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Reports on Polar and Marine Research

The Expeditions PS95.1 and PS95.2 of the Research Vessel POLARSTERN to the Atlantic Ocean in 2015

Edited by
Rainer Knust and Karin Lochte
with contributions of the participants

HELMHOLTZ GEMEINSCHAFT

Die Berichte zur Polar- und Meeresforschung werden vom Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung (AWI) in Bremerhaven, Deutschland, in Fortsetzung der vormaligen Berichte zur Polarforschung herausgegeben. Sie erscheinen in unregelmäßiger Abfolge.

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Titel: Expeditionsteilnehmer des NoSoAT (North South Atlantic Transect) Teams vor dem Werfen des täglichen XBTs. Foto: Pauhla McGrane, Marine Institute, Galway.

Cover : Expedition participants of the NoSoAT (North South Atlantic Transect) team prior to the daily XBT deployment. Photo: Pauhla McGrane, Marine Institute, Galway.

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PS95.1

29 October 2015 – 10 November 2015

Bremerhaven – Las Palmas

Chief Scientist
Rainer Knust

PS95.2

10 November 2015 – 3 December 2015

Las Palmas – Cape Town

Chief Scientist
Karin Lochte

Coordinator
Rainer Knust

Contents

1.	**Zusammenfassung und Fahrtverlauf**		**2**
	Summary and Itinerary		**3**
2.	**Weather Conditions during PS95**		**5**
3.	**The North South Atlantic Transect (NoSoAT)**		**9**
4.	**Atmospheric Measurements of Aerosols, Clouds, and Cloud Microphysics within the Mobile Sea Facility Oceanet**		**17**
5.	**Calibration of Hydroacoustic Systems**		**26**
	5.1	**Calibration of the multi-beam echo sounder ATLAS HYDROSWEEP DS 3**	**26**
	5.2	**Calibration of wave radar WAMOS II, applying wave buoy**	**28**
	5.3	**Investigation of HEAVE compensation**	**28**
	5.4	**Calibration of the scientific multi-frequency echo-sounder Simrad EK60/80 and testing of newly installed Wideband-Transceivers**	**33**
A.1	**Teilnehmende Institute / Participating Institutions**		**35**
A.2	**Fahrtteilnehmer / Cruise Participants**		**39**
A.3	**Schiffsbesatzung / Ship's Crew PS95.1**		**41**
	Schiffsbesatzung / Ship's Crew PS95.2		**42**
A.4	**Stationsliste / Station List PS95**		**43**

1. ZUSAMMENFASSUNG UND FAHRTVERLAUF

Rainer Knust, Karin Lochte AWI

Die Transitfahrt von Bremerhaven nach Kapstadt war in zwei Abschnitte geteilt. Der erste Abschnitt von Bremerhaven nach Kapstadt begann wie geplant am 29.10.2015 und endete am 10.11.2015 in Las Palmas. Auf diesem Abschnitt wurden u.a. die hydroakustischen Messsysteme getestet und geprüft, sowie ein neuer Motion Sensor zur Lagemessung des Schiffes getestet, um genauere Messergebnisse beim Einsatz des Fächerlots (DS 3) und des PARASOUND-Systems zu erzielen. Alle Tests und Kalibrierungen hierzu konnten bis zum Einlaufen in Las Palmas erfolgreich abgeschlossen werden.

In Las Palmas übernahm Prof. Karin Lochte die Fahrtleitung für den zweiten Abschnitt. *Polarstern* verließ Las Palmas planmäßig am Nachmittag des 10.11.2015. Am 02.12.2015 lief *Polarstern* in Kapstadt (Südafrika) ein, die 95. Expedition endete am 03.12.2015 mit dem Ausschiffen der wissenschaftlichen Fahrtteilnehmer.

Beide Fahrtabschnitte standen im Zeichen der studentischen Ausbildung. An dem Programm NoSoAT (North South Atlantic Transect) nahmen insgesamt 32 Studenten aus 19 Ländern teil, die die grundlegenden Prinzipien der biologischen Ozeanographie kennenlernten. Bei der Fahrt von Bremerhaven bis nach Kapstadt wurde ein weiter biogeographischer Bereich abgedeckt, der sich vom flachen Gebiet des Ärmelkanals, über die Biskaya, das Gebiet des Ampère Seamount, die Kapverdischen Inseln und weitere Stationen im Südatlantik bis nach Kapstadt erstreckte. Dabei lernten die Teilnehmer unterschiedliche Methoden der Probennahme auf See kennen, indem zahlreiche Geräte zum Einsatz kamen. Für die Messungen physikalischer und chemischer Parameter wurden CTD mit Wasserschöpfer, xBTs und Ferrybox eingesetzt. Die Phyto- und Zooplankton Gemeinschaften wurden durch Probennahmen mit dem CPR (Continuous Plankton Recorder) und Planktonnetzen gesammelt und an Bord analysiert. In unterschiedlichen Gruppen wurden Laborexperimente und Datenanalysen durchgeführt und Methoden des Remote-Sensing kennengelernt. Das gemeinsame Arbeiten und Lernen wurde organisiert durch das Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (AWI) in Kooperation mit der "Strategic Marine Alliance for Research & Training" (SMART) und der "Partnership for Observation of the Global Oceans" (POGO). Die Summer School wurde durch die Stiftung Mercator und die Nippon Foundation / POGO Centre of Excellence unterstützt.

Ebenfalls auf beiden Fahrtabschnitten führte das Leibniz-Institut für Troposphärenforschung (TROPOS) chemische und physikalische Messungen zum Energie- und Materialaustausch zwischen Ozean und Atmosphäre durch. Die Arbeiten konnten mit Einlaufen in Kapstadt, wie bereits auf anderen Transitfahrten mit *Polarstern*, sehr erfolgreich abgeschlossen werden.

SUMMARY AND ITINERARY

The transit cruise from Bremerhaven to Cape Town was split into two legs. As planned the first leg began on 29 October 2015 in Bremerhaven and ended on 10 November 2015 in Las Palmas. During this cruise leg hydro-acoustic measuring systems were tested. Furthermore a new motion sensor for position measurement of the ship was tested to facilitate more accurate measurements of the echo sounder (DS 3) and the PARASOUND system. All tests and calibration work had successfully been carried out when we arrived in Las Palmas.

In Las Palmas Prof. Karin Lochte took over the position as chief scientist for the second leg. *Polarstern* left Las Palmas according to schedule in the afternoon of 10 November 2015. On 2 December 2015 *Polarstern* arrived in Cape Town (South Africa) and the 95th expedition ended on 3 December when the scientific crew had disembarked.

Both cruise legs were dedicated to the education of students. 32 students from 19 different nations took part in the NoSoAT program (North South Atlantic Transect). During this expedition they got acquainted with the basic principles of biological oceanography. On the journey from Bremerhaven to Cape Town a wide biogeographical range was covered. It ranged from the shallow region of the English Channel to the Bay of Biscay, the region around the Ampère Seamount, the Cape Verde Islands and further stations in the South Atlantic up to Cape Town. The participants were introduced to various methods of sampling using different equipment. For the measurement of physical and chemical parameters the CTD with water samplers, xBT and ferrybox were deployed. Phyto- and zooplankton communities were sampled with the CPR (Continuous Plankton Recorder) and plankton nets and were analyzed on board. Laboratory experiments and data analyzes were conducted in different groups and methods of remote sensing were introduced. The joint working and learning was organized by the Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (AWI) in cooperation with the “Strategic Marine Alliance for Research & Training“ (SMART) and the “Partnership for Observation of the Global Oceans“ (POGO). The summer school was supported by the Mercator Foundation and the Nippon Foundation / POGO Centre of Excellence.

During both cruise legs the Leibniz Institute for Tropospheric Research (TROPOS) carried out chemical and physical measurements of energy and material exchange between ocean and atmosphere. All work was successfully completed on arrival in Cape Town as on other transit cruises with RV *Polarstern*.

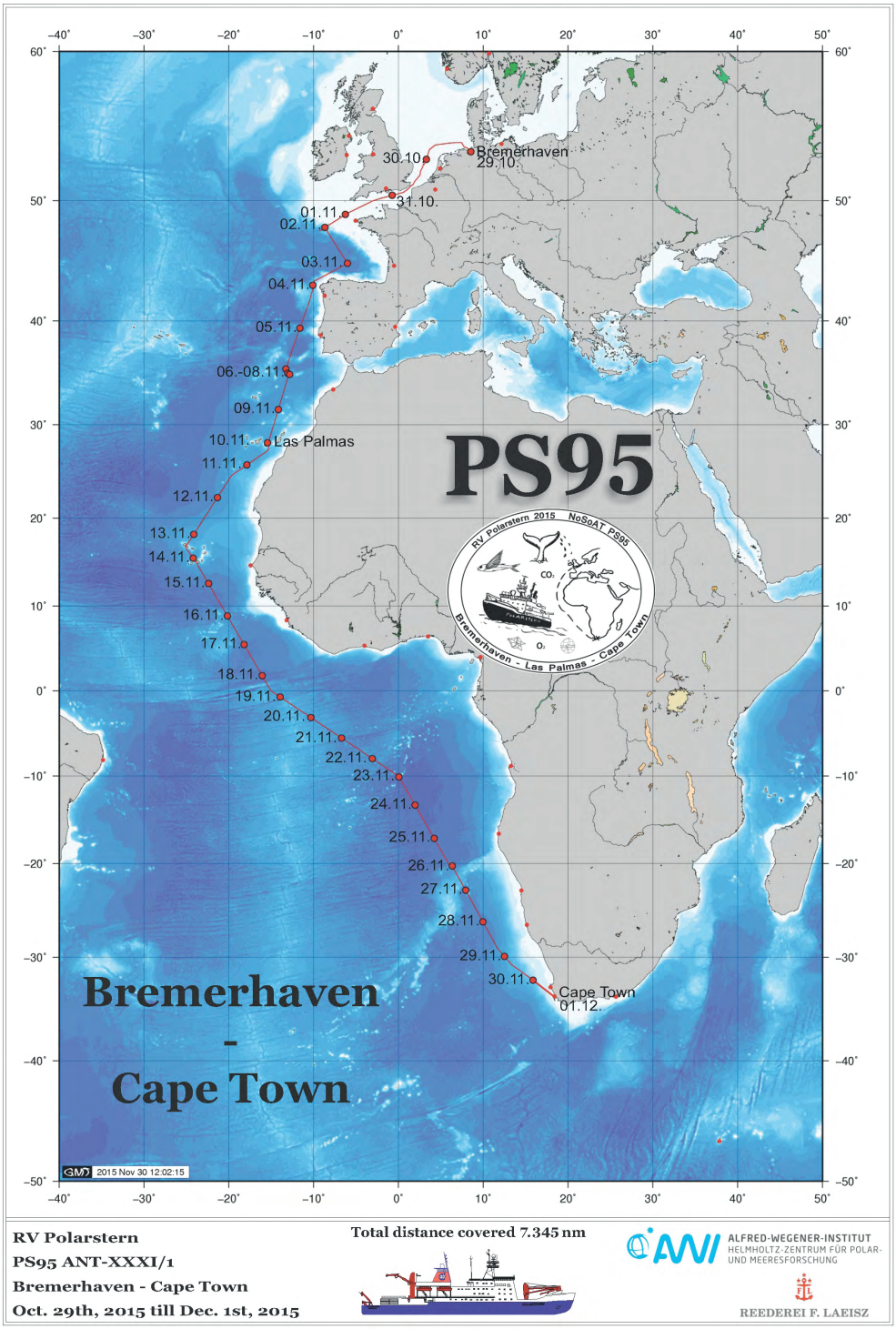

Abb.1: Kursplot der Polarstern-Expedition PS95.1+2 (s. doi:10.1594/PANGAEA.859019 und doi:10.1594/PANGAEA.859020)

Fig. 1: Course track of Polarstern expedition PS95.1+2 (see doi:10.1594/PANGAEA.859019 and doi:10.1594/PANGAEA.859020)

2. WEATHER CONDITIONS DURING PS95

Hartmut Sonnabend DWD

Polarstern left the harbour of Bremerhaven for the cruise leg PS95.1 on October 29, 2015 at 13:00 CET under misty and temporarily foggy weather conditions. In the transient area between high pressure over Eastern Europe and a large low pressure system over the central North- and East Atlantic a light southeasterly breeze predominated at first. During the following day, the southeast wind increased to force 6–7 Beaufort and an associated sea state of 1.5 - 2 meters, when a trough moved from the western Biscay towards Ireland. The same evening the wind started to decrease, levelling to a soft to moderate southeasterly to easterly breeze soon after the passage of the Strait of Dover. Due to the moistly air mass in the lower levels the visibilities improved only gradually and remained misty during the whole period. After having reached the western part of the English Channel and during the first station work an elongated westerly swell with wave heights of 3 - 3.5 meters at first became noticeable, gradually flattening later on. Heading southwest to the next station RV *Polarstern* encountered once more an area of very dense fog patches during the afternoon of 2 November persisting until the following night. Next day a new low formed over Spain causing easterly winds force 6 Beaufort. During 3 November the low moved across the central Biscay northeastward allowing the wind to freshen to force 6-7 Beaufort from west to southwest in the afternoon and evening of this day. After a short break, the next trough being embedded into the North Atlantic frontal zone followed from southwest. During the navigation around Cape Finisterre, the northwestern tip of Spain, the wind increased during the morning and forenoon of 4 November once more to temporarily force 7-8 Beaufort from south with a corresponding sea state of 3 – 3.5 meters. Until the afternoon of the following day, the cruise line of RV *Polarstern* remained located in the eastern flank of a large low pressure system centred over the central North Atlantic in a fresh and temporarily strong southsouthwesterly airflow. Approaching the next research area above the Ampere Seamount the wind decreased more and more under increasing high pressure influence. Embedded near the axis of a high pressure ridge, the following research activities in the target area were favoured by fine weather conditions, soft and variable winds and a westnorthwesterly swell with heights of around 2 meters. After having finished all station work in the afternoon of 8 November, RV *Polarstern* continued its cruise towards Las Palmas. Getting south of the axis of the large high pressure zone a soft to moderate northeasterly to easterly trade wind set in gradually. In the morning of 10 November *Polarstern* entered the harbour of Las Palmas.

The cruise leg PS95.2 started in the afternoon of the same day with the departure from Las Palmas towards the Cape Verde Islands. Located between the southern slope of the Subtropical High in the north and the Equatorial trough in the south, the trade wind airflow increased to force 5 Beaufort, rising to force 6–7 with an associated windsea up to 1.5 – 2m temporarily during the morning and forenoon of 11 November. Beginning in the afternoon and evening of the same day these wind conditions levelled off to a moderate to fresh breeze from eastnortheast to northeast.

Soon after the departure from Las Palmas RV *Polarstern* encountered a large dust plume drifting seaward from the Sahara Desert, advancing to the most significant meteorological event during the following nearly 6 days. During this period, the visibility remained reduced to 6 -10 kilometres on average.

After a short intermediate stop at the Pilot Station of Mindelo in the evening of 13 November, *Polarstern* reached its next research station within the Archipelago of the Cape Verde Islands during the following night under nearly unchanged wind- and weather conditions. After having finished this station, the ship moved into the immediate lee of the island of Sao Tiago for calibration works. Continuing the cruise towards the Equator and the equatorial trough the trade wind decreased more and more to a light breeze or temporarily near calm conditions during 16 November. In the afternoon of 17 November *Polarstern* crossed the axis of the Intertropical Convergence Zone (ITCZ) a few miles south of the latitude of 5 degrees north. The ITCZ was characterized by only a jump of the wind direction from eastnortheast to southeast. All available satellite images however depicted the nearly complete lack of any organized and deep convection in the far environment of our cruise line so that the ship remained untroubled by any thunderstorm- or heavy shower activity. Having left the area of the ITCZ behind and approaching the Equator, a few showers occurred and crossed the cruise line of *Polarstern*. The vertical growth of the producing cumulus clouds did not exceed a level of 3 km on average. The southeast trade wind increased during the night to 18 November to force 4-5 Beaufort and accelerated to force 5 - 6 Beaufort until the next day, associated by a relative rough sea of around 2 meters from ahead. Soon after having crossed the Equator southeastward, *Polarstern* encountered large areas of clouds. This carpet of clouds, interrupted by only a few sunny spells produced light to moderate showers of drizzle rather frequently. The briskly wind constellation lasted until afternoon of 22 November, when a weakening of the steering South Atlantic Subtropical High and subsequently the air pressure gradient caused a deceleration in wind speed, fading into a light to moderate breeze and sunny weather conditions during station work on 23 November near the coordinates of 10°S/0°E. A significant swell however with wave heights of around 3 meters passed the cruise line and working area during this day. The transect towards the last working station was characterized by a moderate to fresh breeze from ahead. As result of the very significant trade wind inversion, the ship crossed repeatedly large areas of *stratocumulus* clouds during these days. After having encountered the area of the strongest air pressure gradient between the nearly stationary high pressure ridge in the west and the seasonal low pressure trough over the southern Africa, the southerly to southeasterly trade wind accelerated to a strong breeze of force 6 with gusts up to Beaufort 7 until the morning of 28 November. The sea state became rough with temporarily wave heights of about 2.5 – 3 meters. The all in all briskly trade wind constellation persisted also through the remaining days of our cruise with an interplay between strong wind conditions during evening and the night and more or less moderate phases during daytime. The relatively rough sea from ahead as a combination of windsea and swell decreased only dilatorily. These final days nevertheless brought a lot of sunshine. During the final approach of the Pilot Station and entering a short time lee along the shoreline near Cape Town, the wind- and sea conditions calmed down to a light to moderate breeze. In the morning of 1 December RV *Polarstern* entered the harbour of Cape Town.

For further statistics see Fig. 2.1 – Fig. 2.3.

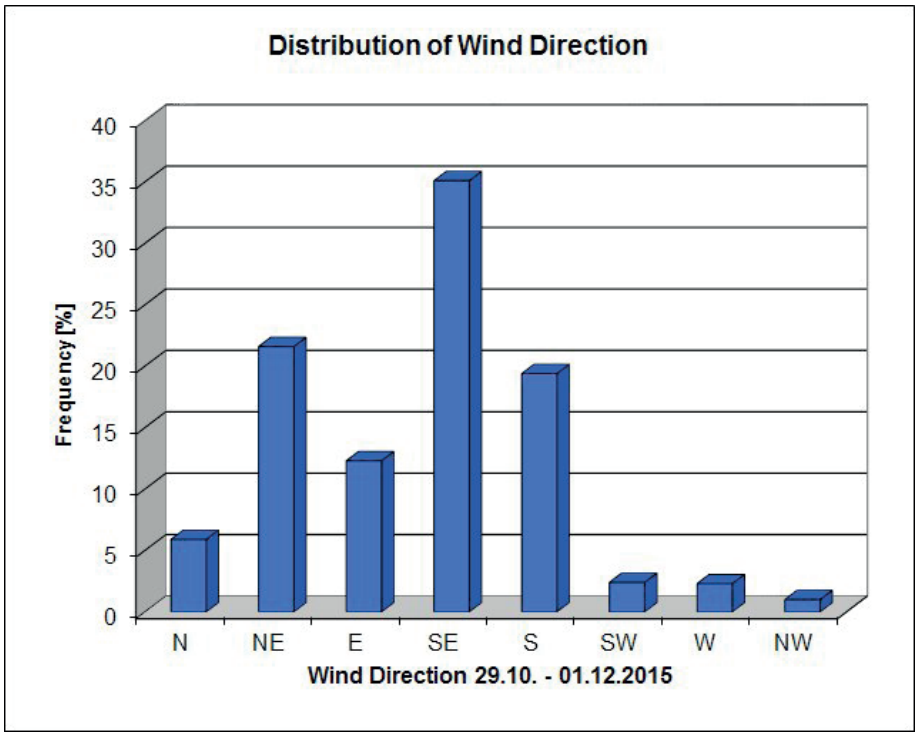

Fig. 2.1: Distribution of wind direction during PS95

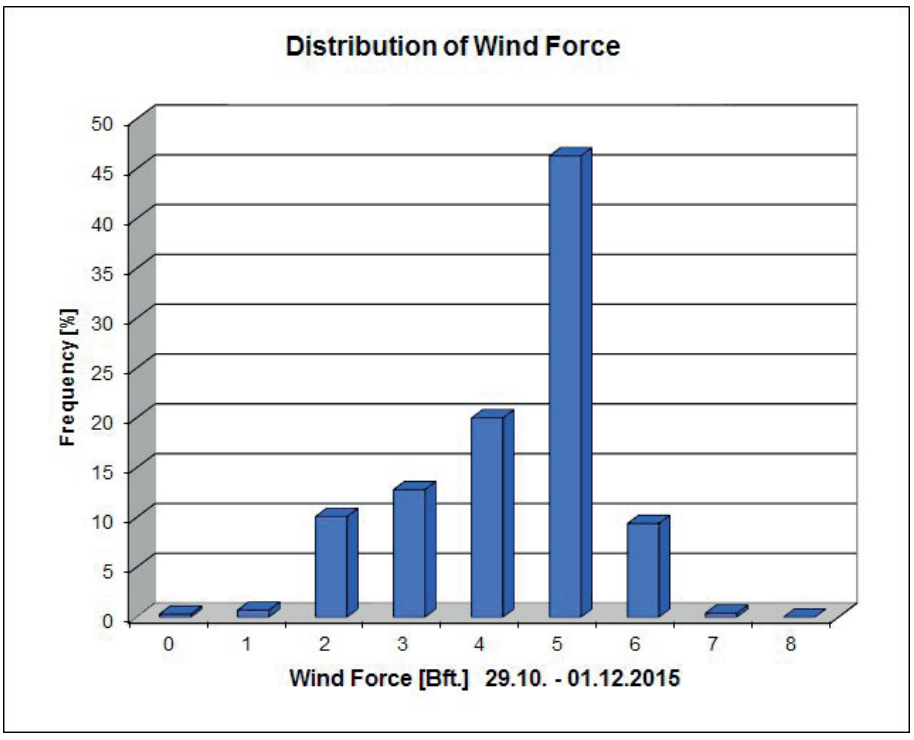

Fig. 2.2: Distribution of wind force during PS95

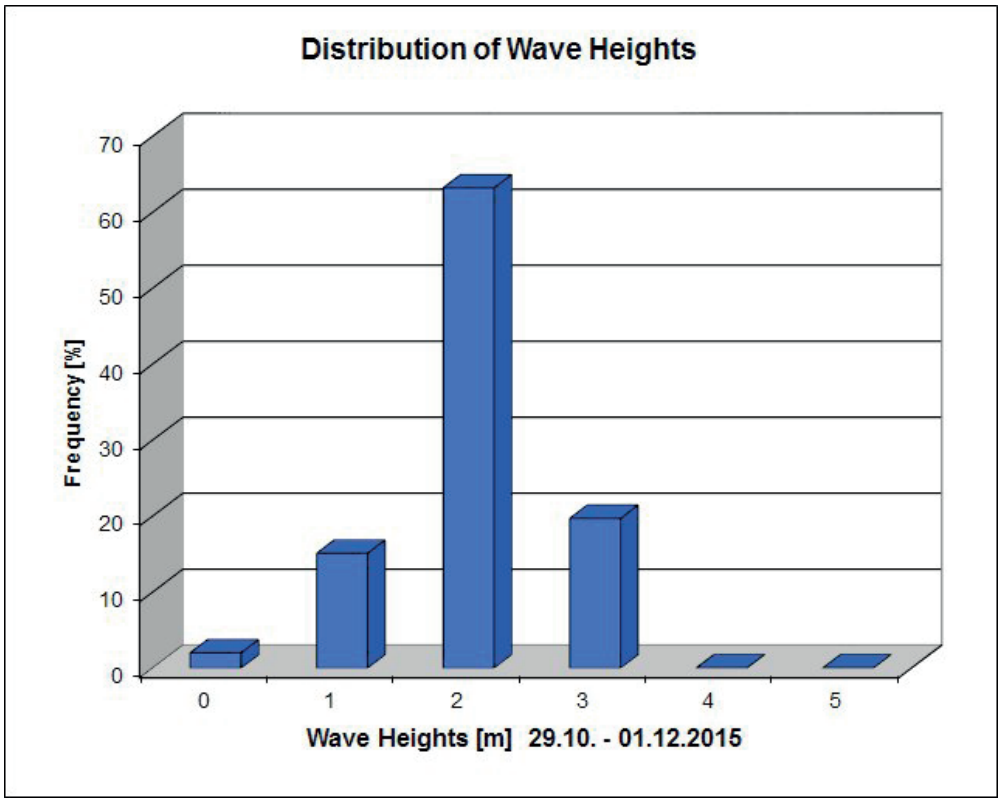

Fig. 2.3: Distribution of wave heights during PS95

3. THE NORTH SOUTH ATLANTIC TRANSECT (NOSOAT)

Karen Wiltshire[1,4], Pauhla McGrane[2],
Karin Lochte[1,5], Claudia Hanfland[1],
Maarten Boersma[1,5], Michael Ginzburg[1],
Birgit Heim[1], Therese Keck[3], Alex Kraberg[1]

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[4]JUB
[5]UHB

Grant-No. AWI_PS95_00

Objectives

The North South Atlantic Transect (NoSoAT) was designed to provide participants with a thorough insight into the fundamental principles of biological oceanography. The cruise from Bremerhaven to Cape Town covered an enormous biogeographic range (from the western entrance to the English Channel via the Bay of Biscay to several stations in the North and South Atlantic) with different hydrographic regimes. These were reflected in considerable shifts in resident phytoplankton and zooplankton communities. The NoSoAT survey aimed to investigate and characterise these different regimes, biomes and the ecological geography of the Atlantic Ocean. The survey brought together international participants through collaboration between the Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (AWI), the Strategic Marine Alliance for Research & Training (SMART) and the Partnership for Observation of the Global Oceans (POGO).

The emphasis was ‘hands on’ practical experience and included sampling (Continuous Plankton Recorder, XBTs, Rosette sampler with CTD sensors, Bongonet, Ferrybox), sample processing (phytoplankton, zooplankton, and ocean chemistry), analysis of samples, data acquisition, along with incubations and growth experiments. These data, coupled with satellite remote sensing studies allowed the identification and categorization of regional ocean patterns and biogeographic provinces of the Atlantic. The practical work was supported by on-board lectures, discussions, practical exercises, data workup sessions and peer-led presentations.

Aim of the North South Atlantic Transect (NoSoAT) Floating Summerschool was to chart and characterize different water bodies according to productivity along a North-South Atlantic Transect, as part of training exercise for capacity building in oceanography. An international group of 32 students (mostly graduate level and doctoral candidates) was selected amongst 470 applications. Main objective was to train students in basic oceanographic principles including sea-going methods and sampling associated with these under “real” research conditions. Participants had to learn how to sample and analyse for phytoplankton and zooplankton, to link physical and biological observations, to connect oceanographic “Ground Truth” information to remote sensing information, and to investigate differences in productivity and trophic interactions on board via incubation experiments. The development of research skills was another objective of the training. By bringing students from different educational and cultural backgrounds together, peer-learning war fostered.

