



MEaSURES Northern Hemisphere State of Cryosphere Weekly 100km EASE-Grid 2.0, Version 1

USER GUIDE

How to Cite These Data

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

Robinson, D. A., M. Anderson, T. W. Estilow, and T. L. Mote. 2015. *MEaSURES Northern Hemisphere State of Cryosphere Weekly 100km EASE-Grid 2.0, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/MEASURES/CRYOSPHERE/nsidc-0535.001>. [Date Accessed].

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

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National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

This data set utilizes three variables to represent Northern Hemisphere snow cover and sea ice extent from 2 January 1979 through 31 December 2012. These variables report:

- The location of snow cover and Arctic sea ice at 100 km resolution, generated by merging snow cover from the [MEaSURES Northern Hemisphere Terrestrial Snow Cover Extent Weekly 100km EASE-Grid 2.0](#) data set with sea ice from the [MEaSURES Arctic Sea Ice Characterization Daily 25km EASE-Grid 2.0](#) data set
- Melt onset status at 100 km resolution across the Greenland Ice Sheet and Arctic sea ice, generated from the [MEaSURES Greenland Surface Melt Daily 25km EASE-Grid 2.0](#) and [MEaSURES Arctic Sea Ice Characterization Daily 25km EASE-Grid 2.0](#) data sets
- The level of agreement between two snow cover maps in the [MEaSURES Northern Hemisphere Terrestrial Snow Cover Extent Weekly 100km EASE-Grid 2.0](#) data set

1.1 Format

Data files are formatted in Network Common Data Form, Version 4 (NetCDF-4) (.nc) following version 1.6 of the Climate and Forecast (CF) metadata conventions. For more information about working with NetCDF formatted data, visit the UCAR Unidata [Network Common Data Form \(NetCDF\)](#) Web site.

1.2 File Naming Convention

This section explains the file naming convention used for this data set with an example.

Example File Name: socw100e2_19790102_19790108_v01r01.nc

socwxxx2_YYYYMMDD_yyyymmdd_v01r01.nc

Refer to Table 1 for the valid values for the file name variables listed above.

Table 1. File Naming Convention

Variable	Description
soc	State of Cryosphere
w	Weekly
xxx	Resolution (km)
e2	EASE-Grid 2.0
YYYYMMDD	First day of week (year, month, and day)
yyyymmdd	Last day of week (year, month, and day)
v01r01	Version 1.1
.nc	netCDF-formatted file

1.3 Spatial Coverage

Southernmost Latitude: 0.0°

Northernmost Latitude: 90.0°

Westernmost Longitude: -180.0°

Easternmost Longitude: 180.0°

1.3.1 Spatial Resolution

100 km

1.3.2 Projection and Grid Description

Data are provided in the 100 km Northern Hemisphere Equal Area Scalable Earth Grid 2.0 (EASE-Grid 2.0). Grid dimensions are 180 x 180. For a complete description of EASE-Grid 2.0, visit NSIDC's [EASE-Grid 2.0 Format Description](#) page.

1.4 Temporal Coverage

2 January 1979 - 31 December 2012

1.4.1 Temporal Resolution

This data set consists of weekly snow and sea ice cover. Each week runs from Tuesday through the following Monday.

1.5 Parameter or Variable

Snow cover, sea ice cover, and status of melt onset are the primary parameters in this data set. Data files also include latitude and longitude arrays that specify the center of each 100 km EASE-Grid 2.0 cell, coordinate system parameters, and the number of days since the beginning of the data record.

1.5.1 Parameter Description

Data files contain the variables listed in Table 2.

Table 2. Variable Names and Descriptions

Variable Name	Description	Dimensions	Data Type
merged_snow_and_sea_ice_extent	Merged snow and sea ice cover	180 x 180	byte (signed)
status_of_melt_onset	Status of melt onset for Greenland and Arctic sea ice	180 x 180	byte (signed)
snow_agreement_with_cdr	Indicates whether MW snow cover agrees with SCE CDR ¹	180 x 180	byte (signed)
latitude	Latitude at the center of each 100 km EASE-Grid 2.0 cell	180 x 180	float ²
longitude	Longitude at the center of each 100 km EASE-Grid 2.0 cell	180 x 180	float ²
cols	x coordinate, center of 100 km EASE-Grid 2.0 cell (m from origin)	1 x 180	int
rows	y coordinate, center of 100 km EASE-Grid 2.0 cell (m from origin)	180 x 1	int
coord_system	EASE-Grid 2.0 grid and projection parameters	—	char
time	Days since 12/31/1978	—	int
¹ Passive microwave (MW) derived snow cover; NOAA/NCDC Northern Hemisphere Snow Cover Extent Climate Data Record (SCE CDR). ² 32-bit single precision floating point. Fill value for grid corners = -999.			

