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

Forrest G. Hall and Karl Huemmrich, Editors

Volume 204

BOREAS TF-8 NSA-OJP and SSA-OBS Ceilometer Data

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National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

November 2000
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Summary

The BOREAS TF-8 team used ceilometers to collect data on the fraction of the sky covered with clouds and the cloud height. Included with these data is the surface-based lifting condensation level, derived from temperature and humidity values acquired at the flux tower at the NSA-OJP site. Ceilometer data were collected at the NSA-OJP site in 1994 and at the NSA-OJP and SSA-OBS sites in 1996. The data are available in tabular ASCII files.

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1. Data Set Overview

1.1 Data Set Identification
BOREAS TF-08 NSA-OJP and SSA-OBS Ceilometer Data

1.2 Data Set Introduction
Ceilometers emit pulses of laser light and measure the time it takes for the photons to return after being scattered off of the cloud base. The ceilometer provides data on cloud base height and cloud cover. The cloud fraction is the time fraction of cloud cover based on ceilometer reports every minute (30 per half hour). The BOReal Ecosystem-Atmosphere Study (BOREAS) Tower Flux (TF)-08 team collected these data to obtain a seasonal record of cloud fraction and cloud type. Data were collected at the Northern Study Area (NSA)-Old Jack Pine (OJP) site in 1994 and at the NSA-OJP and Southern Study Area (SSA)-Old Black Spruce (OBS) sites in 1996.

1.3 Objective/Purpose
The objective was to collect information on cloud characteristics in conjunction with tower flux measurements.
1.4 Summary of Parameters
Measurements include fraction of cloud cover, the height of the cloud base, backscatter range, and
the lifting condensation level. In 1996, cloud heights and backscatter ranges were reported for two
cloud layers.

1.5 Discussion
Ceilometers were located near the flux towers to measure the fraction of cloud cover and the height
of the cloud base. In 1994 a single Belfort ceilometer operated at the NSA-OJP site. That ceilometer
collected data from 31-May-1994 to 20-Sep-1994. In 1996, two Vaisala ceilometers were used, one at
the NSA-OJP, the other at the SSA-OBS site. The NSA-OJP ceilometer operated from 03-Jun-1996 to

1.6 Related Data Sets
BOREAS AFM-05 Level-2 Upper-Air Network Standard Pressure Level Data
BOREAS AFM-06 NOAA/ETL 35-GHz Cloud/Turbulence Radar GIF Images
BOREAS TF-08 NSA-OJP Tower Flux, Meteorological, and Soil Temperature Data
BOREAS TF-03 NSA-OBS Tower Flux, Meteorological, and Soil Temperature Data

2. Investigator(s)

2.1 Investigator(s) Name and Title
David R. Fitzjarrald
Research Associate
Atmospheric Sciences Research Center

Kathleen E. Moore
Research Scientist
Atmospheric Sciences Research Center

2.2 Title of Investigation
Surface Exchange Observations in the Canadian Boreal Forest Region

2.3 Contact Information

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Atmospheric Sciences Research Center
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Albany, NY 12203
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(518) 437-8758 (fax)
moore@asrc.cestm.albany.edu

Contact 2:
David R. Fitzjarrald
Research Associate
Atmospheric Sciences Research Center
251 Fuller Rd.
Albany, NY 12203
(518) 437-8735
(518) 437-8758 (fax)
fitz@asrc.cestm.albany.edu
3. Theory of Measurements

The operating principle of the laser ceilometer is based on measuring the time needed for a short pulse of light to traverse the distance through the atmosphere from the transmitter of the ceilometer to a backscattering cloud base and back to the ceilometer's receiver. From that time measurement, the height of the cloud base is calculated. The instantaneous magnitude of the return signal provides information on the backscatter properties of the atmosphere at a certain height. The cloud fraction is the time fraction of cloud cover based on ceilometer reports every minute (30 per half hour).

4. Equipment

4.1 Sensor/Instrument Description

4.1.1 Collection Environment

Measurements were collected at the NSA-OJP site from late May through mid-September 1994 and early June through mid-November of 1996. At the SSA-OBS site, data were collected from mid-June through mid-October of 1996. Over the entire time period of data collection, temperature conditions from less than -15 °C to over 30 °C were experienced, as well as both rain and snow.

