Sea Ice Trends and Climatologies from SMMR and SSM/I-SSMIS, Version 3

USER GUIDE

How to Cite These Data

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

Stroeve, J. and W. N. Meier. 2018. *Sea Ice Trends and Climatologies from SMMR and SSM/I-SSMIS, Version 3*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/IJ0T7HFHB9Y6. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0192

National Snow and Ice Data Center

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1 DATA DESCRIPTION

NSIDC provides this data set to aid investigations of variability and trends in sea ice cover. Ice cover in these data are indicated by sea ice concentration: the percentage of the ocean surface covered by ice. The ice-covered area indicates how much ice is present; it is the total surface area of a pixel multiplied by the ice concentration in that pixel. Ice persistence is the percentage of months over the data set time period that ice existed at a location. The ice extent indicates whether ice is present; here, ice is considered to exist in a pixel if the sea ice concentration exceeds 15 percent. This data set provides users with data about total ice-covered areas, sea ice extent, ice persistence, and monthly climatologies of sea ice concentrations.

Total Ice-Covered Areas and Sea Ice Extent Data

Along with one historical data file from the Electrically Scanning Microwave Radiometer (ESMR), these data are derived from the Scanning Multichannel Microwave Radiometer (SMMR), the Special Sensor Microwave/Imager (SSM/I), and the Special Sensor Microwave Imager/Sounder (SSMIS).

Daily and Monthly Total Ice-Covered Area and Total Sea Ice Extent Data

Daily Arctic and Antarctic ice-covered area and total sea ice extent ASCII text data files list the total ice-covered area (km^2) and total sea ice extent (km^2) for both the Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS and/or the NASA Team Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data algorithms.

Monthly mean sea ice concentrations were used to derive monthly extents for both the NASA Team and Bootstrap algorithms.

Regional Graphs: Time-Series Plots

The total ice-covered area and sea ice extent data are used to create .png images of regional monthly time-series plots of ice-covered areas, area anomalies, ice extent, and extent anomalies for both the NASA Team and Bootstrap algorithms. The scientific basis for these algorithms and their validation are discussed in Parkinson and Cavalieri (2012), Cavalieri and Parkinson (2008), and Parkinson et al. (1999).

Ice Persistence

Monthly climatologies of ice persistence binary data files with corresponding .png images are intended for users interested in persistence of ice over a particular month during the time series, which includes January 1979 through current processing. Ice persistence fields provide information

on how frequently ice occurs in a region during a given month over the time period of the data. The ice extent climatologies are derived each month from monthly-averaged sea ice concentrations using the NASA Team data.

Monthly Climatology of Sea Ice Concentration

Monthly sea ice concentration climatology binary data files with corresponding .png images represent mean ice concentration for each month over the entire time period of January 1979 through current processing. The data

1.1 Parameters

Parameters include:

- Sea Ice Concentration
- Total Ice-Covered Area (km^2)
- Total Sea Ice Extent (km^2)

1.1.1 Parameter Description

Ice Persistence

The ice persistence data indicate the historical frequency of the presence of ice with at least 15 percent concentration in each pixel of the 25 km polar stereographic grid in binary format.

Northern Hemisphere binary files are 304 x 448 bytes.
Southern Hemisphere binary files are 316 x 332 bytes.

Table 1. Data Values for Ice Persistence Files

Value	Description
0	Water, no ice
1 - 100	Historical frequency of the presence of ice, as a percentage
253	Coastlines (land adjacent to water)
254	Land

Monthly Climatology of Sea Ice Concentration

The monthly climatology data give the average sea ice concentration for each polar stereographic pixel. A minimum concentration value of 15 percent is imposed. When concentrations are lower than this, the grid cell is considered to be free of ice.

Northern Hemisphere binary files are 304 x 448 bytes.
Southern Hemisphere binary files are 316 x 332 bytes.

Table 2. Data Values for Monthly Climatology of Sea Ice Concentration Files

Value	Description
0	Water, no ice
15 - 100	Average ice concentration; minimum concentration is 15 percent
251	Indicates pole hole; no direct satellite observation
253	Coast (land adjacent to water)
254	Land

Total Ice-Covered Areas and Sea Ice Extent

The daily and monthly total sea ice extent and sea ice area data for specified Arctic and Antarctic regions are displayed in ASCII text tables. Anomalies are also provided, which indicate departures from the long-term averages.

1.2 Sample Data Images

Total Ice-Covered Areas and Sea Ice Extent

Year	Mon	Day	DOY	Ver	TotalArc	Okhotsk	Bering	Hudson	Baffin	Grnland	BarKara	ArctOcn	CanArch	StLawr
1978	11	1	305	v02	9124575	0	11838	368424	514839	449528	1173910	5863843	742190	0
1978	11	3	307	v02	9150738	0	15547	346038	550806	457167	1181536	5856762	742879	0
1978	11	5	309	v02	9299006	0	7003	390244	555634	477701	1245651	5880963	741807	0
1978	11	7	311	v02	9528439	0	15282	496152	581214	482290	1271710	5939355	742433	0
1978	11	9	313	v02	9553892	0	12337	531939	624273	492326	1229110	5926217	737687	0
1978	11	11	315	v02	9591397	0	3229	567163	647898	518421	1209015	5900749	744920	0
1978	11	13	317	v02	9816890	0	6015	654283	677444	506800	1279570	5949430	743344	0
1978	11	15	319	v02	9889642	0	29870	677254	718648	523623	1237478	5963175	739591	0
1978	11	17	321	v02	9924935	0	46980	720856	712857	541954	1230941	5931567	739777	0
1978	11	19	323	v02	10212517	0	29168	897044	743948	574728	1277376	5950398	739853	0
1978	11	21	325	v02	10361690	0	32636	960350	767589	611240	1339061	5913073	737737	0
1978	11	23	327	v02	10563681	0	53951	1059671	760252	585429	1411006	5953451	739919	0
1978	11	25	329	v02	10800735	0	63997	1103472	783131	615149	1517886	5978058	739038	0
1978	11	27	331	v02	10985122	0	67305	1122610	748754	704073	1575691	6022456	744229	0
1978	11	29	333	v02	11063032	41110	74963	1158649	735224	669277	1595011	6038921	736592	0
1978	12	1	335	v02	11024497	31993	68893	1186292	807140	678534	1461653	6021755	739855	0
1978	12	3	337	v02	11110463	54510	78101	1193905	811621	650508	1470697	6039008	741666	32027
1978	12	5	339	v02	11178828	68945	56693	1193393	839419	665590	1499255	6041243	737427	27944

Figure 1. Total Ice-Covered Areas and Sea Ice Extent ASCII Text Bootstrap Sample Data File for the Northern Hemisphere (gsfc.bootstrap.daily.area.1978-2015.n)

