NABOS - II

NANSEN AND AMUNDSEN BASINS OBSERVATIONAL SYSTEM

IARC Technical Report #12

Report of the NABOS 2023 Expedition

Activities in the Arctic Ocean

With support from:

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GLOSSARY

Institutions and organizations:

EEZ Exclusive Economic Zone
IARC International Arctic Research Center, University of Alaska Fairbanks, Alaska, USA
NPI Norwegian Polar Institute, Norway
RU Rowan University
UAF University of Alaska Fairbanks, Alaska, USA
UW University of Washington, USA
WHOI Woods Hole Oceanographic Institution, USA

Equipment:

ADCP Acoustic Doppler Current Profiler, an instrument that measures these parameters.
BPR Bottom Pressure Recorder, an instrument that measure these parameters.
CTD Conductivity, Temperature and Depth; an instrument that measures these parameters.
MMP McLane Moored Profiler
SBE Seabird, a Seattle based company that produces a number of oceanographic instruments

PREFACE

September–October 2023 saw the completion of our thirteenth NABOS cruise. That year was unique since it was the first in the program's history that we conducted fieldwork without using a Russian ship. Regretfully, the global political climate compelled us to look for a different strategy, and with the assistance of staff from the National Science Foundation's Office of Polar Programs, we were able to find it. We successfully completed our cruise onboard the USCGC *Healy* in spite of numerous logistical difficulties. Despite strict constraints on available ship time and personnel capacity, we managed to undertake field observations that included physical and chemical oceanographic observations, moorings, and drifting buoy deployments. I thank the six program team members for their accomplishments! We are also appreciative of the ship's crew, who offered great assistance. We want to underline just how crucial the STARC team was to the science mission's success. Special thanks to Michele Schallip, the Captain of the *Healy*. These observations are essential to the Arctic Ocean observing network.

Our 2023 cruise was a success. A thorough mooring operation resulted in the recovery of eight moorings that were deployed in 2021. The harsh ice conditions and ship time constraints resulted in one mooring left in the water for an extra two-year cycle, even though it was confirmed to be alive. All nine moorings that were supposed to be deployed for this year's activities were deployed for 2023–2025. Most instruments from the recovered mooring provided full two year long records. For over twenty years, our climatologic record was preserved thanks to mooring data from the eastern Eurasian Basin mooring location, which were initiated in 2002. The wide geographic coverage of the mooring observations, which extended from the central Laptev Sea on the west to the eastern East Siberian Sea on the east (with adjusted portions of deep basins), provided an abundance of data to characterize the geographical pattern of changes in the Siberian Arctic Ocean. Oceanographic surveys and water samples were added to mooring data to better investigate the water mass composition in the region.

For the success of the cruise, performance of NABOS team and the ship crew and STARC team was critical. Observations carried out in this key part of the Arctic Ocean provide new insight into the increasing role of the Arcvtic Ocean in shaping climatic changes in the eastern Arctic Ocean.

Igor Polyakov
Project leader

I.1. INTRODUCTION (*I. Polyakov, IARC*)

Our 37-days long 2023 Arctic research cruise aboard the United States Coast Guard Cutter "*Healy"* was the 13th expedition under the aegis of NABOS (the Nansen and Amundsen Basins Observational System) conducted by the International Arctic Research Center (IARC) of the University of Alaska Fairbanks (UAF), in partnership with the Woods Hole Oceanographic Institution (WHOI) and Rowan University (RU). Chief Scientist Andrey Pnyushkov and Chief Chemist Laura Whitmore led the NABOS team. All observations in 2023 were conducted outside of the Russian Exclusive Economic Zone.

The Siberian Arctic Ocean, where NABOS conducts its observations, is the Arctic region where the last 15 years had likely seen the greatest climate changes in the Arctic. This is partially due to processes involving the topography-guided advection of anomalous biota and inflow waters into the polar basin from the Pacific (pacification) and sub-Arctic Atlantic (atlantification). However, preliminary examination of the recently retrieved mooring data from Arctic waters indicates that the alterations detected by our devices surpass our anticipations. For example, mooring records suggest the loss of permanent halocline in the eastern Eurasian Basin and advancement of Atlantification into the Amerasian Basin as far as 173^{o}E. Thus, these new, unique scientific data collected along the Eurasian and Makarov basins and Siberian seas under extreme climatological conditions will be vital for understanding Arctic climate change.

During this expedition we:

- ✓ Eight moorings were recovered and nine moorings were deployed for the next two-year cycle. Mooring record from the eastern Eurasian Basin is a continuation of our climatologic record which started with mooring deployment in 2002 and the ongoing measurements are key to maintain sustain observations in the area.
- ✓ CTD casts: 39 stations.
- ✓ Water samples: 3,313 water samples for 12 different parameters.
- ✓ Radium samples: 44 stations for a total of 95 samples. Recovery/deployment of chemistry sensors:
- ✓ – two moored radium (Ra) samplers were recovered after two-year deployment and two Ra samplers were deployed
  – one methane sensor was deployed.
- ✓ Continued our tradition of international collaboration. As an example, water samples for Korean and Norwegian researchers were collected and shipped. Researchers from several countries will join us later, for data processing and analysis.

I.2. RESEARCH VESSEL (source: Wikipedia)

USCGC *Healy* (WAGB-20), the largest icebreaker in the US Coast Guard fleet, is also the most technologically advanced icebreaker in the country. Avondale Industries built *Healy* in New Orleans, Louisiana, and it was placed into service in 1999. The name *Healy* is in honor of US Revenue Cutter Service Captain Michael A. Healy. She is classified as a medium icebreaker by the Coast Guard. She is homeported in Seattle, Washington.

The ship's main technical characteristics are presented in **Table I.2.1**. *Healy* is equipped with two A-frames, one on the aft working deck and one on the starboard side. Two articulated cranes are located on the aft working deck; the starboard crane is rated at 15 short tons (14 t), while the port crane is rated at 5 short tons (4.5 t). The aft working deck provides ample space for scientific and research operations. *Healy* has a forecastle crane with a capacity of three short tons (2.7 t) and two 04 level cranes with respective load capacities of 15 tons. During science missions, *Healy*'s Dynamic Positioning System (DPS) uses her 2200 horsepower Omnithruster Bow Thruster system to assist with station maintenance and navigation. Her flight deck accommodates both of the Coast Guard's helicopter airframes, and two Eurocopter HH-65 Dolphin helicopters can be housed in the adjacent hangar. Eight ISO vans, which are used as science labs and workstations, can fit on board *Healy*. *Healy* has three small boats. The Arctic Survey Boat (ASB), which is 38 feet (12 meters) in length, is located on the starboard side. *Healy* possesses two Cutter Boat Large (CBL) Rigid Hull Inflatable Boats (RHIB) that are each 26 feet (7.9 meters) in length. Numerous electronic sensor systems, oceanographic winches, and over 4,200 square feet (390 m^2) of scientific laboratory space are among *Healy*'s many amenities, which enable up to 50 scientists to carry out a variety of research activities. *Healy* is made to continuously shatter 4.5 feet (1.4 meters) of ice at 3 knots (5.6 km/h; 3.5 mph) or ice that is 10 feet (3.0 meters) thick while backing and ramming, and can even operate in temperatures as low as −50 °F (−46 °C). *Healy*'s position as a Coast Guard cutter not only provides support for potential missions in arctic regions, but it also gives her a platform for law enforcement, environmental protection, search and rescue, and ship escort.

Figure I.2.1: USCGC Healy.

Table I.2.1: Main technical characteristics of the USCGC Healy

Length, Overall	420'0" (128 meters)
Beam, Maximum	82'0" (25 meters)
Draft, Full Load	29'3" (8.9 meters)
Displacement, Full Load	16,000 LT
Propulsion	Diesel Electric, AC/AC Cycloconvertor
Generating Plant	4 Sultzer 12Z AU40S
Drive Motors	2 AC Synchronous, 11.2 MW
Shaft Horsepower	30,000 Max HP
Propellers	2 Fixed Pitch, 4 Bladed
Auxiliary Generator	EMD 16-645F7B, 2400kW
Fuel Capacity	1,220,915 GAL (4,621,000 liters)
Cruising Speed	12 knots @ 105 RPM
Max Speed	17 knots @ 147 RPM
Icebreaking Capability	4.5 ft @ 3 knots (continuous) 8 ft (2.44 m) Backing and Ramming
Science Labs	Main, Bio-Chemical, Electronics, Meteorological, Photography
Accommodations	19 Officer, 12 CPO, 54 Enlisted, 35 Scientists, 15 Surge, 2 Visitors

A LEBUS winch used for mooring recovery and deployment operations was installed on the main deck of the USCGC *Healy*. The winch was welded to the main deck in Seattle before the cruise and removed after the cruise (**Fig. I.2.2**).

Figure I.2.2: The LEBUS winch (left) and A-frame (right) installed on the main deck of the USCGC *Healy*.

I.3. CRUISE TRACK (A. *Pnyushkov*)

The overall research area for the cruise included the southern parts of the Eurasian and Makarov basins and northen Laptev and East Siberian seas – all outside the Russian Exclusive Economic Zone, EEZ (**Fig. I.3.1**). USCGC *Healy* was loaded and mobilised at the USCG base in Kodiak, Alaska during August 23-26, 2023. Uploading was conducted with ship cranes and was quite efficient. A substantial part of the mooring equipment was shipped to Seattle before the cruise and loaded onboard Healy in July 2023. The LEBUS winch used by NABOS was loaded and welded to the main deck in Seattle and connected to the ship's electrical supply by ship engineers. Before the cruise all equipment was tested in port for correct rotation and load lifting.

The ship left Kodiak on August 26th and the scientific part of the cruise began.

First, the vessel arrived at a test station (marked as "0" station in **Fig. I.3.1**) on September 1st where we tested various scientific instrumentation. Then the ship proceeded to the southern point of our "standard" NABOS cross-slope CTD section across the East Siberian Sea (ESS) slope. On September 3rd we arrived at the location of our MB9 mooring which was successfully recovered. On the same day we deployed mooring MB9 and started an cross-slope CTD section proceeding northward towards the deep part of the Makarov Basin (**Fig. I.3.1**). CTD work was complemented by mooring deployments. On September 4th we recovered and redeployed our second mooring MB8 and two days later (on September 6th) mooring MB7. All mooring recoveries and deployments were conducted as 'same-day' operations.

After deploying the MB7 mooring, the ship proceeded north for CTD work. However, due to stormy weather conditions, several originally planned CTD stations were skipped. Our second attempt to complete these stations on the way back to the NABOS zonal section was only partially successful. The northern end of the ESS section (stations #15-16; **Fig. I.3.1**) was conducted in heavy ice conditions which made ship navigation difficult. At some segments of the ship trajectory, it took up to 7 hrs to transit from one CTD station to another separated by just 28-30 miles. Despite that, on September 8th we finished CTD and water sampling work at our first CTD section.

On September 9th, the ship arrived at station #17 - the first CTD station at the along-slope section (**Fig. I.3.1**) and started moving west with CTD and hydrochemistry work. We continued our mooring program with successful recovery and deployment of MB6 (September 11th), MB5 (September 13th), and MB4 (September 16th) moorings. During the deployment of the MB6 mooring, the end connection of the mooring line unexpectedly broke, leading to a loss of two acoustic releases and delay of 12 hours in the installation operations. Mooring recovery and deployment at MB5 were performed in the vicinity of seasonal ice edge. All mooring operations before September 13th were in open water conditions. After MB5 mooring release, the buoy popped up under ice floe, preventing visual detection of its position. Operations to locate and hook it took more than 12 hours. Due to time constraints the CTD stations between the moorings MB5 and MB4 were cancelled.

After redeploying the MB4 mooring, the ship continued steam westward to MB3, reaching it on September 17th. Following successful 'same-day' recovery and deployment operations at this site, we proceeded to the moorings MB2 and MB1. However, due to time constraints in the NABOS operations schedule, all CTD operations between MB3 and MB2 were canceled. The ship arrived at the MB2 mooring site in the morning on September 18th and initiated recovery operations. However, all attempts to communicate with the two acoustic releases and the EdgeTech CAT pinger installed on this mooring were unsuccessful. After more than 12 hours of unsuccessful attempts to recover this mooring at several potential sites, we deployed a new mooring approximately 1.7 miles southwest from the position of the MB2 anchor, as surveyed in 2021.

The oceanographic section (**Fig. I.3.1**) between the MB2 and M1-4 moorings was conducted under heavy ice conditions, significantly slowing down ship navigation. At certain segments of the ship's trajectory, its speed reduced to 3-4 knots. Despite the unexpectedly challenging ice conditions for that part of the Laptev Sea slope, on September 19rd, we completed our extensive east-west CTD section (**Fig. I.3.1**) and arrived at the M1-4 mooring (also known as MB1). After conducting a CTD profile there, we

successfully recovered the mooring on September 23rd and re-deployed it for the next two years on the same day, thus continuing our climatological record. Conducting operations on the M1-4 mooring in one day allowed the time saved to be used to enhance CTD work on the last NABOS section.

From this location, we proceeded northward with CTD work and hydrochemistry water sampling on the NABOS climatic section along the 125ºE meridian. The last CTD station #39 (**Fig. I.3.1**) on this section was completed on September 23rd, marking the conclusion of field work for the 2023 NABOS cruise.

We started our transit to Tromso (Norway) on Septenber 23rd and arrived there on October 1st, where all NABOS expedition members disembarked. Thus, the 12th NABOS research voyage was successfully finished.

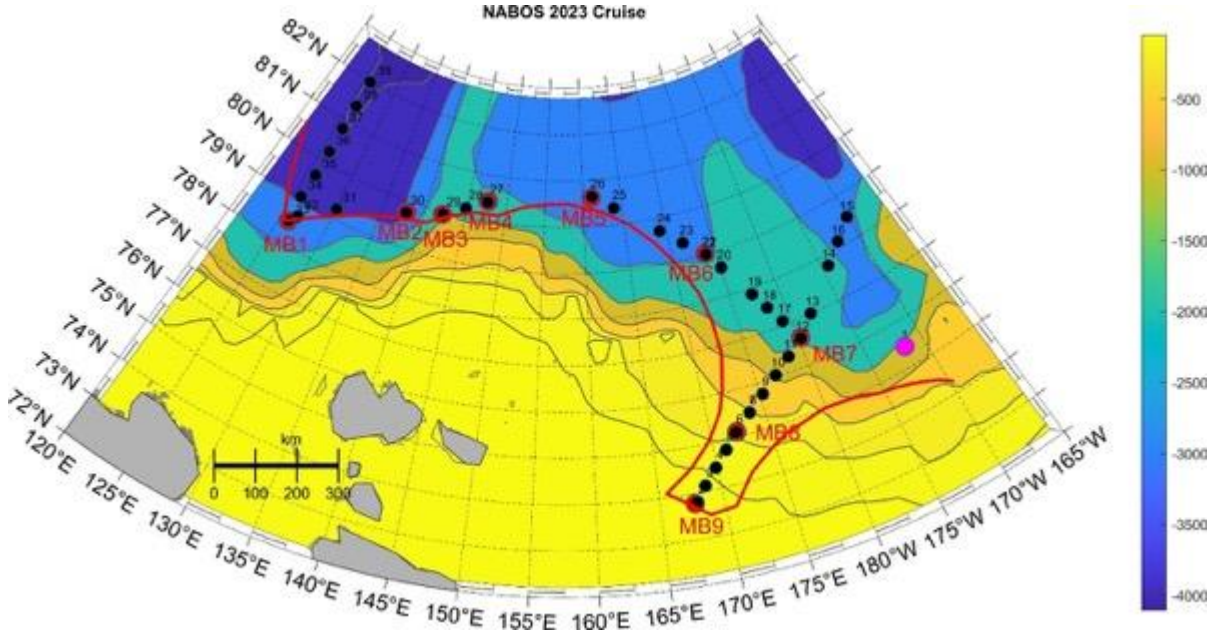


Figure I.3.1: 2023 cruise map. Eight moorings were recovered. MB2 mooring was left in the water due to a lack of time and heavy ice conditions. Nine moorings were deployed as planned. The locations of recovered or deployed moorings during the 2023 cruise are indicated by red dots. Several planned CTD stations were skipped due to weather conditions or time constrains. The color-coded bottom depth distribution (in meters) is displayed. The borders of the Russian Exclusive Economic Zone (EEZ) are shown by the red line.

I.4. SCIENTIFIC PARTY

Science party						
#	Name	Team	Position	Affiliation	E-mail	Country
Administration						
1	Pnyushkov, Andrey	admin	Chief Scientist	IARC/UAF	avpnyushkov@alaska.edu	USA
Chemistry						
1	Kelly, Laura	chem	Team leader	IARC/UAF	lmwhitmore@alaska.edu	USA
2	Kipp, Lauren	chem	Scientist	Rowan U.	kipp@rowan.edu	USA

Technical group						
1	Kemp, John	tech	Team leader	WHOI	jkemp@whoi.edu	USA
2	Batryn, Jennifer	tech	Mooring tech	WHOI	jbatryn@whoi.edu	USA
3	Llanos, Eduardo	tech	Mooring tech	WHOI	nllanos@whoi.edu	USA

Figure I.4.1: 2023 NABOS cruise participants together with the crew of the USCGC *Healy* and STARC team.

I.5.1. OCEANOGRAPHIC OBSERVATIONS

I.5.1.1. CTD measurements

I.5.1.1.1. Approach

39 CTD casts were carried out during the cruise (see Appendix I). These stations were taken at several transects, as shown in **Fig. I.3.1** In the deep basin (>1500 m), one out of between three and four casts was to the bottom. The casts in between were to 1000-1200 m. Casts were to a depth of 5 to 30 m above the seabed, depending on water depth. All samples were taken during the up-cast, and the device was always stopped at each sampling depth. See **Fig. I.5.1.1** showing T-S diagram of processed data showing good quality of obtained data. At the test station (marked as station #1 - the magenta dot in **Fig. I.3.1**), all equipment (including the ship-borne CTD winch and rosetta) was tested and proved operationally ready. During the cruise the CTD package and oceanographic winch were operated by the Ship-based Technical Support in the Arctic (STARC) team and the Healy crew. During the transit time between stations the CTD package was stored inside a heated hangar to protect sensors from freezing. All CTD operetions were perfomed without serious issues. Minor problems with the PAR and oxygen sensors were fixed promptly and did not lead to any substantial delays in operations. Several planned CTD stations were skipped due to bad weather conditions or lack of ship time.

I.5.1.1.2 *Equipment*

Conductivity, Temperature, and Depth (CTD) profiles of the water column were made using a Seabird SBE911plus CTD system. This system measures conductivity, temperature, and pressure at a 24 Hz sample rate throughout the full water column or to pre-determined end points—typically 1000 m on this occasion. Given a normal descent rate of 60 m/min, or 100 cm/sec, this provides a vertical resolution of around 4-5 cm. The CTD system also integrates other auxiliary sensor systems, including paired Dissolved Oxygen sensors; a C-Star Transmissometer; an ECO CDOM Fluorometer, an ECO Chlorophyll Fluorometer; and a Valeport VA500 sonar altimeter, to avoid collisions with the seabed. The 9*plus* underwater profiling system output can be logged and monitored in real time on computers aboard the ship, via a conducting cable to the 11*plus* deck unit. The profiling sensor system was housed in a SBE32 24-way water sampling frame, carrying 24 × 12 liter OceanTest Equipment (OTE) water sampling bottles. These can be closed remotely on demand from the 11*plus* deck unit. This allows samples for salinity and oxygen to be collected at discrete depths within a profile for comparison with electronic sensor outputs.

All Seabird sensors had been calibrated in April-July 2023 by the manufacturer before the 2023 expedition. Technical descriptions for sensors, according to the specifications of Seabird Electronics, Inc., are presented in **Table I.5.1.1**. The full information can be downloaded from http://www.seabird.com/sbe911plus-ctd.

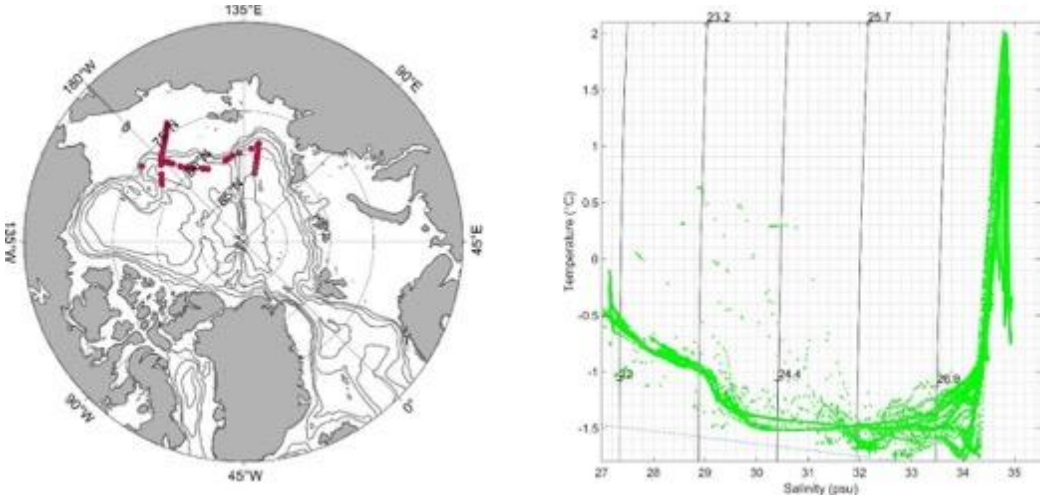


Fig. I.5.1.1. Map showing locations of CTD stations and T-S diagram of all 2023 NABOS CTD casts.

Table I.5.1.1: Seabird SBE911plus package technical information.

Sensors	Parameter	Range	Accuracy	Typical stability (per month)	Resolution
SBE 4C	Conductivity	0-9 S/m	0.0003 S/m	0.0003 S/m	0.00004 S/m
SBE 3Plus	Temperature	-5 to +35 °C	0.005 °C	0.0002 °C	0.0001 °C
Digiquartz®	Pressure	6800 m	±0.015 % of full scale range	±0.004 % of full scale range	±0.002 % of full scale range
SBE 43	Oxygen	120 % of Surface Saturation	±2 % of Saturation	±0.5 % per 1000 hours	
Seabird Scientific ECO-Fluorometer	Chlorophyll-a and fDOM	0-125 µg/l 0-500 ppb			0.02 µg/l Chl 0.36 ppb/count
Seabird Scientific C-star Transmissio meter	Beam Transmission (25 cm path)	650 nm (Red)	0.02 % Full Scale/°C		14 bit
Seabird Scientific PAR sensor	Photosynthetic ally Active Radiation	0 - 5000 µmol photons m^{-2} s^{-1}	within 3% @ 0–60°; within 10% @ 60–85°		
Valeport VA500 Altimeter	Distance to the bottom	0.1-100m	±0.01% of full scale range		1 mm

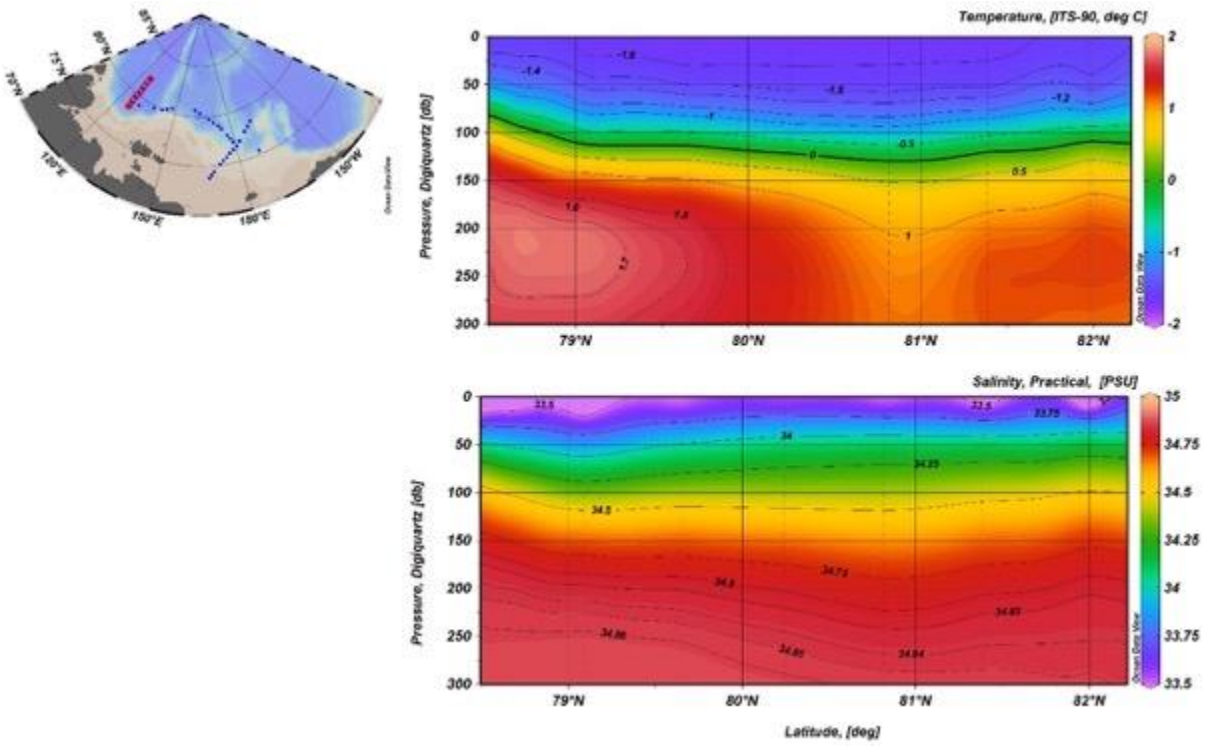
I.5.1.1.3 Preliminary results (*I. Polyakov, IARC*)

In situ temperature and salinity measured along three major sections taken during the cruise are shown in **Figs. I.5.1.2–I.5.1.4**. For locations of sections and CTD stations.

Meridional (125°E) cross-slope section in the northern Laptev Sea was occupied since 2002. The water mass structure observed in this area in summer 2023 was rather typical for the last years except for the very surface layer. In the past decade, the southern part of the section was typically ice free, and that was associated with relatively high water temperatures due to atmospheric radiative heating. In 2023, sea ice remained in the area throughout whole summer keeping surface water temperatures below zero (**Fig. I.5.1.2**). At tehsame time, below the surface mixed layer, temperature and salinity were close to their values normal for the last decade, with the maximum Atlantic water temperature and salinity at >1.9°C and 34.88, respectively. Note also a salty (with slight temperature increase) core at the southern edge of the section at ~650-700m which is probably a signature of the Barents Sea Atlantic water branch.

The regional differences between the Eurasian and Amerasian water masses are clearly depicted at the section running along the continental slope from the mooring site MB1 in the Laptev Sea to the mooring site MB7 in the East Siberian Sea (**Fig. I.5.1.3**). For example, in the Eurasian Basin we found much warmer and saltier surface and intermediate Atlantic water, and fresher and colder deeper water, compared with the Amerasian Basin. We also note a distinct role of the Lomonosov Ridge as a conduit of fresh waters exiting the Siberian shelf into the abyssal ocean due to weakened topographic steering at the conjunction of the Lomonosov Ridge and the shelf/slope.

At the easternmost section crossing the East Siberian slope, the temperature has a local maximum of –1.4°C at approximately 25m which is probably associated with the summer Pacific Water (**Fig. I.5.1.4**).



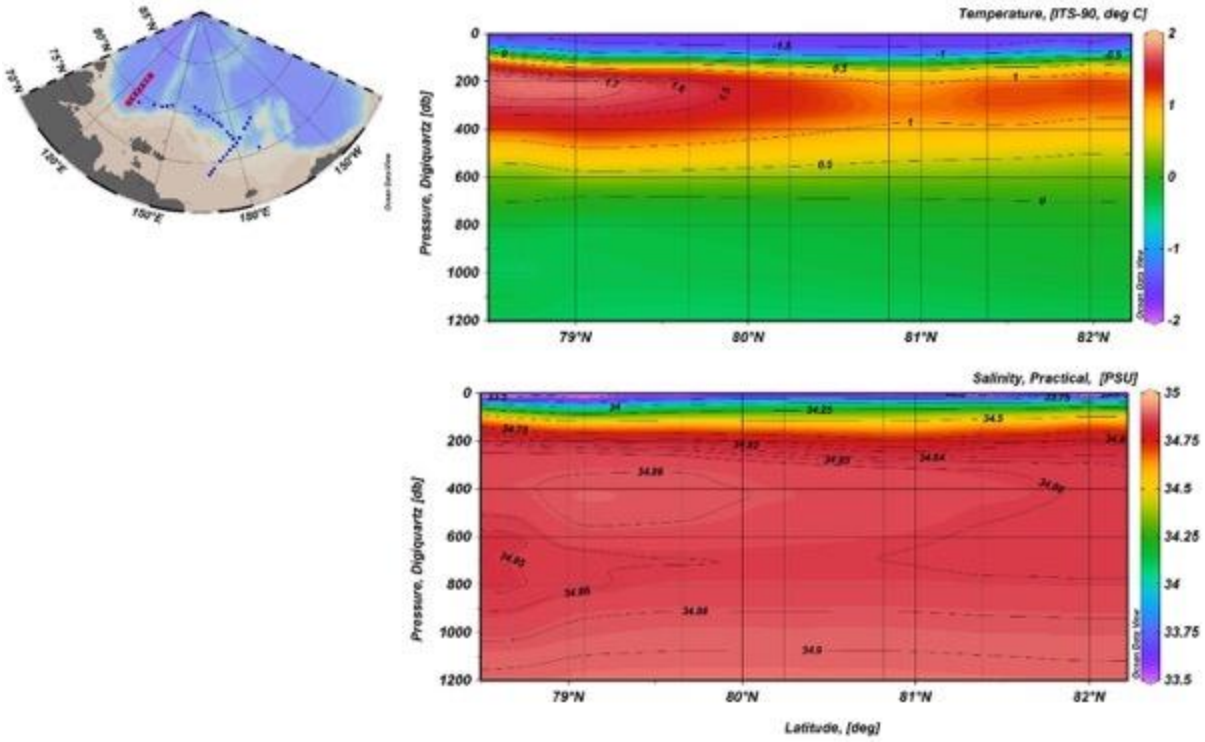


Figure I.5.1.2: Vertical distribution of in-situ temperature and salinity for the cross-slope section in the Laptev Sea running from M1-4 mooring site on the continental slope to the nothernmost site in the deep basin (see inserts for location). Two upper panels show these parameters for the upper 300m whereas two lower panels show them for the depth range of 0-1200m.

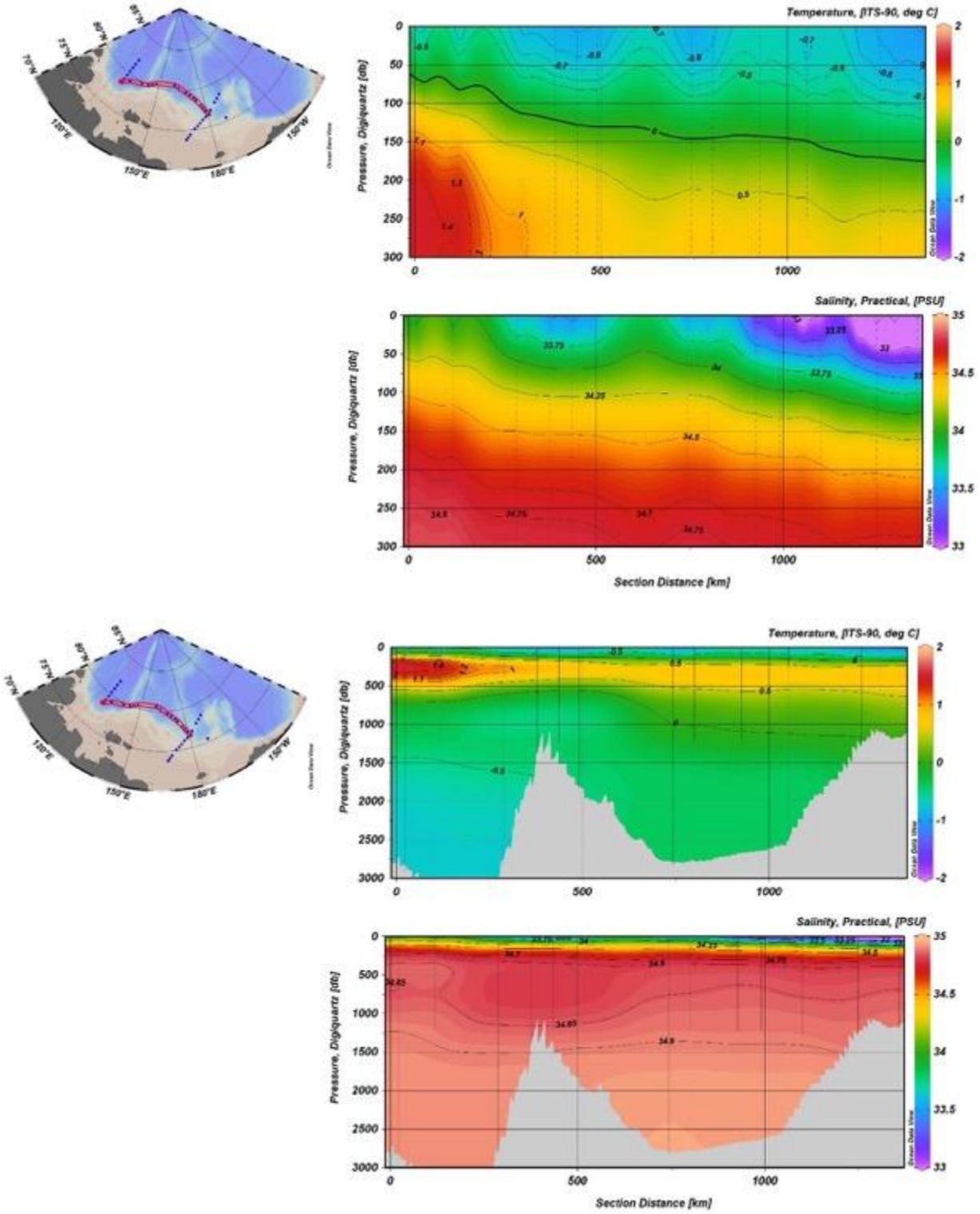


Figure I.5.1.3: Vertical distribution of in-situ temperature and salinity for the along-slope section running from MB1 mooring site in the Laptev Sea (shown as the left edge of the section) to MB7 mooring site in the East Siberian Sea (see inserts for location). Two upper panels show these parameters for the upper 300m whereas two lower panels show them for the depth range of 0-3000m.