4.1.2 Source/Platform

The ceilometers were placed on wooden platforms. The platforms were less than 0.5 m off the ground and within 25 m of the flux towers.

4.1.3 Source/Platform Mission Objectives

The objective was to provide stable and level support for the ceilometer.

4.1.4 Key Variables

The ceilometers measured fraction of cloud cover, the height of the cloud base, and backscatter range. In 1996, cloud heights and backscatter ranges were reported for two cloud layers. The cloud fraction was the time fraction of cloud cover based on ceilometer reports every minute (30 per half hour). The surface-based lifting condensation level was derived from temperature and humidity values acquired at 22.68 m above ground level on the NSA-OJP flux tower.

4.1.5 Principles of Operation

The Belfort ceilometer used a 20-watt near-infrared Gallium-Arsenide laser operating at a wavelength of 0.91 microns. It employed 1,024 range gates, which yielded a vertical resolution of 7.62 m (25 feet) up to a maximum altitude of 7,802 m (25,600 feet). The fields of view of the transmitter and receiver were approximately 1°. The time interval between consecutive observations was set at 1 minute.

The Vaisala CT12K ceilometer digitally sampled the return signal every 100 ns and had a vertical resolution of 15.24 m (50 feet) from ground level to an altitude of 3,901 m (12,500 feet).
4.1.6 Sensor/Instrument Measurement Geometry
The ceilometers sat on a wooden platform within openings in the forest canopy allowing an unobstructed view of the sky.

4.1.7 Manufacturer of Sensor/Instrument
Belfort Instrument Company
727 South Wolfe Street
Baltimore, MD 21231
USA
(410) 342-2626
(410) 342-7028 (fax)
http://www.belfort-inst.com/

Vaisala Inc.
U.S. Office
100 Commerce Way
Woburn, MA 01801-1068
USA
(781) 933-4500

4.2 Calibration

4.2.1 Specifications
None given.

4.2.1.1 Tolerance
The Belfort ceilometer had a vertical resolution of 7.62 m (25 feet), and the Vaisala CT12K ceilometer had a vertical resolution of 15.24 m (50 feet).

4.2.2 Frequency of Calibration
Unknown.

4.2.3 Other Calibration Information
None given

5. Data Acquisition Methods
For each ceiling observation, the Belfort ceilometer goes through a cycle of measurements. The laser is fired 5,120 times, and the reflected signal is sampled for each range gate. On each of the 5,120 scans, for each range gate, the signal is compared with the appropriate noise level for that gate. Depending on whether the received signal is above, below, or within the noise level band, an integer value of 1, -1, or zero is assigned to that gate. These assigned integers are then summed for each gate and thus represent a modified histogram of counts versus height. A peak-location algorithm is then applied to this product to produce a first-order estimate of the cloud ceiling.

For the Vaisala CT12K ceilometer, the return signal strength is derived from the Lidar Equation. A threshold for the backscatter coefficient (a measure of reflection) is based upon assumed visibilities in cloud being in the range of 15 to 150 m.
6. Observations

6.1 Data Notes
None.

6.2 Field Notes
None.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage
The ceilometers measured cloud conditions at a single point. In 1994, data were collected only at NSA-OJP; in 1996, data were collected at both NSA-OJP and SSA-OBS sites. The ceilometers were located within 25 m of the flux towers. The North American Datum of 1983 (NAD83) coordinates for the sites were:

<table>
<thead>
<tr>
<th>Site</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSA-OJP tower</td>
<td>55.92842° N</td>
<td>98.62396° W</td>
<td>255.1 m</td>
</tr>
<tr>
<td>SSA-OBS tower</td>
<td>53.98717° N</td>
<td>105.11779° W</td>
<td>628.9 m</td>
</tr>
</tbody>
</table>

7.1.2 Spatial Coverage Map
Not applicable.

7.1.3 Spatial Resolution
The ceilometer laser was aimed vertically and the fields-of-view of the transmitter and receiver were approximately 1°.

