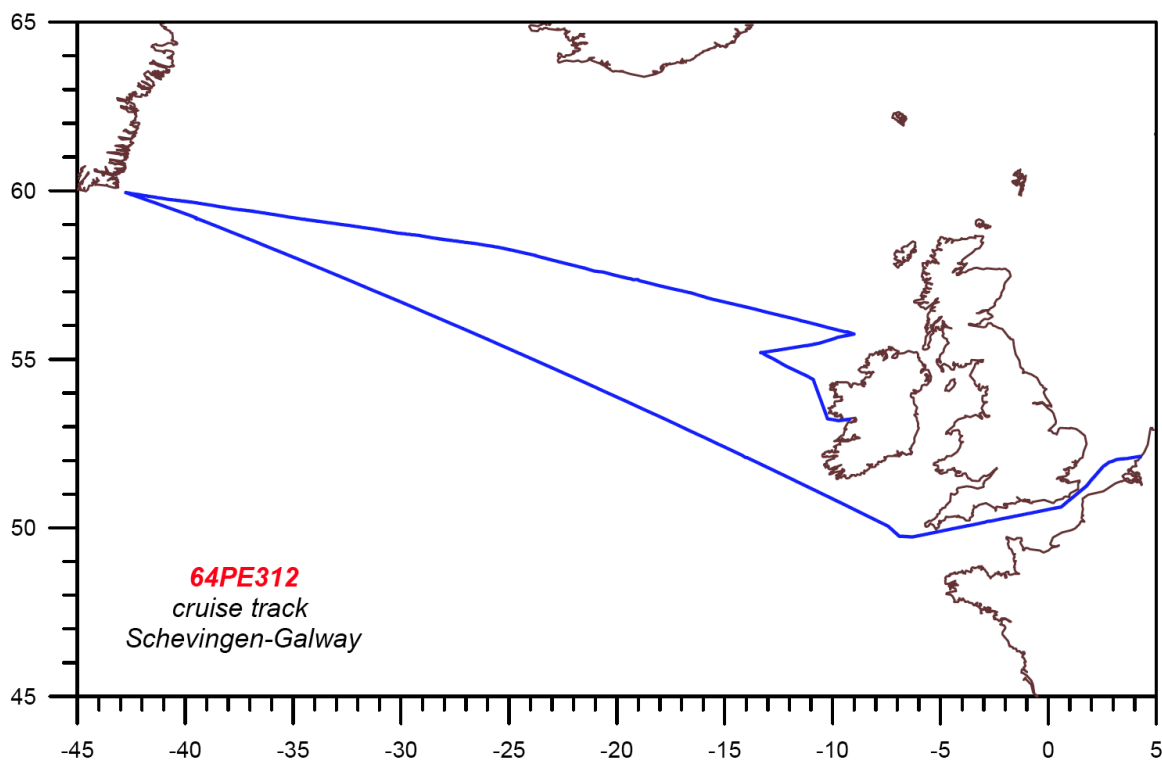


CRUISE REPORT: AR07E

(Updated MAR 2015)



Highlights

Cruise Summary Information

Section Designation	AR07E (aka: 64PE312)	
Expedition designation (ExpoCodes)	64PE20090924	
Chief Scientists	Hendrik M. van Aken / NIOZ	
Dates	2009 SEP 24 - 2009 PCT 13	
Ship	RV Pelagia	
Ports of call	Scheveningen to Galway	
Geographic Boundaries	59° 56.88' N	9° 0' W
	42° 45.19' W	
	52° 27.94' N	
Stations	42	
Floats and drifters deployed	0	
Moorings deployed or recovered	1 deployed, 1 recovered	

Contact Information:

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Links To Select Topics

Shaded sections are not relevant to this cruise or were not available when this report was compiled.

Cruise Summary Information	Hydrographic Measurements
Description of Scientific Program	CTD Data:
Geographic Boundaries	Acquisition
Cruise Track (Figure): PI CCHDO	Processing
Description of Stations	Calibration
Description of Parameters Sampled	Temperature Pressure
Bottle Depth Distributions (Figure)	Salinities Oxygens
Floats and Drifters Deployed	Bottle Data
Moorings Deployed or Recovered	Salinity
	Oxygen
Principal Investigators	Nutrients
Cruise Participants	Carbon System Parameters
	CFCs
Problems and Goals Not Achieved	Helium / Tritium
Other Incidents of Note	Radiocarbon
Underway Data Information	References
Navigation Bathymetry	
Acoustic Doppler Current Profiler (ADCP)	
Thermosalinograph	
XBT and/or XCTD	
Meteorological Observations	Acknowledgments
Atmospheric Chemistry Data	
Data Processing Notes	

RV Pelagia Shipboard Report: Cruise 64PE312, Project THOR

H.M. van Aken
Chief Scientist



THOR 2009



Royal Netherlands Institute for Sea Research

Texel, 2009

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Acknowledgements

The research reported here has received funding from the European Community's 7th framework programme (FP7/2007-2013) under grant agreement No. GA212643 (THOR: "Thermohaline Overturning – at Risk", 2008-2012) and also contributes to the Dutch CLIVARNET Atlantic Monitoring Programme (CAMP). The moored equipment was funded by the LOCO investment programme of the Netherlands Foundation for Scientific Research (NWO).

1 Cruise Narrative

1.1 Highlights

a: Goals: The re-survey of former WOCE Hydrographic Program Repeat Section A1/AR7E between Ireland and Greenland with an additional section near Ireland and the recovery and deployment of a long term mooring in the Irminger Sea as part of the EU THOR programme.

b: Expedition Designation (EXPOCODE): 64PE312

c: Chief Scientist: Dr. Hendrik M. van Aken
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d: Ship: RV Pelagia, Call Sign: PGRQ, Captain: Mr. John Ellen
length 66 m.
beam 12.8 m
draft 4 m
maximum speed 11 knots

e: Ports of Call: Scheveningen to Galway

f: Cruise dates: September 24 2009 to October 13 2009

1.2 Cruise Summary Information

Summary

In the evening of Thursday 24 September, RV Pelagia left Scheveningen and set course to the position in the Irminger Sea where the LOCO2 profiling mooring has been recovered and re-deployed. After leaving port the underway recording system for navigational, meteorological, ADCP, and sea surface data was activated. After the mooring activities a CTD survey was carried out along the AR7E section between Greenland and Ireland, and along an additional small section near Ireland. On October 13 RV Pelagia entered the port of Galway.

