



# The Dehn Collection of Arctic Sea Ice Charts, 1953-1986, Version 1

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## USER GUIDE

### How to Cite These Data

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

National Snow and Ice Data Center (comp.). 2005. The Dehn Collection of Arctic Sea Ice Charts, 1953-1986, Version 1. [Indicate subset used]. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. <https://doi.org/10.7265/N5F769GD>. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT [NSIDC@NSIDC.ORG](mailto:NSIDC@NSIDC.ORG)

FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/G01111>



National Snow and Ice Data Center

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# 1 DETAILED DATA DESCRIPTION

The National Snow and Ice Data Center holds a collection of charts depicting ice conditions in the seas off Alaska and western Canadian coasts. Ice edge position and some ice concentration and other information are included, though the notations on the charts are often sparse and discontinuous in space and time, especially for older charts in the series. These charts, more than 6,800 in number, were donated to NSIDC by the estate of William S. Dehn. NSIDC has partnered with the NOAA Climate Database Modernization Program (CDMP) and the National Geophysical Data Center (NGDC) to scan the charts and to make them available through a searchable interface.

This collection was compiled by William S. Dehn and his organization, Sea Ice Consultants, Inc., and donated to NSIDC/World Data Center for Glaciology, Boulder, by his estate after his death for use by the climate and global change research community. William S. Dehn was one of the first ice observers for the U.S. Navy, flying in the 1950s on ice reconnaissance flights. The charts show location and extent of sea ice cover, charted (depending on year in the series) from aerial reconnaissance, ship observations, and satellite imagery. For 1975-1986 charts, the collection comprises the entire real-time analysis/forecast activity of Sea Ice Consultants, Inc., including detailed analyses for Alaskan and western Canadian waters.

To make the charts more accessible, NSIDC, in partnership with NOAA NGDC, had the collection scanned under the NOAA Climate Database Modernization Program (CDMP), a partnership between the NOAA National Climatic Data Center (NCDC) and private industry to image and key paper and microfilm records and to make them available online to members of the climate and environmental research community. NSIDC maintains Dehn chart metadata in a database through which the collection can be searched and browsed by date range or geographic region.

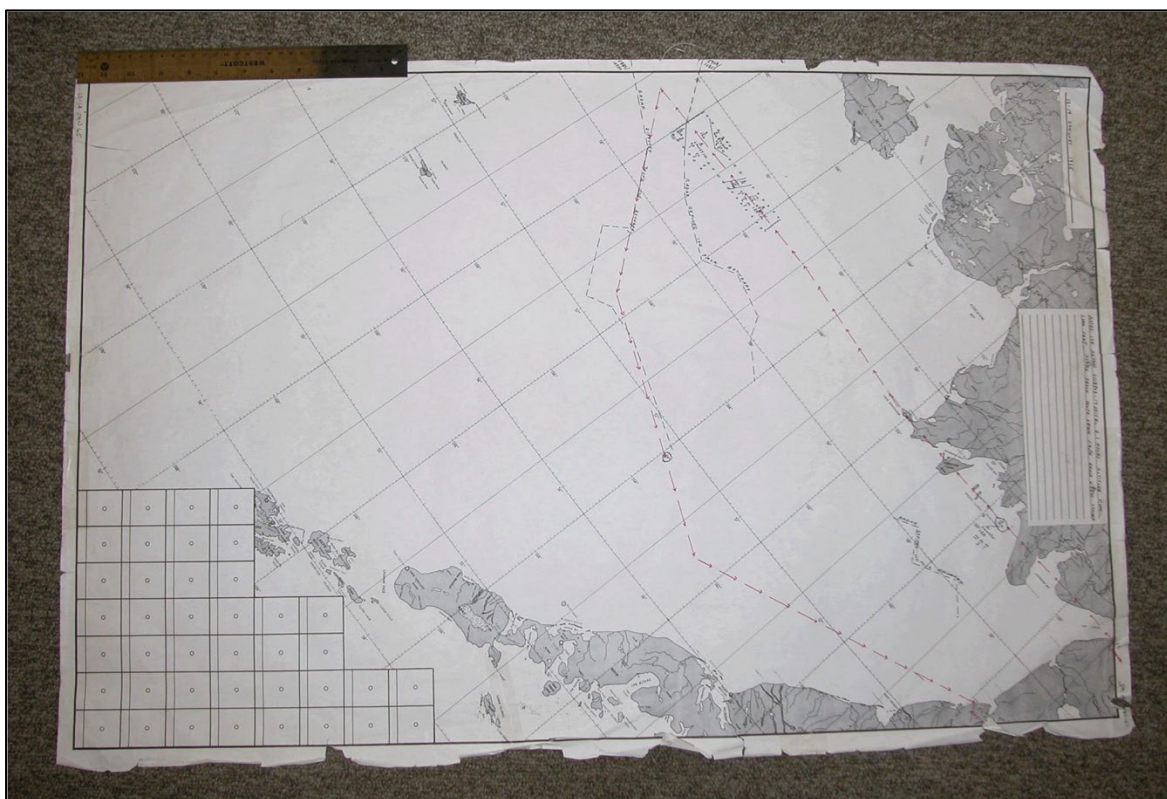
NSIDC housed the analog collection of 6,896 paper ice charts upon which this digital data set is based until August of 2018 when it was moved to the University of Colorado (CU) Libraries Archives in August 2018, where it is part of the [Roger G. Barry glaciology collection](#).

