ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR-
UND MEERESFORSCHUNG

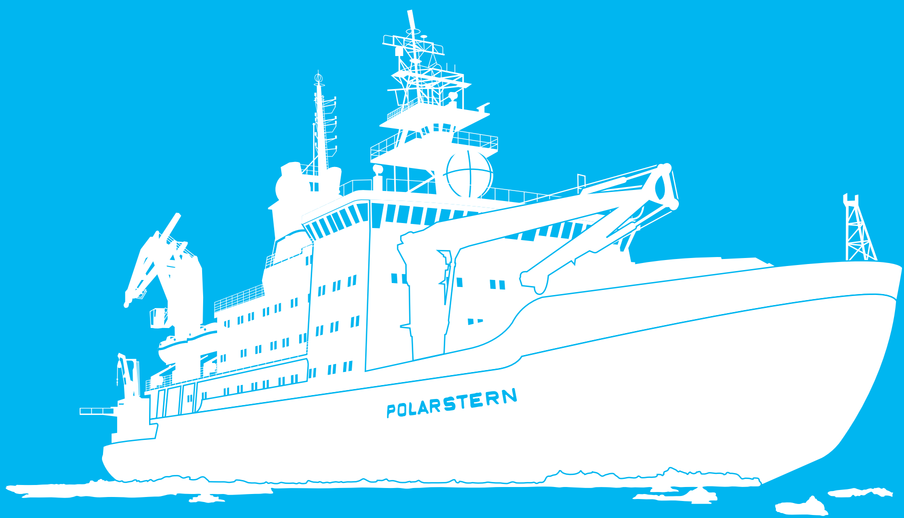
EXPEDITION PROGRAMME PS132

Polarstern

PS132
Bremerhaven - Cape Town
30 August 2022 - 29 September 2022

Coordinator: Ingo Schewe

Chief Scientist: Karen Wiltshire



HELMHOLTZ

Bremerhaven, July 2022

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The Expedition Programme *Polarstern* is issued by
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Marine Research (AWI) in Bremerhaven, Germany.

The Programme provides information about the planned goals and scientific work programmes of expeditions of the German research vessel *Polarstern*.
The papers contained in the Expedition Programme *Polarstern* do not necessarily reflect the opinion of the AWI.

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Karen Helen Wiltshire

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Ingo Schewe

1. ÜBERBLICK UND FAHRTVERLAUF

Karen Helen Wiltshire, Eva-Maria Brodte (not on board), DE.AWI
Peter Lemke, Angelika Dummermuth

Die Transitfahrt der *Polarstern* von Bremerhaven über Las Palmas nach Kapstadt (Südafrika) startet am 30. August 2022 und ist in zwei Abschnitte geteilt: Bremerhaven – Las Palmas und Las Palmas – Kapstadt (Abb. 1.1). Beide Abschnitte stehen als Expedition PS132 ganz im Zeichnen der studentischen Ausbildung. Über NIPPON-POGO Stipendien wird eine internationale Gruppe von 14 Scholars aus 14 Ländern während einer "schwimmenden Sommerschule" in Wissen und Techniken der Ozeanographie geschult. Dabei sollen sie Methoden der Probennahme, der Aufarbeitung der Proben und den Umgang mit erhobenen Daten lernen.

Als weitere Aufgabe während der Transitfahrt werden chemische und physikalische Messungen zum Energie- und Massen-Austausch zwischen Ozean und Atmosphäre durchgeführt. Zudem bekommen die Studierenden eine Einführung in die Physik des Klimasystems, internationale Klimaverhandlungen und die Ziele der UN Ocean Decade.

Die "schwimmende Sommerschule" ist ein gemeinsames Projekt zwischen dem Alfred-Wegener-Institut, dem Max-Planck-Institut für Marine Mikrobiologie in Bremen (MPI Bremen), Partnership for Observation of the Global Oceans (POGO) und Educational Passages. Die Sommerschule wird durch die Nippon Foundation / POGO Centre of Excellence finanziert und von REKLIM (Helmholtz Verbund Regionale Klimaveränderung) unterstützt. Sie ist als Aktivität der UN Ocean Decade gelistet.

Am 29. Septemer 2022 wird *Polarstern* in Kapstadt einlaufen und beendet damit die Expedition PS132.