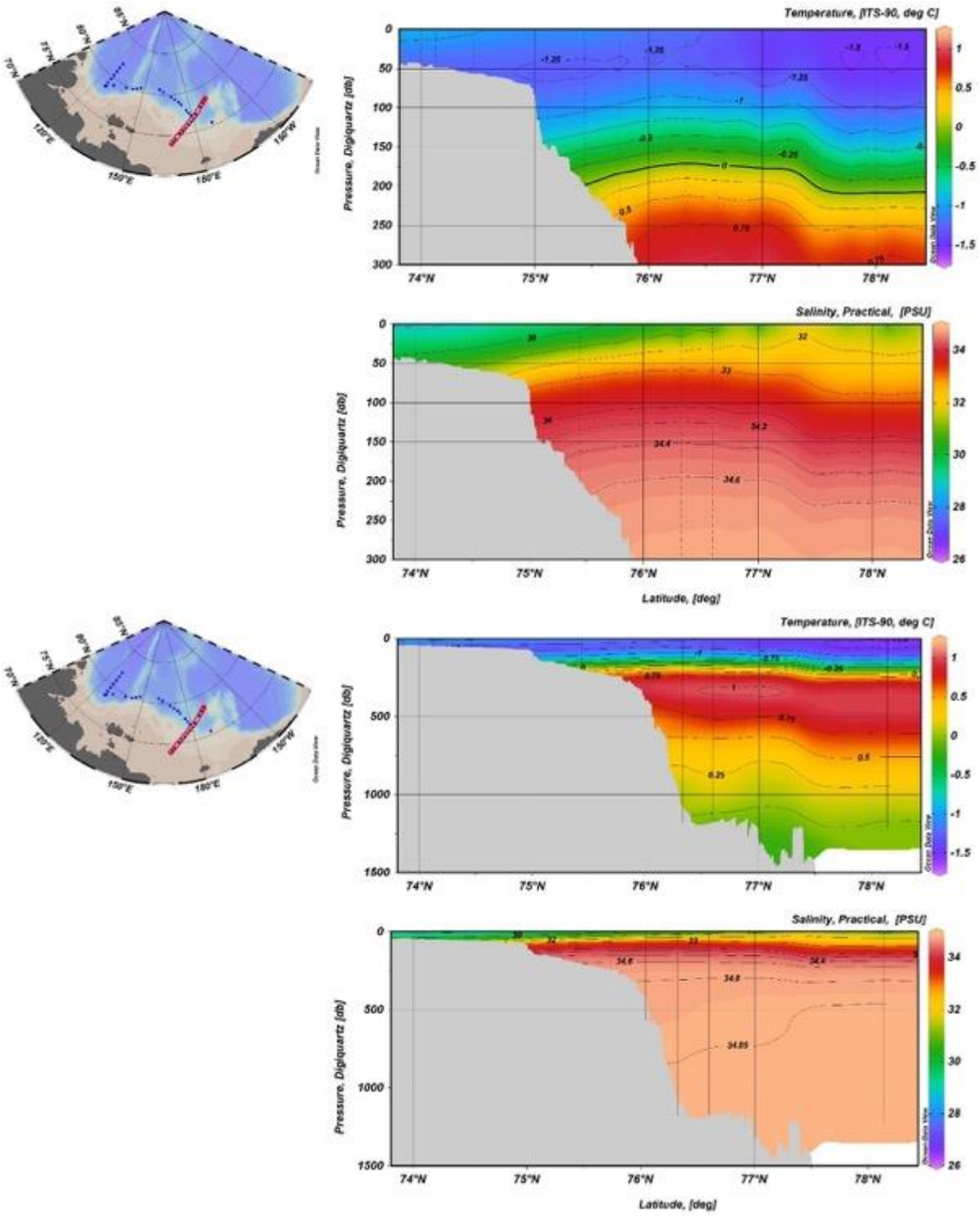


Figure I.5.1.4: Vertical cross-section of in situ temperature and salinity for the East Siberian Sea section (see inserts for location). Two upper panels show these parameters for the upper 300m whereas two lower panels show them for the depth range of 0-1500m.

I.5.1.2. Mooring observations

I.5.1.2.1. Introduction

The primary goal of mooring observations was to understand the role of stratification in controlling transports of the Atlantic Water heat and other properties to the upper ocean and ice. Primary objectives included quantifying the structure and temporal variability of the main water masses and obtaining detailed information about upper ocean, halocline and AW layer dynamics and seasonal variations. A summary of the 2023 NABOS mooring operations is presented in **Tables I.5.1.2** and **I.5.1.3**. Mooring schematics are presented in Appendices II (recovered moorings) and III (deployed moorings). There are two types of moorings used by our program. One type uses the McLane Moored Profiler (MMP), designed and manufactured by McLane Research Laboratories, Inc. Technical information and description are available at http://www.mclanelabs.com. Our other type of mooring is conventional, consisting of Acoustic Doppler Current Profilers (ADCPs) and Seabird SBE37 Microcat CTDs.

I.5.1.2.2. Mooring recovery

Since 2018 was the last funded year of NABOS-II program, only one long-term mooring, M1-4c at 78º28.084N and 125º57.679E, 2700m, was deployed during the NABOS 2018 cruise. The position of this mooring is shown in **Figure I.5.1.1**. The mooring M1-4c was successfully recovered on September 19, 2021. This mooring was designed to carry CTD sensors (SBE-37) at standard depths of 55, 125, 200, 250, 400, and 600 m (**Table I.5.1.2, Fig. A.II.1**). The mooring was heavily equipped with current meters. It used a combination of two 300 kHz ADCPs, to measure the velocity profile in the upper 120m of the water column. Two 75 kHz ADCPs (Longrangers) measured the velocity profile in 200-600m of the water column. All instruments of the recovered mooring provided three years long records.

Table I.5.1.2: Summary of NABOS mooring recovery in 2023

M00RING	Date of deployment	Date of recovery	Lat./Long.	Depth	Instruments
M1-4d	19 September, 2021	19 September, 2023	78º 30.002 N 125º 58.652 E	2689m	1 x SBE-37 1 x ADCP 300 kHz 1 x Therm Array 1 x MMP
M3g	13 October, 2021	17 September, 2023	79º 56.579 N 142º 12.261 E	1359m	6 x SBE37 6 x SBE56 1 x ADCP 300khz 1 x ADCP75khz 1 x Ra sampler 1 x Therm Array
MB4	22 September, 2021	16 September, 2023	80º 25.471 N 147º 32.654 E	1813m	6 x SBE37 6 x SBE56 1 x ADCP 300khz 1 x ADCP 75kHz 1 x Therm Array
MB5	24 September, 2021	13 September, 2023	80º 37.778 N 161º 06.235 E	2775m	1 x SBE37 1 x ADCP 300khz 1 x MMP 1 x BPR 1 x Therm Array
MB6	27 September, 2021	11 September, 2023	79º 00.560 N	2517m	1 x SBE37

			173° 44.346 E		1 x ADCP 300khz 1 x MMP 1 x Ra sampler 1 x ULS
MB7	29 September, 2021	6 September, 2023	76° 36.846 N 179°46.673 W	1150m	1 x SBE37 1 x ADCP 300khz 1 x MMP 1 x Therm Array
MB8	6 October, 2021	4 September, 2023	75° 06.843 N 172° 13.569 E	143m	4 x SBE37 1 x ADCP 300khz 1 x ADCP 75 kHz 1 x Therm Array
MB9	7 October, 2021	3 September, 2023	73° 46.963 N 167° 42.842 E	40m	1 x SBE37 1 x ADCP 300 kHz 1 x Therm Array

I.5.1.2.2.1. Data processing procedures (*A. Pnyushkov, IARC*)

In this section, we briefly describe procedures used to process data collected by mooring instruments – MMPs, ADCPs, RBR, and SBEs.

Processing MMP records: MMP data processing includes seven operations, performed using McLane Research Laboratories (http://www.mclanelabs.com) and Woods Hole Oceanographic Institution (WHOI) software.

1) Retrieving MMP binary data files. The raw MMP data are stored in binary files. After recovering each MMP instrument, the engineering, CTD and ACM binary data files have been extracted from the MMP flashcard.

2) Unpacking binary data to ASCII formats. The raw MMP data have been converted to ASCII files by employing data Unpacker program for Windows (version 2.0.1) developed by McLane Research Laboratories.

3) Converting ASCII data to raw Matlab format files has been performed with a "McLane Moored Profiler Data Reduction and Processing Procedures" set of scripts developed by John Tool (WHOI).

4) Determining optimal bias for compass readings. Raw readings of the MMP compass were used to estimate the horizontal compass channel bias and range coefficients by mapping the horizontal compass components to the unit circle. for this task, we have used the routine which takes into account uneven density of compass readings among angular sectors.

5) Interpolating to pressure grid. At the stage of interpolating, the original data values were averaged over 2-dbar pressure bins depending on the distribution of the data with respect to pressure within each bin. Missing points within the vertical extents of profile data were filled by interpolation. At this stage, magnetic declination determined from the World Magnetic Model (WMM-2020) for the corresponding mooring position and deployment date (see https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml; last access September 2023) was added to the MMP compass readings.

6) The gridded datasets underwent visual inspection for artificial trends. If any were found, the data were additionally filtered or removed.

7) Archiving data in several formats. Processed data have been archived in different formats and converted to ASCII PSTUV_dP_2.txt files using Matlab scripts.

Processing ADCP records: For all records downloaded from ADCPs, we have performed multi-step quality assessment for marking or removing current velocities with poor or suspicious quality. At the first stage of the assessment, ADCP velocities are marked as "bad" if the percentage of good velocity measurements retrieved from the instrument within each ensemble, estimated using three or four beam solutions, is less than 20%. At the next step, we have performed error velocity control in which all ADCP velocities with the absolute error greater than 15 cm/s are marked as "bad". In addition, the quality flags were set to "bad" if the pulse-to-pulse correlation in a ping estimated for each depth cell was 20 counts or less. Based on the visual inspection of the ADCP records, we note that velocity measurements collected in the first (the nearest to the instrument) bins of all instruments are suspicious due to substantial echo contamination by residual energy from the transmission pulse. All ADCP current vectors were rotated by adding magnetic declination, determined from the WMM-2020 model.

Processing SBE37, RBR, and SBE56 records utilized standard data processing packages provided by vendors. Some records provided by SBE37 and RBR instruments required corrections to salinity in order to remove vertical instabilities. In the event of sensor failure, parts of the SBE37 records were eliminated, and the corresponding data quality flags were set.

Processing RBR thermistor chain records: The RBR thermistor chain records were downloaded from the instruments immediately after mooring recovery. However, all records showed an unphysical range of variability and artificial long-term drift several weeks after their deployment in 2021. Therefore, all RBR thermistor chains and data loggers were sent to the manufacturer for investigation.

I.5.1.2.2.2. Preliminary results (A. Pnyushkov, IARC)

In this section, we present records provided by all instruments deployed at the NABOS moorings in 2021 and recovered in 2023. Most of the mooring instruments, with several exceptions, provided full two-year-long records. We note that in this report, we include all data, including those where we suspect that the quality may not be optimal. For example, ADCP records at the surface and immediately at the instrument depth are often contaminated by noise. This issue cannot be eliminated through QA/QC processing. We mention in this report that these levels are suspicious but keep records from all depth levels, leaving the judgment of data quality and their use in the hands of the users.

M1-4d mooring: The M1-4d mooring was deployed on the 19th of September 2021 at 78°30.002N and 125°58.652E, at water depth 2689 m. The M1-4d mooring consists of a McLane mooring profiler, Seabird SBE37, RBR CTD, and one Teledyne ADCP (**Table I.5.1.5** and **Fig. A.II.1**). This mooring was recovered successfully on September 19, 2023. All instruments except the SBE-37 Microcat at 34 m depth provided full two-year-long records of good quality.

Time series from the Microcat SBE37 and RBR CTD are shown in **Fig. I.5.1.5**. The temperature records from both instruments show two seasonal cycles, with larger (>3°C) amplitude of seasonal changes in fall 2021 compared to those observed in 2022 and 2023. The smaller summer temperature changes in 2022 and 2023 are likely connected to higher sea ice concentrations at the mooring site for those periods. The conductivity and salinity records from the uppermost Microcat #4975 at 34-m depth show anomalous low variability after January 2022, likely as the result of sensor failure. These data were marked as 'bad' due to suspicious quality. The conductivity and salinity records from the RBR CTD #206977 are of good quality, with only a few data spikes. These spikes were replaced by values calculated using linear interpolation in time between the nearest good measurements.

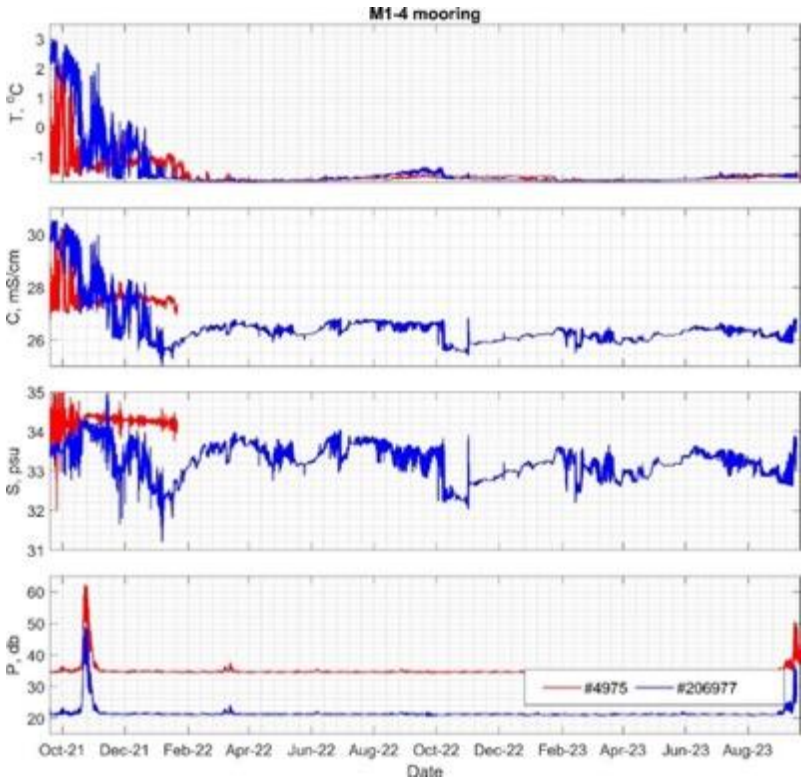


Figure I.5.1.5: Time series derived from SBE37 Microcat and RBR CTD deployed at NABOS M1-4 mooring.

The MMP deployed at this mooring provided two years of temperature, salinity, and ocean velocity observations (**Fig. I.5.1.6**). Preliminary data processing showed that the MMP record at this mooring has unphysically low salinities at depth levels from 50 to 1000m until mid-March 2022. Those data were marked as "bad". The MMP temperature record above the Atlantic water layer shows clear signatures of seasonal cycle and deep winter ventilation occurred in February-March each year.

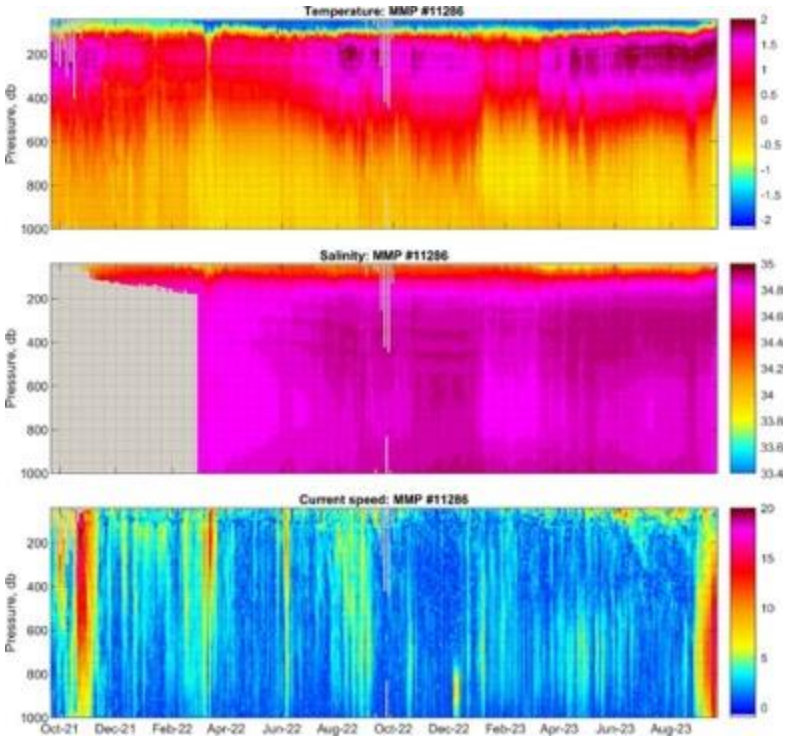


Figure I.5.1.6: Time series derived from MMP#11286 deployed at NABOS M1-4 mooring.

The velocity record from MMP #11286 reveals numerous instances of increased currents observed throughout the entire water column covered by the observations (**Figure I.5.1.7**; bottom panel). These events are likely linked to the passage of mesoscale eddies through the mooring site. The passage of these eddies led to significant alterations in the vertical thermohaline structure of the water column. For instance, the presence of a mesoscale eddy evident in the mooring record in August-September 2023 led to the lifting of warm Atlantic water with temperatures >0 °C to depths of 70-80 meters.

The quality of temperature and salinity records from the MMP#11286 was assessed by comparing them with the SBE37 and RBR CTD records (**Figure I.5.1.7**) at depths of 22 and 35 meters, respectively. As the SBE37 and RBR instruments were positioned in the halocline layers characterized by steep vertical temperature and salinity gradients, the correlation coefficients (R) between the MMP record from the uppermost MMP level and CTD records were relatively low (the coefficients R were in the range from -0.15 to 0.36). Nevertheless, both the temperature and salinity records from 2021 to 2023 exhibit significant changes at synoptic to seasonal scales, indicating their good quality.

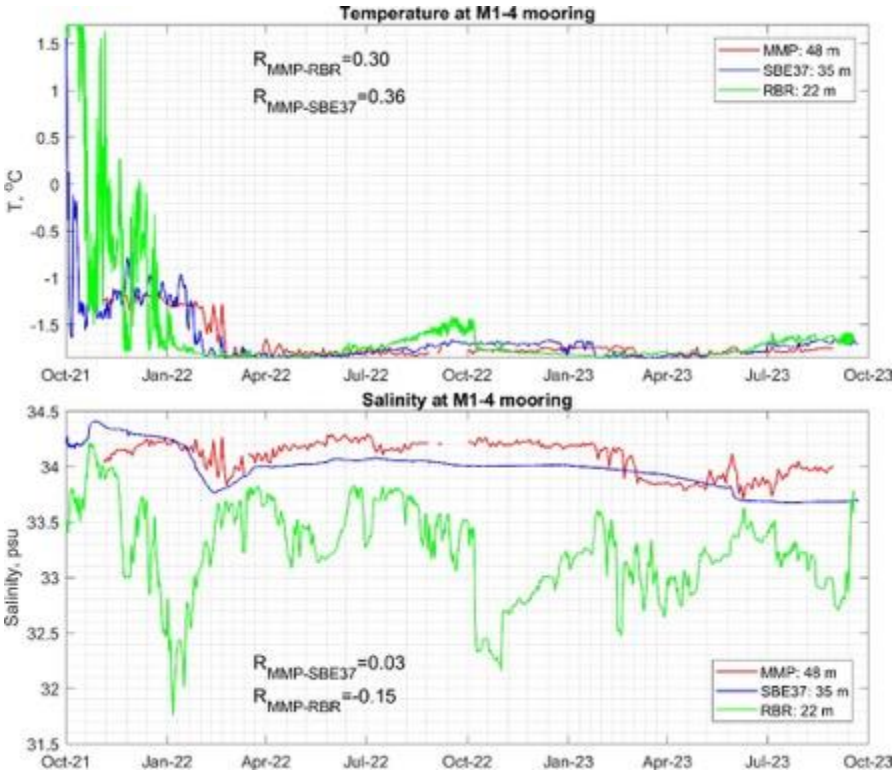


Figure I.5.1.7: Comparison of daily temperature and salinity series at two nearest depth bins from SBE37, RBR CTD, and MMP #11286 deployed at mooring M1-4. The correlation coefficients *R* are calculated between daily time series.

The upward-looking 300 kHz Teledyne ADCP #24902 was deployed at 36 m, covering a depth range of 0-31 m with a vertical resolution of 2 m and hourly temporal resolution (**Fig. I.5.1.8**). Quality control estimates are presented in **Fig. I.5.1.9**, indicating that approximately 92% of the raw ADCP velocity measurements are of good quality. However, the first deepest bin and two bins at the surface are contaminated by noise. Additionally, velocity measurements from the entire ADCP cells at 23 m and the 7 m cell in February-July 2023 were removed from the record due to acoustic signal contamination. The record reveals enhanced summer currents in 2021, which align with the increased seasonal temperature variability in the surface mixed layer (see **Figure I.5.1.5**). Frequency spectra computed using the 300-kHz ADCP's records do not show any increase in energy at high frequencies, indicating that contamination of the signal by noise is at a reasonably low level. Instead, the signal is dominated by peaks at the inertial and semi-diurnal frequencies, suggesting the important role of tidal and inertial dynamics (**Fig. I.5.1.9**).

In addition, the quality of the ADCP record from the recovered M1-4d mooring was evaluated by calculating correlations for the time series from the closest ADCP and MMP #11286 levels (**Fig. I.5.1.10**). It is noted that the velocity correlations for the instruments vary in the range from 0.3 to 0.4 and the records show no evident biases. The moderate correlations suggest good quality of the records provided by the instruments.

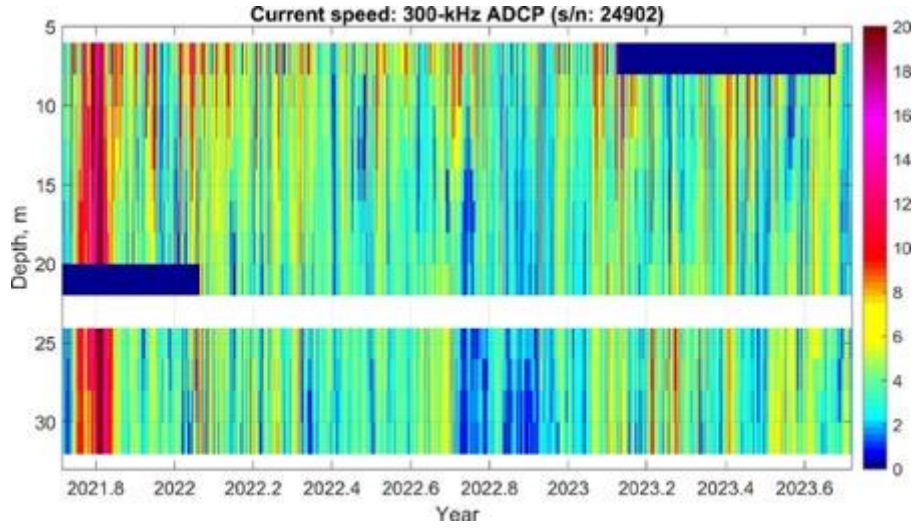


Figure I.5.1.8: Time-depth section of current speed (cm/s) from ADCP #24902 deployed at mooring M1-4 in 2021-2023.

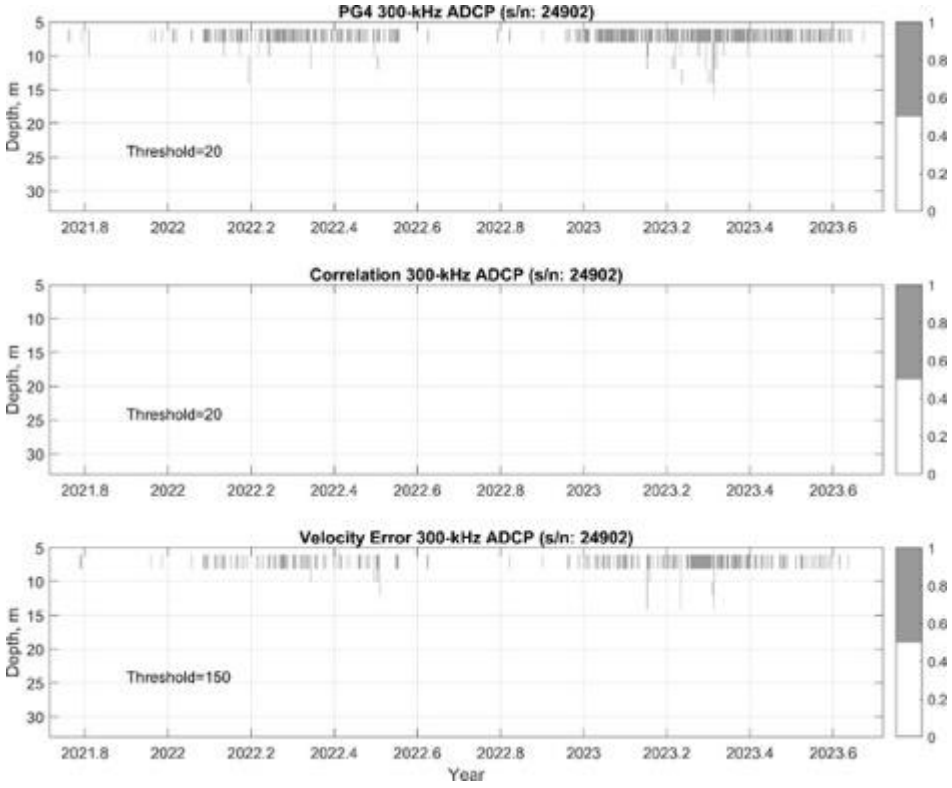


Figure I.5.1.9: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #24902 deployed at mooring M1-4.

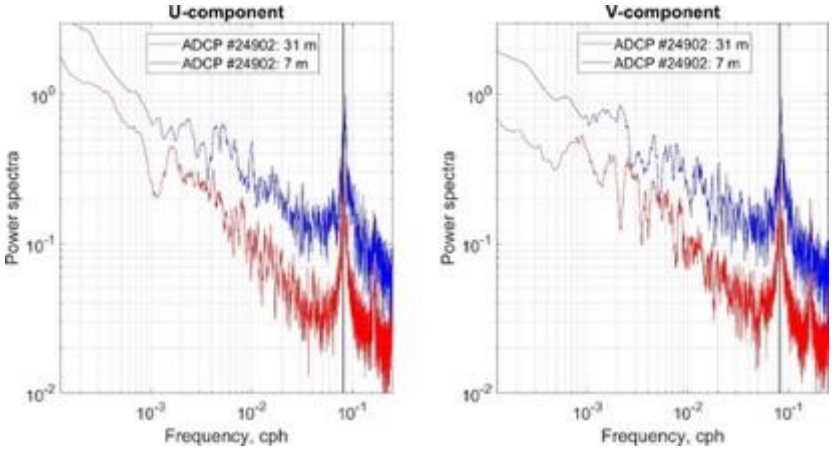


Figure I.5.1.10: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #24902 deployed at mooring M1-4 in 2021-2023.

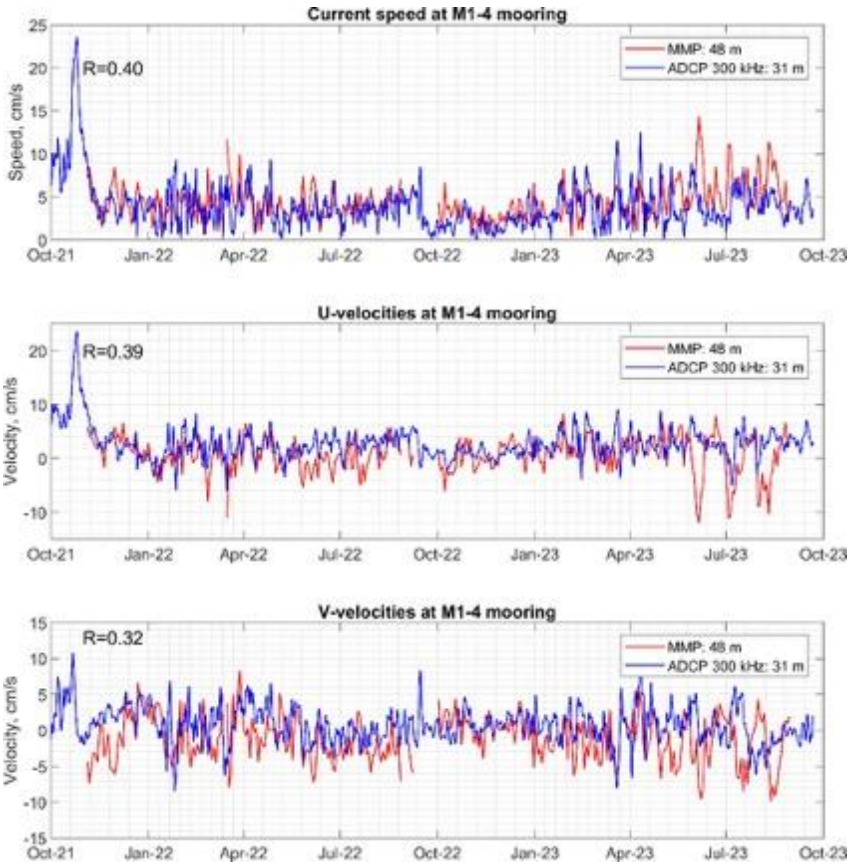


Figure I.5.1.11: Comparison of daily current speed, eastward (U), and northward (V) velocities at two nearest depth bins from ADCP 300 kHz #24902 and MMP #11286 deployed at mooring M1-4. The correlation coefficients *R* are calculated between daily time series.

MB3 mooring: The MB3 mooring was deployed on the 13th of October 2021 at 79°56.579N and 142°12.261E, at water depth 1359 m. The MB3 mooring consists of six Seabird SBE37, six SBE56, RBR CTD, upward-looking 300-kHz Teledyne ADCP, and downward-looking 75-kHz Longranger ADCP (**Table I.5.1.5** and **Fig. A.II.2**). This mooring was recovered successfully on September 17, 2023. All instruments provided full two-year-long records of good quality.

Time series from six Microcats SBE37, RBR CTD, and six thermistors SBE56 are shown in **Fig. I.5.1.12 - I.5.1.13**. The recovered Microcat #4978 from MB3 mooring at 130 m depth has suspicious pressure values

after September 2022 and anomalously high water temperatures, exceeding 4°C in June-July and September 2022, which surpass the typical range of water temperatures for the region. All these data for this Microcat were marked as 'bad. The temperature records from two Microcats deployed at 130 and 185 m show strong seasonal cycles due to winter ventilation, with amplitudes of seasonal changes larger than 1.5°C. At the same time, the most pronounced seasonal changes in salinity were observed in the records from the shallowest Microcat #6309 and RBR CTD deployed at 35 and 20 m, responding to summer freshening and sea ice melt. The conductivity and salinity records from Microcat #5551 at a depth of 185 m show suspicious values in June and September 2022 and in June-August 2023, likely as a result of conductivity cell failure. These data were marked as 'bad' due to suspicious quality. The conductivity and salinity records from other instruments are of good quality, with a small number of data spikes. As for the rest of the moorings, these spikes were replaced by values calculated using linear interpolation in time between the nearest good measurements, and appropriate data quality flags were set up.

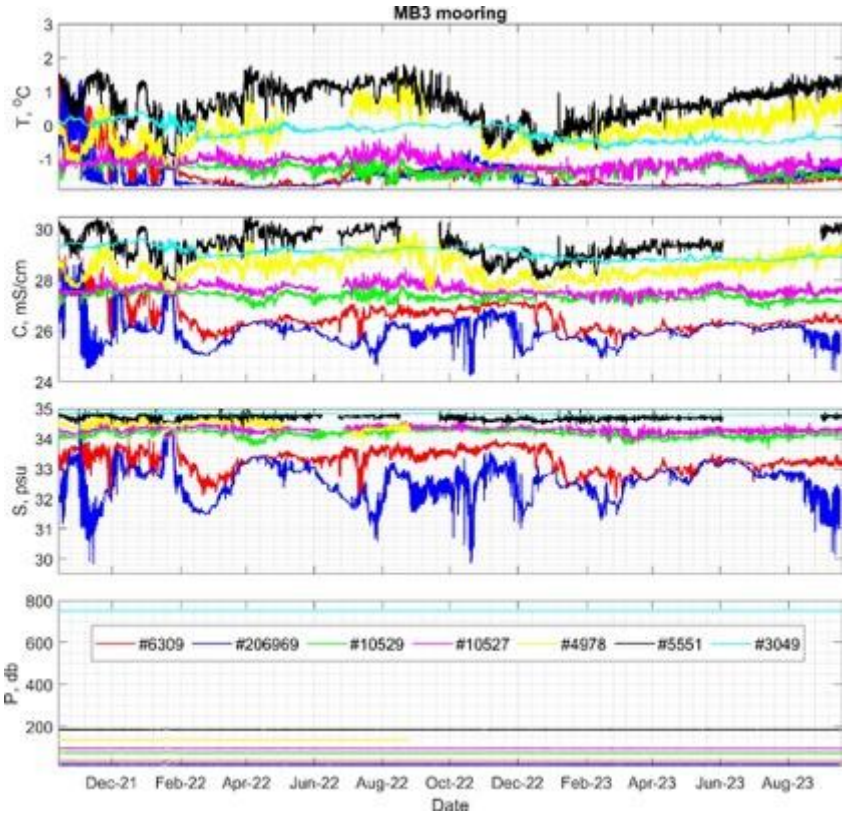


Figure I.5.1.12: Time series derived from SBE37 Microcats and RBR CTD deployed at NABOS MB3 mooring.

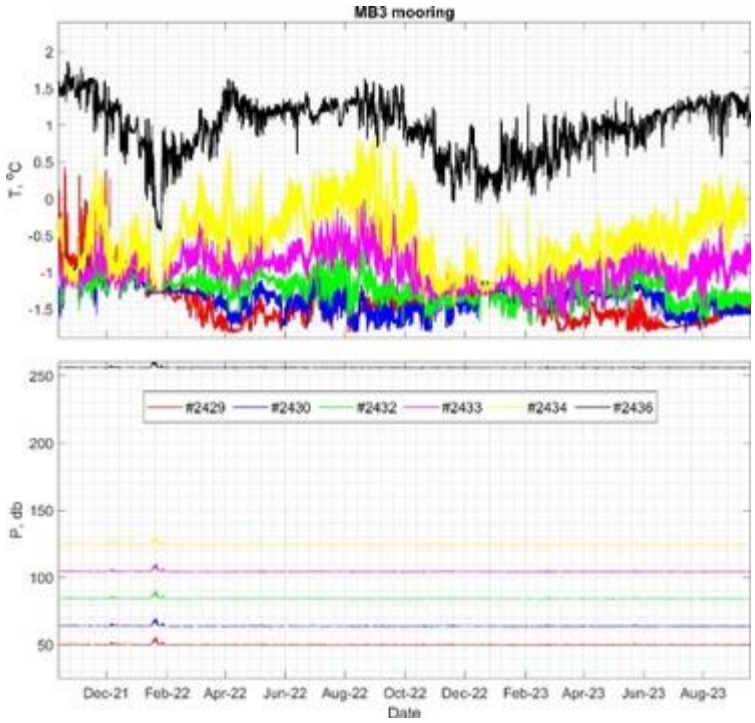


Figure I.5.1.13: Time series derived from SBE 56 thermistors deployed at NABOS MB3 mooring.

The upward-looking 300 kHz Teledyne ADCP #22119 was deployed at 34 m, covering the depth range of 2-30 m with a vertical resolution of 2 m and hourly temporal resolution (**Fig. I.5.1.14**). Quality control estimates are presented in **Fig. I.5.1.15**, indicating that approximately 93% of the raw ADCP velocity measurements are of good quality. Most of the suspicious data were concentrated near the surface bin; therefore, we removed that bin from the record. Additionally, velocity measurements from the bins at 20 and 22 m were also removed from the record due to acoustic signal contamination, resulting in unphysical vertical jumps in the measured ADCP velocities. The record reveals enhanced currents in the layer below 20 m in fall and early winter 2021, which align with the increased currents over the same periods captured by another ADCP deployed in the deeper layer (see **Figure I.5.1.14**; bottom panel).

The downward-looking 75-kHz (Longranger) ADCP #11292 was deployed at 46 m, providing hourly records for the 70-370m depth range with a 10-m vertical resolution. The bin around the 100-m level contains errors due to signal contamination and was flagged as bad. Quality control estimates are shown in **Fig. I.6.2.16**, suggesting a high percentage (>98%) of good data in the Longranger ADCP record. The ADCP record shows a vertically uniform (barotropic) current pattern with several eddy-like events evident as vertical stripes of enhanced (up to 20 cm/s) currents.

Frequency spectra computed using the 300- and 75-kHz ADCP's records do not show a substantial increase in energy at high frequencies, indicating that contamination of the signal by noise is at a reasonably low level. As at the previous mooring, the signal is dominated by peaks at the inertial and semi-diurnal frequencies, suggesting strong tidal and inertial dynamics at the mooring site (**Fig. I.5.1.17**). As expected, power spectra of 75-kHz ADCP record have maxima at the inertial and semi-diurnal frequencies; however, both spectra at 71 and 361 m depth demonstrate faster spectrum flattening at high frequencies compared to those from the 300-kHz ADCP #22119. The flat 75-kHz ADCP spectra suggests a lower level of signal-to-noise ratio for processes with periods < 10 hrs **(Fig. I.6.2.17**).

The comparison between ADCP velocity records at this mooring from the two closest levels with observations indicates moderate correlation coefficients calculated for velocity components and current speed (**Fig. I.5.1.18**). The highest correlation was observed for current speed and exceeded 0.7. These moderate correlations suggest that the records provided by the instruments are of good quality.