If you are interested in the analog collection, you can search for "The Dehn Collection of Arctic Sea Ice Charts, 1953-1986" from the [CU search interface](#), but be aware that it may not yet be catalogued, or it may be catalogued under a different name. If you have questions, contact [sca@colorado.edu](mailto:sca@colorado.edu).

The charts in this collection are believed to contain much unique information. Many of the charts pre-date the regular ice charting activities of the NOAA/Navy/Coast Guard National Ice Center (formerly the Navy - NOAA Joint Ice Center), which began in the 1970s. Charts predate regular satellite observations as well. Applications for the data may include research on sea ice edge

position for climate studies, fisheries research, and coastal processes research. For example, hindcast studies of wind and waves in Beaufort Sea show multi-decadal variability, with many high-ranking events in the 1950s to 1970s. Ice information for this period is needed to understand interplay of ice and weather, and is potentially important in understanding Alaska coastal erosion.

In 1992 the collection was examined by Don Barnett, a colleague of William Dehn and long-time ice analyst at the Navy - NOAA Joint Ice Center and its predecessor organizations. Mr. Barnett verified the quality and importance of the collection and provided a summary that is included as a reference in this documentation. There are two main impediments to deriving useful information from the Dehn charts: the spotty nature of the drawn ice features, especially on the earlier charts in the series, and incomplete understanding of the ice analysis code or notations used.



## 1.1 Format

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Images are available as PNG images (the thumbnail and reference images) and as high-quality TIFF images (the archive images).

## 1.2 File and Directory Structure

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Thumbnail images are in directories by year, for example,  
[http://nsidc.org/data/dehn\\_ice\\_charts/thumbnail/1986/1986123001.png](http://nsidc.org/data/dehn_ice_charts/thumbnail/1986/1986123001.png)

Reference images are in directories by year on HTTPS in  
<https://noaadata.apps.nsidc.org/NOAA/G01111/>.

## 1.3 File Naming Convention

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Dehn chart IDs were assigned at NSIDC based on the year, month, and day written on the chart, and an index number. For example, the file corresponding to the Point Barrow base map illustrated above is 1982052105.png, where the date of the chart is 21 May 1982, and it is the fifth in a possible series of charts with this date, resulting in the chart ID of 1982052105. In cases where there are duplicate chart IDs, \_X, with X being an index number, was added to the date-based number. Duplicates may be the result of charts with the same date being drawn for different areas.

Note that all three digital image files of this chart--the thumbnail, reference, and archive--have the same base file name. Thumbnail and reference files have .png extensions, while archive files have .tif extensions.

## 1.4 File Size

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The scanned images of the charts have files that range in size as follows:

PNG (reference images): ~200 KB; PNG (thumbnail images): ~20 KB; TIFF (archive images): Up to about 450 MB

## 1.5 Spatial and Temporal Coverage and Resolution

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The chart analyses were drawn on eight base maps that NSIDC has named Mackenzie Bay (MAC), Bering Strait (BS), Point Barrow (B), Bering Sea (BER), Bering Sea East (BSE), Bering Sea West (BSW), Beaufort Sea (BFT), and Chukchi Sea (CHK). (Abbreviations used in the file name are in parenthesis above). An example of each area is shown below.

