SnowEx21 Senator Beck Basin and Grand Mesa, CO 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:

Skiles, M. and C. Vuyovich. 2023. *SnowEx21 Senator Beck Basin and Grand Mesa, CO 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/ZAI3M64WWN5V. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX21_SSR

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

This data set provides apparent surface spectral reflectance imagery which demonstrates snow albedo and snow optical property evolution across two distinct snow-covered environments in Colorado: Senator Beck Basin and Grand Mesa. The data are a time series across varying snow conditions, collected as part of the NASA SnowEx mission.

1.2 File Information

1.2.1 Format

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

Note: After downloading, both the image file (.img) 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 .img 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 .img 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.

`SNEX21_SSR_ang[YYYYMMDD]t[HHNNSS]_[site]_rfl_[VVV]`

Table 1. File Naming Convention

Variable	Description
SNEX21_SSR	Short name for SnowEx2021 surface spectral reflectance data

Variable	Description
[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]	Two-digit site code: GM (Grand Mesa), SB (Senator Beck Basin).
[VVV]	Processing version marker

1.3 Spatial Information

1.3.1 Coverage

Data were collected from two study sites: Senator Beck Basin in southwest Colorado and Grand Mesa in west central Colorado. Both sites are within the geographical bounds described below and are shown as blue rectangles in Figure 1:

Northernmost Latitude: 40.0°
Southernmost Latitude: 37.0°
Westernmost Latitude: -109.0°
Easternmost Latitude: -107.0°

1.3.2 Resolution

The horizontal spatial resolution is 4 meters.

1.3.3 Geolocation

Table 2 provides information for geolocating this data set.

Table 2. Geolocation Details

Geographic coordinate system	WGS 84	WGS 84
Projected coordinate system	WGS 84 / UTM zone 12N	WGS 84 / UTM zone 13N
Longitude of true origin	-111	-105
Latitude of true origin	0	0

Scale factor at longitude of true origin	0.9996	0.9996
Datum	WGS 1984	WGS 1984
Ellipsoid/spheroid	WGS 84	WGS 84
Units	Meter	Meter
False easting	500000	500000
False northing	0	0
EPSG code	32612	32613
PROJ4 string	+proj=utm +zone=12 +datum=WGS84 +units=m +no_defs +type=crs	+proj=utm +zone=13 +datum=WGS84 +units=m +no_defs +type=crs
Reference	https://epsg.io/32612	https://epsg.io/32613

1.4 Temporal Information

1.4.1 Coverage

Data were acquired between 19 March 2021 and 29 April 2021.

1.4.2 Resolution

Flights were conducted on three days in the spring of 2021: 19 March, 11 April, and 29 April. For each data set, four overlapping flight lines were collected from each study area for a total of 24 flight lines.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The apparent surface spectral reflectance data described here include 8 georeferenced, orthocorrected and overlapping flight lines. These data can be used to understand the optical properties of snow and snow albedo. Data were collected from two regions of Colorado: Senator Beck Basin and Grand Mesa, during March and April 2021. The two regions (shown as blue boxes in Figure 1 below) were chosen in order to compare spectral reflectance between distinct terrestrial environments across a time series of varying snow conditions. Senator Beck Basin is a high elevation alpine basin in the San Juan mountains in southwest Colorado. The basin features complex topography and minimal vegetation due to its location above tree line. Grand Mesa is a flat-topped mountain located in west central Colorado. The northwest portion of Grand Mesa

selected for this work is relatively flat and well-forested. The three dates selected for data collection exhibited changing snow conditions through time: 1) cold, clean snow (19 March), 2) warming, clean snow (11 April), and 3) melting, dirty snow (29 April).

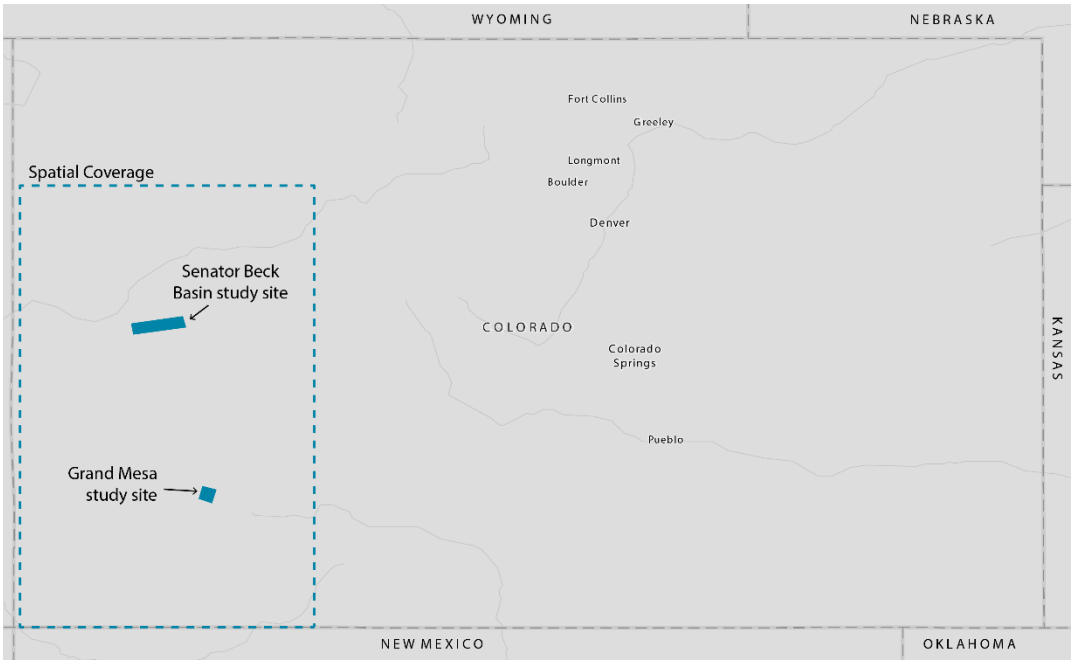

Figure 1. Location of the two study sites: Senator Beck Basin and Grand Mesa. The region defined by the dashed box represents the geographic bounds described in Section 1.3.1.

2.2 Acquisition

Spectral imaging was collected using an Airborne Visible InfraRed Imaging Spectrometer – Next Generation (AVIRIS-NG) mounted aboard a Beechcraft King Air B-200 aircraft. The aircraft was flown at ~25,000 feet above sea level, and data collection typically occurred during cloud-free periods within two hours of solar noon.

2.3 Instrumentation

2.3.1 Description

The AVIRIS-NG instrument is an airborne imaging spectrometer that 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.

2.4 Processing

The raw flight science data collected using the AVIRIS-NG instrument are processed in conjunction with corresponding navigation data to produce the Level 2 apparent surface reflectance data products available in this data set. A flow diagram showing intermediate processing steps is available from NASA/JPL.

2.5 Quality, Errors, and Limitations

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).

3 SOFTWARE AND TOOLS

Additional information about AVIRIS-NG hyperspectral data use and structure can be found in the SnowEx Hackweek 2022 Jupyter notebook, available here.

4 VERSION HISTORY

Table 3. Version History Summary

Version	Release Date	Description of Changes
1	January 2023	Initial release

5 RELATED DATA SETS

SnowEx at NSIDC | Data Sets

6 RELATED WEBSITES

SnowEx at NSIDC | Overview

Snow Ex at NASA

7 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

8 DOCUMENT INFORMATION

8.1 Publication Date

February 2023

8.2 Date Last Updated

February 2023