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UND MEERESFORSCHUNG

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The Expedition PS123 of the Research Vessel POLARSTERN to NEUMAYER STATION III in 2020/2021

Edited by

Tim Heitland

with contributions of the participants

HELMHOLTZ

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Titel: Entladung der Polarstern am Nordanleger, Neumayer-Station III (Tim Heitland)

Cover: Unloading of Polarstern at Nordanleger, Neumayer Station III (Tim Heitland)

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PS123

20 December 2020 – 1 February 2021

Bremerhaven – Port Stanley

Chief scientist
Tim Heitland

Coordinator
Ingo Schewe

Contents

1. ÜBERBLICK UND FAHRTVERLAUF

Tim Heitland [1]DE.AWI

Die weltweite SARS CoV-2 Pandemie ließ aufwändige Maßnahmen zum sicheren Erreichen der *Neumayer-Station III*, zur Versorgung, technischen Ertüchtigung, Arbeit in den Observatorien und Austausch des Überwinterungsteams notwendig werden. Eine alleinige Anreise mit *Polarstern* wurde gewählt, da sie den sichersten Weg bot, um einen etwaigen Eintrag des Virus in die Antarktis und die *Neumayer-Station III* zu verhindern. Nach einer neuntägigen Einzelquarantäne im Hotel Best Western Fischereihafen und zwei negativen PCR-Tests auf CoV-2 verlegten wir unseren Aufenthalt am 20. Dezember 2020 plangemäß in zwei Chargen auf die *Polarstern*. Die Kammern wurden bezogen, die Sicherheitseinweisung erfolgte in den zwei Gruppen, die dann auch bis zum Ende der weiteren Quarantänemaßnahmen zusammenbleiben sollten. Zudem wurde eine Stellprobe auf dem Helideck durchgeführt. Ablegt wurde am 20. Dezember um 16:00 Uhr. Die Fahrt durch den Englischen Kanal verlief ohne Besonderheiten. Am 21. Dezember erfolgte die erste Wissenschafts-Besprechung mit Wetter-Briefing. In der Biskaya herrschte ab dem Abend des 22. Dezember bis zum Abend des 23. Dezember ein Sturm mit 8, in Böen 10 Windstärken und 6–7 m Welle von vorne. Pünktlich zum 24. Dezember zeigte sich die See wieder ruhig – *Polarstern* war weihnachtlich geschmückt und die verschärften Hygienemaßnahmen konnten aufgehoben werden. Am 27. Dezember wurde wie geplant ein dritter Corona-Abstrich genommen und vor Las Palmas kontaktlos an einen Agenten übergeben. Der Abstrich wurde via Luftfracht nach Bremerhaven geschickt und dort ins Labor Schuhmacher überbracht. Die geophysikalischen *En-Route*-Messungen mit Bathymetrie (Multibeam), Sedimentecholot und Magnetometer liefen wie geplant.

Das Wetter zeigte sich zunehmend sommerlich. Auf Höhe der Kanarischen Inseln stand das Thermometer bereits bei 18 °C, die Kapverdischen Inseln passierten wir bei 26 °C, wolkenlosem Himmel und sanfter Dünung um 2 m aus Nord.

Die Überwinternden wurden auf dem Weg zur *Neumayer-Station III* an Bord gruppenweise auf ihre jeweilige Observatoriumsarbeit vorbereitet, lernten im Hospital die Ausstattung kennen, wissenschaftliches Gerät wurde installiert. Ein Erste-Hilfe-Kurs fand statt, Nachmittagsbesprechungen erfolgten und Vorträge wurden gehalten.

Am 30. Dezember wurde das HydroSweep Multibeam kalibriert. Während der Werftliegezeit wurde der Transducer ausgetauscht und zum Abgleich der neuen Einbauposition musste nun zunächst eine Sound Velocitiy Probe durchgeführt, danach drei Kalibrierungslinien abgefahren werden.

Am 02. Januar 2021 passierten wir um 14:45 Uhr den Äquator.

Die Schiffsentladung wurde daraufhin vorbereitet, die wissenschaftliche Arbeit währenddessen fortgesetzt, ebenso die Einarbeitung der Überwinternden und die Besprechungen und Vorträge. Es wurde kälter und zunehmend zog Bewölkung auf.

Im Bereich der Atka-Bucht tobte unmittelbar vor der geplanten Ankunft ein starker Sturm mit fliegendem Schnee und Bedingungen, die eine Schiffsentladung zunächst unmöglich machten, sodass die Entladung um einen Tag verschoben werden musste. Nach Wetterbesserung konnte

Polarstern am Morgen des 19. Januar 2021 an die Schelfeiskante gehen und die Versorgung der *Neumayer-Station III* beginnen. Die Entladung dauerte vom 19. bis 21. Januar und verlief ohne Komplikationen. 25 Personen (inklusive Fahrtleiter) stiegen hier ab, um die Sommersaison an der *Neumayer-Station III* zu verbringen. *Polarstern* verließ die Schelfeiskante am 22. Januar in Richtung Falklandinseln. Ankunft war dort am Morgen des 01. Februar 2021.

