Berichte
zur Polar- und Meeresforschung

589 2009

Reports on Polar and Marine Research

The Expedition of the Research Vessel "Polarstern" to the Arctic in 2008 (ARK-XXIII/1)

Edited by
Gereon Budéus
with contributions of the participants

HELMHOLTZ GEMEINSCHAFT

ALFRED-WEGENER-INSTITUT FÜR
POLAR- UND MEERESFORSCHUNG
In der Helmholtz-Gemeinschaft
D-27570 BREMERHAVEN
Bundesrepublik Deutschland

ISSN 1866-3192

Hinweis

Die Berichte zur Polar- und Meeresforschung werden vom Alfred-Wegener-Institut für Polar-und Meeresforschung in Bremerhaven* in unregelmäßiger Abfolge herausgegeben.

Sie enthalten Beschreibungen und Ergebnisse der vom Institut (AWI) oder mit seiner Unterstützung durchgeführten Forschungsarbeiten in den Polargebieten und in den Meeren.

Es werden veröffentlicht:

— Expeditionsberichte (inkl. Stationslisten und Routenkarten)
— Expeditionsergebnisse (inkl. Dissertationen)
— wissenschaftliche Ergebnisse der Antarktis-Stationen und anderer Forschungs-Stationen des AWI
— Berichte wissenschaftlicher Tagungen

Die Beiträge geben nicht notwendigerweise die Auffassung des Instituts wieder.

Notice

The Reports on Polar and Marine Research are issued by the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven*, Federal Republic of Germany. They appear in irregular intervals.

They contain descriptions and results of investigations in polar regions and in the seas either conducted by the Institute (AWI) or with its support.

The following items are published:

— expedition reports (incl. station lists and route maps)
— expedition results (incl. Ph.D. theses)
— scientific results of the Antarctic stations and of other AWI research stations
— reports on scientific meetings

The papers contained in the Reports do not necessarily reflect the opinion of the Institute.

The „Berichte zur Polar- und Meeresforschung”
continue the former „Berichte zur Polarforschung”

* Anschrift / Address
Alfred-Wegener-Institut
Für Polar- und Meeresforschung
D-27570 Bremerhaven
Germany
www.awi.de

Editor in charge:
Dr. Horst Bornemann

Assistant editor:
Birgit Chiaventone

Die "Berichte zur Polar- und Meeresforschung" (ISSN 1866-3192) werden ab 2008 ausschließlich elektronisch als Open-Access-Publikation herausgegeben
(URL: http://epic.awi.de).

The Expedition of the Research Vessel "Polarstern" to the Arctic in 2008 (ARK-XXIII/1)

———————————————————————————————————————

Edited by
Gereon Budéus
with contributions of the participants

Ber. Polarforsch. Meeresforsch. 589 (2009)
ISSN 1866-3192

ARK-XXIII/1

12 June 2008 - 2 July 2008

Bremerhaven - Longyearbyen

Fahrtleiter / Chief Scientist

Gereon Budéus

Koordinator / Coordinator

Eberhard Fahrbach

CONTENTS

1. FAHRTVERLAUF UND ZUSAMMENFASSUNG

Gereon Budéus, Alfred-Wegener-Institut

Der erste Fahrtabschnitt der 23. *Polarstern*-Expedition in die Arktis begann am 12. Juni 2008 in Bremerhaven. Das Forschungsschiff *Polarstern* nahm Kurs auf die grönländische Küste bei 74°N und lief dort dicht vor der grönländischen Küste in eisbedeckte Gewässer. Auf dem Weg wurden wegen eines Maschinenwellenschadens vor Bergen Ersatzteile per Helikopter eingeflogen. Als erste Forschungsaktivität wurden geodätische Arbeiten auf dem grönländischen Festland durchgeführt. Per Helikopter wurden Meßstationen ausgebracht, die die Vertikalbewegungen des Festlandes bestimmen, welche durch die abnehmende Eislast verursacht werden. Auf drei Breiten zwischen 74°N und 76°N wurden je eine Station in Küstennähe sowie eine Station etwa 100 km weiter landeinwärts ausgebracht. Diese Stationen benötigen Meßzeiten von einigen Wochen und wurden erst auf dem nachfolgenden Fahrtabschnitt wieder geborgen. Zusätzlich wurden einige bereits bestehende dänische GPS-Messpunkte wiedervermessen bzw. instandgesetzt. Bedingt durch ausgezeichnete Wetterverhältnisse konnte der sehr knappe Zeitplan trotz der jahreszeitlich bedingten noch erheblichen Eisbedeckung eingehalten werden.

Auf die geodätischen Arbeiten folgte ein zonaler hydrographisch/chemischer Schnitt über die Grönlandsee. Der Schnitt verläuft von der Küste Grönlands bis zur Bäreninsel. Er dient zur Erfassung und Erklärung der Veränderungen im Becken der Grönlandsee und in seinen Randströmen. In diesem Ozeanbecken findet man eine global einzigartige rezente Strukturveränderung, die durch einen Süßwasserpuls aus dem Arktischen Ozean zu Anfang der 90er Jahre verursacht wurde. Der vorher bestehende Kaltwasserdom wurde durch eine bis heute persistente Zweischichtung ersetzt, die eine Ventilation des unteren Stockwerks effektiv verhindert. Da die zweigeschichtete Struktur sich bezüglich Lage und Ausdehnung ändert, ist ein Langzeitprojekt etabliert. Auch die arktischen Gewässer sind durch hohe Dynamik gekennzeichnet und die komplexen Veränderungen, bedingt durch Konvektion und Austausch mit den Randwassermassen, können nur mit Hilfe langer Zeitreihen konsistenter Qualität richtig erklärt werden. In den vergangenen Jahren zeigte sich ein verstärkter Einstrom von Atlantischen Wassermassen, der weitreichende Implikationen besitzt. Dieser verstärkte Einstrom ist mit dafür verantwortlich, dass die Grönlandsee mittlerweile im Winter üblicherweise eisfrei bleibt. Er setzte sich auch 2008 fort. Als weiterer Projektbestandteil wurden autonom profilierende Tiefsee-Verankerungen und eine speziell zur Untersuchung des Frischwassereintrags konzipierte Flachwasserverankerung ausgetauscht. Aufgrund der Zeitknappheit musste die Lage der westlichen Stationen gegenüber den Vorjahren modifiziert werden.

Studien zur paläontologischen Proxy-Validierung unter Verwendung von Foraminiferen und Coccolithophoren nutzten die Seewasserversorgung des Schiffes, um die Verteilungen in den Hauptwassermassen und Fronten entlang des Schiffsweges zu bestimmen. Ein weiteres Ziel dieses Projektes ist eine Verbesserung des Verständnisses der Interaktion zwischen Ökosystem und Umweltbedingungen in der Arktis insbesondere im Hinblick auf die Fähigkeit des Biosystems zur Anpassung an die aktuellen und vorhergesagten klimatischen Veränderungen. Mit ARK-XXIII/1 wurde erstmals eine interannuelle Verleichsstudie in diesem Gebiet durchgeführt.

Die Verteilung von Seevögeln und marinen Säugern unterliegt ebenfalls den klimatischen Veränderungen, besonders im Hinblick auf die wechselnde Ausdehnung der eisbedeckten Flächen. Der besondere Wert der auf ARK-XXIII/1 durchgeführten Quantifizierung dieser Tiere liegt dementsprechend in ihrem Charakter als Langzeitstudie, die 1973 begonnen wurde. Die Verteilung der Walvorkommen im Nordatlantik zeigt bereits eine deutliche Veränderung aufgrund der Modifikation der Eisbedeckung in der Arktis. Die Zählungen wurden entlang des gesamten Schiffsweges durchgeführt.

Am 2.7.2008 lief *Polarstern* plangemäß in Longyearbyen ein.

R/V POLARSTERN
ARK XXIII/1
physical oceanography geodesy
GREEN · LAND · SEA
marine chemistry marine biology
Bremerhaven - Longyearbyen · 12.06.08-02.07.08
R/V POLARSTERN

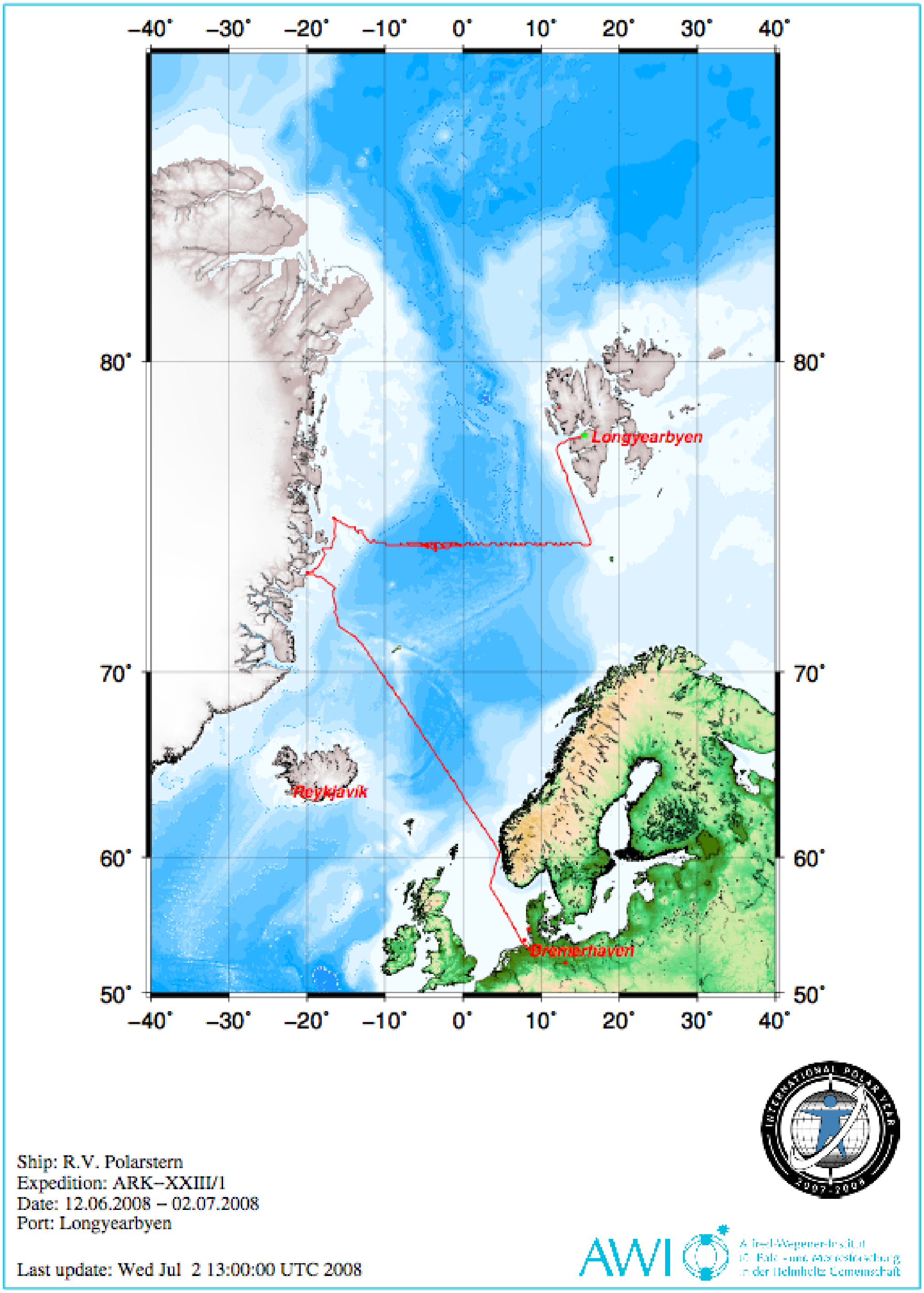

Abb. 1: Fahrtroute der Polarstern während der Expedition ARK-XXIII/1
Fig. 1: Track of Polarstern during the expedition ARK-XXIII/1

CRUISE NARRATIVE AND SUMMARY

The first leg of the 23rd *Polarstern* expedition to the Arctic started on 12 June 2008 from Bremerhaven. The ship headed directly to the east Greenland coast at 74°N and entered ice covered waters close to the Greenland coast. Due to an engine fault, spare parts for the ship's engine were collected by a helicopter from Bergen, Norway while we were steaming. The first research activities were geodetic works on Greenland. GPS receivers were installed on land with the use of helicopters. The receivers determine the vertical movement of the land masses which are caused by the decreasing ice load. At three latitudes between 74°N and 76°N receiver pairs were installed, one close to the coast, and the second about 100 km inland. The instruments need a measuring period of some weeks and were to be recovered during the next cruise leg. In addition to this, already existing Danish GPS fixpoints were re-evaluated or serviced. Owing to favourite weather conditions it was possible to comply with the tight time schedule despite the still dense ice cover related to the relatively early season.

After the geodetic work a hydrographic transect across the Greenland Gyre was performed. This transect extends from the Greenland coast to Bear Island. It serves as a mean to record and explain ongoing changes in the Greenland Basin and its rim currents. In this basin a globally unique recent structure modification has been observed which is caused by a fresh water input pulse during the early 90s. The formerly present cold water dome was superseded by a persistent two-layer structure which prevails until today and which effectively inhibits the ventilation of the lower storey. As the two-storey structure is changing continously, a long-term project has been established for its observation. The highly dynamic changes, the complex modifications by convection, and the exchange with the surrounding waters can be correctly explained only with the aid of quality consistent long-term time series. During recent years, an increased input of Atlantic waters has been perceived which has far reaching implications. This increased input of Atlantic waters essentially contributes to the fact that nowadays the Greenland Sea remains usually ice–free in winter and it continued in 2008. Another issue on the working plan of the project was the exchange of autonomously profiling deep sea moorings and of a shallow water profiling mooring which is specifically designed to assess the fresh water introduction into the gyre. Due to time constraints the positions of some stations in the western part of the transect had to be modified.

Paleo proxy validation studies used the ship's sea water supply for the sampling of foraminifera and coccolithophores with a particular focus on gaining track samples across the main frontal systems. A major aim of this research project was to contribute temperature and ice-cover reconstructions of the Holocene to the existing climate databases. A second aim is to improve our current understanding of environment-ecosystem interactions and to estimate to which extent Arctic biota can absorb the currently predicted climate changes. During ARK-XXIII/1 it was the first time to perform an interannual comparative study in this area .

The distribution of higher trophic levels (seabirds and marine mammals) is also dependent on climatic changes, in particular with respect to the changing size of ice–covered areas. The specific quality of the quantification of these species during ARK-XXIII/1 is due to its long-term approach which has started already in 1973. The distribution of certain whale species in the North Atlantic has already shown a marked modification as a results of the reduced ice cover in the Arctic. The observations of higher trophic levels was carried out along the ship's entire pathway.

The cruise leg was finished in time at the port of Longyearbyen on 2 July 2008 .

