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ll and Jaime Nickeson, Editors

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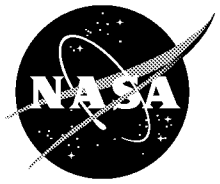

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Jaime Nickeson, Editors

Volume 48

BOREAS RSS-3 Imagery and Snapshots from a Helicopter-Mounted Video Camera

Charles L. Walthall, U.S.D.A. Agricultural Research Service, Beltsville, Maryland
Sara Loechel, University of Maryland

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

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BOREAS RSS-3 Imagery and Snapshots from a Helicopter-Mounted Video Camera

Charles L. Walthall, Sara Loechel

Summary

The BOREAS RSS-3 team collected helicopter-based video coverage of forested sites acquired during BOREAS as well as single-frame "snapshots" processed to still images. Helicopter data used in this analysis were collected during all three 1994 IFCs (24-May to 16-Jun, 19-Jul to 10-Aug, and 30-Aug to 19-Sep), at numerous tower and auxiliary sites in both the NSA and the SSA. The VHS-camera observations correspond to other coincident helicopter measurements. The field of view of the camera is unknown. The video tapes are in both VHS and Beta format. The still images are stored in JPEG format.

Note: An extensive helicopter log (in Acrobat format) is available for the 1994 IFC's. Environmental, technical, instrumental, and operational conditions are noted for each observation where applicable. It is strongly recommended that any researcher doing extended work with this data set review this helicopter log.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS RSS-03 Imagery and Snapshots from a Helicopter-Mounted Video Camera

1.2 Data Set Introduction

The Remote Sensing Science (RSS)-03 helicopter-based video data set was compiled during the BOReal Ecosystem-Atmosphere Study (BOREAS) 1994 Intensive Field Campaigns (IFCs) with a color VHS video camera mounted on a helicopter platform. Video imagery was taken from the helicopter platform at BOREAS sites simultaneous with radiometric ground measurements and

sunphotometer measurements from the same platform. The instrumentation used was designed and developed at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC). The data were collected during the green-up, peak, and senescent stages of the growing season at numerous tower and auxiliary sites in both the Northern Study Area (NSA) and the Southern Study Area (SSA). The images were taken during the following periods:

- 31-May-1994 to 10-Jun-1994 (IFC-1)
- 21-Jul-1994 to 08-Aug-1994 (IFC-2)
- 06-Sep-1994 to 16-Sep-1994 (IFC-3)

Multiple observations were captured from the video at sites where the cover changed significantly during the scan time; this was determined subjectively by the operator.

1.3 Objective/Purpose

The study objective was to acquire multispectral, bidirectional reflectance, and surface temperature data of the study sites for assessments of spectral, spatial, and temporal variability, and the impacts of these variabilities on vegetation indices. A helicopter with a pointable, stabilized mount was used to carry a spectrometer (visible and near-infrared), spectroradiometer, infrared thermometer, video camera, and a sun tracking photometer.

1.4 Summary of Parameters

Helicopter-based VHS video photographs of tower and auxiliary sites during all three IFCs in 1994. Video observations were captured while onboard devices were in operation over sites.

1.5 Discussion

The video imagery was taken to capture visual conditions at the site during data collection that could then later be referred to as necessary when processing the data to aid in the quality assessment of the data.

1.6 Related Data Sets

BOREAS RSS-01 PARABOLA Surface Reflectance and Transmittance Data
BOREAS RSS-02 Level-1b ASAS Imagery: At-sensor Radiance in BSQ Format
BOREAS RSS-03 Reflectance Measured from a Helicopter-Mounted SE-590
BOREAS RSS-03 Reflectance Measured from a Helicopter-Mounted Barnes MMR
BOREAS RSS-03 Atmospheric Conditions from a Helicopter-Mounted Sunphotometer
BOREAS RSS-19 Background Spectral Reflectance Data
BOREAS RSS-20 POLDER Measurements of Surface BRDF

