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

*Forrest G. Hall and Andrea Papagno, Editors*

**Volume 185  
BOREAS TE-21 Daily Surface  
Meteorological Data**

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Greenbelt, Maryland 20771

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October 2000

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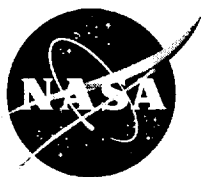
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# **BOREAS TE-21 Daily Surface Meteorological Data**

John Kimball

## **Summary**

The BOREAS TE-21 team collected data sets in support of its efforts to characterize and interpret information on the meteorology of boreal forest areas. Daily meteorological data were derived from half-hourly BOREAS TF and AMS mesonet measurements collected in the SSA and NSA for the period of 01-Jan-1994 until 31-Dec-1994 . The data were stored in tabular ASCII files.

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## **1. Data Set Overview**

### **1.1 Data Set Identification**

BOREAS TE-21 Daily Surface Meteorological Data

### **1.2 Data Set Introduction**

Daily meteorological data were assembled from 1994 half-hourly BOREal Ecosystem-Atmosphere Study (BOREAS) Tower Flux (TF) and Automatic Meteorological Station (AMS) mesonet measurements collected in the Southern Study Area (SSA) and Northern Study Area (NSA).

### **1.3 Objective/Purpose**

The purpose of this data set is to provide a full-year meteorological data base for stand hydrologic and biogeochemical model simulations at the BOREAS TF sites.

## 1.4 Summary of Parameters

Each data set contains the date, total incoming photosynthetically active radiation (PAR), total incoming solar radiation (direct + diffuse), total incoming longwave radiation, maximum daily air temperature, minimum daily air temperature, average daily air temperature, average daily windspeed, average daily relative humidity, daily precipitation derived from tipping bucket and Belfort gauges, and an identification flag for precipitation.

## 1.5 Discussion

Half-hourly meteorological data were derived from 1994 TF and AMS mesonet measurements. These data often contained temperature, wind, and humidity data at one or more heights. When data at more than one height were available, data were taken from the upper height that corresponded most closely with the top of the canopy or the upper level at which water and CO<sub>2</sub> fluxes were measured. No attempt was made to adjust the data to account for differences in measurement heights.

Full-year half-hourly data files for each tower site were created by placing several adjacent tower site data files together in series. Missing values were then selected from adjacent data files with complete data for the same time period. Preceding data were always favored first in the selection process. The following series were used to create complete data files for each tower site:

NSA-FEN site: NSA-FEN, NSA-OBS, NSA-OJP-SRC, NSA, INT  
NSA-OBS site: NSA-OBS, NSA-OJP-SRC, NSA-YJP, NSA-FEN, INT  
NSA-OJP site: NSA-OJP-SRC, NSA-OBS, NSA-YJP, NSA-FEN, INT  
NSA-YJP site: NSA-YJP, NSA-OJP-SRC, NSA-FEN, NSA-OBS, INT  
SSA-FEN site: SSA-FEN, SSA-YA, SSA-OA-SRC, SSA-OA, INT  
SSA-OA site: SSA-OA-SRC, SSA-OA, SSA-YA, SSA-OBS, INT  
SSA-OBS site: SSA-OBS, SSA-OJP-SRC, SSA-OA, SSA-YA, INT  
SSA-OJP site: SSA-OJP-SRC, SSA-OBS, SSA-OA, SSA-OJP, INT  
SSA-YA site: SSA-YA, SSA-OA-SRC, SSA-OA, SSA-OBS, INT

where:

NSA-FEN	- NSA-FEN TF Site
NSA-OJP-SRC	- Airborne Fluxes and Meteorology (AFM)-07 Saskatchewan Research Council (SRC) Met Tower at NSA-Old Jack Pine (OJP) site
NSA-OBS	- NSA-Old Black Spruce (OBS) TF site
NSA-OJP	- NSA-OJP TF site
SSA-OJP-SRC	- AFM-07 SRC Met Tower at SSA-OJP
NSA-YJP	- NSA-Young Jack Pine (YJP) TF site
NSA-9BS-YTH	- AFM-07 SRC Met Tower at Thompson
SSA-OA-SRC	- AFM-07 SRC Met Tower at SSA-Old Aspen (OA)
SSA-FEN	- SSA-FEN TF site
SSA-OA	- SSA-OA TF site
SSA-OBS	- SSA-OBS TF site
SSA-OJP	- SSA-OJP TF site
SSA-YA	- SSA-Young Aspen (YA) TF site
SSA	- Combination of SSA-OA-SRC, SSA-OJP-SRC, NSA-OJP-SRC, NSA-9BS-YTH, and SSA-OA
NSA	- Combination of NSA-OJP-SRC, NSA-9BS-YTH, SSA-OA-SRC, SSA-OJP-SRC, and NSA-OBS
INT	- NSA and SSA with temporally interpolated missing values

