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Cruise Report
POSEIDON P437-2

Reykjavik – Tromsø
15. August – 7. September 2012
Technical Report

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Aims of the cruise

The research cruise of RV POSEIDON to the Nordic Seas during summer 2012 was used to pursue and complete ongoing research in the Nordic Seas.

The main goals of the research cruise were a large-scale hydrographic CTD survey along 75°N through the Greenland Sea (station distance 10 nm) and, embedded into this section, a mesoscale hydrographic survey across the Polar Front with the Underway-CTD (station distance 2 nm). The Greenland Sea is one of the few regions in the high latitudes were deep reaching convection during winter takes place. From 1993 to 2010 the 75°N section through the Greenland Sea was carried out every summer. Our CTD survey continued these observations and enables us to observe the long-term development of hydrography in the area. For the water mass transformation within the Greenland Sea the lateral exchange between inner basin and boundary current is of crucial importance. The exchange across the Polar Front is meant to be managed by mesoscale eddies. These structures were insufficiently observed in the past. Now insight is given by the high-resolution UCTD survey.

Additionally two Argo-floats were deployed in the Greenland Sea Basin and Lofoten Basin to maintain the large-scale monitoring of the Nordic Seas. On the east Greenland shelf a mooring array was planned to be recovered, if ice-conditions are favourable.

The cruise was also used as practical education for three students of physical oceanography at the University of Hamburg.

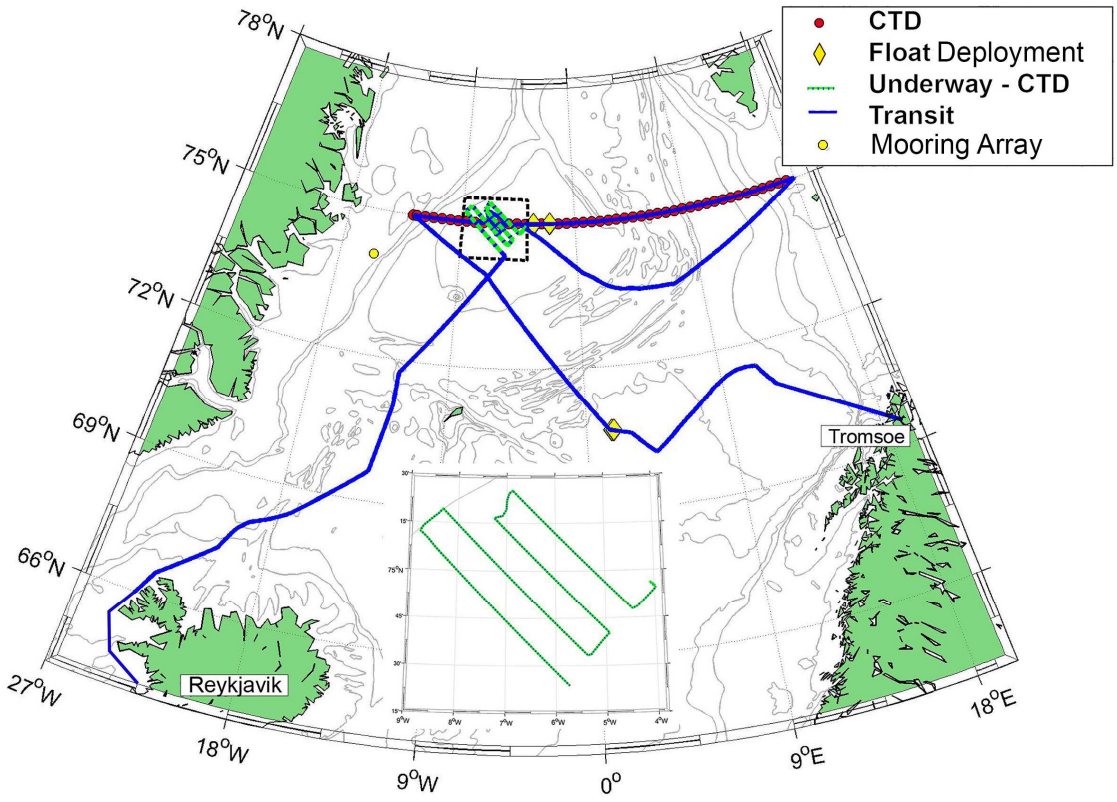

Figure 1: cruise track of RV Poseidon cruise P437-2, August 15 to September 7 2012, with CTD-casts (red dots), Argo float deployments (yellow diamonds) and UCTD-profiles (dashed green-blue line). Enlargement of the UCTD-survey in the lower part of the map.

2. Cruise participants

Scientists

Katrin Latarius	Chief Scientist	IfM-ZMAW
Leonie Esters	Student	IfM-ZMAW
Finn Hartwig	Student	IfM-ZMAW
Martin Moritz	Student	IfM-ZMAW
Hanna Paulsen	Student	IfM-ZMAW
Achim Randelhoff	Student	IfM-ZMAW
Magdalena Tropp	Student	IfM-ZMAW
Norbert Verch	Technician	IfM-ZMAW

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Crew

Matthias Günther	Master
Jan Philip Günther	Chief Officer
Sebastian Pengel	2nd Officer
Kurre-Klaas Kröger	Chief Engineer
Hans-Jörg Freund	2nd Engineer
Hartmut Janßen	Electrician
Rüdiger Engel	Motorman
Frank Schrage	Bosun
Sven Domschke	Ship Mechanist
Ralf Peters	Ship Mechanist
Sebastian Knuth	Ship Mechanist
Fabian Lunau	Ship Mechanist
Rene Papke	Able bodied Seaman
Wilfried Kluge	Cook
Bernd Gerischewski	Steward

3. Narrative

Wednesday, 15th August 2012
Noon position: 64° 25’ N, 022°49’ W
Wind: ESE 5 Bft., Air temperature: 13.5°C, Water temperature: 12.8°C

At 8 a.m. the scientific crew got a safety instruction by the second mate.
The CTD/lADCP with the water sample caroussel was already built up during the previous cruise. The UCTD winch was installed on the afterdeck the day before.
At 9 a.m. RV Poseidon left Reykjavik in direction to Denmark Strait and the Nordic Seas. As the weather forecast predicted 9 Bft northeasterly near the coast of Greenland it was decided to take the easternmost course through Denmark Strait and continue on an eastern course.
At 10 a.m. an emergency practice was executed followed by an instruction in the live-saving equipment for the scientists.
During the day the students were made familiar with the UCTD and CTD data acquisition systems.

Thursday, 16th August 2012
Noon position: 67° 10’ N, 021°20’ W
Wind: NNE 6 Bft., Air temperature: 6.4°C, Water temperature: 6.5°C

On the transit to the first station chemicals for the O_2-analyses were prepared and the handling of the UCTD-winch was trained as long as weather conditions were fairly well.
At lunch time the wind started to increse and the sea was getting very rough. Most of the students got seasick for the rest of the day.

Friday, 17th August 2012
Noon position: 68° 39’ N, 016°32’ W
Wind: E 4 Bft., Air temperature: 7.6°C, Water temperature: 5.7°C

In the morning the weather calmed down again and almost all students overcome their seasickness. But fog arose. The students were trained how to deploy and haul the probe of the UCTD by using the test probe. In the evening the chief scientist gave a talk about the scientific background of the cruise and the plans ahead.

Saturday, 18th August 2012
Noon position: 71° 33’ N, 012°19’ W
Wind: WSW 4 Bft., Air temperature: 6.1°C, Water temperature: 5.5°C

We were still on the way to our research area. As the ice edge in the East Greenland Current was far to the east during this summer we decided to cancel our first goal of the reasearch program, the recovery of a mooring array on the East Greenland shelf. This array was not accessible for Poseidon under the current ice conditions. So, course was set to the first CTD station at 74°20’N and 005°30’W in the Greenland Sea. During the day the students examined some test-UCTD-Profiles and made themselves familiar with the ship mounted ADCP.

Sunday, 19th August 2012
Noon position: 73° 16’ N, 008°24’ W
Wind: SSW 4 Bft., Air temperature: 4.5°C, Water temperature: 4.9°C

Because of heavy fog the ships speed was reduced.
During the day two students gave a talk on recent research in the Nordic Seas. Afterwards the scientists practice the preparation of the CTD, lADCP and water samples of the rosette for the station. Watches started in the evening and the first CTD station was reached at aroud 9 p.m. It was also used for calibration ofd the UCTD. The UCTD probes were fixed on the rosette and on the upcast every 50 m stops for 3 min were made. Then we started with the first UCTD-section going NW. The cruise speed was 4 knots on all UCTD-sections and approximately every half an hour a UCTD-profile was taken. During the night conditions on deck for working with the UCTD were quite unconfortable with air temperature aroud 1°C and 4 Bft. We were very happy to have polare overalls for the shifts.

Monday, 20th August 2012
Noon position: 74° 58’ N, 007°54’ W
Wind: SSW 2 Bft., Air temperature: 0.9°C, Water temperature: 5.8°C

Bright sunshine and ligth breeze during the whole day, perfect conditions to work near the ice edge.
At 4 p.m. the first UCTD section was finished without reaching the ice edge and we sailed NE to the start position of the second UCTD section. At 7 p.m. the second UCTD section was started with a CTD station for UCTD calibration pruposes. Afterwards UCTD-profiles were taken along the section going SE.

Tuesday, 21th August 2012
Noon position: 74° 33’ N, 005°21’ W
Wind: NNE 4 Bft., Air temperature: 3.6°C, Water temperature: 6.1°C

Still sunny and calm weather conditions. At 12 a.m. the second UCTD section was finished and we sailed NE to the start position of the third UCTD section. At 3 p.m. the third UCTD section was started with a CTD station for UCTD calibration.

