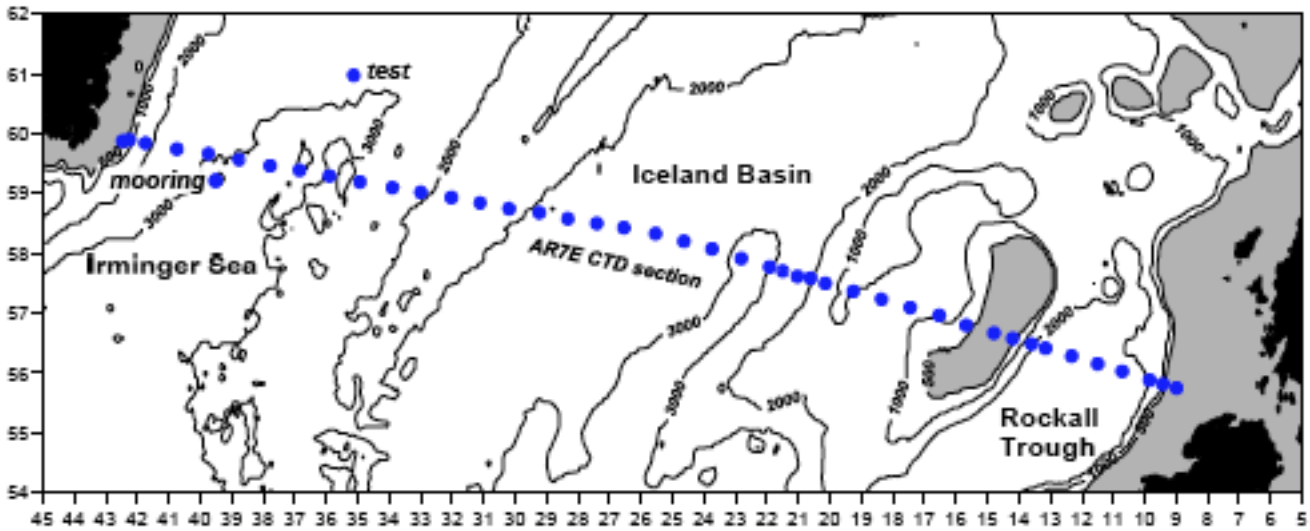
CRUISE REPORT: AR07E

(Updated APR 2014)



Highlights

Cruise Summary Information

WOCE Section Designation	**AR07E**
Expedition designation (ExpoCodes)	**64PE20110724 (aka: 64PE342)**
Chief Scientists	**H.M. van Aken / NIOZ**
Dates	July 24 2011 to August 8 2011
Ship	*RV Pelagia*
Ports of call	Reykjavik (iceland) to Texel (the Netherlands)
Geographic Boundaries	60° 58.75' N 42° 27.99' W 8° 59.98' W 55° 45.01' N
Stations	42
Floats and drifters deployed	7 APEX ARGO floats deployed
Moorings deployed or recovered	1 deployed, 1 recovered

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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 64PE342, Project THOR

H.M. van Aken
Chief Scientist

THOR 2011

Royal Netherlands Institute for Sea Research

Texel, 2011

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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 the recovery and redeployment of a long term mooring in the Irminger Sea as part of the EU THOR programme.

b: Expedition Designation (EXPOCODE): 64PE342

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d: Ship: RV Pelagia, Call Sign: PGRQ, Captain: Ms. Corky Burkhard
length 66 m.
beam 12.8 m
draft 4 m
maximum speed 11 knots

e: Ports of Call: Reykjavik (iceland) to Texel (the Netherlands)

f: Cruise dates: July 24 2011 to August 8 2011

1.2 Cruise Summary Information

Summary

In the evening of 24 July 2011, RV Pelagia left Reykjavik and set course to the position in the Irminger Sea to the position of the LOCO2 profiling mooring. After leaving port the underway recording system for navigational, meteorological, ADCP, and sea surface data was activated and a test cast with the CTD was carried out. A CTD cast was performed and the mooring (LOCO2-8) was recovered on July 27. After these mooring activities a CTD survey was carried out along the AR7E section between Greenland and Ireland. Two planned CTD stations in the continental shelf of Greenland were cancelled because of the presence of large quantities of pack ice. The CTD section was interrupted at July 29 for the redeployment of the mooring (LOCO2-9) and an extra CTD cast on that position. In the Irminger Sea 7 profiling ARGO floats were deployed in water deep then 2400 m. The last CTD cast was performed on August 5 on the continental shelf northwest if Ireland. In the evening August 8 RV Pelagia entered the NIOZ harbour at Texel.

Cruise Track

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

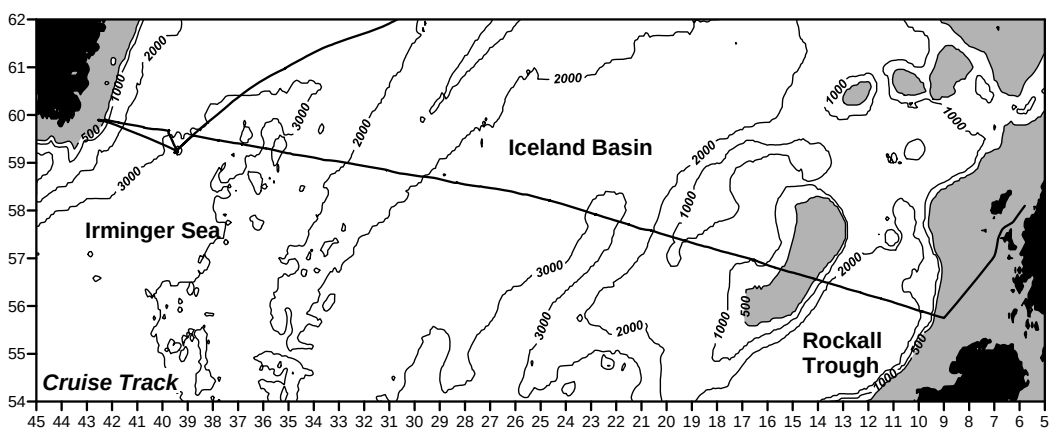

Figure 1. Cruise track of Pelagia cruise 64PE342, between Reykjavik (Iceland) and Texel (the Netherlands).

Mooring Deployments

Mooring LOCO2-8 was recovered on July 27 while mooring LOCO2-9 was deployed on July 29 (MOR in appendix A). The mooring operations took place during daytime. The position of the deployment of LOCO2-9 is: 59°12.21'N, 39°30.32'W (cross in Figure 2), the deployment time was 12:22 UTC. During the last 10 minutes before deployment Pelagia has followed a course over ground in the direction of 260° relative to North. Both LOCO2-8 and 2-9 are profiling moorings, fitted with a McLane/FSI CTD profiler, two RDI Long Ranger ADCPs and an SBE Microcat CTD. They were positioned 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.

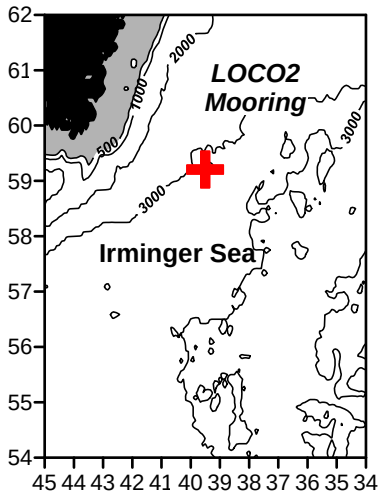

Figure 2. The position of the profiling mooring LOCO2-9

Number of Hydrographic Stations

A total of 42 CTD casts were performed along the former WOCE AR7E section, one test station before that section was surveyed, and two CTD casts near the mooring site. The location of these casts is shown in figure 3. The mutual station distance is about 30 nautical miles, while over steep topography that distance was reduced to about 15 miles. Due to the good weather conditions no CTD stations had to be cancelled. Further information on the time and location of the stations can be found in the Cruise Summary File (CTD and ROS in Appendix A).