2. WEATHER CONDITIONS

Klaus Dittmer, Klaus Buldt
DWD Deutscher Wetterdienst

At the beginning of the voyage a low pressure system over Karelia moved to northern Russia and weakened. The northwesterly wind in the German Bight of about 5 Bft decreased a little for a time due to the development of a secondary depression over the Netherlands. Later on in association with another secondary low over the Skagerrak the wind speed increased and during the night from 12 to 13 June the maximum wind was 7 Bft with a sea of 3 metres.

The mentioned secondary low moved towards southern Norway within the next 24 hrs and in the vicinity of the centre near Utsira the wind abated. A helicopter-flight on 14 June to Bergen was done without disturbances by showers, which were only observed in a far distance. Sailing on the northerly winds reached Bft 6 to 7 again.

On 15 June a new depression developed off southeastern Greenland. Until 17 June it moved to the area west of Scotland while deepening to a low with gale force in its rear.

Polarstern however was not affected by strong winds or gales but sailed into the ridge of a high over Greenland which developed on the western coast and later on drifted to central Greenland. Except from a short period of BFT 6 in the evening of 17 June northerly winds of 4 and 5 Bft along its eastern flank were observed.

In the morning of 18 June *Polarstern* approached the ice edge west of Jan Mayen which was covered by the typical arctic fog belt.

Closer to the coast of Greenland the fog patches disappeared so that an ice-reconnaissance-flight was possible. Meanwhile a new low had developed off northwestern Greenland which moved southeast in the upper level. Along with this a new depression developed on the surface in the Denmark Strait.

At this time *Polarstern* operated on 74° N off the eastern coast of Greenland from where the first GPS-stations were brought to land during the night of 19 June. Although frontal clouds crossed Greenland they did not cause any problems to the helicopter-flight operations as the ceiling was high enough and mostly above the tops of the mountains due to a significant Föhn effect.

In the evening of 19 June more helicopter flights were scheduled. At this time the clouds were above 8,000 ft and thus above the mountain tops.

During the night of 20 to 21 June the last GPS equipment was brought to Greenland near 76° North. Isolated shallow fog patches over the sea-ice area could be flown over.

On 21 June southerly winds in front of a small low off Northeast-Greenland intensified the fog situation. As no helicopter flights were scheduled this was only of disadvantage for navigation and observing animals.

From 21 to 22 June a low moved from the coast of middle Norway to the area southwest of Bear Island. In the rear of this low the northerly wind increased to Bft 6 and a sea of 3 metres. On 24 June this low had filled up and the wind decreased to 4 Bft for a time.

With a new low over northern Scandinavia and a secondary depression south of Bear Island the wind increased again to Bft 6-7 on 27 June. After the development of another low near Bear Island moving towards Jan Mayen, the northeasterly wind reached Bft 6-7 once more on 29 June after a period of moderate winds.

During the last two days of the leg the wind decreased and later on the weather became calm.

In summary the wind and sea as well as the fog distribution were below mean climatological values. The reason was the main track of low pressure systems that mostly extended from Newfoundland over the British Isles to Scandinavia and thus far south or southeast of the research area.

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

Gereon Budéus, Thea Dammrich, Juliane Jacob, Lisa Kattner, Viktoria Mohr, Rainer Plugge, Henning Pulz, Harald Rohr, Hannah Weber, Oliver Zenk
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 hydrographic 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 carefully observe the hydrographic development. 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 have changed 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.

Recently, suprisingly long-lived submesosclae vortices (SCVs) have been detected in the Greenland Sea (diameter about 10 to 20 km). In the centre of these features, convection reaches depths that are about 1,000 m greater than in the background (some 2,600 m vs. 1,600 m). These eddies seem to survive a number of years by a repeated homogenisation during winter. It is in the centres of these eddies where winter convection is expected to meet the ocean bottom first. A special small scale survey is necessary to investigate their structure.

At all depth levels, the Greenland Sea represents a highly dynamical environment with considerable temporal changes. Our present knowledge about the relevant hydrographic processes does not allow to predict the future hydrographic 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).

Within the project LOTEVA-GS, a unique hydrographic time series is being established by an annually repeated zonal transect across the Greenland Gyre center and by measurements of autonomous profilers (EP/CC-Jojo, daily profiles, full ocean depth, 1 year exchange cycle) 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 interiour 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 indispensable 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, SCVs 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.

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 exchanged. 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 3,700m. In order to assess the annual fresh water cycle in the Greenland Gyre, a special profiling shallow water yoyo CTD has been installed in 2007 (NGK winch and Optimare/Sea-Bird instrument). This mooring reveals profiles between 160 m and the surface proper, and has been exchanged, too.

Preliminary results

a) General

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 vertial 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 formes a slight depression in the gyre centre now. A second remarkable result is the increase of the upper layer salinities from 2007 to 2008. 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 decend 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 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, as is the case for the winter 2007/08, ice formation is inhibited and the ventilated waters increase in temperature and salinity.

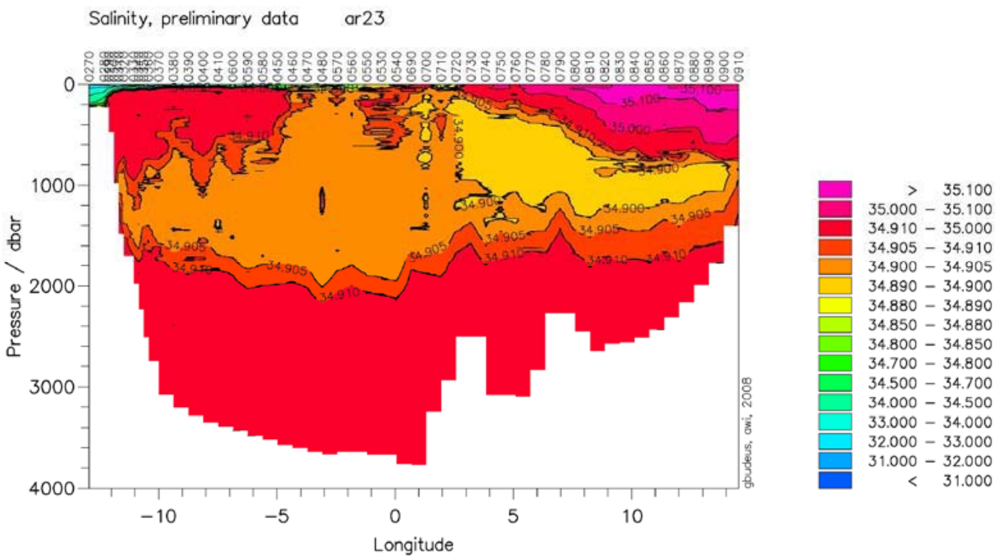

Fig. 3.1: Salinity distribution on the zonal CTD-transect (west is left), preliminary values

This increase of both parameters due to winter convection can readily be seen from the (uncalibrated) time series of the autonomous profiler.

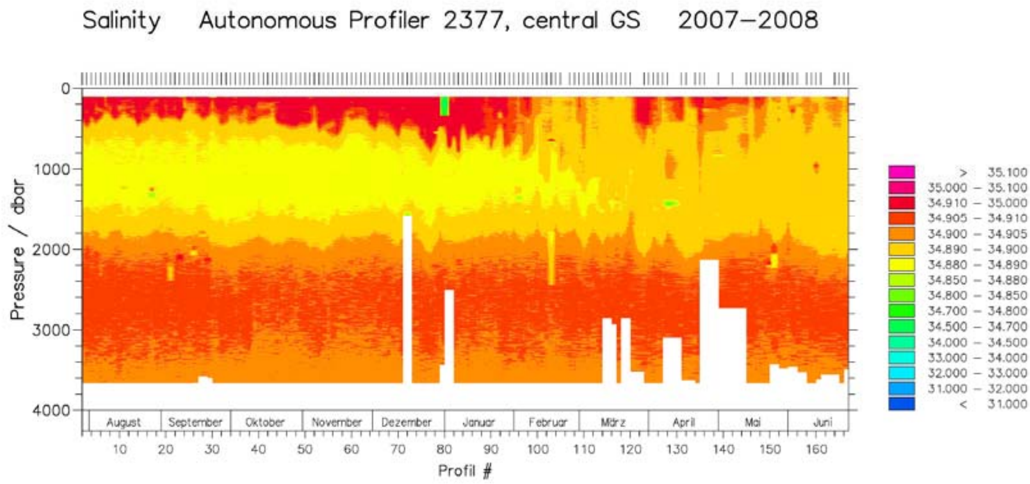

Fig. 3.2: Salinity development between summer 2007 and summer 2008 from profiles of the moored autonomous profiler. Each tick mark represents a profile. Uncorrected data

Remarkably, there is no water left in any depth horizon of the Greenland Gyre which still fits into the TS-space related category of Greenland Sea Waters which have been limited to salinities below 34.900.

b) NGK/Optimare shallow water surface approaching underwater profiling CTD system

The performance of the NGK/Optimare shallow water surface approaching underwater system deserves a special chapter, as the deployment is the first in Arctic waters, the first use outside Asia, and the first which was scheduled to operate over a time interval of such a length. Considerable redesign has been applied in order to meet the needed specifications.

The Automated Elevator System by NGK, Japan, consists of a sophisticated combination of an underwater winch, a control unit, multiple parallel power supplies, and a structure of frame and buoyancy. It is intended for the use in the open ocean where it has to reside in a depth smaller than 300 m and enables measurements right into the ocean surface. This important inclusion of the surface layer poses severe problems to mooring designs, and no commercially available operational alternative to the NGK solution is apparent. When the NGK system pays out rope, a buoyant instrument ascends until it reaches the water surface proper. The winch is halted then and reverses it's rotational direction, thus moving the instrument back to its parking position close to the winch. A tension sensor in the elevator system detects the instrument's arrival at the surface. Our mooring in the Greenland Sea is the premier use of the NGK system in Europe.

In our mooring, the Optimare/Sea-Bird Electronics CTD-logger is the buoyant instrument which is moved to the surface and back to the winch. It comprises a pumped SBE41 CTD module and a custom designed pressure case containing the special electronics and the electrical supply. The synchronisation of the Elevator System and the CTD is realised by their clocks only, there is no communication between them.

This shallow water yoyo-mooring is added to a site where EP/CC Deep Sea Jojo moorings have been deployed for a number of years. These deep sea yoyos reside in a depth of roughly 100 m and measure daily profiles between this depth and the ocean bottom at about 4 km. The shallow water yoyo complements these measurements by covering the important upper part of the water column with daily measurements, too.

The mooring which contains the NGK Automated Elevator System and the Optimare/Sea-Bird Electronics CTD-logger has been deployed on 27.07.2007 during a cruise with RV *Maria S. Merian*. Position is 76°56'N, 4°37'E. Water depth at the mooring site is 3,680 m.

The buoyancy of the NGK system is about 500 N. In order to carry the mooring rope and to apply a reasonable tension to it, buoyancy must be added. We used a modular set of cylindric syntactic foam pieces, which have the same diameter as the NGK frame, for this purpose. Three slices of syntactic foam have been located just beneath the winch, and one has been mounted on it's top. Each of these four foam pieces provides a buoyancy of ca. 900 N, so the total buoyancy is approx. 4,000 N. The rope is an 8.6 mm Aramid rope by Lippmann, Hamburg.

The Optimare/Sea-Bird Electronics CTD-logger has a buoyancy of about 20 N, a diameter of 160 mm and a length of 1.05 m. It's buoyancy does not suffice to keep the necessary tension on the winch's rope. Two plastic spheres with 30 N buoyancy each were therefore added to the logger.

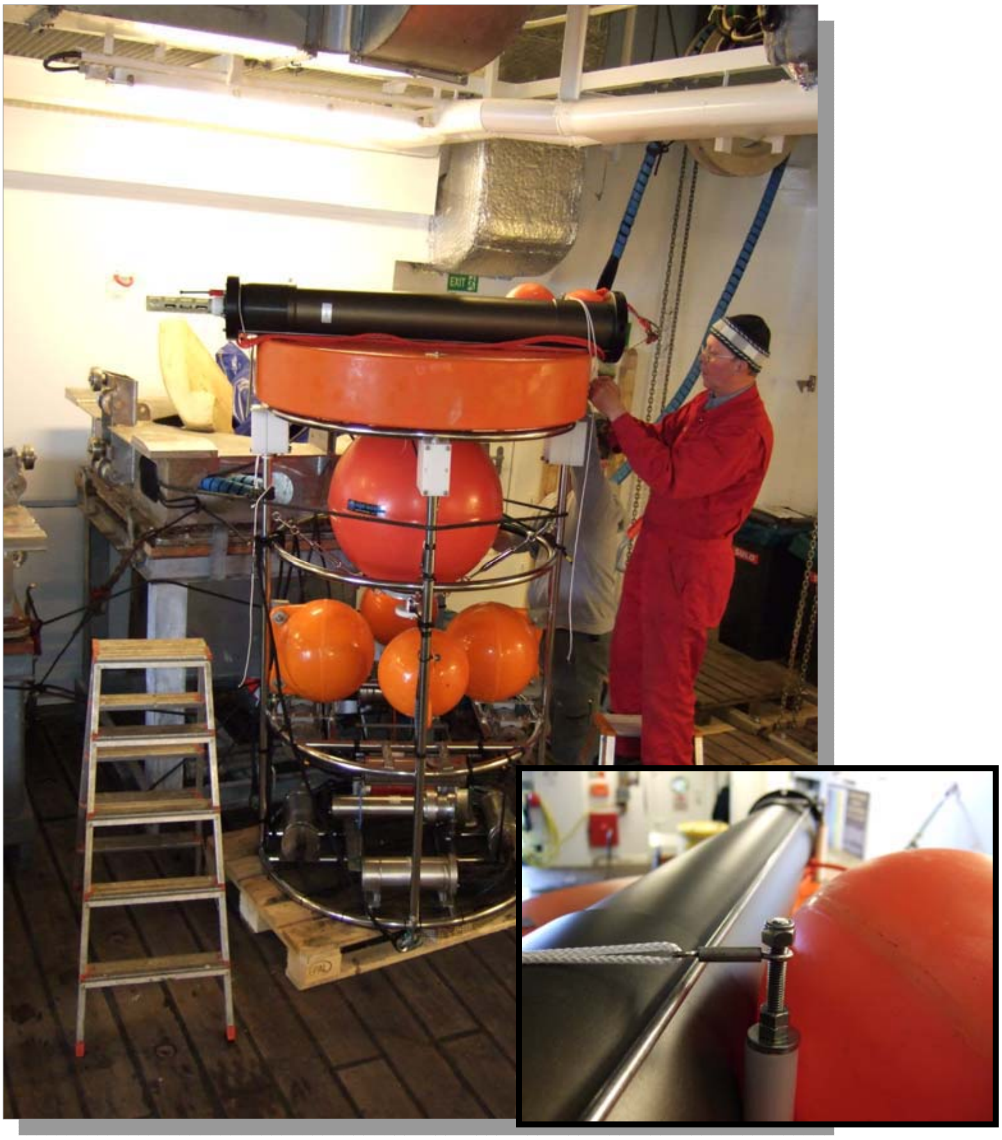

Fig. 3.2: NGK Automated Elevator System with an added buoyancy slice of syntactic foam and the Optimare/Sea-Bird Electronics CTD-logger on top before deployment in 2007 (left). The CTD-logger is initially fixed to the winch frame utilizing corrosion links (bottom right).

