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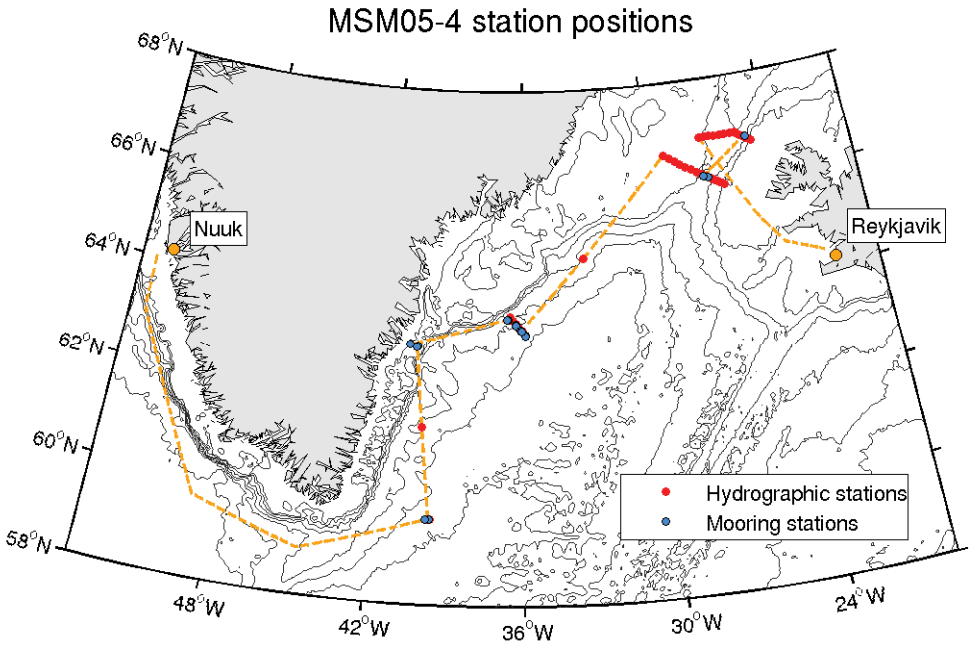
Cruise Report
RV MARIA S. MERIAN Cruise MSM05-4

Nuuk - Reykjavik
5. July – 16. July 2007
Chief Scientist: Detlef Quadfasel
Captain: Klaus Bergmann

Technical Report 1-07

On citing this report in a bibliography, the reference should be followed by the words *unpublished manuscript.*

*The scientific party of RV Maria S. Merian cruise MSM05-4 in Denmark Strait (**Photo Klaus Bergmann**).*



Ship track of RV Maria S. Merian cruise MSM05-4 with locations of moorings and CTD casts marked.

1. Objectives

RV Maria S. Merian cruise MSM05-4 was carried out jointly by the Institut für Meereskunde at the Centre for Marine and Atmospheric Sciences of the University of Hamburg, IfM-GEOMAR at the University of Kiel and the Lowestoft Laboratory of CEFAS. Scientists and technicians from the Naturinstitut in Nuuk (Greenland), Scripps Institution of Oceanography La Jolla, USA, the Faroese Fisheries Laboratory, Torhavn, the Germanischer Lloyd, Hamburg, and the Institut für Seefahrt Leer also participated in the cruise.

The measurements mainly contributed to three projects:

- the Marine Environment and Security for the European Area (MERSEA), funded by the European Union
- the Arctic Subarctic Ocean Flux Study (ASOF), partly funded by the European Commission under DAMOCLES, and
- the Nordatlantikprojekt, funded by the German Ministry of Education and Research

The main objective of the cruise was to recover and deploy self contained current meter and hydrographic moorings for the above projects. In addition, 47 CTD profiles were acquired at selected locations and underway measurements of meteorological and near surface ocean parameters were made, using the ship board observing system. Additional measurements were carried out to study vibrations of the of the vessel's moon pool structure. Also water samples for studying the CO_2 uptake of Polar waters were taken.

2. Narrative

Thursday, 5. July 2007
Noon position: Nuuk

The scientific party of cruise MSM05-4 embarked at 9 a.m. and loading of the equipment was done under the sunny skies of Nuuk. The instrumentation was set up in the laboratories and a diver installed the sensors for the vibration measurements in the moon pool.

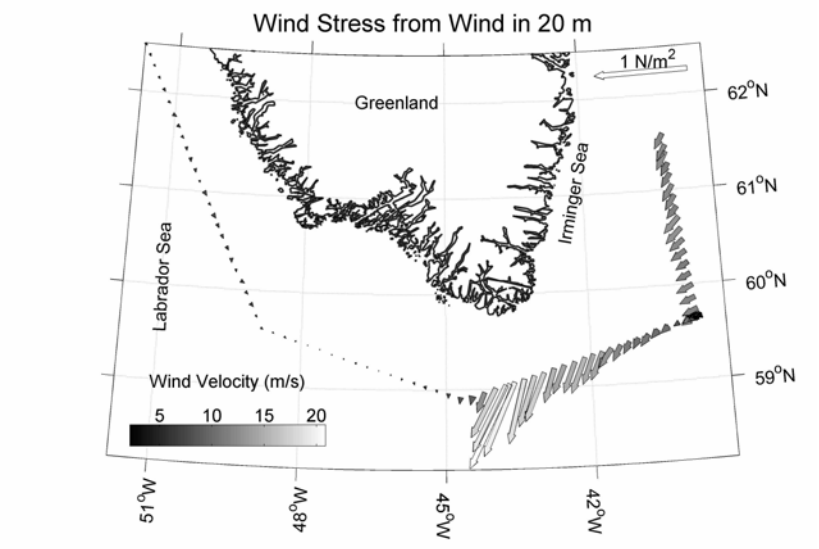
Friday, 6. July 2007
Noon position: 64° 07.3' N, 051° 54.0' W
Air temperature: 4.3 °C, wind: N 2 Bft

After breakfast the Chief mate gave an introduction to safety regulations and the newcomers had a guided tour around the vessel. RV Maria S. Merian sailed from the port of Nuuk at 9 a.m. In the fjord several runs with ship speeds ranging from zero to 14.5 knots were made, with the moon pools being open, closed and with instrumentation frames installed, to measure strains, water pressure, and accelerations at different locations in the moon pool. When the runs were finished, Merian set course for the first mooring position in the southern Irminger Sea. The different working groups started preparing the mooring instrumentation. During the afternoon the chief scientist gave an overview over the measurement program of the cruise.

Saturday, 7 July 2007
Noon position: 59° 31.4' N, 048° 18.1' W
Air temperature: 5.2 °C, wind: NNW 4 Bft

Preparation of the mooring instrumentation and the CTD system continued, and were only interrupted by a general alarm practice at 10:30 a.m. During the seminar in the evening Gunnar Voet gave a talk on Eddy induced entrainment into the Denmark Strait Overflow plume. Jürgen Göken talked about his work in material science at the University of Kassel.

Winds during the day were generally moderate, but after rounding Cape Farewell they increased from 3 to 8 Bft within just one hour. About 80 nm further east wind speeds diminished again to less than 4 Bft. This strong jet was caused by a convergence of the wind in eastern Greenland, where mountains reach heights of more than 2500 m. The large synoptic analyses of the weather services do not resolve these regional features.



Wind stress vectors along Merian's track to the south of Greenland, showing the narrow jet associated with the wind convergence east of the continent.

Sunday, 8. July 2007
Noon position: 59° 40.5' N, 39° 41.6' W
Air temperature: 10.5°C, wind: ENE 4 Bft

The Central Irminger Sea (CIS) mooring in a water depth of 3000 m was reached at 10:30 a.m. and recovered within less than 3 hours. An incident occurred when the plastic coated wire slipped on the capstan and the float containing two ADCPs fell on deck. There was a small damage to one of the transducers. The planned CTD profile had to be abandoned, because signals from the temperature and salinity sensors showed large fluctuations with periods of several seconds. Since changing cables, sensors, deck units, and even the conducting wire did not solve the problem, we had to exchange the entire underwater unit. That instrument then provided good profiles. After dinner the CIS mooring was re-deployed without any problems in just over two hours and we proceeded to the next mooring array on the East Greenland shelf.

Monday, 9. July 2007
Noon position: 62° 15.3' N, 40° 19.7' W
Air temperature: 7 °C, wind: NNE 5 Bft

Halfway to the mooring position the vessel stopped for a few minutes to allow sampling of near surface water for the Greenland CO_2 program. At 4 p.m. the bottom mounted ADCP with a Microcat on the shelf was released and taken on board. All instruments had worked well during the one year deployment period. The hydrographic tube mooring was released after dinner and recovered in just 45 minutes. Much to our disappointment the upper tube containing two Microcats was not attached to the mooring anymore. We suspect that passing ice bergs had ripped off the upper part of the mooring during the deployment period. Since tube moorings at this location had been lost also during the previous two years it was decided not to re-deploy.

Based on data from a quick CTD survey the bottom mounted ADCP was re-deployed about 10 nm further inshore from the previous mooring site at a water depth of 280 m. All operations at this site were completed at 11:30 p.m. and the vessel proceeded to the Angmagssalik array.

The East Greenland coast at the location of the shelf array, July 9th 2007.

Tuesday, 10. July 2007
Noon position: 63° 27.8' N, 36° 17.2' W
Air temperature: 9 °C, wind NE 5 Bft

The first of the four overflow moorings, F1/2, was reached at 9 a.m., released and successfully recovered. No communication with the acoustic releaser of the second mooring, UK1, could be established, the same happened at the third mooring site, G1. The fourth mooring was then approached and released, and was on deck safely at 4 p.m. At 7:30 p.m. we started dredging for UK1. Although the dynamic positioning system of Merian allowed the dredging wire to be laid out in an almost perfect circle around the mooring position, this attempt was not successful and operations were halted at 1 a.m. the next day. In the on board seminar Uta Neumann gave a talk on convection in the Irminger Sea, based on several years of CIS mooring data.

Wednesday, 11. July 2007
Noon position: 63° 38.0' N, 35° 34.1' W
Air temperature: 8 °C, wind NNE 5 Bft.

Work continued at 2 a.m. with a CTD survey along the mooring line. During some of the stations the acoustic releasers to be deployed were tested and calibration runs for the recovered Microcats were made. Starting at 1 p.m. mooring F1/2, and in sequence UK1, G1 and UK2 were re-deployed, with the last anchor being dropped at 10:10 p.m. We then sailed back to the G1 position to dredge for the mooring that had given no acoustic response.

Thursday, 12. July 2007
Noon position: 63° 22.7' N, 36° 04.6' W
Air temperature: 10 °C, wind NE 6 Bft.

At 4 a.m. the dragging gear was deployed, consisting of three drag anchors mounted at the end of an 11 mm wire. About 5000 m of wire was paid out in a circular pattern around the mooring position. When no additional tension was seen on the wire during hauling, a second smaller circler was laid out, in the form of a spiral around the nominal mooring position. The wire was then hauled in, the anchors were back on deck at about 10 a.m., but the mooring had not been caught. Moorings UK1 and G1 thus have to be considered lost. After another Microcat calibration profile on the CTD the vessel proceeded to Denmark Strait, with a very frustrated chief scientist scratching his head. Johannes Karstensen gave a talk on new ocean research technologies, in particular on floats and gliders.

Friday, 13. July 2007
Noon position: 66° 30.8' N 28° 44.7' W
Air temperature: 1° C, wind: NNE 5 Bft.