SUMMARY AND ITINERARY

Tim Heitland [1]DE.AWI

Due to the persisting CoV-2 pandemic, the logistics of this year's Antarctic summer campaign with resupplying *Neumayer Station III* and the exchange of the overwintering team needed to be adjusted. In order to prevent the virus from being introduced to Antarctica in the best possible manner, it was decided to deploy all personnel by *Polarstern* only. All expeditioners as well as the entire crew of *Polarstern* underwent a 9-day hotel-quarantine (and two PCR Tests) at Bremerhaven before boarding *Polarstern* for the non-stop passage to Atka Bay. Boarding and departure of the ship was on 20 December 2020.

The passage through the English Chanel was eventless, the first team meeting and weather briefing took place on 21 December. A stormy crossing of the Biscay with winds around 8 Bft, gusts around 10 Bft and 6–7 m significant wave height followed. With the 24 December the weather improved, the strict quarantine regulations could be eased and Christmas Eve celebrated together. On 27 December the third SARS CoV-2 PCR test was taken and handed over without contact to an agent we met at sea outside of Las Palmas. The test was taken to Bremerhaven and analyzed in Labor Schumacher. All geophysical en-route measurements could be performed as planned.

The weather turned increasingly pleasant, with warm and sunny days and a calm sea. The new overwintering team members prepared for their respective work in the observatories, there was a first-aid training and scientific presentations.

A calibration of the HydroSweep Multibeam was done on 30 December, that became necessary as the transducer was changed during the docking time in Bremerhaven. To adjust the new position a sound velocity probe was performed and three calibration lines were measured.

The Equator was crossed on 02 January. We then started to prepare for the cargo operations.

A severe storm over Atka Bay delayed the possible start of the cargo operations for one day. On the morning of 19 December *Polarstern* arrived at the Nordanleger and the unloading began. It was finished without any complications on 21 December. 25 persons (including the chief scientist) disembarked in order to spent the summer season at *Neumayer Station III*. *Polarstern* left the ice edge on 22 December for the Falklands where she arrived on 1 February 2021.

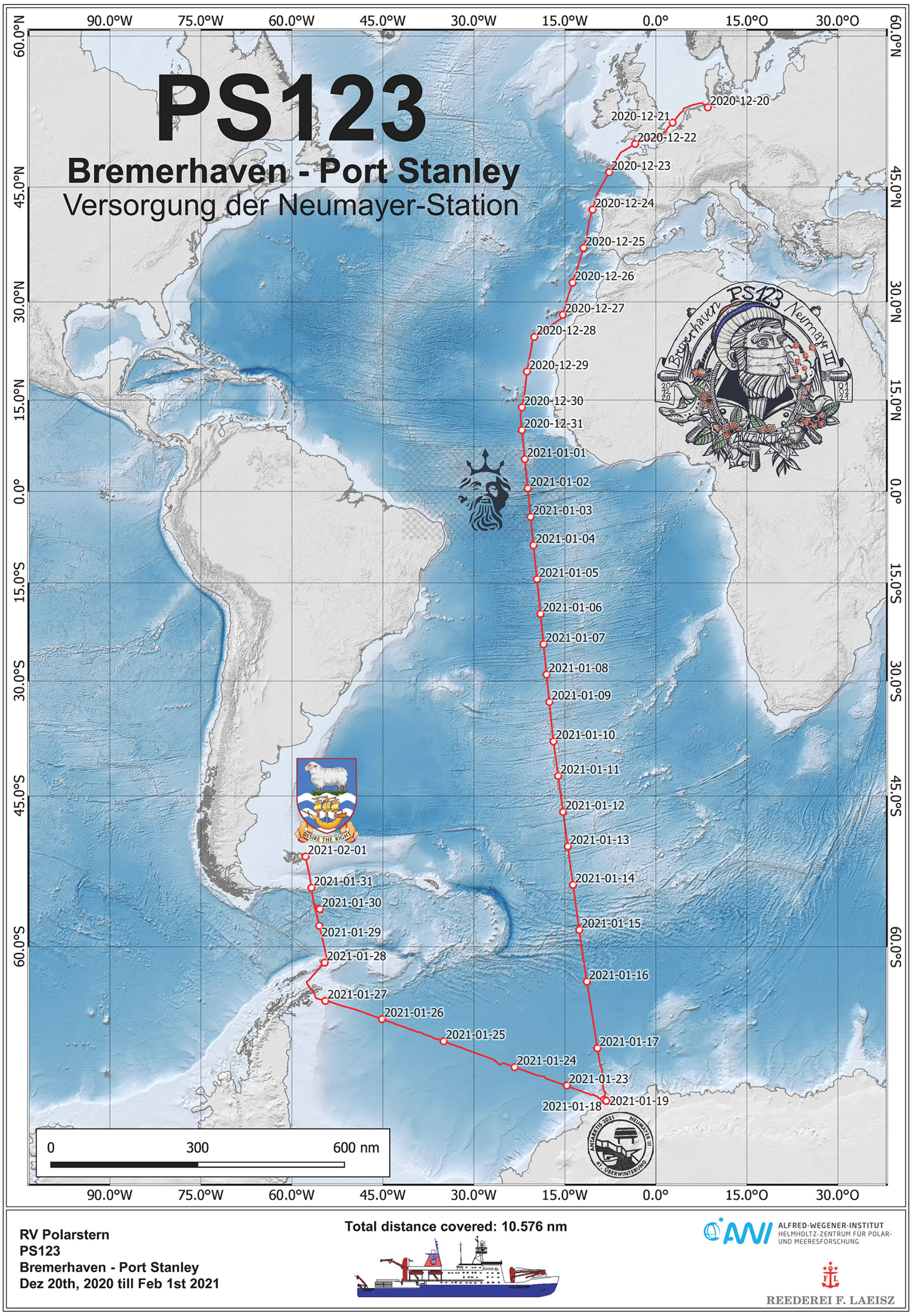

Abb. 1.1: Fahrtverlauf der Expedition PS123 von Bremerhaven nach Port Stanley. Siehe https://doi.pangaea.de/10.1594/PANGAEA.931788 für eine Darstellung des master tracks in Verbindung mit der Stationsliste der Expedition PS123.

