Near-Real-Time NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 2

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, and S. Stewart. 2021. *Near-Real-Time NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 2*. [Indicate subset used]. https://doi.org/10.7265/tgam-yv28. [Date Accessed].

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National Snow and Ice Data Center

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1 DATA DESCRIPTION

Notice: The near-real-time CDR fills the temporal gap between updates of the final CDR, occurring roughly every three to six months, and provides the most recent data. The NRT CDR is preliminary and uses input data that do not go through the same quality control measures as the final CDR. 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 CDR updates, please register for the data set mailing list on the final CDR Registration page.

1.1 Summary

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

The major differences between the final CDR and this NRT CDR is that the NRT CDR uses brightness temperature data from a different input source than the final CDR. The NRT CDR uses the *Near-Real-Time DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures* (NSIDC-0080) data set whereas the final CDR uses the *DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures* (NSIDC-0001) data set. NSIDC-0001 brightness temperatures are supplied to NSIDC by Remote Sensing Systems (RSS), and undergo stringent quality control. NSIDC-0080 relies on brightness-temperature swath data from NOAA Comprehensive Large Array-Data Stewardship System (CLASS) that are available in near-real time. For complete details on the differences in these two input data sets, please view their respective data set user guides.

The Near-real-time NOAA/NSIDC sea ice concentration Climate Data Record (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 CDR algorithm, see the Summary in the *NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration* 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 (Meier et al., 2021).

The data are on the NSIDC polar stereographic grid with nominal 25 x 25 km grid cells and are available in NetCDF4 CF-1.6 file format.

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. Land areas are coded with a land mask value.

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-1.6 (Eaton et al. 2010) and the Attribute Convention for Data Discovery (ACDD) 1.3.

The variables in both the daily and monthly files are described in the sections 1.3.2.1 Daily File Variable Description and 1.3.2.2 Monthly File Variable Description, respectively.

1.3.2 File Contents

1.3.2.1 Daily File Variable Description

The daily netCDF4 files contain the variables listed in Table 1, which provides a brief description of each. The sections below this table provide more detailed information. Note that in Version 2 of this data product the latitude and longitude variables have been removed from the data files. These are now in separate ancillary data files. See section 1.3.2.3 Ancillary Data for information on how to access these files.

Table 1. Daily Variables at a Glance. Click Variable Name for More Information.

Variable Name	Brief Description
cdr_seaice_conc	NOAA/NSIDC daily sea Ice concentration CDR
melt_onset_day_cdr_seaice_con	The day of year on which melting sea ice was first detected in each grid cell for the daily NOAA/NSIDC CDR (applies to the Northern Hemisphere only)
nsidc_bt_seaice_conc	NSIDC-processed Bootstrap daily sea ice concentrations
nsidc_nt_seaice_conc	NSIDC-processed NASA Team daily sea ice concentrations
projection	Projection information for the data
qa_of_cdr_seaice_conc	A number of different quality flags related to the daily NOAA/NSDIC CDR.

Variable Name	Brief Description
spatial_interpolation_flag	Provides details on the grid cells that were spatially interpolated
stdev_of_cdr_seaice_conc	Standard deviation for the daily NOAA/NSIDC CDR sea ice concentration
temporal_interpolation_flag	Provides details on the grid cells that were temporally interpolated
time	Time in days since 1601-01-01 00:00:00
xgrid	X-offset in meters of the projection grid centers
ygrid	Y-offset in meters of the projection grid centers

cdr_seaice_conc

Description NOAA/NSIDC CDR sea ice concentrations which is the fraction of ocean area covered by sea ice that span 25 October 1978 through most recent processing. This variable is merged from the NASA Team processed sea ice concentrations and Bootstrap processed sea ice concentrations using the CDR Algorithm. For a description of the algorithm used to merge these, see the final CDR (G02202) user guide. See Table 2 for a list of all flag values.

Data Type Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.

Valid Range 0 to 1. Note: Byte values are actually stored in the files from 0 to 100 but are presented by most, but not all, netCDF readers as values ranging from 0 to 1 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers. Flag values range from 251 to 255.

