

Short Cruise Report, RV Meteor, cruise M85, leg 1, Brest-St. John's, Jun 24<sup>th</sup> – Aug 2<sup>nd</sup> 2011

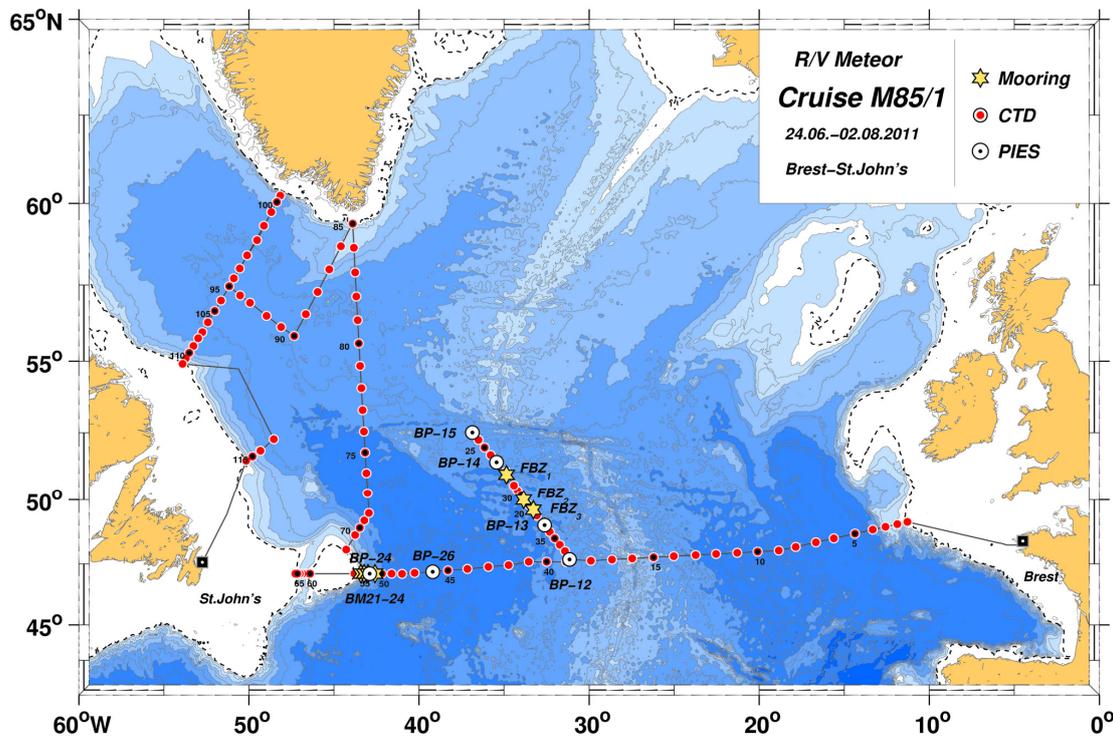
Dr. Dagmar Kieke  
Institut für Umweltphysik  
AG Ozeanographie  
Universität Bremen  
Otto-Hahn-Allee  
D-28359 Bremen

Tel.: +49-421-218-62154  
Fax: +49-421-218-7018  
email: dkieke@uni-bremen.de



**Short Cruise Report**  
**- RV Meteor, cruise M85/1 -**

**Brest – St. John's**  
**24<sup>th</sup> June - 02<sup>nd</sup> August 2011**  
**Chief Scientist: Dr. Dagmar Kieke**  
**Captain: Michael Schneider**



## **1. Objectives**

Cruise M85, leg 1, is funded by the German *Federal Ministry of Education and Research* (BMBF) as part of the cooperative research program 'North Atlantic'. The respective work package 2.1 is shared by the University of Bremen (PI: M. Rhein) and the *Federal Maritime and Hydrographic Agency* (BSH, PI: B. Klein) in Hamburg.

Many numerical ocean models suggest a relation between the strength of the meridional overturning, the formation of deep water components and the strength of the subpolar gyre. Various regions of the subpolar North Atlantic are thus considered as key regions, since obtaining observational data from these regions is crucial for studying the different processes. The following objectives are key questions that are to be addressed based on observational data obtained during METEOR cruise M85/1:

- 1) Inference of the interannual variability in the strength of the subpolar gyre from bottom-mounted pressure-recording inverted echo sounders (PIES). These are combined with shipboard measurement (T/S, velocity data), hydrographic profiles from profiling Argo floats, and satellite altimetry data to obtain transport time series.
- 2) Assessment of the strength of the volume transport and changes in the water mass characteristics in the area of the Deep Western Boundary Current (DWBC) off Flemish Cap as well as in Flemish Pass. Analyses are based on data received from deep-sea moorings deployed in the DWBC as well as shipboard measurements of T/S/O, velocity, and tracers.
- 3) Analysis of the interannual variability and present pathways of North Atlantic Deep Water and of the North Atlantic Current as they move across the Mid-Atlantic Ridge through the Faraday Fracture Zone.
- 4) Studying the large-scale changes in the deep water properties following the latitude of 47°N, on sections along the western flank of the Mid-Atlantic-Ridge, as well as along various sections crossing the exits and center of the Labrador.
- 5) Estimating the formation rate of Labrador Sea Water (LSW), the lightest contribution to North Atlantic Deep Water, for the period 2009-2011 from changes in the water mass inventories of anthropogenic tracers such as chlorofluorocarbon (CFC).