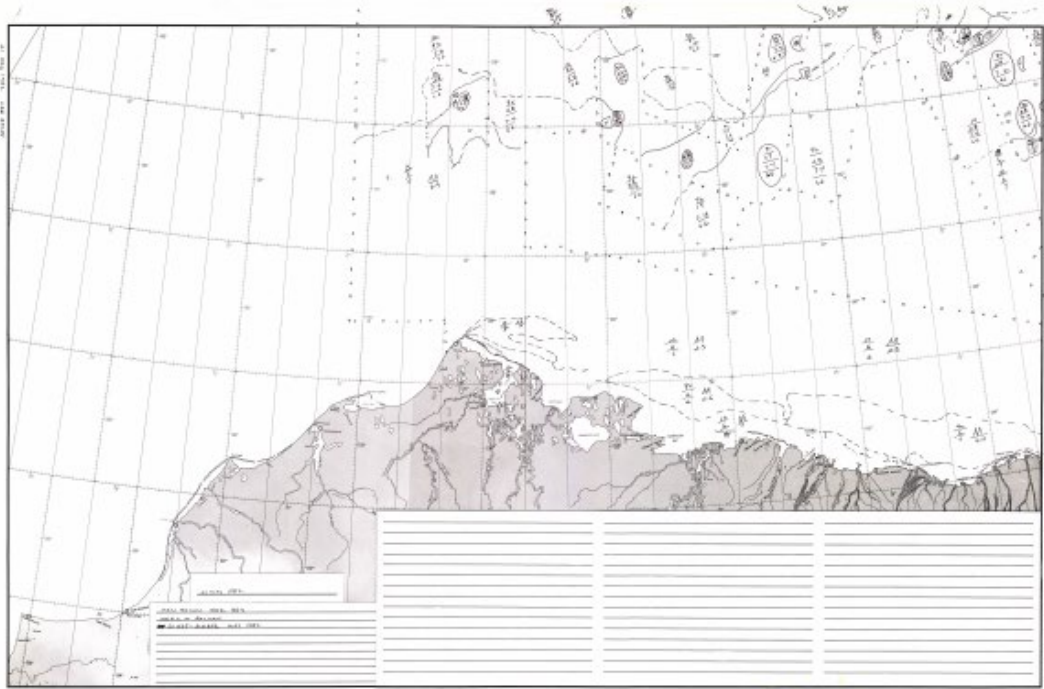


Figure 1. B = Point Barrow North is up.

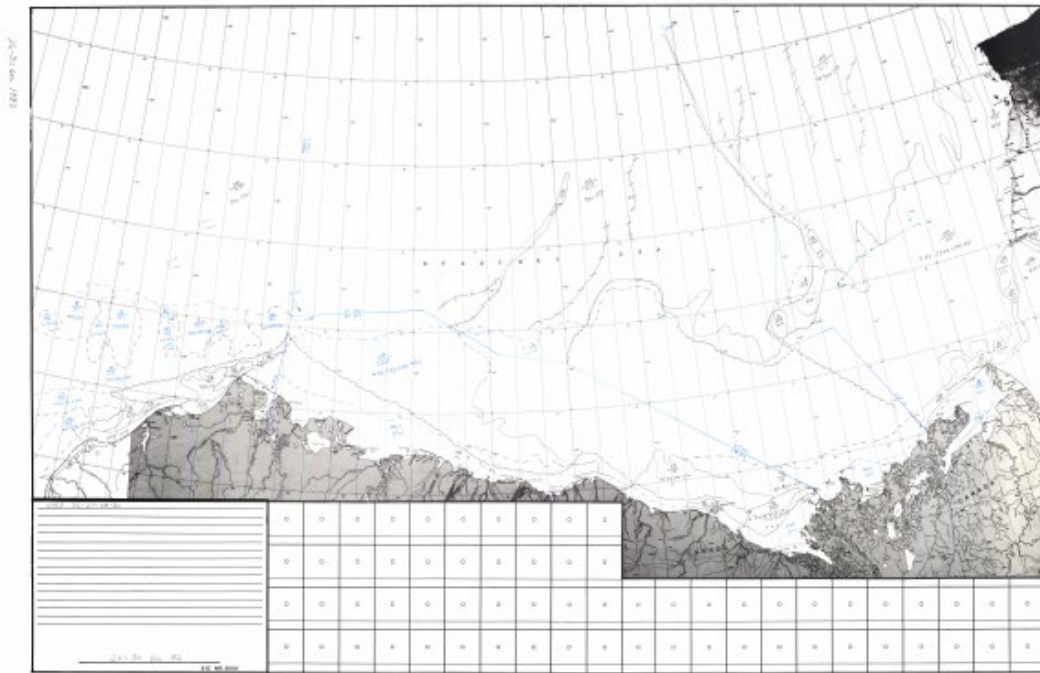


Figure 2. BFT = Beaufort Sea North is up.