Fill Value 255

Units Unitless

Table 2. Flag Values for Sea Ice Concentration Variables

Flag Name	Value
Northern Hemisphere pole hole (the region around the pole not imaged by the sensor)	251
Lakes	252
Coast/Land adjacent to ocean	253
Land	254
Missing/Fill	255

melt_onset_day_cdr_seaice_conc

Description	Contains the day of year on which melting sea ice was first detected in each grid cell. Once detected, the value is retained for the rest of the year. For example, if a grid cell started melting on day 73, the variable for the grid cell on that day will be 73, as will all subsequent days until the end of the year. The melt onset day is only calculated for the melt season: days 60 through 244, inclusive. Before melting is detected or if melt is never detected for that grid cell, the value will be -1 (missing / fill value). NOTE: This variable applies to Northern Hemisphere files only.
Data Type	Byte array with dimensions [304, 448, 1] (North), which are the xgrid, ygrid, and time, respectively.
Valid Range	60 to 244
Fill Value	-1
Units	Unitless

nsidc_bt_seaice_conc

Description	NSIDC-processed Bootstrap daily sea ice concentrations from 25 October 1978 through most recent processing. For a list of flag values for this variable, see Table 2.
Data Type	Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	0 to 1. Note: Byte values are actually stored in the files from 0 to 100 but are presented by most, but not all, netCDF readers as values ranging from 0 to 1 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers. Flag values range from 251 to 255.
Fill Value	255
Units	Unitless

nsidc_nt_seaice_conc

Description	NSIDC-processed NASA Team daily sea ice concentrations from 25 October 1978 through most recent processing. For a list of flag values for this variable, see Table 2.
Data Type	Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	0 to 1. Note: Byte values are actually stored in the files from 0 to 100 but are presented by most, but not all, netCDF readers as values ranging from 0 to 1 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers. Flag values range from 251 to 255.
Fill Value	255
Units	Unitless

projection

Description	Provides details about the polar stereo projection information for the data.
Data Type	Char
Valid Range	N/A
Fill Value	N/A
Units	Meters

qa_of_cdr_seaice_conc

Description	A number of different quality flags related to the daily NOAA/NSDIC CDR sea ice concentration. See Table 3 for a list of the flags. Note: Grid cells that meet multiple conditions will have a value that is the sum of the values of each individual condition. For example, where the Bootstrap weather filter (`BT_weather_filter_applied`) and land spillover (`BT_land_spillover_filter_applied`) are applied, the flag value will be 5 (1 for BT weather plus 4 for BT land spillover).
Data Type	Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	1 to 255
Fill Value	0
Units	Unitless

Table 3. Daily QA 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).
BT land spillover applied	4	BT_land_spillover_filter_applied	Indicates that the BT land-spillover correction was applied to this grid cell. This means that sea ice concentration was set to zero (open ocean).

Condition	Flag Value	Label in NetCDF Variable	Description
NT land spillover applied	8	NT_land_spillover_filter_applied	Indicates that the NT land-spillover correction was applied to this grid cell. This means that the sea ice concentration was reduced by either 20%, 40%, or 60% depending on how far the grid cell is from the coast. If the value goes below zero, the concentration for that grid cell is set to zero.
Valid ice mask applied	16	valid_ice_mask_applied	Indicates that this grid cell has been designated as ocean (sea ice concentration set to zero) via an ocean mask or valid ice mask.
Spatially interpolation applied	32	spatial_interpolation_applied	Indicates that this grid cell was spatially interpolated. For more information on what spatial interpolation occurred, see the `spatial_interpolation_flag` variable.
Temporal interpolation applied	64	temporal_interpolation_applied	Indicates that this grid cell was temporally interpolated. For more information on what temporal interpolation occurred, see the `temporal_interpolation_flag` variable.
Start of Melt Detected (Arctic only)	128	melt_start_detected	Indicates that the ice in this grid cell has shown evidence of starting to melt, so values may be less reliable. The melt onset test is used starting on day of year 60, around the time when the maximum sea ice extent is reached each year. Once a grid cell is flagged as melting, it remains so through the rest of the summer until day of year 244, roughly the time when extent reaches its minimum value. When the sea ice concentration is zero, the flag will be turned off. For the specific date that melt started, see the `melt_onset_day_cdr_seaice_conc` variable.

spatial_interpolation_flag

Description Provides details on the grid cells that were spatially interpolated. Spatial interpolation occurs on the brightness temperature channels. See Table 4 for a list of the flag values and the Quality Control Procedures section of the C-ATBD (Meier et al., 2021) for details. If a grid cell was not spatially interpolated, then the value in this variable is set to zero for that grid cell.

