NASA/TM—2000–209891, Vol. 212

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

Forrest G. Hall and Sara Conrad, Editors

Volume 212

BOREAS TF-11 CO_2 and CH_4 Flux Data from the SSA-Fen

D.W. Valentine

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

November 2000

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BOREAS TF-11 CO_2 and CH_4 Flux Data from the SSA-Fen

David Valentine

Summary

The BOREAS TF-11 team collected several data sets in its efforts to fully describe the flux and site characteristics at the SSA-Fen site. This data set contains fluxes of methane and carbon dioxide at the SSA-Fen site measured using static chambers. The measurements were conducted as part of a 2 x 2 factorial experiment in which we added carbon (300 g/m^2 as wheat straw) and nitrogen (6 g/m^2 as urea) to four replicate locations in the vicinity of the TF-11 tower. In addition to siting and treatment variables, it reports air temperature and water table height relative to the average peat surface during each measurement. The data set covers the period from the first week of June 1994 through the second week of September 1994. The data are stored in tabular ASCII files.

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1. Data Set Overview

1.1 Data Set Identification

BOREAS TF-11 CO_2 and CH_4 Flux Data from the SSA-Fen

1.2 Data Set Introduction

This data set contains fluxes of methane and carbon dioxide at the BOReal Ecosystem-Atmosphere Study (BOREAS) Southern Study Area (SSA) Fen site measured using static chambers. The measurements were conducted as part of a 2 x 2 factorial experiment in which we added carbon (300 g/m^2 as wheat straw) and nitrogen (6 g/m^2 as urea) to four replicate locations in the vicinity of the Tower Flux (TF)-11 tower. In addition to siting and treatment variables, it reports air temperature and water table height relative to the average peat surface during each measurement. The data set covers the period from the first week of June 1994 through the second week of September 1994.

1.3 Objective/Purpose

Much of the area within the boreal forest biome consists of wetlands, in which large carbon stores and high water tables drive fundamentally different atmospheric interactions than occur under the other forest types studied by BOREAS. One key difference is in the form carbon is emitted following soil microbial respiration; in wetlands, much of it is emitted as methane. Wetlands are the dominant influence of boreal forests on atmospheric methane.

This study was undertaken in order to assess responses of methane emissions in northern wetlands to potential changes in plant productivity, nitrogen availability or both. Whiting and Chanton (1993) recently observed that methane emissions from wetlands across the globe are well related to net primary productivity (NPP). This may be for a variety of reasons, including enhanced plant transport, increased methanogenic substrates from root exudates, increased litter input cascading to enhanced substrate availability for methanogenesis, or enhanced C and N mineralization of decomposing residues. Previous work by others and us (Valentine et al., 1994) has shown that substrate availability is a key constraint on methane production in wetlands. The present study was an effort to test whether substrate manipulation results from laboratory studies could be mirrored under field conditions.

1.4 Summary of Parameters

The primary focus is on the net fluxes of methane and carbon dioxide measured using 30-minute static chamber enclosures. These were measured at weekly intervals at four replicate platform locations, four treatment levels (control, +C, +N, and +C+N), and two microtopographic positions (hummock and hollow). A total of 32 chamber locations contributed to the set.

The data set also includes the height of the water table above the average peat surface, defined as the average height of 16 points on a 5-cm grid within a 30-cm * 30-cm chamber collar. The grid was measured once during the growing season at each location and referenced to a bogwell at each of the four replicate locations, and the water table level in the bogwell was measured at weekly intervals coincident with the flux measurements.

1.5 Discussion

These data were collected from a set of small locations within the fen, and therefore no one location represented the entire study site. In fact, the fen in which this work was conducted was characterized by a large-scale gradient of vegetation, microtopography, and hydrology such that the study site itself is representative only of the portion of the fen in which it was located (i.e., the lower 1/3).

These data were collected at the same site and over the same time period as Shashi Verma and his team measured methane and carbon dioxide fluxes using eddy correlation. Measurements made using micrometeorological and chamber techniques comprised the two major components of the TF-ll effort.