Cruise Track

The cruise was carried out in the northern North Atlantic Ocean. The cruise track is shown in figure 1

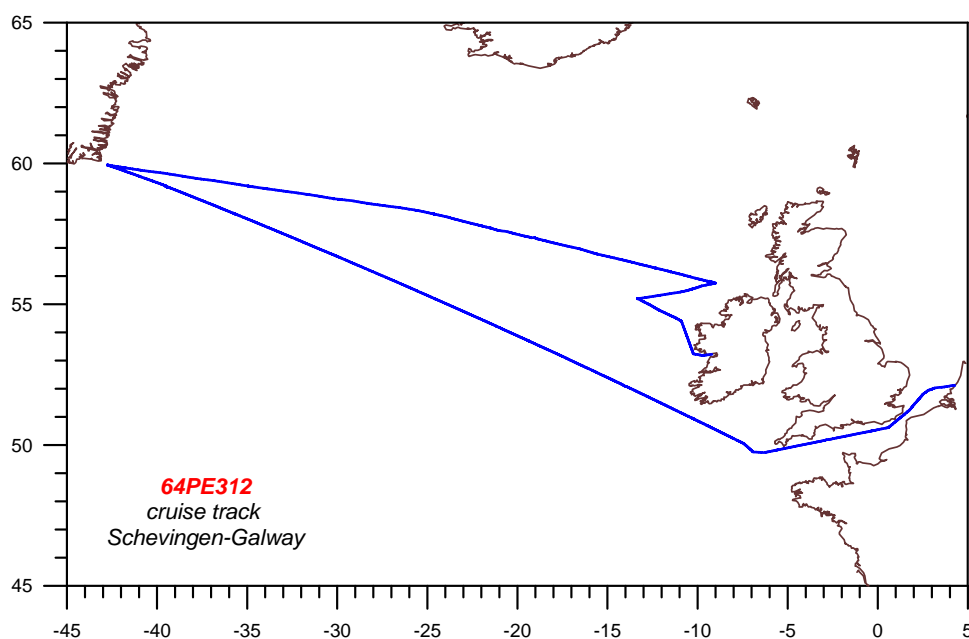


Figure 1. Cruise track of Pelagia cruise 64PE312, from Scheveningen (Netherlands) to Galway (Ireland).

Mooring Deployments

Mooring LOCO2-6 was recovered after which mooring LOCO2-7 was deployed on October 2. The mooring operations took place during daytime. The position of the deployment of LOCO2-7 is: 59°12.21'N, 39°30.49'W (cross in Figure 2), the deployment time is 17:44 UTC. During the last 10 minutes before deployment

Pelagia has followed a course over ground in the direction of 314° relative to North. Both LOCO2-6 and 2-7 are profiling moorings, fitted with a McLane/FSI CTD profiler, two RDI Long Ranger ADCPs and an SBE Microcat CTD. They were deployed at a depth of about 3000 m at the foot of the East Greenland slope, approximately in the centre of the Irminger Gyre. See also Appendix B.

Number of Hydrographic Stations

A total of 42 CTD casts were performed along the former WOCE AR7E section, and 6 stations along the additional section across the Irish continental slope. The location of these casts is shown in figure 2. The mutual station distance is about 30 nautical miles, while over steep topography that distance was reduced to about 15 miles. Due to adverse weather conditions a planned CTD station 30 miles east of the Hatton Bank had to be cancelled. Further information on the time, location can be found in the Cruise Summary File (Appendix A).

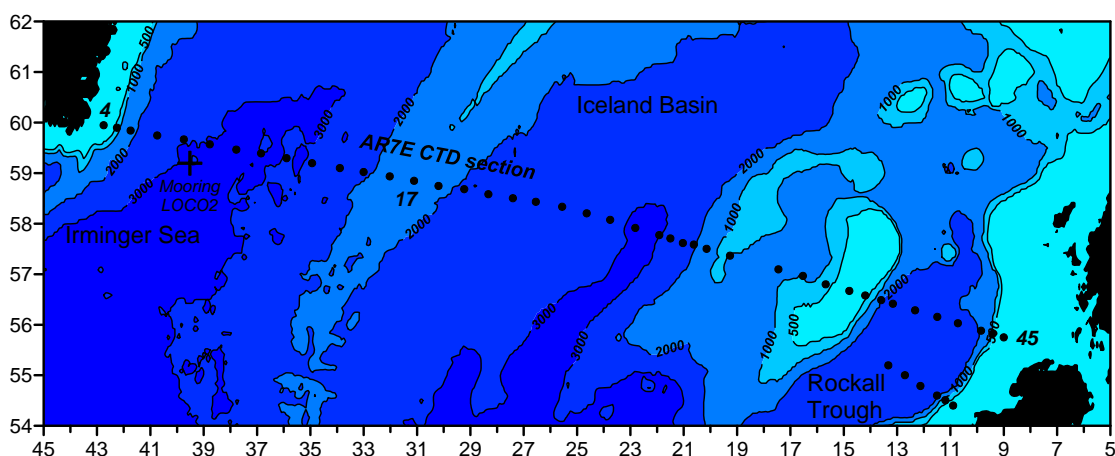


Figure 2. Hydrographic stations along the former WOCE hydrographic Program section AR7E, surveyed during Pelagia cruise 64PE312.

1.3 List of principal Investigators

<u>Name</u>	<u>Responsibility</u>	<u>Affiliation</u>
Dr. H.M. van Aken	Ocean hydrography	NIOZ/Texel
Ir. R. Gelderloos	moorings	KNMI/De Bilt

1.4 Scientific Programme and Methods

The dual goal of the research carried out during the cruise was to establish the hydrography along a zonal section between Greenland and Ireland to allow

the study of inter-annual hydrographic variability and to service an instrumented mooring in the Irminger Sea, both as part of the EU THOR programme, and as an extension of the CAMP monitoring programme of NIOZ.

The zonal section is the former A1E/AR7E section of the WOCE Hydrographic Programme, which has been surveyed near-annually since 1990. The re-survey of this section is carried out in order to determine climate related inter-annual changes of the hydrographic structure in the North Atlantic Ocean.

The CTD frame was fitted with weights in order to secure a fast enough falling rate. This package was lowered with a velocity of about 1 m/s, except in the lowest 100 m where the veering velocity was reduced. Measurements during the down-cast went on to within 12 m from the bottom, until the bottom switch indicated the proximity of the bottom. During the up-cast a few temperature samples were taken with the SBE35 reference thermometer at prescribed depths, when the CTD winch was stopped.

The mooring which was recovered (LOCO2-6) and re-deployed (LOCO2-7) was funded as part of the Dutch Long-term Ocean Climate Observations programme (LOCO). This programme aims at the establishment of a monitoring system which records climate relevant oceanographic parameters at several locations in the world ocean. The moorings contain a profiling CTD which will record on a daily basis profiles of temperature and salinity between ~2400 and 160 m depth (McLane profiler). Additionally ADCPs will record the velocity profiles in the upper and lower 600 m. Mooring LOCO2-7 is the 7-th of a series of moorings, each deployed for one year in the centre of the Irminger gyre.

On board data processing of the ADCP data was carried out. From the profiler data preliminary ASCII files with temperature and density as functions of the pressure were produced. Not enough time was available for complete data processing, which will be carried out back at NIOZ. Because of a misunderstanding the Microcat was redeployed before the data were retrieved. These data will become available only when the mooring is recovered in 2010.

In support of the CTD observations the sea surface temperature and salinity were recorded continuously as well as several meteorological parameters. Also the currents in the upper 600 m were recorded with the vessel mounted acoustic Doppler current profiler (VMADCP).

1.5 Lists of Cruise Participants

Scientific crew

person	responsibility	Institute
H.M. van Aken	Chief Scientist	NIOZ/Texel
R. Gelderloos	Moorings & hydrowatch	KNMI/De Bilt
A.J. Asjes	Electronic engineering	NIOZ/Texel
L. Wuis	Marine engineering	NIOZ/Texel
B.A. Grijseels	Hydrowatch	IMAU/Utrecht
K.T. Frankhuizen	Hydrowatch	IMAU/Utrecht
M.L.M. Witteveen	Hydrowatch	IMAU/Utrecht
P. Bakker	Hydrowatch	IMAU/Utrecht
V. Kamphuis	Hydrowatch	IMAU/Utrecht
F. Kellerer	Irish National observer	NUI/Galway

NIOZ: Royal Netherlands Institute for Sea Research, Texe

IMAU Institute for Marine and Atmospheric Research, Utrecht University.

