Daily 4 km Gridded SWE and Snow Depth from Assimilated In-Situ and Modeled Data over the Conterminous US, Version 1

USER GUIDE

How to Cite These Data

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

Broxton, P., X. Zeng, and N. Dawson. 2019. *Daily 4 km Gridded SWE and Snow Depth from Assimilated In-Situ and Modeled Data over the Conterminous US, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/0GGPB220EX6A. [Date Accessed].

Zeng, X., P. Broxton, and N. Dawson. 2018. Snowpack Change From 1982 to 2016 Over Conterminous United States, *Geophysical Research Letters*. 45. 12940-12947. https://doi.org/10.1029/2018GL079621

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0719

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

The data files contain snow water equivalent (SWE; in mm H2O) and snow depth (in mm) for each water year (WY) from 1981 to 2020. The corresponding parameters in the data files are called SWE and DEPTH, respectively (see Table 1).

Table 1. Parameter Descriptions

Parameter	Description	Units
`crs`	Coordinate Refernce System (CRS) definition	-
`lat`	Latitude	Degrees North
`lon`	Longitude	Degrees East
`time`	Time	Number of days since 1900-01-01
`time_str`	Time (string); format is "dd-mmm-yyyy"	-
`DEPTH`	Snow depth	mm
`SWE`	Snow water equivalent (SWE)	mm H_2O
`SWE_MASK`	Mask for `SWE`. The values for `SWE_MASK` are: Value of 1: Water Value of 2: Permanant snow/ice Value of 3: Located outside of the conterminous US Note: The parameter `SWE_MASK` is only provided in the file `SWE_Mask_v01.nc`.	-

1.2 File Information

1.2.1 Format

The data files and SWE mask file (`SWE_Mask_v01.nc`) are provided in netCDF (`.nc`) format.

1.2.2 File Contents

As an example of the file contents, Figure 1 shows the snow depth (`DEPTH`) on 08 January 2017 from the file `4km_SWE_Depth_WY2017_v01.nc`.

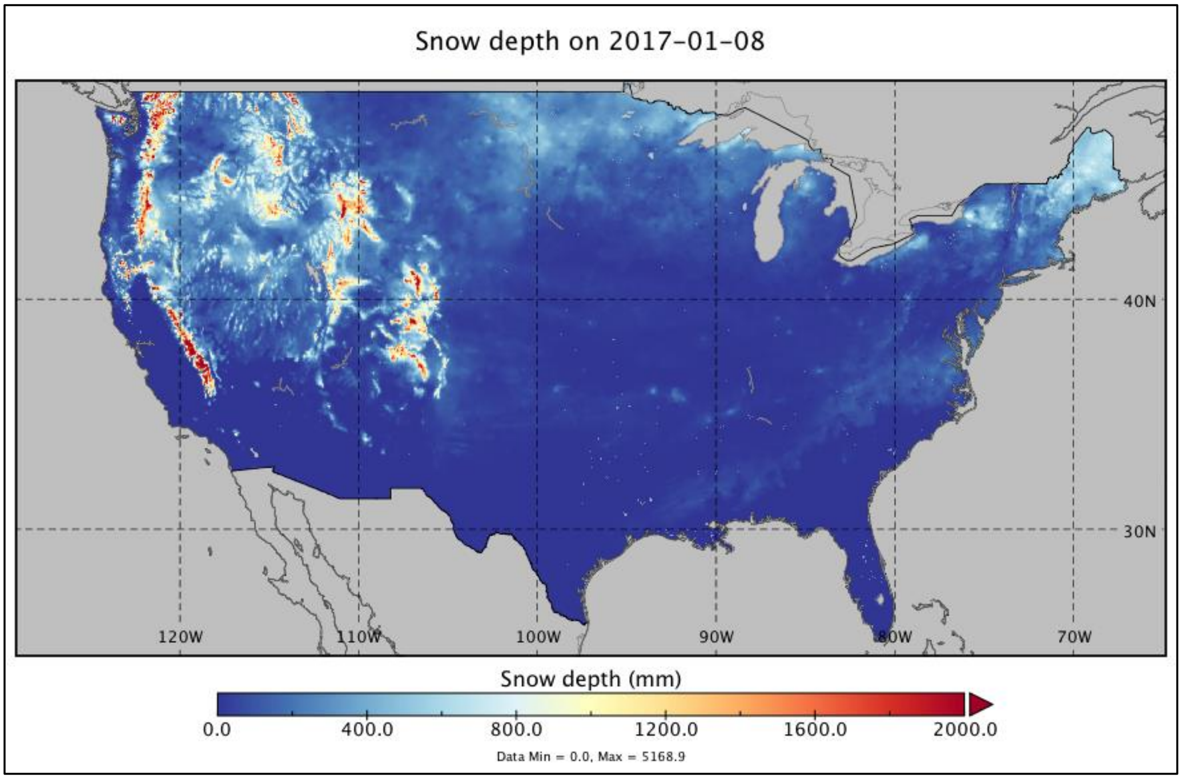

Figure 1. Snow depth (in mm) on 08 January 2017

1.2.3 Directory Structure

The data files are located in the following directory:

https://daacdata.apps.nsidc.org/pub/DATASETS/nsidc0719_SWE_Snow_Depth_v1/

1.2.4 Naming Convention

Each data file name contains the water year of collection. A water year starts in the beginning of October of the previous year and ends at the end of September of the current year. For example, a water year of 1982 (WY1982) means that the data start on 01 October 1981 and end on 30 September 1982. Water years that are leap years include 29 February for a total of 366 days.