The mooring was adjusted so that the parking position of the CTD and the winch were at a nominal depth of 160 m. With the winch's 300 m rope length the surface could be securely reached from this depth. The winch was scheduled to perform one cycle per day, whereas the CTD-logger was programmed to measure 30 min periods in time intervals of 12 hours. Hereby, CTD data sets are recorded alternatingly during an ascent/descent cycle and at the parking position.

The mooring had been recovered on 23.6.2008. After inspection and exchange of the batteries, it was redeployed at the same location 3 days later.
After the one year deployment period the optical condition of the NGK system seemed to be impeccable, and so did the Optimare/Sea-Bird Electronics CTD-logger. However, the two plastic buoyancy spheres, which were added to the logger, were lacking. As they had been fixed securely to the rope which holds the CTD-logger (a central hole in the spheres is used to let the rope run through), this was an – unpleasant – surprise and indicated a break-down of scheduled operation at some time during the deployment period. A quick data check showed that this occurred rather late during mid April 2008, so that the entire winter is covered by measurements.

In detail, the performance history is as follows. The evaluation is based on the CTD-logger record. The CTD-logger worked faultlessly.

After the start of the mooring period, the CTD-logger resides at the winch for several days. This is owing to the fact that the CTD is attached to the Automated Elevator frame using corrosion links, which release the CTD-logger after 13 days (CTD-logger record number 26). Regular profiles are performed then, with occasional pauses occurring up to day 50 (record 100). From then on, more than 200 daily profiles are performed. Regular performance stopped on 17 April 2008. The reason is clear from the depth record: An unexpectedly deep dive to more than 500 dbar (555 dbar) resulted in a collapse of the plastic buoyancy spheres, which had a nominal pressure rating of 300 dbar. This dive is caused by a major current event, which is rare yet known in the region. Small scale, fast rotating eddies possess high velocities at their outer rim. The lateral drag on the 4 km long mooring components leads to a related vertical shift of winch and CTD-logger. Subsequently, the CTD-logger remained with its own buoyancy only, which is below the tension threshold of the system. Shutting off the profiling action under this condition is as systematically as are the preceding profiles.

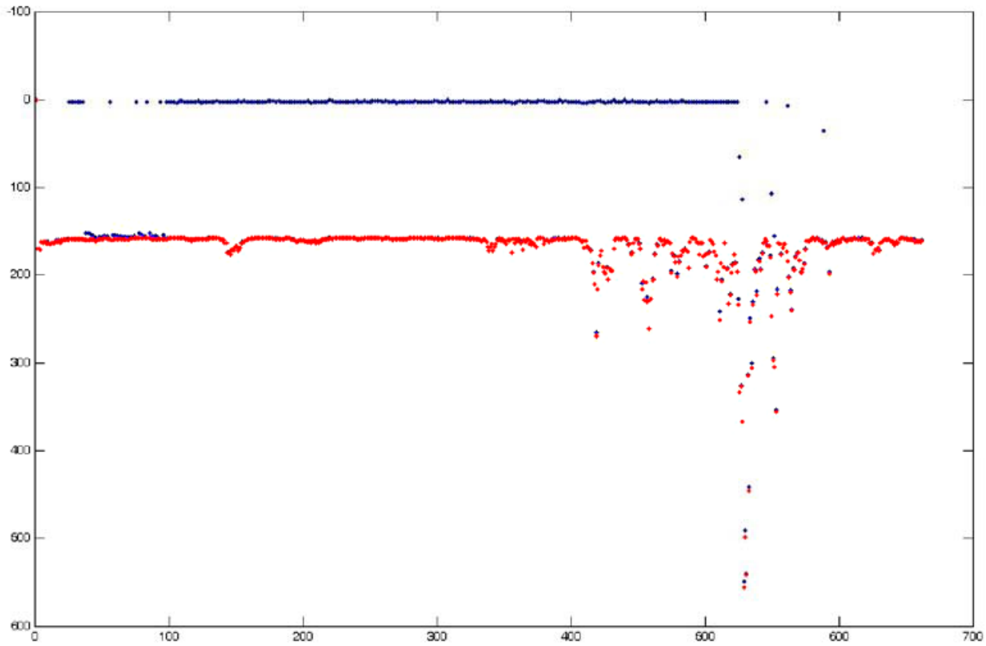

Fig. 3.3: First and last pressure of each CTD-logger record interval (duration 30 min every 12 h). Pressure is in dbar against CTD-logger record number

The system's behaviour in the surrounding of the deepest dive (CTD record 529) is worth noting. During some later instances, the CTD ascends despite the lacking buoyancy spheres. Apparently, the drag by the strong ocean currents is sufficient to exceed the tension threshold of the winch. From very deep positions, the winch pays out all it's rope (300 m), but the CTD-logger does not reach the ocean surface. The winch retracts the rope as planned under these circumstances. From CTD record No. 600 on, no further current event occurred and the winch remained in its systematic parking mode.

The energy supply's capacity which was mounted to the winch was sufficient for the described operation under the cold temperatures in the subarctic waters (about 0°C). This is as expected, because fewer profiles than originally scheduled have been performed due to the destruction of the CTD-logger's main buoyancy. We will evaluate the energy remaining in the battery set as soon as possible.

After this one year performance, the rope of the winch was perfectly intact and well spooled. Profiling speed was between 25 and 30 cm/s.

The main buoyancy of the mooring could be enhanced in order to prevent dives as deep as experienced in April 2008. The buoyancy attached to the CTD-logger should have a higher pressure resistance (redeployment considered this already).

The entire system of NGK Automated Elevator System and Optimare/Sea-Bird Electronics CTD-logger proved to work fully operational for a long work time interval of one year in cold subarctic waters. Energy supply, mechanics, and electronics worked perfectly. More than 200 cycles between a nominal depth of 160 m (exceeded on occasions) and the ocean surface proper were performed. Both the NGK system and the Optimare/Sea-Bird Electronics CTD-logger turned up in an as-new optical condition after the deployment period.

An unprecedented record of Eulerian measurements in the centre of the Greenland Gyre has been collected all year round in the complete uppermost layer of the water column which contains the important fresh water signal. The previously impossible extension of moored measurements right into the ocean surface will reveal new insights into the fresh water balance of this climatologically sensible region of deep water formation.

4. LONG-TERM VARIABILITY OF THE OXYGEN DISTRIBUTION IN THE GREENLAND SEA (LOTEVA/OX-GS)

Eva Falck, Helle A. Botnen
University of Bergen

Objectives

The present state of the hydrographic 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 essential, however, to study 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 misinterpretation. Since the 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 combined use of electronic and chemical methods to measure oxygen concentration will be used to evaluate the younger ventilation history of the upper part of the Greenland Sea Gyre on the one hand and to examine the grade of isolation of the lower part on the other. Such combined measurements exist from fieldwork in 2005 and 2007.

Work at sea

From all water samples taken with the rosette sampler at different depths, oxygen was measured by the Winkler method. 23 stations were taken on the East Greenland shelf and 55 stations along the 75ºN transect. With 24 Niskin bottles on the rosette a good vertical resolution was achieved.

Preliminary results

The analysed water samples show a pool of higher oxygen concentrations in the centre of the Greenland Sea down to about 1,500 m (Fig. 4.1). The concentrations are lower in the deeper parts with lowest values for the Norwegian Sea Deep Water to the east. The oxygen values from the Winkler titrations will be used to calibrate the data taken with the oxygen sensor and the ventilation history from this winter will be compared to the one from the previous winter. A comparison of bottle data taken during 2007 and 2008 from the centre of the Greenland Sea is shown in Fig. 4.2. It shows a deepening of the high oxygen top layer between 2007 and 2008, which can be explained only by winter convection, and a decrease in the oxygen concentrations of the bottom layer, substantiating its isolation from atmospheric inputs.

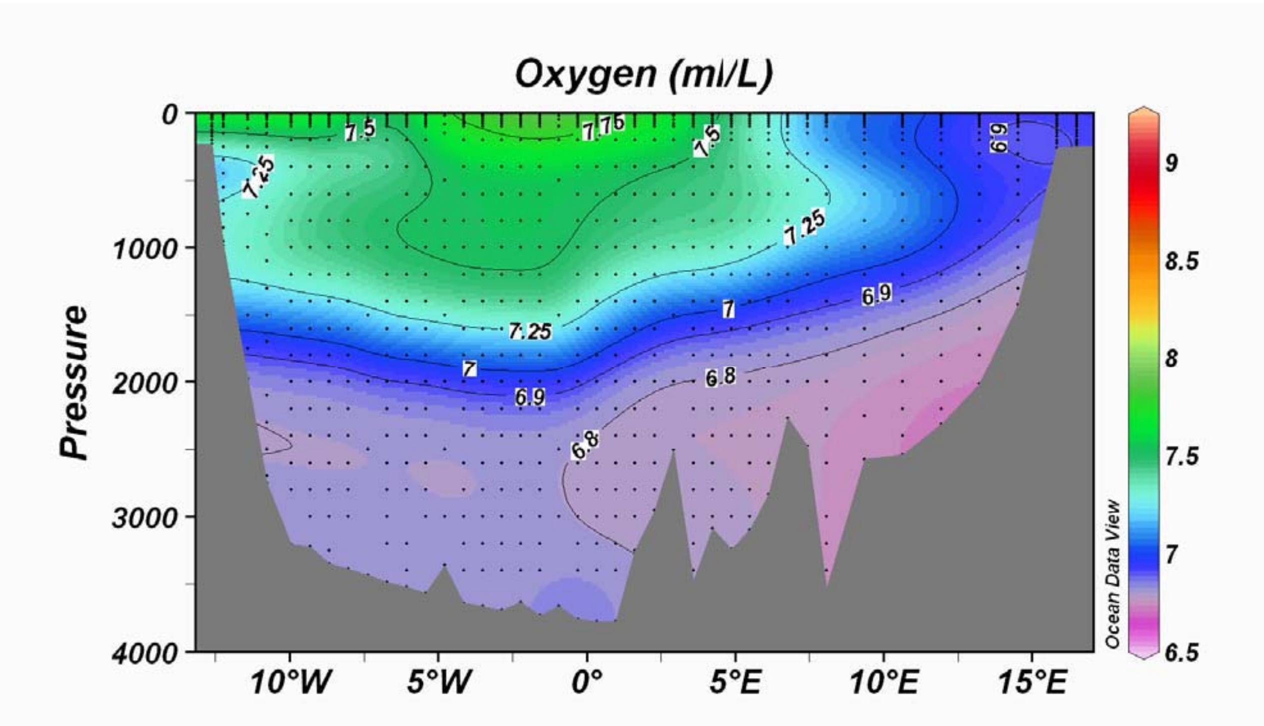

Fig. 4.1: Distribution of dissolved oxygen from bottle samples along the 75°N transect (preliminary data)

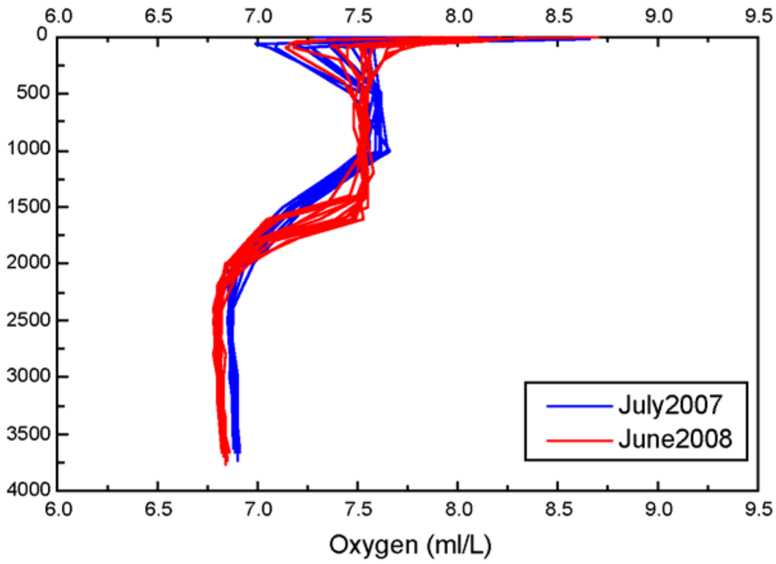

Fig. 4.2: Dissolved oxygen (bottle samples) from the centre of the Greenland Sea. Blue profiles show measurements from 2007 and red profiles are from 2008.

5. ARCTIC CLIMATE AND ECOSYSTEM RESPONSE – A MULTI-PROXY APPROACH

Bastian Hambach, Susanne Fietz — Universitat Autònoma de Barcelona (UAB)

Objectives

Our work on board *Polarstern* in June 2008 was part of the project ICECARB, "Climate control on Holocene variability in Arctic sea-ice and marine carbon export production" within the framework of the International Polar Year (IPY). ICECARB is set out to determine processes responsible for the variability of past and present changes in the Arctic climate system and their impacts on the marine ecosystem. Current focus is the reconstruction of past Arctic climate variability (approx. last 10,000 years), as well as the study of climate and marine ecosystem interactions. The hypothesis is that climate impacts on sea ice cover within the Arctic will have profound ecological consequences, e.g. for community composition and food-web structures.

Environmental and community changes can be observed from fossil markers where no data from instrumental measurements are available (i.e. centennial or millennial time scales). Within ICECARB we use a range of biomarkers in a multi-proxy approach. First sediment cores and water samples have been collected during previous campaigns in 2005 (*Polarstern*) and 2007 (RV *M.S. Merian*).

Our major aim for the cruise ARK-XXIII/1 was to improve the validation and calibration of the existing classical proxies for environmental conditions, e.g. of the alkenones UK-37 index, the Mg/Ca ratio in foraminifera, or the coccolithophore species. Joining data from 2005, 2007, and 2008 cruises allows us to assess the interannual and spatial variability, as a one year study is constrained to a 'snap-shot'. During ARK-XXIII/1 sampling was also extended to include more proxies, e.g. novel paleotemperature proxy based on archaeal membrane lipid composition changes ('TEX-86'), as well as proxies that contain additional information about community composition and food web structure (pigments, fatty acids, sterols) to assess ecosystem and export production variability.

Work at sea

We started our work off the coast of Bergen, Norway (Fig. 5.1), using the ship's sea water supply. Surface water from about 6 m depth was provided by the ship's membrane pump, taking water from an inlet at the bow of the vessel. In regular intervals (every degree latitude North, Fig. 5.1) we took underway samples for biomarkers and coccolithophorids as well as the accompanying parameters dissolved inorganic carbon and total alkalinity. Temperature and salinity data were gathered from the ship's thermosalinograph system (Fig. 5.2). Heading directly for the coast of Greenland 14 stations were sampled during this first transect (Fig.5.1).