Longwave incoming radiation (lw) measurement data from the NSA-OJP AMS mesonet tower site (NSA-OJP-SRC) and the SSA-OJP AMS mesonet tower site (SSA-OJP-SRC) were used to represent longwave radiation characteristics for tower sites in the BOREAS NSA and SSA, respectively. Missing values were estimated using a multiple linear regression fit between measured longwave radiation, estimated clear-sky longwave radiation, and relative humidity:

$$lw.est = 80.3855 + 0.7521 * lw.clr + 0.4525 * RH \quad (1)$$

where:  $lw.est$  = estimated  $lw$  irradiance ( $W/m^2$ )  
 $lw.clr$  = estimated clear-sky  $lw$  irradiance ( $W/m^2$ )  
 $RH$  = measured relative humidity (%)

$lw.clr$  was estimated from air temperature and relative humidity measurements using an approach described by Marks and Dozier (1979).

Incoming solar radiation and PAR files were created by combining NSA-OJP-SRC, NSA-9BS-YTH, SSA-OA-SRC, SSA-OJP-SRC, and NSA-OBS files. Missing solar radiation that was not available was estimated as  $(PAR * 2.0)$  and missing PAR radiation as 50% of the solar radiation value. Daily data were derived from the complete half-hourly data files created for each tower site. Daily tipping bucket and Belfort precipitation data were combined at each site. Precipitation data from adjacent tower sites were then used to fill in missing values. Each daily precipitation value is flagged with the identification flag of the tower site file where it came from.

The 1994 full-year half-hourly data used to create the daily data files are available upon request from Terrestrial Ecology (TE)-21.

## 1.6 Related Data Sets

BOREAS AFM-07 SRC Surface Meteorological Data  
 BOREAS TE-05 Surface Meteorological and Radiation Data  
 BOREAS TF-01 SSA-OA Tower Flux and Meteorological Data  
 BOREAS TF-02 SSA-OA Tower Flux and Meteorological Data  
 BOREAS TF-03 NSA-OBS Tower Flux, Meteorological, and Soil Temperature Data  
 BOREAS TF-04 SSA-OJP Flux and Meteorology Data  
 BOREAS TF-05 SSA-OJP Tower Flux and Meteorological Data  
 BOREAS TF-06 SSA-YA Surface Energy Flux and Meteorological Data  
 BOREAS TF-09 SSA-OBS Tower Flux, Meteorological, and Soil Temperature Data  
 BOREAS TF-10 NSA-Fen Tower Flux and Meteorological Data  
 BOREAS TF-11 SSA-Fen Tower Flux and Meteorological Data

## 2. Investigator(s)

### 2.1 Investigator(s) Name and Title

Dr. Steve Running  
 Dr. John Kimball

### 2.2 Title of Investigation

Simulation of Boreal Ecosystem Carbon and Water Budgets: Scaling from Local to Regional Extents

### 2.3 Contact Information

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### **3. Theory of Measurements**

None given.

### **4. Equipment**

#### **4.1 Sensor/Instrument Description**

##### **4.1.1 Collection Environment**

Data were derived from 1994 TF and AMS mesonet measurements. Refer to the documentation for the data sets listed in Section 1.6 for further information.

##### **4.1.2 Source/Platform**

None given.

##### **4.1.3 Source/Platform Mission Objectives**

None given.

##### **4.1.4 Key Variables**

Each data set contains the date, total incoming PAR, total incoming solar radiation (direct + diffuse), total incoming longwave radiation, maximum daily air temperature, minimum daily air temperature, average daily air temperature, average daily windspeed, average daily relative humidity, daily precipitation derived from tipping bucket and Belfort gauges, and an identification flag for precipitation.

##### **4.1.5 Principles of Operation**

None given.