After the disappointing experience during the previous days the chief scientist cancelled all mooring deployments on this Friday the 13th and instead we ran a closely spaced CTD section over the sill across Denmark Strait. In parallel the instruments for the final mooring deployments were prepared. In the seminar Stephen Dye talked about results from the Shelf and Angmagssalik arrays.

Saturday, 14. July 2007
Noon position: 66° 24.4' N, 26° 17.5' W
Air temperature: 2 °C, wind: NNE 4 Bft.

The CTD section was completed at 6 p.m. and before 10 p.m. the two ADCP moorings over the sill were deployed without any problems. We then steamed north, for the final mooring positions. An exploratory CTD cast at the PIES position showed large intrusions between Atlantic and Polar waters and it was decided to first run several CTDs at the eastern part of the planned section. Based on these results we shifted the PIES mooring site slightly to the east to better cover the two layer structure of northward flowing Atlantic and southward flowing overflow waters. The PIES was deployed at 9 p.m., but due to the presence of 13 fishing vessels in the immediate surrounding we refrained from also deploying the thermistor chain. After that we proceeded with the CTD section. In the seminar Gino Passalacqua talked about the recent IPCC report on climate change.

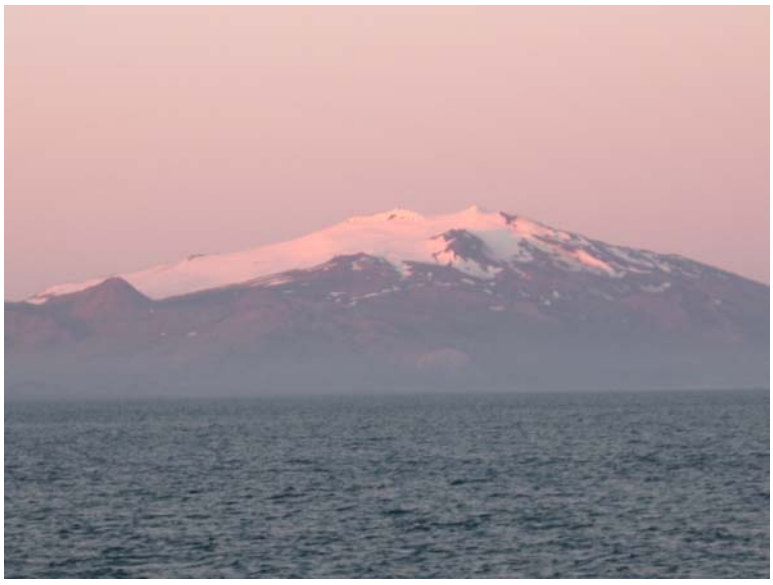
Deployment of the Inverted Echo Sounder (PIES) in Denmark Strait, , July 14th 2007.

Sunday, 15. July 2007
Noon position: 66° 30.7' N, 26° 46.4' W
Air temperature: 3 °C, wind: N 2 Bft.

This was a beautiful day. After several days of dense fog the sky was clear with bright sunshine. Whales were sighted and at last the cruise developed a touristy character. The last CTD station was completed at 9:20 a.m. and Merian set course for Reykjavik, running on two engines only, with a leisurely speed of 10 knots. Sunday's church in the chief scientist's cabin was followed by an excellent lunch and the whole crew, except the people on watch, retired for an afternoon nap. Later that afternoon we packed the containers, and cleaned the laboratories and cabins. Uwe Weidner gave the last seminar of the cruise, providing information on some of the German Lloyd's work, before the captain in the evening invited for a barrel of beer on the aft deck. In all the cruise had been quite successful, if not counting the 2 ½ mooring losses.

Monday 16. July 2007
Noon position: Reykjavik old harbour

The sea passage ended early in the morning, the Reykjavik pilot came on board at 9 a.m. and RV Maria S. Merian went alongside at 10 p.m. After lunch at 1 p.m. the scientific crew disembarked the vessel.



Snaefellsjökull northwest of Reykjavik in the evening sun. This volcano was used by Jules Verne as the entry point when travelling to the centre of the Earth. Regional warming coupled with a reduction of precipitation over Iceland has reduced the snow cover of this volcano substantially during the past decade.

3. Cruise participants

Scientific party:

Quadfasel, Detlef	Chief Scientist	IfM-ZMAW
Drübbisch, Ulrich	moorings	IfM-ZMAW
Dye, Stephen	moorings	CEFAS
Kristiansen, Regin	moorings	FFL
Karstensen, Johannes	moorings	IFM-GEOMAR
Göken, Jürgen	nautics	IS
Lennert, Kunuk	moorings, CTD	GINR
Needham, Neil	moorings	CEFAS
Neumann, Uta	moorings	IFM-GEOMAR
Niehus, Gerd	moorings	IFM-GEOMAR
Passalacqua, Gino	moorings, CTD	SIO
Rodehacke, Christian	CTD, ADCP	IfM-ZMAW
Verch, Norbert	CTD, moorings	IfM-ZMAW
Voet, Gunnar	CTD, moorings	IfM-ZMAW
Weidner, Uwe	vibration measurements	GL

IfM-ZMAW:	Institut für Meereskunde Centre for Marine and Atmospheric Sciences University of Hamburg, Germany
CEFAS:	Centre for Environment, Fishery and Aquaculture Sciences Lowestoft Laboratory, U.K.
FFL:	Fisheries Laboratory of the Faroes Torshavn, Faroe Islands
IFM-GEOMAR:	Leibniz Institut für Meereswissenschaften Kiel, Germany
IS:	Institut für Seefahrt Leer, Germany
GINR:	Greenland Institute of Natural Resources Nuuk, Greenland
SIO:	Scripps Institution of Oceanography La Jolla, U.S.A.
GL:	Germanischer Lloyd Hamburg, Germany

Ship crew:

BERGMANN, Klaus	Master
GUENTHER, Matthias	Chief Officer
SCHMIDT, Ralf	1st Officer
SOSSNA, Yves-Michael	2nd Officer
OGRODNIK, Thomas	Chief Engineer
ROGERS, Benjamin	2nd Engineer
DOHRN, Thomas	Motorman
NEITZEL, Gerd	Electrician
RIEDEL, Frank	Electronics
TOMIAK, Martin	SysOps
KREFT, Norbert	Bosun
NEVROTOV, Evgenij	Fitter
BADTKE, Rainer	A/B
SCHWIEGER, Hardy	A/B
SCHOENBECK, Thorsten	A/B
PRUCHNOW, Bernhard	A/B
BREITZKE, Ulrike	S/M
ECKARDT, Alexander	S/M
ARNDT, Waldemar	Cook
LUX, Karl-Heinz	2nd Cook
LIIDERS, Frank	Steward

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Abt. Forschungsschifffahrt
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5. Technical information

CTD system

47 CTD casts were completed on this cruise using a 12 bottle stainless steel frame configured in the following way:

Seabird 9/11 plus CTD
Seabird 24 position carousel
12 x 5 L Ocean Test Equipment “niskin” bottles

IfM CTD-1 showed large variability in the temperature and salinity traces. After cleaning all plugs, exchanging cables, sensors and the deck unit it became clear that the problems was with the under water unit. Data from station 558, where six casts were taken, are not suitable for scientific interpretation. From station 560 onwards IfM CTD-2 was used, providing good data throughout the cruise.

The configuration of IfM CTD-2 was:
Seabird 9+ underwater unit
Seabird 3 P temperature sensor s/n 1526
Seabird 4 Conductivity sensor s/n 1222
Digiquartz temperature compensated pressure sensor s/n 53573
Seabird 5T submersible pump
Seabird altimeter s/n 1119
Seabird 24 position carousel
Seabird 11+ V2 deck unit

Casts were initiated and terminated on deck. Between 5 and 12 water samples were taken per cast for calibration of the conductivity sensor. The near surface bottle was also sampled for the biogeochemical analysis.

Biogeochemical sampling

It has recently been suggested that sea ice may act as carbon pump in polar seas. During sea ice formation in polar seas, brine rejection increases the density in the underlying water column and thereby contributes to the formation of deep and intermediate water masses in the world ocean. Evidence has been presented that TCO_2 is rejected together with brine from growing sea ice and that low temperatures may result in a significant change in the ratio of TCO_2 and alkalinity in Arctic sea ice compared with surface waters. Water samples in the ice melt zone were collected to verify previous model calculation showing that this sea ice-driven carbon pump affects surface water partial pressure of CO_2 significantly in polar seas and potentially sequesters large amounts of CO_2 to the deep ocean. In short, surface samples from the water column were collected at each CTD station for determination of dissolved inorganic carbon (TCO_2), total alkalinity (TA), ^{18}O, nutrients and chlorophyll contents. Care was taken when filling the gas tight glass bottles (250 ml) for TCO_2, TA and ^{18}O determination to avoid bubble trapping and to ensure sufficient overflow. Samples were preserved with 50 µl $HgCl_2$ (saturated solution) and kept cold (2^{o}C) until analysis. Water samples for nutrients and Chlorophyll determination were frozen (-18^{o}C) until analysis. Standard methods of analysis will be performed on these samples in the laboratory in Nuuk.

ADCP

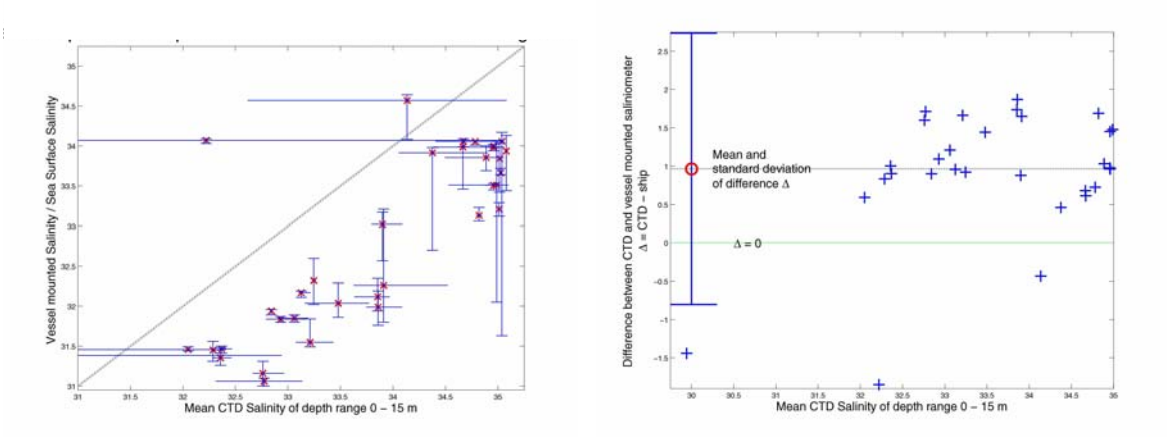
The Acoustic Doppler Current Profiler (ADCP) had been running almost constantly during the cruise without any problems. The instrument, which has been manufactured by RD Instruments (Poway, Ca., USA), has a working frequency of 75 kHz, ping rate of 0.7 Hz, and is specified for a maximal ship speed of 22 kn. Despite the fact that this instrument is specified for a maximal bottom track depth of 950 m, the operational maximal bottom search depth was set to 500 m. A constant salinity of 35 was utilized to calculate the velocities.

Thermosalinograph

The Thermosalinograph is permanently flushed by pure sea water. The manufacturers are Sea & Sun Technology GmbH (salinity sensor, type: CT 48) and Isotech (temperature sensor, type: PT100-1509). These sensors have a working range of 0-65 mS/cm and –3° C to 36° C.