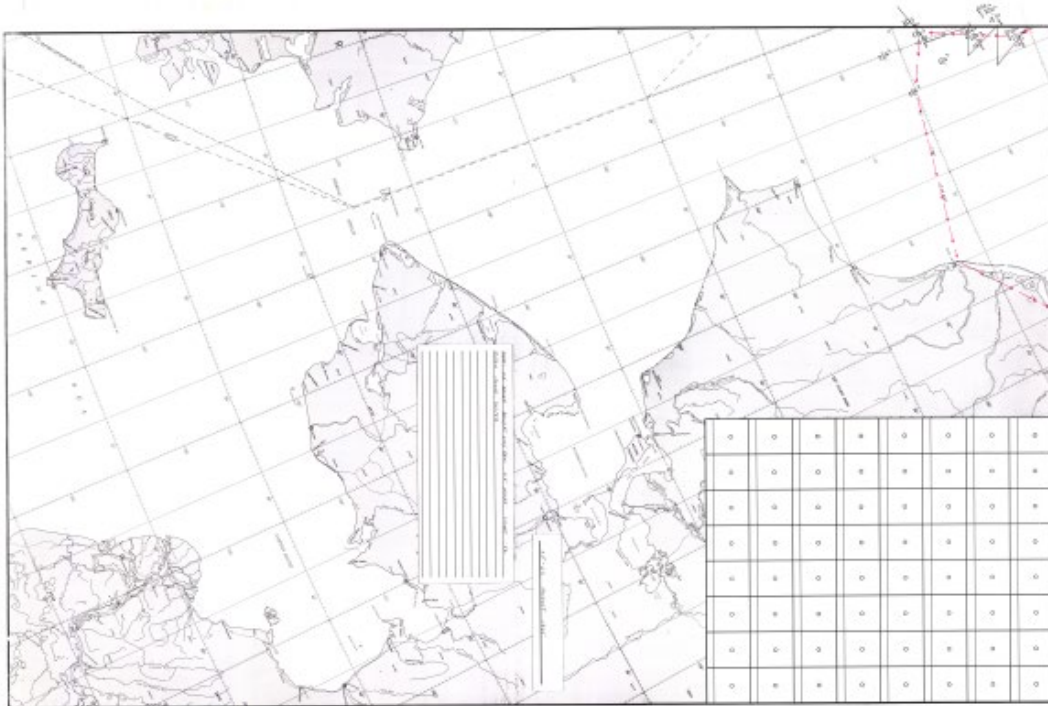


Figure 3. BS = Bering Strait North is to the right.

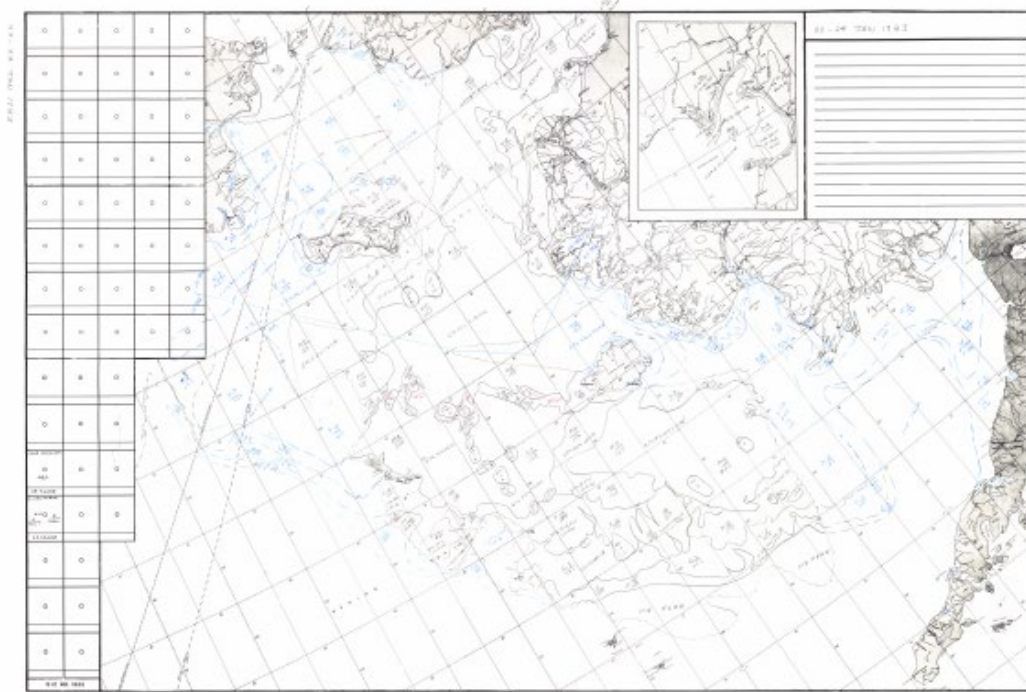


Figure 4. BER = Bering Sea North is up.