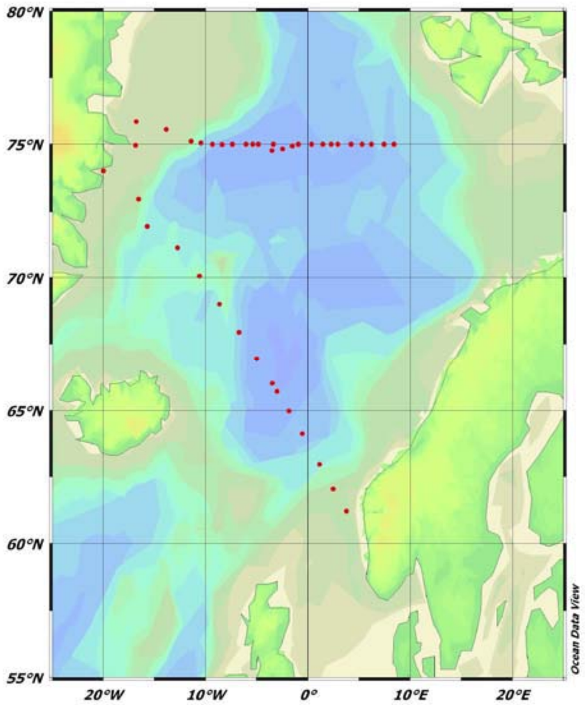

Fig. 5.1: Sampling locations in the Greenland Sea during ARK-XXIII/1

Within the ice, close to the Greenland coast, we continued sampling surface water (6 m depth) with the ship's sea water supply and took additional samples at three CTD stations using the 12 L Niskin bottles (CTD Rosette). Bottle samples were taken from the chlorophyll-maximum and below (e.g. 30 and 50 m) at these relatively shallow coastal stations. The chlorophyll maximum could be detected while lowering the CTD based on data plots from the attached fluorimeter and transmissiometer (AWI).

During the Greenland-Svalbard transect along 75ºN we took 25 surface water samples at least every degree of longitude. At six CTD stations (every fourth degree of longitude) along this transect two more depths were sampled

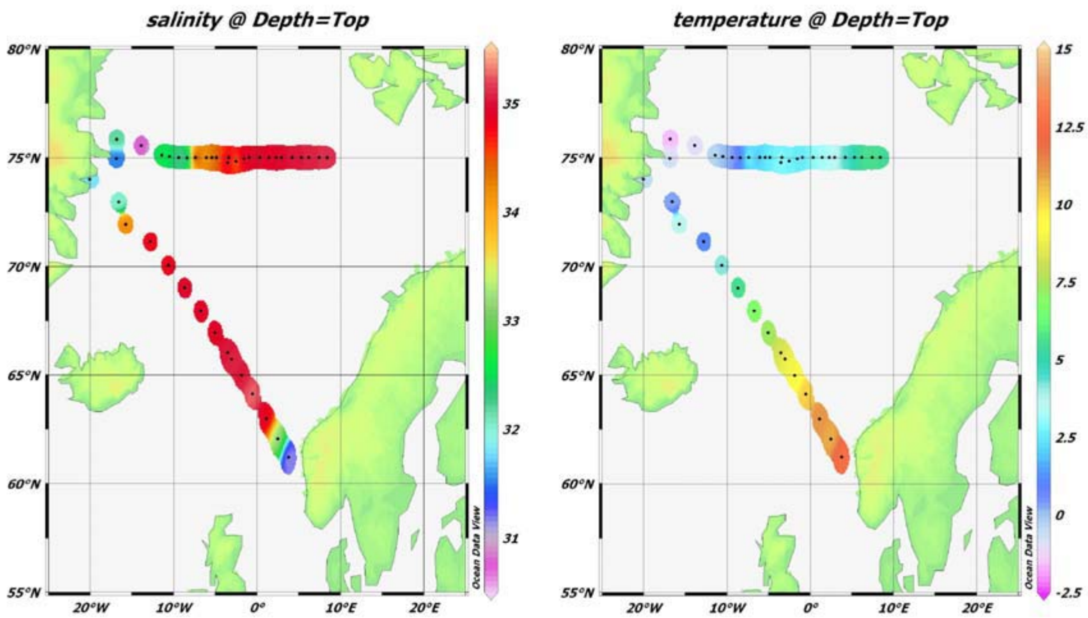

Fig. 5.2: Surface salinity (left) and temperature (right) given by the ship's thermosalinograph (at approx. 6 m water depth)

using the Niskin bottle rosette. Sampling depths were chosen depending on the chlorophyll maximum and the distribution of the distinct water masses (e.g. Polar water, Atlantic return water, Arctic water). Using the surface water pump and the CTD rosette we obtained a sufficient amount of water from the surface and at least two more depths for our biomarker analyses. Surface water was filtered using an inline filter holder system and bottle samples were filtered using a filtration ramp (Fig. 5.3).

Since the starting off the coast of Bergen, parallel plankton samples for foraminifer studies were also obtained continuously by filtering surface water from the ship's system for up to 24 hours through a 100 µm plankton net.

In total we sampled 45 stations, out of which nine were CTD stations. We obtained approximately 350 filters for biomarker analyses, 50 filters for coccolithophoride determination, and 23 samples from the plankton net for foraminifer studies. A total of 118,400 L were filtered. Largest amounts (113,441 L) were used for foraminifer studies.

Fig. 5.3: Filtration ramp for CTD water (left) and inline filter holder system (right) on board Polarstern during ARK-XXIII/1

The filters are stored frozen or were dried on board and will be analyzed in the laboratory at ICTA Barcelona (GEPOC group). Water samples for accompanying parameters will be partly analyzed at AWI Bremerhaven (Gerald Langer). We will use liquid and gas chromatography (HPLC, GC) coupled with mass spectrometry (MS) for the biomarker analyses.

6. AT-SEA DISTRIBUTION OF SEABIRDS AND MARINE MAMMALS

René-M. Lafontaine, Bart B. Tessens, Bert Pecceu
Laboratory for Polar Ecology

Objectives

The aim of our study was to quantify the at-sea distribution of seabirds and marine mammals as a function of the main hydrological parameters (water temperature, salinity). The data that we collected during this cruise will be completed by data collected during ARK-XXIII/2 by Claude Joiris and Henri Robert and then integrated into the time series running since 1973. This will permit us to detect possible evolution in numbers for the last 35 years.

The cruise was very successful for us due to the good weather conditions. We were able to make our counts much of the time while the vessel was sailing except for one foggy day, the day we left the pack ice.

Work at sea

Nearly 380 counts (expected total at the end of the cruise, current status 346) were conducted, meaning no less than 190 hours of counting. If it is compared to a total of 336 (24 hours/day x 14 days) possible hours or more correctly to a total of 200 available hours (= possible hours less approx. 135 hours for stopping due to CTDs, tests, stopover for geodetic works, etc.), this means a very high part of the available hours, more than 95 percent.

During this cruise a total of 40 bird species were observed, including 27 in the Greenland Sea and 22 marine birds species (see list annexed). On the other hand, 12 species of marine mammals were also encountered, including 9 species (5 pinnipeds, 3 cetaceans and *Ursus maritimus*) during counting periods.

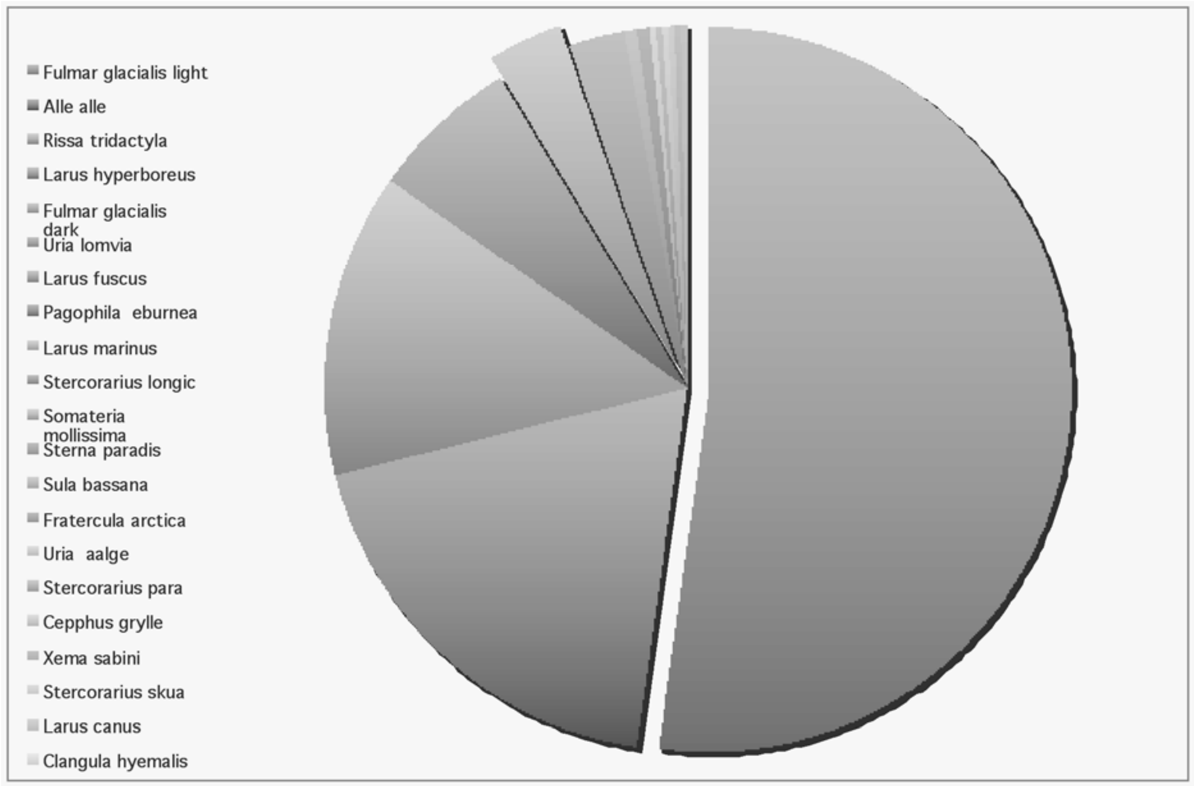

Fig 6.1: Relative abundance of bird species seen during the counting (based on data collected up to the 27 of June)

The total number of seabird encountered in the Greenland Sea is 7,710 birds individuals (up to June 29 included).

The mean number of birds seen per half-an-hour count is 22.88. This includes the five most common species, 13.8 individuals of Fulmar, *Fulmarus glacialis*; 3.66 individuals of Little Auk, *Alle alle*; 2.85 individuals of Kittiwake, *Rissa tridactyla*; 1.32 individuals of Glaucous Gull, *Larus hyperboreus*, and 0.6 individual of Brunnich Guillemot, *Uria lomvia*.

Generally this is very similar to what was observed during previous census conducted in June in the same general area and with a pack-ice component (see synthesis in Joiris, 2000)

The main species are the same as during previous censuses conducted between 1973 and 2007, except that the value observed for Brunnich Guillemot seems to be much lower than during previous counts and that value for Glaucous Gull (*Larus hyperboreus*) seems to have considerably increased. Glaucous Gull is now becoming more abundant than any of the large alcidae (*Uria* sp and *Fratercula arctica*).

This is mainly due to the very high number of Glaucous Gull seen in the pack ice, where it was the second most abundant bird seen after the Little Auk (see Fig. 6.2)

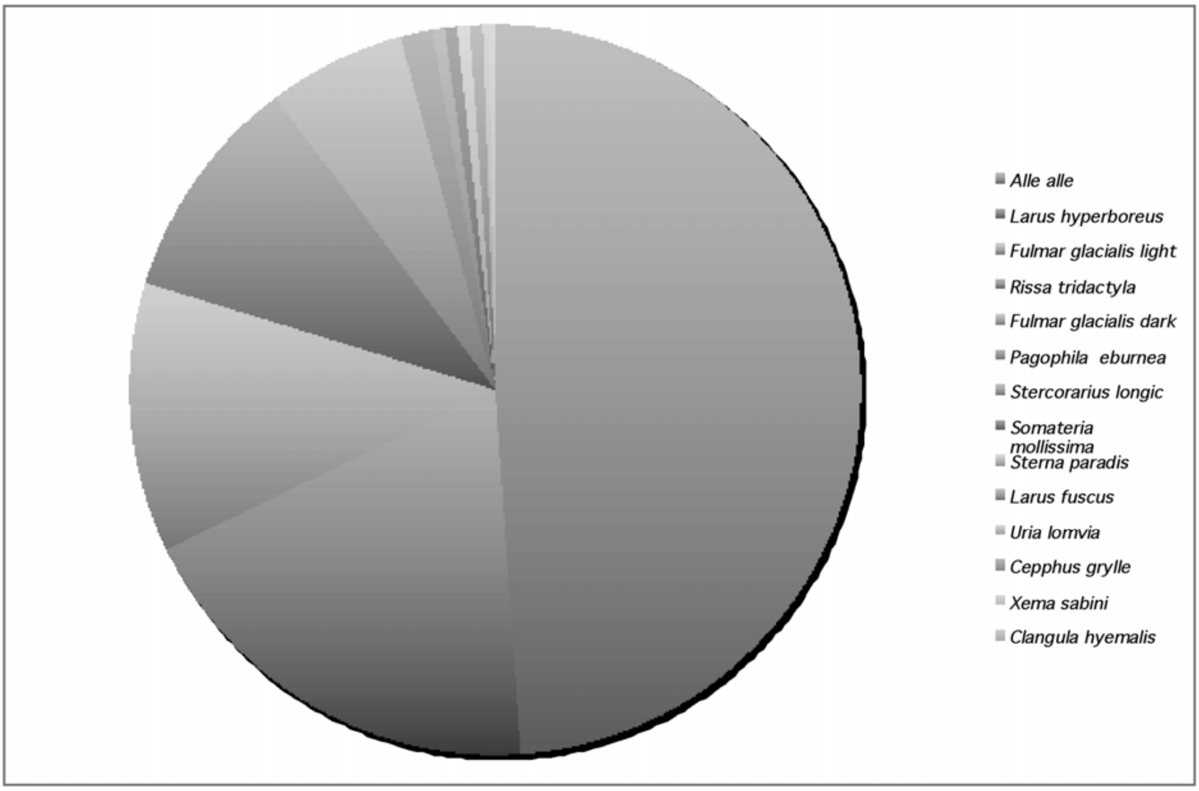

Fig 6.2: Relative abundance of bird species seen in the pack-ice (based on data collected up to the 27 of June)

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, become less numerous, as opposed to an opportunistic species which are able to quickly adapt to a changing environment, and to use the resources now available. This very preliminary interpretation certainly needs to be tested and confirmed with more data and results. Other reasons for the relatively large number of Gulls could also exist, like i.e. the possibility that a (large) breeding colony was close to the trajectory followed by the ARK-XXIII/1 cruise.

At this preliminary stage, during this first part of our study in 2008 we were unable to confirm recent suspected changes for Little Auk (decrease of breeding success or failure of breeding in the southern part of the range of the species having not observed any large movements of birds flying north), the total number of birds counted still needs to be compared with previous numbers obtained during the same month in the same area. Also the huge number of large cetaceans (i.e. Fin Wale, Blue Whale and Bowhead Whale) observed in 2007 were not seen (up till now) in 2008.