## **2. Narrative of cruise M85/1**

The scientific party arrived in Brest and embarked on RV METEOR on June 23<sup>rd</sup> 2011. RV METEOR left Brest on June 24<sup>th</sup> 2011 at 09:15 a.m. local time. After work related to compensating the magnetic compass was finished she was on transit towards the break of the European continental shelf. Wind and swell of westerly and southwesterly direction reduced ship speed down to 6-8 kn. Transit time was used to finish work on lab installations, CTD and water sampler preparations, and on training scientific members new to the sea-going business.

Continuous data recording was started on June 25<sup>th</sup>, 11:00 UTC. Starting in the afternoon of June 25<sup>th</sup> a first hydrographic section spanning the West European Basin from the shelf break to 31°08.94'W along 47°-49°N was conducted. At distances of around 50nm CTD/O and lowered ADCP casts from top to bottom were carried out. Salinity and oxygen samples were taken at each profile location for calibrating the oxygen and conductivity sensors of the CTD/O package. Two profiling floats of type PROVOR, equipped with oxygen sensors, were deployed along this section

Unfortunately, the analytical tracer system of the group from the University of Bremen (UniHB) could not be delivered on time to Brest due to an average of the cargo ship at sea and subsequent delayed arrival at Bremerhaven. Direct measurements and analysis of anthropogenic tracers such as chlorofluorocarbon (CFC) and sulphurhexafluoride (SF<sub>6</sub>), therefore, could not be carried out during the cruise. Instead, water samples for the home-lab analysis of chlorofluorocarbons (CFCs) were tapped regularly from all sampler bottles on every station and sealed afterwards for storage reasons. These samples will be analyzed at the gas-chromatographic laboratory at UniHB after the cruise is finished.

On behalf of our Dutch partners from the University of Groningen C14 samples were taken and prepared for storage on every second or third station. Three stations (#8, #9, #11) during June 27<sup>th</sup> and June 28<sup>th</sup> were used as calibration stations for SeaCATs and MicroCATs that were to be deployed as part of the BSH moorings near Faraday Fracture Zone.

On July 1<sup>st</sup> RV METEOR arrived at 47°40.25'N, 31°08.94'W, the location of the pressure-recording inverted echo-sounder (PIES) BP-12/3, and data collected by the PIES throughout the past year was retrieved via acoustic data telemetry. Course was changed towards northwest, thereby following the course of the Mid-Atlantic Ridge (MAR) on its

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western side. Having finished two further CTD-stations RV METEOR arrived at the location of PIES BP-13/2 on July 2<sup>nd</sup>, 01:30 UTC. Telemetric data recording lasted on until 03:00 UTC, but was not successful and therefore aborted since an important signal, necessary to reassemble the data sent on four different frequencies, could not be recorded. Since this location would be occupied once again on the way back to 47°N, the PIES was left at its present location, and another telemetry attempt was shifted to a later point of time.

On July 2<sup>nd</sup>, 08:00 UTC, RV METEOR arrived at 49°36.39'N, 33°16.84'W, the location of mooring FFZ-3, deployed by the BSH group in August 2010 (METEOR cruise M82/2). The mooring was safely recovered and put into water again the same day with the bottom weight deployed at 19:15 UTC. The following day, July 3<sup>rd</sup>, mooring FFZ-2 was visited, recovered, and redeployed the same day. The original intention was to proceed with exchanging mooring FFZ-1 located further to the north, but worsening weather conditions resulted in adjusting the work plan. For this reason RV METEOR headed towards 50°N, 33°51'W, the northernmost position of this section and the location of the northernmost instrument (BP-15/2) of the Bremen PIES array at the MAR. There, she arrived on July 4<sup>th</sup>, 18:40 UTC, the hydrophone was put into the water, and telemetric data recording began and was successfully finished at 21:25 UTC. RV METEOR changed course again and sailed back towards 47°N basically following the same track.

On July 5<sup>th</sup> RV METEOR arrived at 51°41'N, 35°47'W, the location of PIES BP-14/1. This instrument could neither be retrieved back last summer, nor was data telemetry successful at that time. Therefore, the instrument was considered as lost. Amazingly, this time it properly responded to certain commands sent in the framework of one last attempt of telemetry. In the end, any valid data could not be received, but releasing the instrument seemed to have worked. After searching the instrument for 2 hours and detecting it at the sea surface also failed, it was definitely considered as lost, and a new instrument was deployed at the same location serving to replace the lost one.

While approaching the 47°N-latitude again, CTDO/IADCP casts were regularly completed, two floats of type APEX were deployed, and the third BSH-mooring (FFZ-1) was successfully recovered and redeployed (July 5<sup>th</sup>).

