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

Forrest G. Hall and Sara Conrad, Editors

Volume 211

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

David W. Valentine
University of Alaska, Fairbanks

November 2000

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Available from:

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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 temperature, pH, and concentration profiles of methane and carbon dioxide within the surface 50 cm of peat. 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. 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.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification
BOREAS TF-11 CO_2 and CH_4 Concentration Data from the SSA-Fen

1.2 Data Set Introduction
This data set contains temperature, pH, and concentration profiles of methane and carbon dioxide within the surface 50 cm of peat. 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 the BOReal Ecosystem-Atmosphere Study (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 us (Valentine et al., 1994) and others 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

We measured concentrations of methane and carbon dioxide dissolved in the porewater of the surface 50 cm of peat using probes integrating a series of "swampsuckers" similar to the device described by Burton and Beauchamp (1994). Measurements are reported for 0 (surface), 5, 10, 20, 30, 40, and 50 cm depths. One profile probe was established per platform and treatment combination, yielding 16 probes. Measurements were made weekly coincident with the flux measurements.

Temperature profiles of the surface 50 cm of peat were obtained using thermocouples integrated with the swampsucker probe. Measurements are reported for 0 (surface), 5, 10, 20, 30, 40, and 50 cm depths. Measurements were made weekly to coincide with the flux measurements in data set one.

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 TE-05 CO2 Concentration and stable isotope composition
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
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Assistant Professor
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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

2.3 Contact Information

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Jeffrey.Newcomer@gsfc.nasa.gov

3. Theory of Measurements

Concentration profiles of methane (CH_4) and carbon dioxide (CO_2) were measured by collecting porewater samples at 0, 5, 10, 20, 30, 40, and 50 cm using a probe integrating a series of swampsuckers, similar in design to the one described by Burton and Beauchamp (1994). Porewater CH_4 concentration was determined by first stripping the porewater by adding an equal amount of air and shaking the syringe for 5 minutes, then measuring the CH_4 concentration in the equilibrated air using a gas chromatograph (GC) equipped with a flame ionization detector (FID), and finally back-calculating the porewater CH_4 concentration based on Henry's law partitioning. Carbon dioxide concentrations in the headspace were measured by passing the chromatographically separated headspace sample through a Shimadzu methanizer just upstream of the FID. Porewater concentrations were calculated using Henry's law partitioning and accounting for pH of the porewater. The porewater pH was measured after headspace equilibration with a Beckman pH meter and a combination pH probe with an Ag/AgCl reference electrode. Temperatures at each porewater sampling depth were measured using twisted wire thermocouples in the gas profile sampling probe.

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
The porewater profile samplers were placed, four per platform, at the beginning of the season and remained in place throughout the summer.

4.1.3 Source/Platform Mission Objectives
Not applicable.

4.1.4 Key Variables

Name	Unit	Description
PWCH4	μmol/L	Dissolved methane
PWCO2	μmol/L	Dissolved carbon dioxide
SOILT	°C	Peat temperature
pH	pH unit	Porewater pH after equilibration with headspace

4.1.5 Principles of Operation
A probe combining sampling tubes and twisted wire thermocouples at several depths is used to measure temperatures and to obtain porewater samples for analysis of pH and concentrations of CH_4 and CO_2.

4.1.6 Sensor/Instrument Measurement Geometry
None given.

4.1.7 Manufacturer of Sensor/Instrument
The profile samplers were built by investigator. They were made of series of Teflon (PTFE) or stainless steel tubing (1/8 OD) embedded in epoxy resin within 3/4" PVC pipe. All tubing elements pass through the upper end of the pipe and terminate in a stopcock used for sampling. Each tubing element terminates at a specific point along the side of the pipe corresponding to the depth to be sampled. Opposite each side opening was a twisted wire thermocouple (copper-constantan), with lead wires also exiting through the upper end of the pipe and terminating with plugs.