Occasionally, the vessel mounted salinograph had reported unrealistic values, which had been too low in comparison to surface data collected by the CTD mounted sensor. After manually flushing of the measuring cell by the Maria S Merian's technical crew, the system seems to work correctly. However, sporadically this problem had occurred again. Ultimately at the end of the cruise the entire sensor head of the measurement cell was replaced to achieve the needed reliability of the instrument.

The mean difference between CTD and vessel mounted sensor was 0.97 with a standard deviation of 0.8. The high standard deviation indicates clearly that this instrument had not worked correctly and that the data are useless.



A comparison of salinities measured with the shipboard thermosalinograph with those obtained from the CTD on station revealed large differences, with a mean of about 1 and a standard deviation of more than 1.5. The problem was caused by a faulty sensor which was replaced by the end of the cruise.

Echosounding

During the cruise a multi-frequency ship mounted echo sounding system had been used, which does not interfere with the above described ADCP. The vertical mounted single beam echo sounding system EA600, manufactured by Kongsberg (Simrad) in Denmark, uses three different frequencies of 12 kHz, 38 kHz, and 200 kHz. With this setup the pulse duration (maximal transmitter power) is 16 ms (2000 W), 4 ms (2000 W), or 1 ms (1000 W), respectively. The maximal detection depth is 10000m, 3000 m, and 500 m, respectively. At mooring stations the system was shut of, when interference with other acoustic instruments, which initiate the release of moorings from its anchor weight, were likely. No problems occurred during the cruise with this instrument.

Meteorology

As part of the below described Data Logging facility, throughout the cruise the following data had been collected permanently: wind direction, wind speed, air temperature, air pressure, and humidity.

The wind direction and speed sensor, manufactured by Thies, are located at the top of the radar mast, where turbulences should be negligible. The accuracy of the direction is 2.5 degree.

The air temperature are measured with a resistor PT-100, manufactured by Friedrichs, and has an accuracy according to 1/3 DIN B or EN60751, respectively. The humidity is measured by a sensor produced by Rotronic. These sensors are mounted in a Labyrinth case located on monkey island.

The air pressure sensor from AIR has an accuracy of 0.5 hPa and is determined by considering QFN (air temperature is considered for calculating the pressure).

No calibrations of the meteorological data had been performed during the cruise.

Data Logging

Every second numerous sensors, which collect scientific relevant data at different locations on the ship, send their data via the ship's network into a central data base. Furthermore, also ship specific data like cruise direction and speed over ground are

integrated into the data base. In total, roughly 250 single sensors contribute to the date base, ranging from meteorological data, like air temperature, wind speed and direction, over oceanographic data, like surface water temperature and salinity, to water column thickness data, like echo sounding. The actual hardware hosting the data base is a pair of two SUNFire V.210-Server, which are configured as a fail-over pair working in load-sharing operation.

The data of the data base can be extracted easily through a web interface from all computers attached to the ships network from all cabins or laboratories. The result of guided data base queries are stored as ASCII text files, which can be downloaded after the query has been proceeded. The here described data base service is only a small part of an integrated data collecting, accessing, and storing system, which is called DavisShip (Datensammel-, -verteilungs- und speichersystem).

The following data have been made available and distributed for each cruise group: Time of measurement (in UTC/GMT), position as decimal latitude and longitude, depth derived from 12 kHz, 38 kHz, and 200 kHz echo sounding, sea surface salinity and temperature, as well as the following meteorological data: absolute wind direction and speed, air pressure, temperature and humidity.

Due to the above described temporal failure of the Thermosalinograph unit, we would like to use combined data base queries, like as setting thresholds for certain values. Best would be to generate SQL statements to use the full potential of data base systems. We wish we had been able to filter unrealistic low salinities directly and relate them directly to other properties, like the corresponding sea surface temperature. We are aware of the additional work load caused by sophisticated data bank queries, which might delay other parallel running data bank queries. However, this can be solved by starting these queries during times of low load.

Another point is that the data bank does not contain salinity values below 31, although during the cruise the online system had shown values as low as 27. If there is a built-in threshold for data this should be described and set according to values expected in the research area.

6. Scientific programmes - preliminary results

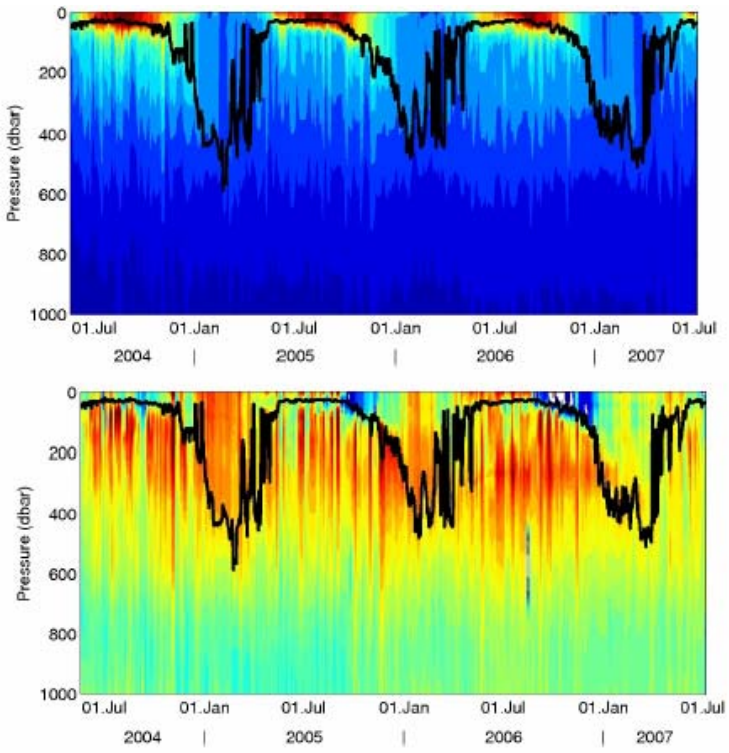
The Marine Environment and Security for the European Area (MERSEA)

Johannes Karstensen

The telemetry of the mooring had sent data during the full deployment period from August 2006 until recovery. However, the quality of the data was getting lower and lower. After recovery it was found that some connectors from the conductive swivels could have been cranked and later broke off possibly interrupting the data flow. Likely a intermittent connection through the sea-water could have been established from time to time. After recovery of the previous mooring from RRS Discovery in 2006 heavy corrosion was found. In particular, corrosion occurred at those parts of the mooring, where stainless steel or titanium came into direct contact with the galvanized shackles. To prevent/minimize the direct contact during the last deployment period a number of Teflon sheets were put between the components. The corrosion was very low during the 2006-07 deployment, however, it is unclear, if indeed the Teflon sheets are responsible for this.

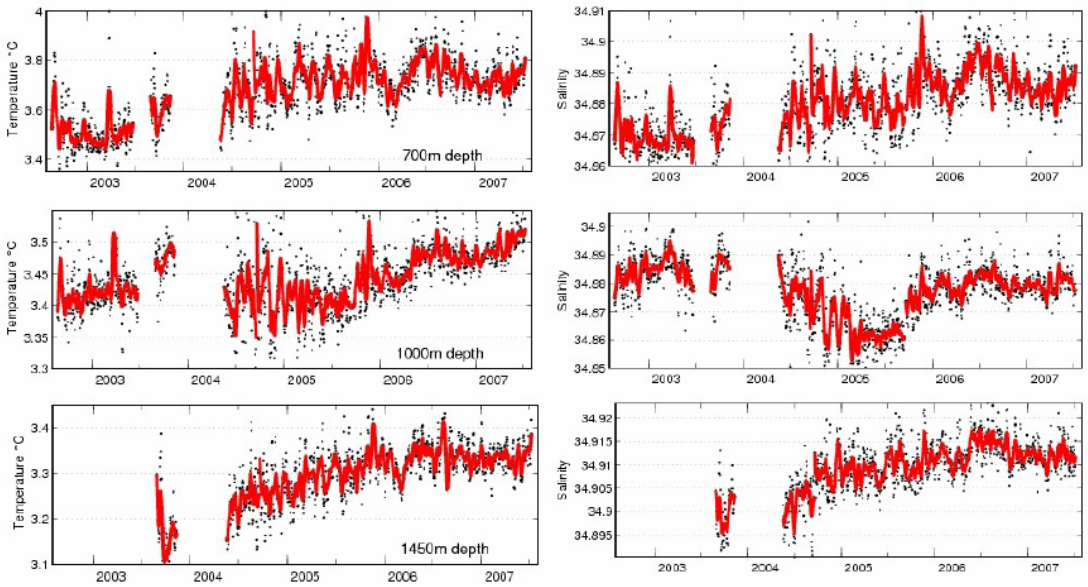
Time series of temperature and salinity from MicroCat data have been analysed for the mixed layer depth, defined by a decrease in temperature of 0.1°. The data reveal that convection has not reached the 600m level during the last three years. It has been

argued that during NAO high phases (as in 2006/2007) convection would be very deep in the Central Irminger Sea, ventilating one of the key water masses of the Atlantic meridional overturning circulation, the Labrador Sea Water. This can not be supported by our data.



Time-depth plots of temperature (top panel) and salinity (lower panel) at the CIS mooring site from summer 2004 to 2007. The black line indicates the mixed layer depth, calculated using a SST – 0.1 K criterion.

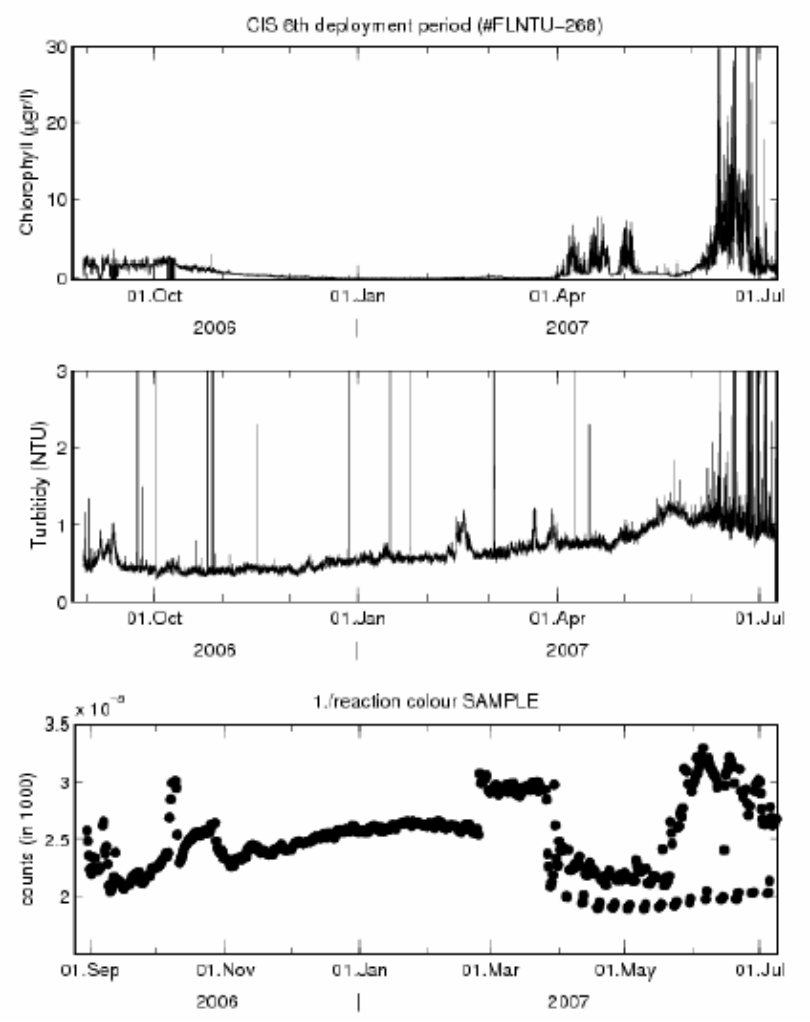
The time series at selected depth levels show only for the deepest level (no instrumentation before the end of 2003) a rather continuous increase in both, temperature and salinity. This depth level is occupied by a heavier mode of Labrador Sea Water, which was ventilated for the last time in the mid-1990s. Through the absence



Time series of temperature (left) and salinity (right) 700, 1000, and 1450m depth.

of further convective renewal in both, the Labrador and the Irminger Sea, this water is warmed and salinified by lateral admixture of warmer and more saline waters from the boundary. The variability at the 700m and 1000m levels appears to be dominated by advection of water from the Labrador Sea, but from lighter blends of Labrador Sea Water which might have been ventilated in recent years. A more detailed investigation of the observed variability in the Irminger Sea with the variability as seen in the Labrador Sea is needed.