7.1.4 Projection
Not applicable.

7.1.5 Grid Description
Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

7.2.2 Temporal Coverage Map
Not applicable.

7.2.3 Temporal Resolution
The time interval between consecutive observations was set at 1 minute for the Belfort ceilometer. The Vaisala CT12K ceilometer digitally sampled the return signal every 100 ns. The cloud fraction was the time fraction of cloud cover based on ceilometer reports every minute (30 per half hour). One-minute ceilometer data and 20-minute lifting condensation level data were interpolated to the half-hour averages provided in the data set.
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_OBS</td>
</tr>
<tr>
<td>MEAN_CLOUD_COVER</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_LOWEST</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_SECOND</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_FIRST_LAYER</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_SECOND_LAYER</td>
</tr>
<tr>
<td>LIFTING_CONDENSATION_LEVEL</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, 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.</td>
</tr>
<tr>
<td>SUB_SITE</td>
<td>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.</td>
</tr>
<tr>
<td>DATE_OBS</td>
<td>The date on which the data were collected.</td>
</tr>
<tr>
<td>TIME_OBS</td>
<td>The Greenwich Mean Time (GMT) of the start of the data collection.</td>
</tr>
<tr>
<td>MEAN_CLOUD_COVER</td>
<td>The fraction of sky covered by clouds, based on ceilometer reports every minute averaged to a half hourly value.</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_LOWEST</td>
<td>The lowest observed cloud base height. If multiple layers of clouds are observed, this is the height of the cloud base of the lower clouds.</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_SECOND</td>
<td>If multiple layers of clouds are observed, this is the height of the cloud base of the second lowest cloud layer.</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_FIRST_LAYER</td>
<td>The range of backscatter in the first cloud layer</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_SECOND_LAYER</td>
<td>The range of backscatter in the second cloud layer</td>
</tr>
</tbody>
</table>
The surface-based lifting condensation level, derived from temperature and humidity values acquired at the 22.68 m level on the flux tower.

The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-?? (CPI but questionable).

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:

<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_OBS</td>
<td>[HHMM GMT]</td>
</tr>
<tr>
<td>MEAN_CLOUD_COVER</td>
<td>[fraction]</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_LOWEST</td>
<td>[meters]</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_SECOND</td>
<td>[meters]</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_FIRST_LAYER</td>
<td>[1000 kilometers^-1][steradians^-1]</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_SECOND_LAYER</td>
<td>[1000 kilometers^-1][steradians^-1]</td>
</tr>
<tr>
<td>LIFTING_CONDENSATION_LEVEL</td>
<td>[meters]</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>[Assigned by BORIS.]</td>
</tr>
<tr>
<td>SUB_SITE</td>
<td>[Assigned by BORIS.]</td>
</tr>
<tr>
<td>DATE_OBS</td>
<td>[Supplied by Investigator.]</td>
</tr>
<tr>
<td>TIME_OBS</td>
<td>[Supplied by Investigator.]</td>
</tr>
<tr>
<td>MEAN_CLOUD_COVER</td>
<td>[Ceilometer]</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_LOWEST</td>
<td>[Ceilometer]</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_SECOND</td>
<td>[Ceilometer]</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_FIRST_LAYER</td>
<td>[Ceilometer]</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_SECOND_LAYER</td>
<td>[Ceilometer]</td>
</tr>
<tr>
<td>LIFTING_CONDENSATION_LEVEL</td>
<td>[psychrometer]</td>
</tr>
<tr>
<td>CRTFCN_CODE</td>
<td>[Assigned by BORIS.]</td>
</tr>
<tr>
<td>REVISION_DATE</td>
<td>[Assigned by BORIS.]</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 Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE_NAME</td>
<td>NSA-OJP-FLXTR</td>
<td>SSA-OBS-FLXTR</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>SUB_SITE</td>
<td>9TF08-CEILO</td>
<td>9TF08-CEILO</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>DATE_OBS</td>
<td>31-MAY-94</td>
<td>10-NOV-96</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>TIME_OBS</td>
<td>0</td>
<td>2330</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MEAN_CLOUD_COVER</td>
<td>0</td>
<td>1</td>
<td>-999</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_LOWEST</td>
<td>0</td>
<td>7315.2</td>
<td>-999</td>
<td>None</td>
<td>None</td>
<td>Blank</td>
</tr>
<tr>
<td>CLOUD_HEIGHT_SECOND</td>
<td>0</td>
<td>3810</td>
<td>-999</td>
<td>None</td>
<td>None</td>
<td>Blank</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_FIRST_LAYER</td>
<td>0</td>
<td>12600</td>
<td>-999</td>
<td>None</td>
<td>None</td>
<td>Blank</td>
</tr>
<tr>
<td>BACKSCATTER_RANGE_SECOND_LAYER</td>
<td>0</td>
<td>500</td>
<td>-999</td>
<td>None</td>
<td>None</td>
<td>Blank</td>
</tr>
<tr>
<td>LIFTING_CONDENSATION_LEVEL</td>
<td>0</td>
<td>3971.77</td>
<td>-999</td>
<td>None</td>
<td>None</td>
<td>Blank</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>17-FEB-99</td>
<td>17-FEB-99</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 Collected** -- 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, MEAN_CLOUD_COVER, CLOUD_HEIGHT_LOWEST,
   CLOUD_HEIGHT_SECOND, BACKSCATTER_RANGE_FIRST_LAYER,
   BACKSCATTER_RANGE_SECOND_LAYER, LIFTING_CONDITION_LEVEL, CRFNCN_CODE, REVISION_DATE