2. Investigator(s)

2.1 Investigator(s) Name and Title

Dr. Charles L. Walthall, Physical Scientist

2.2 Title of Investigation

Biophysical Significance of Spectral Vegetation Indices in the Boreal Forest

2.3 Contact Information

Contact 1:
Dr. Charles L. Walthall
Physical Scientist
USDA Agricultural Research Service
Remote Sensing and Modeling Laboratory
Rm. 008, Bldg. 007, BARC-West
10300 Baltimore Avenue
Beltsville, MD 20705 USA
(301) 504-6074
(301) 504-5031 (fax)
cwalthal@asrr.arsusda.gov

Contact 2:
Sara Loechel
Faculty Research Assistant
Department of Geography
University of Maryland
Remote Sensing and Modeling Laboratory
Rm. 008, Bldg. 007, BARC-West
10300 Baltimore Avenue
Beltsville, MD 20705 USA
(301) 504-6823
(301) 504-5031 (fax)
sloechel@asrr.arsusda.gov

Contact 3:
Jaime Nickeson
Raytheon ITSS
NASA GSFC
Code 923
Greenbelt, MD 20771
(301) 286-3373
(301) 286-0239 (fax)
Jaime.Nickeson@gsfc.nasa.gov

3. Theory of Measurements

The video imagery was taken to capture visual conditions at the site during data collection that could then later be referred to as necessary when processing the data to aid in the quality assessment. Two video cameras are used in the system. One video camera is bore-sighted with the main instruments on the pointable platform, and the other is next to the 70 mm photographic camera set to view nadir only. Video data are fed through a time and date video generator to superimpose month, day, year, and system clock time on the video tape frames.

4. Equipment

4.1 Sensor/Instrument Description

Color Video System. The color video system consists of Charge-Coupled Device (CCD)-based color video cameras connected to a stereo-audio VCR. During IFC-1 and IFC-2, the VCR was a Beta format unit that had been used with the helicopter system since the mid-1980s. Beta format was originally chosen over VHS to take advantage of its higher video image resolution. Prior to IFC-3, an industrial-quality Super-VHS unit was installed and used for the rest of the experiment.

The image is then displayed on a 14-inch color screen in the center instrument rack. Images from the nadir-only viewing camera are fed directly to a small color screen located on the pilot's instrument panel and then to a selector switch. The selector switch allows the back-seat instrument operators to view either the images from the bore-sighted video camera or the pilot's video camera. The bore-sighted camera provides feedback to the instrument operator when pointing the instrument package, and the nadir camera image is used by the pilot while positioning the helicopter during hovers. During IFC-1, a video camera with an operator-controlled electronic zoom and focus system with a was used. During IFC-2 and IFC-3, this lens was replaced with the same type of lens used with the nadir-looking camera. These lenses had a manual focus and a 20 to 80 mm zoom range, which was set at 30 to 35 mm.

The stereo audio tracks of the VCR are used for an additional data record. One track is used to record an audible tone that is generated each time the instruments are triggered. The other audio track records the cabin intercom conversations among the aircrew.

4.1.1 Collection Environment

In general, the helicopter was flown during relatively clear days when possible. Data collection was attempted during conditions of highest possible solar elevation. All observations were attempted from a nadir observation point and usually at 300 m above ground level (AGL). Exceptions are noted in the helicopter log.

4.1.2 Source/Platform

A Bell UH-1H "Iroquois" helicopter, operated by the NASA's Wallops Flight Facility (WFF) was used as the airborne platform during BOREAS. This particular aircraft, call number N415, was built in 1965 and was acquired by WFF in 1993. Upon acquisition, the aircraft was slightly modified for use as a scientific platform.

Helicopter N415 operates with standard or low-mount, rear-leaning skids. The engine is a Lycoming T53/L13, which provides 1,400 shaft HP with 1,290 transmission HP. The fuel capacity provides 2.0 hours flying time with a 20 minute fuel reserve under normal modes of operation. The addition of an auxiliary fuel tank in the port-side door crewman's position provided an additional 15 minutes of flight time during BOREAS given optimum flight conditions. The weight of the entire helicopter system with full instrumentation, full fuel, and crew members was 9,500 lbs.

