

SHORT CRUISE REPORT

RV METEOR: cruise M82/2

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from St. John's, Canada to Ponta. Delgada, Acores, Portugal
August 5 to September 1, 2010

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1.2 Research Program

The cruise is part of the German joint research project 'Nordatlantik' and is supported by the German Ministry of education and research, BMBF, and the Deutsche Forschungsgemeinschaft (DFG). The close in-project collaboration between the Bremen University (M. Rhein) and the Bundesamt fuer Seeschifffahrt und Hydrographie, BSH (B. Klein) is extended to the Woods Hole Oceanographic Institution, WHOI (A. Bower). The Woods Hole efforts are dedicated to measure the transport through the Gibbs Fracture Zone by moored sensors. The mooring will be recovered in 2012.

The oceanography department of the Bremen University operates a subpolar North Atlantic observing system, comprised of the following long term measurements: biennial change in the production rate of Labrador Sea Water (since 1997), the transport variability of the subpolar gyre (since 2006), the export of deep water in the Western Boundary Current (since 2009), and the fluctuations of the North Atlantic current inflow across 47°N (since 2010). The cruise M82/2 contributes to most of the components of this system. The objectives of the cruise are (i) to infer the transport variability of the subpolar gyre through combined data from moored Inverted Echo Sounders (PIES), moored instruments (velocity, temperature, salinity), shipboard measurements, float profiles from the ARGO program, and satellite altimetry, (ii) to study the transports and water mass characteristics in the Flemish Pass, and in the deep western boundary current off Newfoundland using shipboard measurements of velocity, temperature, salinity as well as time series from moored sensors, (iii) to study the changes in water mass characteristic in the Atlantic approximately along 47°N, following the former WOCE section A2 in the Eastern Atlantic.

1.3 Narrative of the Cruise

The METEOR left St. John's on August 5, 15 UTC heading west approximately along 47°N towards the Flemish Pass. The first CTD/LADCP station was reached at August 6, 9:00¹ Station spacing was about 6nm, starting at water depths of 450m on the western side of the Flemish Pass at 47°06'N, 47°16'W, and ending at the eastern side at 46°24.5'W (water depth 350m). The CTD/LADCP measurements were carried out successfully, and tracer samples were taken and will be later analysed in the Bremen home lab. The METEOR behaved very stable, so that we received high quality velocity data from the Lowered ADCPs (Acoustic Doppler Current Profiler). The Flemish Pass survey was finished in late afternoon.

The distance to the continental slope at 47°N is about 130nm, and the position of the Bremen boundary current moorings were reached at dawn, August 7. The mooring B23 at 43°07'W was released at 7:50, and was on board at 10:00. The centre mooring (B22) at 43°14'W couldn't be released when reaching the location due to heavy fog. After the fog became slightly thinner, the mooring was released at 11:50.

¹ All times in UTC

It took about two hours finding the mooring, while the visibility deteriorated fast, and the radio on the top buoy didn't emit a signal. The mooring was found by contacting one of the releasers with the Posidonia system of the METEOR. The mooring was recovered with the releasers first (at 14 UTC), and the top element was on board at 15:30. The third mooring (B21) at 43°25'W was released at 16:40, and on board at 17:50. The METEOR headed west towards Flemish cap to begin the CTD/LADCP boundary current section at 47°06'N, 43°47.5'W at a water depth of 570m. The station spacing was between 3 and 6nm, depending on the steepness of the continental slope. The water depth increased by about 500m on subsequent stations.

On August 8, the location of PIES B24 (Inverted echo sounder with bottom pressure sensor) at 42°54'W was reached, and the data transmitted using acoustic telemetry. B24 is located on eastern limit of the boundary current array, and serves to study the relation between transport fluctuations offshore and in the deep western boundary current. Due to ambient noise, presumably by whales hovering close to the ship, the data transfer had to be interrupted at 17:00. Meanwhile, the six acoustic mooring releasers, recovered the day before, were tested by lowering them to 1000m depth. The test was successful for all releasers. Since the ambient noise level did not change, and the whales stayed close to the ship, the telemetry was abandoned. The next CTD station 12nm further east was used to calibrate the MicroCATS, which will be redeployed the following day. The CTD stations were continued to 41°36.5' W. After the CTD was back on board, the METEOR turned west and the acoustic telemetry at PIES B24 was repeated. This time the data transfer was successful.

The position of the Bremen mooring BM23-2 was reached at August 9. At 20:00, the deployment started, and the anchor weight was slipped at 21:50. It turned out that the top buoy did not sink, obvious through the continuing radio signal and the flashlight. The top buoy was hauled back to the METEOR. All instruments including the releasers were recovered. It turned out, that the brand new rope between the releasers and the anchor weight was broken. In the following hours the METEOR carried out two boundary current transects with the two vm-ADCPs. At August 10, 10:20, the Bremen moorings BM22-2 and BM21-2 were deployed followed by the deployment of mooring BM23-2. The mooring work was finished at August 10, 19:00. It is planned to retrieve and recover the moorings in summer 2011 during METEOR cruise M85/1.