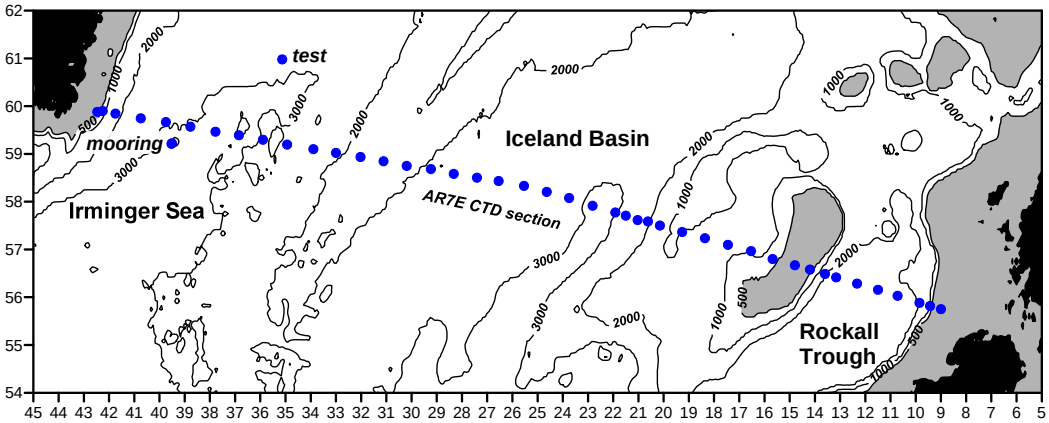

Figure 3. The positions of the CTD casts, performed during cruise 64PE342.

Deployment of ARGO floats

Seven APEX ARGO floats were deployed in the Irminger Sea on behalf of Dr. A Sterl of the Dutch national meteorological service (KNMI), directly after a CTD cast (Figure 4, FLT in appendix A). All 7 buoys made contact the ground station by satellite (see: also http://www.knmi.nl/~sterl/Argo/).

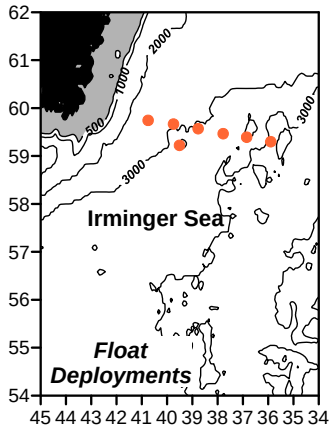

Figure 4. The position in the Irminger Sea where the ARGO floats were deployed.

1.3 List of principal Investigators

Name	*Responsibility*	*Affiliation*
Dr. H.M. van Aken	Ocean hydrography	NIOZ/Texel
Dr. M.F. de Jong	moorings	NIOZ/Texel
Dr. A Sterl (no participant)	ARGO floast	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 water mass formation since 1990, 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 11 m from the bottom, until altimeter and/or 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 upto 12 prescribed depths, when the CTD winch was stopped, while water samples were collected with Niskin bottles for the determination of the salinity and the dissolved oxygen concentration. The CTD was also fitted with a lowered ADCP for the measurement of current profiles from the sea surface to the bottom, an oxygen sensor, a beam transmissometer for the determination of the turbidity (660 nm, path length 25 cm), and with a Fluorometer for the determination of the Chlorophyll-a concentration.

The mooring which was recovered (LOCO2-8) and re-deployed (LOCO2-9) was made available 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 records on a daily basis profiles of temperature and salinity between ~2400 and 160 m depth (McLane profiler). Additionally ADCPs record the velocity profiles in the upper and lower 600 m. Mooring LOCO2-9 is the 9-th of a series of moorings, each deployed for one year in the centre of the Irminger gyre.

On board data processing of the CTD 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 has been carried out back at NIOZ, including the LADCP processing.

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
M.F,. de Jong	Moorings & hydrowatch	NIOZ/Texel
S. Ober	CTD & ADCP, hydrowatch	NIOZ/Texel
R. van der Heide	mooring instrumentation, & hydrowatch	NIOZ/Texel
K. Bakker	Oxygen Determination	NIOZ/Texel
L. Boom	Marine engineering	NIOZ/Texel
J.-W. Meijerink	Hydrowatch	IMAU/Utrecht
J. van Lent	Hydrowatch	IMAU/Utrecht
J. Menninga	Hydrowatch	IMAU/Utrecht
M. van der Mheen	Hydrowatch	IMAU/Utrecht
R. de Oude	Hydrowatch	IMAU/Utrecht

NIOZ: Royal Netherlands Institute for Sea Research, Texe
IMAU Institute for Marine and Atmospheric Research, Utrecht University.

Ships crew

C. Burkhard	Captain
J. van Haaren	First Mate
D. Verheyen	Second Mate
J. Seepma	Chief Engineer
M. Frankfort	Second Engineer
S. Maas	Able Seaman
C. Stevens	Able Seaman
J. Vitoria	Able Seaman
M. de Vries	Able Seaman
A. Lont	Cook
M. Zagars	Steward

2 Underway Measurements

2.1 Navigation

A differential GPS receiver was used for the determination of the position. The data from the GPS receiver and the gyro compass were recorded in the underway data logging system. An additional Seapath dual antenna GPS receiver also determined the ship's heading. Data processing has been carried out back at NIOZ. The speed over ground and course over ground were determined from the

GPS positions for successive one minute periods. After removal of occasional spikes, the data were smoothed with a 5 min. running mean and sub-samples every 5 minutes.

2.2 Echo Sounding

The Kongsberg EA600 echo sounder was used on board to determine the water depth. The uncorrected depths from this echo sounder were recorded in the Casino underway data logging system. Erroneous data have been removed back at NIOZ. It appeared that in the deep part of the Rockall Channel the majority of the echo sounder data was erroneous.

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. Back at NIOZ these sensors have been calibrated by comparison with the CTD-cast at 3 m. After removal of occasional spikes, the data were smoothed with 5 5 min running mean and sub-samples every 5 min.

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 true wind speed and direction were online calculated and also recorded. The connection with the solarimeter appeared to be defect. Therefore the solar radiation data are missing from the meteorological records. After removal of occasional spikes, the data were smoothed with a 5 min. running mean and sub-sampled every 5 min.

2.5 ADCP meaurements

The 75 kHz ADCP mounted under the Pelagia has been used to collect current data from the mooring recovery onwards. 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. The final processing of the data still has to take place at Texel.

3 Hydrographic measurements - Descriptions, Techniques, and Calibrations

3.1 CTD Data Collection and Processing

A recently (June 2011) 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-034812, SBE4 conductivity sensor SN-043385, a Digiquatz pressure sensor SN-53978, SBE43 oxygen sensors SN-430350 (station 1 to 19) and SN- 431932 (station 20 to 42), a Wetlab CStar beam transmission meter SN-CST-1406DR with a path length of 25 cm, 660 nm wavelength, a Seapoint turbidity sensor SN-11541, and a Chelsea Aqua 3 fluorometer SN-088026, and a Tritech altimeter SN- 52077. The Seapoint turbidity sensor appeared to produce mainly faulty data.

The CTD was mounted in a special rack, which did contain 12 Niskin water samplers. The additional sensors of the CTD system were also recently calibrated by the manufacturers. 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 when water samples were taken with the Niskin samplers. The water from these samplers was sub-sampled for the determination of dissolved oxygen, salinity, and ^{14}C. THe latter samples will be analyzed at Groningen University in support of the GEOTRACES programme.

For the data collection the new Seasave software for Windows (version V 7.21d), 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.

Also mounted in the CTD rack was a Lowered ADCP (LADCP). Initially two ADCPs were used, a master and a slave. However, problems were encountered with the synchronisation cable or its connectors. Therefore most of the CTD casts were performed with only a single down looking master ADCP.

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. The final calibration and data processing has been 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 every time a Niskin sampler was closed by the CTD operator. These SBE35 temperature data have been used to control the calibration of the CTD temperature sensor. The mean difference T_{SBE35}-T_{CTD} amounts to -0.0001°C (±0.0010°C stdev, N=323). No further corrections were applied to the CTD temperature.

3.3 Salinity water samples

At the deep stations up to 3 water samples were collected from relatively homogenous parts of the water column. The (practical) salinity of these samples was determined in a constant-temperature laboratory container with a Guldline 8400B salinometer. The standard water we used was from batch P146 (S = 34.992). The mean difference S_{sample}-S_{CTD} amounts to 0.0014 (±0.0013 stdev, N=39). The CTD salinity was corrected for this offset.