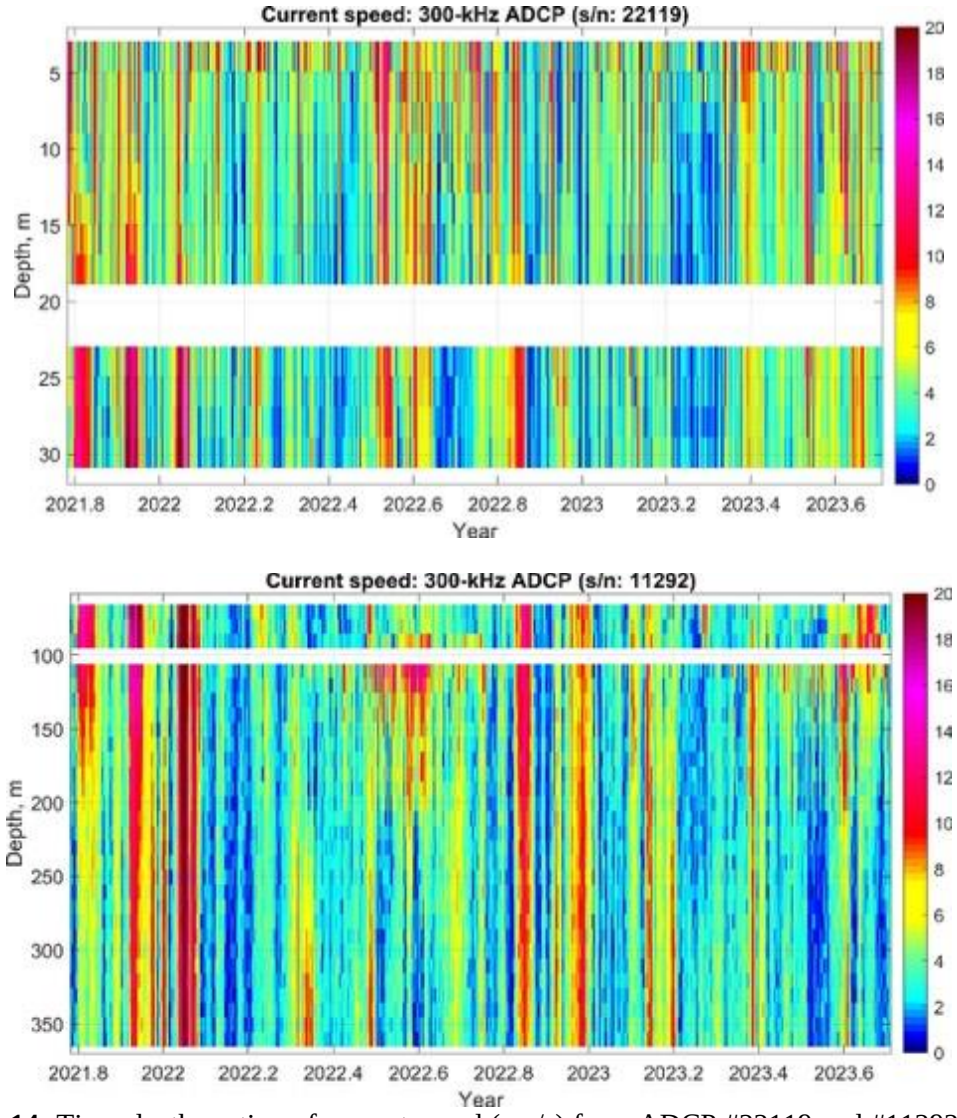


Figure I.5.1.14: Time-depth section of current speed (cm/s) from ADCP #22119 and #11292 deployed at mooring MB3 in 2021-2023.

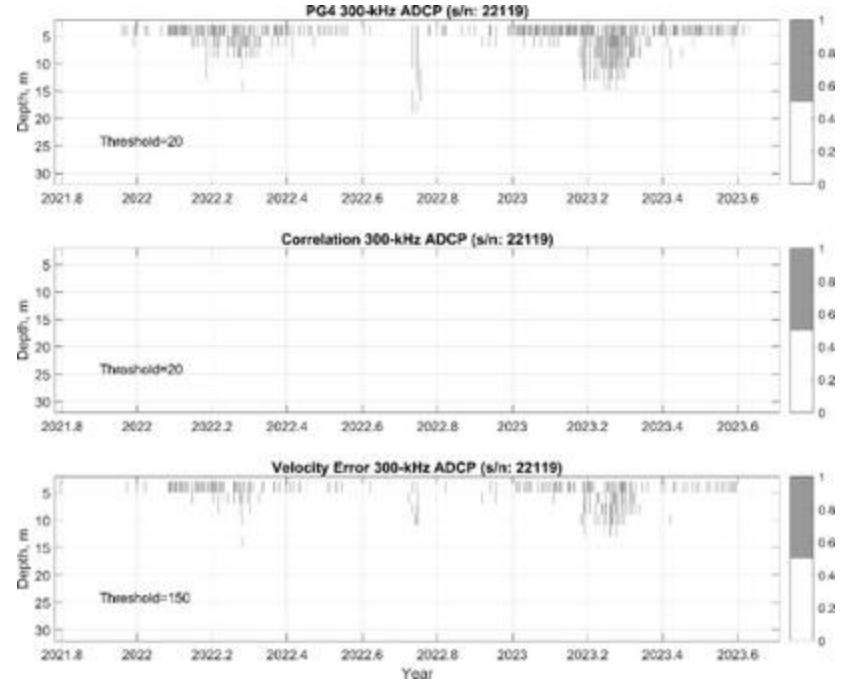


Figure I.5.1.15: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #22119 deployed at mooring MB3.

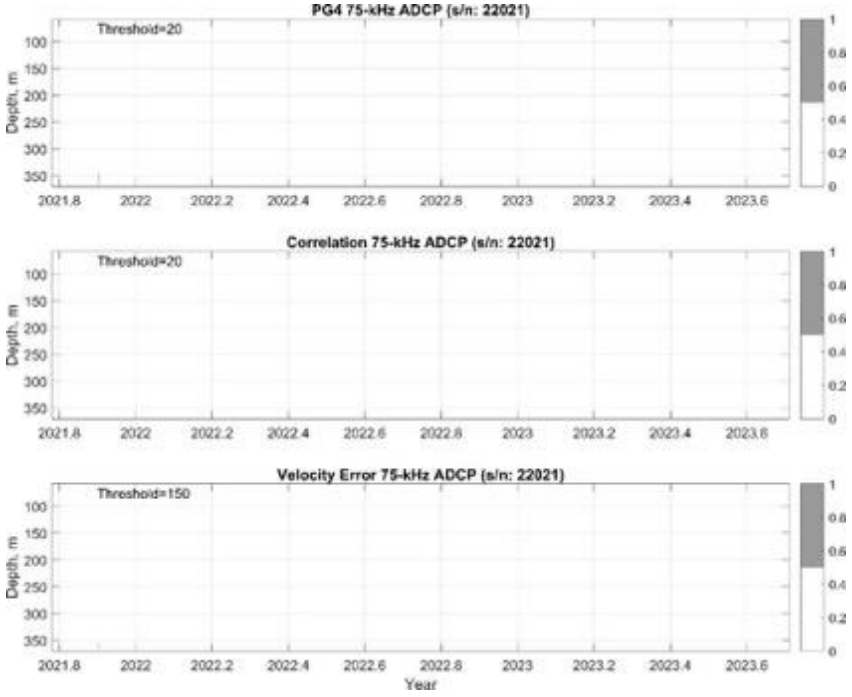


Figure I.5.1.16: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #22021 deployed at mooring MB3.

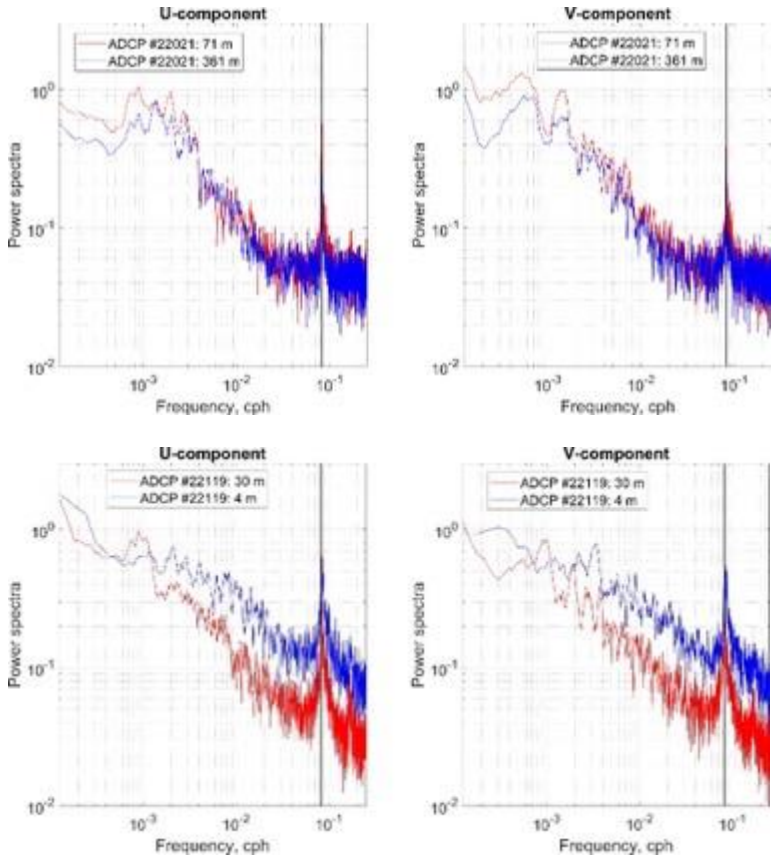


Figure I.5.1.17: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #22119 and #22021 deployed at mooring MB3 in 2021-2023.

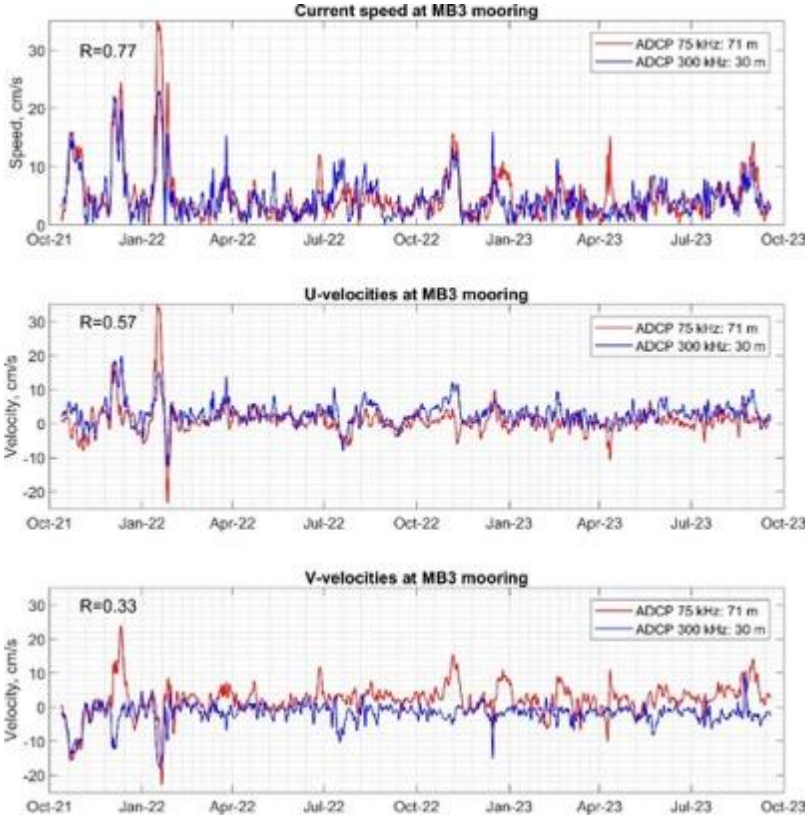


Figure I.5.1.18: Comparison of daily current speed, eastward (U), and northward (V) velocities at two nearest depth bins from ADCP 300 kHz #24902 and ADCP 75 kHz #24902 deployed at mooring MB3. The correlation coefficients *R* are calculated between daily time series.

MB4 mooring: The MB4 mooring was deployed on September 22, 2021, to the east of the Lomonosov Ridge at coordinates 80°25.471N and 147°32.654E, at a water depth of 1813 m. The instrument setup at MB4 mirrors that of MB3 and includes six Seabird SBE37 Microcats, six SBE56 thermistors, RBR CTD, an upward-looking 300-kHz Teledyne ADCP, and a downward-looking 75-kHz Longranger ADCP (**Table I.5.1.5** and **Fig. A.II.3**). This mooring was successfully recovered on September 16th, 2023. All instruments provided complete two-year-long records.

Time series from the Microcats SBE37, RBR CTD, and six thermistors SBE56 are shown in **Fig. I.5.1.19 - I.5.1.20**. In March 2022, the upper buoy at this mooring was damaged by ice keels, causing the RBR CTD to fall from its targeted depth of 18 m to 42 m. However, the RBR instrument was not damaged and continued its work until mooring recovery in September 2023. The conductivity and salinity records from Microcat #4703 at a depth of 185 m show suspicious values in July-September 2022 and after March 2023. The data for these periods were marked as 'bad'. Similar issues with the conductivity sensor were observed for Microcat #4838 in July-August 2022, and in July and September 2023 (**Fig. I.5.1.19**, magenta line**)**. Following the same approach, we marked these data as 'bad'. The data spikes in other conductivity and salinity SBE37 records at the mooring were replaced using linear interpolation in time, and the required QA/QS flags were set accordingly. The recovered Microcat #2368 from 750 m depth has suspicious pressure values exceeding 1100 db. These data were replaced with the last good pressure measurement, and the corresponding data quality flags were set up. The temperature record from the uppermost Microcat #6158 at 30 m shows a substantial heat accumulation that occurred at the beginning of the record in October 2021, when water temperatures exceeded 2°C. These anomalously high temperatures were accompanied by low salinities captured by two CTD instruments at 18 and 30 m, not evident in the next seasonal cycle.

Figure I.5.1.19: Time series derived from SBE37 Microcats and RBR CTD deployed at NABOS MB4 mooring.

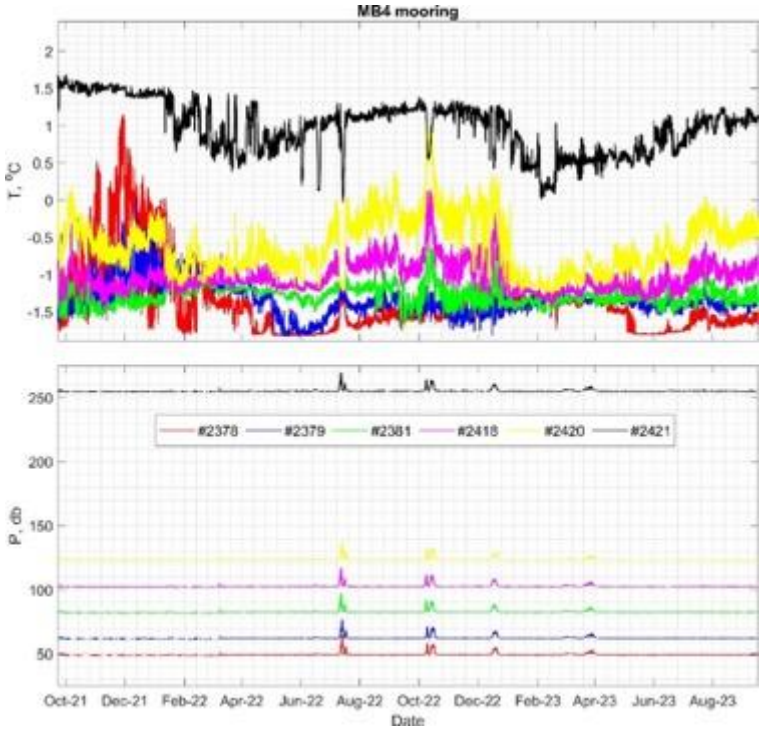


Figure I.5.1.20: Time series derived from SBE 56 thermistors deployed at NABOS MB4 mooring.

At this mooring, the upward-looking 300 kHz ADCP #11240 was deployed at 34 m, covering the depth range of 3-29 m with a vertical resolution of 2 m and hourly temporal resolution (**Fig. I.5.1.21**). Quality control estimates are shown in Fig. I.5.1.22, indicating that approximately 87% of the raw ADCP velocity measurements are of good quality. Similar to the MB3 mooring, the noisiest data were concentrated near the surface bin, reflecting the surface ringing effect; therefore, we removed that bin from the record. Additionally, velocity measurements from the bin at 18 m were also removed from the record due to unphysical vertical jumps in the measured ADCP velocities.

The downward-looking 75-kHz ADCP #19143 was deployed at 46 m, providing hourly records for the 70-360m depth range with a 10-m vertical resolution. Quality control estimates are shown in **Fig. I.5.1.23**, suggesting good initial quality for almost all raw observations in the Longranger ADCP record. However, further QA/QC showed that the bin around the 100-m level contains signatures of acoustic signal contamination and was flagged as 'bad'. The same issue was found for velocity data in the bin at 90 m depth, for which we removed measurements in September 2022 and after July 2023. The ADCP record shows numerous eddy-like events in both the barotropic and baroclinic structure, evident as vertical stripes of enhanced currents with a vertically uniform current pattern or with cores at 250-300m in the Atlantic water layer.

Frequency spectra computed using the 300- and 75-kHz ADCP's records do not show a substantial increase in energy at high frequencies, suggesting a reasonable level of noise in the data (**Fig. I.6.2.24**).

The comparison between ADCP velocity records at this mooring from the two closest levels with observations indicates moderate correlation coefficients calculated for velocity components and current speed (**Fig. I.5.1.25**). The approximately same level of correlation (~0.45) was observed for the current speed and eastward velocity component. These moderate correlations for the velocity components and current speed suggest that the records provided by the instruments at this mooring are of good quality.

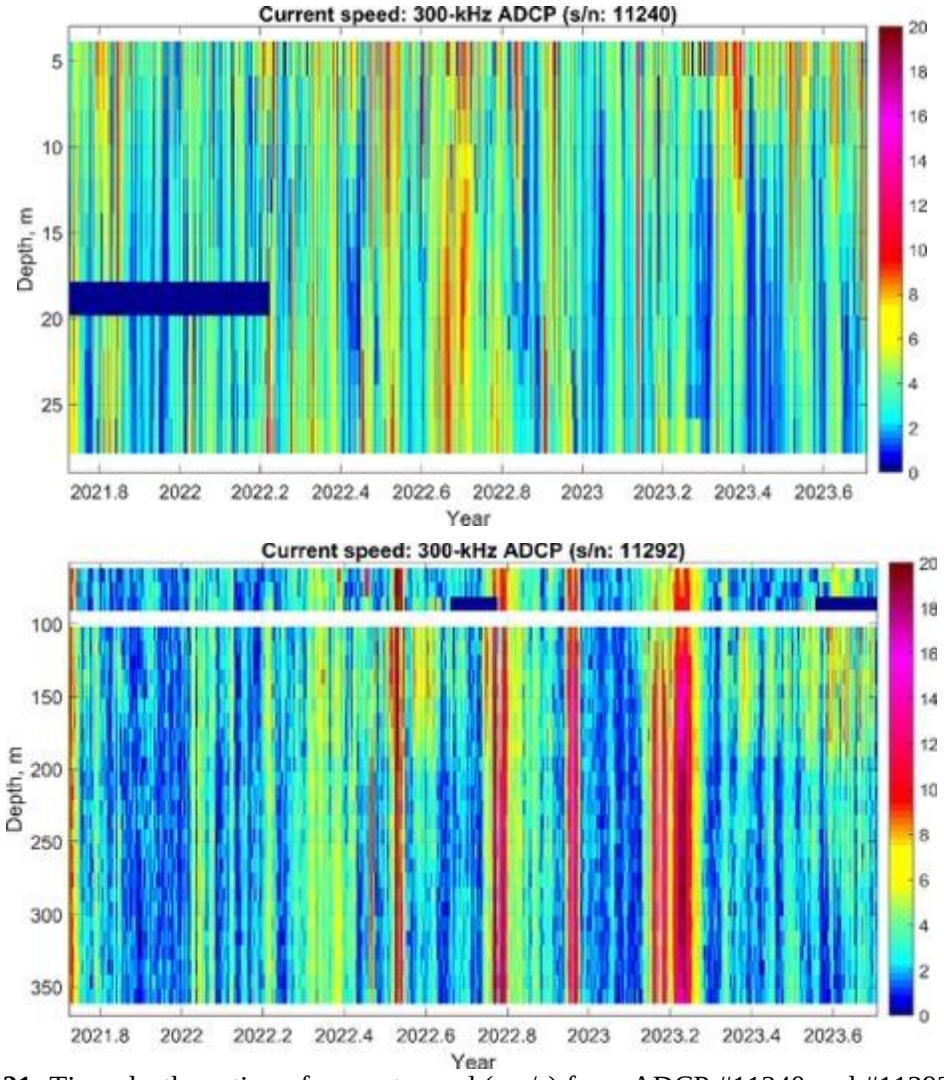


Figure I.5.1.21: Time-depth section of current speed (cm/s) from ADCP #11240 and #11292 deployed at mooring MB4 in 2021-2023.

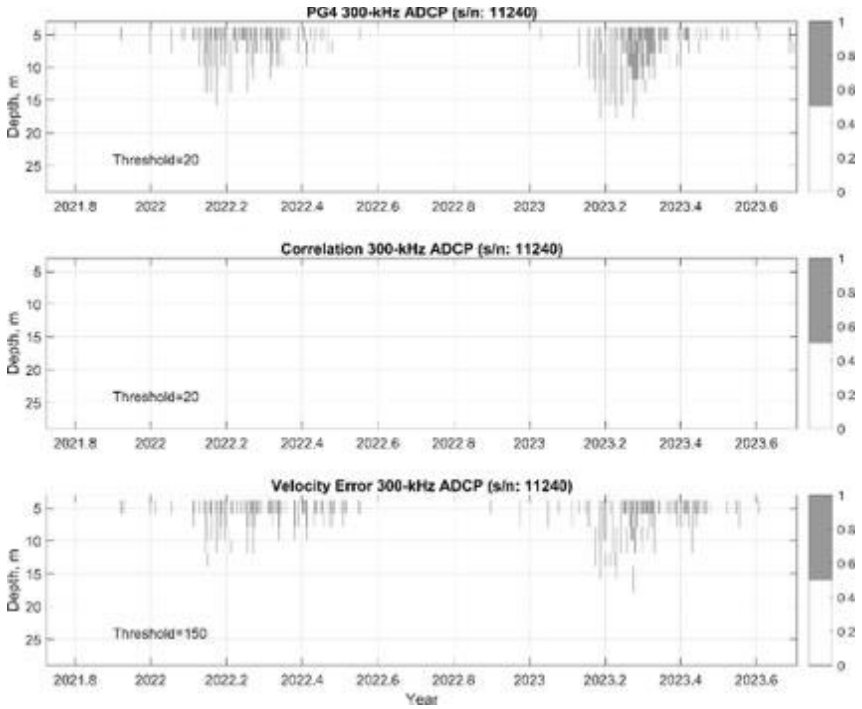


Figure I.5.1.22: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #12240 deployed at mooring MB4.

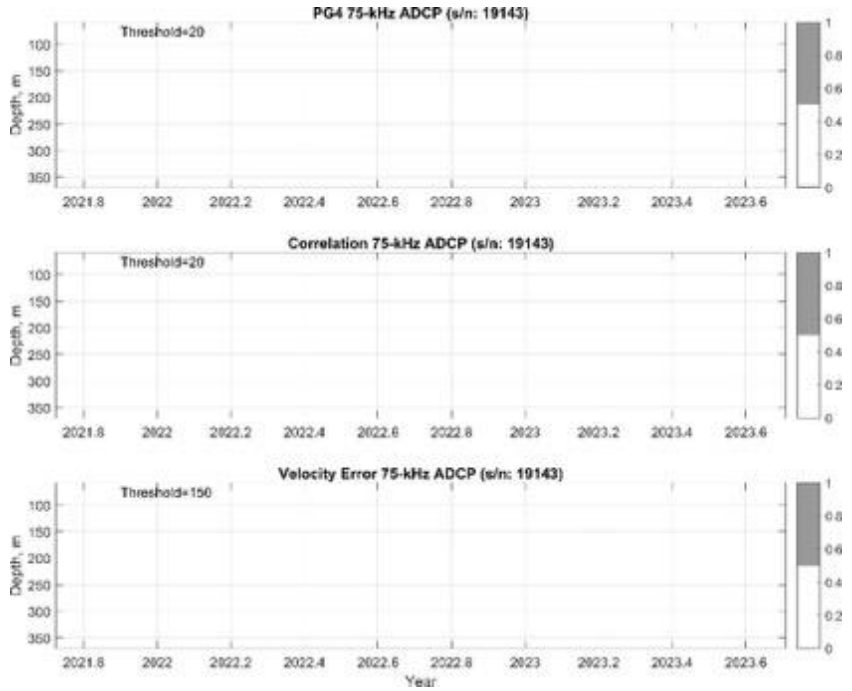


Figure I.5.1.23: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #19143 deployed at mooring MB4.

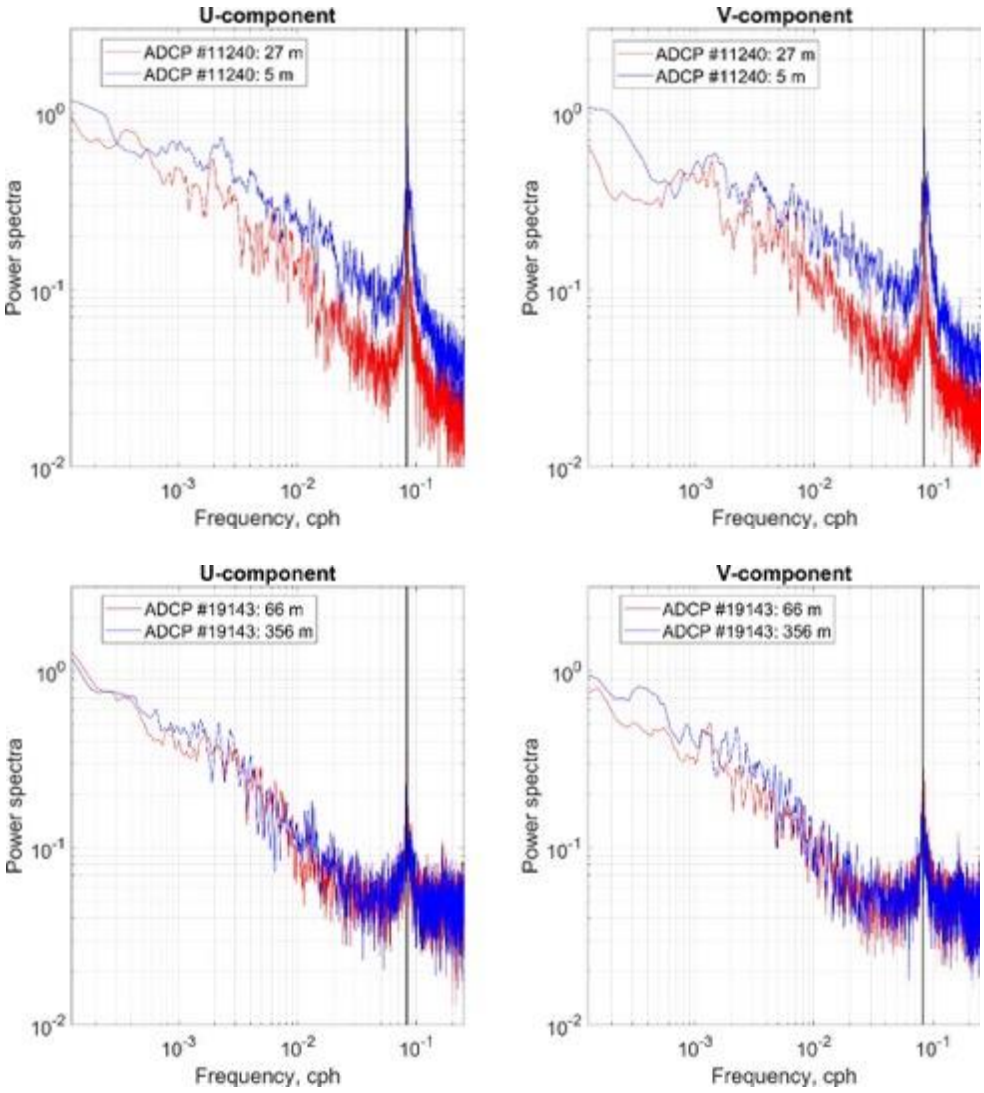


Figure I.5.1.24: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #11240 and #19143 deployed at mooring M1-4 in 2021-2023.

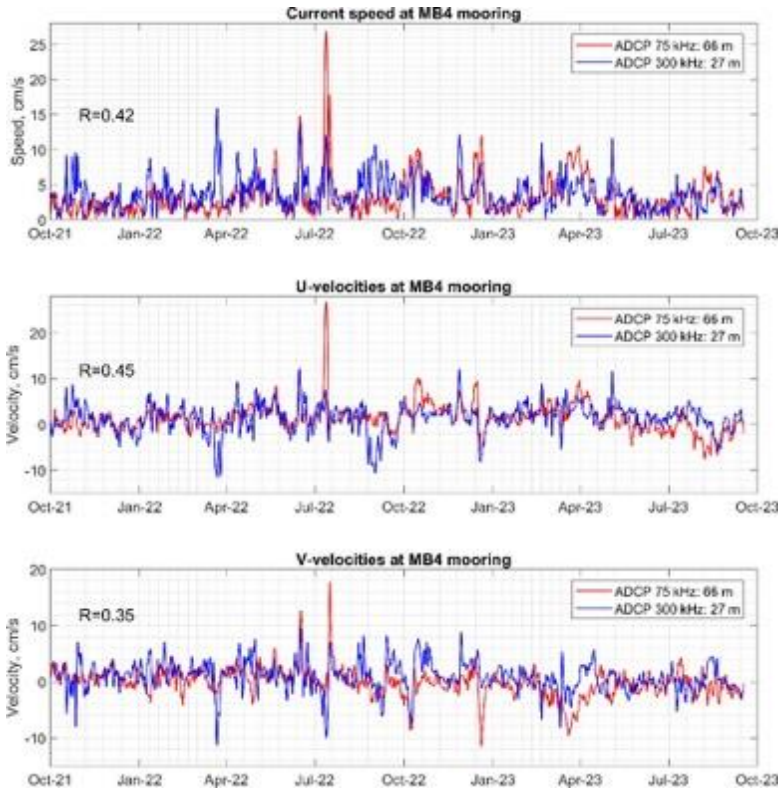


Figure I.5.1.25: Comparison of daily current speed, eastward (U), and northward (V) velocities at two nearest depth bins from ADCP 300 kHz #11240 and ADCP 75 kHz #19143 deployed at mooring M1-4. The correlation coefficients *R* are calculated between daily time series.

MB5 mooring: The MB5 mooring was deployed on September 24, 2021 at 80° 37.778N and 161° 06.235E, at a water depth of 2775 m. This mooring consists of a MMP, Seabird SBE37, RBR CTD, and one 300-kHz Teledyne ADCP (**Table I.5.1.5** and **Fig. A.II.4**). This mooring was successfully recovered on September 13th, 2023.

The time series from the Microcats SBE37 and RBR CTD are shown in **Fig. I.5.1.26**. These records exhibit two seasonal cycles, with higher (>1.3 °C) amplitudes of temperature changes observed in summer-fall 2023 compared to those in 2022 and 2021. It is likely that the varying seasonal amplitudes are linked to the state of the summer ice cover in the particular year, which, in turn, affects the summer accumulation of solar heat. The seasonal cycle was also evident in the salinity records. However, several events of low salinity evident in the RBR record in September 2022 may be due to signal contamination produced by unpumped conductivity sensors of the RBR instrument and require extra caution.

The MMP#11494 deployed at this mooring provided two years of temperature and salinity observations (**Fig. I.5.1.27**). However, due to the ACM sensor failure right after the mooring deployment, the instrument did not collect ocean velocity measurements. The MMP temperature and salinity records at the mooring appear reasonable and of good quality, with the only exceptions being several profiles in September-October 2022 when the instrument failed for an unknown reason.

The quality of temperature and salinity records from MMP#11494 was evaluated by comparing them with the SBE37 record (**Figure I.5.1.28**) at 36 meters. Replicating the comparison at the M1-4d mooring, the correlation coefficients (R) between the MMP and CTD temperature and salinity series at MB5 were relatively low (-0.07 and 0.58, respectively). Despite the low correlation between two records, we note that

the timing of seasonal temperature minimum, when temperatures drop to the freezing point, is consistent between the two records, considering the potential lag required for winter ventilation to penetrate to the level of the deepest instrument. After that ventilation in April 2022 and 2023, both instruments show approximately the same values of temperatures and salinities (**Figure I.5.1.26**).

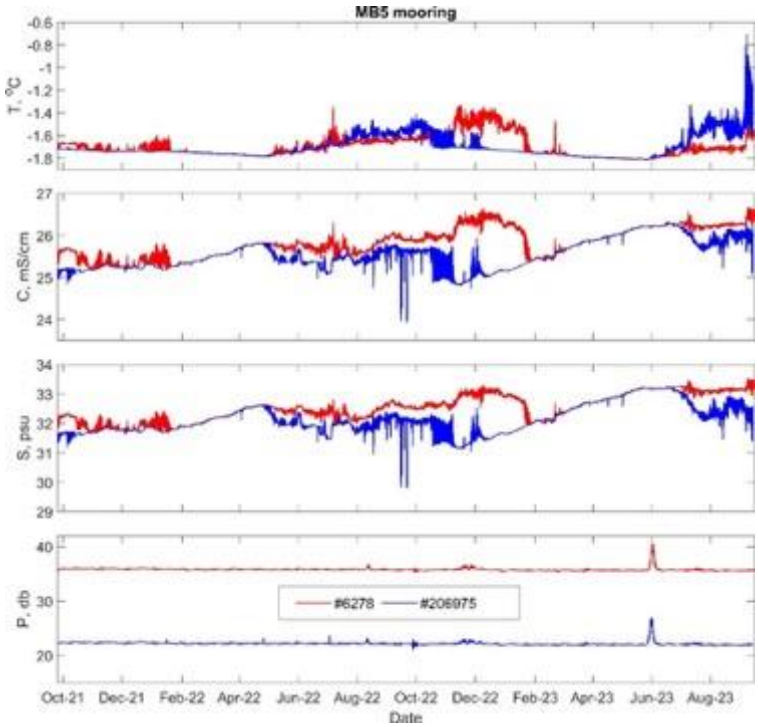


Figure I.5.1.26: Time series derived from SBE37 Microcat and RBR CTD deployed at NABOS MB5 mooring.

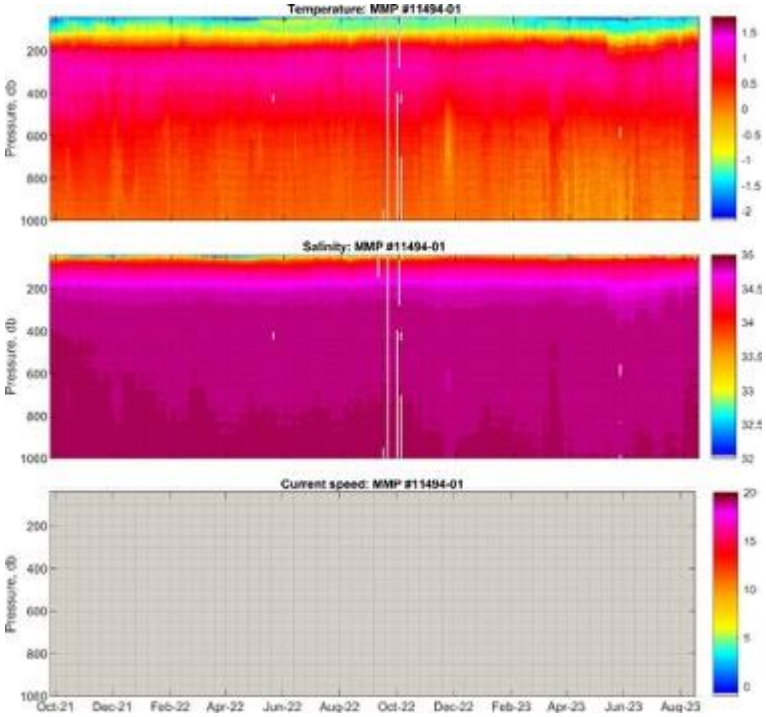


Figure I.5.1.27: Time series derived from MMP#11494 deployed at NABOS MB5.