The METEOR turned east and the CTD casts at the 47°N section were resumed starting at 40°59.5'W. The CTD stations were interspersed with XBTs every 12nm. The CTD data from the upper 1000m are transmitted timely to the French CORIOLIS data centre SISMER. At 41°W (CTD 19), the METEOR hit the core of the northward flowing North Atlantic Current (NAC), with surface velocities around 3kn, and the vessel mounted 38kHz ADCP showed more than 0.8m/s in the upper 300m and elevated velocities down to 600m depth.

At August 12, 3:30, PIES BP26 was deployed at 47°11'N, 39°12'W at 4580m depth. Judging from former ADCP sections and high resolution model simulations, this position is the eastern bound of the northward flowing NAC across 47°N. The data from BP26 together with the PIES B24 in the boundary current array off Flemish Cap and the PIES B12 at 47°40'N at the Midatlantic Ridge, allows to calculate the NAC import into the subpolar North Atlantic and study relations between the latter and the

transports in the Deep Western Boundary Current and the NAC recirculation east of 39°12'W.

At CTD 24 at 38°18'W, the data transfer was interrupted by spikes. The inspection of the conducting wire showed water intrusions, and 75m of wire had to be cut off. The CTD was switched from winch 2 to winch 3, but the CTD stopped transmitting at 50m depth. After the repair work on winch 2 was finished, The CTD was switched back. Meanwhile, and in order to minimize time loss, the location of the CTD cast was moved eastward by 12nm, and was carried out without any incidents. Winch 3 failed due to a bad connector on the wire. After exchange and a new termination, winch 3 is now on standby. At 36°30'W and at 35°19'W, Argo floats were launched at August 12 and 13, respectively. When analysing the duration of the CTD casts and the LADCP profiles, it turned out that the winch velocities of winch 2 were erroneous by about 10-20%, and the velocities were corrected.

The work along the 47°N section stopped at August 14, 4, and the METEOR turned to the northwest parallel to the Midatlantic Ridge (MAR). At 5:30, the southernmost PIES (B12/3) of the Bremen array along the MAR at 47°40'N, 31°09'W was reached, and the data retrieved by acoustic telemetry. The PIES was deployed in November 2009 to replace PIES B12/2, which surfaced sometime after August 2009 and drifted to Ireland. The PIES was found near Galway and we got the instrument back. Unfortunately, no data could be retrieved, leaving us with a time gap from July 2008 to November 2009 in the southernmost time series. PIES B13 is 98 nm further north and the data retrieval began at August 14, 20:30. Data transmission stopped at 0:10. Afterwards, the PIES was released after four years of deployment to replace the batteries and install a more advanced version of the firmware. That is the longest time, a PIES was ever continually deployed. The PIES needed about 70 minutes to reach the surface and was sighted at August 15. 0:50, and on board at 1:20.

The weather and waves remained unusually clement. At August 15, 9:00, the recovery of the BSH mooring FBZ 3 at 49°36'N, 33°17'W commenced and was finished at 12:20. After carrying out a CTD cast at the same position, a new mooring was deployed, with the anchor weight slipped at 19:20, and at depth at 19:45. The next 11 hours were filled with two CTD casts and the transit to mooring FBZ 2 at 50°N, 33°50'W. The mooring was released at August 16, 7:00 and on board at 10:30.

After finishing the deployment of the new mooring FBZ 2 at the same position at 15:20, the METEOR headed to 51°25'N, 35°26'W (location of PIES B14). The next mooring FBZ 1 is located closer to FBZ2, but we wanted to avoid mooring retrieval at night. In contrast to the moorings, retrieval of PIES is preferably done during darkness, where the powerful flashlight can be sighted easily. In daytime, white caps on waves and the glow of sunlight on the water makes it difficult to spot the PIES. PIES B14 did not respond to the ranging nor to the telemetry command, i.e. we were unable to receive the data. The release command was executed and confirmed, every four seconds a pulse was received but not the reflection of the pulse on the bottom. The larger the time lag between the original pulse and the bottom reflection, the greater the distance of the PIES to the bottom. Although the PIES most probably stayed at the bottom, it was also searched for at the surface. After three hours in release mode, the telemetry command was sent again, but no data could be collected. The PIES was reset into the release mode at August 17, 6:00, but no

indication was found that the PIES left the bottom. The efforts to recover the PIES will be resumed at August 18.

