



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

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].

### Literature Citation

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](mailto: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

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The data files contain snow water equivalent (SWE; in mm H<sub>2</sub>O) and snow depth (in mm) for each water year (WY) from 1981 to 2022. 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 Reference 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 <sub>2</sub> O

## 1.2 File Information

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### 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.

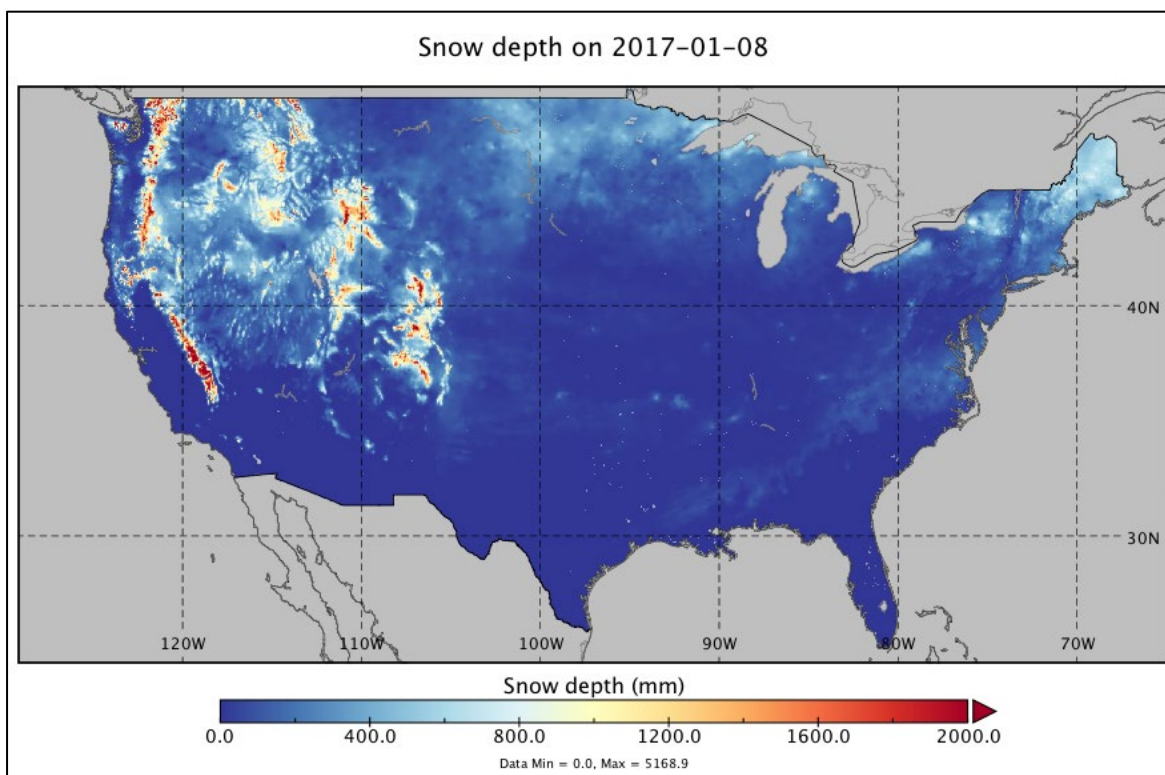


Figure 1. Snow depth (in mm) on 08 January 2017

### 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/](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\_v01.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
v01	Version number
.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 Spatial Information

### 1.3.1 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

### 1.3.2 Resolution

The spatial resolution is 4 km by 4 km.

### 1.3.3 Geolocation

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

Table 3. Geolocation Details

<b>Geographic coordinate system</b>	NAD83
<b>Projected coordinate system</b>	N/A
<b>Longitude of true origin</b>	N/A
<b>Latitude of true origin</b>	N/A
<b>Scale factor at longitude of true origin</b>	N/A
<b>Datum</b>	North_American_Datum_1983
<b>Ellipsoid/spheroid</b>	GRS 1980
<b>Units</b>	degree
<b>False easting</b>	N/A

<b>False northing</b>	N/A
<b>EPSG code</b>	4269
<b>PROJ4 string</b>	+proj=longlat +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +no_defs
<b>Reference</b>	<a href="https://epsg.io/4269">https://epsg.io/4269</a>

## 1.4 Temporal Information

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### 1.4.1 Coverage

01 October 1981 to 30 September 2022.

### 1.4.2 Resolution

Daily (includes 29 February for leap years).

## 2 DATA ACQUISITION AND PROCESSING

### 2.1 Acquisition and Processing

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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 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

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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

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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

### **Prof. Xubin Zeng and Dr. Patrick Broxton**

Department of Hydrology and Atmospheric Sciences

University of Arizona

Tucson, Arizona, USA

### **Nicholas Dawson**

Idaho Power Company

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## 8 DOCUMENT INFORMATION

### 8.1 Publication Date

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March 2019

### 8.2 Date Last Updated

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