SUMMARY AND ITINERARY

The transit cruise of *Polarstern* from Bremerhaven via Las Palmas to Cape Town (South Africa) starts on the 30 August 2022 and is divided into two sections: Bremerhaven – Las Palmas and Las Palmas – Cape Town (Fig. 1.1). Both legs are dedicated as expedition PS132 to the training of NIPPON-POGO scholarship scolars. An international group of 14 scolars from 14 countries will be trained in oceanographic techniques and ocean knowledge during a "floating summer school". They will learn methods of data collection, processing and handling.

As an additional task during the transit, chemical and physical measurements of the energy and mass exchange between ocean and atmosphere will be performed. Furthermore, the students will get an introduction to the physics of the climate system, and the goals of the UN Ocean Decade.

The "floating summer school" is a joint project between the Alfred Wegener Institute, the Max Planck Institute for Marine Microbiology in Bremen (MPI Bremen), the Partnership for Observation of the Global Oceans (POGO) and Educational Passages. The summer school is funded by the Nippon Foundation / POGO Centre of Excellence and supported by REKLIM (Helmholtz Network on Regional Climate Change and Humans). It is listed as an activity of the UN Ocean Decade.

On 29 September 2022 *Polarstern* will arrive in Cape Town, ending expedition PS132.

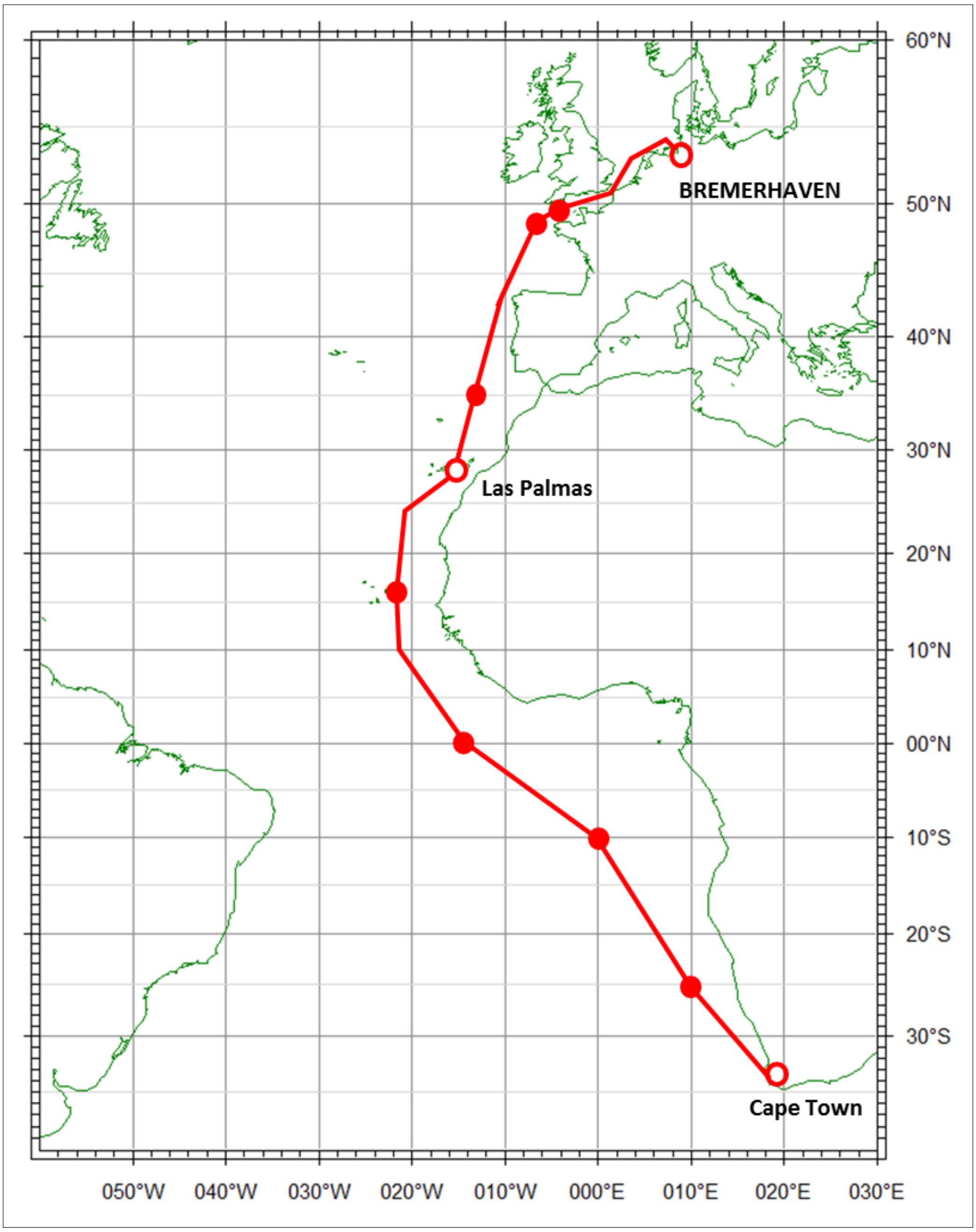

Abb. 1.1: Der generelle Kurs für PS132;
offene Kreise = Häfen; gefüllte Kreise = Stationen/Wegpunkte

Fig. 1.1: The general course plot PS132;
open circles = ports; closed circles = stations / waypoints

2. NORTH SOUTH ATLANTIC TRAINING 2022 (OCEANCAPX | NOSOAT)

Karen Helen Wiltshire[1], Eva-Maria Brodte[1] (not on board), Peter Lemke[1], Angelika Dummermuth[1], Maité Guignard[1], Rudolf Ignaz Aman[2]; Peter Croot[3], Alex Baker[4]

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Grant-No. AWI_PS PS132_01

Outline

In the framework of the *UN Ocean Decade – The Science We Need for the Ocean We Want* (https://www.oceandecade.org/) these educational and outreach activities will train young scientist in hands-on oceanographic methods and practical knowlege by an international team of teachers. During this expedition, these early career professionals in marine science will connect globally with a wider audience including pupils.

Objectives

