

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

Tel.: +49-421-218-62154  
Fax: +49-421-218-62165  
email: dkieke@uni-bremen.de



**Short Cruise Report**  
**- RV Maria S. Merian, cruise MSM-28 -**

**St. John's – Tromsø**  
**09<sup>th</sup> May - 20<sup>th</sup> June 2013**  
**Chief Scientist: Dr. Dagmar Kieke**  
**Captain: Ralf Schmidt**

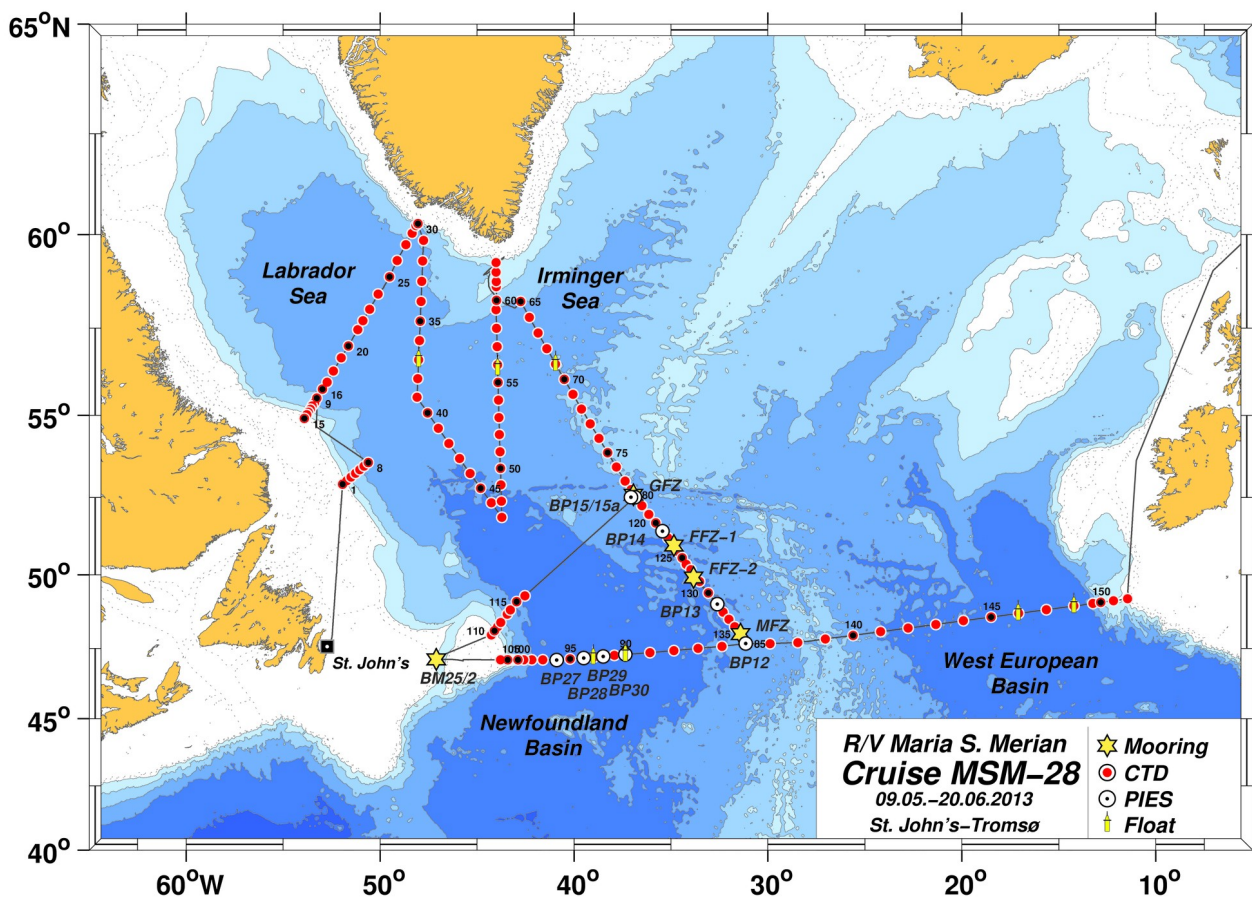


Figure 1: Track of RV Maria S. Merian, cruise MSM-28.

## 1. Objectives

Measurements conducted during cruise *MSM-28* contribute to the cooperative research project *RACE* (**R**egional **A**tlantic **C**irculation and Global Chang**E**), which is funded by the German Federal Ministry of Education and Research (BMBF). Investigations were carried out in the framework of work package 1.2 (*NOAC*, **N**Orth **A**tlantic **C**hanges), affiliated to the University of Bremen, Germany, and the German Federal and Maritime Hydrographic Agency (BSH), Hamburg, Germany.