On July 7<sup>th</sup>, PIES BP-13/2 was revisited. Once again, data telemetry was not successful. For this reason the release command was sent to the instrument (July 8<sup>th</sup>, 00:53 UTC), and after its ascend to the sea surface the instrument could be safely picked up at 02:40

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UTC. Close inspection the next day revealed severe water intrusions into the instrument's interior, thereby damaging the electronic devices, boards, and batteries. Mooring and PIES related work at the MAR was thus finished, and on July 9<sup>th</sup>, RV METEOR headed towards west to fill and complete the 47°N section with CTDO/IADCP stations. Also, two further APEX floats were deployed along 47°N.

On July 11<sup>th</sup> RV METEOR arrived at 47°11N, 39°11'W, the location of the Bremen PIES BP-26/1. This instrument was deployed there last year. Data recording via acoustic telemetry failed, however. For this reason the PIES was released at 13:00 UTC and could be safely recovered at 14:45 UTC.

On July 13<sup>th</sup> RV METEOR arrived at 47°06'N, 43°07'W, the location of the Bremen mooring BM-23/2. The mooring was contacted via acoustic ranging of the releasers, and the release signal was sent at 07:00 UTC. Unfortunately, any signal stemming from the radio transmitters of the top buoy could not be received. Therefore, it was not possible to take the bearing of the top buoy and locate any mooring elements at the surface. Ranging of the releasers lasted on until 10:15 UTC, when any valid returns could no longer be received. In the meantime the weather conditions had reduced, changing from fine and clear conditions in the beginning to rain and fog shortly following. Several locations in the vicinity of the assumed mooring location were occupied, and ranging was resumed several times without receiving acceptable and reliable distance values for the releasers. Foggy weather conditions worsened reducing the visibility down to less than 300m. The deckunit and the hydrophone in use were exchanged and used in different instrumental combinations to exclude any kind of technical malfunction, and signal transmission was increased at certain times by using an amplified hydrophone. Ranging of the BM-23/2 releasers lasted on until 19:00 UTC, when three floatation bodies were identified at the surface at a visibility of less than 300m. The floatation bodies were picked up together with a pair of releasers and pieces of a torn rope. One hook of a releaser was found open. These elements turned out to belong to mooring BM-22/2 which was supposed to be still in the water about 4nm further west. After the radio receiver was set to receive the radio signal of the corresponding top element, indeed bearing of the top buoy could be taken. Between 20:20 UTC to 22:50 UTC mooring BM-22/2 was entirely recovered, while there was still missing any information pointing to the location of mooring BM-23/2. While wind speeds started to increase to wind force 7-8, and visibility was still down to only a few

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hundred meters, further time was spent (23:15-05:30 UTC next morning) to search for the missing mooring. From the drifting time and direction of mooring BM-22/2 several positions to the southeast of the initial location of BM-23/2 were determined and subsequently occupied. At three out of six different positions it was possible to range the releasers and to receive a few replies that resulted in unreliable distances. At least, this gave evidence that BM-23/2 had drifted away from its deployment location since its release towards southeast, but it was not possible to determine its actual position. At 05:30 UTC on July 14<sup>th</sup> mooring BM-23/2 was considered as lost. Station work consisting of CTDO/IADCP stations was resumed again, another APEX float was deployed, and the section across the DWBC at 47°N was finished in the evening hours the same day. After station 771/53 was finished notable problems in the beam performance of one Workhorse IADCP made its exchange necessary. The night time was used to conduct vm-ADCP surveys across the DWBC. On July 15<sup>th</sup> RV METEOR arrived at 47°06'N, 43°25'W, the location of the third Bremen mooring BM-21/2. The mooring was released at 09:50 UTC, and again, any radio signal making the top float detectable when at the surface was missing. Also dense fog again greatly reduced sight down to less than 300m. The releasers, however, could be perfectly ranged. At 09:30 UTC the top float was detected, and recovery of BM-21/2 began and lasted on until 10:35 UTC. At 10:55 UTC RV METEOR set course towards west and started a survey with vm-ADCP across Flemish Cap. Station work in Flemish Pass began on July 15<sup>th</sup>, 23:30 UTC, and was finished on July 16<sup>th</sup> after completion of six CTDO/IADCP stations. Most of these works were done at conditions of dense fog with reduced visibility. The time between departure from the mooring region and re-arrival was used to check and read out the collected mooring data and refurbish all recovered mooring sensors. Mooring work in the DWBC area was resumed again on July 17<sup>th</sup> when three deep-sea moorings were subsequently deployed to capture the strength and variability of the deep western boundary current and the deep water export. Due to the loss of the mooring BM-23/2 certain current meters and T/S sensors were not available anymore. Any data gaps could be avoided by adding RCM-7/8 current meters with temperatures sensors to these moorings. The RCMs were generously provided by project partners from the BSH. On July 17<sup>th</sup>, 21:00 UTC, all moorings were located again at their intended location, though none of the top floats could be observed during their descend to greater depths because of fog. In the morning hours of July 18<sup>th</sup> the last remaining PIES, BP-24/1, was visited, and all

recorded data could be received successfully via acoustic telemetry.

