SnowEx23 University of Wyoming Ground Penetrating Radar, Version 1

USER GUIDE

How to Cite These Data

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

Webb, R. 2024. *SnowEx23 University of Wyoming Ground Penetrating Radar, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/H3D9IT1W6JT6. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/snex23_uw_gpr

National Snow and Ice Data Center

TABLE OF CONTENTS

1 DATA DESCRIPTION

1.1 Parameters

This data set contains the results of 1 GHz ground-penetrating radar surveys conducted at the Arctic Coastal Plain (ACP) site and the Upper Kuparuk/Toolik (UKT) site in northern Alaska during the SnowEx23 field campaign. Data include two-way travel time, derived snow depth, and derived snow water equivalent.

1.2 File Information

1.2.1 Format

All data is collected in two comma-separated value (.csv) files.

1.2.2 File Contents

Each .csv file contains 12 columns with the parameters listed in Table 1.

Table 1. Data Parameters

Name	Description	Unit/Format
Date_mddyyyy	Date using five digits representing month, day and year	mddyyyy
Time_HHMM	Time (Note: all values are recorded as NA)	[HHMM]
Longitude_DD	Longitude	degree
Latitude_DD	Latitude	degree
Elevation_masl	Elevation (meters above sea level)	m
Northing	Easting	m
Easting	Northing	m
UTM_Zone	Universal Transverse Mercator zone	N/A
TWT_ns	Two-way travel time	ns
SnowDepth_cm	Snow depth	cm
SWE_mm	Snow water equivalent	mm
comments	Snow pit ID (i.e., N659) and sampling method (spiral or trench)	N/A

1.2.3 Naming Convention

The data files are named `SNEX23_UW_GPR_ACP_20230311_20230314_V01.0.csv` and `SNEX23_UW_GPR_UKT_20230308_20230310_V01.0.csv`. `SNEX23` refers to the SnowEx 2023 Field Campaign. `UW` refers to University of Wyoming, the home institution of the data set author. `GPR` refers to ground penetrating radar. `ACP` and `UTK` refer to the Arctic Coastal Plain and Upper Kuparuk/Toolik field sites, respectively. The numbers are formatted as `YYYMMDD` and represent the start and end dates of the temporal coverage

1.3 Spatial Information

1.3.1 Coverage

These data are provided in two different sites, as defined by the bounding boxes in Table 2 below.

Table 2. Spatial Coverage

Spatial Extent	Arctic Coastal Plain	Upper Kuparuk/Toolik
Northernmost Latitude	70.0846 N	68.63965 º N
Southernmost Latitude	70.0036 º N	68.58784 º N
Easternmost Longitude	148.61304 ° W	149.34396 ° W
Westernmost Longitude	148.77094 ° W	149.54981 ° W

1.3.2 Resolution

Point measurements.

1.3.3 Geolocation

The following table provide information for geolocating this data set.

Table 3. Geolocation Details

Geographic coordinate system	WGS 84
Projected coordinate system	UTM zone 6N
Longitude of true origin	-147
Latitude of true origin	0
Scale factor at longitude of true origin	0.9996
Datum	WGS 84
Ellipsoid/spheroid	WGS 84
Units	meters
False easting	500000

False northing	0
EPSG code	32606
PROJ4 string	+proj=utm +zone=6 +datum=WGS84 +units=m +no_defs +type=crs
Reference	https://epsg.io/32606

1.4 Temporal Information

1.4.1 Coverage

8 March 2023 to 10 March 2023 (UKT) and 11 March 2023 to 14 March 2023 (ACP)

1.4.2 Resolution

Varies

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This dataset contains the results of a ground penetrating radar (GPR) survey conducted at the two field sites in Alaska during the SnowEx23 campaign – Arctic Coastal Plain (ACP) and Upper Kuparuk/Toolik (UKT). The main parameters are two-way travel time, snow depth, and snow water equivalent (SWE). Snow depth and SWE are derived from two-way travel times.

2.2 Acquisition

Ground-penetrating radar (GPR) surveys were conducted using a Sensors and Software PulseEKKO PRO radar system and a shielded 1000 MHz antenna. The control unit and antenna were pulled in a plastic sled behind the operators along two configurations: a 5 m trench adjacent to each pit site and a spiral path centered around each snow pit.

2.3 Processing

Raw data files were processed using Matlab and ReflexW software. The traces had a sample rate of 0.1 ns. The base of the snowpack was manually picked following a consistent positive phase at the snow-ground interface.

Measured two-way travel times were converted to snow depth and snow water equivalent using pit-measured snow densities and an empirically derived radar velocity (Kovacs et al., 1995). Snow density was measured in two pits at different locations within the study area for each survey date. The snow density/velocity from the nearest pit was applied to the corresponding radar measurements.

2.4 Quality, Errors, and Limitations

During time periods when liquid water may have been present in the snowpack the Kovacs et al. (1995) equation used to calculate snow depths from two-way travel times may introduce greater uncertainty in the resulting snow depth and SWE values.

2.5 Instrumentation

Description Data were collected using a Sensors & Software pulseEKKO PRO ground penetrating radar (GPR) system and a 1 GHz antenna.

3 VERSION HISTORY

Table 4. Version History Summary

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
v01.0	April 2024	8 March 2023 to 14 March 2023	Initial early data release at Basic Level of Service
v01.0	August 2024	8 March 2023 to 14 March 2023	Update to Standard Level of Service

4 RELATED DATA SETS

SnowEx at NSIDC | Data Sets

5 RELATED WEBSITES

SnowEx at NSIDC | Overview

SnowEx at NASA

6 REFERENCES

Kovacs, A., A. J. Gow & R. M. Morey. (1995). The in-situ dielectric constant of polar firn revisited. Cold Regions Science and Technology, 23(2), 245-256, https://doi.org/10.1016/0165-232X(94)00016-Q.

7 DOCUMENT INFORMATION

7.1 Publication Date

August 2024

7.2 Date Last Updated

August 2024