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

Forrest G. Hall and Shelaine Curd, Editors

Volume 139
BOREAS TE-5 Soil Respiration Data

J. Ehleringer, J.R. Brooks, and L. Flanagan

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

October 2000
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Technical Report Series on the
Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Shelaine Curd, Editors

Volume 139
BOREAS TE-5 Soil Respiration
Data

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Greenbelt, Maryland 20771

October 2000
BOREAS TE-5 Soil Respiration Data

Jim Ehleringer, J.Renee Brooks, Larry Flanagan

Summary

The BOREAS TE-5 team collected measurements in the NSA and SSA on gas exchange, gas composition, and tree growth. Soil respiration data were collected from 26-May-94 to 07-Sep-94 in the BOREAS NSA and SSA to compare the soil respiration rates in different forest sites using a LI-COR 6200 soil respiration chamber (model 6299). The data are stored in tabular ASCII files.

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1. Data Set Overview

1.1 Data Set Identification

BOREAS TE-05 Soil Respiration Data

1.2 Data Set Introduction

Soil respiration data were collected in the field in the BOREal Ecosystem-Atmosphere Study (BOREAS) Northern Study Area (NSA) and Southern Study Area (SSA) using a LI-COR 6200 portable photosynthesis system and a LI-COR soil respiration chamber (model 6299).

1.3 Objective/Purpose

The data were collected to compare the soil respiration rates in different forest sites in the BOREAS NSA and SSA.
1.4 Summary of Parameters
• CO₂ flux (positive respiration)
• soil temperature
• chamber CO₂ concentration
• chamber air temperature
• chamber vapor pressure

1.5 Discussion
In the SSA, measurements were collected at the Old Jack Pine (OJP), Old Black Spruce (OBS), and Old Aspen (OA) sites. In the NSA, measurements were collected at the OJP, T6R5S TE Upland Black Spruce (UBS), and OA sites.

1.6 Related Data Sets
BOREAS TE-05 Leaf Gas Exchange Data
BOREAS TE-05 Leaf Carbon Isotope Data
BOREAS TE-05 Surface Meteorological and Radiation Data

2. Investigator(s)

2.1 Investigator(s) Name and Title
J.R. Ehleringer
University of Utah
Department of Biology

L.B. Flanagan
Carleton University
Department of Biology

2.2 Title of Investigation
Vegetation-Atmosphere CO₂ and H₂O Exchange Processes: Stable Isotope Analyses

2.3 Contact Information

Contact 1:
J. Renee Brooks
Department of Biology
University of South Florida
Tampa, FL 33620 USA
(813) 974-7352
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jrbrooks@chuma.cas.usf.edu

Contact 2:
Dr. Larry Flanagan
Department of Biological Sciences
University of Lethbridge
4401 University Drive
Lethbridge, Alberta
T1K 3M4, CANADA
(403) 380-1858
(403) 329-2082 (fax)
larry.flanagan@uleth.ca
3. Theory of Measurements

Measurements were made using a LI-COR soil respiration chamber (model 6299) attached to a LI-COR 6200 portable photosynthesis system, an instrument that uses a dynamic, closed chamber technique. Theoretical details of the measurements and instruments can be obtained from the manufacturer: LI-COR, Inc., P.O. Box 4425 Superior Street, Lincoln, NE 68504, USA. Toll-free telephone 1-800-447-3576 (USA and Canada), telephone (402) 467-2819.

4. Equipment

4.1 Sensor/Instrument Description

4.1.1 Collection Environment

The equipment operated under ambient environmental conditions during the measurement periods. Please see BOREAS TE-05 Surface Meteorological and Radiation Data for specifics.

4.1.2 Source/Platform

None given.

4.1.3 Source/Platform Mission Objectives

The data were collected to compare the soil respiration rates in different forest sites.

4.1.4 Key Variables

CO₂ Flux
Vapor Pressure
Soil Temperature
Air Temperature

4.1.5 Principles of Operation

Measurements were made using a LI-COR soil respiration chamber (model 6299) attached to a LI-COR 6200 portable photosynthesis system, an instrument that uses a dynamic, closed chamber technique.

