# SnowEx20 Grand Mesa IOP UNM 800 and 1600 MHz MALA GPR, Version 1

## USER GUIDE

**How to Cite These Data**

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

Webb, R. 2021. *SnowEx20 Grand Mesa IOP UNM 800 and 1600 MHz MALA GPR, Version 1* [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/WE9GI1GVMQF6. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX20_UNM_GPR

National Snow and Ice Data Center

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# 1 DATA DESCRIPTION

## 1.1 Parameters

This data set contains the results of a ground penetrating radar (GPR) survey conducted at Grand Mesa, Colorado during the SnowEx20 campaign. The main parameters in this data set include two-way travel time, snow depth and snow water equivalent (SWE). Two-way travel time is the time it takes a radar wave to travel from the point of release to the reflection point and back. Snow depth and SWE are derived from two-way travel times.

## 1.2 File Information

### 1.2.1 Format

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

### 1.2.2 File Contents

The .csv files contain 12 columns with the parameters listed in Table 1.

Table 1. Data Parameters

| Name | Description | Unit/Format |
|---|---|---|
| DATE_dd_mmm_yy | Date of data acquisition: 2-digit day followed by 3-digit short name of the month and 2-digit year representation | [dd-mmm-yy] |
| TIME_GMT | Greenwich Mean Time (hour and minute) of data acquisition | [HH:MM] |
| FREQ_MHz | GPS antenna frequency | MHz |
| LONG | Longitude | degree |
| LAT | Latitude | degree |
| ELEV_m | Elevation | m |
| NORTHING | Northing | m |
| EASTING | Easting | m |
| UTMZone | Universal Transverse Mercator time zone | [NA] |
| TWT_ns | Two-way travel time | ns |
| DEPTH_m | Snow depth | m |
| SWE_mm | Snow water equivalent | mm |

### 1.2.3 Naming Convention

The single data file is named `SNEX20_UNM_GPR.csv`, which refers to SnowEx20 University of New Mexico ground penetrating radar data collected at Grand Mesa, Colorado.

## 1.3 Spatial Information

### 1.3.1 Coverage

Northernmost Latitude: 39.050º N
Southernmost Latitude: 39.005º N
Easternmost Longitude: 108.12º W
Westernmost Longitude: 108.21º W

### 1.3.2 Resolution

Point measurements

### 1.3.3 Geolocation

The following table provides information for geolocating this data set.

Table 2. Geolocation Details

| | |
|---|---|
| **Geographic coordinate system** | WGS 84 |
| **EPSG code** | 4326 |
| **PROJ4 string** | +proj=longlat +datum=WGS84 +no_defs |
| **Reference** | https://epsg.io/4326 |

In addition to latitude/longitude in WGS 84 (epsg.io/4326) the data file also contains northing/easting in WGS 84 / UTM zone 12N (epsg.io/32612).

## 1.4 Temporal Information

### 1.4.1 Coverage

28 January 2020 to 06 February 2020

### 1.4.2 Resolution

Seconds

# 2 DATA ACQUISITION AND PROCESSING

## 2.1 Background

This data set contains the results of ground-penetrating radar surveys conducted at Grand Mesa, Colorado during the SnowEx20 field campaign. Data were collected between 28 January 2020 and 06 February 2020 using a MALA Geosciences ground penetrating radar unit with an 800 MHz and 1600 MHz antenna.

## 2.2 Acquisition

Data were collected using a MALA Geosciences Professional Explorer (ProEx) GPR unit with an 800 MHz and 1600 MHz antenna. Data were logged approximately every 0.1 seconds. A skier towed the GPR unit.

## 2.3 Processing

Two-way travel times between the snow surface and the ground surface were chosen using a semi-automatic method in the ReflexW2D software package.

Two-way travel times were converted to snow depth and SWE using equations described in Kovacs et al. (1995). Average snow density data corresponding to the day of GPR measurements were collected from the snow pit observation nearest to the GPR surveys.

## 2.4 Quality, Errors, and Limitations

Uncertainty of two-way travel times, snow depth, and SWE are in the order of 0.2 ns, 3 cm, and 5-10%, respectively.

## 2.5 Instrumentation

Data were collected using a MALA Geosciences Professional Explorer (ProEx) control unit. More information about this instrument can be found on the MALA Ground Penetrating Radar website.

# 3 SOFTWARE AND TOOLS

The .csv files can be accessed using software that reads ASCII text.

# 4 VERSION HISTORY

Table 3. Version History Summary

| Version | Release Date | Description of Changes |
|---|---|---|
| V1 | 03 June 2021 | Initial release |

# 5 RELATED DATA SETS

SnowEx at NSIDC | Data Sets

# 6 RELATED WEBSITES

SnowEx at NSIDC | Overview

SnowEx at NASA

# 7 CONTACTS AND ACKNOWLEDGMENTS

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# 8 REFERENCES

Kovacs, A., Gow, A. J., & Morey, R. M. (1995). The in-situ dielectric constant of polar firn revisited. Cold Regions Science and Technology, 23, 245–256, https://doi.org/10.1016/0165-232X(94)00016-Q.

# 9 DOCUMENT INFORMATION

## 9.1 Publication Date

03 June 2021

## 9.2 Date Last Updated

03 June 2021