1.6 Related Data Sets

BOREAS TF-11 Biomass Data over the SSA-Fen
BOREAS TF-11 CO2 and CH4 Flux data from the SSA-Fen
BOREAS TGB-01/TGB-03 CH4 Chamber flux data over the NSA-Fen
BOREAS TGB-01/TGB-03 Water Table and Peat Temperature Data over the NSA
BOREAS TGB-03 Plant Species Composition Data over the NSA-Fen
BOREAS TGB-01/TGB-03 NEE Data over the NSA-Fen
BOREAS TGB-03 CH4 and CO2 Chamber Flux Data over NSA Upland Sites

2. Investigator(s)

2.1 Investigator(s) Name and Title

David Valentine
Assistant Professor
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University of Alaska
Fairbanks, AK 99775-7200

2.2 Title of Investigation

Influence of Substrate Characteristics and Other Environmental Factors on Methane Emissions from the BOREAS Southern Study Area Fen Site. I. Chamber Flux Data

2.3 Contact Information

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Jeffrey.Newcomer@gsfc.nasa.gov

3. Theory of Measurements

Methane flux was measured using a static chamber technique in which the headspace CH_4 concentration is measured at 5-minute intervals over 30 minutes. The slope of concentration change over time is calculated using least-squares regression, and then translated into flux by multiplying by chamber headspace volume and dividing by surface area covered (Klinger et al., 1994).

Carbon dioxide flux is measured similarly to methane flux. During the 30-minute enclosure, however, the rate of carbon dioxide uptake decreases. The slope is therefore calculated by fitting the data with a saturating exponential equation of the form Y=a-b(exp(cT)), where Y and T represent CO_2 concentration and time, respectively, and a, b, and c are fit parameters. The slope is then calculated as the derivative of the above at time 0, i.e., b*c. As with methane flux, the slope is then translated into flux by multiplying by chamber headspace volume and dividing by surface area covered.

The location of the water table relative to the peat surface was measured within a perforated PVC "bog well" using a measuring tape. The height of the well relative to all the other instruments at each platform was measured and checked at the beginning and end of the season. The average peat surface height in each chamber location was measured relative to the bogwell at the end of the growing season. We assumed that the water table was level across all sites, and calculated the water table height at each chamber at each date as (PSo-BWo)-(BWt-BWo), where PS and BW refer to peat surface and water table height relative to the top of the bogwell, respectively, and the subscripts o and t refer to reference and other dates, respectively.

4. Equipment

4.1 Sensor/Instrument Description

4.1.1 Collection Environment

Data were collected near mid-day (+/- 2 h) at weekly intervals for each platform. Flooding at the site at the end of July 1994 prevented data collection for 1 week.

4.1.2 Source/Platform

All chamber sites were fitted with stainless steel chamber collars cut into the surface 10 cm of peat at the beginning of the season. All collars remained in place during the entire summer.

4.1.3 Source/Platform Mission Objectives

The purpose of the collars was to provide a consistent seating place to place the chambers.

4.1.4 Key Variables

- Methane flux (positive = flux to atmosphere)
- Carbon dioxide flux
- Water table height above peat surface

4.1.5 Principles of Operation

Fluxes of CO_2 and CH_4 were measured using static chambers. This technique entails measurement of headspace concentration change of CO_2 or CH_4 over a defined period (30 minutes) using a gas chromatograph (GC). The slope of the change is multiplied by the ratio of chamber volume to covered area to obtain flux data.

4.1.6 Sensor/Instrument Measurement Geometry

Not applicable.

4.1.7 Manufacturer of Sensor/Instrument

The gas flux chambers were built by investigator, and were made of transparent FEP Teflon attached to outside of welded aluminum frame using double-sided tape. Chamber is attached to a permanently installed stainless steel collar at the time of sampling using a series of spring clamps.