4.1.3 Source/Platform Mission Objectives

The video imagery was collected to capture site conditions at a fine spatial resolution during data collection that could then later be referred to as necessary when processing the data and to aid in the quality assessment of the data.

4.1.4 Key Variables

Video imagery.

4.1.5 Principles of Operation

The system is configured for multiple sensor data collection. The Modular Multiband Radiometer (MMR), Spectron Engineering spectroradiometer (SE-590), infrared thermometer, autotracking sunphotometer, and video sensor were the primary payload during BOREAS. The video camera was run continuously during data collection.

4.1.6 Sensor/Instrument Measurement Geometry
Unknown.

4.1.7 Manufacturer of Sensor/Instrument
Unknown.

4.2 Calibration
Images are not calibrated. However, the images provide an overhead view of the tower and auxiliary sites with fine spatial resolution.

4.2.1 Specifications

4.2.1.1 Tolerance
Not applicable.

4.2.2 Frequency of Calibration
Not applicable.

4.2.3 Other Calibration Information
Not applicable.

5. Data Acquisition Methods

The NASA GSFC/WFF helicopter-based optical remote sensing system was deployed to acquire canopy multispectral data while hovering approximately 300 meters AGL (Walthall et al., 1996). A VHS color video camera was in operation during all data collection flights. The field of view (FOV) of the lens is unknown. Images are not calibrated. However, the images provide an overhead view of the tower and auxiliary sites with fine spatial resolution. A visual record of conditions at the time of the spectral data collection can assist in analysis.

The video snapshots were generated on a Power Macintosh PC 8500/220 using a VHS video player and Avid VideoShop 3.0.2. The images were then converted from PICT format to JPEG for universal accessibility.

6. Observations

6.1 Data Notes
An extensive helicopter log is available. Environmental, technical, instrumental, and operator conditions are noted for each observation where applicable.

6.2 Field Notes
See helicopter log.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

The helicopter visited all of the NSA and SSA tower and category-1 auxiliary sites. Each site listed below was observed by this instrument at least once during the 1994 campaign at BOREAS. The coordinates in the table are based on the North American Datum of 1983 (NAD83).

Site Id	Operat'l Grid ID	Longitude	Latitude	UTM Easting	UTM Northing	UTM Zone
Flux Tower Sites						
SSA:						
SSA-FEN	F0L9T	104.61798° W	53.80206° N	525159.8	5961566.6	13
SSA-OBS	G8I4T	105.11779° W	53.98717° N	492276.5	5982100.5	13
SSA-OJP	G2L3T	104.69203° W	53.91634° N	520227.7	5974257.5	13
SSA-YJP	F8L6T	104.64529° W	53.87581° N	523320.2	5969762.5	13
SSA-9OA	C3B7T	106.19779° W	53.62889° N	420790.5	5942899.9	13
SSA-9YA	D0H4T	105.32314° W	53.65601° N	478644.1	5945298.9	13
NSA:						
NSA-OBS	T3R8T	98.48139° W	55.88007° N	532444.5	6192853.4	14
NSA-OJP	T7Q8T	98.62396° W	55.92842° N	523496.2	6198176.3	14
NSA-YJP	T8S9T	98.28706° W	55.89575° N	544583.9	6194706.9	14
NSA-BVP	T4U6T	98.02747° W	55.84225° N	560900.6	6188950.7	14
NSA-FEN	T7S1T	98.42072° W	55.91481° N	536207.9	6196749.6	14
Auxiliary Sites						
SSA:						
SSA-9BS	D0H6S	105.29534° W	53.64877° N	480508.7	5944263.4	13
SSA-9BS	G2I4S	105.13964° W	53.93021° N	490831.4	5975766.3	13
SSA-9BS	G2L7S	104.63785° W	53.90349° N	523793.6	5972844.3	13
SSA-9BS	G6K8S	104.75900° W	53.94446° N	515847.9	5977146.9	13
SSA-9BS	G9I4S	105.11805° W	53.99877° N	492291.2	5983169.1	13
SSA-9JP	F5I6P	105.11175° W	53.86608° N	492651.3	5968627.1	13
SSA-9JP	F7J0P	105.05115° W	53.88336° N	496667.0	5970323.3	13
SSA-9JP	F7J1P	105.03226° W	53.88211° N	497879.4	5970405.6	13
SSA-9JP	G1K9P	104.74812° W	53.90880° N	516546.7	5973404.5	13
SSA-9JP	G4K8P	104.76401° W	53.91883° N	515499.1	5974516.6	13
SSA-9JP	G7K8P	104.77148° W	53.95882° N	514994.2	5978963.8	13
SSA-9JP	G8L6P	104.63755° W	53.96558° N	523778.0	5979752.7	13
SSA-9JP	G9L0P	104.73779° W	53.97576° N	517197.7	5980856.0	13
SSA-9JP	I2I8P	105.05107° W	54.11181° N	496661.4	5995963.1	13
SSA-ASP	B9B7A	106.18693° W	53.59098° N	421469.8	5938447.2	13
SSA-ASP	D6H4A	105.31546° W	53.70828° N	479177.5	5951112.1	13
SSA-ASP	D6L9A	104.63880° W	53.66879° N	523864.0	5946733.2	13
SSA-ASP	D9G4A	105.46929° W	53.74019° N	469047.1	5954718.4	13
SSA-MIX	D9I1M	105.20643° W	53.72540° N	486379.7	5952989.7	13
SSA-MIX	F1N0M	104.53300° W	53.80594° N	530753.7	5962031.8	13
SSA-MIX	G4I3M	105.14246° W	53.93750° N	490677.3	5976354.9	13
SSA-CLR	FRSHCL	104.69194° W	53.91639° N	520205.2	5974269.4	13

