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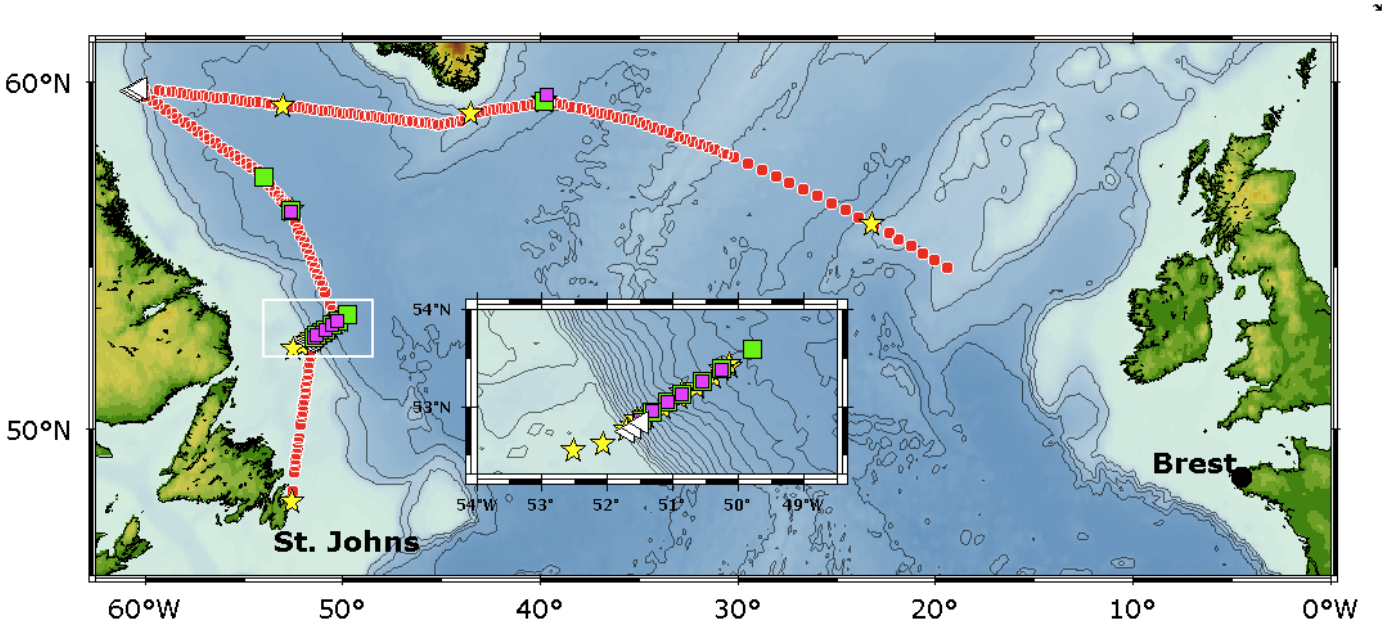
Short Cruise Report
RV THALASSA cruise MSM40

St. Johns, Canada – Brest, France
06. August – 24. August 2014
Chief scientist: Johannes Karstensen
Captain: Jean-Rene Glehen



Cruise track of RV THALASSA cruise MSM40: underway CTD stations (red dots), deployed moorings (green squares), recovered moorings (magenta squares), bottom pressure sensor locations (white triangles), CTDO2/lADCP stations (yellow starts) are indicated.

Objectives

The scientific program from the RV THALASSA expedition MSM40 concerned studies on the Deep Western Boundary Current (DWBC) and water mass transformation processes in the Labrador and Irminger Sea. The work program comprised the recovery and deployment of moored instrumentation as well as of surveys of the water column at selected stations. The moored instrumentation records the local temporal evolution of physical properties (temperature, salinity, density, currents). Only the continuous installation of such system over many years, up to decades, can provide the observational base for the analysis of variability of the interior ocean. The time series data is supplemented by hydrographic and current surveys along selected sections using (u)CTD/ (l)ADCP systems. Quasi-continuous underway data collection includes single depth data from the Thermosalinograph (Temperature, Salinity), and surface meteorological observations, but also ship mounted ADCP systems.

Narrative

On the 04th August 2014 most scientists embarked on board the RV THALASSA in port St. Johns, Canada. Five containers and additional material from colleagues from the Bedford Institute (Canada), Dalhousie University (Canada), Memorial University (Canada) and Woods Hole Oceanographic Institutions (USA) were delivered to the ship by truck. On the following days all material was stored and installed on RV THALASSA. The Develogics surface telemetry system for the K1 mooring was set up on the deck in order to perform test runs.

We set sail on the 06th August and left St. Johns by 10:00am (local time). Shortly after departure, the first CTD was done at “Station 27”, a Canadian time series station, and a first set of salinity and oxygen samples were collected. A first test underway CTD (uCTD) was done at 12:30 with a dummy probe at 12kn ship speed. Given the successful launch of the test uCTD the regular sampling was started, launching an uCTD every hour. The uCTD system was installed on the outer port side of the ship which allowed us to turn the system perpendicular to the course and which facilitated the save return of the sonde on deck. The other underway data acquisition systems (ADCP, TSG) were also started in parallel.

