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The Expedition of the Research Vessel "Polarstern" to the Arctic in 2010 (ARK-XXV/1)

Edited by
Gereon Budéus
with contributions of the participants

HELMHOLTZ GEMEINSCHAFT

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ARK-XXV/1

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Fahrtleiter / Chief scientist

Gereon Budéus

Koordinator / Coordinator

Eberhard Fahrbach

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1. ZUSAMMENFASSUNG UND FAHRTVERLAUF

Gereon Budéus
Alfred-Wegener-Institut

Der erste Fahrtabschnitt der 25. *Polarstern* Expedition in die Arktik begann am 10. Juni 2010. Das Schiff lief von Bremerhaven aus, um in der Grönlandsee, sowie im folgenden Fahrtabschnitt in der Framstraße, multidisziplinäre Forschungen durchzuführen.

Das genannte Gebiet steht seit einigen Jahrzehnten verstärkt im Fokus des wissenschaftlichen Interesses, da sich dort Schlüsselprozesse im Ozean abspielen. Der Transfer zwischen Atmosphäre und Ozean bezüglich mechanischer Energie, Wärme und Süßwasser ist hoch, insbesondere während der kalten Wintermonate. Wassermassen aus niedrigen und hohen Breiten treffen dort aufeinander und interagieren durch Vermischung an Fronten, Überschichtungen, Einmischungen und Winterkonvektion. Meereis wird gebildet in den nördlichen und westlichen Teilen des Gebiets und Eis wird gen Süden transportiert mit den kalten und salzarmen Oberflächenwassermassen im ostgrönländischen Strom. Es werden Wassermassen hoher Dichte erzeugt, die einen wesentlichen Beitrag zur tiefen meridionalen Zirkulation im Atlantik leisten. Dies alles macht die Region ausgesprochen empfindlich gegenüber klimatischen Veränderungen, wobei Rückkopplungsmechanismen bezüglich des nordeuropäischen Klimas besondere Beachtung verdienen. Auch dem Beziehungsgeflecht und den Rückwirkungsmechanismen zwischen dem Ozeanklima und der Biosphäre sowie biogeochemischen Abläufen gilt aufgrund der mittlerweile erkannten Bedeutung das besondere Interesse. Es ist selbstverständlich, dass solche großräumigen klimatischen Betrachtungen auf hochwertigen regionalen Beobachtungen lokaler Veränderungen aufbauen müssen.

Die hydrographischen Arbeiten auf diesem Fahrtabschnitt etablieren einen weiteren Mosaikstein von Langzeit-Messreihen, wie sie für die klimabezogene Forschung unverzichtbar sind. In der Grönlandsee, aber auch in der Framstraße, hat das Alfred-Wegener-Institut bereits eine beachtliche Forschungshistorie aufzuweisen, welche die Quantifizierung solch wichtiger Vorgänge, wie die des meridionalen Wärmeflusses, der winterlichen Konvektionstiefen, der Speicherung von Wärme und Salz im Ozean und dergleichen mehr gestattet, sowie die Variabilitäten und Trends der mit diesen verbundenen physikalischen Parameter bestimmbar macht. In den Projekten werden Stationsarbeiten vom Schiff aus durchgeführt, es finden aber auch innovative autonome selbstprofilierende Verankerungen Verwendung.

Ein besonderes Merkmal der Grönlandsee ist das Zusammentreffen dreier hydrographischer Zonen (polare, arktische und atlantische Zone) auf engem Raum und gleicher geographischer Breite. Dies ermöglicht Studien zur Beziehung zwischen dem pelagischen Ökosystem und veränderlichen Klimaparametern unter gleichbleibenden Belichtungsverhältnissen. Neben den Änderungen des Ozeanklimas finden aber auch Modifikationen der chemischen Gleichgewichtszustände und

des Elementenaustausches in der Oberflächenschicht des Ozeans statt. Diese physikalischen und chemischen Veränderlichkeiten zeitigen höchstwahrscheinlich weitreichende Konsequenzen sowohl für das pelagische Ökosystem als auch für die Kohlenstoffbilanz der arktischen Ozeane. In den subpolaren Gebieten hat der aktuelle Klimatrend bereits zu einer Verlagerung der charakteristischen Phytoplanktonarten geführt. Da die Spurengasemissionsmenge direkt vom Auftreten bestimmter Planktonarten abhängt, können solche Verlagerungen über die Veränderung der Spurengasemmission sogar Einfluß auf die Chemie der Atmosphäre haben und auch die Strahlungsbilanz durch die Atmosphäre beeinflussen. Das Vorkommen und das Verhalten von marinen Säugern und Seevögeln ist Gegenstand weiterer Projekte. Die sich verändernde Eisbedeckungsstruktur in der Aktis führt bereits heute zu veränderten Vorkommen einiger Arten und die zu erwartende Zunahme des Geräuschpegels im Ozean durch die Nutzung der nördlichen Schiffsrouten schon in der näheren Zukunft impliziert die Notwendigkeit, verlässliche Bestandsänderungsabschätzungen unverzüglich vorzunehmen.

Der Weg in die Grönlandsee führte uns zunächst vorbei an Helgoland und Südnorwegen, wo uns ein Schlechtwettergebiet erheblich aufhielt. Windstärken bis 10 Beaufort und Seegang bis 5 m verlangten, alle Gegenstände an Bord gründlich festzulaschen. An ein Auspacken der wissenschaftlichen Instrumente war unter diesen Bedingungen gar nicht zu denken. Auf dem Weg in das Arbeitsgebiet kamen wir dicht an der kleinen isolierten Insel Jan Mayen vorbei, auf deren Ostseite ein hochaufragender Vulkankegel ein prominentes Wahrzeichen darstellt. Üblicherweise von Wolken und Nebel umhüllt, gilt ein Blick auf seine Bergspitze als außerordentlich glücklich. Da auch unser Tag von dichtestem Nebel geprägt war, war die Überraschung, für etwa 20 Minuten urplötzlich einen freien Blick auf die höchsten Zacken des Vulkans zu haben, ungemein groß.

Die Eisbedingungen vor Grönland bestimmten nachfolgend weitestgehend unseren räumlichen Fortschritt. Die Fernerkundung per Satellit wies ausgedehnte Gebiete mit 100% Eisbedeckung aus – auch in Regionen, in denen wir forschen wollten. Ein kleiner Streifen parallel zur grönländischen Küste war auf den Satellitenbildern jedoch als weniger stark eisbedeckt zu erkennen. Diese Küstenpolynya zog sich von etwa 73°N bis fast an die von uns gewünschte Breite von 75°N hin. Wir entschieden uns, statt durch die Gebiete hoher Eiskonzentration durch diese Polynya zu fahren, was im Nachhinein als Glücksgriff zu bewerten ist, da wir so in absolut ungewöhnlich kurzer Zeit die Arbeit in den eisbedeckten Regionen bewältigten. Hierbei war von großer Bedeutung, dass uns ein lokales Hochdruckgebiet verlässlich begleitete, so dass sowohl die Satelliten als auch der Helikopter und die Brücke gute Sicht auf das Packeis hatten. Üblicherweise liegt im Sommer oftmals Nebel über den Eisgebieten. Mehrmals mussten riesige Schollen von vielen Kilometern Ausdehnung zielgenau umschifft werden, was ohne Unterstützung durch die Flugaufklärung nicht gelingt.

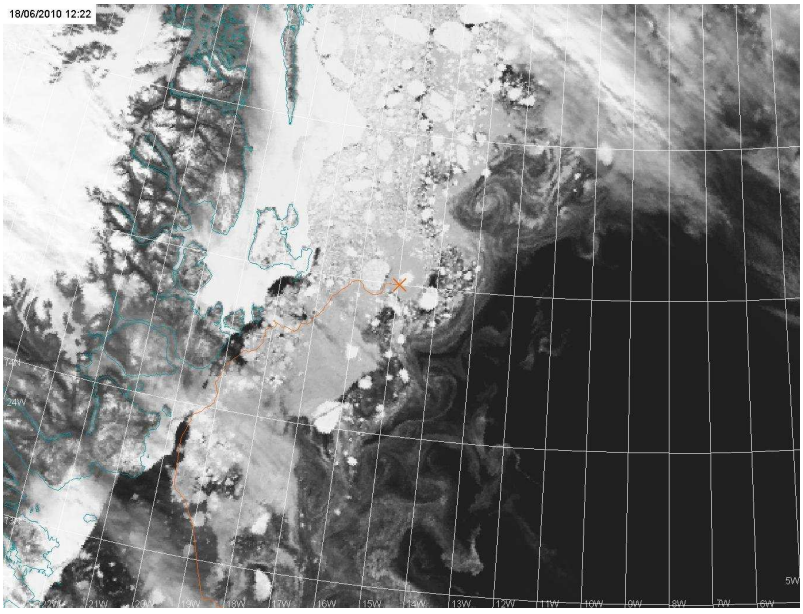


Fig. 1.1: Satellitenbild der Eisbedeckung und Route von FS Polarstern
Satellite image of ice cover and track of R/V Polarstern

Eine der wenigen offenen Wasserflächen nutzten wir, um vom Schlauchboot aus einige Fotos für FONA zu machen. Das ist eine Abkürzung für ‚Forschung für nachhaltige Entwicklung', ein Zusammenschluß von über 500 Forschungseinrichtungen. Das breite Forschungsspektrum hat als zentrales Anliegen, den zivilisationsbedingten Klimawandel zu bremsen. Kooperationen mit technologisch weniger entwickelten Ländern stehen ebenso auf der Agenda wie ein besseres Verständnis des Erd- und Klimasystems. Auch das Alfred-Wegener-Institut ist an diesen Forschungen beteiligt.

Fig. 1.2: Das FONA Logo auf einer Packeisscholle
The FONA logo on top of a pack ice floe

Der anschließende Weg lenkte uns strikt nach Osten. Auf einem etwa 1000 km langen ‚Zonalschnitt' längs des 75. Breitengrades führten wir im Ozean physikalische, biologische, chemische und optische Messungen durch.

Der Fahrtabschnitt endete am 30. Juni 2010 in Longyearbyen auf Spitzbergen.

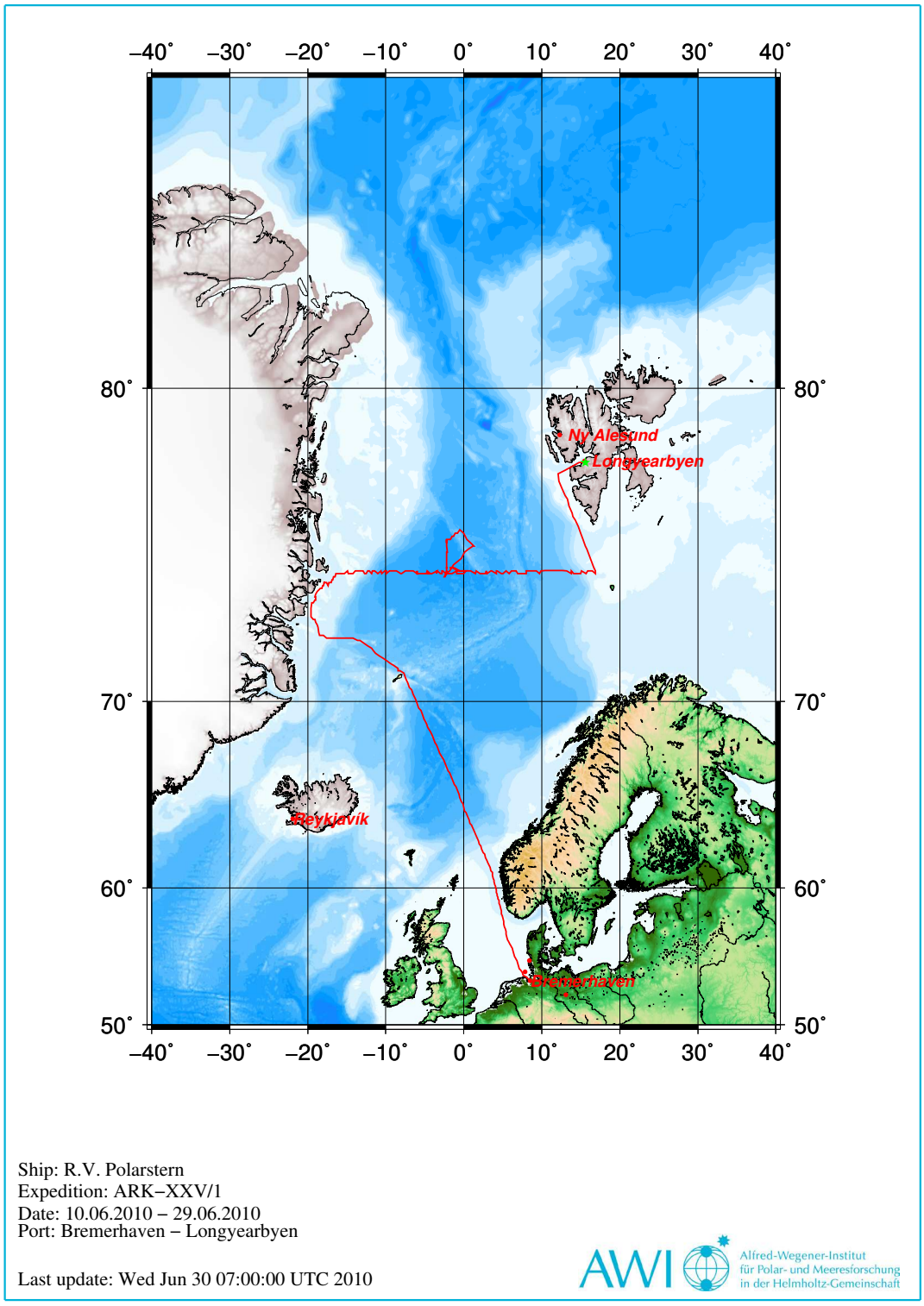


Fig. 1: Cruise track of R/V Polarstern during ARK-XXV/1
Abb.1. Fahrtverlauf von F/S Polarstern während ARK-XXV/1

OVERVIEW AND ITINERARY

The start of the first leg of the 25th *Polarstern* expedition to the Arctic was scheduled for June 10, 2010. The ship departed from Bremerhaven to do research in the Greenland Sea and during the succeeding cruise leg in Fram Strait.

This sub-Arctic region attains increased scientific attention during the recent few decades due to a number of key properties. The atmosphere ocean transfers of momentum, heat and freshwater are strong - particularly during the cold winter months. Water masses from low and high latitudes meet and interact by means of mixing at fronts, subduction, entrainment, and winter convection. Sea ice is formed in the northern and western parts and is transported southward with the cold and fresh surface waters in the East Greenland Current (EGC). Dense waters are formed which act as a major contribution to the Atlantic Meridional Overturning Circulation or as the source of deep Arctic Waters. All this makes the region highly sensitive to climatic changes and also leads to feedback mechanisms which vice versa affect the North European climate. Interrelations and feedbacks between the ocean climate and ocean biota and biogeochemical properties have also gained increasing interest recently due to the recognition of their importance. Investigations of these climatic aspects must evidently be based on long-time series and a sound perception of local modifications.

The hydrographic work during this cruise leg contributes to the establishment of long-term time series as are indispensable to study the ocean climate. Both in the Greenland Sea and in Fram Strait, the Alfred Wegener Institute already has had a long research history which allows to quantify such important processes like meridional heat fluxes, winter convection depths, heat and salt storage in the ocean, and also to determine variabilities and trends of the related physical parameters. The projects of ARK-XXV/1 include station work, conventional moorings as well as innovative autonomously profiling moorings.

The Greenland Sea is unique in the fact that three hydrographic domains (polar, Arctic, Atlantic), which represent different biogeographic climate zones, are present on the same latitude at a relatively small spatial scale. This allows to study the relationship between climate variability and pelagic ecosystems under the same light regime. In addition to ocean climate changes, changes in surface ocean chemical equilibrium and elemental cycling are occurring due to ocean acidification. Such physical and chemical changes of the environment will eventually bear enormous consequences for the pelagic system and for the net carbon balance of Arctic ecosystems. In the sub-polar areas climatic change already induced a shift of phytoplankton key species. Since the magnitude of trace gas emission is strongly related to particular plankton groups, such effects can result in variations of trace gas emissions by phytoplankton and might have an impact on the atmospheric chemistry, and eventually induce positive or negative feedback in the radiation balance. Furthermore, the occurance and behaviour of marine mammals and seabirds were studied. The changing ice cover in the Arctic leads to modified routes of many species already to date, and the expected increase in

ocean noise as is related to the use of the northern routes by freight ships in the near future necessitates monitoring of its effects now.

On the way to the Greenland Sea we passed Helgoland and southern Norway, where a region with adverse weather conditions caused much delay. Windforces up to 10 Beaufort and sea up to 5 m required to secure each and every item on board tightly. Under these conditions, no thought was spent on unpacking of our scientific equipment. On our way to the region of field work we passed the small isolated island of Jan Mayen. On its eastern end, a high volcano forms a prominent landmark. As its peak is usually covered by clouds and fog, a sighting of its top is regarded as outstandingly lucky event. As our day was dominated by the thickest fog, too, the surprise was great to have a clear sight of the volcano for about 20 minutes while passing by.

The ice conditions in front of Greenland determined decisively our further progress in space. Remote sensing by satellite showed extended areas of 100 % ice cover – including regions on our work plan. According to the satellite images, a small strip parallel to the Greenland coast should be less intensely covered by ice, however. This coastal polynya was indicated from about 73°N to near 75°N, which was the latitude of the planned field work. We decided to go north through this polynya rather than crossing the solid pack ice cover. It turned out that this was a lucky strike, as we were able to finish our work in the ice covered regions in an absolutely outstanding short time interval. Of great importance was the fact, that a local high pressure area constantly accompanied us, so that both satellites and helicopters had free sight on the ice conditions, and the bridge of *Polarstern,* too. During summer time, fog is a common feature in these regions. Several gigantic ice floes, extending over many kilometers, had to be surrounded well aimed – a task that is hardly feasible without support by helicopter ice reconnaissance.

We used one of the rare and small open water areas to shoot some photos of the FONA-N from the Zodiak. The FONA-N is a three dimensional N of orange colour and serves as the logo of FONA. This is the German abbreviation of ‘Research for sustainable development’, a combination of more than 500 research facilities. The broad research spectrum has a central aim: to slow down the anthropogenic climate change. Cooperation with technologically less developed countries stands on the agenda together with a better understanding of the earth and climate system. Self evidently, the Alfred Wegener Institute is part of the body of institutes.

Our further pathway headed strictly eastwards. On a zonal transect of about 600 miles length, located at a latitude of 75° N, we carried out physical, biological, chemical, and optical measurements.

The cruise leg ended on June 30 2010 at Longyearbyen, Svalbard.

2. WEATHER CONDITIONS

Max Miller, Hartmut Sonnabend
Deutscher Wetterdienst

In the evening (10:30 pm) of Thursday, June 10, *Polarstern* left Bremerhaven and started its cruise (ARK-XXV/1) to the Arctic Ocean. At the same time a low moved from Iceland to Southern Scandinavia and intensified. Therefore stormy winds from northwest were forecasted for *Polarstern* on its way north. Because there was no significant possibility of a detour, it was decided to maintain the planned course near the Norwegian coast. In the night to Saturday the northwesterly wind increased up to Bft 7 yet and reached Bft 9 on Saturday morning. Additionally we had waves around 5 to 6 meters, which slowed down *Polarstern.* But already on Saturday afternoon the wind began to decrease. Starting on Sunday (June 13) we only had weak pressure gradient and temporarily even high pressure influence. While staying in open waters there was now the problem of fog.

Around noon time on June 15 *Polarstern* had to pass the island of Jan Mayen along its eastern coast. Weak westerly winds caused a stripe of less cloud on the leeward side of the island. This area could be seen clearly on satellite images. So we could hold out hope to the participants of the cruise for a scenic view. And indeed, the Beerenberg, the most northern volcano of the earth could have been seen under sunny skies.

The first goal of the cruise was Shannon Island off the Greenland coast. There the measurements along 75° N should start. We had two possibilities to go there. With the help of ice charts and satellite images it was decided to head for Shannon from the south, using a polynya. We reached the ice edge on Wednesday (June 16). First fog patches were a problem, but soon the above mentioned high pressure influence caused less wind and sunny skies. Satellite images in connection with reconnaissance flights built the essential assistance to find the best route through the ice. So we reached the starting point near Shannon Island sooner as mentioned on Thursday, June 17.