Site Id	Operat'l Grid ID	Longitude	Latitude	UTM Easting	UTM Northing	UTM Zone
Auxiliary Sites						
NSA:						
NSA-9BS	S8W0S	97.84024° W	55.76824° N	572761.9	6180894.9	14
NSA-9BS	T0P7S	98.82345° W	55.88371° N	511043.9	6193151.1	14
NSA-9BS	T0P8S	98.80225° W	55.88351° N	512370.1	6193132.0	14
NSA-9BS	T0W1S	97.80937° W	55.78239° N	574671.7	6182502.0	14
NSA-9BS	T3U9S	97.98339° W	55.83083° N	563679.1	6187719.2	14
NSA-9BS	T4U8S	97.99325° W	55.83913° N	563048.2	6188633.4	14
NSA-9BS	T4U9S	97.98364° W	55.83455° N	563657.5	6188132.8	14
NSA-9BS	T5Q7S	98.64022° W	55.91610° N	522487.2	6196800.5	14
NSA-9BS	T6R5S	98.51865° W	55.90802° N	530092.0	6195947.0	14
NSA-9BS	T6T6S	98.18658° W	55.87968° N	550887.9	6192987.9	14
NSA-9BS	T7R9S	98.44877° W	55.91506° N	534454.5	6196763.6	14
NSA-9BS	T7T3S	98.22621° W	55.89358° N	548391.8	6194505.6	14
NSA-9BS	T8S4S	98.37111° W	55.91689° N	539306.4	6197008.6	14
NSA-9BS	U5W5S	97.70986° W	55.90610° N	580655.5	6196380.8	14
NSA-9BS	U6W5S	97.70281° W	55.91021° N	581087.8	6196846.5	14
NSA-9JP	99O9P	99.03952° W	55.88173° N	497527.8	6192917.5	14
NSA-9JP	Q3V3P	98.02473° W	55.55712° N	561517.9	6157222.2	14
NSA-9JP	T7S9P	98.30037° W	55.89486° N	543752.4	6194599.1	14
NSA-9JP	T8Q9P	98.61050° W	55.93219° N	524334.5	6198601.4	14
NSA-9JP	T8S9P	98.28385° W	55.90456° N	544774.3	6195688.9	14
NSA-9JP	T8T1P	98.26269° W	55.90539° N	546096.3	6195795.3	14
NSA-9JP	T9Q8P	98.59568° W	55.93737° N	525257.1	6199183.2	14
NSA-9OA	T2Q6A	98.67479° W	55.88691° N	520342.0	6193540.7	14
NSA-ASP	P7V1A	98.07478° W	55.50253° N	558442.1	6151103.7	14
NSA-ASP	Q3V2A	98.02635° W	55.56227° N	561407.9	6157793.5	14
NSA-ASP	R8V8A	97.89260° W	55.67779° N	569638.4	6170774.8	14
NSA-ASP	S9P3A	98.87621° W	55.88576° N	507743.3	6193371.6	14
NSA-ASP	T4U5A	98.04329° W	55.84757° N	559901.6	6189528.2	14
NSA-ASP	T8S4A	98.37041° W	55.91856° N	539348.3	6197194.6	14
NSA-ASP	V5X7A	97.48565° W	55.97396° N	594506.1	6204216.6	14
NSA-ASP	W0Y5A	97.33550° W	56.00339° N	603796.6	6207706.6	14
NSA-MIX	Q1V2M	98.03769° W	55.54568° N	560718.3	6155937.3	14
NSA-MIX	T0P5M	98.85662° W	55.88911° N	508967.7	6193747.3	14