The METEOR steamed back to mooring FBZ 1 at 50°58'N, 34°52'W. The mooring was released at August 7, 9:45 and the releasers were on deck at 13:20. A new mooring was deployed at the same position, and finished at 18:20. Deployment was more complicated than usual due to the sudden advent of surface currents up to 0.7m/s and the presence of a huge tree trunk, which the top element barely avoided during descent.

PIES B14 was reached again at 22:00. B14 is still sitting at the bottom. The acoustically transferred data were incomplete and very sporadic, and are not usable. The release command was confirmed, but B14 most likely stayed at the bottom. Although the chance that it did ascend was more than slim, we took the time to search the vicinity the PIES was supposed to be due to the pings received, but did not find the PIES.

The northernmost mooring (dubbed CGFZ A) of the Charlie Gibbs Fracture Zone array at 52°56'N, 35°26'W was reached at August 18, 10:20. The moorings contain current meters, Microcats, and every second a CTD-profiler. After a short topographic survey of the slope, the deployment started at 11:00 and the anchor weight slipped at 13:05. Mooring CGFZ B is located 5nm to the south and downhill and lasted from 14:20 to 16:20. CGFZ C is at a water depth of 3000 m, and the deployment was finished at August 18, 20:00. During the night, CTD casts were carried out near the three mooring positions A, B, and C starting at 20:45.

Moorings D, E, and F were deployed on August 19, starting at 8:20. Mooring D at a water depth of 3700m measures the water mass characteristics and transports in the northern channel of the Charlie Gibbs Fracture Zone, and moorings E and F are located on top of the hill at 3000 m depth, separating the northern from the deeper southern channel. After deploying mooring D, an ARGO float was released at 52°39'N, 35°20'W. The mooring activities at that day ended at 18:20. The moorings in the southern channel (G) and roughly 10nm south of it (H) were deployed on August 20, 10:30 -19:00, after four CTD casts close to the mooring positions had been done at night.

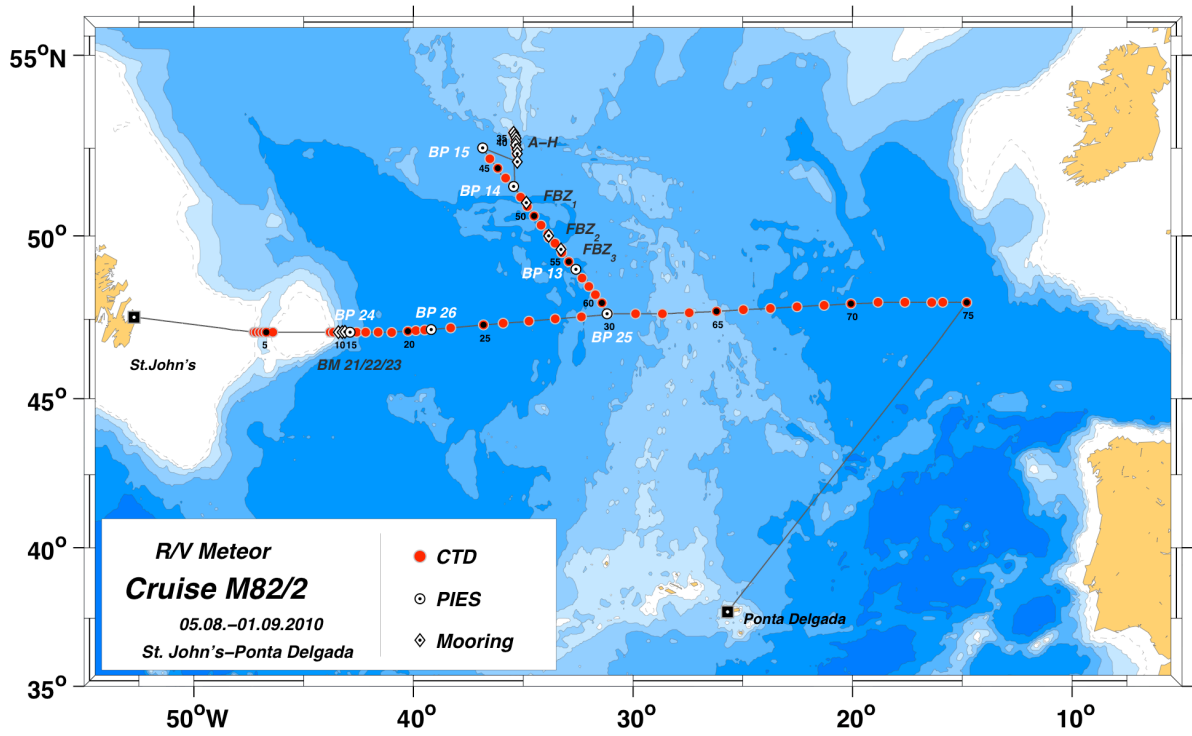
METEOR left the Gibbs Fracture Zone and headed west to the northernmost PIES (B15) located at 52°30'N, 36°51'W. Starting at 23:40, B15 transmitted the data without problems, and afterwards confirmed the release command. Despite the missing signal from the bottom reflection, B15 was found by radio and flashlight at August 21, 03:50, and was on board at 4:35. The PIES retrieved a week earlier was deployed at the same position, and the location confirmed by ranging from different positions. The CTD casts at the PIES line commenced at 7:00, and on the way south CTD/LADCP profiles were taken every 20nm. An ARGO float was deployed at August 21, 18:00.

