



# SnowEx20 Grand Mesa Autumn 2019 Snow Depth, Version 1

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## USER GUIDE

### How to Cite These Data

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

Brucker, L., C. Hiemstra, J. Johnston and C. Vuyovich. 2021. *SnowEx20 Grand Mesa Autumn 2019 Snow Depth, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/C1JYLA4YUO5X>. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT [NSIDC@NSIDC.ORG](mailto:NSIDC@NSIDC.ORG)

FOR CURRENT INFORMATION, VISIT [https://nsidc.org/data/SNEX20\\_A19\\_SD](https://nsidc.org/data/SNEX20_A19_SD)



National Snow and Ice Data Center

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# 1 DATA DESCRIPTION

The main parameter in this data set is snow depth collected with Magnaprobes or manual depth probes.

## 1.1 File Information

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### 1.1.1 Format

Data are provided in a single comma-separated values (.csv) file.

### 1.1.2 File Contents

The file starts with a header indicating the location Grand Mesa, Colorado as study site and the UTM Zone 12. This is followed by 8 columns of data. Column names are described in Table 1.

Table 1. Data Parameters

Column Title	Description	Unit/Format
Date (YYYYMMDD)	Date of data acquisition	YYYYMMDD
Time (HHMM)	Time of day of data acquisition	HHMM
Easting (m)	UTM Easting	m
Northing (m)	UTM Northing	m
Snow Depth (cm)	Snow depth measurement	cm
Source (Magnaprobe or Manual Depth Probe)	Instrument used for snow depth measurements. The two options are a Magnaprobe or a manual depth probe.	N/A
Notes	Notes taken during measurements	N/A
Surveyor	Surveyor taking the measurement	N/A

### 1.1.3 Naming Convention

This data set consists of a single file, named: SNEX20\_A19\_SD\_GM\_v01.csv

The file naming convention is described in Table 2.

Table 2. File Naming Convention

Variable	Description
SNEX20_A19_SD_	SnowEx 2020 Grand Mesa Autumn 2019 Snow Depth
GM	Data sampling location: Grand Mesa, Colorado
v01	Data set version

Variable	Description
.csv	File extension

## 1.2 Spatial Information

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### 1.2.1 Coverage

Northernmost Latitude: 39.046174° N  
 Southernmost Latitude: 39.008296° N  
 Easternmost Longitude: 108.150626° W  
 Westernmost Longitude: 108.201372° W

### 1.2.2 Resolution

Point measurements

### 1.2.3 Geolocation

The following table provides information for geolocating this data set.

Table 3. Geolocation Details

<b>Geographic coordinate system</b>	WGS 84
<b>Projected coordinate system</b>	WGS 84 / UTM Zone 12 North
<b>Longitude of true origin</b>	-111
<b>Latitude of true origin</b>	0
<b>Scale factor at longitude of true origin</b>	0.9996
<b>Datum</b>	WGS 1984
<b>Ellipsoid/spheroid</b>	WGS 84
<b>Units</b>	meters
<b>False easting</b>	500000
<b>False northing</b>	0
<b>EPSG code</b>	32612
<b>PROJ4 string</b>	+proj=utm +zone=12 +datum=WGS84 +units=m +no_Defs
<b>Reference</b>	<a href="https://epsg.io/32612">https://epsg.io/32612</a>

## 1.3 Temporal Information

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### 1.3.1 Coverage

Start Date: 04 November 2019

End Date: 06 November 2019

### 1.3.2 Resolution

Point measurements

## 2 DATA ACQUISITION AND PROCESSING

### 2.1 Background

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Snow depth was measured in autumn 2019 (04-07 November) as part of the NASA SnowEx 2020 campaign at Grand Mesa, CO. Measurements were taken in the vicinity of snow pit locations and between pit locations using a Magnaprobe or manual depth probes. Additional snow depth observations were collected as part of the snow pit measurements and snow water equivalent (SWE) measurements. For more information, please see the SnowEx20 Grand Mesa Autumn 2019 Snow Water Equivalent and Snow Pit data sets in the Related Data Sets section.

### 2.2 Instrumentation and Acquisition

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#### 2.2.1 Magnaprobe

Due to shallow early season snow conditions, most of the depths were measured with a GPS-Magnaprobe (Sturm and Holmgren, 2018), a commercially-available snow probe with an attached datalogger and GPS unit for rapid collection of data points. The equipment consists of a snow probe with a basket that remains on the snow when the probe is inserted into snow. The operator pressed a button for every measurement. The depth was measured after an audible signal and recorded on the unit's datalogger with an attendant GPS location and elevation. At the end of every day, the data were downloaded.

#### 2.2.2 Manual probe and hand-held GPS

Whenever dense canopy led to poor GPS reception and prevented the use of the GPS-Magnaprobe, snow depth was measured with a manual probe. This incremented snow depth probe (or avalanche probe) was used in conjunction with a hand-held GPS unit (e.g. GPSMAP 64ST).

Measurements were hand-written in field notebooks and transcribed electronically every night. After all records in the data set were verified, transcription errors were corrected.

## 2.3 Processing

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### 2.3.1 Magnaprobe

1. Download data
2. Calculate latitude and longitude, and convert to UTM zone 12N
3. Eliminate erroneous measurements and data errors, including GPS related data errors
4. Export data to a single csv file

### 2.3.2 Manual probe and hand-held GPS data

1. Transcribe the hand-written values into electronic format
2. Assess data quality

## 2.4 Quality, Errors, and Limitations

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GPS systems of various accuracies were used to geolocate the measurements. The accuracy of handheld GPS units was ~3-15 m depending on canopy conditions. The accuracy of the Magnaprobe GPS was ~3 m in the open and <15 m in forested areas.

There are also known depth errors associated with probing, due to both insertion of the probe into thawed soil or vegetation/organic layers (overprobing), and snow surface compaction from the GPS-Magnaprobe basket (cratering). The error due to overprobing is close to zero for frozen soils and between 5-10 cm in soft substrates. The error due to cratering is estimated around 1 cm.

## 3 SOFTWARE AND TOOLS

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

## 4 VERSION HISTORY

Table 4 Version History Summary

Version	Release Date	Description of Changes
V1	21 September 2021	Initial Release

## 5 REFERENCES

Sturm, M., and Holmgren, J. An automatic snow depth probe for field validation campaigns. *Water Resources Research*, 54, 9695– 9701, <https://doi.org/10.1029/2018WR023559>, 2018.

## 6 RELATED DATA SETS

[SnowEx at NSIDC| Data Sets](#)

[SnowEx20 Grand Mesa Autumn 2019 Gravimetric Soil Moisture](#)

[SnowEx20 Grand Mesa Autumn 2019 Snow Water Equivalent](#)

[SnowEx20 Grand Mesa Autumn 2019 Snow Pits](#)

## 7 RELATED WEBSITES

[SnowEx at NSIDC | Overview](#)

[SnowEx at NASA](#)

[NASA SnowEx 2020 Experimental Plan](#)

## 8 CONTACTS AND ACKNOWLEDGMENTS

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## 9 DOCUMENT INFORMATION

### 9.1 Publication Date

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### 9.2 Date Last Updated

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