Wednesday, 22th August 2012
Noon position: 75° 11’ N, 005°58’ W
Wind: WNW 4 Bft., Air temperature: 2.8°C, Water temperature: 5.2°C

The third UCTD section was not run as far west as planned because the ice edge was sighted. The last UCTD profile was taken at 75°16’N and 7°11’W at 4 a.m. Then, Poseidon sailed NE to the next UCTD section in safe distance from the ice edge. At 7 a.m. the fourth UCTD section started with a CTD station for UCTD calibration purposes and was then continued with UCTD-profiles in SE direction.
The weather forecast announced the formation of a low pressure system at the southern tip of Svalbard, which was expected to move SW in direction to Denmark Strait. Maximum wind speeds of 12 Bft were predicted at the front in the Greenland

Sea. We planned to continue the UCTD survey as long as a safe deployment of the UCTD was possible. Afterwards, we would escape from the low pressure system by sailing within the calm section, going first SSE, later E and NE.
At 8 p.m. the fourth UCTD section was finished. We sailed NE and reached the start position of the next UCTD-section at around 10 p.m. A CTD station was carried out for UCTD calibration purposes and afterwards the first UCTD-profile on the fifth section was taken. But meanwhile the wind increased so much that work had to be aborted. The UCTD winch was removed from the rail and we escaped from the central Greenland Sea to the East.

Thursday, 23th August 2012
Noon position: 73° 55' N, 000°36' E
Wind: W 7 Bft., Air temperature: 3.3°C, Water temperature: 5.4°C

Taking into account the actual weather forcast which pronounced storm in the Greenland Sea for at least the next 3 days, we revised our plans. We decided to begin with the 75°N CTD section in the east at Bear Island, where winds were weaker the whole days through. So, the course was set to the first CTD station at 75°N and 018° E.

Friday, 24th August 2012
Noon position: 73° 56' N, 010°08' E
Wind: SE 7 Bft., Air temperature: 5.4°C, Water temperature: 7.0°C

Transit to Bear Island. Rain and poor visibility.
In the morning we continued the students seminar with two talks.
In the afternoon we started to process the UCTD-profiles.

Saturday, 25th August 2012
Noon position: 75° 00' N, 017°57' E
Wind: ESE 6-7 Bft., Air temperature: 5.6°C, Water temperature: 5.5°C

The first CTD-station near Bear Island was reached at 11 a.m. We got sunshine and the winds calm down. But waves and swell from different directions made the launch of the CTD very difficult. The CTD section was continued westward with shallow casts on the edge of the Barents Shelf.

Sunday, 26th August 2012
Noon position: 75° 00' N, 011°18' E
Wind: ESE 4 Bft., Air temperature: 6.9°C, Water temperature: 6.7°C

Ongoing CTD work along 75°N. During the 19th CTD cast problems with the single-conductor cable were detected. Seawater intruded through the plug. Therefore, 5 m of the cable was cut and the connection was renewed. At 10 p.m. the station was repeated.

Monday, 27th August 2012
Noon position: 75° 00' N, 006°39'
Wind: S 2 Bft., Air temperature: 6.1°C, Water temperature: 6.1°C

During our CTD work along 75°N problems were detected in the data transmission. For three times the pump stopped working and the communication between sonde and deck unit failed. The reason for these problems was neither found in the single-conductor cable nor in the connections between cabel and sonde or in the connections between sonde and external sensors.

Tuesday, 28th August 2012
Noon position: 75° 00’ N, 002°10’ E
Wind: S 5 Bft., Air temperature: 4.3°C, Water temperature: 4.9°C

Again the communication between sonde and deck unit failed. This time the problem was solved by replacing the deck unit and the following CTD casts were executed without any communication errors.

Wednesday, 29th August 2012
Noon position: 75° 00’ N, 002°00’ W
Wind: NE 5 Bft., Air temperature: 4.7°C, Water temperature: 4.4°C

In the morning again communication errors between deck-unit and CTD sonde were detected. Measurements of a small resistor between CTD sonde and earth were interpreted as an indication for an at least part time short-circuit within the sonde. We fixed the problem by replacing the whole CTD sonde with another one. Running the next CTD casts with the new sonde, produced no failure anymore.
We had already reached the deep Greenland Sea Basin and so two Argo floats were deployed at the position of CTD station 403 and 405.

Thursday, 30th August 2012
Noon position: 75° 00’ N, 004°42’ W
Wind: SE 4 Bft., Air temperature: 5.3°C, Water temperature: 4.5°C

At 4 a.m. problems with the single-conductoir cable were detected due to water intrusion through the plug and it was cut by 5 m again. At 10 a.m. CTD work was resumed. But we run into another problem. We connected an external thermometer to the sonde and though broke one of the pins of the caroussel’s plug. This problem could only be solved by replacing the whole caroussel. At 11 p.m. the system was ready for use again. But meanwhile the wind had increased to 8 Bft and high cross sea made the launching of the CTD impossible. Work was stopped and we weathered the storm during night.

Friday, 31th August 2012
Noon position: 75° 11’ N, 007°00’ W
Wind: WSW 8 Bft., Air temperature: 1.4°C, Water temperature: 4.5°C

In the morning we still had 8 Bft. with squalls of 9 Bft and a fully developed state of the sea. CTD work was impossible and everybody within the scientific crew had enough problems of their own.

Saturday, 1th September 2012
Noon position: 75° 00’ N, 007°20’ W
Wind: SE 3 Bft., Air temperature: 4.2°C, Water temperature: 4.3°C

The weather had calmed down in the morning and we resumed CTD work at 8 a.m. CTD sonde and caroussel were working properly during the whole day.

Sunday, 2th September 2012
Noon position: 75° 00’ N, 012°00’ W
Wind: N 5 Bft., Air temperature: -2.4°C, Water temperature: 0.5°C

As the ice moved to the west during the storms we were able to continue the CTD section to 12°75’W. At this position the last CTD cast of the 75°N section was executed at 3 p.m. down to a water depth of 360 m, with the ice edge in view. Afterwards we started the transit to the Lofoten Basin, were two Argo floats are planned to be deployed as the last goal of our research program.

Monday, 3th September 2012
Noon position: 72° 57’ N, 004°13’ W
Wind: WNW 5 Bft., Air temperature: 3.2°C, Water temperature: 4.3°C

Transit in direction to the Lofoten Basin. We had a students seminiar in the morning and started with the data processing of the CTD and lADCP data in the afternoon.

Tuesday, 4th September 2012
Noon position: 70° 35’ N, 002°39’ E
Wind: S 4 Bft., Air temperature: 8.9°C, Water temperature: 7.7°C

We got roped into another low pressure system. Therfore the two floats were deployed underway without taking CTD casts for calibration. We used the day to continue the data processing.

Wednesday, 5th September 2012
Noon position: 71° 25’ N, 009°13’ E
Wind: NNW 4 Bft., Air temperature: 8.3°C, Water temperature: 8.8°C

During the day the data processing and visualisation of preliminary results of the cruise were finished and we started with the dismantling and packing of the scientific equipment.

Thursday, 6th September 2012
Noon position: 75° 00’ N, 004°42’ E
Wind: Bft., Air temperature: °C, Water temperature: °C

The packing of the equipment was finished and afterwards the laboratories were cleaned. In the evening the chief scientist gave a talk on the first results of the cruise.

Friday, 7th September 2012
Noon position: 69° 42' N, 019°00' E
Wind: Bft., Air temperature: °C, Water temperature: °C

At 5 a.m. the pilot was picked up and at 8 a.m. RV POSEIDON berthed along side at Breivica Terminal, Tromsø. The equipment was stored on deck for unloading and at 2 p.m. the scientists disembarked.

4. Students' Seminar on board

Magdalena Tropp: Introduction to the Nordic Seas – Bathymetry, Weather and Ice conditions
Based on: *J. Blindheim, S. Østerhus: The Nordic Seas, Main Oceanographic Features, The Nordic Seas (2005).*

Martin Moritz: Circulation of the Nordic Seas
Based on: *G. Voet, D. Quadfasel, K.A. Mork, H. Søiland (2010): The mid-depth circulation of the Nordic Seas derived from profiling float observations, Tellus 62A.*

Leonie Esters: Water mass transformation in the Greenland Sea – Deep convection
Based on: *Budeus, G., Ronski, S. 2009. An integral view of the hydrographic development in the Greenland Sea over a decade. The Open Oceanography Journal 3, 9-40.*

Finn Hartwig: Water mass transformation in the boundary currents
Based on: *Mauritzen, C. (1996) Production of dense overflow waters feeding the North Atlantic across the Greenland-Scotland Ridge. Part 1: Evidence for a revised circulation scheme, Deep Sea Research I, 43, No. 6, pp. 769-806.*

Achim Randelhoff: Freshwater fluxes through arctic und subarctic Seas
Based on: *R. Dickson, B. Rudels, S. Dye, M. Karcher, J. Meincke, I. Yashayaev (2007). Current estimates of freshwater flux through Arctic and subarctic seas. Progress in Oceanography 73, 210-230, doi: 10.1016/j.pocean.2006.12.003.*

Hanna Paulsen: Is oceanic heat transport significant in the climate system?
Based on: *P. Rhines, S. Häkkinen, S. A. Josey. Is oceanic heat transport significant in the climate system? Arctic-Subarctic ocean Fluxes (2008).*