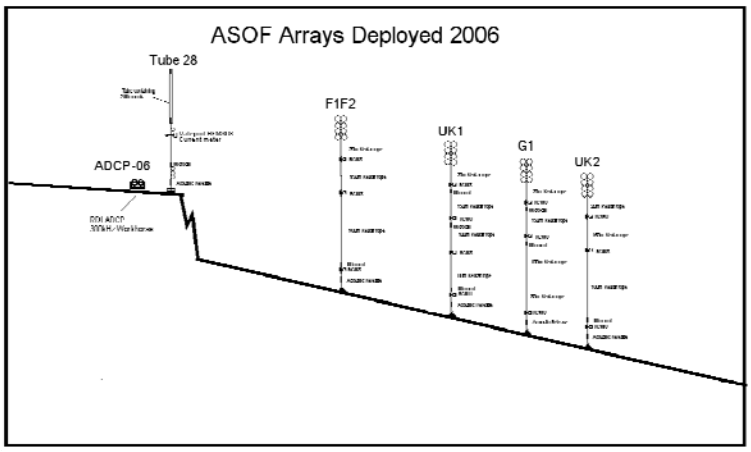
The time series of Chlorophyll-a phytoplankton indicates two blooms at the CIS region: One shortly after restratification (April) which might be even higher up in the water column than the 40m depth covered by the instrument. The second bloom occurs in mid June and is more intense. The stronger bloom is also associated with more diluted material (turbidity) and a decrease in nitrate (note figure shows reversed scale).



Time series of Chlorophyll-a (upper), Turbidity (middle), and Nitrate counts at nominally 40m depth during the 6th deployment of CIS. Note data is not calibrated yet.

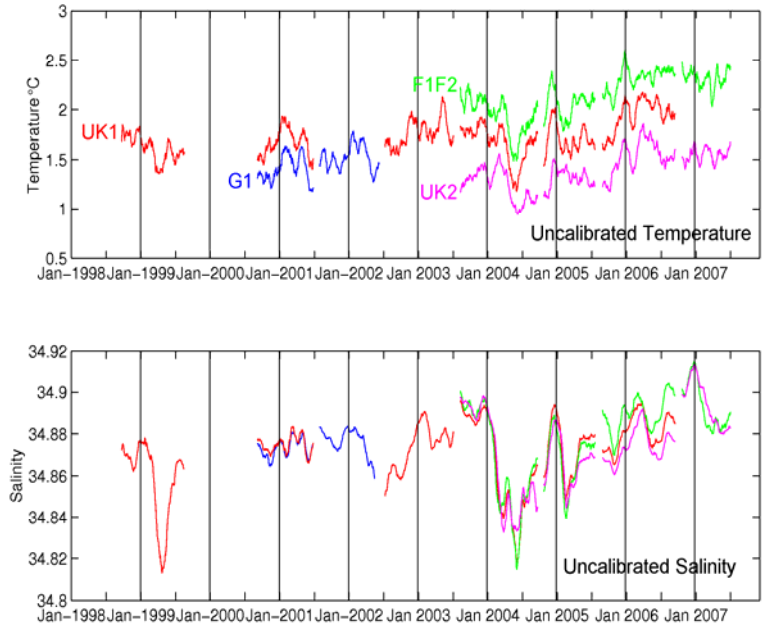
ASOF- Ocean fluxes South of Denmark Straits (ASOF-OFSOD)
Stephen Dye

Two arrays of moored instruments are maintained off SE Greenland by IfM-ZMAW, FIMR and CEFAS continuing the work of ASOF and partially contributing to the Damocles programme.



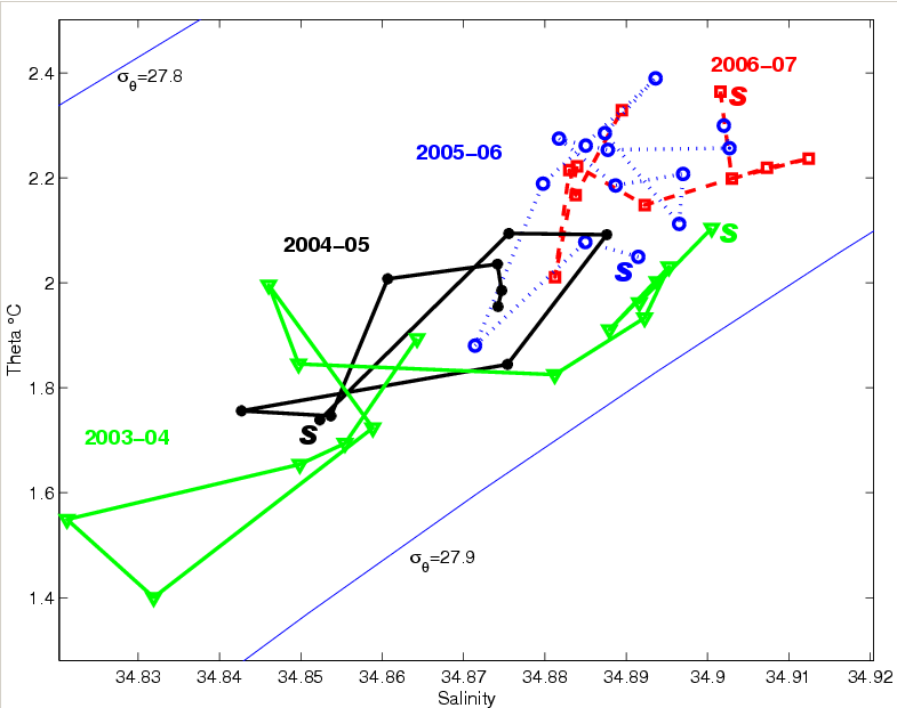
Configuration of the mooring arrays deployed in 2006 from RRS Discovery.

The Angmagssalik Current Meter Array monitors change in the cold, dense Denmark Strait Overflow where it descends the Continental Slope off SE Greenland. The first occupation of the Angmagssalik Current Meter Array was in 1986 and there has been a continuous presence since 1995. In September 2006, Cruise 311 of the RRS Discovery deployed 4 current meter moorings along this array – Moorings F1F2, UK1, G1 and UK2. Of these moorings UK1 and G1 could not be recovered on this cruise due to lack of contact with the acoustic releases. Dragging for both moorings was unsuccessful. All four moorings were redeployed.



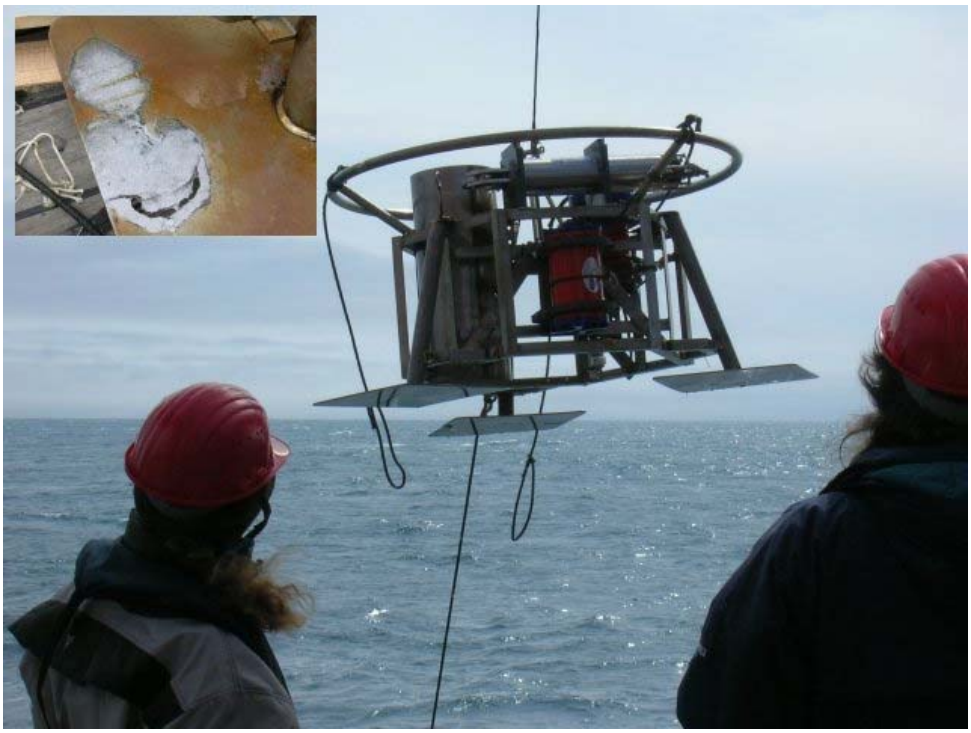
Deep current meter moorings have been augmented over recent years with Seabird SBE 16 or SBE 37 moored CTDs. Here we include the provisional data from the 2006-07 deployment of the moorings F1F2, UK1, G1 and UK2 within the full time-series so far recovered from the deepest instrumentation at 20m above bottom. The panels show T and S respectively (10 minute samples) as 28 day running means.

The most evident feature of these data in the latest year of the deployment is that the turn of the year saw a shift in salinity of the overflow water to the highest yet observed by the array. The salinities have yet to be finally calibrated but the instrument on UK2 was deployed straight from the factory. Despite the provisional status of the data it suggests that a high salinity period gave way to lower salinities across the array through the spring of 2007. The water observed at the array is also 0.5 - 1 °C warmer across the array than it was during the very low salinity event of 2004. The Theta-S plot from the F1F2 mooring illustrates the progression of the water mass properties since 2003 suggesting a gradual overall warming and salinification following the cold fresh event in 2004.