Work at sea

The participants were divided into five groups randomly which rotated between different disciplines. Every six days the students changed topic, with transfer between topics associated

with overview lectures of the work carried out in the previous six days on the evening before and a teaching/learning period on the morning of the transfer where the outgoing groups taught the incoming students. The themes of the five topics were: oceanography, remote sensing, phytoplankton, zooplankton and tools. The aim of oceanography was to characterize water masses and examine the hydrographic regime along the transect, measuring temperature, salinity, oxygen content, pH and algal biomass using a range of different instruments. In Remote Sensing the students received an overview of optical remote sensing and a general understanding of the connection of *in-situ* and satellite-derived measurements and radiative transfer, analysed satellite data, and carried out measurements on radiance of the water. Students identified and counted microalgae in the Phytoplankton topic and created identification guides for some of the taxa observed. Furthermore they analysed the biodiversity of the plankton community in the different sampling stations. In Zooplankton, the students sampled zooplankton using different nets and devices, compared the outcome and carried out experiments to estimate the grazing impact of different zooplankton size fractions on phytoplankton. The Tools topic taught the students skills on presentation, good scientific practice as well as self and group management.

Tab. 3.1: List of students' on-board instructors

No.	On-board Instructor	Topic	Position	Institute
1	Prof Dr Karen Wiltshire	Oceanography	AWI vice-director	AWI/POGO/JUB
2	Dr Pauhla McGrane	Oceanography	SMART Coordinator	MIG/GMIT
3	Michael Ginzburg	Oceanography	PhD Student	AWI
4	Dr Birgit Heim	Remote Sensing	Research Scientist	AWI
5	Therese Keck	Remote Sensing	PhD student	FU Berlin
6	Dr Alex Kraberg	Phytoplankton	Research Scientist	AWI
7	Prof Dr Maarten Boersma	Zooplankton	Section head SSSE	AWI/UB
8	Dr Claudia Hanfland	Tools	POLMAR Coordinator	AWI
9	Prof Dr Karin Lochte	Tools	AWI Director	AWI/UB

Preliminary results

Oceanography and remote sensing

Hydrographic observations were carried out using a Seabird SBE 911 and a rosette system. Repeat vertical profiles of temperature, salinity, transmissivity and fluorescence of the water column were taken at selected stations. Expendable Bathythermographs (XBTs) were deployed daily to measure water temperature with depth along the transect. An LI-192 Underwater Quantum sensor was deployed to measure PAR at different water depth at each station. Data were processed using SBE Data Processing Win32 and data were averaged to 1 m vertical bins. Profiles and sections of temperature and salinity and T-S plots were made using Ocean Data View 4.

Seawater samples were collected in Niskin bottles (12 L) from the CTD rosette for analysis. Water depths were selected based on the hydrographic profiles and chlorophyll maximum. Temperature, salinity, pH and dissolved oxygen were measured using Multi and Oxy sensor probes (VWR) on recovery on water samples. Dependant on the level of productivity, 5-10 L of sea water was collected on 0.4 µm nylon filters for later pigment analysis. Samples were stored

in 250 µl of acetone and frozen (-20 °C). 150 ml of filtrate was reserved for nutrient analysis and frozen (-20 °C). Samples for phytoplankton analysis were preserved with Lugol's iodine and stored in dark glass bottles. Discrete samples were analysed on recovery for pigments using a Fluoroprobe (BBE Algae Analyser).

Continuous measurements of chlorophyll, temperature, salinity and several other parameters were recorded on the ship's Ferry Box, stored on DShip database and processed. Chl-a values from satellite observations from the GlobColour project (ESA, EU) that provides a continuous data set of merged Ocean Colour satellite products were extracted using BEAM Visat software.

The water masses present along the Atlantic transect were identified using T-S (temperature-salinity) profiles (Fig. 3.1). Three primary water masses were identified along the north-south transect; North/South Atlantic Central Water (NACW), Mediterranean Outflow Water (MOW) and Antarctic Intermediate Water (AAIW). The temperature-salinity plot (Fig. 3.2) also shows a clear division of the different water masses.

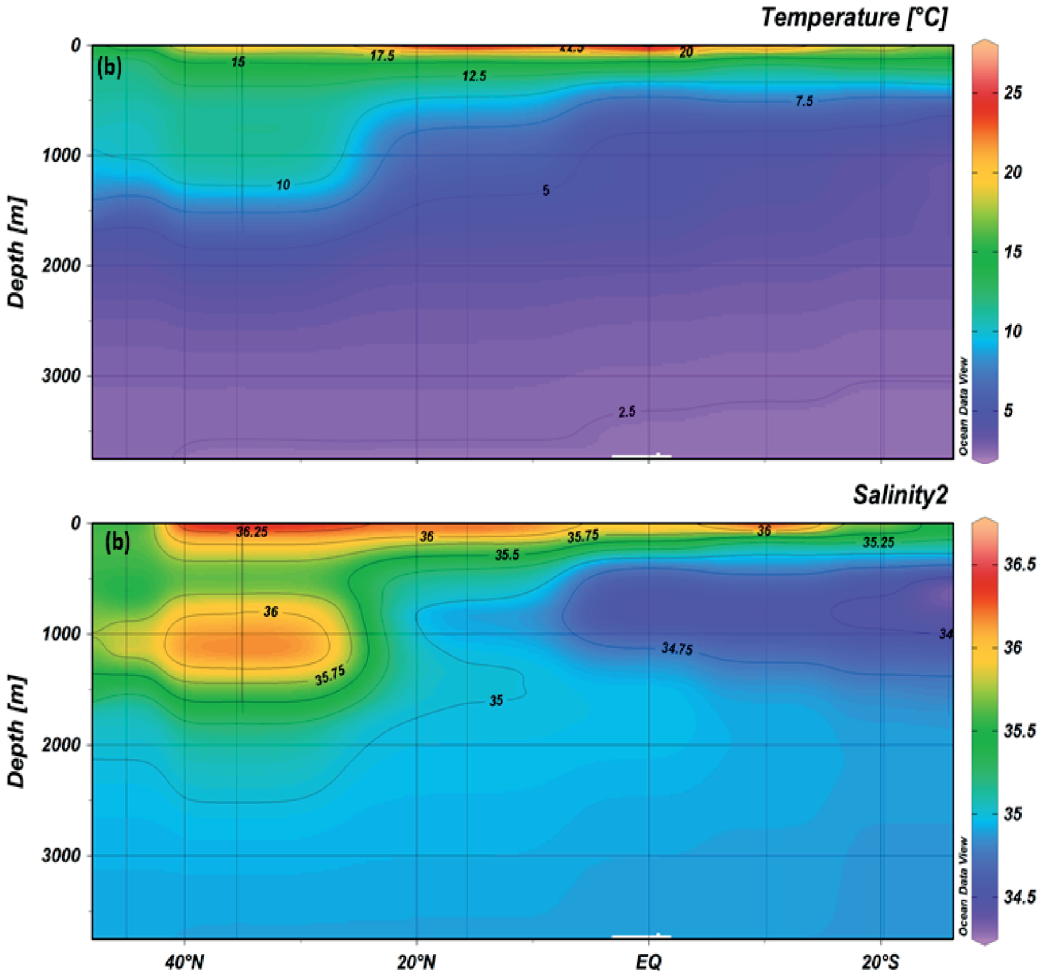

Fig. 3.1: Temperature and salinity profile of the transect using the CTD data. Clearly visible are the inflow of Mediterranean Water at around 1,000 m depth at ~35 °N, and the tongue of colder but less saline Antarctic water as far as the Equator.

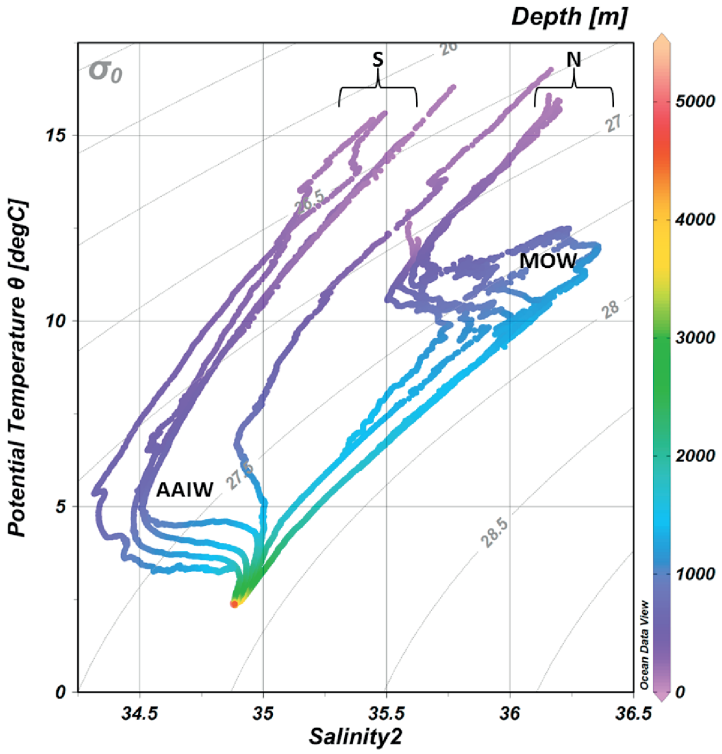

Fig. 3.2: Temperature-Salinity diagram for selected CTD profiles in >2,000m water depth from the transect. Colour coding indicates depth (m) and dashed lines show isopycnals (σ_θ, kg m^{-3}) with contour intervals at 0.5.

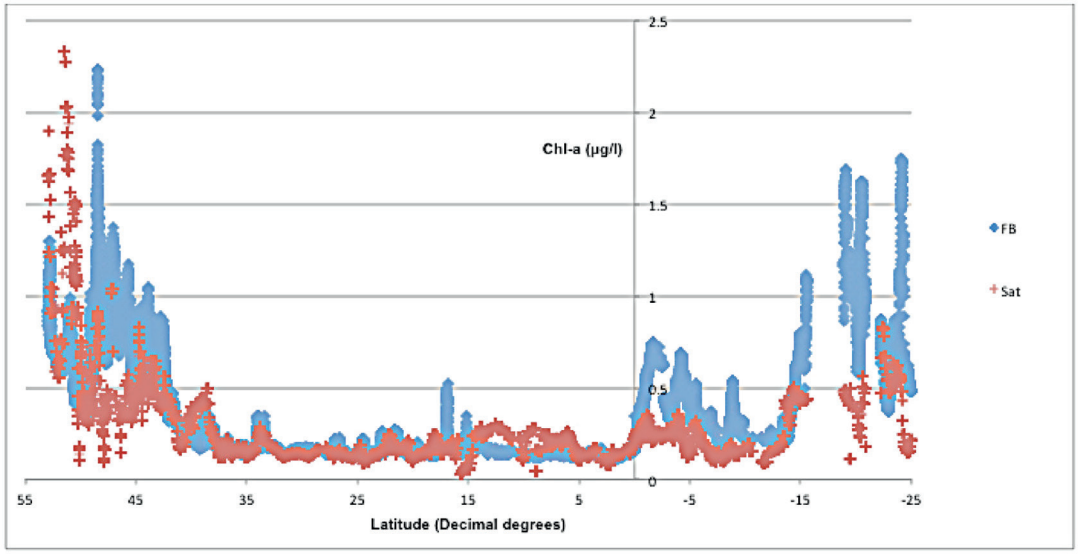

Fig. 3.3: Comparison of the estimates of chlorophyll concentration (µg l-1) along the transect (blue: ferry box data, red: satellite data).

A comparison between satellite and ferry box data is shown in Fig. 3.3. It appears that in the English Channel area, the satellite overestimates the chl-a values of the ferry box by almost 70 %, while in the Bay of Biscay area, it underestimates the chl-a values by almost 40 %. Along the transect from the Iberian Peninsula to the Equator, the satellite and ferry box values are quite closely matched, with the former only underestimating the latter's values by about 3 %. South of the Equator, the values become less similar again, with differences in the region near the Guinea current, and in the region approaching the Benguela Current, of 44 % and 48 % respectively. However, despite areas with a mismatch in the values, the peaks and trends of the satellite data are quite similar to those of the ferry box data.

Biodiversity and Production

Different sampling gears ranging from Bongo nets with mesh sizes of 200 µm, 150 µm, 100 µm; CalCoFi nets with mesh sizes of 500 µm, 80 µm, 20 µm and Continuous Plankton Recorder with mesh size of 270 µm were deployed in order to obtain a robust representative phytoplankton and zooplankton biodiversity of the waters. The Continuous Plankton Recorder was towed all the way from the first station in the English Channel to the Benguela Upwelling System. Silks were collected, and will be analysed using the standard techniques available from SAHFOS. At every CTD station, a Bongo net was towed from the ship for 10 min at 1.5 knots at a depth of 15 m. This was done to compare results with the results from the CPR, in order to estimate the selectivity of the different devices. Furthermore, a vertical Bongo net plus a CalCoFi were deployed to a depth of 50 m under the chlorophyll maximum. Samples were taken from these Bongo nets for the later analysis of stable isotopes. Phytoplankton nets were deployed for the collection of larger phytoplankton cells, and samples were taken from every bottle from the rosette for quantitative counts of the phytoplankton. Furthermore, at the CTD stations water was collected from the chlorophyll maximum to estimate the grazing impact of microzooplankton and mesozooplankton, using the methods of Landry and Hassett (1982) and Frost (1972), respectively.

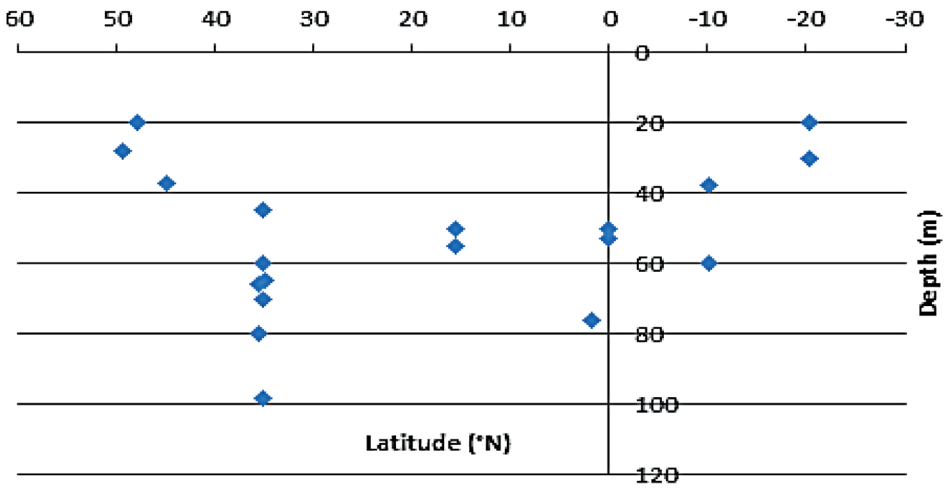

Fig. 3.4: Depth of the chlorophyll maximum over the latitudinal gradient

The depth of the chlorophyll maximum varied considerably over the latitudinal gradient, with shallower chlorophyll maxima at either end (Fig. 3.4.).

Semi-quantitative data were obtained from the plankton net counts and were used to make presence/absence analyses, while qualitative data come from buckets and CTD samples. Ordination by non-metric multidimensional scaling (nMDS) based on Bray Curtis similarity with presence/absence transformation of the data was used to visualize patterns in the biological dataset (Fig. 3.5). Four groups were identified: closer to the continental shelf (stations 2, 3, 4 and 9), Ampere Sea Mount (stations 11, 12, 13 and 14), Cape Verde and southern area (stations 22-day, 34, 42 and 47) and Cape Verde night station (station 22-night).

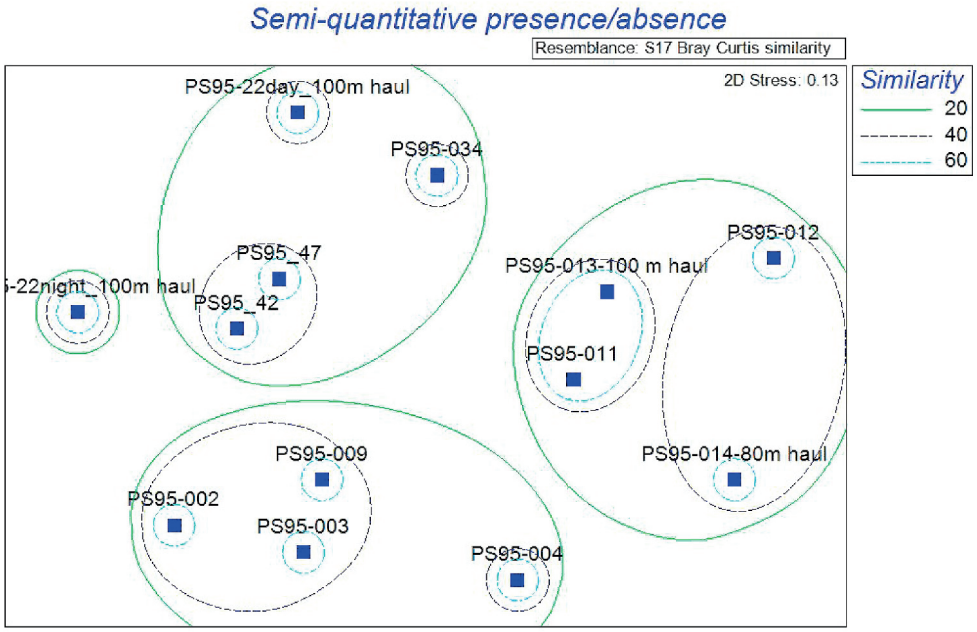

Fig. 3.5: Non-metric multidimensional scaling with presence/absence transformation of the data for the North-South Atlantic transect

The impact of microzooplankton grazing on the phytoplankton community varied regionally and was related to the total amount of chlorophyll in the water (Fig. 3.6). Where the impact of grazing was low at very low algal densities, it increased at middle ones and then decreased again. As a result, the grazing impact was highest at the Northern most stations, with an estimated 150 % of the algal standing stock consumed by microzooplankton per day. Grazing of copepods on phytoplankton was negligible relative to microzooplankton (Fig 3.7.). In fact, the experiments also showed that the copepods actually preferred microzooplankton over algae, thus releasing the predation pressure on the algae.

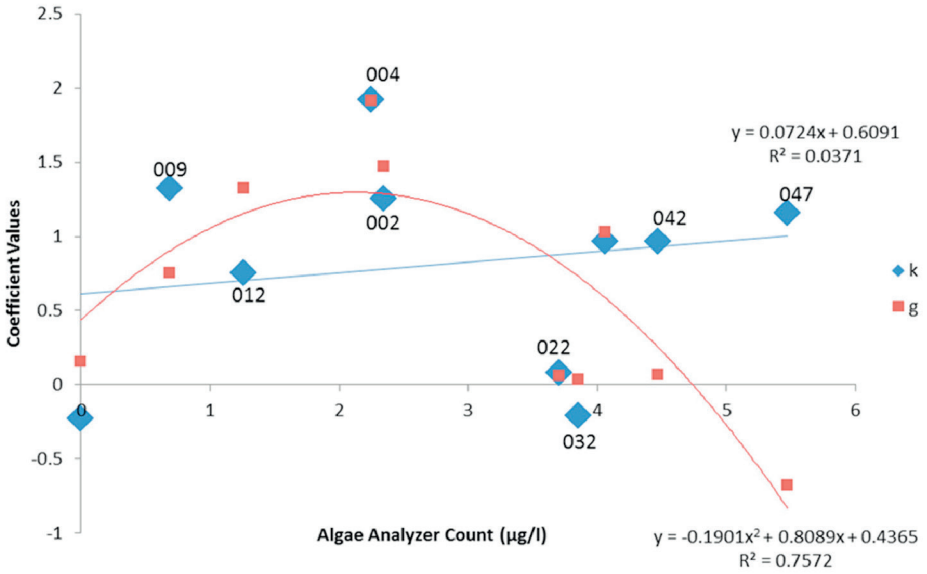

Fig. 3.6: Microzooplankton grazing rates and algal growth rates obtained from the dilution experiments at different stations (numbers at the points) related to the total chlorophyll content of the water

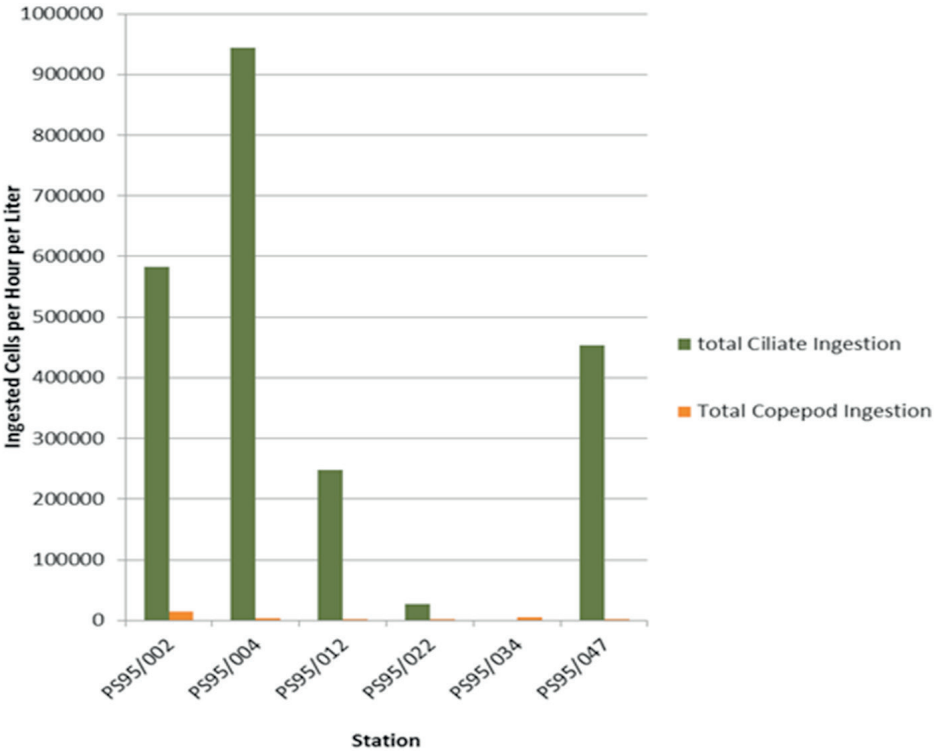

Fig. 3.7: The impact of grazing by mesozooplankton (copepods) relative to microzooplankton (ciliates) grazing

Conclusion

The concerted action of measuring physical and biological parameters on the North-South trajectory of PS95 yielded important information on the hydrography and biology of the Atlantic Ocean. It might serve as a basis for similar efforts in future years, which will eventually allow us to study the change processes taking place in this, thus far relatively understudied part of the World's oceans. Furthermore, taking 32 students from 19 different nations on a cruise leg of the *Polarstern* was a very valuable experience. Not only did the target group, the students, benefit enormously from this endeavour, but also for the teachers it was a very rewarding experience.

Data management

The data collected will all be made available through the data base PANGAEA as soon as soon as the samples are counted and analysed and the data have been quality-controlled.

References

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Landry MR, and Hassett RP (1982) Estimating the grazing impact of marine micro-zooplankton. Marine Biology, **67**, 283-288.

4. ATMOSPHERIC MEASUREMENTS OF AEROSOLS, CLOUDS, AND CLOUD MICROPHYSICS WITHIN THE MOBILE SEA FACILITY OCEANET

Ronny Engelmann, Stephanie Bohlmann, Paul Herenz, Maik Merkel, Daniel Merk, Laurent Poulain, Andre Welti

TROPOS

Grant-No. AWI_PS95_00

Objectives

The net radiation budget at the surface is an important regulator in the climate system of the Earth. Next to well-known greenhouse gas effects it is mainly influenced by the complex spatial distribution of aerosols and clouds (liquid and ice water clouds) in the atmosphere. The manifold interactions between aerosol particles and cloud particles still cause many uncertainties in climate models. While aerosol can directly scatter and absorb light depending on their type and chemical composition they also act as cloud condensation nuclei (CCN) and ice nuclei (IN).

The TROPOS scientists (S. Bohlmann, R. Engelmann, P. Herenz, D. Merk, M. Merkel, L. Poulain, A. Welti) were aboard the PS95 transect to primarily collect data for a better understanding of the aerosol and cloud interaction. One of the main goals was to measure CCN and IN for the first time within the OCEANET programme. Therefore several remote-sensing and *in-situ* instruments were on board. Two containers were installed, the remote-sensing OCEANET Container at the “Helideck” (starboard) (Fig. 4.1) and the Aerosol Container at the “Peildeck”, (bridge top portside). The measurements are used to increase the statistical dataset over the Atlantic where measurement data are extremely sparse. Additional to the measurements of TROPOS, a MICROTOPS Sun photometer is used aboard (T. Keck) to measure the Aerosol Optical Depth along the cruise. These measurements are performed within the framework of the Maritime Aerosol Network (MAN) as part of the Aerosol Robotic Network (AERONET).

Remote sensing (OCEANET container)

The primary instrument is a multi-wavelength Raman lidar (type: Polly-XT) which measures profiles of the backscatter coefficient at three wavelengths, of the extinction coefficient and of the depolarisation at two wavelengths as well as of the water-vapour mixing ratio. The portable lidar Polly performed 24/7 measurements aboard *Polarstern*, whenever the weather conditions were appropriate. Aerosol particle optical properties in terms of the particle backscatter and extinction coefficient can be determined directly and serve as input for height-resolved inversion methods to estimate the main microphysical properties (e.g. size distribution) at any measured height. Thus, lofted free-tropospheric aerosol layers can be characterized separately from the marine boundary layer. Typical known free-tropospheric aerosols are anthropogenic emissions from North America, dust from the Saharan region or smoke from biomass burning in Central Africa. These aerosols can be lifted up above land and are transported over the Atlantic Ocean for several days. During this transport aerosols influence the radiation budget of the Earth.

Thus, the height-resolved information as derived from lidar is a crucial input for radiative transfer calculations to determine the direct aerosol radiative effect more precisely. In addition, the height-resolved measurements offer the opportunity to determine the extent of simultaneously occurring clouds, as well as the clouds state of phase to investigate aerosol-cloud interactions and to determine the indirect aerosol radiative effect, which shows the highest uncertainties in climate research. Latest studies reported that even an estimation of IN is possible from depolarization lidar data.