   'NSA-OJP-FLXTR', '9TF08-CEILO', 01-AUG-96, 0, 2646.68, -999.0, 50.0, -999.0, 2450.76, 'CPI', 17-FEB-99
   'NSA-OJP-FLXTR', '9TF08-CEILO', 01-AUG-96, 100, 0.0, 0.0, 0.0, 0.0, 0.0, 2491.06, 'CPI', 17-FEB-99

8. Data Organization

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

8.2 Data Format
   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.

9.1.1 Derivation Techniques and Algorithms
   None given.

9.2 Data Processing Sequence

9.2.1 Processing Steps
   BORIS staff processed these data by:
   • Reviewing the initial data files and loading them online for BOREAS team access.
   • Designing relational data base tables to inventory and store the data.
   • Loading the data into the relational data base tables.
   • Working with the team to document the data set.
   • Extracting the data into logical files.

9.2.2 Processing Changes
   None.

9.3 Calculations
9.3.1 Special Corrections/Adjustments
One-minute ceilometer data and 20-minute lifting condensation level data were interpolated to half-hour averages.

9.3.2 Calculated Variables
The surface-based lifting condensation level was derived from temperature and humidity values acquired at 22.68 m above ground level on the NSA-OJP flux tower. The cloud fraction was the time fraction of cloud cover based on ceilometer reports every minute (30 per half hour).

9.4 Graphs and Plots
None.

10. Errors

10.1 Sources of Error
None given.

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
The Belfort ceilometer had a vertical resolution of 7.62 m (25 feet), and the Vaisala CT12K ceilometer had a vertical resolution of 15.24 m (50 feet).

10.2.4 Additional Quality Assessments
None given.

10.2.5 Data Verification by Data Center
Data were examined to check for spikes, values that were four standard deviations from the mean, long periods of constant values, and missing data.

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

The ceilometer data provide a continuous record of cloud conditions that can be linked with surface observations of heat and moisture fluxes measured from the flux towers.

13. Future Modifications and Plans

None.

14. Software

14.1 Software Description
None given.

14.2 Software Access
None.

15. Data Access

The NSA-OJP and SSA-OBS ceilometer 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

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


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
- GMT - Greenwich Mean Time
- GSFC - Goddard Space Flight Center
- HTML - HyperText Markup Language
- IFC - Intensive Field Campaign
- NAD83 - North American Datum of 1983
- NASA - National Aeronautics and Space Administration
- NOAA - National Oceanic and Atmospheric Administration
- NSA - Northern Study Area
- OBS - Old Black Spruce
- OJP - Old Jack Pine
- ORNL - Oak Ridge National Laboratory
- PANP - Prince Albert National Park
- SSA - Southern Study Area
- TF - Tower Flux
- TGB - Trace Gas Biogeochemistry
- URL - Uniform Resource Locator

20. Document Information

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20.2 Document Review Date(s)
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When using these data, please include the following acknowledgment as well as citations of relevant papers in Section 17.2:
These data were provided by Drs. David R. Fitzjarrald and Kathleen E. Moore.

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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

20.5 Document Curator

20.6 Document URL
The BOREAS TF-8 team used ceilometers to collect data on the fraction of the sky covered with clouds and the cloud height. Included with these data is the surface-based lifting condensation level, derived from temperature and humidity values acquired at the flux tower at the NSA-OJP site. Ceilometer data were collected at the NSA-OJP site in 1994 and at the NSA-OJP and SSA-OBS sites in 1996. The data are available in tabular ASCII files.