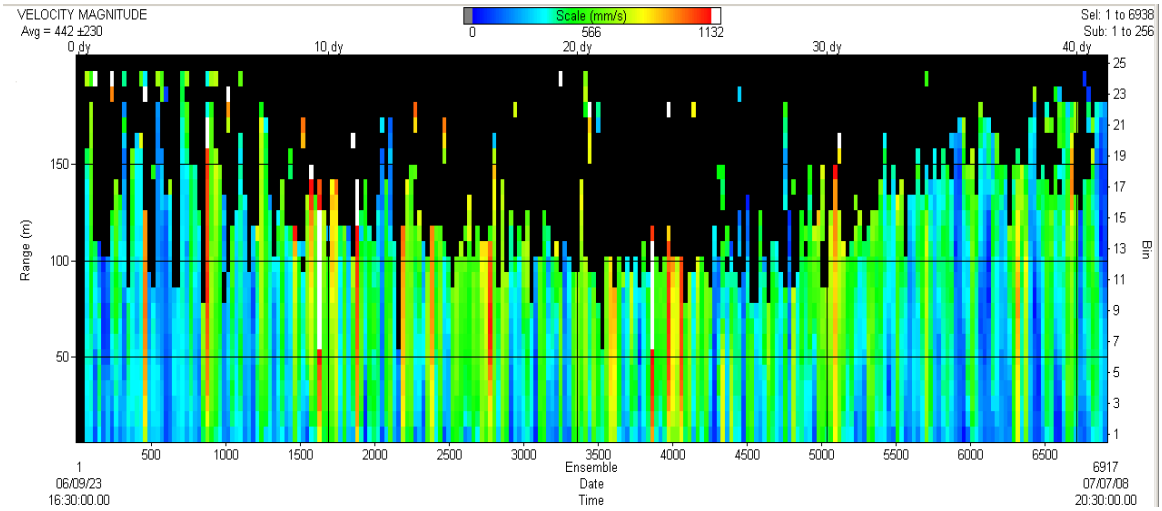


The microcat records at F1F2 shown in progression by 28 day mean. The range of temperature is 1°C and in salinity is 0.09. The change is gradual along an isopycnal with some clear diapycnal events, the latest provisional data from 2006-07 is the most saline, but not the warmest yet recovered at this mooring.

The ASOF - Damocles 63°N Freshwater Flux (FWF) Array is positioned to measure the freshwater flux which passes south along the east Greenland shelf. The 2006 FWF array moorings consisted of one 40 m tube providing protection for 2 Seabird SBE37 microcats at the top and bottom of the tube with a Valeport 308 current meter 30m below, and a further microcat at the bottom of the mooring. A bottom lander ADCP was also deployed with microcat near to the tube mooring. The tube mooring on recovery had been damaged resulting in only the microcat and current meter being recovered. The data from these instruments has not yet been examined but the microcat appears to have collected a full time-series and we hope that its pressure sensor will help to identify the period when the tube was damaged. The ADCP-06 lander was recovered successfully with full data record intact though the stainless steel frame did show signs of corrosion. Due to losses no tube was redeployed at this site, however the ADCP lander has been redeployed at a position closer to the coast in order to further investigate the structure of the current in this region.

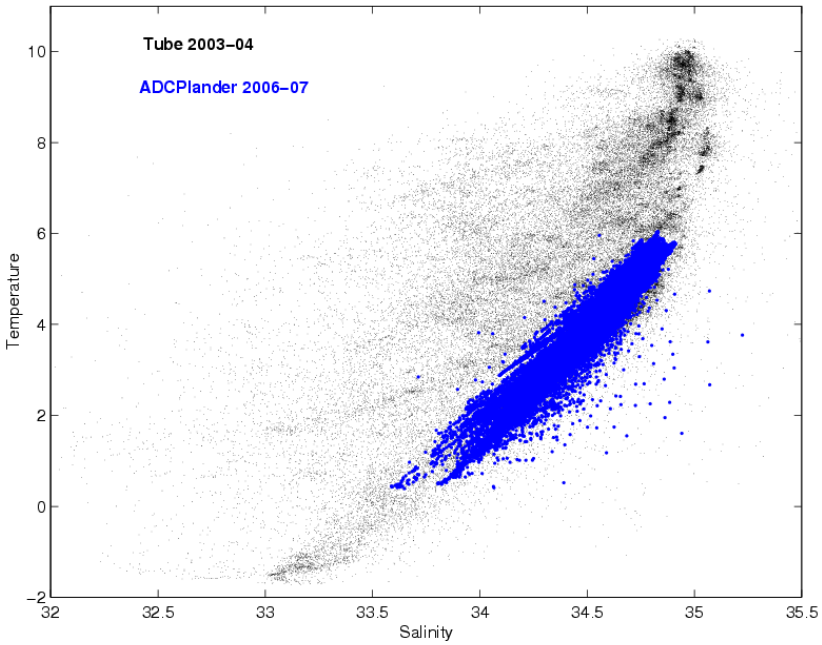


Recovered ADCP frame with inset example of the corrosion. Here a hole has been corroded through one of the feet.



ADCP-06 full data record of the deployment from September 2006 to July 2007. Shown is the raw speed in all bins for every 1 hourly sample. The plot suggests a seasonal cycle in the range at which good data is collected possibly due to interference from ice or by availability of biological reflectors in the spring and summer months towards the end of the record.

The T-S diagram from the microcat on the ADCP frame shows mixing between oceanic and coastal freshwater during the 2006-07 deployment. This is compared to the record from the upper water microcat in 2003-04. The mixing line is fairly similar to that seen on the upper microcat but without evidence of seasonal heating, as might be expected due to the depth of the ADCP frame microcat.



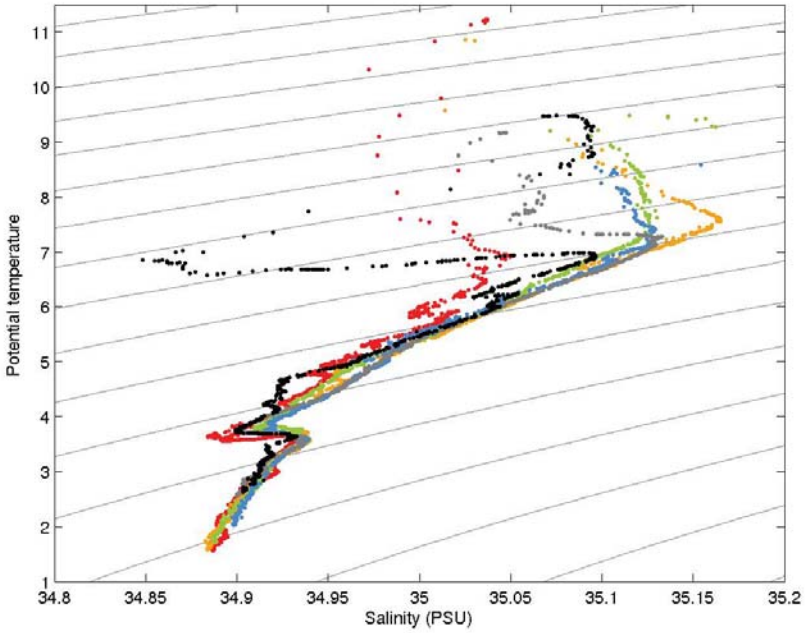
ADCP-06 T-S plot of the microcat record. T and S show a simple two endpoint mixing that lies within that experienced by the tube microcat in 2003-04. This will be examined in conjunction with the ADCP records to determine how this relates to changes in the current field, and may show the shift of the front between coastal and oceanic waters.

CTD observations

Detlef Quadfasel

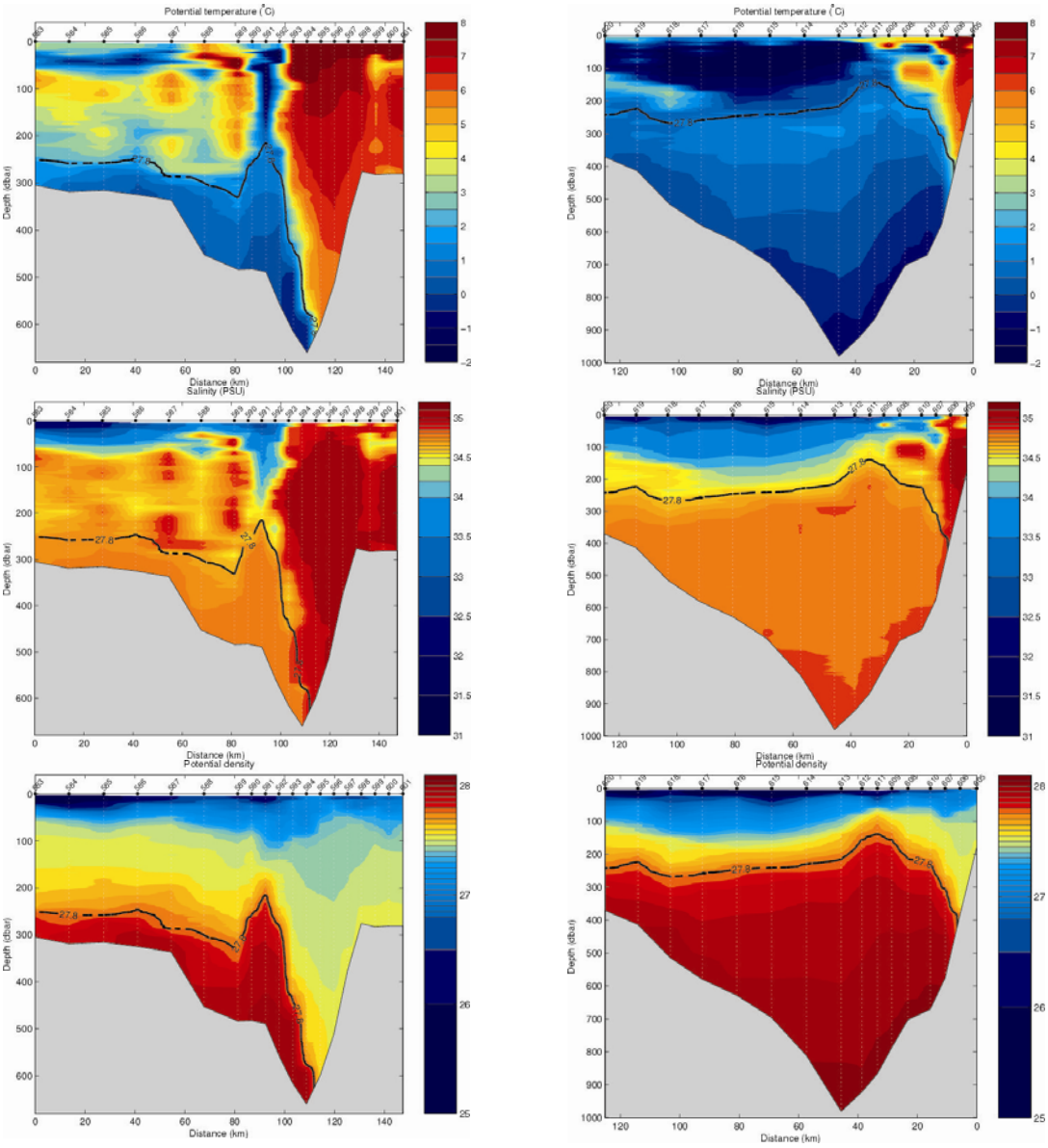
Originally it was planned to run only a few CTD casts at the mooring positions to provide calibration values for the moored instrumentation and to test the acoustic releasers prior to deployment. Through the combination of favourable weather and highly professional performance of both, ship and scientist crews, time was saved, allowing in addition two complete sections to be run across Denmark Strait.

On the Angmagssalik section the same features as have been observed in the last 10 years during the VEINS and ASOF programmes were found. The Denmark Strait overflow plume was cold (<2^{o}C) and of low salinity (S around 34.88) and had a less saline lid above the deepest part. The Denmark Strait Overflow Water (DSOW) was clearly denser than the warmer, more saline Iceland Scotland Overflow Water (ISOW), which was seen as a salinity maximum (S ≈ 34.93) with a temperature around 3^{o}C, and the density stratification in the upper part of the overflow plume was mainly due to the temperature stratification. Above the salinity maximum of the ISOW a salinity minimum was observed. This is most likely a remnant of the cold, dense Labrador Sea Water produced during the 1990s. The warmer Irminger Current water was encountered between 100m and 500m depths. It was warmest and most saline in the central part of the section, in agreement with the Irminger Current circulating around the northern rim of the Irminger Sea. The low salinity at the surface could either be due to eddy fluxes from the low salinity East Greenland Current, arise from net precipitation, or from advection of less saline surface water from the central Irminger Sea.