PIES B14 is collocated with CTD 47. During the CTD casts the ship's echosounder was switched off as long as the CTD was between 200 and 3000m depth in order to be able to communicate with B14. This time, B14 executed the ranging command, so that we were able to confirm the position of the PIES. When the CTD cast was finished, the telemetry and release commands were sent subsequently, but

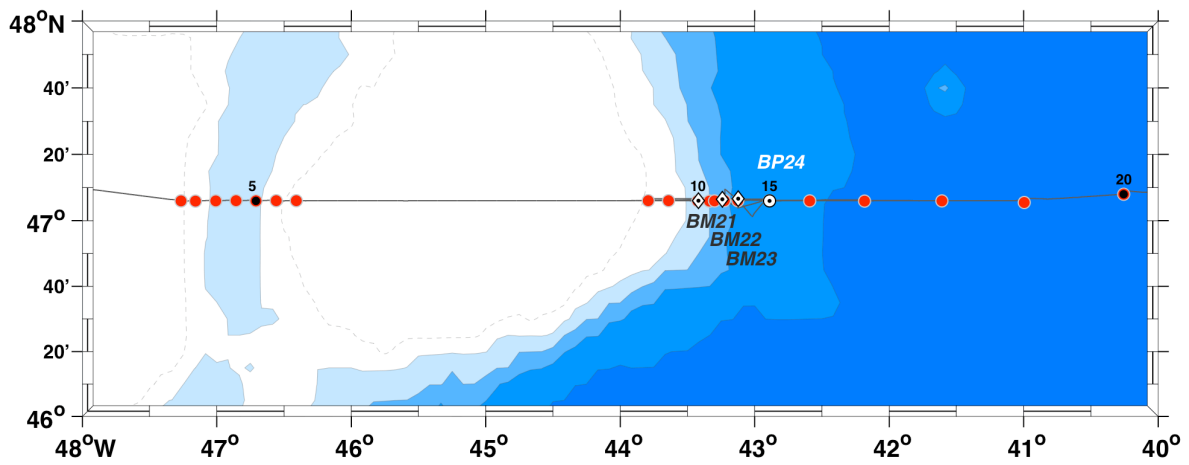
unfortunately to no avail: the transferred data were not usable, and no reaction of the PIES to the release command was observed. The efforts were abandoned at August 22, 4:20, and the CTD work was resumed at 6:30 at 51°07'N, 35°07'W.

At 2:15, ARGO float No. 5 was deployed. The winch problems increased during the CTD casts, and lead to time delays up to 30 minutes per station. At August 23, 14:50, the up-cast of CTD 55 was used to measure the diameter of the wire every 100m or 500m, respectively. At August 23, 3:40, the last of the four PIES along the MAR was deployed at the former position of PIES 13 (49°N, 32°35'W). The CTD/LADCP stations along the PIES line were finished at August 24.

On the eastern part of the 47°N section (the former WOCE section A2), CTD casts every 50nm were interspersed with XBTs every 17nm. The easternmost XBT was cast at 18°25'W. The water depths gradually increased further east, reaching 4800m at 16°25'W on August 28. The winch problems increased with the depths of the profiles, so that for the deepest stations the upward cast took longer by more than one hour. CTD cast 74 was then carried out with winch 3 instead of winch 2. At the next CTD cast (75), the winch was switched back to winch 2. The CTD lasted from August 28, 23:04 to August 29, 2:40. Due to lack of time, the CTD section had to stop at 14°48'W. The METEOR started the transit and headed towards the Acores Island. On the transit, three Argo floats were deployed at latitudes of 47°N (August 29), 44°N (August 30), and 41°N (August 30). METEOR embarked in Ponta Delgada (Acores) at September 1.



Cruise track of RV METEOR M82/2, Aug.5 – Sep.1 2010, St. John's – Ponta Delgada



Detail of the CTD/LADCP- and mooring work, at the Flemish Pass and the continental slope off Flemish Cap.