3.4 Oxygen reference water samples (K. Bakker and J. Menninga)

Water samples were for the determination of the dissolved oxygen concentration were taken from the Niskin bottle at up to 12 depths per CTD cast. From the deepest bottle 3 subsamples were taken. The oxygen concentration was determined with a spectrophotometric analysis with Winkler chemistry.

Equipment and methods:

After reacting with the pickling reagents according to Winkler (1888), acid was added and the Iodine-colour formed was measured in an acclimatised lab container equipped with a, Technicon TRAACS 800 spectrophotometer, connected to a homemade sampler and peristaltic pump with a capacity of 30 Oxygen bottles. The sample rate was set at 30 samples per hour, measuring about 500 samples during the cruise

Sample handling:

The Oxygen samples were collected in approx 113ml glass BOD bottles, after being filled flushed over three times with sample without any air trapped, taken directly from the CTD-rosette bottles. On the deck, immediately after sampling, the pickling reagents MnCl and NaOH/KI were added with dispensers; the tip down into the shoulder level of the bottle, the glass stopper placed, and shakes to

react to form higher oxidation state of the Manganese. After 15 minutes the samples were shake again, and then placed with a rubber bang around the stopper in a storage container filled with water to prevent direct air-contact. The samples were kept at lab temperature of 20°C, and analysed typically within 10 hours, and 16 hours as a maximum, but always after being settled for first two hours in the storage container under water.

Calibration and Standards:

KIO_3 as primary stock standard was prepared home at the lab, containing 71.48 mM of “Oxygen” equivalents, and used in addition to so called seawater blanks (seawater treated with inverse chemistry addition without any oxygen reaction) in calibrated Oxygen bottles. The calibration standards were prepared daily by diluting the separate stock standards, using an electronic pipette into four BOD-bottles when the stopper is removed, taking in account the extra volume of the pipette added.

In the lab the sample bottles with the settlement of the Manganese-oxides were gently lifted out of the storage container and with a dispenser 1 ml of 10 M of Sulphuric Acid was added to oxidise the available Iodide to form Iodine caused by liberation of the Manganese-oxides in acid medium. A teflonised magnetic stirring rod was put in the bottle and the bottle-opening immediately covered with parafilm to prevent any Iodine loss by evaporation, and covered to prevent light induced iodine forming.

Sample bottles including the calibration standards used were both sealed with "parafilm" under tension, a sharpened sample needle easily penetrated through leaving a small hole in the film. A peristaltic pump transporting the coloured solution to the flow cell in the spectrophotometer measuring the Absorbance at 460 nm light, produced with a LED and a bandpass filter.

To obtain high resolution values, an attempt was made to set the range for Oxygen to be measured in that way that the samples were always at a level of 40-80% of full scale values. To use the full A/D convertor of the spectrophotometer optimal and to reduce carryover, a baseline solution of around 160 µM O_2 in seawater was prepared being lower then the lowest Oxygen sample expected, and a maximum of 350 µM Oxygen calibrant was used to be the highest expected value.

Reference standard:

This Baker standard acts as a lab reference and its use is described under "quality control". It is diluted from a concentrated ampoule in the lab containing KIO_3, finally representing a concentration of 100 mM O_2 per litre. The average recovery found during this cruise is 100.2% of the certified value, n=17.

Quality Control:

The reference standard of Baker is measured in every run, its value showed no trend during the cruise, being stable over time. It is vitally important to get a good method to produce a 100% Oxygen standard in order to obtain real accuracy and so better comparison between labs and cruises. In Japan an attempt is made to prepare even an Oxygen reference standard, ready for use?!

After the cruise the KIO_3 standard has been measured against a new KIO_3 standard, together with the collected natural standards to check whether a correction will be necessary, because the KIO_3 stock standard onboard was made of KIO_3 crystals containing some lumpy stuff. This led to a final correction with 0.8% of the original concentration.

Statistics:

Precision of the Spectrophotometer set up was performed by analysing 5 samples from one mixed Iodine coloured seawater solution, showing a standard deviation of 0.06 µM O_2 on a level of 283 µM O_2 showing a instrumental c.v. of 0.02%, being close to the resolution of the spectrophotometer of 0.04 µM at the used range. However running a test CTD-station showed a s.d. of 0.41 µM O_2 on this level, for 23 duplicates with one outlier removed.

To obtain cross-run statistical values, analyses were carried out twice on the same sample from the bottle closed at the bottom layer in the first run, and one duplicate in the consecutive run. This gives the possibility to estimate the precision from station to station in a horizontal way. It's well known that the reproducibility in one calibrated run is much better than measurements made across several runs, with each run having its own calibration settings. Analysis of these duplicates in the runs show an RMS difference of 0.38 µM (n=32, within runs precision). Cross runs duplicate samples show absolute differences with an RMS of 0.93 µM (avg. level 250 µM, n=35)

One reference used is a diluted Baker Ampoule, monitored during all runs, and the other is 20 litre of seawater mixed and tapped under lab conditions. An attempt was made to “back correct” on its average value after the cruise and check if the RMS of the duplicates in-between the runs get smaller? Raw duplicate difference expressed in RMS get a smaller value from 0.93uM to 0.78uM overall, showing a slight improvement.

Problems:

During the first day there was quite some noise o the TRAACS of a level of +/- 2%. Changing the current from the ships net from “fine” to “coarse”; improved this by reducing the noise to “0”.

Sometimes during a run, sticky Iodine colour was settled to the flow cell walls and be seen as gradual raise of the normal horizontal peak-plateau. By “babysitting” during the analysis, worse case could be avoided by pressing the pump-tubes after the flow cell for a few seconds so this could be removed by sudden under pressure in the flow line. Afterwards the problem was linked with the fact that first week the sampler setting was wrong, with sample to wash ratio of 105seconds over 15seconds?? During the second half of the cruise this was set back to its original setting of 90 s over 30 s what improved the peak shape a lot, showing less carryover and less Iodine sticking to the flow cell walls.

The difference between the oxygen concentration from the water samples (OXYGEN) and CTD oxygen concentration appeared to depend significantly (linear correlation) on the oxygen concentration (CTDOXY) itself, on pressure (CTDPRS), temperature (CTDTMP) and on the time, expressed as station number (STNNBR). A multi-parameter linear regression was used to determine the correction for the CTD oxygen concentration in the form:

$$OXYGEN = A \times CTDOXY + B \times CTDPRS + C \times CTDTMP + D \times STNNBR + E$$

The linear regression to determine the paramters A to E gave the following results (estimated value and standard deviation):

A = 1.032 (±0.003)

B = 0.0026 (±0.0002)

C = 0.16 (±0.04)

D = 0.096 (±0.008)

E = -8.0 (±0.9) .

The residual of the linear regression had a standard deviation of 0.7 µmol/kg (N = 203). This regression equation was used for the correction of the "raw" CTD oxygen concentration.

3.5 Data Management

All raw data were copied to a cruise directory on the network computer of RV Pelagia in different groups of sub-directories. Subsequent processed data, final products, documents and figures were copied to separate sub-directories within the same 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 and on the disc of a notebook computer. 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 Potential Temperature

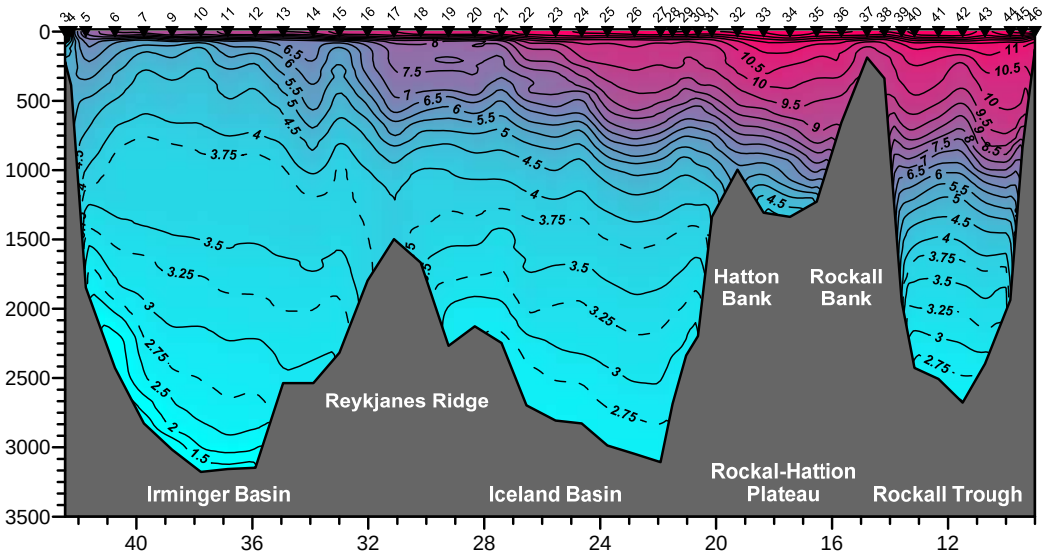

Figure 6. The distribution of potential temperature (°C) along the AR7E section, derived from the CTD downcasts.

