Sea-ice Thickness and Draft Statistics from Submarine ULS, Moored ULS, and a Coupled Model, Version 1

USER GUIDE

How to Cite These Data

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

Moritz, R. and M. Wensnahan. 2011. *Sea-ice Thickness and Draft Statistics from Submarine ULS, Moored ULS, and a Coupled Model, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. https://doi.org/10.7265/N53N21BT. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/G02194

National Snow and Ice Data Center

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1 BACKGROUND INFORMATION

These data are intended to be used to evaluate the consistency and temporal coherence among the three input data sets: submarine ULS ice draft, moored ULS ice draft, and the simulated ice-thickness model of Zhang and Rothrock (2003) called the Coupled Ice-Ocean Model (CIOM). These data are also intended to evaluate decadal to multi-decadal trends in sea-ice thickness given the long temporal range of the data set, 1979 to 2004.

2 DETAILED DATA DESCRIPTION

2.1 Parameters

The parameters of this data set are sea-ice draft and sea-ice thickness given in meters. Ice draft is a measurement of the thickness of the sea ice below the waterline and often serves as a close proxy for total ice thickness. Note that both draft and thickness are not available for the entire temporal coverage. See the Temporal Coverage section of this document for complete details.

2.2 Spatial Coverage

The data cover two regions centered around the North Pole. One region is north of 89° N, and the other is north of 87° N.

Region A
Southernmost Latitude: 89° N
Northernmost Latitude: 90° N
Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

Region B
Southernmost Latitude: 87° N
Northernmost Latitude: 90° N
Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

2.3 Temporal Coverage

The data span from 1979 to 2004; however, only the CIOM ice thickness data covers this full range. The ULS submarine ice draft data span 1986 to 1999 averaged over spring months (March - June) and 1988 to 2000 averaged over summer months (August - November). The ULS moored ice draft data span April 2001 to April 2003 and are monthly averages over this time period. The

CIOM ice thickness data span 1979 to 2004 averaged over spring (April) and summer (September) months. See Table 1 for specific dates by parameter.

Table 1. Dates of Data Available by Parameter

Parameter	Dates
Ice Draft	Spring 1986 -1999 Summer 1988 – 2000 April 2001 - 2003
Ice Thickness	Spring and Summer 1979 - 2004

2.4 Format

The format of the data file is a space-delimited ASCII text file with headers. The file begins with a header containing background information, data sources, and processing. The header is followed by the DATA section. The DATA section is divided into 3 main parts:

I. Submarine ULS Ice Draft Data
II. Moored ULS Ice Draft Data
III. Model Output Ice Thickness Data from CIOM

2.4.1 Submarine ULS Data

Section I is further broken up into four sections: Spring Region A, Summer Region A, Spring Region B, and Summer Region B. Spring Region A contains the data acquired during the spring in Region A and so forth. Each section contains four columns of data. The columns are described in Table 2.

Table 2. Column Description for Submarine ULS Data

Column	Name	Description
1	CruiseID	ID of the submarine cruise ("--" indicates an ID was not assigned to this cruise).
2	Year	4-digit year in which the cruise occurred
3	Draft (m)	Ice draft measurement in meters (m)
4	Source	Source of the data (research group that produced it, NSIDC is the distributor): NSIDC-CRREL: Cold Regions Research and Engineering Lab NSIDC-EWG: Environmental Working Group NSIDC-UC: University of Cambridge NSIDC-UW: University of Washington Applied Physics Lab

2.4.2 Moored ULS Data

Section II contains one section of data with four columns as described in Table 3.

Table 3. Column Description for Moored ULS Data

Column	Name	Description
1	Year	4-digit year in which the moored ULS obtained the data
2	Month	1- and 2-digit month in which the moored ULS obtained the data
3	Time (days)	The decimal time, in days after 00:00:00 UTC 31 December, 2000. Thus, 00:00:00 UTC 01 January 2001 corresponds to Time = 1.0.
4	Draft (m)	Ice draft measurement in meters (m)

2.4.3 CIOM Model Data

Section III is further broken up into four sections: Spring Region A, Summer Region A, Spring Region B, and Summer Region B. Spring Region A contains the data acquired during the spring in Region A and so forth. Each section contains two columns of data. The columns are described in Table 4.

Table 4. Column Description for CIOM Model

Column	Name	Description
1	Year	4-digit year in which the moored ULS obtained the data
2	Thickness	Ice thickness output from the CIOM model in meters (m)

2.5 File and Directory Structure

The single data file resides in one directory on the HTTPS site: `https://noaadata.apps.nsidc.org/NOAA/G02194/`.

