



SnowEx20 Grand Mesa In Situ Dielectric Soil Moisture, Version 1

USER GUIDE

How to Cite These Data

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

Cosh, M. 2021. *SnowEx20 Grand Mesa In Situ Dielectric Soil Moisture, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/FWUZU0FTZKYI>. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX20_DSM



National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

This data set contains in situ soil moisture and soil temperature measurements collected at three different depths (5, 10, 20 cm) with a Stevens Water HydraPrope.

1.2 File Information

1.2.1 Format

Data is available in comma separated values file (.csv). A separate data file exists for each measurement location within the Colorado Grand Mesa study area.

1.2.2 File Contents

The .csv files contain one main data tab with 18 columns described in Table 1. The data files contain two differently calibrated soil moisture values. Factory calibrated soil moisture is calibrated based on a generic loam calibration equation (Seyfried et al., 2005); site-specific calibrated soil moisture refers to a soil moisture estimate based on a locally developed calibration equation, specific to the soils found at the site (Cosh et al., 2005). For most applications the site-specific calibrated soil moisture should be used.

Table 1. Data Parameters

Parameter short name	Description	Unit
TS	Time stamp using the following format: (D)D/MM/YY/ hh:mm where the first digit is only used when the day of the month is 10 or larger.	N/A
RN	Record number	N/A
Site	Station identification number	N/A
Batt_volt_Min	Battery voltage	V
SM_5cm	Factory calibrated soil moisture at 5 cm	m ³ /m ³
SM_10cm	Factory calibrated soil moisture at 10 cm	m ³ /m ³
SM_20cm	Factory calibrated soil moisture at 20 cm	m ³ /m ³
TempC_5cm	Soil temperature at 5 cm	°C
TempC_10cm	Soil temperature at 10 cm	°C
TempC_20cm	Soil temperature at 20 cm	°C
RDC_5cm	Real dielectric constant (soil permittivity) at 5 cm	N/A

Parameter short name	Description	Unit
RDC_10cm	Real dielectric constant (soil permittivity) at 10 cm	N/A
RDC_20cm	Real dielectric constant (soil permittivity) at 20 cm	N/A
IDC_5cm	Imaginary dielectric constant (soil permittivity) at 5 cm	N/A
IDC_10cm	Imaginary dielectric constant (soil permittivity) at 10 cm	N/A
IDC_20cm	Imaginary dielectric constant (soil permittivity) at 20 cm	N/A
Hydra-cal vsm 5cm	Site specific calibrated volumetric soil moisture at 5 cm	m ³ /m ³
Hydra-cal vsm 10cm	Site specific calibrated volumetric soil moisture at 10 cm	m ³ /m ³
Hydra-cal vsm 20cm	Site specific calibrated volumetric soil moisture at 20 cm	m ³ /m ³

1.2.3 Naming Convention

Data files utilize the following naming convention which is described in Table 2:

SNEX20_DSM_USDA_TempNet_VWC_[XXX]_all_cal_v01.<ext>

Table 2. File Naming Convention

Variable	Description
SNEX20_DSM	SnowEx 2020 Grand Mesa In Situ Dielectric Soil Moisture.
USDA	Refers to United States Department of Agriculture as funding agency.
TempNet	Refers to the temporary measurement network.
VWC	Volumetric water content
XXX	3-digit station number from 101-110, see Table 4 for more details.
all_cal	Indicates that there is additional calibrated information in the files.
v01	Version number
.csv	File extension

Examples:

- SNEX20_DSM_USDA_TempNet_VWC_105_all_cal_v01.csv

1.3 Spatial Information

1.3.1 Coverage

Northernmost Latitude: 39.037° N

Southernmost Latitude: 39.004° N

Easternmost Longitude: 108.15° W

Westernmost Longitude: 108.22° W

1.3.2 Resolution

Point Measurements

1.3.3 Geolocation

The following table provides information for geolocating this data set

Table 3. Geolocation Details

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

1.4 Temporal Information

1.4.1 Coverage

24 September 2019 – 03 June 2020

Note: Two of the data loggers at the measurement stations 101 and 110 (Table 4) the sensors were destroyed during the field campaign and the data ends already on 05 November 2019.

1.4.2 Resolution

Hourly

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This data set consists of soil moisture and soil temperature measurements taken during the SnowEx 2020 field campaign. Stevens Water HydraProbes were deployed at 10 stations within the Colorado Grand Mesa study area. Table 4 lists the station names and locations.

The following table lists the 3-digit station number with its SnowEx 2020 site name and latitude/longitude values.

Table 4. Measurement station details

Station number	Site name	Latitude	Longitude
101	FL3C	39.004225° N	108.154675° W
102	FL1A	39.02106° N	108.210766° W
103	FL2B	39.033281° N	108.215172° W
104	FL2A	39.034904° N	108.219653° W
105	FL2C	39.032616° N	108.199954° W
106	FL3A	39.036317° N	108.189587° W
107	FL2D	39.032746° N	108.177544° W
108	FL3B	39.024154° N	108.175447° W
109	FL1B	39.021914° N	108.174772° W
110	(not named site)	39.035005° N	108.19023° W

2.2 Acquisition

The Stevens Water HydraProbes were installed at 5 cm, 10 cm, and 20 cm from the top of the soil surface. Actual probe depths varied 3-7 cm (nominal 5 cm probe), 8-12 cm (nominal 10 cm probe), and 18-22 cm (nominal 20 cm probe).

Probes were deployed in September 2019. The sites were revisited and data downloaded in November 2019. The next revisit and data retrieval of the stations occurred in June 2020 as a result of COVID-19 restrictions. This resulted in some data loss from November 2019 to January 2020 as the datalogger memory cards were full.

2.3 Processing

The data were downloaded and a calibration equation was applied based on laboratory work using soils from the installation sites, with like soils aggregated into a single equation. This method

follows Cosh et al. (2005) considering the specific dielectric and organic matter contents of the soil at the site. Data are additionally made available using a factory calibration using a generic loam equation based on soils found across the continental U.S. For most applications the site-specific calibrated soil moisture should be used.

2.4 Quality, Errors, and Limitations

Sensors were calibrated in the laboratory using a wetting and drying method from soil collected during the installation of the sensors in the field. Sensors are considered to be identical with approximately 0.01 cm³/cm³ inter-sensor variability. Calibrations of the sensor resulted in average errors of 0.03-0.04 m³/m³.

2.5 Instrumentation

All data was collected with [Stevens Water HydraProbes](#).

3 SOFTWARE AND TOOLS

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

4 VERSION HISTORY

Table 5. 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

Cosh, M. H., Jackson, T. J., Bindlish, R., Famiglietti, J. S., & Ryu, D. (2005). Calibration of an impedance probe for estimation of surface soil water content over large regions. *Journal of Hydrology*, 311(1–4), 49–58, DOI: 10.1016/j.jhydrol.2005.01.003.

Seyfried, M. S., Grant, L. E., Du, E., & Humes, K. S. (2005). Dielectric loss and calibration of the Hydra probe soil water sensor. *Vadose Zone Journal*, 4, 1070–1079, DOI: 10.2136/vzj2004.0148.

9 DOCUMENT INFORMATION

9.1 Publication Date

03 June 2021

9.2 Date Last Updated

03 June 2021