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9. Karbe, Fritz	Moorings, data analysis	UniHB
10. Kieke, Dagmar	CTD, Tracer, underway data, analysis	UniHB
11. Klinkmann, Anett	meteorology	DWD
12. Köhler, Janna	CTD/IADCP-watch	UniHB
13. Li, Mingming	CTD/IADCP-watch	UniHB
14. Ludwig, Reimund	moorings, XBTs, Argo floats	BSH
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16. Mertens, Christian	vm-, LADCPs, moorings, analysis	UniHB
17. Rizevski, Marko	Verankerungen, CTD/IADCP-Wache	UniHB
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19. Schneider, Linn	CTD/IADCP-watch, tracer	UniHB
20. Steinfeldt, Reiner	CTD calibration, data analysis	UniHB
21. Stendardo, Ilaria	oxygen analysis	ETH
22. Ströh, Achim	PIES, data analysis	UniHB
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Table 1 PIES activities during cruise M82/2, 2010

Name No	Latitude	Longitude	Depth	Deployment	Telemetry	Recovery
BP 24 235	47°05.90'N	42°53.73'W	3440m		9/8	
BP 26 201	47°10.83'N	39°11.30'W	4580m	12/8		
BP12/3 240	47°40.25'N	31°08.94'W	4084m		14/8	
BP13 075	49°00.86'N	32°36.87'W	3983m		14/8	15/8
BP14 188	51°25.64'N	35°26.29'W	3566m		failed	failed
BP15 056	52°30.56'N	36°51.09'W	3425m		29/8	21/8
BP15/2 075	52°30.50'N	36°51.60'W	3404m	21/8		
BP13/2 056	49°00.92'N	32°36.75'W	3935m	23/8		

PIES: Inverted Echo Sounder with Pressure sensor, all equipped with radio and flashlight

Table 2 A: Boundary Current Moorings M82/2, IUPHB

Name	Latitude	Longitude	Depth	Recovered	Deployment
BM21-2	47°06.00'N	43°24.90'W	1290m	7.8., 17:50 with radio beacon ¹ , flashlight	10.8., 14:00
BM22-2	47°06.31'N	43°13.81'W		7.8., 15:30 with radio beacon ¹ , flashlight, Argos-watchdog	10.08., 10:00
BM23-2	47°06.07'N	43°07.18'W	3500m	7.8., 10:00 with radio beacon, flashlight	09.08., 20:16
after deployment, top element stayed at the surface: rope between anchor weight and releasers broke, complete mooring was recovered, except anchor weight					
BM23-2	47°06.07'N	43°07.18'W	3500m	7.8., 10:00 with radio beacon, flashlight	10.08., 17:00

¹: not functioning during recovery, replaced before redeployment

Table 2 B Faraday Fracture Zone Moorings, M82/2, BSH

Name	Latitude	Longitude	Depth	Recovered	Deployment
FBZ 3	49°36.39'N	33°16.84'W	4109m	15.8.,10:00	15.8.,15:58
FBZ 2	50°00.07'N	33°50.72'W	4248m	16.8.,7:00	16.8.,11:30
FBZ 1	50°57.79'N	34°51.65'W	4312m	17.8., 10:00	17.8.,14:46

All moorings with radio beacon

Table 2 C Charlie Gibbs Fracture Zone Moorings, M82/2, WHOI

Name	Latitude	Longitude	Depth	Recovered	Deployment
CGFZ A	52°55.50'N	35°26.68'W	2000m		18.8., 11:08
CGFZ B	52°50.80'N	35°22.40'W	2775m		18.8., 14:38
CGFZ C	52°46.48'N	35°19.44'W	3000m		18.8., 17:39
CGFZ D	52°40.82'N	35°19.85'W	3725m		19.8., 08:26
CGFZ E	52°35.09'N	35°20.63'W	2975m		19.8., 12:11
CGFZ F	52°27.54'N	35°16.07'W	3009m		19.8., 16:27
CGFZ G	52°20.12'N	35°17.81'W	3879m		20.8., 10:05
CGFZ H	52°07.09'N	35°16.35'W	3866m		20.8., 15:32