GC: GC-8A equipped with 1-mL sample injection loop, FID, and methanizer, manufactured by:

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

The electronic thermometer: Omega microprocessor thermometer model HH21, was manufactured by:

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

The pH meter: Beckman 11 portable pH meter with automatic temperature compensation with Beckman combination pH probe (Ag/AgCl reference electrode), manufactured by:

Beckman Instruments Inc.
2500 Harbor Boulevard
Box 3100
Fullerton, CA 92634-3100
(800) 742-2345
(800) 643-4366 (fax)

4.2 Calibration

4.2.1 Specifications
   Profile samplers: Air bubbles drawn into the syringe from the sampler reflect gas bubbles in the profile, and are typically very concentrated in CH_4 (often 40% by volume). Our interest in the concentration profile centered on how dissolved gases were distributed, and therefore we decided to expel any sampled bubbles immediately.
   Based on comparisons of the electronic thermometer with a laboratory mercury thermometer at typical soil temperature ranges, all temperatures obtained from the thermocouples were adjusted upward by 0.5 °C.
   The pH meter was calibrated using commercially available pH buffers at pH 4 and 7.
   The GC column oven was operated at 70 °C, FID temperature was 180 °C, and 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.
   The pH probe was subject to drift, so a 2-point calibration was performed after every 10 samples.

4.2.3 Other Calibration Information
None given.

5. Data Acquisition Methods

Profiles of peat temperature and concentrations of methane and carbon dioxide were measured concurrently with the flux measurements. We sampled 20 mL of the surface water directly with a 60-mL polypropylene syringe, and for subsurface concentrations combined the syringe with a sampler similar to the one described by Burton and Beauchamp (1994) with ports at 5, 10, 20, 30, 40, and 50 cm. We added a twisted wire copper-constantan thermocouple at each depth, and measured temperature using an electronic thermometer. Any bubbles drawn into the syringe were expelled immediately after sampling, and the water samples were stored in a refrigerator at 4 °C until analysis within 4 days. Analysis consisted first making a 1:1 headspace:water mixture in the syringe using ambient air, then shaking vigorously for 5 minutes. The equilibrated headspace was then injected into the GC and analyzed as above for CH_4 and CO_2. Original porewater concentrations were calculated based on Henry's Law partitioning corrected for temperature and, for CO_2, the water pH after equilibration (after Shurpali et al., 1993).

Temperature at each depth was measured simply by plugging each thermocouple lead into the electronic thermometer.

The pH of each porewater sample was measured after headspace equilibration. The sample was stirred gently during the measurement, and the pH was recorded after the reading stabilized (generally after 2 min.).

6. Observations

6.1 Data Notes
Profile 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 data are point measurements 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 for each platform were collected weekly from 08-Jun-1994 until 15-Sep-1994.

