SnowEx23 GIS References and Field Maps, Version 1 Technical Reference

1 DATA DESCRIPTION

1.1 Summary

This dataset contains geolocation information for ground-based and airborne measurements collected in Alaska, USA as part of the NASA SnowEx 2023 campaign (Vuyovich et al., 2024). The purpose of this compilation is to facilitate the use of SnowEx 2023 Alaska data by providing Geographical Information System (GIS) files in one location.

1.2 Parameters

The dataset compiles geolocation data for ground-based snow pit measurements (Mason et al., 2024), airborne lidar data collection areas (Larsen et al., 2024), airborne SWESARR swaths (dataset in preparation), soil and tree moisture sensors, and location of corner reflectors (Stuefer et al., 2025). Field maps used for planning and site navigation are also included. Geolocation files cover three Intensive Observation Periods (IOPs) - October 2022, March 2023, and October 2023. Information from the April 2023 IOP may be added later; in the meantime, please refer to Fitts et al. (2024) for April 2023 geolocation data.

1.3 File Information

1.3.1 Format

Data files are available in the following formats: tab-delimited text (.txt); vector data storage for geographic information system, e.g. shapefile (.shp); keyhole markup language for Earth browsers (.KML); and digital images as portable document format (.pdf).

1.3.2 File Name and Content

1.3.2.1 Research Plots

In this dataset, we report the geolocation information for the snow pit at each research plot in a tab-delimited text file (.txt) and as points in a compressed shapefile format (.shp). One data file is provided for each IOP and file names are:

SNEX23_GIS_REF_AK_OCT22_Pit_locations-v01.txt
SNEX23_GIS_REF_AK_MAR23_Pit_locations-v01.txt
SNEX23_GIS_REF_AK_OCT23_Pit_locations-v01.txt
SNEX23_GIS_REF_AK_OCT22_Pit_locations-v01.shp
SNEX23_GIS_REF_AK_MAR23_Pit_locationsv01.shp
SNEX23_GIS_REF_AK_OCT23_Pit_locationsv01.shp

The parameters included in the ground sampling files are State, County, Site_ID (study area), Pit_ID (identification of ground sampling snow pit at the plot), Date (of ground sampling in dd/mm/yyyy), Easting (meters, UTM Zone 6, WGS84), Northing (meters, UTM Zone 6, WGS84), Latitude (decimal degrees, WGS84), Longitude (decimal degrees, WGS84), and Version (product version number).

1.3.2.2 Soil and Tree Moisture Sensors

Geolocation information for the soil and tree moisture sensors is provided in a tab-delimited text file (.txt) and as points in a compressed shapefile format (.shp). File names are:

SNEX23_GIS_REF_AK_Moisture_Stationsv01.txt
SNEX23_GIS_REF_AK_Moisture_Stationsv01.shp

The parameters included in the soil and tree moisture geolocation files are State, County, Site ID (study area), Station_ID (identification of station), Station_Name (name of monitoring station), Easting (meters, UTM Zone 6, WGS84), Northing (meters, UTM Zone 6, WGS84), Latitude (decimal degrees, WGS84), Longitude (decimal degrees, WGS84), and Version (product version number).

1.3.2.3 Corner Reflectors

Geolocation information for the corner reflectors is provided in a tab-delimited text file (.txt) and as points in a compressed shapefile format (.shp). One data file is provided for each IOP and file names are:

SNEX23_GIS_REF_AK_OCT22_CornerReflectorsv01.txt
SNEX23_GIS_REF_AK_OCT22_CornerReflectorsv01.shp
SNEX23_GIS_REF_AK_MAR23_CornerReflectorsv01.txt
SNEX23_GIS_REF_AK_MAR23_CornerReflectorsv01.shp
SNEX23_GIS_REF_AK_OCT23_CornerReflectorsv01.txt
SNEX23_GIS_REF_AK_OCT23_CornerReflectorsv01.shp

The parameters included in the corner reflector files are State, County, Site_ID (study area), CR_ID (identification of corner reflector), IOP (MMMYY) Easting (meters, UTM Zone 6, WGS84), Northing (meters, UTM Zone 6, WGS84), Latitude (decimal degrees, WGS84), Longitude (decimal degrees, WGS84), and Version (product version number).Data files are available in the following formats: tab-delimited text (.txt); vector data storage for geographic information system, e.g. shapefile (.shp); keyhole markup language for Earth browsers (.KML); and digital images as portable document format (.pdf).

