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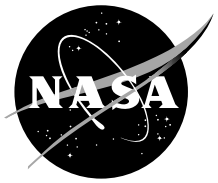

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Jeffrey A. Newcomer, Editors

Volume 15

BOREAS AFM-07 SRC Surface Meteorological Data

H. Osborne, K. Young, V. Wittrock, and S. Shewchuck

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

June 2000

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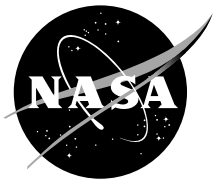

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BOREAS AFM-7 SRC Surface Meteorological and Radiation Data

Heather Osborne, Kim Young, Virginia Wittrock, Stan Shewchuck

Summary

The Saskatchewan Research Council (SRC) collected surface meteorological and radiation data from December 1993 until December 1996. The data set comprises Suite A (meteorological and energy balance measurements) and Suite B (diffuse solar and longwave measurements) components. Suite A measurements were taken at each of 10 sites, and Suite B measurements were made at 5 of the Suite A sites. The data cover an approximate area of 500 km (North-South) by 1,000 km (East-West) (a large portion of northern Manitoba and northern Saskatchewan). The measurement network was designed to provide researchers with a sufficient record of near-surface meteorological and radiation measurements. The data are provided in tabular ASCII files, and were collected by AFM-7.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS AFM-07 SRC Surface Meteorological and Radiation Data

1.2 Data Set Introduction

BOReal Ecosystem-Atmosphere Study (BOREAS) personnel at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) and the Canada Centre for Remote Sensing (CCRS) established a contract with the Saskatchewan Research Council (SRC) to implement and maintain a network of automatic meteorological stations (AMS) to measure surface meteorological and radiation parameters during BOREAS activities in Saskatchewan and Manitoba, Canada. SRC personnel installed and monitored the equipment, collected and quality checked the data, and delivered the data to the BOREAS Information System (BORIS) on a regular basis from 1994 through early 1997. The SRC AMS network comprises 10 Suite A and 5 Suite B sites.

1.3 Objective/Purpose

The SRC AMS data were collected to:

- Measure the microclimatic variability across the BOREAS sites.
- Provide input data for numerical simulation models.
- Collect broad-band reflected and emitted radiation to help with evaluating and calibrating satellite and aircraft imagery.

1.4 Summary of Parameters

The parameters measured at Suite A sites included date and time, within- and above-canopy temperature, atmospheric pressure, relative humidity, wind speed and direction, precipitation, snow depth, soil temperature profiles, shortwave radiation, photosynthetically active radiation (PAR), and net radiation. The parameters measured at Suite B sites included date and time, and shortwave and longwave radiation.

1.5 Discussion

The SRC AMS stations cover an area of roughly 500 km (North-South) by 1,000 km (East-West) (a large portion of northern Manitoba and northern Saskatchewan). The 10 Suite A stations were installed within the BOREAS study region (see Figure 1) prior to the first Intensive Field Campaign (IFC) that occurred in May 1994. All Suite A stations were equipped to measure basic meteorological and radiation parameters. The Suite A radiation sensors measured shortwave and net radiation, PAR, and longwave radiation. The measurement height for all the above-canopy measurements was approximately two to six meters above the canopy top. The below-canopy measurements were made at approximately 2 meters from the forest floor. The infrared radiation sensor is pointed at an angle of 45 degrees to measure canopy top temperature of the forest at each individual site. The infrared sensor is located at all the sites except Saskatoon and Meadow Lake. Precipitation at each site is measured with a Belfort weighing precipitation gauge that is mounted with an alter shield. Rainfall intensity is measured with a tipping bucket rain gauge at each site.

Five of the Suite A sites were augmented with additional radiation sensors to form a Suite B classification. Suite B sensors consist of a diffuse shortwave radiation sensor and a pyrgeometer. Figure 2 illustrates a typical boreal forest instrumentation array.

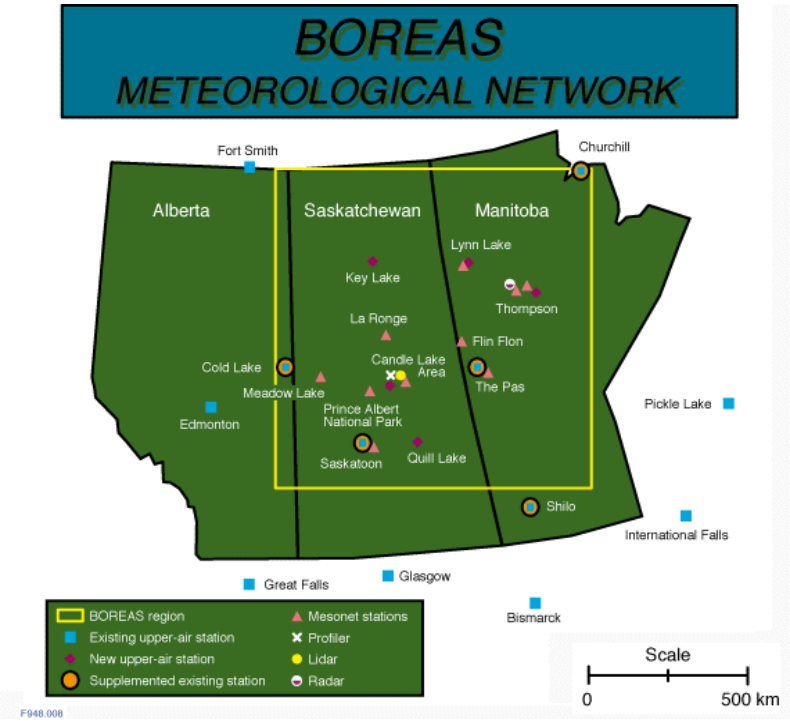

Figure 1: BOREAS Meteorological Network

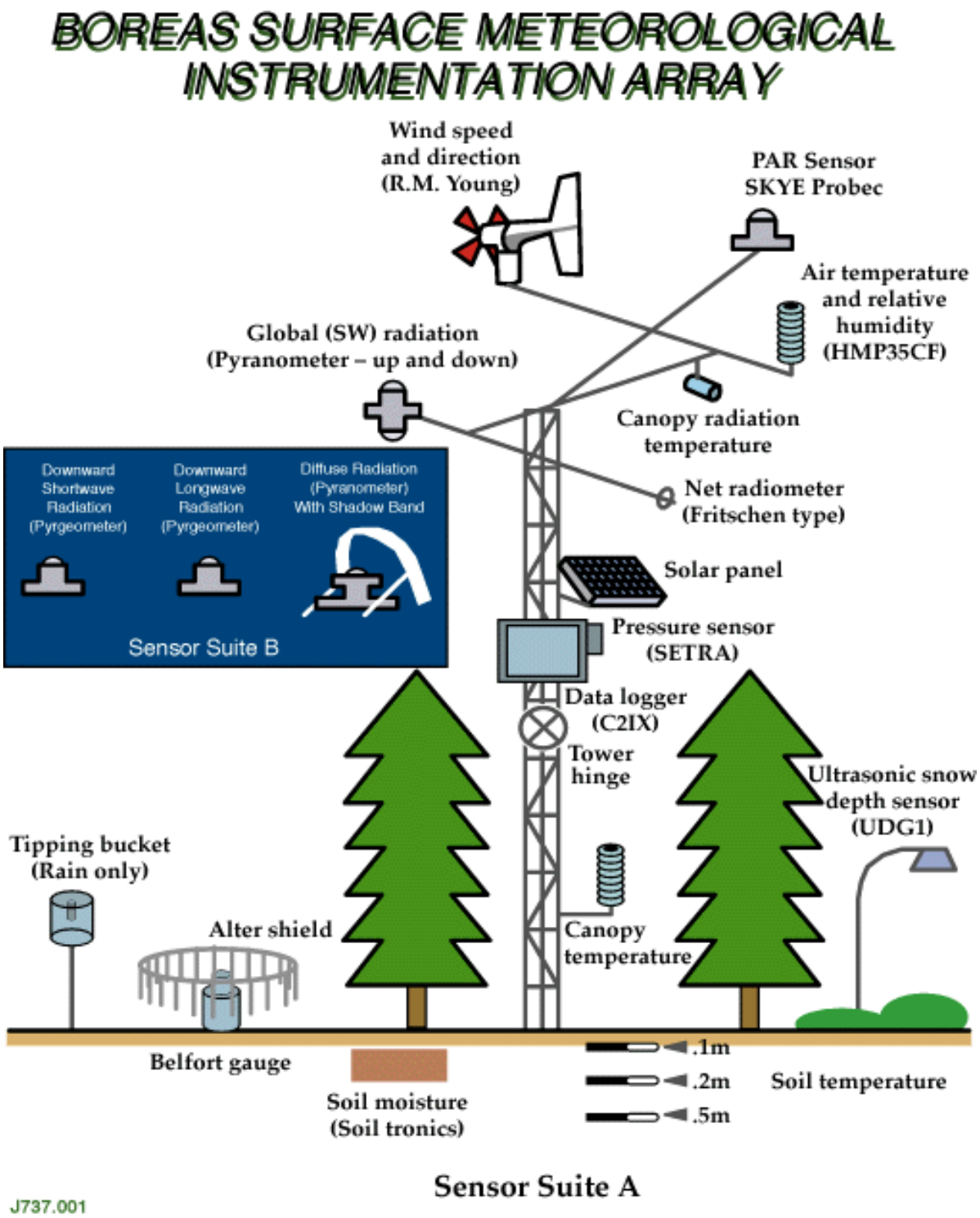

Figure 2: BOREAS Surface Met Array

1.6 Related Data Sets

BOREAS AES Campbell Scientific Surface Meteorological Data
BOREAS AES MARSII Surface Meteorological Data
BOREAS AES READAC Surface Meteorological Data

2. Investigator(s)

2.1 Investigator(s) Name and Title

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Atmospheric Sciences Section
Environment Technology Division
Saskatchewan Research Council

2.2 Title of Investigation

Atmospheric Sciences Infrastructure Core Measurements for BOREAS (AFM-07)

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3. Theory of Measurements

The theory behind the meteorological measurements is to understand the general climate of the Canadian boreal region. The main purpose of each AMS station is to gather enough precipitation, temperature, and other meteorological information to fully understand the climate of the boreal forest. Data from all of the instruments were stored on a data logger, which performed some of the initial data processing.

4. Equipment

4.1 Sensor/Instrument Description

This section is a comprehensive description of each AMS site. The parameters included are: site name, location and elevation, and a list of each instrument at the site. There is a detailed description of each instrument in the first site that contains the instrument. Within each detailed instrument description there is an explanation of what the instrument is used for; heights of each instrument; its supplier and/or manufacturer; and serial number. Additionally, the description of radiation sensors will contain the wavelengths they are able to measure. At subsequent sites containing the same instrument a shorter description is given, containing only the serial number and location details specific to that site.

The sites were inspected by human observers. Suite B sites were visited every 3 days. Suite A sites were visited every 7 to 10 days in the summer and every 3 to 5 days in the winter to check for frost build up on the instruments.

4.1.1 Collection Environment

The collection environment for the SRC AMS stations varied greatly from season to season and site to site. All instruments, except where otherwise noted, were exposed to the elements at all times. The sites were all located in relatively undisturbed locations and the instruments were checked regularly.

During winter, the instruments were exposed to frequent snow storms and temperatures that reached -40 °C. During the summer months, temperatures at the sites reached 30 °C. No covers were built to protect the instrumentation from precipitation, wind, animal damage, or vandalism.

4.1.2 Source/Platform

Suite A sites use a triangular cross-section Rohn tower as a platform for mounting the majority of the Suite A instruments. Each side of the tower is roughly 0.5 meters across and is internally supported by solid steel "zigzag" cross braces. The tower is designed with a hinge roughly halfway along its length that allows the tower to be folded down so that instruments may be attached and serviced without climbing gear. When the installation is complete, the tower can be extended to its full height. The only sites that do not use a Rohn tower are Meadow Lake and Saskatoon, where no forest exists and a tall tower is not required. Components mounted on the tower include the data logger, pressure sensor, solar panel, albedometer, net radiometer, air temperature and relative humidity sensors, PAR sensor, and wind speed and direction sensor. A lightning rod is also attached to the top of each tower.

The precipitation gauges at each site are mounted on a separate wooden platform located a short distance from the Rohn tower. The distance varies by site. The platform is 3 meters high, 0.9 meters wide, and 2.4 meters long. These platforms are located at all AMS sites except Meadow Lake and Saskatoon.

The Suite B sites are usually located a fair distance away from the Rohn tower that holds the Suite A instrumentation (Meadow Lake and Saskatoon being the exceptions). The Suite B sites recorded information on a separate data logger (usually a CR10).

4.1.3 Source/Platform Mission Objectives

The objective of the Rohn tower is to provide a stable place to hang instrumentation for the duration of the experiment. Additionally, the tower provides a method of placing instruments at various levels within the canopy.

Suite A Instruments

Instrument Type	Measured Parameters
PAR radiometer	PAR radiation
Net radiometer	Net radiation
Albedometer	Incoming solar radiation
	Reflected solar radiation
Temperature and relative humidity probe	Upper canopy air temperature
	Relative humidity
Temperature probe	Lower canopy air temperature
Soil temperature probe	Soil temperature
Barometric pressure	Air pressure
IR temperature	Surface IR temperature
Wind monitor	Wind direction
	Wind speed
Belfort rainfall transmitter	Precipitation
Ultrasonic depth gauge	Snow depth
Soil moisture sensor	Soil moisture
Tipping bucket rain gauge	Precipitation

Suite B Instruments

Instrument Type	Measured Parameters
Pyrgeometer	Incoming longwave radiation
	Outgoing longwave radiation
Pyranometer with shadow band	Diffuse solar radiation

4.1.5 Principles of Operation

Suite A Instruments

Instrument	Principle of Operation
Data Logger	This instrument is used to store and partially manipulate the data.
Multiplexer	The Multiplexer is used to increase the number of sensors that may be scanned by Campbell Scientific (CS) data loggers.
Spark Gapped Junction Box	The Junction Box is designed to minimize damage to instruments connected to wires on which a high voltage could be induced through electrostatic discharge due to lightening.There are two per tower.
Modem	The DC112 Modem is a 300/1200 baud modem employing the "AT" command set. It is used as a remote site modem connected to a CS data logger.
Solar Panels	The Model MSX-30 Solarex Solar Panel photovoltaic module is designed to operate DC loads with small to moderate energy requirements.
PAR Radiometer	The Skye Single Channel PAR Sensor is used to measure PAR Radiation. These sensors have cosine-corrected heads, each containing a semiconductor diode and filter system responding to light.
Net Radiometer	The Fritschen Q-6 Net Radiometer is a high output instrument that is designed to measure net radiation. Net radiation is defined as the sum of all incoming radiation minus the outgoing radiation. Incoming radiation consists of direct and diffuse shortwave radiation and longwave sky radiation. Outgoing radiation consists of reflected andterrestrial longwave radiation.
Albedometer (Solar & Reflected)	None given

Temperature and Relative Humidity Probe (Above Canopy)	None given
Temperature Probe (Lower Canopy)	None given
Soil Temperature Probe	None given
Barometric Pressure sensor	None given
IR Thermometer	The Everest Interscience Model 4000AL Infrared Thermometer measures the IR radiation emitted by objects and outputs the temperature, or a signal that is related to the temperature, of the object. The major advantage of this IR sensor is that no physical contact is made with the object being measured.
Wind Direction/Wind Speed sensor	None given
Belfort Precipitation Gauge	None given
Snow Depth Sensor	None given
Soil Moisture Sensor	The Matrix Water Potential Soil Moisture Sensor measures soil moisture by measuringthe heat differential between a warmed temperature probe and an unwarmed probe. The theory is that when a probe is heated the temperature rise will be a function ofthe water content of the medium (the soil). By inserting a heater and a temperature sensor in a fixed porous block in contact with soil, the temperature rise of the heater can be correlated to the water potential of the soil.
Tipping Bucket Precipitation Gauge	None given

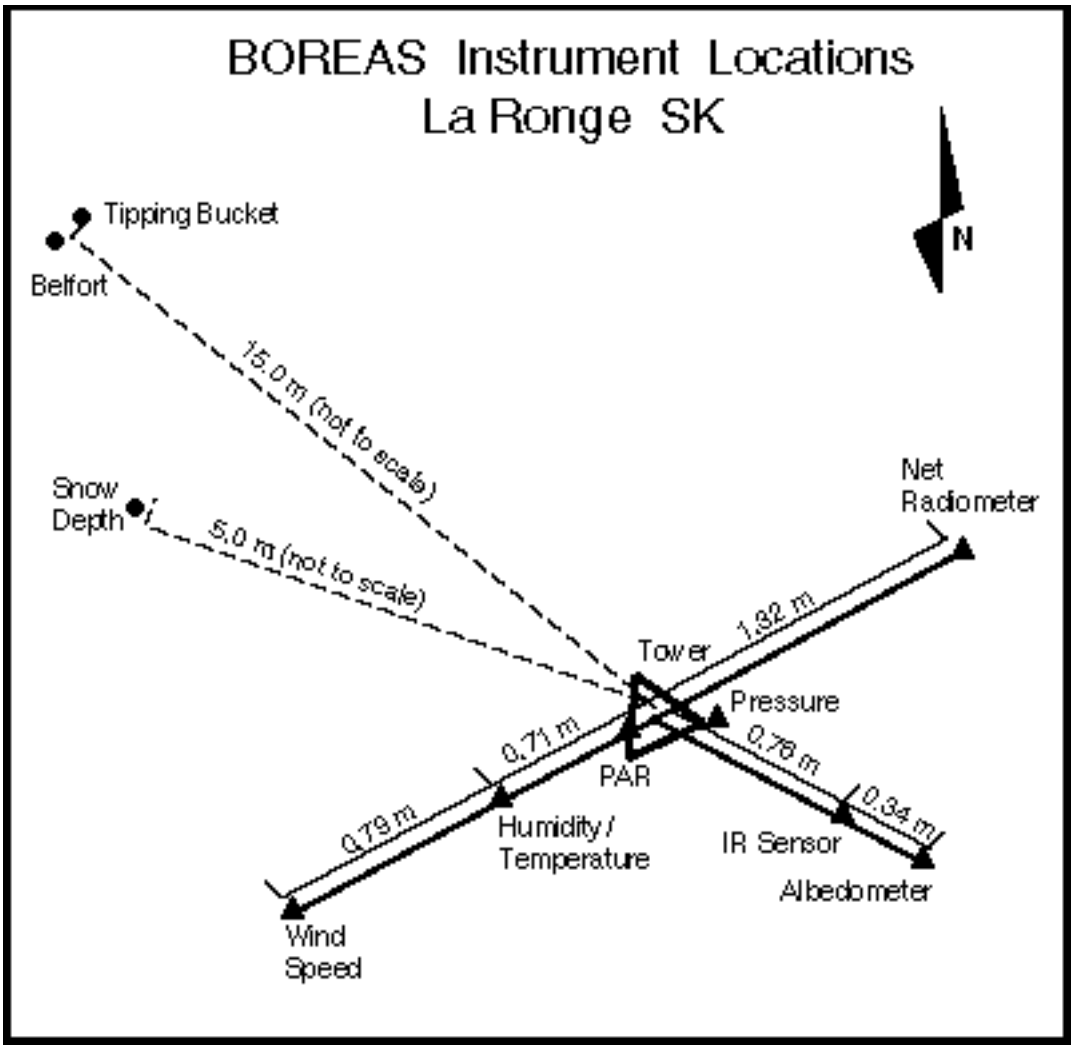
Suite B Instruments

Instrument	**Principle of Operation**
Data Logger	This instrument is used to store and partially manipulate the data.
Pyrgeometer	This instrument measures the exchange of radiation between a horizontal blackened surface and the target viewed. For the measurement of longwave radiation in general,and for the isolation of this from the solar shortwave radiation in daytime, a 30mm diameter hemisphere of silicon is used. This instrument is measuring downward longwave radiation from the atmosphere only.
Pyranometer	None given
Shadow Band Stand	The shadow band attaches to the suite B pyranometer that measures incoming solar radiation. The shadow band is intended to block out the direct rays of the sun and force the pyranometer to measure only the diffuse component of solar radiation. Theband is wide enough to block the sun's direct rays for a few weeks at a time. A local observer adjusted the shadow band monthly.