5. Technical Information (and Methods)

CTD/Rosette and hydrographical samples

Altogether 54 standard hydrographic stations were occupied during the cruise, employing a SeaBird SBE911 plus CTD-O_2 sonde, attached to a SeaBird carousel 12 bottle water sampler. These stations were running to full depth or, for UCTD calibration casts, to 1000 m depth. All sensors except of pressure are sent to the factory once a year for calibration. The pressure sensor is sent to calibration as often

as required. The SBE1 was used on station 363 to 403 and the SBE2 on station 404 to 420. The serial numbers of the CTD sondes and sensors are:

SBE1	
Instrument/Sensor	**Serial Number**
SBE 9plus	09P6395-0285
Temperature 1: SBE-3plus	035456
Conductivity 1: SBE-4C	043960
Pressure 410K-105	050633
Temperature 2: SBE-3plus	034024
Conductivity 2: SBE-4C	042166
Altimeter PSA 916D	885
Oxygen SBE 43	2144

SBE2	
Instrument/Sensor	**Serial Number**
SBE 9plus	09P9013-0313
Temperature 1: SBE-3-02/F	031540
Conductivity 1: SBE-4-02/0	041222
Pressure 410K-105	053573
Temperature 2: SBE-3-02/F	031526
Conductivity 2: SBE-4-02/0	041232
Altimeter PSA 916D	1118
Oxygen SBE 43	1171

At all stations water samples were taken from different depth levels within the water column for oxygen and salinity analyses (within the deep basin from 5 levels, on the shallow shelfs from 1 to 2 levels). The salinity samples were analysed on board using a Guildline Autosal Salinometer. The batch–no. of the standard seawater samples is P153 which have a K15-factor of 0.99970. At the water sample levels additionally measurements with an external thermometer (SBE Thermometer SBE-35 RT Sn.0067) were taken for calibration of the CTD temperature values. The oxygen samples were analysed on board using a TITRINO plus.

Current measurements

Vertical profiles of horizontal currents were made with a lADCP-2 system attached to the rosette water sampler. The system consists of two ADCPs of the Workhorse type (WHS300) manufactured by RD Instruments and operating at a frequency of 300 kHz. The serial numbers of the lADCPs are S/N 14109 (Master, down looking) and S/N 14411 (Slave, up looking).

Underway CTD measurements

Underway measurements of temperature and conductivity profiles to a maximum depth of ~ 800 m were made with an Ocean Science UCTD. We take measurements with ship speed of 4 kn, with spooling line onto the tail of the probe. We used two different CTD-probes during this cruise: Probe 0067 (IFM Hamburg) and probe 0068 (IFM-Geomar Kiel) and one UCTD-winch

UCTD 1 (IFM Hanburg)	**Serial Number 0067**
Temperature/Salinity Sensor	Seabird , SN 0067
Pressure Sensor	2000 dBar Kistler, SN 2078954
Firmware Version	V 2.01a
Interface Type	Bluetooth/RS-232C (9600, 8, N)
Conductivity Range	0-7 S/m
Maximum Depth	2000 meters
Temperature Calibration	19-Nov-11, ITS-90 temperature Scale
Conductivity Calibration	19-Nov-11, PSS 1978: C(35,15,0)=4.2914 Siemens/meter
Pressure Calibration	09-Nov-11, 2900 psia S/N 2078954

UCTD 2 (IFM-Geomar Kiel)	**Serial Number 0068**
Temperature/Salinity Sensor	Seabird , SN 0068
Pressure Sensor	2000 dBar Kistler, SN 2078955
Firmware Version	V 2.01a
Interface Type	Bluetooth/RS-232C (9600, 8, N)
Conductivity Range	0-7 S/m
Maximum Depth	2000 meters
Temperature Calibration	23-Jan-11, ITS-90 temperature Scale
Conductivity Calibration	23-Jan-11, PSS 1978: C(35,15,0)=4.2914 Siemens/meter
Pressure Calibration	20-Jan-11, 2900 psia S/N 2078954

UCTD winch (IFM Hanburg)	**Serial Number**
	S/N WI-0033

Underway Surface temperature and salinity measurements

Underway temperature and salinity measurements were made with a SeaBird thermosalinograph installed in the ship's port well. Additional water samples and measurements of temperature at the instrument's mouth for calibration purposes were made during the cruises. The water samples were analysed together with the water samples from the CTD.

Underway Current measurements

Underway current measurements were taken with a vessel-mounted 75 kHz Ocean Surveyor (ADCP) from RDI, covering approximately the top 500-700m of the water column. The bin size was set to 8 m, the ADCP run in narrowband mode. The instrument was controlled by computers using the conventional VMDAS software

under a MS Windows system. Pinging was set to 2 s. No interferences with other used acoustical instruments were observed s long as the echo sounder from the bright is offline. Additional navigational data was available from the ship's DAVIS system.

6. First Results

Argo floats

During the cruise 4 Argo floats have been deployed in the Greenland Sea (GS) and in the Lofoten Basin (LB), 2 in each basin (details see in the table below; positions see figure 1).

typ	WMO.No.	Ser. No.	profile depth (dbar)	deploy date	position lat	position long	area	Program (EURO-Argo)
APEX	6901904	6289	2000	2012/08/29 13:19	74° 59.92' N	1° 59.88' W	GS	Finnland
APEX	6901903	6288	2000	2012/08/29 21:49	74° 59.42' N	3° 20.19' W	GS	Finnland
APEX	6901081	5979	2000	2012/09/04 07:39	70° 39.91' N	1° 34.82' E	LB	Germany
APEX	6901080	6041	2000	2012/09/04 08:29	70° 39.36' N	1° 42.57' E	LB	Germany

These float deployments are part of the German and Finnish EURO-Argo program. Float deployments in the other two basins of the Nordic Seas (the Norwegian Basin and the Icelandic Plateau) were conducted on the Poseidon cruise POS 436 in July 2012 (chief scientist: Colin Devey).

This kind of measurements are carried out since 2001 in the Greenland Sea, since 2003 in the Norwegian Basin and since 2005 in the Lofoten Basin and on the Iceland Plateau. They enable us to monitor the development of the hydrography in the Nordic Seas, which is of crucial interest when changes in the climate are expected. The Nordic Seas are part of the areas in the high latitudes, where transformation of near-surface Atlantic water masses into dense water masses take place. The dense waters will leave the area again to the south as near-bottom outflows across the deep passages of the Greenland-Scotland-Ridge (so called "overflows") contributing substantially to the North Atlantic Deep Water. This transformation is part of the northern branch of the global scale Atlantic Meridional Overturning Circulation.

The important advantage of floats is that they supply measurements during the whole year, which offers us insight into the complete seasonal cycle of hydrography. In the past this was not at all possible with ship based measurements because of the harsh weather conditions in the area during winter. The most important restriction of Argo floats is that profiles of temperature and salinity reach at maximum 2000 m depth. That means we are not able to observe the development of the deep part of the water column.

CTD section along 75°N in the Greenland Sea

Along 75°N large-scale hydrographic measurements were carried out with the CTD. The section was running from 18°E near Bear Island to 12°57' W on the East Greenland Shelf. All 48 casts were taken from the surface to the bottom. The station distance was 10 nm. The derived hydrographic section accomplish the time series of 75°N sections from Gereon Budéus from 1993 to 2010 (analyses of the sections from

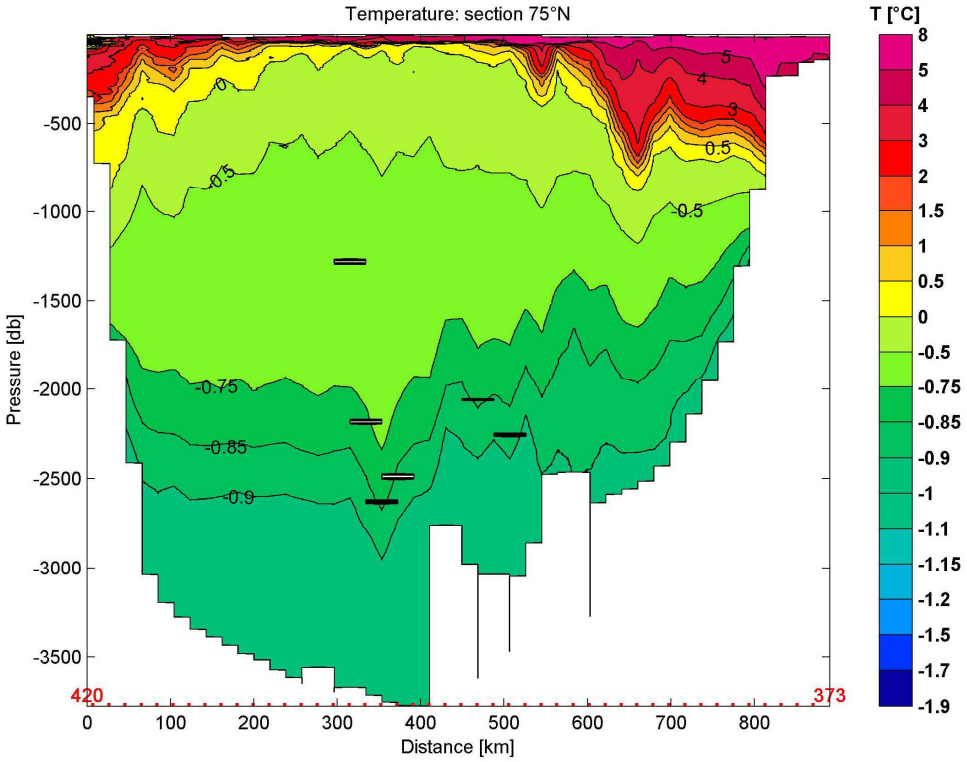

Figure 3 a: Temperature section along 75°N, August 2012. The temperature scale is nonlinear, the colours are chosen in the style of the colour maps from Budéus and Ronski, 2009.