Aim of the floating summer school is to chart and characterize different water bodies along a North-South Atlantic transect, as part of training exercise for capacity building in oceanography. An international group of 14 students (mostly graduate level and doctoral candidates) will be trained in basic oceanographic principles including seagoing methods and sampling associated with these. The cruise track will cross coastal, shelf and open Atlantic Ocean waters. Specifically, participants will learn how to sample and analyse the ocean properties, also as "Ground Truth" information for Remote Sensing information.

Intended study objectives of the floating summer school include:

- Differentiation of different water masses via temperature, salinity, turbidity etc.
- Localization of thermocline
- Detection of salinity gradients and turbidity
- Comparison of ground-truth data with remote sensing
- Measurements of atmospheric properties
- Studies of climate physics
- Discussion of the law of the sea and its impacts on in-situ marine observations

Work at sea

The map of the planned stations are shown in Figure 2.1 and 2.2. After embarkation, students will present their previous research projects (Master or PhD) in short talks and will be assigned to a project during the expedition. All participants need to pick a topic to be followed in discussion groups regularly taking place during the cruise. Topics comprise oceanography, climate & meteorology, microbiology, bathymetry and science communication and outreach. Additionally, the modules will be taught in a rotating system during the length of the expedition. Station work will take place along the route, e.g. on the Western European Shelf, the Western European Slope, to thr north west off the Ampere Sea Mount, and at least three more stations in the South Atlantic.

Deployed instruments comprise eXpendable Bathy/Thermographs (XBTs), CTD rosette casts, and surface radiance, as well aerosol collection (*en-route*). XBTs will be dropped from the (sailing) ship to measure temperature as they fall through the water. Deployment of XBTs will complement the oceanographic data collected during station work by CTD casts.

CTD Rosette Sampling

Investigations of the hydrographic regime will include 10–11 CTD casts measuring temperature, salinity and depth coupled with additional sensors to provide information on fluorescence, turbidity, oxygen etc. (Fig. 2.1, exact locations are given in Table 2.1). Water samples from depth will be recovered via Niskin bottles in a rosette frame and analysed for quantitative determination of chlorophyll-*a* concentration.

