REPORT

Physical oceanography data from moorings in the Lofoten Basin, Norwegian Sea: June 2016 – September 2017

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17 March 2020

1. Background

The data set described herein was collected as a part of the project "Water mass transformation processes and vortex dynamics in the Lofoten Basin of the Norwegian Sea (ProVoLo)". ProVoLo was led at the Geophysical Institute, University of Bergen (PI: Ilker Fer) and was funded by the Research Council of Norway (project number 250784) for the period 01.01.2016-31.12.2019.

The overall objective of ProVoLo was to describe and quantify the processes and pathways of energy transfer and mixing in the Lofoten Basin and their role in water mass transformation. The field component included cruises when temperature, salinity and current profiles, as well as ocean microstructure profiles were collected in summer and in winter. The observations were coordinated with deployments of gliders and RAFOS floats and an array of moorings (this report). The related cruises were on board *Håkon Mosby* (HM 2016611, 26 May – 15 June 2016), and *Kristine Bonnevie* (KB 2017606, 10 - 23 March 2017, and KB 2017618, 2 – 15 September 2017). The data sets from the three cruises including the measurements of currents, hydrography and ocean microstructure, together with cruise reports, can be obtained from *Fer et al.* [2019]

The oceanographic moorings were deployed during the HM 2016611 and recovered during the KB 2017618 cruise, returning 15 month long time series. This report summarizes the details of the moorings, instrument setups and processing, and gives an overview of the data collected. The data set covers the period from June 2016 to September 2017, and includes time series of ocean temperature, salinity and currents at the shelf break and upper slope of the Lofoten Escarpment, and in deeper water in the Lofoten Basin. The data from the slope moorings are analyzed and presented in *Fer et al.* [2020]. The data set is submitted to and openly available from the Norwegian Marine Data Centre. Metadata and attributes for each submitted netCDF file (ncdisp output) are provided as an appendix.

2. Moorings

2.1. Overview

In total, 6 bottom-anchored oceanographic moorings were deployed, 5 on the continental slope of the Lofoten Escarpment off the Lofoten Islands and 1 in the Lofoten Basin. The positions are detailed in Table 1 and shown in Figure 1. Mooring names follow South (MS), North (MN), West (MW), and Basin (MB). Along-isobath distance between MS to MN is 26 km. The cross-isobath distance, MN to MW is 6 km. Each mooring was equipped with instruments logging temperature, salinity and currents. The details of the instrumentation are given in Table 2 and in the mooring diagrams in the Appendix.

Because of the risk due to fishing activity in the region, we separated each MS and MN mooring into a bottom unit with a Microcat CTD and spherical buoy equipped with an uplooker ADCP, and a water column line including temperature loggers and CTDs. The bottom units are approximately 25 m tall, "short" moorings and are dubbed MSs and MNs. These units were deployed within a couple of 100 m distance to MS and MN. All moorings were deployed in June 2016 with anchor last, from the stern. No complications occurred.



Figure 1. (a) Mooring positions, bathymetry of the Lofoten Basin (contours at 500 m intervals) and the geostrophic EKE from satellite altimeter observations, averaged over the period 1993 to 2018 (from *Fer et al.* [2020]). General circulation of the warm Atlantic Water (red) and the Norwegian Coastal Current (blue) are indicated. (b) A zoom-in to the moorings together with 200–600 m depth-averaged current vectors.

Table 1. Mooring deployment details. Deployment time is the anchor drop. Bottom depth is the
best estimate using the ship's echo sounder measurement, instrument pressure records and
the mooring part lengths.

Mooring	Latitude	Longitude	Depth (m)	Deployed (UTC)	Recovered (UTC)
MS	68 N 50.128	012E 45.082	670	31.05.2016 21:06	08.09.2017 06:20 (bottom part only)
MSs	68 N 50.038	012E 44.777	672	31.05.2016 21:50	08.09.2017 07:20
MN	68 N 56.06	013E 20.24	645	01.06.2016 00:02	24.08.2016 (upper part) 08.09.2017 09:00 (rest)
MNs	68 N 56.109	013E 19.866	655	01.06.2016 00:48	08.09.2017 10:00
MW	68 N 58.759	013E 16.845	1500	01.06.2016 05:37	08.09.2017 12:10
MB	69 N 52.89	011E 11.89	2925	02.06.2016 13:44	09.09.2017 04:10

2.2. Instrumentation and set-up

The moorings were equipped with Sea-Bird Electronics temperature (SBE39) and conductivity and temperature recorders (SBE37 Microcat), Aanderaa Instruments (AADI) point current meters (RCM-7/8 and Seaguard RCM), and acoustic Doppler current profilers (ADCP, RD-Instrument 300 kHz Sentinel and 75 kHz Longranger). Some of the instruments were equipped with a pressure sensor. The details of the mooring instrumentation are given in Table 2. Instrument depths listed in Table 2 are corrected using the instrument pressure records and the mooring part lengths, and may differ from the planned target heights.

All instruments were set to sample starting from 31 May 2016, 1200 UTC.

All SBE instruments were set to sample a single record every 300 s (5 min). The conductivity cell of all the Microcats was a flow through (i.e., none were equipped with an internal pump).

Seaguards were equipped with a double set of lithium batteries (2x35Ah) and recorded 10 min averages of 200 pings in burst mode. All Seaguards (SNs 240, 1902, 1904, 1898) were fitted with a temperature, pressure and conductivity (except SN240) sensors.

All ADCPs recorded in Earth coordinates. Their compasses were calibrated in Bergen, on 24 to 26 May 2016 on lawn, away from magnetic influence, to typical errors between 1° and 4°. The 300 kHz instruments were set to sample in long range (narrow band) mode with 35 depth cells of 4 m thickness, as 35 pings per ensemble. Time between pings was 1 second. Ensemble interval was 30 minutes. Single ping standard deviation was 1.26 cm/s. The 75 kHz instruments were set to sample in long range (narrow band) mode with 35 pings per ensemble. Time between pings as 35 pings per ensemble. Time between pings was 3 second. Ensemble interval was 60 minutes. Single ping standard deviation was 2.47 cm/s. The RDI deployment files are listed in Table 3.

Table 2. Mooring instrument details. Target depths are best estimates using mooring line lengths and pressure records from the instruments. 210:8:730 means 8 m increments from 210 m to 730 m. Parameters are temperature (T), conductivity (C), pressure (P), horizontal velocity (V) and vertical velocity (W). Instruments are given with their serial numbers (SN).

Mooring	Target Depth (m)	Parameter	Instrument
MB	68, 743, 1492	Т, С, Р	Microcat SN6097, 5452, 7222
	389, 2198, 2500	Т, С	Microcat 7336, 4446, 7821
	136, 1593	Т, Р	SBE39 3252, 3143
	85,94,115	Т	SBE56 4311, 4312, 4314
	187, 237,288, 490	Т	SBE56 SN4315, 4316, 4318, 4320
	591, 993, 1242	Т	SBE56 SN4322, 4319, 4323
	748	Р	RDI 75kHz Longranger, SN10740
	210:8:730	V, W	//, uplooking profile
	1497	Р	RDI 300kHz Longranger, SN11434
	1401:4:1485	V, W	//, uplooking profile
	1800	V, C, T, P	Seaguard-RCM, SN1904
	2775	V	RCM-8, SN9912
MW	75, 380, 980	Т, С, Р	Microcat SN13357, SN6017, SN6018
	177, 278, 480,	Т	SBE56 SN5192, 1948, 1953
	580, 780, 880,	Т	SBE56 SN1951, 1954, 1955
	1085, 1190, 1400	Т	SBE56 SN1965, 4200, 4203
	742	Р	RDI 75kHz Longranger, SN21447
	188:8:724	V, W	//, uplooking profile
	975	V	RCM-7, SN12338
	1476	V, C, T, P	Seaguard-RCM, SN1902
MN	165, 648	Т, С, Р	Microcat SN13351, SN7373
	455	1,0	Microcat SN/334
		Ŧ	
	262, 358, 551,	I	SBES0 SIN4320, 4325, 4331
	647	\/ \A/	DDI 75kHz Longrangor SN19447
	60.8.620	v, vv	//
	63/	ИСТР	Seaguard-RCM_SN240
MS	665	ТСР	Microcat SN7372
	000	,, ,, ,	
	664	V. W	RDI 75kHz Longranger, SN15963
	102:8:646	.,	//, uplooking profile
	647	V. C. T. P	Seaguard-RCM, SN1898
	U 17	, , , , , ,	