RV METEOR changed the work area, and on July 18<sup>th</sup>, station work began in the region of the DWBC at the northeastern tip of Flemish Cap. At station 793/68 any disturbance affected the conductivity cell and the oxygen sensor, resulting in unreliable values and in part severe differences in the shape of the down- and upcast profile. Data processing techniques were not successful to retain reliable CTD data for this profile. On July 19<sup>th</sup> the section across the boundary current was finished and RV METEOR sailed along ~43°30'W towards Greenland. While crossing the *northwest corner*, the two remaining APEX floats were deployed. *Multibeam* data logging was switched off on July 22<sup>nd</sup>, while RV METEOR was about to enter the Danish EEZ. CTDO/IADCP stations were conducted at typical distances of 46nm. On the way towards north two PROVOR floats were deployed.

Closest vicinity to Cape Farewell was reached at 59°23.46'N, 43°53.72'W on July 23<sup>rd</sup>. This was one of the rare moments of good sight that allowed spotting one of the icebergs being transported with the East Greenland Current towards the Labrador Sea. Here, after finishing station work course was changed again, and RV METEOR followed a section leading from the southern tip of Greenland towards the central axis of the Labrador Sea. Station distances slightly increased to almost 50nm.

On July 26<sup>th</sup>, RV METEOR arrived in the central Labrador Sea to conduct the first CTDO/IADCP on the so-called AR7W-line, a repeat hydrographic section regularly visited by various research groups since 1990. Here, another PROVOR float was put into water. On stations 825/95 and 826/96 any reliable IADCP data could not be obtained due to a beam problem of the master instrument. On its way towards the Greenland side of this section a leap-frog-like station pattern was chosen with every second station left out on the way towards Greenland. On the way towards the Canadian side of AR7W the resulting gaps were afterwards filled with stations. This increased the station net along this section and allowed to adjust the working program to the daily weather situation which was most of the time influenced by foggy conditions.

On July 28<sup>th</sup> the last PROVOR float was deployed, and RV METEOR arrived on the western side of AR7W where she continued this section at station distances between 22 nm down to 13 nm. On July 29<sup>th</sup> the shallowest station was conducted at a water depth of ~450m which marked the arrival at the western end of AR7W. The remaining station work was shifted to the DWBC region further south at about 52°N. RV METEOR left the AR7W

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line, and course was set towards east which later on changed into a southeastern course to avoid ice and foggy conditions in the boundary current area. On July 31<sup>st</sup> the final section was begun and finished after completing four CTDO/IADCP stations across the DWBC area at ~52°N. Station work was finished at 21:50 UTC, and RV METEOR started her transit towards St. John's, Newfoundland. Continuous data recording stopped on August 1<sup>st</sup> 17:30 UTC, and RV METEOR finished cruise M85/1 in St. John's in the morning hours of August 2<sup>nd</sup>.

**Acknowledgements**

We greatly appreciate the assistance and hospitality of Captain Michael Schneider and the entire METEOR crew during this six-weeks-long trip to the subpolar North Atlantic.

**Participants Meteor M85/1**

1. Kieke, Dagmar	chief scientist	UniHB
2. Albert, Christine	oxygen analysis	UniHB
3. Altube Vasquez, Patricia	CTD/IADCP-watch	UniHB
4. Böke, Wolfgang	moorings, CTD, PIES	UniHB
5. Brinkhoff, Lena-Anneke	tracer sampling	UniHB
6. Buß, Antje	CTD/IADCP-watch	UniHB
7. Chen, Stephanie	tracer sampling	UniHB
8. Denker, Claudia	moorings, data analysis	BSH
9. Hänsel, Carola	meteorology	DWD
10. Hauck, Dennis	moorings, floats	BSH
11. Karbe, Fritz. R.	moorings, data analysis	UniHB
12. Kattein, Ole	moorings, floats	BSH
13. Köhler, Janna	lowered ADCP-analysis	UniHB
14. Ludwig, Reimund	moorings, floats	BSH
15. Raeke, Andreas	meteorology	DWD
16. Rütten, Sebastian	CTD/IADCP-watch	UniHB
17. Schneider, Linn	CTD/IADCP-watch	UniHB
18. Schulenberg, Jörg	moorings, CTD, PIES	UniHB
19. Souti, Maria-Evangelia	CTD/IADCP-watch	UniHB
20. Steinfeldt, Reiner	CTD calibration, salinometry	UniHB
21. Uhe, Christian	CTD/IADCP-watch	UniHB
22. Walter, Maren	vesselmounted-ADCP analysis	UniHB

BSH: Bundesamt für Seeschifffahrt und Hydrographie, Hamburg, Germany

DWD: Deutscher Wetterdienst, Seeschifffahrtsberatung, Hamburg, Germany

UniHB: Universität Bremen, Institut für Umweltphysik, AG Ozeanographie  
Bremen, Germany

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**Table 1. PIES activities during cruise M85/1, 2011**