During the whole night, and half of the day, the hourly uCTD program was continued until we reached the 53°N array area. First, the recovery of the K7 mooring was prepared. On the 8th August, at 14:30 the recovery of K7 mooring was started. Shortly after sending the release command (all ships noise was switched off) an element from the upper part of the mooring appeared at the surface. The top floatation could not be identified (later it turned out the element was lost) and the recovery was done using a ship/ZODIAC combination. Although the procedure took some time (2h) it resulted in a save recovery. The last element was recovered at 20:30 and all instruments were safely recovered on board. The weak-link IceCat, designed to break off when the upper mooring element is dragged away by ice, was still at place. Two RCMs had lost the rotor and all three segments of “Benthos floatation, RCM & MicroCat” were entangled. A number of CTD casts were done overnight towards the shelf break (and following the “OSNAP station” grid).

In the morning we returned to the 53°N array but stopped at 07:00am at the P4 bottom pressure sensor (Kiel type) in order to recover this instrument. The receiver (RT661) communicated without problems. However, we could not detect the rising of the device from the seabed. Different angles and ships positions were taken but the instrument seemed not to move. In contrast, the following recovery of the P5 instrument went without problems. The release responded immediately (Benthos release) and P5 came to the surface 20 minutes later. During the day we felt the

remaining swell from hurricane Berth, but other than that the weather was very nice and sunny. The recovery of the DSOW1 mooring was the next operation on the 8th August and that went smooth and no ZODIAC was used. Immediately after recovery the DSOW1 was deployed again. This was the first deployment for us on RV THALASSA and was done by using the mooring capstan from the ship and that worked out well. The next operation was the recovery of the P6 bottom pressure sensor (Proudman Laboratory Liverpool type). During the night more full depth CTD stations (following the OSNAP grid) were made, including a first MicroCat calibrations cast that mainly had devices from the K7 recovery in it.

We started on the 09th August early at 06:00 with the preparation for the K7 mooring deployment. The deployment went smooth but the water depth was deeper than anticipated. As the mooring should provide measurement of deep flow but also the upper layer variability (40m) an additional 150m of wire were introduced which was a compromise as eventually the core of the DWBC may be not fully resolved. However, the topography is very steep here and the nearby CTD profiles showed a DWBC core extending a few hundred meters above the sea floor. Next followed the K8 recovery. The weather was still nice, calm with winds not exceeding Bft 4. The following deployment of K8 started at 17:30 and the anchor was released at 20:30. In order to inspect the position of the P4 Kiel type BPR again, we returned to the side and did an acoustic survey. The response time in DIAGNOSE mode indicated that the instrument was in still at the bottom and in a normal (vertical) position.

The following CTD stations (following the “OSNAP grid”) went ok, except of some minor cable problems. At the bridge a screen double of CTD PC display was installed to verify the altimeter depth. At 09:00 on the 10th August the K9 mooring was released and the whole mooring line was well aligned at the surface about 30min later. On the 11th August K9 was installed starting at 08:00am. The weather was calm and sunny, with some minor ground swell. Preparations for the DSOW2 deployment were next. We had some problems with the McLane profiler because the control files were accidently deleted and no backup for this specific (serial number 12255) at hand. It was decided to change plans and go to the DSOW5 deployment site first (distance more than 40nm). However, on our transit for DSOW5, the company McLane was contacted and they responded quickly and send the missing software about 1 hour later. The profiler programming could thus be finished and the DSOW2 mooring deployment started late, at 08:00pm, and went on until 11:00pm. A MicroCat calibration cast was done at night in order to have the instruments ready for the K10 deployment on the following day.

The deployment of DSOW5 started at 08:00am and took about 1h. This mooring is the outer most one of the 53°N array and shall provide an endpoint estimate of the DWBC, likely to be in the recirculation regime. During the following two hours we steamed to the K10 position and prepared for deployment. A 500m release-test cast was performed and finally the mooring deployment begun at 12:30am. The mooring will serve as a reference in the OSNAP network and as such has been upgraded and extended closer to the surface. This was the last deployment within the 53°N array and we started our transit of about 210nm toward the K1 mooring in the central Labrador Sea. At 18:30 an iceberg was sighted on port side, about 2km away from us. The weather was calm but air temperature were much colder and wafts of mist appeared on the horizon. The uCTD program was continued during the transit to K1 with a cast every hour and went on through the whole night.

The southerly tailwind winds pushed us and we made good progress towards K1. The weather was overcast and partially misty but only moderate wind and waves. The recovery of K1 took only 2 hours and the following CTD was also used to test acoustic releases and to do a calibration profile for the mooring. An Argo float (for BIO, Canada) was deployed close to the K1 position. During the CTD upcast problems with the winch / hydraulic system appeared, but without much impact on our work. The K1 deployment was finally started at 18:00 and finalized at 22:00, when we followed the surface telemetry top float that had flasher on. Afterwards the first set of data was received via the Iridium based telemetry system.

