SnowEx23 Oct23 IOP Snow Pit Measurements, Version 1 Technical Reference

1 INTRODUCTION

1.1 Data Set Overview

The data set presents snow pit measurements collected during the NASA SnowEx October 2023 Intensive Observation Period (IOP) in Alaska, USA. In total, 127 snow pits were excavated between the five sites at locations representing a range of snow depth, vegetation, and topographic conditions. Three study areas represented boreal forest snow near Fairbanks, AK: Farmers Loop Creamers Field (FLCF), Caribou Poker Creek Research Watershed (CPCRW), and Bonanza Creek Experimental Forest (BCEF). Two study areas represented Arctic tundra snow: Arctic Coastal Plain (ACP) and Upper Kuparuk Toolik (UKT).

1.2 File Information

1.2.1 Format

The data are available in 384 granules. 127 of the granules comprise the primary data files; each granule represents a single snow pit and contains six data files formatted as comma-separated value files (`.csv`). An additional 127 multi-file granules contain site photos; each granule represents a single snow pit and contains multiple photos (.jpg) for each snow pit. 127 single-file granules contain scans of the handwritten field notes ('pit sheet') for each pit, formatted as .pdf files. One single-file granule contains the pit sheet template, formatted as a .xlsx file. One multi-file granule contains browse images formatted as .jpg files. The remaining multi-file granule contains all the summary documentation formatted as comma-separated value files (`.csv`) and .xlsx files.

1.2.2 Naming Convention and File Contents

The granules containing the primary data files are named according to the following convention:

`SNEX23_OCT23_SP_[SITE_TYPE]_[PIT_ID]_[YYYMMDD]_data.v01.0`,

where `SNEX23_Oct23_SP` is the data set short name, `SITE_`TYPE is either `Forest` or `Tundra`, `PIT_ID` is the snow pit identification number, and `YYYYMMDD` is the date of data collection.

The data files within the granules follow a similar naming convention but are appended with the data parameter as such:

SNEX23_OCT23_SP_[SITE_TYPE]_[PIT_ID]_[YYYMMDD]_[PARAMETER]_data.v01.0

Available parameter files for each snow pit are described in Table 1 below.

Table 1. Parameters available for each snow pit

Parameter File	Contents	File Format
pitSheet	All snow pit data	.xlsx
siteDetails	Location, site and pit ID, date/time, UTM coordinates, Latitude, Longitude, height of snow (HS), observers, weather, environment conditions, vegetation characteristics, and comments,	.csv
stratigraphy	Layer thickness, grain size, grain type, manual wetness, hand hardness, and comments	.csv
sweTube	Three SWE Tube samples with measured snow depth (cm) and snow water equivalent (SWE) (mm) and calculated density (kg/m^3)	.csv
lwc	Liquid water content mesasurements	.csv
temperature	Temperature (°C) at surface and 10 cm intervals on 10s (e.g. 27, 20, 10, 0)	.csv

The granule containing the summary files follows a similar naming convention, and is named:

SNEX23_Oct23_SP_Summary_ 20231017-20231028_v01.0.

The data files within the summary granule follow a similar naming convention but are appended with the data parameter as such:

SNEX23_OCT23_SP_Summary_20231017-20231028_[PARAMETER].v01.0

A description of each available summary parameter is described in Table 2 below.

Table 2. Available summary files

Parameter File	Contents	File Format
Environment	One summary file for all snow pits. Each row contains qualitative observations about potentially impactful environmental conditions, such as precipitation, cloud cover, wind, ground cover, vegetation heights, forest type, and percent canopy cover.	.csv
Substrate	One summary file for all snow pits. Each row contains metadata related to the snow pit (see SWE list below), along with substrate depths and conditions for the following top and bottom layer	.csv

Parameter File	Contents	File Format
	heights for vegetation, organic soil, and mineral soil. If a soil moisture sample was collected it is marked by Yes/No column along with the top and bottom depth of the SM sample. The top and bottom layer of the frozen substrate is also noted.	
SWE	One summary file for all snow pits. Each row contains the site and snow pit ID, date/time, UTM coordinates, Latitude, Longitude, height of snow (HS) (cm), snow thickness (cm), mean SWE (mm), mean density (kg/m^3), and stratigraphy profile void space (cm) caused by snow over vegetation or air gaps.	.csv
Revisions_log	Contains a record of changes made to data files due to transcription errors or other issues.	.xlsx

The granules containing the image files follow a similar naming convention and is named:

SNEX23_OCT23_SP_[SITE_TYPE]_[PIT_ID]_[YYYMMDD]_photo_v01.0.

The files within the image granule follow a similar naming convention but are appended with the image type as such:

SNEX23_OCT23_SP_[SITE_TYPE]_[PIT_ID]_[YYYMMDD]_[#]_[TYPE]_photo.v01.0

A description of each available image type is described in Table 3 below.

Table 3. Available image files

Type	Contents	File Format
Directional: • north • east • south • west • up • down • oblique	The image type listed in the file name describes the orientation of the image relative to the snow pit. Not all orientations are available for each snow pit	.jpg
Pit 1, Pit 2	All photos labeled as pit are taken showing the extent of the pit. Pit photos are not always available for each snow pit	.csv
soil	All photos labeled as soil are images of soil samples. Soil samples were not collected from all snow pits.	.csv

The granules containing the scanned images of each pit sheet are named using the following convention:

`SNEX23_OCT23_SP_[SITE_TYPE]_[PIT_ID]_[YYYMMDD]_scan_v01.0.`

The granule containing the browse images is named:

`SNEX23_Oct23_SP_20231017-20231028_browse_v01.0`

The granule containing the pit sheet template is named:

`SNEX23_OCT23_SP_pitSheetTemplate_v01.0.`

1.3 Spatial Information

1.3.1 Coverage

Northernmost Latitude: 70.0888779° N
Southernmost Latitude: 64.7019606° N
Easternmost Longitude: 147.4857° W
Westernmost Longitude: 149.58293° W

1.3.2 Geolocation

This data set conforms to the WGS 84 coordinate reference system (EPSG 4326).

1.4 Temporal Information

1.4.1 Coverage and Resolution

17 October 2023 to 28 October 2023

2 BACKGROUND

Snow pit and ground condition measurements were collected during the NASA SnowEx October 2023 Intensive Observation Period (IOP) for use in calibrating and validating coincident airborne lidar measurements and ground-based radar systems, including a NASA SWESARR overflight. These measurements supported the SnowEx strategy for quantifying snow water equivalent (SWE) and snow depth (HS). Airborne lidar surveys were acquired at all study areas concurrently with ground-based measurements. Snow pits were excavated at two Arctic tundra sites (ACP, UKT) and three Boreal Forest sites (FLCF, CPCRW, BCEF) between October 17-28, 2023. In total, 127 snow

pits were completed, spanning a range of snow depths, vegetation types, and topographic conditions across the five sites.

3 ACKNOWLEDGEMENTS

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4 REFERENCES

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