The potential temperature distribution along the AR7E section (Figure 6) shows the usual structure. In the Irminger Sea the subarctic gyre in the Irminger Basin causes a doming of cold water in the centre of the basin, while along the edges of the basin a warmer boundary current (Irminger Current) surrounds the cold core. From the Reykjanes Ridge eastwards the permanent thermocline descends from about 500 dbar to over 1000 dbar, in agreement with the near geostrophic balance of the northward flowing warm near surface water of the North Atlantic current over slowly moving intermediate water. The relatively large isotherm distance between the seasonal thermocline at about 40 dbar (Figure 7) and the deeper permanent thermocline is indicative of the presence of Subarctic Mode Water, formed in the previous winter.

In the near bottom layers of the Irminger Basin the isotherms follow the topography of the East Greenland Slope closely, as can be expected from the fast, near geostrophic flowing Denmark Strait Overflow Water. In the western Iceland Basin the slightly warmer (2.5 to 3.0°C) Iceland-Scotland Overflow Water

also causes the isotherms closely. Over the western slope of the Hatton Bank in the Iceland Basin the slope of both the topography and the isotherms is reversed due to the narrow northward flowing Deep Northern Boundary Current which transports the aged Lower Deep Water, admixed with traces of Antarctic Bottom Water. The slight topography following slope of the deepest isotherms in the Rockall Trough may be interpreted as a contour following flow in the deep layers of this narrow basin.

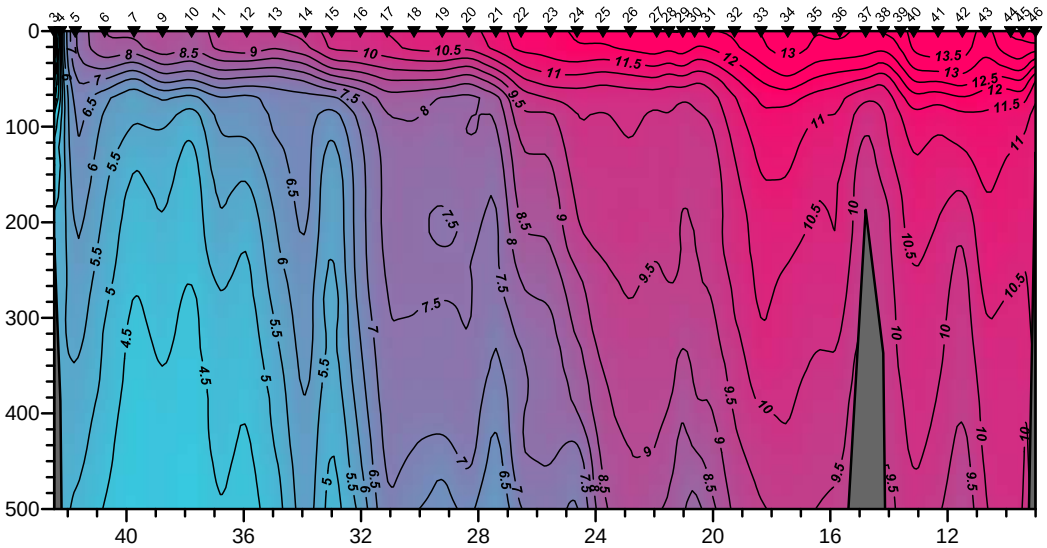

Figure 7. The distribution of potential temperature (°C) in the upper 500 dbar, derived from CTD downcasts.

In the upper 500 dbar the temperature distribution (Figure 7) shows a near constant depth of the seasonal thermocline at ~40 dbar, likely reflecting a near homogeneous wind climate. The large scale zonal trend of the temperature is interrupted by narrow cold bulges, which can be interpreted as transient cyclonic mid-ocean eddies, although the topography following doming of the isotherms around the Rockall Bank also can be connected with topography bound cyclonic circulation. Note here that in general the horizontal resolution of the survey (station distance) is not better than 30 n. miles (55 km) apart from the stations over steep topography which have a smaller mutual distance.

4.2 Salinity

The salinity distribution along the AR7E section (Figure 8) shows in the upper 1000 dbar an eastward increase from the central Irminger Basin to the Irish slope. In the upper 40 dbar, above the thermocline, salinity is slightly reduced

due to the precipitation excess since spring, when the seasonal stratification began. At station 3, over the Greenland continental shelf, surface water with a salinity below 32.0 was observed, well below the surface salinity of nearly 34.7 at the following station over the upper slope. This reflects the presence of the relatively fresh East Greenland Shelf Current and the more saline western part of the Irminger Current. In the Irminger Current encircling the Irminger Basin, near stations 5, 6 and 14, a high salinity subsurface core (S > 35.0) is encountered between 100 and 400 dbar. From this core relatively high salinities extend at 100 to 200 dbar towards the centre of the Irminger gyre.

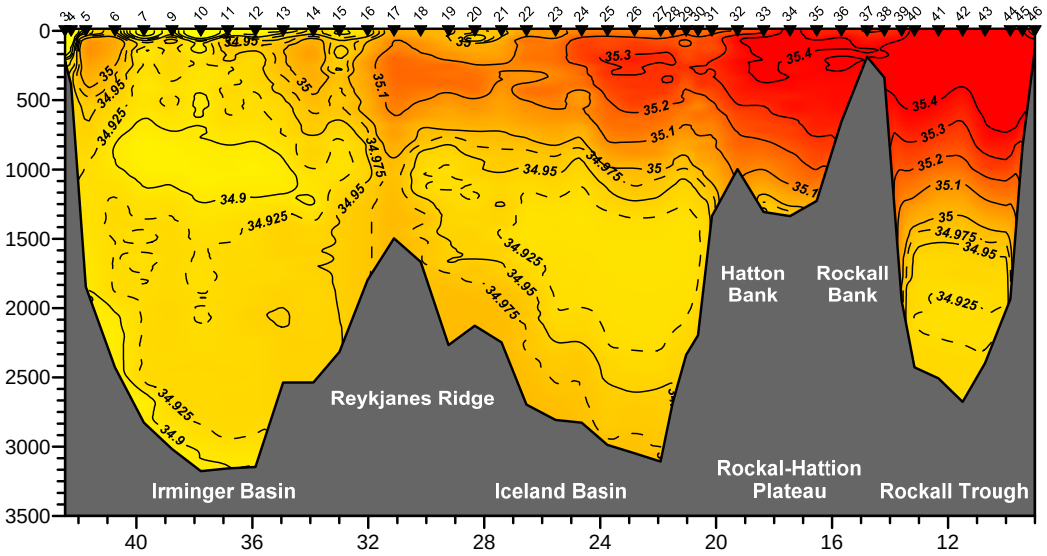

Figure 8. The distribution of salinity (PSS-78) along the AR7E section, derived from the CTD downcasts.

The low salinity core in the Irminger Basin between 600 and 1200 dbar reflect the Labrador Sea Water, as the name indicates formed in the Labrador Sea. Similar low salinity cores are also observed in the Iceland Basin and Rockall Trough (near ~ 22500 dbar), reflecting the eastward advection and descent of this intermediate water mass in the northern North Atlantic Ocean. The Denmark Strait Overflow Water near the bottom of the Irminger Basin has a salinity (S < 34.925) slightly below the salinity of the directly overlying water mass. The latter water mass is an advective extension towards the western Atlantic basins of the more saline (S > 34.975) Iceland Scotland Overflow that reached the Irminger Sea via the Charlie-Gibbs Fracture Zone at ~52°N. Over the top of the Reykjanes Ridge intermediate water with a salinity higher than the Labrador Sea Water is encountered, which most likely originates from mixing of thermocline

water with Iceland Scotland Overflow Water southeast of Iceland (Icelandic Slope Water).

