Polar Stereographic Valid Ice Masks Derived from National Ice Center Monthly Sea Ice Climatologies, Version 1

USER GUIDE

How to Cite These Data

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

Meier, W. N., J. Stroeve, F. Fetterer, M. Savoie, and H. Wilcox. 2015. *Polar Stereographic Valid Ice Masks Derived from National Ice Center Monthly Sea Ice Climatologies, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/M4PUJAQRI2DS. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0622

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

These valid ice masks provide a way to remove spurious ice caused by residual weather effects and land spillover in passive microwave data. They are derived from the National Ice Center Arctic Sea Ice Charts and Climatologies data set and show where ice could possibly exist based on where it has existed in the past.

1.1 Format

There are 12 valid ice masks, one for each month, in netCDF4 following CF1.6 compliance with all associated metadata. The data are on a 304 x 448 grid. Table 1 describes the variables and data values in the files.

Table 1. NetCDF File Variable Description

Variable	Description
coordinate_reference_system	NSIDC Sea Ice Polar Stereographic North on the Hughes 1980 Ellipsoid
rows	Y coordinate at the grid cell center
cols	X coordinate at the grid cell center
latitude	Latitude at the grid cell center in degrees North
longitude	Longitude at the grid cell center in degrees East
valid_ice_flag	Mask flag indicating where ice is possible, also includes other surface types.

Flag Value (Bytes)	Meaning
0	Ocean
1	Valid Ice
2	Coastal land (defined as land grid cells that are adjacent to ocean cells)
3	Land
4	Lake

1.2 File and Directory Structure

All 12 masks reside on HTTPS in https://daacdata.apps.nsidc.org/pub/DATASETS/nsidc0622_valid_seaice_masks.

1.3 File Naming Convention

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

Generic File Name: `NIC_valid_ice_mask.N25km.MM.1972-2007.nc`

Example File Name: `NIC_valid_ice_mask.N25km.12.1972-2007.nc`

Where

Table 2. File Naming Convention

Variable	Description
`NIC_valid_ice_mask`	Identifies this file as a valid ice mask derived from NIC data
`N25km`	Identifies this as containing Northern Hemisphere data at a 25 km resolution
`MM`	2-digit month of year
`1972-2007`	Indicates the span of years used in the climatology
`.nc`	File extension identifying the file as netCDF

1.4 File Size

Each mask file is approximately 2.2 MB with a combined total volume for the 12 masks of 26.4 MB.

1.5 Spatial Coverage

This data set covers the Northern Hemisphere at a resolution of 25 km with the following bounding coordinates:

Northernmost Latitude: 90° N
Southernmost Latitude: 38° N
Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

The spatial coverage of the input NIC climatologies is limited to north of 45° N latitude, however, there are instances where valid sea ice occurs south of this latitude for certain winter months. To capture commonly occurring ice in these areas, the valid-ice region in the mask is extended in two separate regions for the months of December and January through April based on the experience of the investigators with many other sources of sea ice information. See Figure 1.

One extension is in the Sea of Japan and the Sea of Okhotsk. This region is between 126° E and 146° E and extends from 45° N latitude to the line formed between the two points (42° N, 146° E) and (39.5° N, 126° E).

The other extension covers much of the Bohai Sea. This region is between 126° E to 115° E and 45° N to 38° N.