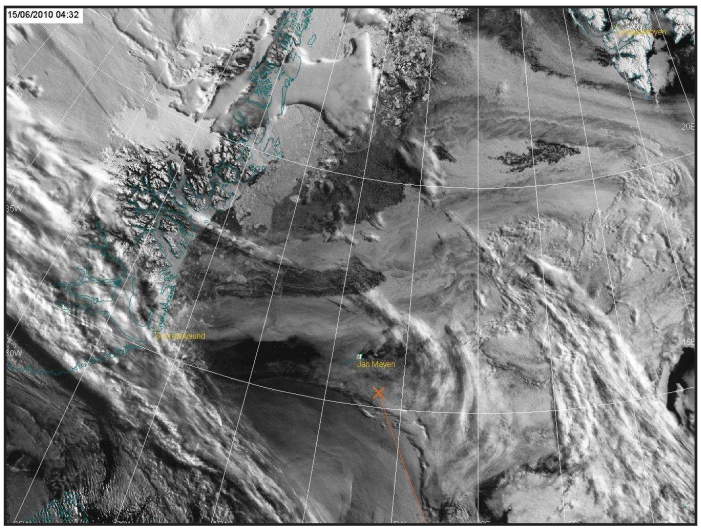
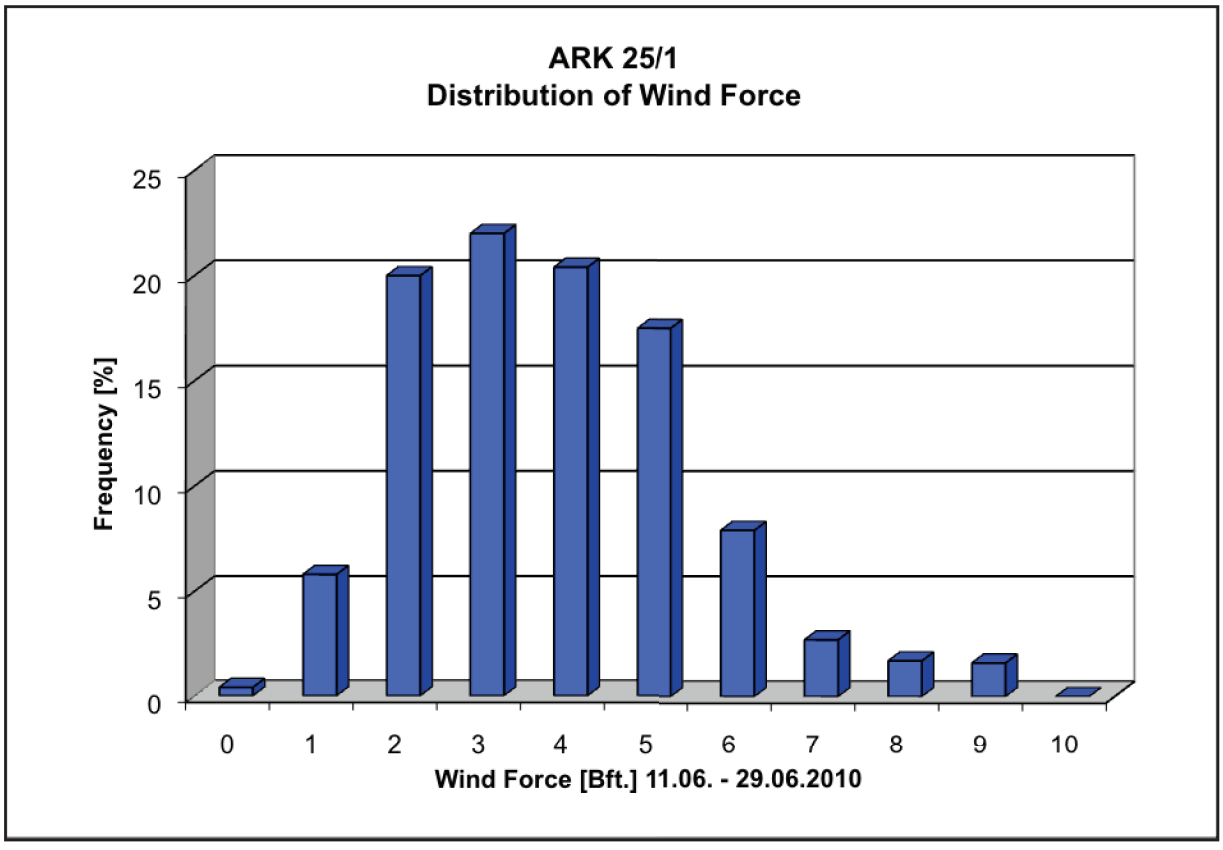
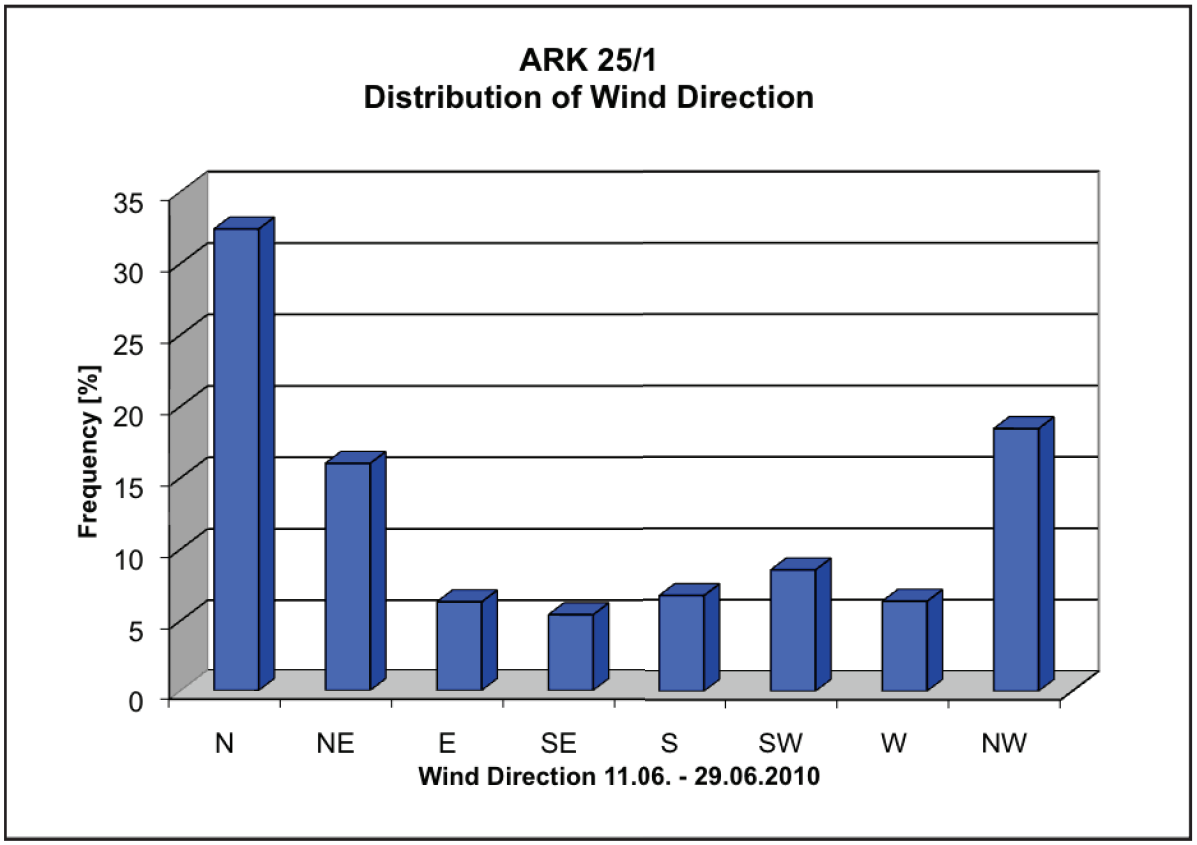


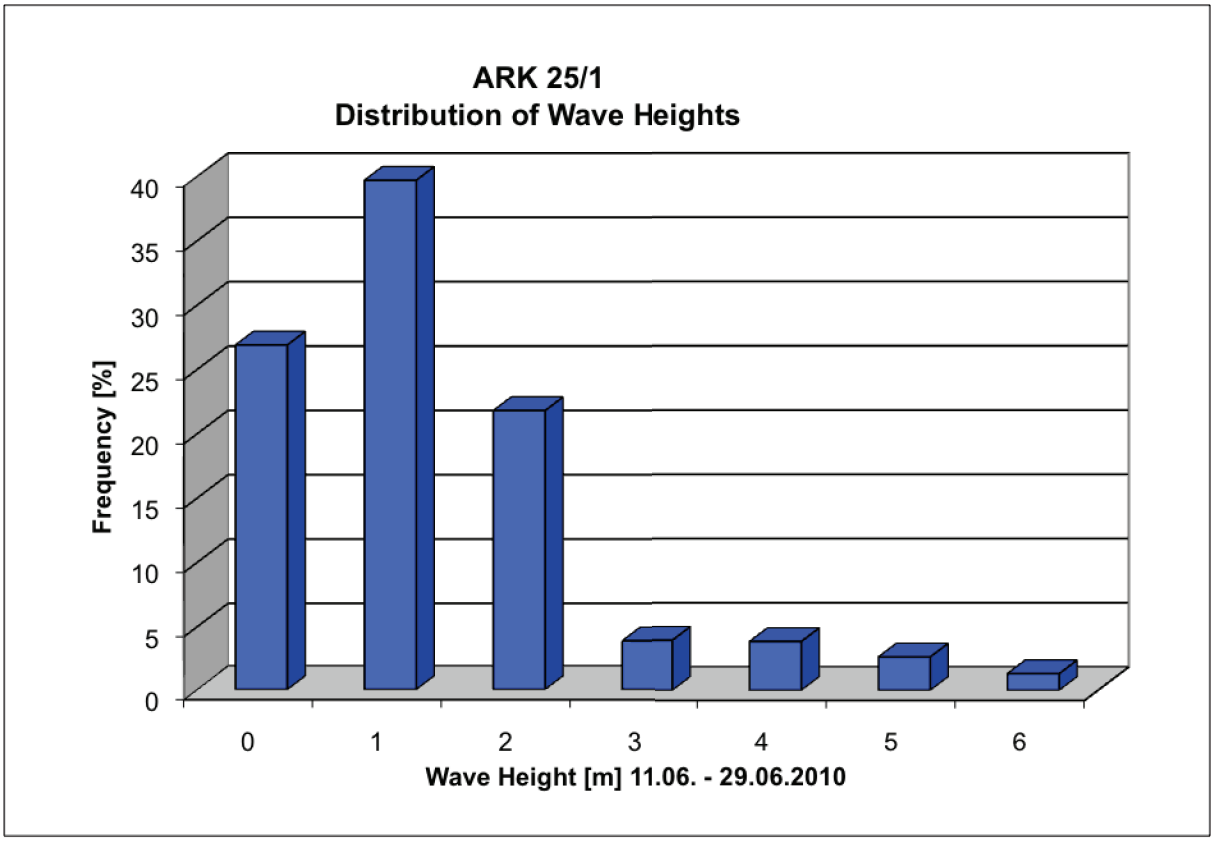
Fig. 2.1: Less cloud in the lee of Jan Mayen

As we left the ice on Saturday morning (June 19) a low near Bear Island developed. That caused northerly winds of Bft 6 on Monday (June 21) and waves up to 3 meters. The scientific works could still be done well and the wind weakened in the night to Tuesday yet. The rest of the week there was only weak pressure gradient with light and variable winds.

The development of a new low off the coast of Northern Norway hit the course of *Polarstern*. Saturday evening (June 26) the northeasterly wind increased and reached its maximum with Bft 8 in the early morning hours of Sunday. The waves grew up to 4 meters. But soon the wind weakened again. The rest of the cruise there were only light and variable winds. On Tuesday the measurements ended and in the morning hours of Wednesday (June 30) *Polarstern* sailed into the harbour of Longyaerbyen / Svalbard.




ARK 25/1
Distribution of Wind Direction
Frequency [%]
35
30
25
20
15
10
5
0
N
NE
E
SE
S
SW
W
NW
Wind Direction 11.06. - 29.06.2010


ARK 25/1
Distribution of Wave Heights
Frequency [%]
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
Wave Height [m] 11.06. - 29.06.2010

3. LONG TERM VARIABILITY OF THE HYDROGRAPHICAL STRUCTURE, CONVECTION AND TRANSPORTS IN THE GREENLAND SEA (LOTEVA-GS)

Gereon Budéus, Sascha v. Egan-Krieger, Juliane Jacob, Moritz Lürig, Ute Menzel, Matthias Monsees, Simone Moos, Rosa Wilm, Olaf Strothmann, Andreas Wisotzki, Svenja Zakrzewski, Oliver Zenk, Nico Zoch
Alfred-Wegener-Institut

Objectives

Physical processes in the entire Polar Oceans are regarded with increased attention because of their high sensibility against climatic changes. This includes the hydrographical development in the Greenland Sea. The changes here represent the first example of a basin wide structural modification as a reaction to an increased fresh water input, which took place in the early 90s. The doming structure of the 80s has subsequently been superseded by a marked two layer structure. The interface between these two layers is accompanied by a density step/stability maximum and is not static, but moves vertically with time. Between 1993 and the most recent years, a descent from about 900 m to almost 2,000 m has been observed. As up to date even modern numerical models include neither this structural change nor the interface movement, it is important to observe the hydrographical development carefully. In the present situation, the lower layer is apparently well isolated from atmospheric influences and effectively shielded against ventilation by winter convection. For years, bottom water properties change towards higher temperatures and salinities. This can to a large part be explained by a vertical displacement of the water column together with bottom water export. At the same time, lateral inputs do also modify deep water as well as shallow water properties. In particular, Atlantic Waters intrude into the Greenland Gyre over proportionally since 2005. This results in a tendency to higher salinities and temperatures in the upper few hundred metres.

At all depth levels, the Greenland Sea represents a highly dynamical environment with considerable temporal changes. Our present knowledge about the relevant hydrographical processes does not allow predicting the future hydrographical development (including convective activity and transports) and consequently most of the analysis relies on field measurements. In order to assess the changes correctly and to gain an adequate perception of the related processes, a longer time series is indispensable. It has to comprise continuous and consistent observations including the water mass end members on the shelves, and has to determine convection history reliably. As convection history is established by comparisons between subsequent years, a disruption of the time series is adverse to its analysis (a one year gap leading to a loss of convection determination of two years).

The present state of the hydrographical structure in the Greenland Basin leads to distinct difficulties with respect to the determination of ventilation depths and ventilation history. A precise determination of the convection depth over several years is however essential if one aims at an identification what processes are responsible for the observed changes from one year to another.

There are a number of unambiguous indicators for convection, but the fact that these indicators are absent is by no means synonymous to the absence of convection activity. Therefore it is often not possible to determine convection depths and ventilated volumes by the development of the physical parameters alone. Measurements from oxygen sensors show that both around the border and in the middle of the ventilated central areas of the Greenland Basin considerable concentration fluctuations take place. With the use of bottle samples only there will be an uncertainty in the total amount of oxygen and exact depth of latest convection which may lead to considerable difficulties in interpretation as well as misinterpretations. Since the electrical oxygen sensor reproduces the fluctuations very well but doesn't have the necessary accuracy (due to hysteresis and drift), the adequate method is to combine electrically measured vertical profiles (which reveal the detailed vertical structure) with bottle sample Winkler titrations (which provide the ultimate accuracy). The development of electrical Oxygen sensors goes on to date and field tests of different sensor types are part of present research activities. The combined application of electronic and chemical methods to determine oxygen concentration is used to evaluate the younger ventilation history of the upper part of the Greenland Sea Gyre on one hand and to examine the grade of isolation of the lower part on the other.

Salinity, together with temperature and pressure, is a basic hydrographical parameter. Considerable efforts are made to ensure that salinities are determined to the best possible accuracy. On board comparisons between the conductivity of water samples and that of the CTD are indispensable for this. A laboratory salinometer is used as the reference instrument. With recent developments and increasing accuracies of CTDs, the existing lab salinometer generation fails to serve as a more precise reference instrument. A salinometer development project has therefore been set up by a cooperation between the Alfred Wegner Institute and a commercial company (Optimare, Bremerhaven). The resulting new Optimare Precision Salinometer is designed to overcome the known shortcomings of the existing salinometer generation and provide accuracies one order better than possible before in a non air conditioned environment. The cruise leg ARK-XXV/1 serves as the first field test of this reference salinometer.

Within the IPY-legacy project LOTEVA-GS, a unique hydrographical time series is being established by an annually repeated zonal transect across the Greenland Gyre centre and by measurements of autonomous profilers (EP/CC-Yoyo, daily profiles, full ocean depth, 1 year exchange cycle, and NGK shallow water profiler for the uppermost 200 m) which give unprecedented insight to winter convective activity as well as to advective modifications. The major aim of the project is to detect and quantify the interannual and seasonal physical/chemical changes in the Greenland Gyre interior as well as in the surrounding large currents and to identify the responsible processes for the former.

Work at sea

Due to the large spatial gradients and relatively small spatial scales involved (Rossby radius about 20 km) it is necessary to perform measurements with a comparatively small station spacing and in a sufficient number. Otherwise spatial and temporal differences, which are of the same order in this region, cannot be distinguished and any derived trend is most likely heavily biased. Furthermore, small scale eddies have to be identified, distinguished from the background, and skipped from the background trend analysis. According to this, the transects are performed with a station spacing of 10 nautical miles or less, what results in about 60 CTD stations on a zonal transect at 75°N. A double sensor set is used for temperature and conductivity and various additional sensors have been utilised. The most important of these is the electrical oxygen sensor. Two different types have been engaged during ARK-XXV/1: A Clark cell (SBE43) and a fast Optode (Rinko III, Alec).

In addition to the electrical measurements, water samples have been taken by a carousel water sampler. The water samples serve as in-situ calibration material and are used to determine oxygen content according to the Winkler method.

Three autonomously profiling EP/CC moorings have been recovered. They are equipped with modified SBE-16 CTDs with Digiquartz pressure sensors. They deliver complete profiles every other day, travelling between the parking position at roughly 100 m and the ocean bottom at 3,700 m. In order to assess the annual fresh water cycle in the Greenland Gyre, a special profiling shallow water yoyo CTD has been installed since 2008 (NGK winch and Optimare/Sea-Bird instrument). This mooring reveals profiles between 160 m and the surface proper, and has been recovered, too, but with the instrument being lost, while all other parts were rescued intact.

A small north-south transect from the Hovgard Fracture Zone to the Greenland Gyre centre has been added to the standard zonal transect in order to make reasonable use of an excursion further north of 75°N that was necessary for an emergency rescue of a derelict Fram Strait mooring.

Preliminary results

a) Greenland Sea

Today it is clear that the straightforward idea of regular, repeated bottom water renewal in winter is not correct at present. Previously proposed concepts for deep convection in the 80s do not adequately describe the actual processes in the Greenland Sea. E.g., there was not a single year during which bottom water has been ventilated by winter convection since regular field expeditions have been started during the end of the 1980s. Work during the recent years showed a.o. that even the seemingly simple identification of winter convection fails when using single criterions. In contrast to present knowledge, temperatures in a ventilated volume can be higher as well as lower after a convection phase. The same is true for salinities. The application of a more complex criterion catalogue shows that in the last decade winter convection penetrated to the density step (interface between the two vertical layers) in mid depth

during many years. This density step is observed in increasing depths levels which allows for increasing convection depths. Consequently, these increasing depths are not synonymous with the ventilation of older water masses.

The interface between the two layers is situated at almost 2,000 m in the centre of the gyre today, as can be seen from the salinity distribution on the transect. This plot shows also that the interface forms a slight depression in the gyre centre now. This is combined with a massive inflow of Atlantic Waters into the gyre. These waters cross the two fronts between the major rim currents and the gyre in near surface layers of a few hundred metres thickness. Winter convection is needed to distribute this salinity signal to greater depths. According to the high temperatures and salinities of the Atlantic Waters (they represent the high salinity and high temperature end member in the TS-space of the Arctic), they descend when cooled in winter. Due to their high salinities, the Atlantic Waters take over the role of ice formation in the previous regime with respect to deep ventilation. As these waters attain high enough densities to sink already far above the freezing point, they may provide a heat input into the deeper layers and prevent ice formation effectively. Thus, when Atlantic Waters dominate the cross frontal input into the gyre, ice formation is inhibited and the ventilated waters increase in temperature and salinity. The salinity distribution in 2010 is almost indistinguishable from that in 2009 and does not allow for an identification of convection depths. The evaluation of the EP/CC mooring data has to be awaited to present reliable estimates for this.

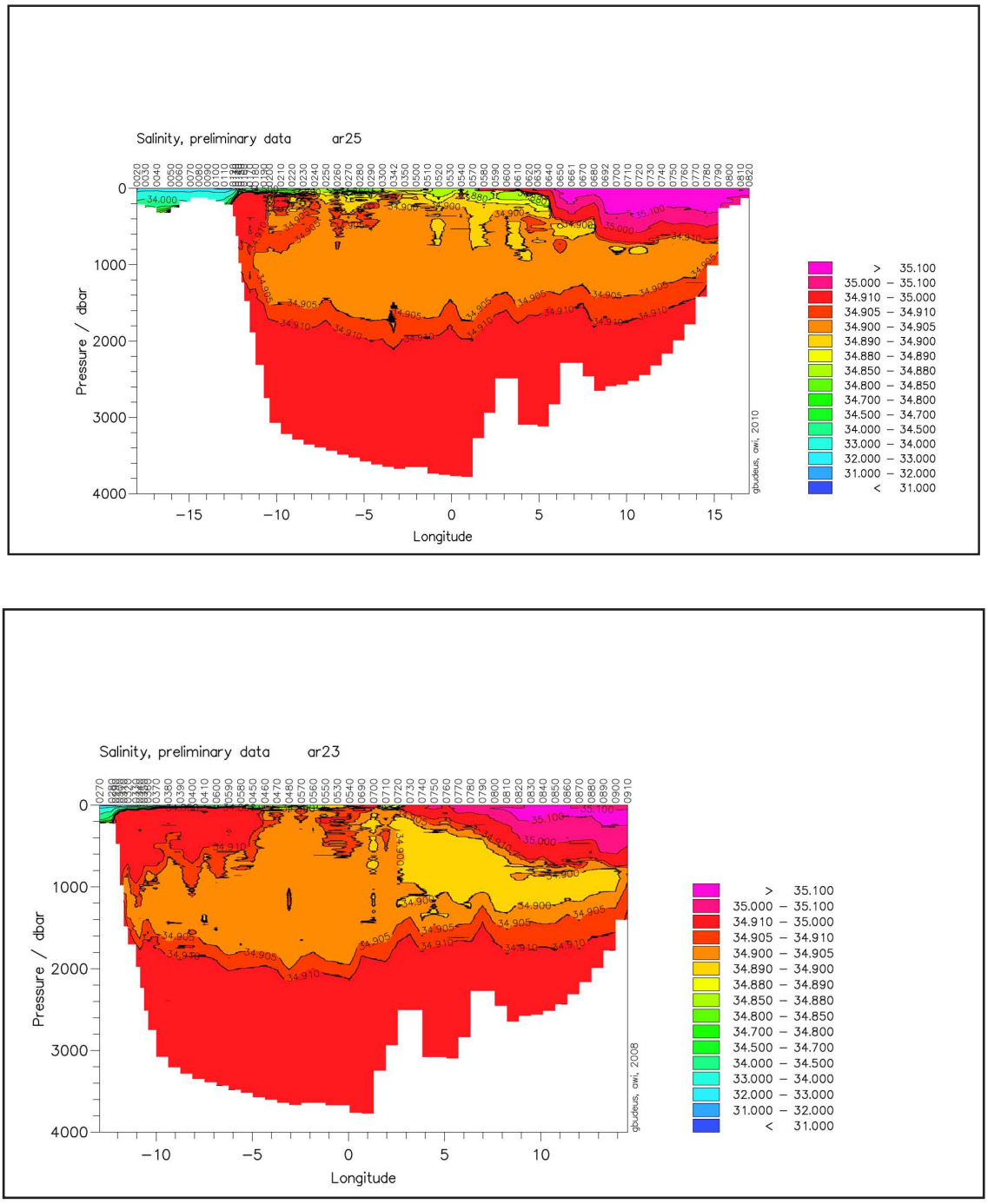


Fig. 3.1: Salinity distribution on the zonal CTD-transect (west is left), preliminary values

b) Oxygen sensors

The innovative fast Oxygen optode Rinko III was not markedly slower than the SBE43. It showed larger station to station fluctuations, however, and also pressure cross dependencies.

c) Optimare Precision Salinometer

The OPS S/N 003 was transported in its Zarges alu-box, the sample intake and cell being filled with standard sea water. Pre bath and main bath were emptied. An ordinary dry lab on the starboard side of *Polarstern* (E-deck) was chosen as the place to set up the OPS. The room is not air-conditioned and the door to the adjacent corridor is mostly left open. Main and pre bath were filled on 11.6.2010, the instrument was switched on in the morning of 12.6. After 5 minutes the instrument reached operational status and the first samples were measured.