##### **4.1.6 Sensor/Instrument Measurement Geometry**

None given.

##### **4.1.7 Manufacturer of Sensor/Instrument**

None given.

#### **4.2 Calibration**

None given.

##### **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**

Not applicable.

## **5. Data Acquisition Methods**

See Section 1.5.

## **6. Observations**

### **6.1 Data Notes**

The 1994 full-year half-hourly data used to create the daily data files are available upon request from TE-21.

1994 full-year 15-minute data for the TF sites have also been created by BOREAS Information System (BORIS) staff.

### **6.2 Field Notes**

None given.

## **7. Data Description**

### **7.1 Spatial Characteristics**

None given.

#### **7.1.1 Spatial Coverage**

The measurement sites and associated North American Datum of 1983 (NAD83) coordinates are:

- NSA-FEN flux tower, site id T7S1T, Lat/Long: 55.91481° N, 98.42072° W, Universal Transverse Mercator (UTM) Zone 14, N: 6,196,749.6, E: 536,207.9.
- NSA-OBS flux tower, site id T3R8T, Lat/Long: 55.88007° N, 98.48139° W, UTM Zone 14, N: 6,192,853.4, E: 532,444.5.
- NSA-OJP-SRC and NSA-OJP flux tower, site id T7Q8T, Lat/Long: 55.92842° N, 98.62396° W, UTM Zone 14, N: 6,198,176.3, E: 523,496.2.
- NSA-YJP flux tower, site id T8S9T, Lat/Long: 55.89575° N, 98.28706° W, UTM Zone 14, N: 6,194,706.9, E: 544,583.9.
- SSA-FEN flux tower, site id F0L9T, Lat/Long: 53.80206° N, 104.61798° W, UTM Zone 13, N: 5,961,566.6, E: 525,159.8.
- SSA-OA-SRC and SSA-OA flux tower, site id C3B7T, Lat/Long: 53.62889° N, 106.19779° W, UTM Zone 13, N: 5942899.9, E: 420790.5.
- SSA-OBS flux tower, site id G8I4T, Lat/Long: 53.98717° N, 105.11779° W, UTM Zone 13, N: 5,982,100.5, E: 492,276.5.
- SSA-OJP-SRC and SSA-OJP flux tower, site id G2L3T, Lat/Long: 53.91634° N, 104.69203° W, UTM Zone 13, N: 5,974,257.5, E: 520,227.7.
- SSA-YA flux tower, site id D0H4T, Lat/Long: 53.65601° N, 105.32314° W, UTM Zone 13, N: 5,945,298.9, E: 478,644.1.
- NSA-9BS-YTH mesonet tower, Station identifier number 5062922, Lat/Long: 55.8° N, 97.87° W, UTM Zone 14, N: 6,184,839, E: 570,580.

### 7.1.2 Spatial Coverage Map

Not available.

### 7.1.3 Spatial Resolution

The data are intended to represent the surface meteorological conditions at the given sites. Due to the substitution and interpolation performed to compile complete data records for each site, users should use their best judgment in interpreting the spatial nature of the data.

### 7.1.4 Projection

Not applicable.

### 7.1.5 Grid Description

Not applicable.

## 7.2 Temporal Characteristics

### 7.2.1 Temporal Coverage

Daily data were collected from 01-Jan-1994 until 31-Dec-1994.

### 7.2.2 Temporal Coverage Map

None given.

### 7.2.3 Temporal Resolution

The data represent daily surface meteorological conditions.