PIES ID	S/N	Latitude	Longitude	Depth [m]	Deployment Date/Time	Telemetry Date/Time	Recovery Date/Time
BP12/3	240	47°40.25'N	31°08.94'W	4084	---	01.07.2011 successful	---
BP13/2	56	49°00.92'N	32°36.75'W	3935	---	02.07.2011 aborted, data incomplete	08.07.2011 00:53
BP13/3	272	49°00.85'N	32°36.94'W	---	08.07.2011 03:05	---	---
BP14/1	188	51°25.64'N	35°26.29'W	3566	---	05.07.2011 failed	05.07.2011 failed
BP14/2	271	51°25.63'N	35°26.27'W	---	05.07.2011 21:38	---	---
BP15/2	75	52°30.50'N	36°51.60'W	3404	---	04.07.2011 successful	---
BP24/1	235	47°05.90'N	42°53.73'W	3440	---	18.07.2011 successful	---
BP26/1	201	47°10.83'N	39°11.30'W	4580	---	11.07.2011 aborted, data incomplete	11.07.2011 12:58
BP27/1	---	---	---	---	---	---	---

All times are given as UTC. PIES: inverted echo-sounders with pressure sensor; all instruments are equipped with flashlights and radio beacons. The position with PIES-ID BP-27/1 could not be occupied as originally intended, since the respective instrument served to replace the PIES identified as BP-13/2.

**Table 2. Faraday Fracture Zone Moorings, BSH, M85/1, 2011**

Moorings ID	Latitude	Longitude	Depth [m]	Deployment Date/Time	Recovery Date/Time	CTD profile #
FBZ-1/2	50°57.79'N	34°51.65'W	4312	---	06.07.2011 06:40	28
FBZ-1/3	50°58.35'N	34°51.00'W	4329	06.07.2011 14:07	---	28
FBZ-2/2	50°00.07'N	33°50.72'W	4248	---	03.07.2011 06:40	22
FBZ-2/3	49°55.66'N	33°49.66'W	4198	03.07.2011 12:25	---	22
FBZ-3/2	49°36.39'N	33°16.84'W	4109	---	02.07.2011 08:00	20
FBZ-3/3	49°36.48'N	33°15.97'W	4101	02.07.2011 15:05	---	20

All times are given as UTC. All moorings are equipped with radio beacons. The top element of mooring FBZ-1/2 did not send radio signals after finishing its ascend to the surface.

**Table 3. Boundary Current Moorings, UniHB, M85/1, 2011**

Mooring ID	Latitude	Longitude	Depth [m]	Deployment Date/Time	Recovery Date/Time	CTD profile #
BM21/2	47°06.00'N	43°24.90'W	1290	---	15.07.2011 09:45 – 10:34	57
BM22/2	47°06.31'N	43°13.81'W	2989	---	13.07.2011 20:18 – 22:50	54
BM22/3	47°06.46'N	43°13.68'W	3024	17.07.2011 07:00 – 11:44	---	54
BM23/2	47°06.07'N	43°07.18'W	3500	---	13.-14.07.2011, 07:00 -05:30 mooring released, but lost	53
BM23/3	47°06.14'N	42°59.92'W	3561	17.07.2011 12:46 – 16:30	---	52 (closest)
BM24/1	47°05.96'N	42°35.45'W	3669	17.07.2011 18:19 – 21:00	---	51

All times are given as UTC. All moorings were equipped with radio beacons and flashlights, BM-22/2+3 had an additional ARGOS watchdog. During recovery radio signals could only be received from mooring BM-22/2.

**Table 4. APEX-Float Deployments, BSH, M85/1, 2011**

Float ID	WMO ID	ARGOS ID	CTD #	Latitude	Longitude	Date	Time [UTC]
5800	6901060	46355	35	48°30.075'N	32°01.079'W	08. Jul. 2011	14:09
5801	6901061	46597	41	47°34.674'N	33°32.642'W	09. Jul. 2011	23:23
5802	6901062	46972	30	50°10.319'N	33°58.351'W	07. Jul. 2011	05:54
5803	6901063	46974	46	47°10.676'N	39°11.522'W	11. Jul. 2011	18:09
5804	6901064	46976	74	51°00.884'N	43°05.246'W	20.Jul.2011	03:10
5805	6901065	47715	72	49°29.364'N	42°56.085'W	19. Jul. 2011	10:57
5806	6901066	47716	57	47°05.595'N	43°25.341'W	14. Jul. 2011	19:11

**Table 5. PROVOR-Float Deployments, Ifremer, M85/1, 2011**

Float ID	WMO ID	ARGOS ID	CTD #	Latitude	Longitude	Date	Time [UTC]
OIN-10-S3-DO-07	1901211	75313	14	47°47.857'N	25°01.239'W	29.Jun.2011	14:00
OIN-10-S3-DO-08	1901212	75314	18	47°37.098'N	29°53.882'W	30.Jun.2011	22:44
OIN-10-S3-DO-09	1901213	75315	26	51°41.523'N	35°47.282'W	05.Jul.2011	14:30
OIN-10-S3-DO-10	1901214	75308	79	54°50.193'N	43°27.350'W	21.Jul.2011	16:50
OIN-10-S3-DO-11	1901215	75224	82	57°07.715'N	43°40.915'W	22.Jul.2011	14:09
OIN-10-S3-DO-13	1901217	75316	95	57°27.345'N	51°09.219'W	26.Jul.2011	02:21
OIN-10-S3-DO-14	1901218	75225	106	56°17.586'N	52°24.448'W	29. Jul.2011	04:45

All PROVOR floats are equipped with oxygen sensors.