; 75 kHz ADCP	; 300 kHz ADCP
CR1	CR1
CQ255	CF11101
CF11101	EAO
EAO	EBO
EBO	ED15000
ED5900	E\$35
ESSE	EV11111
E333	E71111101
	WASU
WA50	WB1
WB1	WD111100000
WD111100000	WFO
WFO	WN35
WN77	WP35
WP35	WS400
WS800	WV175
WV175	TE00:30:00.00
TE01:00:00 00	
	TE16/05/31 15:00:00
TE16/0E/21 14:00:00	
(F10/05/51 14.00.00	
CK	
CS	;
; ;	;Instrument = Workhorse Sentinel
;Instrument = Workhorse Long Ranger	;Frequency = 307200
;Frequency = 76800	;Water Profile = YES
;Water Profile = YES	;Bottom Track = NO
;Bottom Track = NO	;High Res. Modes = NO
;High Res. Modes = NO	;High Rate Pinging = NO
:High Rate Pinging = NO	:Shallow Bottom Mode= NO
Shallow Bottom Mode= NO	:Wave Gauge = NO
Wave Gauge = NO	$ _{Owered ADCP} = NO$
Howard ADCR = NO	
Jeo Track – NO	Surface Track - NO
Surface Track NO	Beem angle 20
Surface frack = NO	;Beam angle = 20
;Beam angle = 20	;Temperature = 3.00
;Temperature = 3.00	;Deployment hours = 11520.00
;Deployment hours = 10320.00	;Battery packs = 1
;Battery packs = 4	;Automatic TP = NO
;Automatic TP = NO	;Memory size [MB] = 256
;Memory size [MB] = 256	;Saved Screen = 1
;Saved Screen = 2	;
;	;Consequences generated by PlanADCP version 2.06:
:Consequences generated by PlanADCP version 2.06:	:First cell range = 4.34 m
:First cell range = 9.58 m	:l ast cell range = 140.34 m
± 135 cell range = 617.58 m	= 155.03 m
= 622.96 m	Standard doviation = 1.26 cm/c
, Maxialige – 025.00 III	
;standard deviation = 2.47 cm/s	;Ensemble size = 854 bytes
;Ensemple size = 1694 bytes	;Storage required = 18.76 MB (19676160 bytes)
;Storage required = 16.67 MB (17482080 bytes)	;Power usage = 403.57 Wh
;Power usage = 1799.61 Wh	;Battery usage = 0.9
;Battery usage = 4.0	;
;	; WARNINGS AND CAUTIONS:
; WARNINGS AND CAUTIONS:	; Advanced settings have been changed.
; Advanced settings have been changed.	; Expert settings have been changed.
: Expert settings have been changed.	
,	

Table 3. Provolo RDI ADCP deployment files (left column, Longranger; right column 300 kHz Sentinel)

2.3. Recovery notes

All moorings were recovered during the cruise KB 2017618 of *Kristine Bonnevie* on 8 September (MS, MN and MW) and 9 September (MB) 2017.

MN was adrift in August 2016. The drifting part of the mooring was recovered on 24.08.2016, from *Kystverket Strilborg*. This earlier recovered upper part of the mooring included Novatech ARGOS A04-007, a hardball float, 4x17" glass spheres, SBE37 SN 13351 and SBE56 SNs 4325 and 4326. The remaining part was successfully retrieved on 8 September 2017.

Upon release, only the bottom part of MS surfaced, including the release, the Seaguard SN 1898 and 4x17" glass spheres. The mooring line was cut by a trawler. The following instruments were lost: SBE56 SNs 4334, 4324 and 4330; SBE37 SNs 7335 and 13350; and ARGOS Xeos 738.

The acoustic release (AR2500 SN948) of MB did not respond to ranging; however, it released successfully. Upper SBE37 SN 6097 and SBE56 SN 4252 (70-80m) were at the same depth. Above the Longranger buoy, SBE37 SN 5452 (750 m) and SBE56 SN 4322 (600 m) were at the same depth. After inspection of the pressure records, the following was concluded: On 13 June 2016, 07:15 UTC, SBE37 SN 6097 slid down from 68 to 78 dbar. On 22 Nov 2016, 04:45 UTC, SBE56 SN 4322 slid downward and reached the Microcat SN 5452 below at 750m, at 08:05 UTC.

3. Data processing

All data were downloaded and converted to physical units using the manufacturers' softwares. The first step of processing was to inspect the pressure records of the instruments, and using the information about their planned target depths and mooring element lengths, to identify the best estimate of the actual target depth after deployment. Using the pressure record from the bottommost instruments (and converting to depth at that the latitude) and the known instrument position from seabed, this also gives a best estimate for the total water depth.

We sought for a drift in the pressure record by inspecting the minimum pressure (proxy of target depth with minimum mooring blow down) in weekly moving windows, and looking for a significant trend. After correcting for a drift, if any, the in situ target depth was estimated from the average of lowest 5 percentile of the time series (least mooring blowdown leads to smaller pressures), and rounded downward to the nearest integer. Once the deployed target depths were obtained for each instrument, their time variable depth (pressure) was constructed at each time stamp using vertical interpolation of hourly averaged pressure time series. This approach was satisfactory, instead of applying a mooring dynamics model, because there were multiple pressure sensors available in each mooring line.

3.1. Salinity and temperature

Time series were inspected for drifts in temperature and salinity and were corrected if necessary (see mooring specific notes). Obvious outliers from salinity records were excluded (threshold values differed for each instrument). Salinity and temperature measurements from the RCM are excluded (C/T parameters for RCMs are not listed in Table 2, but several instruments were equipped with C/T sensors. None of the Microcats were pumped and caution is advised in interpreting the salinity data from the Microcats.

All temperature and salinity records were then compared against 1) a calibration cast after recovery, and 2) CTD profiles collected from the ship when the moorings were in water. When the ship CTD profiles had accompanying current profiles (lowered ADCP), they were also used to compare with the moored velocity profiles.

The calibration cast was sta785 (KB 2017618). All SBE instruments were attached to the CTD frame. The downcast was followed by 3 stops of 15-min duration during the upcast at approximately 850, 225 and 15 m depth (Figure 2). The ship's profile was processed as 1-dbar as well as 1-s averages for comparison with the mooring instruments. Note that all ship profiles were calibrated against water samples. The profile part was not useful for calibration of the moored sensors. Three comparison data points were obtained as time averages at the stop depths (Figure 2).

For all SBE instruments (except SBE37 SN7222, because of a drift identified later), pressure was good to within a few dbar and did not require any correction. For temperature and salinity, the comparison of average samples relative to the ship's calibration cast, is shown in Figure 3. The applied corrections following this analysis is listed for each instrument in Table 4.

The variability at 15 m level was too large to be used in the analysis, hence the samples from 15 m were excluded for the offset corrections. After applying the offset corrections, the agreement with the ship's CTD has significantly improved.



Figure 2. Calibration cast with all SBE instruments attached to the ship's CTD frame. Pressure, temperature and salinity record from the ship's CTD is shown as 1-sec averaged data. The three depth levels during the upcast are used for calibration. Average temperature and salinity from these periods, after despiking the salinity, are used as reference values.



Figure 3. Difference between the reference values measured by the ship CTD and the measurements from the moored instruments for (upper row) salinity and (lower row) temperature. The horizontal axis is an arbitrary instrument counter. Data are shown for the three depth levels (15, 225 ad 850 m), and before and after the correction applied. Resulting rms error values are indicated (excluding the 15 m level with large variability).

The corrected data were then compared to the available CTD profiles during several cruises, collected nearby the moorings. The following profiles were available:

June 2016 (cruise HM 2016611): All casts after deployment. All without LADCP (except at MB).

MS = sta471; MN = sta472; MW = sta473; MB = sta475 (with LADCP)

Sep 2017 (cruise KB 2017618): All with LADCP and before recovery.

MS = sta782, MW = sta783; MB = sta784

The agreement was generally satisfactory. The bottommost 4 Microcats at MB (SN 5452, 7222, 4446, 7821) and SN 7334 at MN required corrections, as listed in the last column of Table 4. The comparison for June and September cruises are shown in Figure 4.



Figure 4. Comparison of temperature and salinity profiles (after offset corrections) from cruises in June and September collected nearby moorings MB, MW and MS.

	Calibration cast	Calibration cast	Cruise profile
SBE SN	Temperature offset	Salinity offset	Salinity offset
	×10 ⁻³	×10 ⁻³	×10 ⁻³
6017	-1	5	
5192	-26		
1948	-11		
1953	-19		
1951	-5		
1954	-16		
1955	-9		
6018	-1	4	
1965	-17		
4200	-36		
4203	-20		
6097		-4	
4252	-28		
4311	-32		
4312	-39		
4314	-32		
3252	-3		
4315	-30		
4316	-35		
4318	-37		
7336		7	
4320	-37		
4322	-31		
5452		7	-5
4319	-28		
4323	-33		
7222	-2	12	-10
3143	-4		
4446		12	-5
7821	-2	9	-3
3351			
4326			
4325			
7334		41	-90
4331	-35		
7373	-1	10	
7372	-1	10	

Table 4. Temperature and salinity offsets inferred from the calibration cast. The last column is the salinityoffset applied after comparison with various cruise CTD profiles.