The GC was a Shimadzu GC-8A equipped with 1-mL sample injection loop, flame ionization detector (FID), and methanizer, manufactured by:

Shimadzu Scientific Instruments, Inc.
7102 Riverwood Drive
Columbia, MD 21046 USA
(410) 381-1227
(800) 477-1227
(410) 381-1222 (fax)

The Electronic thermometer used for air temperature measurements was an Omega microprocessor thermometer model HH21, manufactured by:

OMEGA Engineering, Inc.
P.O. Box 4047
One Omega Drive
Stamford, CT 06907-0047
(800) 826-6342
(203) 359-1660
(203) 359-7700 (fax)

4.2 Calibration

4.2.1 Specifications

Flux measurement attempts in which the R^2 for concentration rate change with time dropped below 0.97 were rejected. EXCEPTION: If deletion of a single data point (outlier) raised the R^2 above 0.97, then the measurement based on the six remaining points was kept.

The GC column oven was operated at 70 °C, FID temperature was 150 °C, and the N_2 carrier gas flowed at 35 mL per minute.

4.2.1.1 Tolerance

None given.

4.2.2 Frequency of Calibration

The GC was calibrated at the start of each day using one of two calibration standards, depending on anticipated concentration ranges. Headspace samples from equilibrating porewater gas profile samples had high concentrations of both methane and carbon dioxide, so we used a standard containing 10,000 ppmv (analysis ± 2%) of both these gases (Scotty IV Can mix 216, obtained from Scott Specialty Gases, Longmont, CO 80501,(303) 442-4700). For flux measurements entailing much lower concentrations of methane and carbon dioxide, we diluted the above-referenced Scotty standard 10:1 with ambient air. This was done by loading a stopcock-fitted, 60-mL polypropylene syringe with excess standard, expelling all but 6 mL, then immediately pulling in outside ambient air to make up 60 mL. Calculation of the diluted standard accounted for average concentrations of methane and carbon dioxide in ambient air. Analyses of diluted standards yielded reproducibility across dilutions of better than 3%. All standards were run on the GC until reproducibility was better than 1% over the course of three standard injections from a single syringe. Calibration was rechecked initially every 10 samples, but detector stability was so high that calibration was checked only at the end of the day for most of the season. End-of-day calibration checks were always within 5% of the starting calibration.

4.2.3 Other Calibration Information

None given.

5. Data Acquisition Methods

Fluxes of CH_4 and CO_2 were assessed weekly at each plot using a static chamber fabricated from transparent FEP film supported by an aluminum frame (0.3 m * 0.3 m * 0.4 m tall). A foam gasket attached to the bottom of each chamber acted to seal the headspace as the chamber was secured onto its collar using four steel spring clamps. Headspace samples (20 mL) were taken with a 35-mL polypropylene syringe fitted with a nylon stopcock at enclosure (time 0) and every 5 minutes for 30 minutes, yielding a total of seven headspace samples. Headspace temperatures were taken at the beginning and end of each enclosure period using a shaded thermometer. We analyzed the gas samples within 6 hours on a Shimadzu GC-8 equipped with a 1-mL sample loop, a methanizer, and a FID. We used N_2 as the carrier gas at a 35-mL/min flow rate through a Porapak Q column in a 70 °C oven, and a detector temperature of 180 °C.

6. Observations

6.1 Data Notes

Chamber flux and other data are sparse or missing for the end of July 1994 because heavy rains raised the water table above the tops of all chamber collars and of most platforms.

6.2 Field Notes

None given.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

All measurements were made along two transects identified by their location relative to the TF-11 micrometeorology tower: a north transect (NA and NB platforms) and a south transect (SA and SB platforms). All measurements were made within 70 m of the TF-11 tower, whose North American Datum of 1983 (NAD83) coordinates are 53.80206°N, 104.61798°W.

7.1.2 Spatial Coverage Map

Not available.

7.1.3 Spatial Resolution

These are point measurements made at the given locations.

7.1.4 Projection

Not applicable.

7.1.5 Grid Description

Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

Data were collected from 08-Jun-1994 until 15-Sep-1994.

7.2.2 Temporal Coverage Map

Not available.

7.2.3 Temporal Resolution

Methane and carbon dioxide flux data are optimally collected at subdaily time intervals.