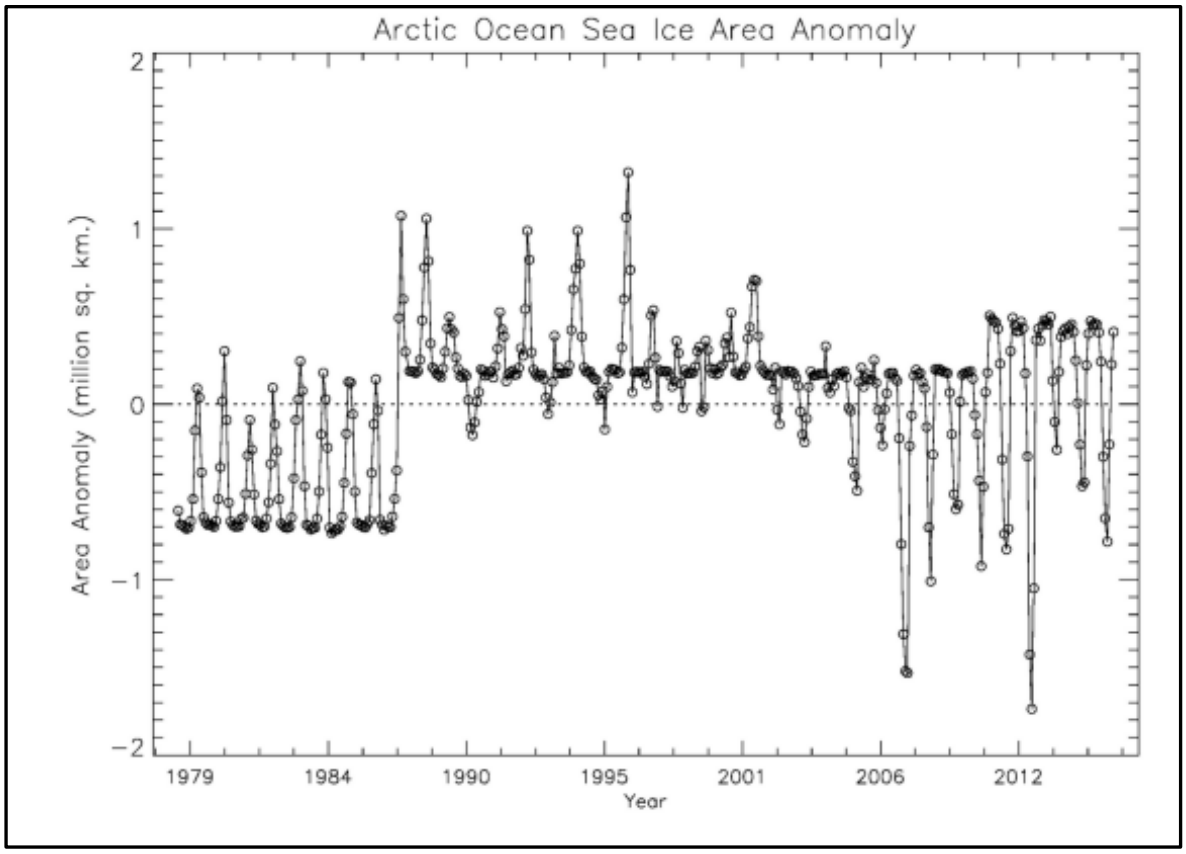

Figure 2. Total Ice-Covered Areas and Sea Ice Extent PNG Bootstrap Sample Data File for the Northern Hemisphere (gsfc.bootstrap.anomaly.area.Arctic-Ocean.1978-2015.n.png)

Year	Mon	Day	DOY	Ver	TotalAnt	Weddell	Indian	Pacific	Ross	BellAm
1978	10	26	299	v1.	13399033	4597097	2500219	1512812	2842652	1946251
1978	10	28	301	v1.	13460477	4652336	2472720	1507421	2857296	1970703
1978	10	30	303	v1.	13317781	4617049	2420854	1422710	2892206	1964959
1978	11	1	305	v1.	13134660	4491628	2400621	1390944	2846293	2005172
1978	11	3	307	v1.	13075505	4509183	2407130	1383612	2879340	1896238
1978	11	5	309	v1.	12840995	4516443	2404125	1308427	2781423	1830575
1978	11	7	311	v1.	12909917	4537097	2466660	1245990	2828219	1831949
1978	11	9	313	v1.	12796243	4610731	2393771	1152650	2853333	1785756
1978	11	11	315	v1.	12365925	4581102	2154145	1058240	2868564	1703873
1978	11	13	317	v1.	12048933	4518020	2041946	998647	2829181	1661138
1978	11	15	319	v1.	11908206	4541636	1989854	1010500	2675589	1690626
1978	11	17	321	v1.	11547705	4495555	1915322	909007	2609579	1618239
1978	11	19	323	v1.	11225740	4385814	1813098	832964	2557290	1636572

Figure 3. Total Ice-Covered Areas and Sea Ice Extent ASCII Text NASA Team Sample Data File for the Southern Hemisphere (gsfc.nasateam.daily.area.1978-2015.s)