Fig. 3.2: Optimare Precision Salinometer

The OPS was left running during the entire cruise leg (though we could have switched it off as it is quickly operational). 10 rinse cycles were used, 3 consecutive measurements with an allowed range of 0.0003 were requested. The OPS was residing in an ordinary dry lab, door to the corridor left open.

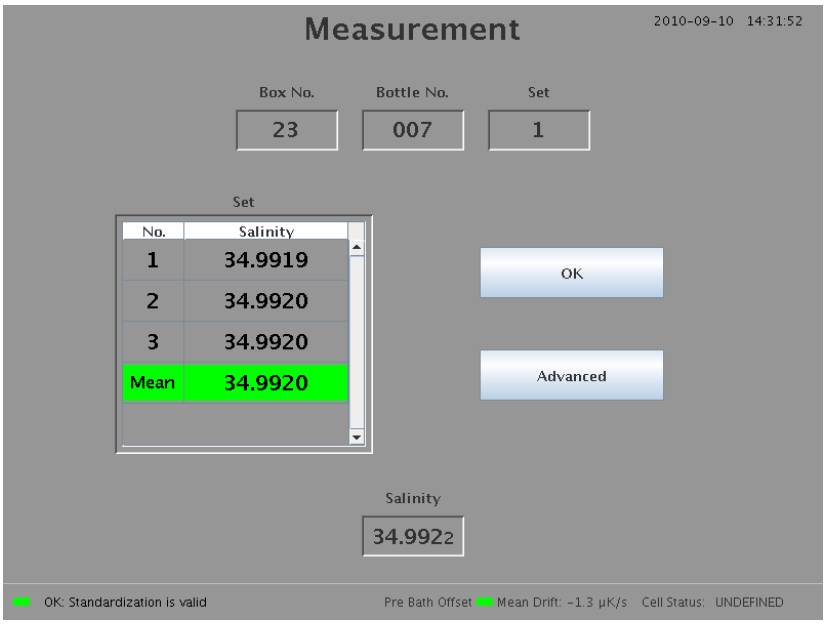
Two examples of results are shown below:

Box 35 bottle 12 First 3 measurements: 34.9161, 34.9162, 34.9161

Box 35 bottle 35 First 3 measurements: 34.9129, 34.9130, 34.9130

All other measurements were of the same quality as these. All samples were immediately stable (first 3 measurements were within the allowed range). Maximum range within a set of three measurements of a single water sample was 0.0002 for two of 34 sample

bottles. The others revealed readings with a range of 0.0001 or 0.0000. An important finding was that both tempering and pressure equilibration are mandatory to achieve ultimate accuracy when measuring salinity of an ocean sample.



The main conclusion is that the Optimare Precision Salinometer OPS provides reference salinity measurements with unprecedented accuracy not only in the lab but also in a less than ideal environment as usually encountered on ship-based expeditions. Automated sample processing allows operating it by less trained persons without compromising the results. A precondition for ultimate accuracy is the correct handling of the ocean sample, which has to be tempered and equilibrated. The sample also needs to be roughly at the temperature of the room where it is being processed. Otherwise stratification in the sample bottle develops quickly (more investigation is needed on this subject). The room temperature has not to be identical with the salinometer's bath temperature. Open questions remain particularly with respect to stratification in the Niskin bottles and the best practice to take samples. If difficulties arise concerning the stability of the OPS readings, one should consider the treatment and status of the water sample rather than direct attention to the instrument. Being fully operational, the instrument was left on board for the succeeding cruise legs.

4. DISTRIBUTION AND REPRODUCTION OF ZOOPLANKTON IN THE GREENLAND SEA IN RELATION TO CLIMATE CHANGES

Hans-Jürgen Hirche, Hannes Höffle
Alfred-Wegener-Institut

Objective and work at sea

The aim of the zooplankton studies during ARK-XXV/1 was to test the hypothesis that increased “Atlantification” of the Greenland Sea Gyre may cause a faunistic shift in the zooplankton leading to a replacement of Arctic key species by Atlantic fauna like the important copepod *C. finmarchicus*. During ARK-XXV/1 stratified zooplankton samples were taken with the multinet (0,25 m² opening; 150 μm mesh) from 1,000 m to the surface at 7 stations across the Greenland Sea Gyre. The samples will be compared with earlier cruises in the 1980s with special focus on Atlantic species.

Only few egg production experiments with *Calanus finmarchicus* were conducted, as females were relatively scarce in the samples.

Bongonet samples (300 and 500 μm mesh) from 500 m or 100 m to the surface were collected at 22 stations to study the distribution of larger predators. Chaetognaths were by far the dominant carnivores, but, contrary to our expectations, ctenophores were rare. Some *Mertensia ovum* were seen by the naked eyes in the surface water when the ship was on station and the sea was calm enough. Concentrations were, however, very low.

5. HIGHER TROPHIC LEVELS: DISTRIBUTION OF SEABIRDS AND MARINE MAMMALS

René-Marie Lafontaine, Roseline C. Beudels-Jamar, Dominique Verbelen (PolE)
(not on board: Claude R. Joiris)

Objective and context

The main objective of the campaign is to quantify and qualify the at-sea distribution of seabirds and marine mammals in the Norwegian and Greenland seas Attempt is then made to interpret such quantitative and qualitative data as a function of the main hydrological parameters, i.e. water temperature and salinity, that characterize the main water bodies (Atlantic Water, Arctic Water, Polar Water, pack ice), and the fronts between water masses or between ice and open water, such as the ice-edge. Data collected can be considered as an indirect representation of food availability for vertebrates in these water masses.

The data collected during this leg will be integrated into a time series running since 1973. This will allow detecting potential modification in numbers and evolution in distribution in the last 30 - 35 years.

The campaign was very successful, due to globally good weather conditions. We were able to record all sightings of seabirds and marine mammals while the ship was moving.

Methods

Continuous transects counts are achieved from the bridge, without width limit when the ship is moving at a speed of around 5 knots minimum. If data collected were to be used for densities estimates, a conversion factor should be applied, the detection limit depending on the visibility at the time of the observation, as well as the size and jizz of each species, as defined and applied earlier in polar marine ecosystems by this team (PolE). Many of the birds, especially the fulmar and the kittiwake, were attracted by the ship and were obvious followers, accompanying the ship for different lengths of time. Other species are known to actively avoid the proximity of vessels (e.g. narval). Raw data should therefore not be used for density estimates. Each recording period is of 30 minutes. Visual detection is the basis of recording, through the use of binoculars (10x42, Swarowski, Leica and Zeiss), particularly to complete and confirm identification at longer range.

Recording for helicopter is also used when available in order to investigate particular habitats out of reach of observation from the ship. These include in particular polynyas (a polynya, common US spelling, or polynia, common UK spelling, is an area of open water surrounded by sea ice), ice-edges, and some land habitats.

Preliminary results

A total of 440 periods of data recording, each of 30 minutes, were conducted. An additional 46 periods of data recording, each of 10 minutes, were recorded from the helicopter, mostly over polynyas and over ice-edges, along the East coast of Greenland.

During this first leg, a total of 32 bird species were observed, including 26 in the Greenland Sea, of which 24 are considered marine bird species (list of species in Annex 1). As far as marine mammals are concerned, 14 species were encountered, including 13 species during recording periods: 4 species of pinnipeds, 8 species of cetaceans and Polar Bear (list of species in Annex 5.2).

During the first leg the total number of seabirds encountered is 18,000 individuals (up to 30 June included).

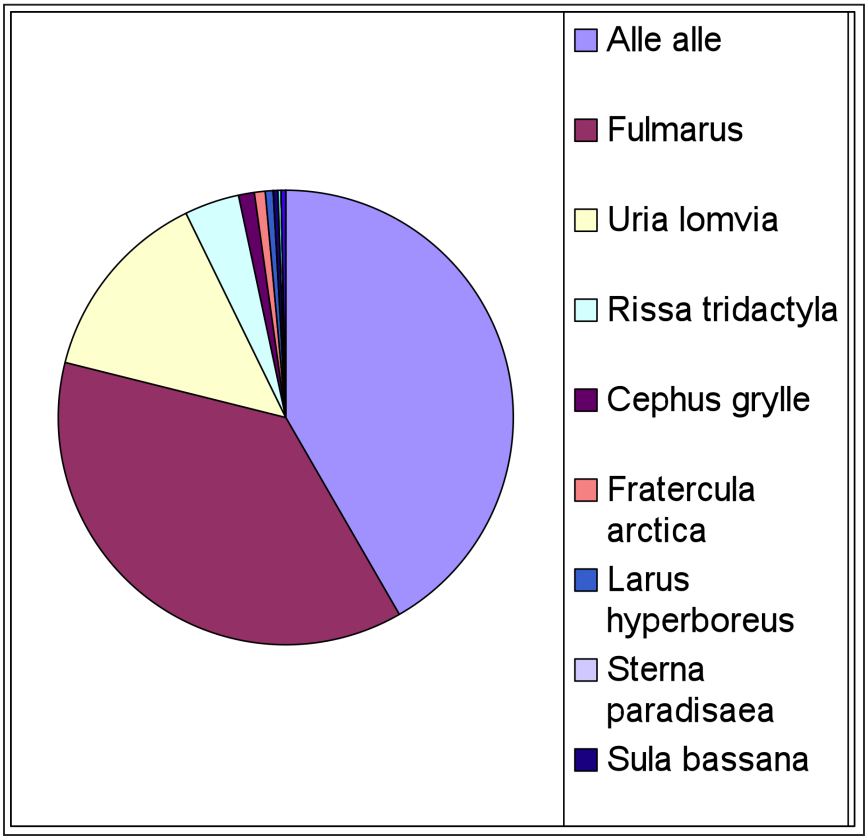


Fig 5.1: Relative abundance of bird species seen during the 440 recording periods from the moving ship (based on data collected up to 30 June 2010)

The mean number of birds seen per half-an-hour count was 41. Including for the four most common species: 17 Little Auks, *Alle alle*; 15 Fulmars, *Fulmarus glacialis;* 6 Brünnich's Guillemots*, Uria lomvia;* and 1.3 Kittiwakes*, Rissa tridactyla.*

At first examination, these results are quantitatively comparable to what was observed by this team during previous campaigns conducted in June along the same general transect, including an ice-pack component (see synthesis in Joiris, 2000).

The most numerous species are the same as those recorded during previous censuses conducted between 1973 and 2007. With the notable exception that this time Little Auk was the most numerous species when normally Fulmars are the most common.

Compared with some recent campaign (2008, 2009), the proportion of Glaucous Gull (*Larus hyperboreus*) seems to have decreased. Nevertheless Glaucous Gull is still more abundant than any of the large alcidae (*Uria sp* and *Fratercula arctica*) in the pack ice.

The relatively high abundance of Glaucous Gull, an opportunistic species like most of the others large *Larus* species, could possibly be indicative of an environmental change in progress. The more specialized bird species, like the large alcids, becoming less numerous, an opportunistic species, able to quickly adapt to a changing environment, is using the ressource now available. This very preliminary interpretation needs certainly to be tested and confirmed with more data and results. Other reasons for the relatively large number of Gulls could also exist, like e.a. the possibility that a (large) breeding colony was close to the traject followed by the cruise

At this stage, after conduction of the first leg of the 2010 campaign, we were unable to confirm changes observed for Little Auk in 2005 (linked to a decrease of breeding success or failure of breeding in the southern part of the range of the species). The total number of birds counted seems very similar with those of counts obtained during the same month in the same area in the 1980s and 1990s and no large movements of birds flying north was observed in 2010. But as 2010 seems to have been a “good” year for pack-ice cover in early summer, similar to the situation observed in those ten years periods, this is not an unexpected result.

Numerous cetaceans, particularly White-beaked Dolphins (*Lagenorhynchus albirostris*) and Fin Whales (*Balaenoptera physalus*), but also Blue Whales (*Baleanoptera musculus*) and others, were observed on a very short periods of time on two consecutive days: from June 28, corresponding to latitude 75°N and longitude 14°E, till June 29, corresponding to latitude 75° N and longitude 16° E, and again in June 29 (from 75°36’ N 16° E till 75°50’N; 15°41’E). The analysis of this data together with the main hydrological and topographic parameters will allow interpretation of these concentrated sightings.

The helicopter flights were also very usefull to census out of reach areas and habitats and to confirm boat sightings. Approximatively 150 Narvals (*Monodon monoceros*) were observed by helicopter, along a global transect following the edge of the pack ice in the polynyas along the East coast of Greenland, latitude 74°12’00”N – 74°51’00”N. This represents a very high proportion of the current published estimate for east Greenland population. Similar large numbers of Narvals were observed in previous years, when helicopter counts were possible, and it seems more than probable that this population was underestimated up to now.

Additionally, 30 Musk Ox (*Ovibos moschatus*) were recorded in a single short flight overland, of around 30 minutes. Arctic Hares (*Lepus arcticus*), a Gyr Falcon (*Falco rusticolus*), Divers (Gavia sp.) were also seen during this flight.

Reference

Joiris C.R. 2000. Summer at-sea distribution of seabirds and marine mammals in polar ecosystems: a comparison between the European Arctic seas and the Weddell Sea, Antarctica. Journal of Marine Systems 27: 267-276

Français	Nomslatins	Deutsch	English	Nbrs
Plongeonimbrin	Gavia immer	Eistaucher	Great Northern Diver	2
Plongeoncatmarin	Gavia stellata	Sterntaucher	Red-throated Diver	x
Fulmarglacial	Fulmarus glacialis	Eissturmvogel	Northern Fulmar	6673
Foude Bassan	Morus bassanus	Basstölpel	Gannet	21
Oieàbeccourt	Anser brachyrhynchus	Kurzschnabelgans	Pink-footed Goose	x
Hareldede Miquelon	Clangula hyemalis	Eisente	Long-tailed Duck	2
Eideràduvet	Somateria mollissima	Eiderente	Common Eider	1
Eideràtêtegrise	Somateria spectabilis	Prachteiderente	King Eider	x
Faucongerfaut	Falco rusticolus	Gerfalke	Gyr Falcon	x
Grandgravelot	Charadrius hiaticula	Sandregenpfeifer	Ringed Plover	1(Ringy)
Bécasseausp.	Calidris sp.	Strandläufer	Sandpiper	11
Phalaropeàbeclarge	Phalaropus fulicarius	Thorshühnchen	Red (orGrey) Phalarope	4
Grandlabbe	Stercorarius skua	Große Raubmöwe	Great Skua	13
Labbepomarin	Stercorarius pomarinus	Spatelraubmöwe	Pomarine Skua	3
Labbeparasite	Stercorarius parasiticus	Schmarotzerraubmöwe	Parasitic Skua	10
Labbeàlonguequeue	Stercorarius longicaudus	Falkenraubmöwe	Long-tailed Skua	11
Goélandbrun	Larus fuscus	Heringsmöwe	Lesser Black-backed Gull	15
Goélandmarin	Larus marinus	Mantelmöwe	Greater Black-backed Gull	2
Goélandbourgmestre	Larus hyperboreus	Eismöwe	Glaucous Gull	93
Goélandargenté	Laru sargentatus	Silbermöwe	Herring Gull	2
Mouettede Sabine	Xema sabini	Schwalbenmöwe	Sabine´s Gull	3
Goélandsénateur	Pagophilae burnea	Elfenbeinmöwe	Ivory Gull	18
Mouettetridactyle	Rissa tridactyla	Dreizehenmöwe	Kittiwake	682
Sternearctique	Sterna paradisea	Küstenseeschwalbe	Arctic Tern	29
GuillemotdeTroïl	Uria aalge	Trottellumme	Common Guillemot	4
Guillemotde Brünnich	Uria lomvia	Dickschnabellumme	Brunnich´s Guillemot	2511
Guillemotsàmiroir	Cephus grylle	Gryllteiste	Black Guillemot	214
Macareuxv (moine)	Fratercula arctica	Papageientaucher	Puffin	121
Mergule (nain)	Alle alle	Krabbentaucher	Little Auk	7431
Bruantdesneiges	Plectrophenax nivalis	Schneeammer	Snow Bunting	1

X = seen from helicopter only

Francais	Latin	Deutsch	English
Cachalot	Physeter macrocephalus	Pottwal	Sperm Whale
Baleine à bosse	Megaptera novaeangliae	Buckelwal	Humpback Whale
Baleine bleue	Balaenoptera musculus	Blauwal	Blue Whale
Rorqual commun	Balaenoptera physalus	Finnwal	Fin Whale
Petit Rorqual	Balaenoptera acutorostrata	Zwergwal	Minke Whale
Hyperoodon (arctique)	Hyperoodon ampullatus	(Nördlicher) Entenwal	Northern Bottlenose Whale
Orque épaulard	Orcinus orca	(Großer) Schwertwal	Killer Whale
Narval	Monodon monoceros	Narwal	Narwhal
Globicephale noir	Globicephala melas	Grindwal	Pilot Whale
Dauphin à bec blanc	Lagenorhynchus albirostris	Weißchnauzendelphin	White-beaked Dolphin
Phoques annelés	Pusa hispida	Ringelrobbe	Ringed Seal
Phoque du Groenland	Pagophilus groenlandicus	Sattelrobbe	Harp Seal
Phoque barbu	Erignathus barbatus	Bartrobbe	Bearded Seal
Phoque à capuchon	Cystophora cristata	Klappmütze	Hooded Seal
Oursblanc	Ursus maritimus	Eisbär	Polar Bear
Svalbardor Greenland only			
[Bélouga	Delphinapterus leucas	Weißwal (oder: Beluga)	Beluga,White Whale]
[Boeuf musqué	Ovibos moschatus	Moschusochse	Musk Ox]
[Lièvre arctique	Lepus arcticus	Polarhase	Arctic Hare]
[Renard polaire	Alopex lagopus	Polarfuchs	Arctic Fox]
[Renne du Spitsberg	Rangifertarandus platyrhynchus	Svalbard Renntier	Svalbard Reindeer]

6. PLANKTON ECOLOGY AND BIOGEOCHEMISTRY IN THE CHANGING ARCTIC OCEAN

(PEBCAO group AWI, coordination E. - M. Nöthig)

During ARK-XXV/1 the following two topics were covered:

- Production, fate and aggregation of organic matter in a changing Arctic Ocean
- Mascha Wurst, Tobias Mattfeldt (Glo Car Anja Engel)
- Investigations on nanoplankton with focus on key species *Phaeocystis pouchetii*
- Sigrid Pfaff (DFG Steffi Gäbler-Schwarz)

Objectives

The Arctic Ocean is one of the most vulnerable regions on earth where effects of climate change are most obviously observable. During the last decade drastic decrease in sea ice cover and extent, temperature increase and, changes in surface ocean chemical equilibrium and elemental cycling due to ocean acidification are observed. However, little is known about the consequences of climate changes on the Arctic plankton community, food web structures and related biogeochemical changes such as the net carbon balance of Arctic ecosystems. Our aim is to contribute to a better understanding of the direction and strength of biological feedback processes in the future Arctic Ocean by detection and tracking of large-scale environmental changes.

6.1 Production, fate and aggregation of organic matter in a changing Arctic Ocean

Based on the awareness, that global change has increasingly changed marine ecosystems, we intend to examine the 'present day' situation of pelagic microbiogeochemistry in the Arctic Ocean, with emphasis on the turnover of organic matter during production and decomposition processes. The data shall serve as a database for a better evaluation of the relevance of changes that are determined in perturbation experiments, such as the Svalbard CO_2 mesocosm study 2010 (EPOCA). Our overarching goal is to contribute to a better understanding of the direction and strength of biogeochemical and microbiological feedback processes in the future ocean. The investigations were conducted along the 75°N transect during ARK-XXV/1 and continued during ARK-XXV/2 in the HAUSGARTEN area and along the 78°50'N transect.

Work at sea/ preliminary results

During ARK-XXV/1, along the transfer to Shannon Island, seawater samples were collected by the onboard membrane pump. During the 75° N transect samples were acquired by a CTD/rosette sampler at different depths, according to the station table (Tab. 6.1) to determine the impact of microbial processes on aggregation and sedimentation as part of the work of the PEBCAO group, in close cooperation with the project of I.Peeken et al. (AWI). Analyses of samples include biogeochemical parameters (particulate organic carbon and nitrogen (POC/PON), dissolved organic carbon (DOC), dissolved organic nitrogen (DON), dissolved and particulate phosphorus (DOP/POP), dissolved and total polysaccharides (DCHO/CHO), dissolved and total amino acids (DAA/AA), transparent exopolymer particles (TEP), coomassie stainable particles (CSP)), pH, total alkalinity (TA) and microbiological parameters (bacterial cell numbers, bacterial DNA). Samples were preserved, kept refrigerated or frozen at -20°C / -80°C for further analyses in the home laboratory.

