RV Pelagia Shipboard Report:

Cruise 64PE312, Project THOR

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Chief Scientist

THOR 2009

Royal Netherlands Institute for Sea Research

Texel, 2009

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Acknowledgements

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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 prifiling mooring has been be 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

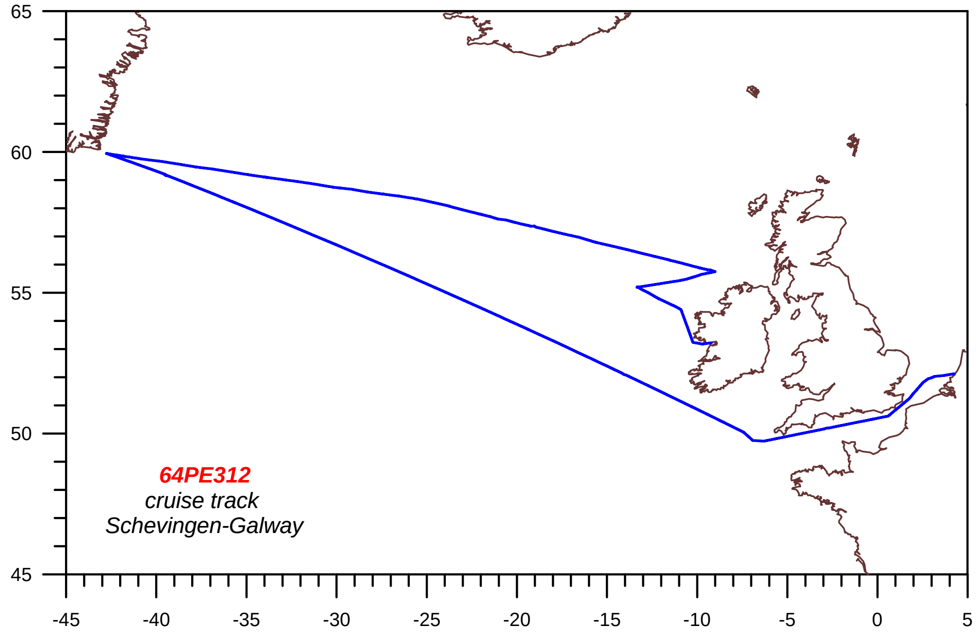

Figure 1. Cruise track of Pelagia cruise 64PE312, from Scheveningen (Netherlands) to Galway (Ireland).

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).

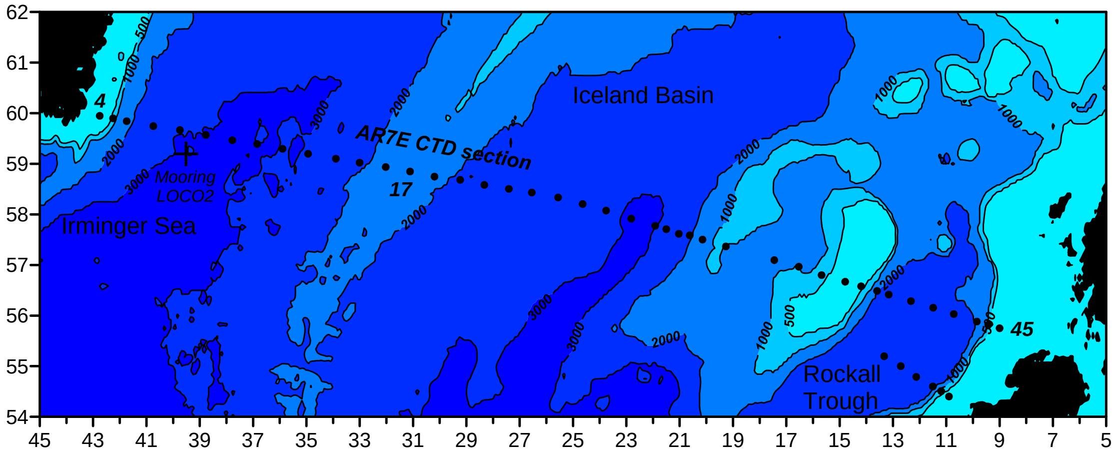

Figure 2. Hydrographic stations along the former WOCE hydrographic Program section AR7E, surveyed during Pelagia cruise 64PE312.

