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BOREAS HYD-8 DEM Data over the NSA-MSA and SSA-MSA in the AEAC Projection

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Available from:

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David Knapp, Xuewen Wang, L.E. Band

Summary

These data were derived from the original DEMs produced by the BOREAS HYD-8 team. The original DEMs were in the UTM projection, while this product is projected in the AEAC projection (see Section 7 for further projection details). The pixel size of the data is 100 meters, which is appropriate for the 1:50,000- scale contours from which the DEMs were made. The original data were compiled from information available in the 1970s and 1980s. This data set covers the two MSAs that are contained within the SSA and the NSA. The data are stored in binary, image format files.

Note that the binary files of this data set on the BOREAS CD-ROMs have been compressed using the Gzip program. See Section 8.2 for details.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification
BOREAS DEM Data over the NSA-MSA and SSA-MSA in the AEAC Projection

1.2 Data Set Introduction
These Digital Elevation Models (DEMs) were resampled into the BOReal Ecosystem-Atmosphere Study (BOREAS) grid projection from the original DEMs produced by the BOREAS Hydrology (HYD)-08 team. The original DEMs were in the Universal Transverse Mercator (UTM) projection. The pixel size of the data is 100 meters, which is appropriate for the 1:50,000-scale contours from which these DEMs were made.

1.3 Objective/Purpose

These data are provided as part of the BOREAS Staff Science Geographic Information System (GIS) Data Collection Program, which included the collection of pertinent map data in both hardcopy and digital form. This data set has been processed to provide raster files that can be used for modeling or for comparison purposes. The objective of these DEMs is to provide the BOREAS investigators with a data product that characterizes the topography of the Modeling Sub-Areas (MSAs) in the Albers Equal-Area Conic (AEAC) projection. The original DEMs were produced by HYD-08 in the UTM projection.

1.4 Summary of Parameters

Elevation above mean sea level

1.5 Discussion

These DEMs were resampled into the AEAC projection from the original DEMs produced by HYD-08. The original DEMs were in the UTM projection. The pixel size of the data is 100 meters, which is appropriate for the 1:50,000-scale contours from which the DEMs were made.

1.6 Related Data Sets

BOREAS Regional DEM in Raster Format and AEAC Projection
BOREAS HYD-08 DEM Data over the NSA-MSA and SSA-MSA in the UTM Projection

2. Investigator(s)

2.1 Investigator(s) Name and Title

Dr. L.E. Band

2.2 Title of Investigation

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

2.3 Contact Information

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3. Theory of Measurements

This data set was produced for modeling purposes. The DEMs can be used to determine the elevation of a given location and the drainage patterns in the MSAs, which are important for understanding the vegetative cover and hydrology of these areas.

4. Equipment

4.1 Sensor/Instrument Description
The equipment and other data-gathering methods used for compiling the original data are unknown.

4.1.1 Collection Environment
Unknown.

4.1.2 Source/Platform
Unknown.

4.1.3 Source/Platform Mission Objectives
Unknown.

4.1.4 Key Variables
Elevation above mean sea level

4.1.5 Principles of Operation
Unknown.

4.1.6 Sensor/Instrument Measurement Geometry
Unknown.

4.1.7 Manufacturer of Sensor/Instrument
Unknown.

4.2 Calibration
Unknown.

4.2.1 Specifications
Unknown.

4.2.1.1 Tolerance
Unknown.

4.2.2 Frequency of Calibration
Unknown.

4.2.3 Other Calibration Information
Unknown.

5. Data Acquisition Methods

The original data were acquired from the National Topographical Data Base and received by the HYD-08 team from the Canadian Centre for Remote Sensing (CCRS). The data came in Standard Interchange Format (SIF), digitized from 1:50,000 topographic maps. HYD-08 used these contours in the TOPOG software package to create gridded DEMs. BOREAS Staff Science received the DEMs from HYD-08 in the UTM projection and reprojected them in the AEAC projection.

6. Observations

6.1 Data Notes
None.

6.2 Field Notes
Not applicable.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

Northern Study Area (NSA):
The area covered by the data is approximately 54 km x 37 km. This area includes areas northwest of Thompson and south of Nelson House, Manitoba. The corner coordinates of the data set are:

	Longitude	Latitude	BOREAS X	BOREAS Y
Northwest	98.92610W	56.13748N	745.900	636.900
Northeast	97.97973W	56.04133N	805.700	636.900
Southwest	99.05263W	55.73102N	745.900	590.900
Southeast	98.11573W	55.63586N	805.700	590.900

Southern Study Area (SSA):
The image area that was modeled covers an area that is approximately 54 km x 44 km. This area includes areas just north and east of Candle Lake, Saskatchewan. The corners of the data set are as follows:

	Longitude	Latitude	BOREAS X	BOREAS Y
Northwest	105.22872W	54.13540N	376.400	364.500
Northeast	104.35586W	54.08517N	433.700	364.500
Southwest	105.29095W	53.69173N	376.400	314.900
Southeast	104.42667W	53.64642N	433.700	314.900

7.1.2 Spatial Coverage Map
See Section 7.1.1.

7.1.3 Spatial Resolution
These data were gridded to a cell size of 100 meters in both the X and Y directions.

7.1.4 Projection
The area mapped is projected in the ellipsoidal version of the AEAC projection. The projection has the following parameters:

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Datum: North American Datum of 1983 (NAD83)
Ellipsoid:  GRS80 or WGS84
Origin:    111.000° W 51.000° N
Standard Parallels:  52° 30' 00"N
                     58° 30' 00"N
Units of Measure:  km
```

7.1.5 Grid Description
See Section 7.1.3.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage
Most of the maps from which these contours were digitized were made in the 1970s or 1980s.

7.2.2 Temporal Coverage Map
Not available.

7.2.3 Temporal Resolution
These elevations represent the state of the terrain at a point in time. Most of the elevation data from which the DEMs were produced were collected in the 1970s or 1980s.

7.3 Data Characteristics

7.3.1 Parameter/Variable
Elevation above mean sea level
7.3.2 Variable Description/Definition
Elevation above mean sea level - The vertical distance between a plane at mean sea level and a parallel plane intersecting this point.

7.3.3 Unit of Measurement
Meters

7.3.4 Data Source
The HYD-08 team received the original data from the CCRS, which acquired it from the National Topographical Data Base.

7.3.5 Data Range
Not available at this revision.

7.4 Sample Data Record
Not applicable to image data.

8. Data Organization

8.1 Data Granularity
The smallest amount of data that can be obtained from this data set is the entire data set.

8.2 Data Format(s)

8.2.1 Uncompressed Data Files
The data set on tape consists of three files with the following descriptions:
- File 1: ASCII Header File listing the files that are on the tape. The file contains 9 records of 80 bytes each.
- File 2: DEM data file for the NSA. This is a binary file containing 1,196 bytes in each of 460 records. Each binary record is a line of the image file and contains 598 2-byte (16-bit) values stored as low-order byte first. Each binary value is the mean elevation above sea level of the location in meters.
- File 3: DEM data file for the SSA. This is a binary file containing 1,146 bytes in each of 496 records. Each binary record is a line of the image file and contains 573 2-byte (16-bit) values stored as low-order byte first. Each binary value is the mean elevation above sea level of the location in meters.

8.2.2 Compressed CD-ROM Files
On the BOREAS CD-ROMs, file 1 listed above is stored as ASCII text; however, files 2 and 3 have been compressed with the Gzip compression program (file name *.gz). These data have been compressed using gzip version 1.2.4 and the high compression (-9) option (Copyright (C) 1992-1993 Jean-loup Gailly). Gzip (GNU zip) uses the Lempel-Ziv algorithm (Welch, 1994) used in the zip and PKZIP programs. The compressed files may be uncompressed using gzip (-d option) or gunzip. Gzip is available from many Web sites (for example, ftp site prep.ai.mit.edu/pub/gnu/gzip-*.*) for a variety of operating systems in both executable and source code form. Versions of the decompression software for various systems are included on the CD-ROMs.

9. Data Manipulations

9.1 Formulae
These data were reprojected from UTM coordinates to the AEAC projection as defined within NAD83. The origin of the grid is at 111°W, 51°N with standard parallels set to 52.5°N and 58.5°N as prescribed in Snyder (1987).

9.1.1 Derivation Techniques and Algorithms
The original UTM data were placed in the AEAC projection using the nearest-neighbor resampling method.

9.2 Data Processing Sequence

9.2.1 Processing Steps
BOREAS Information System (BORIS) personnel processed the data by:
- Converting the corners of the original DEM to BOREAS grid coordinates
- Using the four corners of the image as ground control points
- Resampling the DEM into the BOREAS grid coordinate using a first order polynomial and or resampling
- Writing the reprojected data file to tape
- Copying the ASCII and compressing the binary files for release on CD-ROM

9.2.2 Processing Changes
None.

9.3 Calculations

9.3.1 Special Corrections/Adjustments
None.

9.3.2 Calculated Variables
None.

9.4 Graphs and Plots
None.

10. Errors

10.1 Sources of Error
Please see the documentation for the original DEM for information regarding error.

10.2 Quality Assessment
Please see the documentation for the original DEM for information regarding quality assessment.

10.2.1 Data Validation by Source
None.

10.2.2 Confidence Level/Accuracy Judgment
Not available.

10.2.3 Measurement Error for Parameters
Not available.

10.2.4 Additional Quality Assessments
Not applicable.

10.2.5 Data Verification by Data Center
BORIS staff visually reviewed the images to see that they did appear to represent a DEM data layer without any obvious anomalies. The only quantitative assessment made was to see that the minimum and maximum elevation values in the raster files approximated those shown on topographic maps of the area.