Tab. 6.1: Stations where water samples were taken with the onboard membrane pump (MB) or from bottles of the CTD-rosette sampling system (CTD)

station name	date	time (UTC)	LAT	LONG	water depth (m)
MB - 001	12.06.2010	16:12	60° 3.703' N	4° 9.222'E	294
MB - 002	13.06.2010	7:13	62° 19.57' N	2° 30.289' E	405
MB - 003	13.06.2010	11:03	62° 58.624' N	1° 53.274' E	995
MB - 004	13.06.2010	13:57	63° 28.925' N	1° 23.870' E	1583
MB - 005	13.06.2010	16:02	63° 50.488' N	1° 2.72' E	2228
MB - 006	14.06.2010	6:02	66° 16.627' N	1° 28.568' W	3574
MB - 007	14.06.2010	11:00	67° 8.571' N	2° 28.971' W	3754
MB - 008	14.06.2010	14:01	67° 40.643' N	3° 7.084' W	3804
MB - 009	14.06.2010	16:02	68° 1.485' N	3° 32.958' W	3773
MB - 010	14.06.2010	18:55	68° 32.498' N	4° 11.868' W	3620
MB - 011	15.06.2010	6:04	70° 32.143' N	6° 49.647' W	2169
CTD -Test 001	15.06.2010	13:00	71° 23.795' N	8° 26.920' W	2199
MB - 012	16.06.2010	6:08	72° 37.619' N	15° 10.555' W	2060
CTD - 002	17.06.2010	17:12	74° 38.57' N	17° 59.23' W	221
CTD - 005	18.06.2010	3:47	74° 54.63' N	16° 26.80' W	331
CTD - 007	18.06.2010	10:23	74° 55.48' N	15° 25.97' W	182
CTD - 017	19.06.2010	5:40	74° 59.96' N	11° 51.91' W	1912
CTD - 020	19.06.2010	13:55	74° 59.54' N	10° 34.92' W	3095
CTD - 025	20.06.2010	9:20	75° 0.18' N	7° 20.57' W	3441
CTD - 026	20.06.2010	12:46	75° 0.73' N	6° 42.65' W	3489
CTD - 030	21.06.2010	4:34	75° 0.01' N	4° 7.97' W	3643
MB - 013	21.06.2010	10:29	74°54.362' N	4° 41.413' W	3612
MB - 014	21.06.2010	14:58	75° 4.424' N	3° 28.376' W	3669

station name	date	time (UTC)	LAT	LONG	water depth (m)
CTD - 034	21.06.2010	20:37	75° 0.17' N	3° 31.54' W	3666
MB - 015	22.06.2010	11:55	75° 21.439' N	0° 15.400' W	5507
CTD - 039	23.06.2010	0:43	76° 20.04' N	0° 29.53' W	3205
CTD - 041	23.06.2010	6:25	76° 12.56' N	1° 9.13' W	2449
CTD - 044	23.06.2010	17:00	76° 0.05' N	2° 13.40' W	3772
CTD - 049	24.06.2010	10:24	75° 8.06' N	2° 13.20' W	3552
CTD - 057	25.06.2010	13:57	75° 0.78' N	0° 59.35' E	3775
CTD - 062	26.06.2010	6:49	75° 0.07' N	4° 14.24' E	3093
CTD - 064	26.06.2010	15:48	75° 0.01' N	5° 29.57' E	3115
CTD - 068	27.06.2010	11:35	75° 0.29' N	8° 2.54' E	3341
CTD - 072	28.06.2010	5:55	74° 59.98' N	10° 39.08' E	2535
CTD - 074	28.06.2010	12:31	75° 0.23' N	11° 55.00' E	2337
MB - 016	28.06.2010	12:21	75° 0.194' N	11° 55.144' E	2337
MB - 017	28.06.2010	19:24	75° 0.159' N	13° 13.363' E	2010
CTD - 080	29.06.2010	4:36	75° 0.04' N	15° 50.61' E	269
CTD - 082	29.06.2010	7:32	74° 59.71' N	16° 60.00' E	135
MB - 018	29.06.2010	7:28	74° 59.744' N	17° 0.021' E	136

6.2 Investigations on nanoplankton with focus on key species *Phaeocystis pouchetii*

Phaeocystis pouchetii is a bloom forming alga recognized an ecologically important member of the Arctic phytoplankton. Dissolved organic compounds released by *Phaeocystis* during bloom conditions can accumulate and, *Phaeocystis* is also thought to be a major contributor to the global sulphur budget by releasing substantial quantities of dimethylsulfide (DMS). Climatically induced changes will also impact species selection in pelagic ecosystems. A shift in species composition is expected in all size classes of the phytoplankton, smaller planktonic algae will gain more importance in mediating element, matter and, export fluxes. One of them, *Phaeocystis pouchetii*, having an intermediate position regarding size can play a key role in the cycle of sulphur and carbon in the Arctic Ocean. However, little is know about the diversity distribution, occurrence and physiology of this species in Arctic pelagic regions.

Work at sea/ preliminary results

During the cruise ARK-XXV/1 handnet-samples were taken from the different stations shown in Fig. 6.1. The handnet was equipped with gauze material (mash size of 35 μm). The samples were taken contemporary with the CTD applications from 10 m water depth.

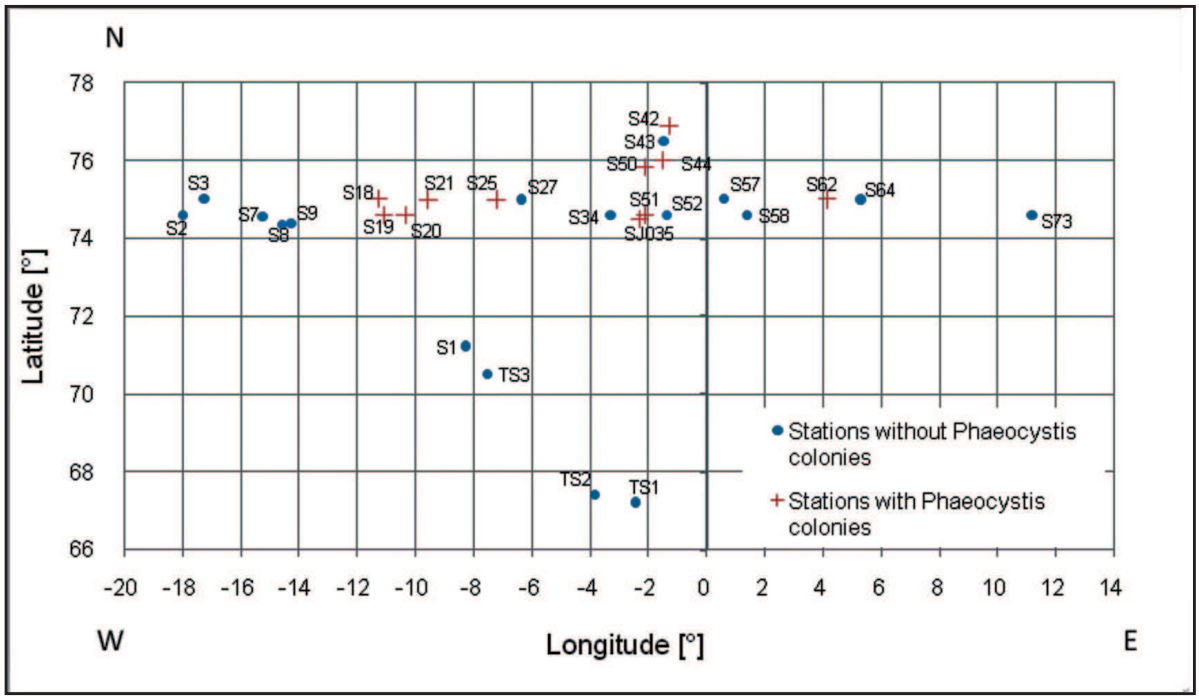


Fig. 6.1: Handnet sampling during ARK-XXV/1 for the isolation of Phaeocystis pouchetii (TS:Test Stations - samples taken from the membrane-pump; S: Stations with handnet sampling)

The isolation was carried out in a lab-container at a temperature of 10°C. The isolates were first stored at 4°C and later they were partially shifted to 0°C. Over the whole cruise leg the isolates where exposed to light for 24 h per day. In addition at every station isolates for the DNA conservation of the algae were taken. They were frozen at -20°C.

Preliminary results

In total, 25 samples were taken during the first cruise leg of ARK-XXV with 11 positive samples for *Phaeocystis pouchetii*. The number of cultures and the amount of isolates for the DNA conservation which were created from every station is shown in Tab. 6.2.

Tab. 6.2: Number of cultures and isolates for DNA conservation of *P. pouchetii* broken down for each station

Stat.No.	Number of cultures	Number of isolates for DNA conservation
S18	23	5
S19	4	5
S20	6	3
S21	10	5
S25	3	3
SJ035	26	5
S42	18	5
S44	30	5
S50	5	5
S51	8	5
S62	5	10
Total	**138**	**56**

7. CLIMATE INDUCED CHANGES OF ARCTIC PHYTOPLANKTON AND POSSIBLE IMPACTS ON TRACE GAS PRODUCTION

Bernard Bonsang, CNRS, Alexandra Cherkasheva, AWI; Anja Theis , AWI/ IFM-GEOMAR, Sophie Tran, CNRS; Britta Wend, AWI,
(not participating: Ilka Peeken, MARUM/AWI; Valérie Gros, CNRS, Roland Sarda-Esteve)

Introduction

Climate change is increasingly affecting physical and biological systems. The polar oceans appear to be very sensitive to global warming due to the positive feedbacks associated with melting sea-ice and snow and the concomitant reduction in albedo (IPCC2007). In the Arctic Ocean the area covered by sea ice is reducing over the last decades (Comiso 2002; Parkinson et al. 1999) reaching the most drastic summer decrease in 2007 (Comiso et al. 2008). The proceeding of these dramatic changes in the sea-ice cover will have major implications for the ecosystem of the Arctic (Carmack and Wassmann 2006), as it has been already seen by the northward progressing of the temperate species Emiliania huxleyi into the polar habitat (Bauerfeind et al. 2009; Hegseth and Sundfjord 2008) or the shift to pico- and nanoplankton dominated communities (Tremblay et al. 2009).

Changes in phytoplankton species will also affect the primary production, which can be globally derived from satellite observations of sea surface temperature (SST), photosynthetic available radiation (PAR) and chl-a conc. Besides the advantage of satellite measurements providing a much better temporal and spatial coverage, they have the disadvantage of being less precise than *in-situ* measurements. Their degree of uncertainty results from the lack of global information on phytoplankton absorption and light penetration depth. Recently Vountas et al (2007) and Bracher et al. (2009) showed that specific phytoplankton absorption spectra as well as information on the light penetration depth can be derived by the differential optical absorption spectorscopy retrieval technique applied to retrieve these oceanic compounds (PhytoDOAS) from hyperspectral measurements of the satellite instruments SCIAMACHY (operating on board of the European environmental satellite ENVISAT). So far, the satellite information on phytoplankton distribution and primary production has been not acquainted to the Arctic Ocean because the validation with in-situ data focused on all other regions of the global oceans due to the lack of *in-situ* data.

In the surface layers of the oceans (euphotic zone) planktonic biomass through photosynthesis results in production of organic compounds into the surrounding seawater. Some of these volatile species with low Henry's Law coefficients are able to escape to the atmosphere. Among these species some can have a significant influence on the photochemistry of the atmosphere, particularly unsaturated hydrocarbons (such as isoprene:2-methyl-1,3 butadiene, or light alkenes) and carbon monoxide (CO) which

have a strong impact on the OH radical and ozone budget as well as on the formation of organic aerosols (Claeys et al. 2004).

Isoprene production from the oceans results from the “in situ biological production in the euphotic zone by seaweeds and phytoplankton under PAR radiation” (Bonsang et al., 1992; Milne et al. 1995; Broadgate et al., 1997; Shaw et al., 2003, Bonsang et al., 2010). Currently there are very few studies available on the quantification of emissions of these volatile organics by the ocean.

Objectives

Do we observe a further northward intrusion of *E. huxleyi* in the Arctic?

Will other key species in the Arctic be affected by climate change?

Can we monitor the changes of Phytoplankton Functional Types (PFTs) with satellite data in the Arctic?

Can we improve remote sensing algorithms for the investigated research area for a better characterisation of the primary production in the Arctic ocean?

What is the role of phytoplankton for emissions of carbon monoxide and Non Methane Hydrocarbons (NMHC) in the Arctic?

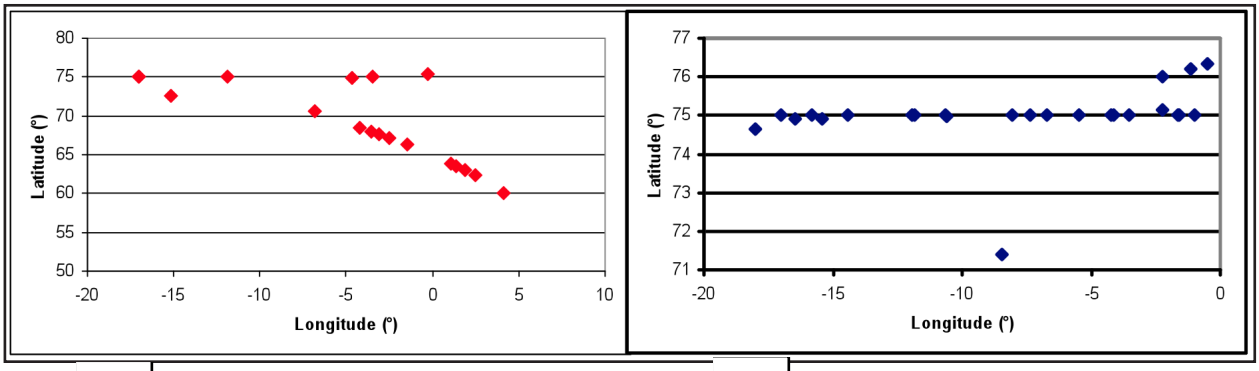
How will sea ice affect emissions of carbon monoxide and Non Methane Hydrocarbons (NMHC) in the Arctic?

Work at sea

Phytoplankton distribution and biomass and biooptical measurements

Samples for high performance liquid chromatography (HPLC) pigment measurements and flow cytometer were taken on stations with Niskin bottles and for the surface with the membrane pump (8m). In total 18 surface samples were collected (Fig. 7.1a) during the cruise and the sampling strategy was combined with observations of the trace gas measurements (see below). 25 stations were sampled from the upper 100 m with a depth resolution of 6 samples per station (Fig. 7.1b). Samples for HPLC were filtered on 25mm GF/F filters (Whatman) and immediately frozen in liquid nitrogen and thereafter stored at -80°C. Samples for flow cytomenter have been preserved with Glutaraldehyde and were also frozen at -80°C. For particulate absorption (PAB) 125 samples were mostly taken for the surface, fluorescence maximum and below. Samples were filtered over 47mm filters and immediately frozen at -80°C. All samples will be analysed within the next 8 month and compared with previous phytoplankton measurements of the same region. The data will further allow a validation of the satellite data and will be used to determine the sources of various trace gases (see below).

Additional particulate absorption in suspension and absorption of coloured dissolved organic mater (CDOM) were measured (55 samples) during the cruise using the point-source integrating-cavity absorption meter (PSICAM) (Röttgers et al. 2005). Data from PSICAM will be analysed together with the PAB filters in order to compare these two different techniques of measuring the same parameters.



a) b)

Fig.7.1:Position of pigment and flow-cytometer samples from the membrane pump (a) and the CTD-casts (b).

For online *in-situ* optical measurements of photosynthetic efficiency and chlorophyll fluorescence a FastTracka Fast Repetition Rate Fluorimeter (FRRF) was installed in a flow-through system with a continuous water supply from the membrane pump.

During 7 stations outside the drifting ice floes radiances and irradiances from 300 to 900 nm were measured with the set of four radiometers. One sensor, mounted on deck, was measuring downwelling irradiance at the sea surface. At the same time, the three other radiometers were measuring upwelling-radiances, upwelling and downwelling irradiances throughout the water column (0-80 m).

The radiometric data are now being processed by Anja Theis (PhD student, PHYTOOPTICS, AWI) in order to obtain remote sensing reflectances, i.e. parameters that are measured by satellite sensors, and other aparent optical properties (diffuse attenuation). Later on these data will be used to validate MERIS, MODIS and SeaWiFS remote sensing reflectance and Chl a products and will also be used to charcterise the underwater radiance field in these waters and adapt current oceanic radiative transfer models for the Arctic waters.

The information on the irradiance profiles together with particulate absorption and absorption by CDOM will be assimilated in the satellite-based primary production model by Antoine and Morel (1996) and Antoine et al (1996) to receive more correct primary production estimates or the Arctic ocean.

Trace gases

The main objective of the cruise was to document spatial (horizontal and vertical within the water column) variability of dissolved carbon monoxide (CO) and non-methane hydrocarbons (NMHC). For this purpose, online measurements of surface (~6 m) water using the ship membrane pump were performed during steaming time of the ship in order to document the horizontal distribution of studied compounds. As the pump was turned off in the pack ice, the variability of the surface seawater was not documented in the areas close to Greenland covered by sea ice. A special focus was made on the study of the compound vertical profiles in the first 100 m of the water column. For this purpose, water samples from the CTD were analysed for 12 selected stations (station 1 or test station near Jan Mayen Island and stations 2,5, 9, 14, 20, 25,41, 44, 64, 68, 75). On average 6 depths were investigated for each profile, for each depth duplicates were

measured in order to characterize the reproducibility of the whole analytical procedure. Immediately after sampling, the first flask was analysed (all the remaining flasks were stored by 0°C and were analysed subsequently). A 6-depths profile analysis on the duplicates (including blank and calibration measurements) required about 12 hours of measurements. Special tests were performed on board in order to check the influence of seawater flasks storage on dissolved CO and hydrocarbons measurements, and evaluate the overall uncertainty of the analytical procedure.

Measurements of CO and NMHC were performed by gas chromatography and therefore the first step of the measurement was dedicated to the extraction of the compounds from the water. For this purpose, extraction cells similar to the system described by Xie et al. (2001) were used. The principle of the extraction is briefly described here. The cell is a home-made glass coil where the water sample and synthetic air are continuously injected. Along the pathway, phase equilibration between CO (NMHC) in the water and CO (NMHC) in the synthetic air occurs and the partially equilibrated gas-phase is then directly injected into the instruments. For CO, the extracted gas was directly injected in the instrument which was a gas chromatograph equipped with a hot mercuric oxide detector (RGD2, Trace Analytical, Menlo Park, CA, USA), according to the method described in Gros et al. (1999). For NMHC, the sample was first pre-concentrated during 20 minutes on a dedicated trap and then injected in a gas chromatograph equipped with a Photo Ionisation Detector (GC-PID, Intersciences, The Netherlands). Measured NMHC include light alkanes (ethane, propane, butanes…), light alkenes (ethene, propene, butenes…) as well as isoprene, a compound known to be directly emitted by phytoplankton. Blank measurement (same analysis but without water sample) and calibrations were performed regularly, at least once a day.

Preliminary Results

Trace gases

Data presented here are preliminary and values should not be considered as absolute. CO values are given as measured ppb whereas NMHC values are given as arbitrary units. Fluorescence data are extracted from CTD downcast profiles and values are in an arbitrary unit.

CO time series

Carbon monoxide was found to be supersaturated in the ocean surface with respect to the atmosphere. Surface measurements of carbon monoxide display a high degree of variability from 100 to 500 ppbv (Fig. 7.2). Surface measurements performed with the water pump of the ship agree fairly well with the measurements from the CTD samples. Such variability can be probably explained by the occurrence of different water masses encountered and will be further investigated in the future. The presence of the ice pack (particularly from June 17 to June 20) near Greenland corresponds to lower CO values which can be partly explained by the limitation of the UV penetration in surface seawater. This point needs further investigations.

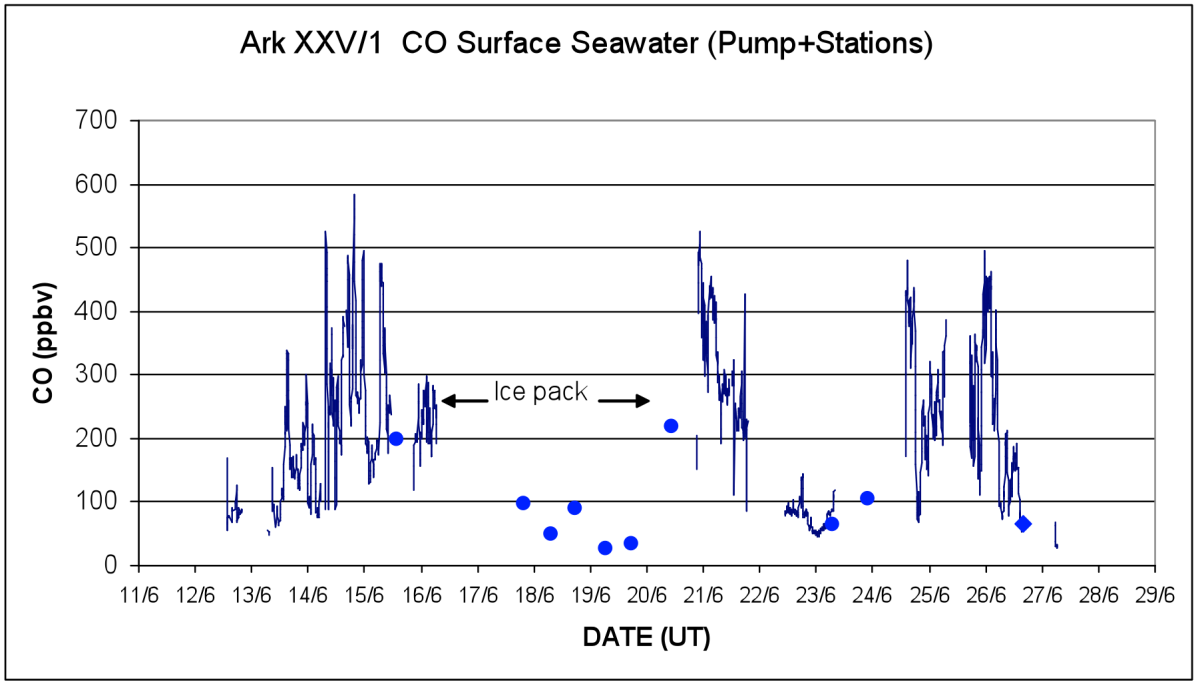


Fig. 7.2: ARK-XXV/1 – Leg 1: Surface water measurements of carbon monoxide (solid line: surface measurements with the water pump; dots: CTD surface samples)

NMHC and CO vertical profiles.

CO vertical profiles obtained from the CTD stations, display a clear gradient from the surface to 100m.depth. The difference of concentrations measured from the duplicates at the same depth remains within a difference lower than 1% which points out the accuracy of the analytical procedure.