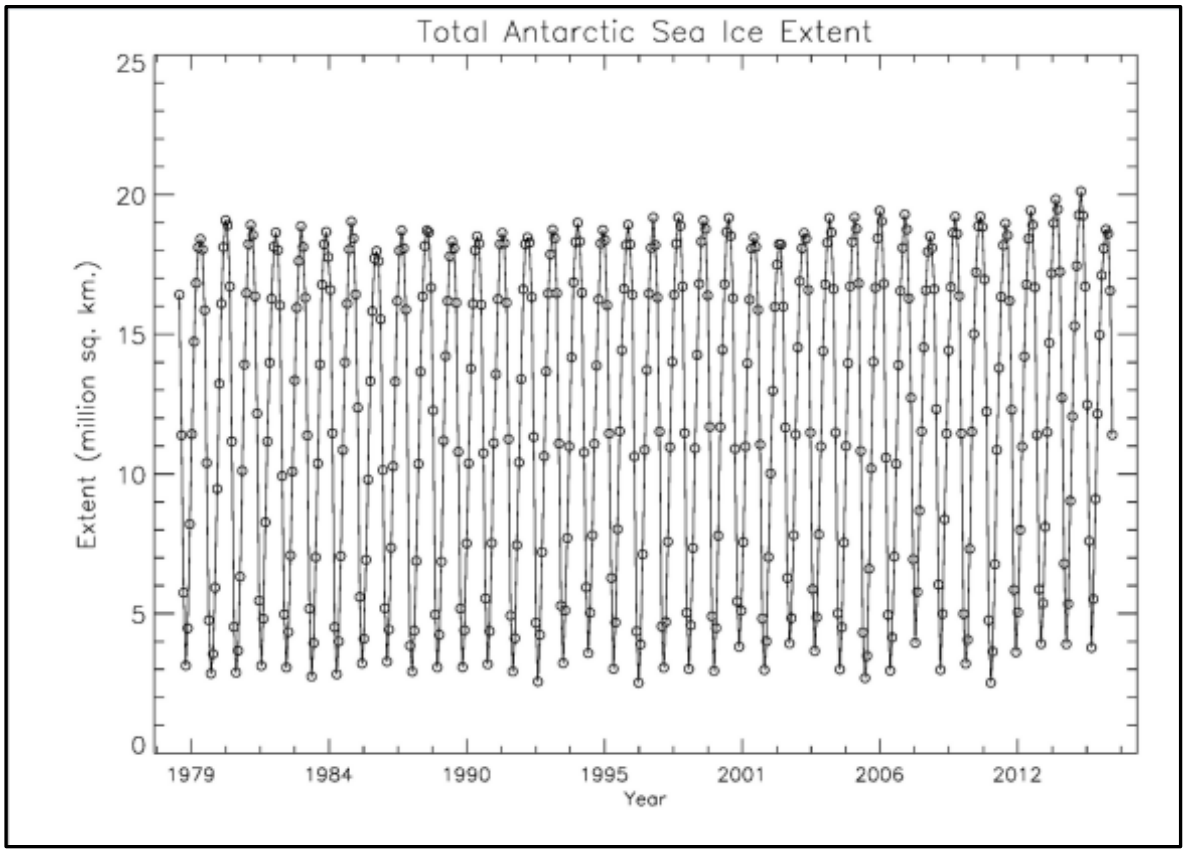

Figure 4. Total Ice-Covered Areas and Sea Ice Extent PNG NASA Team Sample Data File for the Southern Hemisphere (gsfc.nasateam.extent.Total-Antarctic.1978-2015.s.png)

Sea Ice Persistence

The following sample data images were created using a deprecated version of this data set which only included data through 2015. Therefore, these images are intended as visual examples only and should not be compared to the latest version.

Coastal values in the binary files are outlined in red in the following figures. Browse images in .png format include a color bar indicating the scale used for the persistence frequency

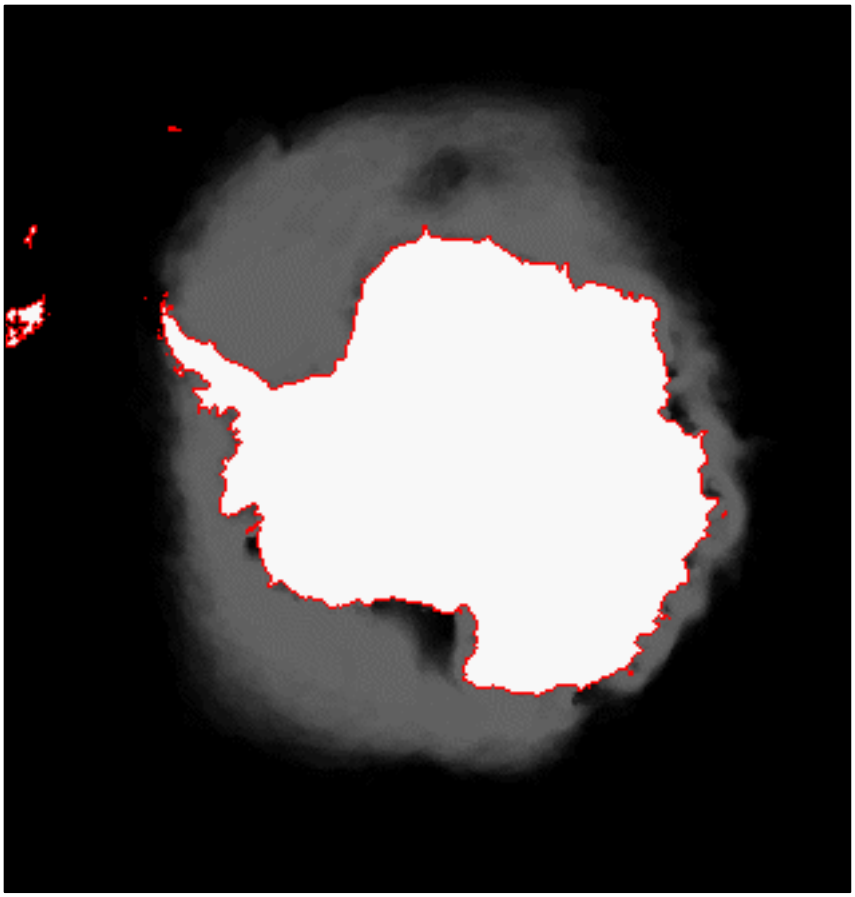

Figure 5. Sea Ice Persistence Binary Sample Data File
of the Southern Hemisphere (persistence.dec.1979-2015.s)

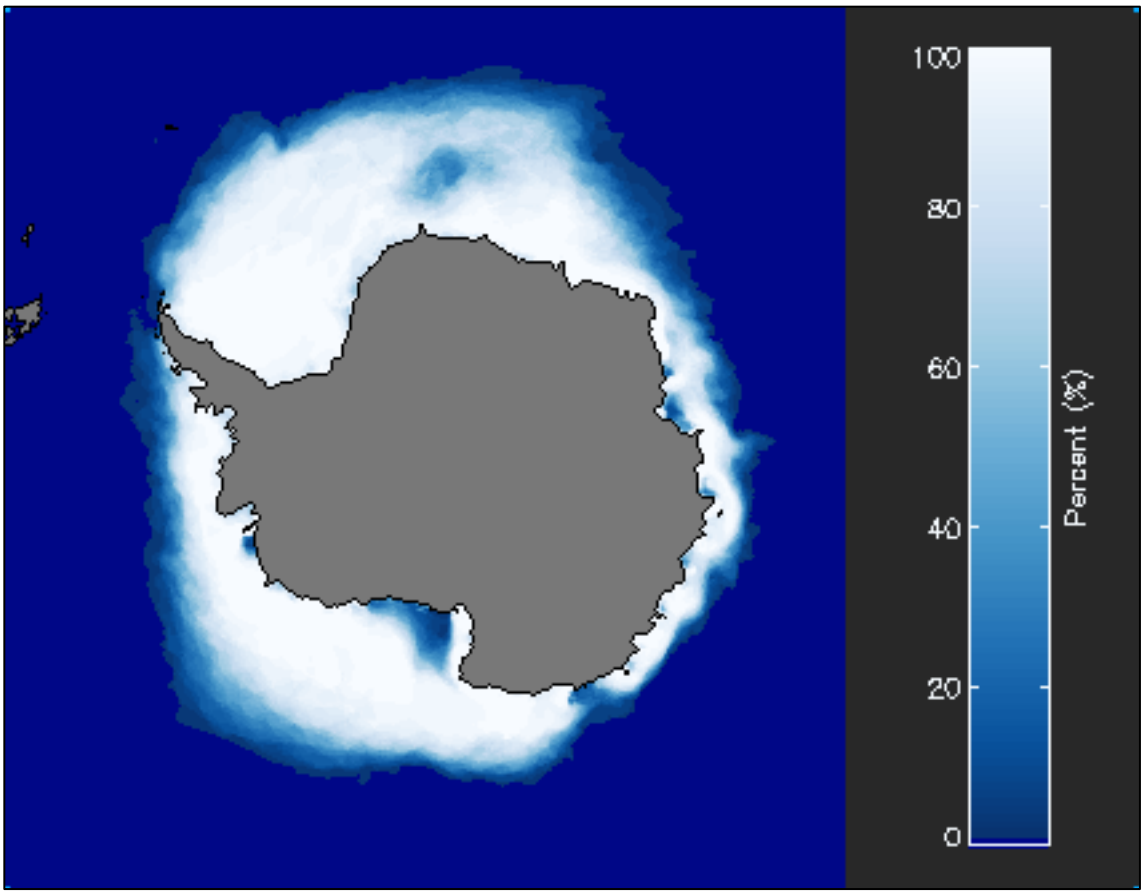

Figure 6. Sea Ice Persistence PNG Sample Data File
of the Southern Hemisphere (persistence.dec.1979-2015.s.png)