7.2.2 Temporal Coverage Map
None.

7.2.3 Temporal Resolution
Each profile was sampled approximately weekly. Concentration profile data were optimally collected at daily 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
PEAT_DEPTH
PEAT_TEMP
DISS_CH4_CONC
DISS_CO2_CONC
POREWATER_PH
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 br 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.
PEAT_DEPTH                              The depth below the peat surface.
PEAT_TEMP                               The peat temperature measured at the given depth.
DISS_CH4_CONC                           Dissolved methane concentration at the given
                                        depth.
DISS_CO2_CONC                           Dissolved carbon dioxide concentration at the
                                        given depth.
POREWATER_PH                            Porewater pH after equilibrium with headspace.
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]
PEAT_DEPTH                        [millimeters]
PEAT_TEMP                         [Celsius]
DISS_CH4_CONC                     [micromoles][liter^-1]
DISS_CO2_CONC                     [micromoles][liter^-1]
POREWATER_PH                      [pH]
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]
PEAT_DEPTH                        [Investigator]
PEAT_TEMP                         [Thermometer]
DISS_CH4_CONC                     [Gas chromatograph]
DISS_CO2_CONC                     [Gas chromatograph]
POREWATER_PH                      [pH meter]
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.

```
                Minimum       Maximum        Missng  Unrel   Below    Data
                Data          Data           Data    Data    Detect   Not
Column Name     Value         Value          Value   Value   Limit    Cllctd
----------------------------------------------------------------------------
SITE_NAME       SSA-FEN-FLXTR SSA-FEN-FLXTR  None    None    None     None
SUB_SITE        9TF11-CON01   9TF11-CON08    None    None    None     None
DATE_OBS        08-JUN-94     17-SEP-94      None    None    None     None
TIME_OBS        1             2202           None    None    None     None
C_ADDED         0             300            None    None    None     None
N_ADDED         0             6              None    None    None     None
PEAT_DEPTH      0             500            None    None    None     None
PEAT_TEMP       -1.1          20.6           None    None    None     Blank
DISS_CH4_CONC   .01           1750.45        None    None    None     Blank
DISS_CO2_CONC   66            14544          None    None    None     Blank
POREWATER_PH    5.59          7.1            None    None    None     Blank
SITE_COMMENTS   N/A           N/A            None    None    None     None
CRTFCN_CODE     CPI           CPI            None    None    None     None
REVISION_DATE   09-SEP-98     09-SEP-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,PEAT_DEPTH,PEAT_TEMP,
DISS_CH4_CONC,DISS_CO2_CONC,POREWATER_PH,SITE_COMMENTS,CRTFCN_CODE,REVISION_DATE
'SSA-FEN-FLXTR','9TF11-CON02',08-JUN-94,1011,300,6,0,,.01,66.0,6.92,
'Hollow: North of Tower, along transect A','CPI',09-SEP-98
'SSA-FEN-FLXTR','9TF11-CON02',08-JUN-94,1011,300,6,50,14.5,1.53,1458.0,6.92,
'Hollow: North of Tower, along transect A','CPI',09-SEP-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
None given.

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
Porewater CH_4 concentration (PWCH4) was calculated as:

$$CH_4hs * P/Po * Kh + Vhs/Vw * (CH_4hs-CH_4amb) * P/RT$$

where: CH_4hs is the equilibrated headspace concentration of CH_4 (ppm)
P and Po are ambient and sea-level atmospheric pressures (101325 Pa)
Kh is the Henry's law constant for CH_4 at ambient temperature (298 K)
Vhs and Vw are the volumes of headspace and water in the syringe
CH_4amb is the ambient CH_4 concentration (1.8 ppmv)
R is the universal gas constant (8314.4 [L Pa]/[K mol]
T is the ambient temperature (298 K)

Porewater CO_2 concentration (PWCO2) was calculated as:

$$CO_2hs * P/Po * Kh*(1+Ka1/10^{pH} * (1+Ka2/10^{pH})) + Vhs/Vw*(CO_2hs-CO_2amb)*P/RT$$

where: CO_2hs is the equilibrated headspace concentration of CO_2 (ppm)
P and Po are ambient and sea-level atmospheric pressures (101325 Pa)
Kh is the Henry's law constant for CO_2 at ambient temperature (298 K)
Ka1 and Ka2 are the 1st and 2nd dissociation constants for aqueous CO_2
pH is the pH of the porewater after stripping
Vhs and Vw are the volumes of headspace and water in the syringe
CO_2amb is the ambient CO_2 concentration (350 ppmv)
R is the universal gas constant (8314.4 [L Pa]/[K mol])
T is the ambient temperature (298 K)

9.4 Graphs and Plots
None given.

10. Errors

10.1 Sources of Error
During sampling, a leak in the syringe or elsewhere in the profile probe system could generate bubbles that would strip gases from the sample. As bubbles were expelled after sampling, this may have reduced the calculated porewater contents of CH_4 and CO_2.

Samples could not be run immediately because the time involved in retuning the GC normal flux measurement mode to lower sensitivity in order to run porewater samples was prohibitive. We stored the porewater samples in a refrigerator at ~4 °C for up to 4 days in order to run all weekly porewater samples once per week. We do not know what error may have accrued from the storage, but microbial respiration may have boosted CO_2 levels and decreased CH_4 levels.

10.2 Quality Assessment

10.2.1 Data Validation by Source
None given.

10.2.2 Confidence Level/Accuracy Judgment
The degree to which CH_4 and CO_2 concentrations may have changed during sample storage is unknown and likely variable. Nevertheless, the existence of good correlations between CH_4 flux and concentration data suggest that these errors are likely small and do not dominate real patterns of gas concentrations in time or space.

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
See Section 10.1.

11.2 Known Problems with the Data
See Section 10.1.

11.3 Usage Guidance
None given.

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. For this data set, we are most interested in how and why CH_4 concentration profiles and flux measurements vary through time and across the landscape.

13. Future Modifications and Plans

None.

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
None given.

15. Data Access

The CO_2 and CH_4 concentration 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 from 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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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 temperature, pH, and concentration profiles of methane and carbon dioxide within the surface 50 cm of peat. 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. 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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