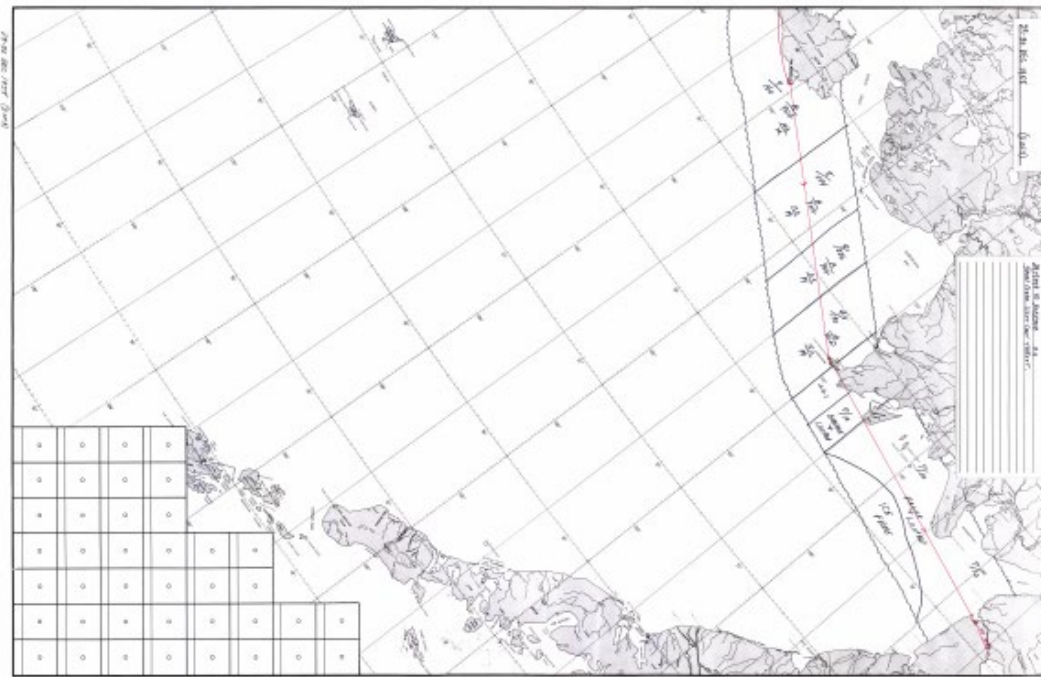


Figure 5. BSE = Bering Sea East North is to the right.

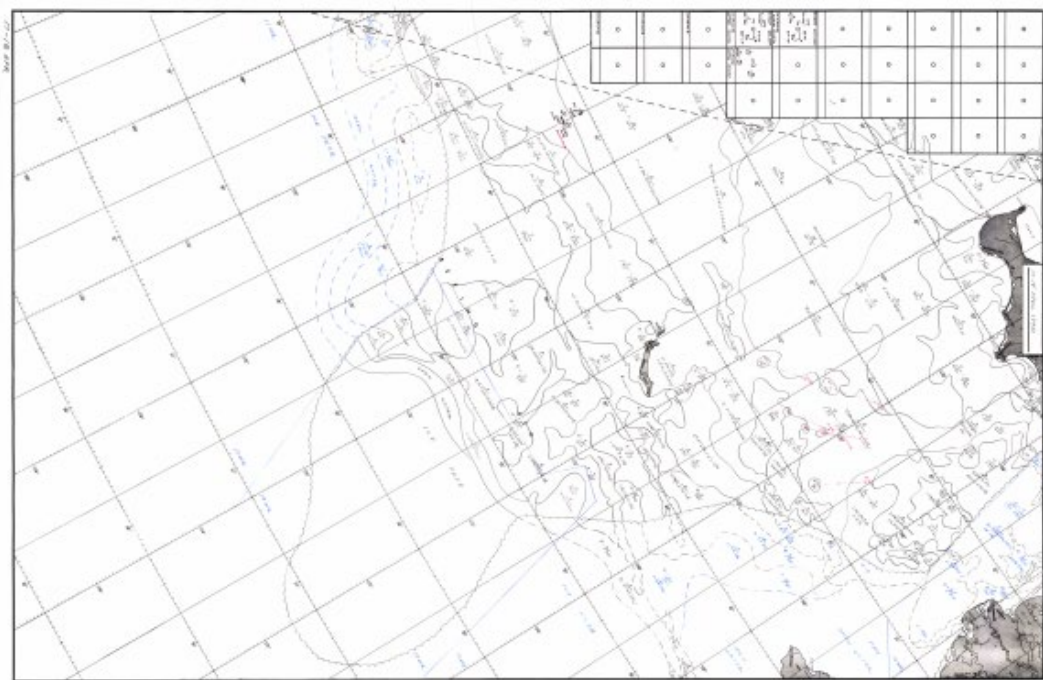


Figure 6. BSW = Bering Sea West North is to the right.