2.6 File Naming Convention

The single data file is named `Npole_Ice_Thickness_Draft_Sub_Moored_Model.txt` and is 14 KB in size.

2.7 Sample Data Record

2.7.1 Submarine ULS Data

The following are the first 3 rows of data (with column names) from Section I:

CruiseID	Year	Draft(m)	Source
1986a	1986	3.10935	NSIDC-CRREL
1986b	1986	3.722	NSIDC-CRREL
1988a	1988	3.854	NSIDC-CRREL

2.7.2 Moored ULS Data

The following are the first three rows of data (with column names) from Section II:

Year	Month	Time(days)	Draft(m)
2001	4	1.1167004e+002	3.4995151
2001	5	1.3655286e+002	3.5284854
2001	6	1.6699709e+002	3.4749251

2.7.3 CIOM Model Data

The following are the first three rows of data (with column names) from Section III:

Year	Thickness
1979	3.7247
1980	3.6361
1981	4.1105

3 DATA ACQUISITION AND PROCESSING

3.1 Submarine ULS Data

The submarine ULS data used to estimate the mean ice draft were acquired from NSIDC. Two different data sets were used:

- Submarine Upward Looking Sonar Ice Draft Profile Data and Statistics
- Environmental Working Group (EWG) Joint U.S.-Russian Atlas of the Arctic Ocean

The submarine ULS ice draft data downloaded from the NSIDC website were produced by various research groups, located at the Cold Regions Research and Engineering Laboratory (CRREL), the University of Washington Applied Physics Laboratory (UW), and University of Cambridge (UC).

The data sets extracted from the EWG Joint U.S.-Russian Atlas CD-ROM were processed by a variety of different groups, including CRREL, UW, Bronson Hills Associates, and the Environmental Research Institute of Michigan (ERIM). See Table 2 for the abbreviations for these data producers.

3.2 Moored ULS Data

The moored ULS data were downloaded from the Earth Observing Lab (EOL) Codiac data system from the North Pole Environmental Observatory (NPEO) Oceanographic Mooring Data.

3.3 CIOM Model Data

The CIOM data (Zhang and Rothrock, 2003) were downloaded from the Projections of an Ice-Diminished Arctic Ocean - Retrospection and Future Projection Web site.

3.4 Data Processing

3.4.1 Submarine ULS Data

The submarine ULS data are average ice drafts for segments at least 10 km long (typically they are 50 km long) of each submarine cruise within the given region. Each cruise is designated as spring or summer, and the means for all segments within regions A or B are averaged together to produce the regional/seasonal averages of the data set. For the submarine data, any cruise occurring during the interval March to June is considered spring, and any occurring during August to November is considered summer. The mean ice drafts have not been adjusted to account for variations in the mean annual cycle of ice draft within the spring and summer intervals.

3.4.2 Moored ULS Data

The moored ULS data are time series of observations acquired at the location of the North Pole Environmental Observatory (NPEO) mooring (typically, latitude 89 degrees 30 minutes north). The observations are made at intervals of 5 minutes (2001 - 2002) and 10 minutes (2002 - 2003). The measurements of draft are time-averaged over each calendar month to produce the values included in this data set. Note that during April 2002, the first NPEO mooring with ULS instrument number 22 was recovered. A few days later, the second NPEO mooring, with ULS instrument number 12, was deployed. The time averages have been computed separately for each instrument, so there are two averages for the month of April 2002.

3.4.3 CIOM Model Data

The variables calculated at each CIOM grid point include a sea-ice thickness distribution. The mean ice thickness at each time increment and spatial grid point is calculated as the average over this distribution. These instantaneous grid point averages are further averaged spatially, over all grid points within the two regions (A and B), and temporally over the months that represent spring and summer for the model data: April and September, respectively.

4 REFERENCES AND RELATED PUBLICATIONS

Moritz and Wensnahan, in prep.

Wensnahan et al., in prep.

Zhang, J. L. and D. A. Rothrock. 2003. Modeling global sea ice with a thickness and enthalpy distribution model in generalized curvilinear coordinates. Monthly Weather Review 131(5): 845-861.

4.1 Related NSIDC Data Collections

Submarine Upward Looking Sonar Ice Draft Profile Data and Statistics
Environmental Working Group Joint U.S.-Russian Atlas of the Arctic Ocean

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Document Authors

This document was created by A. Windnagel from correspondence with and documentation from Richard Moritz.

6.2 Publication Date

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6.3 Date Last Updated

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