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

Forrest G. Hall and Jeffrey A. Newcomer, Editors

Volume 127

BOREAS TE-1 CO_2 and CH_4 Flux Data over the SSA-OBS Site

D. Anderson and A. Papagno

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

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BOREAS TE-1 CO_2 and CH_4 Flux Data over the SSA-OBS Site

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BOREAS TE-1 CO_2 and CH_4 Flux Data over the SSA-OBS Site

Darwin Anderson, Andrea Papagno

Summary

The BOREAS TE-1 team collected various data to characterize the soil-plant systems in the BOREAS SSA. Particular emphasis was placed on nutrient biochemistry, the stores and transfers of organic carbon, and how the characteristics were related to measured methane fluxes. The overall transect in the Prince Albert National Park (Saskatchewan, Canada) included the major plant communities and related soils that occurred in that section of the boreal forest. Soil physical, chemical, and biological measurements along the transect were used to characterize the static environment, which allowed them to be related to methane fluxes. Chamber techniques were used to provide a measure of methane production/uptake. Chamber measurements coupled with flask sampling were used to determine the seasonality of methane fluxes. This particular data set contains carbon dioxide and methane flux values from the SSA-OBS site. The data were collected from 09-Jun to 04-Sep-1994. The data are stored in tabular ASCII files.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS TE-01 CO_2 and CH_4 Flux Data over the SSA-OBS Site

1.2 Data Set Introduction

Particular emphasis in this study was on nutrient biochemistry, the stores and transfers of organic carbon, and how the characteristics were related to measured methane fluxes. The transect in Prince Albert National Park (PANP) included the major plant communities and related soils that occurred in that section of the boreal forest. Soil physical, chemical, and biological measurements along the transect were used to characterize the static environment, which allowed them to be related to methane

fluxes. Chamber techniques were used to provide a measure of methane production/uptake. Chamber measurements coupled with flask sampling were used to determine the seasonality of methane fluxes.

1.3 Objective/Purpose

The objective of the research was to characterize the methane and carbon dioxide soil flux at the BOReal Ecosystem-Atmosphere Study (BOREAS) Southern Study Area (SSA) Old Black Spruce (OBS).

1.4 Summary of Parameters

The main parameters are daily and nightly CH_4 and CO_2 fluxes.

1.5 Discussion

None given.

1.6 Related Data Sets

BOREAS TGB-01 CH4 Tower flux data over NSA
BOREAS TGB-01 CO2 and CH4 Chamber Flux data over the NSA
BOREAS TGB-01/TGB-03 NEE Data over the NSA Fen
BOREAS TGB-03 CO2 and CH4 Chamber Flux data over the NSA
BOREAS TGB-05 CO, CO2, and CH4 Chamber Flux data over the NSA

2. Investigator(s)

2.1 Investigator(s) Name and Title

Dr. Darwin Anderson
Research Professor
University of Saskatchewan

2.2 Title of Investigation

Stores and Dynamics of Organic Matter in Boreal Ecosystems

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(301) 286-0239 (fax)
Andrea.Papagno@gsfc.nasa.gov

3. Theory of Measurements

None given.

4. Equipment

4.1 Sensor/Instrument Description

4.1.1 Collection Environment
CH_4 and CO_2 fluxes were measured during all ambient environmental conditions at the sites.

4.1.2 Source/Platform
Ground.

4.1.3 Source/Platform Mission Objectives
The mission objective was to determine the flux of CH_4 and CO_2 at the SSA-OBS site.

4.1.4 Key Variables
The key variables measured during the fluxes were CH_4 and CO_2 flux.

4.1.5 Principles of Operation
None given.

4.1.6 Sensor/Instrument Measurement Geometry
Not applicable.

4.1.7 Manufacturer of Sensor/Instrument
None given.

4.2 Calibration
None given.

4.2.1 Specifications

4.2.1.1 Tolerance
None given.

4.2.2 Frequency of Calibration
None given.

4.2.3 Other Calibration Information
None given.

5. Data Acquisition Methods

None given.

6. Observations

6.1 Data Notes
None given.

6.2 Field Notes
None given.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage
The North American Datum of 1983 (NAD83) coordinates of the SSA-OBS flux tower (site id G8I4T), close to where the measurements were taken, are 53.98717° N Lat, 105.11779° W Long, Universal Transverse Mercator (UTM) Zone 13, N: 5,982,100.5, E: 492,276.5.

7.1.2 Spatial Coverage Map
Not available.

7.1.3 Spatial Resolution
These are point source measurements along a transect near the given location.

7.1.4 Projection
Not applicable.

7.1.5 Grid Description
Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage
The data were collected from 09-Jun to 04-Sep-1994.