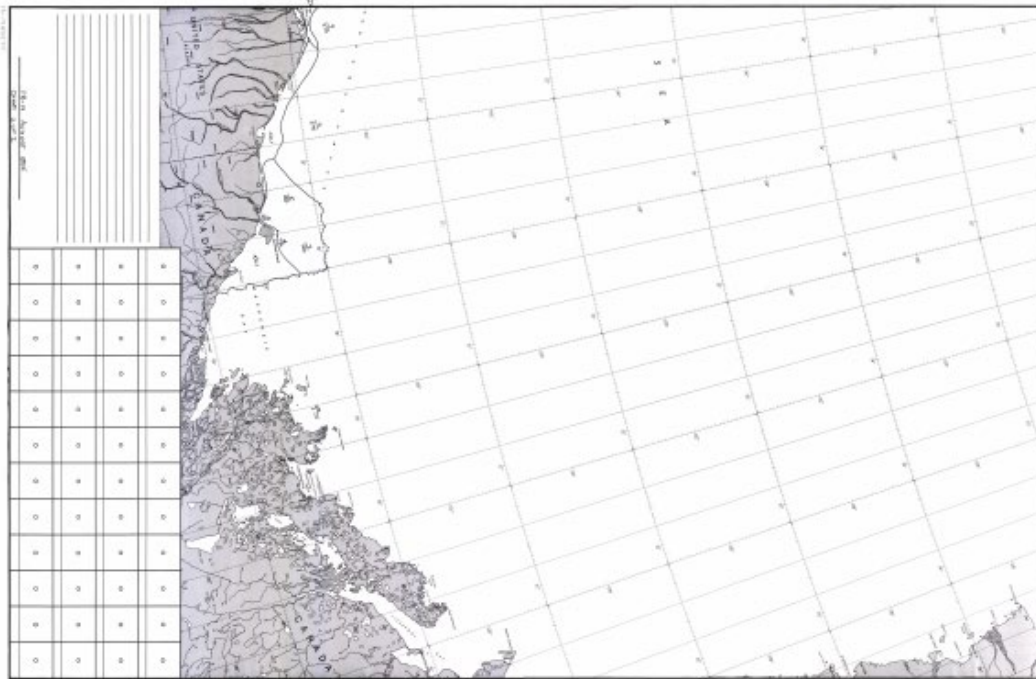


Figure 7. MAC = Mackenzie Bay North is to the right.

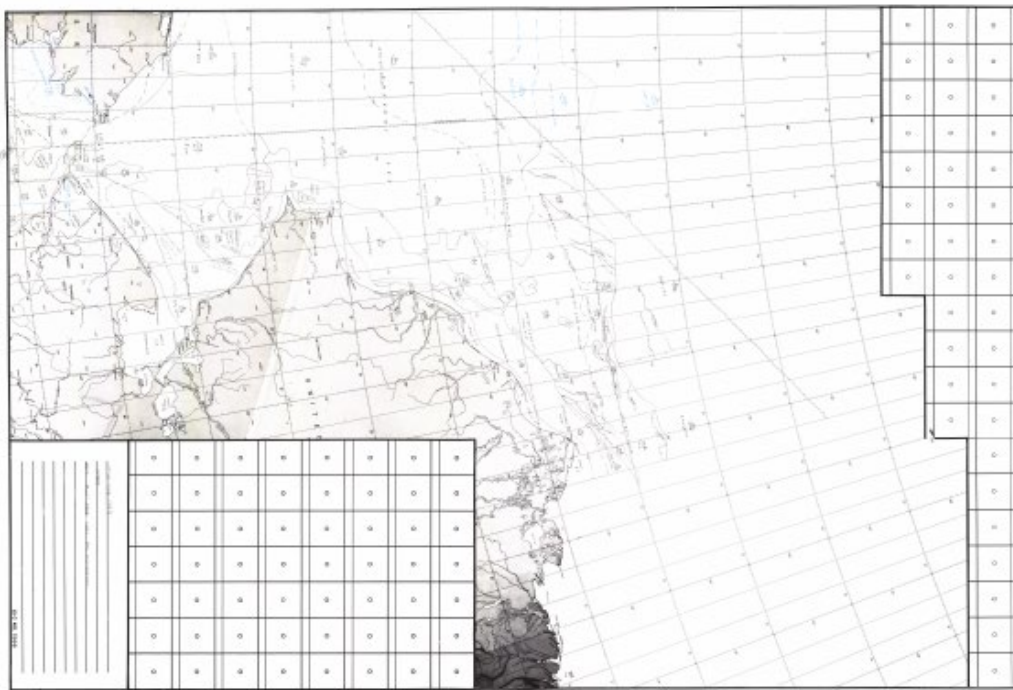


Figure 8. CHK = Chukchi Sea North is to the right.