Data Type Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.

Valid Range 0 to 63

Fill Value 0

Units Unitless

Table 4. Spatial interpolation 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
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_value_interpolated

stdev_of_cdr_seaice_conc

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 (for nine values total) from both the NASA Team and Bootstrap data. This means that the standard deviation is computed using a total of 18 values: nine from the intermediate NISDC NASA Team data and nine from the intermediate NSIDC Bootstrap data. Grid cells with high standard deviations indicate values with lower confidence levels.
Data Type	Float array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	0.0 to 1.0
Fill Value	-1.0
Units	1

temporal_interpolation_flag

Description	Provides details on the 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., 2021) for details. The value for each flag is a 1- or 2-digit number indicating the data points used in the interpolation. For example, if the value is 30, then the missing grid cell was filled with the sea ice concentration value from three days prior. If a grid cell was not temporally interpolated, then the value in this variable is set to zero for that grid cell. Note that the temporal interpolation for the NRT sea ice CDR does look forward in time. Only data from up to five days in the past are used to fill gaps in the NRT data.
Data Type	Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	0 to 50
Fill Value	0
Units	Unitless

time

Description	Time in days since 1601-01-01 00:00:00.
Data Type	Float with a dimension of 1.
Valid Range	N/A
Fill Value	N/A
Units	Days since 1601-01-01 00:00:00

xgrid

Description	X-offset in meters of the projection grid centers.
Data Type	Float 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

ygrid

Description	Y-offset in meters of the projection grid centers.
Data Type	Float 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

1.3.2.2 Monthly File Variable Description

The monthly netCDF4 files contain the variables listed in Table 5, which provides a brief description of each. The sections below this table provide more detailed information. Note that in Version 2 of this data product the latitude and longitude variables have been removed from the data files. These are now in separate ancillary data files. See section 1.3.2.3 Ancillary Data for information on how to access these files.

Table 5. Monthly Variables at a Glance. Click Variable Name for More Information.

Variable Name	Brief Description
cdr_seaice_conc_monthly	NOAA/NSIDC monthly sea ice concentration CDR
melt_onset_day_seaice_conc_monthly_cdry	The day of year on which melting sea ice was first detected in each grid cell for the monthly NOAA/NSIDC CDR. This applies to the Northern Hemisphere only.
nsidc_bt_seaice_conc_monthly	NSIDC-processed Bootstrap monthly sea ice concentrations
nsidc_nt_seaice_conc_monthly	NSIDC-processed NASA Team monthly sea ice concentrations
projection	Projection information for the data.

Variable Name	Brief Description
qa_of_cdr_seaice_conc_monthly	A number of different quality flags related to the monthly NOAA/NSDIC CDR
stdev_of_cdr_seaice_conc_monthly	Standard deviation for the monthly NOAA/NSIDC CDR sea ice concentration
time	Time in days since 1601-01-01 00:00:00.
xgrid	X-offset in meters of the projection grid centers.
ygrid	Y-offset in meters of the projection grid centers.

cdr_seaice_conc_monthly

Description The monthly average of the daily NSIDC-produced CDR sea ice concentrations (`cdr_seaice_conc`). See Table 2 for a list of flag values used in this variable.

Data Type Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.

Valid Range 0 to 1. Note: Byte values are actually stored in the files from 0 to 100 but are presented by most, but not all, netCDF readers as values ranging from 0 to 1 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers. Flag values range from 251 to 255.

Fill Value 255

Units Unitless

melt_onset_day_seaice_conc_monthly_cdr

Description Contains the day of year on which melting sea ice was first detected in each grid cell. Once detected, the value is retained for the rest of the year. For example, if a grid cell started melting on day 73, the variable for the grid cell on that day will be 73, as will all subsequent days until the end of the year. The melt onset day is only calculated for the melt season: days 60 through 244, inclusive. Before melting is detected or if melt is never detected for that grid cell, the value will be -1 (missing / fill value). Note: This variable applies to Northern Hemisphere files only.

Data Type Integer array with dimensions [304, 448, 1] (North), which are the xgrid, ygrid, and time, respectively.