7.3 Data Characteristics

7.3.1 Parameter/Variable

The parameters contained in the data files on the CD-ROM are:

Column Name
SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
C_ADDED
N_ADDED
START_AIR_TEMP
END_AIR_TEMP
CH4_FLUX
CO2_FLUX
WATER_TABLE_HEIGHT
SITE_COMMENTS
CRTFCN_CODE
REVISION_DATE

7.3.2 Variable Description/Definition

The descriptions of the parameters contained in the data files on the CD-ROM are:

Column Name	Description
SITE_NAME	The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type.
SUB_SITE	The identifier assigned to the sub-site by BOREAS, in the format GGGGG-IIIII, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
TIME_OBS	The Greenwich Mean Time (GMT) when the data were collected.
C_ADDED	Estimated amount of carbon contained in the wheat straw that was added to the plot.
N_ADDED	Estimated amount of nitrogen contained in the urea that was added to the plot.
START_AIR_TEMP	The air temperature within the chamber at the start of the measurement period.
END_AIR_TEMP	The air temperature within the chamber at the end of the measurement period.
CH4_FLUX	Methane flux.
CO2_FLUX	Carbon Dioxide flux.
WATER_TABLE_HEIGHT	Height of the water surface above the surface of the peat.
SITE_COMMENTS	Descriptive information to clarify or enhance the

	site information.
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 data files on the CD-ROM are:

Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
C_ADDED	[grams C][meter^-2]
N_ADDED	[grams C][meter^-2]
START_AIR_TEMP	[Celsius]
END_AIR_TEMP	[Celsius]
CH4_FLUX	[micromoles][meter^-2][second^-1]
CO2_FLUX	[micromoles][meter^-2][second^-1]
WATER_TABLE_HEIGHT	[millimeters]
SITE_COMMENTS	[none]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

7.3.4 Data Source

The sources of the parameter values contained in the data files on the CD-ROM are:

Column Name	Data Source
SITE_NAME	[Assigned by BORIS Staff]
SUB_SITE	[Assigned by BORIS Staff]
DATE_OBS	[Investigator]
TIME_OBS	[Investigator]
C_ADDED	[Investigator]
N_ADDED	[Investigator]
START_AIR_TEMP	[Thermometer]
END_AIR_TEMP	[Thermometer]
CH4_FLUX	[Gas Chromatograph]
CO2_FLUX	[Gas Chromatograph]
WATER_TABLE_HEIGHT	[Investigator]
SITE_COMMENTS	[Investigator]
CRTFCN_CODE	[Assigned by BORIS Staff]
REVISION_DATE	[Assigned by BORIS Staff]

7.3.5 Data Range

The following table gives information about the parameter values found in the 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
SITE_NAME	SSA-FEN-FLXTR	SSA-FEN-FLXTR	None	None	None	None
SUB_SITE	9TF11-FLX02	9TF11-FLX09	None	None	None	None
DATE_OBS	08-JUN-94	16-SEP-94	None	None	None	None
TIME_OBS	0	2327	None	None	None	None
C_ADDED	0	300	None	None	None	None
N_ADDED	0	6	None	None	None	None
START_AIR_TEMP	2	32	None	None	None	None
END_AIR_TEMP	4	39	-999	None	None	None
CH4_FLUX	0	.639	None	None	None	Blank
CO2_FLUX	-19.398	2.144	None	None	None	Blank
WATER_TABLE_HEIGHT	-58	237	None	None	None	None
SITE_COMMENTS	N/A	N/A	None	None	None	None
CRTFCN_CODE	CPI	CPI	None	None	None	None
REVISION_DATE	01-OCT-98	01-OCT-98	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.
```

7.4 Sample Data Record

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

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,C_ADDED,N_ADDED,START_AIR_TEMP,END_AIR_TEMP,
CH4_FLUX,CO2_FLUX,WATER_TABLE_HEIGHT,SITE_COMMENTS,CRTFCN_CODE,REVISION_DATE
'SSA-FEN-FLXTR','9TF11-FLX02',08-JUN-94,1610,300,6,23,29,.005,1.082,-11,
'Hummock: North of Tower, along Transect A','CPI',01-OCT-98
'SSA-FEN-FLXTR','9TF11-FLX03',08-JUN-94,1611,300,6,23,29,.011,.648,47,
'Hollow: North of Tower, along Transect A','CPI',01-OCT-98
```

8. Data Organization

8.1 Data Granularity

The smallest unit of data tracked by the BOREAS Information System (BORIS) is the measurement(s) made for a given site on a given day.

