Near-Real-Time NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 4

USER GUIDE

How to Cite These Data

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

Meier, W. N., F. Fetterer, A. K. Windnagel, J. S. Stewart, and T. Stafford. 2026. *Near-Real-Time NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 4*. [Indicate subset used]. https://doi.org/10.7265/tm2n-1m33. [Date Accessed].

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

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National Snow and Ice Data Center

TABLE OF CONTENTS

1 DATA DESCRIPTION

Notice: The near-real-time V4 sea ice concentration (SIC) CDR provides the most recent SIC CDR data and fills the temporal gap between updates of the final V6 CDR, which lags by about three weeks. The NRT V4 SIC CDR is preliminary and does not go through all the automated quality controls that the final V6 CDR does. When the final V6 CDR is updated, users should download these data to replace any NRT data they may be using.

1.1 Summary

The Near-Real-Time NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration (NRT SIC CDR) Version 4 data set is the daily-update version of the *NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 6* (final SIC CDR).

With the release of NRT CDR V4, the product now uses the same input data source as the final CDR V6 product: *AMSR2 Daily Polar Gridded Brightness Temperatures, Version 2*. Previously, the NRT product used an NRT input source. The major difference between the NRT SIC CDR and the final SIC CDR is that the NRT SIC CDR cannot perform the full temporal gap filling interpolation because no forward data is available when a date is processed. Once enough data become available, the final product is processed with full temporal interpolation and users should replace their NRT files with the final product.

The Version 4 NRT NOAA/NSIDC SIC CDR is produced using an algorithm that joins ice concentrations from two well established algorithms developed at the NASA Goddard Space Flight Center (GSFC): the NASA Team (NT) algorithm (Cavalieri et al. 1984) and the Bootstrap (BT) algorithm (Comiso 1986). The CDR algorithm then blends the NT and BT output concentrations by selecting, for each grid cell, the higher concentration value. For a high-level overview of the SIC CDR algorithm, see the SIC CDR Algorithm section in the *NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 6* User Guide. For full details on the algorithms, filters, interpolations, and error sources, see the Climate Algorithm Theoretical Basis Document (C-ATBD): Sea Ice Concentration, Rev. 12 (Windnagel et al., 2026).

Addition of AMSR2 Sea Ice Concentration

With the release of the NRT SIC CDR Version 4, the NRT SIC CDR time series now uses input data from the AMSR2 sensor. Because the DMSP satellites are aging, it is important to ensure the continuation of a quality-controlled sea ice concentration time series, thus the addition of this new sensor. Furthermore, the AMSR2 instrument is a next-generation sensor with better spatial resolution than its predecessor SSM/I and SSMIS instruments. The better resolution suggests that an AMSR2 sea ice concentration field represents sea ice more accurately than the same ice

represented in an SSMIS ice concentration field. This is true even after the AMSR2 field – whose native resolution is 12.5 km – is re-gridded to match the 25 km SSMIS grid. This is discussed further in Section 3.4.3 of the C-ATBD (Windnagel et al., 2026).

1.2 Parameters

The parameter of this data set is sea ice concentration which is the fraction of ocean area covered by sea ice. Sea ice concentration represents an areal coverage of sea ice. For a given grid cell, the parameter provides an estimate of the fractional amount of sea ice covering that cell, with the remainder of the area consisting of open ocean.

1.3 File Information

1.3.1 Format

These data are provided in netCDF4 file format and are compliant with the Climate and Forecast (CF) Metadata Convention CF-1.11 and the Attribute Convention for Data Discovery (ACDD) 1.3.

The CDR data are provided in two temporal resolutions: daily and monthly averages. The data variables in netCDF files are described in section 1.3.4 File Contents.

1.3.2 Directory Structure

The data files are organized on the HTTPS site into two main directories by hemisphere (Figure 1): **north** and **south**. These are further subdivided into three folders:

- **checksums**: Contains md5 checksums of the individual daily and monthly data files to ensure accuracy in data transfer. It is divided into two folders: daily and monthly, which correspond to structure of the netCDF data files.
- **daily**: Contains individual files for each day, organized by year.
- **monthly**: Contains individual files for each month of every year. CDR data only. The AMSR2 data is not provided as monthly averages.

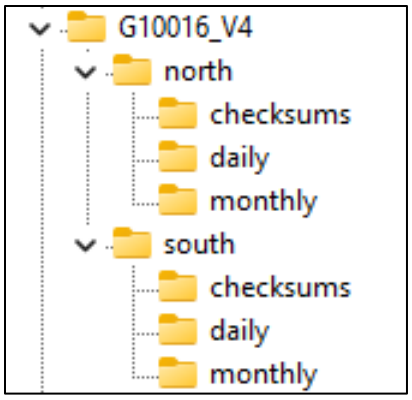

Figure 1. Directory Structure

1.3.3 Naming Convention

The file naming convention for the daily and monthly files is listed below and described in Table 1:

Daily files: `sic_ps[h]25_[yyyymmdd]_[sat]_icdr_[vXXrXX].nc`
Monthly files: `sic_ps[h]25_[yyyymm]_F17_icdr_[vXXrXX].nc`