The primary objectives of cruise *MSM-28* were:

- 1) To exchange two deep-sea mooring arrays installed across the Deep Western Boundary Current (DWBC) east of Flemish Cap at 47°N and along the western flank of the Mid-Atlantic Ridge (MAR). Both arrays serve to measure the velocity structure and temperature and salinity of different components of North Atlantic Deep Water (NADW) as well as of the North Atlantic Current (NAC). Since the DWBC mooring array could not be completely recovered during the previous cruise *MSM-27*, it was not redeployed.
- 2) To analyze the strength and variability in the strength of the exported NADW in relation to the variations in the strength of the NAC in the Newfoundland Basin.
- 3) To infer the main pathways of the NADW components and the NAC in the open subpolar North Atlantic and the strength of the subpolar gyre as it crosses the MAR.
- 4) To estimate the present rate of formation of Labrador Sea Water (LSW), inferred from changes of tracer inventories.
- 5) To assess the role of LSW formation and different NAC circulation patterns for the lateral propagation of heat and freshwater anomalies.

## 2. Narrative of cruise MSM-28

*RV Maria S. Merian* left St. John's/Newfoundland on May 09<sup>th</sup>, 2013, at 14:15 UTC. Having passed the 12 nm-zone<sup>1</sup>, continuous logging of underway data (thermosalinograph and vessel-mounted Acoustic Doppler Current Profilers (ADCP), operated at 38 and 75 kHz) was switched on at 16:56 UTC. Northern course was set, and station work began on May 10<sup>th</sup>, 2013, 16:55 UTC, by conducting a first hydrographic section consisting of stations 271/001 to 278/008 (Table 6) that crossed the Deep Western Boundary Current (DWBC) at the latitude of ~53°N. Station work included vertical casts carried out with a conductivity-temperature-depth-oxygen (CTDO) sensor package and two lowered ADCPs operated at 300 kHz and attached to a water sampler unit. Water samples were taken with respect to analyze oceanic concentrations of chlorofluorocarbon-12 (CFC-12), sulphurhexafluoride (SF<sub>6</sub>), salinity and oxygen. The latter two parameters were used to calibrate the conductivity and oxygen sensors of the CTDO sensor package.

Having finished this section on May 11<sup>th</sup>, *RV Maria S. Merian* headed towards the northwest to begin station work along the approximate course of the so-called *AR7W* section. This hydrographic repeat line crosses the central Labrador Sea in northeastern direction from the Canadian to the Greenland continental shelf. The presence of an ice field on the Labrador Shelf, however, made a small detour necessary. Station work along the *AR7W* section, therefore, started at a water depth of around 3000 m and was carried out towards the Canadian shelf again.

Having finished the shallowest station on the Canadian side of the section (May 12<sup>th</sup>, station 285/015, 450 m), the vessel turned towards the northeast and continued hydrographic station work at a water depth of 3100 m (May 12<sup>th</sup>, station 286/016). At station distances varying between 15 and 33 nm, *RV Maria S. Merian* crossed the central Labrador Sea but on its way faced severe cross seas due to variable wind and wave conditions. On May 15<sup>th</sup>, the shallowest station on the Greenland side of the *AR7W* section was conducted (station 300/030). Afterwards, the vessel turned south and followed the 48°W meridian back into the central Labrador Sea again. On May 16<sup>th</sup>, the first out of seven *APEX* floats (Table 2) contributing to the global *Argo* program was deployed.

Having reached the southernmost station of the 48°W-section (May 17<sup>th</sup>, station 309/039), a southeastern course was set towards the *Northwest Corner* of the Newfoundland Basin,

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1 nm = nautical mile

station distances were 32-34 nm as was the case for the 48°W section. On May 19<sup>th</sup>, the southernmost station of the section that followed the axis of the Labrador Sea was carried out (station 317/047). Subsequently, course was set towards north, and *RV Maria S. Merian* started her ascend towards Kap Farvel at the southern tip of Greenland (station distances of 31 nm). Before entering the Greenlandic Exclusive Economic Zone (EEZ) the second *APEX* float was deployed. Very calm sea state and favorable low winds were experienced until May 21<sup>st</sup>. Wind rapidly increased while approaching Greenland. On May 22<sup>nd</sup>, wind speeds exceeded 12 Beaufort (Bf). Though station work could still be carried out at 10 Bf (station 334, 64), it had to be interrupted subsequently due to very unfavorable weather conditions.

Work was presumed again on May 23<sup>rd</sup>, when *RV Maria S. Merian* headed towards the southeast and approached the Mid-Atlantic Ridge (MAR, station 350/080). On May 24<sup>th</sup>, the third *APEX* float was deployed. Between May 26<sup>th</sup> and May 29<sup>th</sup>, the deep-sea mooring *GFZ* (Table 4) was recovered and redeployed at the western exit of Charlie-Gibbs Fracture Zone, deep-sea moorings *FFZ-1* and *FFZ-2* were recovered at the western exit of Faraday Fracture Zone, as well as four locations with inverted echo-sounders equipped with pressure sensors (PIES) installed at the sea-bottom were visited (Table 3). Recorded PIES data consisting of measurements of acoustic travel time and pressure was retrieved via acoustic telemetry, another instrument was placed next to PIES *BP-15* (new location *BP-15a*), and PIES station *BP-13* was given up by recovering the installed instrument and preparing it for redeployment at another location.