On the next day (14th August) the sound source mooring (A. Bower, WHOI) deployment was prepared and the deployment started at 09:00am. After the deployment we began our transit to the bottom pressure sensor field (three instruments) in the northwester part of the Labrador Sea. During the transit the uCTD work continued with hourly stations. The weather was sunny with moderate to fresh winds. On deck the recovered mooring wire, that was polled during the recovery on the big fish trawling winch, was spooled back to empty wooden reels. The bottom pressure sensor field was reached on 15th August at 06:30am. The sea was calm but the weather was misty with relatively low visibility. The P2 sensor (POL device; 1000m deployment depth) was released first and could be quickly recovered. The same was true for the P1 sensor (Kiel OBS type; deployed at 500m), the first of the three Kiel OBS type units that we could recover. The unit showed strong corrosion on the mounting brackets. Moreover it turned out that the device stopped working in January 2014, likely because the Parascientific pressure sensor was flooded. Next we moved towards the P3 device, another Kiel OBS type device (at 1500m deployment depth) but no response to our acoustic commands (ENABLE, XPAND, RELEASE, DIAGNOSTIC) were received. Again different angles and distances to the nominal position were tested. The nominal position was verified again based on the MSM21/1 protocols and DVS data. Moreover, we investigated if signals from the ARGOS beacon had been broadcasted but that was not the case. Finally we left the position and started transit towards the Irminger Sea. The hourly uCTD program was started again.

The CIS telemetry system was assembled and tested. From earlier testing of the telemetry system that was deployed on the K1 mooring, we knew that the air pressure sensor was strongly dependent on the internal temperature of the housing. One very likely reason is a delay in releasing pressure through the membrane that is mounted in front of the sensor in order to protect it during extreme subduction periods, were the device may be pulled down by several hundred meters. As one possible solution to minimize this problem we drilled very small (0.7mm) holes into the protection disk. As the hydraulic system of the CTD winch was not fully operational, a test CTD was done during the transit to CIS, which was also used for the calibration of recovered MicroCat and temperature loggers. In preparation for the upcoming deployment, the CIS telemetry system was fully assembled and tested.

On 17th August we had an ad-hoc meeting at 05:45am with RV KNORR (Woods Hole Oceanographic Institution) and some communication via radio. At that day we were informed that the ARGOS beacon of the P4 bottom pressure sensor – the sensor that we could not be recovered from the 53°N array, was sending messages since the 14th August. This suggests that it took the sensor 6 days to come to the surface after the release command had been send the first time (8th August). Our position was too far away for a recovery and we investigated other possibilities for a recovery e.g. with our Canadian and US colleagues. A CTD at the southern tip of Greenland was

done to test the Underwater Video Profiler (UVP). The UVP was later used to record a diurnal record of zooplankton migration at the CIS site. During the further transit to the CIS site the hourly uCTD program continued.

We surveyed the topography in order to identify a new deployment area for the CIS mooring to the southeast of the original site. At the original site the "global node Irminger Sea" of the US Ocean Observation Initiative (OOI) was planned to be installed in mid September with RV KNORR. After recovery of the CIS mooring a CTD cast to 1000m was done in order to get a daytime distribution of organisms/particles recorded by the UVP. A profile at night and again in the early morning were done to complete this data set.

The following hours where used to prepare the CIS deployment as we were keen in deploying the mooring as quick as possible to profit from the calm weather. The deployment begun at 17:30 and was finished at about 21:00, while the installation of the surface telemetry system prolonged the deployment by 1 to 2 hours compared to a normal mooring of this length and sensor configuration. From the depth survey we did before, a potential deployment target area was identified that fitted well the design depth of 2950m spot (the mooring design was slightly changed and shortened by 50m). The deployment went well and the flasher on the dome of the telemetry unit provided an easy way to track the mooring during the sinking of the anchor. The immediately following CTD/UVP cast was performed during the potential rising of the zooplankton.

Two more CTD / UVP casts followed on 19th August (03:00am and 08:00am) in order to sample the night and morning particle distribution. Being close to the mooring we had the chance to spot again the CIS telemetry system at the surface. While this looked good it became clear that the telemetry system did not operated as planned, only two of the ten MicroCats and no O_2 logger nor an Aquadopp broadcasted data. Most likely one of the two conductive swivels installed under the first two MicroCats (5m & 20m) is interrupted or creates a shortcut. In addition, data from the surface buoy sensors (air temperature & air pressure) is not renewed and constant values are broadcasted.

After completing all work in the CIS area we started the transit to Brest. The uCTD program continued with one hourly sampling until about 13:00, when we crosses the Reykjanes Ridge and left the Irminger Sea area. Shortly before a test in order to compare the uCTD device with an XBT (T7 Probe) was done. The THALASSA ship science team was interested in exploring the option to replace the XBT launches with uCTD operations. The casts agreed well in temperature but some depth difference (empirically estimated for the T7 and measure for the uCTD) were identified – the difference increased with depth. One possible reason could be that the RV THALASSA steamed with only 3 kn during the test and which is maybe too slow for the Sippican T7 (designed for launches up to 15 knots). The uCTD program continued further but with two hourly sampling. A last CTD cast (#24) was done on 24th August in the Porcupine area in order to calibrated MicroCats. Packing started and presentations by the cruise participants were done in order to ensure the proper documentation of operations that had been done during the cruise.

