



SnowEx23 Oct23 Ground Surface Roughness Reconstruction, Version 1

USER GUIDE

How to Cite These Data

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

Meyer, J. 2024. *SnowEx23 Oct23 Ground Surface Roughness Reconstruction, Version 1*.
[Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center
Distributed Active Archive Center. <https://doi.org/10.5067/9BTG86R3ISR3>. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX23_OCT23_GSR



National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Summary

This data set presents ground surface roughness data collected during the NASA SnowEx 2023 field campaign between 17 and 28 October 2023. The data are formatted as point clouds, compiled from images acquired using a digital camera. Images were collected from 22 snow pits located across three study sites: Upper Kuparuk and Toolik (UKT), an arctic tundra environment in Northern Alaska, and Caribou Poker Creek watershed (CPCW) and Farmers Loop Creamers Field (FLCF), two boreal forest sites near Fairbanks, Alaska. The raw imagery from which these data are derived are available as [SnowEx23 Oct23 Ground Surface Roughness Imagery, Version 1](#).

1.2 File Information

1.2.1 Format

Data are provided as .laz (LIDAR Aerial Survey zip) files.

1.2.2 Naming Convention

Data files utilize the following naming convention which is described in Table 1.

SNEX23_OCT23_GSR_[site]_[pit_ID]_[YYYYMMDD]_[camera]_V01.0.laz

Table 1. File naming convention

Variable	Description
SNEX23	SnowEx 2023 field campaign
OCT23	Month and year of data collection
GSR	Ground Surface Roughness
[site]	Study site: Upper Kuparuk and Toolik (UKT), Caribou Poker Creek watershed (CPCW), or Farmers Loop Creamers Field (FLCF)
[pit_ID]	Snow pit ID
[YYYYMMDD]	Date images was taken, formatted as 4-digit year, two-digit month, and two-digit day
[camera]	Camera type used (SONY or LUMIX)
v<nn.n>	Indicates version number of the data set
.laz	File extension: LIDAR Aerial Survey zip files

1.3 Spatial Information

1.3.1 Coverage

Northernmost Latitude: 68.70° N
 Southernmost Latitude: 68.50° N
 Easternmost Longitude: 149.30° W
 Westernmost Longitude: 149.60° W

Northernmost Latitude: 65.20° N
 Southernmost Latitude: 64.80° N
 Easternmost Longitude: 147.50° W
 Westernmost Longitude: 147.80° W

1.3.2 Resolution

Varies

Note: The point cloud files are not geolocated. Geographic coordinates have been assigned to each file, based on a point measurement representative of each snow pit location.

1.3.3 Geolocation

Table 2. Geolocation Details

Geographic coordinate system	WGS 84
Longitude of true origin	Prime Meridian, Greenwich
Datum	World Geodetic System 1984
Ellipsoid/spheroid	WGS 84
Units	Degrees
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs +type=crs
Reference	https://epsg.org/crs_4326/WGS-84.html

1.4 Temporal Information

1.4.1 Coverage

17 Oct 2023 to 28 Oct 2023

1.4.2 Resolution

Varies

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This data set presents ground surface roughness data produced using digital photographs taken of snow pits dug as part of the NASA SnowEx23 Alaska field campaign during the March 2023 Intensive Observation Period (IOP). Photogrammetric methods were used to derive the data, which are formatted as point clouds. Each point cloud file is representative of the ground surface of a single snow pit. Table 3 below provides additional details the data, including data of data acquisition, pertinent weather details, pit ID, study site, type of camera, and relevant comments.