Fig. 1.1: Cruise track of expedition PS123 from Bremerhaven to Port Stanley. See https://doi.pangaea.de/10.1594/PANGAEA.931788 to display the master track in conjunction with the station list for expedition PS123

2. WEATHER CONDITIONS DURING PS123

Julia Wenzel[1]

[1]DE.DWD

The main goal of the PS123 cruise was the supply of the *Neumayer Station III*. The cruise of *Polarstern* started in Bremerhaven and directly led to Antarctica, continuing to the Falkland Islands.

Bremerhaven – Canary Islands

On 20 December 2020 at 16:00 (15:00 UTC) *Polarstern* left the harbour of Bremerhaven. The beginning of the journey was strongly influenced by a low pressure complex with multiple centres north of Great Britain. Therefore, on 21 December a mean wind speed up to 8 Bft occurred in the southern parts of the North Sea (please note: All mentioned wind speeds in this report were measured at the mast of *Polarstern* in 39 m height).

While moving through the English Channel on 22 December, *Polarstern* got more and more affected by another strong low pressure system moving from the northeastern part of the Atlantic Ocean to the east and reaching the English Channel on 23 December. Crossing the Bay of Biscay on 23 December the wind intensified to 9 to 10 Bft and shifted from southwest to west. The sea state reached a significant wave height of 6 m.

Afterwards, a strong high pressure system over the Northeast Atlantic widened until the coast of Portugal. Consequently, in the night to 24 December the wind shifted to north. Additionally, the wind slowed down to 5 Bft and the sea state decreased to 3 m. Due to a weak low west of the Canary Islands the wind temporary went up to 6 Bft on 26 December. Until reaching the Canary Islands on 27 December *Polarstern* was located at the outer edge of the high, whereas the wind continued to shift to east and went down to 2 Bft.

Canary Islands – *Neumayer Station III*

Near the Canary Islands and south of them the wind was weak and came from different directions and swell of 1 m from the North was observed.

Moving south *Polarstern* got more and more in the region of the northeast trade winds, which slowly intensified to 5 Bft until 30 December.

On 1 January *Polarstern* crossed the Inter-Tropical Convergence Zone (ITCZ) with weak wind from east and calm sea. From 2 January on *Polarstern* was situated in moderate to fresh southeast trade winds. Reaching the subtropical high-pressure system over the South Atlantic, from 4 January on the wind slowly shifted to east and in the centre of the high (7 January) it was weak and came from different directions.

Afterwards, *Polarstern* reached the west wind drift area within the latitudes 40° to 60° South.

From 9 to 15 January four lows crossed the cruise track from west to east: The first one on 9 January and the second one on 10 January were quite weak and caused only temporary wind shifts, a slight increase of the sea to 1.5 m and rain showers. The third low led to a temporary rise of wind speed to 5 Bft and sea state to 3 m on 12 January. Inside of its warm sector fog occurred.

The fourth low (14 and 15 January) was a deep low with a central pressure of 954 hPa, moving southeastwards. When crossing its cold front in the night from 13 to 14 January, the wind shifted to northwest and increased to 6 Bft. Thanks to the reduction of the ships speed the area with the highest sea state was located south of *Polarstern* and moved eastwards before *Polarstern* could reach this area. Thus, the maximum significant wave height that occurred during the night from 14 to 15 of January was only 3.5 m. On 15 January, the core of the low was situated between *Polarstern* and the Antarctic Dronning-Maud-Land. It continued southwestwards and filled. By 16 January wind and sea state continuously decreased to 3 Bft and 1.5 m.

Another deep low that was located North of *Polarstern* on 15 January and moved southwards towards Dronning-Maud-Land describing a bow towards the East. West of the low *Polarstern* moved southwards, whereas the wind firstly shifted to south and on 17 January to east increasing to 7 to 8 Bft. At the same time the wave height raised up to 4 m on 17 January. When reaching the sea ice region during the night to 18 January the sea state significantly calmed down. In the late morning of 18 January, the wind reached its maximum with 8 to 9 Bft. Afterwards, the low moved to northeast while weakening and consequently the wind slowly went down from 6 to 3 Bft and shifted to southeast. Due to the strong winds on 18 January, *Polarstern* waited north of the shelf ice edge and only in the morning of 19 January moored at the shelf ice edge close to the Atka Bay.

The supply of the *Neumayer Station III* took until 22 January. In the meanwhile, a high-pressure ridge that extended from a high just east of the coast of Argentina until Antarctica slowly moved northeastwards. Thus, weak winds prevailed which shifted to southwest by 21 January and temporarily increased to 6 Bft in the afternoon and night to 22 January.