Valid Range 60 to 244

Fill Value -1.0

Units Unitless

nsidc_bt_seaice_conc_monthly

Description	NSIDC-processed Bootstrap monthly sea ice concentrations from 1978 through most recent processing. For a list of flag values for this variable, see Table 2.
Data Type	Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	0 to 1. Note: Byte values are actually stored in the files from 0 to 100 but are presented by most, but not all, netCDF readers as values ranging from 0 to 1 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers. Flag values range from 251 to 255.
Fill Value	255
Units	Unitless

nsidc_nt_seaice_conc_monthly

Description	NSIDC-processed NASA Team monthly sea ice concentrations from 1978 through most recent processing. For a list of flag values for this variable, see Table 2.
Data Type	Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	0 to 1. Note: Byte values are actually stored in the files from 0 to 100 but are presented by most, but not all, netCDF readers as values ranging from 0 to 1 because of a scaling factor attribute (scale_factor) for this variable of .01 that is applied by most netCDF readers. Flag values range from 251 to 255.
Fill Value	255
Units	Unitless

projection

Description	Provides details about the polar stereo projection information for the data.
Data Type	Char
Valid Range	N/A
Fill Value	N/A
Units	Meters

qa_of_cdr_seaice_conc_monthly

Description	A number of different quality flags related to the monthly NSDIC CDR sea ice concentration variable (`cdr_seaice_conc_monthly`). See Table 6 for a list of the monthly flags. Note 1: Grid cells that meet multiple conditions will have a value that is the sum of the values of each individual condition. For example, if spatial interpolation was performed and melt detected then the value will be 160 (32 + 128)
Data Type	Byte array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.
Valid Range	1 to 255
Fill Value	0
Units	Unitless

The QA flags listed in Table 6 include whether the average concentration exceeds 15%, which is commonly used to define the ice edge and can be used to easily quantify the total extent. Another flag indicates when 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. Another flag indicates whether 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. Additionally, there is a flag that indicates whether 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. There are flags to show if a cell was masked by the valid ice mask and whether spatial or temporal interpolation was performed. Finally, there is a flag to note whether 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 6. Monthly QA 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
Valid ice mask applied	16	Region_masked_by_ocean_climatology
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) (Arctic only)	128	At_least_one_day_during_month_has_melt_detected
Average concentration exceeds 15%	1	Average_concentration_exceeds_0.15

stdev_of_cdr_seaice_conc_monthly

Description Standard deviation for the monthly NOAA/NSIDC CDR sea ice concentration variable (`cdr_seaice_conc_monthly`). This value is the standard deviation of the concentration of all daily values for the month at that grid cell.

Data Type Float array with dimensions [304, 448, 1] (North) and [316, 332, 1] (South), which are the xgrid, ygrid, and time, respectively.

Valid Range 0.0 to 1.0

Fill Value -1.0

Units Unitless

time

Description Time in days since 1601-01-01 00:00:00.

Data Type Float with a dimension of 1.

Valid Range N/A

Fill Value N/A

Units Days since 1601-01-01 00:00:00

xgrid

Description	X-offset in meters of the projection grid centers.
Data Type	Float 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

ygrid

Description	Y-offset in meters of the projection grid centers.
Data Type	Float 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

1.3.2.3 Ancillary Data

Two ancillary files accompany this data set, one for the Northern Hemisphere and one for the Southern Hemisphere: G02202-cdr-ancillary-nh.nc and G02202-cdr-ancillary-sh.nc. These files reside via HTTPS: https://noaadata.apps.nsidc.org/NOAA/G10016/. The files contain the land mask, latitude, longitude, minimum concentration mask, pole hole masks, and valid ice masks used in processing the sea ice CDR. Table 7 describes the contents of the data files.