Figure 7. Sea Ice Persistence Binary Sample Data File of the Northern Hemisphere (persistence.dec.1979-2015.n)

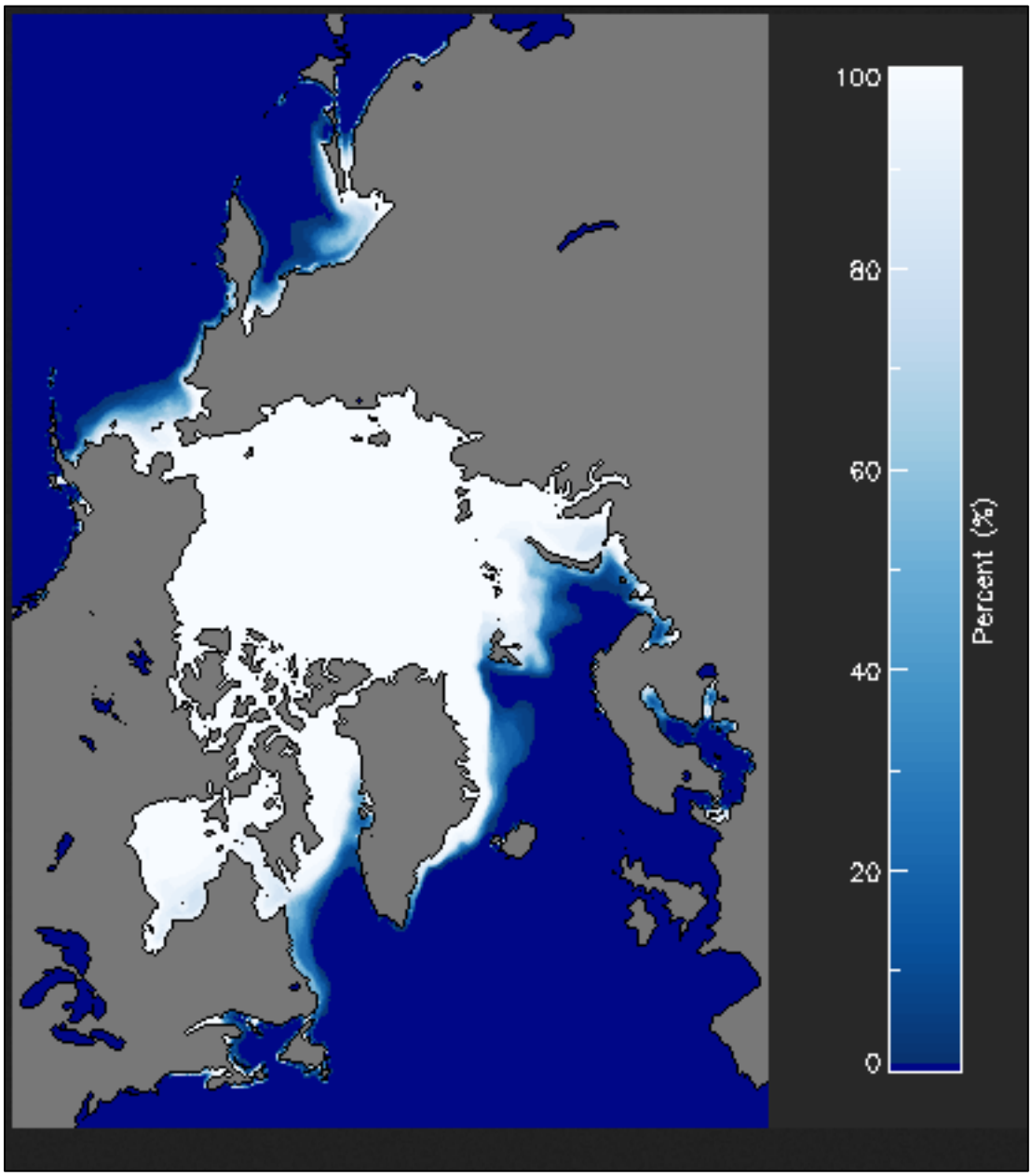

Figure 8. Sea Ice Persistence PNG Sample Data File of
the Northern Hemisphere (persistence.dec.1979-2015.n.png)