Once the salinity data were corrected with offsets, a basic despiking was applied. Significant outliers were detected and removed in two passes using 5-minute time series. In the first pass, smoothed salinity (S_{mov_av}) and standard deviation over moving windows (S_{mov_std} ; a continuous std, similar to the moving average operation) were calculated using 600 data point windows. Measurements exceeding a $S_{mov_av} \pm 6S_{mov_std}$ envelope were removed. In the second pass, the procedure was repeated with 120 point windows and a 4 std threshold. All removed data points were filled in with linear interpolation in time.

3.2. Speed and direction

The magnetic declination (positive east of true north) at the average position of the MS/MN/MW moorings (69N, 13E) was 5°E \pm 0.54° on 1 Jan 2017, changing by 0.23° E per year. All velocity data (from the ADCPs, the RCMs ad the SGs) were corrected for magnetic declination using a constant 5° offset.

All ADCPs recorded in Earth coordinates and ensemble averaged data internally. The RDI ADCPs had 4 transducers, and 3-beam solutions were allowed. The averaged profiles from the instruments were further post-processed. We flagged data points as bad when the "percent-good" parameter was less than 50%, or when pitch or roll were in excess of 20°, or error velocity exceeded 1 m s⁻¹, or the vertical velocity exceeded 1 m s⁻¹, or the horizontal velocity exceeded 2 m s⁻¹. Depth cells close (within 10% of the total instrument range) to the surface (for upward pointing) or to the seabed (for downward pointing ADCPs) were also flagged as bad. After removing these points, together with the times prior to and after the deployment and recovery, we applied the following quality control. A smoothed version of the error velocity was calculated by moving averaging in time and range using 20 point length vertical and time windows. The standard deviation (std) of the original data at each bin was calculated. At each bin, outliers were identified as velocity measurements exceeding ± 3 std in 40 ensemble windows at each bin, were removed. Short gaps less than 90 min length in time and two cell size in the vertical were interpolated.

3.3. Mooring specific notes

Mooring MB: We removed the pressure and salinity trend from SBE37 SN 7222, corresponding to - 0.0573 dbar/day for pressure and 1.8478×10^{-5} /day for the salinity record. Adjustments were made for the sensors which slid vertically on the mooring line. We excluded the data from SBE56 4252 (at 78 dbar) after the time SBE37 SN 6097 slid to that depth. We excluded the record from SBE56 SN 4322 after 22 Nov 2016, 04:40 UTC. The Seaguard speed and direction measurements required an offset correction of -0.005 m s⁻¹ and -5° to obtain a smooth vertical velocity profile at the mooring.

Mooring MW: The salinity record from the Seaguard SN1902 was of high quality and used in the final mooring gridded data after applying an offset correction of 0.03 to obtain a stable vertical profile. The first 315 points were noisy and excluded.

Mooring MN: Note that MN includes a bottom unit with a Microcat CTD and spherical buoy equipped with an uplooker ADCP, and a water column line including temperature loggers and CTDs. The units were deployed within a couple of 100 m distance to each other and treated as one mooring (water column line was lost 3 months into the deployment). We did not use the temperature from the Seaguard SN240 as we have a Microcat nearby. Seaguard fell to seabed when the flotation was cut on 22 Aug 2016, 15:00.

Mooring MS: Similar to MN, this mooring had a bottom unit and a water column line. The most part of the column line was lost with no data return, except a near-bottom Seaguard. We decided not to use the Seaguard for velocity, because the instrument was at the same level of the first good bin of the 75kHz ADCP. The salinity record from the Seaguard was not reliable (judged from the T/S plots). We retain it for the instrument-wise data product, but exclude it from the gridded data.

3.4. Gridded mooring data

Data from all instruments are first averaged into one hour intervals (if the sampling rate was faster) and then interpolated to a common 1-hour time stamp. As described in Section 3, the time variable depth (pressure) records were constructed at each time stamp and for each instrument using vertical interpolation of the known target depth (of instruments with pressure sensor) and the measured pressure to the target depths of all instruments. Hourly profiles of temperature, salinity and horizontal current were then vertically interpolated to 10-m vertical resolution. A depth level with a data coverage less than 30% of the total measurement duration was excluded. This 1-hour-10 m vertical homogenous, gridded data matrix was cleaned from short segments of data (especially in the outer ranges of the ADCPs) by filling with NaNs when a duration of segment with data was less than 3 days.

3.5. Accuracy and error

The initial accuracy of the SBE sensors are $\pm 2 \times 10^{-3}$ °C for temperature, $\pm 3 \times 10^{-4}$ S m⁻¹ for conductivity, and ± 1 dbar for pressure (drift over 1 year is comparable to initial accuracy for temperature and pressure, and 10 times the initial accuracy for conductivity). The comparison with the calibration casts resulted in an rms error of 0.02 °C for temperature and 0.001 for salinity. For the deployment setup used, the ADCPs have a single ping (profile) statistical error of 2.5 cm s⁻¹, which reduces to 0.4 cms⁻¹ for the ensemble average profile with 35 pings. The compass direction is accurate to $\pm 2^{\circ}$. Conservative error estimates are ± 1 cm s⁻¹ for velocity, $\pm 10^{-2}$ °C for temperature and $\pm 10^{-2}$ for practical salinity. The salinity data from the unpumped microcats, in general, must be used with caution. The 10-m vertically interpolated salinity product is not resolved and must be used with caution, referring to the target depths of conductivity sensors.

4. Summary plots

4.1. Pressure time series

In the following set of figures, the pressure time series are presented for each mooring. These records were used to construct the time variable instrument position for all sensors before gridding the data in the vertical.



Figure 5. (2 pages) Pressure time series from various instruments on the moorings MB, MW, MN and MS. Values on the left in brackets are the average and one standard deviation of the pressure record. Values on the right are the target depths of the pressure sensor.



Figure 5 continued for MS and MN.

4.2. Time-depth distributions of u, v, T and S



Figure 6 (4 pages). Time-depth distribution of east and north velocity components, temperature and practical salinity for Mooring MB, (following pages) MW, MN, and MS. Measurement target depths are indicated on the vertical axis. The hourly and 10-m gridded fields are shown without any smoothing or filtering. Gaps in data are due to instruments stopping recording, mooring blow down or the limited range of the ADCPs.



Figure 6 continued for MW. The bottommost salinity is from the Seaguard. The early record in the second Microcat and the Seaguard was removed due to bad quality and the reaming two instruments were not vertically interpolated leaving the gap in the beginning of the time series.



Figure 6 continued for MN. The velocity structure is from the short, bottom unit. The temperature salinity structure is from the water column unit which was cut 3 months into the time series.



Figure 6 continued for MS. The velocity structure is from the short, bottom unit. The temperature salinity structure is from a single Microcat on the bottom unit. The water column line was lost.

4.3. Time-averaged profiles



Time-averaged Profiles, Mooring MB

Figure 7. Time-averaged profiles from the gridded data. Mean (black) and one std (gray envelope) are shown. Measurement target depths are on the vertical axis. *If the length of the record at a depth level is less than 80% of the total length, the data points is shown with a red pentagram.

Time-averaged Profiles, Mooring MS



Figure 7. continued.

5. Acknowledgements

This study received funding from the Research Council of Norway, through the project Water mass transformation processes and vortex dynamics in the Lofoten Basin in the Norwegian Sea (PROVOLO), project 250784. We thank the crew and participants of the deployment and recovery cruises, and particularly Helge Bryhni, Algot Peterson and Henrik Søiland for their help with the mooring work, and Anthony Bosse with assistance on data calibration and interpretation.

6. References

- Fer, I., A. Bosse, and J. Dugstad (2020), Norwegian Atlantic Slope Current along the Lofoten Escarpment, *Ocean Sci. Discuss.*, 2020, 1-23, 10.5194/os-2020-15.
- Fer, I., A. Bosse, H. Søiland, B. Ferron, and P. Bouruet-Aubertot (2019), Ocean currents, hydrography and microstructure data from PROVOLO cruises, Geophysical Institute University of Bergen (Norway), doi: 10.21335/NMDC-1093031037.