Annex: List of birds and mammals observed during ARK-XXIII/1

Latin	English
Fulmarus glacialis	Northern Fulmar
Morus bassanus	Gannet
Anser brachyrhynchus	Pink-footed Goose
Tadorna tadorna	Shelduck
Somateria mollissima	Eider Duck
Clangula hyemalis	Long-tailed Duck
Falco rusticolus	Gyr Falcon
Numenius phaeopus	Whimbrel
Calidris maritima	Purple Sandpiper
Phalaropus fulicarius	Red (or Grey) Phalarope
Stercorarius skua	Great Skua
Stercorarius pomarinus	Pomarine Skua
Stercorarius parasiticus	Parasitic Skua
Stercorarius longicaudus	Long-tailed Skua
Larus hyperboreus	Glaucous Gull
Larus marinus	Greater Black-backed Gull
Larus fuscus	Lesser Black-backed Gull
Larus argentatus	Herring Gull
Larus canus	Common Gull
Larus ridibundus	Black-headed Gull
Rhodosthetia rosea	Ross´s Gull
Xema sabini	Sabine´s Gull
Rissa tridactyla	Kittiwake
Pagophila eburnea	Ivory Gull
Sterna hirundo	Common Tern
Sterna paradisea	Arctic Tern
Alle alle	Little Auk

Latin	English
Uria aalge	Common Guillemot
Uria lomvia	Brunnich´s Guillemot
Cephus grylle	Black Guillemot
Fratercula arctica	Puffin
Columba palumbus	Wood Pigeon
Columba livia var domestica	Domestic Pigeon
Phylloscopus collybita	Chiffchaff
Phoenicurus ochruros	Black Redstart
Passer domesticus	House Sparrow
Corvus corone	Carrion Crow
Plectrophenax nivalis	Snow Bunting
Orcinus orca	Killer Whale
Hyperoodon ampullatus	Northern Bottlenose Whale
Phoca vitellus	Harbour Seal
Pusa hispida	Ringed Seal
Pagophilus groenlandicus	Harp Seal
Cystophora cristata	Hooded Seal
Erignathus barbatus	Bearded Seal
Odobenus rosmarus	Walrus
Ursus maritimus	Polar Bear

7. GPS OBSERVATIONS IN NORTH-EAST GREENLAND TO DETERMINE VERTICAL AND HORIZONTAL DEFORMATIONS OF THE EARTH'S CRUST

Mirko Scheinert, Andreas Groh and Ralf Rosenau
TU Dresden

Objectives

The main goal of the geodetic works during leg ARK-XXIII/1 was the reconnaissance and set-up of new GPS stations at up to seven ice-free locations in the coastal area of East Greenland between 74 and 77°N. The network configuration of the planned observation stations contains – on the one hand – a west-east component (stations at the ice edge and close to the coast, resp.), and covers – on the other hand – the entire area of investigation, which will be extended up to 81°N during the second cruise leg.

The stations will be observed for the first time. After having carried out a repetition of the GPS observations at a later time it will be possible to infer deformations, which will deliver as independent information a valuable contribution to the validation and improvement of models of the glacial-isostatic adjustment and of the recent mass balance in North-East Greenland. The significance of horizontal deformations will be checked in order to contribute to the investigation of the tectonic situation in the area of investigation.

This project is a contribution to the internationally coordinated project POLENET (Polar Earth Observatory Network) of the International Polar Year 2007/08 (IPY).

Work at sea and land

Polarstern with its two helicopters provided a basis for the realization of the works. In order to reach the locations on land, *Polarstern* had to sail to positions close enough to the Greenlandic coast. For all three sub-areas (at approx. 74, 75 and 76°N) these anchor positions are listed in table 7.1 (and are also shown at the overview map Fig. 7.2).

Tab. 7.1: Anchor positions of *Polarstern* in the three sub-areas

sub-area	**period** date / time [UTC]	**position of R/V Polarstern**		
		latitude	longitude	Geographical region
1	19.06.08, approx. 03:00 19.06.08, approx. 09:20	73°59'55"N	19°59'38"W	Gael Hamke Bugt, NW of Jackson Ø
2	19.06.08, approx. 19:30 20.06.08, approx. 01:20	74°49'23"N	18°06'36"W	Hochstetterbugten, S of Shannon
3	20.06.08, approx. 17:00 21.06.08, approx. 01:20	75°50'46"N	16°48'11"W	SE of Store Koldewey

Starting from these positions it was possible to reach all planned locations at land. The four participants of the group (M. Scheinert, A. Groh and R. Rosenau (all TU Dresden) and K. Engsager (DTU Space, Copenhagen)) formed two groups of two people each in order to fly with both helicopters and to work at an optimum time schedule. All helicopter flights took place in the periods listed in table 7.1.

All seven stations planned for deployment in the area of investigation could be realized and set up for the first observation. For this, a special marker is fixed to the rock, which serves to take the GPS antenna and which works as a forced centering for the antenna. The power supply is realized by means of solar modules and sealed batteries, specially adapted for usage with solar power. GPS receiver, batteries and further devices (charging controller, data logger) are stored in a Zarges aluminium box, which protects the equipment from the influence of the weather. Figure 7.1 shows an example of the set-up of a GPS station. The receivers collect data for a longer period (due to receiver model, at least for ten days) with a data rate of 30s in order to meet the goal of an accuracy of the determined coordinates of some millimetres. A list of the new GPS stations is given by table 7.2, the locations are also shown at the overview map (Fig. 7.2).

Additionally, eight locations of the Danish land survey in Greenland could be reached (see also Tab. 7.2 and Fig. 7.2). These locations are part of about 100 locations, which were observed by the Danish colleagues of Kort- og Matrikelstyrelsen (KMS, Copenhagen) applying Doppler measurements in North Greenland in the period of 1977 to 1982. The Doppler observations served as a basis to realize a geodetic base network as well as reference points for the airborne photogrammetric surveys and the subsequent edition of topographic maps at the scales 1:500.000 and 1:250.000, resp. The accuracy of the Doppler positioning was approx. 1.5 m. The presently realized re-observation of the visited eight locations by means of short-term GPS measurements (for about 15 to 20 minutes each) will help to improve the reliability and accuracy of the network, e.g. by linking the points to the most recent terrestrial reference frame and by solving yet unknown orientation parameters.

As a scientific service for the group of the University of Bergen (E. Falck) water samples were taken from surface discharges (glacial rivers or other melting water discharge) at six locations in the area of investigation. These water samples deliver valuable *in-situ* material for the analyses in the framework of the oceanographic-hydrochemical investigations at the Greenland Sea.

Tab. 7.2: List of the GPS Stations with approximate coordinates

institution *planning number*	**ID**	**longitude** [deg]	[min]	[sec]	**latitude** [deg]	[min]	[sec]	**ellips. height** [m]	**geographical region**
TUD-101	**HOPE**	-20	22	25	73	52	12	502	Hold with Hope NE (Home Forland)
TUD-102	**BART**	-24	9	38	74	10	28	1046	Ole Rømer Land W
TUD-201	**SHAN**	-17	39	7	74	56	1	64	Shannon S
TUD-202	**OSTE**	-22	6	38	75	17	1	1025	C.H. Ostenfeld Land
TUD-301	**SKOL**	-18	40	13	76	8	58	574	Store Koldewey S
TUD-302	**RECH**	-21	52	58	76	14	25	1021	Rechnitzer Land E (Soranerbræen)
TUD-303	**LOUI**	-23	2	29	76	42	12	279	Dronning Louise Land CE (Storstrømmen/L. Bistrup Bræ/Borgjøkel)
KMS	**41040**	-26	6	39	74	32	9	1645	Berthin Land
KMS	**41517**	-23	31	12	74	35	38	1426	Marianne Nunatakker
KMS	**41555**	-17	39	23	74	55	56	48	Shannon South (Kap Philip Broke)
KMS	**34300**	-18	2	45	75	25	33	43	Shannon North (Kap Børgen)
KMS	**34296**	-23	19	7	75	11	20	1397	C.H. Ostenfeld Land Heinckels Gletscher
KMS	**34154**	-18	40	17	76	9	1	611	Store Koldewey
KMS	**34155**	-20	21	29	75	57	26	44	Trums Ø (Bessel Fjord)
KMS	**34180**	-21	52	57	76	14	25	1018	Rechnitzer Land

Fig. 7.1: Typical set-up of a GPS station.
Upper left: The special marker is fixed to the rock, the antenna will then be mounted on the marker thus providing a forced centering.
Upper right: Geodetic GPS receiver (model Trimble 4000SSi). Data having already been recorded for five minutes. The black bar in the lower left of the information screen indicates that the battery is fully charged.
Lower left: Sealed battery (80Ah), charge controller and receiver (not to be seen at that photograph) are stored in a Zarges aluminium box, which then will be closed to provide some shelter against weather.
Lower right: Complete set-up with antenna (in the middle), two solar panels and Zarges aluminium box (in the foreground). The red box (middle left) contains the drilling machine and has been taken back to the ship.

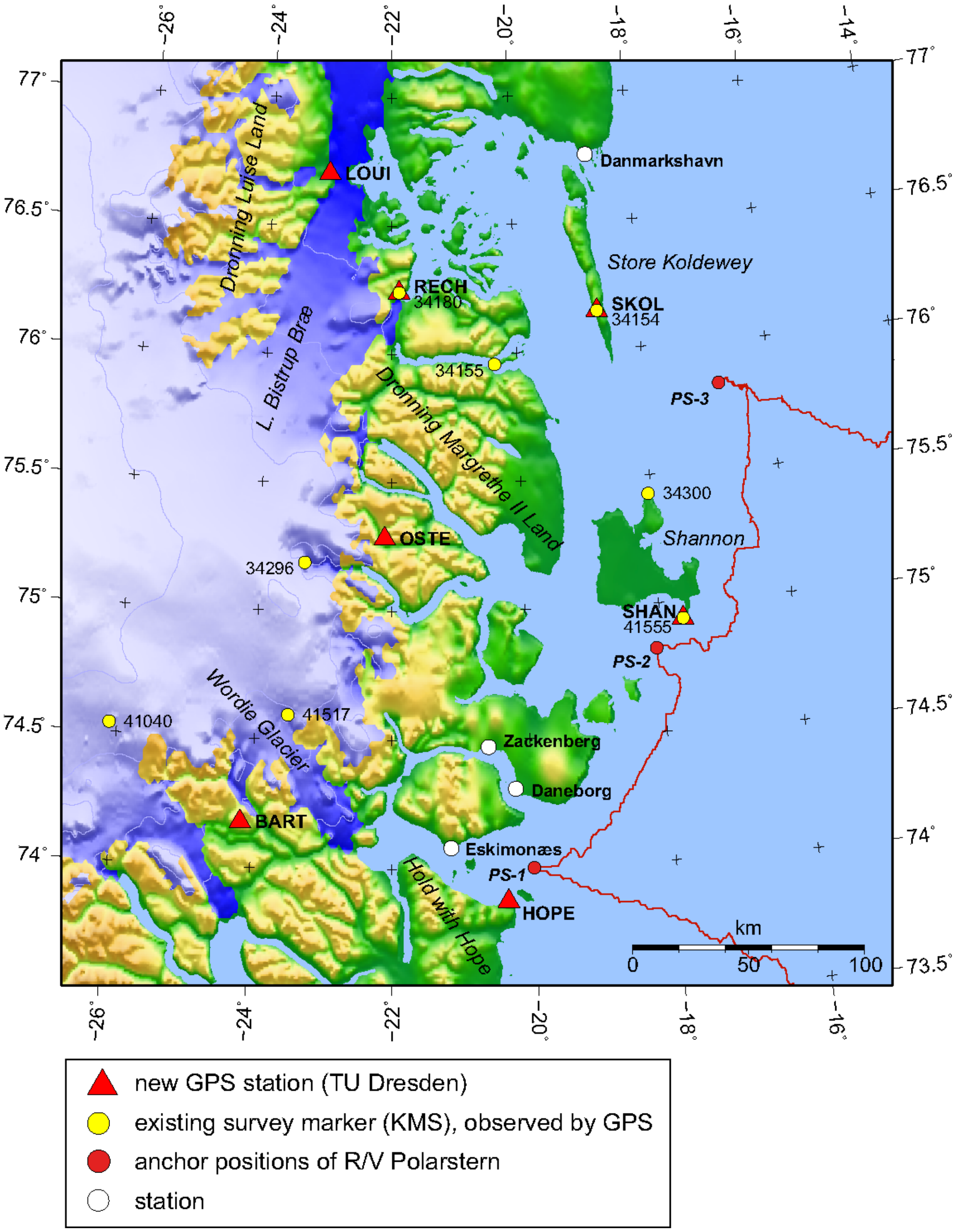

Fig. 7.2: Overview map showing the locations of the newly developed and observed GPS-stations as well as of the re-observed already existing KMS survey markers

APPENDIX

A.1 PARTICIPATING INSTITUTIONS

A.2 CRUISE PARTICIPANTS

A.3 SHIP'S CREW

A.4 STATION LIST

A.1 TEILNEHMENDE INSTITUTE/ PARTICIPATING INSTITUTIONS

	Adresse Address
AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft Postfach 120161 27515 Bremerhaven Germany
DWD	Deutscher Wetterdienst Geschäftsbereich Wettervorhersage Seeschifffahrtsberatung Bernhard Nocht Str. 76 20359 Hamburg
Heli Service	Heli Service International GmbH Im Geisbaum 2 63329 Egelsbach Germany
NSI Copenhagen	National Space Institute/DTU Juliane Mariesvej 30 DK - 2100 Copenhagen Denmark
University Bergen	University of Bergen Geophysical Institute Allegaten 70 5007 Bergen Norway
University Barcelona	Universitat Autònoma de Barcelona (UAB) Institut de Ciencia i Tecnologia Ambientals (ICTA) Bellaterra E - 08193 Barcelona Spain
PolE	Laboratory for Polar Ecology Rue du Fodia 18 B-1367 Ramillies Belgium

	Adresse **Address**
Radio Bremen	Radio Bremen Studio Bremerhaven Obere Bürger 17 27568 Bremerhaven Germany
Optimare	Optimare Sensorsysteme AG Am Luneort 15A 27572 Bremerhaven Germany
Laeisz	Reederei F. Laeisz (Bremerhaven) GmbH Brückenstraße 25 27568 Bremerhaven Germany
TU Dresden	Technische Universität Dresden Institut für Planetare Geodäsie 01062 Dresden Germany