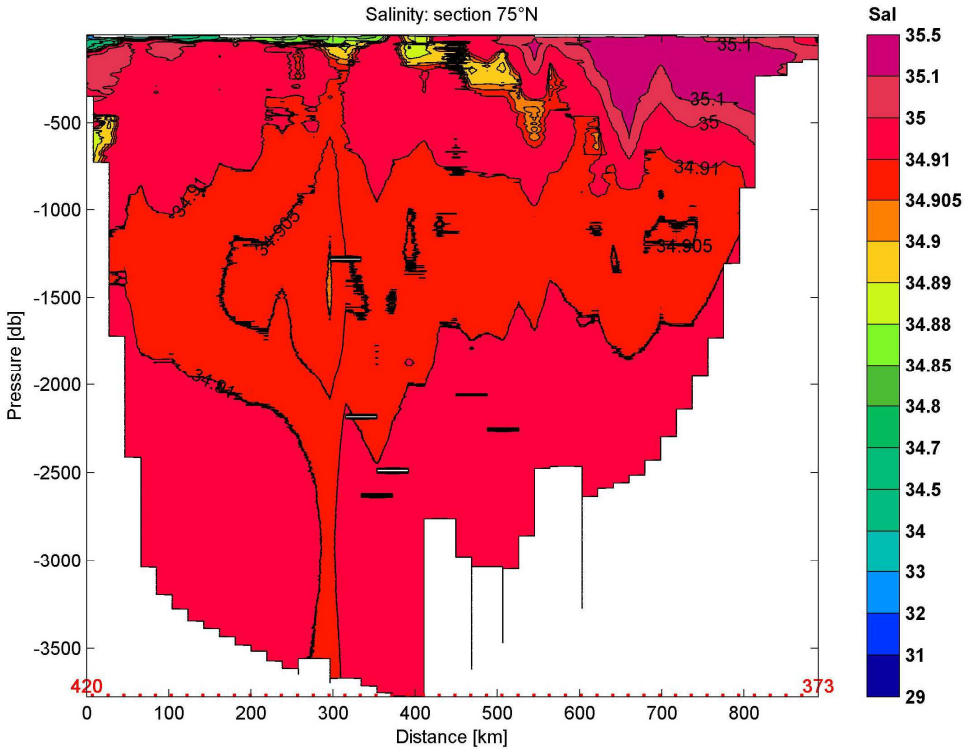

Figure 3 b: Salinity section along 75°N, August 2012. The salinity scale is nonlinear, the colours are chosen in the style of the colour maps from Budéus and Ronski, 2009.

1993 to 2005 are published in: Budéus and Ronski, 2009). The 2012 sections of temperature and salinity are shown in figure 3.

Temperature and salinity characteristics, which were found in the upper 1000 m of the water column on the eastern and western side of the Greenland Sea gyre are similar to the ones found there in 2005, but temperatures and salinities within the gyre increased in the whole water column from approximately 200 m down to the bottom. This indicates that the intermediate waters of the gyre are no longer

dominated by water masses locally formed by convection during winter but progressively influenced by the isopycnal intrusion of Canadian Basin and Eurasian Basin Intermediate waters. These water masses are transported with the East Greenland Current from the Arctic Ocean along the Greenland shelf through the Nordic Seas.
In contrast to the situation in 1993 to 2000, where a doming of the isotherms within the gyre was observed, now at least below 1500 m a slumping of the isotherms is visible. This indicates an overall downward motion of the water column in the central Greenland Sea during the last decade.
Until 2005 salinities in the gyre down to 1500 m were relatively low (<34.9) in contrast to the deeper layers. At present salinities below 34.9 only appear in the near surface layer and extended downward to 600 m only in a small regione on the western side of the Arctic Front. The rest of the gyre is occupied by salinities similar to the ones below 1500 m, which are between 34.9 and 35. In the past water with low salinity was mixed downward form the surface layer during winter convection. Increasing salinities at intermediate depth therefore point to reduced convective activity.

Budeus, G., Ronski, S. 2009. An integral view of the hydrographic development in the Greenland Sea over a decade. The Open Oceanography Journal 3, 9-40.

UCTD survey near the Polar Front in the western Greenland Sea

A mesoscale hydrographic survey across the Polar Front, embedded into the 75°N section, with the Underway-CTD was planned. At the Polar Front the strong gradient between the water masses of polar characteristic from the Arctic ocean and the arctic water masses from the Greenland Sea is found. The front is expected to lie upon the steep sloping topography from the Greenland Shelf to the deep Greenland Sea Basin.
However, our UCTD survey was carried out in the deep basin, because this summer the ice edge was found far east and work with the UCTD in at least part wise ice-covered waters is impossible (the area of the UCTD-survey can be found in the enlargement of figure 1; station distance 2 nm, distance between the UCTD sections 10 nm). Still then the 3th and 4th section were shortened in the west because of the ice-coverage. But the measurements nevertheless give a first impression of the mesoscale structures. While sailing with 4 kn profiles were taken down to 800 m every 2 nm.

The manufacturer promised an accuracy of ± 0.002 for temperature and ± 0.005 for salinity. We carried out calibration casts for the UCTD during our cruise at the beginning of each UCTD-section, where we attached the two probes to the CTD rosette. These measurements provided us with data for checking the two probes against each other and comparing the probes with the CTD.
In a first approach (on board) the temperature and salinity difference from one probe to the other was calculated and one probe was corrected in relation to the other. Differences were neither stable in time nor in relation to depth, which points out the importance of calibration casts during an UCTD-survey.

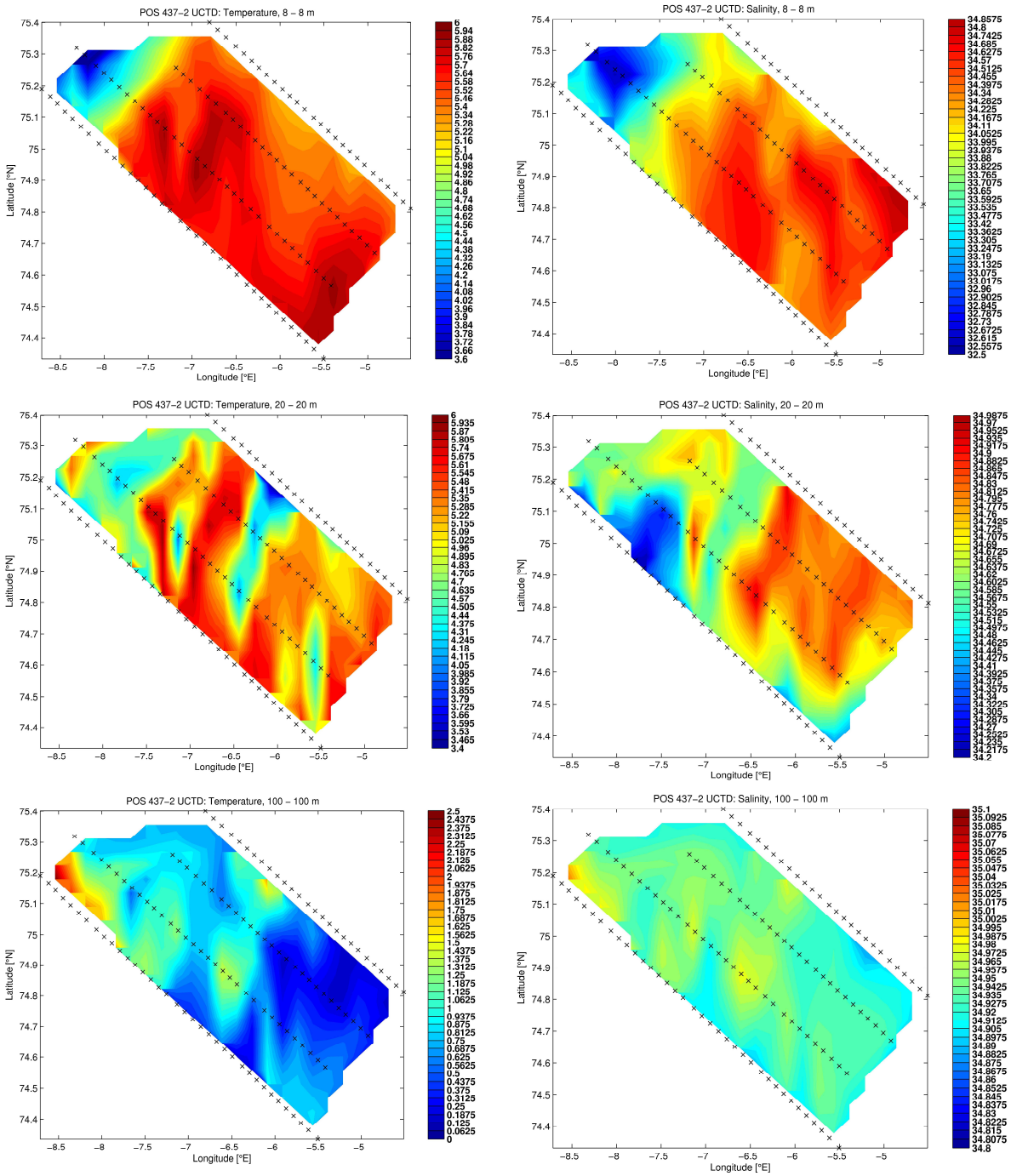

Figure 4: Horizontal temperature (left) and salinity (right) distribution at 8 m (top), 20 m (middle) and 100 m (bottom) depth. The colour scales are adjusted to the minima and maxima of the individual depth levels.