Where:

Table 1. File Naming Convention

Variable	Description
sic	Identifies files containing sea ice concentration data
ps	Indicates files are gridded to the polar stereographic grid
h	Hemisphere (n: North, s: South)
25	Indicates that the data in these files have a spatial resolution of 25 km.
yyyy	4-digit year
mm	2-digit month
dd	2-digit day of month
sat	Source satellite (am2: AMSR2)
icdr	Identifies this as and interim NRT CDR
vXXrXX	Version and revision number of the data file (e.g. v04r00: Version 4, Revision 0)
.nc	Denotes a netCDF file
.nc.mnf	Identifies an md5 checksum file

1.3.4 File Contents

Each daily and monthly netCDF file has a variable for the concentration product, as well as variables containing standard deviation, quality flags, and projection information. These are described in further detail below in sections organized by the temporal resolution.

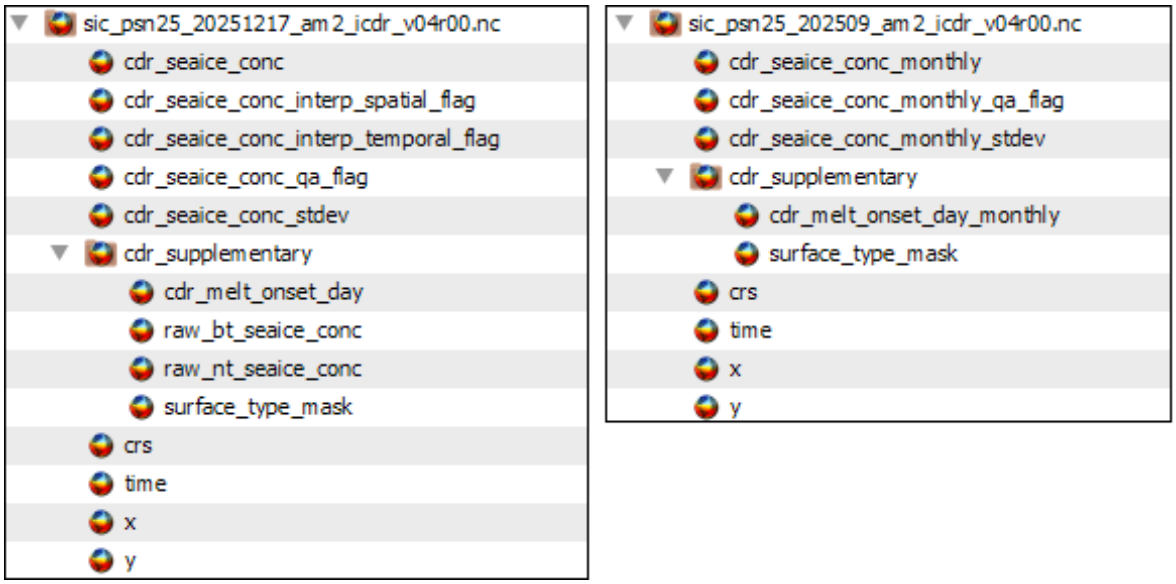

Figure 2. File Contents of a Northern Hemisphere CDR daily file (left) and monthly file (right)

1.3.4.1 Daily File Variable Description

The daily CDR netCDF4 files contain the variables and groups shown in Figure 2 and listed in Table 2. The sections below this table provide more detailed information.

Table 2. List of Daily CDR Variables

Variable Name	Brief Description
cdr_seaice_conc	NOAA/NSIDC daily sea Ice concentration CDR.
cdr_seaice_conc_interp_spatial_flag	Indicates the NOAA/NSIDC CDR grid cells that were spatially interpolated.
cdr_seaice_conc_interp_temporal_flag	Indicates the NOAA/NSIDC CDR grid cells that were temporally interpolated.
cdr_seaice_conc_qa_flag	Quality flags for the cdr_seaice_conc variable.
cdr_seaice_conc_stdev	Standard deviation of the daily NOAA/NSIDC CDR sea ice concentration (cdr_seaice_conc).
cdr_melt_onset_day	Day of year when melting sea ice was first detected in each grid cell for the daily NOAA/NSIDC CDR (applies to the Northern Hemisphere only). Located in the cdr_supplementary group.

Variable Name	Brief Description
raw_bt_seaice_conc	NSIDC-processed Bootstrap daily sea ice concentrations. Located in the cdr_supplementary group.
raw_nt_seaice_conc	NSIDC-processed NASA Team daily sea ice concentrations. Located in the cdr_supplementary group.
surface_type_mask	Provides a mask of different Earth surface types. Located in the cdr_supplementary group.
crs	Projection information for the data.
time	Date of the data (days since 1970-01-01).
x	Projection grid x centers in meters.
y	Projection grid y centers in meters.

cdr_seaice_conc

Description NOAA/NSIDC CDR sea ice concentrations representing the fraction of ocean area covered by sea ice. This variable is computed from the NASA Team and Bootstrap processed sea ice concentrations using the CDR Algorithm. For a description of the algorithm used to merge these, see the SIC CDR Algorithm Section of the final SIC CDR V6 User Guide.