A.2 FAHRTTEILNEHMER / CRUISE PARTICIPANTS

Name/ Last name	Vorname/ First name	Institut/ Institute	Beruf/ Profession
Botnen	Helle Augdal	University Bergen	Student, physic.
Brauer	Jens	Heliservice	Mechanic
Büchner	Jürgen	Heliservice	Pilot
Budéus	Gereon	AWI	Oceanographer, chief
Buldt	Klaus	DWD	Technician
Dammrich	Thea	AWI	Student, phys. oceanography
Dittmer	Klaus	DWD	Meteorologist
Engsager	Karsten Enggaard	NSI Copenhagen	Senior Adviser, geodesy
Falck	Eva	University Bergen	Oceanographer
Fietz	Susanne	University Barcelona	Biologist
Groh	Andreas	TU Dresden	Engineer
Hambach	Bastian	University Barcelona	Biologist
Heckmann	Markus	Heliservice	Mechanic
Jacob	Juliane	FU Berlin	Student, phys. oceanography
Kattner	Lisa	AWI	Student, phys. oceanography
Lafontaine	René	PolE	Zoologist
Mohr	Viktoria	AWI	Student, phys. oceanography
Möller-Berthin	Elke	Radio Bremen	Journalist
Pecceu	Bert	PolE	Biologist
Plugge	Rainer	AWI	Technician
Pulz	Henning	AWI/IPY	Teacher
Rohr	Harald	Optimare	Technician
Rosenau	Ralf	TU Dresden	Geophysicist
Scheinert	Mirko	TU Dresden	Geophysicist
Schier	Felix	Heliservice	Pilot
Tessens	Bart	PolE	Student, biology
Weber	Hannah Sophia	AWI	Student, phys. oceanography
Zenk	Oliver	Optimare	Engineer

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

No.	Name	Rank
01.	Pahl, Uwe	Master
02.	Grundmann, Uwe	1.Offc.
03.	Ziemann, Olaf	Ch. Eng.
04.	Bratz, Herbert	2.Offc./L.
05.	Hering, Igor	2.Offc.
06.	Janik, Michael	2.Offc.
07.	Lambrecht, Wolfgang	Doctor
08.	Koch, Georg	R.Offc.
09.	Kotnik, Herbert	2.Eng.
10.	Schnürch, Helmut	2.Eng.
11.	Westphal, Henning	2.Eng.
12.	Holtz, Hartmut	Elec Eng.
13.	Dimmler, Werner	Electron.
14.	Feiertag, Thomas	Electron.
15.	Fröb, Martin	Elec.Tech
16.	Rehe, Lars	Electron.
17.	Clasen, Burkhard	Boatsw.
18.	Neisner, Winfried	Carpenter
19.	Burzan, Gerd-Ekkeh.	A.B.
20.	Grabbert, Steve	A.B.
21.	Hartwig-Lab., Andreas	A.B.
22.	Kreis, Reinhard	A.B.
23.	Kretzschmar, Uwe	A.B.
24.	Moser, Siegried	A.B.
25.	Pousada Martinez, S.	A.B.
26.	Schröder, Norbert	A.B.
27.	Beth, Dethlef	Storek.
28.	Dinse, Horst	Mot-man
29.	Fritz, Günter	Mot-man
30.	Schünemann, Mario	Mot-man
31.	Watzel, Bernhard	Mot-man
32.	Witt, Manfred	Mot-man
33.	Fischer Matthias	Cook
34.	Tupy, Mario	Cooksmate
35.	Völske, Thomas	Cooksmate
36.	Dinse Petra	1.Stewardess
37.	Schöndorfer, Ottilie	Stwdss/Kr
38.	Hischke, Peggy	2.Stewardess
39.	Hu, Guo Yong	2.Steward
40.	Streit, Christina	2.Stewardess
41.	Sun, Yong Sheng	2.Steward
42.	Wartenberg, Irina	2.Steward
43	Yu, Kwok Yuen	Laundrym.
44	Pagels, Christian	Apprent.
45	Pluhar, Arne	Apprent.

A.4 STATIONSLISTE / STATION LIST PS 72

Station PS72/	Date	Time	Position Lat	PositionLon	Depth [m]	Gear Abbrevia-tion	Action	Comment
001-1	19.06.08	09:32	74° 0,01' N	20° 0,34' W	294,7	CTD/RO	surface	
001-1	19.06.08	09:44	73° 59,97' N	20° 0,39' W	289,0	CTD/RO	at depth	
001-1	19.06.08	09:58	73° 59,96' N	20° 0,43' W	289,0	CTD/RO	on deck	
002-1	19.06.08	11:02	74° 3,99' N	19° 29,21' W	346,2	CTD/RO	surface	
002-1	19.06.08	11:14	74° 4,01' N	19° 29,22' W	345,2	CTD/RO	at depth	
002-1	19.06.08	11:21	74° 4,01' N	19° 29,24' W	345,0	CTD/RO	on deck	
003-1	19.06.08	12:19	74° 4,58' N	19° 12,94' W	274,2	CTD/RO	surface	
003-1	19.06.08	12:27	74° 4,58' N	19° 12,98' W	274,0	CTD/RO	at depth	EL 31, 254m
003-1	19.06.08	12:36	74° 4,56' N	19° 13,04' W	275,5	CTD/RO	on deck	
004-1	19.06.08	13:46	74° 11,44' N	18° 54,04' W	169,7	CTD/RO	surface	
004-1	19.06.08	13:53	74° 11,42' N	18° 54,00' W	169,5	CTD/RO	at depth	EL 31: 151m
004-1	19.06.08	13:57	74° 11,41' N	18° 53,99' W	169,7	CTD/RO	on deck	
005-1	19.06.08	15:01	74° 17,95' N	18° 33,70' W	157,0	CTD/RO	surface	
005-1	19.06.08	15:07	74° 17,93' N	18° 33,70' W	156,7	CTD/RO	at depth	EL 31; 137m
005-1	19.06.08	15:14	74° 17,92' N	18° 33,75' W	157,2	CTD/RO	on deck	
006-1	19.06.08	16:16	74° 25,39' N	18° 15,91' W	158,7	CTD/RO	surface	
006-1	19.06.08	16:23	74° 25,34' N	18° 15,81' W	160,2	CTD/RO	at depth	142 m, EL 31
006-1	19.06.08	16:31	74° 25,29' N	18° 15,74' W	159,2	CTD/RO	on deck	
007-1	20.06.08	01:29	74° 49,53' N	18° 6,36' W	324,5	CTD/RO	surface	
007-1	20.06.08	01:38	74° 49,53' N	18° 6,39' W	324,0	CTD/RO	at depth	EL 31; 316m
007-1	20.06.08	01:52	74° 49,54' N	18° 6,48' W	323,7	CTD/RO	on deck	
008-1	20.06.08	02:59	74° 51,03' N	17° 34,76' W	334,0	CTD/RO	surface	
008-1	20.06.08	03:10	74° 51,03' N	17° 34,56' W	334,7	CTD/RO	at depth	EL 31; 324m
008-1	20.06.08	03:24	74° 51,06' N	17° 34,48' W	336,2	CTD/RO	on deck	
009-1	20.06.08	04:25	74° 49,84' N	17° 19,48' W	339,5	CTD/RO	surface	
009-1	20.06.08	04:34	74° 49,80' N	17° 19,46' W	339,5	CTD/RO	at depth	331 m, EL31
009-1	20.06.08	04:47	74° 49,75' N	17° 19,37' W	342,0	CTD/RO	on deck	
010-1	20.06.08	05:48	74° 52,82' N	16° 58,02' W	363,2	CTD/RO	surface	
010-1	20.06.08	05:59	74° 52,69' N	16° 58,24' W	365,0	CTD/RO	at depth	357 m, EL31
010-1	20.06.08	06:18	74° 52,52' N	16° 58,66' W	366,7	CTD/RO	on deck	
011-1	20.06.08	07:19	74° 57,58' N	16° 50,65' W	337,0	CTD/RO	surface	
011-1	20.06.08	07:29	74° 57,53' N	16° 50,84' W	336,2	CTD/RO	at depth	330 m, EL31
011-1	20.06.08	07:40	74° 57,48' N	16° 50,98' W	339,0	CTD/RO	on deck	
012-1	20.06.08	10:51	75° 13,38' N	16° 25,89' W	278,5	CTD/RO	surface	
012-1	20.06.08	11:00	75° 13,36' N	16° 25,83' W	275,7	CTD/RO	at depth	
012-1	20.06.08	11:13	75° 13,33' N	16° 25,88' W	274,0	CTD/RO	on deck	
013-1	20.06.08	14:13	75° 37,62' N	16° 25,05' W	111,0	CTD/RO	surface	
013-1	20.06.08	14:19	75° 37,64' N	16° 25,02' W	111,7	CTD/RO	at depth	EL 31; 99m
013-1	20.06.08	14:24	75° 37,63' N	16° 25,06' W	111,2	CTD/RO	on deck	
014-1	21.06.08	00:10	75° 50,79' N	16° 48,07' W	44,2	CTD/RO	surface	
014-1	21.06.08	00:15	75° 50,78' N	16° 48,08' W	44,2	CTD/RO	at depth	EL 31, 33m
014-1	21.06.08	00:19	75° 50,78' N	16° 48,08' W	44,2	CTD/RO	on deck	
015-1	21.06.08	01:59	75° 48,90' N	16° 27,84' W	0,0	CTD/RO	surface	
015-1	21.06.08	02:03	75° 48,89' N	16° 27,82' W	25,2	CTD/RO	at depth	EL 31; 20m
015-1	21.06.08	02:08	75° 48,89' N	16° 27,82' W	20,2	CTD/RO	on deck	
016-1	21.06.08	03:15	75° 45,65' N	16° 11,12' W	168,2	CTD/RO	surface	
016-1	21.06.08	03:26	75° 45,68' N	16° 11,15' W	171,2	CTD/RO	at depth	EL 31; 151m
016-1	21.06.08	03:36	75° 45,71' N	16° 11,24' W	161,2	CTD/RO	on deck	

Station PS72/	Date	Time	Position Lat	PositionLon	Depth [m]	Gear Abbrevia-tion	Action	Comment
017-1	21.06.08	04:49	75° 44,99' N	15° 50,77' W	184,7	CTD/RO	surface	
017-1	21.06.08	04:56	75° 44,98' N	15° 50,55' W	185,7	CTD/RO	at depth	173 m, EL31
017-1	21.06.08	05:07	75° 44,99' N	15° 50,30' W	184,5	CTD/RO	on deck	
018-1	21.06.08	06:13	75° 40,05' N	15° 23,04' W	207,7	CTD/RO	surface	
018-1	21.06.08	06:21	75° 40,05' N	15° 22,83' W	210,2	CTD/RO	at depth	201 m, EL 31
018-1	21.06.08	06:28	75° 40,05' N	15° 22,76' W	210,7	CTD/RO	on deck	
019-1	21.06.08	07:27	75° 35,71' N	14° 51,34' W	185,7	CTD/RO	surface	
019-1	21.06.08	07:33	75° 35,71' N	14° 51,53' W	185,7	CTD/RO	at depth	173 m, EL31
019-1	21.06.08	07:40	75° 35,72' N	14° 51,64' W	192,7	CTD/RO	on deck	
020-1	21.06.08	08:49	75° 31,75' N	14° 27,42' W	234,0	CTD/RO	surface	
020-1	21.06.08	08:56	75° 31,73' N	14° 27,60' W	233,5	CTD/RO	at depth	
020-1	21.06.08	09:02	75° 31,71' N	14° 27,78' W	233,7	CTD/RO	on deck	
021-1	21.06.08	10:08	75° 33,67' N	14° 9,58' W	205,7	CTD/RO	surface	
021-1	21.06.08	10:14	75° 33,68' N	14° 9,81' W	206,5	CTD/RO	at depth	
021-1	21.06.08	10:20	75° 33,67' N	14° 9,96' W	203,0	CTD/RO	on deck	
022-1	21.06.08	11:25	75° 34,68' N	13° 50,22' W	210,5	CTD/RO	surface	
022-1	21.06.08	11:37	75° 34,64' N	13° 50,05' W	208,2	CTD/RO	at depth	
022-1	21.06.08	11:40	75° 34,61' N	13° 50,12' W	209,2	CTD/RO	on deck	
023-1	21.06.08	12:42	75° 30,96' N	13° 54,08' W	226,0	CTD/RO	surface	
023-1	21.06.08	12:51	75° 31,01' N	13° 54,08' W	226,7	CTD/RO	at depth	EL 31; 217m
023-1	21.06.08	13:04	75° 30,97' N	13° 54,13' W	226,0	CTD/RO	on deck	
024-1	21.06.08	14:43	75° 24,91' N	13° 47,16' W	232,5	CTD/RO	surface	
024-1	21.06.08	14:51	75° 24,90' N	13° 47,07' W	231,2	CTD/RO	at depth	EL 31; 220m
024-1	21.06.08	15:03	75° 24,87' N	13° 46,95' W	231,5	CTD/RO	on deck	
025-1	21.06.08	16:20	75° 23,82' N	13° 26,61' W	238,2	CTD/RO	surface	
025-1	21.06.08	16:29	75° 23,79' N	13° 26,60' W	237,2	CTD/RO	at depth	228 m, EL 31
025-1	21.06.08	16:34	75° 23,78' N	13° 26,59' W	238,5	CTD/RO	on deck	
026-1	21.06.08	17:47	75° 25,95' N	13° 4,20' W	197,7	CTD/RO	surface	
026-1	21.06.08	17:55	75° 25,99' N	13° 4,28' W	194,0	CTD/RO	at depth	182 m, EL 31
026-1	21.06.08	18:01	75° 26,02' N	13° 4,34' W	185,5	CTD/RO	on deck	
027-1	21.06.08	19:39	75° 20,24' N	12° 55,54' W	238,2	CTD/RO	surface	
027-1	21.06.08	19:46	75° 20,25' N	12° 55,61' W	237,5	CTD/RO	at depth	227 m, EL 31
027-1	21.06.08	19:54	75° 20,26' N	12° 55,63' W	237,2	CTD/RO	on deck	
028-1	21.06.08	21:05	75° 11,07' N	12° 36,70' W	239,2	CTD/RO	surface	
028-1	21.06.08	21:13	75° 10,93' N	12° 36,75' W	239,2	CTD/RO	at depth	
028-1	21.06.08	21:22	75° 10,82' N	12° 36,92' W	239,0	CTD/RO	on deck	
029-1	21.06.08	22:04	75° 8,44' N	12° 26,56' W	491,5	CTD/RO	surface	
029-1	21.06.08	22:15	75° 8,25' N	12° 27,21' W	488,5	CTD/RO	at depth	
029-1	21.06.08	22:24	75° 8,12' N	12° 27,82' W	483,0	CTD/RO	on deck	
030-1	21.06.08	23:10	75° 7,25' N	12° 13,32' W	1010,2	CTD/RO	surface	
030-1	21.06.08	23:29	75° 6,96' N	12° 14,23' W	1004,0	CTD/RO	at depth	
030-1	21.06.08	23:46	75° 6,73' N	12° 15,19' W	997,2	CTD/RO	on deck	
031-1	22.06.08	01:04	75° 4,73' N	11° 59,66' W	0,0	CTD/RO	surface	
031-1	22.06.08	01:35	75° 4,57' N	12° 0,29' W	1509,5	CTD/RO	at depth	EL 31; 1524m
031-1	22.06.08	01:54	75° 4,45' N	12° 0,53' W	1512,0	CTD/RO	on deck	
032-1	22.06.08	02:38	75° 5,93' N	11° 42,86' W	1742,5	CTD/RO	surface	
032-1	22.06.08	03:13	75° 6,03' N	11° 43,22' W	1728,0	CTD/RO	at depth	EL 31; 1750m
032-1	22.06.08	03:35	75° 6,11' N	11° 43,46' W	1717,2	CTD/RO	on deck	
033-1	22.06.08	04:15	75° 6,87' N	11° 24,85' W	2002,0	CTD/RO	surface	
033-1	22.06.08	04:55	75° 6,82' N	11° 25,10' W	2000,5	CTD/RO	at depth	2028 m, EL31
033-1	22.06.08	05:27	75° 6,82' N	11° 25,38' W	1995,2	CTD/RO	on deck	