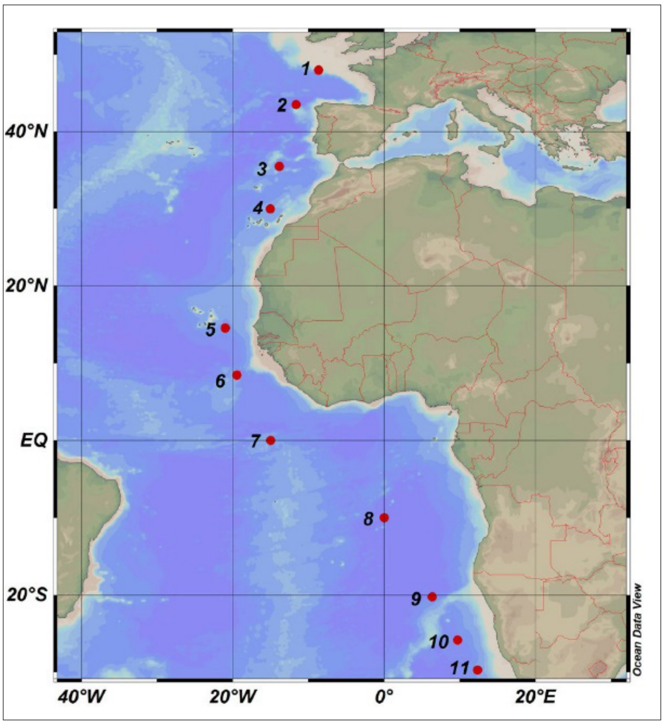

Fig. 2.1: Locations of CTD stations along the transect

XBT Deployments

Physical environmental data will be enhanced by regular deployment of Expendable Bathythermographs (XBTs) to measure the thermal structure of the upper 1.8 km of the water column. XBT probes are 'fired' when the vessel is underway at a speed of approximately 6 knots. In order to resolve fine scale shelf features such as fronts and mesoscale eddies XBT probes are generally deployed at a distance of ~25 km. For larger scale ocean processes, distances between deployments are in the order of ~150 km. The position and number of XBT stations for the NoSoAT survey is dependent on a number of factors and station positions will be *en route* (Fig. 2.2).

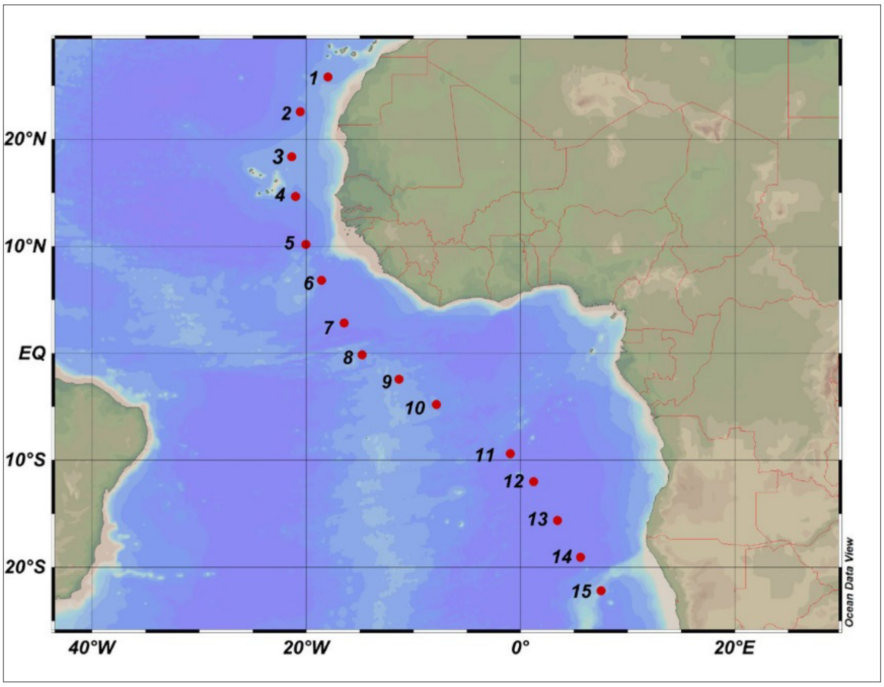

Fig. 2.2: Locations of XBT stations along the transect

Thermosalinograph DAS Measurements & Sampling

In addition, underway sub-surface (ca. 3 m) temperature, salinity and fluorescence data will be collected using the vessels thermosalinograph unit and underway data acquisition system (DAS).