MI Marine Institute, Galway, Ireland

Ships crew

J.C. Ellen	Captain
J. van Haaren	First Mate
E. Verheyen	Second Mate
J. Seepma	Chief Engineer
M. Frankfort	Second Engineer
S. Maas	Able Seaman
R. van der Heide	Able Seaman
J. Vitoria	Able Seaman
G. Vermeulen	Able Seaman
A. Lont	Cook
A. Popov	Steward

2 Underway Measurements

2.1 Navigation

A differential GPS receiver was used for the determination of the position. The data from the Sercel GPS receiver and the gyro compass were recorded every ten seconds in the underway data logging system. An additional Seapath dual antenna GPS receiver also determined the ship's heading. Data processing will be carried out back at NIOZ.

2.2 Echo Sounding

The 3.5 kHz echo sounder was used on board to determine the water depth. The uncorrected depths from this echo sounder were recorded in the underway data logging system.

2.3 Thermo-Salinograph Measurements

The Sea Surface Temperature and Salinity were measured continuously with the SBE Seacat thermo-salinograph system with the water intake at a depth of about 3 m. These sensors will be calibrated by comparison with the CTD-cast at 3 m.

2.4 Meteorological data

Air temperature and humidity, relative wind velocity and direction as well as air pressure and solar radiation were measured and recorded by the underway logging system. The connection with the solarimeter appeared to be defect. Therefor the solar radiation data are missing from the meteorological records.

2.5 ADCP measurements

The 75 kHz ADCP mounted under the Pelagia has been used to collect current data from the Irish continental break onwards. The final processing of the data will take place back at Texel. The VMADCP data were collected with a dedicated service computer, together with the appropriate navigational data. Daily these data were transferred to the appropriate directory of the ships computer network. On board the first phase of VMADCP data processing took place.

3 Hydrographic measurements - Descriptions, Techniques, and Calibrations

3.1 CTD Data Collection and Processing

A recently (August 2009) calibrated SBE 9/11+ CTD, SN-0942, has been used to measure temperature, salinity, and turbidity profiles. The sensors mounted on the CTD were an SBE3 temperature sensor SN-034384, SBE4 conductivity sensor SN-040995, a Digiquartz pressure sensor SN-113589, and a Wetlab CStar beam transmission meter SN-CST-1112DR with a path length of 25 cm.

The CTD was mounted in a special rack, which did not contain water samplers. The sensors of the CTD were recently calibrated by the manufacturer. To control the temperature measurements an SBE 35 Deep Ocean Standards thermometer was mounted next to the temperature sensor of the CTD. Reference

temperature samples were taken with this thermometer in deep low-gradient layers.

For the data collection the new Seasave software for Windows (version V 7.18c), produced by SBE, was used. The CTD data were recorded with a frequency of 24 data cycles per second. After each CTD cast the data were copied to a hard disk of the ship's computer network, where a daily back-up copy was made.

The CTD data were processed with the recently obtained calibration data, using the Seasoft software, also produced by SBE, and reduced to 1 dbar average ASCII files. These were used for the preliminary analysis of the data. The final data processing will be completed at Royal NIOZ, Texel.

3.2 Reference temperature measurements

Mounted on the CTD-rack was a high precision SBE35 reference temperature sensor, which recorded the temperature on commands given by the CTD operator. These SBE35 temperature data will be used to control the calibration of the CTD temperature sensor. The preliminary difference $T_{\text{SBE35}} - T_{\text{CTD}}$ amounts to -0.002°C ($\pm 0.001^{\circ}\text{C}$ stdev).

3.3 Data Management

All raw data were copied to a cruise directory on the network computer in different groups of sub-directories. Subsequent processed data, final products, documents and figures were copied to separate sub-directories within the cruise directory. Back ups of the network disks were made on a daily basis. At the end of the cruise copies of the whole cruise directory have been made on portable hard-disk. By help of paper measurement forms and computerized data inventory files all data are tracked. A final inventory of the mooring activities, hydrographic stations, and the available raw data files was made in a cruise summary file (Appendix A).

4 Preliminary results

4.1 The Irminger Sea

The θ -S diagram for the CTD stations in the Irminger Sea (Figure 3) shows that the most saline water in this basin is observed over the Reykjanes Ridge (stations 15 to 17) and over the continental slope of Greenland (stations 6 and 7).

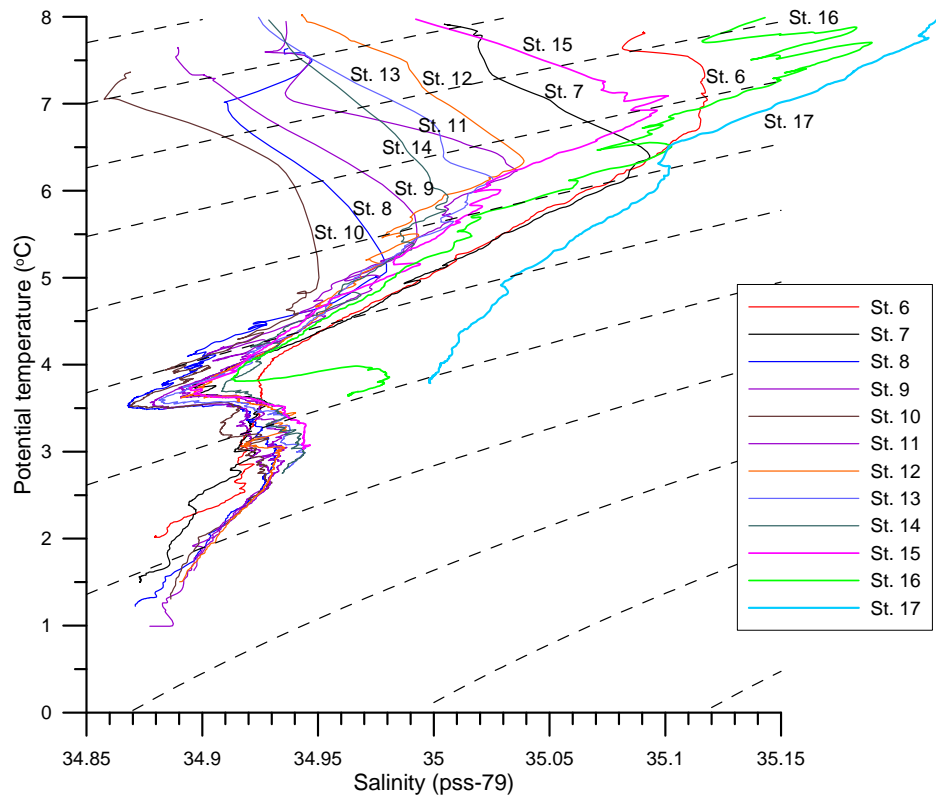


Figure 3. θ -S diagram for the CTD stations in the Irminger Sea, from the Greenland continental shelf to the top of the Reykjanes Ridge.