Typical depth profiles for CO can be found on Fig. 7.3, generally carbon monoxide concentration regularly decrease regularly from the surface to 100m depth toward the detection limit (station 9), suggesting that the main production process is driven by the penetration of radiations (UV) in seawater. However in some cases (Station 14) it is observed a different pattern with a depletion near the surface or/and a peak of production at 20 - 40 m depth possibly due to a secondary production process in relation with the fluorescence (chlorophyll) maximum which would be in agreement with the CO biological production observed in laboratory (Gros et al., 2009). The interpretation needs further investigations and the use of 1D modelling of the production/destruction, and sink processes in the water column.

Profiles of NMHC and particularly alkenes (propene and isobutene) generally display the same figure as for CO with a more or less regular decrease versus depth. It is particularly interesting to note (profile station 14) that isobutene can follow the distribution of CO, and therefore can result also from two different production processes involving a photo-production by UV on CDOM and a direct production by phytoplankton species.

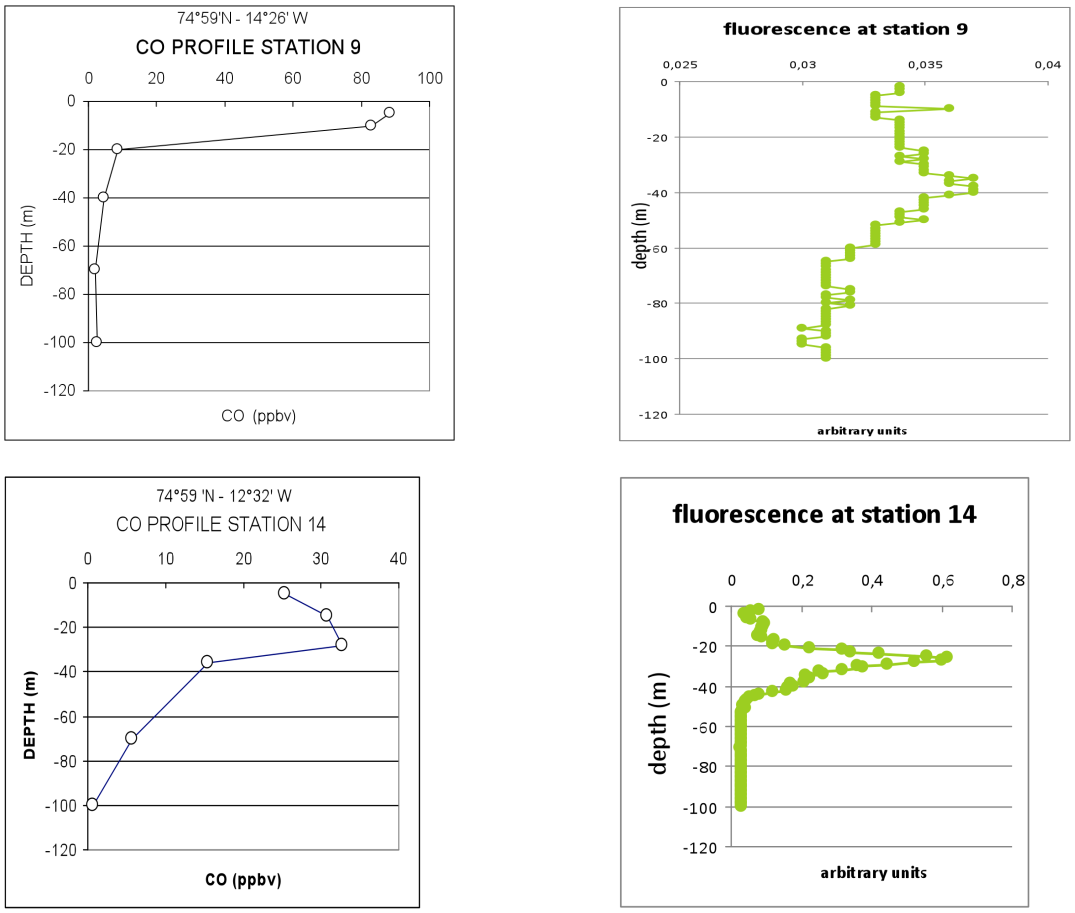
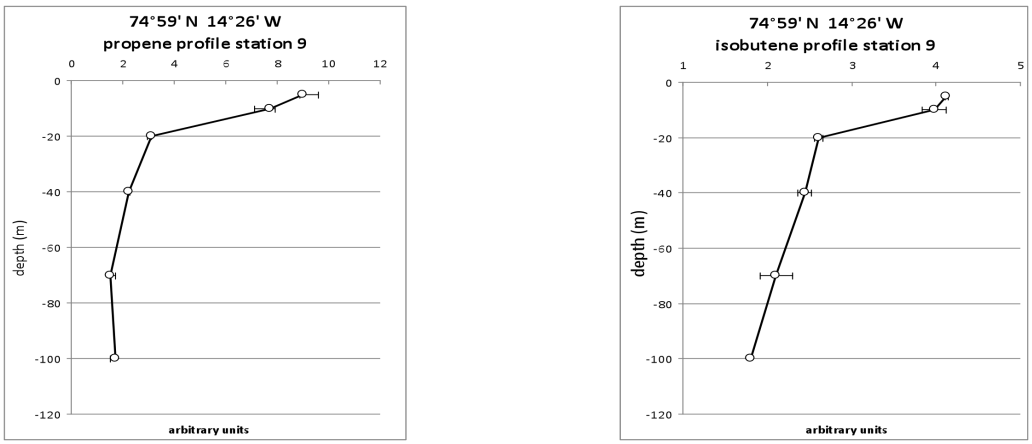


Fig. 7.3: ARK-XXV/1 – Leg 1. Selected CO and fluorescence (courtesy G. Budéus, AWI) profiles from CTD samples (note: for CO the difference between the duplicates remains between the size of the data points).



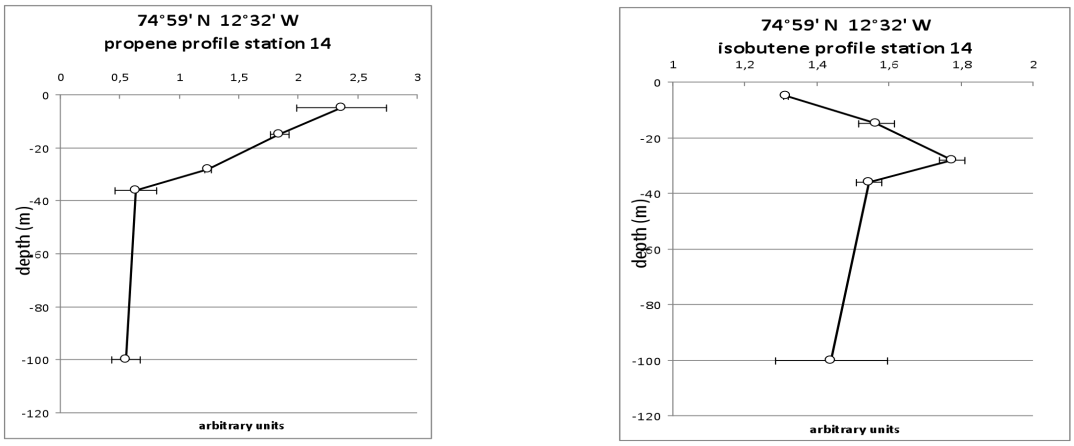


Fig. 7.4 : ARK-XXV/1 – Leg 1. Non Methane Hydrocarbon (NMHC) profiles from selected CTD samples (mean values and errors bars on the X axis)

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APPENDIX

A.1 Beteiligte Institute / Participating institutes

A.2 Fahrtteilnehmer/Cruise participants

A.3 Schiffsbesatzung/ Ship's crew

A.4 Stationsliste / Station list

A. 1 BETEILIGTE INSTITUTE / PARTICIPATING INSTITUTES

	Address
AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft Am Handelshafen 12 27570 Bremerhaven / Germany
DWD	Deutscher Wetterdienst Geschäftsbereich Wettervorhersage Seeschifffahrtsberatung Bernhard-Nocht-Strasse 76 20359 Hamburg /Germany
Heli Service	HeliService international Am Luneort 15 27572 Bremerhaven /Germany
IFM-GEOMAR	Leibniz Institute for Marine Sciences, University of Kiel Wischhofstrasse 1-3 24148 Kiel/Germany
LSCE	Laboratoire des Sciences du Climat et de l'Environnement Centre National de la Recherche Scientifique, CNRS-UMR 8212 Orme des Merisiers, Bat 701 91191Gif sur Yvette / France
Optimare	OPTIMARE Am Luneort 15a 27572 Bremerhaven / Germany
PolE	Laboratory for Polar Ecology Rue du Fodia 18 B-1367 Ramillies / Belgium
University of Bremen	Universität Bremen Bibliothekstraße 1 28359 Bremen / Germany

A.2 FAHRTTEILNEHMER / CRUISE PARTICIPANTS

Name/ Last name	Vorname/ First name	Institut/ Institute	Beruf/ Profession
Baudorff	Christian	Heliservice	Pilot
Beudels	Roseline Claire	PolE	Zoologist
Bonsang	Bernard	CNRS	Nuclear chemist
Budéus	Gereon	AWI	Oceanographer
Büchner	Jürgen	Heliservice	Pilot
Cherkasheva	Alexandra	University Bremen	PhD Student
Heckmann	Markus	Heliservice	Technician
Hirche	Hans-Jürgen	AWI	Biologist
Höffle	Hannes	AWI	Biologist
Jacob	Juliane	FU Berlin	Student
Lafontaine	René-Marie	PolE	Zoologist
Lürig	Moritz	University Oldenburg	Student
Menzel	Uta	AWI	Student, physics
Miller	Max	DWD	Meteorologist
Monsees	Matthias	AWI	Technician
Moos	Simone Beatrice	AWI	Student, oceanography
Pfaff	Sigrid	AWI	Student
Sonnabend	Hartmut	DWD	Technician
Theis	Anja	IfM GEOMAR	Scientist
von Egan-Krieger	Sascha	AWI	PhD Student
Tran	Sophie	LSCE Gif s. Yvette	Student
Walter	Jens	Heliservice	Technician
Wend	Britta	AWI	Biologist
Wilm	Rosa		Student
Wisotzki	Andreas	AWI	Oceanographer
Wurst	Mascha	AWI	Environmental scientist
Zakrzewski	Svenja	AWI	Student, oceanography
Zenk	Oliver	Optimare	Engineer
Zoch	Nico	FU Berlin	Student

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

No.	Name	Rank
01.	Schwarze, Stefan	Master
02.	Birnbaum, Thilo	1. Offc.
03.	Krohn, Günter	Ch.Eng.
04.	Fallei, Holger	2. Offc.
05.	Gründling, Ulli	2. Offc.
06.	Dugge, Heike	2. Offc.
07.	Erich, Matthias	Doctor
08.	Hecht, Andreas	R.Offc.
09.	Sümnicht, Stefan	1. Eng.
10.	Minzlaff, Hans-Ulrich	2. Eng.
11.	Schaefer, Marc	2. Eng.
12.	Scholz, Manfred	ElecEng.
13.	Muhle, Helmut	ELO
14.	Himmel, Frank	ELO
15.	Stronzeck, David	ELO
16.	Winter, Andreas	ELO
17.	Loidl, Reiner	Boatsw.
18.	Reise, Lutz	Carpenter
19.	Bäcker, Andreas	A.B.
20.	Brickmann, Peter	A.B.
21.	Guse, Hartmut	A.B.
22.	Hagemann, Manfred	A.B.
23.	Scheel, Sebastian	A.B.
24.	Schmidt, Uwe	A.B.
25.	Wende, Uwe	A.B.
26.	Winkler,Michael	A.B.
27	Preußner, Jörg	Storek.
28.	Elsner, Klaus	Mot-man
29.	Pinske, Lutz	Mot-man
30.	Schütt, Norbert	Mot-man
31.	Teichert, Uwe	Mot-man
32.	Voy, Bernd	Mot-man
33.	Müller-Homburg, R.-D	Cook
34.	Martens, Michael	Cooksmate
35.	Silinski, Frank	Cooksmate
36.	Jürgens, Monika	1.Stwdess
37.	Wöckener, Martina	Stwdss/Kr
38.	Czyborra, Bärbel	2.Stwdess
39.	Gaude, Hans-Jürgen	2.Steward
40.	Huang, Wu-Mei	2.Steward
41.	Möller, Wolfgang	2.Steward
42.	Silinski, Carmen	2.Stwdess
43.	Yu Kwok Yuen	Laundrym.

A. 4 STATION LIST PS 76

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0001-1	15.06.10	11:40:00	71-23,41'N	8-27,80'W	2203,2	CTD/rosette water sampler	in the water
0001-2	15.06.10	11:41:00	71-23,41'N	8-27,78'W	2202,7	Hand net	in the water
0001-2	15.06.10	11:46:00	71-23,44'N	8-27,77'W	2202,2	Hand net	on ground / max depth
0001-2	15.06.10	11:49:59	71-23,47'N	8-27,72'W	2202,7	Hand net	on deck
0001-3	15.06.10	11:50:00	71-23,48'N	8-27,71'W	2202,7	Spectro radiometer	in the water
0001-1	15.06.10	11:51:00	71-23,49'N	8-27,70'W	2203,2	CTD/rosette water sampler	on ground / max depth
0001-1	15.06.10	11:52:00	71-23,50'N	8-27,68'W	2203,2	CTD/rosette water sampler	hoisting
0001-1	15.06.10	12:00:59	71-23,54'N	8-27,60'W	2202,2	CTD/rosette water sampler	on deck
0001-3	15.06.10	12:05:00	71-23,53'N	8-27,57'W	2202,2	Spectro radiometer	on ground / max depth
0001-4	15.06.10	12:07:00	71-23,53'N	8-27,56'W	2202,2	CTD/rosette water sampler	in the water
0001-3	15.06.10	12:08:59	71-23,54'N	8-27,55'W	2202,2	Spectro radiometer	on deck
0001-4	15.06.10	12:17:00	71-23,57'N	8-27,49'W	2201,7	CTD/rosette water sampler	on ground / max depth
0001-4	15.06.10	12:18:00	71-23,56'N	8-27,49'W	2202,0	CTD/rosette water sampler	hoisting
0001-4	15.06.10	12:24:59	71-23,59'N	8-27,44'W	2201,7	CTD/rosette water sampler	on deck
0001-5	15.06.10	12:31:00	71-23,69'N	8-27,31'W	2200,2	CTD/rosette water sampler	in the water
0001-5	15.06.10	13:13:00	71-23,76'N	8-26,96'W	2198,7	CTD/rosette water sampler	on ground / max depth
0001-5	15.06.10	13:13:01	71-23,76'N	8-26,96'W	2198,7	CTD/rosette water sampler	hoisting
0001-5	15.06.10	13:49:59	71-23,85'N	8-26,69'W	2197,5	CTD/rosette water sampler	on deck
0001-6	15.06.10	14:12:00	71-23,91'N	8-26,48'W	2196,7	Multiple net	in the water
0001-6	15.06.10	14:26:00	71-23,94'N	8-26,51'W	2196,7	Multiple net	on ground / max depth
0001-6	15.06.10	14:44:59	71-23,95'N	8-26,58'W	2196,5	Multiple net	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0001-7	15.06.10	14:58:00	71-23,96'N	8-26,53'W	2196,5	Bongo net	in the water
0001-7	15.06.10	15:17:00	71-23,94'N	8-26,50'W	2196,5	Bongo net	on ground / max depth
0001-7	15.06.10	15:36:59	71-23,94'N	8-26,49'W	2196,2	Bongo net	on deck
0002-1	17.06.10	17:12:00	74-38,57'N	17-59,23'W	221,7	CTD/rosette water sampler	in the water
0002-2	17.06.10	17:12:00	74-38,57'N	17-59,23'W	221,7	Hand net	in the water
0002-2	17.06.10	17:13:00	74-38,57'N	17-59,24'W	222,5	Hand net	on ground / max depth
0002-2	17.06.10	17:14:00	74-38,56'N	17-59,26'W	222,2	Hand net	on deck
0002-2	17.06.10	17:15:00	74-38,56'N	17-59,29'W	222,0	Hand net	in the water
0002-2	17.06.10	17:16:00	74-38,56'N	17-59,30'W	222,0	Hand net	on ground / max depth
0002-2	17.06.10	17:16:59	74-38,56'N	17-59,30'W	222,0	Hand net	on deck
0002-1	17.06.10	17:22:00	74-38,53'N	17-59,42'W	220,0	CTD/rosette water sampler	on ground / max depth
0002-1	17.06.10	17:34:59	74-38,48'N	17-59,74'W	223,7	CTD/rosette water sampler	on deck
0002-3	17.06.10	17:45:00	74-38,44'N	17-60,00'W	221,7	Bongo net	in the water
0002-3	17.06.10	17:53:00	74-38,41'N	18-0,11'W	220,0	Bongo net	on ground / max depth
0002-3	17.06.10	18:02:59	74-38,38'N	18-0,15'W	221,0	Bongo net	on deck
0003-1	17.06.10	20:38:00	74-36,10'N	17-27,29'W	259,2	CTD	in the water
0003-2	17.06.10	20:43:00	74-36,07'N	17-27,31'W	258,5	Hand net	in the water
0003-1	17.06.10	20:51:00	74-35,99'N	17-27,35'W	261,0	CTD	on ground / max depth
0003-2	17.06.10	20:51:00	74-35,99'N	17-27,35'W	261,0	Hand net	on ground / max depth
0003-2	17.06.10	20:52:59	74-35,98'N	17-27,36'W	260,5	Hand net	on deck
0003-1	17.06.10	20:58:00	74-35,97'N	17-27,29'W	260,2	CTD	at surface
0003-1	17.06.10	20:59:59	74-35,97'N	17-27,27'W	257,5	CTD	on deck
0004-1	18.06.10	00:06:00	74-43,50'N	16-55,51'W	364,0	CTD/rosette water sampler	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0004-1	18.06.10	00:17:00	74-43,44'N	16-55,55'W	363,5	CTD/rosette water sampler	on ground / max depth
0004-1	18.06.10	00:18:00	74-43,43'N	16-55,55'W	363,5	CTD/rosette water sampler	hoisting
0004-1	18.06.10	00:25:59	74-43,41'N	16-55,57'W	365,5	CTD/rosette water sampler	on deck
0005-1	18.06.10	03:34:00	74-54,61'N	16-26,65'W	330,0	CTD/rosette water sampler	in the water
0005-1	18.06.10	03:47:00	74-54,63'N	16-26,80'W	331,0	CTD/rosette water sampler	on ground / max depth
0005-1	18.06.10	03:58:59	74-54,64'N	16-26,91'W	332,7	CTD/rosette water sampler	on deck
0006-1	18.06.10	06:32:00	74-59,60'N	15-59,01'W	260,5	CTD	in the water
0006-1	18.06.10	06:42:00	74-59,61'N	15-58,99'W	260,0	CTD	on ground / max depth
0006-1	18.06.10	06:47:59	74-59,61'N	15-58,99'W	259,7	CTD	on deck
0006-2	18.06.10	07:01:00	74-59,62'N	15-58,97'W	259,7	Bongo net	in the water
0006-2	18.06.10	07:11:00	74-59,62'N	15-58,96'W	259,7	Bongo net	on ground / max depth
0006-2	18.06.10	07:21:59	74-59,62'N	15-58,94'W	260,0	Bongo net	on deck
0007-1	18.06.10	10:00:00	74-55,46'N	15-25,75'W	185,2	Hand net	in the water
0007-2	18.06.10	10:04:00	74-55,47'N	15-25,81'W	184,7	CTD/rosette water sampler	in the water
0007-1	18.06.10	10:11:00	74-55,46'N	15-25,94'W	181,7	Hand net	on ground / max depth
0007-1	18.06.10	10:13:59	74-55,47'N	15-25,96'W	181,7	Hand net	on deck
0007-2	18.06.10	10:14:00	74-55,47'N	15-25,96'W	182,2	CTD/rosette water sampler	on ground / max depth
0007-2	18.06.10	10:15:00	74-55,47'N	15-25,96'W	182,0	CTD/rosette water sampler	hoisting
0007-2	18.06.10	10:23:59	74-55,48'N	15-25,97'W	182,0	CTD/rosette water sampler	on deck
0008-1	18.06.10	13:08:00	75-0,13'N	14-56,51'W	252,7	CTD/rosette water sampler	in the water
0008-2	18.06.10	13:09:00	75-0,13'N	14-56,52'W	251,5	Hand net	in the water
0008-1	18.06.10	13:17:00	75-0,12'N	14-56,53'W	253,7	CTD/rosette water sampler	on ground / max depth
0008-1	18.06.10	13:17:01	75-0,12'N	14-56,53'W	253,7	CTD/rosette water sampler	hoisting