On May 28<sup>th</sup>, *RV Maria S. Merian* reached the latitude of 47°N and turned west. While station distances were about 50 nm in the beginning, spacing was reduced to 2 nm when crossing the DWBC east of Flemish Cap (stations 355/085 to 377/107). During May 31<sup>st</sup> and June 1<sup>st</sup>, four additional PIES were deployed along the 47°N section in the deep Newfoundland Basin. Furthermore, two more *APEX* floats were deployed on May 1<sup>st</sup>. While crossing the DWBC unfavorable wind and sea state conditions led to kinks in the conducting sea cable of the vessel's winch EL2 that was successfully used until then. Stations 371, 373, 375-377 were run using winch EL1, after which station work using winch EL2 was presumed again. This winch was in operation for the entire remaining time of the cruise.

Having finished hydrographic station work east of Flemish Cap, *RV Maria S. Merian* left

the DWBC region and sailed 136 nm towards Flemish Pass. On June 3<sup>rd</sup>, mooring *BM-25/2* was placed on the western side of Flemish Pass at a water depth of ~1000 m. After another transit of 126 nm, station work was presumed again on June 4<sup>th</sup> at the northeastern flank of Flemish Cap. Another hydrographic section crossing the DWBC at station distances of 11 to 22 nm followed (stations 379/109 to 386/116).

*RV Maria S. Merian* then crossed the Newfoundland Basin and headed again on a northeastern course towards the northern end of the PIES-line at the MAR (transit of 309 nm). On June 6<sup>th</sup>, hydrographic station work was continued along the PIES line following the western flank of the MAR (hydrographic stations 387/117 to 406/136). Between June 7<sup>th</sup> and June 9<sup>th</sup>, deep-sea moorings FFZ-1 and FFZ-2 were redeployed again, and the entire array was extended by adding a fourth mooring (MFZ) at the western exit of Maxwell Fracture Zone further south.

On June 9<sup>th</sup>, *RV Maria S. Merian* arrived again at 47°N and continued its course along this approximate latitude towards the eastern side of the subpolar North Atlantic. Station distances of 58 nm were chosen to be able to cross the West European Basin while measuring in the remaining time of the field period of cruise *MSM-28*. The last two *APEX* floats were deployed in the West European Basin on June 13<sup>th</sup>. On June 14<sup>th</sup>, the last hydrographic stations crossing the boundary current on the eastern side of the subpolar North Atlantic were conducted. Station distances were reduced to 18-38 nm. Station work was finished at 09:33 UTC the same day, when *RV Maria S. Merian* started a transit of 1556 nm towards Tromsø/Norway, the intended port of arrival. Continuous logging of underway data was stopped on June 19<sup>th</sup>, 16:00 UTC. On June 20<sup>th</sup>, 04:00 UTC, the vessel arrived at the pilot station and docked in Tromsø harbour at 06:40 UTC the same day, when cruise *MSM-28* was finished.

## **Acknowledgements**

Cruise *MSM-28* was probably one of the longest cruises conducted with *RV Maria S. Merian*. Thus, team spirit, enthusiasm and close cooperation between the different scientific teams, and the scientific group and the ship's crew cleared the way for the great success of this cruise. For this reason, we would like to thank the master of *RV Maria S. Merian*, Ralf Schmidt, and his entire crew for the assistance and support granted to us during cruise *MSM-28* which made our stay aboard very comfortable, even at times of very

unfavorable weather and sea state conditions. Further thanks goes to the “helping hands” at our home laboratories and the agencies (*BMBF*, the *Senatskommission für Ozeanographie*, and the *Leitstelle Deutsche Forschungsschiffe*) that provided the necessary ship time, funding, and support to pursue all scientific work.

**Table 1. Participants of cruise MSM-28, RV Maria S. Merian**

	<b>Name</b>	<b>Institution</b>	<b>Field of Activity</b>
1.	Kieke, Dagmar	IUPHB	chief scientist
2.	Abels, Lotte	IUPHB	CTD/IADCP watch
3.	Böke, Wolfgang	IUPHB	technics, PIES/CTD/IUPHB moorings
4.	Bulsiewicz, Klaus	IUPHB	tracer analysis
5.	Denker, Claudia	BSH	CTD/IADCP watch
6.	Hauck, Dennis	BSH	technics, BSH moorings and float deployment
7.	Hertzberg, Stefan	IUPHB	CTD/IADCP watch
8.	Koopmann, Nikolaus	IUPHB	CTD/IADCP watch
9.	Lahl, Rebecca	IUPHB	CTD/IADCP watch
10.	Lange, Julia	IUPHB	tracer sampling
11.	Löb, Jonas	IUPHB	CTD/IADCP watch
12.	Müller, Vasco	IUPHB	CTD/IADCP watch
13.	Peters, Maike	IUPHB	tracer sampling
14.	Roessler, Achim	IUPHB	vessel-mounted and lowered ADCP data processing, PIES analysis
15.	Steinfeldt, Reiner	IUPHB	salinometry, CTD data processing and calibration
16.	Stendardo, Ilaria	IUPHB	oxygen analysis
17.	Uhde, Hans	BSH	technics, BSH moorings and float deployment