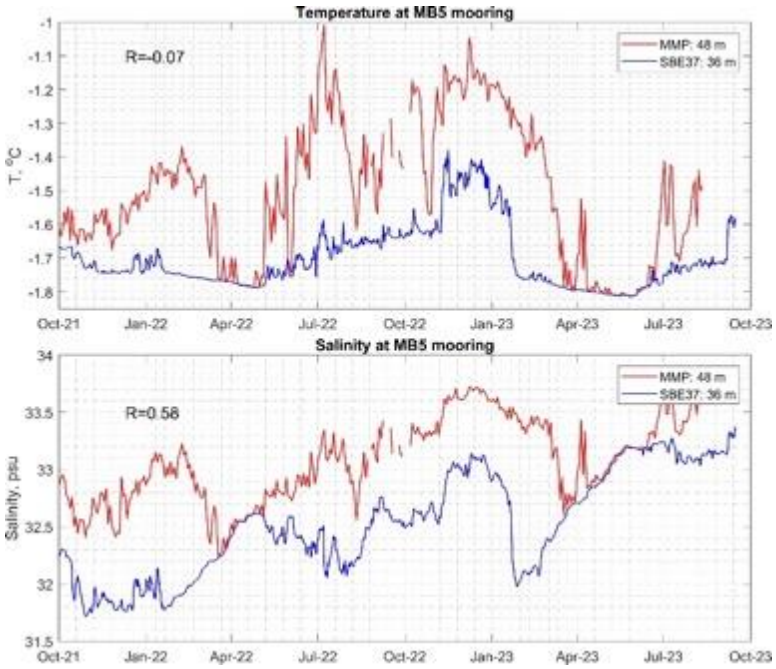


Figure I.5.1.28: Comparison of daily temperature and salinity series at two nearest depth levels from SBE37 and MMP #11494 deployed at mooring M1-4. The correlation coefficients *R* are calculated between daily time series.

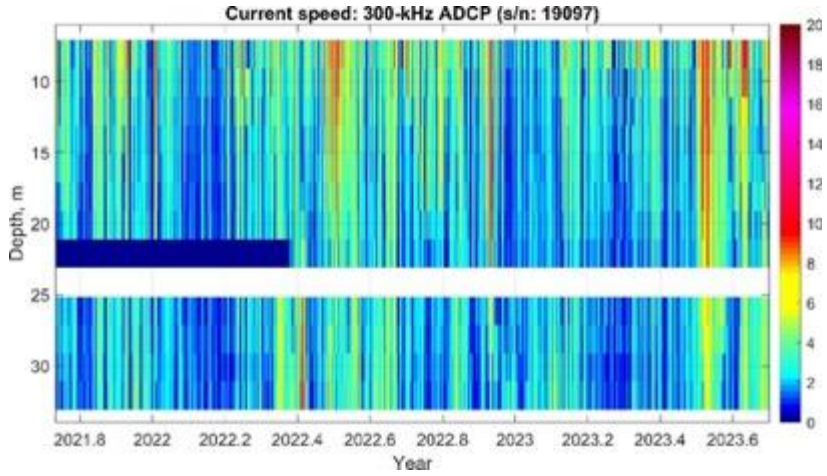


Figure I.5.1.29: Time-depth section of current speed (cm/s) from ADCP #19097 deployed at mooring MB5 in 2021-2023

The upward-looking 300 kHz ADCP #19097 was deployed at 36 m, covering the depth range of 6-32 m with a vertical resolution of 2 m and hourly temporal resolution (**Fig. I.5.1.29**). The quality flags set after the initial control routine are shown in **Fig. I.5.1.30**. The highest level of noise in the ADCP data was observed in two surface bins in summer of all years, reflecting the surface ringing effect. Additionally, velocity measurements from the bin at 24 m were also removed from the record due to unphysical vertical jumps in the measured ADCP velocities. Additional QA/QC showed that the ADCP cell at the 22-m level in October 2021 through April 2022 are contaminated by noise and, thus, was flagged as 'bad'.

Frequency spectra computed using the 300-kHz ADCP's record do not show a substantial increase in energy at high frequencies, suggesting a reasonable level of noise in the data (**Fig. I.6.2.24**). The dominant frequency, which has the largest spectral density, lies in the near-inertial band, reducing toward higher frequencies. The secondary peak in the spectrum, at periods of about 6 hours, likely represents tidal overtones.

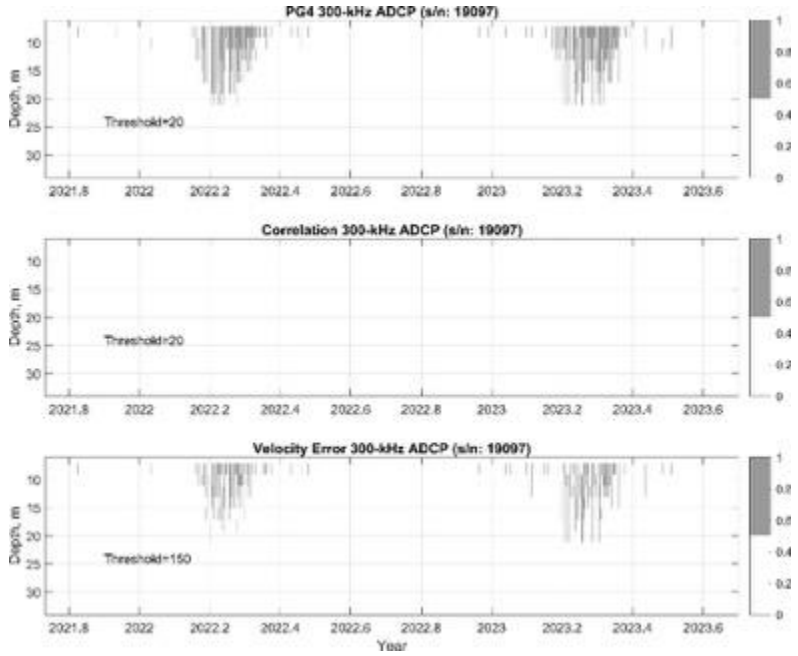


Figure I.5.1.30: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #19097 deployed at mooring MB5.

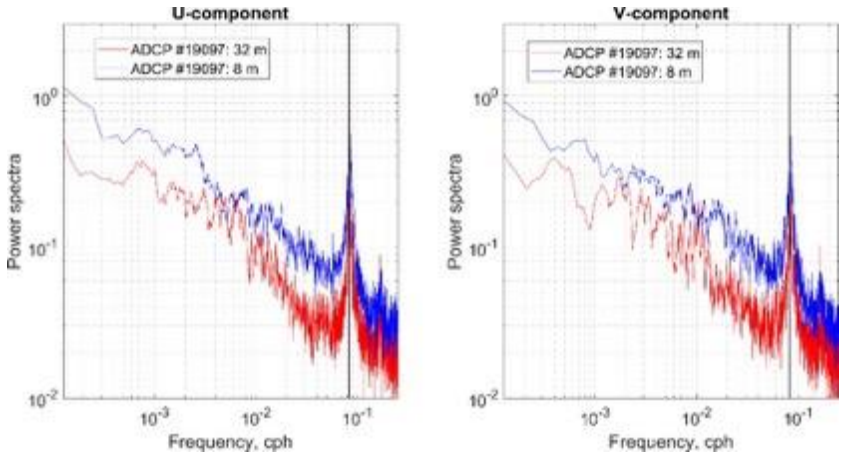


Figure I.5.1.31: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #19097 deployed at mooring MB5 in 2021-2023.

MB6 mooring: The MB6 mooring was deployed on September 27, 2021 at 79° 00.560N and 173° 44.346E, at a water depth of 2517 m. This mooring was equipped with a MMP, one Seabird SBE37, and one 300-kHz Teledyne ADCP (**Table I.5.1.5** and **Fig. A.II.5**). This mooring was successfully recovered on September 11th, 2023.

The time series from the Microcat SBE37 #6282, deployed at approximately 50 m depth, is shown in **Fig. I.5.1.32**. The SBE37 record exhibits moderate positive trends in both temperature and salinity. For example, water temperatures increase from the freezing point of -1.7°C in October 2021 to -1.2°C in summer 2023. The corresponding increase in salinity over the same period was from approximately 32.5 psu to more than 33.6 psu by the end of the mooring record.

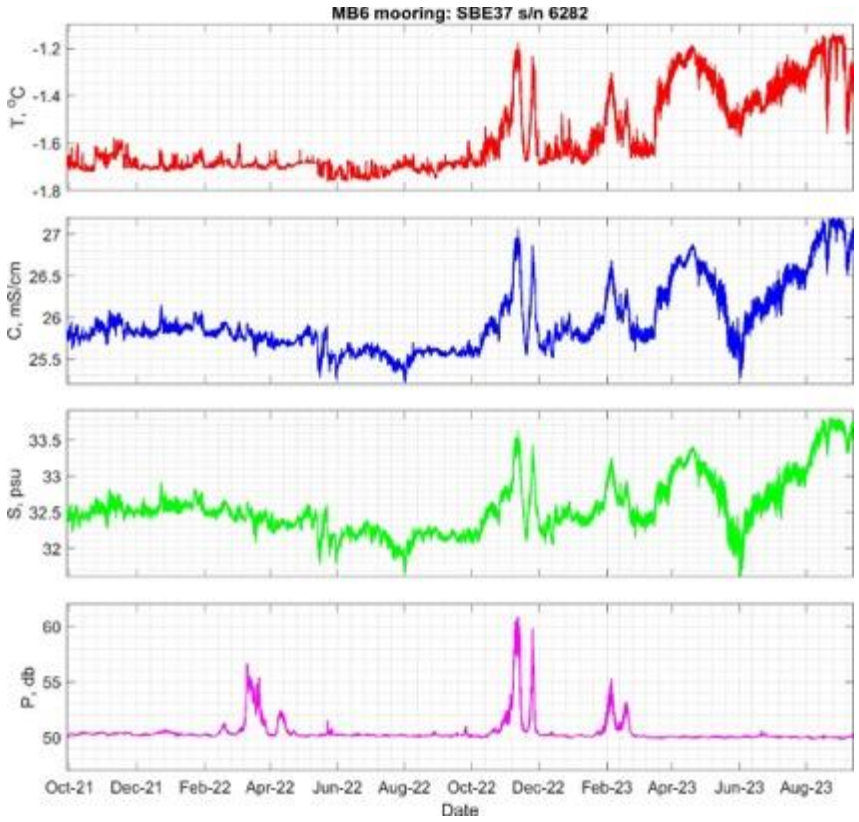


Figure I.5.1.32: Time series derived from the SBE37 Microcat deployed at NABOS MB6 mooring.

The MMP #15207-01 deployed at this mooring provided two years of temperature, salinity, and ocean velocity observations (**Fig. I.5.1.33**) within the 60-1000 m depth layer. All profiles in the MMP record are complete and of satisfactory quality, with no missing data. The velocity record from MMP #15207-01 reveals numerous events of increased currents associated with mesoscale eddies observed throughout the entire water column covered by the observations (**Fig. I.5.1.33**; bottom panel). Mesoscale eddies were identified in two distinct layers: within the halocline layer above approximately 200 m depth, and within the Atlantic water layer below 200 m. The nature of these mesoscale eddies at this specific mooring is complex and likely to vary. The strongest eddy-like event was evident in the mooring record in November 2022 when the current speed in the eddy core at ~100 m depth exceeded 25 cm/s. A similar magnitude of ocean currents (>20 cm/s) was observed at the same depth in February 2023, associated with the passing of another eddy through the mooring site. The temperature and salinity MMP records at MB6 show that the passing of eddies is accompanied by a substantial deflection of temperature and salinity isolines, mostly evident in the deep layer (> 300 m) of weak stratification.

The quality of temperature and salinity records from the MMP#15207-01 was assessed by comparing them with the SBE37 # 6282 record (**Figure I.5.1.34**) deployed at a depth of 50 meters. Both the MMP and SBE37 temperature and salinity records exhibit similar variability patterns, showing high correlations (R>0.7) between them. In addition, the quality of the MMP velocity record at MB6 mooring was evaluated by calculating correlations between the closest current records from the MMP and 300-kHz ADCP #24910 (**Fig. I.5.1.35**). Those correlations vary in the range from 0.61 to 0.71 and the records show no evident biases. The moderate correlations suggest good quality of the records provided by the instruments.

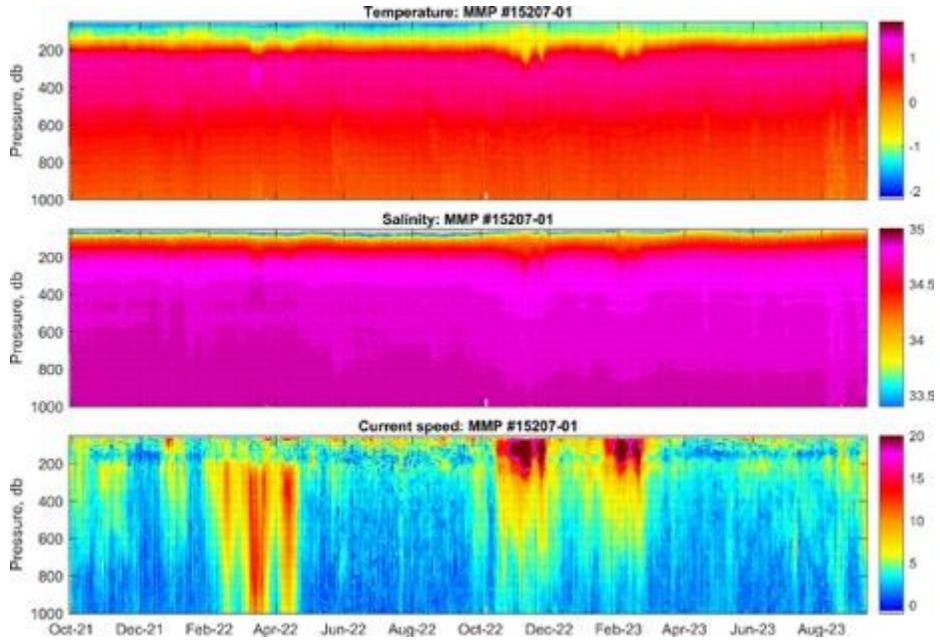


Figure I.5.1.33: Time series derived from MMP#15207-01 deployed at NABOS MB6.

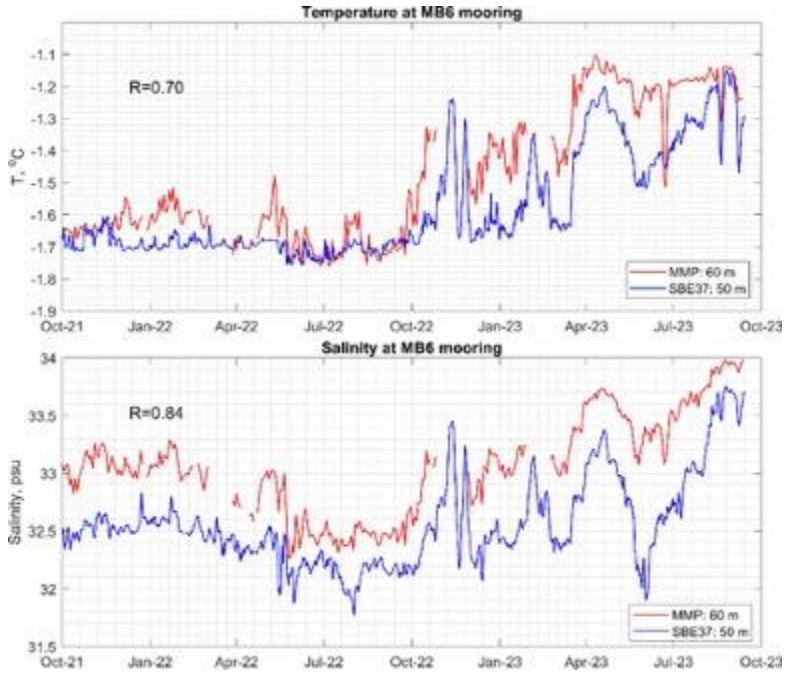


Figure I.5.1.34: Comparison of daily temperature and salinity series at two nearest depth levels from SBE37 and MMP #11494 deployed at mooring MB6. The correlation coefficients *R* are calculated between daily time series.

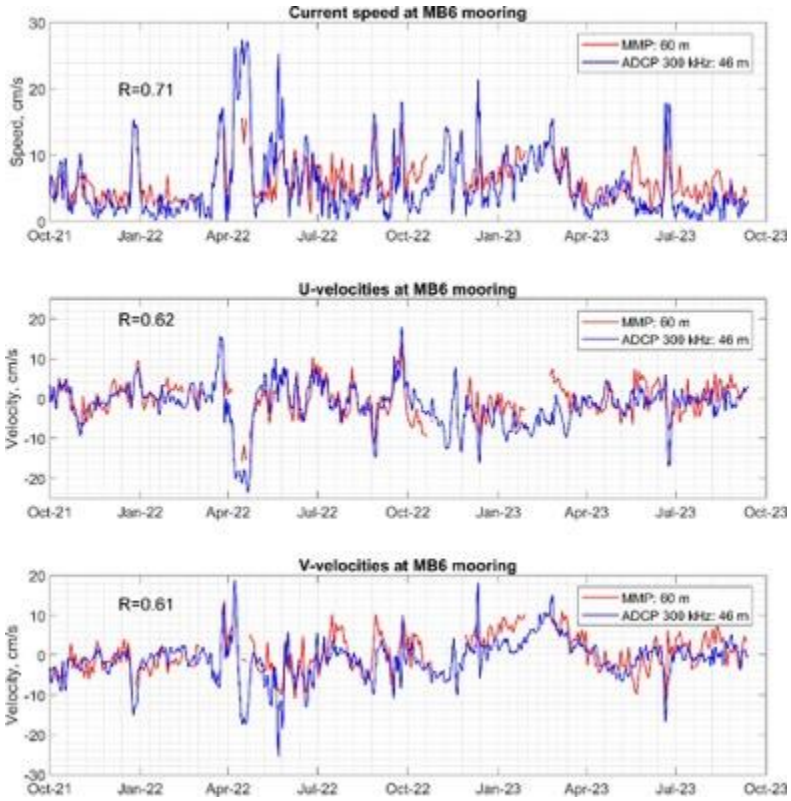


Figure I.5.1.35: Comparison of daily current speed, eastward (U), and northward (V) velocities at two nearest depth bins from ADCP 300 kHz #24910 and MMP #15207-01 deployed at mooring MB6. The correlation coefficients *R* are calculated between daily time series.

The upward-looking 300 kHz ADCP #24910 was deployed at 52 m, covering the depth range of 6-48 m with a vertical resolution of 2 m and hourly temporal resolution (**Fig. I.5.1.36**). The layer above 6 m was contaminated by acoustic noise generated by surface reflection and surface waves. The quality flags set after the initial QA/QC routine are shown in **Fig. I.5.1.37**, suggesting that approximately 96% of the raw velocity data in the ADCP record are of good quality. Numerous events of enhanced velocities (>10 cm/s) in the ADCP record suggest that the halocline eddies found in the MMP record at this mooring can reach the base of the upper mixed layer at approximately 25 m depth, or they may even propagate within that layer, as was evident in August 2023.

Frequency spectra computed using the 300-kHz ADCP record do not show a substantial increase in energy at high frequencies, suggesting a reasonable level of noise in the data (**Fig. I.6.2.38**). Spectral peaks were observed in the near-inertial band and at periods of approximately 6 hours, likely representing tidal overtones.

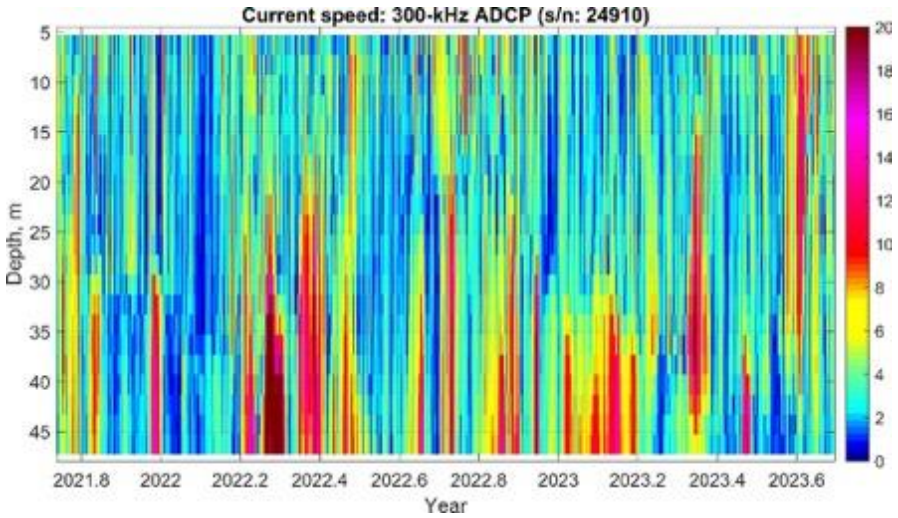


Figure I.5.1.36: Time-depth section of current speed (cm/s) from ADCP #24910 deployed at mooring MB6 in 2021-2023.

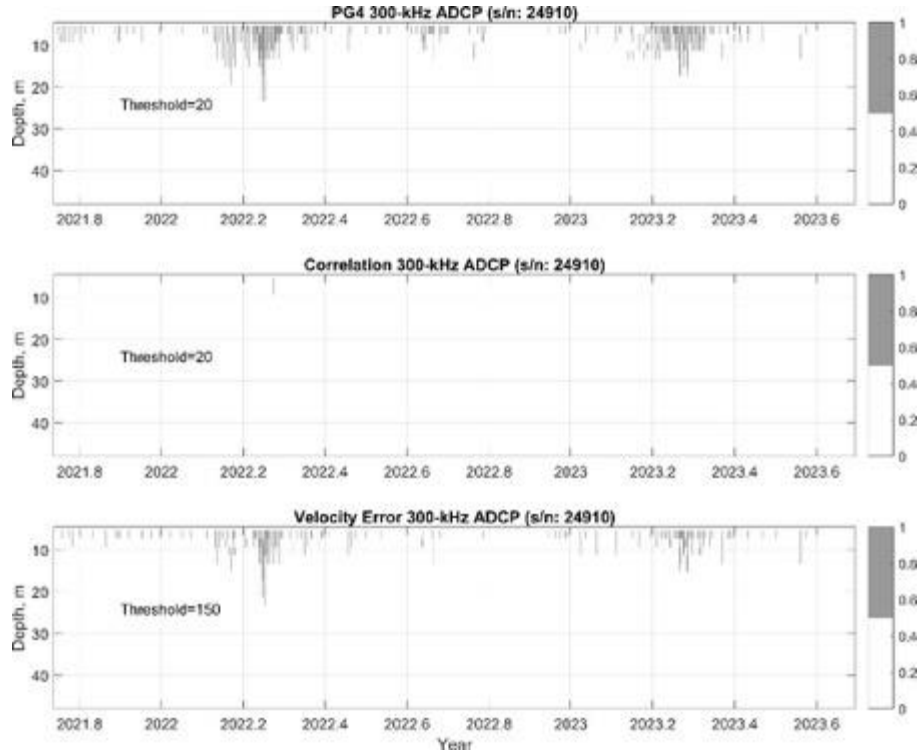


Figure I.5.1.37: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #24910 deployed at mooring MB6.

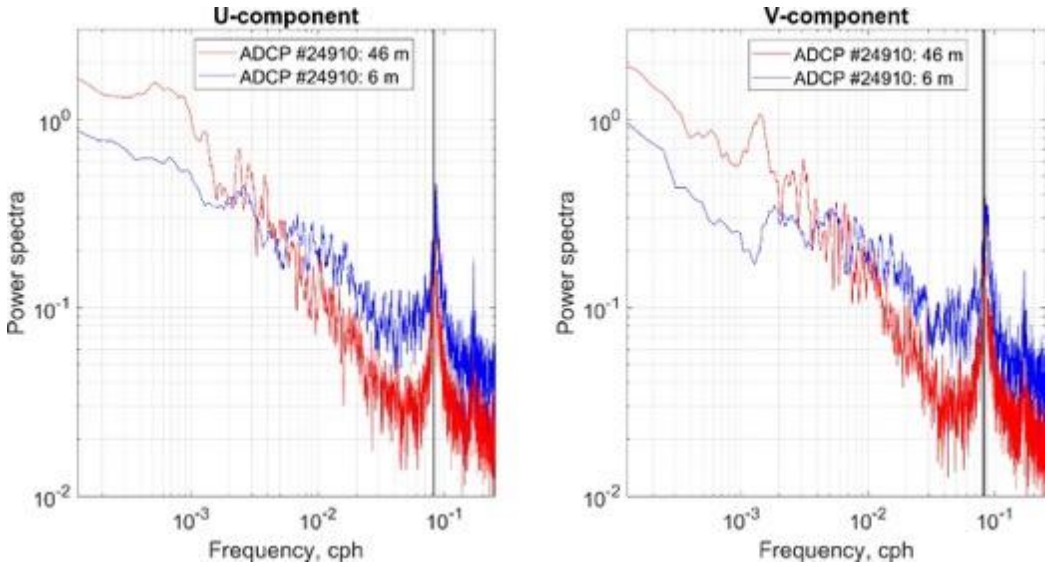


Figure I.5.1.38: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #24910 deployed at mooring MB6 in 2021-2023.

MB7 mooring: The easternmost mooring MB7 was deployed in water on September 29th, 2021 at coordinates 76°36.846N and 179°46.673W, at a depth of 1150 m. This mooring consists of a MMP, Seabird SBE37, RBR CTD, and one 300-kHz Teledyne ADCP (**Table I.5.1.5** and **Fig. A.II.6**). This mooring was successfully recovered on September 6th, 2023. All recovered instruments provided complete two-year-long records.

Time series from the Microcats SBE37 and RBR CTD are shown in **Fig. I.5.1.39**. In June 2022, the upper buoy at this mooring was damaged, likely, by ice keels, causing the RBR CTD to fall from its targeted depth of 18 m to 43 m. Fortunately, the RBR instrument was not damaged during this event and continued its functioning until recovery in September 2023. The temperature records from both instruments show clear seasonal cycles with temperature maximum at 30 m depth of -1.3 °C observed in September-October. The winter ventilation reached the level of the deepest instrument at around 43 m in mid-January, when the temperature and salinity differences between the two instruments became negligible.

The MMP #15207-02 deployed at MB7 provided two years of temperature, salinity, and ocean velocity observations (**Fig. I.5.1.40**) within the 42-1000 m depth layer. All profiles in the MMP record are of satisfactory quality. However, due to power consumption issues, all profiles starting from December 2022 were stopped at shallower depths, limiting the actual MMP profiling range to approximately 650 m over the last month. The temperature and salinity records from the MMP show reduced variability for all depths compared to those observed at moorings MB6 and MB5, likely reflecting substantial changes in ocean dynamics in that region of the Arctic Ocean. This reduced variability in temperature and salinity is accompanied by weaker currents and suppressed mesoscale dynamics in the deep layer (> 200 m depth) at this mooring.

The quality of temperature and salinity records from the MMP#15207-01 was assessed by comparing them with the SBE37 #6280 record (**Figure I.5.1.41**) collected at a depth of 30 meters. Both the temperature and salinity records from the MMP at 42 m depth and SBE37 at 30-meter depth exhibit similar variability patterns with high correlations (R>0.5) between the instrumental time series. As for the previous mooring, the quality of the MMP velocity record at MB6 mooring was evaluated by calculating correlations between time series of velocities from the MMP and 300-kHz ADCP #19033 (**Fig. I.5.1.42**). Those correlations vary in the range from 0.41 to 0.56 and the records show no evident biases suggesting good quality of the records provided by the instruments.

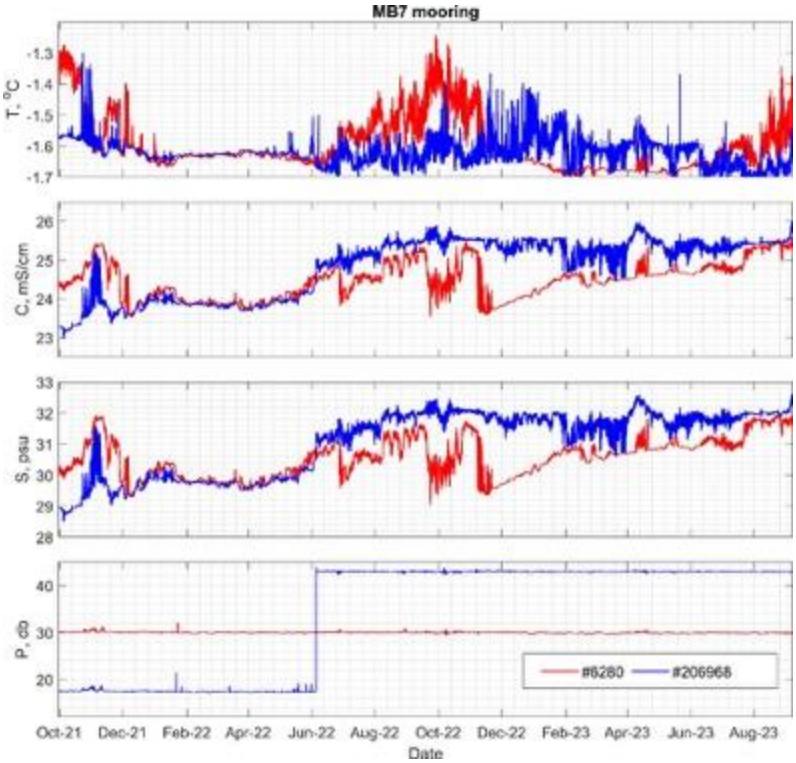


Figure I.5.1.39: Time series derived from SBE37 Microcat and RBR CTD deployed at NABOS MB7 mooring.

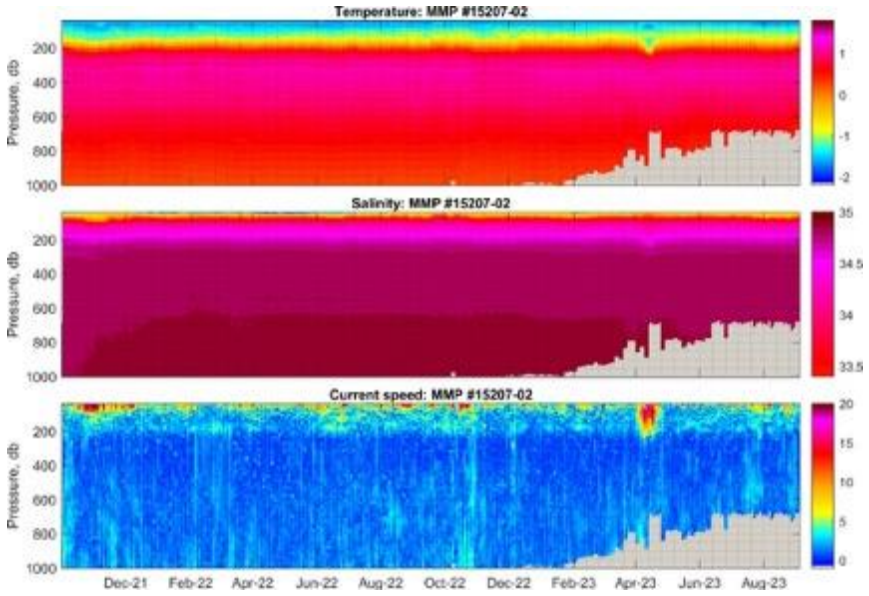


Figure I.5.1.40: Time series derived from MMP#15207-02 deployed at NABOS MB7.

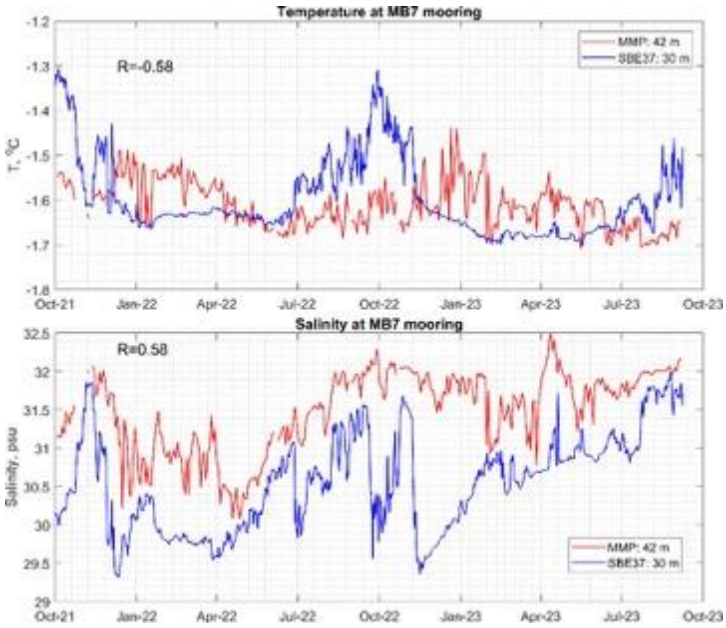


Figure I.5.1.41: Comparison of daily temperature and salinity series at two nearest depth levels from SBE37 and MMP #15207-02 deployed at mooring MB7. The correlation coefficients *R* are calculated between daily time series.

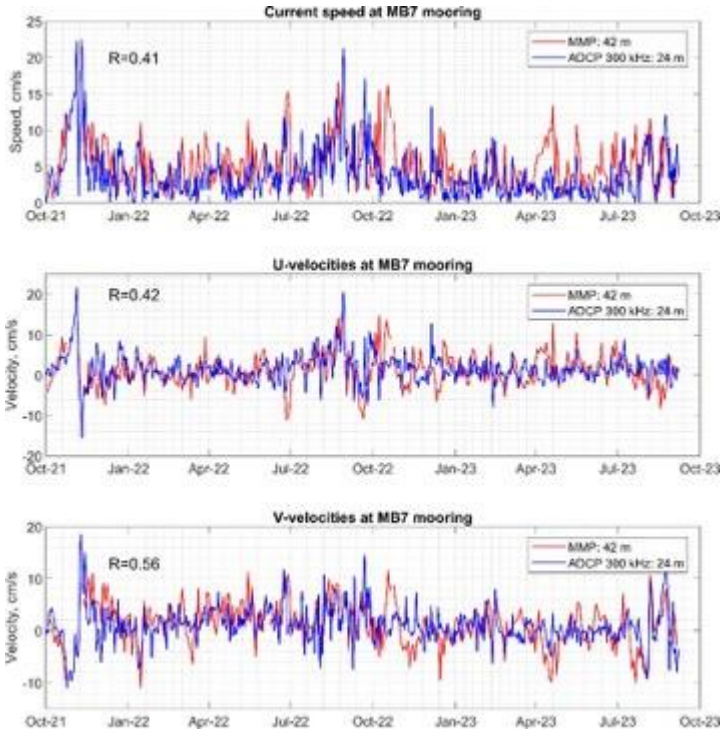


Figure I.5.1.42: Comparison of daily current speed, eastward (U), and northward (V) velocities at two nearest depth bins from ADCP 300 kHz #19033 and MMP #15207-02 deployed at mooring MB7. The correlation coefficients *R* are calculated between daily time series.

The upward-looking 300 kHz ADCP #19033 was deployed at 30 m, covering the depth range of 6-24 m with a vertical resolution of 2 m and hourly temporal resolution (**Fig. I.5.1.43**). The layer spanning from the ocean surface to 6 m was contaminated by acoustic noise generated by surface reflection and waves, and it was therefore excluded from the record. The quality flags set after the initial QA/QC routine are shown in **Fig. I.5.1.44**. The effect of surface ringing affected the quality of ADCP measurements even at

depths deeper than 6 m, so after an additional QA/QC routine, we found suspicious measurements at the 8-m depth cell, and those measurements were marked as 'bad'. Furthermore, velocity measurements from the bins at 18 and 20 meters between September 2021 and June 2022 were also excluded from the record due to unphysical vertical jumps observed in the measured ADCP velocities.

Frequency spectra computed using the 300-kHz ADCP record do not show a substantial increase in energy at high frequencies, suggesting a reasonable level of noise in the data (**Fig. I.6.2.45**). As for most of our moorings, spectral peaks were observed in the near-inertial band and at periods of approximately 6 hours suggesting an important role of non-linear tidal dynamics in the region.