All moorings with ARGOS beacon

Table 3 CTD/LADCP/Tracer stations

Meteor		M82/2	CTD Stations				Measurements				Page 1
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	CFC	O ₂	LADCP	Comments
1	513	2010/08/06	09:13	47° 5.97' N	47° 15.98' W	480	471	x	x	x	
2	514	2010/08/06	10:20	47° 5.93' N	47° 9.52' W	860	862	x	x	x	
3	515	2010/08/06	11:52	47° 5.97' N	47° 0.45' W	1120	1117	x	x	x	
4	516	2010/08/06	13:28	47° 6.05' N	46° 51.41' W	1162	1154	x	x	x	
5	517	2010/08/06	15:07	47° 5.97' N	46° 42.51' W	1131	1123	x	x	x	
6	518	2010/08/06	16:48	47° 6.02' N	46° 33.48' W	500	495	x	x	x	
7	519	2010/08/06	18:00	47° 6.01' N	46° 24.50' W	350	345	x	x	x	
8	523	2010/08/07	19:26	47° 6.00' N	43° 47.49' W	580	569	x	x	x	
9	524	2010/08/07	20:57	47° 6.01' N	43° 38.47' W	760	751	x	-	x	
10	525	2010/08/07	22:45	47° 5.99' N	43° 25.40' W	1261	1254	x	x	x	
11	526	2010/08/08	00:37	47° 5.93' N	43° 20.19' W	1775	1774	x	x	x	
12	527	2010/08/08	02:39	47° 5.98' N	43° 17.96' W	2528	2523	x	x	x	
13	528	2010/08/08	05:08	47° 6.04' N	43° 13.54' W	3012	3000	x	x	x	
14	529	2010/08/08	08:09	47° 6.00' N	43° 7.50' W	3444	3438	x	x	x	
15	530	2010/08/08	11:39	47° 6.05' N	42° 53.48' W	3446	3435	-	x	x	
16	532	2010/08/08	20:51	47° 5.97' N	42° 35.47' W	3652	3652	x	x	x	Microcat calib.
17	533	2010/08/09	01:41	47° 5.92' N	42° 10.95' W	4090	4095	x	x	x	
18	535	2010/08/09	06:40	47° 5.99' N	41° 36.50' W	4286	4282	x	x	x	
19	545	2010/08/11	04:46	47° 5.49' N	40° 59.74' W	4485	4482	x	x	x	
20	547	2010/08/11	10:58	47° 7.99' N	40° 15.37' W	4534	4548	x	x	x	
21	548	2010/08/11	15:16	47° 8.83' N	39° 53.22' W	4547	4564	-	x	x	
22	550	2010/08/11	19:49	47° 9.97' N	39° 29.36' W	4563	4575	x	x	x	
23	551	2010/08/12	00:10	47° 10.87' N	39° 11.92' W	4565	4580	x	x	x	
24	556	2010/08/12	09:30	47° 13.79' N	38° 17.96' W	4578	4553	x	x	x	
25	560	2010/08/12	18:17	47° 19.52' N	36° 48.48' W	4392	4404	x	x	x	
26	566	2010/08/13	00:54	47° 22.51' N	35° 54.88' W	4332	4346	x	x	x	
27	571	2010/08/13	08:16	47° 26.53' N	34° 44.03' W	4072	4070	x	x	x	
28	575	2010/08/13	15:31	47° 30.50' N	33° 32.49' W	4087	4080	x	x	x	
29	579	2010/08/13	22:30	47° 34.50' N	32° 21.09' W	4109	4114	x	x	x	
30	584	2010/08/14	08:26	47° 40.34' N	31° 8.78' W	4068	4073	-	x	x	
31	587	2010/08/15	01:44	49° 1.07' N	32° 36.44' W	3934	3947	-	x	x	
32	589	2010/08/15	12:46	49° 37.01' N	33° 16.47' W	4096	4098	-	x	x	
33	591	2010/08/15	21:17	49° 46.99' N	33° 33.05' W	4220	4222	-	x	x	
34	592	2010/08/16	01:25	49° 57.03' N	33° 50.18' W	4160	4165	-	x	x	
35	601	2010/08/18	20:45	52° 46.85' N	35° 21.54' W	3259	3254	x	x	x	
36	603	2010/08/18	23:42	52° 50.89' N	35° 24.52' W	2895	2891	x	x	x	
37	604	2010/08/19	02:52	52° 55.52' N	35° 28.17' W	2096	2096	x	x	x	
38	609	2010/08/19	18:40	52° 27.70' N	35° 18.46' W	3044	3036	x	-	x	
39	610	2010/08/19	21:36	52° 35.11' N	35° 22.51' W	3039	3045	x	x	x	
40	611	2010/08/20	00:16	52° 40.37' N	35° 21.31' W	3715	3715	x	x	x	
41	612	2010/08/20	03:46	52° 30.99' N	35° 20.00' W	2655	2645	x	x	x	
42	613	2010/08/20	06:26	52° 20.93' N	35° 18.26' W	3875	3870	x	x	x	