4.3 Dissolved Oxygen

The distribution of dissolved oxygen (Figure 9) shows oxygen maxima in the Irminger Sea at 300 to 500 dbar, overlying the salinity minimum of the Labrador Sea Water. This is likely to present the local Irminger Sea Mode Water, ventilated in the previous winter by convective mixing. Similar but lower oxygen maxima (~250 to 260 μmol/kg) are observed at the same depth range in the more saline Atlantic water above the main thermocline, the Sub-Arctic mode Water. The permanent thermocline is characterized by an oxygen minimum.

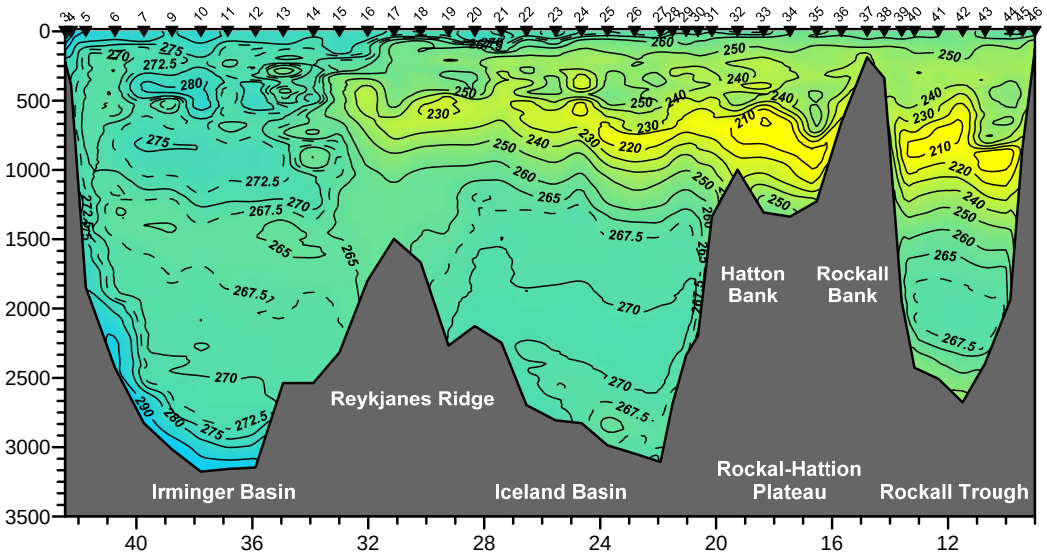

Figure 9. The distribution dissolved oxygen (μmol/kg) along the AR7E section, derived from the CTD downcasts.

The salinity minimum of the Labrador Sea Water is characterized by a secondary oxygen maximum, slightly lower than the maximum of the Irminger Sea Mode Water. The oxygen content of this water type in the Iceland Basin and Rockall Trough has lower values (~267.5 μmol/kg in the latter basin).

The overflow waters are characterized by relatively high oxygen concentrations, (~270 μmol/kg in the Iceland Basin, >290 μmol/kg in the Irminger Sea).

4.4 Potential vorticity

The planetary potential vorticity (PV, Figure 10) is a near conservative parameter, reflecting the static stability of the water column. The distribution of PV confirms the earlier findings, presented above. The Mode Waters in all three basins are characterized by a PV minimum, as is the underlying Labrador Sea Water below the permanent thermocline. The overflow waters are capped by a PV maximum, indicative for the enhanced stability due to the relatively large density difference between the overflow waters and the overlying older water mass.

A peculiar characteristic of the PV distribution is the minimum, directly overlying the top of the Reykjanes ridge. This is a recurrent feature, observed during all surveys of the AR7E section since 1990, and is likely caused by turbulent mixing, driven by breaking internal waves over the rough topography of the ridge.

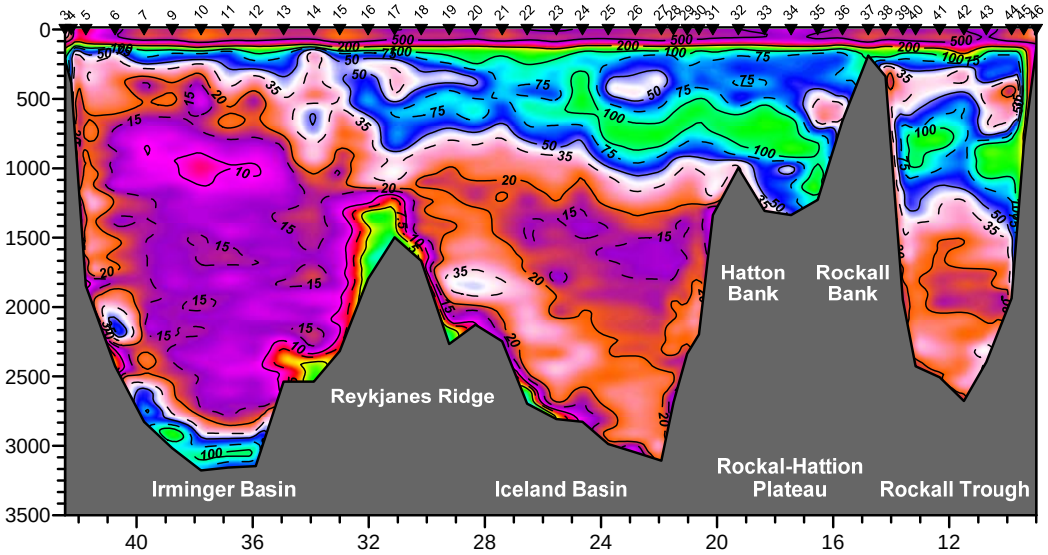

Figure 10. The distribution of the potential planetary vorticity ($10^{-12}s^{-1}$) along the AR7E section derived from the CTD downcasts.

4.5 Velocity

Overall the LADCP observations reveal mainly a near columnar (=barotropic) flow, modified by some typical baroclinic features. The typical horizontal scales of the uni-directional velocity columns amounts to about 150 to 200 km. The meridional velocity (Figure 11) shows a mainly cyclonic circulation in the Irminger Sea at nearly all depths. In the near bottom layer, where Denmark Strait Overflow Water is found, two southward high velocity cores (V < -20 cm/s) are observed. In the centre of that basin that water type in the near-bottom layer

recirculates to the north again. In the near bottom layer in the Iceland Basin, the Iceland-Scotland Overflow water is transported southwards in two separate high velocity cores, while along the western slope of the Hatton Bank the deep flow transports Lower Deep water to the north.

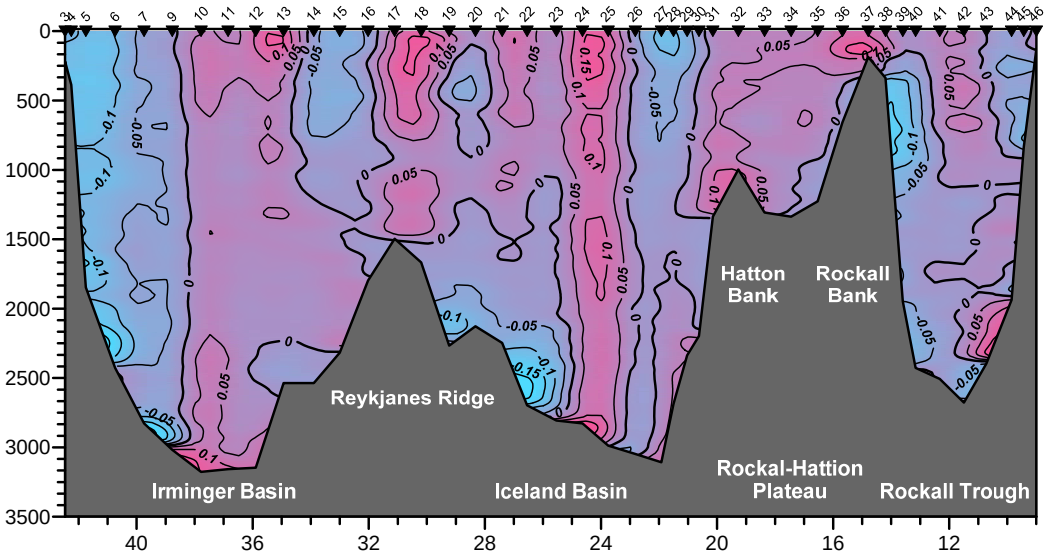

Figure 11. The distribution of the North component of the water velocity (m/s) along the AR7E section, measured with the LADCP during the CTD casts.