The uCTD program and TSG/ADCP was stopped when we entered the Irlandic EEZ. The RV THALASSA was moored on 24th August at 10:10 in Brest. During the following days unloading of the gear and transportation was done.

Acknowledgement

We like to thank captain Jean-Rene Glehen, his officers and crew of RV THALASSA for their hospitality and enthusiasm and support to achieve the cruise objectives. We thank Sylvie Van Iseghem and Jean-Xavier Castrec (both GENAVIR) for help with the diplomatic clearance and Klas Lackschwitz (GEOMAR) for launching the ship time search via the „Ocean Facilities Exchange Group“ (OFEG) and the DFG and BMBF as well as the members of the MARIA S MERIAN advisory board for providing ship time funding and revising the application for the replacement cruise on THALASSA. Financial support for the different projects carried out during the cruise was provided though the German RACE program and the EU FP7 NACLIM project. The expedition is a contribution to the OSNAP project.

Cruise participants science:

	Name	Task	Institution
1	Johannes Karstensen	Chief scientist	GEOMAR
2	Andreas Pinck	Mooring & Electronics	GEOMAR
3	Uwe Papenburg	Mooring, Logistics	GEOMAR
4	Till Baumann	lADCP (L), CTD/uCTD watch leader	CAU KIel
5	Villu Kikas	Mooring instruments, CTD/uCTD watch	TMS
6	Taavi Liblik	uCTD (**L**), CTD (watch leader), help: mooring	GEOMAR
7	Katharina Müller	Titration (L), CTD/uCTD watch leader, bottom pressure sensors	AWI
8	Thilo Klenz	ADCP (L), CTD/uCTD watch	GEOMAR
9	Josefine Herrford	Salinometer (L), Helper: mooring data, CTD/uCTD watch	CAU KIel
10	Kristin Burmeister	Thermosal, Helper: mooring data; CTD/uCTD watch	CAU KIel
11	Ann Katrin Seemann	Mooring protocol; Helper: Titration, CTD/uCTD watch	CAU KIel
12	Simona Skyraite	Underway data & station list; Helper: Titration CTD/uCTD watch	VU
13	Eike Köhn	Float (L), Mooring instruments, CTD/uCTD watch	CAU KIel
14	Samuel Morgain	Bird Watch	CWS

GEOMAR: Helmholtz-Zentrum für Ozeanforschung Kiel, Kiel, Germany
CAU Kiel: Christian-Albrechts-Universität zu Kiel, Kiel, Germany
AWI: Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany
VU: Vilnius University, Vilnius, Lithuania
CWS: Canadian Wildlife Service, Dartmouth, Canada
TMS: Marine Systems Institute at Tallinn University of Technology, Tallinn, Estonia

Part of the crew and science cruise participants of RV THALASSA MSM40 expedition

Station list RV Thalassa MSM40

Gear coding
CTD/RO: CTD/lowered Acoustic Doppler Current Profiler/and rosette sampler
uCTD: Underway CTD
MOOR: Mooring operation
UVP: Underwater Video Profiler
BPS: Bottom Pressure sensors