7. Appendices

- A. Mooring drawings
- B. Metadata and attributes for each netCDF file (ncdisp output)









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	ŧ	ARGOS Novatech A04 HardBall Floats 750 m	4-007
	8	457 mm, buoyancy 25 kg	9
		Vitrovex 17" buoyancy 25	kg x 4
145 m		SBE-37 Microcat CTD	s/n 13351
245 m	Į	SBE-56 - T	s/n 4326
345 m]	SBE-56 - T	s/n 4325
479m Kevlar 8mm			
445 m	■ Research T	SBE-37 Microcat CT	s/n 7334
545 m	0	SBE-56 - T	s/n 4331
added 1m more chain 620 m		Vitrovex 17" buoyancy 25	kg x 2
		Seaguard CTD	s/n 240
		Acoustic Release. # 122 AR2500 ARM: 089C	5
20m Rope PP splitfib	ber	REL: 0855	
3m Chain 15mm			
645 m		Anchor 600kg	

MN

Project:	
Location:	
Position:	68 N 56.06′ 013 E 20.24′
Depth:	645 m
Deployment:	1 June 2016, 00:02 UTC
Recover:	8 Sept 2017, 0900 UTC

The data return from this upper part is until 22 Aug 2016, 15:00, when it was cut loose and recovered by a fisherboat. After losing the buoyancy, the instruments on the lower part sank. The Seaguard data are OK thanks to the 4 glass spheres.



MS



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68 N 50.128' 012 E 45.082'
680 m
31 May 2016, 21:06 UTC
8 Sep 2017, 0620 UTC

CTD sta782 before recovery

Position from sonar: 68 N 50.169' 012 E 45.201'



		MS	5	Project: Location: Position: Depth: Deployment: Recover:	IVERSITETET I BERGEN Geofysisk Institutt <u>N68 50.038' E 012 44.777'</u> <u>681 m</u> <u>31 May 2016, 21: 50 UTC</u> 8 Sep 2017, 07:20 UTC
1.5 m kuler	670,5 m	RDI ADCP-Longranger uplooker, s/n 15963 ARGOS Xeos 44 tommer buoy 1500m Buoyancy 288 kg	75 kHz	SBE37 m average c	ean depth from time f P is 665 m
1.5m m kevlar rope	675 m	SBE-37 Microcat CTD	s/n 7372		
2 m inst + kuler		Acoustic Release. # 1797 AR 2500 ARM: 0AFB			
2 m Rope PP splitfi	ber	LL. UADD			
3 m Chain 15mm	681 m	Anchor 450kg			

1	Source:		
2		\\tjalve.uib.no\home	<pre>>\ngfif\work\MOORED\Lofoten_2016\DataSubmit_NMDC\PROVOLO_Mooring_MB.nc</pre>
3	Format:		
4		netcdf4_classic	
5	Global Att	tributes:	
6		title	= 'Mooring MB: physical oceanography data from the Lofoten Basin, June 2016 - September 2017'
-7		history	= 'Version 1'
8		summary	= 'As a part of the "Water mass transformation processes and vortex dynamics in the Lofoten Basin of
10			the Norwegian Sea" (PROVOLO) project, a set of 4 moorings was deployed in the eastern Loroten Basin.
1 U			The observations cover a 14-month period from June 2016 to September 2017.
10			This data set is from the Mooring Basin (MB), in the Dasin at 09.00 N, 11.190 E, at 2925 m
12			water depth. We was rocated in an energetic rocation but away from the slope to address the mesoscale
14			Lofater Ecarpment (Mooring North MN, South MS, and West MW)
15			horoten Escarpment (Mooring North Fin, South Fis, and West Fin).
16			All time series are averaged into a common uniform 1-hour resolution time stamp
17			Two sets of hourly-averaged time series of temperature salinity and horizontal currents are provided
18			One 10 m vertically gridded (interpolated) after mooring motion correction (variables u. v. TEMP, PSAL).
19			and one as time series at time-variable measurement level because of mooring motion (variables TEMP ins.
20			PRES ins, u ins etc. with corresponding depth records zTEMP ins, zPRES ind, zu ins etc.
21			See the variable names for details. The dimensions follow the number of sensors on the mooring.)
22			These fields are used for gridding. Details on the data processing, mooring drawings and a detailed
23			list of instrumentation are provided in the attached report. A brief overview is given in the comment.
24			PROVOLO was supported by the Research Council of Norway (project number 250784).
25			
26		comment	= 'Data from pressure sensors are used to correct for the mooring motion.
27			Magnetic declination (5degE) is corrected for. Gappy segments with record length less than 3 days
28			are filled with NaN in the gridded data set.
29			Conductivity sensor is not pumped and the salinity data must be used with caution.
30			
31			The initial accuracy of the SBE sensors are 2x10-3C for temperature, 3x10-4 S/m for
32			conductivity, and I abar for pressure. A calibration cast resulted in an rms error of 0.02C
33 24			the encomple surveyed profile is loss than 1 gm/g. The statistical error of velocity measurements for
34			The ensemble average profile is less than i cm/s. The compass difection is accurate to zdeg.
35			The form martically interpolated salinity product is not resolved and must be used with caution
37			The 10 m vertically interpolated satisfy product is not resolved and must be used with caution.
38			The distribution of the instruments on this mooring is as follows (T=TEMP: S=PSAL: V=1 v: P=PRES)
39			Target Depth (m) Parameter Instrument
40			68, 743, 1492 T. S. P. Microcat SN6097, 5452, 7222
41			389, 2198, 2500 T, S Microcat 7336, 4446, 7821
42			136, 1593 T, P SBE39 3252, 3143
43			85,94,115 T SBE56 4311, 4312, 4314
44			187, 237,288, 490 T SBE56 SN4315, 4316, 4318, 4320
45			591, 993, 1242 T SBE56 SN4322, 4319, 4323
46			748 P RDI 75kHz Longranger, SN10740
47			210:8:730 V uplooking profile
48			1497 P RDI 300kHz Longranger, SN11434
49			1401:4:1485 V uplooking profile
50			1800 V, S, T, P Seaguard-RCM, SN1904
51			2775 V RCM-8, SN9912
52			
53			Utiset corrections applied to various sensors are described in the attached report.
54 57			THE DOLLOMMOST 4 MICROCALS REQUIRED CORRECTIONS WITH THE IOLIOWING CONSTANT SALINITY OFFSETS:
55 56			SN5452, $\pm 0.002i$ SN/222, $\pm 0.002i$ SN4440, $\pm 0.001i$ SN/821, $\pm 0.000i$. No further removed the programs and calimity trend from CDE27 CN7222, corresponding to
00 57			we fullier removed the pressure and satisfy trend from SBE3/ SN/222, corresponding to -0.0573 dbar/day for programs and 1.8478×10^{-5} /day for the calimity record
) / 5 /			-U.UD/S UDAL/UAY LUI PIESSULE AND 1.04/0XLU-D/DAY LOT THE SALINITY RECORD.
00			WE EXCLUDED THE LECOLD IION BEED BN7322 ALLEL 22 NOV 2010, 04.40 ULC WHEN IL SILD VELLICALLY

59			to the level of the Microcat below.			
60			The Sequerd SN1904 speed and direction measurements required an offset correction of -0.005 m/s			
61			and -5deg to obtain a smooth vertical velocity profile at the morring			
62						
63		type	= 'Hourly-averaged time series of temperature, salinity and horizontal velocity'			
64		creation time				
65		date update				
66		Conventions				
67		data modo				
60		nlatform turno				
60		praciorm_cype	- Mouring			
09			- Norwegian Sea, Loroten Basin, Loroten Escarpment			
70			= 09.8815			
/ 1		longitude				
72		sea_floor_depth_below_sea_level				
73		geospatial_lat_min	= 69.8815			
74		geospatial_lat_max	= 69.8815			
75		geospatial_lon_min	= 11.1982			
76		geospatial_lon_max	= 11.1982			
77		time_coverage_start	= '2016-06-02T15:00:00Z'			
78		time_coverage_end	= '2017-09-08T23:00:00Z'			
79		institution	= 'University of Bergen'			
80		principal_investigator	= 'Ilker Fer'			
81		principal_investigator_ORCID	= '0000-0002-2427-2532'			
82		author	= 'Ilker Fer'			
83		author_ORCID	= '0000-0002-2427-2532'			
84		contact	= 'ilker.fer@uib.no'			
85		project_name	= 'PROVOLO'			
86		source	= 'https://nmdc.no/'			
87		license	= 'CC-BY 4.0'			
88		references	= 'Fer, I., Bosse, A., and Dugstad, J.: Norwegian Atlantic Slope Current along			
89			the Lofoten Escarpment, Ocean Sci. Discuss.,			
90			https://doi.org/10.5194/os-2020-15, in review, 2020'			
91		keywords	= 'Norwegian Sea, Lofoten Basin, oceanography, currents, hydrography'			
92		creator name	= 'Ilker Fer'			
93		creator email	= 'ilker.fer@uib.no'			
94		creator url	= 'https://www.uib.no/qfi'			
95		acknowledgement	= 'This data set is made possible by the funding from the Research Council of Norway, project number 250784'			
96		date created	= '2020-03-16'			
97	Dimensions					
98	2 2 11 0 11 0 2 0 11 0	TTME = 11121				
99		DEPTH = 272				
100		ZP = 6				
101		ZT – 19				
102		79 – 6				
102		ZI – 90				
104	Variables	20 - 20				
105	var tadies. Timp					
105	TTME	Cinc: 11101-1				
107		Dimongiong: TIME				
100		Dimensions, double				
100		Datatype: double				
110		ALLIDUTES:				
111		standard_name = 'ti				
		long_name = 'De	cimal day			
112		units = 'Da	ys since 2016-01-01T00:002'			
113		axıs = 'T'				
114	DEPTH					
115		Size: 272x1				
116		Dimensions: DEPTH				