11. Notes

11.1 Limitations of the Data
There are elevational variations within the lakes, especially large lakes, because there are no contours in the lakes that can cause a stair step effect in the lakes.

Because these DEMs were reprojected from the original DEMs, there may be minor differences in the relationship between neighboring pixels that can result in significant differences if the DEM is used to determine drainage patterns. If your application of these DEMs is sensitive to this problem, it is suggested that the original DEMs (in the UTM projection) be used.

11.2 Known Problems with the Data
See Section 11.1.

11.3 Usage Guidance
Before uncompressing the Gzip files on CD-ROM, be sure that you have enough disk space to hold the uncompressed data files. Then use the appropriate decompression program provided on the CD-ROM for your specific system.

11.4 Other Relevant Information
None.

12. Application of the Data Set

These data can be used as a reference for the elevation trnsds over the NSA. Also, see Section 11.1.

13. Future Modifications and Plans

None.

14. Software

14.1 Software Description
The data manipulation capabilities in the EASI/PACE software package (Version 5.2) were used to reproject/grid the data. However, almost any image processing package could have been used to resample this imagery.

Gzip (GNU zip) uses the Lempel-Ziv algorithm (Welch, 1994) used in the zip and PKZIP commands.

14.2 Software Access
EASI/PACE is a proprietary software package developed by PCI, Inc. Contact PCI for details.

PCI, Inc.
50 West Wilmot St.
Richmond Hill
Ontario, Canada L4B 1M5
(905) 764-0614
(905) 764-9604 (fax)

Gzip is available from many Web sites across the Internet (for example, ftp site prep.ai.mit.edu/pub/gnu/gzip-*.*) for a variety of operating systems in both executable and source code form. Versions of the decompression software for various systems are included on the CD-ROMs.

15. Data Access

The DEM data over the NSA-MSA and SSA-MSA in the AEAC projection 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
The DEM data can be made available on 8-mm, Digital Archive Tape (DAT), or 9-track tapes at 1600 or 6250 Bytes Per Inch (BPI).

16.2 Film Products
None.

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

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation
Snyder, J.P. 1987. Map Projections - A Working Manual. USGS Professional Paper 1395.

Topog User Guide (Version 5.0). 1994. Division of Water Resources, CSIRO. Canberra, Australia.

Welch, T.A. 1984. A Technique for High Performance Data Compression. IEEE Computer, Vol. 17, No. 6, pp. 8-19.

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

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AEAC      - Albers Equal-Area Conic
ASCII     - American Standard Code for Information Interchange
BOREAS    - Boreal Ecosystem-Atmosphere Study
BORIS     - BOREAS Information System
BPI       - Bytes Per Inch
CD-ROM    - Compact Disk-Read-Only-Memory
DAAC      - Distributed Active Archive Center
DAT       - Digital Archive Tape
DEM       - Digital Elevation Model
EOS       - Earth Observing System
EOSDIS    - EOS Data and Information System
GIS       - Geographic Information System
GMT       - Greenwich Mean Time
GSFC      - Goddard Space Flight Center
MSA       - Modeling Sub-Area
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
SIF       - Standard Interchange Format
SSA       - Southern Study Area
URL       - Uniform Resource Locator
UTM       - Universal Transverse Mercator
WWW       - World Wide Web
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20. Document Information

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   The NSA and SSA DEM product was processed by BORIS personnel from the original data supplied by Dr. Larry Band. The contributions of Dr. Band and BORIS staff in completing this data set are greatly appreciated.

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

Wang, X., L.E. Band and D. Knapp ,"BOREAS Staff Science GIS Data Collection Program." in Collected Data of The Boreal Ecosystem-Atmosphere Study. Eds. J. Newcomer, D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A.Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers. CD-ROM. NASA, 2000.

Also, cite the BOREAS CD-ROM set as:

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

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20.6 Document URL

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13. ABSTRACT *(Maximum 200 words)*

These data were derived from the original DEMs produced by the BOREAS HYD-8 team. The original DEMs were in the UTM projection, while this product is projected in the AEAC projection (see Section 7 for further projection details). The pixel size of the data is 100 meters, which is appropriate for the 1:50,000- scale contours from which the DEMs were made. The original data were compiled from information available in the 1970s and 1980s. This data set covers the two MSAs that are contained within the SSA and the NSA. The data are stored in binary, image format files.

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