7.2.2 Temporal Coverage Map
Not available.

7.2.3 Temporal Resolution
Measurements were collected on a daily basis. Mean flux measurements were calculated every 2 to 10 days from 09-Jun to 04-Sep-1994. The mean and standard deviation of the nighttime methane measurements were taken during the night of 14-Aug to 3 a.m. 15-Aug-1994.

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
MEAN_CH4_FLUX
```

STD_ERR_CH4
CH4_FLUX_NIGHT
STD_ERR_CH4_NIGHT
MEAN_CO2_FLUX
STD_ERR_CO2
CO2_FLUX_NIGHT
STD_ERR_CO2_NIGHT
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.
MEAN_CH4_FLUX	Mean of all daily methane flux measurements.
STD_ERR_CH4	Standard error of means.
CH4_FLUX_NIGHT	Measurements done during the night of Aug 14 to 3 AM Aug 15.
STD_ERR_CH4_NIGHT	Standard error for measurements done during the night of Aug 14 to 3 AM Aug 15.
MEAN_CO2_FLUX	Mean of the daily CO2 flux measurements.
STD_ERR_CO2	Standard error of means.
CO2_FLUX_NIGHT	Measurements done during the night of Aug 14 to 3 AM Aug 15.
STD_ERR_CO2_NIGHT	Standard error for measurements done during the night of Aug 14 to 3 AM Aug 15.
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]
MEAN_CH4_FLUX	[micromoles][meter^-2][second^-1]
STD_ERR_CH4	[micromoles][meter^-2][second^-1]
CH4_FLUX_NIGHT	[micromoles][meter^-2][second^-1]
STD_ERR_CH4_NIGHT	[micromoles][meter^-2][second^-1]
MEAN_CO2_FLUX	[micromoles][meter^-2][second^-1]
STD_ERR_CO2	[micromoles][meter^-2][second^-1]
CO2_FLUX_NIGHT	[micromoles][meter^-2][second^-1]
STD_ERR_CO2_NIGHT	[micromoles][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 the data files on the CD-ROM are:

Column Name	Data Source
SITE_NAME	[BORIS Designation]
SUB_SITE	[BORIS Designation]
DATE_OBS	[Human Observer]
MEAN_CH4_FLUX	[Laboratory Equipment]
STD_ERR_CH4	[Laboratory Equipment]
CH4_FLUX_NIGHT	[Laboratory Equipment]
STD_ERR_CH4_NIGHT	[Laboratory Equipment]
MEAN_CO2_FLUX	[Laboratory Equipment]
STD_ERR_CO2	[Laboratory Equipment]
CO2_FLUX_NIGHT	[Laboratory Equipment]
STD_ERR_CO2_NIGHT	[Laboratory Equipment]
CRTFCN_CODE	[BORIS Designation]
REVISION_DATE	[BORIS Designation]

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-OBS-FLXTR	SSA-OBS-FLXTR	None	None	None	None
SUB_SITE	9TE01-FLX01	9TE01-FLX01	None	None	None	None
DATE_OBS	09-JUN-94	04-SEP-94	None	None	None	None
MEAN_CH4_FLUX	-.000081	.0974537	None	None	None	None
STD_ERR_CH4	.00001157	.01157407	-999	None	None	None
CH4_FLUX_NIGHT	.01094907	.05153935	-999	None	None	None
STD_ERR_CH4_NIGHT	.00322917	.00322917	-999	None	None	None
MEAN_CO2_FLUX	-1.5966782	2.0808912	-999	None	None	None
STD_ERR_CO2	.02233	1.20968	-999	None	None	None

```
CO2_FLUX_NIGHT        1.4959          1.8601          -999    None    None    None
STD_ERR_CO2_NIGHT     .2525           .47403          -999    None    None    None
CRTFCN_CODE           CPI             CPI             None    None    None    None
REVISION_DATE         07-NOV-96       07-NOV-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.
-------------------------------------------------------------------------------
```

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,MEAN_CH4_FLUX,STD_ERR_CH4,CH4_FLUX_NIGHT,
STD_ERR_CH4_NIGHT,MEAN_CO2_FLUX,STD_ERR_CO2,CO2_FLUX_NIGHT,STD_ERR_CO2_NIGHT,
CRTFCN_CODE,REVISION_DATE
'SSA-OBS-FLXTR','9TE01-FLX01',09-JUN-94,.00018519,-999.0,.05153935,-999.0,-999.0,
-999.0,-999.0,-999.0,'CPI',07-NOV-96
'SSA-OBS-FLXTR','9TE01-FLX01',09-JUN-94,-.000081,.00001157,.01094907,.00322917,
-999.0,-999.0,1.4959,.27341,'CPI',07-NOV-96
```

8. Data Organization

8.1 Data Granularity

The smallest unit of data tracked by the BOREAS Information System (BORIS) was the data collected at a given site on a given date.

