



Arctic Sea Ice Seasonal Change and Melt/Freeze Climate Indicators from Satellite Data, Version 1

USER GUIDE

How to Cite These Data

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

Steele, M., A. C. Bliss, G. Peng, W. N. Meier, and S. Dickinson. 2019. *Arctic Sea Ice Seasonal Change and Melt/Freeze Climate Indicators from Satellite Data, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/KINANQKEZI4T>. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/NSIDC-0747>



National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

The parameters for this data set are described in Table 1.

Table 1. Parameter Descriptions

Parameter name as it appears in the netCDF file	Description	Units
AHRA MO	Earliest melt onset date derived from Advanced Horizontal Range Algorithm (AHRA) algorithm (Anderson et al. 2014)	Day of year
EMO	Early melt onset date (Markus et al. 2009)	Day of year
EFO	Early freeze onset date (Markus et al. 2009)	Day of year
CMO	Continuous melt onset date (Markus et al. 2009)	Day of year
CFO	Continuous freeze onset date (Markus et al. 2009)	Day of year
DOO	Day of opening; last day the sea ice concentration drops below 80%	Day of year
DOR	Day of retreat; last day sea ice concentration drops below 15%	Day of year
DOA	First day of advance; first day sea ice concentration increases above 15%	Day of year
DOC	First day of closing; first day sea ice concentration increases above 80%	Day of year
OIFP	Outer ice-free period; DOC - DOO	Days
IIFP	Inner ice-free period or the open-water period; DOA - DOR	Days
SLIP	Seasonal loss of ice period; DOR - DOO	Days
SGIP	Seasonal gain of ice period; DOC-DOA	Days
SIZ	Seasonal ice zone	Days

1.2 File Information

1.2.1 Format

The data are provided in a single netCDF (.nc) file.

An Extensible Markup Language (.xml) file with associated metadata is also provided.

1.2.2 Naming Convention

The file name is:

arctic_seaice_climate_indicators_nh_v01r01_1979-2017.nc

1.2.3 File Size

The data file is approximately 38 MB.

1.3 Spatial Information

1.3.1 Coverage

Northernmost Latitude: 90° N

Southernmost Latitude: 30° N

Easternmost Longitude: 180° W

Westernmost Longitude: 180° W

1.3.2 Resolution

25 km

1.3.3 Geolocation

The following tables provide a description of the projection and grid used for this data set.

Table 2. Geolocation Details

Geographic coordinate system	Unspecified datum based upon the Hughes 1980 ellipsoid
Projected coordinate system	NSIDC Sea Ice Polar Stereographic North
Longitude of true origin	-45
Latitude of true origin	70

Scale factor at longitude of true origin	1
Datum	Not_specified_based_on_Hughes_1980_ellipsoid
Ellipsoid/spheroid	Hughes 1980
Units	meter
False easting	0
False northing	0
EPSG code	3411
PROJ4 string	+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
Reference	https://epsg.io/3411

Table 3. Grid Details

Grid cell size (x, y pixel dimensions)	Grid cell size varies with location
Number of rows	448
Number of columns	304
Geolocated lower left point in grid	33.92° N, 279.26° W
Nominal gridded resolution	25 km x 25 km
Grid rotation	N/A
ulxmap – x-axis map coordinate of the center of the upper-left pixel (XLLCORNER for ASCII data)	-3850 projected km
ulymap – y-axis map coordinate of the center of the upper-left pixel (YLLCORNER for ASCII data)	5850 projected km

1.4 Temporal Information

1.4.1 Coverage

01 March 1979 through 28 February 2018

1.4.2 Resolution

Yearly

Annual sea ice parameters are tracked through February of the following year. For example, 2016 fields were derived from input sources spanning 1 March 2016 through 28 February 2017.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This product contains a suite of sea ice melt-season indicators. Parameters track the evolution of the Sea Ice Concentration (SIC) from early to continuous surface melt onset, including when the ice cover opens (SIC drops below 80%); retreats, i.e. becomes open water (SIC drops below 15%); advances, i.e. ice starts to form (SIC rises above 15%); and closes (SIC increases above 80%). These sea ice descriptions provide an assessment of how the melt season is changing across the Arctic. The gridded format of these data allow these changes to be observed on a regional scale.

The melt-onset parameters are derived from Brightness Temperature (Tb) data collected on different Passive Microwave (PM) channels. Melt onset is detectable because PM Tb are sensitive to the state of water (frozen vs. liquid).

2.2 Acquisition

The data derive from Scanning Multichannel Microwave Radiometer (SMMR), Special Sensor Microwave/Imager (SSM/I), and Special Sensor Microwave Imager/Sounder (SSMIS) Brightness Temperature (Tb) observations. Input data come from the NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 3 (Meier et al. 2017) and the DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures, Version 4 (Maslanik and Stroeve 2004) data sets at NSIDC.

2.3 Processing

A SIC mask is used to constrain where melt onset is calculated from Tb. This mask is derived from the Merged Goddard parameter in the *NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration* data set. For each grid cell and each melt-season parameter, a multi-day smoothing is applied to remove noise from synoptic events (e.g. short-term ice growth/melt or advection). Further details on processing steps, and the product in general, can be found in Biiss et al. (2019) and Peng et al. (2018).

2.4 Quality, Errors, and Limitations

First, though the data are gridded at a resolution of 25 km, the SMMR, SSM/I, and SSMIS sensors have much coarser spatial resolutions (up to ~45 km x ~70 km), so Tb observations may not capture smaller openings in the ice. Second, surface melt during the summer, and new ice formation during the fall and winter, can bias SIC estimates derived. Surface melt tends to skew the

Day of Opening (DOO) (and possibly the Day of Retreat, DOR) earlier in the year and the First Day of Advance (DOA) and the First Day of Closing (DOC) later.

2.5 Instrumentation

For a description of the SMMR, SMMI, SSMI/S instruments, visit the [SMMR, SSMI, and SSMIS Sensors Summary](#).

3 VERSION HISTORY

Table 4. Version History Summary

Version	Summary
1.1	Changes and updates to this version include: <ul style="list-style-type: none"> • The data record was updated through 2017. • The full data record was also reprocessed to correct an error in the CFO field. In the previous version, the CFO field was written with a copy of the EFO field. • Some geophysical data fields (e.g. year) were updated in the netCDF file to better reflect common netCDF practices (e.g. the year field is now labeled as time).
1.0	Initial release

4 RELATED DATA SETS

[NOAA/NSIDC Climate Data Record of Passive Microwave Sea Ice Concentration, Version 3](#)

[DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures, Version 4](#)

5 CONTACTS AND ACKNOWLEDGMENTS

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5.2 Acknowledgements

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6 REFERENCES

Anderson, M., A. C. Bliss, and S. Drobot. 2019. Snow Melt Onset Over Arctic Sea Ice from SMMR and SSM/I-SSMIS Brightness Temperatures, Version 4. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. doi: [10.5067/A9YK15H5EBHK](https://doi.org/10.5067/A9YK15H5EBHK)

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7 DOCUMENT INFORMATION

7.1 Publication Date

11 June 2019

7.2 Date Last Updated

30 September 2020