Table 2.1: Coordinates of the suggested CTD stations along the transit

Station	Latitude	Longitude	Depth [m]
1	47.92739	-8.65945	1970
2	43.50087	-11.63216	5022
3	35.49660	-13.84810	4824
4	29.99234	-15.04483	3315
5	14.55696	-20.98812	4251
6	8.48235	-19.46458	4497
7	0.00009	-15.00127	3775
8	-10.00058	-0.00015	5570
9	-20.24987	6.34998	4705
10	-25.82946	9.70163	4651
11	-29.70478	12.34144	3734

Data Analyses

Simple T/S (CTD) and scatter plots (XBT) will be worked up along the transect to give students a good understanding of differing water mass characteristics and data handling. Section plots will be worked up using open software such as Ocean Data View (ODV, see http://odv.awi.de), which will be integrated with related data sets (phytoplankton, zooplankton, MODIS SST remote sensing data) to determine different water masses and biogeographic and provinces. Comparison with previous trans-meridional data sets will also be undertaken, as well as comparison from actually live measurements and satellite images.

Communication, Ocean Literacy and Outreach

Similar to successful outreach activities during previous transit expeditions in collaboration with POGO we will use the *Polarstern* App and the AWI Twitter account. In addition a “miniboat” project (https://educationalpassages.org/) will be launched. Building on the success and lessons learned in 2016 and 2019, four ‘Miniboats’ from Educational Passages – a not-for-profit organisation – will be launched in international waters as a sensor system. The Miniboats are 1.5 m long uncrewed vessels, which each have a satellite transmitter, allowing them to be tracked while sailing across the ocean. They carry sensors for air and water surface temperature. They are supplied as a ‘build-your-own’ kit, designed to be assembled and decorated by school students as part of a guided project.

On-board, students will be part of creative working groups set up to showcase the NoSoAT through a range of media fora including blogging, vlogging, video production and photography across a range of innovative social media.

The teaching programme and concept will be presented at the CommOCEAN (https://www.commocean.org/) in December 2022.

Preliminary (expected) results

The expedition from Bremerhaven to Cape Town will cover an enormous geographic range as we transit through temperate, sub-tropical and tropical regions. During the transect, participants will be trained in the principles of oceanographic, meteorological, and atmospheric interactions and their impacts on climate. Work on-board will focus on active learning and hands-on, practical applied research techniques, supported by a suite of background lectures, exercises and presentations. Participants will gain hands-on training in the set-up and operation of scientific instrumentation and equipment, acquisition and processing of samples and analysis and interpretation of the respective data. In addition, participants will receive training in understanding climate processes, simple climate modelling and the legal framework of ocean governance and its impacts on research activities at sea. Students will also receive training in:

- Physics of the climate: processes and models
- Physical, chemical and biological oceanography
- Microbiology
- Bathymetry
- Science communication

These data will allow us to categorise regional oceanic and atmospheric patterns and to identify biogeographic provinces of the Atlantic. The practical work will be supported by on-board lectures, discussions, practical exercises, data workup sessions and peer-led presentations which will enable interpretation of the respective data.

In the outreach projects with the minboats from eEducational Passages, we are partnering with oceanographic institutions in Ireland, Germany, Spain and South Africa, who are each working with a local school to assemble the miniboats. These will then be deployed enabling the school students to track the progress of their own vessel, and that of other groups involved, and learn about ocean currents, weather, technology, etc. The international collaborative nature of the project provides an extraordinary opportunity for school children in four different countries to interact with each other, their local oceanographic institution and researchers as well as young marine science trainees on board the ship. In the preparatory phase (spring/summer 2022), the schools and partner institutions are communicating their progress to a public audience via social media.

Data management

Environmental data 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 at the latest. By default, the CC-BY license will be applied.

Molecular data (DNA and RNA data) will be archived, published and disseminated within one of the repositories of the International Nucleotide Sequence Data Collaboration (INSDC, www.insdc.org) comprising of EMBL-EBI/ENA, GenBank and DDBJ).

Any other data will be submitted to an appropriate long-term archive that provides unique and stable identifiers for the datasets and allows open online access to the data.

In all publications based on this expedition, the **Grant No. AWI_PS132_01** will be quoted and the following publication will be cited:

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (2017) Polar Research and Supply Vessel POLARSTERN Operated by the Alfred-Wegener-Institute. Journal of large-scale research facilities, 3, A119. http://dx.doi.org/10.17815/jlsrf-3-163.