117		Datatype:	double
110		ALLI IDULES.	standard name - 171
120			
121			long name = 'Wertical distance below the sea surface'
122			axis = 'Z'
123	TEMP		
124		Size:	272×11121
125		Dimensions:	DEPTH, TIME
126		Datatype:	double
127		Attributes:	
128			standard_name = 'sea_water_temperature'
129			units = 'degree_Celsius'
130			long_name = 'sea water temperature in-situ ITS-90 scale'
131	PSAL		
132		Size:	272x11121
133		Dimensions:	DEPTH, TIME
134		Datatype:	double
135		Attributes:	
136			standard_name = 'sea_water_practical_salinity'
137			units = '1'
138			long_name = 'Practical salinity on the PSS-78 scale'
139	u		
140		Size:	272x11121
141		Dimensions:	DEPTH, TIME
142		Datatype:	double
143		Attributes:	
144			standard_name = 'eastward_sea_water_velocity'
145			units = m s - 1
146			long_name = 'Absolute eastward sea water velocity'
147	v	0	07011101
148		Size:	
149		Dimensions:	
151		Attributes:	dompte
152		ALLIDULES	standard name - 'northward sea water velocity'
153			units m_s_1'
154			long name = 'Absolute northward sea water velocity'
155	ZPRES	ins	
156	21100_	Size:	6×11121
157		Dimensions:	ZP. TIME
158		Datatype:	double
159		Attributes:	
160			units = 'm'
161			long name = 'Vertical distance below sea surface of pressure sensor at time-varying measurement level (not gridded)'
162	zTEMP	ins	
163	_	Size:	19x11121
164		Dimensions:	ZT,TIME
165		Datatype:	double
166		Attributes:	
167			units = 'm'
168			<pre>long_name = 'Vertical distance below sea surface of temperature sensor at time-varying measurement level (not gridded)</pre>
169	zPSAL_	ins	
170		Size:	6x11121
171		Dimensions:	ZS,TIME
172		Datatype:	double
173		Attributes:	
174			units = 'm'

175			long_name =	'Vertical distance below sea surface of conductivity sensor at time-varying measurement level (not gridded)'
176	zu	ı_ins		
177		Size:	90x11121	
178		Dimensions:	ZU,TIME	
179		Datatype:	double	
180		Attributes:		
181			units =	'm'
182			long_name =	'Vertical distance below sea surface of horizontal velocity sensor at time-varying measurement level (not gridded)'
183	PF	RES_ins		
184		Size:	6x11121	
185		Dimensions:	ZP,TIME	
186		Datatype:	double	
187		Attributes:		
188			units =	'decibar'
189			long_name =	'Sea water pressure at time-varying measurement level (not gridded), equals 0 at sea-level'
190	TE	EMP_ins		
191		Size:	19x11121	
192		Dimensions:	ZT,TIME	
193		Datatype:	double	
194		Attributes:		
195			units =	'degree_Celsius'
196			long_name =	'sea water temperature at time-varying measurement level (not gridded), in-situ ITS-90 scale'
197	PS	SAL_ins	-	
198		Size:	6x11121	
199		Dimensions:	ZS,TIME	
200		Datatype:	double	
201		Attributes:		
202			units =	'1'
203			long name =	'Practical salinity at time-varying measurement level (not gridded), PSS-78 scale'
204	u	ins	5=	
205	-	- Size:	90x11121	
206		Dimensions:	ZU,TIME	
207		Datatype:	double	
208		Attributes:		
209			units =	'm s-1'
210			long name =	'Absolute eastward sea water velocity at time-varving measurement level (not gridded)'
211	v	ins	5_ 5	
212		Size:	90x11121	
213		Dimensions:	ZU, TIME	
214		Datatype:	double	
215		Attributes:		
216		11002 2200000	units =	'm s-1'
217			long name =	'Absolute northward sea water velocity at time-varying measurement level (not gridded)'
218	>>			
-				

1	Source:		
2		\\tjalve.uib.no\ho	me\ngfif\work\MOORED\Lofoten_2016\DataSubmit_NMDC\PROVOLO_Mooring_MW.nc
3	Format:		
4		netcdf4_classic	
5	Global At	tributes:	
б		title	= 'Mooring MW: physical oceanography data from the Lofoten Basin, June 2016 - September 2017'
7		history	= 'Version 1'
8		summary	= 'As a part of the "Water mass transformation processes and vortex dynamics in the Lofoten Basin of
9			the Norwegian Sea" (PROVOLO) project, a set of 4 moorings was deployed in the eastern Lofoten Basin.
10			The observations cover a 14-month period from June 2016 to September 2017.
11			This data set is from the Mooring West (MW), on the upper slope at 68.979 N, 13.28 E, at 1500 m
12			water depth. MW is one of the three moorings located on the shelf break and slope of the
13			Lofoten Escarpment (Mooring North MN, South MS, and West MW). The fourth mooring was located
14			deeper in the basin (Mooring Basin MB).
15			
16			All time series are averaged into a common, uniform 1-hour resolution time stamp.
17			Two sets of hourly-averaged time series of temperature, salinity and horizontal currents are provided.
18			One 10 m vertically gridded (interpolated) after mooring motion correction (variables u, v, TEMP, PSAL),
19			and one as time series at time-variable measurement level because of mooring motion (variables TEMP_ins,
20			PRES_ins, u_ins etc. with corresponding depth records zlemp_ins, zPRES_ind, zu_ins etc.
21			see the variable names for details. The dimensions follow the number of sensors on the mooring.)
22			These fields are used for gridding. Details on the data processing, mooring drawings and a detailed
23			Depution and my the Depoted in the attached report. A brief overview is given in the comment.
24			rovolo was supported by the research council of Norway (project humber 250784).
20 26		commont	- Upsta from programs appared are used to gerrage for the meaning motion
20		Comment	= Data from pressure sensors are used to correct for the mooring motion.
27			are filled with NaN is the gridded date get
20			are fifted with Man in the gridded data set.
29			conductivity sensor is not pumped and the satinity data must be used with caution.
21			The initial accuracy of the CDE concerts are 2x10.20 for temperature 2x10.4.5/m for
30			and activity and 1 dear for programme A apliphation aget regulated in an american of 0.020
22			for temperature and 0.001 for calinity. The statistical error of velocity measurements for
21			the engently average profile is less than 1 and 3 The company diverties is accurate to 2deg
35			From estimates are 1 cm/s for velocity 1010 for temperature and 0.01 for practical salinity
36			The 10-m vertically interpolated salinity product is not resolved and must be used with caution
37			The 10 m vertically interpolated satisfy product is not resolved and must be used with caution.
38			The distribution of the instruments on this mooring is as follows (T-TEMD: S-DEAL: V-1, V: D-DEES)
39			Target Depth (m) Parameter Instrument
40			75 380 980 $ $ T S P $ $ Microcat SN13357 SN6017 SN6018
41			177, 278, 480 T SBE56 SN5192, 1948, 1953
42			580, 780, 880 T SBE56 SN1951, 1954, 1955
43			1085, 1190, 1400 T SBE56 SN1965, 4200, 4203
44			742 P RDI 75kHz Longranger. $SN21447$
45			188:8:724 V uplooking profile
46			975 II V II RCM-7, SN12338
47			1476 V, S, T, P Seaguard-RCM, SN1902
48			
49			Offset corrections applied to various sensors are described in the attached report.
50			The salinity record from the Seaguard SN1902 was of high quality and used in the final mooring
51			gridded data after applying an offset correction of 0.03 to obtain a stable vertical profile.
52			The first 315 points were noisy and excluded.
53			
54		type	= 'Hourly-averaged time series of temperature, salinity and horizontal velocity'
55		creation_time	= '2020-03-16T12:20:39Z'
56		date_update	= '2020-03-16T12:20:39Z'
57		Conventions	= 'CF-1.6, ACDD-1.3'
58		data_mode	= 'D'