Station PS72/	Date	Time	Position Lat	PositionLon	Depth [m]	Gear Abbrevia-tion	Action	Comment
034-1	22.06.08	06:11	75° 5,67' N	11° 12,92' W	2253,5	CTD/RO	surface	
034-1	22.06.08	06:55	75° 5,46' N	11° 13,14' W	2258,0	CTD/RO	at depth	2295 m, EL 31
034-1	22.06.08	07:23	75° 5,38' N	11° 13,52' W	2254,0	CTD/RO	on deck	
035-1	22.06.08	08:03	75° 4,72' N	10° 58,19' W	2522,2	CTD/RO	surface	
035-1	22.06.08	08:52	75° 4,23' N	10° 57,99' W	2549,0	CTD/RO	at depth	
035-1	22.06.08	09:23	75° 3,93' N	10° 58,13' W	2562,0	CTD/RO	on deck	
036-1	22.06.08	10:00	75° 4,07' N	10° 46,44' W	2758,2	CTD/RO	surface	
036-1	22.06.08	10:53	0° 0,00' N	0° 0,00' E	0,0	CTD/RO	at depth	
036-1	22.06.08	11:32	75° 3,79' N	10° 46,35' W	2774,2	CTD/RO	on deck	
037-1	22.06.08	12:21	75° 3,10' N	10° 27,40' W	1431,7	CTD/RO	surface	
037-1	22.06.08	13:19	75° 3,06' N	10° 27,49' W	3091,7	CTD/RO	at depth	EL 31; 3062m
037-1	22.06.08	13:58	75° 2,98' N	10° 27,72' W	3092,7	CTD/RO	on deck	
038-1	22.06.08	15:06	74° 59,96' N	9° 56,75' W	3222,5	CTD/RO	surface	
038-1	22.06.08	16:08	74° 59,77' N	9° 56,49' W	3220,7	CTD/RO	at depth	3188 m, EL31
038-1	22.06.08	16:56	74° 59,69' N	9° 57,18' W	3219,2	CTD/RO	on deck	
039-1	22.06.08	18:14	75° 0,11' N	9° 19,03' W	3298,7	CTD/RO	surface	
039-1	22.06.08	19:18	74° 59,93' N	9° 20,32' W	3295,7	CTD/RO	at depth	3281 m, EL31
039-1	22.06.08	20:08	74° 59,90' N	9° 21,44' W	3291,0	CTD/RO	on deck	
040-1	22.06.08	21:32	75° 0,00' N	8° 39,86' W	3360,2	CTD/RO	surface	
040-1	22.06.08	22:36	74° 59,57' N	8° 39,79' W	3362,7	CTD/RO	at depth	
040-1	22.06.08	23:25	74° 59,20' N	8° 39,69' W	3364,7	CTD/RO	on deck	
041-1	23.06.08	00:40	74° 59,92' N	8° 1,15' W	3399,2	CTD/RO	surface	
041-1	23.06.08	01:45	75° 0,05' N	8° 1,95' W	3398,7	CTD/RO	at depth	EL 31, 3369m
041-1	23.06.08	02:41	75° 0,21' N	8° 2,04' W	3399,2	CTD/RO	on deck	
042-1	23.06.08	08:44	74° 55,91' N	4° 37,52' W	3617,2	MOR	released	JP 31
042-1	23.06.08	08:44	74° 55,91' N	4° 37,52' W	3617,2	MOR	on the surface	JP 31
042-1	23.06.08	09:51	74° 54,85' N	4° 39,45' W	3613,0	MOR	Hydrophone on Deck	JP 31
042-1	23.06.08	09:54	74° 54,80' N	4° 39,52' W	3612,7	MOR	mooring on deck	
043-1	23.06.08	10:19	74° 55,19' N	4° 37,18' W	3615,2	MOR	Hydrophone into the water	J 31
043-1	23.06.08	10:22	74° 55,14' N	4° 37,33' W	3615,2	MOR	on the surface	J 30
043-1	23.06.08	10:25	74° 55,09' N	4° 37,53' W	3615,0	MOR	Hydrophone on Deck	J 30
043-1	23.06.08	11:38	74° 54,18' N	4° 39,53' W	3612,7	MOR	releaser on deck	J 30
043-1	23.06.08	11:38	74° 54,18' N	4° 39,53' W	3612,7	MOR	mooring on deck	J 30
044-1	23.06.08	13:12	74° 55,03' N	4° 36,92' W	3616,2	MOR	surface	Ankerstein Re-leaser, Seacat
044-1	23.06.08	14:38	74° 55,03' N	4° 36,94' W	3616,5	MOR	surface	CTD
044-1	23.06.08	14:57	74° 55,03' N	4° 36,95' W	3616,7	MOR	surface	Henne, Transponder, Doppel-stahlkugel
044-1	23.06.08	15:01	74° 55,03' N	4° 37,01' W	3616,2	MOR	slipped	Verankerung abgesetzt
045-1	23.06.08	17:00	74° 60,00' N	5° 24,67' W	3575,7	CTD/RO	surface	
045-1	23.06.08	18:10	75° 0,01' N	5° 24,66' W	3575,2	CTD/RO	at depth	EL 31 3546m gefiert
045-1	23.06.08	19:04	75° 0,09' N	5° 24,60' W	3575,2	CTD/RO	on deck	
046-1	23.06.08	20:12	75° 0,02' N	4° 47,04' W	3613,5	CTD/RO	surface	
046-1	23.06.08	21:22	74° 59,86' N	4° 50,15' W	3610,7	CTD/RO	at depth	

Station PS72/	Date	Time	Position Lat	PositionLon	Depth [m]	Gear Abbrevia-tion	Action	Comment
046-1	23.06.08	22:20	74° 60,00' N	4° 51,18' W	3609,7	CTD/RO	on deck	
047-1	23.06.08	23:47	74° 59,92' N	4° 7,76' W	3643,5	CTD/RO	surface	
047-1	24.06.08	00:56	75° 0,01' N	4° 8,10' W	3643,5	CTD/RO	at depth	EL 31; 3614m
047-1	24.06.08	02:09	75° 0,07' N	4° 8,59' W	3642,7	CTD/RO	on deck	
048-1	24.06.08	03:28	74° 59,98' N	3° 29,71' W	3668,5	CTD/RO	surface	
048-1	24.06.08	04:35	74° 59,98' N	3° 29,65' W	3668,7	CTD/RO	at depth	3644 m, EL31
048-1	24.06.08	05:34	75° 0,03' N	3° 29,62' W	3668,5	CTD/RO	on deck	
049-1	24.06.08	06:15	75° 4,89' N	3° 27,10' W	3667,7	MOR	Hydrophone into the water	
049-1	24.06.08	06:16	75° 4,89' N	3° 27,11' W	3668,0	MOR	released	
049-1	24.06.08	06:19	75° 4,85' N	3° 27,07' W	3668,2	MOR	on the surface	
049-1	24.06.08	06:20	75° 4,84' N	3° 27,05' W	3668,5	MOR	Hydrophone on Deck	
049-1	24.06.08	06:42	75° 4,90' N	3° 26,30' W	3668,7	MOR	on deck	2 Auftriebs-körper und Transponder
049-1	24.06.08	06:53	75° 4,79' N	3° 26,48' W	3668,7	MOR	on deck	Henne
049-1	24.06.08	07:39	75° 4,28' N	3° 25,63' W	3670,2	MOR	on deck	Seacat
049-1	24.06.08	07:40	75° 4,27' N	3° 25,62' W	3670,0	MOR	releaser on deck	Nest und Releaser
049-1	24.06.08	07:40	75° 4,27' N	3° 25,62' W	3670,0	MOR	mooring on deck	
050-1	24.06.08	08:28	75° 4,97' N	3° 26,99' W	3667,5	MOR	surface	
050-1	24.06.08	09:55	75° 5,01' N	3° 27,09' W	3667,5	MOR	released	
050-1	24.06.08	09:55	75° 5,01' N	3° 27,09' W	3667,5	MOR	on the ground	
051-1	24.06.08	12:43	74° 49,83' N	2° 30,15' W	3696,7	MOR	Hydrophone into the water	Verankerung AWI-J 029
051-1	24.06.08	12:48	74° 49,75' N	2° 29,51' W	3696,5	MOR	released	
051-1	24.06.08	12:50	74° 49,73' N	2° 29,50' W	3696,5	MOR	Hydrophone on Deck	
051-1	24.06.08	12:50	74° 49,73' N	2° 29,50' W	3696,5	MOR	on the surface	
051-1	24.06.08	12:56	74° 49,80' N	2° 29,30' W	3697,2	MOR	action	am Haken
051-1	24.06.08	13:01	74° 49,82' N	2° 29,28' W	3697,2	MOR	on deck	2 Toppkugeln
051-1	24.06.08	13:07	74° 49,83' N	2° 29,36' W	3697,5	MOR	on deck	Henne
051-1	24.06.08	13:50	74° 49,63' N	2° 29,67' W	3697,0	MOR	on deck	CTD
051-1	24.06.08	13:53	74° 49,60' N	2° 29,69' W	3696,7	MOR	mooring on deck	Fangkorb, Doppel-auslöser
052-1	24.06.08	14:49	74° 50,00' N	2° 29,93' W	3697,2	MOR	surface	AWI-J 029, Ankerstein, Doppelauslöser, Fang-korb
052-1	24.06.08	16:36	74° 50,03' N	2° 30,00' W	3697,5	MOR	surface	Seacat
052-1	24.06.08	16:48	74° 50,01' N	2° 30,01' W	3697,2	MOR	surface	Henne
052-1	24.06.08	16:53	74° 50,01' N	2° 30,00' W	3697,2	MOR	surface	Transponder und 2 Auftriebskörper
052-1	24.06.08	16:58	74° 50,01' N	2° 29,99' W	3697,2	MOR	released	
052-1	24.06.08	17:00	74° 50,01' N	2° 30,00' W	3697,2	MOR	on the ground	
053-1	24.06.08	20:20	75° 0,03' N	0° 56,00' W	3683,7	CTD/RO	surface	
053-1	24.06.08	21:32	75° 0,11' N	0° 56,37' W	3665,7	CTD/RO	at depth	
053-1	24.06.08	22:27	75° 0,05' N	0° 56,81' W	3654,2	CTD/RO	on deck	
054-1	24.06.08	23:40	74° 59,94' N	0° 18,06' W	3763,5	CTD/RO	surface	
054-1	25.06.08	00:54	74° 59,83' N	0° 18,48' W	3763,2	CTD/RO	at depth	EL 31; 3735m

Station PS72/	Date	Time	Position Lat	PositionLon	Depth [m]	Gear Abbrevia-tion	Action	Comment
054-1	25.06.08	01:50	74° 59,87' N	0° 18,68' W	3763,5	CTD/RO	on deck	
055-1	25.06.08	03:50	75° 0,02' N	1° 35,04' W	3729,7	CTD/RO	surface	
055-1	25.06.08	04:59	74° 60,00' N	1° 35,14' W	3729,7	CTD/RO	at depth	3706 m, EL31
055-1	25.06.08	05:56	75° 0,00' N	1° 35,29' W	3729,2	CTD/RO	on deck	
056-1	25.06.08	07:06	75° 0,08' N	2° 13,05' W	3635,0	CTD/RO	surface	
056-1	25.06.08	08:14	75° 0,04' N	2° 13,18' W	3639,0	CTD/RO	at depth	
056-1	25.06.08	09:15	75° 0,11' N	2° 13,07' W	3634,2	CTD/RO	on deck	
057-1	25.06.08	10:32	74° 59,97' N	2° 50,93' W	3692,2	CTD/RO	surface	
057-1	25.06.08	11:42	74° 59,96' N	2° 51,18' W	3692,5	CTD/RO	at depth	
057-1	25.06.08	12:35	74° 59,99' N	2° 51,44' W	3692,5	CTD/RO	on deck	
058-1	25.06.08	17:27	75° 0,09' N	6° 3,84' W	3525,5	CTD/RO	surface	
058-1	25.06.08	18:32	75° 0,13' N	6° 4,01' W	3525,2	CTD/RO	at depth	3443 m, EL31
058-1	25.06.08	19:26	75° 0,08' N	6° 4,24' W	3524,7	CTD/RO	on deck	
059-1	25.06.08	20:34	75° 0,00' N	6° 43,33' W	3488,2	CTD/RO	surface	
059-1	25.06.08	21:41	75° 0,09' N	6° 43,84' W	3487,2	CTD/RO	at depth	
059-1	25.06.08	22:40	75° 0,11' N	6° 44,44' W	3486,7	CTD/RO	on deck	
060-1	25.06.08	23:50	75° 0,02' N	7° 21,94' W	3438,5	CTD/RO	surface	
060-1	26.06.08	00:55	75° 0,06' N	7° 22,37' W	3438,0	CTD/RO	at depth	EL 31; 3416m
060-1	26.06.08	01:54	75° 0,12' N	7° 22,51' W	3438,0	CTD/RO	on deck	
061-1	26.06.08	06:40	74° 56,02' N	4° 36,92' W	3618,5	MOR	surface	AWI-JP34 Ankerstein, Doppel-auslöser und 2 Bentoskugel
061-1	26.06.08	07:18	74° 56,03' N	4° 36,86' W	3618,5	MOR	surface	Transponder und Auftriebskörper
061-1	26.06.08	07:36	74° 56,02' N	4° 36,91' W	3618,0	MOR	surface	Winde mit CTD und Auslöser
061-1	26.06.08	07:43	74° 56,02' N	4° 36,90' W	3618,5	MOR	released	
061-1	26.06.08	07:44	74° 56,02' N	4° 36,90' W	3618,0	MOR	on the ground	
061-1	26.06.08	07:46	74° 56,02' N	4° 36,90' W	3618,5	MOR	releaser on deck	
062-1	26.06.08	10:03	74° 45,94' N	3° 30,11' W	3663,5	CTD/RO	surface	
062-1	26.06.08	11:11	74° 45,93' N	3° 31,51' W	3662,2	CTD/RO	at depth	
062-1	26.06.08	12:17	74° 45,98' N	3° 31,56' W	3662,2	CTD/RO	on deck	
063-1	26.06.08	13:14	74° 53,11' N	3° 29,75' W	3666,2	CTD/RO	surface	
063-1	26.06.08	14:25	74° 52,94' N	3° 30,20' W	3666,5	CTD/RO	at depth	EL 31; 3659m
063-1	26.06.08	15:32	74° 53,02' N	3° 30,66' W	3666,2	CTD/RO	on deck	
064-1	26.06.08	16:30	74° 59,98' N	3° 29,99' W	3668,0	CTD/RO	surface	
064-1	26.06.08	17:41	74° 60,00' N	3° 30,19' W	3668,0	CTD/RO	at depth	3652 m, EL31
064-1	26.06.08	18:44	75° 0,01' N	3° 29,86' W	3668,5	CTD/RO	on deck	
064-2	26.06.08	18:49	75° 0,03' N	3° 29,93' W	3668,0	FLOAT	into water	
065-1	26.06.08	20:29	74° 52,95' N	3° 50,25' W	3653,0	CTD/RO	surface	
065-1	26.06.08	21:36	74° 53,14' N	3° 50,93' W	3651,0	CTD/RO	at depth	
065-1	26.06.08	22:43	74° 53,28' N	3° 51,20' W	3600,0	CTD/RO	on deck	
066-1	27.06.08	00:11	74° 52,99' N	3° 10,24' W	3669,7	CTD/RO	surface	
066-1	27.06.08	01:20	74° 52,99' N	3° 10,11' W	3670,7	CTD/RO	at depth	EL 31, 3655m
066-1	27.06.08	02:23	74° 53,01' N	3° 10,41' W	3669,5	CTD/RO	on deck	
067-1	27.06.08	06:42	74° 57,35' N	1° 0,32' W	3754,0	FLOAT	into water	
068-1	27.06.08	08:45	74° 59,24' N	0° 0,26' W	3768,2	FLOAT	into water	
069-1	27.06.08	09:35	74° 59,90' N	0° 21,04' E	3771,5	CTD/RO	surface	
069-1	27.06.08	10:46	74° 59,99' N	0° 21,13' E	3771,5	CTD/RO	at depth	
069-1	27.06.08	11:44	75° 0,03' N	0° 21,09' E	3771,2	CTD/RO	on deck	