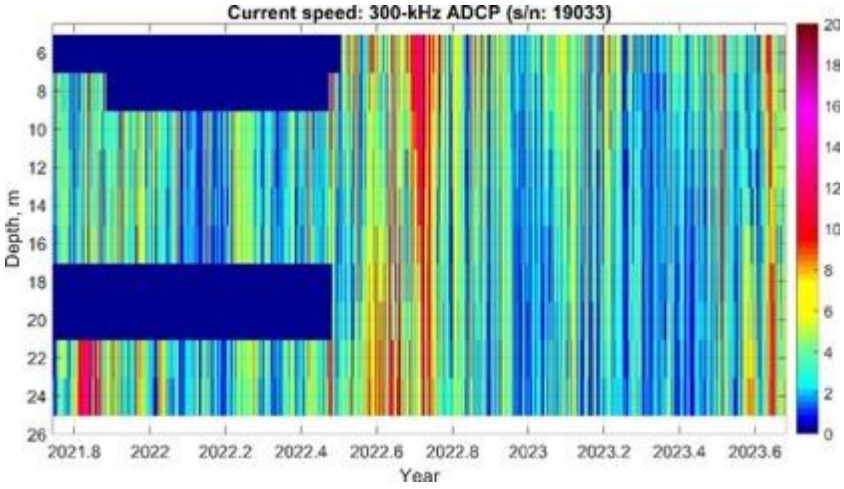


Figure I.5.1.43: Time-depth section of current speed (cm/s) from ADCP #19033 deployed at mooring MB7 in 2021-2023.

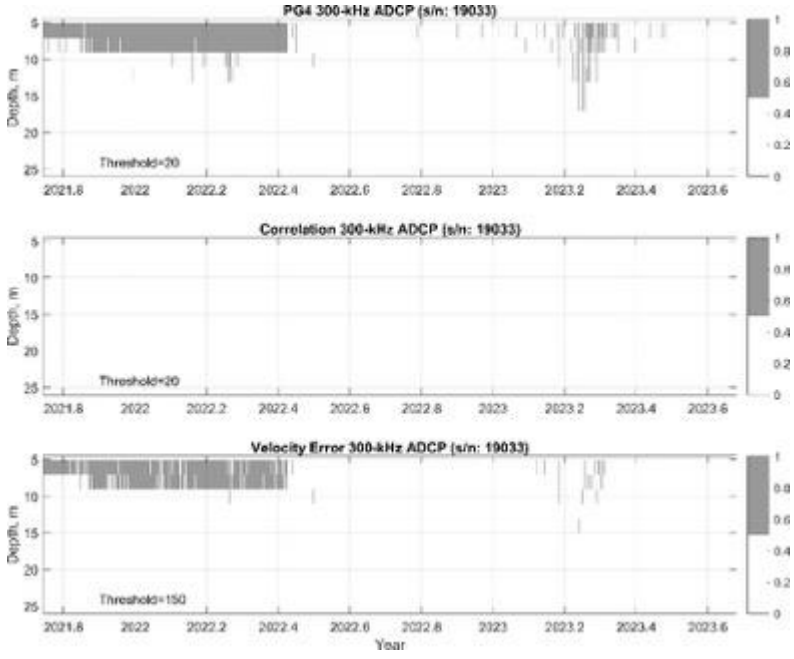


Figure I.5.1.44: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #19033 deployed at mooring MB7.

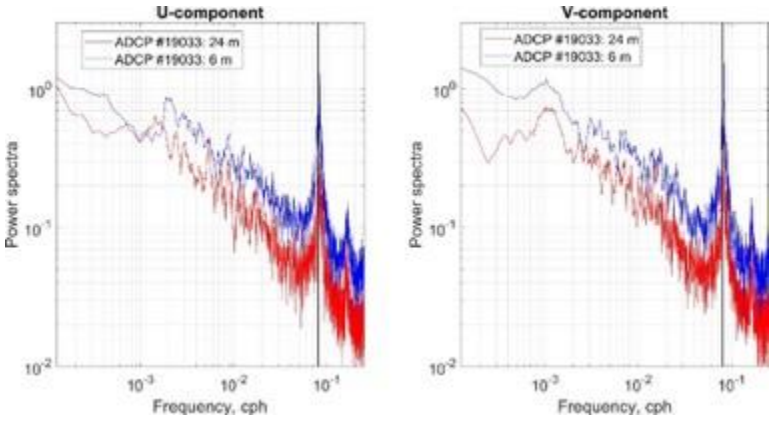


Figure I.5.1.45: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #19033 deployed at mooring MB7 in 2021-2023.

MB8 mooring: The MB8 mooring was deployed on October 6th, 2021 at 75°06.843N and 172°13.569E at a bottom depth of 143 m. The instrument setup at MB8 includes four Seabird SBE37 Microcats, RBR CTD, an upward-looking 300-kHz Teledyne ADCP, and a downward-looking 75-kHz Longranger ADCP (**Table I.5.1.5** and **Fig. A.II.7**). This mooring was successfully recovered on September 4th, 2023. All instruments provided complete two-year-long records.

Time series from the Microcats SBE37 and RBR CTD are shown in **Fig. I.5.1.46**. The temperature record from the uppermost Microcat #3380 at 30 m and RBR CTD at 18 m show a seasonal cycle with substantial heat accumulation occurred summer 2023, when water temperatures at 18 m depth rises from the freezing point to -0.7 °C. The seasonal cycle in upper ocean temperatures was accompanied by a similar pattern in salinity, with the highest salinities observed in April-May at the end of the ice growth season.

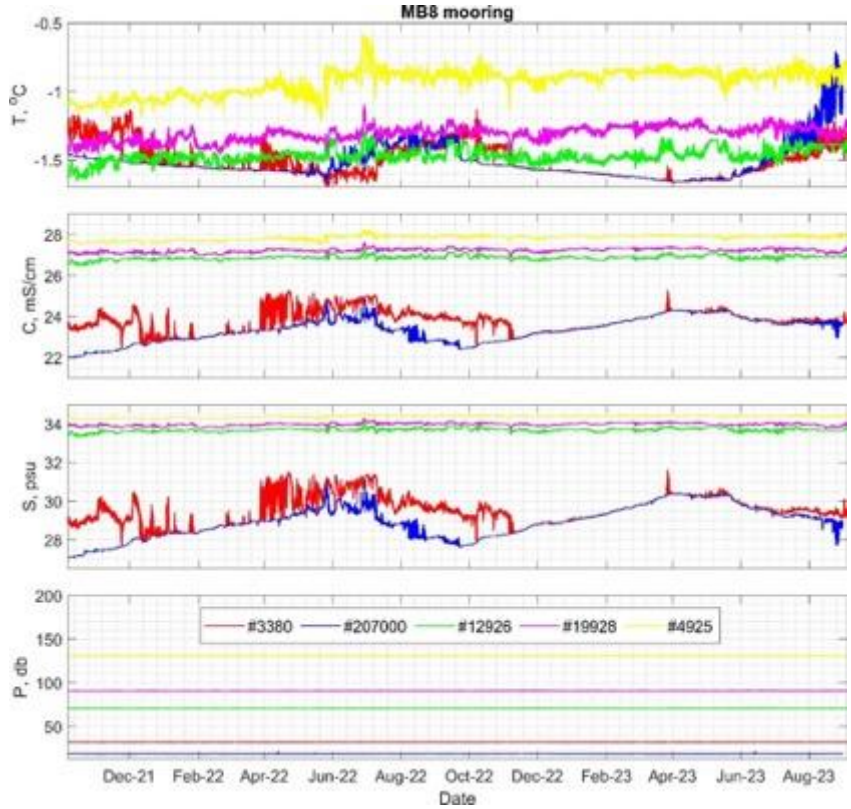


Figure I.5.1.46: Time series derived from SBE37 Microcats and RBR CTD deployed at NABOS MB8 mooring.

At this mooring, the upward-looking 300 kHz ADCP #19100 was deployed at 30 m, covering the depth range of 6-26 m with a vertical resolution of 2 m and hourly temporal resolution (**Fig. I.5.1.47**). Quality

control estimates are shown in **Fig. I.5.1.48**, indicating that approximately 91% of the raw ADCP velocity measurements are of good quality. Two ADCP's bins at 18 and 20 m had unreasonable jumps in velocities violated the dominant barotropic pattern of currents at this mooring and were removed from the record.

The downward-looking 75-kHz ADCP #19062 was deployed at 43 m, providing hourly records for the 70-130m depth range with a 10-m vertical resolution. Quality control estimates for that ADCP are shown in **Fig. I.5.1.49**, suggesting good initial quality for the record. However, further QA/QC showed that the bin around the 100-m level in September 2022 and after July 2023 contains signatures of acoustic noise and was flagged as 'bad'.

Frequency spectra computed using the 300- and 75-kHz ADCP records do not show a substantial increase in energy at high frequencies, suggesting a reasonable level of noise in the data (**Fig. I.6.2.50**). The spectrum calculated for the 75-kHz ADCP shows flatter spectral densities at frequencies higher than 0.1 cph compared to those of the 300-kHz ADCP. This flatness suggests an increased signal-to-noise ratio. Therefore, extra caution should be exercised when using the 75-kHz ADCP data for analyzing high-frequency processes.

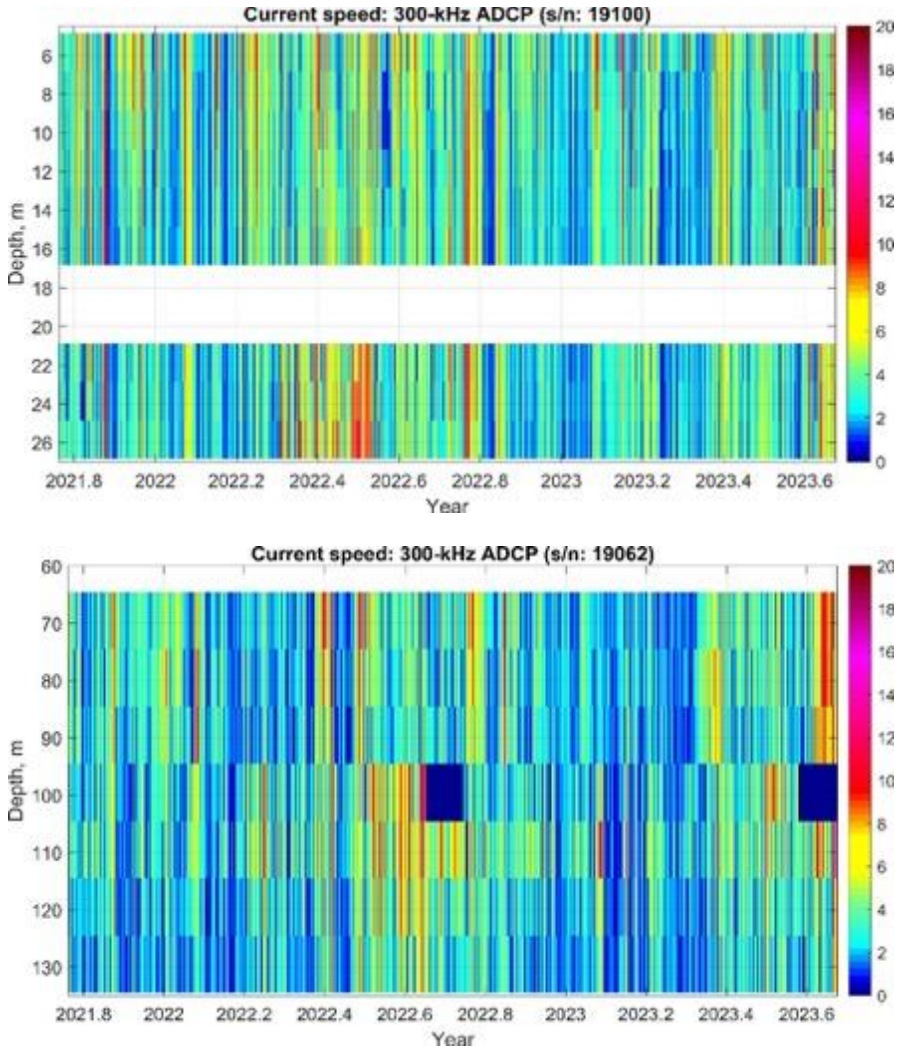


Figure I.5.1.47: Time-depth section of current speed (cm/s) from ADCP #19100 and #119062 deployed at mooring MB8 in 2021-2023.

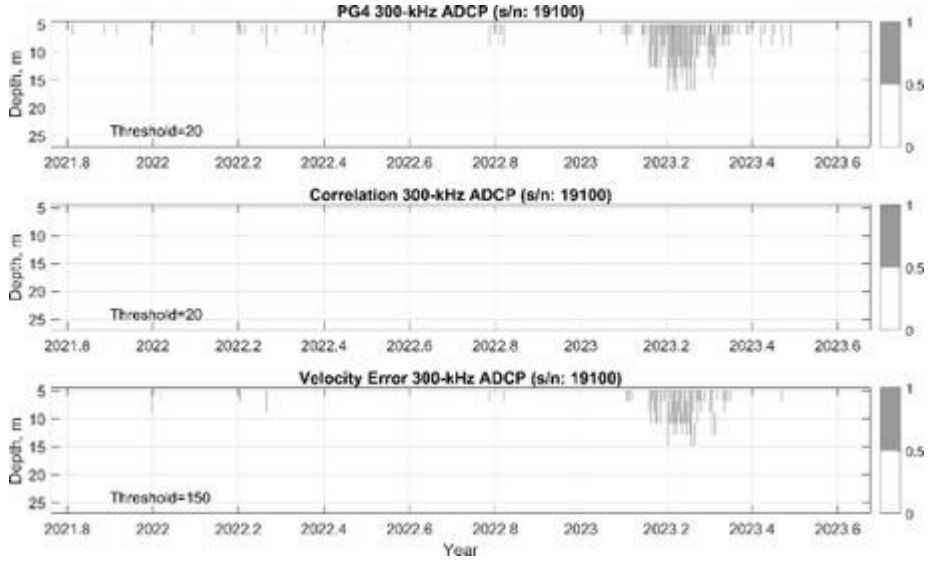


Figure I.5.1.48: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #19033 deployed at mooring MB8.

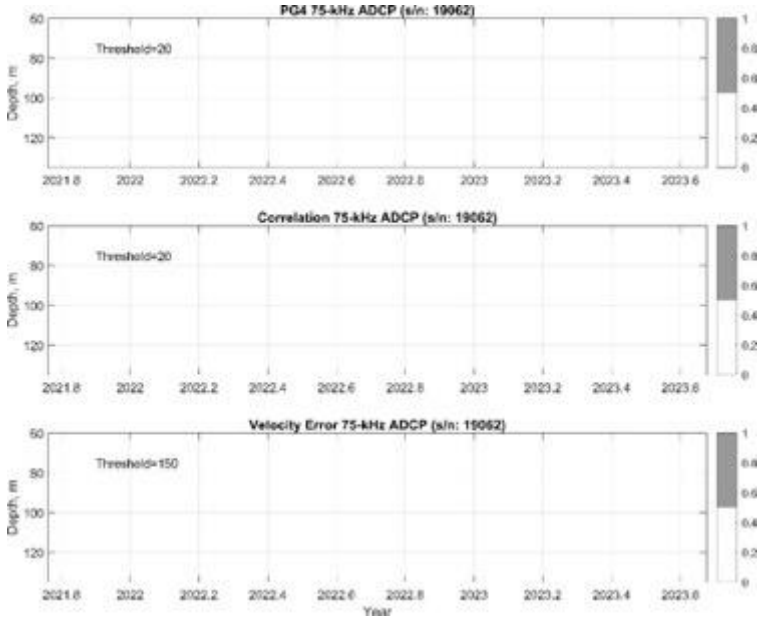


Figure I.5.1.49: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #19062 deployed at mooring MB8.

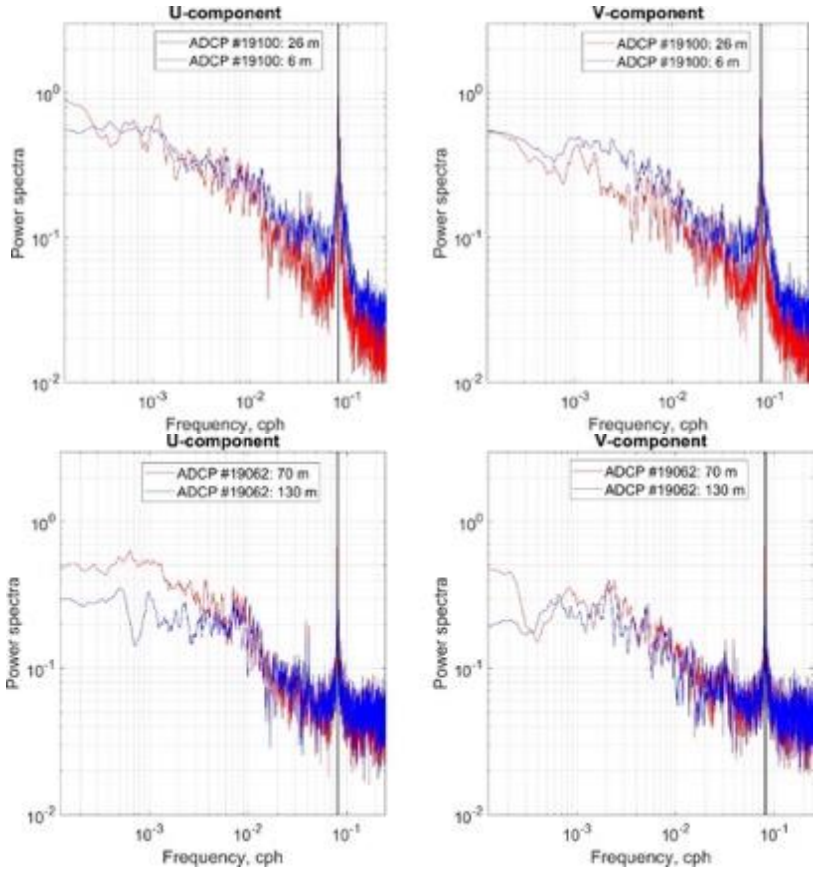


Figure I.5.1.50: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #19100 and #19062 deployed at mooring MB8 in 2021-2023.

The comparison between ADCP velocity records at this mooring from the two closest levels with observations shows similar pattern of all the series compared. This similarity is also supported by moderate (from 0.29 to 0.59) correlation coefficients calculated for velocity components and current speed (**Fig. I.5.1.49**). These moderate correlations for the velocity components and current speed suggest that the records provided by the instruments at this mooring are of good quality.

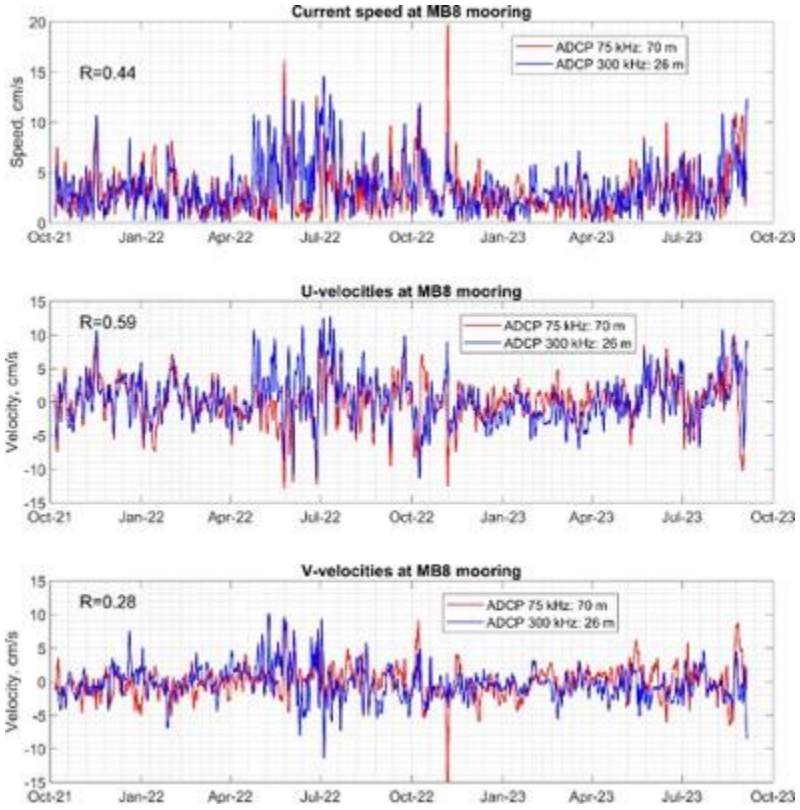


Figure I.5.1.51: Comparison of daily current speed, eastward (U), and northward (V) velocities at two nearest depth bins from ADCP 300 kHz #19100 and ADCP 75 kHz #19062 deployed at mooring MB8. The correlation coefficients *R* are calculated between daily time series.

MB9 mooring: The shallowest mooring MB9 was deployed in water on October 7th, 2021 at coordinates 73°46.963N and 167°42.842W, at a depth of 40 m. This mooring was equipped with a Seabird SBE37 Microcat, RBR CTD, and one 300-kHz Teledyne ADCP (**Table I.5.1.5** and **Fig. A.II.8**). This mooring was successfully recovered on September 3rd, 2023. All recovered instruments except the RBR CTD provided complete two-year-long records.

Time series from the Microcats SBE37 and RBR CTD are shown in **Fig. I.5.1.52**. In June 2022, the upper buoy at this mooring was damaged by ice keels, causing the RBR CTD to fall from its targeted depth at 18 m to 43 m. Unfortunately, after this incident the RBR conductivity sensor was damaged or was on the ground so that the conductivity and salinity measurements from this instrument became unreliable. The temperature record from this instrument does not include suspicious data and can be used for further analysis. The temperature records from both instruments replicate each other and show clear seasonal cycles with temperature maximum at 38 m depth of -1.2 °C observed in October-November. The winter ventilation reached the level of the deepest instrument m in February, when the temperatures dropped to the freezing point of -1.7 °C.

The upward-looking 300 kHz ADCP #19292 was deployed at a depth of 33 meters, covering the range from 3 to 29 meters with a vertical resolution of 2 meters and hourly temporal resolution (**Fig. I.5.1.53**). The quality flags set after the initial QA/QC routine are shown in **Fig. I.5.1.54**. The effect of surface ringing and waves was not strong, resulting in approximately 96% of the raw ADCP velocity measurements being of good quality. The ADCP velocity record exhibits some signatures of a seasonal cycle, with stronger currents observed during the summer period of each year. The vertical structure of the currents was nearly barotropic, as evidenced by the vertical stripes in the current speed record.

Frequency spectra computed using the 300-kHz ADCP record do not show a substantial increase in energy at high frequencies, indicating a reasonable level of noise in the data (**Fig. I.6.2.55**). Spectral peaks for both velocity components were observed in the near-inertial band. However, unlike most of our moorings, the second peak at a period of around 6 hours was not evident in the spectra.

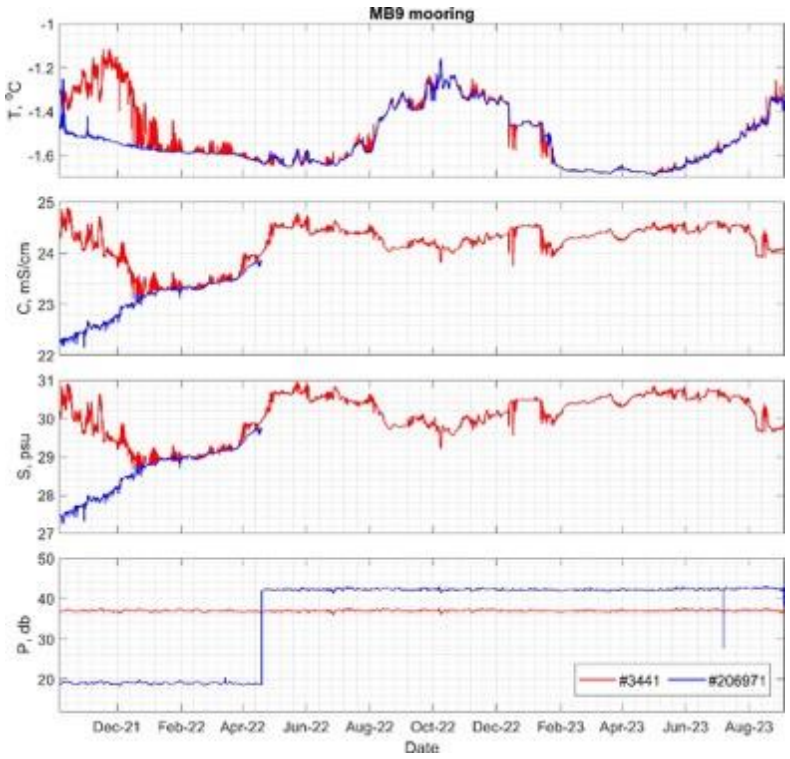


Figure I.5.1.52: Time series derived from SBE37 Microcat and RBR CTD deployed at NABOS MB9 mooring.

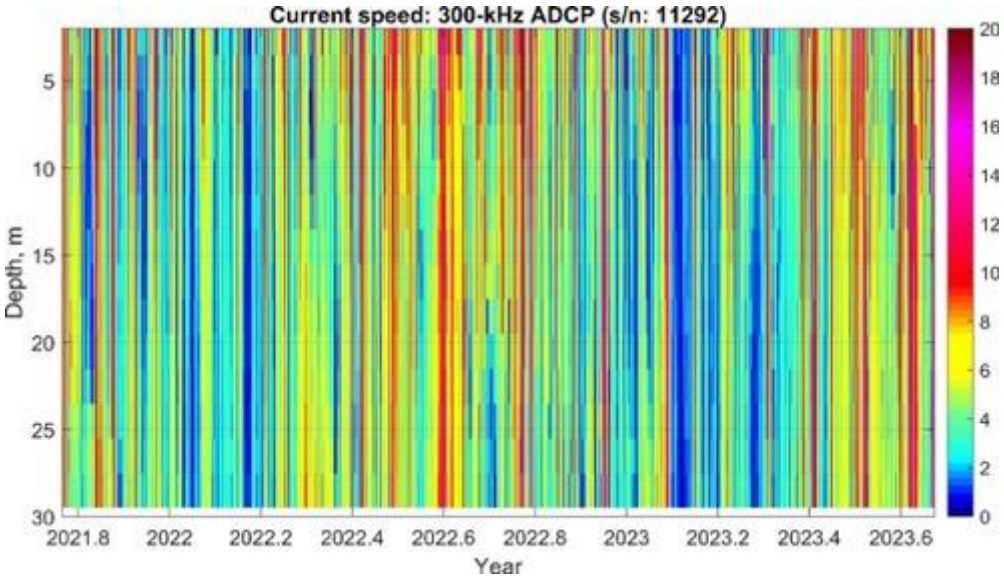


Figure I.5.1.53: Time-depth section of current speed (cm/s) from ADCP #11292 deployed at mooring MB9 in 2021-2023.

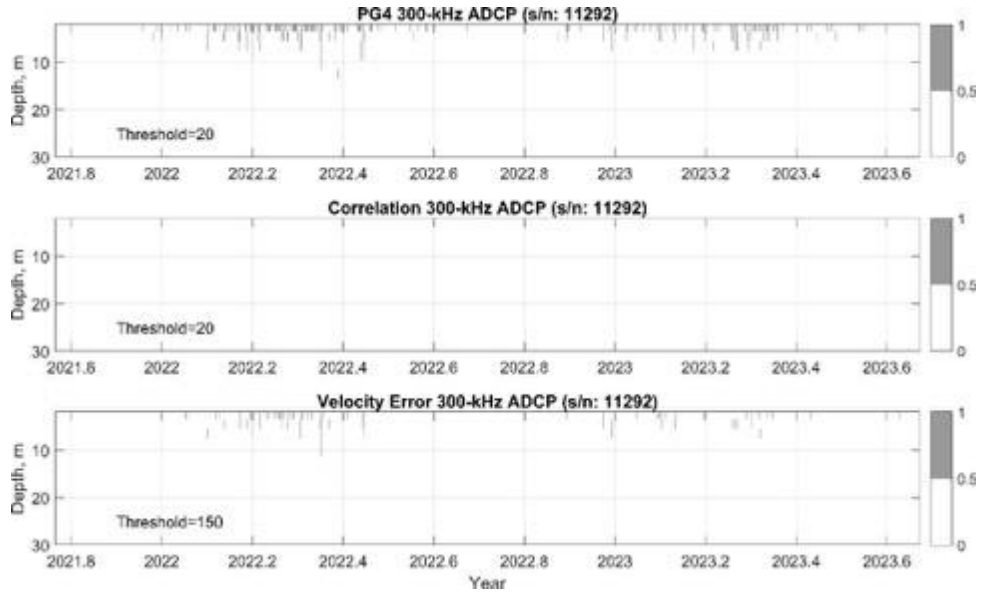


Figure I.5.1.54: Quality masks (0 and 1 were used for good and bad data, respectively) from ADCP #11292 deployed at mooring MB9.

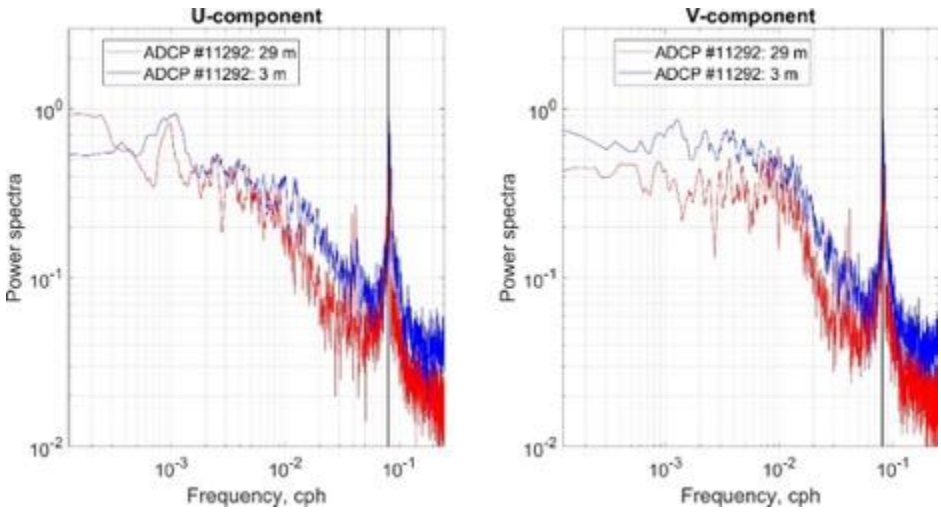


Figure I.5.1.55: Power spectra of the eastward (U) and northward (V) components of current velocity from ADCP #19292 deployed at mooring MB9 in 2021-2023.

I.5.1.2.3. Mooring deployments

Nine moorings were deployed during the NABOS 2023 cruise (**Table I.5.1.3**). Mooring schematics are in Appendix III, **Figs. A.III.1-9.** Logs for moorings deployed in 2023 are placed in Appendix V. To ensure the correct targeted depth for mooring deployment, depth surveys were conducted along two perpendicular ship tracks prior to each deploying at the deep mooring sites. These depth surveys utilized a multibeam acoustic sonar installed onboard the *Healy*. Simultaneously, the bottom depth at the mooring CTD station was measured using pressure and altimeter sensors installed on the CTD rosette when it approached the seafloor. Comparing these measurements provided corrections used for observations at other points where only sonar data were available. These surveys proved invaluable for accurate mooring deployments, crucial for our observations in the very top ocean layer (e.g., our thermistor strings target a depth range of 30-15m).

After several mooring recoveries, we discovered that the upper mooring buoys deployed in 2021 were damaged by ice keels. As a safety precaution for the instruments, we decided to deploy our thermistor chains 5 meters deeper, at approximately 20 meters depth.

Table I.5.1.3: Summary of deep-water mooring deployments in 2023

M00RING	Date	Operation	Lat./Long.	Depth	Instruments
M1-4e	21 September, 2023	Deployment	78° 30.039 N 126° 00.741 E	2698m	1 x SBE-37 1 x ADCP 300 kHz 1 x Therm Array 1 x MMP
MB2	19 September, 2023	Deployment	79° 44.359 N 137° 50.384 E	2779m	7 x SBE37 6 x SBE56 1 x ADCP 300khz 1 x ADCP75khz 1 x Nortek Signature 250 ADCP
MB3	18 September, 2023	Deployment	79° 56.183 N 142° 12.950 E	1370m	6 x SBE37 6 x SBE56 5 x ADCP 300khz 1 x McLane High Volume PPS 1 x Therm Array
MB4	16 September, 2023	Deployment	80° 25.360 N 147° 31.958 E	1819m	6 x SBE37 6 x SBE56 5 x ADCP 300khz 1 x Therm Array
MB5	15 September, 2023	Deployment	80° 38.372 N 161° 00.770 E	2783m	1 x SBE37 1 x ADCP 300khz 1 x MMP 1 x RBR quartz3 BPR 1 x Therm Array
MB6	12 September, 2023	Deployment	79° 00.505 N 173° 44.548 E	2528m	1 x SBE37 1 x MMP 1 x McLane High Volume PPS 1 x Nortek Signature 250 ADCP
MB7	06 September, 2023	Deployment	76° 36.716 N 179° 46.809 W	1156m	1 x SBE37 1 x ADCP 300khz 1 x MMP 1 x Therm Array
MB8	4 September, 2023	Deployment	75° 06.806 N 172° 13.593 W	145m	4 x SBE37 3 x ADCP 300khz 1 x Therm Array
MB9	3 September, 2023	Deployment	73° 46.960 N	43m	1 x SBE37 1 x ADCP 300 kHz

			167° 42.936 E		1 x Therm Array 1 x CH4 Sensor

I.5.2. Data availability

All data collected during the cruise will be checked thoroughly for errors and will be archived online with accompanying metadata detailing any chemical analysis, data post-processing, and/or analyses at the NSF Arctic Data Center (https://arcticdata.io/), a repository for data collected during research projects funded by the National Science Foundation under the Arctic Observing Network program. Data sets will also be archived on the project website (http://nabos.iarc.uaf.edu/data/registered/main.php).

Acknowledgments

The U.S. part of the progect was funded by the Arctic Oberving Network Program of the National Science Foundation (NSF), grants #1724523 and 2135600. The successful recovery and deployment of our moorings was a great team effort by all onboard the USCGC *Healy*. Many thanks to all who helped achieve such great scientific results.