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
None given.

9.4 Graphs and Plots
None.

10. Errors

10.1 Sources of Error
None given.

10.2 Quality Assessment

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
None given.

11.2 Known Problems with the Data
None given.

11.3 Usage Guidance
None given.

11.4 Other Relevant Information
None given.

12. Application of the Data Set

None given.

13. Future Modifications and Plans

This data set is in its final format.

14. Software

14.1 Software Description
None given.

14.2 Software Access
None given.

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.

17.2 Journal Articles and Study Reports

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. 2000. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM.

Sellers, P. and F. Hall. 1994. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1994-3.0, NASA BOREAS Report (EXPLAN 94).

Sellers, P. and F. Hall. 1996. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1996-2.0, NASA BOREAS Report (EXPLAN 96).

Sellers, P., F. Hall, and K.F. Huemmrich. 1996. Boreal Ecosystem-Atmosphere Study: 1994 Operations. NASA BOREAS Report (OPS DOC 94).

Sellers, P., F. Hall, and K.F. Huemmrich. 1997. Boreal Ecosystem-Atmosphere Study: 1996 Operations. NASA BOREAS Report (OPS DOC 96).

Sellers, P., F. Hall, H. Margolis, B. Kelly, D. Baldocchi, G. den Hartog, J. Cihlar, M.G. Ryan, B. Goodison, P. Crill, K.J. Ranson, D. Lettenmaier, and D.E. Wickland. 1995. The boreal ecosystem-atmosphere study (BOREAS): an overview and early results from the 1994 field year. Bulletin of the American Meteorological Society. 76(9):1549-1577.

Sellers, P.J., F.G. Hall, R.D. Kelly, A. Black, D. Baldocchi, J. Berry, M. Ryan, K.J. Ranson, P.M. Crill, D.P. Lettenmaier, H. Margolis, J. Cihlar, J. Newcomer, D. Fitzjarrald, P.G. Jarvis, S.T. Gower, D. Halliwell, D. Williams, B. Goodison, D.E. Wickland, and F.E. Guertin. 1997. BOREAS in 1997: Experiment Overview, Scientific Results and Future Directions. Journal of Geophysical Research 102(D24): 28,731-28,770.

17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List of Acronyms

AES	- Atmospheric Environment Services
ASCII	- American Standard Code for Information Interchange
BOREAS	- BOReal Ecosystem-Atmosphere Study
BORIS	- BOREAS Information System
BP	- Beaver Pond
CD-ROM	- Compact Disk-Read-Only Memory
CMDL	- Climate Monitoring and Diagnostics Laboratory
DAAC	- Distributed Active Archive Center
ECD	- Electron Capture Detector
EOS	- Earth Observing System
EOSDIS	- EOS Data and Information System
FID	- Flame Ionization Detector
GC	- Gas Chromatograph
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
NSA	- Northern Study Area
OBS	- Old Black Spruce
ORNL	- Oak Ridge National Laboratory
PANP	- Prince Albert National Park
SSA	- Southern Study Area
TCD	- Thermal Conductivity Detector
TE	- Terrestrial Ecology
TGB	- Trace Gas Biogeochemistry
URL	- Uniform Resource Locator
UTM	- Universal Transverse Mercator

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D. Anderson: University of Saskatchewan, Saskatoon, SK, Canada; A.Papagno and J.A. Newcomer: Raytheon ITSS, NASA Goddard Space Flight Center, Greenbelt, Maryland

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13. ABSTRACT *(Maximum 200 words)*

The BOREAS TE-1 team collected various data to characterize the soil-plant systems in the BOREAS SSA. Particular emphasis was placed on nutrient biochemistry, the stores and transfers of organic carbon, and how the characteristics were related to measured methane fluxes. The overall transect in the Prince Albert National Park (Saskatchewan, Canada) included the major plant communities and related soils that occurred in that section of the boreal forest. Soil physical, chemical, and biological measurements along the transect were used to characterize the static environment, which allowed them to be related to methane fluxes. Chamber techniques were used to provide a measure of methane production/uptake. Chamber measurements coupled with flask sampling were used to determine the seasonality of methane fluxes. This particular data set contains carbon dioxide and methane flux values from the SSA-OBS site. The data were collected from 09-Jun to 04-Sep-1994. The data are stored in tabular ASCII files.

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