Additionally, a microwave radiometer (type: HATPRO) is operated which measures brightness temperatures in the microwave region and uses water-vapour and oxygen absorption bands to derive integrated water vapour (IWV) and the liquid water path (LWP). In combination with the variability of the downward radiative quantities these time series make it possible to observe small scale atmospheric structures and cloud inhomogeneity.

A shadow-band radiometer is mounted to the container roof as well. This radiometer measures spectrally the down-welling radiation (diffuse and total). The instrument is running since Bremerhaven. Two all sky cameras are also mounted on the roof taking pictures every 20 sec. Also the DWD meteorological station measures standard parameters such as temperature, pressure, humidity, and solar and infrared radiation on a 1-s time basis.

Aerosol in-situ characterisation (aerosol container)

The instrumental setup deployed inside the Aerosol container is focused on the physico-chemical characterisation of the ambient marine aerosols. This time there was a special focus on the behaviour of the ambient aerosol particles in presence of water vapour to better understand their impacts on cloud formation.

Hygroscopicity properties at 90 % relative humidity (RH) are studied using a newly designed Volatility and Hygroscopicity Twin Differential Mobility Analyser (VH-TDMA) measuring the capacity of particles to absorb water at this relative humidity.

The ability of ambient aerosol particles to form cloud droplets or ice crystals are measured using 2 sets of instruments. First, a one column Cloud Condensation Nuclei counter (CCNc) of DMT measures the size spectra of aerosol particles that activate to a cloud droplet. The size-segregated CCN measurements are conducted at super saturations of 0.1 %, 0.15 %, 0.2 %, 0.3 %, 0.5 % and 0.7 % with respect to water. Second, the DMT Spectrometer for Ice Nuclei (SPIN) counts the number concentration of particles able to serve as IN. SPIN operates on the principle of a Continuous Flow Diffusion Chamber (CFDC). This allows to investigate the ice nucleating properties of the ambient aerosol in a wide range of temperature and humidity. To cover different ice nucleation modes measurements between -25 °C and -42 °C are conducted in sub as well as supersaturated regimes with respect to water.

To fully exploit hygroscopicity, CCN and IN measurements, a detailed picture of the aerosol size distribution and chemical composition is required as well. For that, particle number size distribution is measured by a Scanning Mobility Particle Sizer (SMPS) ranging from 10 to 800 nm in diameter completed by an Aerodynamic Particle Sizer (APS) ranging from 600 nm to approximately 3 µm in diameter corresponding to the upper cut size of the inlet. The combination of the spectral measured CCN number concentration and the size distribution allows the application of the Kappa-Köhler theory in order to determine Kappa. Kappa values are used to explore the hygroscopicity of the aerosol along the cruise track. Two different approaches are used to provide the particle chemical composition. A classical off-line system collecting aerosol particles on a filter for later analysis in the laboratory. Two offline systems

are deployed. A PM_1 high volume sampler (DIGITEL), which is continuously sampling during 24h from mid-night to mid-night on a quartz fiber filter with an upper cut size of 1 µm. This instrument is also equipped with a wind sensor to automatically pause measurements when relative wind is coming from the back of the ship in order to avoid contaminations by the ship's engine exhaust. Samples will later be analysed by a state-of-the-art analytical instrumentation including for example LC-MS, GC-MC to identify individual chemical species like water soluble ions, OC/EC, dicarboxylic acids, amines, aldehydes, etc. In addition, filter samples can be used for off-line ice nucleation experiments to determine the concentration of rare high-temperature IN. A drop freezing array (equipped with an ethanol bath thermostat) is used to expose filter snippets immersed in water-filled tubes to temperatures down to -25 °C. The second off-line system is a mini 3-stage impactor system measuring 2 times 5 min every day (09:00 and 16:00 UTC). Samples will be later analysed by electronic microscopy in order to provide chemical and structure information on individual particles. On line size resolved chemical composition of the aerosol particle is obtained using an Aerosol Mass Spectrometer (AMS) measuring non-refractory PM_1 components (i.e. organic, sulfate, nitrate, ammonium and chloride) with a time resolution of 2 min. Additionally, an Integrated Three-Wavelengths Nephelometer and a Multi Angle Absorption Photometer (MAAP) as well as a Particle Soot Absorption Photometer (PSAP) were operated simultaneously to characterize the particle optical properties. They measure the particle scattering and absorption coefficient and the black-carbon concentration.

Fig. 4.1: The OCEANET container with the laser beam was installed at the Helideck

Work at sea

Remote sensing

The OCEANET container includes several instruments for the optical characterisation of aerosols and clouds. The measurements were taken en-route and are not depending on any station work. The instrument container was setup on 28 October in Bremerhaven after the helicopters were stored in the hangar. After installation the container was connected to the ships power grid. Two 32A cables are required. The UV1 cable is connected directly to the ships grid (A/C, water chiller, blowers), while the UV2 cable is connected to the ships UPS system (all instruments). A 32A connector is not available at the Helideck, so that a 16 A-to-32 A adapter was used. It was found that the 3-phase 16 A is enough for the instruments as they are distributed equally over all 3 power phases.

The system was taken into operation in the night to 29 October. It was found that the container must have experienced a rough transport. The main lidar computer did jump out of its location resulting in some ripped cables. These cables could be fixed with little effort. But unfortunately the Glan-Tayler polarizer, which cleans the laser polarisation, fell out of its mount and cracked somewhat. Within the short timeframe it was only possible to glue this crystal back to its place. In this procedure the proper alignment of the polarizer was lost. Finally, at the stop in Las Palmas this polarizer could be properly replaced. Later studies have to show how reliable the lidar data were between Bremerhaven and Las Palmas.

HATPRO was calibrated with liquid nitrogen (25L) in the morning of 29 October in the harbour. The procedure went as planned and the radiometer is measuring continuously.

Regular maintenance procedures included daily cleaning of the radiation sensors and the All-Sky-Camera dome. The lidar window was also cleaned on a regular basis depending on obvious sea-spray or other contamination. Starting from 23 November the lidar was turned off for 2-3h during noon because of high Sun elevation. Direct sunlight must be prevented from entering the 30-cm telescope.

Measurements with the MICROTOPS sun photometer were performed on a regular basis whenever clear-sky conditions prevailed. Several scientists shared this manual measurement task.

Aerosol in-situ characterisation

The Aerosol container was set up starting from 27 October after loading at the “Peildeck” was finished. The container was taken into operation by the TROPOS setup team. The inlet was mounted, the container was connected to power and network, and the individual instruments were connected to the aerosol distribution system.

Most data are available from 31 October. Table 4.1 summarizes all the scientific instrumentation deployed on the Aerosol Container to characterize marine aerosol including time resolution and working period. Unfortunately, due to technical issues, the AMS only started measuring after the delivery of a spare acquisition card at our stop in Las Palmas on 10/11/2015.

Regular maintenance tasks included butanol and water refill, replacing aerosol dryers, regenerating silica gel in the oven located in the wet lab 1 and instrument calibration. While most setups are able to run continuously, the SPIN experiment has to be restarted every 4-8 hours.

Tab. 4.1: Overview of the scientific instruments deployed on the Aerosol Container during the PS95 *Polarstern* cruise

Instruments	Time Resolution	Data Availability
Scanning Mobility Particle Sizer (SMPS)	5 min	31.10.2015 – 29.11.2015
Aerodynamic Particle Sizer (APS)	5 min	31.10.2015 – 29.11.2015
Condensation Particle Counter (CPC)	5 min	31.10.2015 – 29.11.2015
Volatility Hygroscopicity Twin Scanning Mobility Particle Sizer (VH-TSMPS)	120 min	01.11.2015 – 29.11.2015
Aerosol Mass Spectrometer (AMS)	2 min	11.11.2015 – 29.11.2015
Cloud Condensation Nucleus Counter (CCNC)	5 min	31.10.2015 – 29.11.2015
Scanning Mobility Particle Sizer for CCNC	5 min	31.10.2015 – 29.11.2015
Ice Nucleus Counter (SPIN)	8 hours	31.10.2015 – 29.11.2015
Particle Soot Absorption Photometer (PSAP)	1 min	02.11.2015 – 29.11.2015
Multi Angle Absorption Photometer (MAAP)	1 min	31.10.2015 – 29.11.2015
Nephelometer	1 min	31.10.2015 – 29.11.2015
High Volume Filter Sampler PM_1 (Digitel)	24 hours	31.10.2015 – 29.11.2015

Preliminary and expected results

Remote sensing

After leaving Bremerhaven in foggy conditions the weather in the North Sea and in the English Channel was dominated by clouds and rain. Many low clouds and precipitation events were observed with the lidar. Fig. 4.2 presents the lidar quicklooks of the range-corrected signal at 1,064 nm and the volume depolarization ratio at 532 nm wavelength. At 9 October the lidar could detect a lofted plume of Saharan dust above the marine boundary layer. The plume extended from 600 m to 3 km height. The lidar was turned off in the port of Las Palmas. At leaving the shore of Gran Canary the lidar was turned on again and could further observe the dust. Around 12 October the lidar shows increased depolarization in the marine boundary layer, which occurred because of the down-mixing/deposition of dust from the higher layer. The visibility was < 10 km at the surface. The dust top height decreased down to 1.4 km height on 13 October. On 14 October a new plume, which extended up to 3.5 km height was observed. The ship steadily moved and crossed the plume in southward direction so that in the evening of 18 October the region of dust was left behind. After that, marine *stratocumulus* occurred frequently and the visibility increased to >30 km on 23 October. The conditions changed to clean-marine type in the boundary layer. Around noon on 23 October minor traces of dust could be observed again between 1 and 4 km. Apparently, MACC simulations showed that this dust departed Kalahari several 5-8 days ago in northwesterly directions. Then the circulation pattern changed to northwesterly winds above 1 km. Most likely this direction change now brought the Kalahari dust back to the position of *Polarstern*. From 24 October mostly overcast sky was predominant.

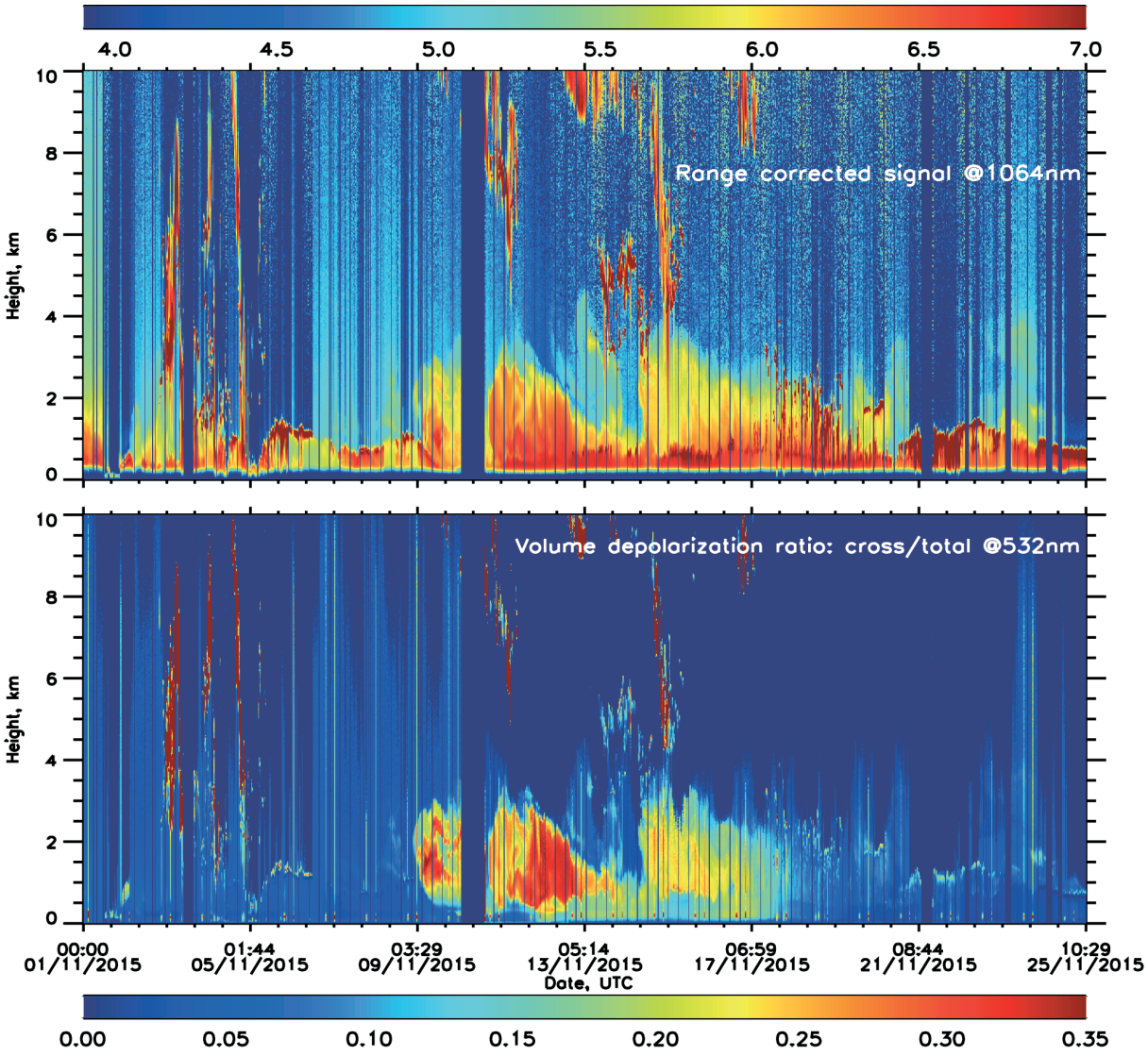

Fig. 4.2: Range-corrected lidar signal at 1,064 nm wavelength (top) and volume depolarization ratio at 532 nm wavelength (bottom)

The microwave radiometer HATPRO measured the integrated water vapour and the liquid water path along the cruise. Fig. 4.3 shows a quick look of these data. The data still have to be reprocessed with the proper retrieval algorithms for finalization. It can already be seen that RV *Polarstern* has crossed the tropical latitudes around 14 - 23 November when the integrated water vapour increased almost by a factor of two to 50 kg/m².

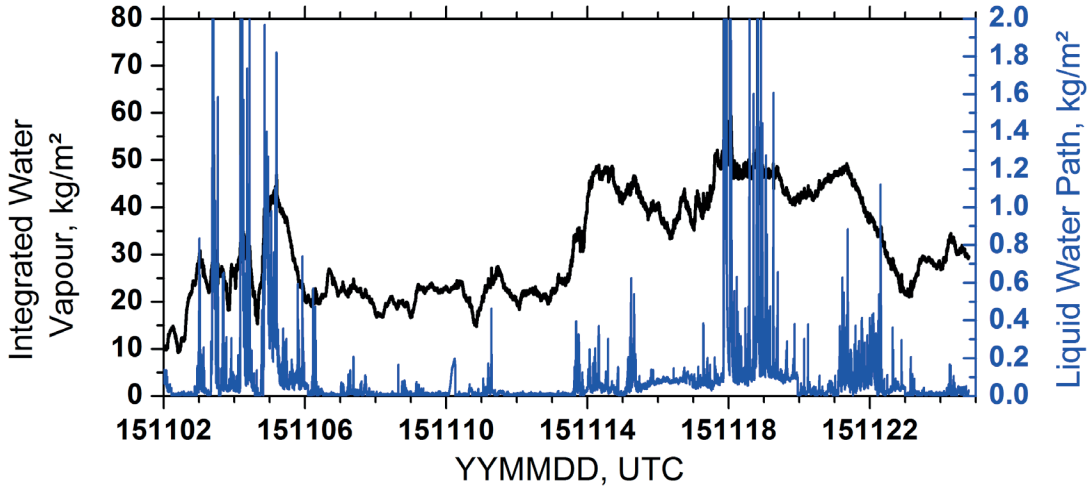

Fig. 4.3: Liquid-water path and integrated water vapour during PS95 measured with the microwave radiometer HATPRO

Measurements with the MICROTOPS sun photometer have already been processed (Level 1.5) at the MAN and are shown in Fig. 4.4. The period of prominent dust observations 10 – 20 November can be identified by the increased Aerosol Optical Depth (AOD) and by the low Ångström exponent (0.1 - 0.4). At the same time, the coarse-mode fraction of the aerosol extinction is also increased, although most likely the dust occurred vertically stratified with additional biomass-burning aerosol, especially after 17 November as indicated by the increasing Ångström exponent. Detailed analysis of lidar/sun photometer combination techniques will be applied for further studies. Also the capability to obtain AOD from the automatic shadow-band radiometer measurements on a ship-based platform will be further explored.

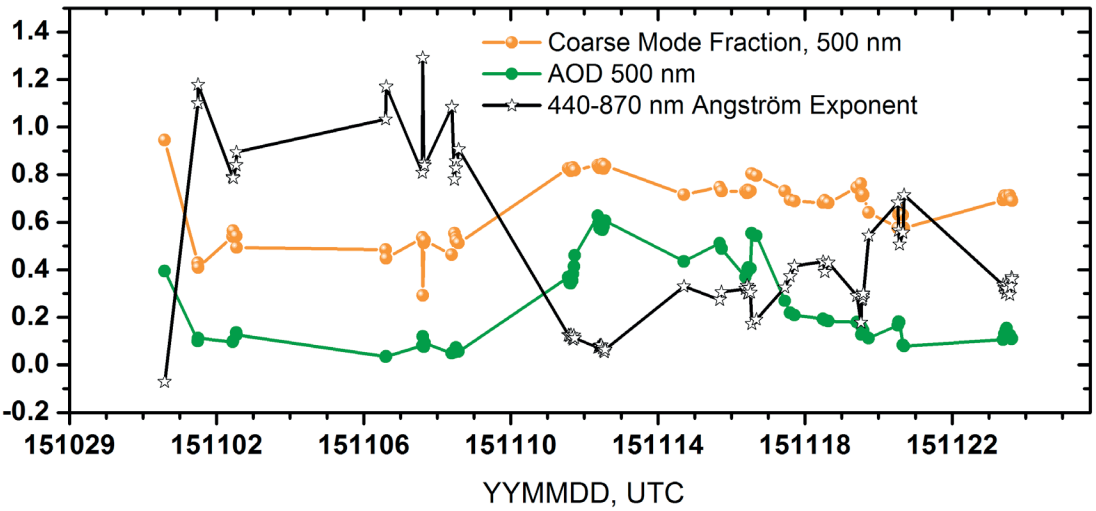

Fig. 4.4: Aerosol Optical Depth at 500 nm, derived coarse-mode fraction, and Ångström exponent measured with Microtops. Shown are Level 1.5 data from the MAN network.

In terms of ice-nuclei estimation, a method to separate dust from non-dust particles with lidar depolarization measurements will be applied. A temperature dependent parameterization for IN estimation from the dust concentration can be used to link the results to the surface based measurements.

Aerosol in-situ characterisation

A quick analysis of the data was made every day to ensure that our instruments were working properly and to provide a first idea on the aerosol properties. The PS95 cruise was characterized by a prominent (in terms of both intensity and duration) Saharan dust event starting few days before reaching the Canary Islands until we passed the Cap Verde Islands. This event was directly followed by a continental pollution episode starting around 16 November. Finally aerosol origin slowly moved to clean marine air masses when approaching the equator. The Fig. 4.5 presents preliminary results for these three periods illustrating changes in aerosol composition and optical properties between the three previously mentioned periods.

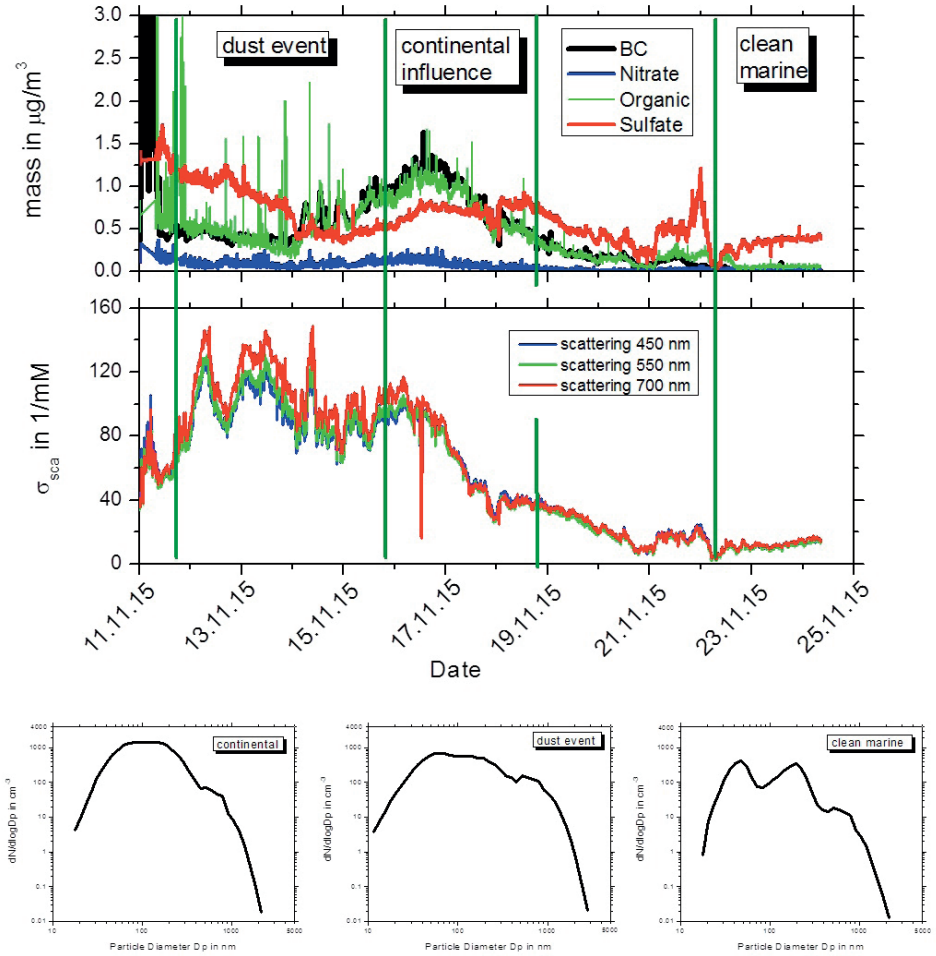

Fig. 4.5: Overview of the aerosol properties for the time period 11 – 25 November 2015 including on the top panel chemical composition (BC, Organic, nitrate and sulfate) and on the middle panel the corresponding optical properties. The three bottom plots represent the typical aerosol number size distribution during the dust, continental, and clean marine periods.

The change in aerosol origin can also be observed in the CCN and IN measurements as shown in Fig. 4.6. While air masses from northern Europe and the Sahara desert are rich in IN, aerosol from marine and Central Africa show a lower concentration. The IN concentration is not directly correlated with particle number concentration. Also CCN concentrations are not influenced by the origin of air masses but a clear signal in hygroscopicity is observed. Lower Kappa values were found from 12 – 17 November when crossing the Saharan dust plume.

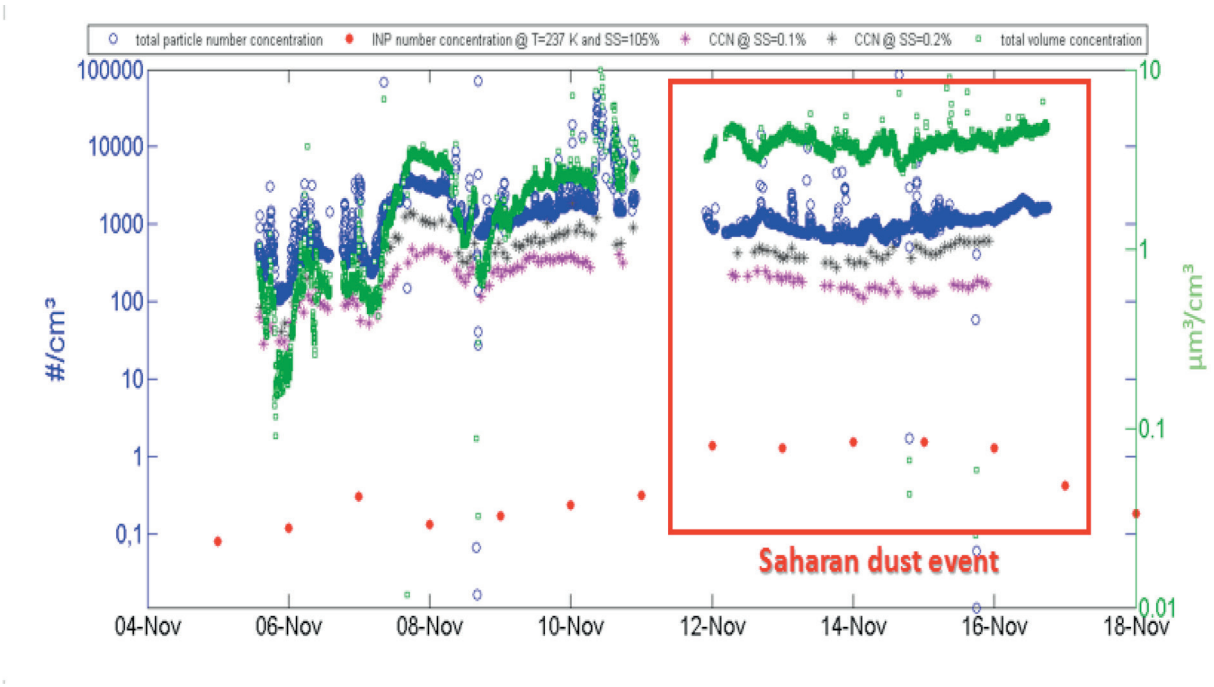

Fig. 4.6: Example time series showing the evolution of total particle, CCN at two different supersaturations and IN concentration. Note the increased volume concentration during the Saharan dust event, coinciding with an increase in IN concentration.

Data management

All remote-sensing and *in-situ* data processing will be carried out at TROPOS and in the laboratories in Leipzig. The primary address for the data access should therefore be TROPOS but as soon as the data are available they can be used by other cruise participants after request. Additionally, it is foreseen to upload the quality checked data to the PANGAEA database. However, this data processing and upload procedure might take a few months.

Finalized CCNC and IN data will be freely accessible in the ACTRIS/GASSP and BACCHUS database, respectively.

The MICROTOPS data were regularly uploaded to the AERONET-MAN (Aerosol Robotic Network, Marine Aerosol Network) website and are processed and provided from NASA Goddard.