Appendix A. Cruise Summary Pelagia Cruise 64PE342

CAST TYPE

CTD	CTD cast	MOR	Mooring
FLT	ARGO Float		

EVENT CODE

BE	Begin	BO	Bottom
EN	End		
RE	Recovered	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
64PE342		01	1	ROS	26-Jul-2011	13:12	BE	60	58.75	N	35	07.95	W	GPS	3001		oxygen sensor S/N 430350	
64PE342		01	1	ROS	26-Jul-2011	13:18	BO	60	58.74	N	35	07.86	W	GPS	3001	205	test	PE342011
64PE342		01	1	ROS	26-Jul-2011	13:27	EN	60	58.75	N	35	07.73	W	GPS	3001		test	
64PE342		02	1	ROS	27-Jul-2011	10:21	BE	59	12.66	N	39	31.39	W	GPS	3043			
64PE342		02	1	ROS	27-Jul-2011	11:12	BO	59	12.65	N	39	31.37	W	GPS	3043	3057		PE342021
64PE342		02	1	ROS	27-Jul-2011	11:48	EN	59	12.65	N	39	31.37	W	GPS	3043			
64PE342		02	2	MOR	27-Jul-2011	13:40	RE	59	12.44	N	39	30.34	W	GPS	3034		LOCO2-8	
64PE342	AR7E	03	1	ROS	28-Jul-2011	06:10	BE	59	52.82	N	42	27.99	W	GPS	222			
64PE342	AR7E	03	1	ROS	28-Jul-2011	06:15	BO	59	52.84	N	42	27.97	W	GPS	222	206		PE342031
64PE342	AR7E	03	1	ROS	28-Jul-2011	06:24	EN	59	52.83	N	42	27.85	W	GPS	221			
64PE342	AR7E	04	1	ROS	28-Jul-2011	08:08	BE	59	53.90	N	42	15.09	W	GPS	395			
64PE342	AR7E	04	1	ROS	28-Jul-2011	08:15	BO	59	53.89	N	42	15.12	W	GPS	394	379		PE342041
64PE342	AR7E	04	1	ROS	28-Jul-2011	08:29	EN	59	53.90	N	42	15.10	W	GPS	394			
64PE342	AR7E	05	1	ROS	28-Jul-2011	10:24	BE	59	50.68	N	41	44.83	W	GPS	1850			
64PE342	AR7E	05	1	ROS	28-Jul-2011	10:59	BO	59	50.68	N	41	44.85	W	GPS	1849	1838		PE342051

64PE342	AR7E	05	1	ROS	28-Jul-2011	11:52	EN	59	50.67	N	41	44.86	W	GPS	1850			
64PE342	AR7E	06	1	ROS	28-Jul-2011	15:30	BE	59	44.72	N	40	44.64	W	GPS	2418			
64PE342	AR7E	06	1	ROS	28-Jul-2011	16:13	BO	59	44.74	N	40	44.55	W	GPS	2418	2414		PE342061
64PE342	AR7E	06	1	ROS	28-Jul-2011	17:20	EN	59	44.68	N	40	44.63	W	GPS	2416			
64PE342	AR7E	06	2	FLT	28-Jul-2011	17:32	DE	59	44.63	N	40	44.85	W	GPS	2413		APEX float S/N 5792, ID A9872	
64PE342	AR7E	07	1	ROS	28-Jul-2011	21:00	BE	59	40.04	N	39	44.61	W	GPS	2413			
64PE342	AR7E	07	1	ROS	28-Jul-2011	21:49	BO	59	40.03	N	39	44.68	W	GPS	2812	2819		PE342071
64PE342	AR7E	07	1	ROS	28-Jul-2011	22:58	EN	59	40.03	N	39	44.67	W	GPS	2811			
64PE342	AR7E	07	2	FLT	28-Jul-2011	23:10	DE	59	40.01	N	39	44.65	W	GPS	2812		APEX float S/N 5788, ID A9906	
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64PE342		08	2	CTD	29-Jul-2011	13:02	BE	59	13.38	N	39	30.22	W	GPS	3034			
64PE342		08	2	CTD	29-Jul-2011	13:56	BO	59	13.37	N	39	30.37	W	GPS	3034	3049		PE342082
64PE342		08	2	CTD	29-Jul-2011	14:50	EN	59	13.34	N	39	30.42	W	GPS	3034			
64PE342		08	3	FLT	29-Jul-2011	14:58	DE	59	13.36	N	39	30.44	W	GPS	3034		APEX float S/N 5789, ID A9902	
64PE342	AR7E	09	1	ROS	29-Jul-2011	18:26	BE	59	34.20	N	38	46.41	W	GPS	2991			
64PE342	AR7E	09	1	ROS	29-Jul-2011	19:19	BO	59	34.21	N	38	46.31	W	GPS	2991	3006		PE342091
64PE342	AR7E	09	1	ROS	29-Jul-2011	20:35	EN	59	34.20	N	38	46.29	W	GPS	2991			
64PE342	AR7E	09	2	FLT	29-Jul-2011	20:43	DE	59	34.19	N	38	46.20	W	GPS	2991		APEX float S/N 5790, ID A9900	
64PE342	AR7E	10	1	ROS	30-Jul-2011	00:10	BE	59	27.93	N	37	46.72	W	GPS	3144			
64PE342	AR7E	10	1	ROS	30-Jul-2011	01:05	BO	59	27.92	N	37	46.76	W	GPS	3145	3162		PE342101
64PE342	AR7E	10	1	ROS	30-Jul-2011	02:30	EN	59	27.85	N	37	46.62	W	GPS	3144			
64PE342	AR7E	10	2	FLT	30-Jul-2011	02:43	DE	59	27.94	N	37	46.79	W	GPS	3144		APEX float S/N 5791, ID A9907	
64PE342	AR7E	11	1	ROS	30-Jul-2011	05:56	BE	59	23.50	N	36	50.98	W	GPS	3127			
64PE342	AR7E	11	1	ROS	30-Jul-2011	06:52	BO	59	23.49	N	36	51.00	W	GPS	3127	3146		PE342111
64PE342	AR7E	11	1	ROS	30-Jul-2011	08:10	EN	59	23.49	N	36	51.00	W	GPS	3127			
64PE342	AR7E	11	2	FLT	30-Jul-2011	08:18	DE	59	23.53	N	36	51.00	W	GPS	3126		APEX float S/N 5787, ID A9913	
64PE342	AR7E	12	1	ROS	30-Jul-2011	11:34	BE	59	17.79	N	35	53.77	W	GPS	3119			
64PE342	AR7E	12	1	ROS	30-Jul-2011	12:32	BO	59	17.83	N	35	53.76	W	GPS	3119	3137		PE342121
64PE342	AR7E	12	1	ROS	30-Jul-2011	13:52	EN	59	17.81	N	35	53.76	W	GPS	3119			
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64PE342	AR7E	13	1	ROS	30-Jul-2011	17:17	BE	59	11.78	N	34	56.19	W	GPS	2520			
64PE342	AR7E	13	1	ROS	30-Jul-2011	18:01	BO	59	11.76	N	34	56.20	W	GPS	2520	2527		PE342131
64PE342	AR7E	13	1	ROS	30-Jul-2011	19:06	EN	59	11.79	N	34	56.19	W	GPS	2521			
64PE342	AR7E	14	1	ROS	30-Jul-2011	22:56	BE	59	06.00	N	33	53.72	W	GPS	2516			
64PE342	AR7E	14	1	ROS	30-Jul-2011	23:46	BO	59	06.01	N	33	53.71	W	GPS	2514	2527		PE342141
64PE342	AR7E	14	1	ROS	31-Jul-2011	00:52	EN	59	05.91	N	33	53.72	W	GPS	2524			
64PE342	AR7E	15	1	ROS	31-Jul-2011	04:15	BE	59	01.35	N	33	00.04	W	GPS	2302			
64PE342	AR7E	15	1	ROS	31-Jul-2011	04:57	BO	59	01.33	N	32	59.99	W	GPS	2303	2301		PE342151
64PE342	AR7E	15	1	ROS	31-Jul-2011	05:58	EN	59	01.33	N	33	00.03	W	GPS	2303			
64PE342	AR7E	16	1	ROS	31-Jul-2011	09:22	BE	58	56.14	N	32	01.51	W	GPS	1794			
64PE342	AR7E	16	1	ROS	31-Jul-2011	09:56	BO	58	56.15	N	32	01.50	W	GPS	1793	1787		PE342161
64PE342	AR7E	16	1	ROS	31-Jul-2011	10:46	EN	58	56.15	N	32	01.50	W	GPS	1793			