Neumayer Station III – Antarctic Peninsula – Port Stanley (Falkland Islands)

On 22 January at 17:15 UTC *Polarstern* left the shelf ice edge and continued its journey towards the Antarctic Peninsula. At first, weak to moderate winds from south to southeast prevailed west of a low pressure complex that was situated north of the Dronning-Maud-Land. On 25 January, the wind temporary raised to 6 Bft and the waves outside of the sea ice increased to 1.5 m due to a small low. On the 26 January, *Polarstern* moved westwards along the northern flank of a high above the western Weddell Sea. At the same time, the wind of 4 to 5 Bft turned to east on 26 January.

Moving westwards *Polarstern* got more and more affected by a low that crossed the Drake Passage from west to east and that was located northwest of Elephant Island on 27 and 28 January, afterwards continuing southeastwards while weakening. Thus, the wind shifted to northeast on 27 January. Due to the shelter of the mountains in the Antarctic Sound, at times there was nearly no wind at all and when leaving the Sound, the wind temporarily increased to 5 Bft due to the orographic situation.

When *Polarstern* travelled northwards it reached the back side of a southeastwards moving low and therefore the wind shifted to west during the night to 29 January. The transit from the Antarctic Peninsula through the Drake Passage to the Falkland Islands started with weak to moderate winds from west to southwest and 1 m wave height.

Between a high-pressure system that formed east of Argentina on the 30 January and a low that crossed the Antarctic Peninsula from west to east, the west wind south of the Falkland Islands increased to 7 to 8 Bft by 31 January, whereas also the sea state increased to 3 m.

Polarstern reached the Falkland Islands in the morning of 1 February 2021.

3. BATHYMETRIC MAPPING AND GEOPHYSICAL UNDERWAY MEASUREMENTS

Simon Dreutter [1], Yvonne Schulze Tenberge[1]
Boris Dorschel[1] (not on board)
[1]DE.AWI

Grant-No. AWI_PS123_00

Objectives

Accurate knowledge of the seafloor topography, hence high-resolution bathymetry data, is key basic information necessary to understand many marine processes. It is of particular importance for the interpretation of scientific data in a spatial context. Bathymetry, or geomorphology, is a basic parameter for the understanding of the general geological setting of an area and geological processes such as erosion, sediment transport and deposition. Even information on tectonic processes can be inferred from bathymetry. Supplementing the bathymetric data, high-resolution sub-bottom profiler data of the top 10s of meters below the seabed provide information of the sediment architecture and the lateral extension of sediment successions. This can be used to study depositional environments on larger scales in terms of space and time, of which the uppermost sediments may be sampled.

While world bathymetric maps give the impression of a detailed knowledge of worldwide seafloor topography, most of the world's ocean floor remains unmapped by hydroacoustic systems. In these areas, bathymetry is modelled from satellite altimetry with a corresponding low resolution. Satellite-altimetry derived bathymetry therefore lack the necessary resolution to resolve small- to meso-scale geomorphological features (e.g. sediment waves, glaciogenic features and small seamounts). Ship-borne multibeam data provide bathymetry information in a resolution that is sufficient to resolve those features.

Therefore, the main tasks of the Bathymetry/Geophysics group on board *Polarstern* during PS123 were:

- collection of bathymetric data, including calibration and correction of the data for environmental circumstances (sound velocity, systematic errors in bottom detection, etc.)
- post processing and cleaning of the data
- data management for on-site map creation
- collection of sound velocity data
- collection of sediment profiling data
- collection of magnetic data

Work at Sea

Technical description

During the PS123 cruise, the bathymetric surveys were conducted with the hull-mounted Multibeam Echosounder (MBES) Teledyne Reson HydroSweep DS3. The HydroSweep is a deep water system for continuous mapping with the full swath potential. It operates on a frequency of ~14 kHz. On *Polarstern*, the MBES transducer arrays are arranged in a Mills cross configuration of 3 m (transmit unit) by 3 m (receive unit). The combined motion, position (Trimble GNSS), and time data comes from an iXBlue Hydrins system and the signal is directly transferred into the Processing Unit (PU) of the MBES to carry out real-time motion compensation in Pitch, Roll and Yaw. With a combination of phase and amplitude detection algorithms the PU computes the water depth from the returning backscatter signal. The system can cover a sector of up to 140° with 70° per side. In the deep sea, an angle of ~50° to both sides could be achieved.

The hull-mounted sub-bottom profiling system PARASOUND generates two primary frequencies, of which the lower frequency is selectable between 18 and 23.5 kHz transmitting in a narrow beam of 4° at high power (PHF). As a result of the non-linear acoustic behavior of water, the so-called “Parametric Effect”, two secondary harmonic frequencies are generated, one of which is the difference (e.g. 4 kHz, SLF) and the other the sum (e.g. 40 kHz, SHF) of the two primary frequencies, respectively. As a result of the longer wavelength, the difference parametric frequency allows sub-bottom penetration up to 200 m (depending on sediment conditions) with a vertical resolution of about 30 cm. The primary advantage of parametric echosounders is based on the fact that the sediment-penetrating pulse is generated within the narrow beam of the primary frequencies, thereby providing a very high lateral resolution compared to conventional 4 kHz systems. For vertical beam transmission (conventional) this capability, however, limits good survey results on seafloor slopes, which are inclined to more than 4° relative to horizontal. The reason is that the energy reflected from the small inclined footprint on the seafloor is out of the lateral range of the receiving transducers in the hull of the vessel.