5. CALIBRATION OF HYDROACOUSTIC SYSTEMS

Grant-No. AWI_PS95_00

5.1 Calibration of the multi-beam echo sounder ATLAS HYDROSWEEP DS 3

Ralf Krocker[1], Thomas Liebe[2], [1]AWI
Boris Dorschel[1] (not on board) [2]RFL

Objectives

In May 2015 five of six transducer elements of echo sounder system ATLAS HYDROSWEEP DS 3 (HS-DS3) were exchanged. During the following ARK season there was no possibility to execute calibration measurements. Therefore, calibration was performed during cruise PS95. As data of ARK cruises do not show artefacts indicating unadjusted mounting angles, a simple roll/pitch calibration was planned. Calibration profiles should always be measured at the default calibration location nearby Ampère Seamount.

Work at sea

Time schedule of station work provided a time window from 1 to 2 November 2015 to measure a calibration profile across the continental slope between positions 47°55' N, 008°40' W and 47°40' N, 009°14.5' W. The previous set of correction angles for roll and pitch has not been set to zero but has been retained unchanged. The profile was sailed downhill and uphill, where seafloor topography is suitable to calibrate the pitch mounting angle. On the first position, a CTD cast listed as station PS95-003/1 was lowered down to a depth of 1553 meter. CTD data of downcast were taken to calculate the sound velocity profile (Tab. 5.1). After finishing the return calibration profile and applying the new sound velocity profile, calibration was calculated with software application CARIS HIPS&SIPS 9.0. Resulting correction angle for pitch was determined as 0.00°.

The main calibration was performed at the Ampère Seamount (Fig. 5.1) on 6 November. Prior to the profiling a CTD cast was lowered. Downcast of CTD station PS95-009/1 was taken to calculate a new sound velocity profile. Roll and pitch calibration were performed between points 35°30' N, 013°16.5' W and 35°17' N, 013°21' W. Flat seafloor is required for roll calibration. An obstacle at the end of the profile in the center line was used for pitch calibration. Pitch angle was found again to be 0.00°. Roll angle was found to be -0.24°.

Preliminary (expected) results

Mounting angles of the HS-DS3 were determined as:
roll = -0.24° and pitch = 0.0°. Previous settings could hence be confirmed.

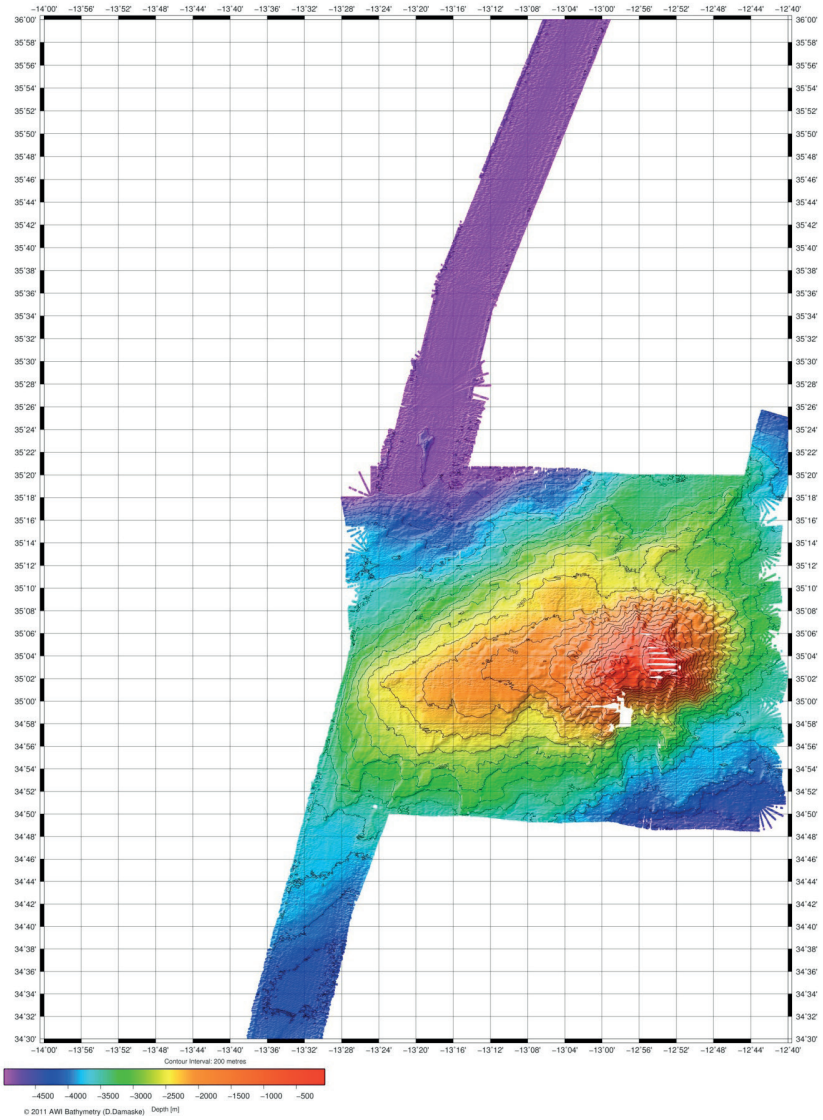

Fig. 5.1: Survey area at the Ampère Seamount

Tab. 5.1: CTD casts taken for calibration analysis

Station	Date time (begin) [UTC]	Position	Depth
PS95-003/1	2015/11/02 08:45	47°55’ N 008°40’ W	1553 m
PS95-009/1	2015/11/06 12:01	35°32’ N 013°16’ W	4776 m

Data management

As the calibration areas completely or partly cover national EEZ, data were used for calibration analysis only and will not be published.

5.2 Calibration of wave radar WAMOS II, applying wave buoy

Ralf Krocker[1], Thomas Liebe[2],
Saad El Naggar[3] (not on board)

[1]AWI
[2]RFL
[3]SELNA

Objectives

X-band radar is used to calculate sea state parameters by means of wave and current parameters. As some parameters (e.g. significant wave height) rely on the strength of the signal these values need to be calibrated. To perform calibration, a comparison of radar data with in situ measurement of a wave buoy is executed. The comparison measurement was scheduled to take place during profiling for Hydrosweep calibration, which takes several hours.

Work at sea

When reaching the calibration area, the wind speed was very low with 2 knots at maximum. X-band radar needs ripple waves to reflect signals, which only appear at wind speeds above 3 to 4 knots. As wind speed was below that threshold, the calibration could not be performed.

During the cruise there was no station time long enough to make up for this measurement.

Preliminary (expected) results

No results, because the calibration could not be executed.

5.3 Investigation of HEAVE compensation

Ralf Krocker[1], Thomas Liebe[2],
Catalina Gebhardt[1], Sebastian Albrecht[3],
Johannes Kässbohrer[3] (not on board),
Saad El Nagar4 (not on board)

[1]AWI
[2]RFL
[3]FILAX
[4]SELNA

Objectives

On board RV *Polarstern* data of the sediment echo-sounder show a wobble in seafloor and sub-seafloor sediment layering with amplitudes of several decimeters to one meter. These artefacts are significant and overlay geologic structures, and they are most likely caused by either erroneous hardware settings or erroneous data of motion/heave sensor. Hardware settings like lever arms or time latencies have been investigated and controlled extensively and could be excluded as cause. To find the reason for these artefacts, a comparison measurement between the fix installed motion sensor Ratheon Anschütz MINS II and a temporarily installed motion sensor of type HYDRINS from IXBLUE company was performed.

Temporal installation of HYDRINS was completed prior to the cruise during ship yard time in October 2015 by FIELAX Company. Teledyne ATLAS Hydrographic Company prepared the sediment echo-sounder PARASOUND and multi-beam echo sounder HYDROSWEEP to be switched manually between both motion sensors.

Work at sea

Tab. 5.2: Time intervals during which the echo-sounder received motion and heave from MINS or HYDRINS.

Von (UTC)	Bis (UTC)	Kommentar	HYDRINS GravRaum	HYDRINS Kastenkiel	Parasound-Input
21.10.2015 13:50	22.10.2015 08:20	Hafenmessung	x		MINS
26.10.2015 14:55	26.10.2015 15:25	Hafenmessung Kastenkiel		x	MINS
27.10.2015 16:15	29.10.2015 09:00	Hafenmessung	x		MINS
29.10.2015 12:00	01.11.2015 15:00	Auslaufen, Nordsee, Ärmelkanal	x		MINS
01.11.2015 15:30	01.11.2015 19:00	Biskaya	x		HYDRINS
01.11.2015 19:30	02.11.2015 18:30	Biskaya	x		MINS
02.11.2015 19:00	03.11.2015 20:00	Westspanien	x		HYDRINS
03.11.2015 20:15	04.11.2015 14:30	Westspanien	x		MINS
04.11.2015 14:35	06.11.2015 11:00	Westspanien		x	HYDRINS
06.11.2015 11:00	07.11.2015 09:10	Richtung Ampère Seamount		x	MINS
07.11.2015 09:45	09.11.2015 10:30	Ampère Seamount	x		MINS

Measurements were carried out between departing harbour Bremerhaven and port of call Las Palmas de Gran Canaria from October 29, 2015 to November 07, 2015. Approaching Las Palmas, the second motion sensor HYDRINS was deinstalled and packed for backhaul.

The data logger was continuously logging roll, pitch, heave and heading from MINS, MINS Interface and HYDRINS sensor. The motion data source for PARASOUND echo-sounder were changed as can be seen in Table 5.1.

If a wobble can be seen in PARASOUND data, it is an indication for wrong motion/heave data from responsible motion sensor.

Preliminary (expected) results

Fig. 5.2 exemplarily shows an excerpt of ten seconds of MINS, MINS Interface and HYDRINS data as well as the difference between MINS Interface and HYDRINS data. As can be seen, the MINS sensor is providing heave data with 200 Hz resulting in a smooth curve. HYDRINS is providing heave data with 50 Hz resulting in a smooth curve as well. In opposite to that, MINS Interface is providing heave data with 5 Hz only causing a stepwise curve.

The most important result is that MINS and HYDRINS curves do not coincide but show a time shift and varying amplitudes. The difference between MINS Interface and HYDRINS is displayed as cyan serrated curve. Unfortunately, the shift and offset are not static in time and amplitude so they cannot be seen as systematic error and thus not be eliminated by change of settings in the echo-sounder.

Fig. 5.3 displays the residual seafloor topography (red line) as determined from the echo-sounder PARASOUND PHF signal along with the difference between the MINS Interface and HYDRINS heave data. Both lines coincide surprisingly well. This indicates that the wobble artefacts are most likely caused by a time lag of heave data fed into the PARASOUND echo-sounder.

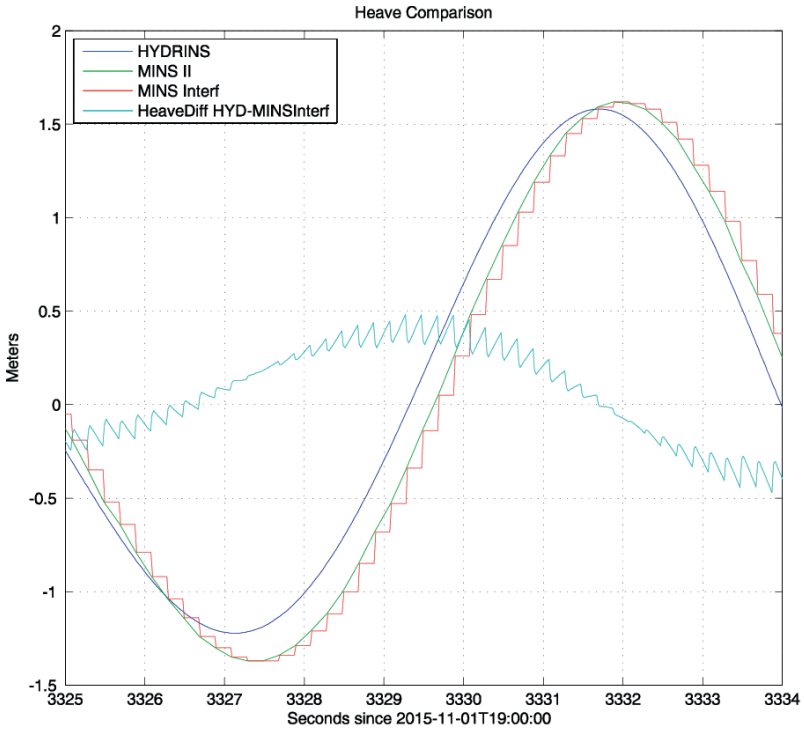

Fig. 5.2: Heave data from both motion sensors (blue, green and red curves) and difference between heave data from MINS Interface and HYDRINS (cyan curve)

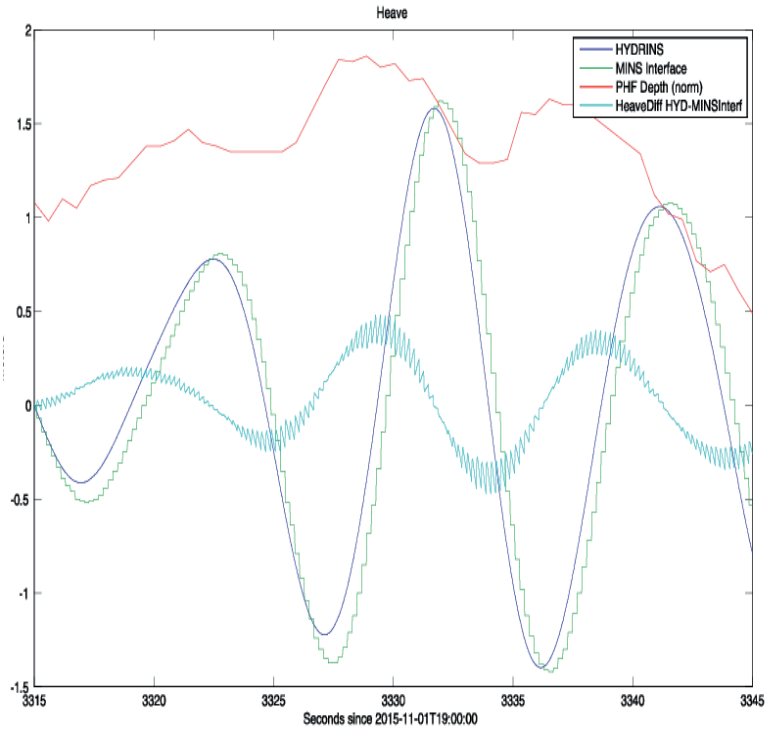

Fig. 5.3: Residual seafloor topography as determined from PARASOUND PHF data (red line), heave data from MINS Interface and HYDRINS (green and blue lines, respectively), and their difference (HYDRINS minus MINS Interface data, cyan line). Note how well the heave difference mimics seafloor topography.

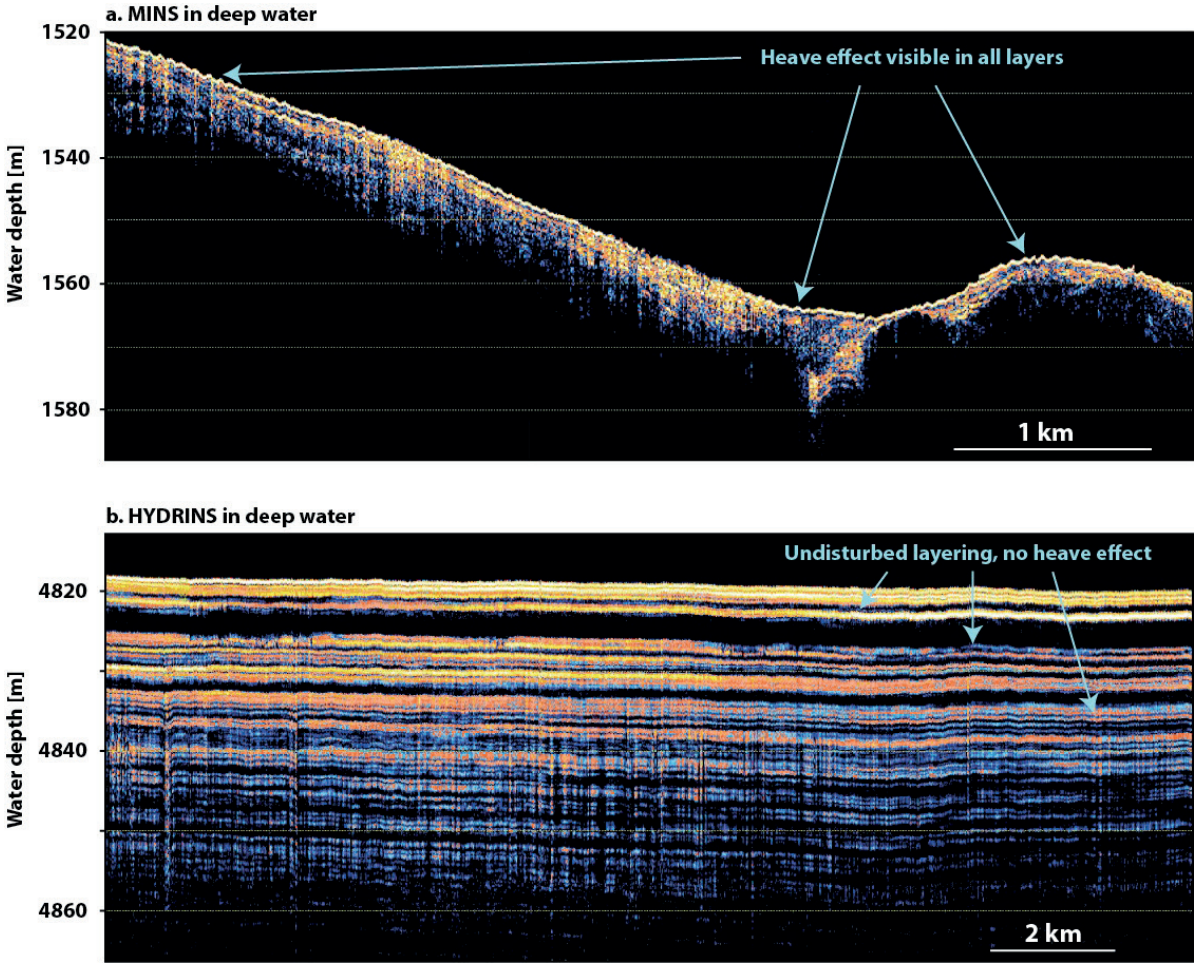

Fig. 5.4: Comparison of PARASOUND data (seafloor topography and sub seafloor sediment layers) from deep water applying motion data of MINS Interface (above) and HYDRINS (below). Wobble artefacts are clearly visible in the upper and absent in the lower panel.

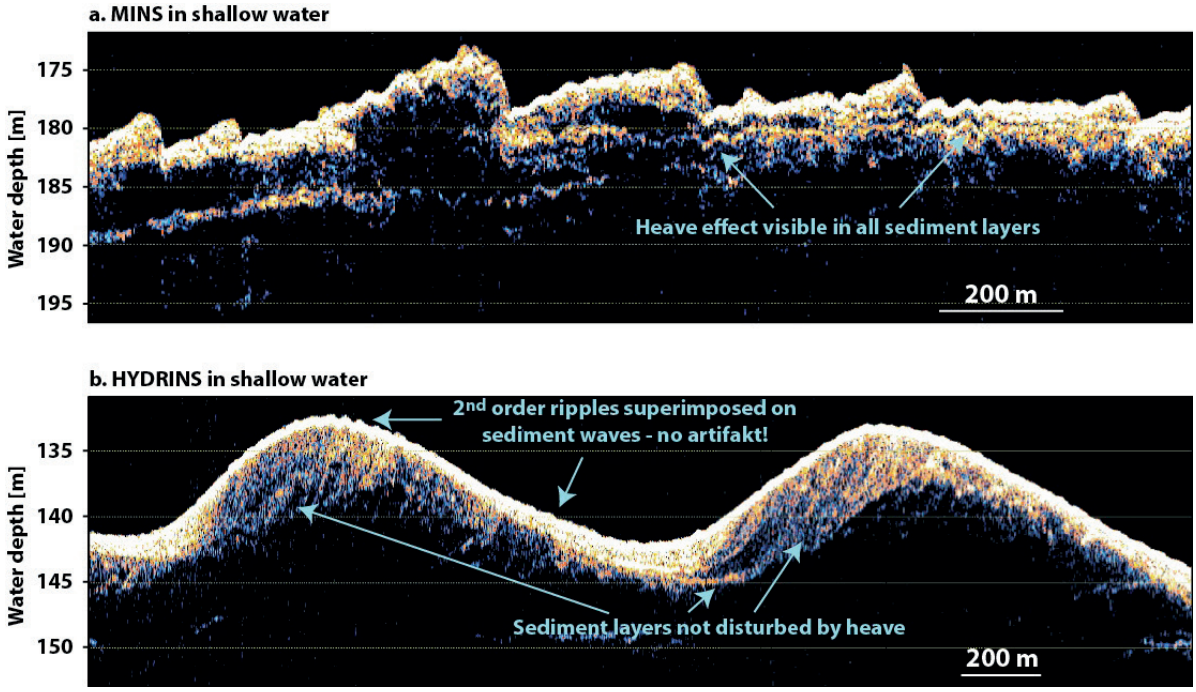

Fig. 5.5: Comparison of PARASOUND data (seafloor topography and sub seafloor sediment layers) from shallow water applying motion data of MINS Interface (above) and HYDRINS (below). Wobble artefact is clearly visible in the upper panel in all layers, while the undulating seafloor topography in the lower panel is real.

Fig. 5.4 and 5.5 show the seafloor topography as well as sub seafloor sediment layers as detected by echo-sounder PARASOUND in deep water and shallow water, respectively.

As can be seen in upper panels of both figures, the wobble artefacts indicated by undulating sediment layers appear in both the seafloor topography and the sediment layers. From a geological point of view, it is highly unlikely that these are real features. In the lower panel of both figures, sediment layers are smooth, even when the seafloor topography shows dunes that are even superimposed by second-order ripples.

The undulating features can be correlated with the difference between heave values of MINS Interface and HYDRINS and do not appear in sediment data referenced with HYDRINS motion but appear in sediment data referenced with MINS motion.Tthe heave values from MINS seem to be erroneous with a (non-static) time lag.

Data management

Motion data used for this sensor test are archived on the internal file server of the Geophysics section at AWI only. Data are not intended to be published.

5.4 Calibration of the scientific multi-frequency echo-sounder Simrad EK60/80 and testing of newly installed Wideband-Transceivers

Sören Krägefsky1, Werner Dimmler[2], [1]AWI
Thomas Feiertag[2] [2]RFL

Objectives

Active hydroacoustic measurements allow for surveying the distribution of organisms in the size range of small macrozooplankton to large nekton with a very high temporal and spatial resolution. This cannot be achieved by any other survey method. In fishery science, hydroacoustic surveys are defined as the standard stock assessment tool for purpose of fisheries management, including krill stock assessment and management in the Antarctic Ocean. On board RV *Polarstern*, a Simrad EK60 scientific multi-frequency echo-sounder with frequencies of 18, 38, 70, 120, 200 kHz is used for these survey tasks. Recently, two Simrad EK 80 Wide Band Transceivers (WBT) were installed, operating within the frequency band of 45-90 kHz and 95-160 kHz, respectively, using existing 70 kHz and 120 kHz Transducers (Simrad EK60).

The backscatter characteristics of different marine organisms is a function of their shape, size and material properties and sound frequency, causing characteristic species or group specific differences in backscattering properties at different frequencies. These differences are used for species (or organism group) discrimination and identification. In order to be able to compare measurements at the different frequencies for species identification and to derive reliable stock estimates, a proper calibration of the echo-sounder is needed. The Simrad EK60 calibration is performed by measuring the backscattering strength (target strength) of spheres with known target strength. For a reliable calibration, a sufficient number of measurements covering the full area of the sound beam is required. Due to the shape and dimensions of RV *Polarstern*, such calibration is a demanding and time-consuming task. A system for supporting calibration of the Simrad EK60 was developed, allowing for a semi-automatic calibration of the Simrad EK60 or similar echo sounders while facilitating the calibration process. The calibration unit consists of a deck unit and electronically controlled underwater winches. Due to the synchronized software-controlled operation of these winches, it is possible to exactly control the position of the calibration sphere in the sound beam of the echo sounder under the ship's hull.

Aim of the calibration procedure during the cruise was to gain a proper calibration of the Simrad EK60, giving priority to the recently replaced 38 kHz transducer. Additionally, the calibration procedure serves calibration and testing of the newly installed Wideband-Transceivers (EK80). These transceivers allow for measurements over a wide sound frequency band, improving, among others, the ability for species identification of backscattering organisms.

Work at sea

Calibration attempts were made on 14 November. and 16 November 2015 in front of the island Santiago (Cape Verde) and in the open ocean, respectively. On 14 November, an underwater winch got damaged due to a very high tensile load exposed to during a ships manoeuvre, causing an abort of the calibration.

After repair of the underwater winch, a second calibration attempt was carried out on 16 November (open ocean). In the early stage of calibration, condition deteriorated increasingly due to increasing amount of unwanted backscatters in the depth horizon of the calibration sphere, allowing no proper calibration of the echo sounder (EK60, EK80). Consequently, there was also an abort of the second calibration attempt. Due to time constraints no further calibration could be carried out during the cruise.

During the cruise leg from Las Palmas to Cape Town there was extensive testing of the new Simrad EK80 hard- and software, addressing its stability and measuring performance and ship's influence on measurements within the operating frequency band of the WBTs. Tests were performed with varying pulse type and length and frequency band settings, among other transceiver settings. Operation of the EK80 was performed over long periods in triggered mode, allowing for synchronisation with other echo-sounders, using the Kongsberg Ksync-Unit for synchronisation purpose. Measurements were made in passive and active measuring modes. Noise floor signatures were analysed. Inference patterns with other echo-sounders were addressed for the ADCP, used for continuous measurements, and Doppler Log, routinely used for measuring ships motion relative to the water.

Measuring performance could only be tested to a limited extent due to the lack of measurements under controlled condition (calibration) or of otherwise known backscatters with known backscattering signatures.

Preliminary results

There were repetitive communication problems between EK80 Software (operating PC) and transceiver units (WBTs, GPTs) at start and during operation of the EK80. However, the EK80 shows otherwise stable operation during the cruise. Noise floor measurements of ship-generated noise within the operating frequency band of the WBTs show some distinct pattern including two singular narrow band peaks, needing further investigation. Dolog operation has strong impact on the EK80 measurements, causing strong interferences. Compared to it, impact of the ADCP is much smaller.

So far, analysis of the data measured with the EK80 Wideband Transceiver during the cruise confirms the expected improved measuring capabilities of the echo sounder.