After the cold winter of 2008 a cold and fresh Sub-Arctic Mode Water was formed in the Irminger Sea with a potential temperature of about 4.5°C and a salinity of 34.85. During the THOR cruise from 2009 the central Irminger Sea was strongly salinified compared to 2008, with sub-surface salinity maxima from 34.93 to 35.01 near the density levels of the 2008 Mode Water.

At the levels of the Labrador Sea Water (LSW) class or vintage, formed in 2000, the θ -S properties hardly had changed, compared to 2007. No trace was found yet of the Labrador Sea Water vintage, formed by deep convection in 2008. The high-density Labrador Sea water, formed in the cold period of 1988 to 1994 (LSW94), still visible as a deep salinity minimum in the Irminger Sea in 2007, could not be recognized in 2009 from the θ -S properties.

The near-bottom temperatures and salinities in the homogeneous near-bottom layers in the western half of the Irminger Sea reflect that the temperature and salinity of the Denmark Strait Overflow Water is colder and less saline than observed during hydrographic surveys in 2007 and 2008.

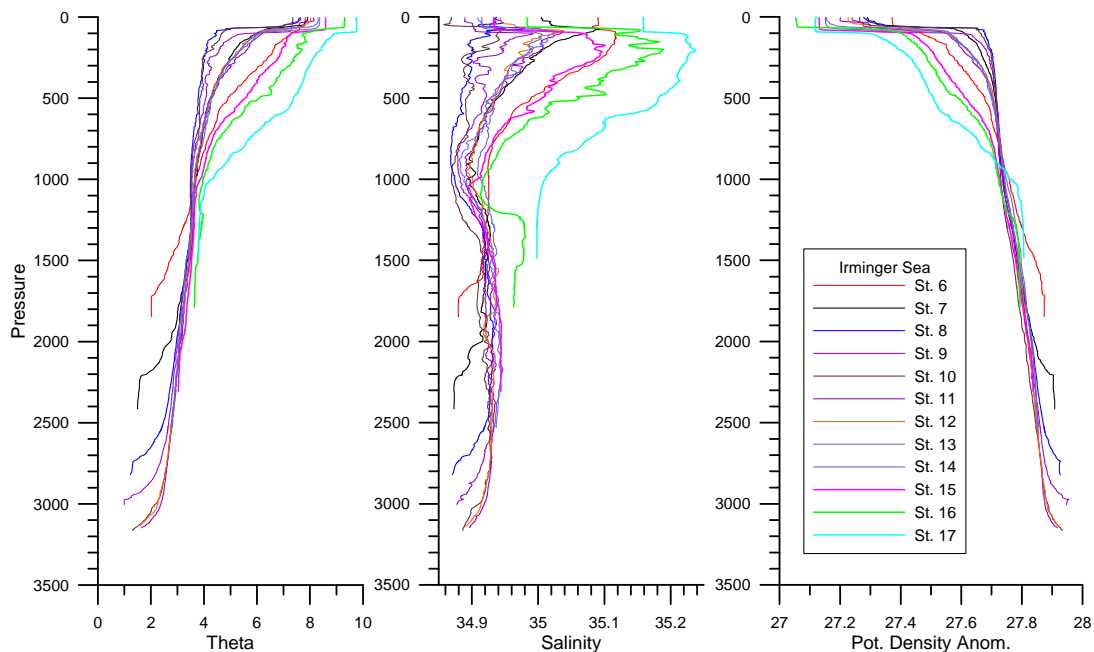


Figure 4. Profiles of potential temperature, salinity, and potential density anomaly from the CTD casts in the Irminger Sea.

The hydrographic profiles from the Irminger Sea (Figure 4) show a doming of the isopycnals in the cyclonic Irminger gyre (part of the sub-arctic gyre), with stations 8 to 10 in the centre of the gyre. These stations also show the lowest sub-surface salinities and temperatures. The density distribution in the upper 1000 m agrees with a southward baroclinic geostrophic transport west of station 8 relative to 1000 dbar of about 1.5 Sv ($1 \text{ Sv} = 10^6 \text{ m}^3/\text{s}$), and a northward transport between station 8 and station 17 over the Reykjanes Ridge of about 4.4 Sv.

The deep density differences between neighbouring CTD-stations over the continental slope of Greenland agree with a strong bottom intensified southward flow of Denmark Strait Overflow Water (DSOW) along the Greenlandic slope. The deep density gradient between stations 15 and 17 suggest a northward baroclinic flow of the saline Icelandic Slope Water in the upper parts of the North East Atlantic Deep Water along the Reykjanes ridge.

4.2 The Iceland Basin

In the upper layers of the Iceland Basin the main difference with the 2007 survey is a less strong gradient in the frontal zone of the North Atlantic Current in 2009. The range of the near surface salinity in the Iceland Basin is similar in both years.

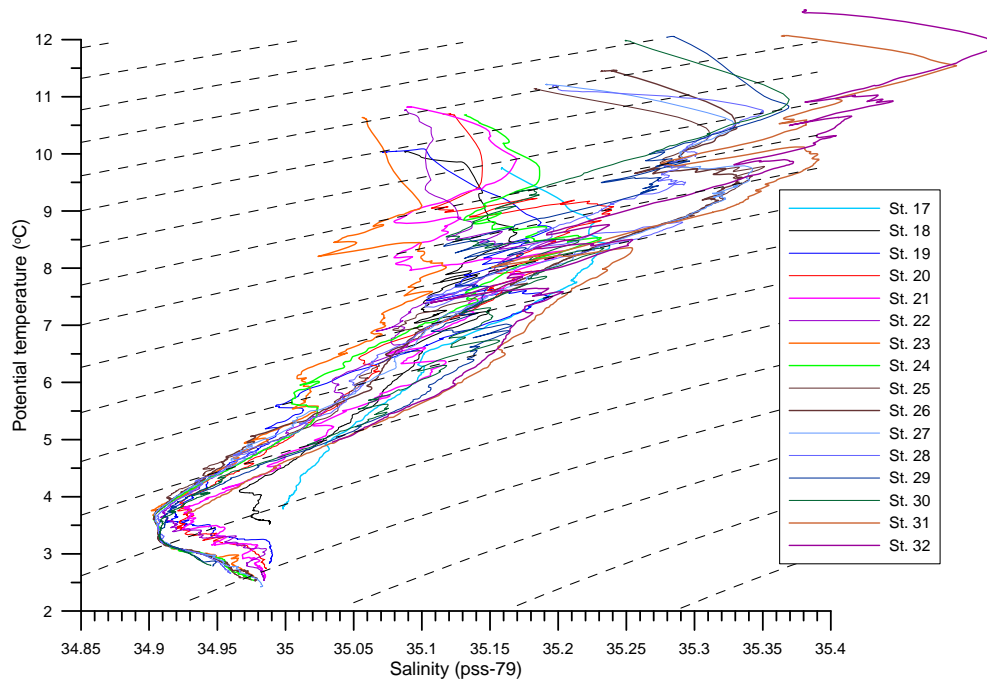


Figure 5. θ -S diagram for the CTD stations in the Iceland Basin between the Reykjanes Ridge and the Hatton Bank.