1.5.2 Parameter Range

The merged_snow_and_sea_ice_extent, status_of_melt_onset, and snow_agreement_with_cdr variables, refer to Table 3 for more information, use coded integers to indicate the location of snow and sea ice, the status of melt onset on the Greenland Ice Sheet and Arctic sea ice, and whether snow cover derived from passive microwave (MW) brightness temperatures agrees with the [NOAA/NCDC Northern Hemisphere Snow Cover Extent Climate Data Record](#) (SCE CDR). The merged snow and sea ice extent variable also indicates the location of the [pole hole](#).

The following tables contain keys to the values stored in this data set's snow and sea ice cover variables.

Table 3. Key for merged_snow_and_sea_ice_extent

Value	Description
10	Snow covered land
20	Snow free land
30	Sea ice cover
40	Open water
90	Missing
91	Pole hole
-99	Fill value for grid corners

Table 4. Key for status_of_melt_onset

Value	Description
0	No melt data
51	Melt onset begins prior to file date
52	Melt onset begins on file date
53	Melt onset begins on a future date
-99	Fill value for grid corners

Table 5. Key for snow_agreement_with_cdr

Value	Description
0	MW does not agree with SCE CDR snow cover ¹
1	MW agrees with SCE CDR ¹
90	No comparison

Value	Description
-99	Fill value for grid corners
¹ Passive microwave (MW) derived snow cover; NOAA/NCDC Northern Hemisphere Snow Cover Extent Climate Data Record (SCE CDR).	

2 SOFTWARE AND TOOLS

2.1 Software and Tools

Unidata at the University Corporation for Atmospheric Research maintains an extensive list of freely available [Software for Manipulating or Displaying NetCDF Data](#).

3 DATA ACQUISITION AND PROCESSING

The following sections describe how each of the variables in this data set were generated. All variables were reconciled with EASE-Grid 2.0 Land-Ocean-Coast-Ice (LOCI) masks obtained from the [EASE-Grid 2.0 Land-Ocean-Coastline-Ice Masks Derived from Boston University MODIS/Terra Land Cover Data](#) data set.

3.1 Merged Snow and Sea Ice Cover

3.1.1 Processing Steps

Snow cover was obtained directly from the weekly_climate_data_record_snow_cover_extent variable in the [MEaSURES Northern Hemisphere Terrestrial Snow Cover Extent Weekly 100km EASE-Grid 2.0](#) data set. Arctic sea ice extent was obtained from the sea_ice_cover variable in [MEaSURES Arctic Sea Ice Characterization Daily 25km EASE-Grid 2.0](#). When these variables were reconciled with their corresponding 100 km and 25 km [EASE-Grid 2.0 LOCI masks](#), changes to the original data were stored using separate codes. For example, the snow cover extent variable contains different values for "snow covered land" and "ocean converted to snow covered land." These values were combined for the purposes of this data set.

The merged_snow_and_sea_ice_extent variable was generated as follows:

1. Weekly sea ice maps were created from daily files by selecting Monday's value as the representative value for each cell, each week. If Monday's data was missing, Sunday's was used instead. If neither day was available, the value for that cell was filled as missing. This

approach—using data weeks that run from Tuesday through the following Monday—was adopted to match the convention used by snow cover source data.

2. Weekly sea ice maps were re-gridded from 25 km to 100 km using Mapx and compared with the 100 km EASE-Grid 2.0 LOCI mask. In cases where land mask mismatches converted a pixel from land to ocean, the discrepancy was reconciled by applying a 3x3 moving box filter through several passes. On the first pass, the filter examined the eight cells surrounding the converted cell and assigned it as sea ice cover if more than 50 percent contained ice. Otherwise the cell was assigned the value for open water. Subsequent iterations reassigned pixels if at least 33 percent of the surrounding cells were ice covered. Iterations were continued until no more changes were found.
3. Values for ocean and land from the 100 km EASE-Grid 2.0 LOCI mask were written to an intermediate array.
4. Values for snow covered land and ocean converted to snow covered land were written to the array using the coding scheme in Table 3.
5. Values for sea ice were written to the array using the coding scheme in Table 3.
6. Data from the intermediate array were written to the merged_snow_and_sea_ice_extent NetCDF variable.

For details about the snow cover source data, refer to the Data Acquisition and Processing section in [MEaSURES Northern Hemisphere Terrestrial Snow Cover Extent Weekly 100km EASE-Grid 2.0](#). For details about the Arctic sea ice cover source data, refer to the Data Acquisition and Processing section in [MEaSURES Arctic Sea Ice Characterization Daily 25km EASE-Grid 2.0](#).

3.2 Status of Melt Onset

3.2.1 Processing Steps

Status of melt onset over Arctic sea ice was derived from the status_of_melt_onset variable in [MEaSURES Arctic Sea Ice Characterization Daily 25km EASE-Grid 2.0](#). Status of melt onset over Greenland was calculated at the University of Georgia using melt onset dates from [MEaSURES Greenland Surface Melt Daily 25km EASE-Grid 2.0](#). These variables were reconciled with the 25 km [EASE-Grid 2.0 LOCI mask](#) when generated for their respective data sets.