Table 3. Overview of data collection details

Date	Weather	Pit ID	Study site	Camera	Comments
17 Oct	overcast with low fog, inconsistent light conditions	A765	UKT	LUMIX	Low ISO (80) in images
				SONY	Marker 8 missing in point cloud and in all right sideview images
18 Oct	Variable sunshine during image collection	A766	UKT	LUMIX	-
				SONY	-
		A767	UKT	LUMIX	-
				SONY	-
19 Oct	Overcast day with snow developing; image markers at times covered with snow flakes	A621	UKT	LUMIX	-
				SONY	-
				SONY	-
		N617	UKT	SONY	-
N613	UKT	SONY	Marker 9 missing in point cloud		
22 Oct	-	N655	UKT	SONY	-
		N656	UKT	SONY	-
		N657	UKT	SONY	Marker 5 missing in point cloud
24 Oct	-	WB025	FLCF	SONY	Dense shrubs
25 Oct	-	DB247	CPCW	SONY	-
		DB248	CPCW	SONY	-
		EB252	CPCW	SONY	-

Date	Weather	Pit ID	Study site	Camera	Comments
26 Oct	-	EB099	FLCF	SONY	-
		EB100	FLCF	SONY	-
		EN097	FLCF	SONY	-
		WN101	FLCF	SONY	-
27 Oct	-	CB068	FLCF	SONY	-
		CN063	FLCF	SONY	-
28 Oct	-	DB107	FLCF	SONY	-

2.2 Acquisition

At each snow pit, photogrammetry markers were arranged as shown in Figure 1. Three markers were positioned on the eastern, western, and northern sides of each pit, and one marker was positioned in the pit center, such that the reference strip on the marker was oriented north to south.

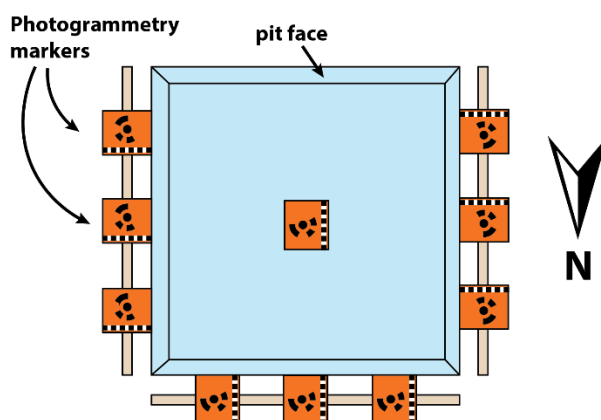


Figure 1. Schematic of snow pit viewed from above, showing placement of photogrammetry markers.

A series of overlapping images of each pit were taken using a digital camera. Two camera models were used: either a Sony ICL6-6000 or a Panasonic Lumix DC-TS.7, as indicated in Table 3 above. At some pits, images were taken with both camera models in order to assess differences in image quality. The same settings were applied to each camera; the camera was set to P (Program Mode), with a max ISO (e.g., light sensitivity) of 200, and a 34 mm zoom. The zoom setting was chosen to reduce distortion of the image edge. Three categories of photographs were taken of each pit following a standardized procedure, as outlined below and as illustrated in Figure 2.

1. Oriented directly above the pit, with the camera facing downward (Figure 2A.)
2. Oriented perpendicular across each pit, with the camera held at a 45° angle to the ground surface (Figure 2B).
3. Oriented from corner to corner across each pit (Figure 2C).