59		platform_typ	pe	= 'Mooring'
60		area		= 'Norwegian Sea, Lofoten Basin, Lofoten Escarpment'
61		latitude		= 68.9793
62		longitude		= 13.2807
63		sea floor de	epth below sea level	= 1500
64		geospatial :	lat min	= 68.9793
65		geospatial	_ lat max	= 68,9793
66		geospatial	lon min	= 13,2807
67		geospatial	lon max	= 13, 2807
68		time covera	ge start	= '2016-06-01T06:00:00Z'
69		time covera	re end	= '2017-09-08T12:00:00Z'
70		institution	<u>jo_ena</u>	= 'Injversity of Bergen'
71		principal in	nvestigator	- 'Ther Fer'
72		principal_i	nvestigator ORCID	
73		principal_i	ivestigator_okerb	- 0000 0002 2427 2552
77		author OPCI	۲	
75		auchor_okch		
75		contact		
70		project_name	3	
70		source		
70		TICense		= CC-BI 4.0
79		references		= 'Fer, I., Bosse, A., and Dugstad, J., Norwegian Atlantic Stope Current along
80				the Loroten Escarpment, Ocean Sci. Discuss.,
81		, ,		nttps://doi.org/10.5194/0s-2020-15, in review, 2020
82		keywords		- 'Norwegian Sea, Lofoten Basin, oceanography, currents, hydrography'
83		creator_name	2	= 'liker Fer'
84		creator_ema:	11	= 'llker.ter@ulb.no'
85		creator_url		= 'https://www.ulb.no/gfi'
86		acknowledger	ment	= 'This data set is made possible by the funding from the Research Council of Norway, project number 250784'
87		date_created	đ	= '2020-03-16'
88	Dimensions	:		
89		TIME = 1114	43	
90		DEPTH = 141		
91		ZP = 5		
92		ZT = 13		
93		ZS = 4		
94		ZU = 70		
95	Variables:			
96	TIME			
97		Size:	11143x1	
98		Dimensions:	TIME	
99		Datatype:	double	
100		Attributes:		
101			standard_name = 'tim	ne '
102			long name = 'De	simal day'
103			units = 'Day	rs since 2016-01-01T00:00:00Z'
104			axis = 'T'	
105	DEPTH			
106		Size:	141×1	
107		Dimensions:	DEPTH	
108		Datatype:	double	
109		Attributes:		
110			standard name = 7	
111			unite - 'm'	
±±± 112			long name - 'Vo	tical distance below the sea surface!
++4 112			$- \sqrt{2}$	allout difference below the sea sufface
11 <i>1</i>	ᡣᢑᢂᡗ			
⊥⊥± 11⊑	TEME	Size:	141-11143	
116		Dimondiand.	TITATITI	
エエロ		DTHIGHSTOHS:	DEFIG, IIME	

117	Datatype:	double
118	Attributes	:
119		standard_name = 'sea_water_temperature'
120		units = 'degree_Celsius'
121		long_name = 'sea water temperature in-situ ITS-90 scale'
122	PSAL	
123	Size:	141x11143
124	Dimensions	: DEPTH, TIME
125	Datatype:	double
126	Attributes	:
127		standard_name = 'sea_water_practical_salinity'
128		units = '1'
129		long name = 'Practical salinity on the PSS-78 scale'
130	u	
131	Size:	141x11143
132	Dimensions	: DEPTH.TIME
133	Datatype:	double
134	Attributes	
135	11001120000	standard name = 'eastward sea water velocity'
136		
137		long name = 'Absolute eastward sea water velocity'
138	37	Tong_name - Abbolate castward Sea water velocity
130	v Size:	141-11143
140	Dimonsions	
141	Dimensions	
140	Datatype:	
142	Attributes	standard name - Inerthward see water velocity!
143		standard_name = hp.s.l.
144		
140		Tong_name = Absolute northward sea water velocity
146	ZPRES_INS	5 11142
14/	Size:	5X11143
148	Dimensions	: ZP, TIME
149	Datatype:	double
150	Attributes	
151		units = 'm'
152		long_name = 'Vertical distance below sea surface of pressure sensor at time-varying measurement level (not gridded)'
153	zTEMP_ins	
154	Size:	13x11143
155	Dimensions	: ZT,TIME
156	Datatype:	double
157	Attributes	:
158		units = 'm'
159		long_name = 'Vertical distance below sea surface of temperature sensor at time-varying measurement level (not gridded)'
160	zPSAL_ins	
161	Size:	4x11143
162	Dimensions	: ZS,TIME
163	Datatype:	double
164	Attributes	
165		units = 'm'
166		long_name = 'Vertical distance below sea surface of conductivity sensor at time-varying measurement level (not gridded)'
167	zu_ins	
168	Size:	70x11143
169	Dimensions	: ZU,TIME
170	Datatype:	double
171	Attributes	:
172		units = 'm'
173		long_name = 'Vertical distance below sea surface of horizontal velocity sensor at time-varying measurement level (not gridded)'
174	PRES ins	

175			Size:	5x11143	
176			Dimensions:	ZP,TIME	
177			Datatype:	double	
178			Attributes:		
179				units = 'decibar'	
180				long_name = 'Sea water pressure at time-varying measurement level (not gridded), equals 0 at sea-level'	
181		TEMP_i	ns		
182			Size:	13x11143	
183			Dimensions:	ZT,TIME	
184			Datatype:	double	
185			Attributes:		
186				units = 'degree_Celsius'	
187				long_name = 'sea water temperature at time-varying measurement level (not gridded), in-situ ITS-90 scale'	
188		PSAL_i	ns		
189			Size:	4x11143	
190			Dimensions:	ZS,TIME	
191			Datatype:	double	
192			Attributes:		
193				units = '1'	
194				long_name = 'Practical salinity at time-varying measurement level (not gridded), PSS-78 scale'	
195		u_ins			
196			Size:	70x11143	
197			Dimensions:	ZU, TIME	
198			Datatype:	double	
199			Attributes:		
200				units = 'm s-1'	
201				long_name = 'Absolute eastward sea water velocity at time-varying measurement level (not gridded)'	
202		v_ins			
203			Size:	70x11143	
204			Dimensions:	ZU, TIME	
205			Datatype:	double	
206			Attributes:		
207				units = 'm s-1'	
208				long_name = 'Absolute northward sea water velocity at time-varying measurement level (not gridded)'	
209	>>				

1	Source:		
2		\\tjalve.uib.no\ho	me\ngfif\work\MOORED\Lofoten_2016\DataSubmit_NMDC\PROVOLO_Mooring_MN.nc
3	Format:		
4		netcdf4_classic	
5	Global Att	tributes:	
6		title	= 'Mooring MN: physical oceanography data from the Lofoten Basin, June 2016 - September 2017'
2		nistory	= 'Version I'
9		Summary	- As a part of the water mass transformation processes and vortex dynamics in the eastern loboten basin of the basic process of a morring was deployed in the eastern loboten Basin
10			The observations cover a 14-month period from June 2016 to September 2017
11			This data set is from the Mooring North (MN), on the shelf break at 68,935 N, 13,33 E, at 655 m
12			water depth. MN is one of the three moorings located on the shelf break and slope of the
13			Lofoten Escarpment (Mooring North MN, South MS, and West MW). The fourth mooring was located
14			deeper in the basin (Mooring Basin MB).
15			MN was composed of a bottom unit (a current profiler and a CTD sensor), and a water-column
16			line with CTD sensors. The water column line is cut after 3 months (see attached report).
17			
18			All time series are averaged into a common, uniform 1-hour resolution time stamp.
19			Two sets of hourly-averaged time series of temperature, salinity and horizontal currents are provided.
20			One 10 m vertically gridded (interpolated) after mooring motion correction (variables u, v, TEMP, PSAL),
21			and one as time series at time-variable measurement level because of mooring motion (variables TEMP_ins,
22			PRES_ins, u_ins etc. with corresponding depth records zTEMP_ins, zPRES_ind, zu_ins etc.
23			See the variable names for details. The dimensions follow the number of sensors on the mooring.)
24			linese fields are used for gridaling. Details on the data processing, mooring drawings and a detailed
25			DEDVICE was supported by the Research Courcil of Norway (project number 250784)
27			,
2.8		comment	= 'Data from pressure sensors are used to correct for the mooring motion.
29		001110	Magnetic declination (5degE) is corrected for. Gappy segments with record length less than 3 days
30			are filled with NaN in the gridded data set.
31			Conductivity sensor is not pumped and the salinity data must be used with caution.
32			
33			The initial accuracy of the SBE sensors are $2 \times 10-3$ C for temperature, $3 \times 10-4$ S/m for
34			conductivity, and 1 dbar for pressure. A calibration cast resulted in an rms error of 0.02C
35			for temperature and 0.001 for salinity. The statistical error of velocity measurements for
36			the ensemble average profile is less than 1 cm/s. The compass direction is accurate to 2deg.
37			Error estimates are 1 cm/s for velocity, 0.01C for temperature and 0.01 for practical salinity.
38			The 10-m vertically interpolated salinity product is not resolved and must be used with caution.
39			The distribution of the instruments on this meaning is as follows (T-TEMD: S-DSAL: M-W W. D-DDES)
41			Target Depth (m) $ $ Darameter $ $ Instrument
42			165. 648 T. S. P. Microcat SN13351, SN7373
43			455 T, S Microcat SN7334
44			262, 358, 551 T SBE56 SN4326, 4325, 4331
45			647 RDI 75kHz Longranger, SN18447
46			69:8:629 V uplooking profile from Longranger
47			634 V, S, T, P Seaguard-RCM, SN240
48			
49			MN includes a bottom unit (a Microcat and a spherical buoy with an uplooker ADCP) and a water column
50			line including temperature loggers and CTDs. The units were deployed within a couple of 100 m distance
51			to each other and treated as one mooring. The water column line was cut on 22 Aug 2016 but the
52			instruments were recovered. Data from SBE37 SNs 13351 and 7334, SBE56 SNs 4325, 4326 and 4331, and
53 E1			Seaguard SN240 are thus until 22 Aug 2010, 15:00 UTC. We did not use the temperature from the Seaguard
54 55			SN240 as we have a Microcat hearby. The salinity of Microcat SN 7334 required a correction of -0.049.
55 56		type	= 'Hourly-averaged time series of temperature salinity and horizontal velocity'
57		creation time	= $10011y$ averaged time series of temperature, satisfy and norizontal verocity = $12020-03-16T13:38:09Z'$
58		date_update	= '2020-03-16T13:38:09Z'