1.3 List of principal Investigators

Name	Responsibility	Affiliation
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 where 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 ACDP 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 meaurements

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 Digiquatz 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 procuced 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_{SBE35}-T_{CTD} amounts to -0.002°C (±0.001°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 en 7).

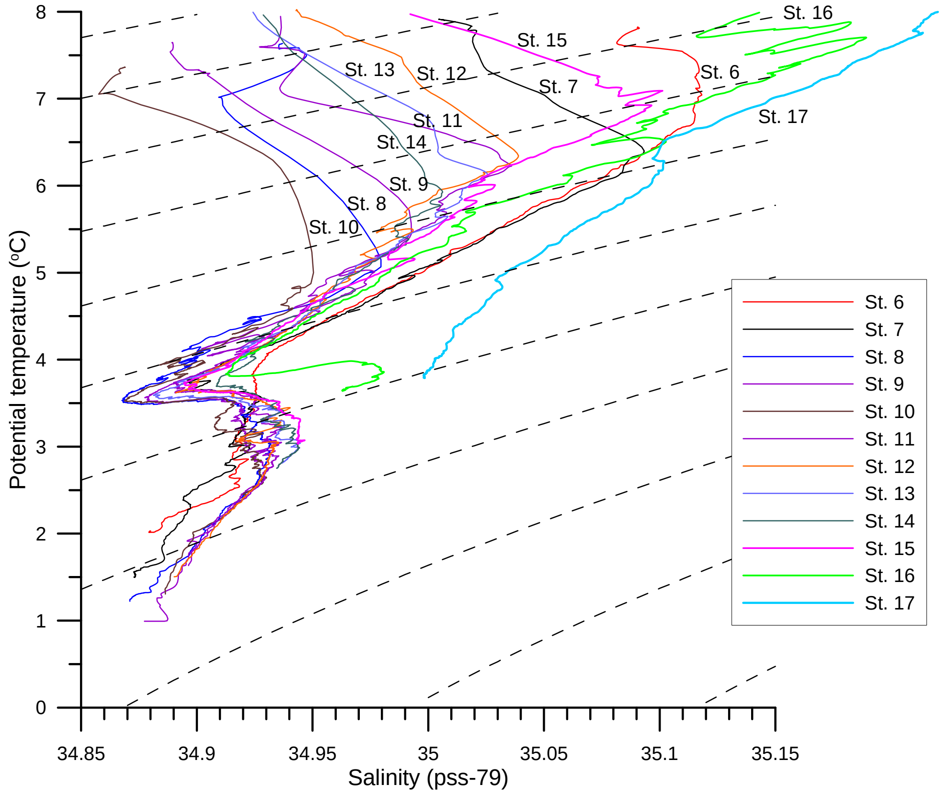

Figure 3. θ-S diagram for the CTD stations in the Irminger Sea, from the Greenland continental shelf to the top of the Reykjanes Ridge.

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.