BSH: Bundesamt für Seeschifffahrt und Hydrographie, Hamburg, Germany

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

**Table 2. Argo-floats deployed during cruise MSM-28**

Float s/n	WMO-ID	Argos-ID	Latitude	Longitude	Deployment Date/Time	CTD-Profile
6655	4901417	128461	56°36.65'N	48°00.75'W	16 May 2013 23:14	307/037
6656	4901418	124862	56°22.39'N	43°56.16'W	20 May 2013 23:26	326/056
6657	4901419	128463	56°29.51'N	40°57.48'W	24 May 2013 05:24	339/069
6658	4901420	128464	47°11.18'N	39°00.49'W	31 May 2013 18:03	363/093
6659	6901227	128465	47°17.57'N	37°21.38'W	31 May 2013 02:22	360/090
6660	6901228	128466	48°42.67'N	17°05.72'W	13 Jun 2013 03:22	416/146
6661	6901229	128467	48°57.45'N	14°13.33'W	13 Jun 2013 18:45	418/148

All times are given as UTC.

**Table 3. List of PIES activities carried out during cruise MSM-28**

PIES ID	s/n	Latitude	Longitude	Depth [m]	Deployment Date/Time	Telemetry Date/Time	Recovery Date/Time	CTD Profile
BP-12/4	201	47°40.11'N	31°08.95'W	4090	---	29 May 2013 10:57-13:30	---	355/085 406/136
BP-13/3	272	49°01.15'N	32°36.69'W	3952	---	28 May 2013 17:26-22:06	28 May 2013 22:27-23:48	354/084
BP-14/2	271	51°25.70'N	35°26.33'W	3604	---	27 May 2013 04:41-07:54	---	351/081 391/121
BP-15/2	075	52°30.50'N	36°51.60'W	3386	---	26 May 2013 03:00-05:38	---	439/079 387/117
BP-15a/1	235	52°30.48'N	36°51.63'W	3386	26 May 2013 05:51-06:59	---	---	349/079
BP-27/1	272	47°05.84'N	40°52.53'W	4498	01 Jun 2013 11:23-13:15	---	---	366/096
BP-28/1	240	47°09.68'N	39°30.06'W	4584	31 May 2013 22:26-00:25	---	---	364/094
BP-29/1	302	47°12.52'N	38°31.09'W	4610	31 May 2013 11:39-13:33	---	---	362/092
BP-30/1	303	47°17.52'N	36°21.47'W	4546	31 May 2013 00:25-01:58	---	---	360/090

PIES: Inverted echo-sounder with pressure sensor. All instruments were equipped with flags, radio senders and flashers. All times are given as UTC.

**Table 4. Moorings deployed/recovered at the Mid-Atlantic Ridge, cruise MSM-28**

Moorings ID	Latitude	Longitude	Depth [m]	Deployment Date/Time	Recovery Date/Time	CTD Profile
GFZ/1	52°35.00'N	36°56.00'W	3269	---	26 May 2013 09:20 – 12:52	350/080
GFZ/2	52°35.00'N	36°56.00'W	3269	26 May 2013 16:09 – 19:35	---	350/080
FFZ-1/4	50°58.35'N	34°51.00'W	4327	---	27 May 2013 11:15 – 15:03	352/082
FFZ-1/5	50°58.35'N	34°51.00'W	4335	07 Jun 2013 06:57 – 11:37	---	393/123
FFZ-2/4	49°55.66'N	33°49.66'W	4194	---	28 May 2013 06:45 – 10:45	353/083
FFZ-2/5	49°55.01'N	33°49.90'W	4030	08 Jun 2013 07:02 – 11:03	---	398/128
MFZ/1	47°59.99'N	31°24.99'W	4020	09 Jun 2013 07:02 – 11:03	---	405/135

All times are given as UTC. All recovered moorings were equipped with *Iridium* beacons and flags. GFZ/2 was also deployed with an attached *Iridium* beacon.

**Table 5. Moorings deployed in Flemish Pass, cruise MSM-28**

Moorings ID	Latitude	Longitude	Depth [m]	Deployment Date/Time	CTD Profile
BM-25/2	47°07.11'N	47°06.38'W	1014	03 Jun 2013 16:54 – 17:10	378/108

All times are given as UTC. The mooring was equipped with two radio beacons, two flashers, and a flag.