4.1.6 Sensor/Instrument Measurement Geometry

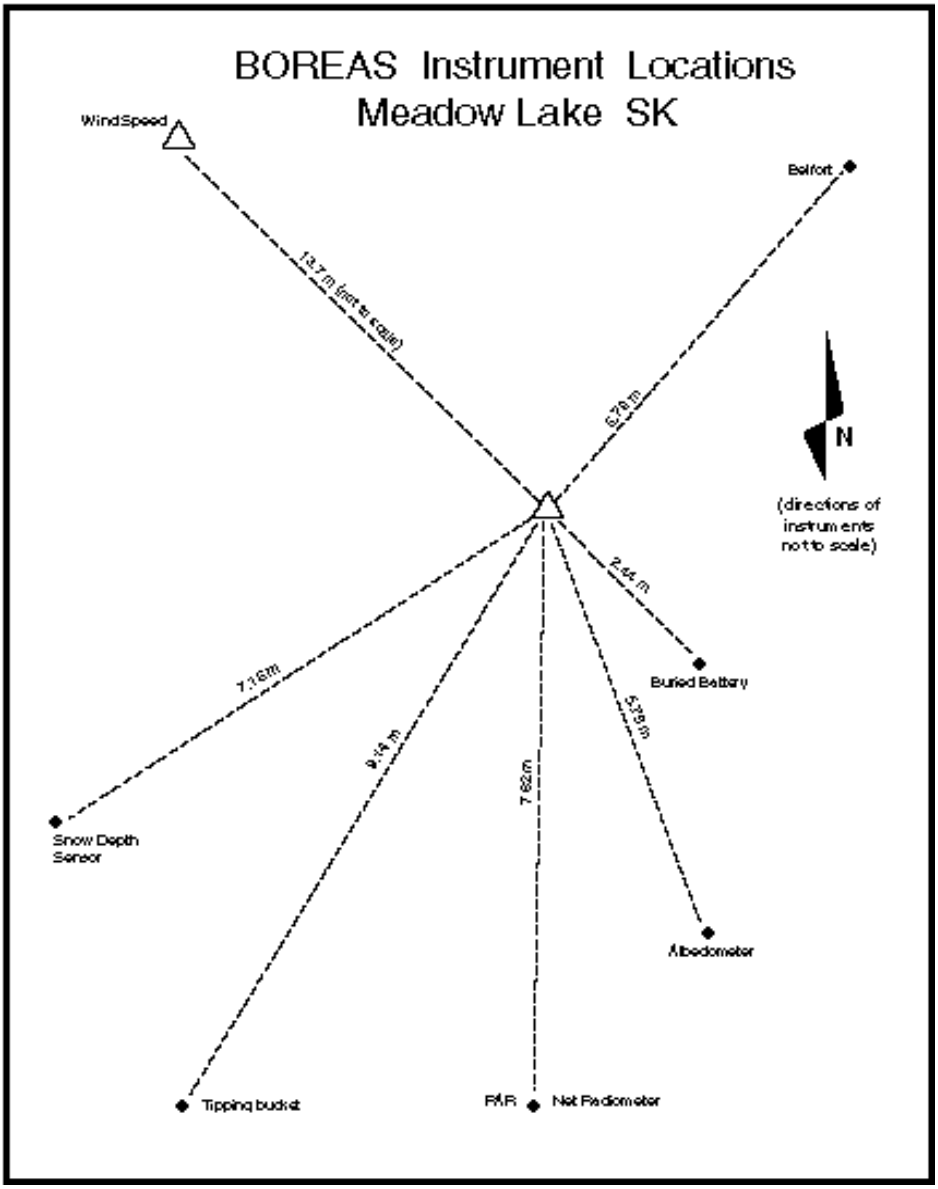
The following figures illustrate the location of each instrument in relation to the other instruments at the data collection sites. Unless otherwise noted, all instrument are on the Suite A tower present at each site. The Meadow Lake and Saskatoon sites are the only sites that do not have towers. At those sites, no relative location information is available. A negative height indicates that the instrument is located below ground surface.

La Ronge, SK

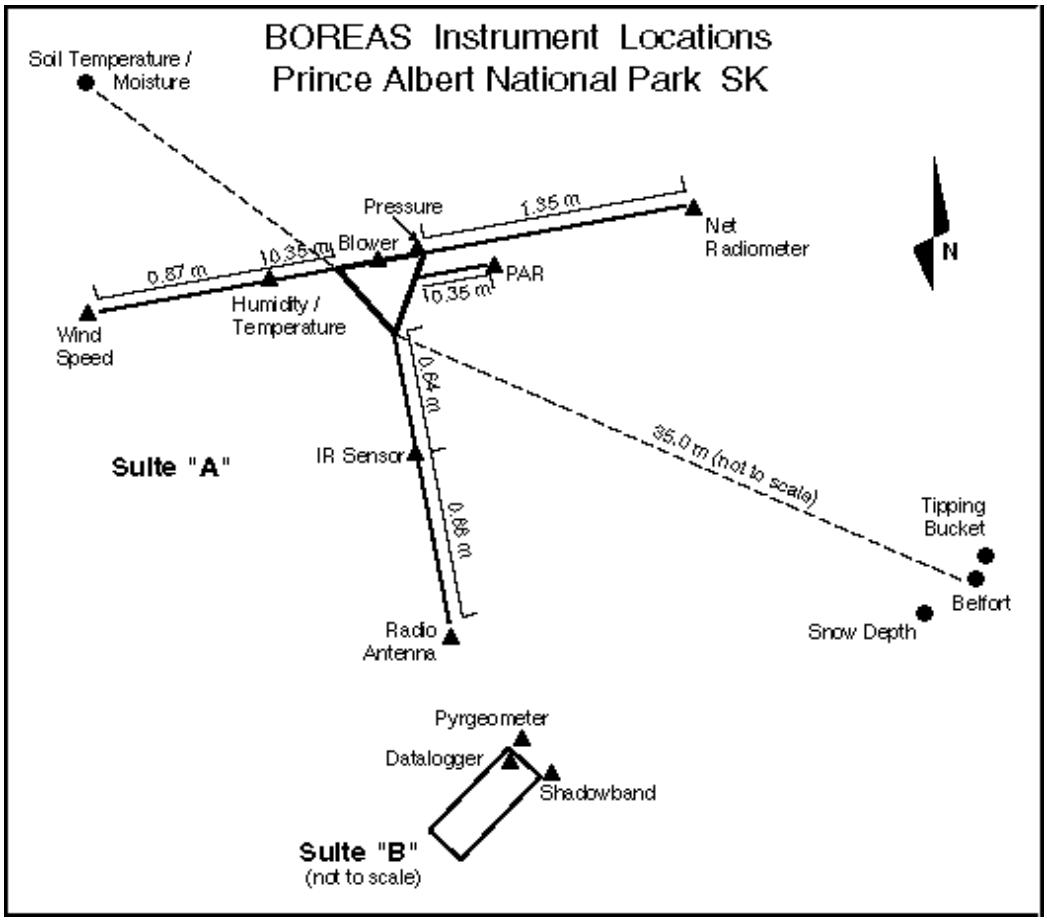


Suite A Instrument	**Height on tower/Location**
PAR radiometer	16.15 m
Net radiometer	16.15 m
Albedometer	16.15 m
Temperature/relative humidity probe	16.15 m
Lower canopy temperature probe	1.83 m
Soil temperature probe	-10 cm, 1.5 m north of tower
Soil temperature probe	-20 cm, 1.5 m north of tower
Soil temperature probe	-50 cm, 1.5 m north of tower
Barometric pressure	16.15 m
IR temperature	16.15 m
Wind monitor	16.15 m
Belfort precipitation gauge	15.0 m north-northwest of tower
Snow depth gauge	1730 cm, 5 m northwest of tower
Soil moisture sensor	-10 cm, location not available
Tipping bucket precipitation	15.0 m north-northwest of tower

Meadow Lake, SK



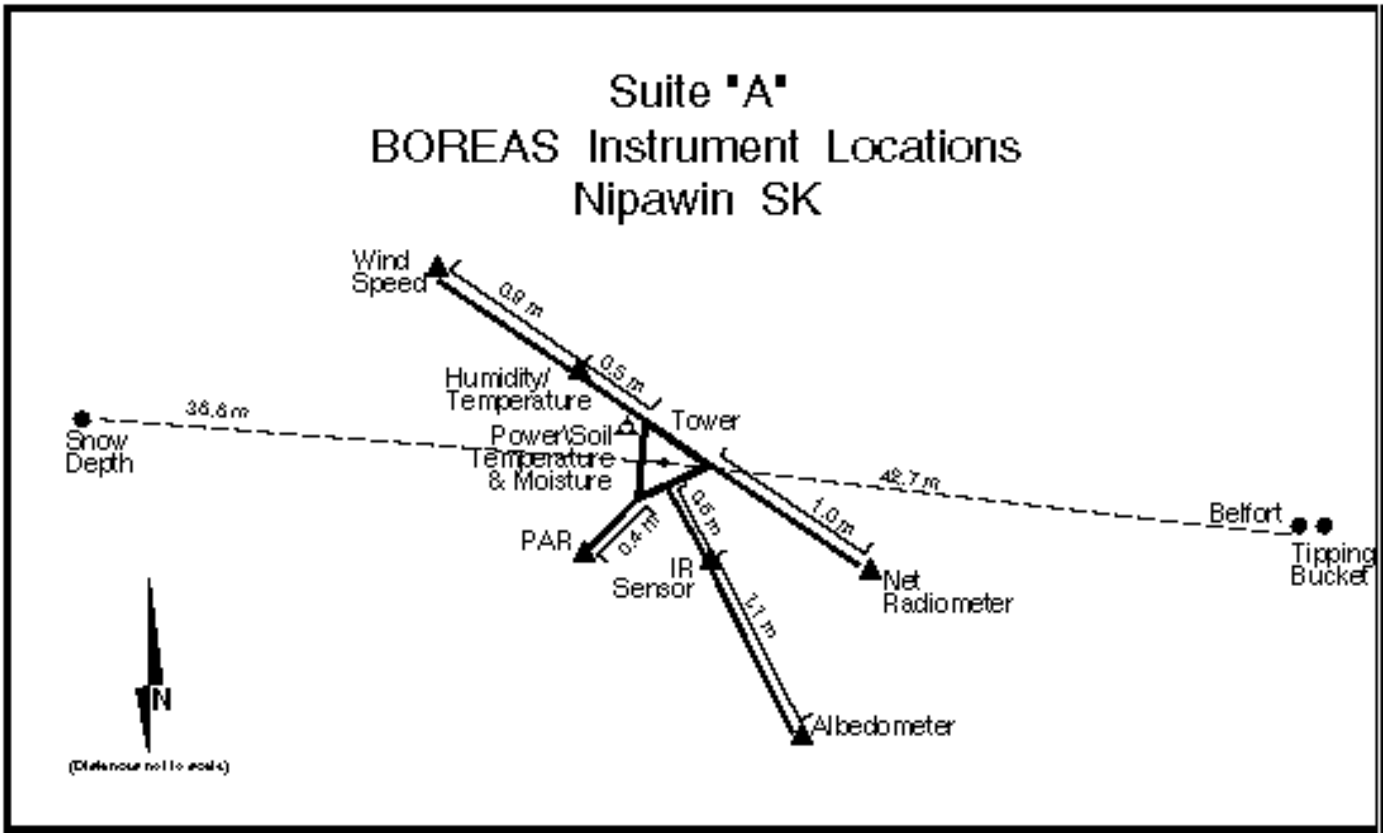
Suite A Instrument	**Height on tower/Location**
PAR radiometer	2.1 m
Net radiometer	2.0 m
Albedometer	1.9 m
Temperature/relative humidity probe	2.59 m
Soil temperature probe	-10 cm
Soil temperature probe	-20 cm
Soil temperature probe	-50 cm
Barometric pressure	2.03 m
Wind monitor	9.75 m
Belfort precipitation gauge	Not available
Snow depth gauge	1570 cm
Soil moisture sensor	-10 cm
Tipping bucket precipitation	Not available



Suite A Instrument	**Height on tower/Location**
PAR radiometer	23.71 m
Net radiometer	23.71 m
Albedometer	23.71 m
Temperature/relative humidity probe	23.71 m
Lower canopy temperature probe	4 m
Soil temperature probe	-10 cm, 1.5 m northwest of tower
Soil temperature probe	-20 cm, 1.5 m northwest of tower
Soil temperature probe	-50 cm, 1.5 m northwest of tower
Barometric pressure	21.87 m
IR temperature	23.71 m
Wind monitor	23.71 m
Belfort precipitation gauge	35.0 m north-northwest of tower
Snow depth gauge	1500 cm, 35 m southeast of tower
Soil moisture sensor	-10 cm, 1.5 m northwest of tower
Tipping bucket precipitation	35.0 m southeast of tower

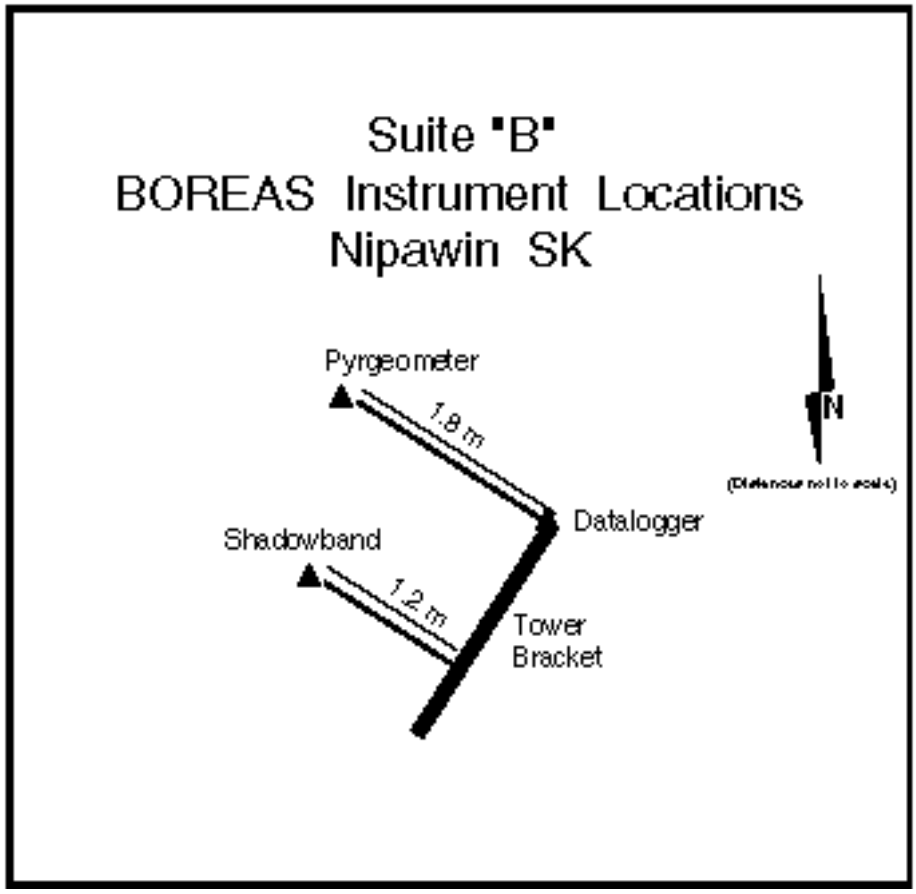
Suite B Instrument	**Height on tower/Location**
(located on the main flux tower)	
Pyrgeometer	36.83 m
Pyranometer	36.68 m
Shadow Band Stand	36.68 m

BOREAS SSA-OJP (Suite A)



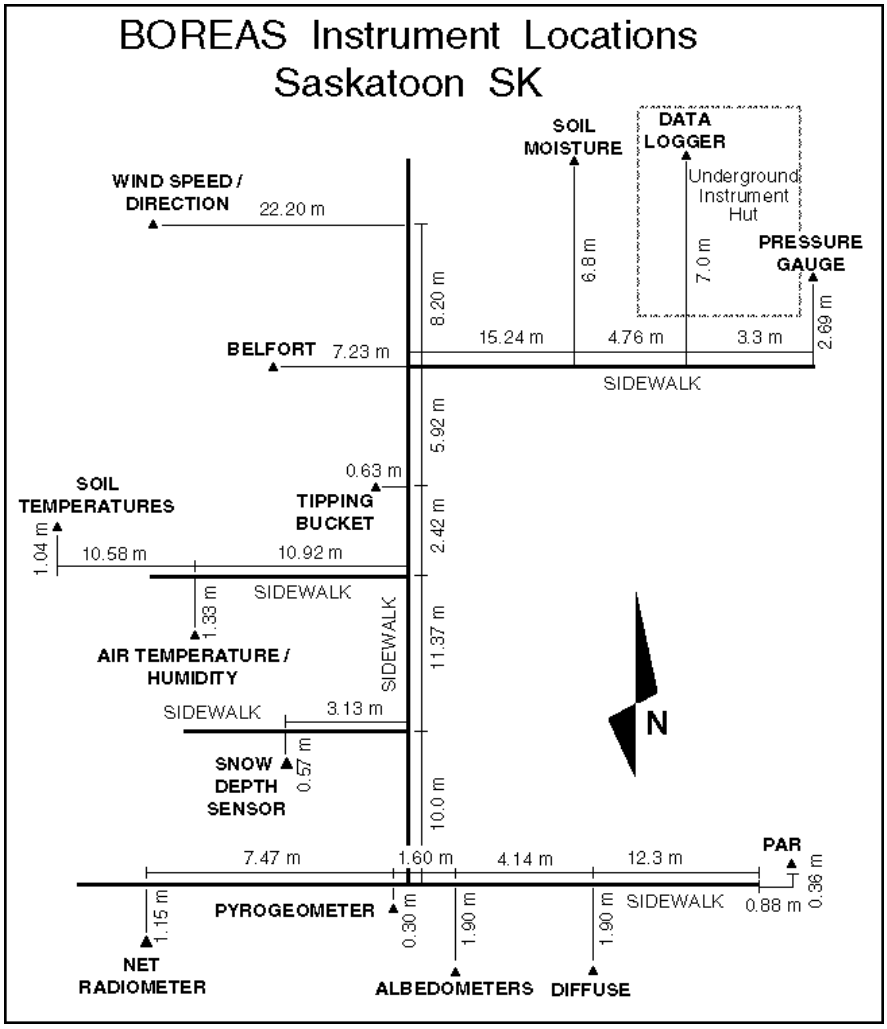
Suite A Instrument	Height on tower/Location
PAR radiometer	20.7 m
Net radiometer	20.7 m
Albedometer	20.7 m
Temperature/relative humidity probe	20.7 m
Lower canopy temperature probe	5.5 m
Soil temperature probe	-10 cm, northwest of tower
Soil temperature probe	-20 cm, northwest of tower
Soil temperature probe	-50 cm, northwest of tower
Barometric pressure	Not available, Not available
IR temperature	20.7 m
Wind monitor	20.7 m
Belfort precipitation gauge	42.7 m east-southeast of tower
Snow depth gauge	1510 cm, 37 m west-northwest of tower
Soil moisture sensor	-10 cm, northwest of tower
Tipping bucket precipitation	42.7 m east-southeast of tower

BOREAS SSA-OJP (Suite B)



Suite B Instrument (located on the main flux tower)	**Height on tower/Location**
Pyrgeometer	35.1 m
Pyranometer	36.6 m
Shadow Band Stand	36.6 m