APPENDIX I: List of NABOS-2023 CTD stations

#	Latitude [deg. N]	Longitude [deg. E]	Year	Month	Day	Hour [UTC]	Minutes	CTD file name
1	75.44583	188.307	2023	9	1	21	9	HLY2302_Station0_Cast1.cnv
2	73.8025	167.88683	2023	9	3	17	39	HLY2302_Station1_Cast1.cnv
3	74.12333	168.7615	2023	9	4	1	50	HLY2302_Station2_Cast1.cnv
4	74.46083	169.875	2023	9	4	6	0	HLY2302_Station3_Cast1.cnv
5	74.78717	171.02417	2023	9	4	10	2	HLY2302_Station4_Cast1.cnv
6	75.1075	172.1895	2023	9	4	14	37	HLY2302_Station5_Cast1.cnv
7	75.4405	173.70633	2023	9	5	1	59	HLY2302_Station6_Cast1.cnv
8	75.43733	173.7055	2023	9	5	3	46	HLY2302_Station6_Cast2.cnv
9	75.7425	175.2615	2023	9	5	8	11	HLY2302_Station7_Cast1.cnv
10	76.04483	176.873	2023	9	5	14	27	HLY2302_Station8_Cast1.cnv
11	76.329	178.548	2023	9	5	21	16	HLY2302_Station9_Cast3.cnv
12	76.6015	180.23217	2023	9	6	3	31	HLY2302_Station10_Cast1.cnv
13	77.01	182.01083	2023	9	7	4	52	HLY2302_Station11_Cast1.cnv
14	77.77983	185.65083	2023	9	7	21	39	HLY2302_Station13_Cast1.cnv
15	78.4975	189.88267	2023	9	8	12	36	HLY2302_Station15_Cast1.cnv
16	78.14133	187.7255	2023	9	8	23	38	HLY2302_Station14_Cast1.cnv
17	77.09067	179.2125	2023	9	9	20	11	HLY2302_Station16_Cast1.cnv
18	77.483	178.261	2023	9	10	2	3	HLY2302_Station17_Cast1.cnv
19	77.86667	177.2645	2023	9	10	7	18	HLY2302_Station18_Cast1.cnv
20	78.6245	175.0295	2023	9	10	16	46	HLY2302_Station20_Cast1.cnv
21	78.99383	173.82417	2023	9	10	21	28	HLY2302_Station21_Cast1.cnv
22	78.99067	173.79567	2023	9	10	23	25	HLY2302_Station21_Cast2.cnv
23	79.35967	171.55117	2023	9	12	5	38	HLY2302_Station22_Cast1.cnv
24	79.7205	169.16683	2023	9	13	3	58	HLY2302_Station23_Cast1.cnv
25	80.365	163.926	2023	9	13	14	19	HLY2302_Station25_Cast1.cnv
26	80.6515	161.19783	2023	9	14	17	26	HLY2302_Station26_Cast1.cnv
27	80.4085	147.50033	2023	9	17	2	55	HLY2302_Station30_Cast1.cnv
28	80.19183	144.89717	2023	9	17	9	12	HLY2302_Station31_Cast1.cnv
29	79.945	142.27783	2023	9	18	0	30	HLY2302_Station32_Cast2.cnv
30	79.746	137.88383	2023	9	18	22	25	HLY2302_Station34_Cast1.cnv
31	79.22317	130.0705	2023	9	20	1	47	HLY2302_Station37_Cast1.cnv
32	78.6835	126.587	2023	9	20	13	42	HLY2302_Station38_Cast1.cnv
33	78.5085	125.95217	2023	9	21	2	17	HLY2302_Station39_Cast1.cnv
34	79.09383	125.80283	2023	9	21	17	20	HLY2302_Station40_Cast1.cnv
35	79.65517	125.96533	2023	9	22	1	6	HLY2302_Station41_Cast1.cnv
36	80.244	125.93883	2023	9	22	9	17	HLY2302_Station42_Cast1.cnv
37	80.81467	125.90367	2023	9	22	16	10	HLY2302_Station43_Cast1.cnv
38	81.384	125.97383	2023	9	22	23	28	HLY2302_Station44_Cast1.cnv
39	81.9825	125.931	2023	9	23	7	35	HLY2302_Station45_Cast1.cnv

APPENDIX II: Schematics of mooring recovered in 2023

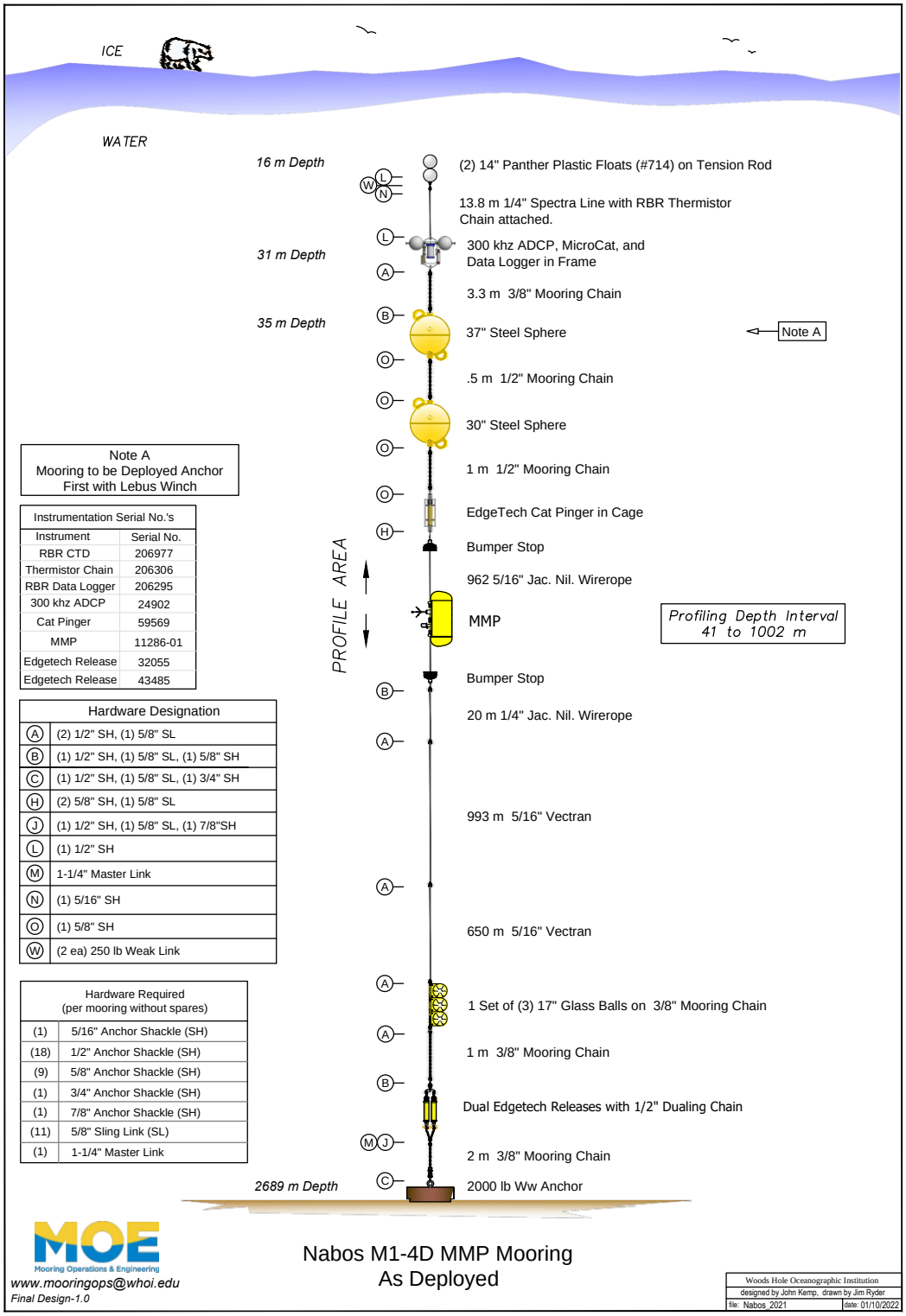


Figure A.II.1. Recovered NABOS M1-4d (2021-2023) mooring schematic.

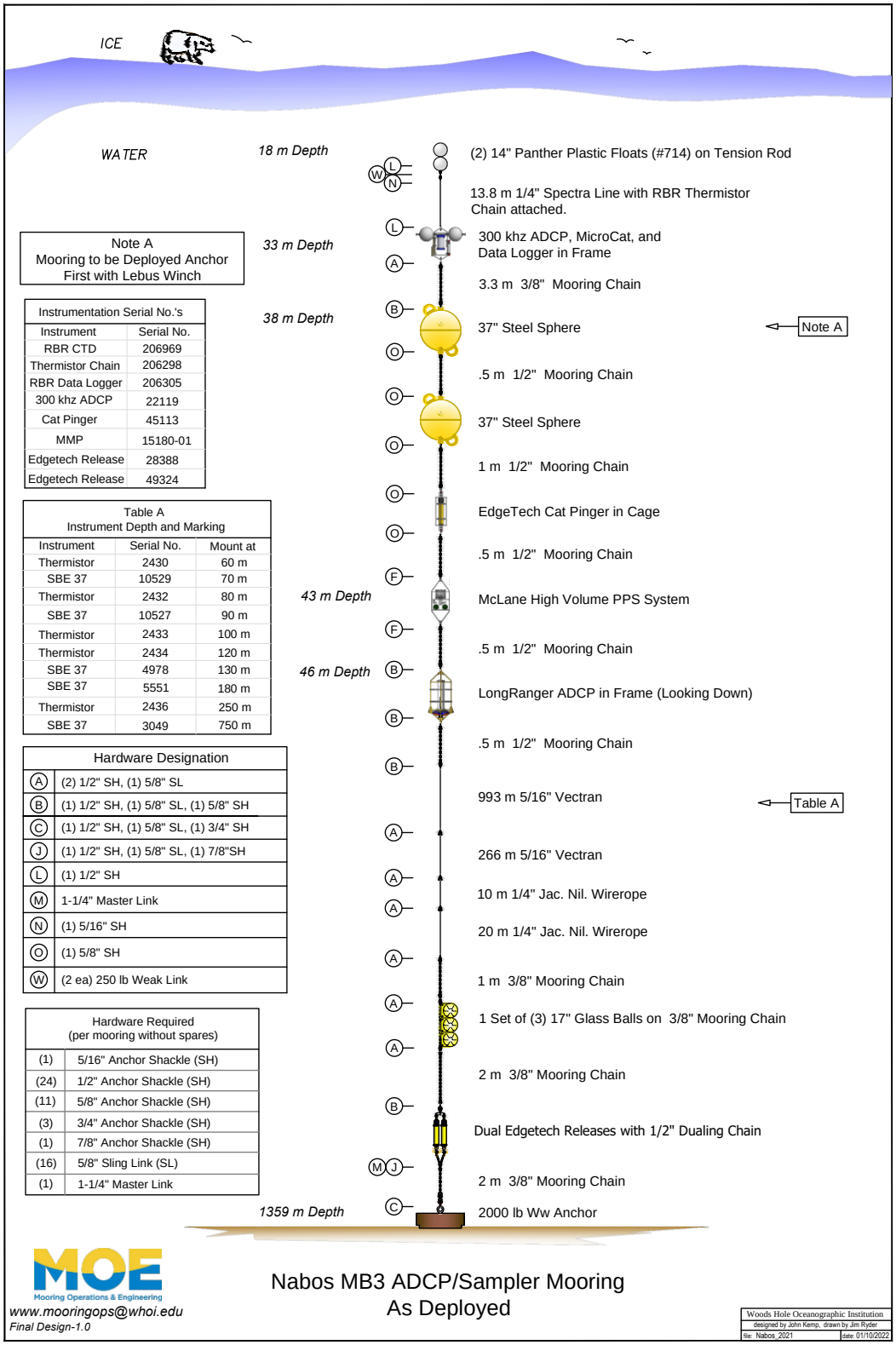


Figure A.II.2. Recovered NABOS MB3 (2021-2023) mooring schematic.

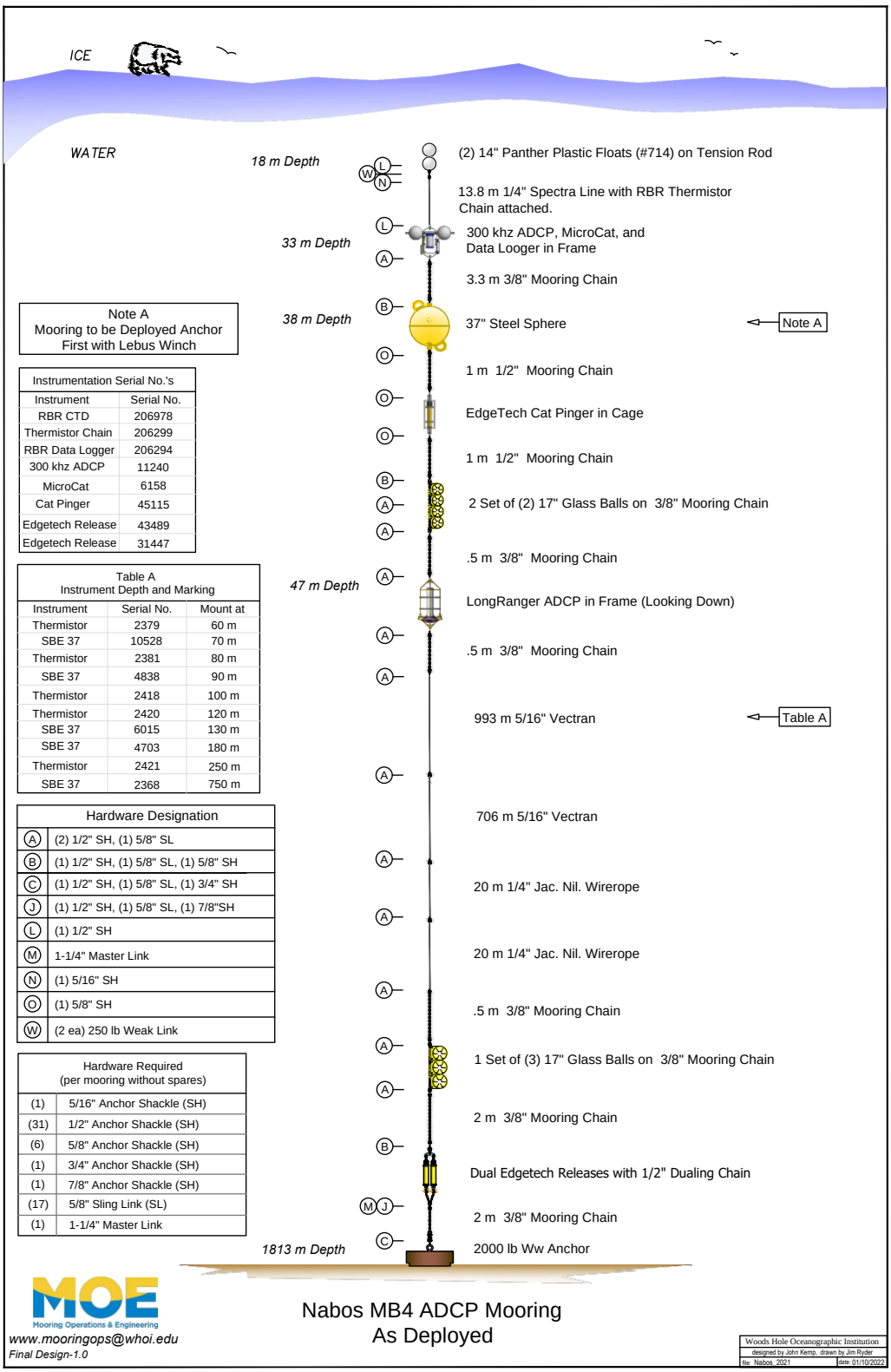


Figure A.II.3. Recovered NABOS MB4 (2021-2023) mooring schematic.

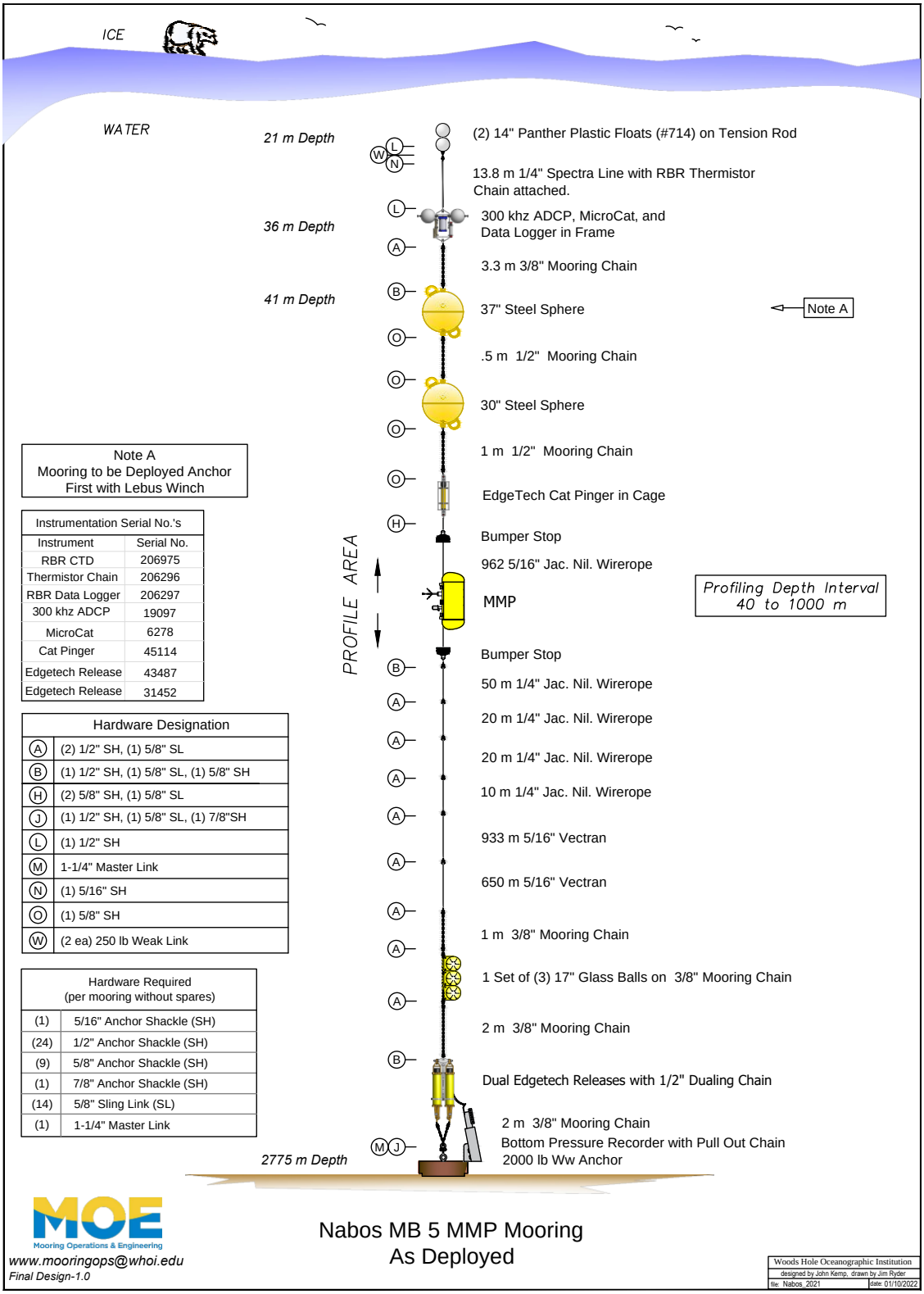


Figure A.II.4. Recovered NABOS MB5 (2021-2023) mooring schematic

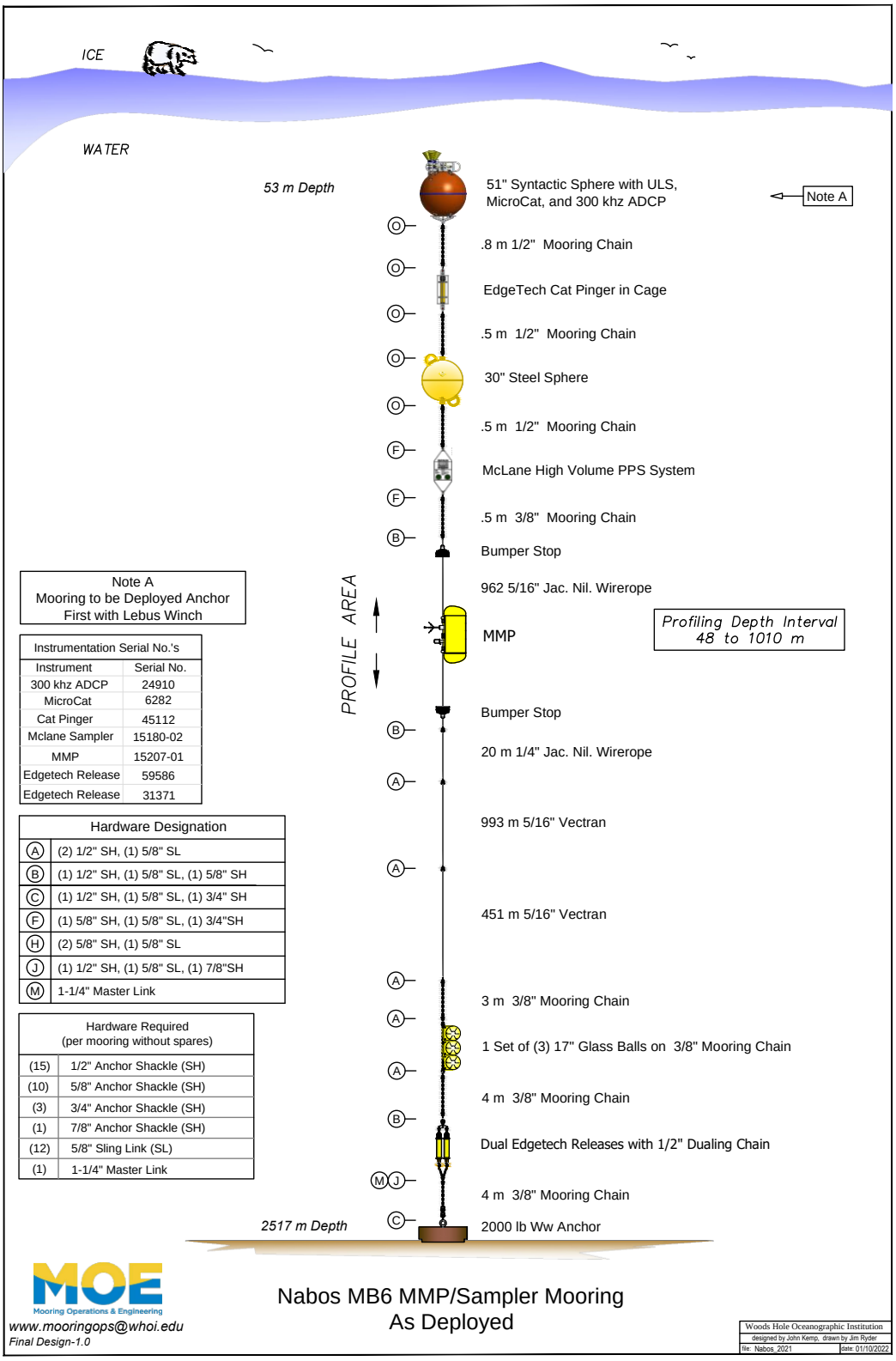


Figure A.II.5. Recovered NABOS MB6 (2021-2023) mooring schematic

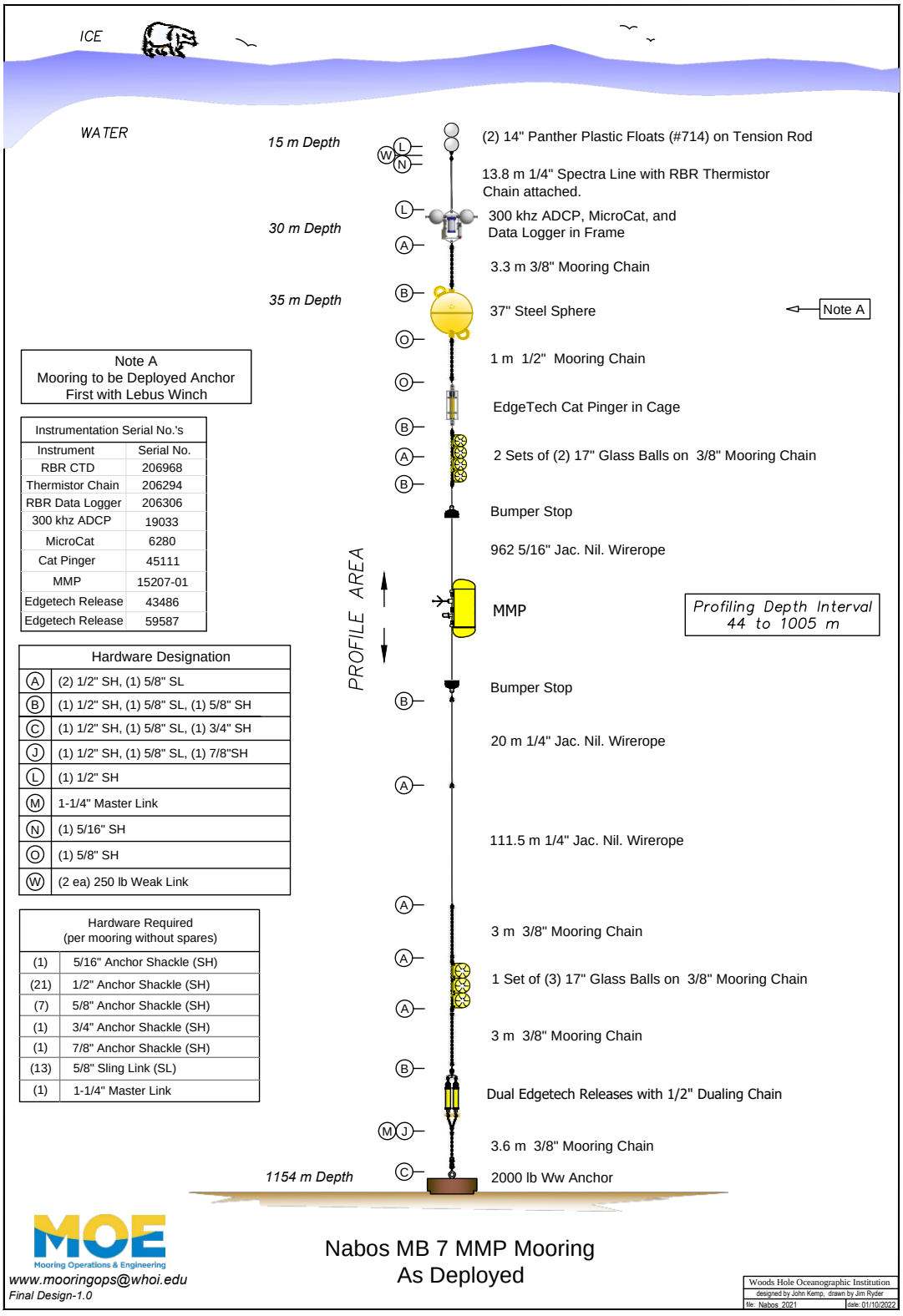


Figure A.II.5. Recovered NABOS MB7 (2021-2023) mooring schematic

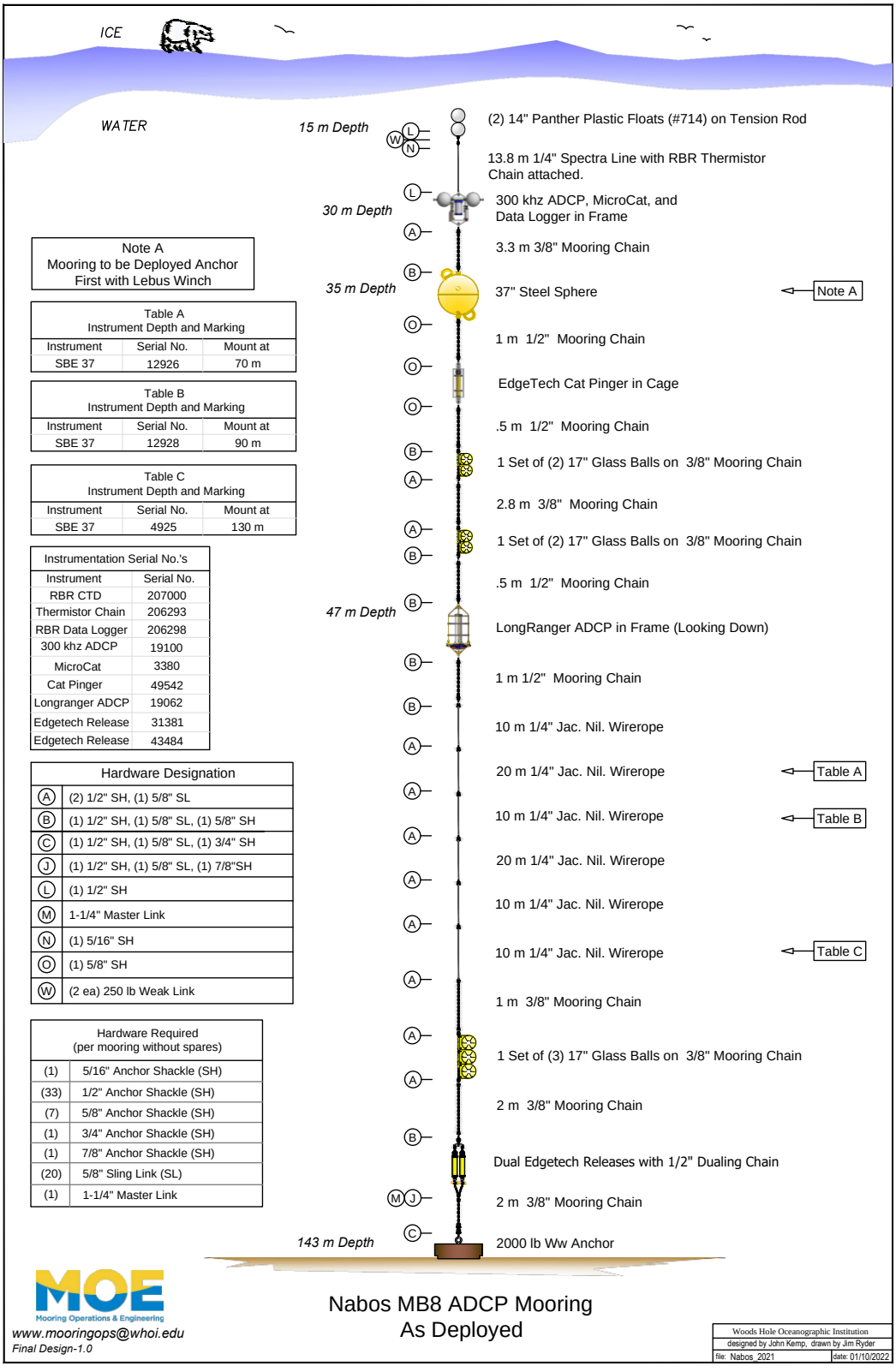


Figure A.II.7. Recovered NABOS MB8 (2021-2023) mooring schematic

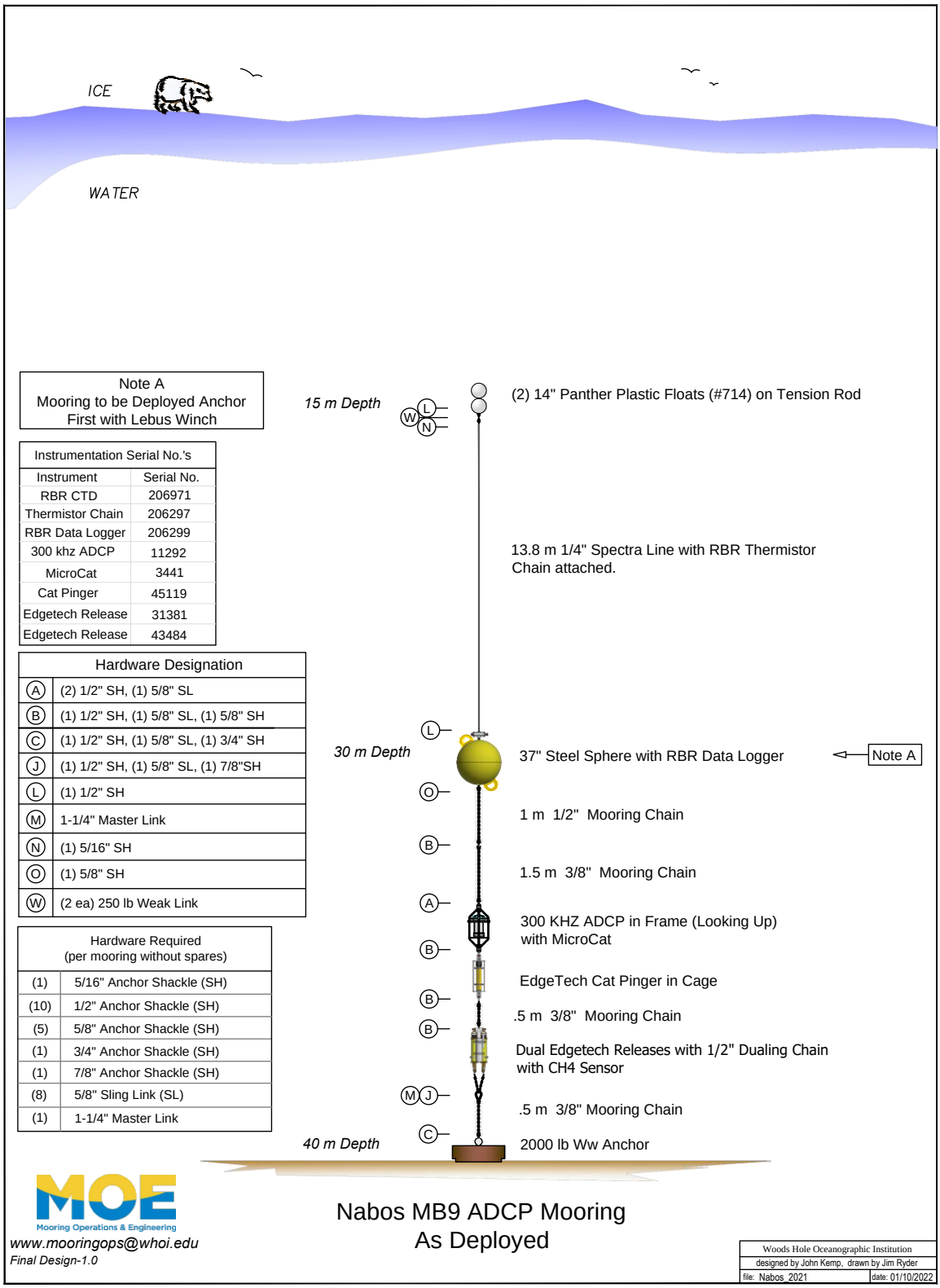


Figure A.II.8. Recovered NABOS MB9 (2021-2023) mooring schematic

APPENDIX III: Schematics of mooring deployed in 2021

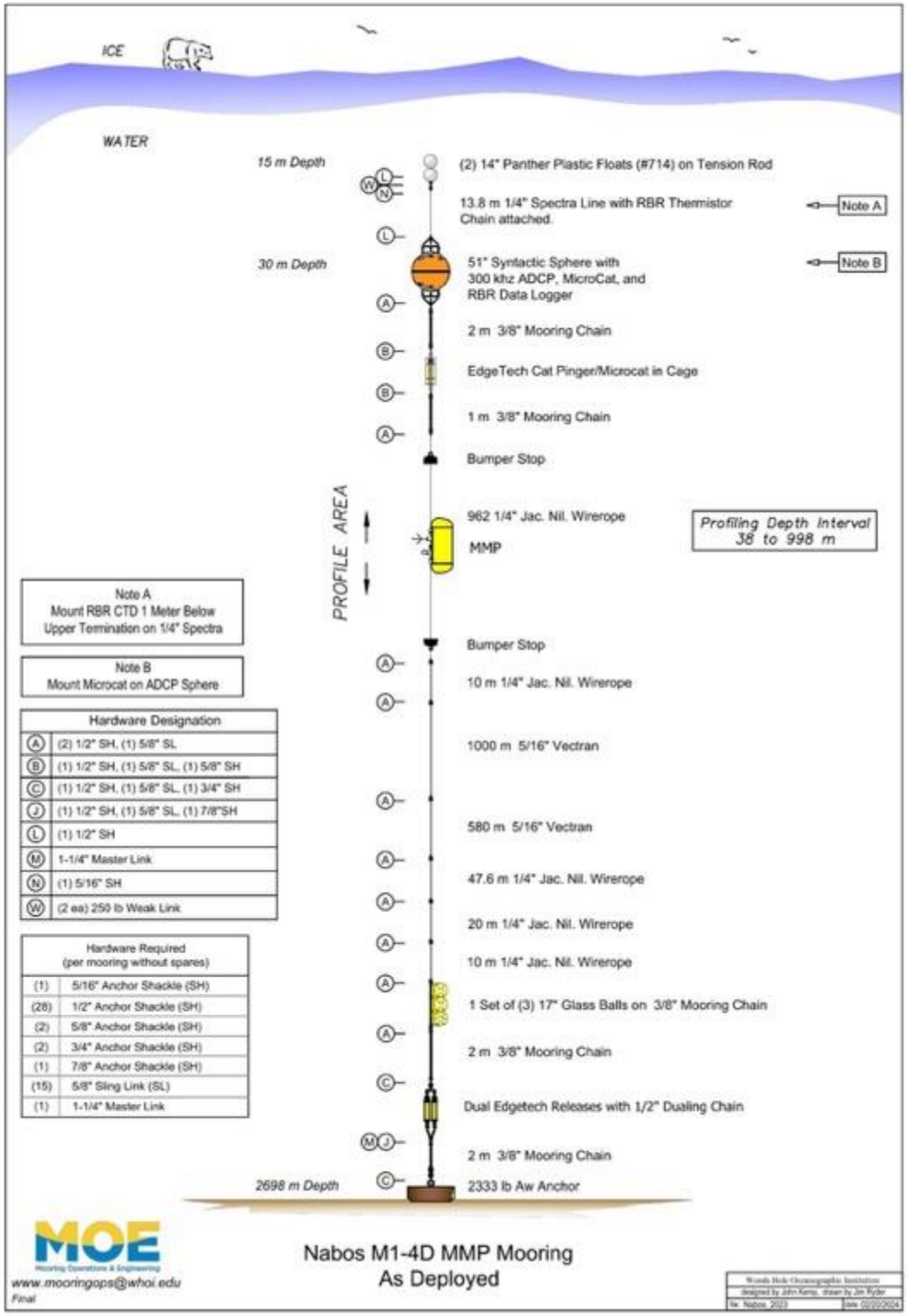


Figure A.III.1. NABOS M1-4d mooring schematic.