Data Type Unsigned byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.

Valid Range 0 to 100. Note: Byte values are stored in the files from 0 to 100 but are typically presented by netCDF readers as values ranging from 0 to 1 due to a scaling factor attribute (scale_factor) of .01.

Fill Value 255

Units Unitless

cdr_seaice_conc_interp_spatial_flag

Description Provides details on the CDR grid cells that were spatially interpolated. Spatial interpolation occurs on the brightness temperature channels. See Table 3 for a list of the flag values and the C-ATBD (Meier et al., 2024) for details. If a grid cell was not spatially interpolated, its value is set to zero. Grid cells meeting multiple criteria contain the sum of all applicable flag values.

Data Type Unsigned byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.

Valid Range 0 to 63

Fill Value 0

Units Unitless

Table 3. Spatial interpolation flag values. A grid cell that satisfies multiple criteria contains the sum of all applicable flag values.

Condition	Flag Value	Label in NetCDF Variable
19 GHz vertical brightness temperature spatially interpolated	1	19v_tb_value_interpolated
19 GHz horizontal brightness temperature spatially interpolated	2	19h_tb_value_interpolated
22 GHz vertical brightness temperature spatially interpolated	4	22v_tb_value_interpolated
37 GHz vertical brightness temperature spatially interpolated	8	37v_tb_value_interpolated
37 GHz horizontal brightness temperature spatially interpolated	16	37h_tb_value_interpolated
Pole hole spatially interpolated (Arctic only)	32	pole_hole_spatially_interpolated_(Arctic_only)

cdr_seaice_conc_interp_temporal_flag

Description Provides details on the CDR grid cells that were temporally interpolated. Temporal interpolation is performed on the sea ice concentrations. See the Sea Ice Concentration Temporal Interpolation section of the C-ATBD (Meier et al., 2024) for details. The flag value is a 1- or 2-digit number showing which sea ice concentration data points were used in the interpolation. For example:

- 24: Missing grid cell interpolated from data two days prior and four days in the future.
- 30: Missing grid cell filled with data from three days prior.
- 1: Missing grid cell filled with data from one day in the future.
- 0: No temporal interpolation applied.

Data Type Unsigned byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.

Valid Range 0 to 55

Fill Value 0

Units Unitless

cdr_seaice_conc_qa_flag

Description	Quality flags for the daily NOAA/NSDIC CDR sea ice concentration (cdr_seaice_conc). See Table 4 for a list of the flags. Note: Grid cells meeting multiple conditions will have a value equal to the sum individual condition values. For example, a grid cell where both the Bootstrap weather filter (BT_weather_filter_applied, value 1) and land spillover (Land_spillover_filter_applied, value 4) are applied will have a flag value of 5.
Data Type	Unsigned byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.
Valid Range	Northern Hemisphere files: 0 to 255, Southern Hemisphere files: 0 to 127
Fill Value	0
Units	Unitless

Table 4. Daily QA Flag Values. A grid cell that satisfies multiple criteria will contain the sum of all applicable flag values.

Condition	Flag Value	Label in NetCDF Variable	Description
BT weather filter applied	1	BT_weather_filter_applied	Indicates that the Bootstrap weather filter was applied to this grid cell. This means that sea ice concentration was set to zero (open ocean).
NT weather filter applied	2	NT_weather_filter_applied	Indicates that the NT weather filter was applied to this grid cell. This means that sea ice concentration was set to zero (open ocean).
Land spillover applied	4	Land_spillover_filter_applied	Indicates that a land-spillover correction (either BT or NT2) was applied to this grid cell. This means that sea ice concentration was set to zero (open ocean).
No T_B input data available	8	No_input_data	Indicates that no input brightness temperature data was available for this grid cell.
Invalid ice mask applied	16	invalid_ice_mask_applied	Indicates that this grid cell has been designated as ocean (sea ice concentration set to zero) via an ocean mask or invalid ice mask.

Condition	Flag Value	Label in NetCDF Variable	Description
Spatially interpolation applied	32	spatial_interpolation_applied	Indicates that this grid cell was spatially interpolated. For more information, see the cdr_seaice_conc_interp_spatial_flag variable.
Temporal interpolation applied	64	temporal_interpolation_applied	Indicates that this grid cell was temporally interpolated. For more information, see the cdr_seaice_conc_interp_temporal_flag variable.
Start of Melt Detected (Northern Hemisphere files only)	128	melt_start_detected	Indicates that the ice in this grid cell has shown signs of melting, potentially reducing the reliability of sea ice concentration values. The melt onset test begins on day 60 of the year, approximately when sea ice extent reaches its annual maximum. Once a grid cell is flagged as melting, it retains this status throughout summer until day 244, around the time when extent reaches its minimum. The flag turns off when sea ice concentration drops to zero. For the exact date melting began, refer to the cdr_melt_onset_day variable.

cdr_seaice_conc_stdev

Description Standard deviation for the daily NOAA/NSIDC CDR sea ice concentration. This value is the standard deviation of a given grid cell along with its eight surrounding grid cells (nine values total) from both the NASA Team and Bootstrap data. The standard deviation is therefore computed using a total of 18 values: nine from the raw NSIDC NASA Team data and nine from the raw NSIDC Bootstrap data. Grid cells with high standard deviations indicate values with lower confidence levels. See the C-ATBD (Meier et al., 2024) for details.