4.1.6 Sensor/Instrument Measurement Geometry

None given.
4.1.7 Manufacturer of Sensor/Instrument
LI-COR, Inc.
P.O. Box 4425 Superior Street
Lincoln, NE 68504, USA
1 (800) 447-3576 (US & Canada)
(402) 467-2819

4.2 Calibration

4.2.1 Specifications
None given.

4.2.1.1 Tolerance
None given.

4.2.2 Frequency of Calibration
None given.

4.2.3 Other Calibration Information
The infrared gas analyzer of the LI-COR 6200 portable photosynthesis system was calibrated using primary standard gas mixtures from Matheson Gas. These gas mixtures were compared to BOREAS project calibration standards.

5. Data Acquisition Methods

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
Samples were collected at NSA OJP, SSA OJP, SSA OBS, and NSA UBS in 1993 and all the sites in 1994. The North American Datum of 1983 (NAD83) coordinates for the sites are:

- SSA OJP flux tower site: Lat/Long = 53.916°N, 104.69°W, UTM Zone 13, N: 5,951,000 E: 479,400.
- NSA OA canopy access tower site (auxiliary site number T2Q6A, BOREAS Experiment Plan, Version 3), Lat/Long = 55.88°N, 98.67°W.
• SSA OA flux tower site: Lat/Long=53.629°N, 106.197°W, UTM Zone 13, N:5,942,688 E:420,874.
• NSA UBS canopy access tower site (auxiliary site number T6R5S, BOREAS Experiment Plan, Version 3), Lat/Long = 55.70°N, 98.51°W.
• SSA OBS flux tower site: Lat/Long = 53.985°N, 105.122°W, UTM Zone 13, N:5,981,904 E:492,000.

7.1.2 Spatial Coverage Map
Not available.

7.1.3 Spatial Resolution
These data are point source measurements at the locations given.

7.1.4 Projection
Not applicable.

7.1.5 Grid Description
Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage
These data were collected over the period of 26-May-94 to 07-Sep-94.

7.2.2 Temporal Coverage Map
Not available.

7.2.3 Temporal Resolution
Each site was visited multiple times during the 1994 growing season.

7.3 Data Characteristics

7.3.1 Parameter/Variable
The parameters contained in the data files on the CD-ROM are:

<table>
<thead>
<tr>
<th>Column Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE_NAME</td>
</tr>
<tr>
<td>SUB_SITE</td>
</tr>
<tr>
<td>DATE_OBS</td>
</tr>
<tr>
<td>TIME</td>
</tr>
<tr>
<td>SOIL_TEMP_10CM</td>
</tr>
<tr>
<td>VAPOR_PRESS_CHAMBER</td>
</tr>
<tr>
<td>AIR_TEMP_CHAMBER</td>
</tr>
<tr>
<td>CO2_CONC_CHAMBER</td>
</tr>
<tr>
<td>CO2_FLUX_CHAMBER</td>
</tr>
<tr>
<td>CRTFCN_CODE</td>
</tr>
<tr>
<td>REVISION_DATE</td>
</tr>
</tbody>
</table>
7.3.2 Variable Description/Definition