Table 7. Ancillary file description

Variable	Description
crs	Coordinate reference system
landmask	Land mask with values 0: Ocean, 2: Lake, 253: Coast, 254: Land
latitude	Latitude in degrees at the center of the grid cell. Values range from 31.1 to 89.8 for the Northern Hemisphere and -39.4 to -89.8 for the Southern Hemisphere
longitude	Longitude in degrees at the center of the grid cell. Values range from 180 to -180
min_concentration	Minimum concentration mask with values 0: ocean far from land, 1: land, all others: minimum sea ice concentration in 10ths of K
month	Unit of time used to delineate the valid ice masks by month of the year.
polehole	Pole hole masks for SMMR, SSM/I, and SSMIS instruments. Values are bit masks and are additive: 0: No pole hole, 1: SMMR pole hole, 2: SSM/I pole hole, 4: SSMIS pole hole. For example, if the value of a grid cell is 7, this grid cell is inside all three pole hole masks.
valid_ice_mask	12 valid ice masks, one for each month of the year

Variable	Description
x	X coordinate in meters
y	Y coordinate in meters

1.3.3 Directory Structure

The data files are organized on the HTTPS site into two main directories by hemisphere: north and south. Within each of these, there are three sub-directories: `checksums`, `daily`, and `monthly`. The `checksums` directory contains md5 checksums of the individual daily and monthly data files. The `daily` directory contains the individual daily data files and is further sub-divided into directories labeled by the 4-digit year (YYYY) beginning with 1978; the daily files reside within their respective year directory. All of the individual monthly files reside directly in the `monthly` directory.

1.3.4 Naming Convention

The file naming convention for the daily and monthly files is listed below and described in Table 8:

Individual daily files: `seaice_conc_daily_hh_yyyymmdd_sat_vXXrXX.nc`
Individual monthly files: `seaice_conc_monthly_hh_yyyymm_sat_vXXrXX.nc`

Where:

Table 8. File Naming Convention

Variable	Description
seaice_conc	Identifies files containing sea ice concentration data
daily	Identifies files containing daily sea ice concentration
monthly	Identifies files containing monthly sea ice concentration
hh	Hemisphere (nh: North, sh: South)
yyyy	4-digit year
mm	2-digit month
dd	2-digit day of month
sat	Satellite the data came from (n07: Nimbus 7, f08: DMSP F8, f11: DMSP F11, f13: DMSP F13, f17: DMSP F17)
vXXrXX	Version and revision number of the data file (v04r00: Version 4, Revision 0)
.nc	Identifies a NetCDF file
.nc.mnf	Identifies this as an md5 checksum file

1.4 Spatial Information

1.4.1 Coverage and Resolution

These data cover both the Northern and Southern polar regions at a 25 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 difference. Resolution refers more properly 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 SSMIS channels used are the 19 GHz vertical, the 19 GHz horizontal, and the 37 GHz vertical. The IFOV of the 19 GHz SSMIS passive microwave channel is approximately 70 km x 45 km. See Table 13 for a complete list of IFOVs by channel.

Since these data are gridded onto a 25 x 25 km grid and the IFOV of the sensor is coarser than this, the sensor is obtaining information from up to a 3 x 2 grid cell (~75 km x 45 km) region, but because a simple drop-in-the-bucket gridding method is used, that signature is placed in a single grid cell. This results in a spatial "smearing" across several grid cells. Also, some grid cells do not coincide with the center of the sensor footprint and are thus left as missing even though there is brightness temperature information available at that region. 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 polar region are the following:

Southernmost Latitude: 31.10° N
Northernmost Latitude: 89.84° N
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 is called the Arctic Pole Hole. For the NRT sea ice concentration CDR, the size of this hole is 1.19 million km^2 with a radius of 611 km and the latitude of the edge of the hole is 84.5° N.

With the release of Version 2, this area is now filled by spatial interpolation instead of being filled with missing values. Note, one cannot assume what the concentration is in the Arctic pole hole, especially in late Arctic summer and early autumn. Thus, we would advise caution in using the interpolated data in long-term trends or climatology analyses. See the C-ATBD (Meier et al., 2021) for more details.

Table 9. Arctic Pole Hole Size by Instrument

Instrument	Pole Hole Area (million km^2)	Pole Hole Radius (km)	Pole Hole Latitude
SMMR	1.19	611	84.5° N
SSM/I	0.31	311	87.2° N
SSMIS	0.029	94	89.18° N

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

Southernmost Latitude: 89.84° S
Northernmost Latitude: 39.36° S
Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

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 10 and Table 11.