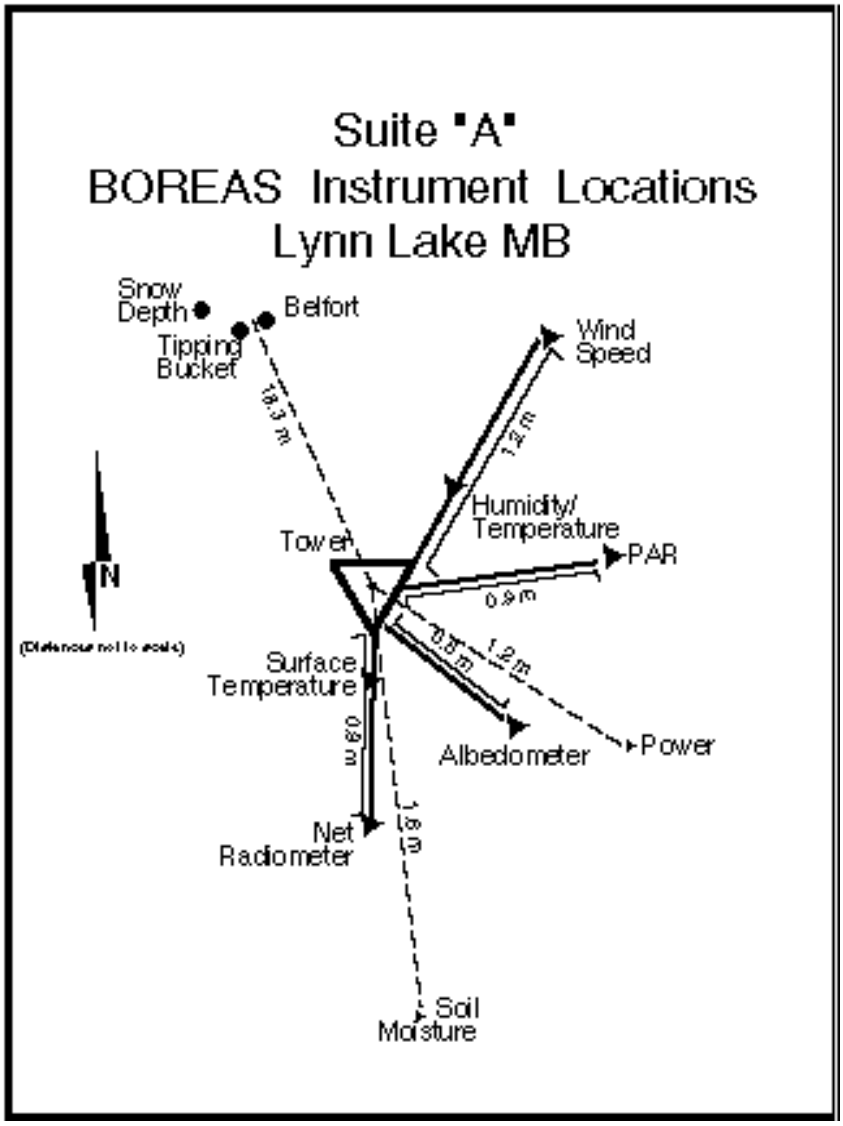
Saskatoon, SK



Suite A Instrument	**Height on tower/Location**
PAR radiometer	1.3 m
Net radiometer	1.45 m
Albedometer	1.62 m
Temperature/relative humidity probe	1.71 m
Soil temperature probe	-10 cm
Soil temperature probe	-20 cm
Soil temperature probe	-50 cm
Barometric pressure	1.3 m
Wind monitor	10 m
Belfort precipitation gauge	1.2 m
Snow depth gauge	1235 cm
Soil moisture sensor	-10 cm
Tipping bucket precipitation	Not available

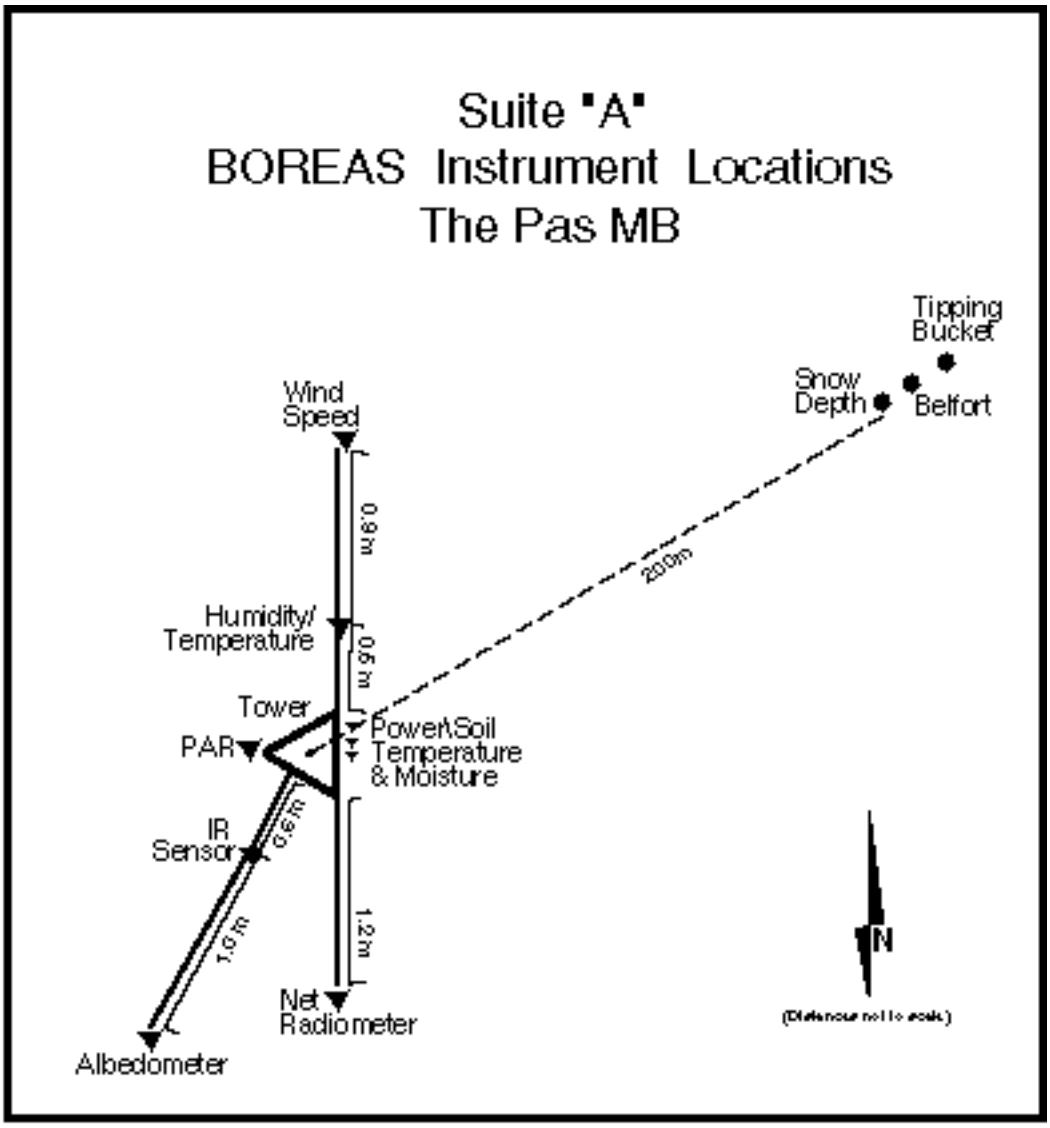
Suite B Instrument (co-located)	**Height on tower/Location**
Pyrgeometer	1.53 m
Pyranometer	1.58 m
Shadow Band Stand	1.58 m

Lynn Lake, MB



Suite A Instrument	**Height on tower/Location**
PAR radiometer	15.2 m
Net radiometer	15.2 m
Albedometer	15.2 m
Temperature/relative humidity probe	15.2 m
Lower canopy temperature probe	2.6 m
Soil temperature probe	-10 cm, 1.8 m south of tower
Soil temperature probe	-20 cm, 1.8 m south of tower
Soil temperature probe	-50 cm, 1.8 m south of tower
Barometric pressure	9.3 m
IR temperature	15.2 m
Wind monitor	15.2 m
Belfort precipitation gauge	8.3 m north-northwest of tower
Snow depth gauge	1700 cm, 18.3 m north-northwest of tower
Soil moisture sensor	-10 cm, 1.8 m south of tower
Tipping bucket precipitation	18.3 m southeast of tower

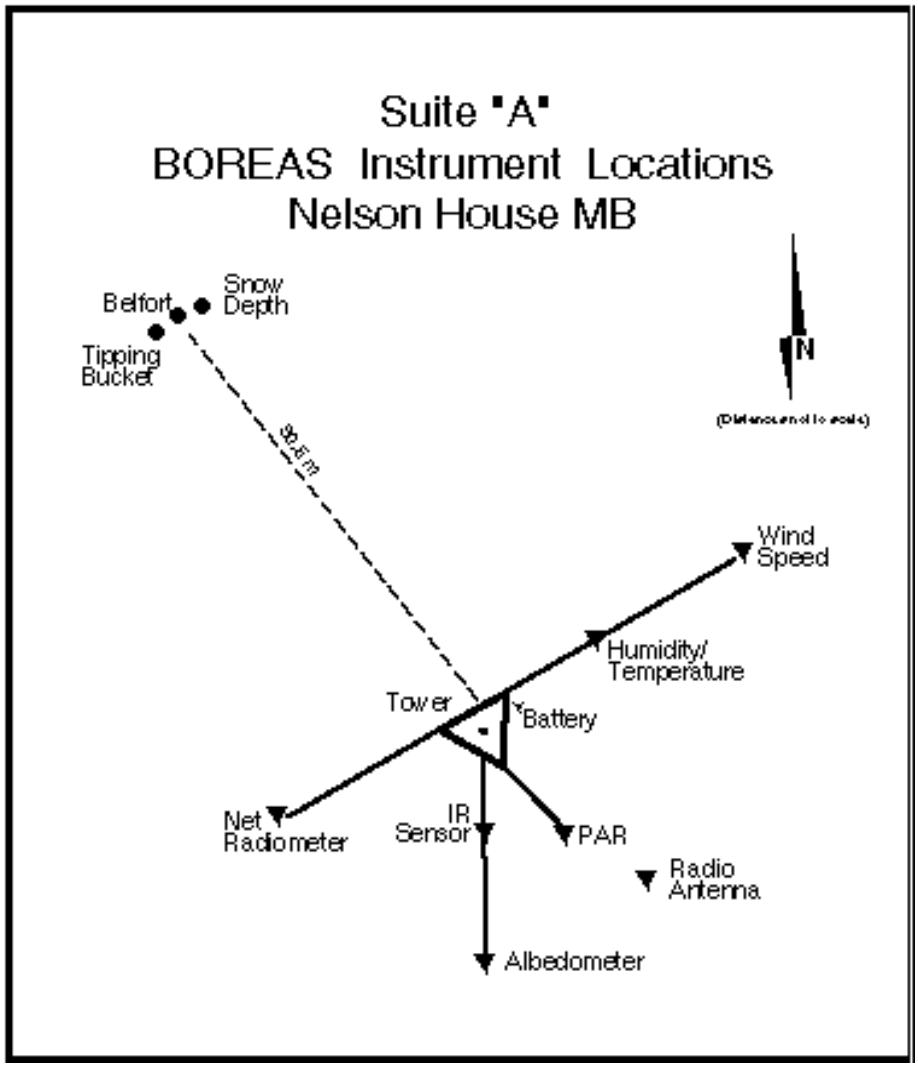
The Pas, MB



Suite A Instrument	**Height on tower/Location**
PAR radiometer	21.9 m
Net radiometer	21.9 m
Albedometer	21.9 m
Temperature/relative humidity probe	21.9 m
Lower canopy temperature probe	2.1 m
Soil temperature probe	-10 cm, slightly east of tower
Soil temperature probe	-20 cm, slightly east of tower
Soil temperature probe	-50 cm, slightly east of tower
Barometric pressure	18.9 m
IR temperature	21.9 m
Wind monitor	21.9 m
Belfort precipitation gauge	200 m northeast of tower
Snow depth gauge	1920 cm, 200 m northeast of tower
Soil moisture sensor	-10 cm, slightly east of tower
Tipping bucket precipitation	200 m northeast of tower

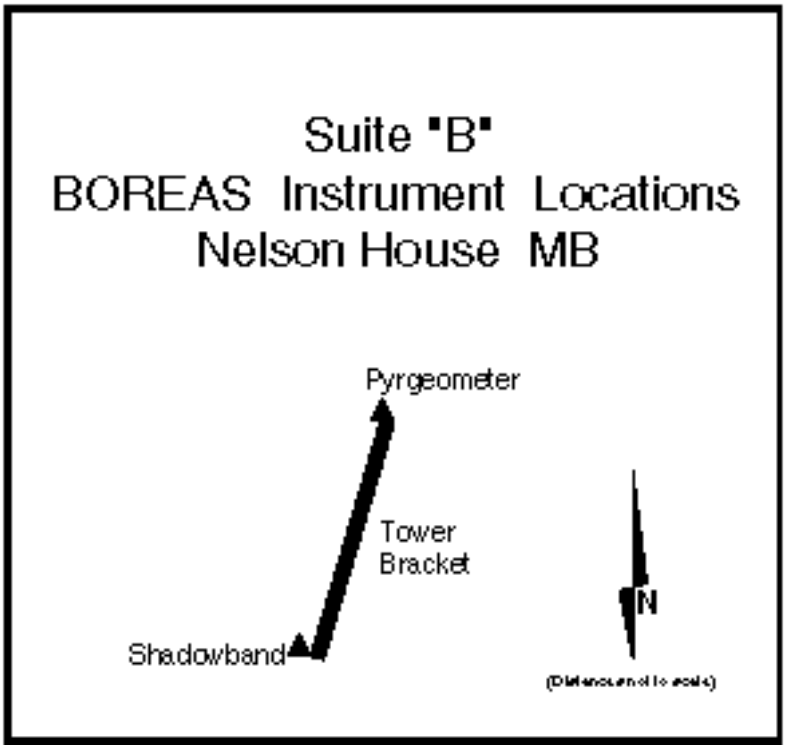
BOREAS NSA-OJP (Suite A)

(Suite B instruments are at the NSA-Fen site, approximately 15 km from the NSA-OJP)



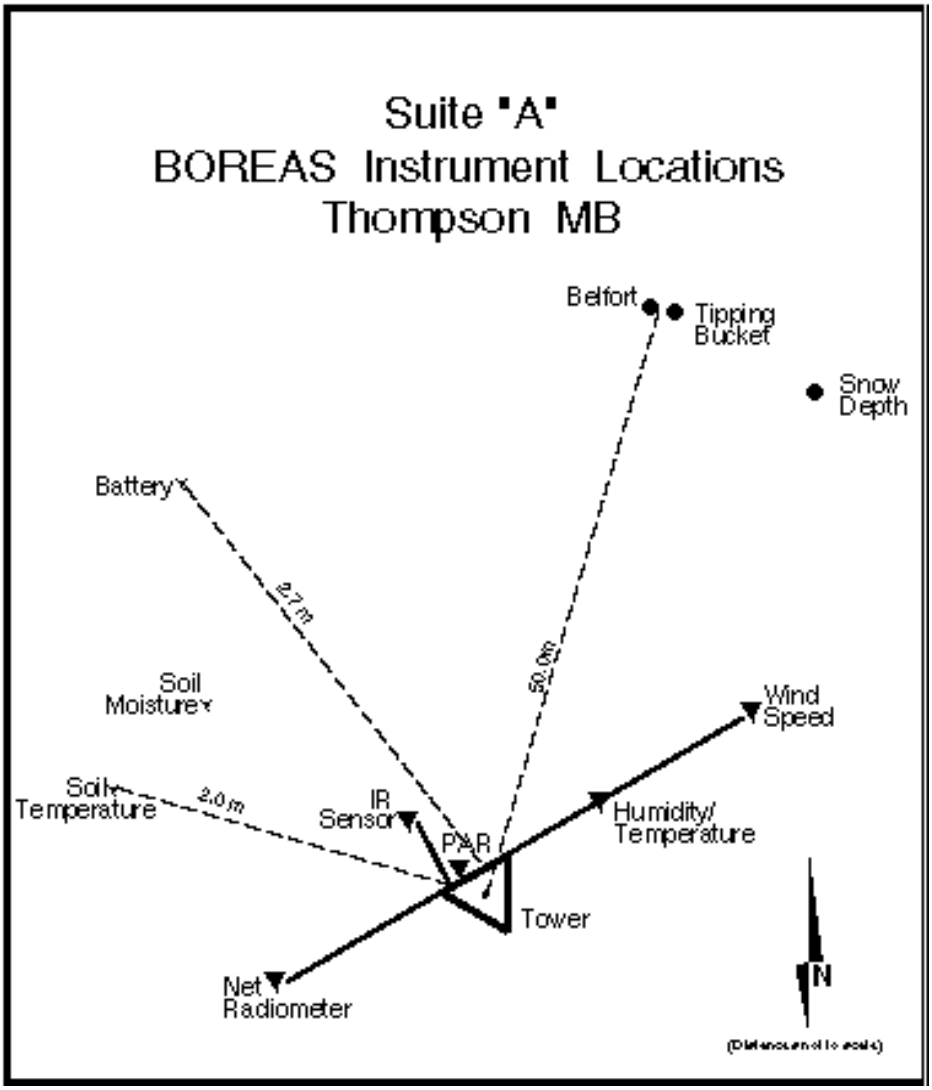
Suite A Instrument	**Height on tower/Location**
PAR radiometer	18.5 m
Net radiometer	18.5 m
Albedometer	18.5 m
Temperature/relative humidity probe	18.5 m
Lower canopy temperature probe	4.6 m
Soil temperature probe	-10 cm, Not available
Soil temperature probe	-20 cm, Not available
Soil temperature probe	-50 cm, Not available
Barometric pressure	16.2 m, north of the tower
IR temperature	18.5 m
Wind monitor	18.5 m
Belfort precipitation gauge	northwest of tower
Snow depth gauge	2200 cm, northwest of tower
Soil moisture sensor	-10 cm, Not available
Tipping bucket precipitation	northwest of tower

BOREAS NSA-Fen (Suite B)



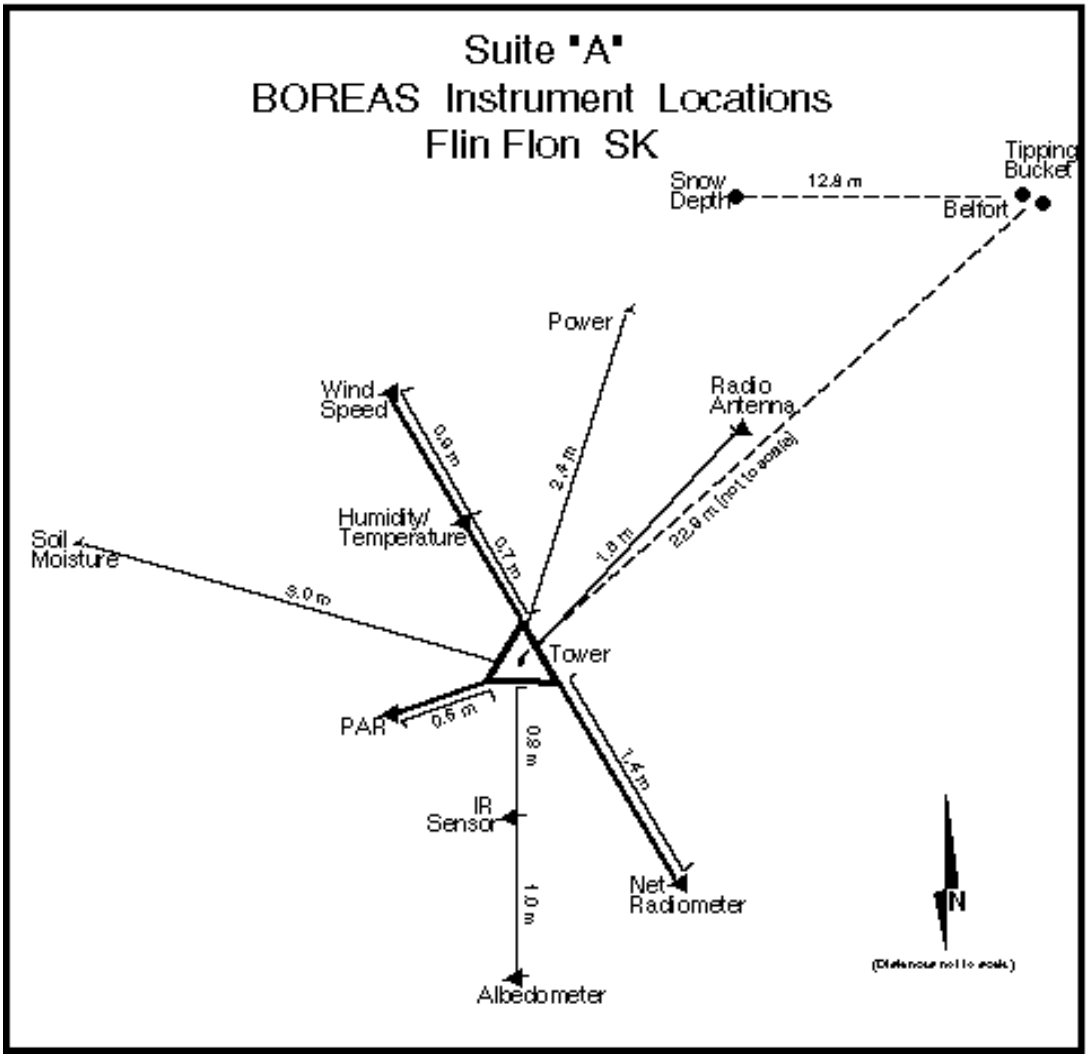
Suite B Instrument	**Height on tower/Location**
Pyrgeometer	3.7 m
Pyranometer	3.7 m
Shadow Band Stand	3.7 m