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

9.1.1 Derivation Techniques and Algorithms

$$\text{Flux (nmol/m}^2\text{/s)} = [(dC/dt * V)/A]*[P/(RT)] * \text{CONVERT}$$

where: dC/dt is the slope of gas concentration over time (ppmv/min),
V is the chamber volume corrected for water table fluctuations (~45 L),
A is the area covered by the chamber (0.09 m^2),
P is local atmospheric pressure (97.1 kPa),
R is the universal gas constant (8.31441 m^3Pa/molK),
T is the average chamber headspace temperature (K), and
CONVERT [(1000 nmol/µmol)/(60 s/min)] gives desired flux unit

9.2 Data Processing Sequence

9.2.1 Processing Steps

None given.

9.2.2 Processing Changes

None given.

9.3 Calculations

9.3.1 Special Corrections/Adjustments

None given.

9.3.2 Calculated Variables

Fluxes of methane and carbon dioxide are calculated using the formula given in Section 9.1.1.

9.4 Graphs and Plots

None.

10. Errors

10.1 Sources of Error

Atmospheric pressure was assumed constant during entire growing season, so flux calculations contain errors equivalent to daily barometric fluctuations. Leaks under and through the chamber, physical disturbance of the peat associated with the measurement, and temperature artifacts associated with heating under the chamber also may have contributed unknown error to the measurements. Finally, all the flux measurements entailed no mechanical automation and involved substantial and intensive operator involvement. As such, each step in the data collection process was subject to human error. All such error identified has been corrected, but not all such error may have been identified.

Reliability of the carbon dioxide fluxes is compromised by two factors. First, the time of day (hence irradiance and photosynthesis) of flux measurement varied. Second, the duration of chamber enclosure during flux measurements likely influenced photosynthetic rates because of changes in CO_2 mixing ratios, humidity, and temperature. Fluxes obtained when time of day is substantially different should be dropped from any time series analysis. Chamber artifacts likely obviate use of the data as absolute estimates of CO_2 exchange, although estimates relative to each other and over time are probably not compromised.

10.2 Quality Assessment

10.2.1 Data Validation by Source

The methane flux data were compared to the mid-day eddy correlation data collected by Verma and his team. A paired t-test comparing the data sets summarized at a weekly time scale did not find a significant ($p < 0.1$) difference between them.

10.2.2 Confidence Level/Accuracy Judgment

The exclusion of the few methane concentration-over-time data yielding $R^2 < 0.95$ implies that the data presented were not strongly influenced by bubbling events during chamber enclosure periods. While some methane emission may occur through ebullition, the influence of the artificial disturbance associated with the measurement cannot be dismissed or easily quantified. Based on our observations of bubbling at this and other fens, exclusion of fluxes based on enclosure periods with strongly nonlinear changes in concentration over time presented the lesser risk of introducing errors.

For the reasons presented in Section 10.1, the carbon dioxide flux data presented here should be interpreted carefully. While comparisons within the data set across the study area and through time are probably valid, comparisons with other data sets produced using humidity and temperature-controlled cuvettes will likely show discrepancies.

10.2.3 Measurement Error for Parameters

All flux enclosures yielding low (<0.95) R^2 for the headspace CH_4 concentration against time regression were omitted from the data set.

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
None given.

11.2 Known Problems with the Data
See Section 10.1.

11.3 Usage Guidance
See Section 10.1.

11.4 Other Relevant Information
None given.

12. Application of the Data Set

Several avenues are being pursued in publications now being produced to answer the following questions:

- How do CH_4 flux measurements compare by technique used in measurement?
- How and why do CH_4 flux measurements vary through time and across the landscape?
- Does plant productivity limit CH_4 emissions?

13. Future Modifications and Plans

None given.