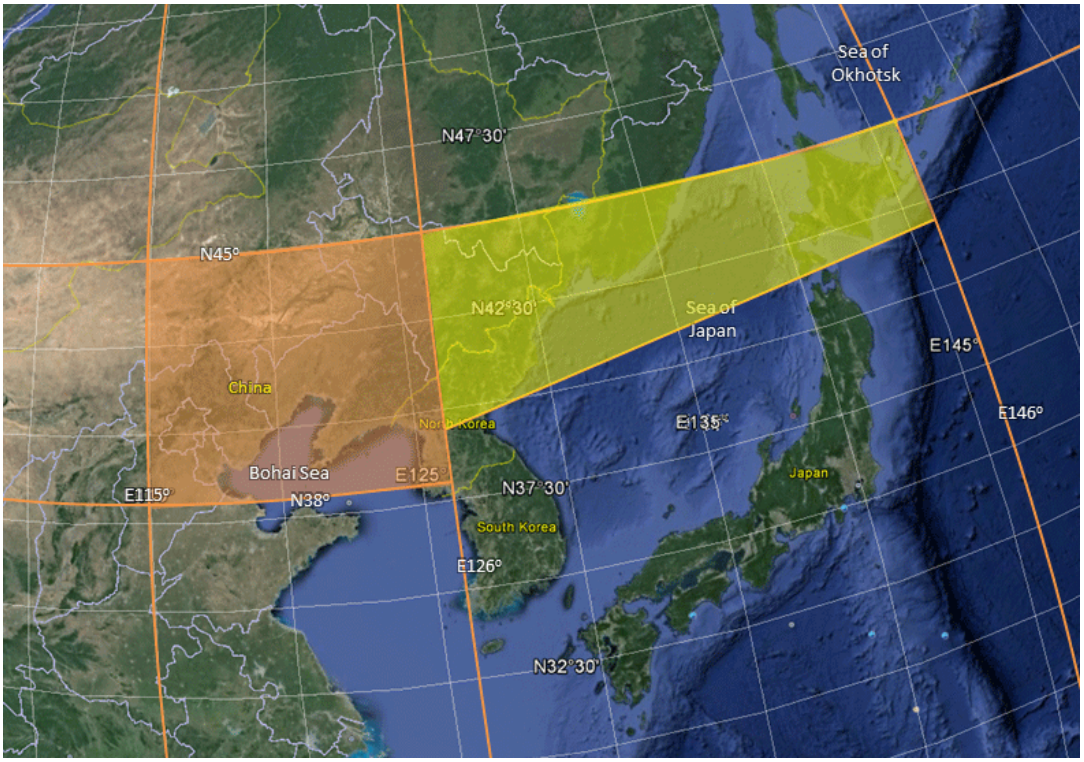


Figure 1. Areas extended in the NIC Valid Ice Masks around Bohai Sea (orange) and the Sea of Japan and Sea of Okhotsk (yellow). Click image for larger version.

1.5.1 Projection and Grid Description

These data are provided on the NSIDC Sea Ice Polar Stereographic North on the Hughes 1980 Ellipsoid projection. The map projection parameter (`.mpp`) file used is `Nps.mpp`, and the grid projection description (`.gpd`) file used is `N3B.gpd`.

1.6 Temporal Coverage

The monthly averaged valid ice masks were derived from a climatology covering 01 January 1972 through 31 December 2007 based on weekly ice charts.

1.7 Parameter or Variable

The main parameter of this data set is valid sea ice. In this context, valid sea ice is defined as places where ice could possibly exist based on where it has existed in the past from a 35-year climatology. In addition to valid sea ice, a number of other surface classifications are also defined: land, lake, ocean, and coast. See Table 1 for a list of data values.

1.7.1 Sample Data Record

Figure 2. January Valid Ice Mask

Figure 3. February Valid Ice Mask

Figure 4. March Valid Ice Mask

Figure 5. April Valid Ice Mask

Figure 6. May Valid Ice Mask

Figure 7. June Valid Ice Mask

Figure 8. July Valid Ice Mask

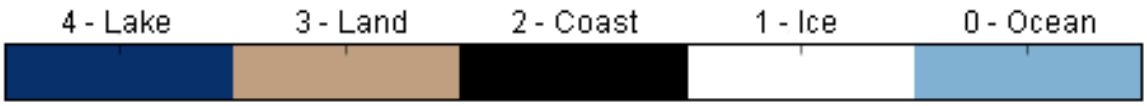
Figure 9. August Valid Ice Mask

Figure 10. September Valid Ice Mask

Figure 11. October Valid Ice Mask

Figure 12. November Valid Ice Mask

Figure 13. December Valid Ice Mask



2 SOFTWARE AND TOOLS

For a list of tools to read netCDF files, see NSIDC's NetCDF Software Tools Web page.

3 DATA ACQUISITION AND PROCESSING

3.1 Theory of Measurements

Weather effects can cause the passive microwave signature of seawater to appear like that of ice. Refer to Cavalieri 1995 for more information. Atmospheric water vapor is often the reason behind false ice detection. Most of these false ice signatures are removed with a standard brightness temperature filter, but some are too close to those of real ice and require another method to be removed. In addition, ice can be falsely detected along coasts due to contamination of ocean pixels by the passive microwave emission of land. This is called land-to-ocean spillover; and it, too, needs to be corrected.

The best way to evaluate where ice can be is to look at a climatology of sea ice occurrence, where the climatology is built from arctic-wide sea ice analyses over as long a period as possible from many different sources. These show where ice detected by the satellite data algorithm is most likely to be valid ice, based on where ice has existed in the past. The climatology used for this data set is the National Ice Center Arctic Sea Ice Charts and Climatologies in Gridded Format. It includes 12 files showing the maximum sea ice extent, one for each month of the year, over the period 1972 to 2007.