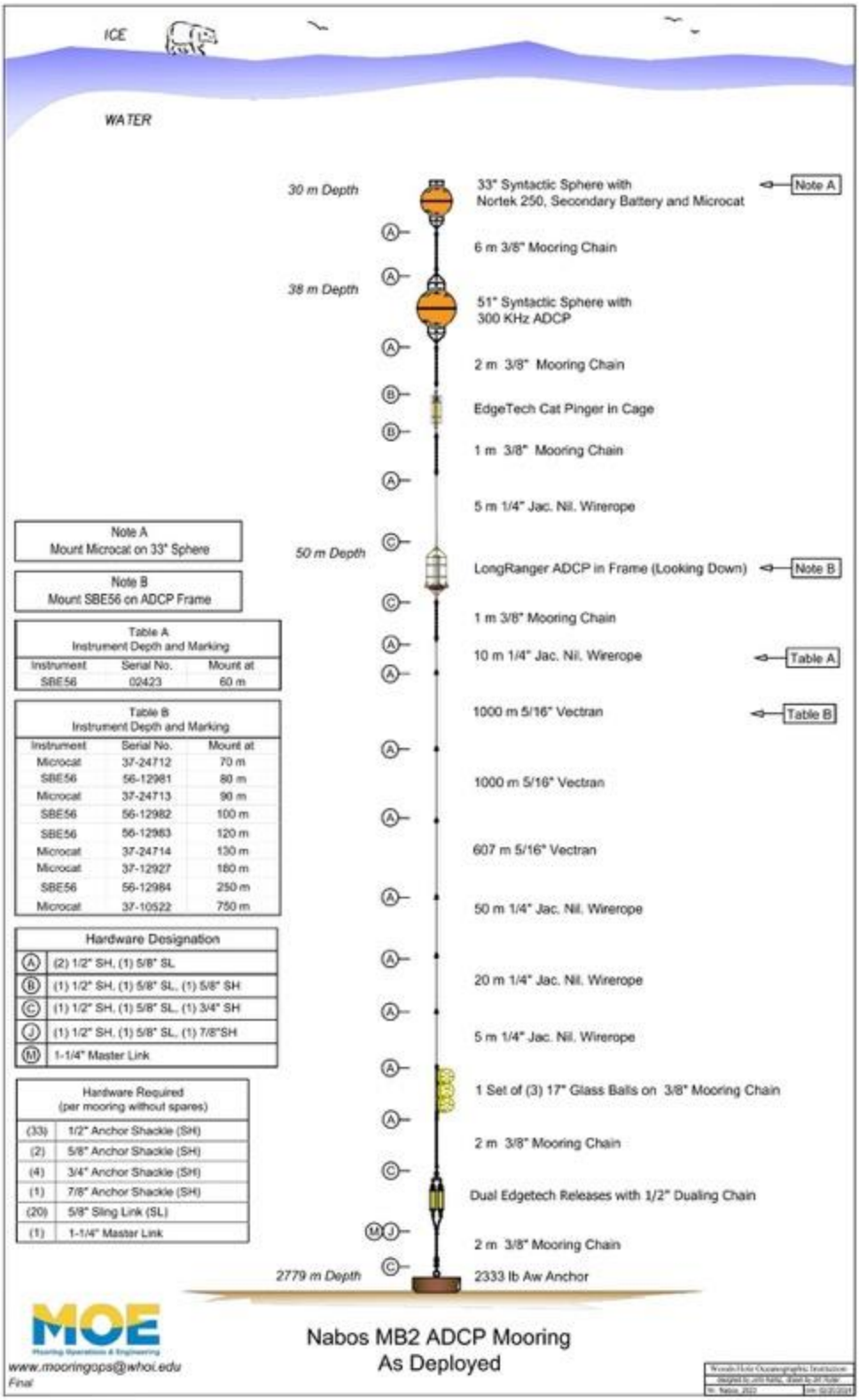


Figure A.III.2. NABOS MB2 mooring schematic.

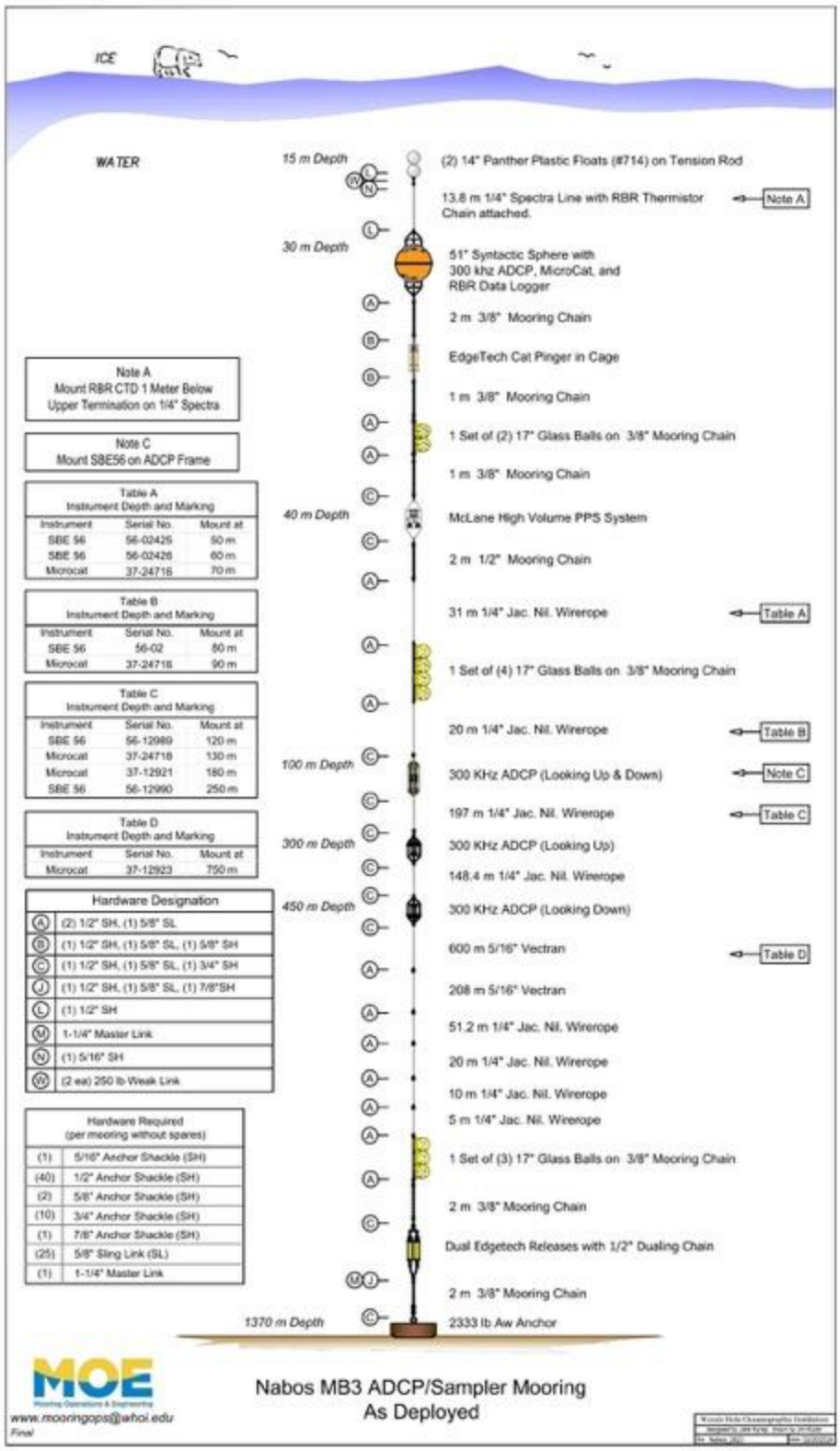


Figure A.III.3. NABOS MB3 mooring schematic.

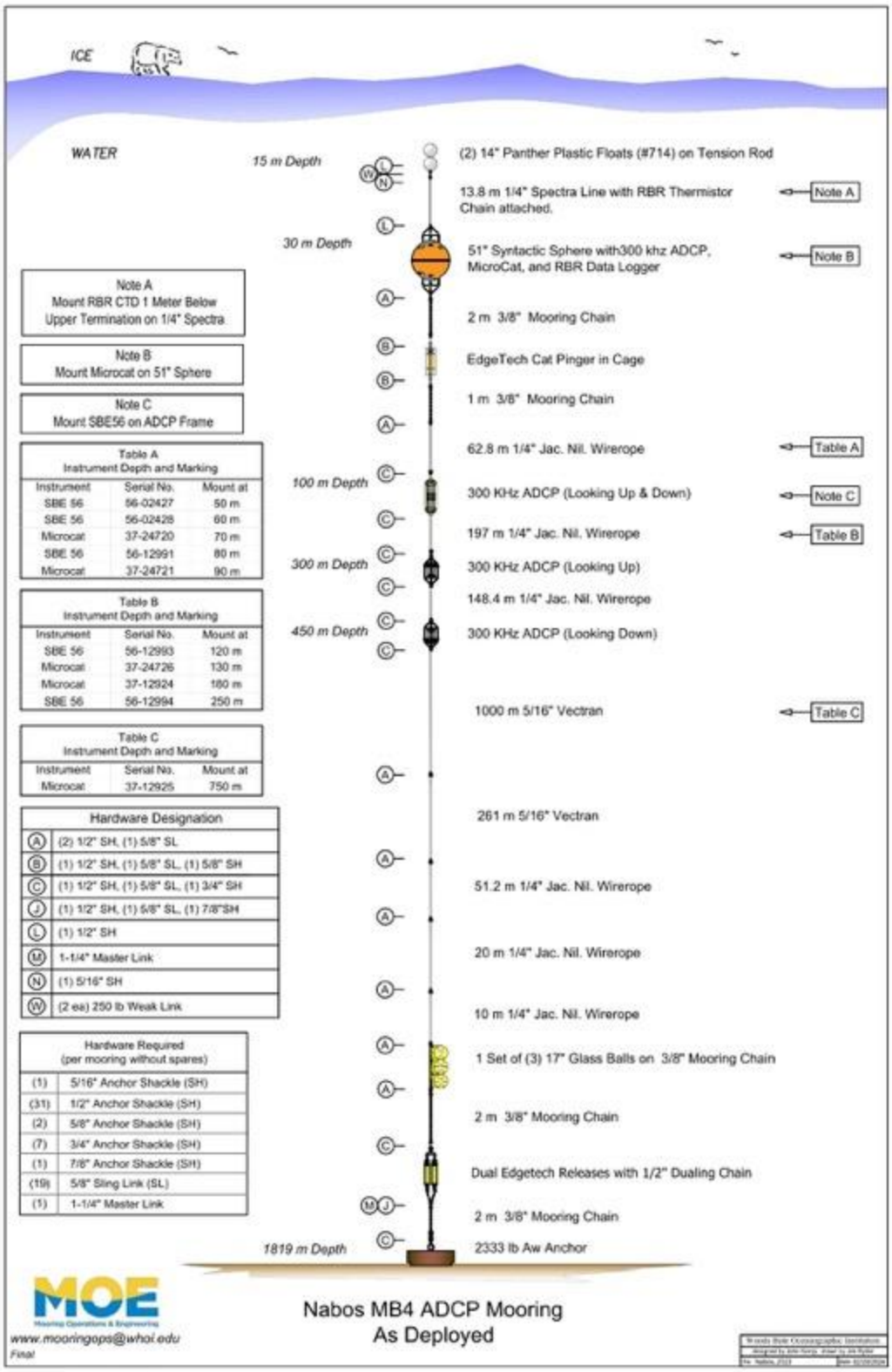


Figure A.III.4. NABOS MB4 mooring schematic.

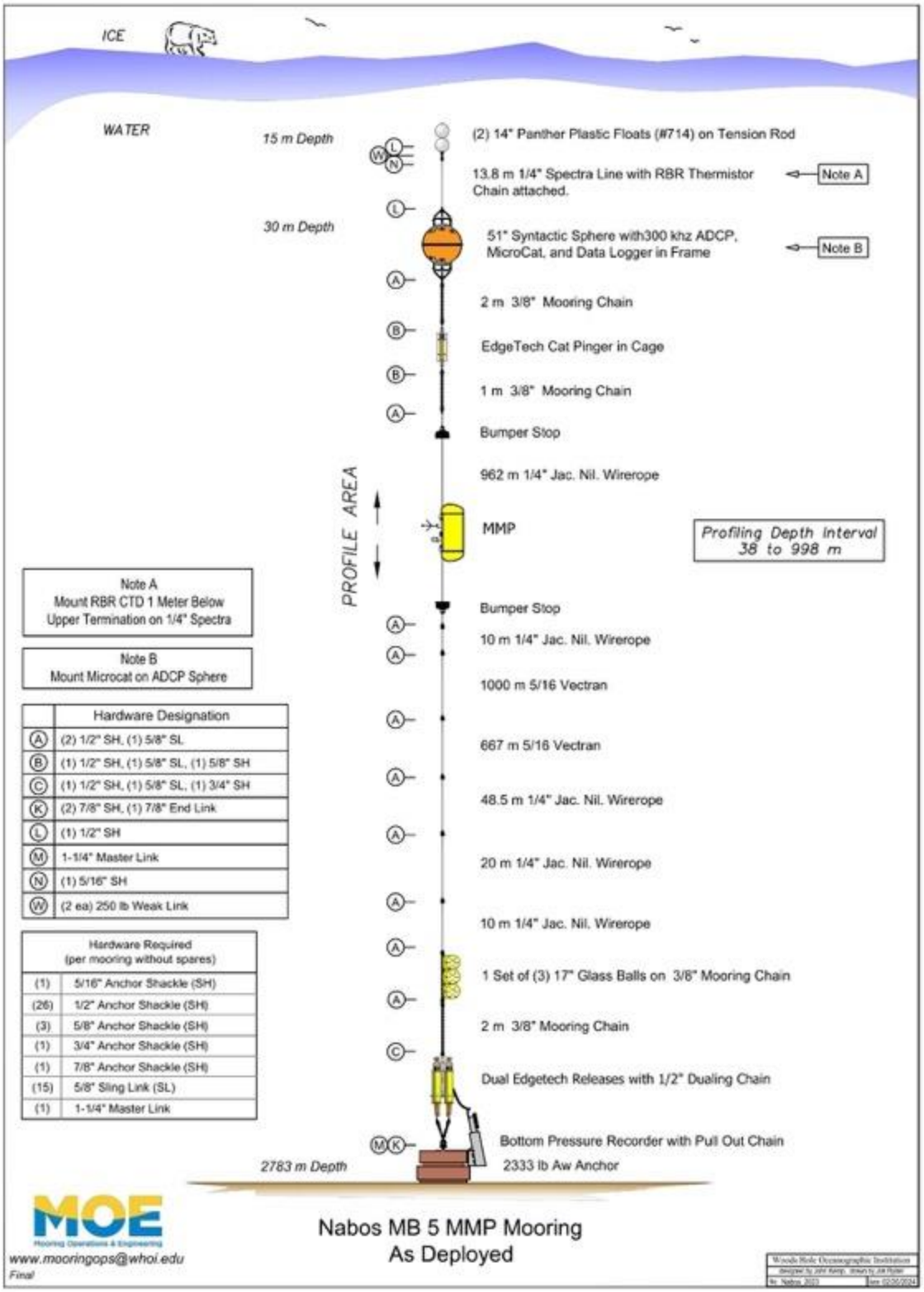


Figure A.III.5. NABOS MB5 mooring schematic.

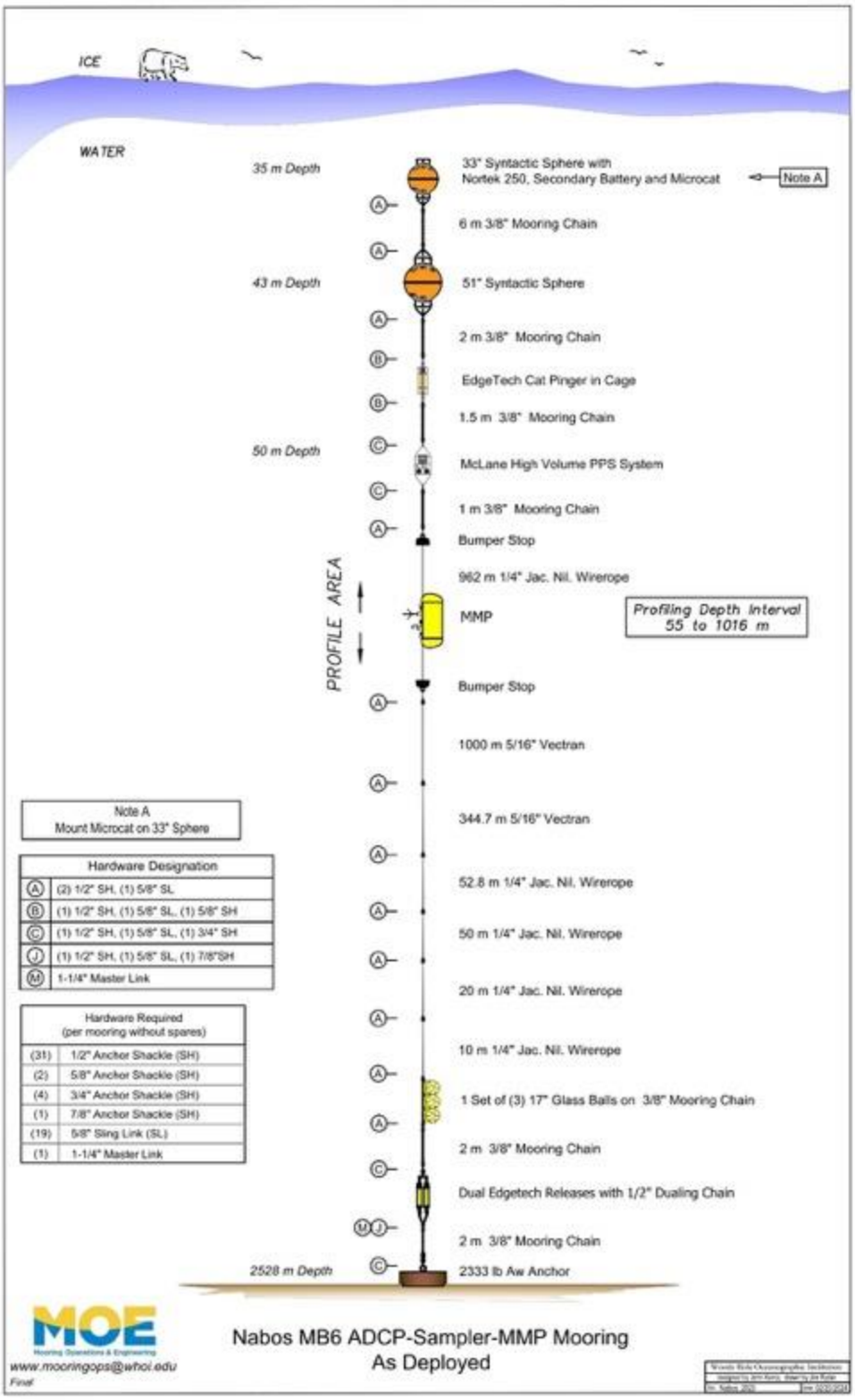


Figure A.III.5. NABOS MB6 mooring schematic.

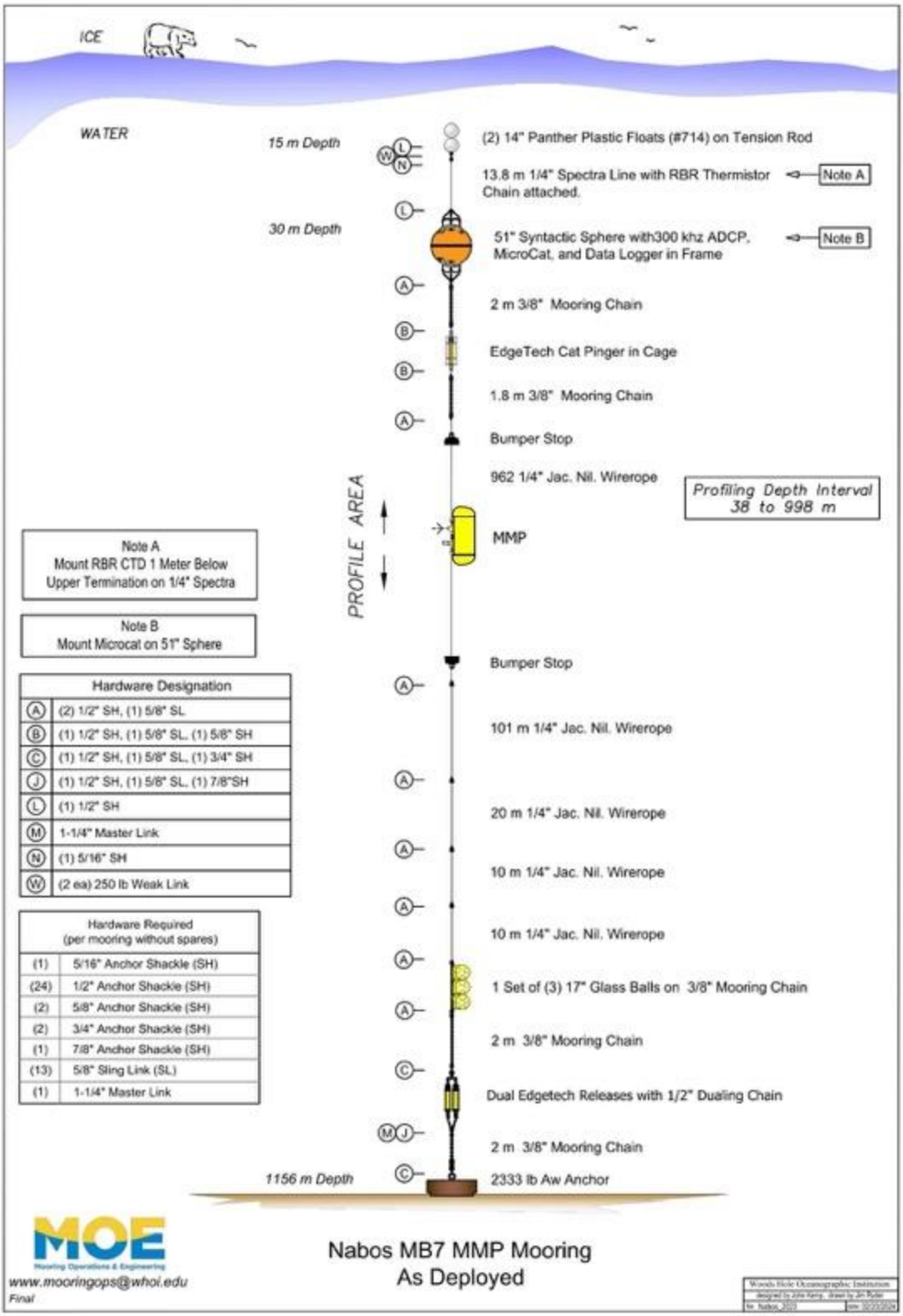


Figure A.III.7. NABOS MB7 mooring schematic.

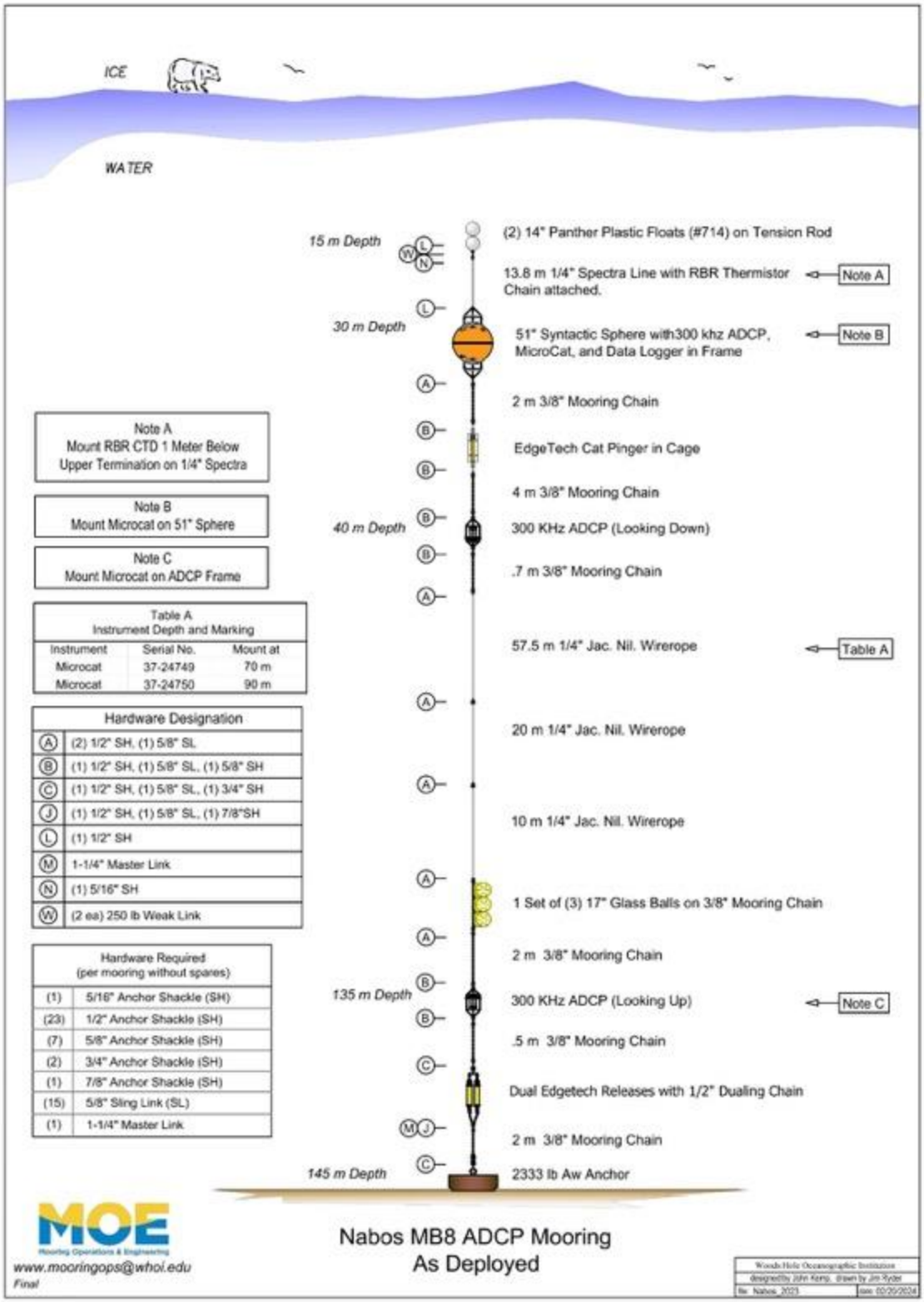


Figure A.III.8. NABOS MB8 mooring schematic.

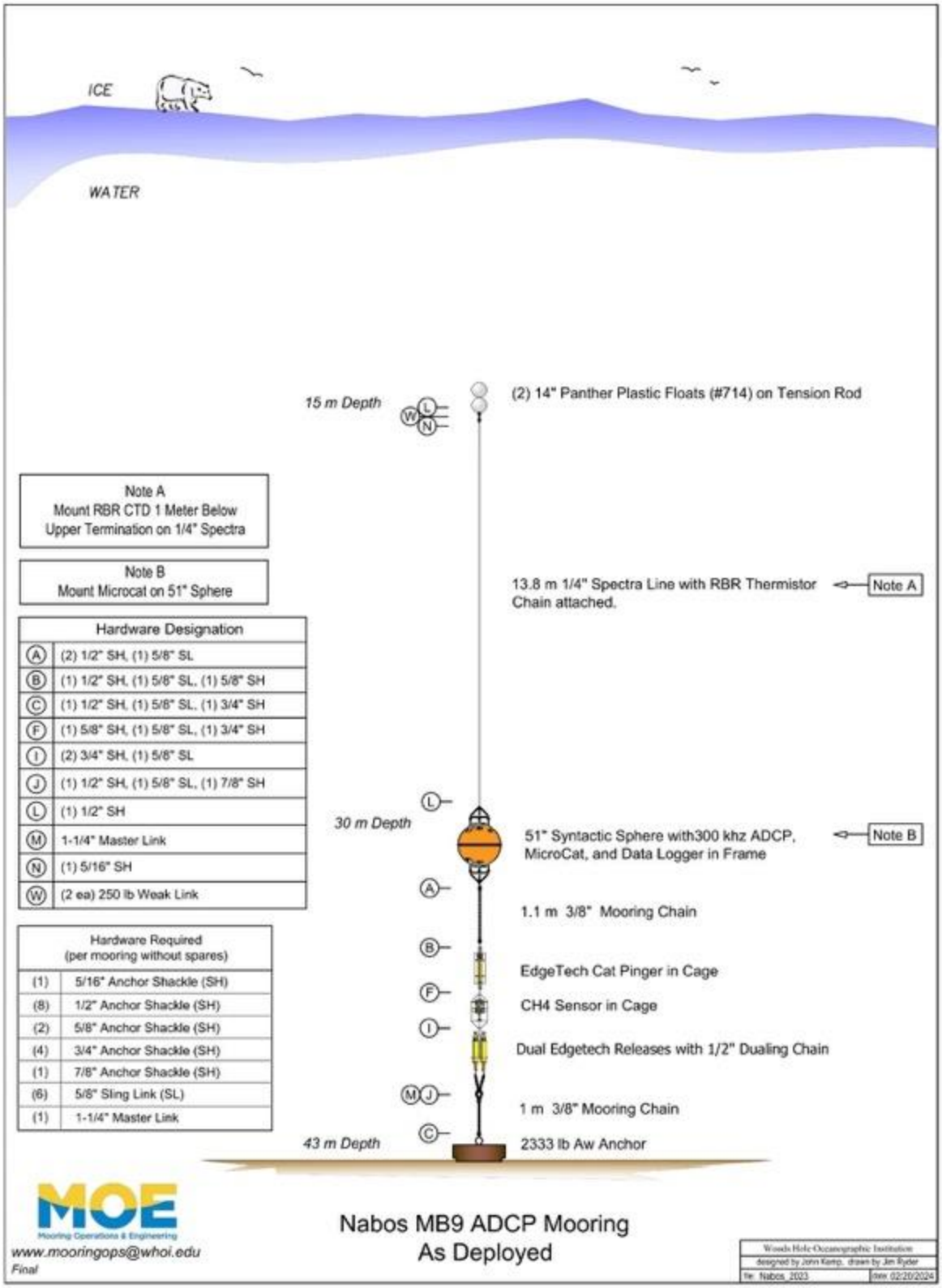


Figure A.III.9. NABOS MB9 mooring schematic.

APPENDIX IV: Logs for moorings recovered in 2023

MOORING LOG NABOS M1-4D - 2021

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** M1- 4D

Launch (Anchor Over)

Date (Day-Month-Year):	9/18/2021	Time:	22:46 UTC
Latitude (N/S, Deg-Min):	78 30.002 N	Longitude (E/W, Deg-Min):	125 58.652 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pnyushkov
Ship and Cruise Number:	AT Tzyoshnikov		
Depth Recorder Reading:	2689 M	Intended Duration:	2 Years
Corrected Water Depth:	2689 M	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	78 29.9805 N	Long (E/W):	125 59.5728 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

Serial Numbers	Release # 1 32055	CAT Pinger 59569	Release # 2 43485
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	561243	510647	464451
Disable Command:	561260	510664	464472
Release Command:	547733	N/A	447201

Recovery (Released Fired)

Date (Day-Month-Year):	20-Sept-2023	Time:	23:23 UTC
Latitiude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:	T. Kemp / E. Uanos	Recorder(s):	A. Pnyushkov
Ship / Cruise No.:	Healy		
Distance of waterline from buoy deck:	m	Actual Duration:	2 Years

Page 1 of 2

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** M1- 4D

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		23:00		9/18/2021
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above		01:43	
4	3/8" Mooring Chain	2				
5	3 - 17" Glassballs	3			01:43	
6	5/16" Vectran	650				
7	5/16" Vectran	993			01:30	
8	1/4" Jac. Wirerope	10			01:01	
9	1/4" Jac.Wirerope	20				
10	5/16" Jac. Wirerope	962				
11	Mclane MMP		11286-01	0:24	00:42	9/19/2021
12	CAT Pinger	0.76	59569		00:03	
13	1/2" Mooring Chain	1				
14	30" Steel Sphere	0.76			23:59	
15	1/2" Mooring Chain	0.5				
16	37" Steel Sphere	0.95			23:59	
17	3/8" Mooring Chain	3.3				
18	ADCP Float Package	0.89			23:52	
19	300 khz ADCP		24902		23:52	
	Micocat		4975			
	RBR Data Logger		206295		23:52	
20	1/4" Spectra Line	13.8				
	Thermistor Chain		206306		23:57	
	RBR CTD		206977		00:08	1 meter below Float Package
21	2 Ball Float Package	0.82		2:10		15 meter depth

Mooring recovered: 01:44

MOORING LOG NABOS MB2 - 2021

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB2

Launch (Anchor Over)

Date (Day-Month-Year):	9/20/2021	Time:	3:51 UTC
Latitude (N/S, Deg-Min):	79 45.525 N	Longitude (E/W, Deg-Min):	137 56.318 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pnyushkov
Ship and Cruise Number:	AT Tzyoshnikov		
Depth Recorder Reading:	2781 M	Intended Duration:	2 Years
Corrected Water Depth:	2781 M	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	79 45.4467 N	See Note	Long (E/W):	137 58.029 E	See Note

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	43490	45117	31450
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	464710	473112	476671
Disable Command:	464733	473131	476700
Release Command:	447336	N/A	452634

Recovery (Released Fired)

Date (Day-Month-Year):	18-Sep-2023	Time:	1800 UTC
Latitiude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:		Recorder(s):	
Ship / Cruise No.:			
Distance of waterline from buoy deck:	m	Actual Duration:	2 Years

Not released. There is no communication with releases and CAT Pinger.