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Table 6. CTD/LADCP/Tracer/C-14-Stations, M85/1, 2011

Meteor		M85/1	CTD Stations				Measurements				Page 1	
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	CFC	O <sub>2</sub>	<sup>14</sup> C	LADCP	Comments
1	693	2011/06/25	15:16	49° 8.54' N	11° 16.88' W	344	333	x	x	-	x	
2	694	2011/06/25	18:37	49° 3.21' N	11° 52.79' W	997	994	x	x	-	x	
3	695	2011/06/25	22:37	48° 57.02' N	12° 34.59' W	1760	1743	x	x	-	x	
4	696	2011/06/26	03:27	48° 50.40' N	13° 19.37' W	3798	3784	x	x	-	x	
5	697	2011/06/26	10:46	48° 41.09' N	14° 22.14' W	4560	4548	x	x	x	x	
6	698	2011/06/26	19:26	48° 30.08' N	15° 36.80' W	4839	4832	x	x	-	x	
7	699	2011/06/27	03:24	48° 20.78' N	16° 39.50' W	4815	4808	x	x	-	x	
8	700	2011/06/27	11:56	48° 10.17' N	17° 51.17' W	4463	4455	x	x	x	x	Seacat calib.
9	701	2011/06/27	19:30	48° 1.34' N	18° 50.85' W	4402	4394	x	x	-	x	Seacat calib.
10	702	2011/06/28	04:29	47° 58.59' N	20° 5.54' W	4307	4304	x	x	x	x	
11	703	2011/06/28	12:05	47° 56.02' N	21° 17.24' W	4470	4463	x	x	-	x	Seacat calib.
12	704	2011/06/28	20:37	47° 53.31' N	22° 31.99' W	4026	4017	x	x	x	x	
13	705	2011/06/29	03:51	47° 50.70' N	23° 43.67' W	4281	4257	x	x	-	x	
14	706	2011/06/29	11:37	47° 47.90' N	25° 1.24' W	3530	3513	x	x	x	x	
15	708	2011/06/29	19:15	47° 45.25' N	26° 12.64' W	3118	3103	x	x	-	x	
16	709	2011/06/30	04:26	47° 42.66' N	27° 27.51' W	2966	2907	x	x	x	x	
17	710	2011/06/30	12:46	47° 39.97' N	28° 39.23' W	2961	2875	x	x	-	x	
18	711	2011/06/30	20:23	47° 37.13' N	29° 53.86' W	3385	3368	x	x	-	x	
19	714	2011/07/01	11:11	47° 39.79' N	31° 8.50' W	4090	4075	x	x	-	x	
20	717	2011/07/02	11:46	49° 34.66' N	33° 15.50' W	4111	4085	-	x	-	x	
21	719	2011/07/03	01:27	50° 21.59' N	34° 13.03' W	3767	3752	-	-	-	x	
22	722	2011/07/03	17:45	49° 56.12' N	33° 50.93' W	4137	4139	-	x	-	x	
23	724	2011/07/04	22:00	52° 30.11' N	36° 52.07' W	3384	3378	x	x	-	x	
24	725	2011/07/05	02:23	52° 14.54' N	36° 30.11' W	3632	3592	x	x	-	x	
25	726	2011/07/05	06:59	51° 57.91' N	36° 8.62' W	3864	3844	x	x	-	x	
26	727	2011/07/05	11:56	51° 41.46' N	35° 47.21' W	3653	3640	x	x	-	x	
27	731	2011/07/05	23:56	51° 25.85' N	35° 26.43' W	3611	3595	x	x	-	x	Microcat calib.
28	733	2011/07/06	11:13	51° 4.13' N	34° 53.67' W	4168	4133	x	x	-	x	
29	735	2011/07/06	21:30	50° 33.67' N	34° 25.22' W	4158	4148	x	x	-	x	
30	736	2011/07/07	03:25	50° 10.32' N	33° 58.25' W	3712	3706	x	x	-	x	
31	738	2011/07/07	08:39	49° 47.00' N	33° 31.31' W	4220	4208	x	x	-	x	
32	739	2011/07/07	14:31	49° 23.68' N	33° 4.40' W	3779	3769	x	x	-	x	
33	740	2011/07/07	21:12	49° 0.63' N	32° 37.02' W	3933	3926	x	x	-	x	
34	745	2011/07/08	06:41	48° 45.02' N	32° 18.87' W	3712	3711	x	x	-	x	
35	746	2011/07/08	11:26	48° 30.03' N	32° 1.01' W	4215	4205	x	x	-	x	
36	748	2011/07/08	16:08	48° 14.98' N	31° 42.96' W	3863	3861	x	x	-	x	
37	749	2011/07/08	20:41	48° 0.02' N	31° 25.10' W	4005	4003	x	x	-	x	
38	750	2011/07/09	01:47	47° 40.29' N	31° 9.08' W	4081	4074	x	x	-	x	
39	751	2011/07/09	06:33	47° 34.53' N	31° 21.08' W	3749	3705	x	x	-	x	
40	752	2011/07/09	13:54	47° 34.59' N	32° 29.35' W	3925	3905	x	x	-	x	
41	753	2011/07/09	20:38	47° 34.57' N	33° 32.57' W	3946	3946	x	x	-	x	
42	755	2011/07/10	04:00	47° 26.54' N	34° 44.00' W	4086	4070	x	x	-	x	