Example file name:

```
4km_SWE_Depth_WY1982_v01.nc
```

The data files are named according to the following convention, which is described in detail in Table 2:

```
4km_SWE_Depth_WYyyyy.ext
```

Table 2. File Naming Convention

Variable	Description
4km_SWE_Depth	Indicates that this data set provides SWE and snow depth at 4 km resolution.
WYyyyy	Water year (WY) consisting of four digits (yyyy). E.g.: WY1982
.ext	File type: .nc = netCDF data file

Note: In addition to the data files, one SWE mask file named SWE_Mask_v01.nc is provided.

1.3 File Size

Total netCDF file volume: 2.6 GB

1.4 Spatial Information

1.4.1 Coverage

Spatial coverage includes conterminous US, as noted by the spatial extents below.

Northernmost latitude: 50.0° N

Southernmost latitude 24.0° N

Easternmost longitude: 66.5° W

Westernmost longitude: 125.0° W

1.4.2 Resolution

The spatial resolution is 4 km by 4 km.

1.4.3 Geolocation

Table 3 provides information on the projection used in this data set.

Table 3. Geolocation Details

Geographic coordinate system	WGS 84
Projected coordinate system	N/A
Longitude of true origin	N/A
Latitude of true origin	N/A
Scale factor at longitude of true origin	N/A
Datum	WGS 84
Ellipsoid/spheroid	WGS 84

Units	Degrees
False easting	N/A
False northing	N/A
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs
Reference	https://epsg.io/4326

1.5 Temporal Information

1.5.1 Coverage

01 October 1981 to 30 September 2020.

1.5.2 Resolution

Daily (includes 29 February for leap years).

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition and Processing

This data set was developed by consistently assimilating PRISM daily 4 km precipitation and temperature data, SWE and snow depth data from thousands of in-situ snow stations from the SNOTEL network, and snow depth data from the COOP network. The assimilation of the SWE and snow depth measurements in this data set was achieved by using the key idea in Broxton et al. (2016b) along with the new snow density model described in Dawson et al. (2017). A summary of the how the method was additionally refined, as well as a trend/driver analysis of the data set, are provided in Zeng et al. (2018).

The ratio between observed SWE, which is normalized by the accumulated snowfall, and modeled ablation (based on a temperature index snow model forced with PRISM data) is interpolated between the station locations. The results are then used to correct a background SWE field generated using a gridded version of the same PRISM-based snow model. The assimilation includes a new snow density parameterization, which is used to combine SWE and snow depth measurements from hundreds of SNOTEL sites with the snow depth measurements from thousands of COOP sites. In addition, snowfall is separated from rainfall using a temperature threshold, which is based on the occurrence of snow and rain at individual stations; the snow ablation is also estimated as a function of temperature, which is based on station data.

2.2 Quality, Errors, and Limitations

The data compare favorably to other high-quality SWE and snow depth data, such as data derived from the Airborne Snow Observatory (ASO) lidar; in addition, derived snow cover in this data set is fairly consistent the NOAA National Environmental Satellite, Data, and Information Service (NESDIS) merged product, which is based on satellite, in situ, and other data. For more information, see Dawson et al. (2018).

Following the approach by Dawson et al. (2016), to eliminate temporal inconsistencies in the station data, values are disregarded if they change by more than 0.5 m/day (for snow depth) or 0.2 m/day (for SWE). Additionally, values of zero are disregarded if they are preceded and followed by days with non-zero values of SWE or snow depth. The PRISM data are not quality controlled, as the station data used in PRISM are already extensively quality controlled (Daly et al., 2008).

2.3 Instrumentation

The data used to create this data set come from three different sources:

1. Parameter-elevation Regressions on Independent Slopes Model (PRISM): an analytical tool that uses point data, a digital elevation model, and other spatial data sets to generate gridded estimates of monthly, yearly, and event-based climatic parameters, such as precipitation, temperature, snowfall, degree days, and dew point. The PRISM Climate Group at Oregon State University gathers climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate data sets to reveal short- and long-term climate patterns.
2. Snow Telemetry (SNOTEL) network: an automated system of snowpack and related climate sensors operated by the Natural Resources Conservation Service (NRCS) and maintained by the California Department of Water Resources.
3. Cooperative Observer Program (COOP): a cooperative weather and climate observing network maintained by the National Weather Service (NWS).

3 SOFTWARE AND TOOLS

NetCDF data files can be opened using netCDF-visualization software, such as Panoply.

4 RELATED DATA SETS

Canadian Meteorological Centre (CMC) Daily Snow Depth Analysis Data

Snow Data Assimilation System (SNODAS) Data Products at NSIDC

Airborne Snow Observatory (ASO) data at NSIDC

5 RELATED WEBSITES

MEaSUREs data at NSIDC

6 CONTACTS AND ACKNOWLEDGMENTS

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7 REFERENCES

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8 DOCUMENT INFORMATION

8.1 Publication Date

14 March 2019

8.2 Date Last Updated

10 December 2020