Cast	Date	Time	PositionLat	PositionLon	Gear	Comment
CTD1	06/08/2014	14:03:00	N 47 32.796	W 052 34.920	CTD/RO	Station 27
uCTD1	06/08/2014	16:00:14	N 47 54.754	W 052 31.658	uCTD	
uCTD2	06/08/2014	19:07:15	N 48 33.626	W 052 25.106	uCTD	
uCTD3	06/08/2014	20:05:35	N 48 45.960	W 052 23.217	uCTD	
uCTD4	06/08/2014	21:11:13	N 48 59.167	W 052 21.077	uCTD	
uCTD5	06/08/2014	22:06:37	N 49 10.369	W 052 18.303	uCTD	
uCTD6	06/08/2014	23:06:47	N 49 22.641	W 052 15.757	uCTD	
uCTD7	06/08/2014	23:57:14	N 49 32.824	W 052 13.616	uCTD	
uCTD8	07/08/2014	0:34:59	N 49 40.566	W 052 11.951	uCTD	
uCTD9	07/08/2014	2:45:03	N 50 07.474	W 052 06.137	uCTD	
uCTD10	07/08/2014	3:54:54	N 50 21.895	W 052 03.002	uCTD	
uCTD11	07/08/2014	4:49:29	N 50 33.092	W 052 00.554	uCTD	
uCTD12	07/08/2014	5:49:43	N 50 45.589	W 051 57.811	uCTD	
uCTD13	07/08/2014	6:35:34	N 50 55.067	W 051 55.722	uCTD	
uCTD14	07/08/2014	7:36:16	N 51 07.703	W 051 52.925	uCTD	
uCTD15	07/08/2014	8:32:29	N 51 19.050	W 051 50.406	uCTD	
uCTD16	07/08/2014	9:32:28	N 51 31.039	W 051 47.732	uCTD	
uCTD17	07/08/2014	10:34:26	N 51 43.446	W 051 44.583	uCTD	
uCTD18	07/08/2014	11:30:38	N 51 54.714	W 051 42.883	uCTD	
uCTD19	07/08/2014	12:28:21	N 52 05.937	W 051 39.874	uCTD	
uCTD20	07/08/2014	13:28:39	N 52 17.384	W 051 37.277	uCTD	
uCTD21	07/08/2014	14:31:56	N 52 29.387	W 051 34.539	uCTD	
uCTD22	07/08/2014	15:33:39	N 52 40.963	W 051 31.180	uCTD	
K7	07/08/2014	17:08:29	N 52 51.939	W 051 29.696	MOOR	released
CTD2	07/08/2014	22:17:00	N 52 51.992	W 051 29.305	CTD/RO	
CTD3	08/08/2014	0:12:33	N 52 47.621	W 051 36.214	CTD/RO	on board
CTD4	08/08/2014	1:37:00	N 52 45.186	W 051 42.204	CTD/RO	
CTD5	08/08/2014	3:47:00	N 52 36.912	W 052 03.316	CTD/RO	
CTD6	08/08/2014	5:51:00	N 52 32.632	W 052 30.711	CTD/RO	
uCTD23	08/08/2014	6:44:52	N 52 35.821	W 052 17.738	uCTD	
uCTD24	08/08/2014	7:44:03	N 52 39.959	W 052 00.848	uCTD	
P4	08/08/2014	9:06:49	N 52 44.624	W 051 41.767	BPS	not recovered
P5	08/08/2014	11:52:19	N 52 46.511	W 051 35.359	BPS	recovered
dsow1	08/08/2014	14:52:10	N 53 02.539	W 051 05.079	MOOR	recovered
dsow1	08/08/2014	18:21:45	N 53 02.764	W 051 04.801	MOOR	anchor released
P6	08/08/2014	20:37:52	N 52 50.234	W 051 29.134	BPS	released
P6	08/08/2014	21:37:03	N 52 50.218	W 051 28.602	BPS	2. released
CTD7	09/08/2014	1:35:30	N 52 53.713	W 051 22.958	CTD/RO	
CTD8	09/08/2014	4:39:00	N 52 59.129	W 051 08.355	CTD/RO	
CTD9	09/08/2014	9:42:00	N 52 51.931	W 051 32.799	CTD/RO	test