3. BATHYMETRIC UNDERWAY MEASUREMENTS

Yvonne Schulze Tenberge[1], Kolja Dorschel[1], Miriam Römer[2] (not on board), Patrick Schwarzbach[1], Boris Dorschel[1] (not on board)

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[2]DE.MARUM

Grant-No. AWI_PS132_03

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, hence geomorphology, is furthermore 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 on the sediments at the seafloor and on the lateral extension of sediment successions.

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 resolution necessary 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 sufficient to resolve those features and for site selection for the other scientific working groups on board.

The collection of underway data during PS132 will contribute to the bathymetry data archive at the AWI and therefore contribute to bathymetric world datasets like GEBCO (General Bathymetric Chart of the Ocean).

Work at sea

Bathymetric data will be recorded with the hull-mounted multibeam echosounder Atlas Hydrosweep DS3. The main task of the bathymetry group is to run hydroacoustic systems during transit. The raw bathymetric data will be corrected for sound velocity changes in the water column, and will be further processed and cleaned for erroneous soundings and artefacts.

Sound velocity profiles will be collected with a CTD (Conductivity Temperature Depth), an Underway-CTD, or an SVP (Sound Velocity Probe) whenever possible.

Preliminary (expected) results

Expected results will consist of high-resolution seabed maps along the cruise track.

Data management

Geophysical and oceanographic data collected during the expedition will be archived and published in the PANGAEA data repository at the AWI in accordance to the AWI research data guideline and directive (https://hdl.handle.net/10013/epic.be2ebee5-fb98-4144-9e74-aa1d38378c5e). Furthermore, the data will be included in regional data compilations such as IBCSO (International Bathymetric Chart of the Southern Ocean) and provided to the Nippon Foundation – GEBCO Seabed 2030 Project.

In all publications based on this expedition, the **Grand No. AWI_PS132_03** will be quoted and the following publication will be cited:

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (2017) Polar Research and Supply Vessel POLARSTERN Operated by the Alfred-Wegener-Institute. Journal of large-scale research facilities, 3, A119. http://dx.doi.org/10.17815/jlsrf-3-163.

4. CARBONYL SULFIDE AND CARBON DISULFIDE EMISSIONS (COS-AT)

Heike Simon[1], Yasmin Avidani[2];
not on board: Sinikka Lennartz[1]

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Grant-No.: AWI_PS132_04

Outline

Sulfur containing trace gases impact Earth's climate, and the ocean is a major natural source for the most abundant sulfur gas in the atmosphere, carbonyl sulfide (COS), and its precursor carbon disulfide (CS_2). Understanding and quantifying COS oceanic emissions is critical in two contexts: First, COS directly influences the aerosol formation in the stratosphere, which impacts the radiative budget of the Earth. Second, COS is a proxy for terrestrial CO_2 uptake by plants. A large gap in the atmospheric budget of COS currently impedes conclusions about trends in stratospheric aerosol formation and gross primary production on a global level. Especially marine emissions are associated with very high uncertainties. With this cruise, we aim to: 1) perform the first measurements of stabile isotope ratios for COS and CS_2 in seawater and marine boundary layer in the open Atlantic, in order to establish a first isotopic signature of oceanic emissions and thus constrain the relative role of ocean emissions with a mass balance approach, and 2) quantify the relationship between photochemical production of COS in surface water and the molecular composition of the large precursor pool of dissolved organic matter (DOM) as well as the organic sulfur content. We will perform "underway"-measurements using an seawater equilibration system and continuous laser absorption spectroscopy for concentration measurements. Water samples will be taken for subsequent analysis at land for the molecular composition of DOM and the isotopic ratios of the trace gases.

Objectives

The overall objective is to further constrain the role of marine emissions in the atmospheric budget of carbonyl sulphide. In particular, the following objectives are addressed:

1. Determine spatial and temporal patterns of stable isotope ratios of seawater and marine boundary layer COS and CS_2 and their covariations with physicochemical parameters along the transect:

   For three different biogeochemical regimes along the transect, we will determine the isotopic sulphur ratio of COS and CS_2 in the surface ocean at three times of the day. To cover the full diurnal cycles that results from photochemical production, samples will be taken before sunrise, in the afternoon and after sunset. In order to cover spatial variability, full diurnal cycles will be sampled at three different locations that vary in physicochemical parameters such as temperature and satellite chlorophyll as a proxy for ocean productivity. Covariations with the composition of the DOM pool (parameters listed below) and other physicochemical parameters will be determined.