The θ -S diagram and the hydrographic profiles for the 2009 survey of the Iceland Basin (Figures 5 and 6) again shows a thick layer with a salinity minimum. This is a combination of the LSW vintages formed in 1988 to 1994 and in 2004. The latter occupied the deeper part of the basin and is absent west of 27°W. the salinity value in the salinity minimum connected with the LSW2000 vintage has increased with over 0.01 since 2007. the salinity increase of the LSW94 class since 2007 is smaller, ~ 0.007 . The relative salinity maximum, connected with the intermediate saline layer between both LSW cores increased in salinity value, but decreased in amplitude, compare to the salinities of both LSW cores.

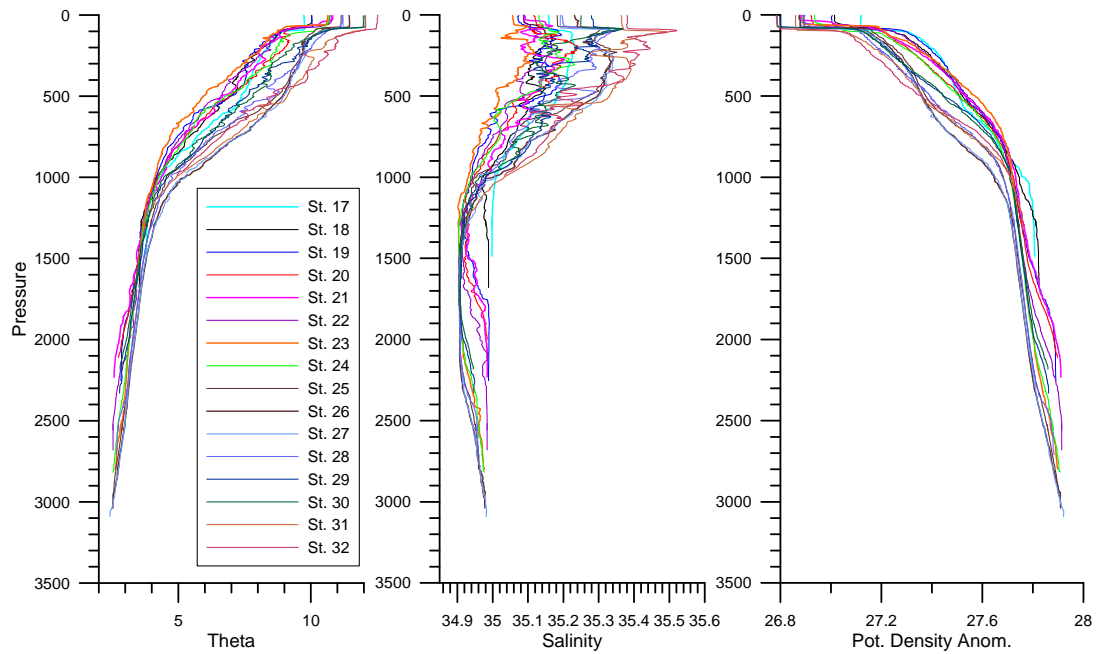


Figure 6. Profiles of potential temperature, salinity, and potential density anomaly from the CTD casts in the Iceland Basin.

As in 2007 a near bottom layer of Iceland-Scotland Overflow (ISOW) water can be recognized as the coldest water over most of the western slope in the Iceland Basin. The salinity and potential temperature of this water type in 2009 is warmer and more saline than in 2007. ISOW shows in the hydrographic profiles as a thick layer with near homogeneous, relatively high salinity. The relatively high potential density in these ISOW layers agrees with a baroclinic bottom intensified southward flow of ISOW over the western slope of the Iceland Basin. East of the deepest point in the Iceland Basin, The Maury Channel, the bottom density is also relatively high compared to the same levels at the station in the Maury Channel, indicative for a bottom intensified northward baroclinic flow over the slope of the Hatton Bank. The usual near-bottom salinity minimum due to the presence of Lower Deep Water in this northward flow is absent in the 2009 data.

4.3 The Rockall Trough

Compared to the other Irminger and Iceland Basins, the Rockall Trough does show less intrusive structures (Figure 7). Overall the θ -S structure in 2009 hardly differs from the structure observed in 2007. The salinity minimum near $\theta = 3.2^{\circ}\text{C}$, connected with the presence of a core of LSW, decreased in salinity with only about 0.003 over the last 2 years.

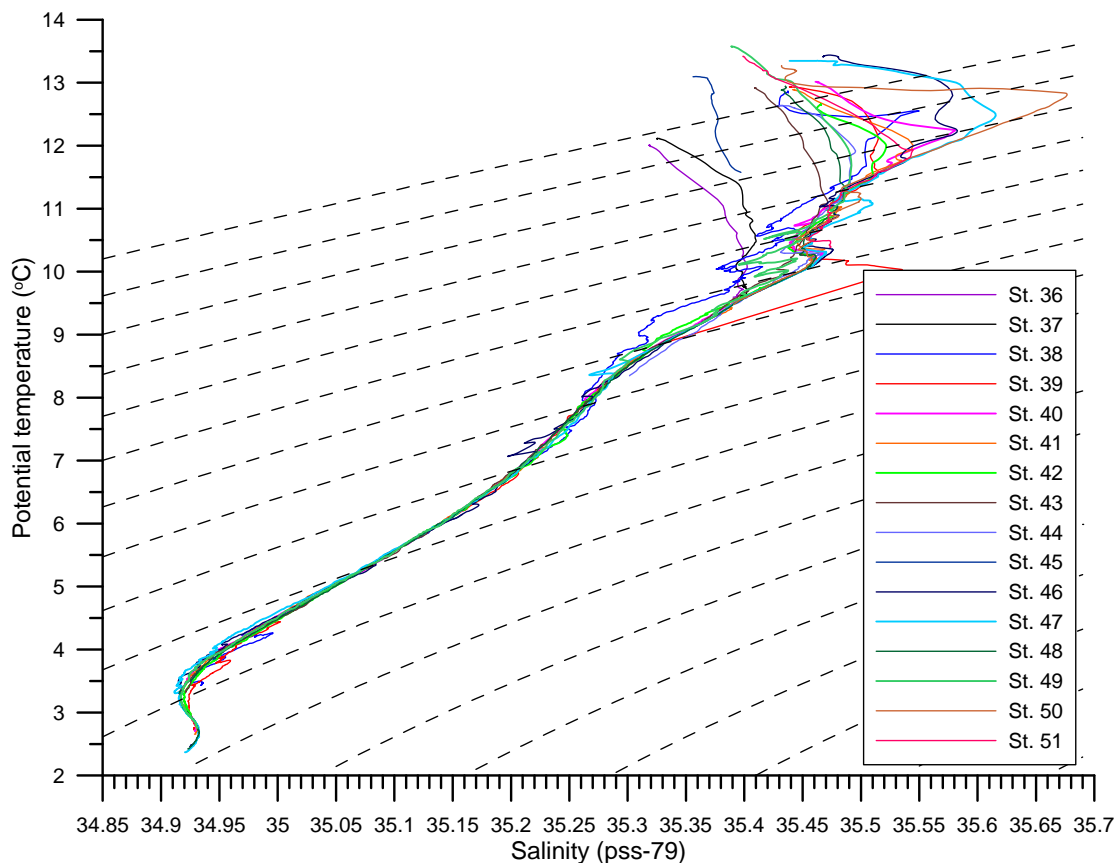


Figure 7. . θ -S diagram for the CTD stations in Rockall Trough.