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0008-2	18.06.10	13:18:00	75-0,12'N	14-56,53'W	250,0	Hand net	on ground / max depth
0008-2	18.06.10	13:21:59	75-0,12'N	14-56,52'W	251,5	Hand net	on deck
0008-1	18.06.10	13:23:59	75-0,12'N	14-56,52'W	251,0	CTD/rosette water sampler	on deck
0008-3	18.06.10	13:32:00	75-0,10'N	14-56,50'W	251,7	Bongo net	in the water
0008-3	18.06.10	13:36:00	75-0,10'N	14-56,50'W	250,7	Bongo net	on ground / max depth
0008-3	18.06.10	13:37:00	75-0,10'N	14-56,50'W	251,5	Bongo net	hoisting
0008-3	18.06.10	13:43:59	75-0,09'N	14-56,49'W	252,7	Bongo net	on deck
0009-1	18.06.10	15:34:00	74-59,73'N	14-26,95'W	155,0	CTD/rosette water sampler	in the water
0009-2	18.06.10	15:35:00	74-59,74'N	14-26,94'W	154,5	Hand net	in the water
0009-2	18.06.10	15:35:01	74-59,74'N	14-26,94'W	154,5	Hand net	on ground / max depth
0009-2	18.06.10	15:36:00	74-59,74'N	14-26,93'W	154,0	Hand net	on deck
0009-2	18.06.10	15:40:00	74-59,77'N	14-26,98'W	155,2	Hand net	in the water
0009-2	18.06.10	15:41:00	74-59,77'N	14-27,00'W	154,7	Hand net	on ground / max depth
0009-2	18.06.10	15:42:00	74-59,77'N	14-27,02'W	153,7	Hand net	on deck
0009-2	18.06.10	15:42:01	74-59,77'N	14-27,02'W	153,7	Hand net	in the water
0009-2	18.06.10	15:44:00	74-59,78'N	14-27,03'W	154,7	Hand net	on ground / max depth
0009-1	18.06.10	15:45:00	74-59,78'N	14-27,03'W	171,0	CTD/rosette water sampler	on ground / max depth
0009-2	18.06.10	15:45:59	74-59,78'N	14-27,03'W	171,0	Hand net	on deck
0009-1	18.06.10	15:52:59	74-59,80'N	14-26,93'W	154,7	CTD/rosette water sampler	on deck
0009-3	18.06.10	16:00:00	74-59,81'N	14-26,87'W	153,7	Bongo net	in the water
0009-3	18.06.10	16:05:00	74-59,84'N	14-26,87'W	154,7	Bongo net	on ground / max depth
0009-3	18.06.10	16:16:59	74-59,88'N	14-26,82'W	154,7	Bongo net	on deck
0010-1	18.06.10	17:46:00	75-0,46'N	13-57,71'W	179,7	CTD/rosette water sampler	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0010-1	18.06.10	17:58:00	75-0,43'N	13-57,58'W	181,0	CTD/rosette water sampler	on ground / max depth
0010-1	18.06.10	18:01:59	75-0,40'N	13-57,54'W	182,5	CTD/rosette water sampler	on deck
0011-1	18.06.10	19:31:00	75-0,56'N	13-26,15'W	223,5	CTD/rosette water sampler	in the water
0011-1	18.06.10	19:44:00	75-0,49'N	13-26,38'W	224,5	CTD/rosette water sampler	on ground / max depth
0011-1	18.06.10	19:54:59	75-0,35'N	13-26,41'W	675,2	CTD/rosette water sampler	on deck
0012-1	18.06.10	21:35:00	75-0,41'N	12-56,03'W	374,7	CTD/rosette water sampler	in the water
0012-1	18.06.10	21:49:00	75-0,13'N	12-56,49'W	376,7	CTD/rosette water sampler	on ground / max depth
0012-1	18.06.10	21:56:59	75-0,00'N	12-56,70'W	377,5	CTD/rosette water sampler	on deck
0013-1	18.06.10	22:38:00	74-59,86'N	12-43,75'W	634,7	CTD/rosette water sampler	in the water
0013-1	18.06.10	22:54:00	74-59,49'N	12-44,64'W	635,5	CTD/rosette water sampler	on ground / max depth
0013-1	18.06.10	22:55:00	74-59,48'N	12-44,64'W	635,7	CTD/rosette water sampler	hoisting
0013-1	18.06.10	23:06:59	74-59,29'N	12-44,82'W	640,5	CTD/rosette water sampler	on deck
0014-1	19.06.10	00:12:00	75-0,05'N	12-31,34'W	1012,2	CTD/rosette water sampler	in the water
0014-1	19.06.10	00:34:00	74-59,87'N	12-32,45'W	978,2	CTD/rosette water sampler	on ground / max depth
0014-1	19.06.10	00:35:00	74-59,87'N	12-32,47'W	978,0	CTD/rosette water sampler	hoisting
0014-1	19.06.10	00:56:59	74-59,74'N	12-33,28'W	973,5	CTD/rosette water sampler	on deck
0015-1	19.06.10	01:30:00	75-0,06'N	12-20,84'W	1260,5	CTD/rosette water sampler	in the water
0015-1	19.06.10	01:58:00	75-0,05'N	12-21,57'W	1240,5	CTD/rosette water sampler	on ground / max depth
0015-1	19.06.10	02:18:59	74-59,99'N	12-22,04'W	1237,2	CTD/rosette water sampler	on deck
0016-1	19.06.10	02:56:00	75-0,09'N	12-10,42'W	1502,5	CTD/rosette water sampler	in the water
0016-1	19.06.10	03:27:00	75-0,08'N	12-10,80'W	1494,2	CTD/rosette water sampler	on ground / max depth
0016-1	19.06.10	03:50:59	75-0,07'N	12-10,84'W	1494,2	CTD/rosette water sampler	on deck
0017-1	19.06.10	04:34:00	75-0,03'N	11-52,29'W	1902,0	CTD/rosette water sampler	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0017-1	19.06.10	05:10:00	74-59,98'N	11-51,97'W	1910,2	CTD/rosette water sampler	on ground / max depth
0017-1	19.06.10	05:40:59	74-59,96'N	11-51,91'W	1912,5	CTD/rosette water sampler	on deck
0018-1	19.06.10	06:43:00	75-0,10'N	11-27,60'W	2337,7	CTD/rosette water sampler	in the water
0018-2	19.06.10	06:51:00	75-0,13'N	11-27,61'W	2336,0	Hand net	in the water
0018-2	19.06.10	06:56:00	75-0,12'N	11-27,64'W	2336,5	Hand net	on ground / max depth
0018-2	19.06.10	06:59:59	75-0,12'N	11-27,61'W	2336,0	Hand net	on deck
0018-1	19.06.10	07:25:00	75-0,16'N	11-27,54'W	2334,0	CTD/rosette water sampler	on ground / max depth
0018-1	19.06.10	08:00:59	75-0,18'N	11-27,24'W	2335,0	CTD/rosette water sampler	on deck
0018-3	19.06.10	08:10:00	75-0,17'N	11-27,18'W	2336,2	Bongo net	in the water
0018-3	19.06.10	08:30:00	75-0,17'N	11-27,06'W	2337,2	Bongo net	on ground / max depth
0018-3	19.06.10	08:47:59	75-0,15'N	11-26,99'W	2339,0	Bongo net	on deck
0019-1	19.06.10	09:40:00	74-59,77'N	11-1,63'W	2752,7	Hand net	in the water
0019-2	19.06.10	09:44:00	74-59,76'N	11-1,50'W	2755,0	CTD/rosette water sampler	in the water
0019-1	19.06.10	09:48:00	74-59,76'N	11-1,38'W	2756,2	Hand net	on ground / max depth
0019-1	19.06.10	09:49:59	74-59,76'N	11-1,35'W	2756,5	Hand net	on deck
0019-2	19.06.10	10:33:00	74-59,68'N	11-0,54'W	2769,7	CTD/rosette water sampler	on ground / max depth
0019-2	19.06.10	10:33:01	74-59,68'N	11-0,54'W	2769,7	CTD/rosette water sampler	hoisting
0019-2	19.06.10	11:15:59	74-59,53'N	11-0,08'W	2781,2	CTD/rosette water sampler	on deck
0020-1	19.06.10	12:15:00	74-59,98'N	10-35,64'W	3073,2	CTD/rosette water sampler	in the water
0020-2	19.06.10	12:21:00	74-59,95'N	10-35,74'W	3074,0	Spectro radiometer	in the water
0020-2	19.06.10	12:45:00	74-59,85'N	10-35,68'W	3078,5	Spectro radiometer	on ground / max depth
0020-2	19.06.10	12:50:59	74-59,83'N	10-35,72'W	3079,2	Spectro radiometer	on deck
0020-3	19.06.10	12:58:00	74-59,78'N	10-35,40'W	3082,5	Hand net	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0020-3	19.06.10	13:04:00	74-59,75'N	10-35,42'W	3083,7	Hand net	on ground / max depth
0020-3	19.06.10	13:07:59	74-59,75'N	10-35,52'W	3083,7	Hand net	on deck
0020-1	19.06.10	13:09:00	74-59,74'N	10-35,51'W	3084,0	CTD/rosette water sampler	on ground / max depth
0020-1	19.06.10	13:09:01	74-59,74'N	10-35,51'W	3084,0	CTD/rosette water sampler	hoisting
0020-1	19.06.10	13:55:59	74-59,54'N	10-34,92'W	3095,7	CTD/rosette water sampler	on deck
0020-4	19.06.10	14:00:00	74-59,53'N	10-35,11'W	3095,2	Bongo net	in the water
0020-4	19.06.10	14:04:00	74-59,53'N	10-35,25'W	3095,0	Bongo net	on ground / max depth
0020-4	19.06.10	14:10:59	74-59,50'N	10-35,23'W	3095,7	Bongo net	on deck
0021-1	19.06.10	15:28:00	75-0,14'N	9-55,87'W	3218,7	CTD/rosette water sampler	in the water
0021-2	19.06.10	15:29:00	75-0,13'N	9-55,85'W	3218,7	Hand net	in the water
0021-2	19.06.10	15:30:00	75-0,13'N	9-55,84'W	3219,2	Hand net	on ground / max depth
0021-2	19.06.10	15:31:59	75-0,13'N	9-55,82'W	3219,2	Hand net	on deck
0021-1	19.06.10	16:23:00	74-59,99'N	9-56,34'W	3222,0	CTD/rosette water sampler	on ground / max depth
0021-1	19.06.10	17:16:59	74-59,92'N	9-56,39'W	3222,7	CTD/rosette water sampler	on deck
0021-3	19.06.10	17:26:00	74-59,93'N	9-56,65'W	3222,5	Bongo net	in the water
0021-3	19.06.10	17:45:00	74-59,97'N	9-56,93'W	3222,2	Bongo net	on ground / max depth
0021-3	19.06.10	18:02:59	75-0,01'N	9-57,03'W	3221,7	Bongo net	on deck
0022-1	19.06.10	19:34:00	75-0,34'N	9-19,05'W	3297,7	CTD/rosette water sampler	in the water
0022-1	19.06.10	20:33:00	75-0,43'N	9-18,16'W	3301,5	CTD/rosette water sampler	on ground / max depth
0022-1	19.06.10	21:23:59	75-0,49'N	9-17,54'W	3303,0	CTD/rosette water sampler	on deck
0023-1	19.06.10	22:49:00	75-0,02'N	8-39,39'W	3361,7	CTD/rosette water sampler	in the water
0023-1	19.06.10	23:58:00	75-0,09'N	8-39,01'W	3361,0	CTD/rosette water sampler	on ground / max depth
0023-1	19.06.10	23:58:01	75-0,09'N	8-39,01'W	3361,0	CTD/rosette water sampler	hoisting

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0023-1	20.06.10	00:52:59	75-0,03'N	8-38,32'W	3362,2	CTD/rosette water sampler	on deck
0024-1	20.06.10	02:14:00	75-0,05'N	8-1,48'W	3399,2	CTD/rosette water sampler	in the water
0024-1	20.06.10	03:13:00	74-59,96'N	8-1,11'W	3399,7	CTD/rosette water sampler	on ground / max depth
0024-1	20.06.10	04:02:59	74-59,90'N	8-1,07'W	3400,2	CTD/rosette water sampler	on deck
0024-2	20.06.10	04:10:00	74-59,94'N	8-0,97'W	3400,2	Bongo net	in the water
0024-2	20.06.10	04:14:00	74-59,95'N	8-0,97'W	3400,2	Bongo net	on ground / max depth
0024-2	20.06.10	04:20:59	74-59,96'N	8-0,97'W	3400,2	Bongo net	on deck
0024-3	20.06.10	04:30:00	74-59,94'N	8-1,03'W	3400,2	Multiple net	in the water
0024-3	20.06.10	05:05:00	74-59,93'N	8-1,02'W	3400,0	Multiple net	on ground / max depth
0024-3	20.06.10	05:52:59	74-59,95'N	8-1,01'W	3400,2	Multiple net	on deck
0025-1	20.06.10	07:21:00	74-59,98'N	7-22,05'W	3440,5	Hand net	in the water
0025-2	20.06.10	07:29:00	74-60,00'N	7-21,77'W	3440,7	CTD/rosette water sampler	in the water
0025-3	20.06.10	07:33:00	75-0,00'N	7-21,68'W	3440,7	Spectro radiometer	in the water
0025-1	20.06.10	07:34:00	75-0,01'N	7-21,66'W	3440,7	Hand net	on ground / max depth
0025-1	20.06.10	07:36:59	75-0,03'N	7-21,63'W	3440,7	Hand net	on deck
0025-3	20.06.10	08:07:00	75-0,06'N	7-21,39'W	3441,0	Spectro radiometer	on ground / max depth
0025-3	20.06.10	08:09:59	75-0,06'N	7-21,38'W	3441,2	Spectro radiometer	on deck
0025-2	20.06.10	08:30:00	75-0,06'N	7-21,11'W	3441,3	CTD/rosette water sampler	on ground / max depth
0025-2	20.06.10	09:20:59	75-0,18'N	7-20,57'W	3441,8	CTD/rosette water sampler	on deck
0026-1	20.06.10	10:43:00	75-0,10'N	6-43,31'W	3488,8	CTD/rosette water sampler	in the water
0026-2	20.06.10	11:42:00	75-0,42'N	6-42,99'W	3488,3	Spectro radiometer	in the water
0026-1	20.06.10	11:44:00	75-0,42'N	6-43,02'W	3488,3	CTD/rosette water sampler	on ground / max depth
0026-1	20.06.10	11:45:00	75-0,42'N	6-43,05'W	3488,3	CTD/rosette water sampler	hoisting

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0026-2	20.06.10	12:00:00	75-0,51'N	6-42,93'W	3488,3	Spectro radiometer	on ground / max depth
0026-2	20.06.10	12:04:59	75-0,56'N	6-42,79'W	3488,5	Spectro radiometer	on deck
0026-1	20.06.10	12:46:59	75-0,73'N	6-42,65'W	3489,0	CTD/rosette water sampler	on deck
0026-3	20.06.10	12:54:00	75-0,88'N	6-42,04'W	3489,8	Bongo net	in the water
0026-3	20.06.10	13:15:00	75-1,00'N	6-41,75'W	3490,0	Bongo net	on ground / max depth
0026-3	20.06.10	13:15:01	75-1,00'N	6-41,75'W	3490,0	Bongo net	hoisting
0026-3	20.06.10	13:37:59	75-1,10'N	6-41,61'W	3490,0	Bongo net	on deck
0027-1	20.06.10	15:00:00	75-0,02'N	6-3,64'W	3526,0	CTD/rosette water sampler	in the water
0027-2	20.06.10	15:01:00	75-0,02'N	6-3,63'W	3526,0	Hand net	in the water
0027-2	20.06.10	15:01:01	75-0,02'N	6-3,63'W	3526,0	Hand net	on ground / max depth
0027-2	20.06.10	15:02:00	75-0,02'N	6-3,61'W	3526,0	Hand net	on deck
0027-2	20.06.10	15:02:01	75-0,02'N	6-3,61'W	3526,0	Hand net	in the water
0027-2	20.06.10	15:03:00	75-0,03'N	6-3,61'W	3526,0	Hand net	on ground / max depth
0027-2	20.06.10	15:04:00	75-0,03'N	6-3,60'W	3526,0	Hand net	on deck
0027-2	20.06.10	15:05:00	75-0,03'N	6-3,59'W	3526,2	Hand net	in the water
0027-2	20.06.10	15:06:00	75-0,03'N	6-3,59'W	3526,2	Hand net	on ground / max depth
0027-2	20.06.10	15:06:59	75-0,03'N	6-3,59'W	3526,2	Hand net	on deck
0027-1	20.06.10	16:01:00	75-0,01'N	6-3,65'W	3526,2	CTD/rosette water sampler	on ground / max depth
0027-1	20.06.10	16:58:59	74-59,97'N	6-3,94'W	3526,2	CTD/rosette water sampler	on deck
0027-3	20.06.10	17:08:00	74-60,00'N	6-3,72'W	3526,3	Drifter	in the water
0027-3	20.06.10	17:09:59	74-59,99'N	6-3,65'W	3526,5	Drifter	on ground / max depth
0027-4	20.06.10	17:10:00	74-59,99'N	6-3,56'W	3526,5	Drifter	in the water
0027-4	20.06.10	17:10:59	74-59,99'N	6-3,56'W	3526,5	Drifter	on ground / max depth

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0027-5	20.06.10	17:11:00	74-59,98'N	6-3,48'W	3526,5	Drifter	in the water
0027-5	20.06.10	17:11:59	74-59,98'N	6-3,48'W	3526,5	Drifter	on ground / max depth
0027-6	20.06.10	17:13:00	74-59,96'N	6-3,30'W	3526,8	Drifter	in the water
0027-6	20.06.10	17:13:59	74-59,96'N	6-3,30'W	3526,8	Drifter	on ground / max depth
0028-1	20.06.10	18:33:00	74-59,92'N	5-24,99'W	3575,8	CTD/rosette water sampler	in the water
0028-1	20.06.10	19:39:00	74-59,84'N	5-25,75'W	3575,2	CTD/rosette water sampler	on ground / max depth
0028-1	20.06.10	20:35:59	74-59,76'N	5-26,85'W	3573,8	CTD/rosette water sampler	on deck
0029-1	20.06.10	22:08:00	74-59,96'N	4-47,14'W	3613,2	CTD/rosette water sampler	in the water
0029-1	20.06.10	23:14:00	75-0,11'N	4-47,17'W	3613,5	CTD/rosette water sampler	on ground / max depth
0029-1	20.06.10	23:15:00	75-0,11'N	4-47,17'W	3613,7	CTD/rosette water sampler	hoisting
0029-1	21.06.10	00:11:59	75-0,17'N	4-46,83'W	3613,3	CTD/rosette water sampler	on deck
0029-2	21.06.10	00:18:00	75-0,17'N	4-46,79'W	3613,3	Bongo net	in the water
0029-2	21.06.10	00:38:00	75-0,16'N	4-46,63'W	3613,5	Bongo net	on ground / max depth
0029-2	21.06.10	00:38:01	75-0,16'N	4-46,63'W	3613,5	Bongo net	hoisting
0029-2	21.06.10	01:00:59	75-0,21'N	4-46,42'W	3613,5	Bongo net	on deck
0030-1	21.06.10	02:30:00	74-59,94'N	4-7,95'W	3643,2	CTD/rosette water sampler	in the water
0030-1	21.06.10	03:32:00	75-0,00'N	4-7,93'W	3643,5	CTD/rosette water sampler	on ground / max depth
0030-1	21.06.10	04:34:59	75-0,01'N	4-7,97'W	3643,5	CTD/rosette water sampler	on deck
0031-1	21.06.10	05:50:01	74-55,75'N	4-36,39'W	3618,2	Mooring	information
0031-1	21.06.10	05:51:00	74-55,76'N	4-36,42'W	3618,2	Mooring	in the water
0031-1	21.06.10	05:56:00	74-55,72'N	4-36,51'W	3617,7	Mooring	on deck
0031-1	21.06.10	06:00:00	74-55,70'N	4-36,73'W	3617,7	Mooring	in the water
0031-1	21.06.10	06:04:00	74-55,65'N	4-36,85'W	3617,7	Mooring	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0031-1	21.06.10	06:12:00	74-56,12'N	4-36,72'W	3619,0	Mooring	in the water
0031-1	21.06.10	06:17:00	74-56,10'N	4-36,83'W	3618,2	Mooring	on deck
0031-1	21.06.10	06:24:00	74-55,89'N	4-37,74'W	3618,0	Mooring	in the water
0031-1	21.06.10	06:25:00	74-55,90'N	4-37,78'W	3617,7	Mooring	action
0031-1	21.06.10	06:33:00	74-55,77'N	4-37,94'W	3617,5	Mooring	at surface
0031-1	21.06.10	06:34:00	74-55,74'N	4-37,95'W	3617,5	Mooring	on deck
0031-1	21.06.10	06:57:00	74-55,91'N	4-36,85'W	3618,7	Mooring	action
0031-1	21.06.10	07:03:00	74-55,92'N	4-36,78'W	3618,7	Mooring	action
0031-1	21.06.10	07:05:00	74-55,90'N	4-36,77'W	3618,2	Mooring	action
0031-1	21.06.10	07:12:00	74-55,81'N	4-36,94'W	3618,2	Mooring	on deck
0031-1	21.06.10	07:18:00	74-55,76'N	4-37,17'W	3617,7	Mooring	on deck
0031-1	21.06.10	07:21:00	74-55,74'N	4-37,32'W	3617,5	Mooring	on deck
0031-1	21.06.10	07:31:00	74-55,75'N	4-37,75'W	3617,7	Mooring	on deck
0031-1	21.06.10	08:29:00	74-55,25'N	4-40,35'W	3614,8	Mooring	on ground / max depth
0031-1	21.06.10	08:34:59	74-55,27'N	4-40,61'W	3614,0	Mooring	on deck
0032-1	21.06.10	08:51:00	74-54,75'N	4-37,63'W	3615,8	Mooring	action
0032-1	21.06.10	08:52:00	74-54,76'N	4-37,64'W	3615,8	Mooring	on deck
0032-1	21.06.10	08:53:00	74-54,75'N	4-37,66'W	3615,7	Mooring	action
0032-1	21.06.10	08:55:00	74-54,72'N	4-37,72'W	3615,2	Mooring	on ground / max depth
0032-1	21.06.10	08:57:00	74-54,68'N	4-37,78'W	3615,3	Mooring	at surface
0032-1	21.06.10	09:12:00	74-55,01'N	4-37,23'W	3615,8	Mooring	action
0032-1	21.06.10	09:21:00	74-54,98'N	4-37,50'W	3615,5	Mooring	on deck
0032-1	21.06.10	09:24:00	74-54,97'N	4-37,67'W	3615,0	Mooring	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0032-1	21.06.10	10:57:00	74-54,53'N	4-42,75'W	3610,5	Mooring	on deck
0032-1	21.06.10	10:59:59	74-54,52'N	4-42,87'W	3610,0	Mooring	on deck
0033-1	21.06.10	13:10:00	75-5,00'N	3-26,78'W	3668,0	Mooring	action
0033-1	21.06.10	13:13:00	75-4,93'N	3-26,86'W	3668,0	Mooring	action
0033-1	21.06.10	13:14:00	75-4,91'N	3-26,85'W	3668,0	Mooring	action
0033-1	21.06.10	13:26:00	75-4,72'N	3-27,03'W	3668,5	Mooring	action
0033-1	21.06.10	13:30:00	75-4,63'N	3-27,13'W	3668,5	Mooring	action
0033-1	21.06.10	13:33:00	75-4,58'N	3-27,00'W	3669,0	Mooring	action
0033-1	21.06.10	13:33:01	75-4,58'N	3-27,00'W	3669,0	Mooring	action
0033-1	21.06.10	13:57:00	75-4,88'N	3-26,14'W	3669,0	Mooring	action
0033-1	21.06.10	14:00:00	75-4,84'N	3-26,23'W	3669,2	Mooring	on deck
0033-1	21.06.10	14:08:00	75-4,69'N	3-26,46'W	3669,2	Mooring	on deck
0033-1	21.06.10	15:34:00	75-4,11'N	3-29,88'W	3668,0	Mooring	on deck
0033-1	21.06.10	15:34:01	75-4,11'N	3-29,88'W	3668,0	Mooring	on deck
0033-1	21.06.10	15:35:00	75-4,10'N	3-29,92'W	3667,7	Mooring	information
0033-1	21.06.10	15:36:59	75-4,08'N	3-29,96'W	3668,0	Mooring	on ground / max depth
0034-1	21.06.10	16:19:00	74-59,96'N	3-30,21'W	3667,5	Bongo net	in the water
0034-2	21.06.10	16:23:00	74-59,96'N	3-30,33'W	3667,7	Hand net	in the water
0034-1	21.06.10	16:24:00	74-59,96'N	3-30,34'W	3667,0	Bongo net	on ground / max depth
0034-2	21.06.10	16:24:00	74-59,96'N	3-30,34'W	3667,0	Hand net	on ground / max depth
0034-2	21.06.10	16:25:00	74-59,96'N	3-30,36'W	3667,7	Hand net	on deck
0034-2	21.06.10	16:26:00	74-59,96'N	3-30,36'W	3667,5	Hand net	in the water
0034-2	21.06.10	16:27:00	74-59,96'N	3-30,35'W	3667,7	Hand net	on ground / max depth