Thompson, MB



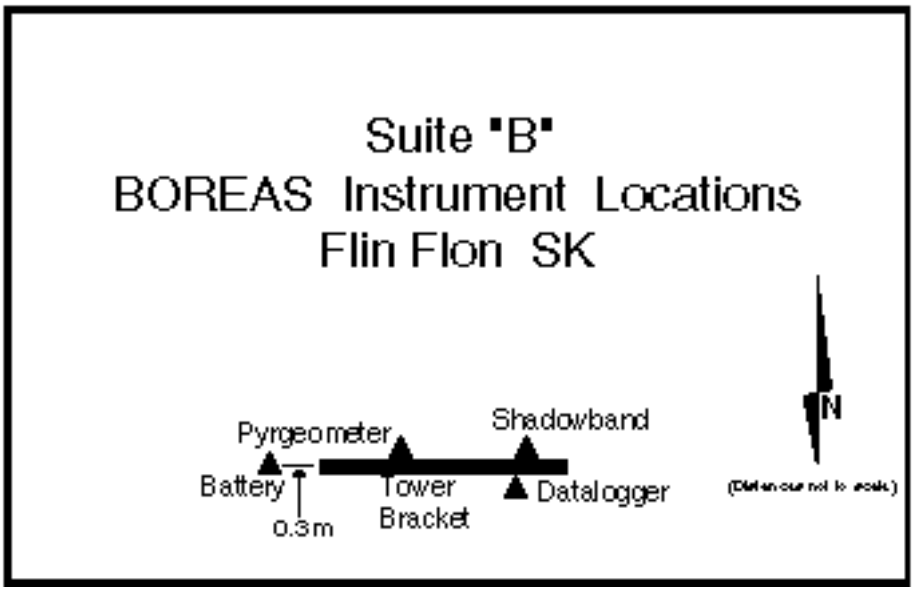
Suite A Instrument	**Height on tower/Location**
PAR radiometer	18.9 m
Net radiometer	18.9 m
Albedometer	18.9 m
Temperature/relative humidity probe	18.9 m
Lower canopy temperature probe	1.8 m
Soil temperature probe	-10 cm, 2 m northwest of the tower
Soil temperature probe	-20 cm, 2 m northwest of the tower
Soil temperature probe	-50 cm, 2 m northwest of the tower
Barometric pressure	5.5 m
IR temperature	18.9 m
Wind monitor	18.9 m
Belfort precipitation gauge	7.3 m, 10 m northeast of tower
Snow depth gauge	2100 cm, 50 m east-northeast of tower
Soil moisture sensor	-10 cm, Not available
Tipping bucket precipitation	50 m east-northeast of tower

Flin Flon, SK (Suite A)



Suite A Instrument	**Height on tower/Location**
PAR radiometer	17.9 m
Net radiometer	17.9 m
Albedometer	17.9 m
Temperature/relative humidity probe	17.9 m
Lower canopy temperature probe	2.2 m
Soil temperature probe	-10 cm, 3 m northwest of the tower
Soil temperature probe	-20 cm, 3 m northwest of the tower
Soil temperature probe	-50 cm, 3 m northwest of the tower
Barometric pressure	2.8 m, north of the tower
IR temperature	17.9 m
Wind monitor	17.9 m
Belfort precipitation gauge	22.9 m northeast of the tower
Snow depth gauge	1900 cm, 21 northeast of the tower
Soil moisture sensor	-10 cm, 3 m northwest of the tower
Tipping bucket precipitation	22.9 m northeast of the tower

Flin Flon, SK (Suite A)



Suite B Instrument	**Height on tower/Location**
Pyrgeometer	1.7 m
Pyranometer	2.0 m
Shadow Band Stand	2.0 m

4.1.7 Manufacturer of Sensor/Instrument

Instrument	Model	Manufacturer
PAR radiometer	Skye Single Channel PAR Sensor	Skye Instruments Ltd.
Net radiometer	Fritschen Q-6 Net Radiometer	Radiation and Energy Balance Systems, Inc.
Albedometer (Solar and reflected)	Eppley Model PSP Precision Spectral Pyranometers	The Eppley Laboratory, Inc.
Temperature and relative humidity probe	Model HMP35CF Temperature and Relative Humidity Probe	Campbell Scientific
Lower canopy temperature probe	Model 107F Temperature Probe	Campbell Scientific
Soil temperature probe	Model 108BAM Temperature Probe	Campbell Scientific
Barometric pressure sensor	Model SBP270 Barometric Pressure Sensor	Setra
IR temperature sensor	Model 4000AL Infrared Thermometer	Everest Interscience
Wind monitor	Model 05103-10 Wind Monitor	R.M. Young
Belfort precipitation gauge	Belfort Rainfall Transmitter	Manufactured by: Belfort Instrument Company
Snow depth gauge	UDG01 Ultrasonic Depth Gauge	Campbell Scientific
Soil moisture sensor	Matrix Water Potential Soil Moisture Sensor	Matrix
Tipping bucket precipitation gauge	Model TE525 Tipping Bucket Rain Gauge	Texas Electronics
Pyrgeometer	Model PIR Precision Infrared Radiometer	The Eppley Laboratory, Inc.
Pyranometer	Model PSP Precision Pyranometer	The Eppley Laboratory, Inc.
Shadow band stand	-	The Eppley Laboratory, Inc.

The following section lists the instrument serial numbers by site.

La Ronge

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937019
Net radiometer	Q94175
Albedometer - Solar	29804F3
Albedometer - Reflected	29805F3
Temperature and relative humidity probe	C1036
Lower canopy temperature probe	C1240
Soil temperature probe at -10 cm	C1825
Soil temperature probe at -20 cm	C1798
Soil temperature probe at -50 cm	C1827
Barometric Pressure	395165
IR Temperature	2608-6
Wind monitor	14637
Belfort precipitation gauge	manufacturer: 11462, bucket: 16470
Snow depth gauge	C1506
Soil moisture sensor	1045
Tipping bucket precipitation gauge	TB0230001

Meadow Lake

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937027
Net radiometer	87122
Albedometer - Solar	29798F3
Albedometer - Reflected	29799F3
Temperature and relative humidity probe	C1049
Soil temperature probe at -10 cm	C1829
Soil temperature probe at -20 cm	C1809
Soil temperature probe at -50 cm	C1801
Barometric Pressure	395172
Wind monitor	14276
Belfort precipitation gauge	manufacturer: 1946
Snow depth gauge	C1187
Soil moisture sensor	1046
Tipping bucket precipitation gauge	13274-394

BOREAS SSA-OA

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937020
Net radiometer	93233
Albedometer - Solar	29803F3
Albedometer - Reflected	29802F3
Temperature and relative humidity probe	C1052
Lower canopy temperature probe	C1238
Soil temperature probe at -10 cm	C1819
Soil temperature probe at -20 cm	C1802
Soil temperature probe at -50 cm	C1810
Barometric Pressure	330019
IR Temperature	2608-7
Wind monitor	14688
Belfort precipitation gauge	manufacturer: 11401
Snow depth gauge	C1339
Soil moisture sensor	1044
Tipping bucket precipitation gauge	Not available

Suite B Instrument	Serial Number
Pyrgeometer	29752F3
Pyranometer	29091F3
Shadow band stand	9906

BOREAS SSA-OJP

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937028
Net radiometer	94174
Albedometer - Solar	29878F3
Albedometer - Reflected	29879F3
Temperature and relative humidity probe	C1048
Lower canopy temperature probe	C1235
Soil temperature probe at -10 cm	C1818
Soil temperature probe at -20 cm	C1817
Soil temperature probe at -50 cm	C1812
Barometric Pressure	395174
IR Temperature	2608-5
Wind monitor	15039
Belfort precipitation gauge	manufacturer: 4845
Snow depth gauge	C1507
Soil moisture sensor	1040
Tipping bucket precipitation gauge	TB023002

Suite B Instrument	Serial Number
Pyrgeometer	28809F3
Pyranometer	2987F3
Shadow band stand	Not available

Saskatoon

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937026
Net radiometer	Q94064
Albedometer - Solar	29796F3
Albedometer - Reflected	29797F3
Temperature and relative humidity probe	C1051
Soil temperature probe at -10 cm	Not available
Soil temperature probe at -20 cm	Not available
Soil temperature probe at -50 cm	Not available
Barometric Pressure	482535
Wind monitor	14294
Belfort precipitation gauge	manufacturer: 1146-2
Snow depth gauge	C1521
Soil moisture sensor	1043
Tipping bucket precipitation gauge	Not available

Suite B Instrument	Serial Number
Pyrgeometer	29750
Pyranometer	29718
Shadow band stand	Not available

Lynn Lake

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937025
Net radiometer	93231
Albedometer - Solar	29792F3
Albedometer - Reflected	29793F3
Temperature and relative humidity probe	C1025
Lower canopy temperature probe	C1241
Soil temperature probe at -10 cm	C1797
Soil temperature probe at -20 cm	C1814
Soil temperature probe at -50 cm	C1811
Barometric Pressure	395166
IR Temperature	2608-8
Wind monitor	15047
Belfort precipitation gauge	manufacturer: 5846
Snow depth gauge	C1516
Soil moisture sensor	1037
Tipping bucket precipitation gauge	Not available

The Pas

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937018
Net radiometer	93214
Albedometer - Solar	29791F3
Albedometer - Reflected	29790F3
Temperature and relative humidity probe	C1053
Lower canopy temperature probe	C1239
Soil temperature probe at -10 cm	C1821
Soil temperature probe at -20 cm	C1804
Soil temperature probe at -50 cm	C1831
Barometric Pressure	395172
IR Temperature	2608-3
Wind monitor	14252
Belfort precipitation gauge	manufacturer: 4810
Snow depth gauge	C1339
Soil moisture sensor	1036
Tipping bucket precipitation gauge	TB37982-64

BOREAS NSA-OJP and NSA-Fen

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937023
Net radiometer	93236
Albedometer - Solar	29806F3
Albedometer - Reflected	29807F3
Temperature and relative humidity probe	C1053
Lower canopy temperature probe	C1234
Soil temperature probe at -10 cm	C1823
Soil temperature probe at -20 cm	C1806
Soil temperature probe at -50 cm	C1808
Barometric Pressure	395168
IR Temperature	2608-9
Wind monitor	14681
Belfort precipitation gauge	manufacturer: Not available
Snow depth gauge	C1505
Soil moisture sensor	1039
Tipping bucket precipitation gauge	Not available

Suite B Instrument	Serial Number
Pyrgeometer	29754F3
Pyranometer	29721F3
Shadow band stand	Not available

Thompson

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937022
Net radiometer	93213
Albedometer - Solar	29876F3
Albedometer - Reflected	29877F3
Temperature and relative humidity probe	C1187
Lower canopy temperature probe	C1233
Soil temperature probe at -10 cm	C1807
Soil temperature probe at -20 cm	C1832
Soil temperature probe at -50 cm	C1805
Barometric Pressure	414247
IR Temperature	2608-1
Wind monitor	14288
Belfort precipitation gauge	manufacturer: 5-4057
Snow depth gauge	C1341
Soil moisture sensor	1038
Tipping bucket precipitation gauge	Not available

Flin-Flon

Suite A Instrument	Serial Number
PAR radiometer	SKE51006937021
Net radiometer	93232
Albedometer - Solar	29795F3
Albedometer - Reflected	29794F3
Temperature and relative humidity probe	C1193
Lower canopy temperature probe	C1518
Soil temperature probe at -10 cm	C1820
Soil temperature probe at -20 cm	C1828
Soil temperature probe at -50 cm	C1815
Barometric Pressure	414249
IR Temperature	2608-2
Wind monitor	15045
Belfort precipitation gauge	manufacturer: 4810
Snow depth gauge	C1518
Soil moisture sensor	1041
Tipping bucket precipitation gauge	TB37983-64

Suite B Instrument	Serial Number
Pyrgeometer	29751F3
Pyranometer	29093F3
Shadow band stand	Not available

4.2 Calibration

4.2.1 Specifications

The following tables give the calibration multiplier and constant (if applicable) for each instrument at each site.

La Ronge

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	0.5	None given
Net radiometer	0.07	14.0 $w^2/(mVm^2)$
Albedometer - Solar	0.5954530	8.41 microV/wm^2
Albedometer - Reflected	0.56947	8.78 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	10 feet
	0.1 (humidity)	-
Lower canopy temperature probe	0.001	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	80
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	0.078259	None given
Snow depth gauge	1.0	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.03	None given

Meadow Lake

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	0.5	None given
Net radiometer	0.0505	10.1 $w^2/(mVm^2)$
Albedometer - Solar	0.639391	7.82 microV/wm^2
Albedometer - Reflected	0.60459	8.27 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	100 feet
	0.1 (humidity)	-
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	80
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	Not available	None given
Snow depth gauge	1.0	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.25	None given

BOREAS SSA-OA

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	0.5	None given
Net radiometer	0.0665	13.3 $w^2/(mVm^2)$
Albedometer - Solar	0.55741	8.97 microV/wm^2
Albedometer - Reflected	0.55991	8.93 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	100 feet
	0.1 (humidity)	-
Lower canopy temperature probe	0.001	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	None given
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	0.07386	None given
Snow depth gauge	1.0	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.024	None given

Suite B Instrument Type	Multiplier	Calibration Constant
Pyrgeometer	None given	None given
Pyranometer	None given	None given

BOREAS SSA-OJP

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	None given	None given
Net radiometer	None given	13.3 $w^2/(mVm^2)$
Albedometer - Solar	0.58616	8.97 microV/wm^2
Albedometer - Reflected	0.57013	8.93 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	35 feet
	0.1 (humidity)	-
Lower canopy temperature probe	0.001	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	None given	None given
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	0.07824	None given
Snow depth gauge	1.0	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.025	None given

Suite B Instrument Type	Multiplier	Calibration Constant
Pyrgeometer	None given	2.76 W/m^2
Pyranometer	None given	8.77 W/m^2

Saskatoon

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	None given	None given
Net radiometer	None given	None given
Albedometer - Solar	1.1891	8.97 microV/wm^2
Albedometer - Reflected	1.1416	8.93 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	10 feet
	0.1 (humidity)	-
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	None given	None given
Snow depth gauge	None given	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.2	None given

Suite B Instrument Type	Multiplier	Calibration Constant
Pyrgeometer	None given	None given
Pyranometer	None given	None given

Lynn Lake

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	0.5	Not available
Net radiometer	0.066	13.2 w^2/(mVm^2)
Albedometer - Solar	0.60533	8.26 microV/wm^2
Albedometer - Reflected	0.59312	8.43 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	35 feet
	0.1 (humidity)	-
Lower canopy temperature probe	35 feet	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	None given
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	0.07181	None given
Snow depth gauge	1.0	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.025	None given

The Pas

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	0.5	Not available
Net radiometer	0.065	13.0 $w^2/(mVm^2)$
Albedometer - Solar	0.58824	8.50 microV/wm^2
Albedometer - Reflected	0.62035	8.06 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	35 feet
	0.1 (humidity)	-
Lower canopy temperature probe	0.001	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	None given
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	0.07155	None given
Snow depth gauge	1.0	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.05	None given

BOREAS NSA-OJP and NSA-Fen

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	None given	None given
Net radiometer	0.0645	12.9 $w^2/(mVm^2)$
Albedometer - Solar	0.59595	8.39 microV/wm^2
Albedometer - Reflected	0.61652	8.11 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	None given
	0.1 (humidity)	-
Lower canopy temperature probe	0.001	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	80
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	0.07824	None given
Snow depth gauge	None given	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	0.025	None given

Suite B Instrument Type	Multiplier	Calibration Constant
Pyrgeometer	None given	3.42 W/m^2
Pyranometer	None given	8.55 W/m^2

Thompson

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	0.5	Not available
Net radiometer	0.0645	12.9 $w^2/(mVm^2)$
Albedometer - Solar	0.58343	8.57 microV/wm^2
Albedometer - Reflected	0.57274	8.73 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	10 feet
	0.1 (humidity)	-
Lower canopy temperature probe	0.001	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	0.12	80
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	0.11518	None given
Snow depth gauge	1.0	None given
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	None given	None given

Flin-Flon

Suite A Instrument Type	Multiplier	Calibration Constant
PAR radiometer	None given	None given
Net radiometer	0.066	13.2 $w^2/(mVm^2)$
Albedometer - Solar	0.56948	8.89 microV/wm^2
Albedometer - Reflected	0.56370	8.21 microV/wm^2
Temperature and relative humidity probe	0.001 (temp)	None given
	0.1 (humidity)	-
Lower canopy temperature probe	0.12	None given
Soil temperature probe at -10 cm	None given	None given
Soil temperature probe at -20 cm	None given	None given
Soil temperature probe at -50 cm	None given	None given
Barometric Pressure	None given	None given
IR Temperature	None given	None given
Wind monitor	0.098 (speed)	None given
	0.071 (direction)	-
Belfort precipitation gauge	1	None given
Snow depth gauge	None given	39
Soil moisture sensor	None given	None given
Tipping bucket precipitation gauge	None given	None given

Suite B Instrument Type	Multiplier	Calibration Constant
Pyrgeometer	None given	None given
Pyranometer	None given	None given

4.2.1.1 Tolerance

The following list gives information relating to the tolerances of the instruments used:

Instrument	Tolerance
PAR radiation	Without filters, this instrument is sensitive to electromagnetic energy with wavelengths between 300 and 1000 nanometers. The instrument contains glass and metal interference filters that cut the response to between 400 and 700 nanometers.
Net radiation	A 5 degree error in leveling the net radiometer may result in an error of up to 6 percent under normal conditions (e.g. the sun is relatively high in the sky). Errors greater than 6 percent may occur when the sun is near the horizon.
Albedometer	The albedometers used in the BOREAS study are sensitive to electromagnetic energy with wavelengths between 285 and 2800 nanometers.
Temperature and relative humidity probe	The temperature piece of this ensemble has an accuracy rating of +/- 0.4° C over a temperature range from -53 to +48° C. The humidity probe has an accuracy of +/- 2 percent relative humidity from 0 to 90 percent and a rating of +/- 3 percent over a relative humidity of 90 percent.
Lower canopy temperature probe	This probe has an accuracy rating of +/- 0.4° C over a temperature range from -53 to +48° C.
Soil temperature probes	The soil temperature probes located at the BOREAS sites have an accuracy of +/- 0.4° C over a from of temperature from -33 to +48° C.
Barometric pressure sensor	The accuracy of the Setra SBP270 is +/- 0.2 millibars.
IR Thermometer	None given.
Wind sensor	The range in wind speeds measured by the R.M. Young Wind Monitor is - to 60 meters/second with a maximum gust survival of 100 meters/second.
Belfort precipitation gauge	None given.
Snow depth sensor	The snow depth sensor can measure depths between 0.6 meters and 10 meters with an accuracy of +/- 1 centimeter or 0.4 percent of the distance from the sensor to the target. The vertical resolution of the sensor is 0.5 millimeters.
Soil moisture	None given.
Tipping bucket precipitation gauge	None given.
Pyrgeometer	The Eppley pyrgeometer has a temperature dependence of +/- 2 percent when the temperature is between -20 and +40° C.
Pyranometer	The pyranometers used for Suite B sites have a temperature dependence of +/- 1 percent over a range in ambient temperatures from -20 to +40° C.

4.2.2 Frequency of Calibration

All instruments were calibrated by the manufacturer or by SRC before being installed in the sites. Most of the instruments were again calibrated at the end of March 1994 during the spring inspection tour. Due to the shortness of the experiments, the instruments were not required to have full laboratory calibrations.

4.2.3 Other Calibration Information

None given.

5. Data Acquisition Methods

The AMS system installed for BOREAS consists of transportable computerized weather observing stations that routinely measure wind, temperature, humidity, pressure, and precipitation at all stations. The stations are equipped to measure soil temperature; surface radiative temperature; shortwave, net, and infrared radiation; and soil moisture. Most of the instruments are scanned every 5 seconds and averaged every 15 minutes. Many of the stations are powered by solar panels, thereby enabling them to be located remotely without the need for commercial power. Data are collected via a modem and commercial phone lines. The data are downloaded every 6 hours to the base station at SRC. A computerized limit checker examines the data to be sure they are within specified limits. SRC staff performed quality checking and once per month sent the Suite A data to BORIS in Lotus 123 version 3.1 format.

Suite B station data were also collected every 5 seconds. Individual storage modules were sent to SSA-OA, SSA-OJP, and Flin Flon once per month. The onsite observer exchanged the modules and sent the previous month's module back to SRC via courier. NSA-OJP and Saskatoon data were downloaded to the SRC via phone lines. At SRC, the data underwent quality checking before being sent to BORIS in ASCII format.