Below the salinity minimum of the LSW core, a salinity maximum of slightly over 34.93 is observed at a depth of about 2700 m, related to the aged ISOW. Near the bottom near 2900 m on the additional CTD section a salinity minimum of $S = 34.92$ is observed, related to the presence of the upper layers of Lower Deep Water (LDW), extending from the Porcupine Abyssal Plain into the Rockall Trough. The low salinity is caused by the presence of small amounts of Antarctic Bottom Water in the LDW. In 2007 the LDW reached further north, and could also be observed at the CTD station on the AR7E section.

Appendix A. Cruise Summary Pelagia Cruise 64PE312

CAST TYPE

CTD CTD cast MOR Mooring

EVENT CODE

BE Begin BO Bottom
EN Bnd
RE Becovered DE Deployed

SHIP/CRS. WOCE STN		CAST		DATE	TIME	EVENT	LATITUDE			LONGITUDE			UNC.	MAX	COMMENTS	CTD		
EXPCODE	SECT.	NBR	NO	TYPE	UTC	CODE	Deg	Min.	H	Deg	Min.	H	NAV	DEPTH	PRESS		DATA file	
64PE312		01	1	CTD	28-Sep-2009	09:31	BE	52	27.96	N	15	14.30	W	GPS	1373			
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64PE312		01	1	CTD	28-Sep-2009	09:42	EN	52	27.95	N	15	14.28	W	GPS	1373			
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64PE312		03	1	MOR	02-Oct-2009	17:44	DE	59	12.21	N	39	30.49	W	GPS	3042		mooring LOCO2-7	
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64PE312	AR7E	04	1	CTD	03-Oct-2009	09:03	BO	59	56.87	N	42	45.15	W	GPS	196	183		PE312041
64PE312	AR7E	04	1	CTD	03-Oct-2009	09:10	EN	59	56.86	N	42	45.11	W	GPS	194			
64PE312	AR7E	05	1	CTD	03-Oct-2009	11:13	BE	59	53.91	N	42	15.17	W	GPS	388			
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64PE312	AR7E	08	1	CTD	04-Oct-2009	00:26	BO	59	40.03	N	39	44.70	W	GPS	2807	2821		PE312081
64PE312	AR7E	08	1	CTD	04-Oct-2009	01:28	EN	59	40.07	N	39	44.60	W	GPS	2807			
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64PE312	AR7E	14	1	CTD	05-Oct-2009	07:47	BE	59	06.03	N	33	53.61	W	GPS	2508			
64PE312	AR7E	14	1	CTD	05-Oct-2009	08:34	BO	59	06.00	N	33	53.72	W	GPS	2514	2524		PE312141
64PE312	AR7E	14	1	CTD	05-Oct-2009	09:30	EN	59	06.03	N	33	53.75	W	GPS	2514			
64PE312	AR7E	15	1	CTD	05-Oct-2009	12:37	BE	59	01.35	N	33	00.25	W	GPS	2301			
64PE312	AR7E	15	1	CTD	05-Oct-2009	13:16	BO	59	01.32	N	33	00.28	W	GPS	2301	2309		PE312151
64PE312	AR7E	15	1	CTD	05-Oct-2009	14:02	EN	59	01.28	N	33	00.35	W	GPS	2301			
64PE312	AR7E	16	1	CTD	05-Oct-2009	17:32	BE	58	56.17	N	32	01.57	W	GPS	1786			
64PE312	AR7E	16	1	CTD	05-Oct-2009	18:01	BO	58	56.15	N	32	01.51	W	GPS	1786	1788		PE312161
64PE312	AR7E	16	1	CTD	05-Oct-2009	18:35	EN	58	56.14	N	32	01.52	W	GPS	1792			
64PE312	AR7E	17	1	CTD	05-Oct-2009	21:50	BE	58	50.87	N	31	06.63	W	GPS	1487			
64PE312	AR7E	17	1	CTD	05-Oct-2009	22:16	BO	58	50.90	N	31	06.74	W	GPS	1481	1486		PE312171
64PE312	AR7E	17	1	CTD	05-Oct-2009	22:47	EN	58	50.92	N	31	06.75	W	GPS	1481			
64PE312	AR7E	18	1	CTD	06-Oct-2009	01:52	BE	58	44.82	N	30	11.78	W	GPS	1652			
64PE312	AR7E	18	1	CTD	06-Oct-2009	02:25	BO	58	44.79	N	30	11.74	W	GPS	1682	1680		PE312181
64PE312	AR7E	18	1	CTD	06-Oct-2009	03:03	EN	58	44.65	N	30	11.94	W	GPS	1664			
64PE312	AR7E	19	1	CTD	06-Oct-2009	06:34	BE	58	41.01	N	29	14.02	W	GPS	2219			
64PE312	AR7E	19	1	CTD	06-Oct-2009	07:14	BO	58	40.98	N	29	13.93	W	GPS	2231	2253		PE312191
64PE312	AR7E	19	1	CTD	06-Oct-2009	08:04	EN	58	40.99	N	29	13.80	W	GPS	2243			
64PE312	AR7E	20	1	CTD	06-Oct-2009	11:13	BE	58	35.04	N	28	19.79	W	GPS	2103			
64PE312	AR7E	20	1	CTD	06-Oct-2009	11:51	BO	58	34.96	N	28	19.59	W	GPS	2109	2111		PE312201
64PE312	AR7E	20	1	CTD	06-Oct-2009	12:36	EN	58	34.86	N	28	19.64	W	GPS	2103			
64PE312	AR7E	21	1	CTD	06-Oct-2009	15:51	BE	58	30.15	N	27	24.49	W	GPS	2762			
64PE312	AR7E	21	1	CTD	06-Oct-2009	16:33	BO	58	30.20	N	27	24.40	W	GPS	2237	2232		PE312211
64PE312	AR7E	21	1	CTD	06-Oct-2009	17:19	EN	58	30.20	N	27	24.20	W	GPS	2237			