Meteor		M82/2	CTD Stations			Measurements				Page 2	
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	CFC	O ₂	LADCP	Comments
43	617	2010/08/21	07:03	52° 30.44' N	36° 50.54' W	3465	3455	x	x	x	
44	619	2010/08/21	11:07	52° 12.45' N	36° 31.49' W	3534	3532	x	x	x	
45	620	2010/08/21	15:18	51° 56.54' N	36° 9.52' W	3858	3849	x	x	x	
46	622	2010/08/21	20:07	51° 40.03' N	35° 47.98' W	3699	3702	x	x	x	
47	623	2010/08/22	00:07	51° 25.66' N	35° 26.14' W	3600	3565	x	x	x	
48	625	2010/08/22	06:20	51° 7.52' N	35° 7.44' W	4057	4063	x	x	x	
49	626	2010/08/22	10:46	50° 51.07' N	34° 48.63' W	3476	3472	x	x	x	
50	627	2010/08/22	14:45	50° 34.95' N	34° 30.02' W	4168	4170	x	x	x	
51	628	2010/08/22	19:03	50° 18.97' N	34° 11.03' W	3636	3551	x	x	x	
52	629	2010/08/22	23:29	50° 3.06' N	33° 52.10' W	4257	4257	x	x	x	
53	631	2010/08/23	04:10	49° 47.02' N	33° 32.94' W	4218	4219	x	x	x	
54	632	2010/08/23	08:56	49° 30.50' N	33° 14.53' W	4037	4035	x	x	x	
55	633	2010/08/23	13:35	49° 14.58' N	32° 55.41' W	3873	3883	x	x	x	
56	634	2010/08/23	18:07	49° 0.91' N	32° 36.84' W	3936	3938	x	x	x	
57	636	2010/08/24	00:56	48° 45.02' N	32° 18.92' W	3707	3712	x	x	x	
58	637	2010/08/24	05:08	48° 30.01' N	32° 0.98' W	4186	4204	x	x	x	
59	638	2010/08/24	09:41	48° 15.01' N	31° 42.97' W	3853	3859	x	x	x	
60	639	2010/08/24	14:03	47° 59.98' N	31° 25.03' W	3998	4006	x	x	x	
61	640	2010/08/24	18:44	47° 39.99' N	31° 11.07' W	3788	3794	x	x	x	
62	643	2010/08/25	02:13	47° 40.02' N	29° 53.01' W	3395	3401	x	x	x	
63	646	2010/08/25	09:09	47° 40.04' N	28° 39.48' W	2878	2867	x	x	x	
64	649	2010/08/25	15:41	47° 41.99' N	27° 25.97' W	2256	2256	x	x	x	
65	652	2010/08/25	21:56	47° 44.55' N	26° 12.00' W	3050	3055	x	x	x	
66	655	2010/08/26	04:36	47° 47.52' N	24° 58.52' W	3220	3223	x	x	x	
67	658	2010/08/26	11:22	47° 49.94' N	23° 44.67' W	4204	4203	x	x	x	
68	662	2010/08/26	18:30	47° 53.02' N	22° 31.58' W	4002	3998	x	x	x	
69	665	2010/08/27	01:41	47° 55.54' N	21° 17.92' W	4444	4454	x	x	x	
70	668	2010/08/27	09:28	47° 58.55' N	20° 4.55' W	4305	4316	x	x	x	
71	671	2010/08/27	17:07	48° 1.02' N	18° 50.49' W	4426	4437	x	x	x	
72	673	2010/08/28	00:37	48° 1.12' N	17° 36.99' W	4556	4566	x	x	x	
73	674	2010/08/28	09:01	48° 0.92' N	16° 23.57' W	4808	4821	x	x	x	
74	675	2010/08/28	14:28	48° 0.98' N	15° 53.46' W	4818	4824	x	x	x	
75	676	2010/08/28	23:06	48° 0.94' N	14° 47.70' W	4786	4794	x	-	x	

Table 4 XBT drops METEOR cruise M82/2

XBT drops during cruise M82/2, RV METEOR (extract from Station Book)