7.1.2 Spatial Coverage Map

None given.

7.1.3 Spatial Resolution

The spatial resolution is somewhat variable based on the altitude of the helicopter and the height of the trees and ground cover.

7.1.4 Projection

None given.

7.1.5 Grid Description

Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

Observations were made during all three BOREAS 1994 IFCs, which occurred during the following periods:

IFC-1 24-May to 16-Jun
IFC-2 19-Jul to 10-Aug
IFC-3 30-Aug to 19-Sep

7.2.2 Temporal Coverage Map

Observations were made at several sites on the following dates:

Date	Study Area
31-May-94	SSA
1-Jun-94	SSA
4-Jun-94	SSA
6-Jun-94	SSA
7-Jun-94	SSA
8-Jun-94	NSA
10-Jun-94	NSA
21-Jul-94	NSA
22-Jul-94	SSA
23-Jul-94	SSA
24-Jul-94	SSA
25-Jul-94	SSA
28-Jul-94	SSA
4-Aug-94	NSA
8-Aug-94	NSA
6-Sep-94	NSA
8-Sep-94	NSA
9-Sep-94	NSA
13-Sep-94	NSA
15-Sep-94	SSA
16-Sep-94	SSA

In addition to the still images from each IFC, videotapes exist for the dates indicated below:

Video Tape Description
RSS-03,HELICOPTER VIDEO, GPS, IFC-1, OA AND YA, 25-MAY-94 AND 27-MAY-94
RSS-03,HELICOPTER VIDEO, GPS, IFC-1, OA AND YA, 25-MAY-94 AND 27-MAY-94
RSS-03,HELICOPTER VIDEO, HELO A & B, IFC-1, 31-MAY-94
RSS-03,HELICOPTER VIDEO, HELO, IFC-1, 01-JUN-94
RSS-03,HELICOPTER VIDEO HELO, IFC-1, 04-JUN-94
RSS-03,HELICOPTER VIDEO, HELO, IFC-1, 06-JUN-94
RSS-03,HELICOPTER VIDEO, HELO, IFC-1, NSA, 07-JUN-94
RSS-03,HELICOPTER VIDEO, HELO, IFC-1, NSA, 08-JUN-94
RSS-03,HELICOPTER VIDEO, HELO, OPTICAL 22-JUL-94
RSS-03,HELICOPTER VIDEO, HELO, 23-JUL-94
RSS-03,HELICOPTER VIDEO, HELO A, TRANSECT B, 24-JUL-94
RSS-03,HELICOPTER VIDEO HELO, 25-JUL-94

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RSS-03,HELICOPTER VIDEO HELO, B HELO, 25-JUL-94
RSS-03,HELICOPTER VIDEO, HELO, A & B 04-AUG-94
RSS-03,HELICOPTER VIDEO, C HELO, 04-AUG-94
RSS-03,HELICOPTER VIDEO, HELO A 08-AUG-94
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7.2.3 Temporal Resolution

Measurements were collected as conditions permitted during each IFC. Each site was visited as often as possible during each IFC, with priority given to tower flux sites and category 1 auxiliary sites. Helicopter flight time was limited to approximately 2 hours by fuel constraints. As many sites as possible were visited during each flight.