Table 6. List of CTD/IADCP/Tracer-Stations, MSM-28

Maria S. Merian		MSM28		CTD Stations			Measurements						Page 1
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	SF <sub>6</sub> , CFC	CFC offl.	<sup>3</sup> H, He	O <sub>2</sub>	LADCP	Comments
1	271	2013/05/10	16:52	52° 54.82' N	51° 56.15' W	453	446	-	-	-	x	x	
2	272	2013/05/10	18:07	52° 58.74' N	51° 49.79' W	998	1009	x	x	-	x	x	
3	273	2013/05/10	19:41	53° 1.46' N	51° 42.83' W	1449	1376	x	x	-	x	x	
4	274	2013/05/10	21:49	53° 8.23' N	51° 29.60' W	2104	2092	x	x	-	x	x	
5	275	2013/05/11	00:21	53° 14.92' N	51° 16.20' W	2655	2647	x	x	-	x	x	
6	276	2013/05/11	03:10	53° 21.61' N	51° 2.89' W	2943	2936	x	x	-	x	x	
7	277	2013/05/11	06:00	53° 28.34' N	50° 49.47' W	3090	3091	x	x	-	x	x	
8	278	2013/05/11	09:01	53° 35.09' N	50° 36.21' W	3279	3269	x	x	-	x	x	
9	279	2013/05/12	01:18	55° 30.47' N	53° 15.61' W	3030	3013	x	-	-	x	x	
10	280	2013/05/12	03:57	55° 22.46' N	53° 22.38' W	2949	2933	x	-	-	x	x	
11	281	2013/05/12	06:28	55° 16.91' N	53° 30.17' W	2660	2652	x	-	-	x	x	
12	282	2013/05/12	08:46	55° 10.85' N	53° 36.10' W	2091	2085	x	-	-	x	x	
13	283	2013/05/12	10:48	55° 5.66' N	53° 42.26' W	1570	1564	x	-	-	x	x	
14	284	2013/05/12	12:26	55° 1.29' N	53° 46.85' W	1100	1081	x	-	-	x	x	
15	285	2013/05/12	14:05	54° 54.41' N	53° 54.29' W	451	442	x	-	-	x	x	
16	286	2013/05/12	19:52	55° 46.13' N	52° 58.71' W	3166	3156	-	-	-	-	x	
17	287	2013/05/12	23:30	55° 58.27' N	52° 44.09' W	3325	3305	x	-	-	x	x	
18	288	2013/05/13	04:09	56° 17.51' N	52° 24.56' W	3534	3517	x	-	-	x	x	
19	289	2013/05/13	09:03	56° 40.12' N	52° 0.23' W	3538	3526	-	-	-	x	x	
20	290	2013/05/13	13:37	57° 0.29' N	51° 38.30' W	3542	3530	x	-	-	x	x	
21	291	2013/05/13	19:08	57° 27.40' N	51° 9.13' W	3510	3491	x	-	x	x	x	
22	292	2013/05/13	22:53	57° 42.46' N	50° 53.00' W	3595	3583	x	-	-	x	x	
23	293	2013/05/14	03:07	58° 1.08' N	50° 32.63' W	3550	3537	-	x	-	x	x	
24	294	2013/05/14	08:05	58° 25.72' N	50° 5.83' W	3530	3516	-	x	-	x	x	