Data Type Float array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.

Valid Range 0.0 to 1.0

Fill Value -1.0

Units Unitless

cdr_melt_onset_day

Description	Contains the day of year when melting sea ice was first detected for the sea ice CDR in each grid cell. It is located in the cdr_supplementary group. Once detected, this value remains constant for the rest of the melt season. For example, if a grid cell begins melting on day 73, the value for that cell will be 73 for that day and all subsequent days until the end of the melt season. The melt onset day is only calculated during the melt season: day of year 60 (March 1/February 29 for leap years) through 244 (September 1/August 31 for leap years), inclusive. At the start of the melt season, a value of 0 indicates sea ice concentration below 50%. Values of 60 to 244 (inclusive) indicate the day of year when melting on sea ice is detected, while 255 indicates no melt detected, including non-ocean grid cells. Before and after the melt season, the value is 255. Note that grid cells initially set to 0 at the melt season's start may develop ice later, which then melts due to advection or ice growth, and are assigned a melt date. Once set, a melt value remains unchanged. This variable applies to Northern Hemisphere files only.
Data Type	Unsigned byte array with dimensions [1, 448, 304] (North), representing time, y, and x, respectively.
Valid Range	0 to 255
Fill Value	N/A
Units	Unitless

raw_bt_seaice_conc

Description	NSIDC-processed Bootstrap daily sea ice concentrations from 25 October 1978 through the most recent processing. It is located in the cdr_supplementary group. These data values are raw BT concentrations, that is, no weather filters, land spillover corrections, or invalid ice masks have been applied. Note: While physically impossible, sea ice concentration values can exceed 100% due to the nature of the BT algorithm and brightness temperature data. For transparency, these values are left as is in the raw BT variable. However, all values over 100% are converted to 100% after they go through the CDR algorithm.
Data Type	Unsigned byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.
Valid Range	0 to 254. Note: Byte values are stored in the files from 0 to 254 but are presented by most, but not all, netCDF readers as values ranging from 0 to 2.54 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers.
Fill Value	255
Units	Unitless

raw_nt_seaice_conc

Description	NSIDC-processed NASA Team daily sea ice concentrations from 25 October 1978 through the most recent processing. It is located in the cdr_supplementary group. These data values are raw NT concentrations, that is, no weather filters, land spillover corrections, or invalid ice masks have been applied. Note: While physically impossible, sea ice concentration values can exceed 100% due to the nature of the NT algorithm and brightness temperature data. For transparency, these values are left as is in the raw NT variable. However, all values over 100% are converted to 100% after they go through the CDR algorithm.
Data Type	Unsigned byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.
Valid Range	0 to 254. Note: Byte values are stored in the files from 0 to 254 but are presented by most, but not all, netCDF readers as values ranging from 0 to 2.54 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers.
Fill Value	255
Units	Unitless

surface_type_mask

Description	This variable provides a mask for different Earth surface types. It is located in the cdr_supplementary group. The mask values are listed in Table 5.
Data Type	Unsigned byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.
Valid Range	50 to 250
Fill Value	N/A
Units	1

Table 5. Flag Values for Surface Mask Variable

Flag Name	Value
Ocean	50
Lakes	75
Pole hole	100
Coast	200
Land	250

crs

Description	Provides details about the polar stereo projection information for the data. See section 1.4.2 Projection and Grid Description for more information.
Data Type	Int
Valid Range	N/A
Fill Value	N/A
Units	Meters

time

Description	Time in days since 1970-01-01 00:00:00.
Data Type	Long with a dimension of 1.
Valid Range	N/A
Fill Value	N/A
Units	Days since 1979-01-01 00:00:00

x

Description	X-offset in meters of the projection grid centers.
Data Type	Double array with dimension [304] (North) and [316] (South)
Valid Range	-3850000.0 to 3750000.0 (North) and -3950000.0 to 3950000.0 (South)
Fill Value	NaN
Units	Meters

y

Description	Y-offset in meters of the projection grid centers.
Data Type	Double array with dimension [448] (North) and [332] (South)
Valid Range	-5350000.0 to 5850000.0 (North) and -3950000.0 to 4350000.0 (South)
Fill Value	NaN
Units	Meters

1.3.4.2 Monthly File Variable Description

The monthly CDR netCDF4 files contain variables and groups shown in Figure 1 and listed in Table 6 along with brief descriptions. The sections below this table provide more detailed information.