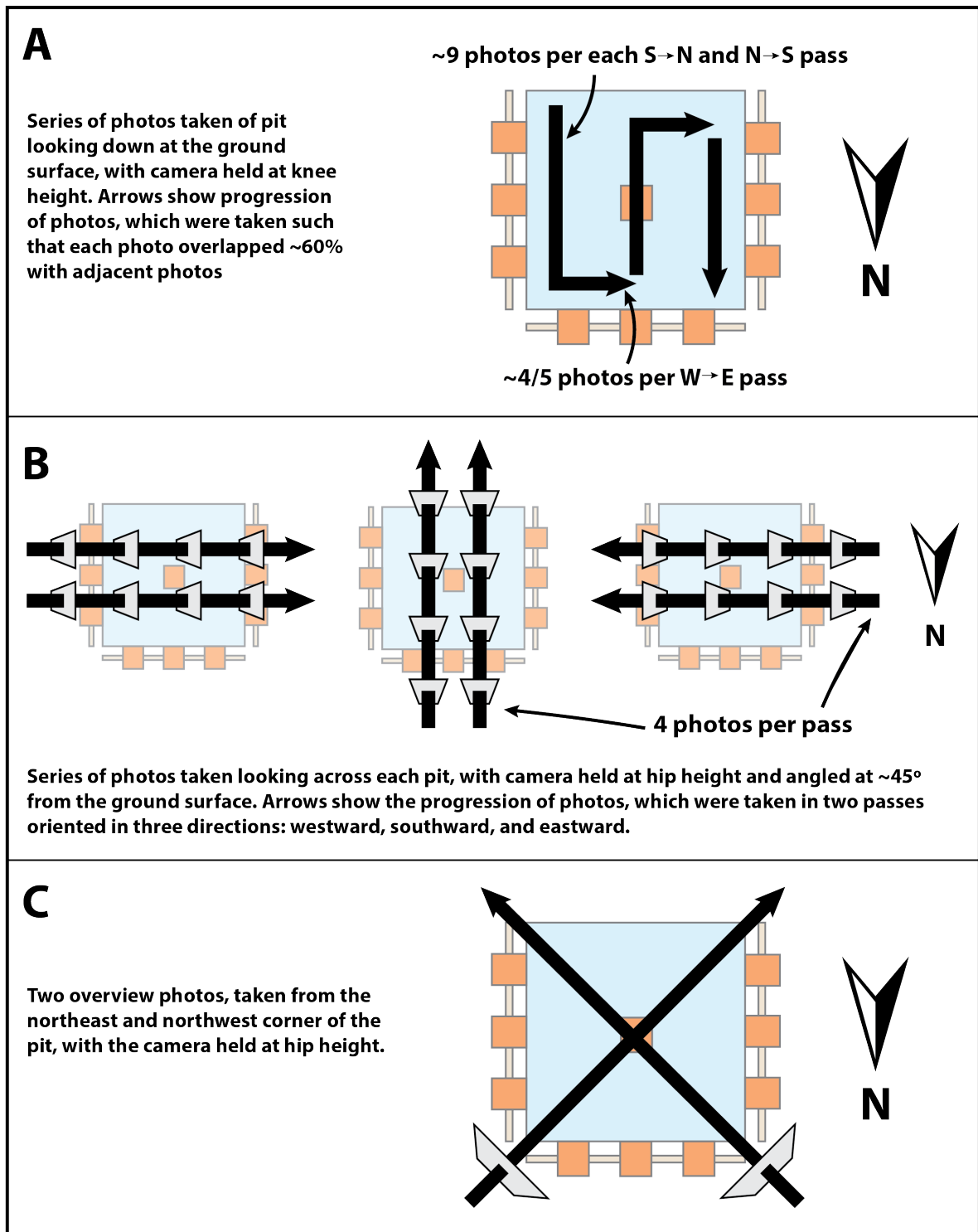


Figure 2. Schematics showing the orientation and progression of each category of photographs in relation to the snow pit, as viewed from above.

2.3 Processing

To create each point cloud, each set of photographs was processed using [Agisoft Metashape](#). The processing workflow is available on [GitHub](#) (Meyer, 2024).

A processing report is available for each data file, which includes image and camera specifications, processing parameters, and the following figures:

- a static image of the point cloud
- a figure demonstrating camera locations and image overlaps
- a figure of the image residuals
- a static image of the reconstructed digital elevation mode (DEM) for each snow pit

These processing reports are compiled into a single technical reference available [here](#).

2.4 Quality, Errors, and Limitations

The provided processing reports (linked above) present quality and error information for each data file, including image calibration coefficients and reprojection errors.

3 VERSION HISTORY

Table 4. Version History

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
v01.0	January 2025	17 Oct 2023 to 28 Oct 2023	Initial release

4 RELATED DATA SETS

[SnowEx23 Oct23 Ground Surface Roughness Imagery, Version 1](#)

[SnowEx at NSIDC | Data sets](#)

5 RELATED WEBSITES

[SnowEx at NSIDC | Overview](#)

[SnowEx at NASA](#)

6 REFERENCES

Meyer, J. (2024). SnowEx/GSR2: 20240412 (Version 20240412). Zenodo.
<https://doi.org/10.5281/zenodo.10967251>

7 DOCUMENT INFORMATION

7.1 Publication Date

January 2025

7.2 Date Last Updated

January 2025