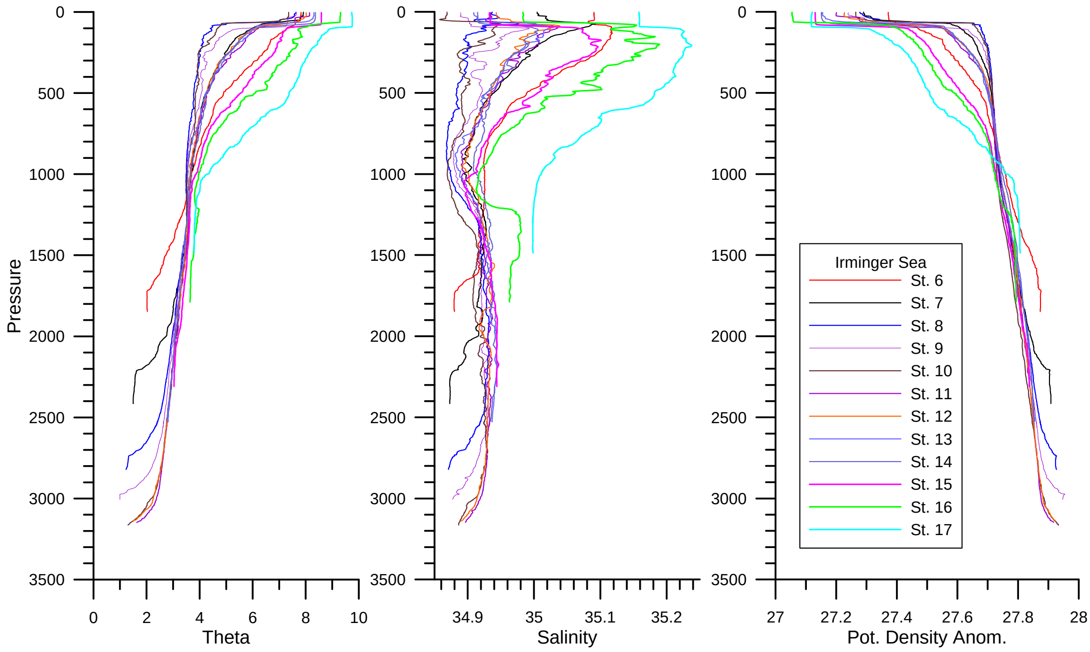

Figure 4. Profiles of potential temperature, salinity, and potential density anomaly from the CTD casts in the Irminger Sea.

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 Sv = 10^6 m^3/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 en 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.

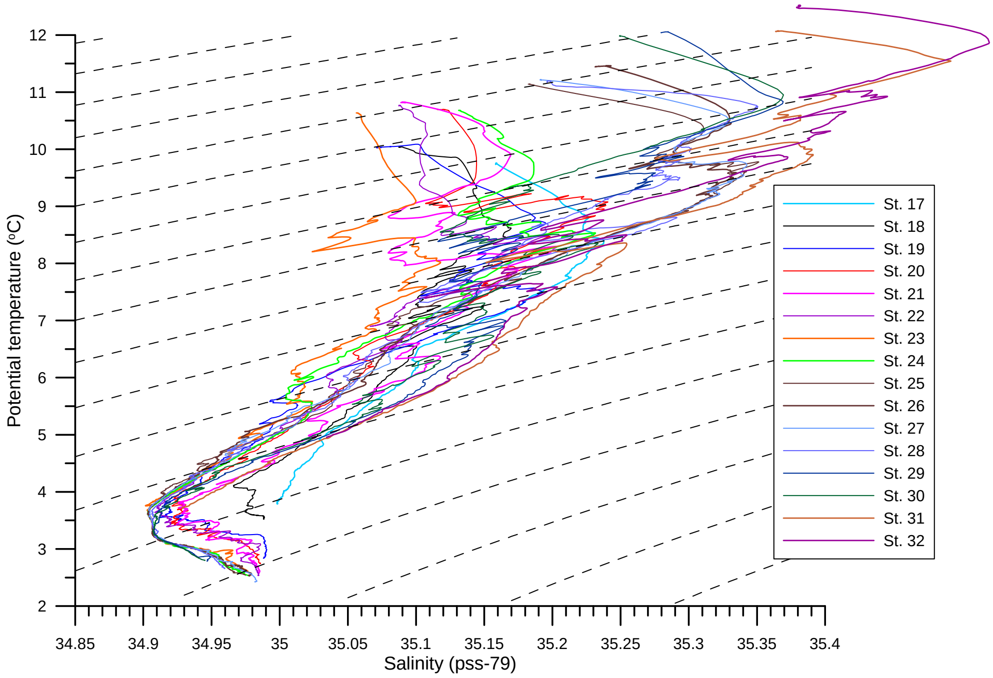

Figure 5. θ-S diagram for the CTD stations in the Iceland Basin between the Reykjanes Ridge and the Hatton Bank.

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 incease 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.