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB2

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		4:05		9/20/2021
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above			
4	3/8" Mooring Chain	2				
5	3 - 17" Glassballs	3				
6	1/4" Jac.Wirerope	20				
7	1/4" Jac.Wirerope	10				
8	5/16" Vectran	606				
9	5/16" Vectran	993				
10	5/16" Vectran	993				Marked for Sensors
	Microcat		6284			750 Meters
	Thermistor		2373			250 Meters
	Microcat		5553			180 Meters
	Microcat		10525			130 Meters
	Thermistor		2371			120 Meters
	Thermistor		2365			100 Meters ~103 M
	Microcat		10524			90 Meters
	Thermistor		2362			80 Meters
	Microcat		10523			70 Meters
	Thermistor		2357			60 Meters
11	3/8" Mooring Chain	0.5				
12	Longranger ADCP	1.6	19063			
	Thermistor		2355			Mounted on ADCP Frame
13	3/8" Mooring Chain	0.5				
14	2-17" Glassballs	2				
15	2-17" Glassballs	2				
16	1/2" Mooring Chain	0.5				
17	CAT Pinger in Cage	0.76	45117			
18	1/2" Mooring Chain	1				
19	37" Steel Sphere	0.95				
20	3/8" Mooring Chain	3				
	300 khz ADCP		11187			
	3/8" Mooring Chain	3				
21	ULS Float Pack	1.35	1148			
	Microcat		6279		9:10	
	Note: May want to redo anchor survey before recovery.					
	Survey points need to be extended to the east of estimated anchor position					

MOORING LOG NABOS MB3 - 2021

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB3

Launch (Anchor Over)

Date (Day-Month-Year):	10/12/2021	Time:	23:45 UTC
Latitude (N/S, Deg-Min):	79 56.579 N	Longitude (E/W, Deg-Min):	142 12.261 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pnyushkov
Ship and Cruise Number:	AT Tzyoshnikov		
Depth Recorder Reading:	m	Intended Duration:	2 Years
Corrected Water Depth:	1359 M	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	79 56.6021 N	Long (E/W):	142 11.8215 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	28388	45113	49324
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	376614	472716	617123
Disable Command:	376637	472735	617146
Release Command:	354547	N/A	632762

Recovery (Released Fired)

Date (Day-Month-Year):	17-Sep-2023	Time:	18:20 UTC
Latitiude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:	J. Kemp / E. Leonard	Recorder(s):	A. Pnyushkov
Ship / Cruise No.:	Healy		
Distance of waterline from buoy deck:	m	Actual Duration:	2 Years

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB3

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		0:21		10/13/2021
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above		20:02	
4	3/8" Mooring Chain	2				
5	3 - 17" Glassballs	3			20:00	
6	3/8" Mooring Chain	1				
7	1/4" Jac.Wirerope	20				
8	1/4" Jac.Wirerope	10				
9	5/16" Vectran	266				
10	5/16" Vectran	993				Cable Marked
	Microcat	3049			19:44	750 Meters
	Thermistor		2436	1:50		250 Meters
	Microcat	5551			19:31	180 Meters
	Microcat	4978			19:28	130 Meters
	Thermistor		2434			120 Meters
	Thermistor		2433		19:24	100 Meters
	Microcat	10527			19:17	90 Meters
	Thermistor		2432		19:16	80 Meters
	Microcat	10529			19:14	70 Meters
	Thermistor		2430	2:30	19:12	60 Meters
11	1/2" Mooring Chain	0.5				
12	Longranger ADCP	1.6	22021		19:07	
	Thermistor		2429			Mounted on ADCP Frame
13	1/2" Mooring Chain	0.5				
14	Mclane Sampler	1.92	15180-01		19:04	
15	1/2" Mooring Chain	0.5				
16	CAT Pinger in Cage	0.76	454113		19:01	
17	1/2" Mooring Chain	1				
18	37" Steel Sphere	0.95			18:57	
19	1/2" Mooring Chain	0.5				
20	37" Steel Sphere	0.95				
21	3/8" Mooring Chain	3.3				
22	ADCP Float Package	1			18:55	
	300 khz ADCP		22119			30 Meter Depth
	Micocat		6309			
23	1/4" Spectra	13.8				
	RBR Data Logger		206305			
	Thermistor Chain		206298			
	RBR CTD		206969			1 meter below Float Package
	2 Ball Float Package	0.82		3:36		15 meter depth

Recovered: 20:05

MOORING LOG NABOS MB4 - 2021

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB4

Launch (Anchor Over)

Date (Day-Month-Year):	9/22/2021	Time:	2:00 UTC
Latitude (N/S, Deg-Min):	80 25.471 N	Longitude (E/W, Deg-Min):	147 32.654 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pnyushkov
Ship and Cruise Number:	AT Tzyoshnikov		
Depth Recorder Reading:	1810 M	Intended Duration:	2 Years
Corrected Water Depth:	1813 M	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	80 25.4485 N	Long (E/W):	147 32.1623 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	43489	45118	31447
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	464642	473154	476530
Disable Command:	464661	473177	476555
Release Command:	447315	N/A	452556

Recovery (Released Fired)

Date (Day-Month-Year):	16-Sep-2023	Time:	17:30 UTC
Latitude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:	J. Kemp / F. Llanos	Recorder(s):	A. Pnyushkov
Ship / Cruise No.:	Healy		
Distance of waterline from buoy deck:	m	Actual Duration:	2 Years

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB4

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		3:10		9/22/2021
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above		19:49	
4	3/8" Mooring Chain	2				
5	3 - 17" Glassballs	3			19:46	
6	1/4" Jac.Wirerope	20				
7	1/4" Jac.Wirerope	20				
8	5/16" Vectran	711				
9	5/16" Vectran	993			19:29	Marked for Sensors
	Microcat		2368	✓	19:07	750 Meters
	Thermistor		2421	✓	18:55	250 Meters
	Microcat		4703	✓	18:53	180 Meters
	Microcat		6015	✓	18:50	130 Meters
	Thermistor		2420	✓	18:48	120 Meters
	Thermistor		2418	✓	18:47	100 Meters
	Microcat		4838	✓	18:40	90 Meters
	Thermistor		2381	✓	18:38	80 Meters
	Microcat		10528	✓	18:36	70 Meters
	Thermistor		2379		18:32	60 Meters
10	3/8" Mooring Chain	0.5				
11	Longranger ADCP	1.6	19143		18:28	
	Thermistor		2378			Mounted on ADCP Frame
12	3/8" Mooring Chain	0.5				
13	2-17" Glassballs	2				
14	2-17" Glassballs	2				
15	1/2" Mooring Chain	1				
16	CAT Pinger in Cage	0.76	45118	✓	18:24	
17	1/2" Mooring Chain	1				
18	37" Steel Sphere	0.95			18:22	
19	3/8" Mooring Chain	3.3				
20	ADCP Float Package	0.89			18:19	
	300 khz ADCP		11240		18:19	
	Micocat		6158		✓	
	RBR Data Logger		206294		✓	
21	1/4" Spectra	13.8				
	Thermistor Chain		206299		✓	
	RBR CTD		206978		✓ 18:19	1 meter below Float Package
22	2 Ball Float Package	0.82		6:08	[illegible] missed	15 meter depth

Recovered: 19:50

MOORING LOG NABOS MB5 - 2021

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB5

Launch (Anchor Over)

Date (Day-Month-Year):	9/24/2021	Time:	6:03 UTC
Latitude (N/S, Deg-Min):	80 37.778 N	Longitude (E/W, Deg-Min):	161 06.235 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pnyushkov
Ship and Cruise Number:	AK. Tzyoshnikov		
Depth Recorder Reading:	2775	Intended Duration:	2 years
Corrected Water Depth:	2775	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	80 37.7358 N	Long (E/W):	161 06.10462 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	43487	45114	31452
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	464545	472750	476765
Disable Command:	464566	472773	477010
Release Command:	447247	N/A	452672

Recovery (Released Fired)

Date (Day-Month-Year):	13-Sep-2023	Time:	20:20 UTC
Latitiude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:	J. Kemp / E. Lunes	Recorder(s):	A. Pnyushkov
Ship / Cruise No.:	Healy		
Distance of waterline from buoy deck:	m	Actual Duration:	2 Years

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB5

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		7:04		9/24/2021
	Bottom Pressure Recorder		5357056-0083		13:50	On anchor in Chute
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above		13:50	
4	3/8" Mooring Chain	1				
5	3 - 17" Glassballs	3			13:48	
6	5/16" Vectran	650				
7	5/16" Vectran	993			13:18	
8	1/4" Jac. Wirerope	10			12:41	
9	1/4" Jac.Wirerope	20				
10	1/4" Jac.Wirerope	20				
11	1/4" Jac.Wirerope	50				
12	5/16" Jac. Wirerope	962				
	Mclane MMP		11494-01	9:00	12:23	
12	CAT Pinger	0.76	45114		11:26	
13	1/2" Mooring Chain	1				
14	30" Steel Sphere	0.76				
15	1/2" Mooring Chain	0.5				
16	37" Steel Sphere	0.95			11:18	
17	3/8" Mooring Chain	3.3				
18	ADCP Float Package	0.89			11:14	
	300 khz ADCP		19097		V	
	Micocat		6278			
	RBR Data Logger		206297		V	
19	1/4" Spectra	13.8				
	Thermistor Chain		206296		V	
	RBR CTD		206975		11:16	1 meter below Float Package
20	2 Ball Float Package	0.82		10:40	missed	15 meter depth

Locked at 12:05 14 Sept 2023

MOORING LOG NABOS MB6 - 2021

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB6

Launch (Anchor Over)

Date (Day-Month-Year):	9/27/2021	Time:	3:48 UTC
Latitude (N/S, Deg-Min):	79 00.560 N	Longitude (E/W, Deg-Min):	173 44.346 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pnyushkov
Ship and Cruise Number:	AT Tzyoshnikov		
Depth Recorder Reading:	2500 M	Intended Duration:	2 Years
Corrected Water Depth:	2517 M	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	79 00.5029 N	Long (E/W):	173 44.5036 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

Serial Numbers	Release # 1	CAT Pinger	Release # 2
	59586	45112	31371
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	511157	472644	472330
Disable Command:	511216	472667	472355
Release Command:	527562	N/A	450301

Recovery (Released Fired)

Date (Day-Month-Year):	11-Sept-2023	Time:	16:53 UTC
Latitiude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:	J. Kemp/E. Lemos	Recorder(s):	A. Pnyushkov
Ship / Cruise No.:	Healy		
Distance of waterline from buoy deck:	m	Actual Duration:	3h 12min

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB6

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		3:50		9/27/2021
2	3/8" Mooring Chain	4				
3	Dualed Releases	1.945	See Above		20:05	
4	3/8" Mooring Chain	4				
5	3 - 17" Glassballs	3			20:02	
6	3/8" Mooring Chain	3				
7	5/16" Vectran	451			14:57	
8	5/16" Vectran	993				Not Marked
9	1/4" Jac.Wirerope	20				
10	5/16" Jac. Wirerope	962				
	Mclane MMP		15207-01		19:06	
11	1/2" Mooring Chain	0.5				
12	Mclane Sampler	1.92	15180-02		18:17	
13	1/2" Mooring Chain	1				
14	CAT Pinger	0.76	45112		18:13	
15	1/2" Mooring Chain	0.5				
16	30" Steel Sphere	0.76				
17	1/2" Mooring Chain	0.8				
18	53" Syntactic Sphere	1.29			18:08	
	300 khz ADCP		24910			
	Microcat		6282	7:35		
	TSS Sonar					1853 released 13 Sept 2023

Recovered as 20:06

MOORING LOG NABOS MB7 - 2021

ARRAY & DEPLOYMENT:	**NABOS 2021**	**MOORING S/N:**	MB7

Launch (Anchor Over)

Date (Day-Month-Year):	9/29/2021	Time:	4:30 UTC
Latitude (N/S, Deg-Min):	76 36.846 N	Longitude (E/W, Deg-Min):	179 46.673 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pnyushkov
Ship and Cruise Number:	AT Tzyoshnikov		
Depth Recorder Reading:	1150 M	Intended Duration:	2 Years
Corrected Water Depth:	1150 M	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	76 36.8475 N	Long (E/W):	179 46.4517 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	43486	45111	59587
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	464503	472602	511235
Disable Command:	464520	472621	511250
Release Command:	447222	N/A	527600

Recovery (Released Fired)

Date (Day-Month-Year):	06-09-2023	Time:	16:51 UTC
Latitiude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:	Kemp/Dunn	Recorder(s):	J. Batryn
Ship / Cruise No.:	Healy		
Distance of waterline from buoy deck:	m	Actual Duration:	1hr 45min

10/07 17:08

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB7

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		5:17		9/29/2021
2	3/8" Mooring Chain	3.6				
3	Dualed Releases	1.945	See Above		18:35	
4	3/8" Mooring Chain	3				
5	3 - 17" Glassballs	3			18:32	
6	3/8" Mooring Chain	3				
7	5/16" Jac. Wirerope	962				
	Mclane MMP		15207-01	6:17	18:10	
8	2 - 17" Glassballs	2				
9	2 - 17" Glassballs	2			17:52	
10	CAT Pinger	0.76	45111		17:17	
11	1/2" Mooring Chain	1				
12	37" Steel Sphere	0.95			17:15	
13	3/8" Mooring Chain	3.3				
14	ADCP Float Package	0.89				
	300 khz ADCP		19033		17:07	
	Micocat		6280			
	RBR Data Logger		206306			
15	1/4" Spectra	13.8				
	Thermistor Chain		206294			
	RBR CTD		206968			1 meter below Float Package
16	2 Ball Float Package	0.82		8:00		15 meter depth

MOORING LOG NABOS MB8 - 2021

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB8

Launch (Anchor Over)

Date (Day-Month-Year):	10/6/2021	Time:	1:37 UTC
Latitude (N/S, Deg-Min):	75 06.843 N	Longitude (E/W, Deg-Min):	172 13.569 E
Deployed By:	Kemp/Dunn	Recorder(s):	A. Pynushkov
Ship and Cruise Number:	AT Tzyoshnikov		
Depth Recorder Reading:	143 M	Intended Duration:	2 Years
Corrected Water Depth:	143 M	Correction Source:	

Surveyed Anchor Position

Lat (N/S):	75 06.8244 N	Long (E/W):	172 13.4579 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	31381	49542	43484
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	472735	636141	464417
Disable Command:	472750	636162	464434
Release Command:	450517	N/A	447163

Recovery (Released Fired)

Date (Day-Month-Year):	04-Sep-2023	Time:	17:01 UTC
Latitiude (N/S, Deg-Min):		Long. (E/W, Deg-Min):	
Recovered By:	Kemp/Lianos	Recorder(s):	Batryn/Pnyshkov
Ship / Cruise No.:	Healy		
Distance of waterline from buoy deck:	m	Actual Duration:	1 hour

ARRAY & DEPLOYMENT: NABOS 2021 **MOORING S/N:** MB8

Subsurface Instruments and Mooring Components						
Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		2:31		10/6/2021
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above		17:56	
4	3/8" Mooring Chain	2				
5	3 - 17" Glassballs	3				
6	3/8" Mooring Chain					
7	1/4" Jac. Wirerope	10				Marked for 130M Microcat
	Microcat		4925		17 52	
8	1/4" Jac. Wirerope	10				
9	1/4" Jac. Wirerope	20				
10	1/4" Jac. Wirerope	10				Marked for 90M Microcat
	Microcat		12928		17 48	
11	1/4" Jac. Wirerope	20				Marked for 70M Microcat
	Microcat		12926		17:13	
12	1/4" Jac. Wirerope	10				
13	1/2" Mooring Chain	1				
14	Longranger ADCP	1.6	19062	3:15	17:40	
15	1/2" Mooring Chain	0.5				
16	2 - 17" Glassballs	2				
17	3/8" Mooring Chain	2.8				
18	2 - 17" Glassballs	2				
19	1/2" Mooring Chain	0.5				
20	CAT Pinger	0.76	49542		17:33	
21	1/2" Mooring Chain	1				
22	37" Steel Sphere	0.95			17:30	
23	3/8" Mooring Chain	3.3				
24	ADCP Float Package	0.89			17:26	9/9/23
	300 khz ADCP		19100			
	Micocat		3380			
	RBR Data Logger		206298			
25	1/4" Spectra	13.8				
	Thermistor Chain		206293			
	RBR CTD		207000		17:30	1 meter below Float Package
26	2 Ball Float Package	0.82		4:00		15 meter depth

MOORING LOG NABOS MB9 - 2021

ARRAY & DEPLOYMENT: NABOS - 2021 **MOORING S/N:** MB9

Launch (Anchor Over)

Date (Day-Month-Year): 10/7/2021 Time: 2:05 UTC

Latitude (N/S, Deg-Min): 73 46.963 N Longitude (E/W, Deg-Min): 167 42.842 E

Deployed By: Kemp/Dunn Recorder(s): A. Pnyushkov

Ship and Cruise Number: AT Tzyoshnikov

Depth Recorder Reading: Intended Duration: 2 Years

Corrected Water Depth: 40 M Correction Source:

Surveyed Anchor Position

Lat (N/S): 73 46.916 N Long (E/W): 167 42.8412 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 400

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	49325	45119	32054
Interrogate Frequency:	11.0 Khz	11.0 Khz	11.0 Khz
Reply Frequency:	12.0 Khz	12.0 Khz	12.0 Khz
Enable Command:	617165	473215	561205
Disable Command:	617207	473236	561226
Release Command:	633017	N/A	547710

Recovery (Released Fired)

Date (Day-Month-Year): 03-Sept 2023 Time: 20:12 UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Kemp/Lianos Recorder(s): A. Pnyushkov

Ship / Cruise No.: Healy

Distance of waterline from buoy deck: m Actual Duration: 02hrs 06min

Release#1 failed to release
#49325

ARRAY & DEPLOYMENT: NABOS - 2021 **MOORING S/N:** MB9

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		2:17		10/7/2021
2	3/8" Mooring Chain	0.5				
3	Dualed Releases	1.945	See Above			
4	3/8" Mooring Chain	0.5				
5	CAT Pinger	0.76	45119			
6	ADCP in Cage	0.3	11292		19:59	
	Microcat in Cage		3441			
7	3/8" Mooring Chain	1.5				
8	1/2" Mooring Chain	1				
9	37" Steel Sphere	0.95			19:59	9/3/es
10	1/4" Spectra	13.8				
	RBR Data Logger		206299			
	Thermistor Chain		206297			was damaged
	RBR CTD		206971			1 meter below Float Package
11	2 Ball Float Package	0.82		3:04		15 meter depth

APPENDIX V: Logs for moorings deployed in 2023

MOORING LOG NABOS MB1 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB1/M1-4

Launch (Anchor Over)

Date (Day-Month-Year): 21-Sep-2023 Time: 04:30

Latitude (N/S, Deg-Min): 78°30.107 N Longitude (E/W, Deg-Min): 126° 00.727E

Deployed By: Kemp/Llanos Recorder(s): A. Pynushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 2698 m Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): 78° 30.0396 N Long (E/W): 126° 00.741579 E

Acoustic Releases

Model: Edgetech 8242 Tested To: 1000 Meters

Serial Numbers	Release # 1	CAT Pinger	Release # 2
	59586	45118	31371
Interrogate Frequency:	11 kHz	11 kHz	11 kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	511157	473154	472330
Disable Command:	511216	473177	472355
Release Command:	527582	N/A	450301

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: m Actual Duration:

Page 1 of 2

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB1

Subsurface Instruments and Mooring Components						
Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		04:32		21 Sep. 2023
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above	04:32		
4	3/8" Mooring Chain	2				
5	3-17" Glassballs on 3/8" Chain	3		04:37		
6	1/4" Jac. Wirerope	10				
7	1/4" Jac. Wirerope	20				
8	1/4" Jac. Wirerope	47.6		05:00		
9	5/16" Vectran	580		05:23		
10	5/16" Vectran	1000		05:52		
11	1/4" Jac. Wirerope	10				
12	1/4" Jac.Nil.Wirerope	962				Upper/Lower MMP Bumpers
13	MMP			06:03		
14	3/8" Mooring Chain	1				
15	CAT Pinger	0.76	See Above	06:36		
16	3/8" Mooring Chain	2				
17	51" Syntactic Sphere with:	2.25	J23087-009	06:58		
	300 khz ADCP					
	Micocat					
	RBR Data Logger					
18	1/4" Spectra	13.8				
	Thermistor Chain					
	RBR CTD					1 meter below Float Package
19	2 Ball Float Package	0.82				15 meter depth

Deployed : 06:58

MOORING LOG NABOS MB2 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB2

Launch (Anchor Over)

Date (Day-Month-Year): 19 Sept 2023 Time: 02:39

Latitude (N/S, Deg-Min): 79° 44.428 N Longitude (E/W, Deg-Min): 137° 50.970E

Deployed By: Kemp/Llanos Recorder(s): A. Pynushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 2779 m Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): 79° 44.3593 N Long (E/W): 137° 50.3841 E

Acoustic Releases

Model: Edgetech 8242 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	63848	45114	63846
Interrogate Frequency:	11 kHz	11 kHz	11kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	7611025351	472750	7611025160
Disable Command:	7611025414	472773	7611025203
Release Command:	7611060536	N/A	7611060423

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: N/A Actual Duration:

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB2

Subsurface Instruments and Mooring Components						
Item No.	Item	Length (M)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		02:46		19 Sept 2023
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above	02:47		
4	3/8" Mooring Chain	2				
5	3 - 17" Glassballs	3		02148		
6	1/4" Jac. Wirerope	5				
7	1/4" Jac. Wirerope	20				
8	1/4" Jac. Wirerope	50		03:02		
10	5/16" Vectran	607		03:13		
11	5/16" Vectran	1000		03:34		
12	5/16" Vectran	1000		04:03		
	Micocat - 750		37-10522	04:08		
	SBE56 - 250		56-12984	04:17		
	Microcat - 180		37-12927	04:19		
	Microcat - 130		37-24714	04:22		
	SBE56 - 120		56-12983	04:24		
	SBE56 - 100		56-12982	04:34		
	Microcat - 90		37-24713	04:36		
	SBE56 - 80		56-12981	04:37		
	Microcat - 70		37-24712	04:39		
13	1/4" Jac. Wirerope	10				
	SBE56 - 60		02423	04:49		
14	3/8" Mooring Chain	1				
15	Longranger ADCP	1.62	3418/02422			
	SBE56 on Frame					
16	1/4" Jac. Wirerope	5				
17	3/8" Mooring Chain	1				
18	CAT Pinger	0.76	See Above	04:53		
19	3/8" Mooring Chain	2				
20	51" Syntactic Sphere	2.25	J230087-006	05:10		
	300 kHz ADCP		25869			
	Microcat		37SMP46[illegible]7-5783			
21	3/8" Mooring Chain	6				
22	33" Syntactic Sphere	1.77	J230088-002	05:13		
	Notek 250 ADCP		1036[illegible]21			
	Battery Case		N/A			
	Microcat		37-1296[illegible]1			

Deployed: 05:15

MOORING LOG NABOS MB3 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB3

Launch (Anchor Over)

Date (Day-Month-Year): 18-Sep-2023 Time: 03:52

Latitude (N/S, Deg-Min): 79° 56.148 N Longitude (E/W, Deg-Min): 142° 12.973 E

Deployed By: Kemp/Llanos Recorder(s): A. Pymushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 1370 m Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): 79° 56.1832 N Long (E/W): 142° 12.9508 E

Acoustic Releases

Model: Edgetech 8242 Tested To: 1000 Meters

Serial Numbers	Release # 1	CAT Pinger	Release # 2
	63844	63905	63806
Interrogate Frequency:	11 kHz	11 kHz	11 kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	7611024764	7611025730	7611024173
Disable Command:	7611025032	7611025777	7611024210
Release Command:	7611060321	N/A	7611060005

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: m Actual Duration:

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB4

Subsurface Instruments and Mooring Components						
Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		03:11		18 Sep. 2023
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above			
4	3/8" Mooring Chain	2				
5	3-17" Glassballs on 3/8" Chain	3		03:57		
6	1/4" Jac. Wirerope	5				
7	1/4" Jac. Wirerope	10				
8	1/4" Jac. Wirerope	20				
9	1/4" Jac. Wirerope	50				
10	5/16" Vectran	208		04:28		
11	5/16" Vectran	600		04:40		
	Microcat	750	37-12923	04:45		
11	300 kHz ADCP Cage (450 M)	0.9	27092	05:03		
12	1/4" Jac.Wirerope	148.4				
13	300 kHz ADCP Cage (300 M)	0.9	27093	05:23		
14	1/4" Jac.Wirerope	197				
	SBE 56	250	56-12990	05:26		
	Microcat	180	37-12921	05:27		
	Microcat	130	37-29718	05:34		
	SBE 56	120	56-12989	05:42		
15	300 kHz Double ADCP Cage (100 M)	1.2	25881/25882/25883		05:49	SBE56 Mounted on ADCP Frame
16	1/4" Jac.Wirerope	20				
17	4-17" Glassballs on 3/8" Chain	4			05:56	
18	1/4" Jac.Wirerope	31				
	Microcat	70	37-29714		06:06	
	SBE 56	60	02926		06:08	
	SBE 56	50	02925		06:09	
19	3/8" Mooring Chain	3				
20	Mclane PPS Frame	1.92	15799-02		06:20	
21	3/8" Mooring Chain	1				
22	2-17" Glassballs on 3/8" Chain	2			06:22	
23	3/8" Mooring Chain	1				
24	CAT Pinger	0.76	See Above	06:27		
25	3/8" Mooring Chain	2				
26	51" Syntactic Sphere with:	2.25	J23087-005	06:37		
	300 khz ADCP		25930			
	Microcat		37-29715			
	RBR Data Logger		206296			
27	1/4" Spectra	13.8				
	Thermistor Chain		20005	06:40		
	RBR CTD		206992			1 meter below Float Package
28	2 Ball Float Package	0.82				15 meter depth

05:53

05:57

Time Deployed: 06:44

MOORING LOG NABOS MB4 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB4

Launch (Anchor Over)

Date (Day-Month-Year): 16-Sept-2023 Time: 21:40

Latitude (N/S, Deg-Min): 80° 25.420 N Longitude (E/W, Deg-Min): 147° 32.148 E

Deployed By: Kemp/Llanos Recorder(s): A. Pynushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 1819 m Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): 80° 25.3609 N Long (E/W): 147° 31.9587 E

Acoustic Releases

Model: Edgetech 8242 Tested To: 1000 Meters

Serial Numbers	Release # 1	CAT Pinger	Release # 2
	43484	49542	63847
Interrogate Frequency:	11 kHz	11 kHz	11 kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	464417	636141	7611025244
Disable Command:	464434	636162	7611025316
Release Command:	447163	N/A	7611060464

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: m Actual Duration:

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB4

Subsurface Instruments and Mooring Components

Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		21:44		
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above			
4	3/8" Mooring Chain	2				
5	3-17" Glassballs on 3/8" Chain	3		21:47		
6	1/4" Jac. Wirerope	5				
7	1/4" Jac. Wirerope	20				
8	1/4" Jac. Wirerope	50				
9	5/16" Vectran	261		22:19		
10	5/16" Vectran	1000		22:36		
	Microcat	750	37-12935	22:49		
11	300 kHz ADCP Cage(40m)	0.9	27049	23:14		
12	1/4" Jac.Wirerope	148.4				
	SBE 56	250	56-12894			
	Microcat	180	37-12924	23:42		
	Microcat	130	37-24726	23:58		
	SBE 56	120	56-12993			
13	300 kHz ADCP Cage(50m)	0.9	25885	00:38		
14	1/4" Jac.Wirerope	197				
	Microcat	90	37-24721	00:16		
	SBE 56	80	56-12991			
	Microcat	70	37-24720			
	SBE 56	60	02928			
	SBE 56	50	02927			
15	300 kHz Double ADCP Cage(60m)	1.2	25881/25885 56-12992	00:10		SBE56 Mounted on ADCP Frame
16	1/4" Jac.Wirerope	62.8				
17	3/8" Mooring Chain	1				
18	CAT Pinger	0.76	See Above	00:30		
19	3/8" Mooring Chain	2				
20	51" Syntactic Sphere with:	2.25				
	300 khz ADCP		25871			
	Micocat		37-24719			
	RBR Data Logger		206300			
21	1/4" Spectra	13.8				
	Thermistor Chain		206304			
	RBR CTD		206973			1 meter below Float Package
22	2 Ball Float Package	0.82				15 meter depth

Deployed 00:47
Warning: Instrument sequence may be not correct

MOORING LOG NABOS MB5 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB5

Launch (Anchor Over)

Date (Day-Month-Year): 15-Sep-2023 Time: 17:24

Latitude (N/S, Deg-Min): 80° 38.470'N Longitude (E/W, Deg-Min): 161° 00.899 E

Deployed By: Kemp/Llanos Recorder(s): A. Pynushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 2783 Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): 80° 38.3729 N Long (E/W): 161° 00.7709 E

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	31381	63907	63841
Interrogate Frequency:	11 kHz	11 kHz	11 kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	472735		7611024440
Disable Command:	472750		7611024512
Release Command:	450517	N/A	7611060157

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: m Actual Duration:

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB5

Subsurface Instruments and Mooring Components						
Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		17:26		15 Sep2023
	Bottom Pressure Recorder					
2	Dualed Releases	1.945	See Above	17:27		
3	3/8" Mooring Chain	2				
4	3-17" Glassballs on 3/8" Chain	3				
5	1/4" Jac. Wirerope	5				
6	1/4" Jac. Wirerope	20				
7	1/4" Jac. Wirerope	50				
8	5/16" Vectran	667		18:02		
9	5/16" Vectran	1000		18:30		
10	1/4" Jac. Wirerope	10				
11	1/4" Jac.Wirerope	962				
12	MMP			19:47		Upper/Lower MMP Bumpers
13	3/8" Mooring Chain	1		20:18		
14	CAT Pinger	0.76	See Above	20:31		
15	3/8" Mooring Chain	2				
16	51" Syntactic Sphere with:	2.25		12:38		
	300 khz ADCP					
	Micocat					
	RBR Data Logger					
17	1/4" Spectra	13.8		12:42		
	Thermistor Chain					
	RBR CTD					1 meter below Float Package
18	2 Ball Float Package	0.82				15 meter depth

Deployed 12:48

MOORING LOG NABOS MB6 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB6

Launch (Anchor Over)

Date (Day-Month-Year): 12-Sept-2023 Time: 17:03

Latitude (N/S, Deg-Min): 79° 00.505'N Longitude (E/W, Deg-Min): 173° 44.548'E

Deployed By: Kemp/Llanos Recorder(s): A. Pynushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 2528 m Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): Long (E/W):

Acoustic Releases

Model: Edgetech 8242 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	32054	45111	63843
Interrogate Frequency:	11 kHz	11 kHz	11kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	561205	472602	7611024671
Disable Command:	561226	472621	7611024723
Release Command:	547710	N/A	7611060273

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: N/A Actual Duration:

ARRAY & DEPLOYMENT: NABOS 2023 MOORING S/N: MB6

Subsurface Instruments and Mooring Components						
Item No.	Item	Length (M)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		17:05		
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above			
4	3/8" Mooring Chain	2				
5	3 - 17" Glassballs	3		17:09		
6	1/4" Jac. Wirerope	52.8				
7	1/4" Jac. Wirerope	50				
8	1/4" Jac. Wirerope	20				
9	1/4" Jac. Wirerope	20				
10	5/16" Vectran	344.7		18:20		
11	5/16" Vectran	1000		18:50		
12	1/4" Jac. Wirerope	962		19:46		Lower and Upper Bumpers
	MMP	0		19:50		
13	3/8" Mooring Chain	1				
14	Mclane PPS System	1.92		20:50		
15	3/8" Mooring Chain	1.5				
16	CAT Pinger	0.76	See Above	20:56		
17	3/8" Mooring Chain	2				
18	51" Syntactic Sphere	2.25	J230087-006	21:10		
19	3/8" Mooring Chain	6				
20	33" Syntactic Sphere	1.77	J230088-002	21:20		
	Notek 250 ADCP		103643			
	Battery Case		N/A			
	Microcat		37-12960			

deployed 21:31

MOORING LOG NABOS MB7 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB7

Launch (Anchor Over)

Date (Day-Month-Year): 06-Sep-2023 Time: 20:43 UTC

Latitude (N/S, Deg-Min): 76° 36,716' N Longitude (E/W, Deg-Min): 179° 46.809 W

Deployed By: Kemp/Llanos Recorder(s): A. Pynushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 1156 m Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): Long (E/W):

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	29336	63907	63842
Interrogate Frequency:	11 kHz	11 kHz	11 kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	220475	7611026111	7611024555
Disable Command:	220504	7611026156	7611024636
Release Command:	242562	N/A	7611060234

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: m Actual Duration:

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB7

Subsurface Instruments and Mooring Components						
Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		20:09		
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above			
4	3/8" Mooring Chain	2				
5	3-17" Glassballs on 3/8" Chain	3		21:12		
6	1/4" Jac. Wirerope	10				
7	1/4" Jac. Wirerope	10				
8	1/4" Jac. Wirerope	20				
9	1/4" Jac. Wirerope	101		21:30		
10	1/4" Jac.Nil.Wirerope	962				Upper/Lower MMP Bumpers
11	MMP			21:43		
12	3/8" Mooring Chain	1.8				
13	CAT Pinger	0.76	See Above	22:27		
14	3/8" Mooring Chain	2				
15	51" Syntactic Sphere with:	2.25		22:50		
	300 khz ADCP					
	Micocat					
	RBR Data Logger			22:50		
16	1/4" Spectra	13.8				
	Thermistor Chain					
	RBR CTD					1 meter below Float Package
17	2 Ball Float Package	0.82				15 meter depth

Deployed: 22:54

MOORING LOG NABOS MB8 - 2023

ARRAY & DEPLOYMENT: NABOS 2023 **MOORING S/N:** MB8

Launch (Anchor Over)

Date (Day-Month-Year): 04-Sep-2023 Time: 20:14

Latitude (N/S, Deg-Min): 75° 06.806'N Longitude (E/W, Deg-Min): 172° 13.593'E

Deployed By: Kemp/Llanos Recorder(s): A. Pynushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 145 m (multibeam) Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): Long (E/W):

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000 Meters

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	63845	36765	63805
Interrogate Frequency:	11 kHz	11 kHz	11 kHz
Reply Frequency:	12 kHz	12 kHz	12 khz
Enable Command:	7611025075	7611025662	7611024066
Disable Command:	7611025127	7611025662	7611024134
Release Command:	7611060366	N/A	7611057763

Recovery (Released Fired)

Date (Day-Month-Year): Time: UTC

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: m Actual Duration:

ARRAY & DEPLOYMENT: NABOS 2023 MOORING S/N: MB8

Subsurface Instruments and Mooring Components						
Item No.	Item	Length/ Depth (m)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		20:22		
2	3/8" Mooring Chain	2				
3	Dualed Releases	1.945	See Above			
4	3/8" Mooring Chain	0.5				
5	300 kHz ADCP in Cage	0.83	25884	20:25		Looking Up
	Microcat (135m)		37-24751			Mounted on ADCP frame
6	3/8" Mooring Chain	2				
7	3 - 17" Glassballs	3		20:31		
8	1/4" Jac. Wirerope	10				
9	1/4" Jac. Wirerope	20				
10	1/4" Jac. Wirerope	57.5				Marked for 70 and 90M Microcat
	Microcat (90m)		37-24750	20:56		
	Microcat (70m)		37-24749	21:03		
11	3/8" Mooring Chain	0.7				
12	300 kHz ADCP in Cage	0.83	25760	21:09		Looking down
13	3/8" Mooring Chain	4				
14	CAT Pinger	0.76	See Above	21:24		
15	3/8" Mooring Chain	2				
16	51" Syntactic Sphere with:	2.25		21:41		Lebos overheated
	300 khz ADCP		25877			
	Micocat		37-24748			
	RBR Data Logger		206303			
17	1/4" Spectra	13.8				
	Thermistor Chain		206303			
	RBR CTD		206979			1 meter below Float Package
18	2 Ball Float Package	0.82		21:45		15 meter depth

Open water Deployed 21:47

MOORING LOG NABOS MB9 - 2023

ARRAY & DEPLOYMENT: NABOS - 2023 **MOORING S/N:** MB9

Launch (Anchor Over)

Date (Day-Month-Year): 03-09-2023 Time: 21:18 UTC

Latitude (N/S, Deg-Min): 73° 46.960 N Longitude (E/W, Deg-Min): 167° 42.936 E

Deployed By: Kemp / Llanos Recorder(s): A. Pnyushkov

Ship and Cruise Number: Healy

Depth Recorder Reading: 43 m Intended Duration: 2 Years

Corrected Water Depth: Correction Source:

Surveyed Anchor Position

Lat (N/S): Long (E/W):

Acoustic Releases

Model: Edgetech 8241 Tested To: 1000

	Release # 1	CAT Pinger	Release # 2
Serial Numbers	63807	63906	63840
Interrogate Frequency:	11kHz	11 kHz	11 kHz
Reply Frequency:	12 kHz	12 kHz	12 kHz
Enable Command:	7611060042	7611026004	7611024342
Disable Command:	7611024305	7611026043	7611024407
Release Command:	7611060042	N/A	7611060110

Recovery (Released Fired)

Date (Day-Month-Year): Time:

Latitiude (N/S, Deg-Min): Long. (E/W, Deg-Min):

Recovered By: Recorder(s):

Ship / Cruise No.:

Distance of waterline from buoy deck: m Actual Duration:

ARRAY & DEPLOYMENT: NABOS - 2023 **MOORING S/N:** MB9

Subsurface Instruments and Mooring Components						
Item No.	Item	Length (M)	Serial No.	Time Over	Time Back	Notes
1	Anchor	0.3		20:48		~~Acoustic~~ WPC
2	3/8" Mooring Chain	1				Sept. 03, 2023
3	Dualed Releases	1.945	See Above	20:59		
4	CH4 Sensor in Cage	1.37	CH4P-0417-002	21:00		
5	CAT Pinger	0.76	See Above	21:00		
7	3/8" Mooring Chain	1.1				
9	51" Syntactic Sphere with:	2.25	J23087-7	21:13		
	300 khz ADCP		25876	21:13		
	Micocat		37-12929	21:13		
	RBR Data Logger		206304	21:13		
10	1/4" Spectra	13.8				
	Thermistor Chain		~~206304~~	21:16		206300
	RBR CTD		206980	21:16		1 meter below Float Package
11	2 Ball Float Package	0.82		21:17		15 meter depth

21:18 Released