Station	Date	Time	Latitude	Longitude	Wind [m/s]	Course [°]	Speed [kn]
517	2010/08/06	16:35	47° 06.16' N	46° 35.63' W	SSW 9	87.3	11.7
534	2010/08/09	05:34	47° 06.00' N	41° 52.93' W	W 5	89.5	11
544	2010/08/11	03:00	47° 06.00' N	41° 17.13' W	SSW 11	90.1	10.8
546	2010/08/11	09:17	47° 07.00' N	40° 37.57' W	S 10	90.6	12.4
549	2010/08/11	18:25	47° 08.93' N	39° 52.77' W	SSW 10	99	6.8
553	2010/08/12	05:55	47° 11.04' N	39° 10.16' W	S 9	91.7	7.9
554	2010/08/12	06:52	47° 12.00' N	38° 54.45' W	S 9	82.9	11.5
555	2010/08/12	07:56	47° 13.00' N	38° 36.59' W	S 9	84.5	11.4
557	2010/08/12	13:34	47° 15.06' N	38° 00.01' W	SSE 10	81.4	11.8
558	2010/08/12	14:37	47° 16.20' N	37° 42.09' W	SSE 11	83.3	11.5
559	2010/08/12	15:41	47° 17.30' N	37° 23.97' W	SSE 10	85.3	12.2
561	2010/08/12	17:12	47° 18.55' N	37° 5.76' W	SSE 10	78	8.2
563	2010/08/12	22:26	47° 20.60' N	36° 30.85' W	SSE 12	97.9	6.7
565	2010/08/12	23:44	47° 21.49' N	36° 12.70' W	SSE 12	82.1	10.4
567	2010/08/13	04:47	47° 23.51' N	35° 36.91' W	S 12	84.3	10.6
568	2010/08/13	05:49	47° 24.49' N	35° 19.25' W	SSE 12	83.5	11.7
570	2010/08/13	07:14	47° 25.00' N	35° 0.97' W	S 10	79.1	11.4
572	2010/08/13	12:13	47° 27.50' N	34° 26.14' W	SSE 10	85.9	9.8
573	2010/08/13	13:19	47° 28.49' N	34° 08.14' W	SSE 9	86.8	10.3
574	2010/08/13	14:24	47° 29.50' N	33° 50.07' W	SSE 10	84.8	11.6
576	2010/08/13	19:09	47° 31.50' N	33° 14.57' W	SSE 9	84.5	11.6
577	2010/08/13	20:15	47° 32.50' N	32° 56.60' W	SSE 10	85.9	11.3
578	2010/08/13	21:20	47° 33.51' N	32° 38.42' W	SSE 9	84.9	11.4
580	2010/08/14	02:12	47° 35.50' N	32° 03.07' W	SSE 12	85.6	11.7
581	2010/08/14	03:14	47° 36.50' N	31° 44.96' W	S 11	86.3	11.7
582	2010/08/14	04:15	47° 37.49' N	31° 27.10' W	SSE 10	83.2	12
641	2010/08/24	22:53	47° 40.00' N	30° 44.92' W	NNE 7	85.8	10.4
642	2010/08/25	00:30	47° 40.00' N	30° 19.17' W	NNE 8	86.5	10.5
644	2010/08/25	06:05	47° 40.00' N	29° 29.19' W	NNW 8	96.2	12.7
645	2010/08/25	07:34	47° 40.00' N	29° 05.10' W	N 8	89.5	10.8
647	2010/08/25	12:35	47° 40.49' N	28° 15.41' W	NNW 8	84	10
648	2010/08/25	14:04	47° 41.70' N	27° 50.14' W	NNE 4	83.9	11.4
650	2010/08/25	18:46	47° 42.99' N	27° 01.20' W	NNE 5	84.5	11.9
651	2010/08/25	20:22	47° 43.50' N	26° 36.12' W	N 7	86.9	11.9
653	2010/08/26	01:32	47° 45.50' N	25° 47.00' W	N 7	83.9	9.4
654	2010/08/26	03:05	47° 46.51' N	25° 21.78' W	WNW 1	87.4	11.8
656	2010/08/26	08:19	47° 48.50' N	24° 33.54' W	NNE 5	86.7	10.7
657	2010/08/26	09:53	47° 49.00' N	24° 08.03' W	NNE 4	86.9	10.9
659	2010/08/26	14:00	47° 49.87' N	23° 44.20' W	NNE 3	81.5	8.6
660	2010/08/26	15:30	47° 51.02' N	23° 19.62' W	NE 4	90.3	11.6
661	2010/08/26	17:00	47° 52.01' N	22° 54.85' W	NNE 6	87.6	11.4
661	2010/08/26	17:03	47° 52.04' N	22° 54.04' W	NNE 6	87.5	10.1
663	2010/08/26	22:34	47° 53.99' N	22° 06.68' W	ENE 3	89.7	11.8
664	2010/08/27	00:08	47° 54.99' N	21° 41.27' W	NE 4	84.9	10.3
666	2010/08/27	06:26	47° 56.50' N	20° 52.96' W	ENE 3	85.3	11.4
667	2010/08/27	08:00	47° 57.50' N	20° 28.00' W	ENE 6	86.4	11.2
669	2010/08/27	14:04	47° 59.00' N	19° 39.04' W	E 6	90.5	11.4
670	2010/08/27	15:36	47° 59.50' N	19° 14.09' W	ENE 7	88.3	11.7
672	2010/08/27	21:41	48° 01.00' N	18° 25.01' W	ESE 10	87.2	11.7

Table 5 Deployment of ARGO Floats, METEOR cruise M82/2

Instr. No.	WMO-ID	ARGOS	Latitude	Longitude	date	time (UTC)
			of deployment		of deployment	
4333	6900582	85964	47°20.434N	36°30.461W	12.08.10	22:37
4334	6900583	85965	47°24.307N	35°17.510W	13.08.10	06:12
95	6900820	82714	52°39.190'N	35°20.140'W	19.08.10	11:09
96	6900821	82716	51°56.630'N	36°09.340'W	21.08.10	18:00
97	6900822	82717	50°03.157'N	33°51.880'W	23.08.10	02:15
106	6900829	82654	46°59.700'N	15°53.700'W	29.08.10	10:06
107	6900830	82685	43°59.780'N	19°02.330'W	30.08.10	07:25
108	6900831	82688	40°32.783'N	22°27.817'W	31.08.10	08:20