Data acquisition and processing

Data acquisition was carried out throughout the entire cruise between Bremerhaven and the Falkland Islands (except for the Antarctic / below 60°S).

The MBES was operated with Hydromap Control and for online data visualization, Teledyne PDS was used. The collected bathymetry was stored in ASD and S7K raw files.

Subsequent data processing was performed using Caris HIPS and SIPS. For generating maps, the data were exported to Quantum GIS in the GeoTIFF raster format.

The PARASOUND was also operated with Hydromap Control and the data was visualized in Parastore. Acquisition included PHF and SLF data. Both PHF and SLF traces were visualized as online profiles on screen. SLF profiles (200 m depth window) and online status reports (60 s intervals or shorter) were saved as PNG files.

For the entire period above, and simultaneously with sounding, six different types of PARASOUND data files were stored on hard disc:

- PHF data in ASD format
- PHF data in PS3 format (carrier frequency, lat, long)
- SLF data in ASD format

- SLF data in PS3 format (carrier frequency, lat, long)
- Navigation and Auxiliary data (60 s intervals) in ASCI format
- SLF Online “Prints” as A4 pages in PNG format
- PARASTORE 3 settings in XML files

Sound velocity profiles

For best survey results with correct depths, daily UCTD (Underway Conductivity Temperature Depth) casts were performed by the Bathymetry group, and were used to measure the water sound velocity in different depths. This is essential, as the acoustic signal travels down the water column from the transducer to the seafloor and back to the surface through several different layers of water masses with each a different sound velocity. The sound velocity (SV) is influenced by density and compressibility, both depending on pressure, temperature and salinity. Wrong or outdated sound velocity profiles lead to refraction errors and reduced data quality.

The UCTD measures conductivity, temperature, and depth in the water column while the ship is moving with 5 knots and the probe falls to roughly 800 m depth, before it is winched back on deck. From these parameters, the sound velocity is calculated.

The sound velocity profiles obtained by the UCTD were immediately processed and applied within the MBES for correct beamforming during the survey.

Additionally, these profiles were combined/extended with WOA13 (World Ocean Atlas 2013) data to create full ocean depth SV profiles.

Stations

Next to the underway stations (PS123_0_Underway-*) for HydroSweep, PARASOUND, and magnetic measurements, the stations listed in Table 3.1 were conducted.

Tab. 3.1: List of stations during PS123

Station Number	Description	Device	Start	End
PS123_1-1	sound velocity profile	OceanScience Underway CTD	2020-12-28 12:56	2020-12-28 13:13
PS123_2-1	sound velocity profile	OceanScience Underway CTD	2020-12-29 12:27	2020-12-29 12:51
PS123_3-1	sound velocity profile	OceanScience Underway CTD	2020-12-30 10:29	2020-12-30 10:50
PS123_4-1	sound velocity profile	Valeport MIDAS SVP	2020-12-30 18:42	2020-12-30 19:40
PS123_4-2	Multibeam path test (calibration of installation parameters)	HydroSweep DS3	2020-12-30 20:12	2020-12-31 00:33
PS123_5-1	sound velocity profile	OceanScience Underway CTD	2020-12-31 13:20	2020-12-31 13:49
PS123_6-1	sound velocity profile	OceanScience Underway CTD	2021-01-01 12:35	2021-01-01 13:00

Station Number	Description	Device	Start	End
PS123_7-1	sound velocity profile	OceanScience Underway CTD	2021-01-02 12:48	2021-01-02 13:18
PS123_8-1	sound velocity profile	OceanScience Underway CTD	2021-01-03 12:35	2021-01-03 13:00
PS123_9-1	sound velocity profile	OceanScience Underway CTD	2021-01-04 12:32	2021-01-04 13:00
PS123_10-1	sound velocity profile	OceanScience Underway CTD	2021-01-05 12:39	2021-01-05 13:14
PS123_11-1	sound velocity profile	OceanScience Underway CTD	2021-01-06 08:28	2021-01-06 08:51
PS123_12-1	sound velocity profile	OceanScience Underway CTD	2021-01-09 11:09	2021-01-09 11:32
PS123_13-1	sound velocity profile	OceanScience Underway CTD	2021-01-10 12:36	2021-01-10 13:12
PS123_14-1	sound velocity profile	OceanScience Underway CTD	2021-01-11 12:39	2021-01-11 13:09
PS123_15-1	sound velocity profile	OceanScience Underway CTD	2021-01-12 12:39	2021-01-12 12:59
PS123_16-1	sound velocity profile	OceanScience Underway CTD	2021-01-13 12:42	2021-01-13 13:05

Preliminary results

During 28 days of survey, a track length of 9,119 nm (16,888 km) was surveyed by the swath bathymetry and the sub-bottom profiling system. Fig. 3 shows the generated bathymetry grid over the Atlantic.