Figure 4 shows the mesoscale structure in temperature and salinity exemplarily for 8 m, 20 m and 100 m depth, as derived from the 4 UCTD-sections (see figure 1). Obviously the Polar Front is captured only in the north-western part of the survey. Here the cold and fresh Polar Surface Waters are found next to the warmer and more saline waters in the Greenland Sea Basin at 8 m depth. The Polar Surface Waters are transported with the East Greenland Current from the Arctic Ocean along the Greenland Shelf. Underneath the warm and saline Recirculating Atlantic Waters are found (100 m depth). At this depth the waters in the boundary current are warmer and more saline than the waters in the Greenland Sea Basin. The transition zone between boundary current and gyre is dominated by eddy-like structures with

diameters of ~ 5-10 km. These structures are well resolved by the UCTD measurements along the section, but inadequately resolved from one section to the next.

Acknowledgements

We would like to thank Captain Matthias Günther, his officers and the crew of RV POSEIDON for the support of our scientific programme, for their unending competent and friendly help. We like to express our special thanks to the chief engineer Kurre-Klaas Kröger, electrician Hartmut Janßen and Bosun Frank Schrage for their help in solving the problems with our CTD.

The ship time of RV POSEIDON and the financial support for the journey of scientists and transport of equipment was provided by the University of Hamburg and by the EU FP7 Project THOR financed by the European Union, under grant agreement 212643. We gratefully acknowledge this support.

Station List

BE Begin of station
BO Near bottom reached on station
EN End of station

EXPO-CODE	Stat. No.	Cast. No.	CTD Cast	Type	Date	Time UTC	Code	POSITION Latitude		Longitude		Bottom depth	Max. press.	Bottom dist.	Comments
POS437-2	363	1	1	CTD/ROS+LADCP+UCTI	19.08.12	21:11	BE	74°20.00	N	5°30.01	W	3509			calibration UCTD
POS437-2					19.08.12	21:33	BO	74°19.99	N	5°30.01	W	3509	1013.9		stop every 50m for 1min
POS437-2					19.08.12	22:21	EN	74°19.99	N	5°29.97	W	3508			at upcast
POS437-2	364	1-36		UCTD-Profile	19.08.12	22:57	BE	74°20.00	N	5°30.01	W				
POS437-2					20.08.12	16:37	EN	75°11.38	N	8°42.80	W				
POS437-2	365	1	2	CTD/ROS+LADCP+UCTI	20.08.12	17:57	BE	75°19.21	N	8°19.00	W	3265			calibration UCTD
POS437-2					20.08.12	18:17	BO	75°19.20	N	8°18.95	W	3258	999.9		stop every 50m for 1min
POS437-2					20.08.12	19:04	EN	75°19.21	N	8°18.97	W	3260			at upcast
POS437-2	366	37-69		UCTD-Profile	20.08.12	19:34	BE	75°19.17	N	8°18.83	W				
POS437-2					21.08.12	12:00	EN	74°34.03	N	5°25.04	W				
POS437-2	367		3	CTD/ROS+LADCP+UCTI	21.08.12	13:22	BE	74°40.31	N	4°55.42	W	3592			calibration UCTD
POS437-2					21.08.12	13:43	BO	74°40.30	N	4°55.46	W	3594	1000.4		stop every 50m for 1min
POS437-2					21.08.12	14:37	EN	74°40.31	N	4°55.48	W	3591			at upcast
POS437-2	368	70-96		UCTD-Profile	21.08.12	15:10	BE	74°40.21	N	4°55.33	W				
POS437-2					22.08.12	03:48	EN	75°15.47	N	7°10.95	W				
POS437-2	369	1	4	CTD/ROS+LADCP+UCTI	22.08.12	06:01	BE	75°25.18	N	6°52.70	W	3438			calibration UCTD
POS437-2					22.08.12	06:20	BO	75°25.18	N	6°52.84	W	3439	999.6		stop every 50m for 1min
POS437-2					22.08.12	07:02	EN	75°25.18	N	6°52.89	W	3439			at upcast
POS437-2	370	97-123		UCTD-Profile	22.08.12	07:33	BE	75°24.03	N	6°48.25	W				
POS437-2					22.08.12	20:17	EN	74°48.70	N	4°30.82	W				
POS437-2	371	1	5	CTD/ROS+LADCP+UCTI	22.08.12	21:42	BE	74°54.46	N	3°58.82	W	2323			calibration UCTD
POS437-2					22.08.12	22:02	BO	74°54.43	N	3°58.72	W	2328	999.9		stop every 50m for 1min
POS437-2					22.08.12	22:48	EN	74°54.41	N	3°58.72	W	2309			at upcast
POS437-2	372	124		UCTD-Profile	22.08.12	23:17	BE	74°54.65	N	3°59.64	W				
POS437-2					22.08.12	23:40	EN	74°55.68	N	4°03.48	W				
POS437-2	373	1	6	CTD/ROS+LADCP	25.08.12	11:35	BE	75°00.02	N	17°59.85	E	156			
POS437-2					25.08.12	11:41	BO	74°59.90	N	17°59.77	E	153		16.0	
POS437-2					25.08.12	11:47	EN	74°59.92	N	17°59.61	E	153			
POS437-2	374	1	7	CTD/ROS+LADCP	25.08.12	13:24	BE	74°59.93	N	17°19.80	E	161			
POS437-2					25.08.12	13:31	BO	74°59.87	N	17°19.62	E	153	152.2	10.0	
POS437-2					25.08.12	13:34	EN	74°59.84	N	17°19.60	E	162			
POS437-2	375	1	8	CTD/ROS+LADCP	25.08.12	15:14	BE	75°00.17	N	16°40.73	E	239			
POS437-2					25.08.12	15:23	BO	75°00.15	N	16°40.58	E	236		8.0	
POS437-2					25.08.12	15:30	EN	75°00.13	N	16°40.51	E	237			
POS437-2	376	1	9	CTD/ROS+LADCP	25.08.12	17:00	BE	75°00.01	N	15°59.99	E	247			
POS437-2					25.08.12	17:09	BO	74°59.99	N	15°59.99	E			14.89	
POS437-2					25.08.12	17:16	EN	75°00.00	N	16°00.02	E				
POS437-2	377	1	10	CTD/ROS+LADCP	25.08.12	18:45	BE	75°00.04	N	15°19.99	E	886			
POS437-2					25.08.12	19:03	BO	75°00.00	N	15°20.01	E			12.3	
POS437-2					25.08.12	19:17	EN	75°00.00	N	15°20.02	E				
POS437-2	378	1	11	CTD/ROS+LADCP	25.08.12	20:52	BE	75°00.06	N	14°40.04	E	1325			LADCP did not work properly
POS437-2					25.08.12	21:16	BO	75°00.04	N	14°40.07	E	1327	1302.0	10.9	
POS437-2					25.08.12	21:41	EN	75°00.04	N	14°40.03	E	1329			
POS437-2	379	1	12	CTD/ROS+LADCP	25.08.12	23:10	BE	74°59.95	N	13°59.95	E	1763			
POS437-2					25.08.12	23:42	BO	74°59.89	N	14°00.06	E	1757	1727.0	8.9	
POS437-2					26.08.12	00:16	EN	74°59.89	N	13°59.98	E	1754			
POS437-2	380	1	13	CTD/ROS+LADCP	26.08.12	01:50	BE	75°00.04	N	13°19.99	E	1970			at downcast 1150 mafunction
POS437-2					26.08.12	02:26	BO	75°00.01	N	13°19.92	E	1973	1948.1	10	of pump
POS437-2					26.08.12	03:02	EN	75°00.01	N	13°19.91	E	1978			
POS437-2	381	1	14	CTD/ROS+LADCP	26.08.12	04:40	BE	75°00.01	N	12°40.00	E	2166			
POS437-2					26.08.12	05:14	BO	75°00.00	N	12°40.00	E		2134.4	14.8	
POS437-2					26.08.12	05:50	EN	75°00.00	N	12°40.00	E				
POS437-2	382	1	15	CTD/ROS+LADCP	26.08.12	07:18	BE	75°00.01	N	11°59.95	E	2314			
POS437-2					26.08.12	07:58	BO	75°00.00	N	12°00.04	E	2254	2294.4	10.4	
POS437-2					26.08.12	08:45	EN	74°59.94	N	11°59.79	E				
POS437-2	383	1	16	CTD/ROS+LADCP	26.08.12	10:18	BE	75°00.00	N	11°19.97	E	2447			malfunction of pump at downcast
POS437-2					26.08.12	11:01	BO	74°59.91	N	11°19.92	E	2450	2426,0	8.7	
POS437-2					26.08.12	11:46	EN	74°59.85	N	11°19.92	E	2447			
POS437-2	384	1	17	CTD/ROS+LADCP	26.08.12	13:20	BE	74°59.99	N	10°40.01	E	2528			
POS437-2					26.08.12	14:06	BO	74°59.91	N	10°40.07	E	2480	2510.8	8	
POS437-2					26.08.12	14:59	EN	74°59.86	N	10°40.01	E				
POS437-2	385	1	18	CTD/ROS+LADCP	26.08.12	16:30	BE	75°00.00	N	9°59.88	E	2574			
POS437-2					26.08.12	17:15	BO	75°00.00	N	9°59.97	E		2553.8	13.6	
POS437-2					26.08.12	18:02	EN	74°59.97	N	9°59.82	E				