Table 6. List of Monthly CDR Variables

Variable Name	Brief Description
cdr_seaice_conc_monthly	NOAA/NSIDC monthly sea ice concentration CDR.
cdr_seaice_conc_monthly_qa	Quality flags for the cdr_seaice_conc_monthly variable.
cdr_seaice_conc_monthly_stdev	Standard deviation of monthly NOAA/NSIDC CDR sea ice concentration (cdr_seaice_conc_monthly).
cdr_melt_onset_day_monthly	Day of year when melting sea ice was first detected in each grid cell for the monthly NOAA/NSIDC CDR (applies to the Northern Hemisphere only). Located in the cdr_supplementary group.
surface_type_mask	Provides a mask of different Earth surface types. Located in the cdr_supplementary group.
crs	Projection information for the data
time	Date of the data (days since 1970-01-01).
x	Projection grid x centers in meters.
y	Projection grid y centers in meters.

cdr_seaice_conc_monthly

Description	Monthly average of daily NSIDC-produced CDR sea ice concentrations (`cdr_seaice_conc`). For a description of the algorithm used to create these, see the SIC CDR Algorithm Section of the final SIC CDR V6 User Guide.
Data Type	Byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.
Valid Range	0 to 100. Note: Byte values are stored in the files from 0 to 100 but are typically presented by netCDF readers as values ranging from 0 to 1 due to a scaling factor attribute (scale_factor) of .01.
Fill Value	255
Units	Unitless

cdr_seaice_conc_monthly_qa

Description	Quality flags for the monthly NSIDC CDR sea ice concentration variable (`cdr_seaice_conc_monthly`). See Table 7 for a list of the monthly QA flags. Note: Grid cells meeting multiple conditions will have a value equal to the sum of the individual condition values. For example, if both spatial interpolation was performed and melt detection occurred then the value will be 160 (32 + 128).
Data Type	Byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.
Valid Range	0 to 127
Fill Value	0
Units	Unitless

The QA flags listed in Table 7 include the following conditions:

- Average concentration exceeds 15%, which is commonly used to define the ice edge and can be used to easily quantify the total extent.
- Average concentration exceeds 30%, which is a commonly used alternate ice edge definition. It may be desired to remove lower concentration ice that tends to have higher errors.
- At least half the days have a concentration greater than 15%. This provides a monthly median extent, which may be a better representation of the monthly ice presence because an average conflates the spatial and temporal variation through the month.
- At least half the days have a concentration greater than 30%. This also provides a monthly median extent, but this higher percentage may leave out questionable or erroneous ice.
- A cell was masked by the invalid ice mask.
- Spatial or temporal interpolation was performed.
- Melt was detected during the month. Since melt tends to bias concentrations lower, this flag gives a sense of whether melt has any effect on the monthly concentration estimate and whether it is having a dominating effect.

Table 7. Monthly QA Flag Values. A grid cell that satisfies more than one criteria will contain the sum of all applicable flag values.

Condition	Flag Value	Label in NetCDF Variable
Average concentration exceeds 15%	1	average_concentration_exceeds_0.15
Average concentration exceeds 30%	2	average_concentration_exceeds_0.30
At least half the days have sea ice conc > 15%	4	at_least_half_the_days_have_sea_ice_conc_exceeds_0.15

Condition	Flag Value	Label in NetCDF Variable
At least half the days have sea ice conc > 30%	8	at_least_half_the_days_have_sea_ice_conc_exceeds_0.30
Invalid ice mask applied	16	invalid_ice_mask_applied
At least one day during month has spatial interpolation	32	at_least_one_day_during_month_has_spatial_interpolation
At least one day during month has temporal interpolation	64	at_least_one_day_during_month_has_temporal_interpolation
Melt detected (at least one day of melt occurred during the month >= 1) (Northern Hemisphere files only)	128	at_least_one_day_during_month_has_melt_detected

cdr_seaice_conc_monthly_stdev

Description Standard deviation of the monthly NOAA/NSIDC CDR sea ice concentration variable (`cdr_seaice_conc_monthly`), calculated from all daily values for the month at each grid cell.

Data Type Float array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.

Valid Range 0.0 to 1.0

Fill Value -1.0

Units Unitless

cdr_melt_onset_day_monthly

Description Contains the day of year when melting sea ice was first detected in each grid cell, taken from the last day of the month in daily files. Located in the cdr_supplementary group and applies to Northern Hemisphere files only. See the description of the daily cdr_melt_onset_day variable for more details on the values.

Data Type Byte array with dimensions [1, 448, 304] (North), representing time, y, and x, respectively.