The earliest chart is from January 1953, and the most recent is from December 1986. They range in number from about 80 to about 350 per year. A major change occurred in 1975, when the number of analyses roughly doubled. From 1975 on, Sea Ice Consultants, Inc. provided near real

time analyses and forecasts. Charts from this period are extremely detailed and are believed to be the best available for Alaskan waters.

The section on Error Sources has more information on spatial and temporal coverage.

### 1.5.1 Sample Data Record

NSIDC cannot at this time provide a description of the coding on the charts. Users with information on the coding scheme (the notations on the charts) are encouraged to contact F. Fetterer. The information below is from Don Barnett's summary letter of 1992.

"In 1968, The United States began reporting ice concentration in eights rather than tenths, then returned to tenths reporting in 1980. Canada retained the tenths format throughout the period. Although SIC worked in eights from their inception in 1975 until their close of business, the generally plotted both U.S. and Canadian reconnaissance as received. As a result, data may appear in either form throughout the data set, and not relying both eights and tenths on the same chart. SIC summary analyses in eights frequently overlay reconnaissance data which is plotted in tenths. Since SIC produced these charts for in-house, not public use, which of these formats is used is seldom noted on the charts. There is also a period when U.S. recon data receives a slightly difference treatment from chart to chart. [For example, in the top] sample below, the ice concentration [8, for 8 tenths] appears next to the station symbol (delta) whereas in [the bottom] sample, the number next to the station symbol [5] is instead the visibility.

<u>4</u>		<u>3</u>		<u>1</u>		80		<u>4</u>		<u>2</u>		<u>1</u>		<u>1</u>
FM		FL		NL				MF		BF		VF		SF
<u>4</u>				50				<u>8</u>						
4FM3L1NL								4MF2BF1V1F1SF						

With a good knowledge of codes and the history of code changes and a dash of intuition and care, it is possible to roam the data set without great fear of misinterpretation. Others entering without some preparation may find it hazardous."

## 2 SOFTWARE AND TOOLS

### 2.1 Software and Tools

#### 2.1.1 Using the Online Search Interface

This section describes tips on using the [Online Search Interface](#).

1. Select the search parameters. You may search by year and/or geographic region. Click Submit to display the Input Search Criteria screen.

2. Search results will display thumbnail images, along with geographic region, date, and chart ID. Click on a thumbnail image to see its corresponding reference image. These are retrieved by FTP, and may take a moment to appear. The reference images are large enough to show where lines and notations appear on a chart. To read the chart, it may be necessary to obtain the TIFF image.
3. To order a high-resolution archive TIFF image, check the box next to the chart ID, and fill in information at the bottom of the search results table. The reference image may be downloaded directly from the search results pages or from the [HTTPS directory](#).

## 2.2 Data Acquisition Methods

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NSIDC acquired the charts in 1992. While they have been included in NSIDC's on-line catalog since 2002, prior to 2005 they were available to users only through an on-site visit. The charts are stored in a map file.

In partnership with NOAA NGDC and LASON Corporation, a CDMP corporate partner, NSIDC had the collection scanned in 2004 and 2005. NSIDC staff prepared the paper charts for shipment to LASON. Preparation included assigning unique identifiers to each chart, repairing tears, and packing them for shipping to the contractor. The charts were scanned as TIFFs at 300 dpi, 8-bit grayscale. Completed digital files were sent to NSIDC on DVDs. Upon receipt of the digitized files, NSIDC checked the quality of each file during the archival process.

NSIDC assigned metadata to each chart, including geographic region covered by the base map, and a chart date range. Metadata for the scanned images was compiled at NSIDC in an Excel spreadsheet that was uploaded to a Sybase database.

### History of Sea Ice Consultants Inc. Chart Series

Early ice reconnaissance missions were carried out by the U.S. Navy. The Navy Hydrographic/Oceanographic Office (NOO) compiled annual reports of their aerial ice reconnaissance program. From 1953 to 1971, the Dehn charts largely duplicate this information; however, the NOO reports were published within two years of the flights, and Sea Ice Consultants, Inc. (SIC), re-plotted the data after 1975, perhaps leading to some differences in interpretation. Both NOO reports and Dehn charts are based on the same ice reconnaissance missions, however.

Until 1983, the standard SIC (Dehn) charts extended only to 73 deg N (Chukchi and U.S. Beaufort) or 74 deg N (Canadian Beaufort). Information from missions that extended north of these latitudes was either included on the standard base maps by hand written notation in the original coded format (rather than drawn analyses) at the bottom of the chart, or, (beginning in 1962), included on a smaller scale base map that extended beyond 80 deg N.

