SnowEx23 Apr23 AVIRIS-NG Surface Spectral Reflectance, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Fitts, A. E., A.W. Nolin, K.E. Gleason, A.J. Suruni, N. Bohn, J. Chapman, D. Thompson, and C. Vuyovich. 2024. *SnowEx23 Apr23 AVIRIS-NG Surface Spectral Reflectance, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/UARNOKDZUSNO. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX23_Apr23_AVIRISNG

National Snow and Ice Data Center

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TABLE OF CONTENTS

1 DATA DESCRIPTION

1.1 Summary

This data set provides apparent surface spectral reflectance imagery which demonstrates snow albedo and snow optical properties during the NASA SnowEx 2023 Alaska field campaign between 7 April 2023 and 5 May 2023. Imagery was collected across several snow-covered boreal forest environments near Fairbanks, Alaska, including: Farmers Loop Creamers Field (FLCF), Caribou Poker Creek Research Watershed (CPCRW), and Delta Junction (DEJU).

1.2 File Information

1.2.1 Format

The data are available as in BIL format (.bil; band interleaved by line). Each image file has a corresponding header metadata file (.hdr) in ASCII format.

Note: After downloading, both the BIL file (.bil) and the header file (.hdr) must be stored in the same directory in order to use the data with certain tools.

1.2.2 File Contents

The .bil files present each flight line as an orthocorrected, georeferenced spectral data cube, where each pixel contains a stack of unitless spectral reflectance values. This data structure is accommodated by formatting the data as band interleaved by pixel files. For each .bil file, there is a corresponding .hdr header file that contains spatial information, wavelength data, and additional metadata. For each flight line, both the .img file and the .hdr file are required to view and process the spectral data.

1.2.3 Naming Convention

This section explains the file naming conventions with examples. The data are named according to the following convention and as described in Table 1.

```
SNEX23_Apr23_AVIRISNG_ang[20230505]t[230059]_[site]_rfl_v[nn.n].[ext]
```

Table 1. File Naming Convention

Variable	Description
SNEX23_Apr23_AVIRISNG	SnowEx 2023 AVIRIS-NG surface spectral reflectance data
[YYYYMMDD]	Airborne survey start dates: 4-digit year, 2-digit month, 2-digit day
[HHNNSS]	Airborne survey acquisition start time, 2-digit hour, 2-digit minute, 2-digit second
rfl	Indicates data is orthocorrected, scaled reflectance
[site]	Four-digit site code: Caribou Poker Creek Research Watershed (CPCW), Farmers Loop Creamers Field (FLCF), and Delta Junction (DEJU); or two-digit No Applicable Site code (NA)
v<nn.n>	Indicates version number of the data set
.ext	File extension (.bil or .hdr)

1.3 Spatial Information

1.3.1 Coverage

Data were collected from study sites near Fairbanks, Alaska. Three of the study sites are named: Caribou Poker Creek Research Watershed (CPCW), Farmers Loop Creamers Field (FLCF), and Delta Junction (DEJU), which are represented by the three bounding boxes identified in Table 2. Six data granules with the site code "NA" were collected from areas not with the bounds of the three formal study sites. A separate bounding box representing these files is listed below.

Table 2. File Naming Convention

Spatial Extent	CPCW	DEJU	FLCF	NA
Northernmost Latitude	65.283325°	63.923672°	64.915781°	63.958389°
Southernmost Latitude	65.095611°	63.849275°	64.839828°	65.217951°
Westernmost Longitude	147.452956°	145.740261°	147.657586°	145.402168°
Easternmost Longitude	147.6783°	145.794581°	147.764758°	147.538696°

1.3.2 Resolution

The horizontal spatial resolution varies between 4.3 to 4.9 meters depending on flight line.

1.3.3 Geolocation

Table 3 provides information for geolocating this data set.

Table 3. Geolocation Details

Geographic coordinate system	WSG 84
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs +type=crs
Reference	https://epsg.org/crs_4326/WGS-84.html

1.4 Temporal Information

1.4.1 Coverage

Data were acquired between 07 April 2023 and 05 May 2023.

1.4.2 Resolution

Data was collected opportunistically within the month-long campaign when weather conditions were favorable.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The apparent surface spectral reflectance data described here include georeferenced, orthocorrected and overlapping flight lines which can be used to understand the optical properties of snow and snow albedo. These data were collected in April and May 2023 as part of the NASA SnowEx 2023 Alaska field campaign.

2.2 Acquisition

Spectral imaging was collected using the NASA Airborne Visible InfraRed Imaging Spectrometer – Next Generation (AVIRIS-NG) mounted aboard a Beechcraft King Air B-200 aircraft. The AVIRIS-NG instrument collects high signal-to-noise spectroscopic measurements in the solar reflected spectral range. It is capable of measuring reflected radiance at 5 nm intervals in the Visible/Short-Wave Infrared (VSWIR) spectral range of 380–2500 nm. Detailed instrument specifications are available from NASA/JPL.

Data was collected throughout the month-long SnowEx April 2023 campaign during periods of favorable weather conditions.

2.3 Processing

The raw spectrometer data were processed in conjunction with corresponding navigation data to produce the apparent surface reflectance data products available in this data set. A flow diagram showing intermediate processing steps is available from NASA/JPL.

2.4 Quality, Errors, and Limitations

2.4.1 Atmospheric Corrections

The presence of gases and aerosols in the atmosphere can interfere with the optimal estimation of surface reflectance values. Atmospheric corrections were applied to the AVIRIS-NG measurements following the probabilistic model inversion method outlined in Thompson et al. (2018).

2.4.2 Illumination Conditions

Illuminations conditions, such as clouds, low sun angle, shadows, surface roughness, topographic variability and mixed pixels, affect accuracy of snow reflectance measurements. To minimize effects of varying solar zenith angle, all measurements were taken within two hours of solar noon. Ground and airborne measurements were only collected and analyzed if clear sky conditions existed. However, in some cases there were high thin cirrus clouds present, but not blocking the solar beam. Subvisual cirrus clouds might have been present but without measurements of atmospheric spectral transmittance, it is not possible to characterize and remove such effects.

3 VERSION HISTORY

Table 4. Version History

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
v01.0	February 2025	07 April 2023 to 05 May 2023	Initial release

4 RELATED DATA SETS

SnowEx at NSIDC | Data Sets

5 RELATED WEBSITES

SnowEx at NSIDC | Overview

Snow Ex at NASA

6 REFERENCES

Thompson, D. R., V. Natraj, R. O. Green, M. C. Helmlinger, B. Gao, M. L. Eastwood. 2018. Optimal estimation for imaging spectrometer atmospheric correction. *Remote Sensing of Environment* 216, doi:10.1016/j.rse.2018.07.003

7 DOCUMENT INFORMATION

7.1 Publication Date

February 2025

7.2 Date Last Updated

February 2025