59		Conventions		= 'CF-1.6, ACDD-1.3'
60		data_mode		= 'D'
61		platform type		= 'Mooring'
62		area	-	= 'Norwegian Sea, Lofoten Basin, Lofoten Escarpment'
63		latitude		= 68.9351
64		longitude		= 13 3311
65		gea floor de	onth below ges le	
66		geographial 1	lot min	
67		geospatial_		
67		geospatial_	lat_max	
68		geospatial_	Lon_min	
69		geospatial_	lon_max	= 13.3311
70		time_coverag	ge_start	= '2016-06-01T02:00:00Z'
71		time_coverag	ge_end	= '2017-09-08T08:00:00Z'
72		institution		= 'University of Bergen'
73		principal_ir	nvestigator	= 'Ilker Fer'
74		principal_ir	nvestigator_ORCID	= '0000-0002-2427-2532'
75		author		= 'Ilker Fer'
76		author ORCII	C	= '0000-0002-2427-2532'
77		contact		= 'ilker.fer@uib.no'
78		project name	2	
79		source	-	= 'https://nmdc.no/'
80		license		
01		references		- CC-BI F.U
01		rererences		- rer, i., bosse, A., and buystad, J., Norweytan Atlantic Stope Cuffent along
82				the Loroten Escarpment, Ocean Sci. Discuss.,
83				https://doi.org/10.5194/os-2020-15, in review, 2020'
84		keywords		= 'Norwegian Sea, Lofoten Basin, oceanography, currents, hydrography'
85		creator_name	9	= 'Ilker Fer'
86		creator_emai	il	= 'ilker.fer@uib.no'
87		creator_url		= 'https://www.uib.no/gfi'
88		acknowledger	ment	= 'This data set is made possible by the funding from the Research Council of Norway, project number 250784'
89		date_created	đ	= '2020-03-16'
90	Dimensions	:		
91		TIME = 1114	43	
92		DEPTH = 58		
93		ZP = 3		
94		ZT = 6		
95		7.5 = 3		
96		$\frac{20}{711} = 72$		
07	Variables	20 = 72		
97	Variables.			
90	1 T MF	<u>a'</u>	11140 1	
99		Size:	11143X1	
100		Dimensions:	TIME	
101		Datatype:	double	
102		Attributes:		
103			standard_name =	time'
104			long_name =	Decimal day'
105			units =	Days since 2016-01-01T00:00:00Z'
106			axis =	T'
107	DEPTH			
108		Size:	58x1	
109		Dimensions:	DEPTH	
110		Datatype:	double	
111		Attributes:		
112			standard name =	Z
113			unite -	
111			long namo -	 Vertical distance below the sea surface!
115				TI
110			alls =	4
エエロ	TEMP			

117 Size: 58x11143 118 Dimensions: DEPTH, TIME 119 Datatype: double 120 Attributes: 121 standard_name = 'sea_water_temperature' 122 units = 'degree_Celsius' 123 long_name = 'sea water temperature in-situ ITS-90 scale' 124 PSAL 125 Size: 58x11143 126 Dimensions: DEPTH, TIME 127 Datatype: double 128 Attributes: 129 standard_name = 'sea_water_practical_salinity' 130 = '1' units 131 long_name = 'Practical salinity on the PSS-78 scale' 132 u 133 Size: 58x11143 134 Dimensions: DEPTH, TIME 135 Datatype: double 136 Attributes: 137 standard_name = 'eastward_sea_water_velocity' 138 units = 'm s-1' 139 long_name = 'Absolute eastward sea water velocity' 140 v 141 Size: 58x11143 142 Dimensions: DEPTH, TIME 143 Datatype: double 144 Attributes: 145 standard_name = 'northward_sea_water_velocity' 146 units = 'm s-1' 147 long_name = 'Absolute northward sea water velocity' 148 zPRES_ins 149 Size: 3x11143 150 Dimensions: ZP,TIME double 151 Datatype: 152 Attributes: 153 units = 'm' 154 long_name = 'Vertical distance below sea surface of pressure sensor at time-varying measurement level (not gridded)' zTEMP_ins 155 156 Size: 6x11143 157 Dimensions: ZT,TIME 158 Datatype: double 159 Attributes: 160 units = 'm' 161 long_name = 'Vertical distance below sea surface of temperature sensor at time-varying measurement level (not gridded)' 162 zPSAL_ins 163 Size: 3x11143 164 Dimensions: ZS,TIME 165 Datatype: double Attributes: 166 167 units = 'm' 168 long_name = 'Vertical distance below sea surface of conductivity sensor at time-varying measurement level (not gridded)' zu ins 169 170 Size: 72x11143 171 Dimensions: ZU, TIME 172 double Datatype: 173 Attributes: 174 units = 'm'

175				long_name =	'Vertical distance below sea surface of horizontal velocity sensor at time-varying measurement level (not gridded)'
176		PRES_i	ns		
177			Size:	3x11143	
178			Dimensions:	ZP,TIME	
179			Datatype:	double	
180			Attributes:		
181				units =	'decibar'
182				long_name =	'Sea water pressure at time-varying measurement level (not gridded), equals 0 at sea-level'
183		TEMP_i	ns		
184			Size:	6x11143	
185			Dimensions:	ZT,TIME	
186			Datatype:	double	
187			Attributes:		
188				units =	'degree_Celsius'
189				long_name =	'sea water temperature at time-varying measurement level (not gridded), in-situ ITS-90 scale'
190		PSAL_i	ns		
191			Size:	3x11143	
192			Dimensions:	ZS,TIME	
193			Datatype:	double	
194			Attributes:		
195				units =	'1'
196				long_name =	'Practical salinity at time-varying measurement level (not gridded), PSS-78 scale'
197		u_ins			
198			Size:	72x11143	
199			Dimensions:	ZU,TIME	
200			Datatype:	double	
201			Attributes:		
202				units =	'm s-1'
203				long_name =	'Absolute eastward sea water velocity at time-varying measurement level (not gridded)'
204		v_ins			
205			Size:	72x11143	
206			Dimensions:	ZU,TIME	
207			Datatype:	double	
208			Attributes:		
209				units =	
210				long_name =	'Absolute northward sea water velocity at time-varying measurement level (not gridded)'
211	>>				