Station PS72/	Date	Time	Position Lat	PositionLon	Depth [m]	Gear Abbrevia-tion	Action	Comment
070-1	27.06.08	12:58	75° 0,03' N	0° 59,14' E	3774,7	CTD/RO	surface	
070-1	27.06.08	14:09	75° 0,03' N	0° 59,26' E	3774,5	CTD/RO	at depth	EL 31, 3758m
070-1	27.06.08	15:12	74° 59,99' N	0° 59,29' E	3774,5	CTD/RO	on deck	
071-1	27.06.08	16:24	74° 59,99' N	1° 37,94' E	3132,2	CTD/RO	surface	
071-1	27.06.08	17:24	75° 0,03' N	1° 37,63' E	3151,5	CTD/RO	at depth	3236 m, EL31
071-1	27.06.08	18:09	75° 0,04' N	1° 37,69' E	3145,0	CTD/RO	on deck	
072-1	27.06.08	19:18	75° 0,03' N	2° 17,04' E	2952,7	CTD/RO	surface	
072-1	27.06.08	20:16	75° 0,06' N	2° 17,05' E	2949,5	CTD/RO	at depth	
072-1	27.06.08	20:54	75° 0,10' N	2° 17,53' E	2927,2	CTD/RO	on deck	
073-1	27.06.08	22:01	74° 60,00' N	2° 56,08' E	2519,5	CTD/RO	surface	
073-1	27.06.08	22:49	74° 59,98' N	2° 55,63' E	2522,5	CTD/RO	at depth	
073-1	27.06.08	23:25	75° 0,04' N	2° 56,02' E	2512,0	CTD/RO	on deck	
074-1	28.06.08	00:44	75° 0,02' N	3° 35,41' E	3483,7	CTD/RO	surface	
074-1	28.06.08	01:50	74° 59,96' N	3° 35,15' E	3480,7	CTD/RO	at depth	EL 31; 3465m
074-1	28.06.08	02:42	75° 0,08' N	3° 34,91' E	3478,5	CTD/RO	on deck	
075-1	28.06.08	03:57	75° 0,03' N	4° 13,90' E	3089,7	CTD/RO	surface	
075-1	28.06.08	04:56	75° 0,03' N	4° 14,00' E	3093,2	CTD/RO	surface	3069 m, EL31
075-1	28.06.08	05:54	75° 0,01' N	4° 13,94' E	3092,5	CTD/RO	on deck	
076-1	28.06.08	09:45	75° 0,02' N	4° 51,96' E	3239,5	CTD/RO	surface	
076-1	28.06.08	10:46	75° 0,03' N	4° 51,94' E	3238,7	CTD/RO	at depth	
076-1	28.06.08	11:41	75° 0,10' N	4° 52,22' E	3234,2	CTD/RO	on deck	
077-1	28.06.08	13:04	74° 59,97' N	5° 30,04' E	3116,5	CTD/RO	surface	
077-1	28.06.08	14:02	75° 0,05' N	5° 30,01' E	3125,7	CTD/RO	at depth	EL 32; 3101m
077-1	28.06.08	14:45	75° 0,02' N	5° 29,76' E	3114,0	CTD/RO	on deck	
078-1	29.06.08	00:03	74° 59,98' N	6° 7,95' E	2841,2	CTD/RO	surface	
078-1	29.06.08	01:01	75° 0,09' N	6° 7,83' E	2837,0	CTD/RO	at depth	SE 32.1, 2833m
078-1	29.06.08	01:44	75° 0,11' N	6° 7,76' E	2839,0	CTD/RO	on deck	
079-1	29.06.08	03:08	74° 59,95' N	6° 46,93' E	2279,2	CTD/RO	surface	
079-1	29.06.08	03:55	75° 0,01' N	6° 47,00' E	2272,2	CTD/RO	at depth	SE 32.1; 2274m
079-1	29.06.08	04:34	74° 59,99' N	6° 46,56' E	2292,5	CTD/RO	on deck	
080-1	29.06.08	06:08	75° 0,02' N	7° 26,01' E	2479,0	CTD/RO	surface	
080-1	29.06.08	06:57	75° 0,01' N	7° 26,07' E	2479,0	CTD/RO	at depth	2453 m, SE 32.1
080-1	29.06.08	07:36	75° 0,00' N	7° 26,11' E	2478,7	CTD/RO	on deck	
081-1	29.06.08	09:15	74° 59,95' N	8° 4,84' E	3533,7	CTD/RO	surface	
081-1	29.06.08	10:24	75° 0,07' N	8° 5,75' E	3538,2	CTD/RO	at depth	
081-1	29.06.08	11:15	74° 59,96' N	8° 6,31' E	3536,7	CTD/RO	on deck	
082-1	29.06.08	12:40	74° 59,99' N	8° 43,57' E	2666,7	CTD/RO	surface	
082-1	29.06.08	13:32	75° 0,09' N	8° 43,93' E	2666,7	CTD/RO	at depth	SE 32.1; 2648m
082-1	29.06.08	14:09	75° 0,20' N	8° 44,18' E	2667,0	CTD/RO	on deck	
083-1	29.06.08	15:34	74° 59,98' N	9° 22,03' E	2594,2	CTD/RO	surface	
083-1	29.06.08	16:24	75° 0,02' N	9° 22,62' E	2594,2	CTD/RO	at depth	2579 m, SE 32.1
083-1	29.06.08	17:00	74° 59,99' N	9° 23,42' E	2593,7	CTD/RO	on deck	
084-1	29.06.08	18:14	75° 0,06' N	9° 59,83' E	2582,0	CTD/RO	surface	
084-1	29.06.08	19:02	75° 0,07' N	9° 59,76' E	2582,0	CTD/RO	at depth	2564 m, SE 32.1
084-1	29.06.08	19:33	75° 0,05' N	10° 0,20' E	2581,2	CTD/RO	on deck	
085-1	29.06.08	21:01	75° 0,04' N	10° 39,12' E	2537,5	CTD/RO	surface	
085-1	29.06.08	21:52	74° 59,99' N	10° 39,11' E	2537,2	CTD/RO	at depth	
085-1	29.06.08	22:30	75° 0,09' N	10° 39,39' E	2537,0	CTD/RO	on deck	
086-1	29.06.08	23:45	75° 0,01' N	11° 17,99' E	2457,5	CTD/RO	surface	
086-1	30.06.08	00:32	75° 0,04' N	11° 17,89' E	2457,0	CTD/RO	at depth	SE 32.1; 2438m
086-1	30.06.08	01:04	75° 0,05' N	11° 18,23' E	2455,5	CTD/RO	on deck	

Station PS72/	Date	Time	Position Lat	PositionLon	Depth [m]	Gear Abbrevia-tion	Action	Comment
087-1	30.06.08	02:25	75° 0,01' N	11° 55,99' E	2334,0	CTD/RO	surface	
087-1	30.06.08	03:10	74° 59,98' N	11° 56,23' E	2333,0	CTD/RO	at depth	SE 32.1; 2316m
087-1	30.06.08	03:43	74° 60,00' N	11° 56,39' E	2332,7	CTD/RO	on deck	
088-1	30.06.08	05:00	74° 60,00' N	12° 34,54' E	2184,7	CTD/RO	surface	
088-1	30.06.08	05:44	74° 60,00' N	12° 34,29' E	2185,2	CTD/RO	at depth	2168 m, SE 32.1
088-1	30.06.08	06:13	74° 60,00' N	12° 34,45' E	2185,2	CTD/RO	on deck	
089-1	30.06.08	07:28	74° 59,95' N	13° 12,75' E	2015,7	CTD/RO	surface	
089-1	30.06.08	08:06	75° 0,08' N	13° 13,02' E	2012,0	CTD/RO	at depth	
089-1	30.06.08	08:39	75° 0,06' N	13° 13,15' E	2011,7	CTD/RO	on deck	
090-1	30.06.08	09:50	74° 59,92' N	13° 52,09' E	1804,0	CTD/RO	surface	
090-1	30.06.08	10:25	75° 0,06' N	13° 52,22' E	1798,7	CTD/RO	at depth	
090-1	30.06.08	10:48	75° 0,17' N	13° 52,23' E	1794,0	CTD/RO	on deck	
091-1	30.06.08	11:57	75° 0,04' N	14° 31,17' E	1425,7	CTD/RO	surface	
091-1	30.06.08	12:27	75° 0,03' N	14° 31,26' E	1424,2	CTD/RO	at depth	SE 32.1, 1407m
091-1	30.06.08	12:47	75° 0,10' N	14° 31,15' E	1423,2	CTD/RO	on deck	
092-1	30.06.08	13:59	75° 0,05' N	15° 9,98' E	1023,5	CTD/RO	surface	
092-1	30.06.08	14:21	75° 0,07' N	15° 9,91' E	1024,0	CTD/RO	at depth	SE 32.1, 1007m
092-1	30.06.08	14:34	75° 0,07' N	15° 9,85' E	1024,5	CTD/RO	on deck	
093-1	30.06.08	15:52	74° 59,98' N	15° 50,04' E	266,2	CTD/RO	surface	
093-1	30.06.08	16:02	74° 59,95' N	15° 50,06' E	265,2	CTD/RO	at depth	255 m, SE 32.1
093-1	30.06.08	16:12	74° 59,96' N	15° 49,85' E	266,5	CTD/RO	on deck	
094-1	30.06.08	17:28	75° 0,02' N	16° 29,87' E	242,7	CTD/RO	surface	
094-1	30.06.08	17:37	75° 0,05' N	16° 29,66' E	254,0	CTD/RO	at depth	243 m, SE 32.1
094-1	30.06.08	17:46	75° 0,09' N	16° 29,77' E	252,7	CTD/RO	on deck	

Die "Berichte zur Polar- und Meeresforschung" (ISSN 1866-3192) werden beginnend mit dem Heft Nr. 569 (2008) ausschließlich elektronisch als Open-Access-Publikation herausgegeben. Ein Verzeichnis aller Hefte einschließlich der Druckausgaben (Heft 377-568) sowie der früheren **"Berichte zur Polarforschung** (Heft 1-376, von 1982 bis 2000) befindet sich im Internet in der Ablage des electronic Information Center des AWI (**ePIC**) unter der URL http://epic.awi.de. Durch Auswahl "Reports on Polar- and Marine Research" auf der rechten Seite des Fensters wird eine Liste der Publikationen in alphabetischer Reihenfolge (nach Autoren) innerhalb der absteigenden chronologischen Reihenfolge der Jahrgänge erzeugt.

To generate a list of all Reports past issues, use the following URL: http://epic.awi.de and select the right frame to browse "Reports on Polar and Marine Research". A chronological list in declining order, author names alphabetical, will be produced, and pdf-icons shown for open access download.

Verzeichnis der zuletzt erschienenen Hefte:

Heft-Nr. 576/2008 — "The 6th Annual Arctic Coastal Dynamics (ACD) Workshop, October 22-26, 2006, Groningen, Netherlands", edited by Pier Paul Overduin and Nicole Couture

Heft-Nr. 577/2008 — "Korrelation von Gravimetrie und Bathymetrie zur geologischen Interpretation der Eltanin-Impaktstruktur im Südpazifik", von Ralf Krocker

Heft-Nr. 578/2008 — "Benthic organic carbon fluxes in the Southern Ocean: regional differences and links to surface primary production and carbon export", by Oliver Sachs

Heft-Nr. 579/2008 — "The Expedition ARKTIS-XXII/2 of the Research Vessel 'Polarstern' in 2007", edited by Ursula Schauer.

Heft-Nr. 580/2008 — "The Expedition ANTARKTIS-XXIII/6 of the Research Vessel 'Polarstern' in 2006", edited by Ulrich Bathmann

Heft-Nr. 581/2008 — "The Expedition of the Research Vessel 'Polarstern' to the Antarctic in 2003 (ANT-XX/3)", edited by Otto Schrems

Heft-Nr. 582/2008 — "Automated passive acoustic detection, localization and identification of leopard seals: from hydro-acoustic technology to leopard seal ecology", by Holger Klinck

Heft-Nr. 583/2008 — "The Expedition of the Research Vessel 'Polarstern' to the Antarctic in 2007 (ANT-XXIII/9)", edited by Hans-Wolfgang Hubberten

Heft-Nr. 584/2008 — "Russian-German Cooperation SYSTEM LAPTEV SEA: The Expedition Lena - New Siberian Islands 2007 during the International Polar Year 2007/2008", edited by Julia Boike, Dmitry Yu. Bolshiyanov, Lutz Schirrmeister and Sebastian Wetterich

Heft-Nr. 585/2009 — "Population dynamics of the surf clams *Donax hanleyanus* and *Mesodesma mactroides* from open-Atlantic beaches off Argentina", by Marko Herrmann

Heft-Nr. 586/2009 — "The Expedition of the Research Vessel 'Polarstern' to the Antarctic in 2006 (ANT-XXIII/7)", edited by Peter Lemke

Heft-Nr. 587/2009 — "The Expedition of the Research Vessel 'Maria S. Merian' to the Davis Strait and Baffin Bay in 2008 (MSM09/3), edited by Karsten Gohl, Bernd Schreckenberger, and Thomas Funck

Heft-Nr. 588/2009 — "Selected Contributions on Results of Climate Research in East Germany (the former GDR)", edited by Peter Hupfer and Klaus Dethloff

Heft-Nr. 589/2009 — "The Expedition of the Research Vessel 'Polarstern' to the Arctic in 2008 (ARK-XXIII/1)", edited by Gereon Budéus