SnowEx23 Mar23 Mobile Tower-Based Dual-Pol C-Band, Version 1

USER GUIDE

How to Cite These Data

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

Brangers, I., G.J.M. De Lannoy, H.P. Marshall, D. Dunmire, R. Bonnell, B. Cox, J. Cappelle, B.W. Baxter, H. Lievens. 2024. *SnowEx23 Mar23 Mobile Tower-Based Dual-Pol C-Band, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/9BTGU6GJXTQT. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX23_CBand

National Snow and Ice Data Center

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TABLE OF CONTENTS

1 DATA DESCRIPTION

1.1 Summary

This data set contains C-band radar data collected during the NASA SnowEx 2023 Alaska field campaign between 08 March 2023 to 15 March 2023. Data was acquired from two study areas near Fairbanks, Alaska using a multi-polarization radar affixed to sled-mounted tower. The study sites (Caribou Poker Creek watershed and Farmer's Loop/Creamer's Field) are boreal forest and wetland environments. Data was also collected from a school adjacent to Farmer's Loop, to record data from man-made surfaces (i.e., concrete and cultivated grass.)

1.2 Parameters

The data set presents eight parameters, described in Table 1 below.

Table 1. Data Parameters and Descriptions

Parameter	Description
Co	Co-polarized radar data (either HH or VV0) measured in volts. Row number increases with distance from the radar and each column contains a measurement profile along a transect.
Cross	Cross-polarized radar data (either HH or VV0) measured in volts. Row number increases with distance from the radar and each column contains a measurement profile along a transect.
Empty_Co	Background radar data collected on a co-polarized channel not connected to an antenna (measured in volts); can be used for correcting background fluctuations in the radar signal.
Empty_Cross	Background radar data collected on a cross-polarized channel not connected to an antenna (measured in volts); can be used for correcting background fluctuations in the radar signal.
FS	Sampling frequency measured in Hertz determines the resolution along the time-domain profile. The sampling frequency varies slightly in time with environmental factors like temperature.
GPS	Location data for each radar measurement, organized by timestamp and transect ID. Data from 08 March to 14 March represent *in situ* GPS measurements taken during radar data collection. No *in situ* GPS measured were collected on 15 March; data with a 15 March timestamp represent estimated locations of each radar measurement.
Setups	Transect IDs and radar setup information, formatted as ID_setup. Ex: Lake_H45 represents the lake transect with the radar transmitting in H pol at an incidence angle of 45º.

Parameter	Description
Timestamps	Time each measurement was taken, formatted as yymmdd_HH_MM.

1.3 File Information

1.3.1 Format

Data are provided in comma-separated value (.csv) files.

1.3.2 File Contents

Data are organized in one multifile granule, which contains eight data files. Each file represents a single data parameter, as described in Table 1 above. The files are formatted such that data in each file are arranged in correlated matrices; i.e a specified row of data in one file correlates to the same row of data across all files, and is therefore representative of the same radar measurement.

1.3.3 Naming Convention

Individual parameter files are named as shown below, where `SNEX23_CBAND` refers to SnowEx 2023 C-Band, `<param>` represents one of the eight parameters identified in Table 1 above, `20230308_20230315` represents the date range of the file, and `v01.1` represents the data set version.

```
SNEX23_CBAND_<param>_20230308_20230315_v01.0.csv
```

1.4 Spatial Information

1.4.1 Coverage

Northernmost Latitude: 65.16º N
Southernmost Latitude: 64.85º N
Easternmost Longitude: 147.48° W
Westernmost Longitude: 149.75° W

1.4.2 Resolution

Instrument measurements were collected approximately 10-20 cm along each ~10 meter transect

1.4.3 Geolocation

Table 2. Geolocation Details

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

1.5 Temporal Information

1.5.1 Coverage

08 March 2023 to 15 March 2023

1.5.2 Resolution

NA

2 DATA ACQUISITION AND PROCESSING

2.1 Background

As part of the NASA SnowEx 2023 Alaska field campaign, a C-band radar system was deployed to collect side-looking time-domain backscatter profiles. Data were collected along seven transects, which were selected to represent variations in vegetation and ground conditions in a boreal forest environment. Descriptions of each transect can be found in Table 3 below.