K7	09/08/2014	12:42:15	N 52 51.935	W 051 28.717	MOOR	anchor released
K8	09/08/2014	16:09:12	N 52 57.501	W 051 19.383	MOOR	recovery/released
K8	09/08/2014	23:11:27	N 52 56.461	W 051 18.956	MOOR	anchor released
CTD10	10/08/2014	6:44:00	N 53 05.786	W 050 52.240	CTD/RO	
CTD11	10/08/2014	9:52:00	N 53 11.790	W 050 37.289	CTD/RO	
K9	10/08/2014	11:27:18	N 53 08.195	W 050 53.392	MOOR	recovery/released
dsow2	10/08/2014	16:26:13	N 53 15.461	W 050 33.725	MOOR	recovery/released
K10	10/08/2014	19:28:00	N 53 22.749	W 050 16.023	MOOR	recovery/released
CTD12	11/08/2014	1:16:00	N 53 18.323	W 050 22.204	CTD/RO	
CTD13	11/08/2014	6:03:00	N 53 24.063	W 050 06.059	CTD/RO	
CTD14	11/08/2014	10:26:00	N 53 08.160	W 050 52.686	CTD/RO	
K9	11/08/2014	14:55:06	N 53 07.842	W 050 52.526	MOOR	anchor released
dsow2	12/08/2014	1:21:25	N 53 15.497	W 050 32.755	MOOR	anchor released
CTD15	12/08/2014	6:06:00	N 53 25.761	W 050 08.060	CTD/RO	
dsow5	12/08/2014	10:56:02	N 53 35.539	W 049 46.864	MOOR	anchor released
CTD16	12/08/2014	13:40:00	N 53 22.796	W 050 14.909	CTD/RO	K10 CTD
K10	12/08/2014	18:26:35	N 53 23.244	W 050 15.282	MOOR	anchor released
uCTD25	12/08/2014	20:11:03	N 53 41.200	W 050 27.828	uCTD	
uCTD26	12/08/2014	21:04:48	N 53 51.378	W 050 35.159	uCTD	
uCTD27	12/08/2014	22:58:26	N 54 13.105	W 050 50.917	uCTD	
uCTD28	12/08/2014	23:57:53	N 54 24.229	W 050 59.037	uCTD	
uCTD29	13/8/2014	0:58:40	N 54 35.403	W 051 07.226	uCTD	
uCTD30	13/8/2014	2:00:06	N 54 46.796	W 051 15.624	uCTD	
uCTD31	13/8/2014	2:59:37	N 54 57.670	W 051 23.669	uCTD	
uCTD32	13/8/2014	3:58:39	N 55 08.633	W 051 31.827	uCTD	
uCTD33	13/8/2014	4:58:00	N 55 19.504	W 051 39.949	uCTD	
uCTD34	13/8/2014	5:54:35	N 55 29.949	W 051 47.786	uCTD	
uCTD35	13/8/2014	7:00:30	N 55 42.026	W 051 56.893	uCTD	
uCTD36	13/8/2014	7:58:33	N 55 52.847	W 052 05.103	uCTD	
uCTD37	13/8/2014	8:57:06	N 56 03.989	W 052 13.566	uCTD	
uCTD38	13/8/2014	10:04:00	N 56 16.537	W 052 23.177	uCTD	
K1	13/8/2014	12:52:41	N 56 33.194	W 052 39.594	MOOR	recovery/released
CTD17_K1	13/8/2014	19:35:00	N 56 36.826	W 052 35.082	CTD/RO	
K1	14/8/2014	0:28:02	N 56 35.448	W 052 38.244	MOOR	anchor released
Argo float	14/8/2014	0:41:00	N 56 36.246	W 052 39.098	ARGO	drop to the water
uCTD39	14/8/2014	1:02:05	N 56 38.532	W 052 42.447	uCTD	
uCTD40	14/8/2014	2:01:51	N 56 45.801	W 052 53.294	uCTD	
uCTD41	14/8/2014	3:00:00	N 56 52.873	W 053 03.876	uCTD	
uCTD42	14/8/2014	3:53:13	N 56 59.163	W 053 13.320	uCTD	
uCTD43	14/8/2014	4:50:26	N 57 06.134	W 053 23.815	uCTD	
uCTD44	14/8/2014	6:11:26	N 57 16.195	W 053 39.025	uCTD	
uCTD45	14/8/2014	7:04:34	N 57 22.818	W 053 49.071	uCTD	
SS2/OSNAP2	14/8/2014	12:56:16	N 57 31.689	W 053 59.599	MOOR	anchor released
uCTD46	14/8/2014	13:20:31	N 57 34.484	W 054 04.207	uCTD	
uCTD47	14/8/2014	14:05:42	N 57 39.063	W 054 17.016	uCTD	
uCTD48	14/8/2014	15:01:05	N 57 44.953	W 054 33.512	uCTD	
uCTD49	14/8/2014	15:57:13	N 57 51.152	W 054 50.932	uCTD	
uCTD50	14/8/2014	17:01:17	N 57 58.207	W 055 10.830	uCTD	
uCTD51	14/8/2014	17:55:49	N 58 03.991	W 055 27.182	uCTD	
uCTD52	14/8/2014	18:59:06	N 58 10.956	W 055 46.928	uCTD	