1.3.2.4 Airborne Lidar

Geolocation information for the airborne lidar swaths is provided in a compressed shapefile format (.shp) and as a compressed KML format (.kmz). File names are:

`SNEX23_GIS_REF_AK_LIDAR_Swaths.shp`
`SNEX23_GIS_REF_AK_LIDAR_Swaths.kmz`

1.3.2.5 Airborne SWESARR

Geolocation information for the airborne SWESARR swaths is provided in a compressed shapefile format (.shp) and as a compressed KML format (.kmz). File names are:

`SNEX23_GIS_REF_AK_SWESARR_Swaths.shp`
`SNEX23_GIS_REF_AK_SWESARR_Swaths.kmz`

1.3.2.6 Field Maps

Field maps are provided in portable document format (.pdf) and are best printed on 11x17 inch paper. File names are:

`SNEX23_GIS_REF_AK_ACP_11x17.pdf`
`SNEX23_GIS_REF_AK_BCEF_11x17_.pdf`
`SNEX23_GIS_REF_AK_CPCRW_11x17.pdf`
`SNEX23_GIS_REF_AK_FLCF_11x17.pdf`
`SNEX23_GIS_REF_AK_UKT_11x17.pdf`

Included in each file is the field map for each study area with the SWESARR swaths, ground sampling plots, corner reflectors, meteorological stations, roads, trails, and landmarks.

1.4 Spatial Information

1.4.1 Coverage

Northernmost Latitude: 70.08434º N
Southernmost Latitude: 64.69925º N
Easternmost Longitude: 147.48583° W
Westernmost Longitude: 149.59716° W

1.4.2 Resolution

The data are points and polygons, images of field maps are also included.

1.4.3 Geolocation

This data set conforms to the WGS 84 UTM Zone 6N coordinate reference system (EPSG 32606)

1.5 Temporal Information

1.5.1 Coverage

01 Oct 2021 to 30 Nov 2023

1.5.2 Resolution

These data are organized as points and polygons.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This dataset compiles geolocation data from ground-based and airborne observations collected during the NASA SnowEx 2023 campaign in Alaska between September 2022 and November 2023 (Vuyovich et al., 2024). The geolocation data cover five study areas. Two study areas were located in the Arctic tundra - Upper Kuparuk-Toolik (UKT) and the Arctic Coastal Plain (ACP) - and three were located in a boreal forest—Bonanza Creek Experimental Forest (BCEF), Caribou Poker Creeks Research Watershed (CPCRW), and Farmer’s Loop Creamer’s Field (FLCF).

2.2 Ground Sampling

2.2.1 Research Plots

This dataset includes general site identification and geolocation information for locations where ground measurements were collected during each NASA SnowEx 2023 IOP. Ground sampling was conducted at randomly selected “study plots” within Arctic and boreal forest study sites. A total of 186 plots were sampled in October 2022, 170 in March 2023, and 127 in October 2023. Ground measurements collected at each plot included:

- Snow pits (profile measurements)
- Snow depth
- Snow water equivalent (SWE)
- Substrate properties (e.g., roughness, vegetation, frozen state)
- Environmental and weather conditions

Plot identification labels were assigned based on vegetation type and snow depth, as described in Vuyovich et al. (2024). This dataset reports the geolocation information for the snow pit at each plot within the two Arctic tundra and three boreal forest study sites.

2.3 Soil and Tree Moisture Stations

Two soil and tree moisture stations were established at BCEF in October 2021, measuring soil and tree moisture content on an hourly interval. Station SMT1-21 (Upper Bonanza Creek) is in a higher elevation deciduous forest and SMT2-21 (Lower Bonanza Creek) is located at lower elevation in a wetland area dominated by spruce trees.