Monthly Climatology of Sea Ice Concentration

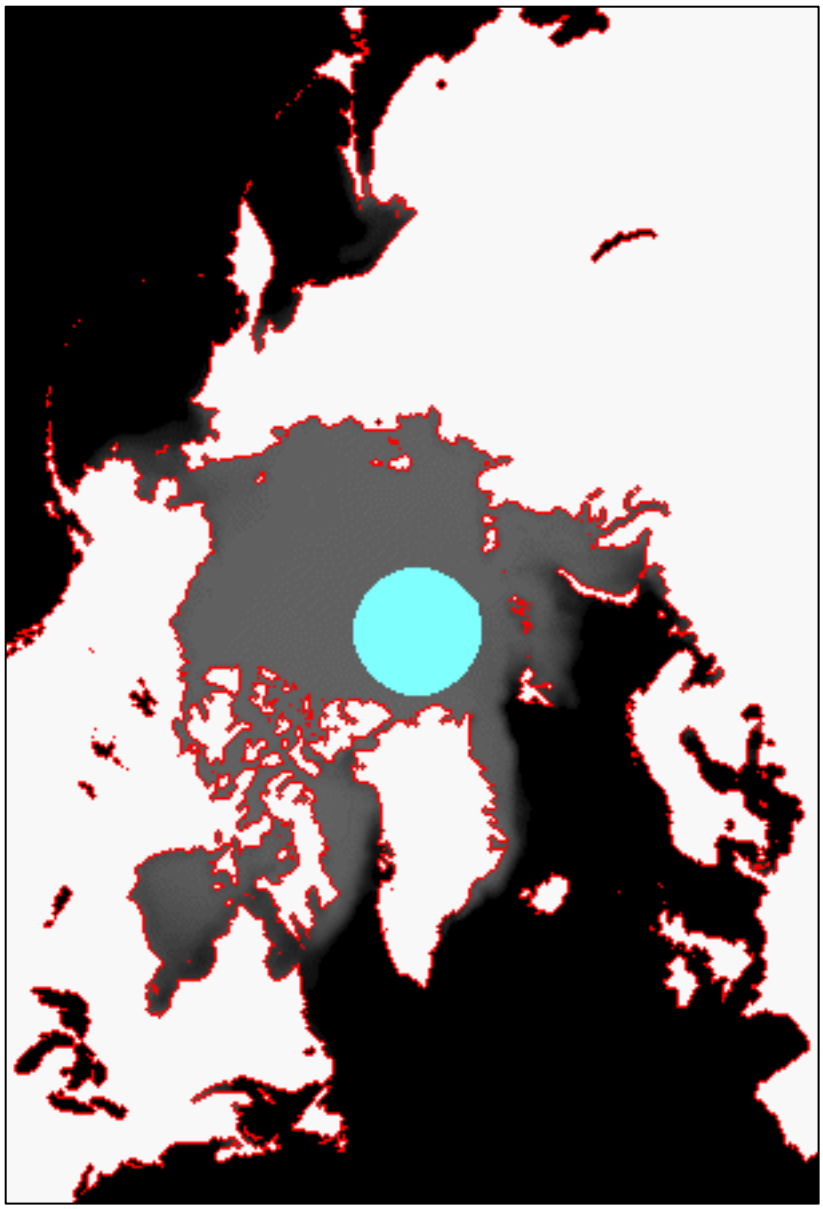

Figure 9. Monthly Climatology of
Sea Ice Concentration Binary Sample Data File of
the Northern Hemisphere (mean.dec.1979-2015.n)

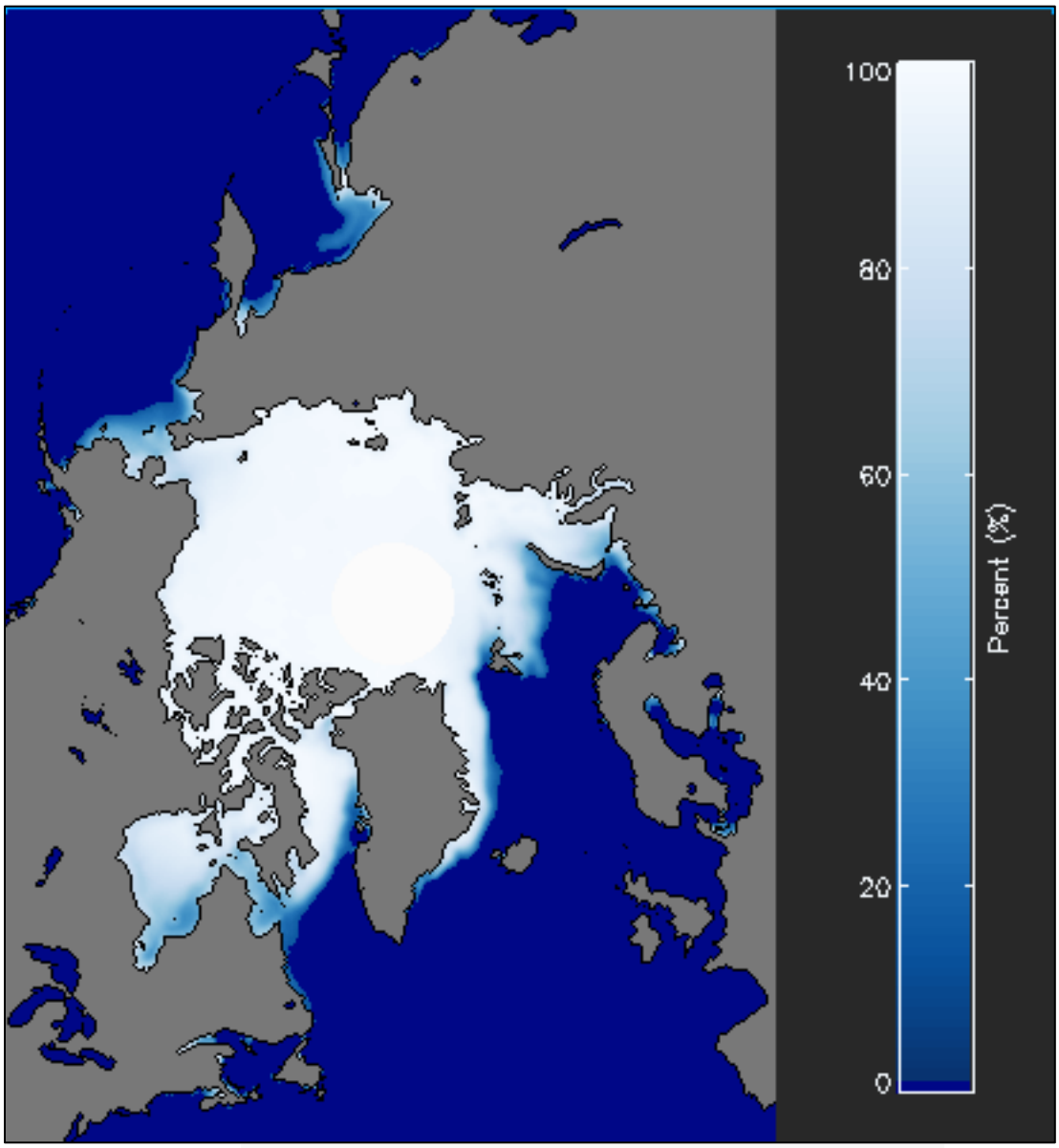

Figure 10. Monthly Climatology of Sea Ice Concentration PNG Sample Data File of the Northern Hemisphere (mean.dec.1979-2015.n.png)

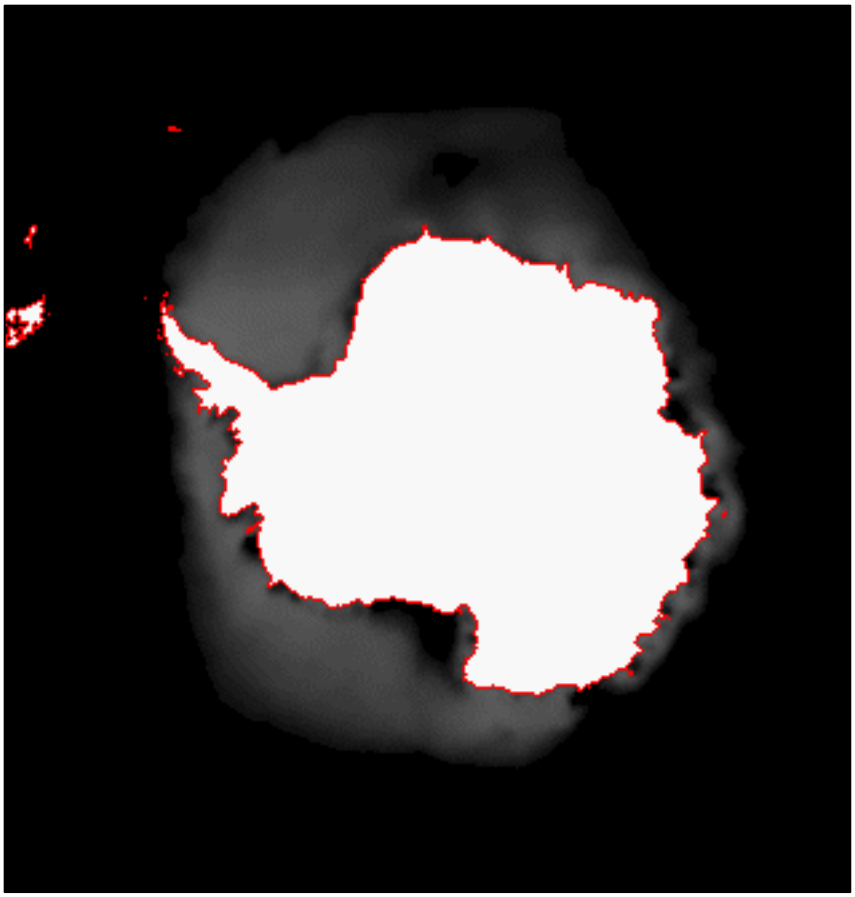

Figure 11. Monthly Climatology of
Sea Ice Concentration Binary Sample Data File
of the Southern Hemisphere (mean.dec.1979-2015.s)