## 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
DAILY_DOWN_FAS
DAILY_DOWN_SOLAR_FAS
DAILY_DOWN_WAVE_FAS
DAILY_MAX_AIR_TEMP
DAILY_MIN_AIR_TEMP
DAILY_MEAN_AIR_TEMP
DAILY_MEAN_WIND_SPEED
DAILY_MEAN_REL_HUM
DAILY_PRECIP
PRECIP_LOCATION
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-IIIIV, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIIV is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
DAILY_DOWN_PAR	The daily downwelling photosynthetically active radiation.
DAILY_DOWN_SOLAR_RAD	The daily downwelling solar radiation.
DAILY_DOWN_LONGWAVE_RAD	The daily downwelling longwave radiation.
DAILY_MAX_AIR_TEMP	The daily maximum air temperature.
DAILY_MIN_AIR_TEMP	The daily minimum air temperature.
DAILY_MEAN_AIR_TEMP	The mean daily air temperature.
DAILY_MEAN_WIND_SPEED	The mean daily wind speed.
DAILY_MEAN_REL_HUM	The mean daily relative humidity.
DAILY_PRECIP	The daily precipitation.
PRECIP_LOCATION	The identification of the tower site file where the precipitation data came from.
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]
DAILY_DOWN_PAR	[MegaJoules][meters <sup>-2</sup> ][day <sup>-1</sup> ]
DAILY_DOWN_SOLAR_RAD	[MegaJoules][meters <sup>-2</sup> ][day <sup>-1</sup> ]
DAILY_DOWN_LONGWAVE_RAD	[MegaJoules][meters <sup>-2</sup> ][day <sup>-1</sup> ]
DAILY_MAX_AIR_TEMP	[degrees Celsius]
DAILY_MIN_AIR_TEMP	[degrees Celsius]
DAILY_MEAN_AIR_TEMP	[degrees Celsius]
DAILY_MEAN_WIND_SPEED	[meters][second <sup>-1</sup> ]
DAILY_MEAN_REL_HUM	[percent]