64PE342	AR7E	17	1	ROS	31-Jul-2011	13:45	BE	58	50.81	N	31	06.56	W	GPS	1495			
64PE342	AR7E	17	1	ROS	31-Jul-2011	14:11	BO	58	50.81	N	31	06.76	W	GPS	1488	1481		PE342171
64PE342	AR7E	17	1	ROS	31-Jul-2011	14:51	EN	58	50.80	N	31	06.98	W	GPS	1487			
64PE342	AR7E	18	1	ROS	31-Jul-2011	18:04	BE	58	44.98	N	30	11.62	W	GPS	1646			
64PE342	AR7E	18	1	ROS	31-Jul-2011	18:36	BO	58	44.98	N	30	11.62	W	GPS	1645	1652	no LADCP	PE342181
64PE342	AR7E	18	1	ROS	31-Jul-2011	19:23	EN	58	44.96	N	30	11.61	W	GPS	1672			
64PE342	AR7E	19	1	ROS	31-Jul-2011	23:04	BE	58	40.99	N	29	13.94	W	GPS	2234			
64PE342	AR7E	19	1	ROS	31-Jul-2011	23:47	BO	58	40.99	N	29	13.94	W	GPS	2234	2251	bad CTD oxygen values from	PE342191
64PE342	AR7E	19	1	ROS	01-Aug-2011	00:46	EN	58	40.98	N	29	13.90	W	GPS	2238		sample 4 upwards	
64PE342	AR7E	20	1	ROS	01-Aug-2011	04:20	BE	58	34.97	N	28	19.61	W	GPS	2112		new oxygen sensor (S/N 431932)	
64PE342	AR7E	20	1	ROS	01-Aug-2011	04:56	BO	58	34.97	N	28	19.59	W	GPS	2113	2112	installed	PE342201
64PE342	AR7E	20	1	ROS	01-Aug-2011	05:53	EN	58	34.99	N	28	19.59	W	GPS	2113			
64PE342	AR7E	21	1	ROS	01-Aug-2011	09:32	BE	58	30.16	N	27	24.29	W	GPS	2232			
64PE342	AR7E	21	1	ROS	01-Aug-2011	10:15	BO	58	30.16	N	27	24.29	W	GPS	2232	2233		PE342211
64PE342	AR7E	21	1	ROS	01-Aug-2011	11:13	EN	58	30.16	N	27	24.31	W	GPS	2232			
64PE342	AR7E	22	1	ROS	01-Aug-2011	14:26	BE	58	26.01	N	26	32.63	W	GPS	2265			
64PE342	AR7E	22	1	ROS	01-Aug-2011	15:15	BO	58	25.97	N	26	32.75	W	GPS	2666	2682		PE342221
64PE342	AR7E	22	1	ROS	01-Aug-2011	16:27	EN	58	25.94	N	26	32.74	W	GPS	2668			
64PE342	AR7E	23	1	ROS	01-Aug-2011	20:06	BE	58	19.89	N	25	32.41	W	GPS	2783			
64PE342	AR7E	23	1	ROS	01-Aug-2011	20:59	BO	58	19.88	N	25	32.38	W	GPS	2782	2799		PE342231
64PE342	AR7E	23	1	ROS	01-Aug-2011	22:09	EN	58	19.89	N	25	32.38	W	GPS	2782			
64PE342	AR7E	24	1	ROS	02-Aug-2011	01:34	BE	58	12.34	N	24	38.32	W	GPS	2797			
64PE342	AR7E	24	1	ROS	02-Aug-2011	02:26	BO	58	12.26	N	24	38.23	W	GPS	2800	2817		PE342241
64PE342	AR7E	24	1	ROS	02-Aug-2011	03:31	EN	58	12.29	N	24	38.30	W	GPS	2798			
64PE342	AR7E	25	1	CTD	02-Aug-2011	06:51	BE	58	04.68	N	23	45.02	W	GPS	2954			
64PE342	AR7E	25	1	CTD	02-Aug-2011	07:45	BO	58	04.66	N	23	45.03	W	GPS	2954	2973	sampling failed	PE342251
64PE342	AR7E	25	1	CTD	02-Aug-2011	07:57	EN	58	04.66	N	23	44.99	W	GPS	2954		upcast aborted	
64PE342	AR7E	26	1	ROS	02-Aug-2011	12:23	BE	57	54.87	N	22	48.94	W	GPS	3007			
64PE342	AR7E	26	1	ROS	02-Aug-2011	13:19	BO	57	54.92	N	22	49.04	W	GPS	3006	3034		PE342261
64PE342	AR7E	26	1	ROS	02-Aug-2011	14:33	EN	57	54.90	N	22	49.00	W	GPS	3007			
64PE342	AR7E	27	1	ROS	02-Aug-2011	17:44	BE	57	46.42	N	21	55.07	W	GPS	3061			
64PE342	AR7E	27	1	ROS	02-Aug-2011	18:40	BO	57	46.44	N	21	55.09	W	GPS	3062	3091		PE342271
64PE342	AR7E	27	1	ROS	02-Aug-2011	19:57	EN	57	46.44	N	21	55.09	W	GPS	3063			
64PE342	AR7E	28	1	CTD	02-Aug-2011	21:44	BE	57	42.47	N	21	30.17	W	GPS	2654			
64PE342	AR7E	28	1	CTD	02-Aug-2011	22:24	BO	57	42.48	N	21	30.19	W	GPS	2656	2676	no LADCP	PE342281
64PE342	AR7E	28	1	CTD	02-Aug-2011	23:24	EN	57	42.49	N	21	30.20	W	GPS	2658			
64PE342	AR7E	29	1	ROS	03-Aug-2011	01:23	BE	57	36.92	N	21	01.97	W	GPS	2316			
64PE342	AR7E	29	1	ROS	03-Aug-2011	02:05	BO	57	36.94	N	21	01.91	W	GPS	2316	2323		PE342291
64PE342	AR7E	29	1	ROS	03-Aug-2011	03:08	EN	57	36.94	N	21	01.85	W	GPS	2317			
64PE342	AR7E	30	1	CTD	03-Aug-2011	04:39	BE	57	35.20	N	20	37.41	W	GPS	2175			
64PE342	AR7E	30	1	CTD	03-Aug-2011	05:17	BO	57	35.19	N	20	37.42	W	GPS	2176	2180		PE342301
64PE342	AR7E	30	1	CTD	03-Aug-2011	05:55	EN	57	35.21	N	20	37.40	W	GPS	2176			