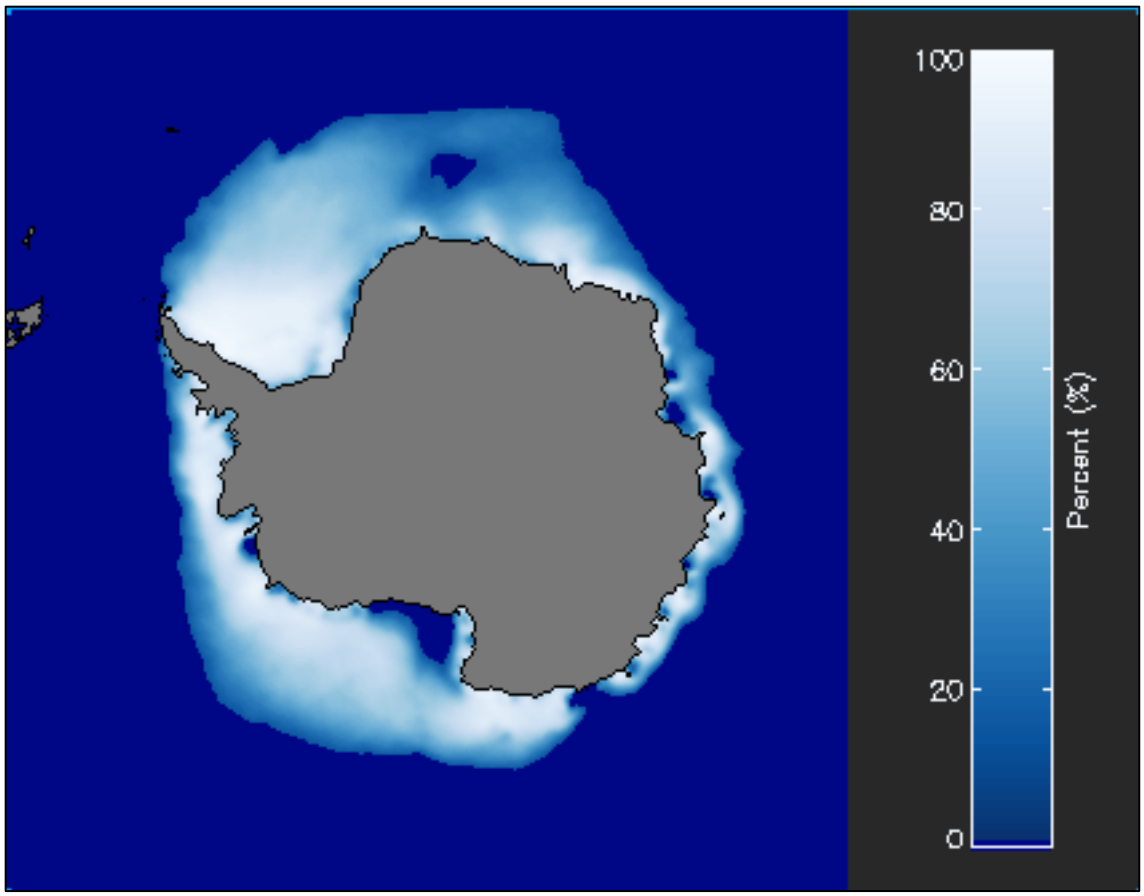

Figure 12. Monthly Climatology of Sea Ice Concentration PNG Sample Data File of the Southern Hemisphere

1.3 File Information

1.3.1 Format

Data are provided in the following formats:

Total Ice-Covered Areas and Sea Ice Extent

- ASCII text
- PNG browse

Ice Persistence

- Two-byte integer binary
- PNG browse

Monthly Climatology of Sea Ice Concentration

- Flat, one-byte integer binary
- PNG browse

1.3.2 File Contents

Data are available at:

https://daacdata.apps.nsidc.org/pub/DATASETS/nsidc0192_seaice_trends_climo_v3/

This main directory contains three folders:

- **ice-persistence/** - Contains monthly climatologies of ice persistence binary data files and a browse/ folder with corresponding .png images of monthly ice persistence
- **monthly-climatology/** - Contains monthly sea ice concentration climatology binary data files and a browse/ folder with corresponding .png images of monthly climatologies
- **total-ice-area-extent/** - Contains three sub folders:
    - **bootstrap/** - Contains ASCII text data files and a browse/ folder with .png files of regional graphs showing monthly time-series plots of ice-covered area, area anomalies, ice extent, and extent anomalies
    - **esmr-smmr-ssmi-merged/** - Contains ASCII text data files of daily and monthly sea ice extent summaries from 01 January 1972 to 31 December 2002 for the Northern Hemisphere and 01 January 1973 to 31 December 2002 for the Southern Hemisphere
    - **nasateam/** - Contains ASCII text data files and a browse/ folder with .png files of regional graphs showing monthly time-series plots of ice-covered area, area anomalies, ice extent, and extent anomalies

1.3.3 Naming Convention

Files are named according to the following conventions:

Ice Persistence

Convention: `persistence.mmm.1979-yyyy.h`

Example: `persistence.apr.1979-2021.n`

where:

Table 3. File Naming Convention for Ice Persistence Data Files

Variable	Description
persistence	Identifies this as an ice persistence data file
mmm	3-character month abbreviation
1979	First year for which data are available
yyyy	4-digit year of the last year for which data are available
h	Hemisphere (n: Northern, s: Southern)

Monthly Climatology of Sea Ice Concentration

Convention: `mean.mmm.1979-yyyy.h`

Example: `mean.apr.1979-2021.n`

where:

Table 4. File Naming Convention for Monthly Climatology Sea Ice Concentration Data Files

Variable	Description
mean	Identifies this as a mean ice concentration percentage data file
mmm	3-digit month abbreviation
1979	First year for which data are available
yyyy	4-digit year of the last year for which data are available
h	Hemisphere (n: Northern, s: Southern)

Total Ice Area Extent

Bootstrap and NASA Team Files

The following file naming conventions pertain to both the NASA Team and Bootstrap algorithm data files. Data are provided in two different temporal resolutions: daily and monthly.

There are two different types of daily files: ice covered area files and sea ice extent files.

There are six different types of monthly files: ice covered area files, sea ice extent files, ice covered area anomaly files, sea ice extent anomaly files, monthly mean ice covered area files, and monthly mean sea ice extent files.