Table 10. Geolocation Details

Geographic coordinate system	Unspecified datum based upon the Hughes 1980 ellipsoid
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	Not specified (based on Hughes 1980 ellipsoid)
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 11. Grid Details

Grid cell size (x, y pixel dimensions)	Northern Hemisphere: 448 x 304 Southern Hemisphere: 332 x 316
Geolocated lower left point in grid	Northern Hemisphere: 33.92° N, 279.26° E Southern Hemisphere: 41.45° S, 225.00 ° E
Nominal gridded resolution	25 km X 25 km
ulxmap – x-axis map coordinate of the center of the upper-left pixel	Northern Hemisphere: -3850000.0 Southern Hemisphere: -3950000.0
ulymap – y-axis map coordinate of the center of the upper-left pixel	Northern Hemisphere: 5850000.0 Southern Hemisphere: 4350000.0

1.5 Temporal Coverage and Resolution

The NRT CDR sea ice concentrations span the end of the temporal coverage of the final CDR (G02202) to the present; provided at both a daily resolution and a monthly averaged resolution. Immediately after the final CDR (G02202) data are processed and released, which occurs every three to six months, the corresponding NRT CDR data files are removed from the NRT archive. 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 CDR updates, please register for the data set mailing list on the final CDR Registration page.

2 DATA ACQUISITION AND PROCESSING

For complete details on derivation techniques and algorithms, automated quality control, and error sources, see the user guide for the final CDR data product: NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration

2.1 Input Data

The input data to NRT sea ice concentration CDR is the Near-Real-Time DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures data set.

2.2 Processing

Below are the processing steps for both the daily and monthly NRT data files. In addition, the source code is provided for transparency of the algorithm and processes used in creating the NRT sea ice CDR. This source code is for reference only and is not intended to be portable to any computer system beyond that of the original CDR producer's environment. You can access the code from the NOAA Climate Data Record Program's Operation CDR Web page under the Oceanic CDRs section.

2.2.1 Daily Files

The following are the general steps NSIDC uses to produce the daily NRT NOAA/NSIDC CDR sea ice concentration product. See Figure 1 for a diagram of the data flow.

1. Obtain input brightness temperatures from the NSIDC *Near-Real-Time DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures* (NSIDC-0080) data set. See **Error! Reference source not found.** for a list of channels used.
2. Spatially interpolate each brightness temperature channel. Fill the `spatial_interpolation_flag` variable. See the Quality Control Procedures section of the C-ATBD (Meier et al., 2021) for details.
3. Process the brightness temperatures into two intermediate sea ice concentration products using both the NASA Team and Bootstrap algorithms.
4. Apply weather filters, land-spillover corrections, and valid ice masks.
5. Perform some initial filling of the QA flags (`qa_of_cdr_seaice_conc`).
6. Temporally interpolate the intermediate NASA Team and Bootstrap sea ice concentrations. See the Quality Control Procedures section of the C-ATBD (Meier et al., 2021) for details. Note that the temporal interpolation for the NRT sea ice CDR does look forward in time. Only data from up to five days in the past are used to fill gaps in the NRT data.
7. For the Arctic, spatially interpolate the pole hole. See the Quality Control Procedures section of the C-ATBD (Meier et al., 2021) for details.

8. Merge the intermediate NSIDC NASA Team (`nsidc_nt_seaice_conc`) and Bootstrap (`nsidc_bt_seaice_conc`) data into the final CDR using the CDR algorithm and populate the `cdr_seaice_conc` variable.
9. Apply a final weather filter and land-spillover correction to the sea ice concentration CDR.
10. Compute the CDR sea ice concentration standard deviation (`stdev_of_cdr_seaice_conc`) and the final QA flag values (`qa_of_cdr_seaice_conc`).
11. Calculate melt onset (melt_onset_day_cdr_seaice_conc) and add melt-indicator flag to the QA variable (`qa_of_cdr_seaice_conc`) via a post-processing step.
12. Populate the daily netCDF variables and create the .nc files.

