altocumulus

Abbreviations in flight descriptions:

rt	round trip
agl	above ground level (in feet)
msl	above mean sea level (in feet)
mult	multiple
TAS	true airspeed
lvl	level
wind	"L" "L" with one leg parallel to wind direction, flown as at least one round trip

19. List of Acronyms

AFM - Airborne Fluxes and Meteorology
ASCII - American Standard Code for Information Interchange
BL - atmospheric Boundary Layer
BOREAS - BOReal Ecosystem-Atmosphere Study
BORIS - BOREAS Information System
CD-ROM - Compact Disk - Read-Only Memory
DAAC - Distributed Active Archive Center
EOS - Earth Observing System
EOSDIS - EOS Data and Information System
GIS - Geographic Information System
GMT - Greenwich Mean Time
GPS - Global Positioning System
GSFC - Goddard Space Flight Center
HTML - HyperText Markup Language
IFC - Intensive Field Campaign
IRS - Intertial Reference System
NAD83 - North American Datum of 1983
NASA - National Aeronautics and Space Administration
NCAR - National Center for Atmospheric Research
NRC - National Research Council, Canada
NSA - Northern Study Area
OA - Old Aspen
ORNL - Oak Ridge National Laboratory
PANP - Prince Albert National Park
PAR - Photosynthetically Active Radiation
RT - Regional Transect
SSA - Southern Study Area
TF - Tower Flux
URL - Uniform Resource Locator

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Kelly, R.D., "Airborne Investigation of Biosphere-Atmosphere Interactions over the Boreal Forest." In Collected Data of The Boreal Ecosystem-Atmosphere Study. Eds. J. Newcomer, D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers. CD-ROM. NASA, 2000.

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13. ABSTRACT *(Maximum 200 words)*

The BOREAS AFM-2 team collected pass-by-pass fluxes (and many other statistics) for a large number of level (constant altitude), straight-line passes used in a variety of flight patterns. The data were collected by the University of Wyoming King Air in 1994 BOREAS IFCs 1-3. Most of these data were collected at 60-70 m above ground level, but a significant number of passes were also flown at various levels in the planetary boundary layer, up to about the inversion height. This documentation concerns only the data from the straight and level passes that are presented as original (over the NSA and SSA) and moving window values (over the Transect). Another archive of King Air data is also available, containing data from all the soundings flown by the King Air 1994 IFCs 1-3. The data are stored in tabular ASCII files.

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