Valid Range 0 to 255

Fill Value 255

Units Unitless

surface_type_mask

Description	This variable provides a mask for different Earth surface types. Located in the cdr_supplementary group. The mask values are listed in Table 5.
Data Type	Byte array with dimensions [1, 448, 304] (North) and [1, 332, 316] (South), representing time, y, and x, respectively.
Valid Range	50 to 250
Fill Value	N/A
Units	1

crs

Description	Provides details about the polar stereo projection information for the data. See section 1.4.2 Projection and Grid Description for more information.
Data Type	Int
Valid Range	N/A
Fill Value	N/A
Units	Meters

time

Description	Time in days since 1970-01-01 00:00:00.
Data Type	Long with a dimension of 1.
Valid Range	N/A
Fill Value	N/A
Units	Days since 1970-01-01 00:00:00

x

Description	X-offset in meters of the projection grid centers.
Data Type	Double array with dimension [304] (North) and [316] (South)
Valid Range	-3850000.0 to 3750000.0 (North) and -3950000.0 to 3950000.0 (South)
Fill Value	N/A
Units	Meters

y

Description	Y-offset in meters of the projection grid centers.
Data Type	Double array with dimension [448] (North) and [332] (South)
Valid Range	-5350000.0 to 5850000.0 (North) and -3950000.0 to 4350000.0 (South)
Fill Value	N/A
Units	Meters

1.3.4.3 Ancillary Data

This data set is accompanied by four ancillary files – two for the Northern Hemisphere and two for the Southern Hemisphere. These comprise the final CDR V6 (NRT CDR V4) ancillary files and the SMMR invalid ice files, which are described below. These ancillary files are located in the final CDR SIC archive at https://noaadata.apps.nsidc.org/NOAA/G02202_V6/ancillary/.

Final CDR V6 Ancillary Files

Two CDR V6 ancillary files (one per hemisphere) contain the land mask, latitude, longitude, land adjacency mask, pole hole masks, and invalid ice masks used in processing the sea ice CDR: G02202-ancillary-psn25-v06r00.nc and G02202-ancillary-pss25-v06r00.nc. Table 8 describes the contents of these files.

Table 8. CDR V6 Ancillary Files Content Description

Variable	Description
adj123	Land adjacency mask indicating an ocean pixel's distance from land. 0: Not near land (>3 grid cells) 1: One grid cell from land 2: Two grid cells from land 3: Three grid cells from land
am2_cdr_seaice_conc_threshold	Sea ice concentration threshold values applied to CDR for AMSR2 source data. Thresholds are derived from methods adapted from Seki et. al. 2024.
crs	Coordinate reference system description of the polar stereographic projection.
doy	Day of year. 366 days are provided to account for leap years.
invalid_ice_mask	Twelve monthly masks denoting areas that should or should not contain sea ice based on climatological analyses of seasonal sea ice locations. Used in combination with the month variable to differentiate the monthly masks. 0: Valid seaice location 1: Invalid seaice location
l90c	Mask defining the coast (land adjacent to water) as 90% sea ice concentration, used in NT2 land spillover correction calculations.
latitude	Latitude of each grid cell in degrees north.
longitude	Longitude of each grid cell in degrees east.
month	The 12 months of the year, used with invalid_ice_mask to differentiate monthly masks.

Variable	Description
polehole_bitmask (Northern Hemisphere file only)	Bitmask indicating different pole hole sizes for each satellite/sensor used in the CDR. Used to mask out the northern hemisphere pole hole (an area of the earth that is not measured by the sensor due to the satellite orbit). Because this is a bitmask, the values are additive. For example, the AMSR2 pole hole is the smallest of the pole holes so it fits inside the others. Therefore, it's value is 127 which is the sum of all the bitmask values. The values for each bit are the following: 1: Nimbus 7 SMMR pole hole 2: DMSP F08 SSM/I pole hole 4: DMSP F11 SSM/I pole hole 8: DMSP F13 SSM/I pole hole 16: DMSP F17 SSMIS pole hole 32: Aqua AMSR-E pole hole (not used in this product) 64: GCOM-W1 AMSR2 pole hole
surface_type	Land surface type mask: 50: ocean 75: lake 200: coast (land adjacent to ocean) 250: land
x	The x coordinate of the projection.
y	The y coordinate of the projection.

SMMR Daily Climatology Invalid Ice Masks

Two SMMR daily climatology invalid ice mask files contain a daily climatology ice mask denoting areas that should or should not contain sea ice for the SMMR era: G02202-ancillary-psn25-daily-invalid-ice-v06r00.nc and G02202-ancillary-pss25-daily-invalid-ice-v06r00.nc. These are day-of-year climatology invalid ice masks derived from the Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS data (NSIDC-0079). These are needed for the older SMMR era data to remove weather effects in the absence of the 22 GHz channel used for weather filtering in other sensors. Table 9 describes the contents of these files.

Table 9. SMMR Daily Climatology Ice Masks Contents

Variable	Description
crs	Coordinate reference system description of the polar stereographic projection.
doy	Day of year (including 366 for the leap year day)

Variable	Description
invalid_ice_mask	Mask indicating where sea ice will not be found on this day based on climatology from NSIDC-0079. 0: Valid seaice location 1: Invalid seaice location
x	The x coordinate of the projection.
y	The y coordinate of the projection.

1.4 Spatial Information

1.4.1 Coverage and Resolution

These data cover both the Northern and Southern polar regions at a 25 km x 25 km grid cell size. Note: While resolution and grid cell size are often used interchangeably with regards to satellite data, there is an important distinction. Resolution refers more accurately to the instantaneous field of view (IFOV) of a particular sensor frequency. That is, resolution is the spot size on the ground that the sensor channel can resolve. The IFOV of some of the passive microwave channels used for processing can be as large as 70 km x 45 km. See Table 2 in the C-ATBD (Meier et al., 2024) for a complete list of IFOVs by channel and sensor.