Data management

No scientific data were produced by calibration measurements

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GMIT	Galway Mayo Institute of Technology Westport Road, Castlebar, Co. Mayo, Ireland
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31	Maxwell	Hugo	UiB	Student	Biology
32	Mc Gee	Donal	IT Sligo	Student	Biology
33	McGrane	Pauhla	MIG	Scientist	Oceanography
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1	Engelmann	Ronny	TROPOS	Scientist	Physics
2	Krägefski	Sören	AWI	Scientist	Biology
3	Lochte	Karin	AWI	Chief Scientist	Biology
4	Merk	Daniel	TROPOS	Student	Physics

A.3 SCHIFFSBESATZUNG / SHIP'S CREW PS95.1

No.	Name	Rank
1	Wunderlich,Thomas	Master
2	Pohl,Klaus	Doctor
3	Spielke,Steffen	ChiefMate
4	Fallei,Holger	2nd Mate
5	Kentges,Felix	2nd Mate
6	Langhinrichs,Moritz	2nd Mate
7	Westphal, Henning	Chief Eng.
8	Buch, Erik-Torsten	2nd Eng.
9	Rusch,Torben	2nd Eng.
10	Schnürch,Helmut	2nd Eng.
11	Brehme,Andreas	E Eng.
12	Hofmann,Jörg	Chief ELO
13	Christian,Boris	ELO
14	Dimmler, Werner	ELO
15	Feiertag,Thomas	ELO
16	Winter,Andreas	ELO
17	Schröter,Rene	Boatsw.
18	Neisner, Winfried	Carpen.
19	Burzan, Gerd-Ekkeh.	A.B.
20	Clasen,Nils	A.B.
21	Gladow,Lothar	A.B.
22	Hartwig-Labahn,Andre	A.B.
23	Kretzschmar,Uwe	A.B.
24	Müller,Steffen	A.B.
25	Schröder, Norbert	A.B.
26	Sedlak, Andreas	A.B.
27	Beth, Detlef	Storek.
28	Dinse,Horst	MM
29	Klein, Gert	MM
30	Krösche, Eckard	MM
31	Plehn,Markus	MM
32	Watzel,Bernhard	MM
33	Redmer,Klaus-Peter	Cook
34	Möller, Wolfgang	Cooksmate
35	Tupy,Mario	Cooksmate
36	Wartenberg,Irina	Chief Stew.
37	Schwitzky-Schwarz,Carmen	StwdssiNurse
38	Chen,Quan Lun	2nd Stew.
39	Chen,Ting Dong	2nd Stew.
40	Duka,Maribei	2nd Stew.
41	Hischke,Peggy	2nd Stew.
42	Hu, Guo Yong	2nd Stew. .
43	Ruan,Hui Guang	Laudrym

SCHIFFSBESATZUNG / SHIP'S CREW PS95.2

No.	Name	Rank
1	Wunderlich, Thomas	Master
2	Pohl, Klaus	Doctor
3	Spielke,Steffen	ChiefMate
4	Fallei,Holger	2nd Mate
5	Kentges, Felix	2nd Mate
6	Langhinrichs,Moritz	2nd Mate
7	Westphal,Henning	Chief Eng.
8	Buch, Erik-Torsten	2nd Eng.
9	Rusch,Torben	2nd Eng.
10	Schnürch,Helmut	2nd Eng.
11	Brehme,Andreas	E Eng.
12	Hofmann,Jörg	Chief ELO
13	Dimmler, Werner	ELO
14	Feiertag,Thomas	ELO
15	Ganter, Armin	ELO
16	Winter, Andreas	ELO
17	Schröter, Rene	Boatsw.
18	Neisner, Winfried	Carpen.
19	Burzan,Gerd-Ekkeh.	A.B.
20	Clasen, Nils	A.B.
21	Gladow, Lothar	A.B.
22	Hartwig-Labahn, Andre	A.B.
23	Kretzschmar, Uwe	A.B.
24	Müller,Steffen	A.B.
25	Schröder,Norbert	A.B.
26	Sedlak, Andreas	A.B.
27	Beth,Detlef	Storek.
28	Dinse, Horst	MM
29	Klein, Gert	MM
30	Krösche, Eckard	MM
31	Plehn, Markus	MM
32	Watzel, Bernhard	MM
33	Redmer, Klaus-Peter	Cook
34	Tupy, Mario	Cooksmate
35	Wartenberg, Irina	ChiefStew.
36	Schwitzky-Schwarz,Carmen	StwdssiNurse
37	Chen, Quan Lun	2nd Stew.
38	Chen, Ting Dong	2nd Stew.
39	Duka,Maribel	2nd Stew.
40	Hischke,Peggy	2nd Stew.
41	Hu, Guo Yong	2nd Stew.
42	Möller, Wolfgang	2nd Stew.
43	Ruan, HuiGuang	Laudrym.

A.4 STATIONSLISTE / STATION LIST PS95

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0001-1	31.10.2015	08:01	XBT	in the water	50° 34,11' N	000° 18,68' E	48,3
PS95/0001-1	31.10.2015	08:01	XBT	on ground/ max depth	50° 34,11' N	000° 18,68' E	48,3
PS95/0001-2	31.10.2015	08:04	BUCKET	in the water	50° 34,04' N	000° 18,22' E	49,9
PS95/0001-2	31.10.2015	08:05	BUCKET	on ground/ max depth	50° 34,01' N	000° 18,07' E	50,7
PS95/0001-2	31.10.2015	08:05	BUCKET	on deck	50° 34,01' N	000° 18,07' E	50,7
PS95/0001-1	31.10.2015	08:06	XBT	on deck	50° 33,99' N	000° 17,92' E	50,1
PS95/0002-1	01.11.2015	08:05	CTD/RO	in the water	49° 02,10' N	005° 59,40' W	111,0
PS95/0002-1	01.11.2015	08:16	CTD/RO	on ground/ max depth	49° 02,08' N	005° 59,40' W	110,0
PS95/0002-1	01.11.2015	08:18	CTD/RO	hoisting	49° 02,09' N	005° 59,41' W	154,0
PS95/0002-1	01.11.2015	08:26	CTD/RO	at surface	49° 02,10' N	005° 59,40' W	108,0
PS95/0002-1	01.11.2015	08:28	CTD/RO	on deck	49° 02,09' N	005° 59,38' W	111,0
PS95/0002-2	01.11.2015	08:52	BONGO	in the water	49° 02,09' N	005° 59,36' W	164,0
PS95/0002-2	01.11.2015	08:56	BONGO	on ground/ max depth	49° 02,07' N	005° 59,38' W	115,0
PS95/0002-2	01.11.2015	08:56	BONGO	action	49° 02,07' N	005° 59,38' W	115,0
PS95/0002-8	01.11.2015	09:04	CPR	on ground/ max depth	49° 01,98' N	005° 59,47' W	107,0
PS95/0002-2	01.11.2015	09:06	BONGO	action	49° 01,95' N	005° 59,49' W	109,0
PS95/0002-2	01.11.2015	09:07	BONGO	hoisting	49° 01,94' N	005° 59,51' W	109,0
PS95/0002-2	01.11.2015	09:08	BONGO	at surface	49° 01,93' N	005° 59,51' W	109,0
PS95/0002-2	01.11.2015	09:11	BONGO	on deck	49° 01,93' N	005° 59,53' W	108,0
PS95/0002-3	01.11.2015	09:19	BONGO	in the water	49° 01,92' N	005° 59,50' W	108,0
PS95/0002-7	01.11.2015	09:20	PLA	in the water	49° 01,92' N	005° 59,50' W	107,0
PS95/0002-7	01.11.2015	09:22	PLA	on ground/ max depth	49° 01,91' N	005° 59,50' W	109,0
PS95/0002-7	01.11.2015	09:25	PLA	on deck	49° 01,90' N	005° 59,52' W	109,0
PS95/0002-3	01.11.2015	09:26	BONGO	on ground/ max depth	49° 01,90' N	005° 59,52' W	106,0
PS95/0002-3	01.11.2015	09:26	BONGO	hoisting	49° 01,90' N	005° 59,52' W	106,0
PS95/0002-3	01.11.2015	09:32	BONGO	at surface	49° 01,88' N	005° 59,53' W	109,0
PS95/0002-3	01.11.2015	09:37	BONGO	on deck	49° 01,88' N	005° 59,55' W	108,0
PS95/0002-4	01.11.2015	09:42	CALCOFI	in the water	49° 01,88' N	005° 59,55' W	106,0
PS95/0002-4	01.11.2015	09:48	CALCOFI	on ground/ max depth	49° 01,85' N	005° 59,56' W	107,0
PS95/0002-4	01.11.2015	09:48	CALCOFI	hoisting	49° 01,85' N	005° 59,56' W	107,0
PS95/0002-4	01.11.2015	09:55	CALCOFI	at surface	49° 01,82' N	005° 59,57' W	110,0
PS95/0002-4	01.11.2015	09:58	CALCOFI	on deck	49° 01,80' N	005° 59,58' W	107,0
PS95/0002-5	01.11.2015	09:59	CALCOFI	in the water	49° 01,79' N	005° 59,58' W	108,0
PS95/0002-5	01.11.2015	10:06	CALCOFI	on ground/ max depth	49° 01,75' N	005° 59,60' W	128,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0002-5	01.11.2015	10:06	CALCOFI	hoisting	49° 01,75' N	005° 59,60' W	128,0
PS95/0002-5	01.11.2015	10:11	CALCOFI	at surface	49° 01,72' N	005° 59,61' W	108,0
PS95/0002-5	01.11.2015	10:14	CALCOFI	on deck	49° 01,70' N	005° 59,62' W	108,0
PS95/0002-6	01.11.2015	10:36	CTD/RO	in the water	49° 01,63' N	005° 59,71' W	107,0
PS95/0002-6	01.11.2015	10:42	CTD/RO	on ground/ max depth	49° 01,60' N	005° 59,75' W	107,0
PS95/0002-6	01.11.2015	10:44	CTD/RO	hoisting	49° 01,59' N	005° 59,76' W	107,0
PS95/0002-6	01.11.2015	10:50	CTD/RO	at surface	49° 01,55' N	005° 59,79' W	107,0
PS95/0002-6	01.11.2015	10:51	CTD/RO	on deck	49° 01,54' N	005° 59,80' W	107,0
PS95/0002-8	01.11.2015	11:02	CPR	in the water	49° 01,31' N	006° 00,44' W	106,0
PS95/0002-8	02.11.2015	08:20	CPR	hoisting	47° 54,04' N	008° 40,09' W	0,0
PS95/0002-8	02.11.2015	08:27	CPR	on deck	47° 54,69' N	008° 40,25' W	1686,2
PS95/0003-1	02.11.2015	08:42	CTD/RO	in the water	47° 55,05' N	008° 40,06' W	1723,2
PS95/0003-2	02.11.2015	08:48	BUCKET	in the water	47° 55,04' N	018° 40,07' W	1707,0
PS95/0003-2	02.11.2015	08:48	BUCKET	on ground/ max depth	47° 55,04' N	018° 40,07' W	1707,0
PS95/0003-2	02.11.2015	08:49	BUCKET	on deck	47° 55,04' N	018° 40,07' W	1703,0
PS95/0003-1	02.11.2015	09:20	CTD/RO	on ground/ max depth	47° 55,02' N	008° 40,08' W	1705,0
PS95/0003-1	02.11.2015	09:28	CTD/RO	hoisting	47° 55,04' N	008° 40,08' W	1705,7
PS95/0003-1	02.11.2015	10:11	CTD/RO	at surface	47° 55,10' N	008° 40,11' W	1704,2
PS95/0003-1	02.11.2015	10:13	CTD/RO	on deck	47° 55,11' N	008° 40,12' W	1763,5
PS95/0003-3	02.11.2015	10:32	BONGO	in the water	47° 55,14' N	008° 40,17' W	1623,5
PS95/0003-3	02.11.2015	10:33	BONGO	on ground/ max depth	47° 55,14' N	008° 40,17' W	1678,2
PS95/0003-3	02.11.2015	10:43	BONGO	action	47° 55,27' N	008° 40,09' W	0,0
PS95/0003-3	02.11.2015	10:43	BONGO	hoisting	47° 55,27' N	008° 40,09' W	0,0
PS95/0003-3	02.11.2015	10:44	BONGO	at surface	47° 55,28' N	008° 40,09' W	1704,7
PS95/0003-3	02.11.2015	10:49	BONGO	on deck	47° 55,30' N	008° 40,09' W	1698,7
PS95/0003-4	02.11.2015	11:01	BONGO	in the water	47° 55,33' N	008° 40,15' W	1678,5
PS95/0003-4	02.11.2015	11:09	BONGO	on ground/ max depth	47° 55,34' N	008° 40,15' W	0,0
PS95/0003-4	02.11.2015	11:09	BONGO	hoisting	47° 55,34' N	008° 40,15' W	0,0
PS95/0003-4	02.11.2015	11:15	BONGO	at surface	47° 55,35' N	008° 40,13' W	0,0
PS95/0003-4	02.11.2015	11:19	BONGO	on deck	47° 55,35' N	008° 40,12' W	0,0
PS95/0003-5	02.11.2015	11:27	CALCOFI	in the water	47° 55,38' N	008° 40,13' W	0,0
PS95/0003-5	02.11.2015	11:34	CALCOFI	on ground/ max depth	47° 55,40' N	008° 40,16' W	1659,5
PS95/0003-5	02.11.2015	11:34	CALCOFI	hoisting	47° 55,40' N	008° 40,16' W	1659,5
PS95/0003-5	02.11.2015	11:42	CALCOFI	at surface	47° 55,41' N	008° 40,15' W	1725,5
PS95/0003-5	02.11.2015	11:43	CALCOFI	on deck	47° 55,41' N	008° 40,15' W	1793,0
PS95/0003-6	02.11.2015	11:44	CALCOFI	in the water	47° 55,41' N	008° 40,14' W	1715,7
PS95/0003-6	02.11.2015	11:52	CALCOFI	on ground/ max depth	47° 55,41' N	008° 40,15' W	1696,0
PS95/0003-6	02.11.2015	11:52	CALCOFI	hoisting	47° 55,41' N	008° 40,15' W	1696,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0003-6	02.11.2015	11:59	CALCOFI	on deck	47° 55,42' N	008° 40,19' W	1629,0
PS95/0003-7	02.11.2015	12:00	BUCKET	in the water	47° 55,42' N	008° 40,19' W	1628,2
PS95/0003-7	02.11.2015	12:02	BUCKET	on ground/ max depth	47° 55,42' N	008° 40,19' W	1628,0
PS95/0003-7	02.11.2015	12:03	BUCKET	on deck	47° 55,42' N	008° 40,19' W	1638,7
PS95/0003-8	02.11.2015	12:12	PLA	in the water	47° 55,41' N	008° 40,19' W	1628,2
PS95/0003-8	02.11.2015	12:19	PLA	on ground/ max depth	47° 55,42' N	008° 40,18' W	1679,0
PS95/0003-8	02.11.2015	12:19	PLA	hoisting	47° 55,42' N	008° 40,18' W	1679,0
PS95/0003-8	02.11.2015	12:26	PLA	on deck	47° 55,44' N	008° 40,16' W	1759,2
PS95/0003-9	02.11.2015	12:35	CTD/RO	in the water	47° 55,49' N	008° 40,14' W	1732,5
PS95/0003-9	02.11.2015	12:43	CTD/RO	on ground/ max depth	47° 55,53' N	008° 40,12' W	1716,5
PS95/0003-9	02.11.2015	12:44	CTD/RO	hoisting	47° 55,54' N	008° 40,12' W	1747,7
PS95/0003-9	02.11.2015	12:51	CTD/RO	on deck	47° 55,58' N	008° 40,10' W	1756,2
PS95/0003-10	02.11.2015	12:59	XBT	in the water	47° 55,29' N	008° 39,78' W	1798,5
PS95/0003-10	02.11.2015	13:04	XBT	on ground/ max depth	47° 54,76' N	008° 39,41' W	1833,7
PS95/0003-11	02.11.2015	13:10	CPR	in the water	47° 54,23' N	008° 38,92' W	1992,0
PS95/0003-11	02.11.2015	13:11	CPR	on ground/ max depth	47° 54,17' N	008° 38,87' W	2375,5
PS95/0003-11	03.11.2015	08:19	CPR	hoisting	45° 02,57' N	006° 02,29' W	4792,0
PS95/0003-11	03.11.2015	08:22	CPR	at surface	45° 02,31' N	006° 02,05' W	4791,5
PS95/0003-11	03.11.2015	08:24	CPR	on deck	45° 02,14' N	006° 01,90' W	4791,5
PS95/0004-1	03.11.2015	08:28	XBT	in the water	45° 01,79' N	006° 01,60' W	4793,0
PS95/0004-1	03.11.2015	08:28	XBT	on ground/ max depth	45° 01,79' N	006° 01,60' W	4793,0
PS95/0004-1	03.11.2015	08:33	XBT	on deck	45° 01,39' N	006° 01,23' W	4790,7
PS95/0004-2	03.11.2015	08:50	CTD/RO	in the water	44° 59,96' N	006° 00,06' W	4791,0
PS95/0004-3	03.11.2015	10:08	BUCKET	in the water	44° 59,95' N	006° 00,10' W	4789,7
PS95/0004-3	03.11.2015	10:08	BUCKET	on ground/ max depth	44° 59,95' N	006° 00,10' W	4789,7
PS95/0004-3	03.11.2015	10:08	BUCKET	on deck	44° 59,95' N	006° 00,10' W	4789,7
PS95/0004-3	03.11.2015	10:09	BUCKET	in the water	44° 59,95' N	006° 00,10' W	4789,7
PS95/0004-3	03.11.2015	10:09	BUCKET	on ground/ max depth	44° 59,95' N	006° 00,10' W	4789,7
PS95/0004-3	03.11.2015	10:09	BUCKET	on deck	44° 59,95' N	006° 00,10' W	4789,7
PS95/0004-2	03.11.2015	10:27	CTD/RO	on ground/ max depth	44° 59,94' N	006° 00,07' W	4789,5
PS95/0004-2	03.11.2015	10:27	CTD/RO	hoisting	44° 59,94' N	006° 00,07' W	4789,5
PS95/0004-2	03.11.2015	12:15	CTD/RO	on deck	45° 00,02' N	006° 00,05' W	4789,5
PS95/0004-4	03.11.2015	12:34	BONGO	in the water	45° 00,01' N	006° 00,04' W	4790,0
PS95/0004-4	03.11.2015	12:35	BONGO	on ground/ max depth	45° 00,01' N	006° 00,03' W	4789,0
PS95/0004-4	03.11.2015	12:36	BONGO	action	44° 60,00' N	006° 00,02' W	4788,0
PS95/0004-4	03.11.2015	12:46	BONGO	action	44° 59,84' N	005° 59,73' W	4781,7

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0004-4	03.11.2015	12:49	BONGO	hoisting	44° 59,81' N	005° 59,66' W	4788,0
PS95/0004-4	03.11.2015	12:54	BONGO	on deck	44° 59,74' N	005° 59,58' W	4787,2
PS95/0004-5	03.11.2015	12:59	BONGO	in the water	44° 59,68' N	005° 59,51' W	4786,7
PS95/0004-5	03.11.2015	13:06	BONGO	on ground/ max depth	44° 59,65' N	005° 59,44' W	4787,5
PS95/0004-5	03.11.2015	13:06	BONGO	hoisting	44° 59,65' N	005° 59,44' W	4787,5
PS95/0004-5	03.11.2015	13:14	BONGO	on deck	44° 59,66' N	005° 59,47' W	4786,5
PS95/0004-6	03.11.2015	13:21	CALCOFI	in the water	44° 59,65' N	005° 59,48' W	4785,7
PS95/0004-6	03.11.2015	13:28	CALCOFI	on ground/ max depth	44° 59,64' N	005° 59,51' W	4786,2
PS95/0004-6	03.11.2015	13:28	CALCOFI	hoisting	44° 59,64' N	005° 59,51' W	4786,2
PS95/0004-6	03.11.2015	13:35	CALCOFI	on deck	44° 59,65' N	005° 59,56' W	4787,7
PS95/0004-7	03.11.2015	13:37	CALCOFI	in the water	44° 59,65' N	005° 59,57' W	4789,0
PS95/0004-7	03.11.2015	13:43	CALCOFI	on ground/ max depth	44° 59,65' N	005° 59,57' W	4787,7
PS95/0004-7	03.11.2015	13:43	CALCOFI	hoisting	44° 59,65' N	005° 59,57' W	4787,7
PS95/0004-7	03.11.2015	13:49	CALCOFI	on deck	44° 59,63' N	005° 59,56' W	4788,7
PS95/0004-8	03.11.2015	14:00	PLA	in the water	44° 59,60' N	005° 59,54' W	4787,7
PS95/0004-8	03.11.2015	14:06	PLA	on ground/ max depth	44° 59,60' N	005° 59,52' W	4788,7
PS95/0004-8	03.11.2015	14:06	PLA	hoisting	44° 59,60' N	005° 59,52' W	4788,7
PS95/0004-8	03.11.2015	14:12	PLA	on deck	44° 59,63' N	005° 59,50' W	4787,2
PS95/0004-9	03.11.2015	14:22	CTD/RO	in the water	44° 59,69' N	005° 59,46' W	4785,5
PS95/0004-9	03.11.2015	14:27	CTD/RO	on ground/ max depth	44° 59,71' N	005° 59,46' W	4786,5
PS95/0004-9	03.11.2015	14:35	CTD/RO	on deck	44° 59,75' N	005° 59,46' W	4786,5
PS95/0004-10	03.11.2015	14:49	CPR	in the water	44° 59,63' N	006° 00,09' W	4787,5
PS95/0004-10	03.11.2015	14:52	CPR	on ground/ max depth	44° 59,47' N	006° 00,67' W	4789,0
PS95/0005-1	04.11.2015	09:03	XBT	in the water	43° 31,55' N	009° 51,52' W	0,0
PS95/0005-1	04.11.2015	09:08	XBT	on ground/ max depth	43° 31,34' N	009° 52,09' W	0,0
PS95/0005-1	04.11.2015	09:08	XBT	on deck	43° 31,34' N	009° 52,09' W	0,0
PS95/0005-2	04.11.2015	09:12	BUCKET	in the water	43° 31,16' N	009° 52,54' W	3000,0
PS95/0005-2	04.11.2015	09:13	BUCKET	on deck	43° 31,12' N	009° 52,66' W	0,0
PS95/0005-2	04.11.2015	09:14	BUCKET	in the water	43° 31,09' N	009° 52,77' W	0,0
PS95/0005-2	04.11.2015	09:14	BUCKET	on ground/ max depth	43° 31,09' N	009° 52,77' W	0,0
PS95/0005-2	04.11.2015	09:15	BUCKET	on deck	43° 31,04' N	009° 52,88' W	0,0
PS95/0006-1	05.11.2015	09:01	XBT	in the water	39° 50,01' N	011° 23,57' W	5047,2
PS95/0006-1	05.11.2015	09:07	XBT	on ground/ max depth	39° 49,46' N	011° 23,84' W	5050,5
PS95/0006-1	05.11.2015	09:08	XBT	on deck	39° 49,38' N	011° 23,88' W	5050,5
PS95/0006-2	05.11.2015	09:09	BUCKET	in the water	39° 49,29' N	011° 23,93' W	5051,7
PS95/0006-2	05.11.2015	09:10	BUCKET	on ground/ max depth	39° 49,20' N	011° 23,97' W	5052,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0006-2	05.11.2015	09:10	BUCKET	on deck	39° 49,20' N	011° 23,97' W	5052,0
PS95/0006-2	05.11.2015	09:11	BUCKET	in the water	39° 49,11' N	011° 24,00' W	5052,2
PS95/0006-2	05.11.2015	09:11	BUCKET	on ground/ max depth	39° 49,11' N	011° 24,00' W	5052,2
PS95/0006-2	05.11.2015	09:12	BUCKET	on deck	39° 49,02' N	011° 24,04' W	5053,5
PS95/0004-10	05.11.2015	16:19	CPR	hoisting	38° 39,29' N	011° 55,96' W	4716,0
PS95/0004-10	05.11.2015	16:23	CPR	on deck	38° 38,97' N	011° 56,08' W	4722,2
PS95/0007-1	05.11.2015	16:39	CPR	in the water	38° 37,56' N	011° 56,75' W	4739,7
PS95/0007-1	05.11.2015	16:45	CPR	on ground/ max depth	38° 37,03' N	011° 56,96' W	4743,7
PS95/0008-1	06.11.2015	09:19	XBT	in the water	35° 51,86' N	013° 07,76' W	4822,2
PS95/0008-1	06.11.2015	09:26	XBT	on ground/ max depth	35° 51,20' N	013° 08,03' W	4822,2
PS95/0008-1	06.11.2015	09:26	XBT	on deck	35° 51,20' N	013° 08,03' W	4822,2
PS95/0008-2	06.11.2015	09:27	BUCKET	in the water	35° 51,11' N	013° 08,07' W	4821,7
PS95/0008-2	06.11.2015	09:27	BUCKET	on ground/ max depth	35° 51,11' N	013° 08,07' W	4821,7
PS95/0008-2	06.11.2015	09:28	BUCKET	on deck	35° 51,02' N	013° 08,10' W	4822,0
PS95/0007-1	06.11.2015	11:12	CPR	hoisting	35° 33,43' N	013° 15,32' W	4825,7
PS95/0007-1	06.11.2015	11:14	CPR	at surface	35° 33,24' N	013° 15,37' W	4826,2
PS95/0007-1	06.11.2015	11:17	CPR	on deck	35° 32,95' N	013° 15,46' W	4825,7
PS95/0009-1	06.11.2015	12:00	CTD/RO	in the water	35° 32,13' N	013° 15,90' W	4825,2
PS95/0009-1	06.11.2015	13:44	CTD/RO	on ground/ max depth	35° 31,74' N	013° 15,91' W	4826,0
PS95/0009-1	06.11.2015	13:44	CTD/RO	hoisting	35° 31,74' N	013° 15,91' W	4826,0
PS95/0009-2	06.11.2015	14:31	BUCKET	in the water	35° 31,65' N	013° 16,01' W	4825,7
PS95/0009-2	06.11.2015	14:32	BUCKET	on ground/ max depth	35° 31,65' N	013° 16,01' W	4826,0
PS95/0009-2	06.11.2015	14:33	BUCKET	on deck	35° 31,65' N	013° 16,02' W	4825,5
PS95/0009-1	06.11.2015	15:34	CTD/RO	on deck	35° 31,64' N	013° 15,99' W	4825,2
PS95/0009-3	06.11.2015	15:46	BONGO	in the water	35° 31,63' N	013° 16,00' W	4826,0
PS95/0009-3	06.11.2015	15:57	BONGO	on ground/ max depth	35° 31,50' N	013° 16,26' W	4825,7
PS95/0009-3	06.11.2015	15:57	BONGO	action	35° 31,50' N	013° 16,26' W	4825,7
PS95/0009-3	06.11.2015	16:07	BONGO	action	35° 31,37' N	013° 16,55' W	4825,5
PS95/0009-3	06.11.2015	16:09	BONGO	hoisting	35° 31,35' N	013° 16,59' W	4825,2
PS95/0009-3	06.11.2015	16:17	BONGO	on deck	35° 31,29' N	013° 16,59' W	4825,7
PS95/0009-4	06.11.2015	16:21	BONGO	in the water	35° 31,26' N	013° 16,57' W	4826,2
PS95/0009-4	06.11.2015	16:24	BONGO	on ground/ max depth	35° 31,23' N	013° 16,55' W	4825,2
PS95/0009-4	06.11.2015	16:25	BONGO	action	35° 31,22' N	013° 16,55' W	4824,7
PS95/0009-4	06.11.2015	16:35	BONGO	action	35° 31,08' N	013° 16,85' W	4825,5
PS95/0009-4	06.11.2015	16:35	BONGO	hoisting	35° 31,08' N	013° 16,85' W	4825,5
PS95/0009-4	06.11.2015	16:38	BONGO	on deck	35° 31,05' N	013° 16,89' W	4825,5
PS95/0009-5	06.11.2015	16:45	BONGO	in the water	35° 30,99' N	013° 16,90' W	4825,7