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0034-2	21.06.10	16:28:59	74-59,96'N	3-30,34'W	3667,5	Hand net	on deck
0034-1	21.06.10	16:31:59	74-59,97'N	3-30,38'W	3667,5	Bongo net	on deck
0034-3	21.06.10	16:46:00	74-59,95'N	3-30,35'W	3667,7	Multiple net	in the water
0034-3	21.06.10	17:18:00	75-0,00'N	3-30,47'W	3667,7	Multiple net	on ground / max depth
0034-3	21.06.10	18:06:59	74-59,98'N	3-30,52'W	3667,7	Multiple net	on deck
0034-3	21.06.10	18:18:00	74-59,99'N	3-30,57'W	3668,2	CTD/rosette water sampler	in the water
0034-3	21.06.10	19:34:00	75-0,06'N	3-31,09'W	3667,5	CTD/rosette water sampler	on ground / max depth
0034-3	21.06.10	20:37:59	75-0,17'N	3-31,54'W	3666,2	CTD/rosette water sampler	on deck
0035-1	21.06.10	22:30:00	74-59,96'N	2-51,16'W	3693,5	CTD/rosette water sampler	in the water
0035-1	21.06.10	23:33:00	74-59,93'N	2-52,06'W	3693,2	CTD/rosette water sampler	on ground / max depth
0035-1	21.06.10	23:34:00	74-59,93'N	2-52,05'W	3693,7	CTD/rosette water sampler	hoisting
0035-1	22.06.10	00:34:59	75-0,17'N	2-51,50'W	3692,5	CTD/rosette water sampler	on deck
0036-1	22.06.10	02:18:00	75-0,03'N	2-12,60'W	3630,0	CTD/rosette water sampler	in the water
0036-1	22.06.10	03:30:00	75-0,01'N	2-13,00'W	3636,8	CTD/rosette water sampler	on ground / max depth
0036-1	22.06.10	04:30:59	75-0,02'N	2-13,00'W	3636,5	CTD/rosette water sampler	on deck
0037-1	22.06.10	06:09:00	74-49,85'N	2-29,78'W	3697,0	Mooring	action
0037-1	22.06.10	06:09:01	74-49,85'N	2-29,78'W	3697,0	Mooring	on deck
0037-1	22.06.10	06:11:00	74-49,83'N	2-29,82'W	3696,7	Mooring	action
0037-1	22.06.10	06:12:00	74-49,82'N	2-29,82'W	3696,5	Mooring	at surface
0037-1	22.06.10	06:32:00	74-50,08'N	2-30,20'W	3697,0	Mooring	action
0037-1	22.06.10	06:36:00	74-50,08'N	2-30,34'W	3697,3	Mooring	on deck
0037-1	22.06.10	06:42:00	74-50,06'N	2-30,49'W	3696,8	Mooring	on deck
0037-2	22.06.10	06:56:00	74-50,05'N	2-31,05'W	3696,8	Hand net	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0037-2	22.06.10	06:59:00	74-50,05'N	2-31,18'W	3696,5	Hand net	on ground / max depth
0037-2	22.06.10	07:02:59	74-50,03'N	2-31,30'W	3697,0	Hand net	on deck
0037-3	22.06.10	07:03:00	74-50,03'N	2-31,34'W	3696,8	Hand net	in the water
0037-3	22.06.10	07:04:00	74-50,03'N	2-31,37'W	3696,0	Hand net	on ground / max depth
0037-3	22.06.10	07:05:59	74-50,02'N	2-31,40'W	3696,3	Hand net	on deck
0037-1	22.06.10	08:02:00	74-50,06'N	2-33,83'W	3695,5	Mooring	on deck
0037-1	22.06.10	08:04:00	74-50,06'N	2-33,90'W	3696,3	Mooring	on ground / max depth
0037-1	22.06.10	08:07:59	74-50,06'N	2-34,03'W	3695,5	Mooring	on deck
0038-1	22.06.10	16:00:00	75-52,63'N	1-19,08'E	3062,2	Mooring	information
0038-1	22.06.10	17:15:01	75-52,69'N	1-23,48'E	3068,7	Mooring	action
0038-1	22.06.10	17:41:00	75-50,81'N	1-22,26'E	3043,0	Mooring	action
0038-1	22.06.10	17:43:59	75-50,79'N	1-22,28'E	3042,7	Mooring	on deck
0038-1	22.06.10	17:44:00	75-50,77'N	1-22,28'E	3043,2	Mooring	on ground / max depth
0039-1	22.06.10	22:31:00	76-20,03'N	0-30,68'W	3207,3	CTD/rosette water sampler	in the water
0039-1	22.06.10	23:37:00	76-20,06'N	0-30,25'W	3206,5	CTD/rosette water sampler	on ground / max depth
0039-1	22.06.10	23:37:01	76-20,06'N	0-30,25'W	3206,5	CTD/rosette water sampler	hoisting
0039-1	23.06.10	00:43:59	76-20,04'N	0-29,53'W	3205,5	CTD/rosette water sampler	on deck
0040-1	23.06.10	01:48:00	76-16,37'N	0-50,23'W	2338,2	CTD/rosette water sampler	in the water
0040-1	23.06.10	02:37:00	76-16,46'N	0-50,98'W	2364,0	CTD/rosette water sampler	on ground / max depth
0040-1	23.06.10	03:20:59	76-16,46'N	0-50,83'W	2358,2	CTD/rosette water sampler	on deck
0040-2	23.06.10	03:36:00	76-16,45'N	0-50,37'W	2341,5	Bongo net	in the water
0040-2	23.06.10	03:38:00	76-16,47'N	0-50,45'W	2343,5	Bongo net	on ground / max depth
0040-2	23.06.10	03:44:59	76-16,49'N	0-50,66'W	2350,2	Bongo net	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0041-1	23.06.10	04:44:00	76-12,46'N	1-8,96'W	2442,5	CTD/rosette water sampler	in the water
0041-1	23.06.10	05:36:00	76-12,52'N	1-9,21'W	2449,0	CTD/rosette water sampler	on ground / max depth
0041-1	23.06.10	06:25:59	76-12,56'N	1-9,13'W	2449,0	CTD/rosette water sampler	on deck
0042-1	23.06.10	07:27:00	76-8,83'N	1-28,45'W	3771,7	CTD/rosette water sampler	in the water
0042-2	23.06.10	07:29:00	76-8,82'N	1-28,48'W	3771,8	Hand net	in the water
0042-2	23.06.10	07:33:00	76-8,81'N	1-28,55'W	3771,5	Hand net	on ground / max depth
0042-2	23.06.10	07:39:59	76-8,81'N	1-28,65'W	3771,5	Hand net	on deck
0042-1	23.06.10	08:40:00	76-8,79'N	1-29,66'W	3772,2	CTD/rosette water sampler	on ground / max depth
0042-1	23.06.10	09:49:59	76-8,87'N	1-30,55'W	3771,5	CTD/rosette water sampler	on deck
0043-1	23.06.10	10:49:00	76-4,97'N	1-47,54'W	3772,0	CTD/rosette water sampler	in the water
0043-2	23.06.10	10:51:00	76-5,01'N	1-47,67'W	3772,2	Hand net	in the water
0043-2	23.06.10	10:55:00	76-5,04'N	1-47,78'W	3772,2	Hand net	on ground / max depth
0043-2	23.06.10	10:58:59	76-5,06'N	1-47,88'W	3772,2	Hand net	on deck
0043-1	23.06.10	12:04:00	76-5,19'N	1-49,04'W	3772,0	CTD/rosette water sampler	on ground / max depth
0043-1	23.06.10	12:04:01	76-5,19'N	1-49,04'W	3772,0	CTD/rosette water sampler	hoisting
0043-1	23.06.10	13:14:59	76-5,45'N	1-50,04'W	3771,7	CTD/rosette water sampler	on deck
0044-1	23.06.10	14:33:00	76-0,13'N	2-12,91'W	3772,5	CTD/rosette water sampler	in the water
0044-2	23.06.10	14:34:00	76-0,13'N	2-12,92'W	3772,2	Hand net	in the water
0044-2	23.06.10	14:35:00	76-0,12'N	2-12,93'W	3772,2	Hand net	on ground / max depth
0044-2	23.06.10	14:36:59	76-0,11'N	2-12,93'W	3772,5	Hand net	on deck
0044-3	23.06.10	14:48:00	76-0,07'N	2-13,10'W	3772,5	Spectro radiometer	in the water
0044-3	23.06.10	14:59:00	76-0,05'N	2-13,16'W	3772,2	Spectro radiometer	on ground / max depth
0044-3	23.06.10	15:04:59	76-0,05'N	2-13,21'W	3772,8	Spectro radiometer	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0044-1	23.06.10	15:44:00	75-59,96'N	2-13,40'W	3772,5	CTD/rosette water sampler	on ground / max depth
0044-1	23.06.10	17:00:59	76-0,05'N	2-13,40'W	3772,5	CTD/rosette water sampler	on deck
0045-1	23.06.10	18:30:00	75-50,02'N	2-12,98'W	3747,0	CTD/rosette water sampler	in the water
0045-1	23.06.10	19:34:00	75-50,26'N	2-12,99'W	3746,0	CTD/rosette water sampler	on ground / max depth
0045-1	23.06.10	20:31:59	75-50,47'N	2-13,17'W	3746,0	CTD/rosette water sampler	on deck
0045-2	23.06.10	20:37:00	75-50,62'N	2-13,39'W	3745,7	FLOAT	in the water
0045-2	23.06.10	20:38:59	75-50,71'N	2-13,52'W	3745,5	FLOAT	on ground / max depth
0046-1	23.06.10	22:07:00	75-39,98'N	2-12,74'W	3732,2	CTD/rosette water sampler	in the water
0046-1	23.06.10	23:13:00	75-39,83'N	2-13,98'W	3731,2	CTD/rosette water sampler	on ground / max depth
0046-1	23.06.10	23:13:01	75-39,83'N	2-13,98'W	3731,2	CTD/rosette water sampler	hoisting
0046-1	24.06.10	00:11:59	75-39,81'N	2-15,57'W	3730,0	CTD/rosette water sampler	on deck
0047-1	24.06.10	02:58:00	75-19,98'N	2-13,29'W	3721,7	CTD/rosette water sampler	in the water
0047-1	24.06.10	04:02:00	75-19,98'N	2-13,60'W	3721,5	CTD/rosette water sampler	on ground / max depth
0047-1	24.06.10	05:04:59	75-19,90'N	2-13,35'W	3721,7	CTD/rosette water sampler	on deck
0048-1	24.06.10	06:40:00	75-9,76'N	2-12,67'W	3685,0	Glider	action
0048-1	24.06.10	06:42:00	75-9,75'N	2-12,68'W	3679,2	Glider	action
0048-1	24.06.10	06:45:00	75-9,74'N	2-12,68'W	3676,3	Glider	in the water
0048-1	24.06.10	06:56:00	75-9,68'N	2-12,64'W	3667,7	Glider	action
0048-1	24.06.10	07:13:00	75-9,59'N	2-12,48'W	3663,5	Glider	at surface
0048-2	24.06.10	07:33:00	75-9,49'N	2-12,28'W	3660,5	Closing trawl	action
0048-2	24.06.10	07:34:00	75-9,49'N	2-12,27'W	3660,5	Closing trawl	profile start
0048-1	24.06.10	07:37:00	75-9,48'N	2-12,28'W	3659,5	Glider	action
0048-1	24.06.10	07:38:00	75-9,48'N	2-12,28'W	3659,5	Glider	on ground / max depth

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0048-2	24.06.10	07:40:00	75-9,47'N	2-12,26'W	3658,5	Closing trawl	in the water
0048-1	24.06.10	07:42:59	75-9,45'N	2-12,23'W	3658,5	Glider	action
0048-2	24.06.10	07:49:00	75-9,37'N	2-11,77'W	3661,0	Closing trawl	action
0048-2	24.06.10	07:53:00	75-9,34'N	2-11,34'W	3670,0	Closing trawl	action
0048-2	24.06.10	08:00:59	75-9,36'N	2-10,22'W	3696,3	Closing trawl	profile end
0049-1	24.06.10	08:23:00	75-8,49'N	2-12,42'W	3631,0	CTD/rosette water sampler	in the water
0049-2	24.06.10	08:23:00	75-8,49'N	2-12,42'W	3631,0	Hand net	in the water
0049-2	24.06.10	08:36:00	75-8,42'N	2-12,49'W	3620,3	Hand net	on ground / max depth
0049-2	24.06.10	08:38:59	75-8,41'N	2-12,52'W	3618,7	Hand net	on deck
0049-1	24.06.10	09:24:00	75-8,22'N	2-12,90'W	3580,8	CTD/rosette water sampler	on ground / max depth
0049-3	24.06.10	09:29:00	75-8,20'N	2-12,94'W	3577,8	Spectro radiometer	in the water
0049-3	24.06.10	09:40:00	75-8,14'N	2-13,08'W	3568,3	Spectro radiometer	on ground / max depth
0049-3	24.06.10	09:48:59	75-8,13'N	2-13,09'W	3564,8	Spectro radiometer	on deck
0049-1	24.06.10	10:24:59	75-8,06'N	2-13,20'W	3552,7	CTD/rosette water sampler	on deck
0049-4	24.06.10	10:27:00	75-7,92'N	2-13,27'W	3534,2	FLOAT	in the water
0049-4	24.06.10	10:27:59	75-7,92'N	2-13,27'W	3534,2	FLOAT	on ground / max depth
0050-1	24.06.10	11:26:00	74-59,98'N	2-12,82'W	3635,8	CTD/rosette water sampler	in the water
0050-2	24.06.10	11:27:00	74-59,98'N	2-12,82'W	3635,7	Hand net	in the water
0050-2	24.06.10	11:30:00	74-59,98'N	2-12,81'W	3635,8	Hand net	on ground / max depth
0050-2	24.06.10	11:33:59	74-59,96'N	2-12,78'W	3640,0	Hand net	on deck
0050-1	24.06.10	12:27:00	74-59,80'N	2-11,95'W	3641,0	CTD/rosette water sampler	on ground / max depth
0050-1	24.06.10	12:28:00	74-59,81'N	2-11,93'W	3640,8	CTD/rosette water sampler	hoisting
0050-1	24.06.10	13:25:59	74-59,64'N	2-10,64'W	3702,2	CTD/rosette water sampler	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0050-3	24.06.10	13:30:00	74-59,52'N	2-9,85'W	3714,2	FLOAT	in the water
0050-3	24.06.10	13:30:59	74-59,52'N	2-9,85'W	3714,2	FLOAT	on ground / max depth
0050-4	24.06.10	13:33:00	74-59,57'N	2-9,06'W	3713,3	Drifter	in the water
0050-4	24.06.10	13:35:00	74-59,62'N	2-8,78'W	3712,7	Drifter	in the water
0050-4	24.06.10	13:36:00	74-59,64'N	2-8,66'W	3712,7	Drifter	in the water
0050-4	24.06.10	13:37:00	74-59,66'N	2-8,53'W	3711,7	Drifter	in the water
0050-4	24.06.10	13:37:59	74-59,66'N	2-8,53'W	3711,7	Drifter	on ground / max depth
0051-1	24.06.10	14:40:00	75-0,02'N	1-35,06'W	3729,5	CTD/rosette water sampler	in the water
0051-2	24.06.10	14:43:00	75-0,02'N	1-35,02'W	3729,5	Hand net	in the water
0051-2	24.06.10	14:44:00	75-0,02'N	1-35,01'W	3729,5	Hand net	on ground / max depth
0051-2	24.06.10	14:45:00	75-0,01'N	1-35,00'W	3729,7	Hand net	on deck
0051-2	24.06.10	14:46:00	75-0,01'N	1-35,00'W	3729,7	Hand net	in the water
0051-2	24.06.10	14:46:01	75-0,01'N	1-35,00'W	3729,7	Hand net	on ground / max depth
0051-2	24.06.10	14:46:02	75-0,01'N	1-35,00'W	3729,7	Hand net	on deck
0051-2	24.06.10	14:47:00	75-0,01'N	1-34,99'W	3729,5	Hand net	in the water
0051-2	24.06.10	14:47:01	75-0,01'N	1-34,99'W	3729,5	Hand net	on ground / max depth
0051-2	24.06.10	14:48:59	75-0,01'N	1-34,99'W	3729,7	Hand net	on deck
0051-3	24.06.10	14:51:00	75-0,00'N	1-34,98'W	3729,7	Spectro radiometer	in the water
0051-3	24.06.10	15:01:00	74-59,98'N	1-34,95'W	3729,5	Spectro radiometer	on ground / max depth
0051-3	24.06.10	15:05:59	74-59,98'N	1-34,94'W	3729,5	Spectro radiometer	on deck
0051-1	24.06.10	15:42:00	74-59,96'N	1-34,73'W	3729,7	CTD/rosette water sampler	on ground / max depth
0051-1	24.06.10	16:44:59	74-59,93'N	1-34,44'W	3729,7	CTD/rosette water sampler	on deck
0052-1	24.06.10	18:00:00	75-0,03'N	0-56,06'W	3681,2	CTD/rosette water sampler	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0052-1	24.06.10	19:03:00	74-59,77'N	0-55,52'W	3744,5	CTD/rosette water sampler	on ground / max depth
0052-1	24.06.10	20:01:59	74-59,53'N	0-55,27'W	3748,0	CTD/rosette water sampler	on deck
0052-2	24.06.10	20:01:59	74-59,53'N	0-55,27'W	3748,0	FLOAT	on ground / max depth
0052-3	24.06.10	20:07:00	74-59,34'N	0-54,94'W	3748,5	Drifter	in the water
0052-4	24.06.10	20:09:00	74-59,30'N	0-54,58'W	3749,0	Drifter	in the water
0052-5	24.06.10	20:10:00	74-59,30'N	0-54,42'W	3749,0	Drifter	in the water
0052-3	24.06.10	20:13:59	74-59,36'N	0-53,75'W	3749,3	Drifter	on ground / max depth
0052-4	24.06.10	20:14:59	74-59,38'N	0-53,32'W	3748,3	Drifter	on ground / max depth
0052-5	24.06.10	20:14:59	74-59,38'N	0-53,32'W	3748,3	Drifter	on ground / max depth
0053-1	24.06.10	21:18:00	74-59,96'N	0-17,96'W	3764,5	CTD/rosette water sampler	in the water
0053-1	24.06.10	22:22:00	74-59,91'N	0-17,36'W	3765,3	CTD/rosette water sampler	on ground / max depth
0053-1	24.06.10	22:23:00	74-59,91'N	0-17,35'W	3765,3	CTD/rosette water sampler	hoisting
0053-1	24.06.10	23:21:59	74-59,90'N	0-17,01'W	3765,2	CTD/rosette water sampler	on deck
0054-1	25.06.10	00:35:00	0-0,00'N	0-0,00'E	0,0	CTD/rosette water sampler	in the water
0054-1	25.06.10	01:40:00	75-0,26'N	0-21,40'E	3772,5	CTD/rosette water sampler	on ground / max depth
0054-1	25.06.10	01:41:00	75-0,27'N	0-21,36'E	3772,2	CTD/rosette water sampler	hoisting
0054-1	25.06.10	02:40:59	75-0,40'N	0-21,69'E	3772,0	CTD/rosette water sampler	on deck
0055-1	25.06.10	06:37:00	75-9,20'N	1-47,47'W	3733,0	Glider	at surface
0055-1	25.06.10	06:44:00	75-9,15'N	1-47,65'W	3733,2	Glider	action
0055-1	25.06.10	06:49:00	75-9,09'N	1-47,77'W	3733,5	Glider	action
0055-1	25.06.10	06:51:00	75-9,06'N	1-47,88'W	3733,5	Glider	on ground / max depth
0055-1	25.06.10	06:55:59	75-9,01'N	1-48,00'W	3733,5	Glider	on deck
0056-1	25.06.10	09:56:59	75-3,36'N	0-0,31'W	3768,0	FLOAT	on ground / max depth