64PE342	AR7E	31	1	ROS	03-Aug-2011	07:43	BE	57	30.06	N	20	08.89	W	GPS	1325			
64PE342	AR7E	31	1	ROS	03-Aug-2011	08:09	BO	57	30.05	N	20	08.88	W	GPS	1325	1322		PE342311
64PE342	AR7E	31	1	ROS	03-Aug-2011	08:47	EN	57	30.05	N	20	08.86	W	GPS	1325			
64PE342	AR7E	32	1	ROS	03-Aug-2011	12:23	BE	57	22.00	N	19	15.98	W	GPS	993			
64PE342	AR7E	32	1	ROS	03-Aug-2011	12:47	BO	57	21.94	N	19	15.96	W	GPS	994	989		PE342321
64PE342	AR7E	32	1	ROS	03-Aug-2011	13:10	EN	57	21.95	N	19	15.96	W	GPS	994			
64PE342	AR7E	33	1	ROS	03-Aug-2011	16:14	BE	57	14.15	N	18	21.72	W	GPS	1302			
64PE342	AR7E	33	1	ROS	03-Aug-2011	16:37	BO	57	14.15	N	18	21.73	W	GPS	1301	1298		PE342331
64PE342	AR7E	33	1	ROS	03-Aug-2011	17:14	EN	57	14.16	N	18	21.72	W	GPS	1302			
64PE342	AR7E	34	1	ROS	03-Aug-2011	20:30	BE	57	05.79	N	17	27.02	W	GPS	1328			
64PE342	AR7E	34	1	ROS	03-Aug-2011	20:55	BO	57	05.79	N	17	27.03	W	GPS	1328	1324		PE342341
64PE342	AR7E	34	1	ROS	03-Aug-2011	21:32	EN	57	05.79	N	17	27.03	W	GPS	1328			
64PE342	AR7E	35	1	ROS	04-Aug-2011	00:47	BE	56	57.98	N	16	32.01	W	GPS	1217			
64PE342	AR7E	35	1	ROS	04-Aug-2011	01:12	BO	56	57.95	N	16	31.99	W	GPS	1216	1214		PE342351
64PE342	AR7E	35	1	ROS	04-Aug-2011	01:46	EN	56	57.95	N	16	32.07	W	GPS	1216			
64PE342	AR7E	36	1	ROS	04-Aug-2011	04:59	BE	56	47.96	N	15	40.69	W	GPS	649			
64PE342	AR7E	36	1	ROS	04-Aug-2011	05:11	BO	56	47.95	N	15	40.70	W	GPS	649	641		PE342361
64PE342	AR7E	36	1	ROS	04-Aug-2011	05:31	EN	56	47.96	N	15	40.70	W	GPS	650			
64PE342	AR7E	37	1	ROS	04-Aug-2011	08:49	BE	56	40.19	N	14	47.59	W	GPS	187			
64PE342	AR7E	37	1	ROS	04-Aug-2011	08:55	BO	56	40.18	N	14	47.59	W	GPS	187	174		PE342371
64PE342	AR7E	37	1	ROS	04-Aug-2011	09:03	EN	56	40.19	N	14	47.59	W	GPS	187			
64PE342	AR7E	38	1	ROS	04-Aug-2011	11:15	BE	56	34.74	N	14	11.78	W	GPS	332			
64PE342	AR7E	38	1	ROS	04-Aug-2011	11:21	BO	56	34.73	N	14	11.78	W	GPS	331	320		PE342381
64PE342	AR7E	38	1	ROS	04-Aug-2011	11:32	EN	56	34.72	N	14	11.79	W	GPS	334			
64PE342	AR7E	39	1	ROS	04-Aug-2011	13:45	BE	56	29.25	N	13	36.01	W	GPS	1926			
64PE342	AR7E	39	1	ROS	04-Aug-2011	14:23	BO	56	29.23	N	13	35.96	W	GPS	1926	1938		PE342391
64PE342	AR7E	39	1	ROS	04-Aug-2011	15:20	EN	56	29.21	N	13	35.96	W	GPS	1927			
64PE342	AR7E	40	1	ROS	04-Aug-2011	17:03	BE	56	24.92	N	13	09.48	W	GPS	2399			
64PE342	AR7E	40	1	ROS	04-Aug-2011	17:46	BO	56	24.92	N	13	09.49	W	GPS	2401	2415		PE342401
64PE342	AR7E	40	1	ROS	04-Aug-2011	18:46	EN	56	24.93	N	13	09.50	W	GPS	2401			
64PE342	AR7E	41	1	ROS	04-Aug-2011	21:46	BE	56	17.13	N	12	19.65	W	GPS				
64PE342	AR7E	41	1	ROS	04-Aug-2011	22:31	BO	56	17.13	N	12	19.67	W	GPS		2495		PE342411
64PE342	AR7E	41	1	ROS	04-Aug-2011	23:38	EN	56	17.11	N	12	19.58	W	GPS				
64PE342	AR7E	42	1	ROS	05-Aug-2011	02:38	BE	56	09.44	N	11	29.84	W	GPS	2244			
64PE342	AR7E	42	1	ROS	05-Aug-2011	03:29	BO	56	09.35	N	11	29.80	W	GPS	2221	2668	not all bottles did close	PE342421
64PE342	AR7E	42	1	ROS	05-Aug-2011	04:46	EN	56	09.34	N	11	29.78	W	GPS	2335			
64PE342	AR7E	43	1	ROS	05-Aug-2011	07:30	BE	56	01.81	N	10	43.21	W	GPS	2370			
64PE342	AR7E	43	1	ROS	05-Aug-2011	08:13	BO	56	01.82	N	10	43.25	W	GPS	2371	2387		PE342431
64PE342	AR7E	43	1	ROS	05-Aug-2011	09:13	EN	56	01.82	N	10	43.25	W	GPS	2372			
64PE342	AR7E	44	1	ROS	05-Aug-2011	12:13	BE	55	52.94	N	9	51.22	W	GPS	1918			
64PE342	AR7E	44	1	ROS	05-Aug-2011	12:49	BO	55	52.90	N	9	51.17	W	GPS	1917	1924		PE342441
64PE342	AR7E	44	1	ROS	05-Aug-2011	13:43	EN	55	52.88	N	9	51.23	W	GPS	1917			

64PE342	AR7E	45	1	ROS	05-Aug-2011	15:23	BE	55	48.97	N	9	26.00	W	GPS	824			
64PE342	AR7E	45	1	ROS	05-Aug-2011	15:38	BO	55	48.97	N	9	25.97	W	GPS	823	821		PE342451
64PE342	AR7E	45	1	ROS	05-Aug-2011	16:04	EN	55	49.00	N	9	25.95	W	GPS	821			
64PE342	AR7E	46	1	CTD	05-Aug-2011	17:49	BE	55	45.01	N	8	59.99	W	GPS	124			
64PE342	AR7E	46	1	CTD	05-Aug-2011	17:51	BO	55	45.02	N	8	59.99	W	GPS	124	112	bottles malfunctioned	PE342461
64PE342	AR7E	46	1	CTD	05-Aug-2011	17:59	EN	55	45.02	N	8	59.98	W	GPS	124			

Appendix B. Mooring summary file of LOCO2-9

Mooring LOCO 2-9	S/N	**relasred**			bumpers	recording rate/release code		remarks
instuments & cables		length	height above bottom	Depth in water (m)				
bottom weight		1		**3018**				corrected depth
			1	3017				
5 m chain		5						
			6	3012				
releases		2						
OCEANO RT	#1227			3010		08D2		
OCEANO AR	#0450		8	3010			1478	
Microcat	2675	573		3003				
cable		572						
			580	2438				
chain		1						
			581	2437				
Longranger ADCP	3699	2						down-looking
			583	2435				
chain		1						
bumper				2433				
			584	2434				
cable		2284						
McLane profiler	11564-01			150-2400				
			2868	150				
bumper				151				
chain		1						
			2869	149				
sub-surface buoy		1						
			2870	148				
chain		2						
			2872	146				
cable		27						
			2899	119				
chain		1						
			2900	118				
Longranger ADCP		1						down-looking
			2901	117				
floating line		10						
top buoy			2911	107				
ARGOS baken	60667							**ID=22580**

CCHDO Data Processing Notes

Date	Person	Data Type	Action	Summary
2012-05-10	van Aken, Hendrik	CTD/BTL/SUM	Submitted	to go online
	Zipped file, Bottle data and summary file in Excel format, CTD data in CSV ASCII files			
2012-09-17	Staff, CCHDO	BTL/SUM/CTD files	Website Update	Available under 'Files as received'
	The following files are now available online under 'Files as received', unprocessed by the CCHDO. 64PE342.zip			
2013-09-19	Shen, Matt	ExpoCode	Website Update	ExpoCode changed
	========== 64PE20110724 processing ========== 2013-09-19 M Shen .. contents:: :depth: 2 Process ======= ExpoCode changed from 64PR20110724 to 64PE20110724. 64PR20110724 added as an alias for the cruise. Directories ========== :working directory: /data/co2clivar/atlantic/ar07e/./original/2013.09.19_expocode_correction_MYS :cruise directory: /data/co2clivar/atlantic/ar07e/ar07e_64PR20110724 Updated Files Manifest ==========			
2014-04-09	Kappa, Jerry	CrsRpt	Website Update	Final PDF vesion online
	I've placed a new PDF version of the cruise report: ar07e_64PR20110724do.pdf into the directory: http://cchdo.ucsd.edu/data/co2clivar/atlantic/ar07e/ar07e_64PR20110724/ . It includes all the reports provided by the cruise PIs, summary pages and CCHDO data processing notes, as well as a linked Table of Contents and links to figures, tables and appendices.			