25	295	2013/05/14	14:52	58° 53.47' N	49° 30.95' W	3457	3443	x	x	-	x	x	
26	296	2013/05/14	19:48	59° 19.65' N	49° 7.31' W	3348	3335	x	-	-	x	x	
27	297	2013/05/15	00:19	59° 44.35' N	48° 40.43' W	3177	3168	x	-	-	x	x	
28	298	2013/05/15	04:17	60° 2.24' N	48° 21.04' W	2881	2872	x	-	-	x	x	
29	299	2013/05/15	07:23	60° 13.70' N	48° 9.30' W	2980	1414	x	-	x	x	x	
30	300	2013/05/15	09:24	60° 16.86' N	48° 3.03' W	537	516	x	-	x	-	x	
31	301	2013/05/15	12:43	59° 51.16' N	47° 45.80' W	2829	2818	-	-	-	x	x	
32	302	2013/05/15	18:00	59° 18.77' N	47° 48.26' W	3066	3059	-	-	-	x	x	
33	303	2013/05/15	22:45	58° 46.40' N	47° 50.77' W	3210	3198	x	-	-	x	x	
34	304	2013/05/16	03:38	58° 14.00' N	47° 53.32' W	3364	3354	x	-	-	x	x	
35	305	2013/05/16	08:54	57° 41.64' N	47° 55.72' W	3315	3305	x	-	-	x	x	
36	306	2013/05/16	14:28	57° 9.22' N	47° 58.24' W	3502	3490	x	-	-	x	x	SEACAT calib.
37	307	2013/05/16	21:07	56° 36.77' N	48° 0.69' W	3646	3633	x	-	-	x	x	
38	308	2013/05/17	02:37	56° 4.40' N	48° 3.20' W	3636	3627	x	-	-	x	x	
39	309	2013/05/17	07:53	55° 31.96' N	48° 5.67' W	3409	3385	x	-	-	x	x	
40	310	2013/05/17	12:41	55° 4.52' N	47° 32.83' W	3541	3531	x	-	-	x	x	
41	311	2013/05/17	17:52	54° 37.10' N	47° 0.05' W	3534	3526	x	-	-	x	x	SEACAT calib.
42	312	2013/05/17	23:47	54° 9.60' N	46° 27.23' W	3494	3486	x	-	-	x	x	
43	313	2013/05/18	04:59	53° 42.12' N	45° 54.42' W	3706	3702	x	-	-	x	x	
44	314	2013/05/18	10:03	53° 14.66' N	45° 21.59' W	3994	3988	-	x	-	x	x	
45	315	2013/05/18	15:28	52° 47.18' N	44° 48.72' W	3981	3968	x	-	-	x	x	
46	316	2013/05/18	20:49	52° 19.75' N	44° 15.99' W	4163	4159	x	-	-	x	x	
47	317	2013/05/19	02:34	51° 52.32' N	43° 43.14' W	4195	4193	x	-	-	x	x	
48	318	2013/05/19	07:51	52° 22.99' N	43° 44.62' W	4169	4166	x	-	-	x	x	
49	319	2013/05/19	13:20	52° 53.65' N	43° 46.17' W	3744	3739	x	-	-	x	x	
50	320	2013/05/19	18:41	53° 24.30' N	43° 47.65' W	4042	3629	x	-	-	x	x	
51	321	2013/05/19	23:49	53° 54.65' N	43° 49.14' W	3930	3598	x	-	-	x	x	