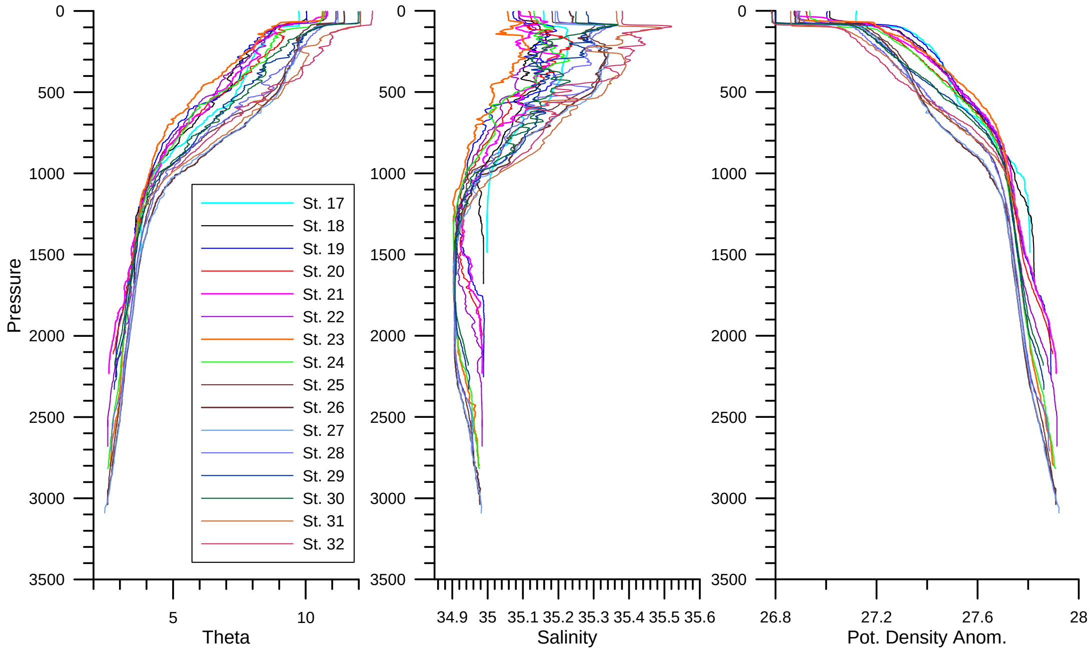

Figure 6. Profiles of potential temperature, salinity, and potential density anomaly from the CTD casts in the Iceland Basin.

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 θ = 3.2°C, connected with the presence of a core of LSW, decreased in salinity with only about 0.003 over the last 2 years.