64PE312	AR7E	22	1	CTD	06-Oct-2009	20:18	BE	58	25.98	N	26	32.85	W	GPS	2658			
64PE312	AR7E	22	1	CTD	06-Oct-2009	21:02	BO	58	25.95	N	26	32.78	W	GPS	2664	2680		PE312221
64PE312	AR7E	22	1	CTD	06-Oct-2009	21:53	EN	58	25.98	N	26	32.51	W	GPS	2670			
64PE312	AR7E	23	1	CTD	07-Oct-2009	01:28	BE	58	19.78	N	25	32.49	W	GPS	2786			
64PE312	AR7E	23	1	CTD	07-Oct-2009	02:18	BO	58	20.08	N	25	33.54	W	GPS	2780	2799		PE312231
64PE312	AR7E	23	1	CTD	07-Oct-2009	03:19	EN	58	20.07	N	25	34.80	W	GPS	2774			
64PE312	AR7E	24	1	CTD	07-Oct-2009	07:02	BE	58	12.39	N	24	38.20	W	GPS	2798			
64PE312	AR7E	24	1	CTD	07-Oct-2009	07:51	BO	58	12.30	N	24	38.34	W	GPS	2792	2818		PE312241
64PE312	AR7E	24	1	CTD	07-Oct-2009	08:50	EN	58	12.35	N	24	38.28	W	GPS	2792			
64PE312	AR7E	25	1	CTD	07-Oct-2009	11:55	BE	58	04.70	N	23	45.10	W	GPS	2951			
64PE312	AR7E	25	1	CTD	07-Oct-2009	12:50	BO	58	04.52	N	23	45.63	W	GPS	2945	2976		PE312251
64PE312	AR7E	25	1	CTD	07-Oct-2009	13:48	EN	58	04.85	N	23	47.07	W	GPS	2939			
64PE312	AR7E	26	1	CTD	07-Oct-2009	17:25	BE	57	54.97	N	22	49.15	W	GPS	3006			
64PE312	AR7E	26	1	CTD	07-Oct-2009	18:16	BO	57	54.91	N	22	49.01	W	GPS	3006	3038		PE312261
64PE312	AR7E	26	1	CTD	07-Oct-2009	19:12	EN	57	54.89	N	22	49.00	W	GPS	3006			
64PE312	AR7E	27	1	CTD	07-Oct-2009	22:42	BE	57	46.47	N	21	55.22	W	GPS	3060			
64PE312	AR7E	27	1	CTD	07-Oct-2009	23:37	BO	57	46.45	N	21	55.13	W	GPS	3054	3091		PE312271
64PE312	AR7E	27	1	CTD	08-Oct-2009	00:43	EN	57	46.35	N	21	55.14	W	GPS	3054			
64PE312	AR7E	28	1	CTD	08-Oct-2009	02:25	BE	57	42.42	N	21	30.12	W	GPS	2640			
64PE312	AR7E	28	1	CTD	08-Oct-2009	03:11	BO	57	42.48	N	21	30.12	W	GPS	2646	2709		PE312281
64PE312	AR7E	28	1	CTD	08-Oct-2009	04:06	EN	57	42.46	N	21	30.13	W	GPS	2646			
64PE312	AR7E	29	1	CTD	08-Oct-2009	06:00	BE	57	36.99	N	21	01.96	W	GPS	2317			
64PE312	AR7E	29	1	CTD	08-Oct-2009	06:41	BO	57	36.99	N	21	01.98	W	GPS	2317	2330		PE312291
64PE312	AR7E	29	1	CTD	08-Oct-2009	07:28	EN	57	36.99	N	21	01.99	W	GPS	2317			
64PE312	AR7E	30	1	CTD	08-Oct-2009	09:02	BE	57	35.19	N	20	37.43	W	GPS	2170			
64PE312	AR7E	30	1	CTD	08-Oct-2009	09:43	BO	57	35.19	N	20	37.42	W	GPS	2170	2183		PE312301
64PE312	AR7E	30	1	CTD	08-Oct-2009	10:30	EN	57	35.25	N	20	37.36	W	GPS	2170			
64PE312	AR7E	31	1	CTD	08-Oct-2009	12:22	BE	57	30.07	N	20	08.92	W	GPS	1318			
64PE312	AR7E	31	1	CTD	08-Oct-2009	12:44	BO	57	30.13	N	20	08.63	W	GPS	1310	1317		PE312311
64PE312	AR7E	31	1	CTD	08-Oct-2009	13:15	EN	57	30.27	N	20	08.29	W	GPS	1298			
64PE312	AR7E	32	1	CTD	08-Oct-2009	18:53	BE	57	21.97	N	19	16.08	W	GPS	995			
64PE312	AR7E	32	1	CTD	08-Oct-2009	19:10	BO	57	21.99	N	19	16.00	W	GPS	995	990		PE312321
64PE312	AR7E	32	1	CTD	08-Oct-2009	19:31	EN	57	21.99	N	19	16.00	W	GPS	995			
64PE312	AR7E	33	1	CTD	09-Oct-2009	06:44	BE	57	05.79	N	17	27.07	W	GPS	1327			
64PE312	AR7E	33	1	CTD	09-Oct-2009	07:10	BO	57	05.77	N	17	27.07	W	GPS	1327	1330		PE312331
64PE312	AR7E	33	1	CTD	09-Oct-2009	07:38	EN	57	05.77	N	17	27.10	W	GPS	1327			
64PE312	AR7E	34	1	CTD	09-Oct-2009	11:21	BE	56	57.94	N	16	32.09	W	GPS	1216			
64PE312	AR7E	34	1	CTD	09-Oct-2009	11:43	BO	56	57.96	N	16	31.96	W	GPS	1216	1216		PE312341
64PE312	AR7E	34	1	CTD	09-Oct-2009	12:10	EN	56	58.01	N	16	31.85	W	GPS	1212			
64PE312	AR7E	35	1	CTD	09-Oct-2009	15:35	BE	56	48.07	N	15	40.74	W	GPS	650			
64PE312	AR7E	35	1	CTD	09-Oct-2009	15:47	BO	56	47.99	N	15	40.64	W	GPS	650	646		PE312351
64PE312	AR7E	35	1	CTD	09-Oct-2009	15:59	EN	56	47.94	N	15	40.65	W	GPS	646			
64PE312	AR7E	36	1	CTD	09-Oct-2009	19:42	BE	56	40.16	N	14	47.59	W	GPS	187			
64PE312	AR7E	36	1	CTD	09-Oct-2009	19:45	BO	56	40.16	N	14	47.55	W	GPS	186	176		PE3123561
64PE312	AR7E	36	1	CTD	09-Oct-2009	19:50	EN	56	40.14	N	14	47.57	W	GPS	187			
64PE312	AR7E	37	1	CTD	09-Oct-2009	22:19	BE	56	34.74	N	14	11.68	W	GPS	333			
64PE312	AR7E	37	1	CTD	09-Oct-2009	22:25	BO	56	34.72	N	14	11.71	W	GPS	331	323		PE312371
64PE312	AR7E	37	1	CTD	09-Oct-2009	22:34	EN	56	34.74	N	14	11.65	W	GPS	332			
64PE312	AR7E	38	1	CTD	10-Oct-2009	00:52	BE	56	29.24	N	13	35.86	W	GPS	1934			
64PE312	AR7E	38	1	CTD	10-Oct-2009	01:29	BO	56	29.27	N	13	35.74	W	GPS	1934	1944		PE312381
64PE312	AR7E	38	1	CTD	10-Oct-2009	02:07	EN	56	29.37	N	13	35.65	W	GPS	1928			
64PE312	AR7E	39	1	CTD	10-Oct-2009	03:58	BE	56	24.89	N	13	09.44	W	GPS	2391			
64PE312	AR7E	39	1	CTD	10-Oct-2009	04:39	BO	56	24.94	N	13	09.50	W	GPS	2391	2416		PE312391
64PE312	AR7E	39	1	CTD	10-Oct-2009	05:23	EN	56	24.92	N	13	09.52	W	GPS	2391			
64PE312	AR7E	40	1	CTD	10-Oct-2009	08:31	BE	56	17.20	N	12	19.62	W	GPS	2601			
64PE312	AR7E	40	1	CTD	10-Oct-2009	09:18	BO	56	17.15	N	12	19.56	W	GPS	2601	2628		PE312401
64PE312	AR7E	40	1	CTD	10-Oct-2009	10:14	EN	56	17.11	N	12	19.68	W	GPS	2601			
64PE312	AR7E	41	1	CTD	10-Oct-2009	13:15	BE	56	09.35	N	11	29.75	W	GPS	2637			
64PE312	AR7E	41	1	CTD	10-Oct-2009	13:59	BO	56	09.32	N	11	29.61	W	GPS	2637	2670		PE312411
64PE312	AR7E	41	1	CTD	10-Oct-2009	14:51	EN	56	08.66	N	11	29.40	W	GPS	2643			
64PE312	AR7E	42	1	CTD	10-Oct-2009	17:41	BE	56	01.75	N	10	43.32	W	GPS	2363			
64PE312	AR7E	42	1	CTD	10-Oct-2009	18:23	BO	56	01.81	N	10	43.21	W	GPS	2363	2389		PE312421
64PE312	AR7E	42	1	CTD	10-Oct-2009	19:14	EN	56	01.82	N	10	43.23	W	GPS	2363			
64PE312	AR7E	43	1	CTD	10-Oct-2009	22:24	BE	55	52.89	N	09	51.15	W	GPS	1918			
64PE312	AR7E	43	1	CTD	10-Oct-2009	22:57	BO	55	52.91	N	09	51.23	W	GPS	1918	1926		PE312431
64PE312	AR7E	43	1	CTD	10-Oct-2009	23:35	EN	55	52.95	N	09	51.22	W	GPS	1918			
64PE312	AR7E	44	1	CTD	11-Oct-2009	01:16	BE	55	48.98	N	09	25.85	W	GPS	818			
64PE312	AR7E	44	1	CTD	11-Oct-2009	01:31	BO	55	48.92	N	09	25.71	W	GPS	812	813		PE312441
64PE312	AR7E	44	1	CTD	11-Oct-2009	01:50	EN	55	49.00	N	09	25.86	W	GPS	815			
64PE312	AR7E	45	1	CTD	11-Oct-2009	03:38	BE	55	45.02	N	09	00.07	W	GPS	123			
64PE312	AR7E	45	1	CTD	11-Oct-2009	03:40	BO	55	45.03	N	09	00.05	W	GPS	123	114		PE312451
64PE312	AR7E	45	1	CTD	11-Oct-2009	03:42	EN	55	45.04	N	09	00.00	W	GPS	122			
64PE312	AR7E	46	1	CTD	11-Oct-2009	21:33	BE	55	11.60	N	13	19.70	W	GPS	2836			
64PE312	AR7E	46	1	CTD	11-Oct-2009	22:21	BO	55	11.81	N	13	19.79	W	GPS	2836	2868		PE312461
64PE312	AR7E	46	1	CTD	11-Oct-2009	23:09	EN	55	12.48	N	13	18.76	W	GPS	2836			
64PE312	AR7E	47	1	CTD	12-Oct-2009	01:47	BE	55	00.12	N	12	42.82	W	GPS	2891			
64PE312	AR7E	47	1	CTD	12-Oct-2009	02:35	BO	55	00.11	N	12	42.43	W	GPS	2891	2931		PE312471
64PE312	AR7E	47	1	CTD	12-Oct-2009	03:27	EN	55	00.10	N	12	42.68	W	GPS	2891			
64PE312	AR7E	48	1	CTD	12-Oct-2009	06:03	BE	54	47.30	N	12	07.63	W	GPS	2873			
64PE312	AR7E	48	1	CTD	12-Oct-2009	06:54	BO	54	47.30	N	12	07.54	W	GPS	2873	2980		PE312481
64PE312	AR7E	48	1	CTD	12-Oct-2009	07:50	EN	54	47.30	N	12	07.52	W	GPS	2873			
64PE312	AR7E	49	1	CTD	12-Oct-2009	10:30	BE	54	35.90	N	11	30.22	W	GPS	2592			
64PE312	AR7E	49	1	CTD	12-Oct-2009	11:12	BO	54	35.92	N	11	30.27	W	GPS	2598	2626		PE312491
64PE312	AR7E	49	1	CTD	12-Oct-2009	11:58												