6. Observations

6.1 Data Notes

Detailed notes on site maintenance and problems are given in Section 11.

6.2 Field Notes

Detailed notes on site maintenance and problems are given in Section 11.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

The SRC AMS data collected for BOREAS cover an area of roughly 1,000 by 1,000 kilometers over much of northern Saskatchewan and Manitoba. The list below provides the North American Datum of 1983 (NAD83) coordinates and descriptions for all of the SRC AMS sites.

BOREAS Site	Spatial Coverage
La Ronge (55 07'31"N 105 17'35"W; Elevation 381 m; Site ID ZBG)	This site has the full complement of Suite A sensors. The dominant vegetation types in the area are spruce and poplar trees that extend to a height of roughly 11.5 meters in the area immediately surrounding the tower. This site is approximately 1 km away from the town of La Ronge.
Meadow Lake (54 07'28"N 108 31'21"W; Elevation 480 m; Site ID ZBH)	This site contains only a partial complement of Suite A instrumentation. It does not include IR radiation or Lower canopy temperature probe. All other Suite A instruments are at this location. The Meadow Lake instruments are located in an area where grassland is the dominant land cover. The few trees in the area are spruce and poplar.
BOREAS SSA-OA (53 37'45"N 106 11'51"W; Elevation 587 m; Site ID ZBI)	The BOREAS SSA-OA site (located in the Prince Albert National Forest) has a full complement of both the Suite A and Suite B instrumentation. This site is located in an aspen-dominated forest where the tallest parts of the canopy reach roughly 21.5 meters. This site is approximately 100 km away from the city of Prince Albert.
BOREAS SSA-OJP (53 54'59"N 104 41'26"W; Elevation 511 m; Site ID ZBJ)	The BOREAS SSA-OJP site (located in the Nipawin Provincial Park) contains all of the Suite A and Suite B instrumentation. This area around the tower is dominated by Jack Pine. The tallest trees in the area around the tower are roughly 16.8 meters, while the top of the tower is at 20.7 meters. This site is approximately 100 km away from the town of Nipawin.
Saskatoon (52 09'50"N 106 36'12"W; Elevation 480 m; Site ID ZBK)	The Saskatoon AMS site is located on a grassland area within the city of Saskatoon. The grass around the instrument site is cut approximately once per week during the growing season. This site does not include the IR sensor or the below canopy temperature sensor. The serial numbers for instruments at the Saskatoon site are missing in many cases because most of the instrument were installed over 20 years ago when the use of serial numbers was not common.
Lynn Lake (56 51'50"N 101 05' 33"W; Elevation 366 m; Site ID ZBL)	Lynn Lake has a full complement of Suite A instruments. This tower is located in a dense stand of Jack Pine. The maximum tree height in the area surrounding the tower is approximately 14.3 meters, while the top of the tower is at 15.2 meters. This site is approximately 20 km from the town of Lynn Lake.
The Pas (53 58'6"N 101 31'15"W; Elevation 267 m; Site ID ZBN)	The Pas hosts all of the Suite A instruments. The tower is located in a forest dominated by spruce and poplar that achieve a maximum height of roughly 18.3 meters. The tower itself extends to 21.9 meters. This site is approximately 15 km away from the town of The Pas.

BOREAS NSA-OJP and NSA-Fen (55 55'41"N 98 38'26"W Elevation 282 m; Site ID ZBO)	The Suite A instruments for this site are located at the BOREAS NSA-OJP tower site. The Suite B instrumentation is located at the BOREAS NSA-Fen site. The trees at the NSA-OJP site are roughly 12.8 meters tall, while the top of the tower extends to 18.9 meters. At the NSA-Fen site there are no significant trees. The shrubbery in the area of the tower is less than 5 meters tall. This site is approximately 40 km away from the settlement of Nelson House.
Thompson (55 48' 13"N 97 52'25"W; Elevation 221 m; Site ID ZBQ)	Thompson is a fully-instrumented Suite A AMS site. The instruments are located in an area that is dominated by spruce and poplar. The tops of the trees nearest the tower are approximately 13 meters while the top of the tower extends to 19 meters. This site is about 1 kilometer away from the town of Thompson.
Flin-Flon (54 40'16"N 101 41'24"W; Elevation 305 m; Site ID ZBR)	The Flin Flon AMS site contains both the Suite A and Suite B BOREAS instruments. The forest around this site is predominantly spruce and poplar, rising to a height of 13.1 meters in the vicinity of the Suite A tower. The tower itself is located on a large, flat rock (roughly 5 meters wide and 10-15 meters long). This site is about 1 kilometer away from the town of Flin Flon.

7.1.2 Spatial Coverage Map
Not available.

7.1.3 Spatial Resolution
The data represent point source measurements taken at the listed sites.

7.1.4 Projection
Not applicable.

7.1.5 Grid Description
Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage
Data at the BOREAS AMS sites nominally cover the period from 01-JAN-1994 to 30-NOV-1996.

7.2.2 Temporal Coverage Map
The table below gives detailed date ranges for individual sites:

Site	Start Date	End Date
La Ronge	15-DEC-1993	30-NOV-1996
Meadow Lake	03-FEB-1994	30-NOV-1996
BOREAS SSA-OA	15-DEC-1993	30-NOV-1996
BOREAS SSA-OJP	15-DEC-1993	30-NOV-1996
Saskatoon	15-FEB-1994	30-NOV-1996
Lynn Lake	15-DEC-1993	30-NOV-1996
The Pas	15-DEC-1993	30-NOV-1996
NSA-OJP and NSA-Fen	16-JAN-1994	30-NOV-1996
Thompson	15-DEC-1993	30-NOV-1996
Flin Flon	22-DEC-1993	30-NOV-1996

Note: This table gives nominal start and end dates for data collection at site. Specific instruments did not necessarily begin or end data collection at the above times.

7.2.3 Temporal Resolution

To fully understand the microclimate of the boreal forest, it was necessary to make consistent measurements over a long time period. Consequently, the nominal sampling period did not change for the duration of the experiment. Individual cases of instrument error or data logger failure occasionally caused the period between recorded data to change. A list of known errors of this type is given in Section 11.

For the most part, the BOREAS SRC AMS sites collected data with the same sampling strategy. Samples of each variable were acquired every 5 seconds. These samples were then averaged over 15-minute periods to get the actual data values. The standard deviations given are for the 5-second samples that make up the 15-minute averages.

The exceptions to this strategy were the Belfort precipitation, snow depth, tipping bucket precipitation, and soil moisture data. The Belfort precipitation and snow depth data were sampled every minute, the reported data values for each hour are the average from minute 55 to minute 59. The tipping bucket precipitation was sampled every 5 seconds, and the data values reported are the running total every 15 minutes. The soil moisture data were sampled every 30 seconds, the data value is given at minute 50.

7.3 Data Characteristics

7.3.1 Parameter/Variable

```
Suite A Column Name
------------------------------
SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
MEAN_ABOVE_CANOPY_TEMP_10M
SDEV_ABOVE_CANOPY_TEMP_10M
MEAN_WITHIN_CANOPY_TEMP_2M
SDEV_WITHIN_CANOPY_TEMP_2M
MEAN_SURF_PRESS_15MIN
SDEV_SURF_PRESS_15MIN
MEAN_REL_HUM_15MIN
SDEV_REL_HUM_15MIN
MIXING_RATIO
MEAN_WIND_SPEED_15MIN
SDEV_WIND_SPEED_15MIN
MEAN_WIND_DIR_15MIN
SDEV_WIND_DIR_15MIN
U_COMPNT_WIND_VELOC
V_COMPNT_WIND_VELOC
RAINFALL_RATE_15MIN
TOTAL_RAINFALL_RATE_15MIN
ACCUM_PRECIP
SNOW_DEPTH
MEAN_INCIDENT_SHORTWAVE_15MIN
SDEV_INCIDENT_SHORTWAVE_15MIN
MEAN_TOTAL_DOWN_PAR_15MIN
MEAN_DOWN_PPFD_15MIN
SDEV_TOTAL_DOWN_PAR_15MIN
MEAN_REFLECTED_SHORTWAVE_15MIN
SDEV_REFLECTED_SHORTWAVE_15MIN
```

MEAN_NET_RAD_15MIN
SDEV_NET_RAD_15MIN
MEAN_IR_TEMP_15MIN
SDEV_IR_TEMP_15MIN
COLD_PROBE_TEMP
WARM_PROBE_TEMP
MEAN_SOIL_TEMP_10CM_15MIN
SDEV_SOIL_TEMP_10CM_15MIN
MEAN_SOIL_TEMP_20CM_15MIN
SDEV_SOIL_TEMP_20CM_15MIN
MEAN_SOIL_TEMP_50CM_15MIN
SDEV_SOIL_TEMP_50CM_15MIN
CRTFCN_CODE
REVISION_DATE

Suite B Column Name

SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
MEAN_DIFFUSE_DOWN_SHORTWAVE
SDEV_DIFFUSE_DOWN_SHORTWAVE
MEAN_DOWN_LONGWAVE
SDEV_DOWN_LONGWAVE
MEAN_THERMOPILE_VOLT
SDEV_THERMOPILE_VOLT
MEAN_RADIOMETER_CASE_TEMP
SDEV_RADIOMETER_CASE_TEMP
MEAN_RADIOMETER_DOME_TEMP
SDEV_RADIOMETER_DOME_TEMP
REVISION_DATE
CRTFCN_CODE

7.3.2 Variable Description/Definition

Suite A 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.
TIME_OBS	The Greenwich Mean Time (GMT) when the data were

	collected.
MEAN_ABOVE_CANOPY_TEMP_10M	The fifteen-minute mean air temperature a few meters above the canopy [see Section 4.1.6 and 7.1.1] based on measurements taken every 5 seconds starting at the given time.
SDEV_ABOVE_CANOPY_TEMP_10M	The standard deviation of the air temperature a few meters above the canopy based on measurements taken every 5 seconds starting at the given time.
MEAN_WITHIN_CANOPY_TEMP_2M	The fifteen-minute mean air temperature at two meters above ground based on measurements taken every 5 seconds starting at the given time.
SDEV_WITHIN_CANOPY_TEMP_2M	The standard deviation of the air temperature at two meters above ground based on measurements taken every 5 seconds starting at the given time.
MEAN_SURF_PRESS_15MIN	The fifteen-minute mean atmospheric pressure measured at station level based on measurements taken every 5 seconds starting at the given time.
SDEV_SURF_PRESS_15MIN	The standard deviation of the atmospheric pressure measured at station level based on measurements taken every 5 seconds starting at the given time.
MEAN_REL_HUM_15MIN	The fifteen-minute mean relative humidity of the air a few meters above the canopy based on measurements taken every 5 seconds starting at the given time.
SDEV_REL_HUM_15MIN	The standard deviation of the relative humidity of the air at ten meters above the canopy based on measurements taken every 5 seconds starting at the given time.
MIXING_RATIO	The derived mixing ratio of the air a few meters above the canopy using the fifteen-minute mean of the above canopy temperature, surface pressure, and relative humidity.
MEAN_WIND_SPEED_15MIN	The fifteen-minute mean speed of the air based on measurements taken every five seconds starting at the given time.
SDEV_WIND_SPEED_15MIN	The standard deviation of the speed of the air based on measurements taken every five seconds starting at the given time.
MEAN_WIND_DIR_15MIN	The fifteen-minute mean direction from which the wind traveled based on measurements taken every five seconds starting at the given time.
SDEV_WIND_DIR_15MIN	The standard deviation of the direction from which the wind traveled based on measurements taken every five seconds starting at the given time.
U_COMPNT_WIND_VELOC	The computed westerly (from the west) vector component of the wind speed and wind direction.
V_COMPNT_WIND_VELOC	The computed southerly (from the south) vector component of the wind speed and wind direction.
RAINFALL_RATE_15MIN	The amount of rain measured by the Tipping bucket rain gauge during the fifteen minute time period starting at the given time.
TOTAL_RAINFALL_RATE_15MIN	The total amount of rain that has fallen since

	the start of data collection, given as the running sum of the amount of rain that has fallen in each fifteen minute time period.
ACCUM_PRECIP	The total amount of precipitation measured by the Belfort gauge since a relative date. This variable is measured at the start of every hour but given for every fifteen-minute time period.
SNOW_DEPTH	The depth of snow on the ground.
MEAN_INCIDENT_SHORTWAVE_15MIN	The fifteen-minute mean total (direct and diffuse) downward shortwave solar radiation based on measurements taken every five seconds starting at the given time. Measured wavelengths range from 0.285 to 2.800 micrometers.
SDEV_INCIDENT_SHORTWAVE_15MIN	The standard deviation of the total (direct and diffuse) downward shortwave solar radiation base based on measurements taken every five seconds starting at the given time. Measured wavelengths range from 0.285 to 2.800 micrometers. See section 9.1.1 about dividing these values by 5 to get standard deviation in Wm-2
MEAN_TOTAL_DOWN_PAR_15MIN	The fifteen-minute mean total (direct and diffuse) downward photosynthetically active radiation based on measurements taken every five seconds starting at the given time. Measured wavelengths range from 0.4 to 0.7 micrometers.
MEAN_DOWN_PPFD_15MIN	The fifteen-minute mean total (direct and diffuse) quantum downward photosynthetic photon flux density calculated from the mean downward PAR using the factor 4.54 microEinsteins sec^-1 Watts^-1 as given in McCartney, 1978.
SDEV_TOTAL_DOWN_PAR_15MIN	The standard deviation of the total (direct and diffuse) downward photosynthetically active radiation based on measurements taken every five seconds starting at the given time. Measured wavelengths range from 0.4 to 0.7 micrometers. See section 9.1.1 about dividing these values by 5 to get standard deviation in Wm-2
MEAN_REFLECTED_SHORTWAVE_15MIN	The fifteen-minute mean of upward shortwave solar radiation reflected from the ground based on measurements taken every five seconds starting at the given time. Measured wavelengths are 0.285 to 2.800 micrometers.
SDEV_REFLECTED_SHORTWAVE_15MIN	The standard deviation of the upward shortwave solar radiation reflected from the ground based on measurements taken every five seconds starting at the given time. Measured wavelengths are 0.285 to 2.800 micrometers. See section 9.1.1 about dividing these values by 5 to get standard deviation in Wm-2
MEAN_NET_RAD_15MIN	The fifteen-minute mean total (incoming and outgoing) radiation based on measurements taken every five seconds starting at the given time.
SDEV_NET_RAD_15MIN	The standard deviation of the mean total (incoming and outgoing) radiation based on

	measurements taken every five seconds starting at the given time. See section 9.1.1 about dividing the values by 5 to get standard deviation in Wm-2.
MEAN_IR_TEMP_15MIN	The fifteen-minute mean infrared temperature looking down from ten meters above the canopy based on measurements taken every five seconds starting at the given time.
SDEV_IR_TEMP_15MIN	The standard deviation of the infrared temperature looking down from ten meters above the canopy based on measurements taken every five seconds starting at the given time.
COLD_PROBE_TEMP	The temperature of a probe inserted into a porous block in the soil at ten centimeters depth before the block area is heated.
WARM_PROBE_TEMP	The temperature of a probe inserted into a porous block in the soil at ten centimeters depth after the block area has been heated for twenty seconds.
MEAN_SOIL_TEMP_10CM_15MIN	The fifteen-minute mean temperature of the soil at ten centimeters below the surface based on measurements taken every 5 seconds starting at the given time.
SDEV_SOIL_TEMP_10CM_15MIN	The standard deviation of the soil temperature at ten centimeters below the surface based on measurements taken every 5 seconds starting at the given time.
MEAN_SOIL_TEMP_20CM_15MIN	The fifteen-minute mean temperature of the soil at twenty centimeters below the surface based on measurements taken every 5 seconds starting at the given time.
SDEV_SOIL_TEMP_20CM_15MIN	The standard deviation of the soil temperature at twenty centimeters below the surface based on measurements taken every 5 seconds starting at the given time.
MEAN_SOIL_TEMP_50CM_15MIN	The fifteen-minute mean temperature of the soil at fifty centimeters below the surface based on measurements taken every 5 seconds starting at the given time.
SDEV_SOIL_TEMP_50CM_15MIN	The standard deviation of the soil temperature at fifty centimeters below the surface based on measurements taken every 5 seconds starting at the given time.
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.

Suite B 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.
TIME_OBS	The Greenwich Mean Time (GMT) when the data were collected.
MEAN_DIFFUSE_DOWN_SHORTWAVE	The fifteen-minute mean diffuse downward shortwave solar radiation. Measured wavelengths range from 0.285 to 2.800 micrometers.
SDEV_DIFFUSE_DOWN_SHORTWAVE	The standard deviation of the diffuse downward shortwave solar radiation. Measured wavelengths range from 0.285 to 2.800 micrometers. See section 9.1.1 about dividing these values by 5 to get standard deviation in Wm-2
MEAN_DOWN_LONGWAVE	The fifteen-minute mean total (direct and diffuse) downward longwave radiation. Measured wavelengths range from 4 to 50 micrometers.
SDEV_DOWN_LONGWAVE	The standard deviation of the total (direct and diffuse) downward longwave radiation. Measured wavelengths range from 4 to 50 micrometers. See section 9.1.1 about dividing these values by 5 to get standard deviation in Wm-2
MEAN_THERMOPILE_VOLT	The fifteen minute mean of the thermopile voltage based on measurements taken every five seconds starting at the given time.
SDEV_THERMOPILE_VOLT	The standard deviation of the thermopile voltage based on measurements taken every five seconds starting at the given time.
MEAN_RADIOMETER_CASE_TEMP	The mean temperature of the radiometer's case.
SDEV_RADIOMETER_CASE_TEMP	The standard deviation of the temperature of the radiometer's case.
MEAN_RADIOMETER_DOME_TEMP	The mean temperature of the radiometer's dome.
SDEV_RADIOMETER_DOME_TEMP	The standard deviation of the radiometer's dome temperature.
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.
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).