Potential temperature – salinity diagram from five CTD casts taken at the Angmagssalik section.

The two sections across Denmark Strait were taken right over the sill and some 70 miles north of that. At the sill section the overflow water hugs against the western flank of the strait, with the front separating it from the northward flowing warm and saline Irminger Current located at its deepest point. The upper boundary of the overflow water, defined by the σ_Θ = 27.8 kg/m^3 isopycnal, was located between 250 and 300 m depth, except close to the front where it raised to 210 m, probably due to the presence of a meso-scale eddy. Overflow water was found to stretch all the way onto the East Greenland Shelf. On the northern section the overflow water covered the whole strait in water depths below 350 m. Its upper level ranged between 160 and 250 m, on average about 50 m shallower than at the southern section. This is in agreement with the dynamics of the flow in the strait being hydraulically controlled. Low salinity Polar Water stretched onto the eastern flank of the strait in the northern section, but only to the central part on the sill section.



Vertical distribution of potential temperature (top row), salinity (middle row) and potential density (lower row) on two sections across Denmark Strait. Left panel shows the data from the section over the sill, right panel the section about 70 miles north of the sill. The σ_Θ = 27.8 kg/m^3 density contour marks the top of the overflow water. Data have not been calibrated yet.

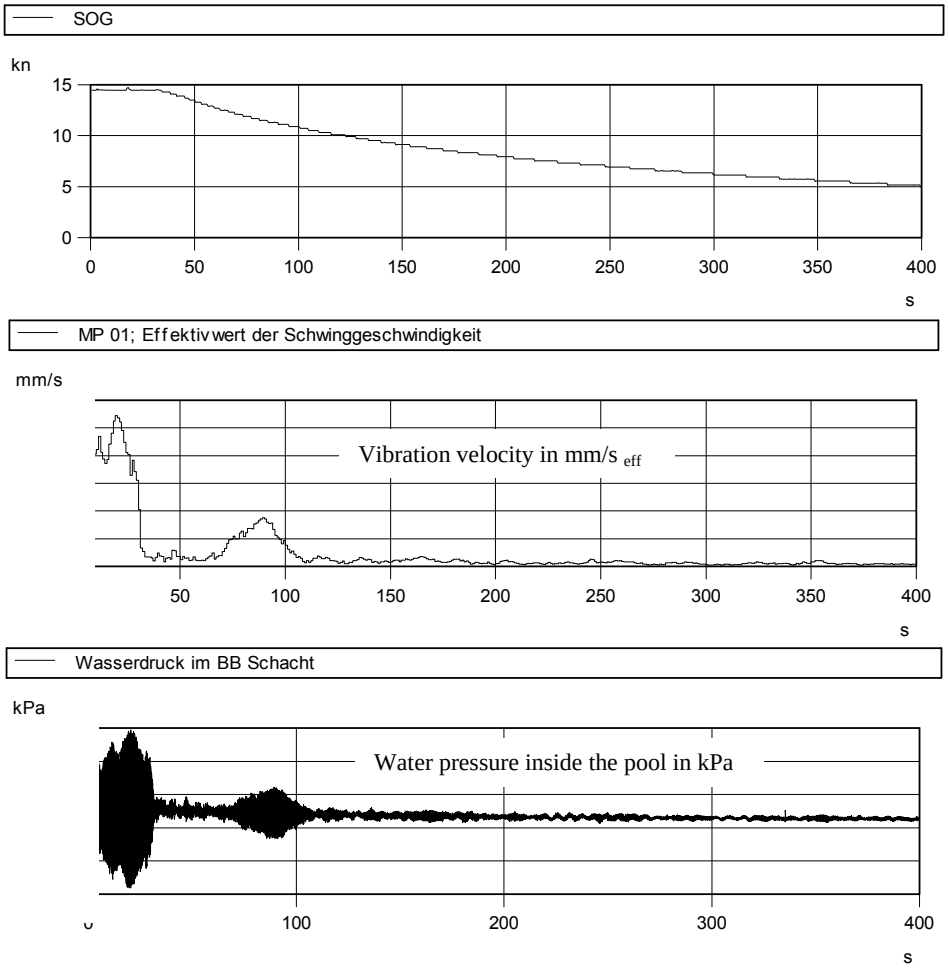
Measurements on the structure of the 'moon pool'

Uwe Weidner

Task: Vibrations were reported on the moon pool structure. This phenomenon occurs at a certain ship speed with moon pool covers open. The measurements should reveal the excitation source and determine the vibration amplitudes. Recommendations shall be given for a save operation.
The following sensors were applied: 6 accelerometers inside the pool
2 strain gauges near welding seams
1 pressure gauge inside the pool water column

Findings: Eddy induced forced vibrations were measured with both covers open. The closing of one cover disturbs the development of the eddy leading to lower excitation forces and low vibration velocities. With both covers closed the eddy induced pressure pulses inside the pool disappear.

Recommendation: The ship should not be operated at cruising speed with both covers open. No restrictions up to a speed of 12.5 kn during operation with one cover open.



Speed, Vibration velocity and water pressure during running out test (No excitation contributed to the engines)

7. Acknowledgements

We like to thank captain Klaus Bergmann, his officers and crew of RV Maria S. Merian for their support of our measurement programme and for creating a very friendly atmosphere on board. We also appreciate that Thor was in a good mood during the first half of July and provided us with weather allowing an efficient use of the cruise time.

The ship time of Merian was provided by the Deutsche Forschungsgemeinschaft within the core program METEOR/MERIAN. Financial support for the different projects carried out during the cruise was provided though the EU-Projects MERSEA and DAMOCLES and the German Ministry of Education and Research (Nordatlantik Programm). We also benefited from financial contributions by the research institutes involved. We gratefully acknowledge all this support.

Mooring recoveries:

MERSEA:	CIS-06:	59° 40.05’ N	39° 43.36’ W	2808 m
		Released:	08.07.2007	10:34 Z
		On deck:		13:34 Z
ASOF:	ADCP-06	63° 01.05’ N	40° 30.95’ W	220 m
		Released:	09.07.2007	15:55 Z
		On deck:		17:20 Z
ASOF:	TUBE-28	63° 00.22’ N	40° 32.73’ W	305 m
		Released:	09.07.2007	18:06 Z
		On deck:		18:52 Z
ASOF:	F1/2	63° 35.48’ N	36° 39.26’ W	1717 m
		Released:	10.07.2007	09:12 Z
		On deck:		10:04 Z
ASOF:	UK1-06	63° 29.01’ N	36° 17.98’ W	1988 m
		10.07.2007	10:14 Z	
		No acoustic contact, later dragging not successful		
ASOF:	G1-06	63° 22.10’ N	36° 04.37’ W	2160 m
		10.07.2007	12:45 Z	
		No acoustic contact, later dragging not successful		
ASOF:	UK2-06	63° 16.92’ N	35° 52.09’ W	2358 m
		Released:	10.07.2007	14:45 Z
		On deck:		15:38 Z

Mooring deployments

MERSEA:	CIS-07	59° 40.03' N 39° 42.71' W	2812 m	
		Top Buoy in water: 08.07.2007	18:13 Z	
		Anchor released:	21:32 Z	
ASOF:	ADCP-07	63° 02.43' N 40° 51.39' W	282 m	ADCP
		63° 02.45' N 40° 51.69' W	250 m	anchor
		ADCP released: 09.07.2007	23:07 Z	
ASOF:	F1/2-07	63° 35.53' N 36° 38.93' W	1714 m	
		Top Buoy in water: 11.07.2007	13:34 Z	
		Anchor released:	14:39 Z	
ASOF:	UK1-07	63° 29.03' N 36° 17.96' W	1989 m	
		Top Buoy in water: 11.07.2007	16:26 Z	
		Anchor released:	17:17 Z	
ASOF:	G1-07	63° 23.13' N 36° 04.24' W	2194 m	
		Top Buoy in water: 11.07.2007	19:02 Z	
		Anchor released:	19:50 Z	
ASOF:	UK2-07	63° 16.89' N 35° 51.97' W	2361 m	
		Top Buoy in water: 11.07.2007	21:16 Z	
		Anchor released:	22:10 Z	
NA:	HHDS1-07	66° 04.72' N 27° 04.89' W	667 m	
		Top Buoy in water: 14.07.2007	08:42 Z	
		Anchor released:	08:44 Z	
NA:	HHDS2-07	66° 07.25' N 27° 16.21' W	577 m	
		Top Buoy in water: 14.07.2007	09:31 Z	
		Anchor released:	09:33 Z	
NA :	HHDS3-07	66° 45.19' N 25° 00.08' W	703 m	
		Released: 14.07.2007	21:10 Z	
		Anchor released:	08:44 Z	

List of Stations

EXPO-CODE	Stat. No.	Cast No.	Type	Date dd.mm.yyyy	Time UTC	Code	Position Latitude	Position Longitude	Bottom depth	Max Press.	Bottom Dist.	Comments
06MSM05/4	557	1	MOR	08.07.2007	10:34	BE	59° 40.14' N	39° 42.47' W	2813.8			Recovery V434-06/CIS06
06MSM05/4	557	1	MOR	08.07.2007	13:34	EN	59° 39.81' N	39° 39.34' W	2825.7			
06MSM05/4	558	1	CTD/RO	08.07.2007	14:10	BE	59° 39.80' N	39° 39.27' W	2826.4			
06MSM05/4	558	5	CTD/RO	08.07.2007	17:08	EN	59° 39.80' N	39° 39.27' W	2825.9			
06MSM05/4	559	1	MOR	08.07.2007	18:13	BE	59° 39.41' N	39° 50.72' W	2805.5			Deployment V434-07/CIS07
06MSM05/4	559	1	MOR	08.07.2007	21:32	EN	59° 40.03' N	39° 42.71' W	2814.4			
06MSM05/4	560	1	CTD/RO	08.07.2007	22:15	BE	59° 39.82' N	39° 43.03' W	2816.8			
06MSM05/4	560	1	CTD/RO	08.07.2007	22:36	BO	59° 39.82' N	39° 43.03' W	2816.9			600 m SL
06MSM05/4	560	1	CTD/RO	08.07.2007	23:08	EN	59° 39.82' N	39° 43.03' W	2816.9			
06MSM05/4	561	1	GO-FLO	09.07.2007	07:58	BE	61° 26.64' N	40° 08.70' W	2212.9			1 Bottle at 3m
06MSM05/4	561	1	GO-FLO	09.07.2007	07:59	EN	61° 26.63' N	40° 08.70' W	2213.7			
06MSM05/4	562	1	B-ADCP	09.07.2007	15:55	BE	63° 00.90' N	40° 31.16' W	220.0			Recovery ADCP GB-06
06MSM05/4	562	1	B-ADCP	09.07.2007	17:20	EN	63° 01.20' N	40° 31.31' W	220.0			
06MSM05/4	563	1	MOR	09.07.2007	18:06	BE	63° 00.12' N	40° 32.92' W				Recovery Tube 28
06MSM05/4	563	1	MOR	09.07.2007	18:52	EN	63° 00.40' N	40° 32.81' W				
06MSM05/4	564	1	CTD/RO	09.07.2007	19:33	BE	62° 59.79' N	40° 33.01' W	333.2			
06MSM05/4	564	1	CTD/RO	09.07.2007	19:49	BO	62° 59.79' N	40° 33.01' W	333.2	323	8	310m SL
06MSM05/4	564	1	CTD/RO	09.07.2007	20:06	EN	62° 59.79' N	40° 33.01' W	333.1			
06MSM05/4	565	1	CTD/RO	09.07.2007	21:07	BE	63° 02.49' N	40° 51.92' W	246.7			
06MSM05/4	565	1	CTD/RO	09.07.2007	21:16	BO	63° 02.49' N	40° 51.92' W	246.5	232	9	227 m SL
06MSM05/4	565	1	CTD/RO	09.07.2007	21:26	EN	63° 02.49' N	40° 51.92' W	245.9			
06MSM05/4	565	2	B-ADCP	09.07.2007	22:08	BE	63° 02.47' N	40° 51.67' W	250.5			Deployment ADCP GB-07
06MSM05/4	565	2	B-ADCP	09.07.2007	23:07	EN	63° 02.45' N	40° 51.37' W	282.4			
06MSM05/4	566	1	MOR	10.07.2007	09:12	BE	63° 35.20' N	36° 39.50' W	1716.8			Recovery F1/2 -06
06MSM05/4	566	1	MOR	10.07.2007	10:04	EN	63° 35.64' N	36° 40.70' W	1722.3			
06MSM05/4	567	1	MOR	10.07.2007	10:14	BE	63° 35.19' N	36° 39.65' W	1727.4			UK1-06 no response
06MSM05/4	567	1	MOR	10.07.2007	11:46	EN	63° 28.74' N	36° 18.73' W	1727.4			

