Moored Upward Looking Sonar Data

NOTE: April 2022 - This document is no longer being maintained but is being provided for provenance.

1 INTRODUCTION

At the request of the World Climate Research Programme's Arctic Climate System Study/Climate and Cryosphere (ACSYS/CliC) Project Office, NSIDC is archiving and distributing moored upward looking sonar data acquired in support of the ACSYS/CliC program.

These pages are for sharing information with data providers and those interested in learning the status of the data. Moored ULS data management was discussed at an Arctic Climate System Study (ACSYS) and Climate and Cryosphere (CliC) Project workshop:
WCRP Informal Report No. 15/2004 – Workshop on Sea-Ice Thickness Measurements from Moored Ice-Profiling Sonars: Calibration, Data Processing, and Application (Tromsø, Norway, 1-3 July 2002).

2 AVAILABLE DATA

- Ice Draft and Ice Velocity Data in the Beaufort Sea, 1990-2003
- Submarine Upward Looking Sonar Ice Draft Profile Data and Statistics
- AWI Moored ULS Data, Weddell Sea (1990-1998)
- AWI Moored ULS Data, Greenland Sea and Fram Strait (1991-2000)

3 ANTICIPATED ADDITIONS TO THE ARCHIVE (LAST UPDATED MAY 2004)

NOTE: This project is no longer active. No further additions will be made. The information here is provided for provenance only.

The table below gives information on data that investigators expect to provide to NSIDC. These data are from four different instrument types that have been processed using four different methods. NSIDC will work with data providers to ensure accurate documentation, to appropriately credit providers and their institutions and funding agencies, and to restrict data as needed until investigators are ready to release it.

Area	Provider	Notes
Antarctic	I. Allison	Four buoy years. Statistics only, not draft. Available in 2003.
Arctic	D. Moritz	About 90% of data from 45 stations available in next 12 months.

Arctic	H. Melling	Spring 1990 - autumn 1999, 26 station-years from eight sites (nearly continuous record from two of these sites).
Arctic	E. Fahrbach	EPOCH data. About 25 buoy years, about 10 more moorings.
Arctic	T.B. Løyning	Fram Strait, 79°N Latitude, 1990-2000
Arctic	A. Proshatinslag	Three moorings in Canada Basin. Deployed August 2003, to be recovered August 2004.

4 MOORING LOCATION MAP (LAST UPDATED MAY 2004)

The map and mooring information were provided by Humfrey Melling, Institute of Ocean Science, Sidney, British Columbia, and Ignatius Rigor, University of Washington, Seattle.

Map isobaths are 2500 m. Oil company installations in the Okhotsk, Pechona, and Caspian Seas are not shown.

Investigator	Symbol	Status
Dick Moritz (APL UW)		currently deployed
		recovered deployments
Fahrbach (AWI)		recovered
Hansen/Loyning (NPI)		recurring deployments in Fram Strait
Melling & collaborators		currently deployed (IOS)
		recovered deployments (IOS)
		currently deployed (IOS/NOAA)
		currently deployed (IOS/NSF)
Proshutinsky (WHOI)		currently deployed
Prinsenberg (BIO)		currently deployed
		recovered deployments

5 FOR DATA PROVIDERS

5.1 Contents Recommended for Data Files from Moored Ice-Profiling Sonar

Finalized by T. Løyning, H. Melling, and F. Fetterer, 10 July 2003. Based on discussions at the ACSY/CliC Moored Upward Looking Sonar Workshop, in Tromso Norway, 1-3 July 2002, and at the ACSYS ULS workshop in Oslo, 1994.

5.1.1 Data File Description

For each mooring, archived data should include an ice draft time series file, a velocity time series file (optional), a raw data file, and a statistical data file. The contents of these are described below.

1. Draft Time Series Data File
    - This file must contain a header with the following items:
        - Latitude, Longitude
        - Water depth (m)
        - Depth of instrument (m)
        - Start time, End time, Sampling interval
        - Instrument type and serial number
        - Sonar frequency (Hz)
        - Sonar beamwidth (degrees)
        - Sonar source level (dB re 1 micropascal at 1 meter)
        - Sonar sensitivity (dB re 1 volt per micropascal)
        - Responsible agency
        - Processing algorithm (Include text describing the algorithm, or a reference to other documents that provide this information. The documentation should also indicate how estimates are corrected for offsets, including the footprint correction.)
    - The following variables must be included in the data file:
        - Time (decimal days of the year of deployment)
        - Ice draft

