



SnowEx21 Prairie Station In Situ Dielectric Soil Moisture and Soil Temperature, Version 1

USER GUIDE

How to Cite These Data

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

Cosh, M. H., E. A. Sproles, R. T. Palomaki, M. Beck, and A. Mullen. 2022. *SnowEx21 Prairie Station In Situ Dielectric Soil Moisture and Soil Temperature, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/ZTAP7GH76M9Y>. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SNEX21_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 four different depths (5, 10, 20, 50 cm) with a Stevens Water HydraProbe.

1.2 File Information

1.2.1 Format

Data is available in comma separated values files (.csv). A separate data file exists for each measurement location within the Montana Prairie Station study area.

1.2.2 File Contents

The .csv files contain one main data tab with 22 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., 2016). For most applications the site-specific calibrated soil moisture should be used.

Table 1. Data Parameters

Parameter short name	Description	Unit
TIMESTAMP	Time stamp using the following format: (D)D/(M)M/YY (h)h:mm where the digits in parenthesis are only used when the value is 10 or larger (e.g., when the day of the month is 10 or larger).	N/A
Date	Date of data acquisition using the following format: (D)D/(M)M/YY where the digits in parenthesis are only used when the value is 10 or larger.	N/A
Hour	Hour of data acquisition using the following format: hh:mm	N/A
RECORD	Record number	N/A
Site	Station identification number	N/A
Batt_Volt_V	Battery voltage	V
RDC_5cm_S/m	Real dielectric constant (soil permittivity) at 5 cm	S/m
RDC_10cm_S/m	Real dielectric constant (soil permittivity) at 10 cm	S/m
RDC_20cm_S/m	Real dielectric constant (soil permittivity) at 20 cm	S/m

Parameter short name	Description	Unit
RDC_50cm_S/m	Real dielectric constant (soil permittivity) at 50 cm	S/m
SM_5cm_m3/m3	Factory calibrated soil moisture at 5 cm	m ³ /m ³
SM_10cm_m3/m3	Factory calibrated soil moisture at 10 cm	m ³ /m ³
SM_20cm_m3/m3	Factory calibrated soil moisture at 20 cm	m ³ /m ³
SM_50cm_m3/m3	Factory calibrated soil moisture at 50 cm	m ³ /m ³
Temp_5cm_C	Soil temperature at 5 cm	°C
Temp_10cm_C	Soil temperature at 10 cm	°C
Temp_20cm_C	Soil temperature at 20 cm	°C
Temp_50cm_C	Soil temperature at 50 cm	°C
SM_5cm_Cal_m3/m3	Soil specific calibrated volumetric soil moisture at 5 cm	m ³ /m ³
SM_10cm_Cal_m3/m3	Soil specific calibrated volumetric soil moisture at 10 cm	m ³ /m ³
SM_20cm_Cal_m3/m3	Soil specific calibrated volumetric soil moisture at 20 cm	m ³ /m ³
SM_50cm_Cal_m3/m3	Soil specific calibrated volumetric soil moisture at 50 cm	m ³ /m ³

1.2.3 Naming Convention

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

SNEX21_DSM_[X]_SnowEx_Hydra_v1.csv

Table 2. File Naming Convention

Variable	Description
SNEX21_DSM	SnowEx21 Prairie Station In Situ Dielectric Soil Moisture and Soil Temperature
X	1-digit Hydra probe number from 1-9, see Table 4 for more details.
SnowEx	Refers to SnowEx measurements.
Hydra	Indicating the used instrument for data collection.
v1	Version number
.csv	File extension

Examples:

- SNEX21_DSM_7_SnowEx_Hydra_v1.csv

1.3 Spatial Information

1.3.1 Coverage

Northernmost Latitude: 47.064° N

Southernmost Latitude: 47.055° N

Easternmost Longitude: 109.946° W

Westernmost Longitude: 109.957° 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

05 November 2020 – 02 April 2021

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 2021 field campaign. Stevens Water HydraProbes were deployed at 9 sites within the Montana Prairie Station 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

Sensor name	Latitude	Longitude
SnowEx01	47.0587° N	109.9569° W
SnowEx02	47.0606° N	109.9570° W
SnowEx03	47.0608° N	109.9582° W
SnowEx04	47.0606° N	109.9554° W
SnowEx05	47.0581° N	109.9528° W
SnowEx06	47.0601° N	109.9499 ° W
SnowEx07	47.0605° N	109.9499 ° W
SnowEx08	47.0640° N	109.9470° W
SnowEx09	47.0644° N	109.9517° W

2.2 Acquisition

The Stevens Water HydraProbes were installed at 5 cm, 10 cm, 20 cm, and 50 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), and 48-52 cm (nominal 50 cm probe).

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. (2016) considering the specific 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

The soil moisture has been calibrated to an accuracy of 0.021 m³/m³ for the soil located in the study site in Montana.

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	01 March 2022	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., Ochsner, T. E., McKee, L., Dong, J., Basara, J. B., Evett, S. R., Hatch, C. E., Small, E. E., Steele-Dunne, S. C., Zreda, M., & Sayde, C. (2016). The Soil Moisture Active Passive Marena, Oklahoma, In Situ Sensor Testbed (SMAP-MOISST): Testbed Design and Evaluation of In Situ Sensors. *Vadose Zone Journal*, 15(4), <https://doi.org/10.2136/vzj2015.09.0122>.

<https://doi.org/10.2136/vzj2015.09.0122>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, <https://doi.org/10.2136/vzj2004.0148>.

9 DOCUMENT INFORMATION

9.1 Publication Date

01 March 2022

9.2 Date Last Updated

09 March 2022