POS437-2	386	1	19	CTD/ROS+LADCP	26.08.12	19:27	BE	75°00.06	N	9°20.00	E	2600			malfunction of CTD at 1500 m
POS437-2													1500.0		
POS437-2					26.08.12	20:22	EN	75°00.06	N	9°19.97	E				
POS437-2	386	2	20	CTD/ROS+LADCP	26.08.12	22:03	BE	75°00.02	N	9°20.07	E	2586			
POS437-2					26.08.12	22:54	BO	74°59.99	N	9°20.01	E	2614	2584.4	10	
POS437-2					26.08.12	23:23	EN	75°00.03	N	9°20.19	E				
POS437-2	387	1	21	CTD/ROS+LADCP	27.08.12	01:28	BE	75°00.07	N	8°40.28	E	2670			
POS437-2					27.08.12	02:17	BO	75°00.12	N		E	2585	2629.8	10	
POS437-2					27.08.12	03:13	EN	75°00.12	N	8°40.77	E				
POS437-2	388	1	22	CTD/ROS+LADCP	27.08.12	04:58	BE	75°00.03	N	8°00.01	E	3278			
POS437-2					27.08.12	05:33	BO	74°59.99	N	8°00.48	E		3268.6	12.6	
POS437-2					27.08.12	06:50	EN	74°59.95	N	8°00.62	E				
POS437-2	389	1	23	CTD/ROS+LADCP	27.08.12	08:24	BE	74°59.98	N	7°18.80	E	2500			
POS437-2					27.08.12	09:05	BO	74°59.92	N	7°19.56	E	2487	2460.2	12,0	
POS437-2					27.08.12	09:49	EN	74°59.83	N	7°18.80	E	2484			
POS437-2	390	1	24	CTD/ROS+LADCP	27.08.12	11:20	BE	75°00.00	N	6°39.92	E	2450			malfunction of CTD at downcast
POS437-2					27.08.12	12:23	BO	74°59.01	N	6°38.90	E	2441	2472.2	10,0	at 600m, stopped and then
POS437-2					27.08.12	13:22	EN	74°59.78	N	6°38.19	E	2545			continued
POS437-2	391	1	25	CTD/ROS+LADCP	27.08.12	14:52	BE	74°59.94	N	6°00.11	E	2877			malfunction of CTD at 2790m
POS437-2					27.08.12	15:45	BO	74°59.80	N	6°00.15	E		2854.9	10,0	and 600m, each time stopped
POS437-2					27.08.12	17:28	EN	74°59.55	N	6°00.44	E				and continued
POS437-2	392	1	26	CTD/ROS+LADCP	27.08.12	19:00	BE	75°00.06	N	5°19.93	E	3069			
POS437-2					27.08.12	19:49	BO	75°00.01	N	5°20.00	E		3045.4	9.3	
POS437-2					27.08.12	20:44	EN	74°59.98	N	5°20.26	E				
POS437-2	393	1	27	CTD/ROS+LADCP	27.08.12	22:26	BE	75°00.02	N	4°40.08	E	3472			malfunction of CTD at downcast
POS437-2					27.08.12	23:40	BO	74°59.92	N	4°39.83	E	3425	3445,0	12.3	at 2202m, stopped and then
POS437-2					28.08.12	00:44	EN	74°59.84	N	4°39.07	E				continued
POS437-2	394	1	28	CTD/ROS+LADCP	28.08.12	02:18	BE	74°59.96	N	3°59.83	E	3060			
POS437-2					28.08.12	03:06	BO	74°59.89	N	3°58.88	E		3033,0	9,0	
POS437-2					28.08.12	04:01	EN	74°59.86	N	3°58.38	E				
POS437-2	395	1	29	CTD/ROS+LADCP	28.08.12	05:25	BE	75°00.04	N	3°19.93	E	2260			malfunction of CTD at upcast
POS437-2					28.08.12	06:37	BO	75°00.03	N	3°19.33	E		3613.2	13.8	at 2016m, stopped and then
POS437-2					28.08.12	07:36	EN	75°00.02	N	3°18.77	E				continued
POS437-2	396	1	30	CTD/ROS+LADCP	28.08.12	09:11	BE	75°00.00	N	02°39.97	E	2995			
POS437-2					28.08.12	10:03	BO	75°00.01	N	02°39.96	E	2924	2975.5	11,0	
POS437-2					28.08.12	10:55	EN	75°00.00	N	02°39.82	E				
POS437-2	397	1	31	CTD/ROS+LADCP	28.08.12	12:31	BE	75°00.01	N	02°00.21	E	2785			
POS437-2					28.08.12	13:22	BO	74°59.97	N	1°59.60	E		2757.7	8	
POS437-2					28.08.12	14:23	EN	74°59.90	N	1°59.43	E				
POS437-2	398	1	32	CTD/ROS+LADCP	28.08.12	15:54	BE	74°59.97	N	1°19.95	E	3766			
POS437-2					28.08.12	16:54	BO	74°59.97	N	1°19.96	E		3768,0	12.6	
POS437-2					28.08.12	17:58	EN	74°59.95	N	1°19.91	E				
POS437-2	399	1	33	CTD/ROS+LADCP	28.08.12	19:17	BE	75°00.00	N	0°40.00	E	3768			
POS437-2					28.08.12	20:23	BO	74°59.96	N	0°40.02	E	3698	3770,0	11	
POS437-2					28.08.12	21:26	EN	75°00.04	N	0°40.40	E				
POS437-2	400	1	34	CTD/ROS+LADCP	28.08.12	22:55	BE	75°00.01	N	0°00.05	E	3760			malfunction of CTD at downcast
POS437-2					29.08.12	00:13	BO	74°59.93	N	0°00.13	E		3764,0	10	at 2424m, stopped and then
POS437-2					29.08.12	01:13	EN	74°59.83	N	0°00.11	E				continued
POS437-2	401	1	35	CTD/ROS+LADCP	29.08.12	02:59	BE	75°00.06	N	0°40.18	W	3767			malfunction of CTD at downcast
POS437-2					29.08.12	04:13	BO	74°59.99	N	0°40.40	W		3748,0	10.5	at 2609m, stopped and then
POS437-2					29.08.12	05:16	EN	74°59.79	N	0°40.33	W				continued
POS437-2	402	1	36	CTD/ROS+LADCP	29.08.12	06:41	BE	74°59.99	N	1°20.18	W	3715			malfunction of CTD at downcast
POS437-2					29.08.12	08:03	BO	74°59.94	N	1°20.18	W	3637	3709,0	12	at 2127m, stopped and then
POS437-2					29.08.12	09:06	EN	74°59.95	N	1°20.16	W				continued
POS437-2	403	1	37	CTD/ROS+LADCP	29.08.12	10:50	BE	74°59.80	N	2°00.06	W	3703			malfunction of CTD at downcast
POS437-2					29.08.12	12:02	BO	74°59.95	N	1°59.80	W		3663,0	8,0	at 1300m, at upcast 3400, stopped and then
POS437-2					29.08.12	13:13	EN	74°59.94	N	1°59.79	W				continued
POS437-2	403-2			Float deployment	29.08.12	13:19		74°59.92	N	1°59.88	W				
POS437-2	404	1	38	CTD/ROS+LADCP	29.08.12	15:29	BE	75°00.02	N	2°40.04	W	3689			no NMEA data
POS437-2					29.08.12	16:32	BO	74°59.98	N	2°39.54	W		3695.6	11.6	only 1 bottle fired
POS437-2					29.08.12	17:34	EN	74°59.88	N	2°38.24	W				from here onward SBE2
POS437-2	405	1	39	CTD/ROS+LADCP	29.08.12	19:36	BE	75°00.00	N	3°20.05	W	3570			no NMEA data
POS437-2					29.08.12	20:38	BO	74°59.80	N	3°20.99	W	3509	3558,0	11,0	
POS437-2					29.08.12	21:39	EN	74°59.50	N	3°20.56	W				
POS437-2	405-2			Float deployment	29.08.12	21:49		74°59.42	N	3°20.19	W				
POS437-2	406	1	40	CTD/ROS+LADCP	30.08.12	00:28	BE	74°59.91	N	3°59.92	W	3641			malfunction of CTD at upcast
POS437-2					30.08.12	01:32	BO	74°59.16	N	4°00.80	W		3645,0	9,0	at 10m, stopped and then
POS437-2					30.08.12	02:35	EN	74°58.61	N	4°02.28	W				continued