06MSM05/4	568	1	MOR	10.07.2007	14:45	BE	63° 16.79' N	35° 53.13' W	2360.4			Recovery UK2 -06
06MSM05/4	568	1	MOR	10.07.2007	15:38	EN	63° 16.89' N	35° 53.88' W	2356.2			
06MSM05/4	569	1	CTD/RO	10.07.2007	15:51	BE	63° 16.87' N	35° 53.96' W	2355.8			
06MSM05/4	569	1	CTD/RO	10.07.2007	16:38	BO	63° 16.87' N	35° 53.96' W	2356.1	2357	10	2323m SL
06MSM05/4	569	1	CTD/RO	10.07.2007	17:40	EN	63° 16.87' N	35° 53.96' W	2354.9			
06MSM05/4	570	1	MOR	10.07.2007	19:58	BE	63° 28.88' N	36° 18.60' W	1982.6			Dredge UK1 -06
06MSM05/4	570	1	MOR	11.07.2007	01:02	EN	63° 29.25' N	36° 19.27' W	1970.9			no succsess
06MSM05/4	571	1	CTD/RO	11.07.2007	02:23	BE	63° 21.98' N	36° 02.10' W	2207.2			
06MSM05/4	571	1	CTD/RO	11.07.2007	03:15	BO	63° 21.98' N	36° 02.11' W	2207.5	2209	12	2184m SL
06MSM05/4	571	1	CTD/RO	11.07.2007	04:40	EN	63° 21.98' N	36° 02.11' W	2207.0			
06MSM05/4	572	1	CTD/RO	11.07.2007	05:30	BE	63° 25.99' N	36° 10.06' W	2102.3			
06MSM05/4	572	1	CTD/RO	11.07.2007	06:11	BO	63° 25.99' N	36° 10.07' W	2101.9	2103	9	2084m SL
06MSM05/4	572	1	CTD/RO	11.07.2007	06:49	EN	63° 25.99' N	36° 10.06' W	2101.9			
06MSM05/4	573	1	CTD/RO	11.07.2007	07:38	BE	63° 30.00' N	36° 18.16' W	1988.8			
06MSM05/4	573	1	CTD/RO	11.07.2007	08:16	BO	63° 30.00' N	36° 18.16' W	1988.2	1985	9	1961 m SL
06MSM05/4	573	1	CTD/RO	11.07.2007	08:56	EN	63° 30.00' N	36° 18.16' W	1988.3			
06MSM05/4	574	1	CTD/RO	11.07.2007	09:42	BE	63° 33.98' N	36° 26.03' W	1822.4			
06MSM05/4	574	1	CTD/RO	11.07.2007	10:18	BO	63° 33.98' N	36° 26.03' W	1822.7	1819	9	1797 m SL
06MSM05/4	574	1	CTD/RO	11.07.2007	10:56	EN	63° 33.98' N	36° 26.03' W	1822.5			
06MSM05/4	575	1	CTD/RO	11.07.2007	11:39	BE	63° 38.02' N	36° 34.05' W	1656.8			
06MSM05/4	575	1	CTD/RO	11.07.2007	12:11	BO	63° 38.02' N	36° 34.06' W	1656.9	1650	11	1637m SL
06MSM05/4	575	1	CTD/RO	11.07.2007	12:49	EN	63° 38.02' N	36° 34.06' W	1657.9			
06MSM05/4	576	1	MOR	11.07.2007	13:34	BE	63° 34.78' N	36° 40.62' W	1746.8			Deployment F1/2 -07
06MSM05/4	576	1	MOR	11.07.2007	14:39	EN	63° 35.57' N	36° 38.86' W	1713.4			
06MSM05/4	577	1	MOR	11.07.2007	16:26	BE	63° 28.07' N	36° 19.36' W	2009.9			Deployment UK11 -07
06MSM05/4	577	1	MOR	11.07.2007	17:17	EN	63° 29.04' N	36° 17.93' W	1989.7			
06MSM05/4	578	1	MOR	11.07.2007	19:02	BE	63° 22.35' N	36° 05.54' W	2191.6			Deployment G1 -07
06MSM05/4	578	1	MOR	11.07.2007	19:50	EN	63° 23.15' N	36° 04.22' W	2138.9			
06MSM05/4	579	1	MOR	11.07.2007	21:16	BE	63° 16.20' N	35° 53.56' W	2364.0			Deployment UK2 -07
06MSM05/4	579	1	MOR	11.07.2007	22:07	EN	63° 16.91' N	35° 51.91' W	2361.3			
06MSM05/4	580	1	MOR	12.07.2007	03:01	BE	63° 22.00' N	36° 04.91' W	2202.2			Dredge G1 -06
06MSM05/4	580	1	MOR	12.07.2007	10:26	EN	63° 22.45' N	36° 04.59' W	2192.7			no succsess

06MSM05/4	581	1	CTD/RO	12.07.2007	10:35	BE	63° 22.45' N	36° 04.58' W	2192.0			Releaser-Test, Seacat-Test
06MSM05/4	581	1	CTD/RO	12.07.2007	11:17	BO	63° 22.45' N	36° 04.58' W	2192.5	2194	9	2163 m SL
06MSM05/4	581	1	CTD/RO	12.07.2007	12:43	EN	63° 22.45' N	36° 04.58' W	2192.6			
06MSM05/4	582	1	GO-FLO	12.07.2007	22:00	BE	64° 44.40' N	33° 14.10' W	1778.5			1 Bottle at 3m
06MSM05/4	582	1	GO-FLO	12.07.2007	22:01	EN	64° 44.40' N	33° 14.11' W				
06MSM05/4	583	1	CTD/RO	13.07.2007	10:07	BE	66° 36.62' N	29° 05.95' W	316.9			
06MSM05/4	583	1	CTD/RO	13.07.2007	10:17	BO	66° 36.62' N	29° 05.96' W	316.9	303	8	297 m SL
06MSM05/4	583	1	CTD/RO	13.07.2007	10:27	EN	66° 36.62' N	29° 05.98' W	315.9			
06MSM05/4	584	1	CTD/RO	13.07.2007	11:19	BE	66° 32.41' N	28° 50.40' W	331.3			
06MSM05/4	584	1	CTD/RO	13.07.2007	11:28	BO	66° 32.42' N	28° 50.39' W	332.0	319	8	313 m SL
06MSM05/4	584	1	CTD/RO	13.07.2007	11:37	EN	66° 32.42' N	28° 50.39' W	331.3			
06MSM05/4	585	1	CTD/RO	13.07.2007	12:28	BE	66° 28.16' N	28° 35.35' W	327.4			
06MSM05/4	585	1	CTD/RO	13.07.2007	13:04	BO	66° 28.19' N	28° 35.45' W	327.6	316	9	SL = 315 m
06MSM05/4	585	1	CTD/RO	13.07.2007	13:20	EN	66° 28.18' N	28° 35.49' W	326.9			
06MSM05/4	586	1	CTD/RO	13.07.2007	14:13	BE	66° 23.98' N	28° 20.47' W	336.6			
06MSM05/4	586	1	CTD/RO	13.07.2007	14:24	BO	66° 23.98' N	28° 20.47' W	338.3	325	9	320m SL
06MSM05/4	586	1	CTD/RO	13.07.2007	14:35	EN	66° 23.87' N	28° 20.67' W	339.0			
06MSM05/4	587	1	CTD/RO	13.07.2007	15:24	BE	66° 19.84' N	28° 05.47' W	349.0			
06MSM05/4	587	1	CTD/RO	13.07.2007	15:37	BO	66° 19.83' N	28° 05.49' W	348.9	337	9	333m SL
06MSM05/4	587	1	CTD/RO	13.07.2007	15:48	EN	66° 19.83' N	28° 05.50' W	349.1			
06MSM05/4	588	1	CTD/RO	13.07.2007	16:37	BE	66° 16.18' N	27° 50.38' W	467.1			
06MSM05/4	588	1	CTD/RO	13.07.2007	16:49	BO	66° 16.17' N	27° 50.38' W	467.2	453	10	448m SL
06MSM05/4	588	1	CTD/RO	13.07.2007	17:00	EN	66° 16.17' N	27° 50.37' W	468.2			
06MSM05/4	589	1	CTD/RO	13.07.2007	17:53	BE	66° 12.03' N	27° 35.56' W	498.5			
06MSM05/4	589	1	CTD/RO	13.07.2007	18:05	BO	66° 12.03' N	27° 35.55' W	498.2	484	9	477m SL
06MSM05/4	589	1	CTD/RO	13.07.2007	18:17	EN	66° 12.03' N	27° 35.55' W	499.8			
06MSM05/4	590	1	CTD/RO	13.07.2007	18:42	BE	66° 10.48' N	27° 29.12' W	498.7			
06MSM05/4	590	1	CTD/RO	13.07.2007	18:54	BO	66° 10.48' N	27° 29.13' W	498.4	483	9	476m SL
06MSM05/4	590	1	CTD/RO	13.07.2007	19:05	EN	66° 10.48' N	27° 29.15' W	498.5			
06MSM05/4	591	1	CTD/RO	13.07.2007	19:31	BE	66° 08.98' N	27° 22.74' W	506.5			
06MSM05/4	591	1	CTD/RO	13.07.2007	19:44	BO	66° 08.98' N	27° 22.75' W	506.6	489	9	489m SL
06MSM05/4	591	1	CTD/RO	13.07.2007	19:59	EN	66° 09.02' N	27° 22.81' W	506.2			
06MSM05/4	592	1	CTD/RO	13.07.2007	20:32	BE	66° 07.51' N	27° 16.53' W	579.0			
06MSM05/4	592	1	CTD/RO	13.07.2007	20:45	BO	66° 07.53' N	27° 16.67' W	575.5	557	9	564 m SL
06MSM05/4	592	1	CTD/RO	13.07.2007	20:59	EN	66° 07.53' N	27° 17.02' W	571.9			