Monthly anomalies of ice-covered area and ice extent are calculated from monthly mean ice concentrations throughout the period of study. These anomalies show the deviations from the mean monthly values averaged over the entire time series.

Conventions:

`gsfc.algorithm.xxxx.area.1978-yyyy.h`
`gsfc.algorithm.xxxx.extent.1978-yyyy.h`
`gsfc.algorithm.xxxx.anomaly.area.1978-yyyy.h`
`gsfc.algorithm.xxxx.anomaly.extent.1978-yyyy.h`
`gsfc.algorithm.xxxx.mean.area.1978-yyyy.h`
`gsfc.algorithm.xxxx.mean.extent.1978-yyyy.h`

where:

Table 5. File Naming Convention for Total Ice Area Extent Files

Variable	Description
gsfc	Indicates that data were acquired from Goddard Space Flight Center (GSFC)
algorithm	Algorithm used to process the data (nasateam or bootstrap)
xxxx	Indicates that this file is either daily or monthly
anomaly	Indicates that this file contains the difference between the monthly data (area or extent) and the total monthly mean for the entire temporal coverage period
area	Indicates that this file contains ice-covered area measurements
extent	Indicates that this file contains sea ice extent measurements
1978	First year for which data are available
yyyy	4-digit year of the last year for which data were available
h	Hemisphere (n: Northern, s: Southern)

ESMR-SMMR-SSM/I-SSMIS-Merged Sea Ice Extent

Data are provided in two different temporal resolutions: daily and monthly.

Conventions:

gsfc.nasateam.extent.1972-yyyy.h

gsfc.nasateam.month.extent.1972-yyyy.h

Examples:

gsfc.nasateam.extent.1972-2002.n

gsfc.nasateam.month.extent.1972-2002.n

where:

Table 6. File Naming Conventions for ESMR-SMMR-SSM/I-SSMIS-Merged Sea Ice Extent Files

Variable	Description
`gsfc.nasateam`	Indicates this is GSFC data processed with the NASA Team algorithm
`extent`	Indicates this file contains sea ice extent measurements
`month`	Indicates this file contains monthly averaged data (otherwise daily)
`1972`	First year for which data are available
`yyyy`	4-digit year (most recent year of processing)
`h`	Hemisphere (n: Northern, s: Southern)

1.3.4 Column Headers in ASCII Text Files

Total Ice Area and Extent

Data are in ASCII text format arranged in columns as described here:

Table 7. Colum Header Descriptions for Total Ice Area and Extent ASCII Text Files

Column	Description
`Year`	4-digit year
`Mon`	1-digit and 2-digit month
`Day`	1-digit and 2-digit day of month
`DOY`	3-digit day of year
`Ver`	Version number of input NASA Team or Bootstrap data (v01: version 01, v02: version 02, v03: version 03)
`Region`	The remaining columns of the Arctic and Antarctic daily area and daily extent files list the total ice-covered area (km^2) and total sea ice extent (km^2), respectively. The columns are labeled by region. Refer to Table 8 and Table 9 for a list of abbreviations for column names.

The following tables list the Arctic and Antarctic regions covered by this data set and define the abbreviations in the data files.

Table 8. Arctic Regions and Abbreviations

Arctic Region	Abbreviation
Total Arctic	TotalArc
Seas of Okhotsk & Japan	Okhotsk
Bering Sea	Bering
Hudson Bay	Hudson
Baffin Bay	Baffin
Greenland Sea	Grnland
Kara and Barents Seas	BarKara
Arctic Ocean	ArctOcn
Canadian Archipelago	CanArch
Gulf of St. Lawrence	StLawr

Table 9. Antarctic Regions and Abbreviations

Antarctic Region	Abbreviation
Total Antarctic	TotalAnt
Weddell Sea	Weddell
Indian Ocean	Indian
Pacific Ocean	Pacific
Ross Sea	Ross
Bellingshausen and Amundsen Seas	BellAm

Merged ESMR-SMMR-SSMI Sea Ice Extent

Data are in ASCII text format arranged in columns as described in Table 10 and Table 11 for the daily and monthly data.

Table 10. Column Descriptions for Merged Daily Data Files

Column Number	Description
1	4-digit year
2	1-digit and 2-digit month
3	1-digit and 2-digit day of month
4	1-digit to 3-digit day of year
5	Observed/interpolated sea ice extent (10^6 km^2)

Table 11. Column Descriptions for Merged Monthly Data Files

Column	Description
`Year`	4-digit year
`Months (remaining 12 columns)`	3-character month abbreviation

1.4 Spatial Information

1.4.1 Coverage

N: -39.23, S: -90, E: 180, W: -180

N: 90, S: 30.98, E: 180, W: -180

1.4.2 Resolution

25 km x 25 km

1.4.3 Geolocation

Projections

- Arctic: NSIDC Sea Ice Polar Stereographic North
- Antarctic: NSIDC Sea Ice Polar Stereographic South

Grids

- For the Northern Hemisphere, the grid size is 304 x 448 pixels.
- For the Southern Hemisphere, the grid size is 316 x 332 pixels.

1.5 Temporal Information

1.5.1 Coverage

The temporal coverage for this data set is 26 October 1978 to 31 December 2022.

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition

These data are derived from the following sources:

- Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS, Version 3 and/or
- Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data, Version 1 (also referred to as NASA Team)
- Polar Stereographic Valid Ice Masks Derived from National Ice Center Monthly Sea Ice Climatologies, Version 1 (Used in processing to remove spurious ice caused by residual weather effects and land spillover in passive microwave data)

2.2 Processing

Total Ice-Covered Areas and Sea Ice Extent

In computing the total ice-covered area and ice extent data with both the NASA Team and Bootstrap algorithms, pixels must have an ice concentration of 15 percent or greater to be included. Total ice-covered area is defined as the area of each pixel with at least 15 percent ice concentration multiplied by the ice fraction in the pixel (0.15 to 1.00). Total ice extent is computed by summing the number of pixels with at least 15 percent ice concentration multiplied by the area per pixel; thus, the entire area of any pixel with at least 15 percent ice concentration is considered to contribute to the total ice extent. Anomalies are the difference between the current time period's average value and the long-term average. A positive anomaly indicates that the current period has greater extent or area than the average.

Ice Persistence

Individual ocean pixels containing a minimum of 15 percent ice cover are summed throughout the time series. The maximum ice persistence value is 100 percent. Each pixel represents the percentage of years for which ice was present during that month. Only the NASA Team algorithm is used to compute these data.

Monthly Climatology of Sea Ice Concentration

A threshold of 15 percent concentration is applied to the monthly climatology fields. Only the NASA Team algorithm is used to compute these data.

2.3 Quality, Errors, and Limitations

Monthly anomalies of ice-covered area and ice extent are calculated from monthly mean ice concentrations throughout the period of study. These anomalies show the deviations from the mean monthly values averaged over the entire time series.