Data management

Bathymetric data collected during PS123 will be archived, published and disseminated according to international standards by the World Data Center PANGAEA Data Publisher for Earth & Environmental Science (https://www.pangaea.de) within two years after the end of the cruise. By default the CC-BY license will be applied. Furthermore, the data will be provided to mapping projects and included in global bathymetry compilations such as the General Bathymetric Chart of the Ocean (GEBCO). Bathymetric data will also be provided to the Nippon Foundation – GEBCO Seabed 2030 Project. All PARASOUND data will be transferred to AWI after the cruise and stored in the data base of the IT section. Once georeferenced, the data will be linked for external accessibility in PANGAEA. Magnetic data will be stored at the AWI and submitted to PANGAEA.

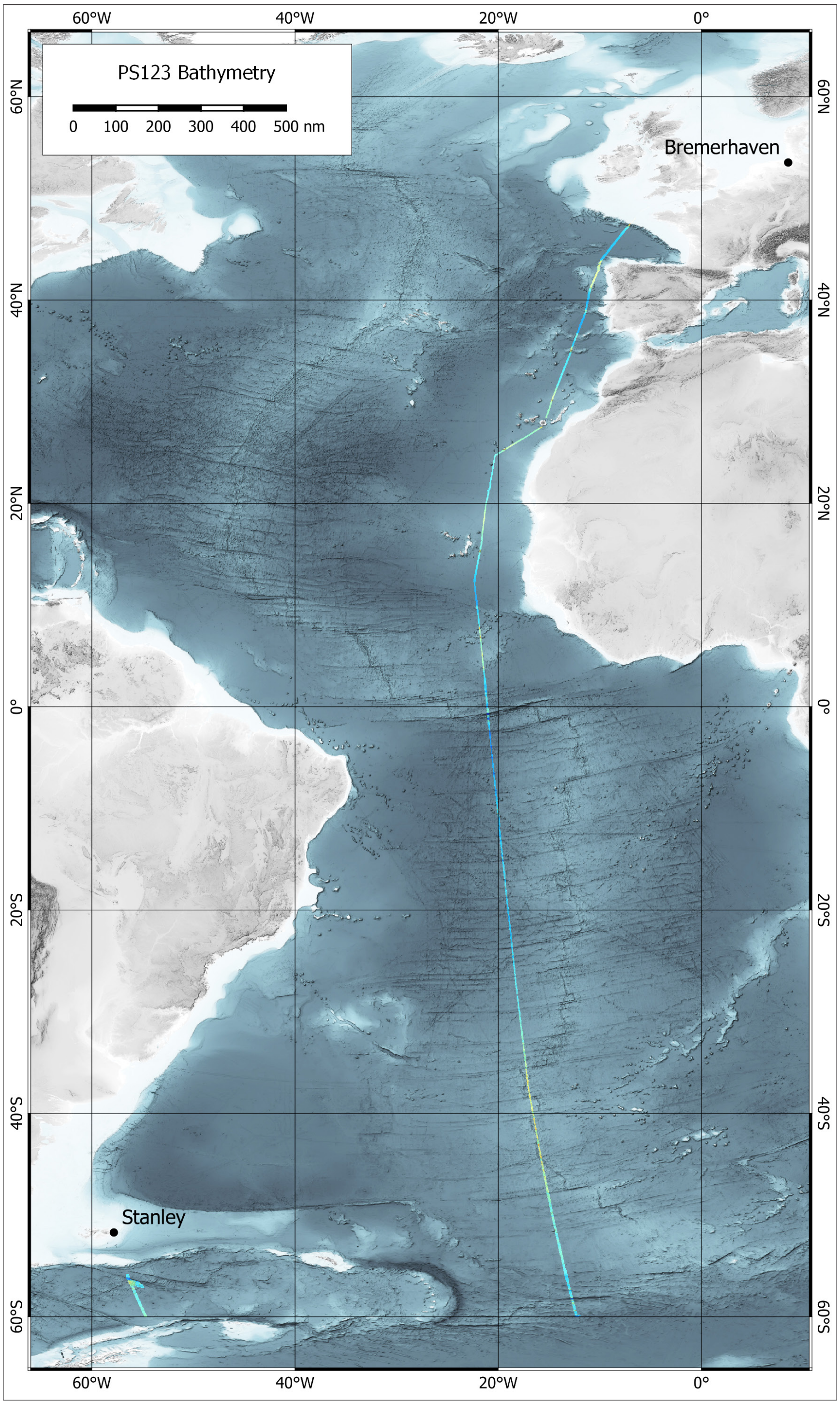

Fig. 3: Overview on the bathymetric data acquired during PS123

APPENDIX

A.1 TEILNEHMENDE INSTITUTE / PARTICIPATING INSTITUTIONS

A.2 FAHRTTEILNEHMER / CRUISE PARTICIPANTS

A.3 SCHIFFSMANNSCHAFT / SHIP'S CREW

A.4 STATIONSLISTE / STATION LIST

A.1 TEILNEHMENDE INSTITUTE / PARTICIPATING INSTITUTIONS

Institution	Address
DE.AWI	Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung Postfach 120161 27515 Bremerhaven Germany
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DE.DWD	Deutscher Wetterdienst Seewetteramt Bernhard Nocht Straße 76 20359 Hamburg Germany