The NIC sea ice climatology charts are created by sea ice analysts, so they are less likely to cut off real ice because the analysts are conservative in where they draw the ice edge. They only draw it where they are confident that ice is not present beyond the edge; they make this determination using multiple satellite, ship, buoy, and in situ data sources. This means that valid ice masks based on the NIC chart climatology are inherently more conservative than would be similar masks based on a passive microwave-derived sea ice climatology. That is, these masks are less likely to filter out valid ice detection as false ice detection. They have the added advantage that the NIC climatology is based on records that extend back to 1972, five years before the satellite based sea ice record began.

3.2 Derivation Techniques and Algorithms

These valid ice masks are based on the maximum sea ice concentration climatologies from the NIC Arctic Sea Ice Climatologies data set. If the NIC climatology indicated that ice is valid in certain areas, then the masks indicate that ice is valid in these areas as well.

3.2.1 Processing Steps

The valid ice masks were created using the following processing steps:

1. Obtain and read in the 12 input maximum sea ice concentration climatologies from the NIC Arctic Sea Ice Climatologies data set. The files have names like `nic_climo_1972_2007_MM_max.v0.bin`, where MM is the 2-digit month.
2. Prepare the input NIC data for reprojection and regridding because they are on the 25 km AVHRR Northern Hemisphere Equal-Area Scalable Earth Grid (Na25), but the target grid is the 25-km Northern Hemisphere Polar Stereographic Grid (N3B). These two grids do not have the same land mask; therefore, doing a straight reprojection from the Na25 grid to the N3B grid would cause inconsistencies where the NIC data are labeled as land but the target grid is classified as ocean. As a result of this, if the reprojected NIC valid ice is simply overlaid onto the N3B land mask, there are areas of ocean that will never get labeled as valid ice simply because the input grid was labeled as land.

   To compensate for this effect, the maximum ice grid is morphologically dilated with a 7x7 diamond-shaped structuring element in order to "push" or "smear" ice up onto land; so that when the data is regridded, there are no mismatched areas where the N3B projection has ocean or ice where Na25 had land. In order to prevent expansion of the possible ice edge, the dilation of ice is restricted only onto areas of land, forbidding dilation of ice into water.
3. Reproject and regrid the NIC Climatologies to the 25-km Northern Hemisphere Polar Stereographic Grid (N3B) with gdalwarp using nearest neighbor resampling.
4. Create the masks by assigning values for land, lake, ocean, and coast from the N3B reference mask and by assigning valid ice locations as they are labeled in the NIC Climatologies.
5. Extend the spatial coverage of the valid ice masks to include Bohai Sea and areas of the Sea of Japan and Sea of Okhotsk. See Section 1.5 Spatial Coverage section of this document for more information on these extensions.
6. Save the gridded data to netCDF4 following CF1.6 compliance.

3.2.2 Version History

Table 3 describes the version history of this product.

Table 3. Version History

Version	Date	Description
Version 1.0	April 2015	Initial release of this data set.

3.2.3 Error Sources

Ideally, a valid ice mask will only let real ice through. However, false detections are still possible within the bounds of the mask. Because this mask covers more area, in most cases, than would a passive microwave climatology-based mask, the area of falsely detected ice could be greater. However, the probability of removing valid ice is less with this mask. In addition, this mask does a better job of not allowing false ice due to land spillover along some coasts.

These valid ice masks are derived from NIC sea ice chart climatologies. For a complete description on the quality of the input product, please see the Quality Assessment section of the NIC climatology documentation.

3.3 Sensor or Instrument Description

The NIC Climatologies, from which these masks were derived, were created from numerous satellite, ship, buoy, and in situ data sources. For a complete description of these data sources, see the NIC Arctic Sea Ice Charts and Climatologies in Gridded Format documentation.

4 REFERENCES AND RELATED PUBLICATIONS

Cavalieri, D. J., K. M. St. Germain, and C. T. Swift. 1995. Reduction of Weather Effects in the Calculation of Sea Ice Concentration with the DMSP SSM/I. Journal of Glaciology. 41(139):455-464.

4.1 Related Data Collections

National Ice Center Arctic Sea Ice Charts and Climatologies in Gridded Format
Sea Ice Index
Near-Real-Time DMSP SSMIS Daily Polar Gridded Sea Ice Concentrations

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

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6.2 Date Last Updated

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