Table 6. Continued ...

Maria S. Merian		MSM28		CTD Stations			Measurements						Page 2
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	SF <sub>6</sub> , CFC	CFC offl.	<sup>3</sup> H, He	O <sub>2</sub>	LADCP	Comments
52	322	2013/05/20	04:58	54° 25.65' N	43° 50.63' W	3475	3467	x	-	-	x	x	
53	323	2013/05/20	09:48	54° 56.34' N	43° 52.08' W	3398	3390	x	-	-	x	x	
54	324	2013/05/20	14:35	55° 26.98' N	43° 53.62' W	3283	3275	x	-	-	x	x	
55	325	2013/05/20	19:07	55° 57.65' N	43° 55.11' W	3346	3337	x	-	-	x	x	
56	326	2013/05/21	00:06	56° 28.32' N	43° 56.60' W	3354	3346	x	-	-	x	x	
57	327	2013/05/21	04:36	56° 59.00' N	43° 58.07' W	3439	3429	x	-	-	x	x	
58	328	2013/05/21	09:09	57° 29.65' N	43° 59.59' W	3429	3417	-	x	-	x	x	
59	329	2013/05/21	13:50	58° 0.38' N	44° 1.08' W	3062	3050	x	-	-	x	x	
60	330	2013/05/21	17:07	58° 15.64' N	43° 59.96' W	2561	2549	x	-	-	-	x	
61	331	2013/05/21	20:30	58° 37.64' N	44° 0.35' W	1678	1669	-	-	-	x	x	
62	332	2013/05/21	22:22	58° 45.92' N	44° 0.72' W	1597	1589	x	-	-	-	x	
63	333	2013/05/22	00:46	59° 1.12' N	44° 1.14' W	1774	1763	-	-	-	x	x	
64	334	2013/05/22	04:08	59° 16.31' N	44° 1.51' W	1381	1362	x	-	x	-	x	
65	335	2013/05/23	08:20	58° 13.96' N	42° 44.92' W	3038	3024	x	-	-	x	x	
66	336	2013/05/23	13:13	57° 47.87' N	42° 17.95' W	3254	3247	x	-	-	x	x	
67	337	2013/05/23	18:00	57° 21.76' N	41° 50.99' W	3302	3295	x	-	-	x	x	
68	338	2013/05/23	22:40	56° 55.61' N	41° 24.21' W	3363	3358	x	-	-	x	x	
69	339	2013/05/24	03:27	56° 29.51' N	40° 57.28' W	3332	3328	x	-	-	x	x	
70	340	2013/05/24	08:11	56° 3.41' N	40° 30.39' W	3455	3447	x	-	-	x	x	
71	341	2013/05/24	12:54	55° 37.29' N	40° 3.49' W	3003	2995	x	-	-	-	x	
72	342	2013/05/24	17:26	55° 11.16' N	39° 36.60' W	3109	3103	x	-	-	-	x	
73	343	2013/05/24	21:59	54° 45.08' N	39° 9.70' W	2776	2767	x	-	-	x	x	
74	344	2013/05/25	02:35	54° 19.01' N	38° 42.68' W	2814	2799	x	-	-	-	x	
75	345	2013/05/25	07:08	53° 52.85' N	38° 15.89' W	2923	2915	x	-	-	x	x	
76	346	2013/05/25	12:13	53° 26.71' N	37° 48.92' W	3015	3004	x	-	-	-	x	
77	347	2013/05/25	17:03	53° 0.59' N	37° 22.06' W	3755	3742	x	-	-	x	x	
78	348	2013/05/25	21:03	52° 44.87' N	37° 2.88' W	3553	3545	x	-	-	-	x	
79	439	2013/05/26	00:48	52° 30.52' N	36° 51.62' W	3386	3371	-	-	-	-	x	
80	350	2013/05/26	13:20	52° 35.00' N	36° 55.98' W	3266	3254	-	-	-	-	x	
81	351	2013/05/27	04:41	51° 25.70' N	35° 26.26' W	3606	3597	-	-	-	-	x	
82	352	2013/05/27	15:31	50° 58.37' N	34° 50.96' W	4323	4313	-	-	-	-	x	
83	353	2013/05/28	03:37	49° 56.26' N	33° 48.34' W	4151	4146	-	-	-	-	x	
84	354	2013/05/28	17:19	49° 1.16' N	32° 36.67' W	3953	3950	-	-	-	-	x	
85	355	2013/05/29	08:22	47° 40.08' N	31° 8.91' W	4090	4073	x	-	-	x	x	
86	356	2013/05/29	18:12	47° 34.44' N	32° 22.39' W	4141	4125	x	-	-	-	x	
87	357	2013/05/30	00:54	47° 29.97' N	33° 36.59' W	4103	4105	x	-	-	x	x	
88	358	2013/05/30	08:09	47° 25.53' N	34° 50.74' W	4131	4129	x	-	-	x	x	
89	359	2013/05/30	14:56	47° 21.09' N	36° 5.10' W	4295	4272	x	-	-	x	x	
90	360	2013/05/30	21:32	47° 17.50' N	37° 21.49' W	4546	4520	x	-	-	x	x	
91	361	2013/05/31	04:16	47° 15.30' N	37° 55.05' W	4585	4584	x	-	-	-	x	
92	362	2013/05/31	08:54	47° 13.16' N	38° 29.99' W	4612	4604	x	-	-	x	x	
93	363	2013/05/31	15:18	47° 11.48' N	39° 0.01' W	4585	4581	x	-	-	-	x	
94	364	2013/05/31	19:49	47° 9.97' N	39° 30.05' W	4583	4578	x	x	-	x	x	
95	365	2013/06/01	03:25	47° 8.13' N	40° 12.02' W	4558	4553	-	-	-	-	x	
96	366	2013/06/01	08:45	47° 5.80' N	40° 54.01' W	4496	4481	x	-	-	x	x	
97	367	2013/06/01	17:11	47° 6.09' N	41° 36.31' W	4297	4282	x	-	-	-	x	
98	368	2013/06/01	23:32	47° 5.91' N	42° 10.81' W	4117	4098	x	-	-	x	x	
99	369	2013/06/02	04:03	47° 5.98' N	42° 35.46' W	3677	3658	x	-	-	-	x	
100	370	2013/06/02	07:59	47° 5.94' N	42° 53.65' W	3469	3433	x	-	-	x	x	
101	371	2013/06/02	11:20	47° 6.08' N	43° 7.10' W	3527	3517	-	-	-	-	x	
102	372	2013/06/02	14:22	47° 5.99' N	43° 13.52' W	3039	3008	x	-	-	x	x	