uCTD53	14/8/2014	19:57:41	N 58 17.362	W 056 05.173	uCTD	
uCTD54	14/8/2014	20:56:20	N 58 23.864	W 056 23.718	uCTD	
uCTD55	14/8/2014	22:07:23	N 58 31.674	W 056 46.075	uCTD	
uCTD56	14/8/2014	23:01:23	N 58 37.059	W 057 01.552	uCTD	
uCTD57	15/8/2014	0:01:34	N 58 43.844	W 057 21.094	uCTD	
uCTD58	15/8/2014	0:59:35	N 58 50.539	W 057 40.436	uCTD	
uCTD59	15/8/2014	1:57:57	N 58 57.256	W 057 59.919	uCTD	
uCTD60	15/8/2014	2:58:30	N 59 04.264	W 058 20.291	uCTD	
uCTD61	15/8/2014	3:57:47	N 59 10.810	W 058 39.405	uCTD	
uCTD62	15/8/2014	4:54:31	N 59 17.104	W 058 57.835	uCTD	
uCTD63	15/8/2014	6:04:40	N 59 25.106	W 059 21.349	uCTD	
uCTD64	15/8/2014	6:57:08	N 59 30.707	W 059 37.871	uCTD	
uCTD65	15/8/2014	7:57:52	N 59 37.568	W 059 58.140	uCTD	
uCTD66	15/8/2014	8:54:02	N 59 44.675	W 060 19.232	uCTD	
P2	15/8/2014	9:47:11	N 59 48.591	W 060 30.729	BPS	released
P1	15/8/2014	10:55:57	N 59 47.370	W 060 37.309	BPS	released
P3	15/8/2014	14:09:42	N 59 51.084	W 060 13.996	BPS	No comm
uCTD67	15/8/2014	16:53:05	N 59 49.728	W 060 05.060	uCTD	
uCTD68	15/8/2014	18:56:52	N 59 46.847	W 059 18.038	uCTD	
uCTD69	15/8/2014	19:56:43	N 59 45.617	W 058 58.045	uCTD	
uCTD70	15/8/2014	20:57:54	N 59 44.313	W 058 36.820	uCTD	
uCTD71	15/8/2014	22:06:34	N 59 42.714	W 058 10.770	uCTD	
uCTD72	15/8/2014	22:54:47	N 59 41.519	W 057 51.269	uCTD	
uCTD73	16/8/2014	0:00:29	N 59 39.935	W 057 25.609	uCTD	
uCTD74	16/8/2014	0:55:38	N 59 38.605	W 057 03.997	uCTD	
uCTD75	16/8/2014	1:55:27	N 59 37.286	W 056 42.535	uCTD	
uCTD76	16/8/2014	2:53:52	N 59 35.960	W 056 21.029	uCTD	
uCTD77	16/8/2014	3:52:12	N 59 34.553	W 055 58.259	uCTD	
uCTD78	16/8/2014	5:04:02	N 59 32.721	W 055 28.612	uCTD	
uCTD79	16/8/2014	5:59:08	N 59 31.338	W 055 06.309	uCTD	
uCTD80	16/8/2014	6:57:45	N 59 29.914	W 054 43.244	uCTD	
uCTD81	16/8/2014	7:59:37	N 59 28.433	W 054 19.305	uCTD	
uCTD82	16/8/2014	9:18:15	N 59 26.603	W 053 49.757	uCTD	
uCTD83	16/8/2014	9:54:45	N 59 25.811	W 053 37.016	uCTD	
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CTD18	16/8/2014	15:40:00	N 59 23.497	W 053 01.688	CTD/RO	
uCTD85	16/8/2014	17:01:36	N 59 21.938	W 052 34.517	uCTD	
uCTD86	16/8/2014	17:58:55	N 59 20.495	W 052 11.369	uCTD	
uCTD87	16/8/2014	18:59:23	N 59 19.072	W 051 48.529	uCTD	
uCTD88	16/8/2014	19:56:17	N 59 17.713	W 051 26.640	uCTD	
uCTD89	16/8/2014	21:01:21	N 59 16.168	W 051 01.905	uCTD	
uCTD90	16/8/2014	21:56:58	N 59 14.877	W 050 41.143	uCTD	
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uCTD92	16/8/2014	23:57:00	N 59 12.120	W 049 56.948	uCTD	
uCTD93	17/8/2014	1:02:14	N 59 10.613	W 049 32.772	uCTD	
uCTD94	17/8/2014	1:57:47	N 59 09.317	W 049 12.087	uCTD	
uCTD95	17/8/2014	2:49:53	N 59 08.159	W 048 53.566	uCTD	
uCTD96	17/8/2014	3:51:40	N 59 06.813	W 048 32.057	uCTD	
uCTD97	17/8/2014	5:03:16	N 59 05.242	W 048 06.957	uCTD	
uCTD98	17/8/2014	5:59:59	N 59 04.021	W 047 47.464	uCTD	

uCTD99	17/8/2014	6:59:21	N 59 02.697	W 047 26.957	uCTD	
uCTD100	17/8/2014	7:58:52	N 59 01.457	W 047 06.576	uCTD	
uCTD101	17/8/2014	9:15:20	N 58 59.927	W 046 42.121	uCTD	
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uCTD103	17/8/2014	10:58:02	N 58 57.847	W 046 09.069	uCTD	
uCTD104	17/8/2014	11:59:22	N 58 56.586	W 045 49.005	uCTD	
uCTD105	17/8/2014	13:14:20	N 58 55.007	W 045 23.950	uCTD	
uCTD106	17/8/2014	13:55:12	N 58 54.140	W 045 10.121	uCTD	
uCTD107	17/8/2014	14:56:33	N 58 54.756	W 044 48.683	uCTD	
uCTD108	17/8/2014	15:51:49	N 58 56.990	W 044 29.060	uCTD	
uCTD109	17/8/2014	17:02:17	N 58 59.958	W 044 02.890	uCTD	
uCTD110	17/8/2014	17:59:03	N 59 05.286	W 043 45.248	uCTD	
CTD 19	17/8/2014	21:21:00	N 59 11.402	W 043 32.800	CTD/RO	UVP
uCTD111	17/8/2014	23:00:30	N 59 13.633	W 043 04.672	uCTD	
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uCTD113	18/8/2014	1:00:33	N 59 16.981	W 042 20.217	uCTD	
uCTD114	18/8/2014	1:57:03	N 59 18.612	W 041 58.590	uCTD	
uCTD115	18/8/2014	2:53:31	N 59 20.221	W 041 37.207	uCTD	
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uCTD117	18/8/2014	5:04:47	N 59 24.069	W 040 45.964	uCTD	
uCTD118	18/8/2014	5:58:45	N 59 25.692	W 040 24.357	uCTD	
uCTD119	18/8/2014	6:59:05	N 59 27.520	W 039 59.938	uCTD	
CIS12	18/8/2014	8:43:11	N 59 41.555	W 039 39.393	MOOR	recovery/released
CTD 20	18/8/2014	17:25:30	N 59 30.657	W 039 47.029	CTD/RO	UVP
CIS13	18/8/2014	22:33:35	N 59 31.827	W 039 47.029	MOOR	anchor released
CTD 21	18/8/2014	22:57:10	N 59 32.086	W 039 45.136	CTD/RO	UVP
CTD 22	19/8/2014	3:00:59	N 59 31.251	W 039 44.072	CTD/RO	UVP
CTD 23	19/8/2014	7:31:48	N 59 31.719	W 039 45.943	CTD/RO	UVP
uCTD120	19/8/2014	10:59:03	N 59 29.224	W 039 32.165	uCTD	
uCTD121	19/8/2014	11:58:55	N 59 26.770	W 039 08.354	uCTD	
uCTD122	19/8/2014	12:48:04	N 59 24.614	W 038 49.112	uCTD	
uCTD123	19/8/2014	13:46:58	N 59 22.046	W 038 26.216	uCTD	
uCTD124	19/8/2014	15:11:50	N 59 18.453	W 037 54.208	uCTD	
uCTD125	19/8/2014	16:04:14	N 59 16.454	W 037 36.415	uCTD	
uCTD126	19/8/2014	16:58:19	N 59 14.102	W 037 15.526	uCTD	
uCTD127	19/8/2014	17:58:01	N 59 11.547	W 036 52.858	uCTD	
uCTD128	19/8/2014	18:57:21	N 59 08.875	W 036 29.189	uCTD	
uCTD129	19/8/2014	19:59:04	N 59 06.181	W 036 05.342	uCTD	
uCTD130	19/8/2014	20:55:48	N 59 03.668	W 035 43.116	uCTD	
uCTD131	19/8/2014	22:00:54	N 59 00.780	W 035 17.607	uCTD	
uCTD132	19/8/2014	22:55:17	N 58 58.302	W 034 56.431	uCTD	
uCTD133	19/8/2014	23:53:44	N 58 54.092	W 034 34.721	uCTD	
uCTD134	20/8/2014	0:53:00	N 58 53.613	W 034 32.260	uCTD	
uCTD135	20/08/2014	01:54:44	N 58 45.213	W 033 48.890	uCTD	
uCTD136	20/08/2014	02:49:59	N 58 41.049	W 033 27.479	uCTD	
uCTD137	20/08/2014	04:01:54	N 58 35.563	W 032 59.317	uCTD	
uCTD138	20/08/2014	04:57:26	N 58 31.347	W 032 37.739	uCTD	
uCTD139	20/08/2014	05:57:38	N 58 26.957	W 032 15.321	uCTD	
uCTD140	20/08/2014	06:56:39	N 58 22.764	W 031 53.933	uCTD	
uCTD141	20/08/2014	08:01:38	N 58 18.020	W 031 29.791	uCTD	