2. Determine spatial patterns of production rates of seawater COS production and their covariations with the large precursor pool of dissolved organic matter:

   Both trace gases are produced by photochemical reactions of dissolved organic matter in seawater. Productions rates will be estimated from continuous underway measurements of COS concentration along the transect using a model established by Lennartz et al. (2017). The climate active trace-gas carbonyl sulfide (OCS), and related to characteristics of the marine DOM pool, including the parameters listed below. Alternating continuous measurements between seawater and air allow for a calculation of emissions along the transect. Since a common production pathway of COS and carbon monoxide (CO) has been proposed (Pos et al. 1998) the presence of a carbonyl group is necessary, while for OCS, a source of reduced sulfur in addition to the carbonyl is required. An acyl radical is postulated to be the key intermediary for OCS and CO photoproduction while a sulfur-centered radical (thiyl or sulfhydryl radical, we will measure CO concentrations as well, to assess similarities and differences in production rates with COS. Rates are obtained from continuous measurements over full diurnal cycles.

Work at sea

The work plan on board includes measurements, sampling and sample preparation for subsequent analysis after the cruise. For discrete measurements of stable isotope ratios (Objective 1), we will sample the marine boundary layer directly from the ship's deck and equilibrated seawater with a custom-made equilibrator (headspace 5 L) after an equilibration time of 1h. Samples will be stored in coated canisters and analysed after the cruise. For Objective 3, we will perform continuous concentration measurements of COS and CO with laser absorption spectroscopy onboard of *Polarstern* at a frequency of 1 Hz. The spectrometer is connected to an equilibrator that is supplied with seawater from the ship's internal seawater system. It alternates between seawater measurements and measurements of air from the marine boundary layer. In addition, underway samples for DOM will be taken twice a day (before sunrise and in the afternoon). These include the following parameters and analyses:

- Dissolved organic carbon (DOC) concentration: samples will be filtered and acidified for subsequent analysis on land.
- Solid-phase extractable dissolved organic matter (SPE-DOM) to asses the molecular composition of the DOM pool: samples will be filtered and solid-phase extracted onboard.
- Solid-phase extractable dissolved organic sulphur (SPE-DOS) to assess the amount of organic sulphur in DOM extracts: samples will be filtered and solid-phase extracted onboard.
- Colored dissolved organic matter (CDOM) to assess the fraction of the DOM pool that absorbs light, a proxy for photochemically active substances: samples will be filtered onboard.
- Fluorescent dissolved organic matter (FDOM) to assess the fraction of the DOM pool that fluoresces, indicative of certain compound groups: samples will be filtered onboard

In addition, seawater for analysis of C14 radiocarbon dating of the BPCA-fraction (benzene polycarboxylic acids) is sampled, and solid-phase extracted onboard. If possible, DOM parameters will also be taken from CTD casts, preferably the surface ocean and the deepest depth of CTD casts or from specific water masses.

Expected results

The goal is to constrain the role of marine emissions in the atmospheric budget of carbonyl sulfide. Analysing the isotopic fingerprint of COS and CS_2 in seawater and the marine boundary layer will help to determine its spatiotemporal variability. Information on this variability will help to constrain the role of oceanic emissions in mass balance approaches, that currently are based on only a few data points with a large coastal impact (Davidson et al. 2021) which are two main fluxes. Here we present sulfur isotopes measurements of marine and atmospheric COS, and of plant-uptake fractionation experiments. These measurements resulted in a complete data-based tropospheric COS isotopic mass balance, which allows improved partition of the sources. We found an isotopic (δ34S ± SE). Here, we will contribute the first open-ocean measurements of the isotopic sulfur ratio in COS and its precursor CS_2.The influence of the DOM composition on the production of COS as well as its relation to CO production will help to further constrain the spatial variation of COS production rates, which is currently the least well constrained process in numerical COS models (Lennartz et al. 2017). The climate active trace-gas carbonyl sulfide (OCS). Overall, we expect the results to establish an oceanic isotopic fingerprint of COS emissions and help to improve mechanistic models of marine COS and CS_2 cycling.