DAILY_PRECIP	[millimeters][day <sup>-1</sup> ]
PRECIP_LOCATION	[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	[BORIS Designation]
SUB_SITE	[BORIS Designation]
DATE_OBS	[Human Observer]
DAILY_DOWN_PAR	[Laboratory Equipment]
DAILY_DOWN_SOLAR_RAD	[Laboratory Equipment]
DAILY_DOWN_LONGWAVE_RAD	[Laboratory Equipment]
DAILY_MAX_AIR_TEMP	[Thermometer]
DAILY_MIN_AIR_TEMP	[Thermometer]
DAILY_MEAN_AIR_TEMP	[Thermometer]
DAILY_MEAN_WIND_SPEED	[Laboratory Equipment]
DAILY_MEAN_REL_HUM	[Laboratory Equipment]
DAILY_PRECIP	[Laboratory Equipment]
PRECIP_LOCATION	[Human Observer]
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 Clctd
SITE_NAME	NSA-FEN-FLXTR	SSA-OJP-FLXTR	None	None	None	None
SUB_SITE	9TE21-MET01	9TE21-MET01	None	None	None	None
DATE_OBS	01-JAN-94	31-DEC-94	None	None	None	None
DAILY_DOWN_PAR	.122217	12.9	None	None	None	None
DAILY_DOWN_SOLAR_RAD	.26677	32.4	None	None	None	None
DAILY_DOWN_LONGWAVE_RAD	10.82358	32.5	None	None	None	None
DAILY_MAX_AIR_TEMP	-35.76	31.01	None	None	None	None
DAILY_MIN_AIR_TEMP	-39.99	19.2	None	None	None	None
DAILY_MEAN_AIR_TEMP	-37.279	23.607	None	None	None	None
DAILY_MEAN_WIND_SPEED	.0111565	7.13842	None	None	None	None
DAILY_MEAN_REL_HUM	22.0516	99.074	None	None	None	None
DAILY_PRECIP	0	81.4	None	None	None	None
PRECIP_LOCATION	N/A	N/A	None	None	None	None
CRTFCN_CODE	CPI	CPI	None	None	None	None
REVISION_DATE	14-JAN-99	14-JAN-99	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,DAILY_DOWN_PAR,DAILY_DOWN_SOLAR_RAD,
DAILY_DOWN_LONGWAVE_RAD,DAILY_MAX_AIR_TEMP,DAILY_MIN_AIR_TEMP,
DAILY_MEAN_AIR_TEMP,DAILY_MEAN_WIND_SPEED,DAILY_MEAN_REL_HUM,DAILY_PRECIP,
PRECIP_LOCATION,CRTFCN_CODE,REVISION_DATE
'NSA-FEN-FLXTR','9TE21-MET01',01-JAN-94,.654753,1.12,22.0,-32.1,-37.8,-35.071,
2.16078,65.3041,0.0,'NOJP AMS mesonet tower site','CPI',14-JAN-99
'NSA-FEN-FLXTR','9TE21-MET01',02-JAN-94,.397476,.52705,22.2,-29.39,-36.7,-34.083,
1.78435,66.7298,0.0,'NOJP AMS mesonet tower site','CPI',14-JAN-99
```

## 8. Data Organization

### 8.1 Data Granularity

The smallest unit of data tracked by 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

See Section 9.3.

#### 9.1.1 Derivation Techniques and Algorithms

None given.

### 9.2 Data Processing Sequence

#### 9.2.1 Processing Steps

Half-hourly meteorological data were derived from 1994 TF and AMS mesonet measurements. These data often contained temperature, wind, and humidity data at one or more heights. When data at more than one height were available, data were taken from the upper height that corresponded most closely with the top of the canopy or the upper level at which water and CO<sub>2</sub> fluxes were measured. No attempt was made to adjust the data to account for differences in measurement heights.

Full-year half-hourly data files for each tower site were created by placing several adjacent tower site data files together in series. Missing values were then selected from adjacent data files with complete data for the same time period. Preceding data were always favored first in the selection process. The following series were used to create complete data files for each tower site:

NSA-FEN site: NSA-FEN, NSA-OBS, NSA-OJP-SRC, NSA, INT  
NSA-OBS site: NSA-OBS, NSA-OJP-SRC, NSA-YJP, NSA-FEN, INT  
NSA-OJP site: NSA-OJP-SRC, NSA-OBS, NSA-YJP, NSA-FEN, INT  
NSA-YJP site: NSA-YJP, NSA-OJP-SRC, NSA-FEN, NSA-OBS, INT  
SSA-FEN site: SSA-FEN, SSA-YA, SSA-OA-SRC, SSA-OA, INT  
SSA-OA site: SSA-OA-SRC, SSA-OA, SSA-YA, SSA-OBS, INT  
SSA-OBS site: SSA-OBS, SSA-OJP-SRC, SSA-OA, SSA-YA, INT  
SSA-OJP site: SSA-OJP-SRC, SSA-OBS, SSA-OA, SSA-OJP, INT  
SSA-YA site: SSA-YA, SSA-OA-SRC, SSA-OA, SSA-OBS, INT

where:

NSA-FEN	- NSA-FEN TF Site
NSA-OJP-SRC	- AFM-07 SRC Met Tower at NSA-OJP
NSA-OBS	- NSA-OBS TF site
NSA-OJP	- NSA-OJP TF site
SSA-OJP-SRC	- AFM-07 SRC Met Tower at SSA-OJP
NSA-YJP	- NSA-YJP TF site
NSA-9BS-YTH	- AFM-07 SRC Met Tower at Thompson
SSA-OA-SRC	- AFM-07 SRC Met Tower at SSA-OA
SSA-FEN	- SSA-FEN TF site
SSA-OA	- SSA-OA TF site
SSA-OBS	- SSA-OBS TF site
SSA-OJP	- SSA-OJP TF site
SSA-YA	- SSA-YA TF site
SSA	- Combination of SSA-OA-SRC, SSA-OJP-SRC, NSA-OJP-SRC, NSA-9BS-YTH, and SSA-OA
NSA	- Combination of NSA-OJP-SRC, NSA-9BS-YTH, SSA-OA-SRC, SSA-OJP-SRC, and NSA-OBS
INT	- NSA and SSA with temporally interpolated missing values

### 9.2.2 Processing Changes

None given.

### 9.3 Calculations

LW measurement data from NSA-OJP-SRC and SSA-OJP-SRC were used to represent longwave radiation characteristics for tower sites in the BOREAS NSA and SSA, respectively. Missing values were estimated using a multiple linear regression fit between measured longwave radiation, estimated clear-sky longwave radiation, and relative humidity:

$$lw.est = 80.3855 + 0.7521 * lw.clr + 0.4525 * RH \quad (1)$$

where:  $lw.est$  = estimated lw irradiance ( $W/m^2$ )  
 $lw.clr$  = estimated clear-sky lw irradiance ( $W/m^2$ )  
 $RH$  = measured relative humidity (%)

$lw.clr$  was estimated from air temperature and relative humidity measurements using an approach described by Marks and Dozier (1979).