7.3 Data Characteristics

7.3.1 Parameter/Variable

Video tapes and still frame imagery. The parameters contained in the video tape inventory file on the CD-ROM are:

Column Name
MEDIA_ID
MEDIA_DESCR

7.3.2 Variable Description/Definition

The still frames were digitized from the video tape as representative views of the sites.The video tapes are Beta and VHS format containing the collected video imagery. The descriptions of the parameters contained in the video tape inventory file on the CD-ROM are:

Column Name	Description
MEDIA_ID	The BORIS identifier assigned to the data/ information containing media. The form of the MEDIA_ID varies with each data set.
MEDIA_DESCR	The description of the information holding media. An example would be: RSS-03 Helicopter video tapes. IFC-1 OA and YA 25-MAY-1994 and 27-MAY-1994 (VHS and BETA formats)

7.3.3 Unit of Measurement

There are no measurement units associated with the video tape or still frame imagery. The measurement units for the parameters contained in the video tape inventory file on the CD-ROM are:

Column Name	Units
MEDIA_ID	[none]
MEDIA_DESCR	[none]

7.3.4 Data Source

The images were gathered with a color, VHS video recorder. The source of the parameter values contained in the video tape inventory file on the CD-ROM are:

Column Name	Data Source
MEDIA_ID	[Assigned by BORIS]
MEDIA_DESCR	[Provided by RSS-03]

7.3.5 Data Range

The following table gives information about the parameter values found in the video tape inventory file on the CD-ROM.

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
MEDIA_ID	N/A	N/A	None	None	None	None
MEDIA_DESCR	N/A	N/A	None	None	None	None

Minimum Data Value -- The minimum value found in the column.
Maximum Data Value -- The maximum value found in the column.
Missng Data Value -- The value that indicates missing data. This is used to indicate that an attempt was made to determine the parameter value, but the attempt was unsuccessful.
Unrel Data Value -- The value that indicates unreliable data. This is used to indicate an attempt was made to determine the parameter value, but the value was deemed to be unreliable by the analysis personnel.
Below Detect Limit -- The value that indicates parameter values below the instruments detection limits. This is used to indicate that an attempt was made to determine the parameter value, but the analysis personnel determined that the parameter value was below the detection limit of the instrumentation.
Data Not Cllctd -- This value indicates that no attempt was made to determine the parameter value. This usually indicates that BORIS combined several similar but not identical data sets into the same data base table but this particular science team did not measure that parameter.

Blank -- Indicates that blank spaces are used to denote that type of value.
N/A -- Indicates that the value is not applicable to the respective column.
None -- Indicates that no values of that sort were found in the column.

7.4 Sample Data Record

The following are wrapped versions of data records from the video tape inventory file on the CD-ROM.

```
MEDIA_ID,MEDIA_DESCR
'VIDHEL001-0','RSS-03 Helicopter video tapes. 25-JUL-1994  (VHS and BETA
formats).'
'VIDHEL002-0','RSS-03 Helocopter video tapes. IFC-1 04-JUN-1994 (VHS and BETA
formats).'
```

8. Data Organization

8.1 Data Granularity

The smallest unit of information for the video tapes is one video tape. The smallest unit of data for the still images is a single image.

8.2 Data Format(s)

The video tapes are stored in Beta and/or VHS format. The still images are stored in JPEG image files that are named with the date when and site where the imagery was acquired.

The Compact Disk-Read-Only Memory (CD-ROM) file of video tape inventory information contains American Standard Code for Information Interchange (ASCII) numerical and character fields of varying length separated by commas. The character fields are enclosed with single apostrophe marks. There are no spaces between the fields.

Each data file on the CD-ROM has four header lines of Hyper-Text Markup Language (HTML) code at the top. When viewed with a Web browser, this code displays header information (data set title, location, date, acknowledgments, etc.) and a series of HTML links to associated data files and related data sets. Line 5 of each data file is a list of the column names, and line 6 and following lines contain the actual data.