Table 3. Transect Descriptions

Transect ID	Vegetation	Ground Conditions	Site	Closest Snow Pit
Pit032	Grass, bare	Saturated, smooth	FLCF	WB032
Pit281	Moss, shrubs, grass, trees	Rough	CPCW	WN281
Pit056a	Grass (cultivated)	Smooth	FLCF	CB056
Pit056b	Grass (cultivated)	Smooth	FLCF	CB056
school-g	Grass (cultivated)	Smooth	School	CB056
school-c	Concrete	Smooth	School	CB056
CPmet	Moss, shrubs	Rough	CPCW	-
Lake	Bare ice	-	FLCF	-

2.2 Acquisition

Data was collected using a pulsed radar system designed to mimic the center-frequency and incidence angle of the radar mounted on the Copernicus Sentinel-1 satellite. The radar was affixed to a tower at ~2.6 m above the ground surface. The tower was attached to a sled (see Figure 1 below), and manually towed over the study areas. The radar had a center frequency of 5.4 GHz, with a 2.4 GHz bandwidth and incidence angle options of either of 30º or 45º. It was capable of simultaneously measuring VV and VH polarization or HH and HV polarization. Backscatter profiles of snow or soil were measured at spacings of 10-20 cm over each ~10 meter transect.

Transects Pit056a and Pit056b represent the same transect, measured on different days. Pit056a was collected over untouched snowpack. Pit056b was collected along the same transect over untouched snowpack. The transect was then extended to include an area where the snowpack had been removed.

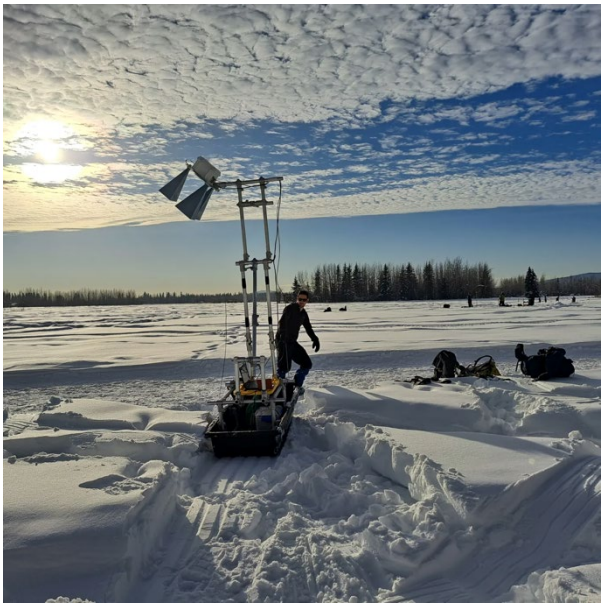

Figure 1. Sled-mounted tower-based radar system being towed along a transect.

2.3 Processing

This data set represents unprocessed radar data. Matlab scripts which can be used to view and process these data can be found in the data repository that accompanies Brangers et al., 2024.

2.4 Quality, Errors, and Limitations

Measured backscatter values vary significantly between sample areas, due to differences in substrate conditions (i.e., snow depth, vegetation, or soil characteristics). Provided empty-cross and empty-co polarization data can be used to correct background fluctuations in data.

3 VERSION HISTORY

Table 4. Version History

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
v01.1	December 2024	08 March 2023 to 15 March 2023	Initial release

4 RELATED DATA SETS

SnowEx23 Mar23 IOP Snow Depth Measurements, Version 1

5 RELATED WEBSITES

SnowEx at NSIDC | Overview
SnowEx at NASA

6 REFERENCES

Brangers, I., Marshall, H.-P., De Lannoy, G., Dunmire, D., Mätzler, C., and Lievens, H.: Tower-based C-band radar measurements of an alpine snowpack, The Cryosphere, 18, 3177–3193, https://doi.org/10.5194/tc-18-3177-2024, 2024.

7 DOCUMENT INFORMATION

7.1 Publication Date

December 2024

7.2 Date Last Updated

December 2024