#### 9.3.1 Special Corrections/Adjustments

None.

#### 9.3.2 Calculated Variables

See Section 9.3.

### 9.4 Graphs and Plots

None given.

## 10. Errors

### 10.1 Sources of Error

Only general error checking has been done to the data to eliminate unreasonably extreme data values. No attempt has been made to identify and correct for errors caused by location, terrain, or instrument elevation differences between TF sites. Analyses of meteorological data showed that daily temperature and humidity differences between TF sites were small within the NSA and SSA, indicating that terrain effects were generally minimal. Differences in daily data as a result of sensor height differences were also found to be small. The daily magnitudes of precipitation between sites, however, tended to be quite variable.

Greater than 80% of the temperature, precipitation, and humidity data for SSA-OJP, SSA-OA, and NSA-OJP sites were measured at those locations. At the other sites, between 20% and 40% of air temperature and humidity measurements and from 40% to 60% of precipitation measurements were actually obtained from those respective locations for 1994. Most of these data were collected during the growing season. The majority of the data during the winter months were obtained from the AMS mesonet sites, which ran over the entire year.

### 10.2 Quality Assessment

#### 10.2.1 Data Validation by Source

General error checking has been done to the data to eliminate unreasonably extreme data values.

#### **10.2.2 Confidence Level/Accuracy Judgment**

See Section 10.

#### **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**

This data set can be used to study the meteorological conditions of the boreal forest.

### **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 daily surface meteorological 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: [ornl daac@ornl.gov](mailto:ornl daac@ornl.gov) or [ornl@eos.nasa.gov](mailto:ornl@eos.nasa.gov)

### **15.2 Data Center Identification**

Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics  
<http://www-eosdis.ornl.gov/>.

### **15.3 Procedures for Obtaining Data**

Users may obtain data directly through the ORNL DAAC online search and order system [<http://www-eosdis.ornl.gov/>] and the anonymous FTP site [<ftp://www-eosdis.ornl.gov/data/>] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

### **15.4 Data Center Status/Plans**

The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

## **16. Output Products and Availability**

### **16.1 Tape Products**

None.

### **16.2 Film Products**

None.

### **16.3 Other Products**

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

## **17. References**

### **17.1 Platform/Sensor/Instrument/Data Processing Documentation**

None given.

### **17.2 Journal Articles and Study Reports**

Marks, D. and J. Dozier. 1979. A clear-sky longwave radiation model for remote alpine areas: Archiv fur Meteorologie Geophysik und Bioklimatologie, ser. B, no. 27, p. 159-187.

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).

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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 given.

## 19. List of Acronyms

AFM	- Airborne Fluxes and Meteorology
AMS	- Automatic Meteorological Station
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
FEN	- Fen TF Site
GIS	- Geographic Information System
GMT	- Greenwich Mean Time
GSFC	- Goddard Space Flight Center
HTML	- HyperText Markup Language
IFC	- Intensive Field Campaign
INT	- NSA and SSA with temporally interpolated missing values
LW	- Long-wave Incoming Radiation
MIX	- Mixed Wood
NAD83	- North American Datum of 1983
NASA	- National Aeronautics and Space Administration
NOAA	- National Oceanic and Atmospheric Administration
NSA	- Northern Study Area
NSA-9BS-YTH	- Thompson AMS Mesonet Tower Site
NSA-OJP-SRC	- NSA Old Jack Pine AMS Mesonet Tower Site
OA	- Old Aspen
OBS	- Old Black Spruce
OJP	- Old Jack Pine
ORNL	- Oak Ridge National Laboratory
PANP	- Prince Albert National Park
PAR	- Photosynthetically Active Radiation
RH	- Relative Humidity
RSS	- Remote Sensing Science
SSA	- Southern Study Area
SSA-OA-SRC	- SSA Old Aspen AMS Mesonet Tower Site
SSA-OJP-SRC	- SSA Old Jack Pine AMS Mesonet Tower Site
TE	- Terrestrial Ecology
TF	- Tower Flux
URL	- Uniform Resource Locator
UTM	- Universal Transverse Mercator
YA	- Young Aspen
YJP	- Young Jack Pine

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John Kimball of the University of Montana.

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Running, S. and J. Kimball, "Simulation of Boreal Ecosystem Carbon and Water Budgets: Scaling from Local to Regional Extents." In Collected Data of The Boreal Ecosystem-Atmosphere Study. Eds. J. Newcomer, D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers. CD-ROM. NASA, 2000.

Also, cite the BOREAS CD-ROM set as:

Newcomer, J., D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers, eds. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM. NASA, 2000.

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