9. Data Manipulations

9.1 Formulae

None given.

9.1.1 Derivation Techniques and Algorithms

None given.

9.2 Data Processing Sequence

None given.

9.2.1 Processing Steps

None given.

9.2.2 Processing Changes

None given.

9.3 Calculations

None given.

9.3.1 Special Corrections/Adjustments

None given.

9.3.2 Calculated Variables

None given.

9.4 Graphs and Plots

None given.

10. Errors

10.1 Sources of Error
None given.

10.2 Quality Assessment
Visual quality assessment during data collection. See reference list and helicopter logs. BOREAS Information System (BORIS) staff viewed some of the JPEG imagery to verify data format. Some of the video tape was viewed in the process of copying from Beta to VHS format.

10.2.1 Data Validation by Source
None given.

10.2.2 Confidence Level/Accuracy Judgment
None given.

10.2.3 Measurement Error for Parameters
None given.

10.2.4 Additional Quality Assessments
None given.

10.2.5 Data Verification by Data Center
See Section 10.2.

11. Notes

11.1 Limitations of the Data
None given.

11.2 Known Problems with the Data
None given.

11.3 Usage Guidance
The video imagery was taken to capture visual conditions at the site during data collection that can be referred to as necessary when using any of the helicopter data sets.

11.4 Other Relevant Information
None given.

12. Application of the Data Set

See Section 11.3.

13. Future Modifications and Plans

None.

14. Software

14.1 Software Description

Avid VideoShop 3.0.2

14.2 Software Access

The software described is publicly available.

15. Data Access

The RSS-03 imagery and snapshots 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

The video tapes are in both VHS and Beta format.

16.3 Other Products

The still imagery is provided as files in JPEG format. These data are available on the BOREAS CD-ROM series.

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

Walthall, C., D.L. Williams, B. Markham, J. Kalshoven, and R. Nelson. 1996. Development and present configuration of the NASA GSFC/WFF helicopter-based remote sensing system. International Geosciences and Remote Sensing Symposium (IGARSS) Spring 1996, Lincoln, Nebraska.

17.2 Journal Articles and Study Reports

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

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

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

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

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

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

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

17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List of Acronyms

```
A/D      - Analog-to-digital
AGL      - Above Ground Level
ASCII    - American Standard Code for Information Interchange
BOREAS   - BOReal Ecosystem-Atmosphere Study
BORIS    - BOREAS Information System
CCD      - Charge-Coupled Device
CD-ROM   - Compact Disk-Read-Only Memory
DAAC     - Distributed Active Archive Center
FOV      - Field of View
GIS      - Geographic Information System
GSFC     - Goddard Space Flight Center
HTML     - HyperText Markup Language
IFC      - Intensive Field Campaign
MMR      - Modular Multiband Radiometer
NAD83    - North American Datum of 1983
NASA     - National Aeronautics and Space Administration
NSA      - Northern Study Area
OA       - Old Aspen
OBS      - Old Black Spruce
OJP      - Old Jack Pine
ORNL     - Oak Ridge National Laboratory
PANP     - Prince Albert National Park
RSS      - Remote Sensing Science
SE-590   - Spectron Engineering spectroradiometer (SE590)
SSA      - Southern Study Area
TM       - Thematic Mapper
URL      - Uniform Resource Locator
UTM      - Universal Transverse Mercator
WFF      - Wallops Flight Facility
YA       - Young Aspen
YJP      - Young Jack Pine
```

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13. ABSTRACT *(Maximum 200 words)*

The BOREAS RSS-3 team collected helicopter-based video coverage of forested sites acquired during BOREAS as well as single-frame "snapshots" processed to still images. Helicopter data used in this analysis were collected during all three 1994 IFCs (24-May to 16-Jun, 19-Jul to 10-Aug, and 30-Aug to 19-Sep), at numerous tower and auxiliary sites in both the NSA and the SSA. The VHS-camera observations correspond to other coincident helicopter measurements. The field of view of the camera is unknown. The video tapes are in both VHS and Beta format. The still images are stored in JPEG format.

14. SUBJECT TERMS
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