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

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE_NAME</td>
<td>The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC,</td>
</tr>
<tr>
<td></td>
<td>where SSS identifies the portion of the study area: NSA, SSA, REG, TRN,</td>
</tr>
<tr>
<td></td>
<td>and TTT identifies the cover type for the site, 999 if unknown, and CCCCC</td>
</tr>
<tr>
<td></td>
<td>is the identifier for site, exactly what it means will vary with site type.</td>
</tr>
<tr>
<td>SUB_SITE</td>
<td>The identifier assigned to the sub-site by BOREAS, in the format GGGGG-IIII</td>
</tr>
<tr>
<td></td>
<td>where GGGGG is the group associated with the sub-site instrument, e.g.</td>
</tr>
<tr>
<td></td>
<td>HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will</td>
</tr>
<tr>
<td></td>
<td>refer to an instrument.</td>
</tr>
<tr>
<td>DATE_OBS</td>
<td>The date on which the data were collected.</td>
</tr>
<tr>
<td>TIME</td>
<td>The Greenwich Mean Time (GMT) when the data were collected.</td>
</tr>
<tr>
<td>SOIL_TEMP_10CM</td>
<td>Soil temperature at 10 cm depth.</td>
</tr>
<tr>
<td>VAPOR_PRESS_CHAMBER</td>
<td>Vapor pressure of the air in the chamber.</td>
</tr>
<tr>
<td>AIR_TEMP_CHAMBER</td>
<td>The temperature of the air in the chamber.</td>
</tr>
<tr>
<td>CO2_CONC_CHAMBER</td>
<td>The CO2 concentration in the chamber.</td>
</tr>
<tr>
<td>CO2_FLUX_CHAMBER</td>
<td>The chamber CO2 flux.</td>
</tr>
<tr>
<td>CRTFCN_CODE</td>
<td>The BOREAS certification level of the data. Examples are CPI (Checked by</td>
</tr>
<tr>
<td></td>
<td>PI), CGR (Certified by Group), PRE (Preliminary), and CPI-?? (CPI but</td>
</tr>
<tr>
<td></td>
<td>questionable).</td>
</tr>
<tr>
<td>REVISION_DATE</td>
<td>The most recent date when the information in the referenced data base</td>
</tr>
<tr>
<td></td>
<td>table record was revised.</td>
</tr>
</tbody>
</table>

7.3.3 Unit of Measurement

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

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE_NAME</td>
<td>[none]</td>
</tr>
<tr>
<td>SUB_SITE</td>
<td>[none]</td>
</tr>
<tr>
<td>DATE_OBS</td>
<td>[DD-MON-YY]</td>
</tr>
<tr>
<td>TIME</td>
<td>[HHMMSS GMT]</td>
</tr>
<tr>
<td>SOIL_TEMP_10CM</td>
<td>[degrees Celsius]</td>
</tr>
<tr>
<td>VAPOR_PRESS_CHAMBER</td>
<td>[millibars]</td>
</tr>
<tr>
<td>AIR_TEMP_CHAMBER</td>
<td>[degrees Celsius]</td>
</tr>
<tr>
<td>CO2_CONC_CHAMBER</td>
<td>[parts per million]</td>
</tr>
<tr>
<td>CO2_FLUX_CHAMBER</td>
<td>[micromoles][meter^-2][second^-1]</td>
</tr>
<tr>
<td>CRTFCN_CODE</td>
<td>[none]</td>
</tr>
<tr>
<td>REVISION_DATE</td>
<td>[DD-MON-YY]</td>
</tr>
</tbody>
</table>
7.3.4 Data Source  
The sources of the parameter values contained in the data files on the CD-ROM are:

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE_NAME</td>
<td>[BORIS Designation]</td>
</tr>
<tr>
<td>SUB_SITE</td>
<td>[BORIS Designation]</td>
</tr>
<tr>
<td>DATE_OBS</td>
<td>[Human Observer]</td>
</tr>
<tr>
<td>TIME</td>
<td>[Human Observer]</td>
</tr>
<tr>
<td>SOIL_TEMP_10CM</td>
<td>[Thermometer]</td>
</tr>
<tr>
<td>VAPOR_PRESS_CHAMBER</td>
<td>[Field Equipment]</td>
</tr>
<tr>
<td>AIR_TEMP_CHAMBER</td>
<td>[Thermometer]</td>
</tr>
<tr>
<td>CO2_CONC_CHAMBER</td>
<td>[Field Equipment]</td>
</tr>
<tr>
<td>CO2_FLUX_CHAMBER</td>
<td>[Field Equipment]</td>
</tr>
<tr>
<td>CRTFCN_CODE</td>
<td>[BORIS Designation]</td>
</tr>
<tr>
<td>REVISION_DATE</td>
<td>[BORIS Designation]</td>
</tr>
</tbody>
</table>

7.3.5 Data Range  
The following table gives information about the parameter values found in the data files on the CD-ROM.

