SnowEx17 Laser Snow Microstructure Specific Surface Area Data, Version 1

USER GUIDE

How to Cite These Data

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

Rutter, N., J. Pan, M. Durand, J. King, C. Derksen, and F. Larue. 2018. *SnowEx17 Laser Snow Microstructure Specific Surface Area Data, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/H9C1UVWN1UK3. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX17_SSA

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

1.1 Parameters

This data set characterizes snow microstructure using vertical profiles of reflectance, specific surface area (SSA, kg/m2), and optical equivalent diameter of snow grains (DO, mm).

1.2 Format

Data files are provided in Comma Separated Values (.csv) format. Quick look (browse) images are also available in PNG format that show side-by-side depth profiles of reflectance, SSA, and equivalent optical diameter of snow grains. Each data file also has an associated XML file that contains science metadata.

1.3 File Contents

Data files begin with a 12-row header that specifies the date and time of acquisition, snowpit ID and location (in UTM), instrument, operator, notes, timing, and total snow depth. For example, data file `SnowEx17_SSA_01E_20170210T2000_IRIS.csv` contains the following header:

```
# Name field campaign: SnowEx_Week1
# Snowpit ID: 01E
# UTMN: 4323962
# UTME: 747952
# UTM Zone: 12
# Instrument: IRIS
# Operator: Fanny Larue
# Timing: 30mins
# Notes: N/A
# Total snow depth (cm): 83
#e SnowEx17_SSA_01E_20170210T2000_IRIS.csv contains the following header:
```

Starting with row 13, the data are stored in columns A through E, with Column F reserved for operator comments (see Figure 1):

13	# Sample signal (mV)	Reflectance (%)	Specific surface area (kg/m^2)	Top Depth (cm)	Do (mm)	Comments
14	499	27.96	14.7	83	0.4438	
15	707	38	25.6	80	0.2558	
16	630	34.41	21	77	0.311	
17	680	36.76	23.9	74	0.2737	
18	577	31.85	18.3	71	0.3576	
19	564	31.22	17.7	68	0.3703	
20	440	24.9	12.4	65	0.5281	
21	570	31.51	18	62	0.3644	
22	538	29.93	16.5	59	0.3977	
23	544	30.23	16.7	56	0.3911	
24	536	29.83	16.4	53	0.3999	
25	541	30.08	16.6	50	0.3944	
26	461	26	13.2	47	0.4958	
27	405	23.04	11.1	44	0.5888	
28	416	23.63	11.5	41	0.5687	

Figure 1. Column headers and sample data from file SnowEx17_SSA_01E_20170210T2000_IRIS.csv

Quick look (browse) images show side-by-side depth profiles of reflectance, SSA, and equivalent optical diameter, as shown in Figure 2:

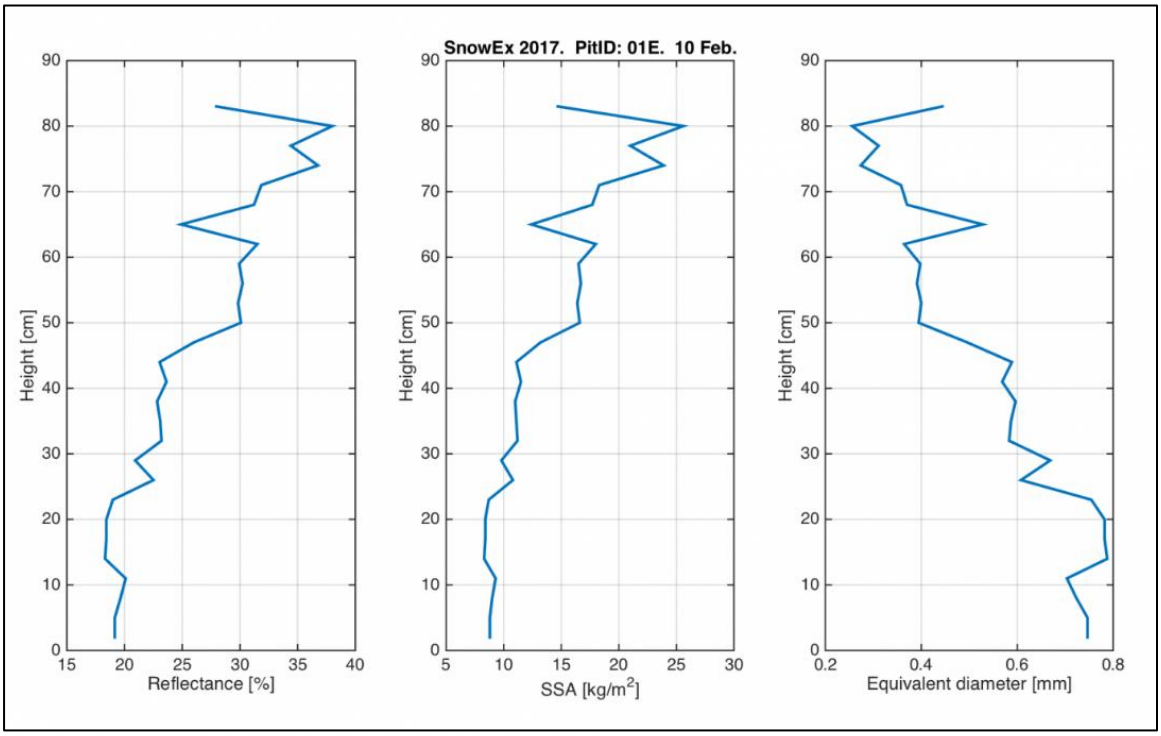

Figure 2. Quick look image for data file SnowEx17_SSA_01E_20170210T2000_IRIS.png.

1.4 File Naming Convention

Data files utilize the following naming convention and as described in Table 1:

SnowEx17_SSA_[SID]_[YYYYMMDD]T[hhmm]_[INST].[EXT]

Table 1. File Naming Convention

Variable	Description
SnowEx17_SSA	SnowEx 2017 field season specific surface area
SID	Three digit station ID.
YYYYMMDD	Year, month, and day of data acquisition
T	Acquisition time follows
hhmm	Hour and minute (UTC) of data acquisition in 24-hour format. E.g., 1800 = 18:00 UTC.
INST	Instrument code. Values are one of IRIS, IceCubeOSU, or IceCubeNU. See Data Acquisition and Processing for details.
EXT	File type: .csv (data file) or .png (quick look)

Example file name:

`SnowEx17_SSA_01E_20170210T2000_IRIS.csv`

XML metadata files have the same name as their corresponding .csv files, but with .xml appended. For example: `SnowEx17_SSA_01E_20170210T2000_IRIS.csv.xml`.

1.5 Volume

CSV files are approximately 2 KB each. PNG files range from approximately 60—80 KB. The entire data set is approximately 7 MB.

1.6 Spatial Coverage

Northernmost Latitude: 39.10552º N
Southernmost Latitude: 39.02098º N
Easternmost Longitude: 107.846975° W
Westernmost Longitude: 108.231345° W

1.6.1 Spatial Resolution

Vertical profiles were obtained at 95 locations within the Grand Mesa study site. The vertical distance (depth) between measurements varies, but never exceeds 3 cm.

1.6.2 Projection and Grid Description

All data lie within UTM Zones 12N and 13N. Refer to Table 2 for details.

Table 2. Geolocation Details

Geographic coordinate system	**WGS 84**
Projected coordinate system	WGS 84 / UTM zone 12N WGS 84 / UTM zone 13N
Longitude of true origin	-111 (12N) -105 (13N)
Latitude of true origin	0
Scale factor at longitude of true origin	0.9996
Datum	WGS 1984
Ellipsoid/spheroid	WGS 84
Units	meters
False easting	500000
False northing	0
EPSG Code	32612 (12N) 32613 (13N)
PROJ4 string	+proj=utm +zone=12 +datum=WGS84 +units=m +no_defs
Reference	https://epsg.io/32612 https://epsg.io/32613

1.7 Temporal Information

1.7.1 Temporal Coverage

07 February 2017 to 25 February 2017.

1.7.2 Temporal Resolution

Measurements for each snow pit were taken within a single time span.

2 SOFTWARE AND TOOLS

2.1 Software and Tools

CSV files can be accessed using software that reads ASCII text.

3 DATA ACQUISITION AND PROCESSING

3.1 Data Acquisition Methods

Vertical profiles of reflectance to a 1310 nm laser were recorded in the field using one of two integrating sphere systems: IRIS (InfraRed Integrating Sphere) or IceCube. These devices utilize the same underlying principle—the relationship between the hemispherical infrared reflectance of snow and SSA—and differ only in their respective sphere sizes. One IRIS and two IceCube instruments were deployed in the field. The instrument used is denoted in data file names by IRIS, IceCubeOSU, or IceCubeNU.

In the field, a snow sample is illuminated with the intrument's laser. An InGaAs photodiode converts the reflected light to current and the voltages are converted to reflectance using certified standards. SSA is calculated from reflectance during post-processing, using custom calibration algorithms for each IRIS or IceCube instrument. Finally, equivalent optical diameter is computed from SSA.

3.2 Derivation Techniques and Algorithms

3.2.1 Quality, Errors, and Limitations

Quality control was performed by visually inspecting graphs of each reflectance, SSA, and equivalent diameter profile.

4 REFERENCES AND RELATED PUBLICATIONS

Gallet, J.-C., F. Domine, C. S. Zender, and G. Picard. 2009. Measurement of the specific surface area of snow using infrared reflectance in an integrating sphere at 1310 and 1550 nm, *The Cryosphere* 3:167-182. doi:10.5194/tc-3-167-2009, 2009.

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6 DOCUMENT INFORMATION

6.1 Publication Date

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6.2 Date Last Updated

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