Table 6. Continued ...

Maria S. Merian		MSM28		CTD Stations				Measurements						Page 3
Prof.	Sta.	Date	Time	Latitude	Longitude	Water Depth	Prof. Depth	SF <sub>6</sub> , CFC	CFC offl.	<sup>3</sup> H, He	O <sub>2</sub>	LADCP	Comments	
103	373	2013/06/02	17:32	47° 6.02' N	43° 17.84' W	2560	2567	x	-	-	-	x		
104	374	2013/06/02	19:59	47° 5.90' N	43° 20.11' W	1875	1753	x	-	-	x	x		
105	375	2013/06/02	22:15	47° 5.98' N	43° 25.22' W	1287	1267	x	-	-	x	x		
106	376	2013/06/03	00:35	47° 6.00' N	43° 38.43' W	775	747	x	-	-	-	x		
107	377	2013/06/03	02:01	47° 6.00' N	43° 47.54' W	588	564	x	-	-	-	x		
108	378	2013/06/03	15:50	47° 7.09' N	47° 6.20' W	1014	992	x	-	-	-	x		
109	379	2013/06/04	05:11	47° 58.19' N	44° 16.15' W	600	583	x	-	-	-	x		
110	380	2013/06/04	06:48	48° 6.73' N	44° 6.33' W	958	938	x	-	-	x	x		
111	381	2013/06/04	08:37	48° 15.29' N	43° 56.45' W	1900	2391	x	-	-	-	x		
112	382	2013/06/04	11:07	48° 23.81' N	43° 46.58' W	2544	2524	x	-	-	x	x		
113	383	2013/06/04	14:43	48° 40.87' N	43° 26.82' W	3384	3366	x	-	-	-	x		
114	384	2013/06/04	17:48	48° 49.38' N	43° 17.04' W	3760	3735	x	-	-	x	x	MicroCAT calib.	
115	385	2013/06/04	22:32	49° 6.45' N	42° 57.31' W	3989	3964	x	-	-	-	x		
116	386	2013/06/05	02:36	49° 17.97' N	42° 31.98' W	4231	4213	x	-	-	x	x		
117	387	2013/06/06	03:36	52° 30.53' N	36° 51.54' W	3408	3363	x	-	-	-	x		
118	388	2013/06/06	07:30	52° 14.54' N	36° 30.11' W	3614	3589	x	-	-	x	x		
119	389	2013/06/06	11:30	51° 57.89' N	36° 8.45' W	3868	3842	x	-	-	-	x		
120	390	2013/06/06	15:41	51° 41.45' N	35° 47.19' W	3670	3634	x	-	-	x	x		
121	391	2013/06/06	19:40	51° 25.72' N	35° 26.35' W	3618	3596	x	-	-	-	x		
122	392	2013/06/06	23:18	51° 12.82' N	35° 9.57' W	3612	3597	-	-	-	x	x		
123	393	2013/06/07	03:42	50° 58.36' N	34° 50.99' W	4300	4313	x	-	-	-	x		
124	394	2013/06/07	12:54	50° 46.48' N	34° 39.21' W	4259	4244	x	-	-	x	x		
125	395	2013/06/07	16:47	50° 33.69' N	34° 25.18' W	4159	4143	x	-	-	-	x		
126	396	2013/06/07	20:29	50° 20.82' N	34° 13.02' W	3733	3719	-	-	-	x	x		
127	397	2013/06/08	00:00	50° 10.33' N	33° 58.22' W	3718	3711	x	-	-	-	x		
128	398	2013/06/08	03:39	49° 54.99' N	33° 49.92' W	4032	4009	x	-	-	x	x		
129	399	2013/06/08	12:28	49° 47.00' N	33° 31.32' W	4224	4204	x	-	-	-	x		
130	400	2013/06/08	17:36	49° 23.69' N	33° 4.42' W	3781	3762	x	-	-	x	x		
131	401	2013/06/08	22:23	49° 0.63' N	32° 37.01' W	3944	3928	x	-	-	-	x		
132	402	2013/06/09	02:27	48° 45.02' N	32° 18.83' W	3721	3713	x	-	-	x	x		
133	403	2013/06/09	06:20	48° 30.03' N	32° 1.02' W	4219	4200	x	-	-	-	x		
134	404	2013/06/09	10:28	48° 14.96' N	31° 42.95' W	3872	3853	-	-	-	x	x		
135	405	2013/06/09	14:39	47° 59.97' N	31° 24.94' W	4021	4004	-	x	-	-	x		
136	406	2013/06/09	23:30	47° 40.13' N	31° 8.94' W	4090	4074	-	-	-	x	x		
137	407	2013/06/10	06:15	47° 39.98' N	29° 53.23' W	3418	3404	-	x	-	-	x		
138	408	2013/06/10	13:05	47° 42.20' N	28° 27.83' W	2914	2899	-	x	-	x	x		
139	409	2013/06/10	19:45	47° 49.72' N	27° 2.28' W	1744	1737	x	x	-	-	x		
140	410	2013/06/11	01:59	47° 57.24' N	25° 36.90' W	3592	3581	x	-	-	x	x		
141	411	2013/06/11	08:56	48° 4.78' N	24° 11.45' W	3997	3986	x	-	-	x	x		
142	412	2013/06/11	16:12	48° 12.31' N	22° 46.05' W	4309	4304	x	x	-	x	x		
143	413	2013/06/11	23:56	48° 19.80' N	21° 20.60' W	4435	4429	x	-	-	x	x		
144	414	2013/06/12	07:34	48° 27.35' N	19° 55.08' W	4265	4258	x	-	-	x	x		
145	415	2013/06/12	17:07	48° 34.87' N	18° 29.65' W	4300	4297	x	x	-	x	x		
146	416	2013/06/13	00:37	48° 42.45' N	17° 4.23' W	4785	4750	x	-	-	x	x		
147	417	2013/06/13	08:24	48° 49.92' N	15° 38.79' W	4827	4819	x	x	-	x	x		
148	418	2013/06/13	16:03	48° 57.47' N	14° 13.32' W	4566	4562	x	-	-	x	x		
149	419	2013/06/13	22:14	49° 2.65' N	13° 14.51' W	3579	3573	x	-	-	x	x		
150	420	2013/06/14	02:01	49° 4.84' N	12° 50.11' W	1790	1783	x	-	-	x	x		
151	421	2013/06/14	05:38	49° 8.25' N	12° 10.91' W	1003	993	x	-	-	x	x		
152	422	2013/06/14	09:07	49° 12.13' N	11° 27.14' W	492	476	x	-	-	-	x		