64PE312	50	1	CTD	12-Oct-2009	13:18	BE	54	30.33	N	11	11.52	W	GPS			
64PE312	50	1	CTD	12-Oct-2009	13:32	BO	54	30.30	N	11	11.35	W	GPS	739	739	PE312501
64PE312	50	1	CTD	12-Oct-2009	13:46	EN	54	30.28	N	11	11.16	W	GPS	732		
64PE312	51	1	CTD	12-Oct-2009	15:10	EN	54	24.07	N	10	54.01	W	GPS	330		
64PE312	51	1	CTD	12-Oct-2009	15:17	EN	54	24.05	N	10	53.98	W	GPS	330	327	PE312511
64PE312	51	1	CTD	12-Oct-2009	15:24	EN	54	24.04	N	10	53.91	W	GPS	330		

CTDPRS	dbar	Pressure, measured with the CTD, expressed in dbar
CTDTMP	ITS-90	Temperature, measured with the CTD, expressed in °C according to the ITS-1990 temperature scale
CTDSAL	PSS-78	Practical salinity according to the PSS-1978 scale, measured with the CTD, dimensionless
THETA	deg.C	Potential temperature, derived from the CTD measurements, expressed in °C according to the ITS-1990 temperature scale
GAMMA	kg/m ³	Potential density anomaly, derived from the CTD measurements, expressed in kg/m ³
BAttCoef	m ⁻¹	Beam attenuation coefficient, measured with a transmission meter in the CTD system, expressed in m ⁻¹

Appendix B. Mooring summary file of LOCO2-7

Mooring

LOCO 2-7

Barcode

41942

	Latitude	Longitude	deployment time	Unc. Depth	Heading		
	59° 12.21'N	39° 30.49'W	02-Oct-2009 17:44	3042	314°		
	S/N	T&T Barcode	released	height above bottom	Depth in water (m)	recording rate/release bump code	remarks
instuments & cables			length				
bottom weight				1	3017		corrected depth
					1	3016	
5 m chain				5			
					6	3011	
releases				2			
OCEANO RT	162	3834				3009	
OCEANO AR	156	11211			8	3009	
Microcat	2671	00925		569		3002	5 min
cable				568			
					576	2441	
chain				2			
					578	2439	
Longranger ADCP	3714	7504		2			down- looking
					580	2437	
chain				2			
bumper		00994				2434	
					582	2435	
cable				2283			
McLane profiler	11564-02	2912			150-2400	1 day	
					2865	152	
bumper		01335				153	
chain				2			
					2867	150	
sub-surface buoy		01373		1			
					2868	149	
chain				2			
					2870	147	
cable				20			
					2890	127	
chain				2			
					2892	125	
Longranger ADCP	3652	857		1			down- looking
					2893	124	
floating line				15			
top buoy		01380			2908	109	
ARGOS							
baken	60675	2103					Id = 23127

CCHDO Data Processing Notes

Date	Person	Data Type	Action	Summary
2014-10-08	Diggs, Steve	CTD/BTL/DOC	Submitted	WOCE formatted data
	One ZIP archive includes WOCE formats for CTD and BOT. Two cruise reports included. ExpoCode needs to be changed from 33KB258/1 to 33KB20131219.			
2015-03-30	Kappa, Jerry	CrsRpt	Website Update	PDF version online
	The PDF version of the cruise report is now online. It includes all reports provided by the cruise PIs, CCHDO summary pages, linked table of contents, figures, tables and appendicies, and these data processing notes.			