POS437-2	407	1	41	CTD/ROS+LADCP	30.08.12	10:42	BE	74°59.59	N	4°40.64	W	3613			
POS437-2					30.08.12	11:45	BO	74°59.34	N	4°41.29	W	3545	3616.1	12,0	
POS437-2					30.08.12	12:56	EN	74°58.78	N	4°42.34	W				
POS437-2	408	1	42	CTD/ROS+LADCP	30.08.12	14:33	BE	74°59.94	N	5°20.12	W	3571			
POS437-2					30.08.12	15:37	BO	74°59.37	N	5°21.45	W	3505	3572,0	10,0	
POS437-2					30.08.12	16:39	EN	74°58.76	N	5°22.62	W				
POS437-2	409	1	43	CTD/ROS+LADCP	30.08.12	18:08	BE	74°59.86	N	6°00.22	W	3563			
POS437-2					30.08.12	19:11	BO	74°59.09	N	6°03.19	W		3514,0	19,0	
POS437-2					30.08.12	20:11	EN	74°58.55	N	6°04.59	W				
POS437-2	410	1	44	CTD/ROS+LADCP	01.09.12	08:22	BE	75°00.01	N	6°40.04	W	3497			from here onward caroussel 2
POS437-2					01.09.12	09:23	BO	75°00.00	N	6°40.14	W	3418	3482,0	13,0	
POS437-2					01.09.12	10:23	EN	74°59.96	N	6°39.95	W				
POS437-2	411	1	45	CTD/ROS+LADCP	01.09.12	11:54	BE	75°00.00	N	7°19.88	W	3450			
POS437-2					01.09.12	12:56	BO	75°00.00	N	7°19.80	W		3435.2	9,0	
POS437-2					01.09.12	13:56	EN	74°59.93	N	7°20.34	W				
POS437-2	412	1	46	CTD/ROS+LADCP	01.09.12	15:31	BE	74°59.96	N	7°59.75	W	3395			
POS437-2					01.09.12	16:32	BO	74°59.98	N	7°59.98	W		3389.5	12,0	
POS437-2					01.09.12	17:34	EN	74°59.99	N	7°59.95	W				
POS437-2	413	1	47	CTD/ROS+LADCP	01.09.12	19:01	BE	74°59.96	N	8°40.03	W	3350			
POS437-2					01.09.12	19:58	BO	74°59.98	N	8°39.92	W	3286	3347,0	13,0	
POS437-2					01.09.12	20:50	EN	74°59.93	N	8°39.94	W				
POS437-2	414	1	48	CTD/ROS+LADCP	01.09.12	22:16	EN	74°59.99	N	9°20.02	W	3287			
POS437-2					01.09.12	23:15	BO	74°59.92	N	9°19.95	W	3220	3279.3	14,0	
POS437-2					02.09.12	00:15	EN	74°59.97	N	9°19.78	W				
POS437-2	415	1	49	CTD/ROS+LADCP	02.09.12	01:59	BE	74°59.94	N	10°00.39	W	3226.8			no LADCP
POS437-2					02.09.12	02:57	BO	75°00.05	N	10°00.11	W		3198,0	12,0	
POS437-2					02.09.12	03:57	EN	75°00.18	N	9°59.92	W				
POS437-2	416	1	50	CTD/ROS+LADCP	02.09.12	05:28	BE	74°59.97	N	10°39.94	W	3050.9			
POS437-2					02.09.12	06:22	BO	75°00.04	N	10°39.40	W		3039.2	12,0	
POS437-2					02.09.12	07:16	EN	75°00.04	N	10°38.43	W				
POS437-2	417	1	51	CTD/ROS+LADCP	02.09.12	08:46	BE	74°59.99	N	11°20.03	W	2435			
POS437-2					02.09.12	09:30	BO	74°59.96	N	11°20.15	W	2374	2414,0	13,0	
POS437-2					02.09.12	10:13	EN	74°59.94	N	11°20.46	W				
POS437-2	418	1	52	CTD/ROS+LADCP	02.09.12	11:32	BE	74°59.98	N	12°00.05	W	1738			
POS437-2					02.09.12	12:03	BO	74°59.97	N	12°00.11	W		1721.6	10,0	
POS437-2					02.09.12	12:30	EN	74°59.98	N	12°00.45	W				
POS437-2	419	1	53	CTD/ROS+LADCP	02.09.12	13:54	BE	75°00.01	N	12°40.18	W	741			
POS437-2					02.09.12	14:09	BO	75°00.05	N	12°40.27	W		725.7	8,0	
POS437-2					02.09.12	14:21	EN	75°00.02	N	12°40.42	W				
POS437-2	420	1	54	CTD/ROS+LADCP	02.09.12	15:05	BE	75°00.11	N	12°57.21	W	359.4			
POS437-2					02.09.12	15:15	BO	75°00.09	N	12°57.30	W			9,0	
POS437-2					02.09.12	15:22	EN	75°00.06	N	12°57.36	W				
POS437-2	421-1			Float deployment	04.09.12	07:39		70°39.91	N	1°34.82	E				
POS437-2	422-1			Float deployment	04.09.12	08:29		70°39.36	N	1°42.57	E				

Sonde	Cast	Date	Time (from - to)	max depth [m]	Latitude			Longitude			ship speed [kn]	Comments
68		19.08.2012	21:11 - 22:20	1000	74	20,01	N	05	30,01	W	0	CTD Stat 363 for UCTD calibration, upcast every 50m stop for 1min
67		19.08.2012	21:12 - 22:20	1000	74	20,01	N	05	30,01	W	0	CTD Stat 363 for UCTD calibration, upcast every 50m stop for 1min
68	1	19.08.2012	22:57 - 23:03	812	74	20,08	N	05	30,27	W	4	start of 1. profile
67	2	19.08.2012	23:34 - 23:58	863	74	21,84	N	05	36,75	W	4	new splice
67	3	20.08.2012	00:04 - 00:26	798	74	23,25	N	05	41,97	W	4	
67	4	20.08.2012	00:33 - 00:55	875	74	24,65	N	05	47,10	W	4	
67	5	20.08.2012	01:01 - 01:23	844	74	26,04	N	05	52,25	W	4	
67	6	20.08.2012	01:30 - 01:52	866	74	27,47	N	05	57,55	W	4	
67	7	20.08.2012	01:58 - 02:20	826	74	28,81	N	06	2,48	W	4	
67	8	20.08.2012	02:26 - 02:48	854	74	30,18	N	06	7,54	W	4	probe smootly touched the ship's side
67	9	20.08.2012	02:55 - 03:16	816	74	31,56	N	06	12,63	W	4	
67	10	20.08.2012	03:23 - 03:44	819	74	32,90	N	06	17,64	W	4	
67	11	20.08.2012	03:50 - 04:12	824	74	34,24	N	06	22,63	W	4	
68	12	20.08.2012	04:28 - 04:50	859	74	36,09	N	06	29,53	W	4	new splice
68	13	20.08.2012	04:57 - 05:19	819	74	37,52	N	06	34,84	W	4	
68	14	20.08.2012	05:27 - 05:48	840	74	39,03	N	06	40,48	W	4	
68	15	20.08.2012	05:55 - 06:18	844	74	40,48	N	06	45,81	W	4	
68	16	20.08.2012	06:25 - 06:48	859	74	41,94	N	06	51,36	W	4	
68	17	20.08.2012	06:55 - 07:18	847	74	43,42	N	06	56,95	W	4	
68	18	20.08.2012	07:25 - 07:47	864	74	44,91	N	07	2,54	W	4	
68	19	20.08.2012	07:54 - 08:17	847	74	46,33	N	07	7,91	W	4	
67	20	20.08.2012	08:34 - 08:40	853	74	48,27	N	07	15,25	W	4	new splice
67	21	20.08.2012	09:03 - 09:26	841	74	49,68	N	07	20,59	W	4	
67	22	20.08.2012	09:33 - 09:26	872	74	51,13	N	07	26,06	W	4	
67	23	20.08.2012	10:02 - 10:24	851	74	52,58	N	07	31,57	W	4	
67	24	20.08.2012	10:31 - 10:53	878	74	53,99	N	07	36,90	W	4	
67	25	20.08.2012	10:59 - 11:22	848	74	55,33	N	07	42,02	W	4	
67	26	20.08.2012	11:28 - 11:50	876	74	56,74	N	07	47,43	W	4	
67	27	20.08.2012	11:57 - 12:02	842	74	58,23	N	07	53,10	W	4	
67	28	20.08.2012	12:25 - 12:46	874	74	59,61	N	07	58,37	W	4	
67	29	20.08.2012	12:52 - 13:14	826	75	1,00	N	08	3,68	W	4	
68	30	20.08.2012	13:27 - 13:49	857	75	2,80	N	08	10,58	W	4	new splice
68	31	20.08.2012	13:55 - 14:18	845	75	4,19	N	08	15,92	W	4	
68	32	20.08.2012	14:25 - 14:46	853	75	5,68	N	08	21,64	W	4	
68	33	20.08.2012	14:52 - 15:14	823	75	7,03	N	08	26,86	W	4	
68	34	20.08.2012	15:20 - 15:41	862	75	8,55	N	08	32,13	W	4	
68	35	20.08.2012	15:47 - 16:09	814	75	9,99	N	08	36,90	W	4	
68	36	20.08.2012	16:16 - 16:37	851	75	11,39	N	08	42,80	W	4	1. profile finished
67		20.08.2012	18:00 - 19:10	1000	75	19,22	N	08	19,01	W	0	CTD Stat 365 for UCTD calibration, upcast every 50m stop for 1min
68		20.08.2012	18:00 - 19:10	1000	75	19,22	N	08	19,01	W	0	CTD Stat 365 for UCTD calibration, upcast every 50m stop for 1min