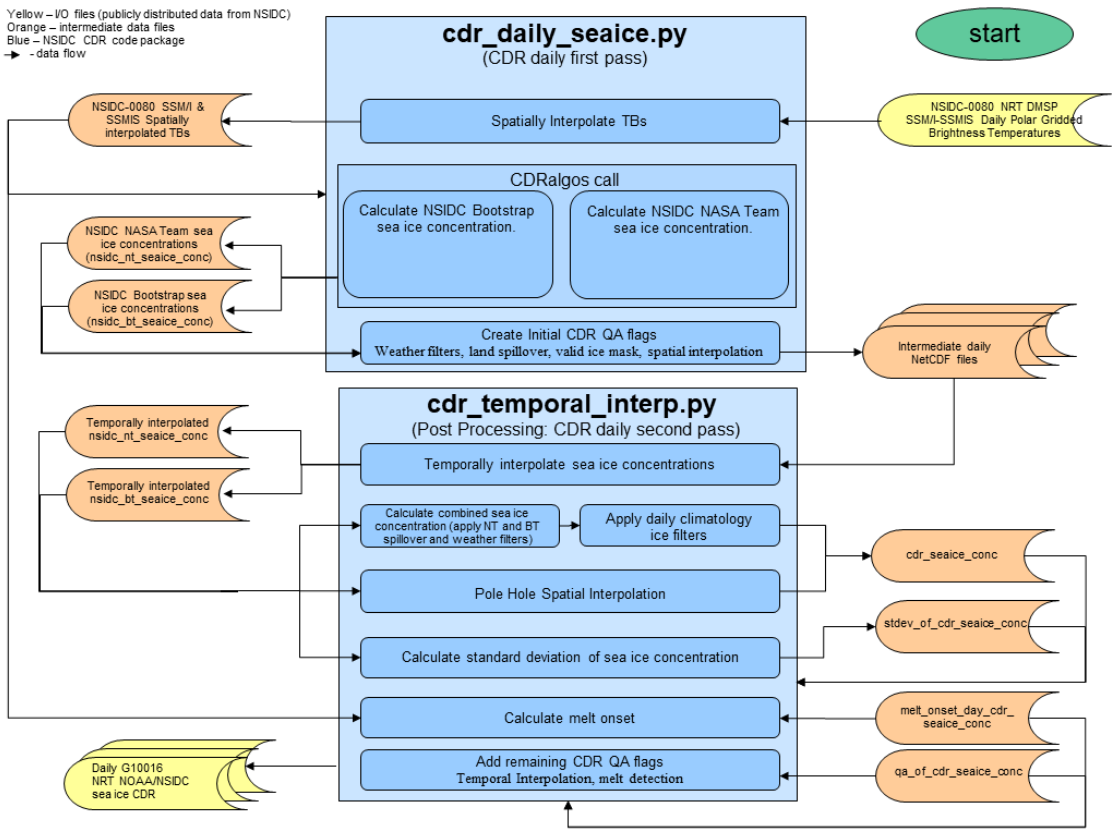

Figure 1. Flow of Data through the Daily NRT CDR Processing.

2.2.2 Monthly Files

The following are the general steps NSIDC uses to produce the monthly NRT NOAA/NSIDC CDR sea ice concentration product. See Figure 2 for a diagram of the data flow.

1. Read the input daily NSIDC NASA Team and Bootstrap sea ice concentration data (`nsidc_nt_seaice_conc` and `nsidc_bt_seaice_conc`).
2. Compute the monthly mean concentration for each grid cell for a given month from the daily NASA Team and Bootstrap values.

3. Merge the monthly intermediate NSIDC NASA Team (`nsidc_nt_seaice_conc_monthly`) and Bootstrap (`nsidc_bt_seaice_conc_monthly`) data into the final CDR using the CDR algorithm and populate the `cdr_seaice_conc_monthly` variable.
4. Compute the standard deviation and quality flags and fill those variables (`stdev_of_cdr_seaice_conc_monthly` and `qa_of_cdr_seaice_conc_monthly`).
5. Set melt onset day (value from the last day of the month) and fill the `melt_onset_day_cdr_seaice_conc_monthly` variable and add melt onset flag to the `qa_of_cdr_seaice_conc_monthly` variable.
6. Populate the monthly netCDF variables and create the .nc files.