14. Software

14.1 Software Description
We used only commercially available software, mostly Quattro Pro spreadsheet and the Statistical Analysis System (SAS).

14.2 Software Access
Not applicable.

15. Data Access

The CO_2 and CH_4 flux 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/.

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

None.

16.2 Film Products

None.

16.3 Other Products

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

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

None given.

17.2 Journal Articles and Study Reports

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Valentine, D.W., E.A. Holland, and D.S. Schimel. 1994. Ecosystem and physiological controls over methane production in northern wetlands. Journal of Geophysical Research 99(D1):1563-71.

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17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List of Acronyms

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ASCII   - American Standard Code for Information Interchange
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
GSFC    - Goddard Space Flight Center
HTML    - HyperText Markup Language
NAD83   - North American Datum of 1983
NASA    - National Aeronautics and Space Administration
NEE     - Net Ecosystem Exchange
NPP     - Net Primary Productivity
NSA     - Northern Study Area
ORNL    - Oak Ridge National Laboratory
PANP    - Prince Albert National Park
PBR     - Productivity/Biomass Ratio
SAS     - Statistical Analysis System
SSA     - Southern Study Area
TE      - Terrestrial Ecology
TF      - Tower Flux
TGB     - Trace Gas Biogeochemistry
URL     - Uniform Resource Locator
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20. Document Information

20.1 Document Revision Date

Written: 29-Jan-1997
Last Updated: 06-Aug-1999

20.2 Document Review Date(s)

BORIS Review: 06-Oct-1998
Science Review:

20.3 Document ID

When using these data, please include the following acknowledgment as well as citations of relevant papers in Section 17.2:

Valentine, D.W. 1996. Influence of substrate characteristics and other environmental factors on methane emissions from the BOREAS Southern Study Area fen site. I. Static chamber flux data.

If using data from the BOREAS CD-ROM series, also reference the data as:

Valentine, D., "Influence of Substrate Characteristics and Other Environmental Factors on Methane Emissions from the BOREAS Southern Study Area Fen Site. I. Chamber Flux Data." 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.

Also, cite the BOREAS CD-ROM set as:

Newcomer, J., 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, eds. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM. NASA, 2000.

20.5 Document Curator

20.6 Document URL

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
November 2000

3. REPORT TYPE AND DATES COVERED
Technical Memorandum

4. TITLE AND SUBTITLE
Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)
BOREAS TF-11 CO_2 and CH_4 Flux Data from the SSA-Fen

5. FUNDING NUMBERS
923
RTOP: 923-462-33-01

6. AUTHOR(S)
David W. Valentine
Forrest G. Hall and Sara Conrad, Editors

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS (ES)
Goddard Space Flight Center
Greenbelt, Maryland 20771

8. PEFORMING ORGANIZATION REPORT NUMBER
2000-03136-0

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS (ES)
National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
TM—2000–209891
Vol. 212

11. SUPPLEMENTARY NOTES
D.W. Valentine: University of Alaska, Fairbanks; Sara Conrad: DynCorp

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Unclassified–Unlimited
Subject Category: 43
Report available from the NASA Center for AeroSpace Information,
7121 Standard Drive, Hanover, MD 21076-1320. (301) 621-0390.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The BOREAS TF-11 team collected several data sets in its efforts to fully describe the flux and site characteristics at the SSA-Fen site. This data set contains fluxes of methane and carbon dioxide at the SSA-Fen site measured using static chambers. The measurements were conducted as part of a 2 x 2 factorial experiment in which we added carbon (300 g/m^2 as wheat straw) and nitrogen (6 g/m^2 as urea) to four replicate locations in the vicinity of the TF-11 tower. In addition to siting and treatment variables, it reports air temperature and water table height relative to the average peat surface during each measurement. The data set covers the period from the first week of June 1994 through the second week of September 1994. The data are stored in tabular ASCII files.

14. SUBJECT TERMS
BOREAS, tower flux.

15. NUMBER OF PAGES
16

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
Unclassified

18. SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

19. SECURITY CLASSIFICATION OF ABSTRACT
Unclassified

20. LIMITATION OF ABSTRACT
UL