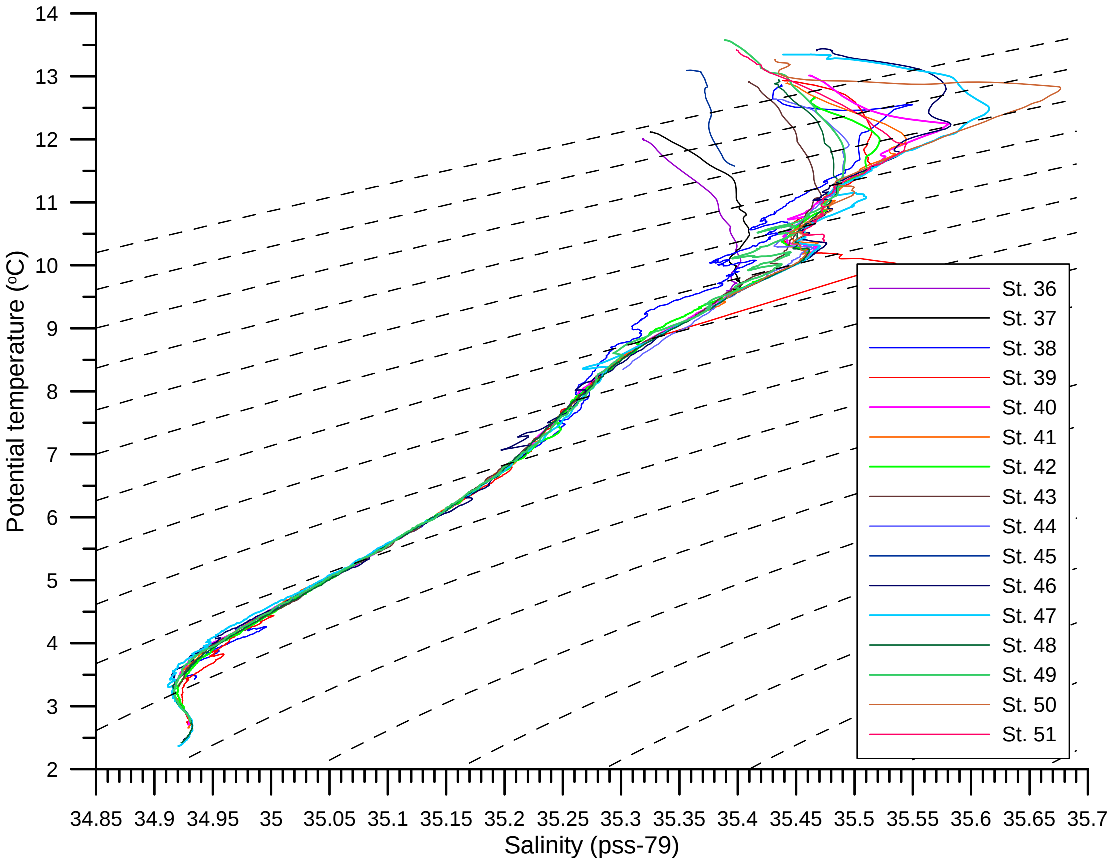

Figure 7. . θ-S diagram for the CTD stations in Rockall Trough.

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 Antarctivc 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. EXPOCODE	WOCE SECT.	STN NBR	CAST NO	CAST TYPE	DATE	TIME UTC	EVENT CODE	LATITUDE Deg	LATITUDE Min.	H	LONGITUDE Deg	LONGITUDE Min.	H	NAV	UNC. DEPTH	MAX PRESS	COMMENTS	CTD 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	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		46	1	CTD	11-Oct-2009	21:33	BE	55	11.60	N	13	19.70	W	GPS	2836		
64PE312		46	1	CTD	11-Oct-2009	22:21	BO	55	11.81	N	13	19.79	W	GPS	2836	2868	PE312461
64PE312		46	1	CTD	11-Oct-2009	23:09	EN	55	12.48	N	13	18.76	W	GPS	2836		
64PE312		47	1	CTD	12-Oct-2009	01:47	BE	55	00.12	N	12	42.82	W	GPS	2891		
64PE312		47	1	CTD	12-Oct-2009	02:35	BO	55	00.11	N	12	42.43	W	GPS	2891	2931	PE312471
64PE312		47	1	CTD	12-Oct-2009	03:27	EN	55	00.10	N	12	42.68	W	GPS	2891		
64PE312		48	1	CTD	12-Oct-2009	06:03	BE	54	47.30	N	12	07.63	W	GPS	2873		
64PE312		48	1	CTD	12-Oct-2009	06:54	BO	54	47.30	N	12	07.54	W	GPS	2873	2980	PE312481
64PE312		48	1	CTD	12-Oct-2009	07:50	EN	54	47.30	N	12	07.52	W	GPS	2873		
64PE312		49	1	CTD	12-Oct-2009	10:30	BE	54	35.90	N	11	30.22	W	GPS	2592		
64PE312		49	1	CTD	12-Oct-2009	11:12	BO	54	35.92	N	11	30.27	W	GPS	2598	2626	PE312491
64PE312		49	1	CTD	12-Oct-2009	11:58	EN	54	35.88	N	11	30.28	W	GPS	2598		

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			

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°

instuments & cables	S/N	T&T Barcode	**released** length	height above bottom	Depth in water (m)	bump	recording rate/release code	remarks
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				20 min	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				20 min	down-looking
				2893	124			
floating line			15					
top buoy		01380		2908	109			
ARGOS baken	60675	2103						**Id = 23127**