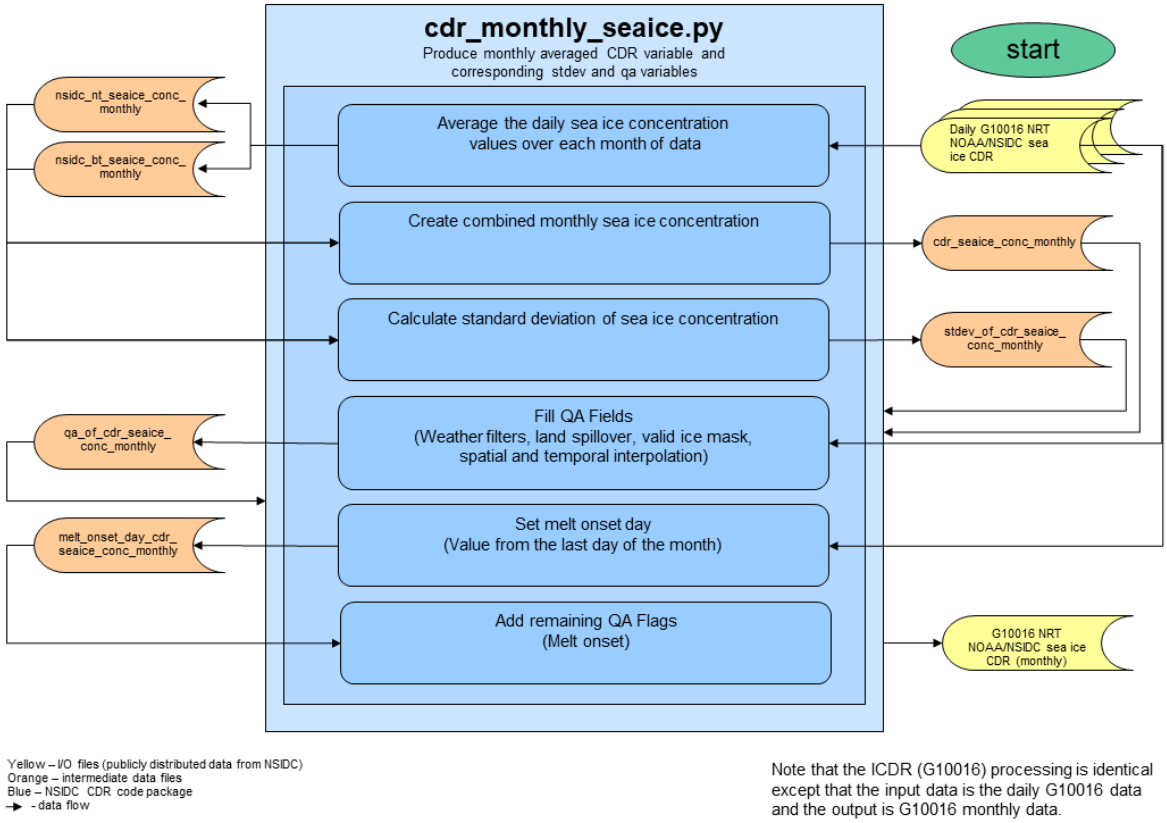

Figure 2. Flow of Data through the Monthly NRT CDR Processing.

2.3 Instrumentation

For the NRT NOAA/NSIDC CDR data (`seaice_conc_cdr`), NSIDC uses brightness temperatures from SSMIS sensors on the DMSP-F18. Table 12 describes the orbital parameters of DMSP-F18.

Table 12. Orbital Parameters of DMSP-F18

Parameter	Value
Nominal Altitude* (km)	833
Inclination Angle (degrees)	98.6
Orbital Period (minutes)	102
Ascending Node Equatorial Crossing (local time)	8:00 p.m.
Algorithm Frequencies* (GHz)	19.4, 37.0
Earth Incidence Angle* (degrees)	53.1
3 dB Beam Width (degrees)*	1.9, 0.4

*Indicates sensor and spacecraft orbital characteristics of the three sensors used in generating the sea ice concentrations.

Table 13 lists the footprint size of the SSMIS instrument.

Table 13. SSMIS Footprint Size

Frequency (GHz)	SSM/I IFOV (km)
19.350	73 x 45
22.235	73 x 45
37.000	41 x 31

For a complete description of the SSMIS instrument, see the SMMR, SSM/I, and SSMIS Sensors Summary.

3 VERSION HISTORY

Table 14. Version History

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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The production of the NRT NOAA/NSIDC sea ice CDR is managed by Ann Windnagel at NSIDC.

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8 DOCUMENT INFORMATION

8.1 Author

A. Windnagel

8.2 Publication Date

August 2017

8.3 Revision History

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