Table 12. Missing Data

Time Periods	Data Type	Description
October 1978, December 1987	Sea ice	Sea ice data are missing for most days, so monthly values are not calculated for these months.
January 1988	Sea ice	January 1988 is missing data for the first half of the month. A value is given for this month, but the value may not represent true monthly mean since the sea ice data are incomplete.

Gap in Coverage over the North Pole

There is a circular section over the Northern Hemisphere pole known as the pole hole, which is never measured due to orbit inclination. For the purposes of ice extent, pixels under the pole hole are always considered to be at least 15 percent. For total ice-covered area, the pixels under the pole hole are not used. The Southern Hemisphere also has a pole hole, but it does not affect this sea ice data set because there is only land under this hole. For SMMR, the hole is 611 km in radius and is located poleward of 84.5 degrees North. For SSM/I and SSMIS, the hole is 311 km in radius and is located poleward of 87.2 degrees North.

The difference in pole hole areas between SMMR and SSM/I-SSMIS results in a discontinuity in the Northern Hemisphere ice-covered area time series across the instrument transitions.

2.4 Instrumentation

2.4.1 Description

For information regarding the sensors used for this product, refer to the SMMR, SSM/I, and SSMIS Sensors Summary.

3 SOFTWARE AND TOOLS

The gridded data files for the regions are on the Polar Stereographic Tools page.

4 VERSION HISTORY

Table 13. Version History

Version	Date Implemented	Description of Updates
V3.1	26 February 2019	• The input data stream now includes the Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS v3.1 files (updated from v3.0). This difference caused changes in all daily and monthly Bootstrap values. Users should expect to see a 1-3% increase in ice area and extent fields. Users should refer to the Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS documentation for details of the algorithm update.
V3	06 April 2018	• Incorporated a change from Version 2 to Version 3 of the Bootstrap data set. For V3 Bootstrap data, the concentration record was re-calculated for the entire period of the data set, 1978 through current processing. The most impactful changes were a lowering of the threshold to 10% for ice extent, and the recalculation of the algorithm's tie points every day. However, despite the new 10% threshold for Bootstrap input data, this Sea Ice Trends and Climatologies data set continues to be derived using a 15% threshold.
V2	01 January 2017	• Updated with Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data, Version 1.1 input data. An examination of the differences between the previous version of NSIDC-0192 and the current version was performed; see notice below from 01 January 2017. • Updated with Polar Stereographic Valid Ice Masks Derived from National Ice Center Monthly Sea Ice Climatologies input data. • Made improvements to the browse images.
V1	28 July 2014	No science changes were made during this update.

Version	Date Implemented	Description of Updates

V1 (cont.)	04 September 2013	• Data derived from the DMSP SSM/I Daily Polar Gridded Sea Ice Concentrations product were removed from production. As a resullt, the primary input data sources are:
		  • Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS
		  • Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data
		• The cutoff value which defines a region as ice-covered or not ice-covered was adjusted from 14.8 to 15%.
		• The ice persistence and monthly climatology of sea ice concentration (monthly means) parameters are now calculated exclusively using the NASA Team algorithm.
		• The ocean mask files and maximum extent mask files were removed as they are not the masks used in the production of these data sets.

	2004	Initial release of this data product.

4.1 Version 3 Update Notice

01 MARCH 2018

The climatology presents a summary of the long-term record of satellite-derived sea ice concentrations calculated using the NASA Team (NT) and Bootstrap (BT) algorithms. Prior to this update, the climatology included NT and BT data from 1978 through 2015. Because no changes were made to the NT data that were used in the previous version of this product, only small differences due to averaging data from an additional year are expected.

Findings

Because the ice persistence and monthly climatology fields are based on the NT data set, there are only small differences. A few grid cells have small changes, but overall there are minimal changes in the ice persistence and monthly climatology fields in both hemispheres for all months.

The NT-derived fields of regional ice extent and areas similarly consist of just the additional year of data; the values through the end of 2015 are unchanged.

The BT-derived fields do show widespread changes because the underlying Bootstrap data have been updated to a new version. While monthly hemisphere-wide areas show average area increases of less than 2%, some smaller regions—for which even small changes in ice area can be a large percentage of the region's total—can show much larger percentage changes.

While monthly hemisphere-wide areas show average area increases of less than 2%, some smaller regions–for which even small changes in ice area can be a large percentage of the region's total–can show much larger percentage changes.

Recommendations

The updated Sea Ice Trends and Climatologies data are consistent in format and value with the previous version and can be used for the same purposes. Because the Bootstrap data have been updated for the entire time series, users of the Bootstrap data should update those applications with the entire Bootstrap data set.

4.2 Version 2 Update Notice

01 JANUARY 2017

In the Northern Hemisphere, very small differences in sea ice extent were found: less than 0.2 percent for the NASA Team algorithm and less than 0.05 percent for the Bootstrap algorithm.

Differences in Northern Hemisphere sea ice area were also small. Most years had less than 0.05 percent. Differences in the Bootstrap sea ice area were generally less than 0.01 percent.

For both the Bootstrap and NASA Team algorithms, the differences in the Southern Hemisphere were negligible.

These small differences are found in the persistence and monthly climatology data also. The Northern Hemisphere monthly fields showed no difference in 95-98 percent of the sea ice values, and fewer than 0.02 percent of pixels had differences in ice concentration of greater than 2 percent.

4.3 Version 1 Update Notice

28 JULY 2014

Data are now available through 31 December 2013 for all Sea Ice Trends and Sea Ice Trends and Climatologies from SMMR and SSM/I-SSMIS data sets.

4.4 Version 1 Update Notice

04 SEPTEMBER 2013

Reprocessing is complete and updated data are now available through 31 December 2012 for all Sea Ice Trends and Sea Ice Trends and Climatologies from SMMR and SSM/I-SSMIS data sets. With this update, the following changes have been implemented:

Total Ice-Covered Area and Extent

The cutoff value which defines a region as ice-covered or not ice-covered has been adjusted from 14.8 percent to 15 percent to more closely match the methodology used to calculate other sea ice extent and area products at NSIDC.

Ice Persistence and Monthly Climatology of Sea Ice Concentration (Monthly Means)

Includes the new 15 percent cutoff value described above.

To prevent inconsistencies between different algorithms, these parameters are now calculated exclusively using the NASA Team algorithm.

Monthly Ocean Masks and Maximum Extent Masks

The ocean mask files and maximum extent mask files were removed as they are not the masks used in the production of these data sets.

This most recent reprocessing also rectifies two previous releases of these data sets that contained erroneous data. In January/February of 2012, and May of 2013, the products were to have contained data from 2007 to 2010 and from 2010 to 2011, respectively. However, the climatology products contained data only through 2007. We recommend replacing previously downloaded 2010 and 2011 climatology data files with the climatology files that now extend through 2012. The Total Ice-Covered Area and Extent data set did contain post-2007 data, but reprocessed data utilizing the new methodology are available in the 2012 release.

5 RELATED DATA SETS

- Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data
- Bootstrap Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS
- Polar Stereographic Valid Ice Masks Derived from National Ice Center Monthly Sea Ice Climatologies

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7 DOCUMENT INFORMATION

7.1 Publication Date

January 2017

7.2 Date Last Updated

June 2023