7.3.3 Unit of Measurement

Suite A Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
MEAN_ABOVE_CANOPY_TEMP_10M	[degrees Celsius]
SDEV_ABOVE_CANOPY_TEMP_10M	[degrees Celsius]
MEAN_WITHIN_CANOPY_TEMP_2M	[degrees Celsius]
SDEV_WITHIN_CANOPY_TEMP_2M	[degrees Celsius]
MEAN_SURF_PRESS_15MIN	[kiloPascals]
SDEV_SURF_PRESS_15MIN	[kiloPascals]
MEAN_REL_HUM_15MIN	[percent]
SDEV_REL_HUM_15MIN	[percent]
MIXING_RATIO	[grams of water vapor][kilogram dry air^-1]
MEAN_WIND_SPEED_15MIN	[meters][second^-1]
SDEV_WIND_SPEED_15MIN	[meters][second^-1]
MEAN_WIND_DIR_15MIN	[degrees true North in a clockwise direction]
SDEV_WIND_DIR_15MIN	[degrees true North in a clockwise direction]
U_COMPNT_WIND_VELOC	[meters][second^-1]
V_COMPNT_WIND_VELOC	[meters][second^-1]
RAINFALL_RATE_15MIN	[millimeters]
TOTAL_RAINFALL_RATE_15MIN	[millimeters]
ACCUM_PRECIP	[millimeters]
SNOW_DEPTH	[millimeters]
MEAN_INCIDENT_SHORTWAVE_15MIN	[Watts][meter^-2]
SDEV_INCIDENT_SHORTWAVE_15MIN	[Watts][meter^-2][*5]
MEAN_TOTAL_DOWN_PAR_15MIN	[Watts][meter^-2]
MEAN_DOWN_PPFD_15MIN	[microEinsteins][meter^-2][second^-1]
SDEV_TOTAL_DOWN_PAR_15MIN	[Watts][meter^-2][*5]
MEAN_REFLECTED_SHORTWAVE_15MIN	[Watts][meter^-2]
SDEV_REFLECTED_SHORTWAVE_15MIN	[Watts][meter^-2][*5]
MEAN_NET_RAD_15MIN	[Watts][meter^-2]
SDEV_NET_RAD_15MIN	[Watts][meter^-2][*5]
MEAN_IR_TEMP_15MIN	[degrees Celsius]
SDEV_IR_TEMP_15MIN	[degrees Celsius]
COLD_PROBE_TEMP	[degrees Celsius]
WARM_PROBE_TEMP	[degrees Celsius]
MEAN_SOIL_TEMP_10CM_15MIN	[degrees Celsius]
SDEV_SOIL_TEMP_10CM_15MIN	[degrees Celsius]
MEAN_SOIL_TEMP_20CM_15MIN	[degrees Celsius]
SDEV_SOIL_TEMP_20CM_15MIN	[degrees Celsius]
MEAN_SOIL_TEMP_50CM_15MIN	[degrees Celsius]
SDEV_SOIL_TEMP_50CM_15MIN	[degrees Celsius]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

Suite B Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
MEAN_DIFFUSE_DOWN_SHORTWAVE	[Watts][meter^-2]
SDEV_DIFFUSE_DOWN_SHORTWAVE	[Watts][meter^-2][*5]
MEAN_DOWN_LONGWAVE	[Watts][meter^-2]
SDEV_DOWN_LONGWAVE	[Watts][meter^-2][*5]
MEAN_THERMOPILE_VOLT	[millivolts]
SDEV_THERMOPILE_VOLT	[millivolts]
MEAN_RADIOMETER_CASE_TEMP	[degrees Celsius]
SDEV_RADIOMETER_CASE_TEMP	[degrees Celsius]
MEAN_RADIOMETER_DOME_TEMP	[degrees Celsius]
SDEV_RADIOMETER_DOME_TEMP	[degrees Celsius]
REVISION_DATE	[DD-MON-YY]
CRTFCN_CODE	[none]

7.3.4 Data Source

Suite A Column Name	Data Source
SITE_NAME	[Assigned by BORIS Staff]
SUB_SITE	[Assigned by BORIS Staff]
DATE_OBS	[CS Data Logger]
TIME_OBS	[CS Data Logger]
MEAN_ABOVE_CANOPY_TEMP_10M	[Calculated by the CS Data logger from the HMP35CF probe readings]
SDEV_ABOVE_CANOPY_TEMP_10M	[Calculated by the CS Data logger from the HMP35CF probe readings]
MEAN_WITHIN_CANOPY_TEMP_2M	[Calculated by the CS Data logger from the 107F temperature probe readings]
SDEV_WITHIN_CANOPY_TEMP_2M	[Calculated by the CS Data logger from the 107F temperature probe readings]
MEAN_SURF_PRESS_15MIN	[Calculated by the CS Data logger from]
SDEV_SURF_PRESS_15MIN	[Calculated by the CS Data logger from]
MEAN_REL_HUM_15MIN	Calculated by the CS Data logger from the HMP35CF probe readings]
SDEV_REL_HUM_15MIN	[Calculated by the CS Data logger from the HMP35CF probe readings]
MIXING_RATIO	[Derived using the fifteen-minute mean of the above canopy temperature, surface pressure, and relative humidity.]
MEAN_WIND_SPEED_15MIN	[Calculated by the CS Data logger from wind monitor instrument readings]
SDEV_WIND_SPEED_15MIN	[Calculated by the CS Data logger from wind monitor instrument readings]
MEAN_WIND_DIR_15MIN	[Calculated by the CS Data logger from wind monitor instrument readings]
SDEV_WIND_DIR_15MIN	[Calculated by the CS Data logger from wind monitor instrument readings]
U_COMPNT_WIND_VELOC	[Calculated by the CS Data logger from wind

	monitor instrument readings]
V_COMPNT_WIND_VELOC	[Calculated by the CS Data logger from wind monitor instrument readings]
RAINFALL_RATE_15MIN	[Calculated by the CS Data logger from tipping bucket instrument readings]
TOTAL_RAINFALL_RATE_15MIN	[Calculated as a running sum of the RAINFALL_RATE_15MIN values]
ACCUM_PRECIP	[Calculated by the CS Data logger from Belfort rain gauge readings]
SNOW_DEPTH	[Calculated by the CS Data logger from the Ultrasonic depth gauge measurements]
MEAN_INCIDENT_SHORTWAVE_15MIN	[Calculated by the CS Data logger from the albedometer readings]
SDEV_INCIDENT_SHORTWAVE_15MIN	[Calculated by the CS Data logger from the albedometer readings] [See Section 9.1.1 for information]
MEAN_TOTAL_DOWN_PAR_15MIN	[Calculated by the CS Data logger from the PAR sensor readings]
MEAN_DOWN_PPFD_15MIN	[Calculated from the MEAN_TOTAL_DOWN_PAR_15MIN using the factor 4.54 microEinsteins sec^-1 Watts^-1 as given in McCartney, 1978.]
SDEV_TOTAL_DOWN_PAR_15MIN	[Calculated by the CS Data logger from the PAR sensor readings] [See Section 9.1.1 for information]
MEAN_REFLECTED_SHORTWAVE_15MIN	[Calculated by the CS Data logger from the albedometer readings]
SDEV_REFLECTED_SHORTWAVE_15MIN	[Calculated by the CS Data logger from the albedometer readings] [See Section 9.1.1 for information]
MEAN_NET_RAD_15MIN	[Calculated by the CS Data logger from the net radiometer readings]
SDEV_NET_RAD_15MIN	[Calculated by the CS Data logger from the net radiometer readings] [See Section 9.1.1 for information]
MEAN_IR_TEMP_15MIN	[Calculated by the CS Data logger from the IR thermometer readings]
SDEV_IR_TEMP_15MIN	[Calculated by the CS Data logger from the IR thermometer readings]
COLD_PROBE_TEMP	[Calculated by the CS Data logger from the unheated probe temperatures]
WARM_PROBE_TEMP	[Calculated by the CS Data logger from the heated probe temperatures]
MEAN_SOIL_TEMP_10CM_15MIN	[Calculated by the CS Data logger from the soil temperature probe measurements]
SDEV_SOIL_TEMP_10CM_15MIN	[Calculated by the CS Data logger from the soil temperature probe measurements]
MEAN_SOIL_TEMP_20CM_15MIN	[Calculated by the CS Data logger from the soil temperature probe measurements]
SDEV_SOIL_TEMP_20CM_15MIN	[Calculated by the CS Data logger from the soil temperature probe measurements]
MEAN_SOIL_TEMP_50CM_15MIN	[Calculated by the CS Data logger from the soil temperature probe measurements]
SDEV_SOIL_TEMP_50CM_15MIN	[Calculated by the CS Data logger from the soil temperature probe measurements]

CRTFCN_CODE	[Assigned by BORIS staff]
REVISION_DATE	[Assigned by BORIS staff]

Suite B Column Name	Data Source
SITE_NAME	[Assigned by BORIS Staff]
SUB_SITE	[Assigned by BORIS Staff]
DATE_OBS	[CS Data Logger]
TIME_OBS	[CS Data Logger]
MEAN_DIFFUSE_DOWN_SHORTWAVE	[Calculated by the CS Data logger from pyranometer measurements]
SDEV_DIFFUSE_DOWN_SHORTWAVE	[Calculated by the CS Data logger from pyranometer measurements] [See Section 9.1.1 for information]
MEAN_DOWN_LONGWAVE	[Calculated by the CS Data logger from the pyrgeometer measurements. The information that BORIS personnel were able to obtain indicates that a dome heating correction was applied in the calculation of these values. See Smith, Crosson, and Tanner, 1992 and Eppley documentation for details on this correction.]
SDEV_DOWN_LONGWAVE	[Calculated by the CS Data logger from pyrgeometer measurements] [See Section 9.1.1 for information]
MEAN_THERMOPILE_VOLT	[Calculated by the CS Data logger from thermopile voltage measurements]
SDEV_THERMOPILE_VOLT	[Calculated by the CS Data logger from thermopile voltage measurements]
MEAN_RADIOMETER_CASE_TEMP	[Calculated by the CS Data logger from radiometer case temperature measurements]
SDEV_RADIOMETER_CASE_TEMP	[Calculated by the CS Data logger from radiometer case temperature measurements]
MEAN_RADIOMETER_DOME_TEMP	[Calculated by the CS Data logger from radiometer dome temperature measurements]
SDEV_RADIOMETER_DOME_TEMP	[Calculated by the CS Data logger from radiometer dome temperature measurements]
REVISION_DATE	[Assigned by BORIS staff]
CRTFCN_CODE	[Assigned by BORIS staff]

7.3.5 Data Range

The actual ranges for the various parameters were not determined due to the large amount of data in this data set.

7.4 Sample Data Record

The following are wrapped versions of the first few data records contained in one of the Suite A and B data files on the BOREAS CD-ROMs:

SRC_Suite_A

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,MEAN_ABOVE_CANOPY_TEMP_10M,
SDEV_ABOVE_CANOPY_TEMP_10M,MEAN_WITHIN_CANOPY_TEMP_2M,
SDEV_WITHIN_CANOPY_TEMP_2M,MEAN_SURF_PRESS_15MIN,SDEV_SURF_PRESS_15MIN,
MEAN_REL_HUM_15MIN,SDEV_REL_HUM_15MIN,MIXING_RATIO,MEAN_WIND_SPEED_15MIN,
SDEV_WIND_SPEED_15MIN,MEAN_WIND_DIR_15MIN,SDEV_WIND_DIR_15MIN,
U_COMPNT_WIND_VELOC,V_COMPNT_WIND_VELOC,RAINFALL_RATE_15MIN,
TOTAL_RAINFALL_RATE_15MIN,ACCUM_PRECIP,SNOW_DEPTH,MEAN_INCIDENT_SHORTWAVE_15MIN,
SDEV_INCIDENT_SHORTWAVE_15MIN,MEAN_TOTAL_DOWN_PAR_15MIN,MEAN_DOWN_PPFD_15MIN,
SDEV_TOTAL_DOWN_PAR_15MIN,MEAN_REFLECTED_SHORTWAVE_15MIN,
SDEV_REFLECTED_SHORTWAVE_15MIN,MEAN_NET_RAD_15MIN,SDEV_NET_RAD_15MIN,
MEAN_IR_TEMP_15MIN,SDEV_IR_TEMP_15MIN,COLD_PROBE_TEMP,WARM_PROBE_TEMP,
MEAN_SOIL_TEMP_10CM_15MIN,SDEV_SOIL_TEMP_10CM_15MIN,MEAN_SOIL_TEMP_20CM_15MIN,
SDEV_SOIL_TEMP_20CM_15MIN,MEAN_SOIL_TEMP_50CM_15MIN,SDEV_SOIL_TEMP_50CM_15MIN,
CRTFCN_CODE,REVISION_DATE
'SSA-9OA-FLXTR','AFM07-SRCA1',01-FEB-96,0,-31.5,.069,-30.4,.076,94.68,.007,47.9,
.414,.139,2.6,1.017,344.6,23.88,.6894,-2.5028,-999.0,-999.0,116.2,-999.0,1.192,
9.0,.514,2.334,1.0,.418,2.0,-45.588,26.0,-33.1,.179,1.266,4.274,-1.74,.005,-1.22,
.005,-.17,.005,'CPI',26-MAR-96
'SSA-9OA-FLXTR','AFM07-SRCA1',01-FEB-96,15,-31.8,.182,-30.7,.083,94.69,.005,49.6,
.479,.14,1.8,.862,340.6,27.56,.5886,-1.6714,-999.0,-999.0,116.2,-999.0,-.698,0.0,
.071,.322,0.0,-.002,0.0,-41.142,10.0,-33.3,.135,1.266,4.274,-1.75,.005,-1.22,
.005,-.17,.005,'CPI',10-MAY-96
```

SRC_Suite_B

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,MEAN_DIFFUSE_DOWN_SHORTWAVE,
SDEV_DIFFUSE_DOWN_SHORTWAVE,MEAN_DOWN_LONGWAVE,SDEV_DOWN_LONGWAVE,
MEAN_THERMOPILE_VOLT,SDEV_THERMOPILE_VOLT,MEAN_RADIOMETER_CASE_TEMP,
SDEV_RADIOMETER_CASE_TEMP,MEAN_RADIOMETER_DOME_TEMP,SDEV_RADIOMETER_DOME_TEMP,
REVISION_DATE,CRTFCN_CODE
'SSA-9OA-FLXTR','AFM07-SRCB1',01-FEB-96,0,5.714,.016,141.367,.021,-.041,.013,
-30.66,.162,-30.7,.159,26-MAR-96,'CPI'
'SSA-9OA-FLXTR','AFM07-SRCB1',01-FEB-96,15,.289,.001,140.444,.039,-.041,.026,
-31.08,.108,-31.11,.075,10-MAY-96,'CPI'
```

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 day.

8.2 Data Format

The Compact Disk-Read-Only Memory (CD-ROM) files contain 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

The data underwent some manipulation before they were sent to BORIS. These manipulations include such things as unit changes, and putting in -999 where there was missing data. The following formulas were used in calculating the variables sent to BORIS. ("aa" is equal to the value from the data logger; also see following note on value adjustments)

- Par Radiation: (aa/900*1000).
- Par Radiation Standard Deviation: (aa*1000).
- Net Radiation: (aa/900*1000).
- Net Radiation Standard Deviation: (aa*1000).
- Solar Down Radiation: (aa/900*1000).
- Solar Down Radiation Standard Deviation (aa*1000).
- Solar Reflected Radiation: (aa/900*1000).
- Wind U Component: (aa*(SIN((ab+180)*3.1459/180))) (where aa is Wind Speed and ab is Wind Direction).
- Wind V Component: (aa*(COS((ab+180)*3.1459/180))) (where aa is Wind Speed and ab is Wind Direction).
- Belfort Precipitation: aa minus initial base reading.
- Snow Depth: Height of snow depth sensor minus aa.

In Dec 1998, Alan Betts discovered that the standard deviations of all radiation values as given (for PAR, Solar, Net, Diffuse, and LW) are 5 times greater than they should be. This error arose because the values were accumulated in KJ/m^2 by the data logger for 5-sec intervals, and the standard Campbell Scientific formula was then used to calculate standard deviation from N = 180 accumulated values, X_i, in a 15-min interval (900 secs).

The 15-min mean in W/m^2 is given by:

$$X_{mean} = (1000/5) * 3X_i/N = (1000/900) * 3X_i$$

The calculation of the mean was done in post-processing by multiplying the accumulated flux by (1000/900).

The 15-min standard deviation in W/m^2 of the 180 5-sec samples is given by:

$$S = (1000/5) * [(3X_i^2 - (3X_i)^2/N)/N]$$

In this case the data logger software was used to compute the term in square brackets from the 5-sec values (units KJ/m^2). The conversion to W/m^2 is again (1000/5), but the data logger value was only multiplied by 1000 in post-processing. Consequently the archived values for the standard deviation of the radiation fluxes must all be divided by a factor of 5.

The data loggers accumulated flux in KJ/m^2 for 5 sec intervals, and the conversion to W/m^2 is aa*(1000/5), not the conversion of aa*1000, listed below, which was actually used in the original data processing.

Appendix Note

** 82 Standard Deviation in Time** formula taken from the Campbell Datalogger:

Function:
Calculate the standard deviation (STD DEV) of a given input location. The standard deviation is calculated using the formula:

$$S = ((3X_i^2 - (3X_i)^2/N)/N)$$

where X_i is the i^{th} measurement and N is the number of samples.

9.2 Data Processing Sequence

9.2.1 Processing Steps
None given.

9.2.2 Processing Changes
In completing data set publication efforts in August 1999, Dr. Alan Betts (Atmospheric Research) informed BORIS staff of a problem with the data provided for the Thompson Airport, Suite-A station (labeled in the final data as NSA-9BS-YTHSA) from December 24, 1994 to December 1, 1996. The problem was that the sign of the V-component of the wind direction was reversed from what it should have been. This resulted in the overall wind direction values being incorrect. BORIS staff worked with Dr. Betts to correct the two data values in each record and update the documentation as needed. Using the column names shown in section 7.3, the corrections (shown in the C programming language) were applied as follows:

```
V_COMPNT_WIND_VELOC = -V_COMPNT_WIND_VELOC;
if (MEAN_WIND_SPEED_15MIN != -999) /* The wind speed value is not undefined */
{
  if (V_COMPNT_WIND_VELOC == 0)
  {
    if (U_COMPNT_WIND_VELOC == 0) /* Both components are 0 */
    {
      MEAN_WIND_DIR_15MIN = 0;
    }
    else if (U_COMPNT_WIND_VELOC > 0)
    {
      MEAN_WIND_DIR_15MIN = 270;
    }
    else if (U_COMPNT_WIND_VELOC < 0)
    {
      MEAN_WIND_DIR_15MIN = 90;
    }
  else if (V_COMPNT_WIND_VELOC > 0)
  {
    MEAN_WIND_DIR_15MIN = 180 +
                        (180/pi)*atan(U_COMPNT_WIND_VELOC/V_COMPNT_WIND_VELOC);
  }
  else if (V_COMPNT_WIND_VELOC < 0)
  {
    MEAN_WIND_DIR_15MIN = 360 +
                        (180/pi)*atan(U_COMPNT_WIND_VELOC/V_COMPNT_WIND_VELOC);
  }
  if (MEAN_WIND_DIR_15MIN > 360)
  {
    MEAN_WIND_DIR_15MIN = MEAN_WIND_DIR_15MIN - 360;
  }
}
```

9.3 Calculations

9.3.1 Special Corrections/Adjustments
See Sections 9.2.2 and 14.

9.3.2 Calculated Variables
See Sections 9.2.2 and 14.

9.4 Graphs and Plots
None.

10. Errors

10.1 Sources of Error
See Sections 4 and 9.1.1.

10.2 Quality Assessment

10.2.1 Data Validation by Source
The observers filled out a checklist each time the site was visited. Appendix A (at the end of this document) is a sample of the checklist the observers used to record needed information.

The AMS data are subjected to several levels of quality assurance. First there is a program (limit checker) that analyzes the data as they are downloaded every 6 hours. The limit checker spots any anomalies that may have occurred in the data in the previous 6-hour time period. The limit checker is a program written in C++. Each instrument has a C++ subroutine file that has the limits defined for that instrument. The printout of each error detected gives time of error, the instrument, and the number of occurrences of the error. The limits used for each parameter were:

- PAR Radiation - Upper 400; Noon 20; Lower -20
- Humidity - Upper 100; Lower 10
- Net Radiation - Upper 700; Midnight 0; Lower -100
- Pressure - Upper 105; Lower 90
- Upper Albedometer - Upper 900; Noon 50; Lower -20
- IR Temperature - Upper 50; Difference 10; Lower -45
- Lower Albedometer -Upper 500; Noon 2; Lower -20
- Wind Speed -Upper 23; Lower 0
- Upper Canopy Temperature - Upper 40; Difference 7; Lower -45
- Wind Direction - Difference 0
- Lower Canopy Temperature - Upper 40; Difference 7; Lower -45
- Belfort - Upper 300; Difference -3.5; Lower 0
- Soil Temperature 10 cm - Upper 30; Difference 10; Lower -20
- Snow Depth - Upper 3000; Lower 400
- Soil Temperature 20 cm - Upper 30; Difference 10; Lower -20
- Soil Moisture - Upper 30; Lower -20
- Soil Temperature 50 cm - Upper 30; Difference 10; Lower -20
- Tipping Bucket - min 2
- Humidity - min 98
- Tipping - min 1
- Battery -Lower 11.5

The data are screened once per month by plotting the data to examine them on a day-to-day basis, looking for any peculiar diurnal effects. The third stage is converting the data into the units requested by BORIS.

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
BORIS personnel have reviewed portions of the actual parameter values and generated plots for use in visually spotting any anomalous values. In addition, BORIS staff applied the correction described in Section 9.2.2 to the wind direction values.

11. Notes

11.1 Limitations of the Data
Specific limitations of the data due to poor quality are given in Section 11.2.

11.2 Known Problems with the Data
This section lists the times when data are unavailable or there is a known difficulty with the data. The information is organized by measurement type (Suite A or Suite B), chronologically, and then by site.

Suite A: December 15, 1993 to January 15, 1994

All Sites
Regular site maintenance was not performed during the reporting period. Consequently heavy frost buildup occurred on all radiation instruments which may affect the accuracy of the data. Due to instrumentation design changes the Infrared sensor was not available for the reporting period. Prior to February 18, 1994, the pressure data at all BOREAS AFM-7 sites were offset by approximately -1.0 to -1.5 kPa. This means that the pressure values prior to February 18, 1994 can only be used to view trends, but the numbers themselves are not accurate and should not be used. The Saskatoon site was not corrected until April 14, 1994.

La Ronge
Snow depth data is relative to December 15, 1993. Belfort precipitation data is relative to December 15, 1993.

SSA-OA
Suite A data unavailable from December 24 to December 31, 1993. Belfort Precipitation Gauge not calibrated. Belfort Precipitation is relative to December 15, 1993. Snow Depth data unavailable. Sensor knocked over by an animal and damaged. Data available for part of January 10 & 11, 1994 due to a power supply shortage at site.