Short Cruise Report, RV Meteor, cruise M85, leg 1, Brest-St. John's, Jun 24<sup>th</sup> – Aug 2<sup>nd</sup> 2011

Table 6. continued ...

Meteor		M85/1	CTD Stations			Measurements				Page 2		
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	CFC	O <sub>2</sub>	<sup>14</sup> C	LADCP	Comments
43	756	2011/07/10	11:20	47° 22.44' N	35° 54.96' W	4333	4319	x	x	x	x	
44	757	2011/07/10	18:53	47° 17.43' N	37° 9.38' W	4456	4454	x	x	-	x	
45	758	2011/07/11	02:37	47° 13.79' N	38° 17.96' W	4589	4592	x	x	-	x	
46	761	2011/07/11	15:03	47° 10.67' N	39° 11.43' W	4582	4586	x	x	x	x	
47	763	2011/07/11	23:36	47° 8.03' N	40° 15.37' W	4555	4549	x	x	-	x	
48	764	2011/07/12	06:18	47° 5.47' N	40° 59.70' W	4493	4484	x	x	x	x	
49	765	2011/07/12	12:11	47° 6.05' N	41° 36.57' W	4293	4292	x	x	-	x	
50	766	2011/07/12	18:04	47° 5.88' N	42° 10.84' W	4113	4095	x	x	-	x	
51	767	2011/07/12	22:48	47° 5.97' N	42° 35.46' W	3670	3672	x	x	-	x	
52	768	2011/07/13	03:04	47° 5.92' N	42° 53.71' W	3473	3436	x	x	x	x	
53	771	2011/07/14	07:16	47° 6.11' N	43° 7.11' W	3500	3512	x	x	-	x	
54	772	2011/07/14	11:09	47° 6.04' N	43° 13.54' W	3020	3010	x	x	x	x	
55	773	2011/07/14	13:56	47° 6.01' N	43° 17.94' W	2539	2542	x	x	-	x	
56	774	2011/07/14	16:22	47° 5.94' N	43° 20.18' W	1720	1716	x	x	-	x	
57	775	2011/07/14	18:15	47° 6.03' N	43° 25.33' W	1281	1262	x	x	-	x	
58	777	2011/07/14	20:22	47° 6.04' N	43° 38.44' W	771	755	x	x	-	x	
59	778	2011/07/14	21:51	47° 6.00' N	43° 47.52' W	586	568	x	x	-	x	
60	782	2011/07/15	23:26	47° 6.01' N	46° 24.46' W	356	347	x	x	-	x	
61	783	2011/07/16	00:46	47° 6.04' N	46° 33.44' W	506	498	x	x	-	x	
62	784	2011/07/16	02:25	47° 5.98' N	46° 42.52' W	1147	1123	x	x	-	x	
63	785	2011/07/16	04:15	47° 6.07' N	46° 51.43' W	1176	1155	x	x	-	x	
64	786	2011/07/16	06:10	47° 5.99' N	47° 0.51' W	1138	1116	x	x	-	x	
65	787	2011/07/16	08:05	47° 5.98' N	47° 9.52' W	878	858	x	x	-	x	
66	788	2011/07/16	09:56	47° 6.00' N	47° 15.93' W	474	459	x	x	-	x	
67	793	2011/07/18	12:37	48° 3.64' N	44° 16.92' W	671	654	x	x	-	x	
68	794	2011/07/18	15:22	48° 20.83' N	44° 0.75' W	2303	2300	x	x	-	x	bad data
69	795	2011/07/18	19:15	48° 37.95' N	43° 44.75' W	2369	2352	x	x	-	x	
70	796	2011/07/18	23:07	48° 55.03' N	43° 28.64' W	3680	3661	x	x	-	x	
71	797	2011/07/19	03:32	49° 12.21' N	43° 12.65' W	3953	3938	x	x	-	x	
72	798	2011/07/19	08:05	49° 29.35' N	42° 56.60' W	4181	4166	x	x	-	x	
73	800	2011/07/19	16:00	50° 15.15' N	43° 1.07' W	4250	4245	x	x	-	x	
74	801	2011/07/19	23:33	51° 0.96' N	43° 5.33' W	4236	4239	x	x	-	x	Microcat calib.
75	803	2011/07/20	07:45	51° 46.83' N	43° 9.80' W	4152	4143	x	x	-	x	
76	804	2011/07/20	15:18	52° 32.71' N	43° 14.18' W	3826	3832	x	x	-	x	
77	805	2011/07/20	23:27	53° 18.51' N	43° 18.52' W	3490	3487	x	x	-	x	
78	806	2011/07/21	06:45	54° 4.39' N	43° 23.18' W	3639	3623	x	x	-	x	
79	807	2011/07/21	14:43	54° 50.25' N	43° 27.46' W	3366	3330	x	x	-	x	
80	809	2011/07/21	21:52	55° 36.04' N	43° 31.97' W	3360	3343	x	x	-	x	
81	810	2011/07/22	04:30	56° 21.94' N	43° 36.24' W	3511	3508	x	x	-	x	
82	811	2011/07/22	11:52	57° 7.74' N	43° 40.70' W	3489	3482	x	x	-	x	
83	813	2011/07/22	19:18	57° 53.72' N	43° 45.05' W	3234	3229	x	x	-	x	
84	814	2011/07/23	03:07	58° 39.46' N	43° 49.54' W	1732	1727	x	x	-	x	