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Minimum Data Value</th>
<th>Maximum Data Value</th>
<th>Missng Data Value</th>
<th>Unrel Data Value</th>
<th>Below Detect Limit</th>
<th>Data Not Cllctd</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE_NAME</td>
<td>NSA-9BS-9TETR</td>
<td>SSA-OJP-FLXTR</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>SUB_SITE</td>
<td>9TE05-SXCO1</td>
<td>9TE05-SXCO1</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>DATE_OBS</td>
<td>26-MAY-94</td>
<td>07-SEP-94</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>TIME</td>
<td>2142</td>
<td>225023</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>SOIL_TEMP_10CM</td>
<td>.08</td>
<td>15</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>VAPOR_PRESS_CHAMBER</td>
<td>4.882</td>
<td>21.61</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>AIR_TEMP_CHAMBER</td>
<td>12.98</td>
<td>31.34</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>CO2_CONC_CHAMBER</td>
<td>260.1</td>
<td>451.4</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>CO2_FLUX_CHAMBER</td>
<td>.522</td>
<td>9.854</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>CRTFCN_CODE</td>
<td>CPI</td>
<td>CPI</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>REVISION_DATE</td>
<td>16-MAR-98</td>
<td>16-MAR-98</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

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, SOIL_TEMP_10CM, VAPOR_PRESS_CHAMBER,
AIR_TEMP_CHAMBER, CO2_CONC_CHAMBER, CO2_FLUX_CHAMBER, CRTFCN_CODE, REVISION_DATE
'NSA-9BS-9TETR', '9TE05-SXC01', 03-JUN-94, 17:12:34, .33, 11.0, 13.98, 260.1, 3.068, 'CEI',
16-MAR-98
'NSA-9BS-9TETR', '9TE05-SXC01', 03-JUN-94, 17:16:17, .24, 10.58, 13.84, 367.0, 2.797, 'CPI',
16-MAR-98

8. Data Organization

8.1 Data Granularity
The smallest unit of orderable data is data collected on one day at one site.

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
None given.

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.

9.3.2 Calculated Variables
None.

9.4 Graphs and Plots
None.

10. Errors

10.1 Sources of error
All known errors have been removed from the data.

10.2 Quality Assessment
None given.

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

These data can be used to compare soil respiration rates in different forest sites in the NSA and SSA.

13. Future Modifications and Plans

None given.

14. Software

14.1 Software Description

None given.

14.2 Software Access

None given.

15. Data Access

The soil respiration 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

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


17.3 Archive/DBMS Usage Documentation
None.
18. Glossary of Terms

None.

19. List of Acronyms

- 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
- HSA - Hemi-surface area
- HTML - HyperText Markup Language
- NASA - National Aeronautics and Space Administration
- NSA - Northern Study Area
- OA - Old Aspen
- OBS - Old Black Spruce
- OJP - Old Jack Pine
- ORNL - Oak Ridge National Laboratory
- PANP - Prince Albert National Park
- SSA - Southern Study Area
- TE - Terrestrial Ecology
- TLA - Total Leaf Area
- UBS - Upland Black Spruce
- URL - Uniform Resource Locator
- UTM - Universal Transverse Mercator

20. Document Information

20.1 Document Revision Date
Written: 10-Jun-1997
Last Updated: 27-May-1999

20.2 Document Review Date(s)
BORIS Review: 10-Jun-1997
Science Review:

20.3 Document

20.4 Citation
When using these data, please contact one of the investigators listed in Section 2.3 as well as citing relevant papers in Section 17.2.
If using data from the BOREAS CD-ROM series, also reference the data as:


Also, cite the BOREAS CD-ROM set as:

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)  
BOREAS TE-5 Soil Respiration Data

Jim Ehleringer, J. Renee Brooks and Larry Flanagan  
Forrest G. Hall and Shelaine Curd, Editors

Goddard Space Flight Center  
Greenbelt, Maryland 20771

National Aeronautics and Space Administration  
Washington, DC 20546-0001

The BOREAS TE-5 team collected measurements in the NSA and SSA on gas exchange, gas composition, and tree growth. Soil respiration data were collected from 26-May-94 to 07-Sep-94 in the BOREAS NSA and SSA to compare the soil respiration rates in different forest sites using a LI-COR 6200 soil respiration chamber (model 6299). The data are stored in tabular ASCII files.