uCTD142	20/08/2014	08:55:56	N 58 14.008	W 031 09.411	uCTD	
uCTD143	20/08/2014	10:19:28	N 58 08.686	W 030 42.588	uCTD	
uCTD144	20/08/2014	10:56:48	N 58 06.626	W 030 32.028	uCTD	
uCTD145	20/08/2014	11:59:42	N 58 01.455	W 030 09.676	uCTD	
uCTD146	20/08/2014	13:55:03	N 57 51.531	W 029 28.163	uCTD	
uCTD147	20/08/2014	16:02:54	N 57 40.885	W 028 43.814	uCTD	
uCTD148	20/08/2014	17:59:39	N 57 30.990	W 028 02.802	uCTD	
uCTD149	20/08/2014	19:57:46	N 57 20.788	W 027 21.156	uCTD	
uCTD150	20/08/2014	21:57:04	N 57 10.626	W 026 38.751	uCTD	
uCTD151	20/08/2014	23:57:38	N 56 59.401	W 025 55.947	uCTD	
uCTD152	21/08/2014	01:58:31	N 56 47.458	W 025 14.314	uCTD	
uCTD153	21/08/2014	04:02:23	N 56 35.361	W 024 32.368	uCTD	
uCTD154	21/08/2014	06:01:40	N 56 23.781	W 023 52.405	uCTD	
CTD 24	21/08/2014	08:20:00	N 56 12.593	W 023 13.802	CTD/RO	
uCTD155	21/08/2014	10:53:19	N 56 10.433	W 023 06.623	uCTD	
uCTD156	21/08/2014	13:27:16	N 55 56.273	W 022 18.319	uCTD	
uCTD157	21/08/2014	15:05:19	N 55 46.541	W 021 48.668	uCTD	
uCTD158	21/08/2014	17:05:27	N 55 34.233	W 021 12.242	uCTD	
uCTD159	21/08/2014	18:58:28	N 55 22.350	W 020 37.241	uCTD	
uCTD160	21/08/2014	20:58:11	N 55 09.742	W 020 00.307	uCTD	
uCTD161	21/08/2014	22:59:29	N 54 57.012	W 019 23.213	uCTD	
uCTD162	22/08/2014	1:02:46	N 54 44.434	W 018 46.758	uCTD	
uCTD163	22/08/2014	3:00:30	N 54 31.997	W 018 12.591	uCTD	
uCTD164	22/08/2014	5:01:24	N 54 18.468	W 017 37.987	uCTD	
uCTD165	22/08/2014	7:02:36	N 54 04.654	W 017 02.851	uCTD	
uCTD166	22/08/2014	8:55:55	N 53 52.005	W 016 30.835	uCTD	