SSA-OJP
Snow depth data is relative to December 15, 1993. Belfort precipitation data is relative to December 15, 1993.

Lynn Lake
Snow depth data is relative to December 15, 1993. Belfort precipitation data is relative to December 15, 1993.

The Pas
Snow depth data is relative to December 15, 1993. Belfort precipitation data is relative to December 15, 1993. PAR Sensor is unavailable from December 22, 1993 to January 15, 1994 due to electronic malfunction.

Thompson
Snow depth data is relative to December 15, 1993. Belfort precipitation data is relative to December 15, 1993. No Pressure measurement available due to malfunction of instrument from December 15, 1993 to January 8, 1994. Data unavailable from January 8 to January 15, 1994.

Flin Flon
Snow depth data is relative to December 22, 1993. Belfort precipitation data is relative to December 22, 1993. Data unavailable from December 15 to December 22, 1993 due to power supply shortage. Partial data for December 24, 1993.

Suite A: January 15 to February 19, 1994

All sites
IR Sensor data unavailable for Dec. 15 to Feb. 19, 1994. Soil moisture instrument out of season therefore no data available. Tipping bucket instrument out of season therefore no data available.

La Ronge
Regular site maintenance began on January 27, 1994.

Meadow Lake
Installation date February 3, 1994. Data for February 3 to February 19, 1994 only. No IR Sensor or Lower Canopy temperature at this site as there is no forest canopy. Soil temperatures to be installed when ground thaws. Regular site maintenance began on March 9, 1994.

SSA-OA
Data unavailable from January 15 to January 20, 1994. Snow depth sensor unavailable due to wildlife damage. Regular site maintenance began on February 22, 1994. Suite B THemisph data missing January 20 to March 29, 1994.

SSA-OJP
Regular site maintenance began on February 18, 1994.

Saskatoon
Data unavailable from January 15 to February 15, 1994. Installation date - February 15, 1994. Belfort precipitation data relative to February 15, 1994. Regular site maintenance began on February 24, 1994.

Lynn Lake
Regular site maintenance began on January 28, 1994.

The Pas
PAR Sensor unavailable from January 15 to January 30, 1994 due to instrument problems. Regular site maintenance began on January 29, 1994.

NSA-OJP
Belfort Precipitation sensor unavailable. Regular site maintenance began on January 28, 1994.

Thompson
Belfort Precipitation reset to zero on January 16, 1994. Regular site maintenance began on January 28, 1994.

Flin Flon
Regular site maintenance began on January 29, 1994.

Suite A: February 19 to March 31, 1994

La Ronge
IR Sensor installed March 26, 1994 (85:2130). Special site maintenance March 26, 1994 -- tower lowered. March 2 to March 10 once an hour all values are missing due to program error.

Meadow Lake
No Belfort Precipitation available due to installation problems. Soil temperatures to be installed when ground thaws. March 2 to March 10 once an hour all values are missing due to program error.

SSA-OA
Data missing from March 17 (76:0600) to March 23 (82:2200), 1994 due to electronic failure of the data logger. Snow Depth data not available until February 22, 1994 (53:2000). March 2 to March 10 once an hour all values missing due to program error. Special site maintenance done on March 29, 1994 -- tower lowered.

SSA-OJP
March 2 to March 10 once an hour all values are missing due to program error. Special site maintenance done on March 31, 1994 -- tower lowered.

Saskatoon
Pressure data not available from February 19 to March 3, 1994 and from March 21 to March 28, 1994. Net radiation data not available from March 21 to March 31, 1994. Suite B data (ThPile, TCase and THemisph) missing February 19 to February 28, 1994. Suite B data (ThPile, TCase and THemisph) missing March 01 to April 03, 1994.

Lynn Lake
IR Sensor data not available until March 11, 1994 when it was installed. March 2 to March 10 once an hour all values are missing due to program error. Special site maintenance done on March 25, 1994 -- tower lowered.

The Pas
March 2 to March 10 once an hour all values are missing due to program error.

NSA-OJP
Belfort precipitation data not available until March 23, 1994 due to instrument problems. March 2 to March 10 once an hour all values are missing due to program error. Special site maintenance done on March 23, 1994 -- tower lowered.

Thompson
March 2 to March 10 once an hour all values are missing due to program error. Special site maintenance done on March 22, 1994 -- tower lowered.

Flin Flon
No IR sensor data available due to instrumentation design changes. March 2 to March 10 once an hour all values are missing due to program error.

Suite A: April 1 to April 30, 1994

La Ronge
Soil moisture temperature data commenced April 17, 1994.

Meadow Lake
Belfort precipitation data commenced April 18, 1994. Soil temperature data unavailable - not yet installed. Soil moisture data unavailable -- not yet installed.

SSA-OA
data missing from 91:2245 to 91:2315 due to program maintenance. Soil moisture data unavailable due to instrument malfunction.

SSA-OJP
Belfort data unavailable. Soil moisture data unavailable due to instrument malfunction.

Saskatoon
Net radiation data commenced April 5, 1994. Data missing part of April 1 and 2, 1994 (91:0215-92:0715).Soil moisture data unavailable -- instrument yet to be installed.

Lynn Lake
Soil moisture data unavailable -- instrument yet to be installed.

The Pas
Soil moisture data commenced April 17, 1994. Snow depth data unavailable from April 4 to April 8, 1994 and from April 14 to April 18, 1994.

NSA-OJP
Soil moisture data commenced April 17, 1994.

Thompson
Belfort precipitation data from April 11 to April 30, 1994 is unavailable.

Flin Flon
IR Temperature data commenced April 8, 1994. Soil moisture data unavailable -- not yet installed.

Suite A: May 1 to May 31, 1994

La Ronge
No data available from May 8 (128:1800) to May 11 (131:1915), 1994.Snow depth data not available for summer months. Tipping bucket data commences May 18, 1994. Soil moisture temperature commences May 18, 1994.

Meadow Lake
Soil Temperatures commenced May 21, 1994. Snow depth data not available for summer months. Belfort precipitation data is relative to April 18, 1994. No data available for May 26, 1994 (145:2200 to 146:2330)

SSA-OA
Snow depth data not available for summer months, 1994. Tipping bucket data commences May 1, 1994. Suite B ThPile data missing 147:2200, 1994.

SSA-OJP
Snow depth data not available for summer months, 1994. Tipping bucket data commences May 1, 1994. Suite B data missing 140:1530 to 140:1745, 1994.

Saskatoon
Pressure data not available from May 18 to May 27, 1994. Snow depth data not available for summer months, 1994. Suite B data missing 131:1430 to 133:0430. Suite B data missing 152:1915, 1994.

Lynn Lake
Snow depth data not available for summer months, 1994. Tipping bucket data commences May 15, 1994.

The Pas
Belfort precipitation data not available from May 17 to May 31, 1994. Snow depth data not available for summer months, 1994. Tipping bucket data commences May 15, 1994. Soil moisture temperature data commences May 25, 1994.

NSA-OJP
Belfort precipitation data not available from May 15 to May 31, 1994. Belfort precipitation is relative to March 23, 1994. Snow depth data not available for summer months, 1994. Tipping bucket data commences May 15, 1994. Soil moisture temperature data commences May 24, 1994.

Thompson
Belfort precipitation data not available from May 1 to May 31, 1994. Snow depth data not available for summer months, 1994. Tipping bucket data commences May 25, 1994. Soil moisture temperature data not available for all of 1994.

Flin Flon
Solar Reflected data not available from May 1 to May 31, 1994. Snow depth data not available for summer months, 1994. Tipping bucket data commences May 1, 1994.Soil moisture data commences May 30, 1994.

Suite A: June 1 to June 30, 1994

La Ronge
Belfort precipitation is relative to December 15, 1993.

Meadow Lake
Belfort precipitation is relative to April 18, 1994. Tipping Bucket Data commences June 1, 1994. Soil moisture temperature data commences June 1, 1994.

SSA-OA
Data missing for part of June 14, 1994. Data missing from June 25 (176:0215) to June 30 (182:2400), 1994. Belfort precipitation is relative to December 15, 1993. Suite B data missing 152:1730 to 152:1845 and 175:0245 to 0300, 1994.

SSA-OJP
Belfort precipitation is relative to December 15, 1993. Soil moisture temperature data commences June 6, 1994.

Saskatoon
Belfort precipitation is relative to February 15, 1994. Tipping Bucket data commences June 2, 1994. Soil moisture temperature data commences June 1, 1994. Suite B data missing 165:1800.

Lynn Lake
Data missing from June 5 (156:1200) to June 14 (165:1800), 1994. Data missing from June 20 (171:1800) to June 24 (175:2245), 1994. Belfort precipitation is relative to December 15, 1993. Tipping bucket total reset to zero June 14, 1994. Tipping bucket total reset to zero June 24, 1994.

The Pas
Belfort precipitation data missing from June 1 to June 30, 1994. Data missing from June 23 (174:1800) to June 29 (180:2045), 1994. Tipping bucket total reset to zero June 29, 1994.

NSA-OJP
Belfort precipitation data missing from June 1 to June 14, 1994. Belfort precipitation is relative to June 14, 1994.

Thompson
Belfort precipitation data missing from June 1 to June 15, 1994. Belfort precipitation is relative to June 15, 1994.

Flin Flon
Belfort precipitation is relative to Dec. 15, 1993.

Suite A: July 1 to July 31, 1994

La Ronge
Data missing from July 4 (185:1800) to July 8 (189:0600), 1994. Data missing from July 9 (190:0630) to July 11 (192:2330), 1994. Data missing from July 16 to July 31, 1994 with the exception of the radiation instruments (PAR, Net, SolarDown and Solar Reflected) for the period July 28 to July 31, 1994. Belfort precipitation not available from July 11 to July 31, 1994. Tipping Bucket total reset to zero on July 12, 1994.

SSA-OA
Data missing from July 10 (191:0015) to July 13 (194:2230), 1994. Data missing for part of July 1, 1994. Data missing for part of July 15, 1994. Data missing from July 16 (197:1815) to July 21 (202:0245), 1994. Data missing for part of July 22 (203:0015 to 1615), 1994. Belfort precipitation is relative to July 1, 1994. Tipping bucket total reset to zero July 2, 1994. Tipping bucket total reset to zero July 13, 1994. Tipping bucket total reset to zero July 15, 1994. Tipping bucket total reset to zero July 21, 1994. Tipping bucket total reset to zero July 23, 1994.

SSA-OJP
Data missing for July 15 (197:0000) to July 20 (201:2030), 1994. Tipping bucket total reset to zero July 20, 1994. Belfort precipitation data missing for July 15 to July 23, 1994. Belfort precipitation is relative to July 23, 1994. Suite B LW Down data missing June 28 to July 19, 1994.

Lynn Lake
Data missing for July 15 (197:0000) to July 18 (199:2000), 1994. Tipping bucket total reset to zero July 18, 1994.

The Pas
Belfort precipitation data missing for July 1 to July 31, 1994. Upper canopy temperature data missing from July 2 to July 10, 1994. Data missing for part of July 22, 1994. Belfort precipitation data relative to July 22, 1994.

Flin Flon
Belfort precipitation data missing for July 4 to July 21, 1994.

Suite A: August 1 to August 31, 1994

La Ronge
Data missing August 1 to August 11, 1994 except for the radiation sensors (PAR, Net, Solar Down and Solar Reflected).

SSA-OA
Data missing from August 6 to August 10, 1994. Tipping bucket total reset to zero August 11, 1994. Data missing from August 27 to August 30, 1994. Tipping bucket total reset to zero August 30, 1994. Belfort Precipitation reset to zero on August 12, 1994. Belfort Precipitation missing from August 6 to August 12, 1994. Belfort Precipitation missing from August 27 to August 31, 1994.

SSA-OJP
Data missing for part of August 19, 1994. Suite B data missing (ThPile, TCase, THemisph) for July 26 to Aug. 19, 1994.

Lynn Lake
Data missing from August 6 to August 16, 1994. Belfort Precipitation missing from August 15 to August 31, 1994. Tipping Bucket total reset to zero August 16, 1994.

The Pas
Note
the spikes in the Belfort precipitation data are due to an electronic malfunction of the instrument, however, the upper values of the graph are correct.

NSA-OJP
Belfort Precipitation missing from August 15 to August 31, 1994. Suite B data missing 2200:2215 to 293:1615 inclusive.

Suite A: September 1 to September 30, 1994

SSA-OA
Belfort Precipitation data missing from September 1 to September 30, 1994. Belfort Precipitation relative to September 30, 1994. Some instruments missing for part of September 1, 1994. SSA-OJP Some instruments missing for part of September 9, 1994. Suite B data missing (LW Down and ThPile) August 19 to October 02, 1994.

Lynn Lake
Belfort Precipitation data missing from September 1 to September 30, 1994. Data missing from September 26 to September 29, 1994. Tipping bucket total reset to zero September 29, 1994.

The Pas
Note
the spikes in the Belfort precipitation data are due to an electronic malfunction of the instrument, however, the upper values of the graph are correct.

NSA-OJP
Belfort Precipitation data missing from September 1 to September 30, 1994.

Flin Flon
Belfort Precipitation data missing from September 7 to September 30, 1994.

Suite A: October 1 to October 31, 1994

Meadow Lake
Tipping bucket data discontinued for winter months October 27, 1994.

SSA-OA
Belfort Precipitation data relative to October 1, 1994.

SSA-OJP
Suite B Data missing 289:1130 to 289:1315, 1994. Suite B data missing (LWDown and ThPile) for October 2 to November 11, 1994.

Saskatoon
Suite B data missing 301:2230 to 310:2245.

Lynn Lake
Belfort precipitation data missing for October 1, 1994. Belfort precipitation data missing for October 9 to October 31, 1994. Missing data for part of October 9, 1994. Missing data for October 16 to October 25, 1994. Tipping Bucket Total Reset to Zero on October 25, 1994.

The Pas
Note: the spikes in the Belfort precipitation data are due to an electronic malfunction of the instrument. The upper values of the graph, however, are correct.

NSA-OJP
Belfort precipitation data missing October 1 to October 31, 1994.

Thompson
Soil Moisture temperature data not available.

Flin Flon
Belfort precipitation relative to October 1, 1994. Tipping bucket data missing October 15 to October 25, 1994. Tipping bucket total reset to zero on October 25, 1994.

Suite A: November 1 to November 30, 1994

La Ronge
Belfort precipitation data missing from November 1 to November 21, 1994. Belfort precipitation relative to November 21, 1994.

Meadow Lake
Belfort precipitation data not available from November 1 to November 29, 1994. Belfort precipitation relative to November 29, 1994.

SSA-OA
November 2, 1994 at 2100 hours the Belfort precipitation gauge had unmelted snow bridging on it which was dumped in all at once by the observer and represents snowfall for that day. Snow depth data missing from November 9 to November 20, 1994. Suite B data missing (LW Down, ThPile, TCase, THemisph) 314:2030 to 314:2100, 1994.

SSA-OJP
Belfort precipitation data missing from November 1 to November 15, 1994.Belfort precipitation relative to November 15, 1994. Suite B data missing - LW Down 322:0015 to 331: 1645; ThPile 315:1945 to 322:0200; T Case and THemisph 322:0015 to 322:0145, 1994.

Lynn Lake
Belfort precipitation data missing from November 1 to November 3, 1994. Belfort precipitation data relative to November 3, 1994. Snow depth data missing from November 10 to November 30, 1994.

The Pas
Snow depth data missing from November 1 to November 30, 1994.

NSA-OJP
Belfort precipitation data missing from November 1 to November 20, 1994. Belfort precipitation relative to November 20, 1994. Snow depth data missing from November 19 to November 30, 1994.

Thompson
Belfort precipitation data missing from November 19 to November 21, 1994. Belfort precipitation relative to November 21, 1994.

Suite A: December 1 to December 31, 1994

La Ronge
Belfort precipitation relative to November 21, 1994. Tipping Bucket data unavailable during winter months.

Meadow Lake
Belfort precipitation relative to November 29, 1994. Tipping Bucket data unavailable during winter months.

SSA-OA
Belfort precipitation relative to October 1, 1994. Tipping Bucket data unavailable during winter months.

SSA-OJP
Belfort precipitation relative to November 15, 1994. Tipping Bucket data unavailable during winter months. Suite B LW Down data missing 331:1700 to 339: 2300, 1994.

Saskatoon
Snow depth data missing from December 4 to December 13, 1994. Belfort precipitation relative to February 15, 1994. Tipping Bucket data unavailable during winter months.

Lynn Lake
Belfort precipitation data missing from December 1 to December 31, 1994.Snow depth data missing from December 1 to December 2, 1994. Snow depth data missing from December 5 to December 7, 1994. Tipping Bucket data unavailable during winter months.

The Pas
Belfort precipitation relative to December 8, 1994. Belfort precipitation data missing from December 1 to December 8, 1994. Tipping Bucket data unavailable during winter months.

NSA-OJP
Belfort precipitation relative to November 20, 1994. Tipping Bucket data unavailable during winter months. Suite B data missing 314:2215 to 342:0130 inclusive. Suite B data missing 341:1530 to 341:1830 inclusive.

Thompson
Wind speed and wind direction data missing from December 4 to December 24, 1994. Soil moisture temperatures missing December 1 to December 31, 1994. Tipping Bucket data unavailable during winter months.

Flin Flon
Belfort precipitation relative to October 1, 1994. Tipping Bucket data unavailable during winter months. Suite B data missing 339:1530 to 330:1600 and 342:1215.

Suite A: January 1 to January 31, 1995

La Ronge
Snow depth sensor may be affected by a rabbit path located directly under sensor from January 1 to January 31, 1995.

SSA-OA
Belfort precipitation data missing from January 1 to January 27, 1995. Belfort precipitation relative to January 27, 1995.

Lynn Lake
Belfort precipitation data missing from January 1 to January 31, 1995.

Thompson
Soil moisture temperature data missing from January 1 to January 31, 1995.

Suite A: February 1 to February 28, 1995

SSA-OA
duplicated time and day (34:15) -- the second one is correct.

Saskatoon
Belfort precipitation missing from February 3 to February 6, 1995. Belfort precipitation missing from February 8 to February 10, 1995.

Lynn Lake
Belfort precipitation missing from February 1 to February 12, 1995.

NSA-OJP
Data missing from February 2 to February 22, 1995. Snow depth data missing February 1 to February 22, 1995.

Thompson
Soil moisture temperature data missing from February 1 to February 28, 1995.

SuiteA: March 1 to March 31, 1995

Thompson
Soil moisture temperature data missing March 1 to March 31, 1995.

Suite A: April 1 to April 30, 1995

The Pas
Note: the spikes in the Belfort Precipitation data are due to electronic malfunction of the instrument, however the general shape of the graph is correct.

Thompson
Soil moisture temperature data missing April 1 to April 30, 1995.

Suite A: May 1 to May 31, 1995

La Ronge
Snow depth sensor removed May 12, 1995 for summer period. Tipping Bucket data restarted May 3, 1995.

Meadow Lake
Snow depth sensor removed May 1, 1995 for summer period. Tipping Bucket data restarted May 1, 1995.

SSA-OA
Snow depth sensor removed May 2, 1995 for summer period. Tipping Bucket data restarted May 1, 1995. Belfort precipitation missing May 22 to May 31, 1995.

SSA-OJP
Snow depth sensor removed May 2, 1995 for summer period. Tipping Bucket data restarted May 7, 1995.

Saskatoon
Snow depth sensor removed April 30, 1995 for summer period. Tipping Bucket data restarted May 1, 1995.

Lynn Lake
Snow depth sensor removed May 9, 1995 for summer period. Tipping Bucket data restarted May 15, 1995. Belfort precipitation missing May 15 to May 31, 1995.

The Pas
Snow depth sensor removed May 2, 1995 for summer period. Belfort precipitation missing May 7 to May 31, 1995. Note: the spikes in the Belfort Precipitation data are due to electronic malfunction of the instrument, however the general shape of the graph is correct.

NSA-OJP
Snow depth sensor removed May 6, 1995 for summer period. Belfort precipitation missing May 24 to May 31, 1995. Suite B missing data 126:1815 to 128:0330 inclusive. Suite B missing data 147:1815 to 149:0045 inclusive.

Thompson
Tipping Bucket data restarted May 8, 1995. Soil moisture temperature missing May 1 to May 31, 1995. Snow depth sensor removed May 16, 1995 for summer period.

Flin Flon
Tipping Bucket data restart May 1, 1995. Snow depth sensor removed May 10, 1995 for summer period.