1	Source:		
2		\\tjalve.uib.no\home\	ngfif/work\MOORED\Lofoten_2016\DataSubmit_NMDC\PROVOLO_Mooring_MS.nc
3	Format:		
4		netcdf4_classic	
5	Global At	tributes:	
6		title	= 'Mooring MS: physical oceanography data from the Lofoten Basin, June 2016 - September 2017'
7		history	= 'Version 1'
8		summary	= 'As a part of the "Water mass transformation processes and vortex dynamics in the Lofoten Basin of
9			the Norwegian Sea" (PROVOLO) project, a set of 4 moorings was deployed in the eastern Lofoten Basin.
10			The observations cover a 14-month period from June 2016 to September 2017.
11			This data set is from the Mooring South (MS), on the shelf break at 68.834 N, 12.746 E, at 672 m
12			water depth. MS is one of the three moorings located on the shelf break and slope of the
13			Lofoten Escarpment (Mooring North MN, South MS, and West MW). The fourth mooring was located
14			deeper in the basin (Mooring Basin MB).
15			MS was composed of a bottom unit (a current profiler and a CTD sensor), and a water-column
16			line with CTD sensors. The water column line was lost with no data return (see attached report).
17			As a result, salinity and temperature are available only near the bottom at MS and are not gridded vertically.
18			
19			All time series are averaged into a common, uniform 1-hour resolution time stamp.
20			Two sets of hourly-averaged time series are provided. 1) The horizontal currents only (no temperature
21			and salinity) are 10 m vertically gridded (interpolated) after mooring motion correction (variables u, v).
22			2)Hourly time series of currents, temperature, pressure and salinity at time-variable measurement level
23			(variables TEMP_ins, PRES_ins, u_ins etc. with corresponding depth records zTEMP_ins, zPRES_ind,
24			zu_ins etc. See the variable names for details. The dimensions follow the number of sensors on the mooring.)
25			These fields (of horizontal velocity) are used for gridding. Details on the data processing, mooring
26			drawings and a detailedlist of instrumentation are provided in the attached report.
27			PROVOLO was supported by the Research Council of Norway (project number 250784).
28			
29		comment	= 'Data from pressure sensors are used to correct for the mooring motion.
30			Magnetic declination (5degE) is corrected for. Gappy segments with record length less than 3 days
31			are filled with NaN in the gridded data set.
32			Conductivity sensor is not pumped and the salinity data must be used with caution.
33			This mooring differs from MN, MW and MB in that there is no gridded temperature and salinity.
34			
35			The initial accuracy of the SBE sensors are 2x10-3C for temperature, $3x10-4$ S/m for
36			conductivity, and 1 dbar for pressure. A calibration cast resulted in an rms error of 0.02C
37			for temperature and 0.001 for salinity. The statistical error of velocity measurements for
38			the ensemble average profile is less than 1 cm/s. The compass direction is accurate to 2deg.
39			Error estimates are 1 cm/s for velocity, 0.01C for temperature and 0.01 for practical salinity.
40			The 10-m vertically interpolated salinity product is not resolved and must be used with caution.
41			
42			The distribution of the instruments on this mooring is as follows. (T=TEMP; S=PSAL; V=u,v; P=PRES)
43			Target Depth (m) Parameter Instrument
44			665 T, S, P Microcat SN7372
45			664 - RDI 75kHz Longranger, SN15963
46			102:8:646 V uplooking profile from Longranger
47			647 V, S, T, P Seaguard-RCM, SN1898
48			
49			The most part of the column line was lost with no data return, except the near-bottom Seaguard.
50			The Seaguard velocity is not used in gridding because the instrument was at the same level of the
51			first good bin of the 75kHz ADCP. The salinity record from the Seaguard was not reliable.
52			We retain the salinity in the instrument-wise data product, but exclude it from the gridded data.
53			
54		type	= 'Hourly-averaged time series of temperature, salinity and horizontal velocity'
55		creation_time	= '2020-03-16T12:40:12Z'
56		date_update	= '2020-03-16T12:40:12Z'

57		Conventions		= 'CF-1.6, ACDD-1.3'
58		data_mode		= 'D'
59		platform typ	be a second s	= 'Mooring'
60		area		= 'Norwegian Sea, Lofoten Basin, Lofoten Escarpment'
61		latitude		= 68,834
62		longitude		= 12 7463
63		gea floor de	nth below see leve	1 - 672
61		goographial 1	at min	
65		geospatial_1		- 00.034 - 00.034
65		geospatial_1	lat_max	
66		geospatial_1	lon_min	= 12.7463
6.7		geospatial_l	lon_max	= 12.7463
68		time_coverag	ge_start	= '2016-06-01T01:00:00Z'
69		time_coverag	ge_end	= '2017-09-08T06:00:00Z'
70		institution		= 'University of Bergen'
71		principal_in	nvestigator	= 'Ilker Fer'
72		principal_in	vestigator_ORCID	= '0000-0002-2427-2532'
73		author		= 'Ilker Fer'
74		author ORCID)	= '0000-0002-2427-2532'
75		contact		= 'ilker.fer@uib.no'
76		project name	2	= 'PROVOLO'
77		source		= 'https://nmdc.no/'
78		license		= (C - RV A O)
79		references		- CEPT T Rosse A and Dugstad J. Norwegian Atlantic Slope Current along
00		TELETENCES		the Lefeton Eggenement Ogeneral Digered
01				http://doi.org/10.0104/co.0000.15. in workey 2020/
81		1		https://doi.org/10.5194/0s-2020-15, in review, 2020
82		keyworas		= 'Norweglan Sea, Loioten Basin, oceanography, currents, hydrography'
83		creator_name	2	= 'llker Fer'
84		creator_emai	11	= 'ilker.fer@uib.no'
85		creator_url		= 'https://www.uib.no/gfi'
86		acknowledgem	nent	= 'This data set is made possible by the funding from the Research Council of Norway, project number 250784'
87		date_created	1	= '2020-03-16'
88	Dimensions	:		
89		TIME = 1114	12	
90		DEPTH = 54		
91		ZP = 2		
92		ZT = 1		
93		ZS = 1		
94		ZU = 69		
95	Variables:			
96	TIME			
97	1 11110	Size	11142-1	
00		Dimongiong:		
90		Dimensions.	1 IME	
100		Datatype.	double	
100		Attributes:		
101			standard_name = 't	
102			long_name = 'D	ecimal day'
103			units = 'D	ays since 2016-01-01T00:00:00Z'
104			axis = 'T	
105	DEPTH			
106		Size:	54x1	
107		Dimensions:	DEPTH	
108		Datatype:	double	
109		Attributes:		
110			standard_name = 'Z	
111			units = 'm	,
112			long_name = 'V	ertical distance below the sea surface'
113			axis = 'Z	
114	u			

115	Size:	54x11142
116	Dimensio	ns: DEPTH,TIME
117	Datatype	: double
118	Attribut	es:
119		standard_name = 'eastward_sea_water_velocity'
120		units = 'm s-1'
121		long_name = 'Absolute eastward sea water velocity'
122	v	
123	Size:	54x11142
124	Dimensio	ns: DEPTH,TIME
125	Datatype	: double
126	Attribut	es:
127		standard name = 'northward sea water velocity'
128		units = 'm s-1'
129		long name = 'Absolute northward sea water velocity'
130	zPRES ins	
131	Size:	2x11142
132	Dimensio	ns: ZP,TIME
133	Datatype	: double
134	Attribut	es:
135		units = 'm'
136		long name = 'Vertical distance below sea surface of pressure sensor at time-varying measurement level (not gridded)'
137	zTEMP ins	
138	Size:	1×11142
139	Dimensio	ns: ZT.TIME
140	Datatype	: double
141	Attribut	
142	11001 12000	units = 'm'
143		In a name = 'Vertical distance below sea surface of temperature sensor at time-varying measurement level (not gridded)'
144	zPSAL ins	
145	Size:	1×11142
146	Dimensio	
147	Datatype	
148	Attribut	
149	11001 12000	units = 'm'
150		In a name = 'Vertical distance below sea surface of conductivity sensor at time-varying measurement level (not gridded)'
151	zu ins	
152	Size:	69×11142
153	Dimensio	ns: ZU.TIME
154	Datatype	: double
155	Attribut	es:
156		units = 'm'
157		long name = 'Vertical distance below sea surface of horizontal velocity sensor at time-varying measurement level (not gridded)'
158	PRES ins	
159	Size:	2x11142
160	Dimensio	ns: ZP,TIME
161	Datatype	double
162	Attribut	es:
163		units = 'decibar'
164		long_name = 'Sea water pressure at time-varying measurement level (not gridded), equals 0 at sea-level'
165	TEMP_ins	
166		1x11142
167	Dimensio	ns: ZT,TIME
168	Datatype	: double
169	Attribut	es:
170		units = 'degree_Celsius'
171		long_name = 'sea water temperature at time-varying measurement level (not gridded), in-situ ITS-90 scale'
172	PSAL_ins	

173		Size:	1x11142		
174		Dimensions:	ZS,TIME		
175		Datatype:	double		
176		Attributes:			
177			units	=	'1'
178			long_name	=	'Practical salinity at time-varying measurement level (not gridded), PSS-78 scale'
179	u_ins				
180		Size:	69x11142		
181		Dimensions:	ZU,TIME		
182		Datatype:	double		
183		Attributes:			
184			units	=	'm s-1'
185			long_name	=	'Absolute eastward sea water velocity at time-varying measurement level (not gridded)'
186	v_ins				
187		Size:	69x11142		
188		Dimensions:	ZU,TIME		
189		Datatype:	double		
190		Attributes:			
191			units	=	'm s-1'
192			long_name	=	'Absolute northward sea water velocity at time-varying measurement level (not gridded)'
193					