Beginning in the mid 1960s, SIC charts include a significant amount of information from Canadian aerial reconnaissance missions, while NOO annual reports contain little of this information.

Beginning in 1967, NOO reports included periodic satellite analyses. Except for a brief period in 1967, SIC charts include little or no satellite data prior to at least 1971.

Beginning in about 1975 through 1986, the number of charts per year about doubles, and analyses make use of satellite and ship data, and U.S., Canadian, and SIC aerial reconnaissance missions. These analyses are extremely detailed. Analyses from this period from the Joint Ice Center (now the U.S. National Ice Center) are on a global rather than regional scale, precluding significant detail.

### 2.2.1 Error Sources

NSIDC worked with the CDMP contractor LASON Corporation to check the quality of image files. Most image files of scanned photographs were checked for correct file name, proper scanning, and proper image size at NSIDC, and were rescanned by the contractor if deemed necessary.

In 1992 the collection was examined by Don Barnett, a colleague of William Dehn and long-time ice analyst at the Navy - NOAA Joint Ice Center and its predecessor organizations. Mr. Barnett verified the quality and importance of the collection and provided an overview of the charts and several other collections from the estate of William Dehn. Mr. Barnett's summary, in the form of a letter to NSIDC/WDC for Glaciology User Services lead Claire Hanson, is summarized below. The letter is also provided, for the sake of completeness, as a scanned PDF file.

## 3 REFERENCES AND RELATED PUBLICATIONS

Dehn, W. S. 1979. [Inadequacies in Archive Sea Ice Data](#). Glaciological Data Report: Workshop on Snow Cover and Sea Ice Data. GD-5 p 101-106. World Data Center A for Glaciology (Snow and Ice). Boulder, CO.

Dehn, W. S. 1972. Alaskan Sea Ice. In *Sea Ice: Proceedings of an International Conference*, Reykjavik, Iceland, May 10-13, 1971, T. Karlsson, ed. National Research Council of Iceland: 125-129.

Drobot, S. (2003), Long-range statistical forecasting of ice severity in the Beaufort-Chukchi Sea. *Weather and Forecasting* 18 (6): 1161-1176.

Fetterer, F. (2022). The Global Digital Sea Ice Data Bank at NSIDC, 1986-2005. NSIDC Special Report 24. Boulder CO, USA: National Snow and Ice Data Center.

<https://nsidc.org/sites/nsidc.org/files/technical-references/NSIDC-Special-Report-24.pdf>.

[Letter \(PDF format\)](#), from Don Barnett to NSIDC/WDC for Glaciology User Services lead Claire Hanson. The letter is provided here for the sake of completeness. Note that the data set (G01111) described in this documentation is only that described in item 1 of Don Barnett's letter. Items 2 through 13 have not been published by NSIDC.

## 3.1 Related Data Collections

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- [Environmental Working Group Arctic Atlases](#)
- [Global Digital Sea Ice Data Bank \(GDSIDB\)](#)
- [Morphometric Characteristics of Ice and Snow in the Arctic Basin: Aircraft Landing Observations from the Former Soviet Union, 1928-1989](#)
- [Arctic Sea Ice Charts from Danish Meteorological Institute, 1893 - 1956](#)

## 4 CONTACTS AND ACKNOWLEDGMENTS

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### **Acknowledgments:**

The NOAA Climate Database Modernization Program (CDPM), under the management of Joseph Elms of the National Climatic Data Center, provided funding and programmatic oversight for scanning the chart collection. The charts were scanned at CDMP Corporate Partner LASON Corporation, Beltsville, MD, under the direction of John Jacobs.

The NOAA team (F. Fetterer, L. Ballagh, and J. Kovarik) developed and maintains this product at NSIDC jointly with A. Howard, NSIDC Data Archivist and Librarian, and I. Wang, Database Administrator. Quality control was provided by the Archive Management Services team led by J. Kovarik. The interface to the online database was designed by L. Ballagh.

Don Barnett's evaluation and summary of the collections provided historical detail and information about the collection without which it would be difficult to document the data set. His assessment, and the endorsement of Vincent J. Cardonne, President, OceanWeather Inc., were instrumental in the selection of the collection for scanning under the CDMP program.

This work is supported by funding from NOAA's National Environmental Satellite, Data, and Information Service and the National Geophysical Data Center.

## 5 DOCUMENT INFORMATION

This documentation was prepared by F. Fetterer based on information in correspondence between NSIDC staff, the Dehn estate, and Don Barnett.

### 5.1 Publication Date

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30 September 2005

### 5.2 Date Last Updated

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26 November 2020