Since these data are gridded onto a 25 x 25 km grid and the sensor's IFOV is coarser, the sensors obtain information from up to a 3 x 2 25 km grid cell (~75 km x 50 km) region, but place that signature into a single grid cell. This results in spatial "smearing" across several grid cells. Furthermore, because a simple drop-in-the-bucket gridding method is used, some grid cells do not coincide with the center of a sensor footprint and, thus, lack a directly assigned brightness temperature despite being partially covered by at least one footprint. Higher frequency channels have finer resolution, but because the sea ice concentration algorithms use data from the 19 GHz channel, the sea ice concentration estimate is affected by the makeup of the surface over an area considerably larger than the nominal 25 km resolution.

The spatial coordinates for the Northern and Southern polar region are the following:

Northern Hemisphere

Northernmost Latitude: 90° N
Southernmost Latitude: 30.1° N
Easternmost Longitude: 180° E
Westernmost Longitude: 180° W

Southern Hemisphere

Northernmost Latitude: 39.2° S
Southernmost Latitude: 90° S
Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

Note that for the Arctic, there is a region around the pole that is not imaged by the passive microwave sensors. This area, called the Arctic Pole Hole, changes size over time depending on the instrument used. See Table 10 for these sizes.

This area is filled by spatial interpolation rather than missing values. However, one cannot assume the concentration value in the Arctic pole hole, especially in late Arctic summer and early autumn. NSIDC advises caution when using the interpolated data in long-term trends or climatology analyses. See the C-ATBD (Meier et al., 2024) for more details.

Table 10. Arctic Pole Hole Size by Instrument.
*Due to the use of the AMSR2 L1R data, the pole hole is slightly larger than the SSMIS pole hole.

Instrument	Pole Hole Area (million km^2)	Minimum Latitude
SMMR	1.193	84.12° N
SSM/I F08	0.318	86.72° N
SSM/I F11	0.318	86.72° N
SSM/I F13	0.318	86.72° N
SSMIS F17	0.0292	89.02° N
AMSR2*	0.064	88.5° N

1.4.2 Projection and Grid Description

The sea ice concentration data are displayed in a polar stereographic projection. For more information on this projection, see the NSIDC Polar Stereographic Projections and Grids Web page. Note that the polar stereographic grid is not equal area; the latitude of true scale (tangent of the planar grid) is 70 degrees. Geolocation and grid details are given in Table 11 and Table 12.

Table 11. Geolocation Details

Geographic coordinate system	Hughes 1980
Projected coordinate system	Northern Hemisphere: NSIDC Sea Ice Polar Stereographic North Southern Hemisphere: NSIDC Sea Ice Polar Stereographic South
Longitude of true origin	Northern Hemisphere: -45° Southern Hemisphere: 0°
Latitude of true origin	Northern Hemisphere: 70° Southern Hemisphere: -70°
Scale factor at longitude of true origin	1

Datum	Hughes 1980
Ellipsoid/spheroid	Hughes 1980
Units	meters
False easting	0°
False northing	0°
EPSG code	Northern Hemisphere: EPSG 3411 Southern Hemisphere: EPSG 3412
PROJ4 string	Northern Hemisphere: +proj=stere +lat_0=90 +lat_ts=70 +lon_0=-45 +k=1 +x_0=0 +y_0=0 +a=6378273 +b=6356889.449 +units=m +no_defs Southern Hemisphere: +proj=stere +lat_0=-90 +lat_ts=-70 +lon_0=0 +k=1 +x_0=0 +y_0=0 +a=6378273 +b=6356889.449 +units=m +no_defs

Table 12. Grid Details

Grid cell size	25 km x 25 km
Grid size (y, x pixel dimensions)	Northern Hemisphere: 448 x 304 Southern Hemisphere: 331 x 316
Geolocated lower left point in grid (km)	Northern Hemisphere: (-3850, -5350) Southern Hemisphere: (-3950, -3950)
Nominal gridded resolution	25 km
Grid rotation (degrees)	Northern Hemisphere: -45 Southern Hemisphere: 0
ulxmap – x-axis map coordinate of the center of the upper-left pixel (km)	Northern Hemisphere: -3,837.5 Southern Hemisphere: -3,937.5
ulymap – y-axis map coordinate of the center of the upper-left pixel (km)	Northern Hemisphere: 5,837.5 Southern Hemisphere: 4,337.5

1.5 Temporal Coverage and Resolution

The NRT V4 CDR sea ice concentrations span the previous three months of data to the present. And provide coverage for the final V6 CDR (G02202) that lags by about 3 weeks. The data are provided at both a daily resolution and a monthly average resolution. When the final CDR is updated, users should download these data to replace any NRT data they may be using. To be notified of final V6 CDR updates, please register for the data set mailing list by clicking on the Subscribe button on the Version 6 data set landing page.