A.2 FAHRTTEILNEHMER / CRUISE PARTICIPANTS

Name/ Last name	Vorname/ First name	Institut/ Institute	Beruf/ Profession	Fachrichtung/ Discipline
Baden	Markus	Laeisz	Overwintering Electrician	Technics
Bunchek	Jess	DLR	Overwintering Botanist	Space-Botanics
Dornhöfer	Timo	AWI	Overwintering Geophysicist	Geophysics
Doron	Tanguy	Laeisz	Overwintering Chef	Chef
Dreutter	Simon	AWI	Scientist	Bathymetry
Eder	Pitt	Laeisz	Technician *NM III*	Technics
Dr. Fromm	Tanja	AWI	Scientist	Geophysics
Geis	Peter	Kässbohrer	Technician *NM III*	Technics
Gischler	Michael	Heli Service	Pilot	Transportation
Dr. Heitland	Tim	AWI	Senior Scientist/FOM	Logistics
Holger	Jens	DWD	Weather Technician	Forecasting
Dr. Jonczyk	Peter	AWI	Overwintering Station Leader/ Physician	Logistics
Koch	Florian	Laeisz	Overwintering Engineer	Technics
Laubach	Hannes	Laeisz	Technician *NM III*	Technics
Lemm	Rene	Laeisz	Housekeeping *NM III*	Housekeeping
Marten	Lorenz	AWI	Overwintering Geophysicist	Geophysics
Ockenfuß	Paul	AWI	Overwintering Meteorologist	Meteorology
Ort	Linda	AWI	Overwintering Atmospheric Physicist	Atmospheric Physics
Piotrowski	Lukas	Heli Service	Pilot	Transportation
Preis	Loretta	AWI	Technician	Meteorology
Riess	Felix	Laeisz	Inspector	IT
Rothenburg	Mark	Heli Service	Technician	Transportation
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Schubert	Holger	Laeisz	Technician	Technics
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Thoma	Theresa	Laeisz	Overwintering IT	IT
Vrakking	Vincent	DLR	Scientist	Space-Botanics
Weißsohn	Jörn	Heli Service	Technician	Transportation
Dr. Weller	Rolf	AWI	Scientist	Atmospheric Physics
Wenzel	Julia	AWI	Forecaster	Forecasting

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

No.	Name	Rank
1	Langhinrichs Moritz	Master
2	Lauber Felix	1. Offc.
3	Ziemann Olaf	Ch. Eng.
4	Langer Carl	2. Offc.
5	Peine Lutz	2. Offc.
6	Waltzer Hofmann	3. Offc.
7	Goessmann-Lange Petra	Doctor
8	Bähler Stefanie	2. Eng.
9	Ehrke Tom	2. Eng.
10	Rusch Torben	2. Eng.
11	Pommerencke Bernd	Elec. Eng.
12	Kliemann Olaf	ELO
13	Schwedka Thorsten	ELO
14	Zivanov Stefan	ELO
15	Fölster Michael	Boatsw.
16	Buchholz Joscha	A.B.
17	Dannhauer Darius	A.B.
18	Johns Bjoern	A.B.
19	Peper Sven	A.B.
20	Sautmann David	A.B.
21	Schade Tom	A.B.
22	Plehn Markus	Storek.
23	Clasen Nils	Mot-man
24	Hansen Jan Nils	Mot-man
25	Meier Jan	Mot-man
26	Schwarz Uwe	Mot-man
27	Thiele Linus	Mot-man
28	Schnieder Sven	Cook
29	Baade Paul	Cooksmate
30	Matter Sebastian	Cooksmate
31	Krause Tomasz	1. Steward
32	Pommerencke Kerstin	Stewardess/N.
33	Bachmann Julia	2. Stewardess
34	Chen Quan Lun	2. Steward
35	Hu Guoyong	2. Steward
36	Pieper Daniel	2. Steward
37	Shi Wubo	Laundrym.
38	Erlenbach Colin	Apprent.

A.4 STATIONSLISTE / STATION LIST PS123

Tab. A.4: Station list of expedition PS123 from Bremerhaven to Port Stanley; the list details the action log for all stations along the cruise track.

See https://doi.pangaea.de/10.1594/PANGAEA.931788 to display the master track in conjunction with the station (event) list for expedition PS123. This version contains Uniform Resource Identifiers for all sensors listed under https://sensor.awi.de.
See https://www.awi.de/en/about-us/service/computing-centre/data-flow-framework.html for further information about AWI's data flow framework from sensor observations to archives (O2A).