Data management

Environmental data 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) upon peer-reviewed publication. By default, the CC-BY license will be applied.

In all publications based on this expedition, the **Grant No. AWI_PS132_04** will be quoted and the following publication will be cited:

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (2017) Polar Research and Supply Vessel POLARSTERN Operated by the Alfred-Wegener-Institute. Journal of large-scale research facilities, 3, A119. http://dx.doi.org/10.17815/jlsrf-3-163.

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Pos WH, Riemer DD, Zika RG (1998) Carbonyl sulfide (OCS) and carbon monoxide (CO) in natural waters: evidence of a coupled production pathway. Mar Chem 62:89–101. https://doi.org/10.1016/S0304-4203(98)00025-5.

APPENDIX

A.1 TEILNEHMENDE INSTITUTE / PARTICIPATING INSTITUTES

A.2 FAHRTTEILNEHMER:INNEN / CRUISE PARTICIPANTS

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Krishnakumar	Hridya	DE.AWI	NF-POGO Scholar	Oceanography
Lemke	Peter	DE.AWI	Senior Scientist	Climatology

Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
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Mvula	Philile	ZA.UCT	NF-POGO Scholar	Oceanography
Nohales Coscolla	Maria	PT.UAlg	NF-POGO Scholar	Oceanography
Owen	Maximilian Arnold	DE.CAU	NF-POGO Scholar	Oceanography
Peters	Silvia	DE.AWI	Technician	Biology
Rohleder	Christian	DE.DWD	Scientist	Meterology
Rößler	Leonard	DE.MPIMM	Scientist	Microbiology
Schulze Tenberge	Yvonne	DE.AWI	Scientist	Bathymetry
Schwarzbach	Patrick	DE.AWI	Engineer	Geophysics
Simon	Heike	DE.UNI-Oldenburg	Scientist	Chemistry
Sultana	Tania	DE.AWI	NF-POGO Scholar	Geography
Tschapek	Andreas	DE.DWD	Scientist	Meterology
Wiltshire	Karen Helen	DE.AWI	Senior Scientist	Oceanography
Zapata Hinestroza	Jorvin Alexander	DE.AWI	NF-POGO Scholar	Oceanography
Zinzindohoue	Coffi Gérard Franck	DE.AWI	NF-POGO Scholar	Oceanography

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

No	Name	Name	Position
01	Schwarze	Stefan	Master
02	Kentges	Felix	Chiefmate
03	TBN		Chiefmate Cargo
04	Grafe	Jens	Chief
05	Hering	Igor	2nd Mate
06	TBN		2nd Mate
07	Müller	Andreas	ELO
08	Goessmann-Lange	Petra	Shops Doc
09	Brose	Thomas Christian Gerhard	2nd. Eng
10	Beyer	Mario	2nd. Eng
11	Haack	Michael Detlev	2nd. Eng
12	Redmer	Jens Dirk	ELO
13	Kliemann	Olaf	ELO
14	Zohrabyan	David Rubeni	ELO
15	Nasis	Ilias	ELO
16	Jäger	Vladimir	ELO
17	Sedlak	Andreas Enrico	Bosun
18	Neisner	Winfried	Carpen.
19	Klee	Philipp	MP Rat.
20	TBN		MP Rat.
21	TBN		MP Rat.
22	Meier	Jan	MP Rat.
23	Frerichs	Nils	MP Rat.
24	Wende	Uwe	AB
25	Baecker	Andreas	AB
26	Burzan	Gerd-Ekkehard	AB
27	Preußner	Jörg	Storek.
28	Schwarz	Uwe	MP Rat.
29	TBN		MP Rat.

No	Name	Name	Position
30	Rhau	Lars-Peter	MP Rat.
31	Klinger	Dana	MP Rat.
32	TBN		MP Rat.
33	TBN		MP Rat.
34	Matter	Sebastian Udo	Cook
35	Silinski	Frank	Cooksm.
36	TBN		Cooksm.
37	Pieper	Daniel	Chief Stew.
38	Braun	Maja Alexandra	Chief Stew.
39	Silinski	Carmen Viola	2nd Stew.
40	Krause	Tomasz	2nd Stew.
41	Dibenau	Torsten	2nd Stew.
42	Arendt	Rene	2nd Stew.
43	Chen	Dansheng	2nd Stew.
44	Sun	Yongsheng	Laundym.