06MSM05/4	593	1	CTD/RO	13.07.2007	21:30	BE	66° 06.01' N	27° 10.22' W	630.5			
06MSM05/4	593	1	CTD/RO	13.07.2007	21:45	BO	66° 06.05' N	27° 10.49' W	630.1	616	9	619 m SL
06MSM05/4	593	1	CTD/RO	13.07.2007	22:01	EN	66° 06.08' N	27° 10.88' W	628.3			
06MSM05/4	594	1	CTD/RO	13.07.2007	22:32	BE	66° 04.50' N	27° 03.88' W	662.3			
06MSM05/4	594	1	CTD/RO	13.07.2007	22:48	BO	66° 04.61' N	27° 03.82' W	671.7	660	9	663 m SL
06MSM05/4	594	1	CTD/RO	13.07.2007	23:03	EN	66° 04.77' N	27° 03.93' W	671.4			
06MSM05/4	595	1	CTD/RO	13.07.2007	23:33	BE	66° 03.00' N	26° 57.56' W	607.2			
06MSM05/4	595	1	CTD/RO	13.07.2007	23:48	BO	66° 03.02' N	26° 57.52' W	607.0	599	8	591 m SL
06MSM05/4	595	1	CTD/RO	14.07.2007	00:06	EN	66° 03.03' N	26° 57.50' W	606.6			
06MSM05/4	596	1	CTD/RO	14.07.2007	00:44	BE	66° 01.48' N	26° 51.36' W	519.7			
06MSM05/4	596	1	CTD/RO	14.07.2007	00:57	BO	66° 01.48' N	26° 51.35' W	519.6	512	8	504m SL
06MSM05/4	596	1	CTD/RO	14.07.2007	01:12	EN	66° 01.47' N	26° 51.36' W	519.5			
06MSM05/4	597	1	CTD/RO	14.07.2007	01:43	BE	65° 59.99' N	26° 45.05' W	376.8			
06MSM05/4	597	1	CTD/RO	14.07.2007	01:53	BO	65° 59.94' N	26° 45.17' W	382.8	376	8	372m SL
06MSM05/4	597	1	CTD/RO	14.07.2007	02:07	EN	65° 59.90' N	26° 45.33' W	386.4			
06MSM05/4	598	1	CTD/RO	14.07.2007	02:38	BE	65° 58.50' N	26° 38.76' W	291.4			
06MSM05/4	598	1	CTD/RO	14.07.2007	02:47	BO	65° 58.47' N	26° 38.83' W	285.2	276	9	272m SL
06MSM05/4	598	1	CTD/RO	14.07.2007	02:58	EN	65° 58.39' N	26° 39.04' W	290.7			
06MSM05/4	599	1	CTD/RO	14.07.2007	03:29	BE	65° 57.00' N	26° 32.40' W	293.2			
06MSM05/4	599	1	CTD/RO	14.07.2007	03:38	BO	65° 57.00' N	26° 32.41' W	292.5	283	9	280m SL
06MSM05/4	599	1	CTD/RO	14.07.2007	03:49	EN	65° 56.95' N	26° 32.60' W	292.2			
06MSM05/4	600	1	CTD/RO	14.07.2007	04:14	BE	65° 55.44' N	26° 26.19' W	290.6			
06MSM05/4	600	1	CTD/RO	14.07.2007	04:24	BO	65° 55.43' N	26° 26.20' W	290.6	281	9	276m SL
06MSM05/4	600	1	CTD/RO	14.07.2007	04:32	EN	65° 55.41' N	26° 26.21' W	290.7			
06MSM05/4	601	1	CTD/RO	14.07.2007	04:59	BE	65° 53.96' N	26° 19.73' W	290.6			
06MSM05/4	601	1	CTD/RO	14.07.2007	05:08	BO	65° 53.94' N	26° 19.74' W	290.7	281	9	274m SL
06MSM05/4	601	1	CTD/RO	14.07.2007	05:16	EN	65° 53.92' N	26° 19.76' W	290.8			
06MSM05/4	602	1	MOR	14.07.2007	08:42	BE	66° 04.67' N	27° 05.04' W	668.6			ADCP HHDS1-07
06MSM05/4	602	1	MOR	14.07.2007	08:44	EN	66° 04.72' N	27° 04.89' W	667.5			
06MSM05/4	603	1	MOR	14.07.2007	09:31	BE	66° 07.19' N	27° 16.35' W	582.2			ADCP HHDS2-07
06MSM05/4	603	1	MOR	14.07.2007	09:33	EN	66° 07.25' N	27° 16.21' W	577.3			
06MSM05/4	604	1	CTD/RO	14.07.2007	14:59	BE	66° 45.90' N	25° 03.06' W	742.7			
06MSM05/4	604	1	CTD/RO	14.07.2007	15:15	BO	66° 45.85' N	25° 03.12' W	742.4	723	8	416m SL
06MSM05/4	604	1	CTD/RO	14.07.2007	15:37	EN	66° 45.71' N	25° 03.28' W	741.6			

06MSM05/4	605	1	CTD/RO	14.07.2007	16:30	BE	66° 39.94' N	24° 44.87' W	185.9				
06MSM05/4	605	1	CTD/RO	14.07.2007	16:37	BO	66° 39.94' N	24° 44.87' W	185.8	178	9	173m SL	
06MSM05/4	605	1	CTD/RO	14.07.2007	16:44	EN	66° 39.94' N	24° 44.87' W	185.9				
06MSM05/4	606	1	CTD/RO	14.07.2007	17:12	BE	66° 41.57' N	24° 51.24' W	390.3				
06MSM05/4	606	1	CTD/RO	14.07.2007	17:22	BO	66° 41.57' N	24° 51.24' W	390.2	383	8	378m SL	
06MSM05/4	606	1	CTD/RO	14.07.2007	17:34	EN	66° 41.59' N	24° 51.10' W	385.2				
06MSM05/4	607	1	CTD/RO	14.07.2007	17:58	BE	66° 43.03' N	24° 57.06' W	595.1				
06MSM05/4	607	1	CTD/RO	14.07.2007	18:13	BO	66° 43.07' N	24° 56.97' W	595.5	576	9	573m SL	
06MSM05/4	607	1	CTD/RO	14.07.2007	18:25	EN	66° 43.10' N	24° 56.85' W	592.0				
06MSM05/4	608	1	CTD/RO	14.07.2007	18:51	BE	66° 44.50' N	25° 03.19' W	724.8				
06MSM05/4	608	1	CTD/RO	14.07.2007	19:07	BO	66° 44.50' N	25° 03.18' W	721.6	703	9	702m SL	
06MSM05/4	608	1	CTD/RO	14.07.2007	19:21	EN	66° 44.46' N	25° 03.23' W	722.0				
06MSM05/4	609	1	CTD/RO	14.07.2007	19:46	BE	66° 46.09' N	25° 09.43' W	810.3				
06MSM05/4	609	1	CTD/RO	14.07.2007	20:10	BO	66° 46.09' N	25° 09.44' W	810.1	788	8		
06MSM05/4	609	1	CTD/RO	14.07.2007	20:21	EN	66° 46.04' N	25° 09.55' W	811.0				
06MSM05/4	610	1	PIES	14.07.2007	21:10	DE	66° 45.19' N	25° 00.08' W	702.6			deployed	
06MSM05/4	610	2	CTD/RO	14.07.2007	21:35	BE	66° 45.18' N	25° 00.08' W	702.5				
06MSM05/4	610	2	CTD/RO	14.07.2007	21:48	BO	66° 45.22' N	24° 59.99' W	702.8	671	20		
06MSM05/4	610	2	CTD/RO	14.07.2007	22:02	EN	66° 45.25' N	24° 59.94' W	702.0				
06MSM05/4	611	1	CTD/RO	14.07.2007	22:47	BE	66° 47.49' N	25° 15.04' W	889.8				
06MSM05/4	611	1	CTD/RO	14.07.2007	23:03	BO	66° 47.49' N	25° 15.04' W	889.8	867	8		
06MSM05/4	611	1	CTD/RO	14.07.2007	23:21	EN	66° 47.49' N	25° 15.04' W	889.5				
06MSM05/4	612	1	CTD/RO	14.07.2007	23:47	BE	66° 48.98' N	25° 21.02' W	945.5				
06MSM05/4	612	1	CTD/RO	15.07.2007	00:05	BO	66° 48.97' N	25° 21.02' W	945.2	922	8	911m SL	
06MSM05/4	612	1	CTD/RO	15.07.2007	00:25	EN	66° 48.98' N	25° 21.02' W	945.2				
06MSM05/4	613	1	CTD/RO	15.07.2007	00:57	BE	66° 51.93' N	25° 27.02' W	1008.0				
06MSM05/4	613	1	CTD/RO	15.07.2007	01:16	BO	66° 51.93' N	25° 27.02' W	1007.9	981	10	971m SL	
06MSM05/4	613	1	CTD/RO	15.07.2007	01:37	EN	66° 51.93' N	25° 27.02' W	1008.0				
06MSM05/4	614	1	CTD/RO	15.07.2007	02:17	BE	66° 51.99' N	25° 43.07' W	840.6				
06MSM05/4	614	1	CTD/RO	15.07.2007	02:33	BO	66° 51.99' N	25° 43.07' W	838.3	812	9	805m SL	
06MSM05/4	614	1	CTD/RO	15.07.2007	02:51	EN	66° 51.94' N	25° 43.27' W	838.9				
06MSM05/4	615	1	CTD/RO	15.07.2007	03:32	BE	66° 52.01' N	25° 59.11' W	719.2				
06MSM05/4	615	1	CTD/RO	15.07.2007	03:46	BO	66° 52.00' N	25° 59.15' W	719.0	697	8	689m SL	
06MSM05/4	615	1	CTD/RO	15.07.2007	04:00	EN	66° 51.94' N	25° 59.33' W	714.5				

06MSM05/4	616	1	CTD/RO	15.07.2007	04:41	BE	66° 52.00' N	26° 15.26' W	650.6			
06MSM05/4	616	1	CTD/RO	15.07.2007	04:55	BO	66° 52.00' N	26° 15.26' W	650.3	629	9	621m SL
06MSM05/4	616	1	CTD/RO	15.07.2007	05:09	EN	66° 52.00' N	26° 15.26' W	650.5			
06MSM05/4	617	1	CTD/RO	15.07.2007	05:49	BE	66° 52.00' N	26° 31.27' W	600.2			
06MSM05/4	617	1	CTD/RO	15.07.2007	06:05	BO	66° 51.99' N	26° 31.27' W	600.0	580	9	572m SL
06MSM05/4	617	1	CTD/RO	15.07.2007	06:16	EN	66° 51.99' N	26° 31.27' W	600.1			
06MSM05/4	618	1	CTD/RO	15.07.2007	06:55	BE	66° 52.00' N	26° 45.95' W	533.5			
06MSM05/4	618	1	CTD/RO	15.07.2007	07:07	BO	66° 52.00' N	26° 45.95' W	533.5	515	8	509m SL
06MSM05/4	618	1	CTD/RO	15.07.2007	07:18	EN	66° 52.00' N	26° 45.95' W	533.7			
06MSM05/4	619	1	CTD/RO	15.07.2007	08:00	BE	66° 51.98' N	27° 00.95' W	429.3			
06MSM05/4	619	1	CTD/RO	15.07.2007	08:07	BO	66° 51.98' N	27° 00.95' W	429.4	414	8	408m SL
06MSM05/4	619	1	CTD/RO	15.07.2007	08:18	EN	66° 51.98' N	27° 00.95' W	429.5			
06MSM05/4	620	1	CTD/RO	15.07.2007	09:02	BE	66° 52.00' N	27° 16.11' W	382.2			
06MSM05/4	620	1	CTD/RO	15.07.2007	09:12	BO	66° 52.00' N	27° 16.11' W	382.8	414	8	368m SL
06MSM05/4	620	1	CTD/RO	15.07.2007	09:21	EN	66° 52.00' N	27° 16.07' W	383.6			