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment
PS123-track		2020-12-20T16:00:00	53.56750	8.55480		CT	Station start	Bremerhaven - Port Stanley
PS123-track		2020-12-20T16:00:00	-51.69000	-57.81200		CT	Station end	Bremerhaven - Port Stanley
PS123_0_ Underway-28		2020-12-20T16:26:48	53.55691	8.55283	5.1	SWEAS	Station start	
PS123_0_ Underway-28		2020-12-20T16:26:48	-55.85695	-56.50395	4423.4	SWEAS	Station end	
PS123_0_ Underway-1		2020-12-21T07:26:31	52.79937	3.75614	16.7	ADCP	max depth	
PS123_0_ Underway-20		2020-12-22T17:30:00	49.18407	-5.02137	93.4	PS	Station start	
PS123_0_ Underway-20		2020-12-22T17:30:00	-55.85733	-56.50381	4423.4	PS	Station end	
PS123_0_ Underway-13		2020-12-22T17:30:00	49.18407	-5.02137	93.4	HS	Station start	
PS123_0_ Underway-13		2020-12-22T17:30:00	-55.85733	-56.50381	4423.4	HS	Station end	
PS123_1-1		2020-12-28T12:56:57	24.72417	-20.24788	3871.9	CTD-UW	Station start	
PS123_1-1		2020-12-28T12:56:57	24.70732	-20.26568	3889.5	CTD-UW	Station end	
PS123_2-1		2020-12-29T12:27:11	19.40141	-21.27511	3416.8	CTD-UW	Station start	
PS123_2-1		2020-12-29T12:27:11	19.34293	-21.27915	3381.2	CTD-UW	Station end	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment
PS123_3-1		2020-12-30T10:29:16	14.10156	-22.04677	4363.8	CTD-UW	Station start	
PS123_3-1		2020-12-30T10:29:16	14.07330	-22.05182	4372	CTD-UW	Station end	
PS123_4-1		2020-12-30T18:42:54	12.49418	-22.34676	4906.8	SVP	Station start	
PS123_4-1		2020-12-30T18:42:54	12.49452	-22.34665	4907.6	SVP	Station end	
PS123_4-2		2020-12-30T20:12:56	12.48185	-22.34880	4906.6	HS	Station start	
PS123_4-2		2020-12-30T20:12:56	12.33884	-22.29851	4945	HS	Station end	
PS123_5-1		2020-12-31T13:20:41	9.86867	-22.07786	4388.2	CTD-UW	Station start	
PS123_5-1		2020-12-31T13:20:41	9.81441	-22.07161	4334.7	CTD-UW	Station end	
PS123_6-1		2021-01-01T12:35:01	5.22644	-21.60698	3014.6	CTD-UW	Station start	
PS123_6-1		2021-01-01T12:35:01	5.18548	-21.60564	2963.3	CTD-UW	Station end	
PS123_7-1		2021-01-02T12:48:07	0.35578	-21.11731	4605.1	CTD-UW	Station start	
PS123_7-1		2021-01-02T12:48:07	0.30184	-21.11563	4618.7	CTD-UW	Station end	
PS123_8-1		2021-01-03T12:35:24	-4.34679	-20.64454	5013.5	CTD-UW	Station start	
PS123_8-1		2021-01-03T12:35:24	-4.38204	-20.64180	5103	CTD-UW	Station end	
PS123_9-1		2021-01-04T12:32:58	-9.02412	-20.17038	4895.3	CTD-UW	Station start	
PS123_9-1		2021-01-04T12:32:58	-9.06970	-20.16666	4896.8	CTD-UW	Station end	
PS123_10-1		2021-01-05T12:39:56	-14.58269	-19.60090	4775.3	CTD-UW	Station start	
PS123_10-1		2021-01-05T12:39:56	-14.64889	-19.59692	5140.2	CTD-UW	Station end	
PS123_11-1		2021-01-06T08:28:05	-19.13518	-19.12277	4495.4	CTD-UW	Station start	
PS123_11-1		2021-01-06T08:28:05	-19.16727	-19.11905	4506.6	CTD-UW	Station end	
PS123_12-1		2021-01-09T11:09:30	-32.89206	-17.57909	4033.3	CTD-UW	Station start	
PS123_12-1		2021-01-09T11:09:30	-32.92254	-17.57406	3948.7	CTD-UW	Station end	
PS123_13-1		2021-01-10T12:36:07	-38.40440	-16.87188	3057	CTD-UW	Station start	
PS123_13-1		2021-01-10T12:36:07	-38.46610	-16.86021	2800.3	CTD-UW	Station end	
PS123_14-1		2021-01-11T12:39:34	-42.74111	-16.09184	3466.3	CTD-UW	Station start	
PS123_14-1		2021-01-11T12:39:34	-42.79435	-16.08250	3578.5	CTD-UW	Station end	
PS123_15-1		2021-01-12T12:39:39	-46.96038	-15.28461	3177.6	CTD-UW	Station start	
PS123_15-1		2021-01-12T12:39:39	-46.99543	-15.27933	3331.2	CTD-UW	Station end	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment
PS123_16-1		2021-01-13T12:42:29	-50.72499	-14.50748	4012.4	CTD-UW	Station start	
PS123_16-1		2021-01-13T12:42:29	-50.75842	-14.50079	4074.8	CTD-UW	Station end	
PS123_0_ Underway-18		2021-01-14T13:03:12	-54.64471	-13.62960	4038.7	UWPCO2	Station start	
PS123_0_ Underway-18		2021-01-14T13:03:12	-58.86183	-12.59001	4261.8	UWPCO2	Station end	
PS123_0_ Underway-11		2021-01-31T04:06:26	-55.85822	-56.50346	4423.4	MAG	Station start	
PS123_0_ Underway-11		2021-01-31T04:06:26	-55.85822	-56.50346	4423.4	MAG	Station end	

** Comments are limited to 130 characters. See https://doi.pangaea.de/10.1594/PANGAEA.931788 to show full comments in conjunction with the station (event) list for expedition PS123.*

Abbreviation	***Method/Device***
ADCP	*Acoustic Doppler Current Profiler*
CT	*Underway cruise track measurements*
CTD-UW	*CTD, underway*
HS	*HydroSweep*
MAG	*Magnetometer*
PS	*ParaSound*
SVP	*Sound velocity profiler*
SWEAS	*Ship Weather Station*
UWPCO2	*Underway pCO2 measurements*

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