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0057-1	25.06.10	11:45:00	75-0,14'N	0-58,75'E	3775,5	CTD/rosette water sampler	in the water
0057-2	25.06.10	11:48:00	75-0,14'N	0-58,71'E	3775,5	Hand net	in the water
0057-2	25.06.10	11:51:00	75-0,15'N	0-58,69'E	3775,8	Hand net	on ground / max depth
0057-3	25.06.10	11:54:00	75-0,17'N	0-58,69'E	3775,5	Spectro radiometer	in the water
0057-2	25.06.10	11:54:59	75-0,17'N	0-58,69'E	3775,5	Hand net	on deck
0057-3	25.06.10	12:38:00	75-0,38'N	0-58,82'E	3775,5	Spectro radiometer	on ground / max depth
0057-3	25.06.10	12:38:01	75-0,38'N	0-58,82'E	3775,5	Spectro radiometer	hoisting
0057-3	25.06.10	12:46:59	75-0,44'N	0-58,94'E	3776,0	Spectro radiometer	on deck
0057-1	25.06.10	12:50:00	75-0,45'N	0-58,90'E	3775,8	CTD/rosette water sampler	on ground / max depth
0057-1	25.06.10	13:57:59	75-0,78'N	0-59,35'E	3775,5	CTD/rosette water sampler	on deck
0057-4	25.06.10	14:02:00	75-0,77'N	0-59,15'E	3775,5	Bongo net	in the water
0057-4	25.06.10	14:08:00	75-0,77'N	0-59,00'E	3776,0	Bongo net	on ground / max depth
0057-4	25.06.10	14:11:59	75-0,80'N	0-59,13'E	3775,5	Bongo net	on deck
0057-5	25.06.10	14:24:00	75-0,98'N	0-59,47'E	3775,3	Multiple net	in the water
0057-5	25.06.10	15:00:00	75-1,32'N	0-59,86'E	3775,2	Multiple net	on ground / max depth
0057-5	25.06.10	15:48:59	75-1,44'N	0-59,89'E	3775,3	Multiple net	on deck
0057-6	25.06.10	15:58:00	75-1,48'N	1-0,32'E	3775,0	FLOAT	in the water
0057-6	25.06.10	15:59:59	75-1,47'N	1-0,64'E	3776,2	FLOAT	on ground / max depth
0057-7	25.06.10	16:00:00	75-1,46'N	1-0,83'E	3775,3	Drifter	in the water
0057-7	25.06.10	16:01:59	75-1,46'N	1-0,97'E	3775,3	Drifter	on ground / max depth
0057-8	25.06.10	16:02:00	75-1,45'N	1-1,14'E	3775,3	Drifter	in the water
0057-8	25.06.10	16:03:59	75-1,44'N	1-1,33'E	3776,2	Drifter	on ground / max depth
0057-9	25.06.10	16:04:00	75-1,43'N	1-1,52'E	3775,5	Drifter	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0057-9	25.06.10	16:05:59	75-1,42'N	1-1,72'E	3775,2	Drifter	on ground / max depth
0058-1	25.06.10	17:06:00	74-59,94'N	1-37,90'E	3133,5	CTD/rosette water sampler	in the water
0058-2	25.06.10	17:10:00	74-59,95'N	1-37,93'E	3132,5	Hand net	in the water
0058-2	25.06.10	17:11:00	74-59,95'N	1-37,92'E	3132,5	Hand net	on ground / max depth
0058-2	25.06.10	17:12:00	74-59,95'N	1-37,90'E	3133,5	Hand net	on deck
0058-2	25.06.10	17:12:01	74-59,95'N	1-37,90'E	3133,5	Hand net	in the water
0058-2	25.06.10	17:13:00	74-59,94'N	1-37,89'E	3133,8	Hand net	on ground / max depth
0058-3	25.06.10	17:14:00	74-59,94'N	1-37,88'E	3134,0	Spectro radiometer	in the water
0058-2	25.06.10	17:14:59	74-59,94'N	1-37,88'E	3134,0	Hand net	on deck
0058-3	25.06.10	17:44:00	74-59,99'N	1-37,46'E	3202,7	Spectro radiometer	on ground / max depth
0058-3	25.06.10	17:50:59	74-60,00'N	1-37,43'E	3182,0	Spectro radiometer	on deck
0058-1	25.06.10	18:03:00	75-0,03'N	1-37,43'E	3177,5	CTD/rosette water sampler	on ground / max depth
0058-1	25.06.10	19:00:59	75-0,15'N	1-37,13'E	3258,2	CTD/rosette water sampler	on deck
0059-1	25.06.10	20:17:00	74-59,98'N	2-16,99'E	2954,2	CTD/rosette water sampler	in the water
0059-1	25.06.10	21:07:00	74-59,95'N	2-17,17'E	2955,2	CTD/rosette water sampler	on ground / max depth
0059-1	25.06.10	21:52:59	74-59,88'N	2-17,83'E	2949,2	CTD/rosette water sampler	on deck
0060-1	25.06.10	23:06:00	75-0,04'N	2-55,48'E	2513,2	CTD/rosette water sampler	in the water
0060-1	25.06.10	23:53:00	75-0,19'N	2-55,74'E	2499,2	CTD/rosette water sampler	on ground / max depth
0060-1	25.06.10	23:54:00	75-0,17'N	2-55,74'E	2500,0	CTD/rosette water sampler	hoisting
0060-1	26.06.10	00:32:59	75-0,24'N	2-55,89'E	2495,0	CTD/rosette water sampler	on deck
0061-1	26.06.10	01:47:00	75-0,02'N	3-34,60'E	3477,3	CTD/rosette water sampler	in the water
0061-1	26.06.10	02:48:00	75-0,06'N	3-34,23'E	3474,3	CTD/rosette water sampler	on ground / max depth
0061-1	26.06.10	03:42:59	75-0,06'N	3-33,93'E	3471,5	CTD/rosette water sampler	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0062-1	26.06.10	05:02:00	75-0,02'N	4-14,13'E	3098,3	CTD/rosette water sampler	in the water
0062-1	26.06.10	05:56:00	75-0,05'N	4-14,07'E	3092,0	CTD/rosette water sampler	on ground / max depth
0062-1	26.06.10	06:49:59	75-0,07'N	4-14,24'E	3093,2	CTD/rosette water sampler	on deck
0062-2	26.06.10	06:55:00	75-0,07'N	4-14,27'E	3093,2	Bongo net	in the water
0062-2	26.06.10	07:15:00	75-0,06'N	4-14,27'E	3094,0	Bongo net	on ground / max depth
0062-2	26.06.10	07:35:59	75-0,05'N	4-14,08'E	3093,0	Bongo net	on deck
0062-3	26.06.10	07:36:00	75-0,05'N	4-14,07'E	3093,2	Hand net	in the water
0062-3	26.06.10	07:37:00	75-0,05'N	4-14,07'E	3092,7	Hand net	on ground / max depth
0062-3	26.06.10	07:39:59	75-0,06'N	4-14,07'E	3092,2	Hand net	on deck
0063-1	26.06.10	08:52:00	74-59,47'N	4-49,82'E	3326,7	CTD/rosette water sampler	in the water
0063-1	26.06.10	09:52:00	74-59,49'N	4-50,18'E	3301,5	CTD/rosette water sampler	on ground / max depth
0063-1	26.06.10	10:46:59	74-59,46'N	4-50,50'E	3279,5	CTD/rosette water sampler	on deck
0063-2	26.06.10	10:53:00	74-59,47'N	4-50,57'E	3276,7	Bongo net	in the water
0063-2	26.06.10	10:57:00	74-59,48'N	4-50,62'E	3274,0	Bongo net	on ground / max depth
0063-2	26.06.10	10:58:00	74-59,48'N	4-50,64'E	3274,0	Bongo net	hoisting
0063-2	26.06.10	11:03:59	74-59,49'N	4-50,68'E	3271,5	Bongo net	on deck
0063-3	26.06.10	11:16:00	74-59,39'N	4-50,07'E	3290,7	Multiple net	in the water
0063-3	26.06.10	11:47:00	74-59,51'N	4-50,59'E	3276,2	Multiple net	on ground / max depth
0063-3	26.06.10	11:49:00	74-59,49'N	4-50,52'E	3278,7	Multiple net	hoisting
0063-3	26.06.10	12:31:59	74-59,52'N	4-50,93'E	3265,0	Multiple net	on deck
0064-1	26.06.10	13:58:00	75-0,07'N	5-29,11'E	3126,2	CTD/rosette water sampler	in the water
0064-2	26.06.10	14:02:00	75-0,06'N	5-29,12'E	3125,5	Spectro radiometer	in the water
0064-3	26.06.10	14:06:00	75-0,06'N	5-29,13'E	3124,5	Hand net	in the water

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0064-3	26.06.10	14:07:00	75-0,06'N	5-29,13'E	3124,5	Hand net	on ground / max depth
0064-3	26.06.10	14:08:00	75-0,06'N	5-29,14'E	3124,5	Hand net	on deck
0064-3	26.06.10	14:09:00	75-0,06'N	5-29,14'E	3124,2	Hand net	in the water
0064-3	26.06.10	14:10:00	75-0,06'N	5-29,15'E	3124,0	Hand net	on ground / max depth
0064-3	26.06.10	14:10:01	75-0,06'N	5-29,15'E	3124,0	Hand net	on deck
0064-3	26.06.10	14:11:00	75-0,06'N	5-29,15'E	3124,0	Hand net	in the water
0064-3	26.06.10	14:12:00	75-0,06'N	5-29,16'E	3123,7	Hand net	on ground / max depth
0064-3	26.06.10	14:12:59	75-0,06'N	5-29,16'E	3123,7	Hand net	on deck
0064-2	26.06.10	14:34:00	75-0,06'N	5-29,25'E	3121,7	Spectro radiometer	on ground / max depth
0064-2	26.06.10	14:40:59	75-0,05'N	5-29,19'E	3122,7	Spectro radiometer	on deck
0064-1	26.06.10	14:52:00	75-0,06'N	5-29,16'E	3123,7	CTD/rosette water sampler	on ground / max depth
0064-1	26.06.10	15:48:59	75-0,01'N	5-29,57'E	3115,5	CTD/rosette water sampler	on deck
0064-4	26.06.10	15:52:00	75-0,01'N	5-29,56'E	3115,5	Bongo net	in the water
0064-4	26.06.10	15:57:00	75-0,01'N	5-29,55'E	3115,5	Bongo net	on ground / max depth
0064-4	26.06.10	16:04:59	75-0,02'N	5-29,58'E	3115,5	Bongo net	on deck
0065-1	26.06.10	17:32:00	75-0,02'N	6-7,97'E	2836,2	CTD/rosette water sampler	in the water
0065-1	26.06.10	18:29:00	75-0,07'N	6-8,10'E	2829,5	CTD/rosette water sampler	on ground / max depth
0065-1	26.06.10	19:13:59	75-0,14'N	6-7,68'E	2838,2	CTD/rosette water sampler	on deck
0065-2	26.06.10	19:17:00	75-0,15'N	6-7,64'E	2839,5	Bongo net	in the water
0065-2	26.06.10	19:23:00	75-0,17'N	6-7,50'E	2844,5	Bongo net	on ground / max depth
0065-2	26.06.10	19:31:59	75-0,19'N	6-7,29'E	2854,2	Bongo net	on deck
0066-1	26.06.10	21:20:00	74-59,94'N	6-46,33'E	2305,7	Bongo net	in the water
0066-1	26.06.10	21:25:00	74-59,97'N	6-46,16'E	2312,7	Bongo net	on ground / max depth

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0066-1	26.06.10	21:34:59	75-0,01'N	6-45,83'E	2324,5	Bongo net	on deck
0066-2	26.06.10	21:43:00	75-0,04'N	6-45,40'E	2341,5	CTD/rosette water sampler	in the water
0066-2	26.06.10	22:26:00	75-0,28'N	6-43,93'E	2288,5	CTD/rosette water sampler	on ground / max depth
0066-2	26.06.10	22:27:00	75-0,28'N	6-43,93'E	2287,7	CTD/rosette water sampler	hoisting
0066-2	26.06.10	23:04:59	75-0,40'N	6-43,78'E	2267,5	CTD/rosette water sampler	on deck
0067-1	27.06.10	02:52:00	74-59,92'N	7-25,45'E	2480,7	CTD/rosette water sampler	in the water
0067-1	27.06.10	03:19:00	74-59,86'N	7-25,29'E	2482,5	CTD/rosette water sampler	information
0067-1	27.06.10	03:21:00	74-59,86'N	7-25,32'E	2483,0	CTD/rosette water sampler	information
0067-1	27.06.10	03:49:00	74-59,91'N	7-25,35'E	2481,7	CTD/rosette water sampler	on ground / max depth
0067-1	27.06.10	04:32:59	74-59,85'N	7-25,18'E	2483,0	CTD/rosette water sampler	on deck
0068-1	27.06.10	09:31:00	75-0,07'N	8-4,30'E	3536,2	CTD/rosette water sampler	in the water
0068-1	27.06.10	10:30:00	75-0,23'N	8-3,36'E	3354,2	CTD/rosette water sampler	on ground / max depth
0068-1	27.06.10	10:32:00	75-0,23'N	8-3,30'E	3405,0	CTD/rosette water sampler	hoisting
0068-1	27.06.10	11:35:59	75-0,29'N	8-2,54'E	3341,5	CTD/rosette water sampler	on deck
0069-1	27.06.10	17:28:00	75-0,01'N	8-43,85'E	2666,0	Bongo net	in the water
0069-1	27.06.10	17:32:00	75-0,05'N	8-43,82'E	2666,0	Bongo net	on ground / max depth
0069-1	27.06.10	17:40:59	75-0,07'N	8-43,87'E	2666,7	Bongo net	on deck
0069-2	27.06.10	17:50:00	75-0,07'N	8-44,04'E	2666,7	Multiple net	in the water
0069-2	27.06.10	18:19:00	75-0,09'N	8-44,08'E	2666,7	Multiple net	on ground / max depth
0069-2	27.06.10	19:02:59	75-0,09'N	8-44,29'E	2667,5	Multiple net	on deck
0069-3	27.06.10	19:12:00	75-0,09'N	8-44,40'E	2667,7	CTD/rosette water sampler	in the water
0069-3	27.06.10	20:01:00	75-0,12'N	8-44,45'E	2667,5	CTD/rosette water sampler	on ground / max depth
0069-3	27.06.10	20:42:59	75-0,13'N	8-44,43'E	2667,7	CTD/rosette water sampler	on deck

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0070-1	27.06.10	22:20:00	75-0,11'N	9-21,54'E	2598,0	CTD/rosette water sampler	in the water
0070-1	27.06.10	23:07:00	75-0,20'N	9-19,89'E	2606,5	CTD/rosette water sampler	on ground / max depth
0070-1	27.06.10	23:07:01	75-0,20'N	9-19,89'E	2606,5	CTD/rosette water sampler	hoisting
0070-1	27.06.10	23:49:59	75-0,30'N	9-18,82'E	2609,5	CTD/rosette water sampler	on deck
0071-1	28.06.10	01:29:00	75-0,04'N	9-59,83'E	2581,2	CTD/rosette water sampler	in the water
0071-1	28.06.10	02:15:00	75-0,15'N	9-59,04'E	2582,2	CTD/rosette water sampler	on ground / max depth
0071-1	28.06.10	02:56:59	75-0,17'N	9-59,20'E	2582,2	CTD/rosette water sampler	on deck
0072-1	28.06.10	04:26:00	74-59,97'N	10-39,12'E	2536,0	CTD/rosette water sampler	in the water
0072-1	28.06.10	05:12:00	75-0,01'N	10-39,28'E	2536,0	CTD/rosette water sampler	on ground / max depth
0072-1	28.06.10	05:55:59	74-59,98'N	10-39,08'E	2535,7	CTD/rosette water sampler	on deck
0073-1	28.06.10	07:24:00	75-0,00'N	11-17,99'E	2456,0	CTD/rosette water sampler	in the water
0073-2	28.06.10	07:29:00	75-0,03'N	11-17,99'E	2455,7	Hand net	in the water
0073-2	28.06.10	07:36:00	75-0,06'N	11-17,87'E	2456,0	Hand net	on ground / max depth
0073-2	28.06.10	07:39:59	75-0,05'N	11-17,84'E	2456,0	Hand net	on deck
0073-1	28.06.10	08:10:00	74-59,97'N	11-17,46'E	2458,7	CTD/rosette water sampler	on ground / max depth
0073-1	28.06.10	08:52:59	74-59,91'N	11-17,01'E	2461,7	CTD/rosette water sampler	on deck
0073-3	28.06.10	08:58:00	74-59,91'N	11-16,91'E	2462,2	Bongo net	in the water
0073-3	28.06.10	09:17:00	74-59,85'N	11-16,71'E	2462,7	Bongo net	on ground / max depth
0073-3	28.06.10	09:39:59	74-59,78'N	11-16,47'E	2463,5	Bongo net	on deck
0074-1	28.06.10	11:06:00	75-0,06'N	11-55,89'E	2336,0	CTD/rosette water sampler	in the water
0074-2	28.06.10	11:11:00	75-0,05'N	11-55,90'E	2336,0	Spectro radiometer	in the water
0074-2	28.06.10	11:40:00	75-0,08'N	11-55,60'E	2338,0	Spectro radiometer	on ground / max depth
0074-2	28.06.10	11:41:00	75-0,09'N	11-55,59'E	2338,0	Spectro radiometer	hoisting

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0074-2	28.06.10	11:47:59	75-0,10'N	11-55,54'E	2338,7	Spectro radiometer	on deck
0074-1	28.06.10	11:50:00	75-0,13'N	11-55,52'E	2337,7	CTD/rosette water sampler	on ground / max depth
0074-1	28.06.10	11:51:00	75-0,14'N	11-55,51'E	2337,5	CTD/rosette water sampler	hoisting
0074-1	28.06.10	12:31:59	75-0,23'N	11-55,00'E	2337,2	CTD/rosette water sampler	on deck
0074-3	28.06.10	12:52:00	75-0,14'N	11-54,63'E	2339,2	Bongo net	in the water
0074-3	28.06.10	12:58:00	75-0,15'N	11-54,56'E	2339,2	Bongo net	on ground / max depth
0074-3	28.06.10	12:58:01	75-0,15'N	11-54,56'E	2339,2	Bongo net	hoisting
0074-3	28.06.10	13:04:59	75-0,15'N	11-54,46'E	2339,2	Bongo net	on deck
0074-4	28.06.10	13:14:00	75-0,06'N	11-54,25'E	2341,2	Multiple net	in the water
0074-4	28.06.10	13:43:00	75-0,09'N	11-53,87'E	2341,7	Multiple net	on ground / max depth
0074-4	28.06.10	13:43:01	75-0,09'N	11-53,87'E	2341,7	Multiple net	hoisting
0074-4	28.06.10	14:24:59	75-0,12'N	11-53,59'E	2341,7	Multiple net	on deck
0075-1	28.06.10	15:48:00	74-59,96'N	12-35,07'E	2183,7	CTD/rosette water sampler	in the water
0075-1	28.06.10	16:29:00	75-0,01'N	12-34,75'E	2182,7	CTD/rosette water sampler	on ground / max depth
0075-1	28.06.10	17:06:59	75-0,07'N	12-34,61'E	2183,0	CTD/rosette water sampler	on deck
0076-1	28.06.10	18:32:00	74-59,98'N	13-13,12'E	2014,2	CTD/rosette water sampler	in the water
0076-1	28.06.10	19:10:00	75-0,11'N	13-13,30'E	2011,2	CTD/rosette water sampler	on ground / max depth
0076-1	28.06.10	19:42:59	75-0,17'N	13-13,41'E	2010,0	CTD/rosette water sampler	on deck
0077-1	28.06.10	21:07:00	75-0,08'N	13-51,84'E	1799,7	CTD/rosette water sampler	in the water
0077-1	28.06.10	21:42:00	75-0,16'N	13-51,00'E	1801,5	CTD/rosette water sampler	on ground / max depth
0077-1	28.06.10	22:13:59	75-0,35'N	13-50,01'E	1801,5	CTD/rosette water sampler	on deck
0078-1	28.06.10	23:43:00	75-0,01'N	14-30,79'E	1431,5	CTD/rosette water sampler	in the water
0078-1	29.06.10	00:12:00	75-0,05'N	14-30,00'E	1441,2	CTD/rosette water sampler	on ground / max depth

Station PS 76/	Date	Time	Position Lat	Position Lon	Depth [m]	Gear	Action
0078-1	29.06.10	00:12:01	75-0,05'N	14-30,00'E	1441,2	CTD/rosette water sampler	hoisting
0078-1	29.06.10	00:36:59	75-0,06'N	14-29,20'E	1454,2	CTD/rosette water sampler	on deck
0079-1	29.06.10	02:06:00	74-59,98'N	15-10,13'E	1028,0	CTD/rosette water sampler	in the water
0079-1	29.06.10	02:29:00	75-0,12'N	15-9,93'E	1023,0	CTD/rosette water sampler	on ground / max depth
0079-1	29.06.10	02:48:59	75-0,19'N	15-10,26'E	1015,7	CTD/rosette water sampler	on deck
0080-1	29.06.10	04:14:00	74-59,98'N	15-50,40'E	265,2	CTD/rosette water sampler	in the water
0080-1	29.06.10	04:23:00	75-0,02'N	15-50,60'E	265,2	CTD/rosette water sampler	on ground / max depth
0080-1	29.06.10	04:36:59	75-0,04'N	15-50,61'E	269,7	CTD/rosette water sampler	on deck
0081-1	29.06.10	05:50:00	75-0,02'N	16-30,35'E	228,2	CTD/rosette water sampler	in the water
0081-1	29.06.10	05:59:00	75-0,07'N	16-30,41'E	227,5	CTD/rosette water sampler	on ground / max depth
0081-1	29.06.10	06:03:59	75-0,09'N	16-30,42'E	228,5	CTD/rosette water sampler	on deck
0082-1	29.06.10	07:04:00	74-60,00'N	16-59,80'E	132,5	CTD/rosette water sampler	in the water
0082-2	29.06.10	07:06:00	74-59,99'N	16-59,81'E	132,7	Spectro radiometer	in the water
0082-1	29.06.10	07:12:00	74-59,94'N	16-59,93'E	134,5	CTD/rosette water sampler	on ground / max depth
0082-2	29.06.10	07:13:00	74-59,93'N	16-59,95'E	135,0	Spectro radiometer	on ground / max depth
0082-2	29.06.10	07:17:59	74-59,89'N	16-59,94'E	136,2	Spectro radiometer	on deck
0082-1	29.06.10	07:18:00	74-59,88'N	16-59,93'E	136,2	CTD/rosette water sampler	at surface
0082-1	29.06.10	07:20:00	74-59,85'N	16-59,92'E	135,7	CTD/rosette water sampler	in the water
0082-1	29.06.10	07:24:00	74-59,80'N	16-59,97'E	135,0	CTD/rosette water sampler	on ground / max depth
0082-1	29.06.10	07:32:59	74-59,71'N	16-60,00'E	135,7	CTD/rosette water sampler	on deck

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