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0009-5	06.11.2015	16:53	BONGO	on ground/ max depth	35° 30,91' N	013° 16,89' W	4825,2
PS95/0009-5	06.11.2015	16:53	BONGO	hoisting	35° 30,91' N	013° 16,89' W	4825,2
PS95/0009-5	06.11.2015	17:03	BONGO	on deck	35° 30,86' N	013° 16,86' W	4820,0
PS95/0009-6	06.11.2015	17:10	CALCOFI	in the water	35° 30,82' N	013° 16,86' W	4826,0
PS95/0009-6	06.11.2015	17:19	CALCOFI	on ground/ max depth	35° 30,77' N	013° 16,87' W	4825,7
PS95/0009-6	06.11.2015	17:19	CALCOFI	hoisting	35° 30,77' N	013° 16,87' W	4825,7
PS95/0009-6	06.11.2015	17:29	CALCOFI	on deck	35° 30,71' N	013° 16,89' W	4825,2
PS95/0009-7	06.11.2015	17:34	PLA	in the water	35° 30,68' N	013° 16,92' W	4825,5
PS95/0009-7	06.11.2015	17:38	PLA	on ground/ max depth	35° 30,65' N	013° 16,95' W	4825,5
PS95/0009-7	06.11.2015	17:38	PLA	hoisting	35° 30,65' N	013° 16,95' W	4825,5
PS95/0009-7	06.11.2015	17:42	PLA	on deck	35° 30,63' N	013° 16,96' W	4825,2
PS95/0009-8	06.11.2015	17:45	LM	in the water	35° 30,61' N	013° 16,98' W	4825,2
PS95/0009-8	06.11.2015	17:47	LM	on ground/ max depth	35° 30,60' N	013° 16,99' W	4824,5
PS95/0009-8	06.11.2015	17:47	LM	hoisting	35° 30,60' N	013° 16,99' W	4824,5
PS95/0009-8	06.11.2015	17:51	LM	profile start	35° 30,58' N	013° 16,99' W	4824,7
PS95/0009-8	06.11.2015	17:51	LM	profile end	35° 30,58' N	013° 16,99' W	4824,7
PS95/0009-8	06.11.2015	17:51	LM	on deck	35° 30,58' N	013° 16,99' W	4824,7
PS95/0009-9	06.11.2015	17:57	CTD/RO	in the water	35° 30,55' N	013° 17,01' W	4825,5
PS95/0009-9	06.11.2015	18:04	CTD/RO	on ground/ max depth	35° 30,51' N	013° 17,03' W	4825,5
PS95/0009-9	06.11.2015	18:05	CTD/RO	hoisting	35° 30,51' N	013° 17,03' W	4825,5
PS95/0009-9	06.11.2015	18:13	CTD/RO	at surface	35° 30,48' N	013° 17,08' W	4825,2
PS95/0009-9	06.11.2015	18:14	CTD/RO	on deck	35° 30,48' N	013° 17,08' W	4825,2
PS95/0009-10	06.11.2015	18:24	CPR	in the water	35° 30,11' N	013° 17,34' W	4824,7
PS95/0009-10	06.11.2015	18:33	CPR	on ground/ max depth	35° 29,02' N	013° 17,34' W	4825,2
PS95/0010-1	06.11.2015	18:38	HS_PS	profile start	35° 28,37' N	013° 17,35' W	4824,5
PS95/0010-1	06.11.2015	19:58	HS_PS	alter course	35° 18,04' N	013° 21,00' W	0,0
PS95/0010-1	06.11.2015	21:55	HS_PS	alter course	35° 30,75' N	013° 16,44' W	0,0
PS95/0010-1	06.11.2015	22:06	HS_PS	alter course	35° 31,64' N	013° 17,68' W	0,0
PS95/0010-1	06.11.2015	23:50	HS_PS	profile end	35° 18,85' N	013° 22,56' W	0,0
PS95/0009-10	07.11.2015	01:33	CPR	hoisting	35° 07,18' N	013° 03,82' W	2206,7
PS95/0009-10	07.11.2015	01:38	CPR	on deck	35° 06,84' N	013° 03,26' W	1984,7
PS95/0011-1	07.11.2015	01:58	CTD/RO	in the water	35° 05,88' N	013° 02,02' W	1740,0
PS95/0011-1	07.11.2015	02:39	CTD/RO	on ground/ max depth	35° 05,80' N	013° 01,97' W	1697,2
PS95/0011-1	07.11.2015	02:41	CTD/RO	hoisting	35° 05,81' N	013° 01,96' W	1702,7
PS95/0011-1	07.11.2015	03:26	CTD/RO	on deck	35° 06,00' N	013° 01,92' W	1733,7
PS95/0011-2	07.11.2015	03:37	BONGO	in the water	35° 06,03' N	013° 01,91' W	1750,5
PS95/0011-3	07.11.2015	03:38	BUCKET	in the water	35° 06,03' N	013° 01,91' W	1742,5

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0011-3	07.11.2015	03:40	BUCKET	on ground/ max depth	35° 06,03' N	013° 01,92' W	1751,2
PS95/0011-3	07.11.2015	03:41	BUCKET	on deck	35° 06,03' N	013° 01,92' W	1764,7
PS95/0011-2	07.11.2015	03:46	BONGO	on ground/ max depth	35° 06,00' N	013° 01,97' W	1749,2
PS95/0011-2	07.11.2015	03:47	BONGO	hoisting	35° 06,00' N	013° 01,97' W	1742,5
PS95/0011-2	07.11.2015	03:55	BONGO	on deck	35° 05,98' N	013° 02,00' W	1754,5
PS95/0011-4	07.11.2015	04:02	CALCOFI	in the water	35° 05,99' N	013° 02,02' W	1764,7
PS95/0011-4	07.11.2015	04:10	CALCOFI	on ground/ max depth	35° 06,01' N	013° 02,02' W	1758,2
PS95/0011-4	07.11.2015	04:11	CALCOFI	hoisting	35° 06,01' N	013° 02,02' W	1762,7
PS95/0011-4	07.11.2015	04:19	CALCOFI	on deck	35° 06,01' N	013° 02,01' W	1762,7
PS95/0011-5	07.11.2015	04:25	PLA	in the water	35° 06,02' N	013° 01,99' W	1754,0
PS95/0011-5	07.11.2015	04:29	PLA	on ground/ max depth	35° 06,02' N	013° 01,99' W	1746,2
PS95/0011-5	07.11.2015	04:29	PLA	hoisting	35° 06,02' N	013° 01,99' W	1746,2
PS95/0011-5	07.11.2015	04:34	PLA	on deck	35° 06,03' N	013° 01,98' W	1756,7
PS95/0011-6	07.11.2015	04:38	LM	in the water	35° 06,04' N	013° 01,97' W	1758,2
PS95/0011-6	07.11.2015	04:38	LM	profile start	35° 06,04' N	013° 01,97' W	1758,2
PS95/0011-6	07.11.2015	04:40	LM	on ground/ max depth	35° 06,04' N	013° 01,96' W	1761,2
PS95/0011-6	07.11.2015	04:40	LM	hoisting	35° 06,04' N	013° 01,96' W	1761,2
PS95/0011-6	07.11.2015	04:43	LM	profile end	35° 06,05' N	013° 01,96' W	1765,5
PS95/0011-6	07.11.2015	04:43	LM	on deck	35° 06,05' N	013° 01,96' W	1765,5
PS95/0011-7	07.11.2015	04:47	LM	in the water	35° 06,03' N	013° 01,98' W	1766,0
PS95/0011-7	07.11.2015	04:47	LM	profile start	35° 06,03' N	013° 01,98' W	1766,0
PS95/0011-7	07.11.2015	04:54	LM	on ground/ max depth	35° 05,99' N	013° 02,05' W	1764,5
PS95/0011-7	07.11.2015	04:54	LM	hoisting	35° 05,99' N	013° 02,05' W	1764,5
PS95/0011-7	07.11.2015	05:00	LM	profile end	35° 05,97' N	013° 02,08' W	1763,5
PS95/0011-7	07.11.2015	05:00	LM	on deck	35° 05,97' N	013° 02,08' W	1763,5
PS95/0012-1	07.11.2015	08:59	XBT	in the water	35° 04,60' N	013° 01,44' W	1425,2
PS95/0012-1	07.11.2015	09:04	XBT	on ground/ max depth	35° 05,01' N	013° 01,69' W	1537,5
PS95/0012-1	07.11.2015	09:04	XBT	on deck	35° 05,01' N	013° 01,69' W	1537,5
PS95/0012-2	07.11.2015	09:06	BUCKET	in the water	35° 05,17' N	013° 01,81' W	1534,2
PS95/0012-2	07.11.2015	09:06	BUCKET	on ground/ max depth	35° 05,17' N	013° 01,81' W	1534,2
PS95/0012-2	07.11.2015	09:06	BUCKET	on deck	35° 05,17' N	013° 01,81' W	1534,2
PS95/0012-2	07.11.2015	09:09	BUCKET	in the water	35° 05,40' N	013° 01,98' W	1556,5
PS95/0012-2	07.11.2015	09:09	BUCKET	on ground/ max depth	35° 05,40' N	013° 01,98' W	1556,5
PS95/0012-2	07.11.2015	09:09	BUCKET	on deck	35° 05,40' N	013° 01,98' W	1556,5
PS95/0012-2	07.11.2015	09:10	BUCKET	in the water	35° 05,47' N	013° 02,04' W	1587,0
PS95/0012-2	07.11.2015	09:10	BUCKET	on ground/ max depth	35° 05,47' N	013° 02,04' W	1587,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0012-2	07.11.2015	09:11	BUCKET	on deck	35° 05,54' N	013° 02,09' W	1642,2
PS95/0012-3	07.11.2015	09:20	CTD/RO	in the water	35° 05,95' N	013° 02,09' W	1763,0
PS95/0012-3	07.11.2015	09:58	CTD/RO	on ground/ max depth	35° 06,05' N	013° 02,04' W	1771,5
PS95/0012-3	07.11.2015	10:00	CTD/RO	hoisting	35° 06,05' N	013° 02,05' W	0,0
PS95/0012-3	07.11.2015	10:45	CTD/RO	at surface	35° 05,99' N	013° 01,99' W	1747,0
PS95/0012-3	07.11.2015	10:46	CTD/RO	on deck	35° 05,99' N	013° 01,98' W	1747,0
PS95/0012-4	07.11.2015	11:08	BONGO	in the water	35° 05,98' N	013° 01,91' W	1735,7
PS95/0012-4	07.11.2015	11:09	BONGO	on ground/ max depth	35° 05,98' N	013° 01,91' W	1740,7
PS95/0012-4	07.11.2015	11:19	BONGO	hoisting	35° 06,16' N	013° 01,84' W	1774,0
PS95/0012-4	07.11.2015	11:20	BONGO	at surface	35° 06,18' N	013° 01,83' W	1791,0
PS95/0012-4	07.11.2015	11:23	BONGO	on deck	35° 06,19' N	013° 01,81' W	1797,7
PS95/0012-5	07.11.2015	11:31	BONGO	in the water	35° 06,15' N	013° 01,82' W	1747,0
PS95/0012-5	07.11.2015	11:40	BONGO	on ground/ max depth	35° 06,15' N	013° 01,79' W	1762,7
PS95/0012-5	07.11.2015	11:40	BONGO	hoisting	35° 06,15' N	013° 01,79' W	1762,7
PS95/0012-5	07.11.2015	11:48	BONGO	at surface	35° 06,15' N	013° 01,79' W	1765,2
PS95/0012-5	07.11.2015	11:50	BONGO	on deck	35° 06,15' N	013° 01,79' W	1797,5
PS95/0012-6	07.11.2015	11:56	CALCOFI	in the water	35° 06,14' N	013° 01,80' W	1762,5
PS95/0012-6	07.11.2015	12:03	CALCOFI	on ground/ max depth	35° 06,14' N	013° 01,80' W	1735,0
PS95/0012-6	07.11.2015	12:04	CALCOFI	hoisting	35° 06,14' N	013° 01,80' W	1786,0
PS95/0012-6	07.11.2015	12:12	CALCOFI	on deck	35° 06,16' N	013° 01,78' W	1765,7
PS95/0012-7	07.11.2015	12:14	CALCOFI	in the water	35° 06,16' N	013° 01,77' W	1779,5
PS95/0012-7	07.11.2015	12:24	CALCOFI	on ground/ max depth	35° 06,13' N	013° 01,77' W	1757,5
PS95/0012-7	07.11.2015	12:24	CALCOFI	hoisting	35° 06,13' N	013° 01,77' W	1757,5
PS95/0012-7	07.11.2015	12:30	CALCOFI	on deck	35° 06,10' N	013° 01,78' W	1724,7
PS95/0012-8	07.11.2015	12:37	PLA	in the water	35° 06,06' N	013° 01,80' W	1740,5
PS95/0012-8	07.11.2015	12:43	PLA	on ground/ max depth	35° 06,05' N	013° 01,80' W	1747,0
PS95/0012-8	07.11.2015	12:43	PLA	hoisting	35° 06,05' N	013° 01,80' W	1747,0
PS95/0012-8	07.11.2015	12:48	PLA	on deck	35° 06,06' N	013° 01,79' W	1740,0
PS95/0012-9	07.11.2015	12:50	LM	in the water	35° 06,05' N	013° 01,80' W	1747,7
PS95/0012-9	07.11.2015	12:50	LM	profile start	35° 06,05' N	013° 01,80' W	1747,7
PS95/0012-9	07.11.2015	12:52	LM	on ground/ max depth	35° 06,04' N	013° 01,80' W	1709,5
PS95/0012-9	07.11.2015	12:52	LM	hoisting	35° 06,04' N	013° 01,80' W	1709,5
PS95/0012-9	07.11.2015	12:54	LM	profile end	35° 06,03' N	013° 01,80' W	1762,5
PS95/0012-9	07.11.2015	12:54	LM	on deck	35° 06,03' N	013° 01,80' W	1762,5
PS95/0012-10	07.11.2015	13:09	CTD/RO	in the water	35° 05,91' N	013° 01,83' W	1682,7
PS95/0012-10	07.11.2015	13:20	CTD/RO	on ground/ max depth	35° 05,89' N	013° 01,80' W	1650,2
PS95/0012-10	07.11.2015	13:22	CTD/RO	hoisting	35° 05,90' N	013° 01,78' W	1660,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0012-10	07.11.2015	13:31	CTD/RO	on deck	35° 05,95' N	013° 01,69' W	1672,5
PS95/0013-1	07.11.2015	15:16	CTD/RO	in the water	35° 02,95' N	012° 54,03' W	142,7
PS95/0013-1	07.11.2015	15:24	CTD/RO	on ground/ max depth	35° 02,98' N	012° 53,96' W	139,0
PS95/0013-1	07.11.2015	15:30	CTD/RO	hoisting	35° 03,01' N	012° 53,94' W	136,5
PS95/0013-1	07.11.2015	15:39	CTD/RO	on deck	35° 03,00' N	012° 53,95' W	137,5
PS95/0013-2	07.11.2015	15:51	BONGO	in the water	35° 03,02' N	012° 53,93' W	136,5
PS95/0013-2	07.11.2015	15:52	BONGO	on ground/ max depth	35° 03,04' N	012° 53,92' W	134,7
PS95/0013-2	07.11.2015	16:02	BONGO	action	35° 03,24' N	012° 53,74' W	131,5
PS95/0013-2	07.11.2015	16:03	BONGO	hoisting	35° 03,26' N	012° 53,73' W	130,0
PS95/0013-2	07.11.2015	16:05	BONGO	on deck	35° 03,27' N	012° 53,73' W	129,5
PS95/0013-3	07.11.2015	16:14	BONGO	in the water	35° 03,29' N	012° 53,74' W	130,0
PS95/0013-3	07.11.2015	16:21	BONGO	on ground/ max depth	35° 03,28' N	012° 53,71' W	128,0
PS95/0013-3	07.11.2015	16:21	BONGO	hoisting	35° 03,28' N	012° 53,71' W	128,0
PS95/0013-4	07.11.2015	16:24	BUCKET	in the water	35° 03,25' N	012° 53,71' W	125,2
PS95/0013-4	07.11.2015	16:25	BUCKET	on ground/ max depth	35° 03,24' N	012° 53,71' W	128,5
PS95/0013-4	07.11.2015	16:25	BUCKET	on deck	35° 03,24' N	012° 53,71' W	128,5
PS95/0013-3	07.11.2015	16:30	BONGO	on deck	35° 03,18' N	012° 53,71' W	110,0
PS95/0013-5	07.11.2015	16:37	CALCOFI	in the water	35° 03,14' N	012° 53,73' W	123,0
PS95/0013-5	07.11.2015	16:45	CALCOFI	on ground/ max depth	35° 03,14' N	012° 53,77' W	132,5
PS95/0013-5	07.11.2015	16:45	CALCOFI	hoisting	35° 03,14' N	012° 53,77' W	132,5
PS95/0013-5	07.11.2015	16:53	CALCOFI	on deck	35° 03,15' N	012° 53,80' W	134,7
PS95/0013-6	07.11.2015	16:55	CALCOFI	in the water	35° 03,15' N	012° 53,81' W	257,7
PS95/0013-6	07.11.2015	17:03	CALCOFI	on ground/ max depth	35° 03,18' N	012° 53,83' W	260,2
PS95/0013-6	07.11.2015	17:03	CALCOFI	hoisting	35° 03,18' N	012° 53,83' W	260,2
PS95/0013-6	07.11.2015	17:12	CALCOFI	on deck	35° 03,18' N	012° 53,80' W	124,0
PS95/0013-7	07.11.2015	17:16	PLA	in the water	35° 03,16' N	012° 53,79' W	131,0
PS95/0013-7	07.11.2015	17:23	PLA	on ground/ max depth	35° 03,13' N	012° 53,77' W	133,0
PS95/0013-7	07.11.2015	17:23	PLA	hoisting	35° 03,13' N	012° 53,77' W	133,0
PS95/0013-7	07.11.2015	17:31	PLA	on deck	35° 03,12' N	012° 53,75' W	129,5
PS95/0013-8	07.11.2015	17:36	LM	in the water	35° 03,12' N	012° 53,73' W	124,7
PS95/0013-8	07.11.2015	17:37	LM	on ground/ max depth	35° 03,12' N	012° 53,73' W	124,5
PS95/0013-8	07.11.2015	17:37	LM	profile start	35° 03,12' N	012° 53,73' W	124,5
PS95/0013-8	07.11.2015	17:40	LM	at surface	35° 03,13' N	012° 53,71' W	127,5
PS95/0013-8	07.11.2015	17:40	LM	profile end	35° 03,13' N	012° 53,71' W	127,5
PS95/0013-8	07.11.2015	17:41	LM	on deck	35° 03,13' N	012° 53,70' W	122,2
PS95/0013-9	07.11.2015	17:50	CTD/RO	in the water	35° 03,16' N	012° 53,64' W	120,7
PS95/0013-9	07.11.2015	17:57	CTD/RO	on ground/ max depth	35° 03,19' N	012° 53,60' W	125,2

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0013-9	07.11.2015	18:02	CTD/RO	on deck	35° 03,20' N	012° 53,57' W	126,7
PS95/0014-1	08.11.2015	09:00	XBT	in the water	35° 00,92' N	012° 50,87' W	1499,2
PS95/0014-1	08.11.2015	09:05	XBT	on ground/ max depth	35° 00,99' N	012° 50,29' W	1377,5
PS95/0014-1	08.11.2015	09:07	XBT	in the water	35° 01,02' N	012° 50,11' W	1491,2
PS95/0014-1	08.11.2015	09:12	XBT	on ground/ max depth	35° 01,03' N	012° 49,64' W	1770,7
PS95/0014-1	08.11.2015	09:13	XBT	on deck	35° 01,03' N	012° 49,54' W	1687,2
PS95/0014-2	08.11.2015	09:15	BUCKET	in the water	35° 01,03' N	012° 49,43' W	1696,7
PS95/0014-2	08.11.2015	09:15	BUCKET	on ground/ max depth	35° 01,03' N	012° 49,43' W	1696,7
PS95/0014-2	08.11.2015	09:16	BUCKET	on deck	35° 01,03' N	012° 49,42' W	1731,7
PS95/0014-2	08.11.2015	09:20	BUCKET	in the water	35° 01,02' N	012° 49,38' W	1807,2
PS95/0014-2	08.11.2015	09:20	BUCKET	on ground/ max depth	35° 01,02' N	012° 49,38' W	1807,2
PS95/0014-2	08.11.2015	09:20	BUCKET	on deck	35° 01,02' N	012° 49,38' W	1807,2
PS95/0014-2	08.11.2015	09:22	BUCKET	in the water	35° 01,01' N	012° 49,36' W	1713,7
PS95/0014-2	08.11.2015	09:22	BUCKET	on ground/ max depth	35° 01,01' N	012° 49,36' W	1713,7
PS95/0014-2	08.11.2015	09:22	BUCKET	on deck	35° 01,01' N	012° 49,36' W	1713,7
PS95/0014-3	08.11.2015	09:30	CTD/RO	in the water	35° 00,99' N	012° 49,35' W	1760,7
PS95/0014-3	08.11.2015	10:11	CTD/RO	on ground/ max depth	35° 01,00' N	012° 49,28' W	1943,7
PS95/0014-3	08.11.2015	10:15	CTD/RO	hoisting	35° 01,02' N	012° 49,30' W	1772,7
PS95/0014-3	08.11.2015	11:02	CTD/RO	at surface	35° 00,97' N	012° 49,32' W	1890,5
PS95/0014-3	08.11.2015	11:03	CTD/RO	on deck	35° 00,96' N	012° 49,32' W	1758,2
PS95/0014-4	08.11.2015	11:14	BONGO	in the water	35° 00,94' N	012° 49,35' W	1983,0
PS95/0014-4	08.11.2015	11:16	BONGO	on ground/ max depth	35° 00,94' N	012° 49,36' W	1855,0
PS95/0014-4	08.11.2015	11:26	BONGO	hoisting	35° 00,84' N	012° 49,53' W	1871,0
PS95/0014-4	08.11.2015	11:27	BONGO	at surface	35° 00,83' N	012° 49,55' W	1873,7
PS95/0014-4	08.11.2015	11:30	BONGO	on deck	35° 00,82' N	012° 49,58' W	1877,0
PS95/0014-5	08.11.2015	11:37	BONGO	in the water	35° 00,80' N	012° 49,60' W	1893,5
PS95/0014-5	08.11.2015	11:43	BONGO	on ground/ max depth	35° 00,80' N	012° 49,60' W	1847,5
PS95/0014-5	08.11.2015	11:43	BONGO	hoisting	35° 00,80' N	012° 49,60' W	1847,5
PS95/0014-5	08.11.2015	11:50	BONGO	at surface	35° 00,80' N	012° 49,63' W	1847,2
PS95/0014-5	08.11.2015	11:53	BONGO	on deck	35° 00,80' N	012° 49,63' W	1841,2
PS95/0014-6	08.11.2015	12:02	CALCOFI	in the water	35° 00,78' N	012° 49,64' W	1841,7
PS95/0014-6	08.11.2015	12:10	CALCOFI	on ground/ max depth	35° 00,75' N	012° 49,63' W	1858,7
PS95/0014-6	08.11.2015	12:10	CALCOFI	hoisting	35° 00,75' N	012° 49,63' W	1858,7
PS95/0014-6	08.11.2015	12:17	CALCOFI	on deck	35° 00,71' N	012° 49,62' W	1970,7
PS95/0014-7	08.11.2015	12:20	CALCOFI	in the water	35° 00,70' N	012° 49,61' W	1952,0
PS95/0014-7	08.11.2015	12:27	CALCOFI	on ground/ max depth	35° 00,65' N	012° 49,60' W	1976,7