        - Depth of sonar (Depth should be computed from total hydrostatic pressure, sea-level atmospheric pressure, and ocean-density profile when possible. Ancillary documentation should be provided describing how depth is computed and the data sources used.)
    - The following variables are optional:
        - Pressure at sonar
        - Temperature at sonar
        - Flag (indicates if the estimated value of ice draft is classified as open water (0), ice (1), or not classified (2).
    - The dimension of the variables shall be as follows:
        - Time: decimal days to five decimal places
        - Ice draft: meters to two decimal places
        - Sonar depth: meters to two decimal places
        - Pressure: bars to three decimal places
        - Temperature: degrees C to two decimal places
        - Flag: dimensionless
        - Missing data should be denoted by -99.99.
2. Velocity Time Series Data File
   This file is optional. When ice velocity information is available, a velocity time series is a useful addition, given that PDFs of ice draft from temporal and pseudo spatial series can differ considerably, and ice velocity is needed to construct pseudo spatial series.
    - This file must contain a header with the following items:
        - Latitude, Longitude
        - Start time, End time, Sampling interval
        - Averaging interval (relevant to resolution of tidal currents)
        - Method of deriving ice velocity
        - Type of velocity (Lagrangian or Eulerian)
        - Instrument type and serial number (if relevant)
        - Responsible agency
        - Processing algorithm (with text describing the algorithm, or a reference to other documents that provides this information.)
    - The following variables should be included in the data file:
        - Time (decimal days of the year of deployment with 5 decimal places)
        - Ice speed east (centimeters per second with 1 decimal place)
        - Ice speed north (centimeters per second with 1 decimal place)
    - Alternatively, the following variables may be used:
        - Speed of drift (centimeters per second with 1 decimal place)
        - Heading of drift (pointing direction of motion vector in degrees clockwise from true North with decimal place)
        - Missing data should be denoted by –999.9999 or –999.9 as appropriate, in time, speed, and heading fields, as appropriate.
3. Raw Data File
   It is important to archive raw data in case improvements in processing algorithms are made, or errors in processing are discovered. The raw data file should be archived at a data center, for example, the NSIDC/World Data Center for Glaciology, Boulder, as well as with the home institution. The home institution is free to specify the terms under which the

raw data file may or may not be distributed. The raw data file may remain in its original format, or in the format most convenient for the home institution.

4. Statistical Data File
   The statistical data file must contain the same header information as the time series data file. In addition, the header file should contain information on how statistics are computed, or alternatively, this information can be provided in separate documentation with a proper reference in the header file.
   The following statistical variables should be calculated from the time series using month-long intervals. Drafts flagged as missing data are not included.
   - Mean ice draft, including open water. This is the unconditional average.
   - Mean ice draft, excluding open water
   - The mean concentration of ice cover, computed as the fraction of data with draft exceeding the upper bound of the first bin
   - The fraction of drafts not classified (that is, the fraction of drafts flagged as missing)
   - The maximum, the minimum, the 5th percentile and the 95th percentile of ice drift speed (optional)
   - The maximum, the minimum, the 5th percentile and the 95th percentile of ice draft
   - The fraction of available data in bins for ice draft that are 0.1 m in width. Bins are centered at values of 0.0, 0.1, 0.2, ... M, where M is the largest integral multiple of 0.1 m that is less than the maximum ice draft. That is, Bin1 (-0.05, 0.05), Bin2 (0.05, 0.15), etc. The fraction of data with draft less than -0.05 m should also be reported.

5.1.2 Documentation

Ancillary documentation should be provided and should include at a minimum, a description of file naming conventions and file formats, and information on the following subjects:

5.1.3 Draft Time Series Data File

A general description of the processing algorithms used, or a reference to other documents that provide this information. Details should include:

- A description of the procedure used to identify and flag, if the flag is used, patches of the sea surface that are free of ice. If the procedure differs in the melting season from that used in the freezing season, that should be described as well.
- A description of how the apparent draft of these occasional ice-free patches has been used to calibrate the drafts computed for ice at all intervening pings. This will include, for example, information on the method used to interpolate the draft correction from ice-free calibration tie-points to the times of every ice observation in the record.
- An indication of the frequency of occurrence by month of zero-draft calibration points. This statistic will give users some indication of the density of calibration tie-points in the time series, and therefore of the relative precision of the calibration to zero draft.
- A description of how draft estimates are corrected for any other offsets, including the footprint (field of view) correction, and any corrections for mooring motion.

- Information on how the field of view is calculated.
- A description of or reference to any ancillary data sources used in calculations.

5.1.4 Velocity Time Series Data File (if included)

- Any additional information on the method used for deriving ice velocity that is not included in the header file.
- Any additional information on the processing algorithm that is not included in the header file. Documentation should indicate how estimates are corrected for offsets, including the footprint correction.

5.1.5 Raw Data File

A description of the format.

5.1.6 Statistical Data File

- Information on exactly how the averages are computed. If, for example, the year is divided into 12 30-day months for convenience, this should be stated.
- Information on how open water drafts are identified for inclusion or exclusion from averages.