Suite A: June 1 to June 30, 1995

La Ronge
Data missing June 17 to June 23, 1995

SSA-OA
Belfort precipitation data missing June 1 to June 11, 1995. Belfort precipitation relative to June 11, 1995. Data missing part of June 17, 1995. Data missing part of June 20, 1995. Tipping Bucket relative to June 20, 1995. Suite B data missing 163:0030 to 163:0045, 1995. Suite B ThPile data missing 171:0515.

SSA-OJP
Data missing June 2 to June 22, 1995. Belfort precipitation relative to June 22, 1995. Tipping bucket precipitation relative to June 22, 1995. IR sensor data missing June 22 to June 30, 1995.

Lynn Lake
Belfort precipitation data missing June 1 to June 30, 1995. Data missing June 4 to June 15, 1995.

The Pas
Belfort precipitation data missing June 1 to June 30, 1995. Relative humidity data missing June 26 to June 30, 1995. Tipping bucket reset to zero June 21, 1995. Soil moisture temperature data missing from June 19-30, 1995.

NSA-OJP
Belfort precipitation data missing June 1 to June 24, 1995. Tipping bucket precipitation data missing June 1 to June 24, 1995. Belfort precipitation relative to June 24, 1995. Tipping bucket precipitation relative to June 24, 1995.

Thompson
Soil moisture temperature data missing June 1 to June 30, 1995.

Flin Flon
Belfort precipitation data missing June 28 to June 30, 1995. Suite B data missing 173:2200 to 173:2215 inclusive.

Suite A: July 1 to July 31, 1995

SSA-OA
No data available for July 11, 1995 due to data logger malfunction. Tipping Bucket reset to zero on July 12, 1995.

SSA-OJP
IR sensor data not available from July 1-6, 1995 due to instrument malfunction.

Lynn Lake
No data available from July 6-15, 1995 due to data logger failure. Only partial data available from July 2-5, 1995 due to multiplexer failure. No data available from July 15-20, 1995 due to data logger failure. Belfort precipitation and tipping bucket reset to zero on July 20, 1995

The Pas
Belfort precipitation data not available from July 1-3, 1995 due to instrument malfunction. Humidity data not available from July 1-7, 1995 due to instrument malfunction. Upper canopy temperature not available from July 9-22, 1995 due to instrument malfunction. Soil moisture temperature data missing from July 1-31, 1995.

Thompson
Soil Moisture temperature data not available due to instrument malfunction.

Flin Flon
Belfort precipitation data not available from July 1-8, 1995 due to instrument malfunction. Belfort precipitation reset to zero on July 8, 1995.

Suite A: August 1 to August 21, 1995

La Ronge
No data available from August 15-21, 1995 due to data logger failure. Belfort precipitation data reset to zero on August 29, 1995. Tipping bucket data reset to zero on August 21, 1995.

SSA-OA
No data available from August 8-10, 1995 due to data logger failure. Belfort precipitation data reset to zero on August 10, 1995. Tipping bucket data reset to zero on August 10, 1995. Some data not available on August 22 and August 27, 1995 due to repairs. Tipping bucket data reset to zero on August 23, 1995.

Saskatoon
20 cm soil temperature data not available from August 8-31, 1995 due to instrument malfunction.

Lynn Lake
No data available from August 2-14, 1995 due to data logger failure. Belfort precipitation data not available from August 2-15, 1995 due to instrument malfunction. Tipping bucket data reset to zero on August 15, 1995. Belfort precipitation data reset to zero on August 17, 1995.

The Pas
No data available from August 9-10, 1995 and August 13-16, 1995 due to data logger failure. Belfort precipitation data not available from August 1-31, 1995 due to instrument malfunction. Upper canopy temperature not available from August 15-25, 1995 due to instrument malfunction. Tipping bucket data reset to zero on August 16, 1996. Soil moisture temperature data missing from August 1-31, 1995.

NSA-OJP
Belfort precipitation not available August 1-15, 1995 not available. Belfort precipitation data reset to zero on August 17, 1995.

Thompson
Soil moisture temperature data not available August 1-31, 1995 due to instrument malfunction. No data available except radiation data (PAR_Rad, Net_Rad, Sol_down, Sol_refl) from August 17-31, 1995 due to multiplexer failure.

Suite A: September 1 to September 30, 1995

Meadow Lake
Tipping bucket data not available from September 1-30, 1995.

Saskatoon
20 cm soil temperature data not available from September 1-8, 1995 due to instrument malfunction.

Lynn Lake
No data available from September 12-24, 1995 due to data logger failure. Belfort precipitation data reset to zero on September 24, 1995. Tipping bucket data reset to zero on September 24, 1995.

The Pas
No data available from September 8-11, 1995 and part of September 15, 1995. Belfort precipitation data not available from September 1-30, 1995 due to instrument malfunction. Tipping bucket data reset to zero on September 11, 1995. Upper canopy temperature not available from September 15-30, 1995 due to instrument malfunction. Soil moisture temperature data missing from September 1-30, 1995.

Thompson
No data available except Radiation Data (PAR_Rad, Net_Rad, Sol_down, Sol_refl) from September 1-27, 1995 due to multiplexer failure. No data available from September 27-30, 1995 due to data logger failure.

Suite A: October 1 to October 31, 1995

Meadow Lake
Tipping bucket data not available from October 1-31, 1995.

Lynn Lake
Soil moisture temperature not available October 1-31, 1995 due to instrument malfunction.

The Pas
Soil moisture temperature data not available October 1-31, 1995 due to instrument malfunction. Belfort precipitation data not available from October 1-13, 1995 due to instrument malfunction. Belfort precipitation data reset to zero on October 14, 1995. Upper canopy temperature not available from October 1-14, 1995 due to instrument malfunction.

Thompson
No data available from October 1-13, 1995 due to data logger failure. Solar down and solar reflected radiation not available from October 13-31, 1995 due to instrument malfunction. Belfort precipitation and tipping bucket reset to zero on October 13, 1995.

Flin Flon
Tipping bucket data not available from October 15-31, 1995.

Suite A: November 1 to November 30, 1995

SSA-OJP
No data available from November 9-11, 1995 due to communication problems. Snow depth data not available from November 15-30, 1995 due to instrument malfunction.

Lynn Lake
Belfort precipitation data not available from November 1-19, 1995. Soil moisture temperature data not available from November 1-30, 1995 due to instrument malfunction. Belfort precipitation data reset to zero on November 19, 1995.

The Pas
Soil moisture temperatures not available November 1-30, 1995 due to instrument malfunction.

Thompson
Solar down and solar reflected radiation not available from November 1-23, 1995 due to instrument malfunction.

Suite A: December 1 to December 31, 1995

SSA-OJP
Snow depth data not available from December 1-21, 1995 due to instrument malfunction.

Lynn Lake
Soil moisture temperatures not available from December 1-31, 1995 due to instrument malfunction.

The Pas
Soil moisture temperatures not available from December 1-31, 1995 due to instrument malfunction.

Flin Flon
No data available from Dec. 30-31, 1995 due to communication problems.

Suite A: January 1 to January 31, 1996

SSA-OA
Snow depth data not available from January 15-31, 1996 due to instrument malfunction.

Lynn Lake
Soil moisture temperatures not available from January 1-31, 1996 due to instrument malfunction.

The Pas
Soil moisture temperatures not available from January 1 - 31, 1996 due to instrument malfunction.

NSA-OJP
Radiation sensors appear to have a buildup of snow/frost (Jan 1-31, 1996) because the observer may not be visiting this site regularly.

Thompson
Humidity data is affected by a malfunctioning sensor (Jan 1-31, 1996).

Suite A: February 1 to February 29, 1996

SSA-OA
Snow depth data not available from February 1-9, 1996 due to instrument damage.

Lynn Lake
Soil moisture temperatures not available from February 1-29, 1996 due to instrument malfunction.

The Pas
Soil moisture temperatures not available from February 1-29, 1996 due to instrument malfunction.

Thompson
Humidity data is affected by a malfunctioning sensor (Feb. 1-15, 1996). Humidity data is not available from Feb. 15-29, 1996 due to instrument malfunction.

Suite A: March 1 to March 31, 1996

Lynn Lake
Soil moisture temperatures not available from March 1-31, 1996 due to instrument malfunction.

The Pas
Soil moisture temperatures not available from March 1-31, 1996 due to instrument malfunction.

Suite A: April 1 to April 30, 1996

Lynn Lake
Soil moisture temperatures not available from April 1-30, 1996 due to instrument malfunction.

The Pas
Soil moisture temperatures not available from April 1-30, 1996 due to instrument malfunction.

Suite A: May 1 to May 31, 1996

La Ronge
No data available from May 9 to May 12, 1996 due to communication problems. Tipping bucket data commenced May 16, 1996. Snow depth data complete May 22, 1996.

Meadow Lake
Tipping bucket data commenced May 1, 1996. Snow depth data completed April 30, 1996.

SSA-OA
Tipping bucket data commenced May 1, 1996. Snow depth data complete May 15, 1996.

SSA-OJP
Tipping bucket data commenced May 12, 1996. Snow depth data complete May 29, 1996.

Saskatoon
Tipping bucket data commenced May 1, 1996. Snow depth data completed May 11, 1996.

Lynn Lake
Tipping bucket data commenced May 1, 1996. Soil moisture temperatures not available May 1 - May 31, 1996 due to instrument malfunction. Snow depth data completed may 24, 1996. No data available may 30-31, 1996 due to data logger malfunction.

The Pas
Snow depth data completed May 10, 1996. Soil Moisture temperatures not available due to instrument malfunction May 1 - May 31, 1996. Tipping bucket data commenced May 26, 1996.

NSA-OJP
Tipping bucket data commenced May 5, 1996. Snow depth data completed May 17, 1996.

Thompson
Snow depth data completed May 28, 1996.

Flin Flon
Tipping bucket data commenced May 1, 1996. Snow depth data completed May 17, 1996.

Suite A: June 1 to June 30, 1996

SSA-OA
No data available from June 3 to 7, 1996.

Lynn Lake
Soil moisture temperatures repaired on June 5, 1996. No data available from June 1 to 5, 1996; June 7 to 13, 1996; June 19 to 24, 1996 and from June 29 to 30, 1996.

The Pas
Soil moisture temperatures repaired on June 4, 1996. No data available from June 19 to 30, 1996.

Suite A: July 1 to July 31, 1996

La Ronge
No data available from July 14 to 15 and from July 24 to 30, 1996. Belfort Precipitation data not available for July 15 to 31, 1996. Tipping bucket data reset to zero on July 15, 1996. Tipping bucket data reset to zero on July 30, 1996.

SSA-OA
No data available from July 5 to 8, 1996 and part of July 11 to 12, 1996. No data available for part of July 21 to 22, July 30 to 31 and from July 24 to 28, 1996 due to data logger failure. Tipping bucket data reset to zero on July 8, July 12, July 21, 1996. Tipping bucket data not available from July 22 to 31, 1996. Belfort precipitation data reset to zero on July 28, 1996.

Lynn Lake
No data available from July 1 to 2, 1996 due to data logger failure. Tipping bucket data reset to zero on July 2, 1996.

The Pas
Tipping bucket data not available from July 1 to 31, 1996. Belfort precipitation data reset to zero on July 1, 1996.

Suite A: August 1 to August 31, 1996

La Ronge
No data available from August 1 to 5 and from August 10 to 14, 1996 due to data logger failure. No Belfort precipitation data from August 14 to 25, 1996 due to instrument malfunction. Belfort precipitation data reset to zero on August 5, 1996. Tipping bucket data reset to zero on August 14, 1996.

SSA-OA
No data available from August 1 to 6, 1996 due to data logger failure. Tipping bucket data reset to zero on August 6, 1996.

Saskatoon
No data available from August 2 to 6, 1996 due to data logger failure. Tipping bucket data reset to zero on August 6, 1996.

Lynn Lake
No data available from August 4 to 12, and from August 21 to 23 due to data logger failure. Belfort precipitation data not available from August 1 to 31, 1996 due to instrument malfunction. Tipping bucket data reset to zero on August 12 and August 23, 1996.

The Pas
Tipping bucket data not available from August 1 to 31, 1996 due to instrument malfunction.

Suite A: September 1 to September 30, 1996

La Ronge
Vandals placed an item into the Belfort Fluid on August 31, 1996 which was removed on September 2, 1996. Disregard the sudden addition and subtraction of the Belfort measurement.

Lynn Lake
Belfort precipitation data not available from September 1 to 30, 1996.

Suite A: October 1 to October 31, 1996

La Ronge
Belfort precipitation not available from October 6 to 15 and from 19 to 31, 1996 due to vandalism at the site. Belfort precipitation data not available from October 19 to 31, 1996 due to vandalism at the site.

Lynn Lake
Belfort precipitation data not available from October 1 to 15, 1996. Belfort precipitation data reset to zero on October 17, 1996.

Suite A: November 1 to November 30, 1996

La Ronge
Snow depth data not available November 1 to 30, 1996 due to vandalism at the site. Belfort precipitation data not available November 1 to 30, 1996 due to vandalism at the site.

Lynn Lake
No data available from November 22 to 30, 1996 due to instrument malfunction.

Thompson
Prior to September 1999, the wind direction data stored in BORIS were incorrect for the Thompson station (NSA-9BS-YTHSA) from 24-Dec-1994 to 01-Dec-1996. See Section 9.2.2 for details on the corrections applied.

Suite B

SSA-OA

- THemisph data not available Jan 20-March 29, 1994.
- Data missing from 314:2030 to 314:2199, 1995 due to site maintenance.
- Data missing 163:0030 to 163:0045, 1995 inclusive.
- ThPile data missing 171:0515, 1995.
- ThPile data missing 254:2345 to 255:0015, 1995 inclusive.
- LW Down, TCase and THemisph data missing 255:0000 to 255:0015, 1995 inclusive.
- Data missing 298:1045 to 321:2330, 1995 inclusive.
- LW Down, ThPile, TCase and THemisph data missing 325:2045 to 325:2100, 1995 inclusive.
- LW Down, ThPile, TCase and THemisph data missing 136:0145 to 136:0215, 1996 inclusive. LW Down, ThPile, TCase and THemisph data missing 168:0000 to 168:0015, 1996 inclusive.
- Data missing 199:1045 to 199:1345, 1996 inclusive.
- Data missing 230:2030 to 237:1745, 1996 inclusive.
- Data missing 237:1800 to 251:1730, 1996 inclusive.
- Data missing 253:0200, 1996.

SSA-OJP

- Data unavailable from July 19 to July 26/94.
- ThPile, TCase and THemisph unavailable from July 20-Oct 02, 1994 due to equipment failure.
- LW Down and ThPile data missing Oct. 2 - Nov. 11, 1994.
- LW Down data missing 322:0015 to 338:2245, 1994.
- ThPile data missing from 315:1945 to 322:0200, 1994.
- TCase and THemisph data missing from 322:0015 to 322:0145, 1994 due to equipment failure.
- Data missing 153:0000 to 173:1730, 1995 inclusive.
- Data missing 268:0900 to 275:1600, 1995 inclusive.
- Data missing 290:1800 to 290:1830, 1995 inclusive.
- Data missing 303:0500 to 303:0530, 1995 inclusive.
- LWDown data missing 326:0015 to 337:1730, 1995 inclusive.
- ThPile, TCase and THemisph data missing 326:0015 to 326:0030, 1995 inclusive.
- Data missing 355:1930 to 355:1445, 1995 inclusive.
- LW Down data missing 337:1745 to 355:2045, 1995 inclusive.
- LW Down, ThPile, TCase and THemisph data missing 155:1330 to 155:1345, 1996 inclusive.
- LW down, ThPile, TCase and THemisph data missing 298:2000-2045, 1996 inclusive.

Saskatoon

- Data missing from 301:2230 to 301:2245, 1994 due to equipment maintenance.
- LW Down data missing 250:0900 to 185:0115, 1995 inclusive.
- ThPile, TCase, THemisph data missing 285:0100 to 285:0115, 1995 inclusive.
- LW Down, ThPile, TCase and THemisph data missing 131:2215, 1996.
- Data missing 214:1400 to 219:1715, 1996 inclusive.

NSA-OJP

- Data missing from 220:2215 to 233:0400, 1994 due to observer error.
- Data missing 341:2215 to 342:0130, 1994 due to site maintenance.
- Data missing 126:1815 to 128:2130, 1995.
- Data missing 147:1215 to 148:1845, 1995.
- Data missing 327:1215 to 345:0400, 1995 inclusive.
- LW Down, ThPile, TCase and THemisph data missing 158:1500, 1996.

Flin Flon

- Data missing 339:1530 to 339:1600, 1994 inclusive.
- Data missing 342:1215, 1994 due to site maintenance.
- Data missing 173:2200 to 173:2215, 1995 inclusive.
- Data missing 326:1745, 1995. LW Down, ThPile, TCase and THemisph data missing 156:0245, 1996.
- Data missing 335:1630 to 336:0600 inclusive.

11.3 Usage Guidance

Guidance on proper usage should come from review of the information given in Sections 9.2.2 and 11.2.

11.4 Other Relevant Information

None.

12. Application of the Data Set

These data will useful in many ways. The length of time over which regular measurements were made presents an unmatched opportunity to study the microclimate of the boreal forest. A succinct list is impossible to create because of the broad nature of studies to which these data are applicable. However, the following short list provides a general description of the types of studies that might find these data useful:

- Modeling of earth surface processes (climate, weather, vegetation growth, etc.)
- Validation of existing models
- Creation of new methods for estimating climate and meteorological parameters

13. Future Modifications and Plans

The data that were collected for the BOREAS project officially ended on 30-Nov-1996. There are a few sites, however, that were maintained for a longer period of time through non-BOREAS funding. These data are not available from the official BOREAS database, but information on how to obtain these supplemental data can be received by contacting the BOREAS staff.

14. Software

14.1 Software Description

Campbell Scientific data logger programs were developed for the various sites. Quality checking software was developed and used at the SRC office.

14.2 Software Access

A file containing the Campbell Scientific data logger programs for the various sites is available and included on the BOREAS CD-ROM. Contact SRC regarding the quality checking software that was developed and used at the SRC office.

15. Data Access

The surface meteorological and radiation 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. A report on analysis of the soil probe/soil moisture measurements is also available and is included on the BOREAS CD-ROM.

17. References

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17.2 Journal Articles and Study Reports

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17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List of Acronyms

AES - Atmospheric and Environmental Services
AFM - Aircraft Flux and Meteorology
AMS - Automatic Meteorological Station
ASCII - American Standard Code for Information Interchange
BOREAS - BOReal Ecosystem-Atmosphere Study
BORIS - BOREAS Information System
BPI - Byte per inch
CCRS - Canada Centre for Remote Sensing
CCT - Computer Compatible Tape
CD-ROM - Compact Disk-Read-Only Memory
DAAC - Distributed Active Archive Center
DAT - Digital Archive Tape
EOS - Earth Observing System
EOSDIS - EOS Data and Information System
FAX - Facsimile
FIFE - First ISLSCP Field Experiment
GIS - Geographic Information System
GMT - Greenwich Mean Time
GSFC - Goddard Space Flight Center
HTML - HyperText Markup Language
IFC - Intensive Field Campaign
IR - Infrared
ISLSCP - International Satellite Land Surface Climatology Project
MARSII - Meteorological Automatic Reporting System II
MESONET - Mesoscale Network
NAD27 - North American Datum of 1927
NAD83 - North American Datum of 1983
NASA - National Aeronautics and Space Administration
NSA - Northern Study Area
ORNL - Oak Ridge National Laboratory
PANP - Prince Albert National Park
PAR - Photosynthetically Active Radiation
READAC - Remote Environmental Automated Data Acquisition Concept
SRC - Saskatchewan Research Council
SSA - Southern Study Area
URL - Uniform Resource Locator
UTM - Universal Transverse Mercator

20. Document Information

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Science Review: 06-Mar-1998

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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 the diligent work of many people within Saskatchewan Research Council. Special thanks go to the observers for their assistance with this report.

If using data from the BOREAS CD-ROM series, also reference the data as:

Shewchuk S.R., "Atmospheric Sciences Infrastructure Core Measurements for BOREAS (AFM-07)." 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.

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The Saskatchewan Research Council (SRC) collected surface meteorological and radiation data from December 1993 until December 1996. The data set comprises Suite A (meteorological and energy balance measurements) and Suite B (diffuse solar and longwave measurements) components. Suite A measurements were taken at each of 10 sites, and Suite B measurements were made at 5 of the Suite A sites. The data cover an approximate area of 500 km (North-South) by 1,000 km (East-West) (a large portion of northern Manitoba and northern Saskatchewan). The measurement network was designed to provide researchers with a sufficient record of near-surface meteorological and radiation measurements. The data are provided in tabular ASCII files, and were collected by AFM-7.

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