Status of melt onset is created by assigning integer values which indicate whether the cell has a melt onset date prior to the current day, on the current day, or later in the year. Cells with no melt onset date are filled with 0 (see Table 5). Melt onset is only calculated for days 61-245 of the year. This range corresponds to 2 March through 2 September in non-leap years and 1 March through 1 September in leap years. Days that lie outside this range are filled with 0.

The combined Arctic-Greenland status of melt onset variable for this data set was generated as follows:

1. Weekly maps were created from daily files by selecting Monday's value as the representative value for each cell, each week. If Monday's data was missing, Sunday's was used instead. If neither day was available, the value for that cell was filled as missing. This approach—using data weeks that run from Tuesday through the following Monday—was adopted to match the merged snow and sea ice cover variable described in the preceding section.
2. Weekly status of melt onset maps over Arctic sea ice and Greenland were regridded to 100 km EASE-Grid 2.0 using Mapx.
3. Values for status of melt onset over Arctic sea ice and Greenland were written to an intermediate array using the coding scheme in Table 4.
4. The data were written to the `status_of_melt_onset` NetCDF variable.

For details about the Arctic Sea Ice and Greenland source data were derived, refer to the Data Acquisition and Processing section in [MEaSURES Arctic Sea Ice Characterization Daily 25km EASE-Grid 2.0](#) and [MEaSURES Greenland Surface Melt Daily 25km EASE-Grid 2.0](#).

3.3 Snow Agreement with SCE CDR

3.3.1 Processing Steps

The `snow_agreement_with_cdr` variable was calculated from the [MEaSURES Northern Hemisphere Terrestrial Snow Cover Extent Weekly 100km EASE-Grid 2.0](#) data set, which contains both SCE CDR and MW-derived snow cover. This data set also contains the variable `merged_snow_cover_extent`, which specifies for each cell whether the SCE CDR, MW-derived snow cover, or both indicate snow.

The `snow_agreement_with_cdr` variable offers a different representation of snow cover in that it reports whether MW-derived snow cover agrees with the SCE CDR. `snow_agreement_with_cdr` was generated from `merged_snow_cover_extent` as follows:

MW agreement was calculated and written to an intermediate array using the coding scheme in Table 5.

Areas where no comparison was performed due to missing data and areas covered by permanent ice in the 100 km EASE-Grid 2.0 LOCI mask were written to the array using the coding scheme in Table 5.

Data from the intermediate array were written to the `snow_agreement_with_cdr` NetCDF variable.

For details about the SCE CDR, MW-derived snow cover, and merged_snow_cover_extent variable, refer to the Data Acquisition and Processing section [MEaSURES Northern Hemisphere Terrestrial Snow Cover Extent Weekly 100km EASE-Grid 2.0](#) for more information.

3.3.2 Version History

Version 1.1 was released in July, 2015. Refer to Table 6 for this data set's version history.

Table 6. Version History

Version	Description
V1.1 (Jul, 2015)	Added 1D arrays named <code>cols</code> and <code>rows</code> that contain x and y coordinates (meters from origin) of the projection. v01r01 appended to data file names.
V1 (Feb, 2015)	Initial version

3.3.3 Error Sources

Missing data represents the biggest impact to overall data quality, as all the input products lack some daily files during the period of record.

The SCE CDR snow cover maps are not constructed according to a formal algorithm, but instead rely on the expertise of trained analysts. Furthermore, because these maps are generated from workstation software that is continually being evaluated and improved, changes in mapping methodologies have occurred over time. Passive microwave derived snow and sea ice cover is subject to errors carrying through from the input data to the output. For details about potential errors in snow and sea ice cover derived from passive microwave brightness temperatures, refer to the Error Sources section in [MEaSURES Greenland Surface Melt Daily 25km EASE-Grid 2.0](#) and [MEaSURES Arctic Sea Ice Characterization Daily 25 km EASE-Grid 2.0](#) for more information.

4 REFERENCES AND RELATED PUBLICATIONS

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4.1 Related Data Collections

- [MEaSURES Northern Hemisphere Terrestrial Snow Cover Extent Daily 25km EASE-Grid 2.0](#)
- [MEaSURES Arctic Sea Ice Characterization Daily 25km EASE-Grid 2.0](#)
- [MEaSURES Greenland Surface Melt Daily 25km EASE-Grid 2.0](#)
- [IMS Daily Northern Hemisphere Snow and Ice Analysis at 4 km and 24 km Resolution](#)
- [NOAA/NCDC Northern Hemisphere Snow Cover Extent Climate Data Record](#)
- [EASE-Grid 2.0 Land-Ocean-Coastline-Ice Masks Derived from Boston University MODIS/Terra Land Cover Data](#)

4.2 Related Websites

- [NOAA National Climatic Data Center | Operational Climate Data Records](#)
- [Northern Hemisphere Snow and Ice Climate Data Records at Rutgers University](#)

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6 DOCUMENT INFORMATION

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