68	37	20.08.2012	19:34 - 19:57	770	75	19,17	N	08	18,83	W	4	start of 2. profile- Stat 366, new splice
68	38	20.08.2012	20:04 - 20:27	858	75	17,77	N	08	13,28	W	4	
67	39	20.08.2012	20:44 - 21:06	834	75	15,85	N	08	5,72	W	4	7,64 V, new splice
67	40	20.08.2012	21:13 - 21:35	871	75	14,46	N	08	0,26	W	4	
67	41	20.08.2012	21:41 - 22:04	856	75	13,15	N	07	55,14	W	4	
67	42	20.08.2012	22:10 - 22:33	874	75	11,77	N	07	49,74	W	4	
67	43	20.08.2012	22:39 - 23:01	849	75	10,40	N	07	44,38	W	4	
67	44	20.08.2012	23:08 - 23:30	875	75	9,05	N	07	39,10	W	4	
67	45	20.08.2012	23:37 - 24:00	829	75	7,67	N	07	33,71	W	4	
67	46	21.08.2012	00:05 - 00:26	886	75	6,35	N	07	28,56	W	4	
67	47	21.08.2012	00:32 - 00:55	855	75	5,13	N	07	23,82	W	4	
67	48	21.08.2012	01:01 - 01:22	867	75	3,75	N	07	18,47	W	4	
68	49	21.08.2012	01:35 - 01:58	859	75	2,13	N	07	12,21	W	4	new splice
68	50	21.08.2012	02:03 - 02:25	867	75	0,82	N	07	7,10	W	4	
68	51	21.08.2012	02:31 - 02:53	833	74	59,46	N	07	1,85	W	4	
68	52	21.08.2012	02:59 - 03:20	853	74	58,06	N	06	56,48	W	4	
68	53	21.08.2012	03:27 - 03:48	829	74	56,71	N	06	51,29	W	4	
68	54	21.08.2012	03:54 - 04:16	850	74	55,43	N	06	46,37	W	4	
68	55	21.08.2012	04:22 - 04:46	843	74	54,12	N	06	41,34	W	4	
68	56	21.08.2012	04:52 - 05:14	910	74	52,77	N	06	36,13	W	4	
68	57	21.08.2012	05:21 - 05:43	861	74	51,50	N	06	31,27	W	4	
68	58	21.08.2012	05:50 - 06:12	890	74	50,23	N	06	26,40	W	4	
67	59	21.08.2012	06:25 - 06:47	832	74	48,54	N	06	19,93	W	4	7,58 V, new splice
67	60	21.08.2012	06:54 - 07:39	864	74	47,16	N	06	14,67	W	4/2	Seil verheddert
67	61	21.08.2012	07:47 - 08:10	870	74	45,21	N	06	7,27	W	4	
67	62	21.08.2012	08:16 - 08:38	890	74	43,83	N	06	2,01	W	4	
67	63	21.08.2012	08:45 - 09:07	850	74	42,44	N	05	56,78	W	4	
67	64	21.08.2012	09:13 - 09:35	889	74	41,08	N	05	51,60	W	4	
67	65	21.08.2012	09:42 - 10:04	829	74	39,67	N	05	46,27	W	4	
67	66	21.08.2012	10:11 - 10:34	889	74	38,24	N	05	40,89	W	4	
67	67	21.08.2012	10:41 - 11:03	826	74	36,77	N	05	35,32	W	4	
67	68	21.08.2012	11:09 - 11:31	870	74	35,41	N	05	30,19	W	4	
67	69	21.08.2012	11:38 - 12:00	851	74	34,03	N	05	25,05	W	4	2. profile finished
67		21.08.2012	13:20 - 14:40	1000	74	40,31	N	04	55,48	W	0	CTD Stat 367 for UCTD calibration upcast every 50m stop for 1min
68		21.08.2012	13:20 - 14:40	1000	74	40,31	N	04	55,48	W	0	CTD Stat 367 for UCTD calibration upcast every 50m stop for 1min
67	70	21.08.2012	15:10 - 15:33	820	74	40,21	N	04	55,33	W	4	start of 3. profile, new splice
67	71	21.08.2012	15:39 - 16:00	856	74	41,64	N	05	0,64	W	4	
68	72	21.08.2012	16:07 - 16:30	847	74	43,03	N	05	5,71	W	4	
68	73	21.08.2012	16:36 - 16:58	902	74	44,41	N	05	10,92	W	4	
68	74	21.08.2012	17:03 - 17:26	871	74	45,66	N	05	15,72	W	4	
68	75	21.08.2012	17:32 - 17:54	895	74	47,02	N	05	20,84	W	4	
68	76	21.08.2012	18:00 - 18:22	851	74	48,38	N	05	26,07	W	4	
68	77	21.08.2012	18:28 - 18:50	893	74	49,75	N	05	31,32	W	4	

68	78	21.08.2012	18:56 - 19:18	849	74	51,05	N	05	36,25	W	4	
68	79	21.08.2012	19:24 - 19:46	908	74	52,29	N	05	40,99	W	4	
68	80	21.08.2012	19:52 - 20:14	863	74	53,56	N	05	45,89	W	4	
67	81	21.08.2012	20:26 - 20:42	889	74	55,16	N	05	52,02	W	4	7,77V, new splice
67	82	21.08.2012	20:54 - 21:00	865	74	56,48	N	05	57,09	W	4	
67	83	21.08.2012	21:23 - 21:44	890	74	57,82	N	06	2,23	W	4	
67	84	21.08.2012	21:50 - 22:12	866	74	59,05	N	06	6,99	W	4	
67	85	21.08.2012	22:18 - 22:40	898	74	0,33	N	06	11,91	W	4	
67	86	21.08.2012	22:46 - 23:08	870	74	1,61	N	06	16,88	W	4	
67	87	21.08.2012	23:14 - 23:37	907	75	2,90	N	06	21,85	W	4	
67	88	21.08.2012	23:42 - 00:05	883	75	4,19	N	06	26,87	W	4	
67	89	22.08.2012	00:11 - 00:31	901	75	5,53	N	06	32,08	W	4	
67	90	22.08.2012	00:37 - 00:59	861	75	6,79	N	06	37,02	W	4	
68	91	22.08.2012	01:12 - 01:35	890	75	8,52	N	06	43,71	W	4	new splice
68	92	22.08.2012	01:41 - 02:03	844	75	9,95	N	06	49,30	W	4	
68	93	22.08.2012	02:08 - 02:29	876	75	11,35	N	06	54,85	W	4	
68	94	22.08.2012	02:37 - 02:57	870	75	12,93	N	07	0,95	W	4	
68	95	22.08.2012	03:03 - 03:23	843	75	14,21	N	07	6,02	W	4	
68	96	22.08.2012	03:29 - 03:48	877	75	15,47	N	07	10,96	W	4	3. profile finished
67		22.08.2012	06:00 - 07:00	1000	75	25,18	N	06	52,63	W	0	CTD Stat 369 for UCTD calibration upcast every 50m stop for 1min
68		22.08.2012	06:00 - 07:00	1000	75	25,18	N	06	52,63	W	0	CTD Stat 369 for UCTD calibration upcast every 50m stop for 1min
67	97	22.08.2012	07:33 - 07:57	815	75	24,04	N	06	48,26	W	4	start of 4. profile
67	98	22.08.2012	08:03 - 08:27	891	75	22,61	N	06	42,63	W	4	
67	99	22.08.2012	08:33 - 08:54	845	75	21,18	N	06	36,94	W	4	
68	100	22.08.2012	09:09 - 09:31	869	75	19,46	N	06	30,16	W	4	new splice
68	101	22.08.2012	09:37 - 09:59	853	75	18,06	N	06	24,68	W	4	
68	102	22.08.2012	10:05 - 10:27	917	75	16,72	N	06	19,33	W	4	
68	103	22.08.2012	10:32 - 10:54	858	75	15,45	N	06	14,36	W	4	
68	104	22.08.2012	11:00 - 11:22	886	75	14,13	N	06	9,19	W	4	
68	105	22.08.2012	11:28 - 11:50	826	75	12,73	N	06	3,74	W	4	
68	106	22.08.2012	11:56 - 12:16	888	75	11,34	N	05	58,27	W	4	
68	107	22.08.2012	12:22 - 12:44	844	75	10,08	N	05	53,38	W	4	
68	108	22.08.2012	12:49 - 13:11	886	75	8,79	N	05	48,36	W	4	
68	109	22.08.2012	13:16 - 13:38	832	75	7,48	N	05	43,23	W	4	
67	110	22.08.2012	13:50 - 14:12	889	75	5,88	N	05	37,00	W	4	new splice
67	111	22.08.2012	14:18 - 14:40	848	75	4,62	N	05	32,09	W	4	
67	112	22.08.2012	14:45 - 15:06	876	75	3,31	N	05	26,99	W	4	
67	113	22.08.2012	15:12 - 15:31	832	75	2,05	N	05	22,11	W	4	
67	114	22.08.2012	15:39 - 15:59	888	75	0,75	N	05	17,07	W	4	
67	115	22.08.2012	16:05 - 16:27	842	74	59,52	N	05	12,33	W	4	
67	116	22.08.2012	16:33 - 16:54	875	74	58,19	N	05	7,21	W	4	
67	117	22.08.2012	17:00 - 17:22	850	74	56,93	N	05	2,38	W	4	
68	118	22.08.2012	17:34 - 17:56	892	74	55,36	N	04	56,33	W	4	new splice

68	119	22.08.2012	18:02 - 18:24	860	74	54,02	N	04	51,18	W	4	
68	120	22.08.2012	18:30 - 18:53	892	74	52,76	N	04	46,35	W	4	
68	121	22.08.2012	18:59 - 19:21	840	74	51,39	N	04	41,08	W	4	
68	122	22.08.2012	19:27 - 19:49	898	74	50,04	N	04	35,92	W	4	
68	123	22.08.2012	19:55 - 20:17	848	74	48,71	N	04	30,82	W	4	4. profile finished
68		22.08.2012	21:42	1000	74	54,47	N	03	58,83	W	0	CTD Stat 371 for UCTD calibration upcast every 50m stop for 1min
67		22.08.2012	21:42	1000	74	54,47	N	03	58,83	W	0	CTD Stat 371 for UCTD calibration upcast every 50m stop for 1min
67	124	22.08.2012	23:17 - 23:40	889	74	54,66	N	03	59,65	W	4	new splice