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0014-7	08.11.2015	12:27	CALCOFI	hoisting	35° 00,65' N	012° 49,60' W	1976,7
PS95/0014-7	08.11.2015	12:34	CALCOFI	on deck	35° 00,60' N	012° 49,60' W	2058,2
PS95/0014-8	08.11.2015	12:39	PLA	in the water	35° 00,56' N	012° 49,61' W	2050,0
PS95/0014-8	08.11.2015	12:48	PLA	on ground/ max depth	35° 00,46' N	012° 49,68' W	2200,5
PS95/0014-8	08.11.2015	12:48	PLA	hoisting	35° 00,46' N	012° 49,68' W	2200,5
PS95/0014-8	08.11.2015	12:57	PLA	on deck	35° 00,41' N	012° 49,77' W	2030,2
PS95/0014-9	08.11.2015	12:58	LM	in the water	35° 00,41' N	012° 49,78' W	2039,0
PS95/0014-9	08.11.2015	12:59	LM	profile start	35° 00,40' N	012° 49,78' W	2034,0
PS95/0014-9	08.11.2015	13:01	LM	on ground/ max depth	35° 00,39' N	012° 49,80' W	2010,5
PS95/0014-9	08.11.2015	13:02	LM	hoisting	35° 00,39' N	012° 49,81' W	2234,2
PS95/0014-9	08.11.2015	13:04	LM	profile end	35° 00,38' N	012° 49,84' W	2003,7
PS95/0014-9	08.11.2015	13:06	LM	on deck	35° 00,36' N	012° 49,86' W	2017,7
PS95/0014-10	08.11.2015	13:20	CTD/RO	in the water	35° 00,29' N	012° 49,94' W	1983,0
PS95/0014-10	08.11.2015	13:29	CTD/RO	on ground/ max depth	35° 00,23' N	012° 49,99' W	2033,2
PS95/0014-10	08.11.2015	13:31	CTD/RO	hoisting	35° 00,21' N	012° 50,00' W	2080,0
PS95/0014-10	08.11.2015	13:38	CTD/RO	on deck	35° 00,15' N	012° 50,04' W	1945,0
PS95/0014-11	08.11.2015	14:14	CPR	in the water	35° 00,76' N	012° 49,77' W	1971,2
PS95/0014-11	08.11.2015	14:22	CPR	on ground/ max depth	35° 01,88' N	012° 49,83' W	1325,2
PS95/0015-1	09.11.2015	09:00	XBT	in the water	32° 02,39' N	013° 58,98' W	4237,5
PS95/0015-2	09.11.2015	09:01	BUCKET	in the water	32° 02,29' N	013° 59,02' W	4237,5
PS95/0015-2	09.11.2015	09:02	BUCKET	on ground/ max depth	32° 02,20' N	013° 59,05' W	4237,7
PS95/0015-2	09.11.2015	09:03	BUCKET	on deck	32° 02,10' N	013° 59,09' W	4237,0
PS95/0015-1	09.11.2015	09:06	XBT	on ground/ max depth	32° 01,83' N	013° 59,18' W	4237,5
PS95/0015-1	09.11.2015	09:06	XBT	on deck	32° 01,83' N	013° 59,18' W	4237,5
PS95/0014-11	10.11.2015	05:56	CPR	on deck	28° 27,50' N	015° 13,79' W	3439,5
PS95/0016-1	10.11.2015	05:58	XBT	in the water	28° 27,30' N	015° 13,85' W	3435,2
PS95/0016-2	10.11.2015	05:58	BUCKET	in the water	28° 27,30' N	015° 13,85' W	3435,2
PS95/0016-1	10.11.2015	06:00	XBT	on ground/ max depth	28° 27,12' N	015° 13,91' W	3430,7
PS95/0016-2	10.11.2015	06:00	BUCKET	on ground/ max depth	28° 27,12' N	015° 13,91' W	3430,7
PS95/0016-1	10.11.2015	06:00	XBT	on deck	28° 27,12' N	015° 13,91' W	3430,7
PS95/0016-2	10.11.2015	06:00	BUCKET	on deck	28° 27,12' N	015° 13,91' W	3430,7
PS95/0017-1	10.11.2015	17:04	CPR	in the water	27° 58,41' N	015° 14,65' W	1049,5
PS95/0017-1	10.11.2015	17:06	CPR	on ground/ max depth	27° 58,22' N	015° 14,66' W	1041,5
PS95/0018-1	11.11.2015	08:58	XBT	in the water	26° 05,81' N	017° 23,61' W	3498,7
PS95/0018-1	11.11.2015	09:04	XBT	on ground/ max depth	26° 05,49' N	017° 24,12' W	3499,0
PS95/0018-1	11.11.2015	09:07	XBT	in the water	26° 05,33' N	017° 24,38' W	3500,7

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0018-1	11.11.2015	09:11	XBT	on ground/ max depth	26° 05,11' N	017° 24,75' W	3501,5
PS95/0018-2	11.11.2015	09:11	BUCKET	in the water	26° 05,11' N	017° 24,75' W	3501,5
PS95/0018-1	11.11.2015	09:11	XBT	on deck	26° 05,11' N	017° 24,75' W	3501,5
PS95/0018-2	11.11.2015	09:13	BUCKET	on ground/ max depth	26° 05,00' N	017° 24,93' W	3500,0
PS95/0018-2	11.11.2015	09:15	BUCKET	on deck	26° 04,89' N	017° 25,11' W	3499,2
PS95/0019-1	12.11.2015	09:03	XBT	in the water	22° 42,92' N	021° 01,17' W	4298,2
PS95/0019-1	12.11.2015	09:09	XBT	on ground/ max depth	22° 43,38' N	021° 00,82' W	0,0
PS95/0019-2	12.11.2015	09:09	BUCKET	in the water	22° 43,38' N	021° 00,82' W	4300,9
PS95/0019-1	12.11.2015	09:09	XBT	on deck	22° 43,38' N	021° 00,82' W	4300,9
PS95/0019-2	12.11.2015	09:11	BUCKET	on ground/ max depth	22° 43,55' N	021° 00,69' W	4301,8
PS95/0019-2	12.11.2015	09:11	BUCKET	on deck	22° 43,55' N	021° 00,69' W	4301,8
PS95/0017-1	12.11.2015	11:50	CPR	hoisting	22° 17,68' N	021° 20,06' W	4367,9
PS95/0017-1	12.11.2015	11:52	CPR	at surface	22° 17,53' N	021° 20,17' W	4367,1
PS95/0017-1	12.11.2015	11:54	CPR	on deck	22° 17,38' N	021° 20,27' W	4368,4
PS95/0020-1	12.11.2015	12:06	CPR	in the water	22° 16,32' N	021° 20,99' W	4378,8
PS95/0020-1	12.11.2015	12:08	CPR	on ground/ max depth	22° 16,13' N	021° 21,12' W	4378,5
PS95/0021-1	13.11.2015	09:00	XBT	in the water	18° 40,68' N	023° 49,77' W	3828,9
PS95/0021-1	13.11.2015	09:06	XBT	on ground/ max depth	18° 41,21' N	023° 49,46' W	0,0
PS95/0021-2	13.11.2015	09:06	BUCKET	in the water	18° 41,21' N	023° 49,46' W	3831,1
PS95/0021-1	13.11.2015	09:06	XBT	on deck	18° 41,21' N	023° 49,46' W	3831,1
PS95/0021-2	13.11.2015	09:07	BUCKET	on ground/ max depth	18° 41,30' N	023° 49,40' W	3832,3
PS95/0021-2	13.11.2015	09:09	BUCKET	on deck	18° 41,48' N	023° 49,28' W	0,0
PS95/0020-1	13.11.2015	18:02	CPR	hoisting	17° 06,54' N	024° 52,03' W	2093,4
PS95/0020-1	13.11.2015	18:06	CPR	on deck	17° 06,15' N	024° 52,28' W	2076,3
PS95/0022-1	14.11.2015	03:59	BONGO	in the water	15° 38,85' N	024° 18,04' W	3902,0
PS95/0022-1	14.11.2015	04:03	BONGO	on ground/ max depth	15° 38,80' N	024° 18,08' W	3903,3
PS95/0022-1	14.11.2015	04:03	BONGO	hoisting	15° 38,80' N	024° 18,08' W	3903,3
PS95/0022-1	14.11.2015	04:10	BONGO	on deck	15° 38,74' N	024° 18,13' W	3904,1
PS95/0022-2	14.11.2015	04:18	CALCOFI	in the water	15° 38,70' N	024° 18,16' W	3905,0
PS95/0022-2	14.11.2015	04:23	CALCOFI	on ground/ max depth	15° 38,67' N	024° 18,18' W	3904,9
PS95/0022-2	14.11.2015	04:23	CALCOFI	hoisting	15° 38,67' N	024° 18,18' W	3904,9
PS95/0022-2	14.11.2015	04:29	CALCOFI	on deck	15° 38,64' N	024° 18,21' W	3904,6
PS95/0022-3	14.11.2015	04:34	PLA	in the water	15° 38,60' N	024° 18,24' W	3903,8
PS95/0022-3	14.11.2015	04:42	PLA	on ground/ max depth	15° 38,56' N	024° 18,30' W	3903,3
PS95/0022-3	14.11.2015	04:42	PLA	hoisting	15° 38,56' N	024° 18,30' W	3903,3
PS95/0022-3	14.11.2015	04:50	PLA	on deck	15° 38,52' N	024° 18,36' W	3902,9

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0022-4	14.11.2015	04:54	LM	in the water	15° 38,49' N	024° 18,38' W	3902,8
PS95/0022-4	14.11.2015	04:54	LM	profile start	15° 38,49' N	024° 18,38' W	3902,8
PS95/0022-4	14.11.2015	04:58	LM	on ground/ max depth	15° 38,47' N	024° 18,41' W	3903,4
PS95/0022-5	14.11.2015	04:58	BUCKET	in the water	15° 38,47' N	024° 18,41' W	3903,4
PS95/0022-4	14.11.2015	04:58	LM	hoisting	15° 38,47' N	024° 18,41' W	3903,4
PS95/0022-5	14.11.2015	04:59	BUCKET	on ground/ max depth	15° 38,46' N	024° 18,42' W	3903,2
PS95/0022-5	14.11.2015	04:59	BUCKET	on deck	15° 38,46' N	024° 18,42' W	3903,2
PS95/0022-4	14.11.2015	05:05	LM	profile end	15° 38,43' N	024° 18,47' W	3904,2
PS95/0022-4	14.11.2015	05:05	LM	on deck	15° 38,43' N	024° 18,47' W	3904,2
PS95/0022-6	14.11.2015	05:08	LM	in the water	15° 38,41' N	024° 18,51' W	3903,7
PS95/0022-6	14.11.2015	05:08	LM	profile start	15° 38,41' N	024° 18,51' W	3903,7
PS95/0022-6	14.11.2015	05:11	LM	on ground/ max depth	15° 38,39' N	024° 18,54' W	3903,9
PS95/0022-6	14.11.2015	05:11	LM	hoisting	15° 38,39' N	024° 18,54' W	3903,9
PS95/0022-6	14.11.2015	05:14	LM	profile end	15° 38,37' N	024° 18,56' W	0,0
PS95/0022-6	14.11.2015	05:14	LM	on deck	15° 38,37' N	024° 18,56' W	3903,3
PS95/0022-7	14.11.2015	05:21	CTD/RO	in the water	15° 38,35' N	024° 18,62' W	3903,6
PS95/0022-7	14.11.2015	06:39	CTD/RO	on ground/ max depth	15° 38,36' N	024° 19,11' W	3906,8
PS95/0022-7	14.11.2015	06:46	CTD/RO	hoisting	15° 38,37' N	024° 19,16' W	3907,3
PS95/0022-7	14.11.2015	08:17	CTD/RO	at surface	15° 38,40' N	024° 19,64' W	3907,8
PS95/0022-7	14.11.2015	08:18	CTD/RO	on deck	15° 38,40' N	024° 19,64' W	3908,2
PS95/0022-8	14.11.2015	08:29	BONGO	in the water	15° 38,41' N	024° 19,66' W	3908,7
PS95/0022-8	14.11.2015	08:30	BONGO	on ground/ max depth	15° 38,41' N	024° 19,66' W	3909,2
PS95/0022-8	14.11.2015	08:40	BONGO	hoisting	15° 38,47' N	024° 19,82' W	3909,8
PS95/0022-8	14.11.2015	08:41	BONGO	at surface	15° 38,47' N	024° 19,84' W	3909,9
PS95/0022-8	14.11.2015	08:44	BONGO	on deck	15° 38,47' N	024° 19,87' W	3910,1
PS95/0022-9	14.11.2015	08:51	BONGO	in the water	15° 38,44' N	024° 19,90' W	3909,5
PS95/0022-9	14.11.2015	08:58	BONGO	on ground/ max depth	15° 38,41' N	024° 19,94' W	3909,5
PS95/0022-9	14.11.2015	08:58	BONGO	hoisting	15° 38,41' N	024° 19,94' W	3909,5
PS95/0022-9	14.11.2015	09:04	BONGO	at surface	15° 38,39' N	024° 19,96' W	3910,7
PS95/0022-9	14.11.2015	09:08	BONGO	on deck	15° 38,41' N	024° 19,97' W	3910,2
PS95/0022-10	14.11.2015	09:11	CALCOFI	in the water	15° 38,43' N	024° 19,98' W	3909,0
PS95/0022-10	14.11.2015	09:17	CALCOFI	on ground/ max depth	15° 38,43' N	024° 20,03' W	3910,3
PS95/0022-10	14.11.2015	09:17	CALCOFI	hoisting	15° 38,43' N	024° 20,03' W	3910,3
PS95/0022-10	14.11.2015	09:24	CALCOFI	at surface	15° 38,41' N	024° 20,09' W	3912,4
PS95/0022-10	14.11.2015	09:27	CALCOFI	on deck	15° 38,40' N	024° 20,10' W	3912,5
PS95/0022-11	14.11.2015	09:28	CALCOFI	in the water	15° 38,40' N	024° 20,11' W	0,0
PS95/0022-11	14.11.2015	09:34	CALCOFI	on ground/ max depth	15° 38,37' N	024° 20,14' W	3913,2

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0022-11	14.11.2015	09:35	CALCOFI	hoisting	15° 38,36' N	024° 20,15' W	0,0
PS95/0022-11	14.11.2015	09:40	CALCOFI	at surface	15° 38,32' N	024° 20,17' W	3911,6
PS95/0022-11	14.11.2015	09:42	CALCOFI	on deck	15° 38,31' N	024° 20,19' W	3912,5
PS95/0022-12	14.11.2015	09:46	PLA	in the water	15° 38,29' N	024° 20,22' W	0,0
PS95/0022-12	14.11.2015	09:54	PLA	on ground/ max depth	15° 38,25' N	024° 20,26' W	3910,9
PS95/0022-12	14.11.2015	09:54	PLA	hoisting	15° 38,25' N	024° 20,26' W	3910,9
PS95/0022-12	14.11.2015	10:00	PLA	at surface	15° 38,22' N	024° 20,29' W	3909,7
PS95/0022-12	14.11.2015	10:03	PLA	on deck	15° 38,21' N	024° 20,31' W	3910,6
PS95/0022-13	14.11.2015	10:06	LM	in the water	15° 38,20' N	024° 20,34' W	3910,3
PS95/0022-13	14.11.2015	10:06	LM	profile start	15° 38,20' N	024° 20,34' W	3910,3
PS95/0022-13	14.11.2015	10:07	LM	on ground/ max depth	15° 38,20' N	024° 20,34' W	3910,9
PS95/0022-13	14.11.2015	10:08	LM	hoisting	15° 38,20' N	024° 20,35' W	3911,1
PS95/0022-13	14.11.2015	10:10	LM	profile end	15° 38,19' N	024° 20,35' W	3911,4
PS95/0022-13	14.11.2015	10:11	LM	at surface	15° 38,19' N	024° 20,36' W	0,0
PS95/0022-13	14.11.2015	10:11	LM	on deck	15° 38,19' N	024° 20,36' W	3911,6
PS95/0022-14	14.11.2015	10:13	BUCKET	in the water	15° 38,18' N	024° 20,36' W	3911,3
PS95/0022-14	14.11.2015	10:14	BUCKET	on ground/ max depth	15° 38,18' N	024° 20,37' W	3911,2
PS95/0022-14	14.11.2015	10:14	BUCKET	on deck	15° 38,18' N	024° 20,37' W	3911,2
PS95/0022-15	14.11.2015	10:22	CTD/RO	in the water	15° 38,12' N	024° 20,41' W	3910,6
PS95/0022-15	14.11.2015	10:33	CTD/RO	on ground/ max depth	15° 38,07' N	024° 20,45' W	3909,5
PS95/0022-15	14.11.2015	10:34	CTD/RO	hoisting	15° 38,07' N	024° 20,45' W	3908,9
PS95/0022-15	14.11.2015	10:42	CTD/RO	at surface	15° 38,04' N	024° 20,51' W	3909,8
PS95/0022-15	14.11.2015	10:42	CTD/RO	on deck	15° 38,04' N	024° 20,51' W	3909,8
PS95/0022-16	14.11.2015	10:53	XBT	in the water	15° 38,38' N	024° 20,19' W	3912,5
PS95/0022-16	14.11.2015	10:58	XBT	on ground/ max depth	15° 38,70' N	024° 19,91' W	3912,1
PS95/0022-16	14.11.2015	10:58	XBT	on deck	15° 38,70' N	024° 19,91' W	3912,1
PS95/0023-1	14.11.2015	11:05	CPR	in the water	15° 38,71' N	024° 19,39' W	3913,9
PS95/0023-1	14.11.2015	11:07	CPR	on ground/ max depth	15° 38,60' N	024° 19,20' W	3913,1
PS95/0023-1	14.11.2015	14:57	CPR	hoisting	15° 03,83' N	023° 49,12' W	0,0
PS95/0023-1	14.11.2015	15:00	CPR	on deck	15° 03,52' N	023° 48,84' W	974,5
PS95/0024-1	14.11.2015	16:55	CAL	in the water	15° 00,20' N	023° 44,94' W	893,4
PS95/0024-1	14.11.2015	17:33	CAL	action	15° 00,50' N	023° 44,80' W	0,0
PS95/0024-1	14.11.2015	17:56	CAL	action	15° 00,59' N	023° 44,98' W	0,0
PS95/0024-1	14.11.2015	19:37	CAL	profile start	15° 00,31' N	023° 44,90' W	0,0
PS95/0024-1	14.11.2015	19:39	CAL	profile end	15° 00,31' N	023° 44,90' W	0,0
PS95/0024-1	14.11.2015	19:39	CAL	on ground/ max depth	15° 00,31' N	023° 44,90' W	0,0
PS95/0024-1	14.11.2015	19:39	CAL	on deck	15° 00,31' N	023° 44,90' W	0,0
PS95/0025-1	14.11.2015	20:10	CPR	in the water	14° 58,39' N	023° 45,45' W	0,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0025-1	14.11.2015	20:12	CPR	on ground/ max depth	14° 58,18' N	023° 45,42' W	1315,1
PS95/0026-1	15.11.2015	09:02	XBT	in the water	12° 59,95' N	022° 36,43' W	4692,5
PS95/0026-1	15.11.2015	09:08	XBT	on ground/ max depth	13° 00,57' N	022° 36,43' W	0,0
PS95/0026-2	15.11.2015	09:08	BUCKET	in the water	13° 00,57' N	022° 36,43' W	4687,6
PS95/0026-1	15.11.2015	09:08	XBT	on deck	13° 00,57' N	022° 36,43' W	4687,6
PS95/0026-2	15.11.2015	09:10	BUCKET	on ground/ max depth	13° 00,78' N	022° 36,43' W	4687,7
PS95/0026-2	15.11.2015	09:10	BUCKET	on deck	13° 00,78' N	022° 36,43' W	4687,7
PS95/0027-1	16.11.2015	09:00	XBT	in the water	09° 17,06' N	020° 25,73' W	4000,0
PS95/0027-1	16.11.2015	09:05	XBT	on ground/ max depth	09° 16,56' N	020° 25,44' W	3977,5
PS95/0027-2	16.11.2015	09:06	BUCKET	in the water	09° 16,46' N	020° 25,38' W	3973,8
PS95/0027-1	16.11.2015	09:06	XBT	on deck	09° 16,46' N	020° 25,38' W	3975,1
PS95/0027-2	16.11.2015	09:07	BUCKET	on ground/ max depth	09° 16,36' N	020° 25,33' W	3966,6
PS95/0027-2	16.11.2015	09:13	BUCKET	on deck	09° 15,77' N	020° 24,97' W	3917,2
PS95/0025-1	16.11.2015	17:30	CPR	hoisting	07° 57,30' N	019° 38,76' W	0,0
PS95/0025-1	16.11.2015	17:33	CPR	on deck	07° 57,07' N	019° 38,61' W	0,0
PS95/0028-1	16.11.2015	17:39	CAL	action	07° 56,80' N	019° 38,48' W	0,0
PS95/0028-1	16.11.2015	17:42	CAL	in the water	07° 56,77' N	019° 38,47' W	0,0
PS95/0028-1	16.11.2015	17:54	CAL	in the water	07° 56,61' N	019° 38,44' W	0,0
PS95/0028-1	16.11.2015	18:00	CAL	profile start	07° 56,53' N	019° 38,42' W	0,0
PS95/0028-1	16.11.2015	18:00	CAL	on ground/ max depth	07° 56,53' N	019° 38,42' W	0,0
PS95/0028-2	16.11.2015	18:15	BUCKET	on ground/ max depth	07° 56,35' N	019° 38,37' W	0,0
PS95/0028-1	16.11.2015	19:12	CAL	on deck	07° 55,47' N	019° 38,33' W	0,0
PS95/0028-1	16.11.2015	20:57	CAL	profile end	07° 53,88' N	019° 38,13' W	0,0
PS95/0028-1	16.11.2015	21:40	CAL	on deck	07° 53,20' N	019° 38,25' W	0,0
PS95/0029-1	16.11.2015	21:52	CPR	in the water	07° 52,59' N	019° 38,24' W	4369,7
PS95/0029-1	16.11.2015	21:55	CPR	on ground/ max depth	07° 52,31' N	019° 38,08' W	4374,1
PS95/0030-1	17.11.2015	08:59	XBT	in the water	05° 56,52' N	018° 27,92' W	4787,9
PS95/0030-1	17.11.2015	09:04	XBT	on ground/ max depth	05° 56,07' N	018° 27,67' W	4788,0
PS95/0030-1	17.11.2015	09:04	XBT	on deck	05° 56,07' N	018° 27,67' W	4788,0
PS95/0030-2	17.11.2015	09:06	BUCKET	in the water	05° 55,89' N	018° 27,56' W	4788,6
PS95/0030-2	17.11.2015	09:06	BUCKET	on ground/ max depth	05° 55,89' N	018° 27,56' W	4788,6
PS95/0030-2	17.11.2015	09:08	BUCKET	on deck	05° 55,71' N	018° 27,45' W	4788,2
PS95/0031-1	18.11.2015	08:58	XBT	in the water	02° 10,30' N	016° 15,87' W	5195,2
PS95/0031-1	18.11.2015	09:03	XBT	on ground/ max depth	02° 09,87' N	016° 15,63' W	5194,3
PS95/0031-1	18.11.2015	09:04	XBT	on deck	02° 09,79' N	016° 15,58' W	5194,3

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0031-2	18.11.2015	09:05	BUCKET	in the water	02° 09,70' N	016° 15,53' W	5193,8
PS95/0031-2	18.11.2015	09:07	BUCKET	on ground/ max depth	02° 09,53' N	016° 15,44' W	5193,5
PS95/0031-2	18.11.2015	09:07	BUCKET	on deck	02° 09,53' N	016° 15,44' W	5193,5
PS95/0029-1	18.11.2015	11:15	CPR	hoisting	01° 49,28' N	016° 03,64' W	4528,4
PS95/0029-1	18.11.2015	11:18	CPR	at surface	01° 49,03' N	016° 03,50' W	0,0
PS95/0029-1	18.11.2015	11:20	CPR	on deck	01° 48,91' N	016° 03,42' W	4513,4
PS95/0032-1	18.11.2015	11:32	CTD/RO	in the water	01° 48,55' N	016° 03,27' W	4588,2
PS95/0032-1	18.11.2015	11:37	CTD/RO	on ground/ max depth	01° 48,54' N	016° 03,31' W	4594,0
PS95/0032-1	18.11.2015	11:39	CTD/RO	hoisting	01° 48,53' N	016° 03,31' W	4594,3
PS95/0032-1	18.11.2015	11:47	CTD/RO	on deck	01° 48,50' N	016° 03,32' W	4582,8
PS95/0033-1	18.11.2015	11:55	CPR	in the water	01° 48,18' N	016° 03,13' W	4583,8
PS95/0033-1	18.11.2015	11:58	CPR	on ground/ max depth	01° 47,86' N	016° 02,95' W	4637,4
PS95/0033-1	18.11.2015	22:58	CPR	hoisting	00° 03,48' N	015° 02,02' W	3404,0
PS95/0033-1	18.11.2015	23:01	CPR	at surface	00° 03,22' N	015° 01,86' W	3511,2
PS95/0033-1	18.11.2015	23:03	CPR	on deck	00° 03,03' N	015° 01,76' W	3554,7
PS95/0034-1	18.11.2015	23:31	CTD/RO	in the water	00° 00,01' N	015° 00,08' W	3774,9
PS95/0034-2	19.11.2015	00:43	BUCKET	in the water	00° 00,03' S	015° 00,01' W	3775,6
PS95/0034-1	19.11.2015	00:45	CTD/RO	on ground/ max depth	00° 00,03' S	015° 00,01' W	3775,6
PS95/0034-2	19.11.2015	00:45	BUCKET	on ground/ max depth	00° 00,03' S	015° 00,01' W	3775,6
PS95/0034-2	19.11.2015	00:47	BUCKET	on deck	00° 00,02' S	015° 00,01' W	3775,2
PS95/0034-1	19.11.2015	00:49	CTD/RO	hoisting	00° 00,01' S	015° 00,01' W	3775,8
PS95/0034-1	19.11.2015	02:19	CTD/RO	on deck	00° 00,03' S	015° 00,00' W	3775,5
PS95/0034-3	19.11.2015	02:30	BONGO	in the water	00° 00,01' S	014° 59,99' W	3775,4
PS95/0034-3	19.11.2015	02:31	BONGO	on ground/ max depth	00° 00,02' S	014° 59,98' W	3775,2
PS95/0034-3	19.11.2015	02:31	BONGO	information	00° 00,02' S	014° 59,98' W	3775,2
PS95/0034-3	19.11.2015	02:41	BONGO	information	00° 00,19' S	014° 59,76' W	3774,0
PS95/0034-3	19.11.2015	02:41	BONGO	hoisting	00° 00,19' S	014° 59,76' W	3774,0
PS95/0034-3	19.11.2015	02:44	BONGO	on deck	00° 00,23' S	014° 59,72' W	3774,0
PS95/0034-4	19.11.2015	02:50	BONGO	in the water	00° 00,26' S	014° 59,70' W	3773,6
PS95/0034-4	19.11.2015	02:58	BONGO	on ground/ max depth	00° 00,26' S	014° 59,68' W	3772,7
PS95/0034-4	19.11.2015	02:58	BONGO	hoisting	00° 00,26' S	014° 59,68' W	3772,7
PS95/0034-4	19.11.2015	03:07	BONGO	on deck	00° 00,30' S	014° 59,59' W	3772,7
PS95/0034-5	19.11.2015	03:11	CALCOFI	in the water	00° 00,30' S	014° 59,60' W	3772,8
PS95/0034-5	19.11.2015	03:19	CALCOFI	on ground/ max depth	00° 00,30' S	014° 59,54' W	3772,5
PS95/0034-5	19.11.2015	03:20	CALCOFI	hoisting	00° 00,30' S	014° 59,53' W	3772,5
PS95/0034-5	19.11.2015	03:27	CALCOFI	on deck	00° 00,33' S	014° 59,45' W	3772,6
PS95/0034-6	19.11.2015	03:29	CALCOFI	in the water	00° 00,34' S	014° 59,45' W	3773,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0034-6	19.11.2015	03:36	CALCOFI	on ground/ max depth	00° 00,34' S	014° 59,42' W	3772,5
PS95/0034-6	19.11.2015	03:37	CALCOFI	hoisting	00° 00,34' S	014° 59,41' W	3772,9
PS95/0034-6	19.11.2015	03:45	CALCOFI	on deck	00° 00,37' S	014° 59,35' W	3772,9
PS95/0034-7	19.11.2015	03:49	PLA	in the water	00° 00,38' S	014° 59,35' W	3773,4
PS95/0034-7	19.11.2015	03:54	PLA	on ground/ max depth	00° 00,38' S	014° 59,34' W	3773,4
PS95/0034-7	19.11.2015	03:55	PLA	hoisting	00° 00,38' S	014° 59,34' W	3772,5
PS95/0034-7	19.11.2015	04:01	PLA	on deck	00° 00,38' S	014° 59,30' W	3772,8
PS95/0034-8	19.11.2015	04:03	LM	in the water	00° 00,38' S	014° 59,28' W	3773,0
PS95/0034-8	19.11.2015	04:03	LM	profile start	00° 00,38' S	014° 59,28' W	3773,0
PS95/0034-8	19.11.2015	04:05	LM	on ground/ max depth	00° 00,38' S	014° 59,27' W	3772,7
PS95/0034-8	19.11.2015	04:05	LM	hoisting	00° 00,38' S	014° 59,27' W	3772,7
PS95/0034-8	19.11.2015	04:09	LM	profile end	00° 00,39' S	014° 59,25' W	3772,6
PS95/0034-8	19.11.2015	04:09	LM	on deck	00° 00,39' S	014° 59,25' W	3772,6
PS95/0034-9	19.11.2015	04:17	CTD/RO	in the water	00° 00,39' S	014° 59,20' W	3772,8
PS95/0034-9	19.11.2015	04:31	CTD/RO	on ground/ max depth	00° 00,41' S	014° 59,13' W	3772,3
PS95/0034-9	19.11.2015	04:32	CTD/RO	hoisting	00° 00,41' S	014° 59,12' W	3773,5
PS95/0034-9	19.11.2015	04:41	CTD/RO	on deck	00° 00,41' S	014° 59,08' W	3773,2
PS95/0035-1	19.11.2015	04:53	CPR	in the water	00° 00,66' S	014° 58,93' W	3773,1
PS95/0035-1	19.11.2015	04:53	CPR	on ground/ max depth	00° 00,66' S	014° 58,93' W	3773,1
PS95/0036-1	19.11.2015	08:57	XBT	in the water	00° 25,12' S	014° 22,54' W	3917,6
PS95/0036-1	19.11.2015	09:02	XBT	on ground/ max depth	00° 25,39' S	014° 22,16' W	4007,1
PS95/0036-1	19.11.2015	09:02	XBT	on deck	00° 25,39' S	014° 22,16' W	4007,1
PS95/0036-2	19.11.2015	09:05	BUCKET	in the water	00° 25,55' S	014° 21,92' W	3993,5
PS95/0036-2	19.11.2015	09:06	BUCKET	on ground/ max depth	00° 25,60' S	014° 21,84' W	0,0
PS95/0036-2	19.11.2015	09:08	BUCKET	on deck	00° 25,71' S	014° 21,68' W	0,0
PS95/0037-1	20.11.2015	08:58	XBT	in the water	02° 50,40' S	010° 45,83' W	3694,3
PS95/0037-1	20.11.2015	09:03	XBT	on ground/ max depth	02° 50,67' S	010° 45,43' W	3617,1
PS95/0037-1	20.11.2015	09:03	XBT	on deck	02° 50,67' S	010° 45,43' W	3617,1
PS95/0037-2	20.11.2015	09:04	BUCKET	in the water	02° 50,72' S	010° 45,35' W	3601,6
PS95/0037-2	20.11.2015	09:05	BUCKET	on ground/ max depth	02° 50,78' S	010° 45,27' W	3568,2
PS95/0037-2	20.11.2015	09:07	BUCKET	on deck	02° 50,88' S	010° 45,12' W	3539,1
PS95/0035-1	21.11.2015	02:58	CPR	hoisting	04° 39,94' S	008° 02,15' W	3792,3
PS95/0035-1	21.11.2015	03:04	CPR	on deck	04° 40,53' S	008° 01,26' W	3792,9
PS95/0038-1	21.11.2015	03:11	CPR	in the water	04° 41,22' S	008° 00,24' W	3872,6
PS95/0038-1	21.11.2015	03:13	CPR	on ground/ max depth	04° 41,41' S	007° 59,93' W	0,0
PS95/0039-1	21.11.2015	08:59	XBT	in the water	05° 16,10' S	007° 07,65' W	4090,4