Short Cruise Report, RV Meteor, cruise M85, leg 1, Brest-St. John's, Jun 24<sup>th</sup> – Aug 2<sup>nd</sup> 2011

Table 6. continued ...

Meteor		M85/1	CTD Stations			Measurements				Page 3		
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	CFC	O <sub>2</sub>	<sup>14</sup> C	LADCP	Comments
85	815	2011/07/23	09:45	59° 23.45' N	43° 53.73' W	1052	1045	x	x	-	x	
86	816	2011/07/23	15:20	58° 42.39' N	44° 35.19' W	1902	1895	x	x	-	x	
87	817	2011/07/23	21:30	57° 59.45' N	45° 16.56' W	2344	2336	x	x	-	x	
88	818	2011/07/24	05:02	57° 16.65' N	45° 57.69' W	3482	3471	x	x	-	x	
89	819	2011/07/24	13:05	56° 33.67' N	46° 38.95' W	3560	3556	x	x	-	x	
90	820	2011/07/24	20:48	55° 50.79' N	47° 20.24' W	3468	3449	x	x	-	x	
91	821	2011/07/25	02:13	56° 8.43' N	48° 6.58' W	3635	3629	x	x	-	x	
92	822	2011/07/25	08:20	56° 30.48' N	48° 57.66' W	3658	3648	x	x	-	x	
93	823	2011/07/25	14:39	56° 55.87' N	49° 56.07' W	3430	3263	x	x	-	x	
94	824	2011/07/25	19:07	57° 9.91' N	50° 30.96' W	3595	3586	x	x	-	x	
95	825	2011/07/26	00:03	57° 27.39' N	51° 9.11' W	3504	3495	x	x	-	-	
96	826	2011/07/26	06:05	58° 1.12' N	50° 32.55' W	3550	3542	x	x	-	-	
97	828	2011/07/26	14:26	58° 53.41' N	49° 31.03' W	3454	3446	x	x	-	x	
98	829	2011/07/26	22:14	59° 44.35' N	48° 40.58' W	3172	3169	x	x	-	x	
99	830	2011/07/27	04:46	60° 13.56' N	48° 9.06' W	1453	1462	x	x	-	x	
100	831	2011/07/27	07:39	60° 2.31' N	48° 21.18' W	2883	2874	x	x	-	x	
101	832	2011/07/27	15:13	59° 19.63' N	49° 7.32' W	3352	3336	x	x	-	x	
102	833	2011/07/27	23:17	58° 25.70' N	50° 5.85' W	3526	3520	x	x	-	x	
103	834	2011/07/28	07:38	57° 42.47' N	50° 52.99' W	3595	3585	x	x	-	x	
104	835	2011/07/28	15:45	57° 0.31' N	51° 38.30' W	3541	3532	x	x	-	x	
105	836	2011/07/28	20:52	56° 40.11' N	52° 0.23' W	3535	3528	x	x	-	x	
106	837	2011/07/29	02:30	56° 17.61' N	52° 24.52' W	3536	3529	x	x	-	x	
107	839	2011/07/29	07:31	55° 58.26' N	52° 44.10' W	3322	3316	x	x	-	x	
108	840	2011/07/29	11:28	55° 46.14' N	52° 58.63' W	3165	3155	x	x	-	x	
109	841	2011/07/29	15:37	55° 30.42' N	53° 15.63' W	3017	3013	x	x	-	x	
110	842	2011/07/29	19:33	55° 16.97' N	53° 30.27' W	2657	2653	x	x	-	x	
111	843	2011/07/29	23:03	55° 5.68' N	53° 42.28' W	1564	1563	x	x	-	x	
112	844	2011/07/30	01:55	54° 54.47' N	53° 54.31' W	446	435	x	x	-	x	
113	845	2011/07/31	07:03	52° 16.13' N	48° 32.03' W	3637	3631	x	x	-	x	
114	846	2011/07/31	13:16	51° 51.02' N	49° 18.95' W	3008	3001	x	x	-	x	
115	847	2011/07/31	17:49	51° 38.55' N	49° 47.57' W	2289	2282	x	x	-	x	
116	848	2011/07/31	21:12	51° 28.95' N	50° 9.63' W	764	762	x	-	-	x	