2.4 Corner Reflectors

Thirty-two corner reflectors (CRs) were installed in the Arctic tundra at UKT and in the boreal forest at BCEF during the three NASA SnowEx Alaska IOPs. This dataset provides the geolocation information for the science and engineering corner reflectors installed at the two study areas during each IOP.

2.5 Airborne Lidar and SWESARR Data Collection Areas

This dataset outlines the airborne data collection areas, represented as polygons and commonly referred to as swaths. Some study areas had a single SWESARR airborne swath (e.g., CPCRW and ACP), while others had two (FLCF and BCEF) or three (UKT) swaths (see Table 2). For airborne lidar, survey areas were represented by a single polygon in the ACP, FLCF, BCEF, and

CPCRW study areas. The UKT study area included three separate polygons representing distinct lidar survey swaths.

Table 1. Summary of SWESARR airborne data collection areas

Study Area Site Name	SWESARR Swath Name	Description
Arctic Coastal Plain (ACP)	ACP_NNE	
Upper Kuparuk Toolik (UKT)	UK_East	Upper Kuparuk
	UK_South	Imnavait
	UK_North	Galbraith-Toolik
Bonanza Creek Experimental Forest (BCEF)	BCEF_North	South to north
	BCEF_SW	Bluff to River snow
	BCEF_NE	River to bluff CR
Caribou Poker Creeks Research Watershed (CPCRW)	CPCRW_East	CPCRW
Farmer's Loop Creamer's Field (FLCF)	FLCF_North	Creamer's Field south to north
	FLCF_SW	Farmer's Loop to Creamer's Field

Airborne lidar data were collected for each study site during each IOP (Larsen, 2024). Airborne SWESARR data collection occurred during March 2023 and October 2023 IOPs.

2.6 Field Maps

Field maps were produced for each IOP to aid in field planning and navigation during field campaigns. Maps were created in ArcGIS Pro software by ESRI and include basemap world imagery by Maxar.

3 ACKNOWLEDGEMENTS

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4 VERSION HISTORY

Table 2. Version History Summary

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
v01.0	July 2025	01 Oct 2021 – 30 Nov 2023	Initial release

5 RELATED WEBSITES

NASA SnowEx

NSIDC SnowEx | Overview

6 REFERENCES

Fitts, A., Nolin, A. W., Gleason, K., Surunis, A. J., Bohn, N., Chapman, J., Thompson, D. & Vuyovich, C. M. (2024). SnowEx23 Apr23 AVIRIS-NG Surface Spectral Reflectance. (SNEX23_Apr23_AVIRISNG, Version 1). Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/UARNOKDZUSNO.

Larsen, C.F. 2024. SnowEx23 Airborne Lidar-Derived 0.25M Snow Depth and Canopy Height, Version 1. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/BV4D8RRU1H7U

Mason, M., C. Vuyovich, S. Stuefer, K. Elder, D. Vas, H.P. Marshall, and M. Durand. 2024. SnowEx23 Mar23 Snow Pit Measurements, Version 1. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/SJZ90KNPKCYR.

Stuefer, S., M. Durand, B. Osmanoglu, M. Perrine, A. Gelvin, H.P. Marshall, E. LaMesjerant, K. Liddle Broberg, J. Keech, and, C. Vuyovich. 2025. SnowEx23 Corner Reflector Location and Orientation, Version 1. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/KGQ0NHESWLKE.

Vuyovich, C., Stuefer, S., Gleason, K., Durand, M., Marshall, H. P., Osmanoglu, B., Elder, K., Vas, D., Mason, M., Nolin, A., Youcha, E. Gelvin, A., Larsen, C., Pedersen, S., Hodkinson, D., Deeb, E., Boyd, D., & (2024). NASA SnowEx 2023 Experiment Plan.

7 DOCUMENT INFORMATION

7.1 Publication Date

July 2025

7.2 Date Last Updated

July 2025