2 DATA ACQUISITION AND PROCESSING

For details on data acquisition, derivation techniques and algorithms, automated quality control techniques, processing steps, error sources, and instrumentation, see the user guide for the final SIC V6 CDR data product: NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 6.

2.1 Input Data

The input data to NRT sea ice concentration CDR is the AMSR2 Daily Polar Gridded Brightness Temperatures, Version 2 data set.

3 VERSION HISTORY

Table 13. Version History

Version	Release Date	Description of Changes
V04r00	January 2025	Release of Version 4 Revision 0 For a complete description of these changes see NSIDC Special Report 29 (Windnagel et al., 2024). The following list provides a summary of the changes: 1. Added AMSR2 as the input brightness temperature source beginning 1 January 2025. 2. Removed the AMSR2 prototype sea ice concentration (prototype_am2 group) that was part of CDR V5. 3. Fixed a bug that allowed sea ice concentration values less than 10% to be considered during land spillover corrections. 4. Updated Python code to use latest versions of core libraries such as NumPy and Xarray.
v03r00	December 2024	Release of Version 3 Revision 0 For a complete description of these changes see NSIDC Special Report 26 (Windnagel et al., 2024). • Added a prototype AMSR2 sea ice concentration. • Uses the NASA Team 2 land spillover correction instead of the original NASA Team correction. • Improved the Arctic pole hole filling. • Uses a new land mask. • The concentration variable (cdr_seaice_conc) contains concentration values only (no land mask). • Added a separate surface type variable (surface_type_mask). • Improved spatial interpolation of TBs. • Includes the raw NT (raw_nt_seaice_conc) and BT (raw_bt_seaice_conc), maintaining full range of values instead of clipping at 100% for provenance and transparency. • Updated the layout and names of variables, with added netCDF groups for better organization. • Sea ice concentration values below 10% in the CDR are set to 0%. • Fixed a bug in the BT tie points calculations. • Fixed a bug in the one-sided temporal interpolation calculation.

Version	Release Date	Description of Changes
V02r00	June 2021	Release of Version 2 Revision 0 1. Added NSIDC-produced daily and monthly NASA Team (NT) and NASA Bootstrap (BT) variables: • nsidc_nt_seaice_conc • nsidc_bt_seaice_conc • nsidc_nt_seaice_conc_monthly • nsidc_bt_seaice_conc_monthly. 2. Gap filling implemented using spatial and temporal interpolation. Two new flag variables (spatial_interpolation_flag and temporal_interpolation_flag) indicate when interpolation has been done. 3. Arctic pole hole filled by spatial interpolation. 4. NSIDC's BT algorithm has been updated to use Goddard's BT version 3.1 algorithm, the current version for the BT product. 5. Updated the NASA Team GR3719 weather filter threshold from 0.053 to 0.057 for the Southern Hemisphere F17 and F18 SSMIS instruments and updated it from 0.07 to 0.076 for the Southern Hemisphere SMMR instrument. 6. Both the NT and BT weather and land spillover filters were applied where as in V1, only the BT filters were applied. 7. The following variables have been renamed: • seaice_conc_cdr → cdr_seaice_conc • melt_onset_day_seaice_conc_cdr → melt_onset_day_cdr_seaice_conc • stdev_of_seaice_conc_cdr → stdev_of_cdr_seaice_conc • qa_of_seaice_conc_cdr → qa_of_cdr_seaice_conc • seaice_conc_monthly_cdr → cdr_seaice_conc_monthly • melt_onset_day_cdr_seaice_conc_monthly → melt_onset_day_cdr_seaice_conc_monthly • stdev_of_seaice_conc_monthly_cdr → stdev_of_cdr_seaice_conc_monthly • qa_of_seaice_conc_monthly_cdr → qa_of_cdr_seaice_conc_monthly 8. Land masks merged into one composite land mask.
v01r00	August 2017	Initial release of the NRT CDR

4 RELATED DATA SETS

- *NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration*
- *DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures*
- *Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I Passive Microwave Data*
- *Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I*
- *Multi-sensor Analyzed Sea Ice Extent (MASIE)*
- *Sea Ice Index*
- *AMSR-E/Aqua Daily L3 12.5 km Brightness Temperatures, Sea Ice Concentration, & Snow Depth Polar Grids*
- *AMSR-E/Aqua Daily L3 25 km Brightness Temperatures & Sea Ice Concentration Polar Grids*

5 RELATED WEBSITES

- NOAA's National Climatic Data Center (NCDC) Climate Data Record (CDR) program
- EUMETSAT Ocean & Sea Ice Satellite Application Facility

- Sea Ice Concentration: NOAA/NSIDC Climate Data Record: Provides an overview of the data product's strengths and weaknesses (Meier and NCAR 2014).

6 CONTACTS AND ACKNOWLEDGMENTS

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8 DOCUMENT INFORMATION

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8.2 Publication Date

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8.3 Revision History

January 2026: A. Windnagel updated the document to reflect changes with the release of Version 4 Revision 0.

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June 2021: A. Windnagel updated the document to reflect changes with the release of Version 2 Revision 0.