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0039-1	21.11.2015	09:00	XBT	information	05° 16,15' S	007° 07,57' W	4065,2
PS95/0039-1	21.11.2015	09:02	XBT	in the water	05° 16,26' S	007° 07,41' W	4080,0
PS95/0039-1	21.11.2015	09:08	XBT	on ground/ max depth	05° 16,57' S	007° 06,94' W	4224,6
PS95/0039-1	21.11.2015	09:08	XBT	on deck	05° 16,57' S	007° 06,94' W	4224,6
PS95/0039-2	21.11.2015	09:09	BUCKET	in the water	05° 16,62' S	007° 06,86' W	4246,5
PS95/0039-2	21.11.2015	09:12	BUCKET	on ground/ max depth	05° 16,79' S	007° 06,61' W	4333,8
PS95/0039-2	21.11.2015	09:14	BUCKET	on deck	05° 16,90' S	007° 06,44' W	4346,6
PS95/0040-1	22.11.2015	08:56	XBT	in the water	07° 40,52' S	003° 30,75' W	4648,3
PS95/0040-1	22.11.2015	09:01	XBT	on ground/ max depth	07° 40,78' S	003° 30,35' W	4672,9
PS95/0040-1	22.11.2015	09:02	XBT	on deck	07° 40,83' S	003° 30,27' W	4678,9
PS95/0040-2	22.11.2015	09:03	BUCKET	in the water	07° 40,89' S	003° 30,19' W	4694,9
PS95/0040-2	22.11.2015	09:04	BUCKET	on ground/ max depth	07° 40,94' S	003° 30,10' W	4699,0
PS95/0040-2	22.11.2015	09:06	BUCKET	on deck	07° 41,06' S	003° 29,92' W	4694,5
PS95/0038-1	23.11.2015	00:56	CPR	hoisting	09° 17,46' S	001° 04,47' W	5289,4
PS95/0038-1	23.11.2015	01:01	CPR	on deck	09° 17,97' S	001° 03,71' W	5244,6
PS95/0041-1	23.11.2015	01:08	CPR	in the water	09° 18,67' S	001° 02,64' W	5145,8
PS95/0041-1	23.11.2015	01:11	CPR	on ground/ max depth	09° 18,95' S	001° 02,20' W	5232,6
PS95/0041-1	23.11.2015	08:46	CPR	hoisting	10° 06,71' S	000° 03,87' E	5517,5
PS95/0041-1	23.11.2015	08:47	CPR	at surface	10° 06,78' S	000° 03,92' E	5515,6
PS95/0041-1	23.11.2015	08:50	CPR	on deck	10° 07,00' S	000° 04,05' E	5508,6
PS95/0042-1	23.11.2015	08:57	XBT	in the water	10° 07,52' S	000° 04,34' E	5505,6
PS95/0042-1	23.11.2015	09:02	XBT	on ground/ max depth	10° 07,91' S	000° 04,59' E	5512,8
PS95/0042-1	23.11.2015	09:02	XBT	on deck	10° 07,91' S	000° 04,59' E	5512,8
PS95/0042-2	23.11.2015	09:04	BUCKET	in the water	10° 08,08' S	000° 04,68' E	5512,4
PS95/0042-2	23.11.2015	09:05	BUCKET	on ground/ max depth	10° 08,14' S	000° 04,71' E	5512,0
PS95/0042-2	23.11.2015	09:07	BUCKET	on deck	10° 08,23' S	000° 04,77' E	5512,5
PS95/0042-3	23.11.2015	09:17	CTD/RO	in the water	10° 08,30' S	000° 04,81' E	5511,2
PS95/0042-3	23.11.2015	10:57	CTD/RO	on ground/ max depth	10° 08,20' S	000° 04,85' E	5512,3
PS95/0042-3	23.11.2015	10:59	CTD/RO	hoisting	10° 08,20' S	000° 04,86' E	5511,6
PS95/0042-3	23.11.2015	12:49	CTD/RO	on deck	10° 08,13' S	000° 04,85' E	5513,2
PS95/0042-4	23.11.2015	13:00	BONGO	in the water	10° 08,14' S	000° 04,89' E	5513,4
PS95/0042-4	23.11.2015	13:04	BONGO	on ground/ max depth	10° 08,18' S	000° 04,99' E	5512,5
PS95/0042-4	23.11.2015	13:04	BONGO	information	10° 08,18' S	000° 04,99' E	5512,5
PS95/0042-4	23.11.2015	13:14	BONGO	hoisting	10° 08,26' S	000° 05,23' E	5516,0
PS95/0042-4	23.11.2015	13:16	BONGO	on deck	10° 08,27' S	000° 05,25' E	5517,2
PS95/0042-5	23.11.2015	13:28	BONGO	in the water	10° 08,25' S	000° 05,31' E	5516,8

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0042-5	23.11.2015	13:35	BONGO	on ground/ max depth	10° 08,22' S	000° 05,33' E	5513,8
PS95/0042-5	23.11.2015	13:35	BONGO	hoisting	10° 08,22' S	000° 05,33' E	5513,8
PS95/0042-5	23.11.2015	13:43	BONGO	on deck	10° 08,19' S	000° 05,36' E	5511,9
PS95/0042-6	23.11.2015	13:49	CALCOFI	in the water	10° 08,16' S	000° 05,38' E	5509,9
PS95/0042-6	23.11.2015	13:59	CALCOFI	on ground/ max depth	10° 08,08' S	000° 05,42' E	5502,5
PS95/0042-6	23.11.2015	14:00	CALCOFI	hoisting	10° 08,07' S	000° 05,43' E	5503,4
PS95/0042-6	23.11.2015	14:09	CALCOFI	on deck	10° 08,00' S	000° 05,46' E	5498,8
PS95/0042-7	23.11.2015	14:11	CALCOFI	in the water	10° 07,99' S	000° 05,46' E	5497,3
PS95/0042-7	23.11.2015	14:18	CALCOFI	on ground/ max depth	10° 07,95' S	000° 05,49' E	5496,8
PS95/0042-7	23.11.2015	14:18	CALCOFI	hoisting	10° 07,95' S	000° 05,49' E	5496,8
PS95/0042-7	23.11.2015	14:25	CALCOFI	on deck	10° 07,91' S	000° 05,52' E	5494,8
PS95/0042-8	23.11.2015	14:29	PLA	in the water	10° 07,89' S	000° 05,54' E	5492,6
PS95/0042-8	23.11.2015	14:37	PLA	on ground/ max depth	10° 07,85' S	000° 05,56' E	5490,4
PS95/0042-8	23.11.2015	14:37	PLA	hoisting	10° 07,85' S	000° 05,56' E	5490,4
PS95/0042-8	23.11.2015	14:46	PLA	on deck	10° 07,81' S	000° 05,58' E	5489,2
PS95/0042-9	23.11.2015	14:50	LM	in the water	10° 07,80' S	000° 05,58' E	5489,1
PS95/0042-9	23.11.2015	14:50	LM	profile start	10° 07,80' S	000° 05,58' E	5489,1
PS95/0042-9	23.11.2015	14:51	LM	on ground/ max depth	10° 07,80' S	000° 05,58' E	5487,8
PS95/0042-9	23.11.2015	14:56	LM	profile end	10° 07,78' S	000° 05,59' E	5487,9
PS95/0042-9	23.11.2015	14:57	LM	on deck	10° 07,78' S	000° 05,60' E	5487,7
PS95/0042-10	23.11.2015	15:07	CTD/RO	in the water	10° 07,77' S	000° 05,60' E	5487,8
PS95/0042-10	23.11.2015	15:15	CTD/RO	on ground/ max depth	10° 07,76' S	000° 05,58' E	5488,2
PS95/0042-10	23.11.2015	15:15	CTD/RO	hoisting	10° 07,76' S	000° 05,58' E	5488,2
PS95/0042-10	23.11.2015	15:24	CTD/RO	on deck	10° 07,77' S	000° 05,56' E	5488,9
PS95/0043-1	23.11.2015	15:31	CPR	in the water	10° 08,18' S	000° 05,84' E	5491,8
PS95/0043-1	23.11.2015	15:33	CPR	on ground/ max depth	10° 08,49' S	000° 05,95' E	5497,7
PS95/0044-1	24.11.2015	07:59	XBT	in the water	12° 45,20' S	001° 36,21' E	5536,9
PS95/0044-1	24.11.2015	08:01	XBT	information	12° 45,36' S	001° 36,31' E	5537,5
PS95/0044-1	24.11.2015	08:03	XBT	in the water	12° 45,53' S	001° 36,40' E	5537,4
PS95/0044-1	24.11.2015	08:08	XBT	on ground/ max depth	12° 45,93' S	001° 36,64' E	5538,8
PS95/0044-1	24.11.2015	08:08	XBT	on deck	12° 45,93' S	001° 36,64' E	5538,8
PS95/0044-2	24.11.2015	08:09	BUCKET	in the water	12° 46,02' S	001° 36,69' E	5537,7
PS95/0044-2	24.11.2015	08:12	BUCKET	on ground/ max depth	12° 46,26' S	001° 36,84' E	5538,8
PS95/0044-2	24.11.2015	08:12	BUCKET	on deck	12° 46,26' S	001° 36,84' E	5538,8
PS95/0043-1	25.11.2015	07:43	CPR	hoisting	16° 32,41' S	003° 50,34' E	5454,4
PS95/0043-1	25.11.2015	07:45	CPR	at surface	16° 32,61' S	003° 50,44' E	5454,9
PS95/0043-1	25.11.2015	07:48	CPR	on deck	16° 32,85' S	003° 50,59' E	5453,5

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0045-1	25.11.2015	07:54	XBT	in the water	16° 33,33' S	003° 50,87' E	5453,9
PS95/0045-1	25.11.2015	07:59	XBT	on ground/ max depth	16° 33,71' S	003° 51,11' E	5452,9
PS95/0045-2	25.11.2015	08:00	BUCKET	in the water	16° 33,79' S	003° 51,16' E	5452,8
PS95/0045-1	25.11.2015	08:00	XBT	on deck	16° 33,79' S	003° 51,16' E	0,0
PS95/0045-2	25.11.2015	08:02	BUCKET	on ground/ max depth	16° 33,94' S	003° 51,25' E	5452,7
PS95/0045-2	25.11.2015	08:03	BUCKET	on deck	16° 34,02' S	003° 51,29' E	5453,8
PS95/0046-1	25.11.2015	08:07	CPR	in the water	16° 34,34' S	003° 51,48' E	5452,5
PS95/0046-1	25.11.2015	08:10	CPR	on ground/ max depth	16° 34,59' S	003° 51,63' E	5452,3
PS95/0047-1	26.11.2015	07:14	XBT	in the water	20° 10,22' S	006° 09,49' E	4065,1
PS95/0047-1	26.11.2015	07:19	XBT	on ground/ max depth	20° 10,42' S	006° 09,93' E	4099,2
PS95/0047-1	26.11.2015	07:19	XBT	on deck	20° 10,42' S	006° 09,93' E	4099,2
PS95/0047-2	26.11.2015	07:20	BUCKET	in the water	20° 10,46' S	006° 10,02' E	4104,8
PS95/0047-2	26.11.2015	07:23	BUCKET	on ground/ max depth	20° 10,60' S	006° 10,31' E	4130,6
PS95/0047-2	26.11.2015	07:23	BUCKET	on deck	20° 10,60' S	006° 10,31' E	4130,6
PS95/0046-1	26.11.2015	08:12	CPR	hoisting	20° 14,46' S	006° 18,76' E	4477,7
PS95/0046-1	26.11.2015	08:15	CPR	at surface	20° 14,66' S	006° 19,19' E	4442,2
PS95/0046-1	26.11.2015	08:18	CPR	on deck	20° 14,84' S	006° 19,59' E	4446,6
PS95/0047-3	26.11.2015	08:34	CTD/RO	in the water	20° 15,59' S	006° 21,25' E	4687,0
PS95/0047-3	26.11.2015	10:10	CTD/RO	on ground/ max depth	20° 15,56' S	006° 21,25' E	4689,1
PS95/0047-3	26.11.2015	10:11	CTD/RO	hoisting	20° 15,56' S	006° 21,25' E	4689,4
PS95/0047-3	26.11.2015	11:57	CTD/RO	on deck	20° 15,50' S	006° 21,14' E	4677,7
PS95/0047-4	26.11.2015	12:06	PLA	in the water	20° 15,46' S	006° 21,11' E	4675,2
PS95/0047-4	26.11.2015	12:14	PLA	on ground/ max depth	20° 15,43' S	006° 21,10' E	4674,7
PS95/0047-4	26.11.2015	12:14	PLA	hoisting	20° 15,43' S	006° 21,10' E	4674,7
PS95/0047-4	26.11.2015	12:23	PLA	on deck	20° 15,44' S	006° 21,09' E	4674,2
PS95/0047-5	26.11.2015	12:29	BONGO	in the water	20° 15,47' S	006° 21,14' E	4676,4
PS95/0047-5	26.11.2015	12:33	BONGO	on ground/ max depth	20° 15,51' S	006° 21,22' E	4684,1
PS95/0047-5	26.11.2015	12:33	BONGO	information	20° 15,51' S	006° 21,22' E	4684,1
PS95/0047-5	26.11.2015	12:43	BONGO	hoisting	20° 15,51' S	006° 21,39' E	4710,4
PS95/0047-5	26.11.2015	12:46	BONGO	on deck	20° 15,50' S	006° 21,42' E	4713,9
PS95/0047-6	26.11.2015	12:54	BONGO	in the water	20° 15,48' S	006° 21,41' E	4716,5
PS95/0047-6	26.11.2015	13:04	BONGO	on ground/ max depth	20° 15,45' S	006° 21,39' E	4716,0
PS95/0047-6	26.11.2015	13:04	BONGO	hoisting	20° 15,45' S	006° 21,39' E	4716,0
PS95/0047-6	26.11.2015	13:13	BONGO	on deck	20° 15,43' S	006° 21,37' E	4718,3
PS95/0047-7	26.11.2015	13:20	CALCOFI	in the water	20° 15,39' S	006° 21,34' E	4716,8
PS95/0047-7	26.11.2015	13:30	CALCOFI	on ground/ max depth	20° 15,33' S	006° 21,30' E	4716,1

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0047-7	26.11.2015	13:30	CALCOFI	hoisting	20° 15,33' S	006° 21,30' E	4716,1
PS95/0047-7	26.11.2015	13:38	CALCOFI	on deck	20° 15,32' S	006° 21,30' E	4717,9
PS95/0047-8	26.11.2015	13:40	CALCOFI	in the water	20° 15,32' S	006° 21,30' E	4716,6
PS95/0047-8	26.11.2015	13:49	CALCOFI	on ground/ max depth	20° 15,29' S	006° 21,30' E	4719,5
PS95/0047-8	26.11.2015	13:49	CALCOFI	hoisting	20° 15,29' S	006° 21,30' E	4719,5
PS95/0047-8	26.11.2015	13:59	CALCOFI	on deck	20° 15,26' S	006° 21,27' E	4720,9
PS95/0047-9	26.11.2015	14:02	LM	in the water	20° 15,25' S	006° 21,26' E	4720,7
PS95/0047-9	26.11.2015	14:02	LM	profile start	20° 15,25' S	006° 21,26' E	4720,7
PS95/0047-9	26.11.2015	14:04	LM	on ground/ max depth	20° 15,24' S	006° 21,25' E	4720,8
PS95/0047-9	26.11.2015	14:04	LM	hoisting	20° 15,24' S	006° 21,25' E	4720,8
PS95/0047-9	26.11.2015	14:08	LM	profile end	20° 15,24' S	006° 21,24' E	4720,9
PS95/0047-9	26.11.2015	14:09	LM	on deck	20° 15,24' S	006° 21,24' E	4720,4
PS95/0047-10	26.11.2015	14:18	CTD/RO	in the water	20° 15,24' S	006° 21,25' E	4733,5
PS95/0047-10	26.11.2015	14:26	CTD/RO	on ground/ max depth	20° 15,24' S	006° 21,25' E	4734,1
PS95/0047-10	26.11.2015	14:27	CTD/RO	hoisting	20° 15,24' S	006° 21,25' E	4721,1
PS95/0047-10	26.11.2015	14:36	CTD/RO	on deck	20° 15,25' S	006° 21,25' E	4719,4
PS95/0048-1	26.11.2015	18:19	CPR	in the water	20° 15,80' S	006° 21,23' E	4672,5
PS95/0048-1	26.11.2015	18:29	CPR	on ground/ max depth	20° 16,72' S	006° 21,97' E	4735,0
PS95/0049-1	27.11.2015	06:57	XBT	in the water	22° 12,44' S	007° 30,16' E	2941,6
PS95/0049-1	27.11.2015	07:02	XBT	on ground/ max depth	22° 12,68' S	007° 30,63' E	2936,8
PS95/0049-1	27.11.2015	07:02	XBT	on deck	22° 12,68' S	007° 30,63' E	2936,8
PS95/0049-2	27.11.2015	07:03	BUCKET	in the water	22° 12,73' S	007° 30,72' E	2935,1
PS95/0049-2	27.11.2015	07:05	BUCKET	on ground/ max depth	22° 12,83' S	007° 30,92' E	2932,7
PS95/0049-2	27.11.2015	07:06	BUCKET	on deck	22° 12,89' S	007° 31,02' E	2935,2
PS95/0048-1	28.11.2015	06:45	CPR	hoisting	25° 49,20' S	009° 40,16' E	4656,1
PS95/0048-1	28.11.2015	06:46	CPR	at surface	25° 49,28' S	009° 40,21' E	4655,6
PS95/0048-1	28.11.2015	06:49	CPR	on deck	25° 49,49' S	009° 40,33' E	4653,9
PS95/0050-1	28.11.2015	06:52	XBT	in the water	25° 49,71' S	009° 40,47' E	4654,5
PS95/0050-1	28.11.2015	06:58	XBT	on ground/ max depth	25° 50,18' S	009° 40,76' E	4658,0
PS95/0050-1	28.11.2015	06:58	XBT	on deck	25° 50,18' S	009° 40,76' E	4658,0
PS95/0050-2	28.11.2015	07:00	BUCKET	in the water	25° 50,34' S	009° 40,86' E	4657,8
PS95/0050-2	28.11.2015	07:02	BUCKET	on ground/ max depth	25° 50,50' S	009° 40,96' E	4657,9
PS95/0050-2	28.11.2015	07:02	BUCKET	on deck	25° 50,50' S	009° 40,96' E	4657,9
PS95/0050-3	28.11.2015	07:12	CTD/RO	in the water	25° 50,68' S	009° 41,16' E	4657,1
PS95/0050-3	28.11.2015	07:48	CTD/RO	on ground/ max depth	25° 50,49' S	009° 41,31' E	4655,5
PS95/0050-3	28.11.2015	07:49	CTD/RO	hoisting	25° 50,48' S	009° 41,31' E	4656,4
PS95/0050-3	28.11.2015	08:38	CTD/RO	at surface	25° 50,41' S	009° 41,48' E	4655,2

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Depth [m]
PS95/0050-3	28.11.2015	08:39	CTD/RO	on deck	25° 50,41' S	009° 41,49' E	4654,9
PS95/0051-1	28.11.2015	08:48	CPR	in the water	25° 50,81' S	009° 41,63' E	4657,6
PS95/0051-1	28.11.2015	08:50	CPR	on ground/ max depth	25° 51,01' S	009° 41,70' E	4656,2
PS95/0052-1	28.11.2015	19:04	XBT	in the water	27° 20,40' S	010° 36,07' E	4721,7
PS95/0052-1	28.11.2015	19:09	XBT	on ground/ max depth	27° 20,84' S	010° 36,35' E	4723,1
PS95/0052-1	28.11.2015	19:09	XBT	on deck	27° 20,84' S	010° 36,35' E	4723,1
PS95/0053-1	29.11.2015	06:55	XBT	in the water	29° 11,65' S	011° 47,18' E	4040,0
PS95/0053-1	29.11.2015	07:00	XBT	on ground/ max depth	29° 12,00' S	011° 47,53' E	4037,5
PS95/0053-1	29.11.2015	07:00	XBT	on deck	29° 12,00' S	011° 47,53' E	4037,5
PS95/0053-2	29.11.2015	07:02	BUCKET	in the water	29° 12,13' S	011° 47,66' E	4035,8
PS95/0053-2	29.11.2015	07:02	BUCKET	on ground/ max depth	29° 12,13' S	011° 47,66' E	4035,8
PS95/0053-2	29.11.2015	07:02	BUCKET	on deck	29° 12,13' S	011° 47,66' E	4035,8
PS95/0054-1	29.11.2015	18:55	XBT	in the water	30° 52,21' S	013° 31,78' E	2188,2
PS95/0054-1	29.11.2015	19:01	XBT	on ground/ max depth	30° 52,55' S	013° 32,31' E	2190,1
PS95/0054-1	29.11.2015	19:01	XBT	on deck	30° 52,55' S	013° 32,31' E	2190,1
PS95/0055-1	30.11.2015	06:57	XBT	in the water	31° 53,47' S	015° 10,69' E	2203,3
PS95/0055-1	30.11.2015	07:02	XBT	on ground/ max depth	31° 53,73' S	015° 11,12' E	2246,8
PS95/0055-1	30.11.2015	07:02	XBT	on deck	31° 53,73' S	015° 11,12' E	2246,8
PS95/0051-1	30.11.2015	09:31	CPR	hoisting	32° 06,93' S	015° 32,58' E	2074,8
PS95/0051-1	30.11.2015	09:33	CPR	at surface	32° 07,07' S	015° 32,79' E	2074,7
PS95/0051-1	30.11.2015	09:36	CPR	on deck	32° 07,28' S	015° 33,10' E	2060,0
PS95/0051-1	30.11.2015	09:49	CPR	in the water	32° 08,12' S	015° 34,47' E	2047,3
PS95/0051-1	30.11.2015	09:50	CPR	on ground/ max depth	32° 08,19' S	015° 34,58' E	2047,3
PS95/0051-1	30.11.2015	09:50	CPR	hoisting	32° 08,19' S	015° 34,58' E	2047,3
PS95/0051-1	30.11.2015	09:50	CPR	at surface	32° 08,19' S	015° 34,58' E	2047,3
PS95/0051-1	30.11.2015	09:54	CPR	on deck	32° 08,43' S	015° 35,01' E	2020,8

List of abbreviations

BONGO	Bongonet
BUCKET	Bucket
CALCOFI	California Cooperative Oceanic Fisheries Investigations nets
CPR	Continuous Plankton Recorder
CTD/RO	Rosette sampler with CTD sensors
HS_PS	Hydrosweek Parasound
LM	
PLA	Plankton net
XBT	Expendable Bathythermograph

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