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

EXPEDITION PROGRAMME PS98

Polarstern

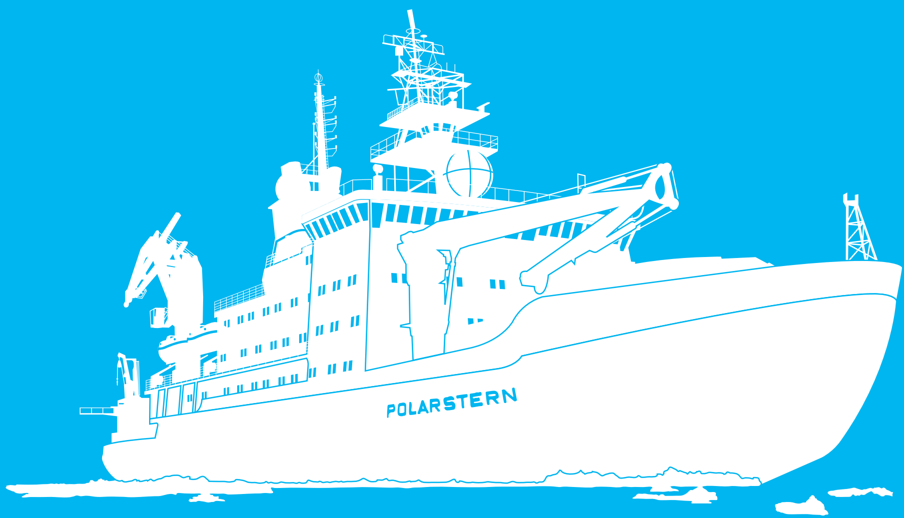
PS98

Punta Arenas - Las Palmas - Bremerhaven

10 April 2016 - 12 May 2016

Coordinator: Rainer Knust

Chief Scientist: Bernhard Pospichal



Bremerhaven, April 2016

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1. ÜBERBLICK UND FAHRTVERLAUF

Bernhard Pospichal
Universität Leipzig

Die Überführungsreise PS98 von Punta Arenas nach Bremerhaven beendet die Forschungskampagnen auf der Südhalbkugel der Sommersaison 2015/16.

Im Rahmen des OCEANET-Programms werden auf dieser Transferfahrt (Fig. 1) erneut detaillierte Beobachtungen der Atmosphäre, insbesondere von Aerosole und Wolken, und zu ihrem Einfluss auf die atmosphärische Strahlung sowie den Austausch zwischen Atmosphäre und Ozean durchgeführt. Eine Besonderheit der Fahrt (wie bereits auf ANT-XXIX/10) ist die geplante kurzfristige Anpassung der Route an die Überflüge des sogenannten A-Train, einer Satellitenkonstellation, die insbesondere ein weltraumgestütztes Aerosol-Lidar (CALIOP) und Wolkenradar (CLOUDSAT) beinhaltet. Hierdurch ergibt sich die einzigartige Gelegenheit, vertikal aufgelöste Wolken- und Aerosolprofile aus Satelliten- und Bodenperspektive über dem Ozean zu vergleichen.

Des Weiteren werden Königskrabben aus den südpolaren Regionen nach Bremerhaven überführt. Außerdem finden Vorbereitungsarbeiten zur Software-Entwicklung eines webbasierten Driftmonitoringsystem statt.

Auf dem Fahrtabschnitt Las Palmas-Bremerhaven findet zusätzlich ein Trainingskurs für Echosound-Instrumente statt. Dabei werden 20 Studenten und 5 Dozenten in Las Palmas an Bord gehen.

SUMMARY AND ITINERARY

Bernhard Pospichal
University of Leipzig

The transfer cruise PS98 from Punta Arenas to Bremerhaven will end the 2015/16 summer season of Antarctic research.

In the framework of the OCEANET programme detailed observations of the atmosphere will be carried out, targeting aerosols and clouds and their effect on atmospheric radiation and atmosphere-ocean exchange. As a further aspect (like already on ANT-XXIX/10), the route (Fig. 1) will be chosen to obtain optimal matchups with satellites from the A-Train constellation, specifically the CALIOP aerosol lidar and the CLOUDSAT cloud radar. The resulting datasets will offer the unique opportunity to compare vertically resolved profiles of clouds and aerosols from the satellite and ground-based perspective.

Furthermore, Antarctic king crabs will be transported to Bremerhaven for further studies. In addition, preparations for the development of a web-based drift monitoring system will be done.

Between Las Palmas and Bremerhaven a training course for Echosound instruments will be held, with 20 students and 5 lecturers.

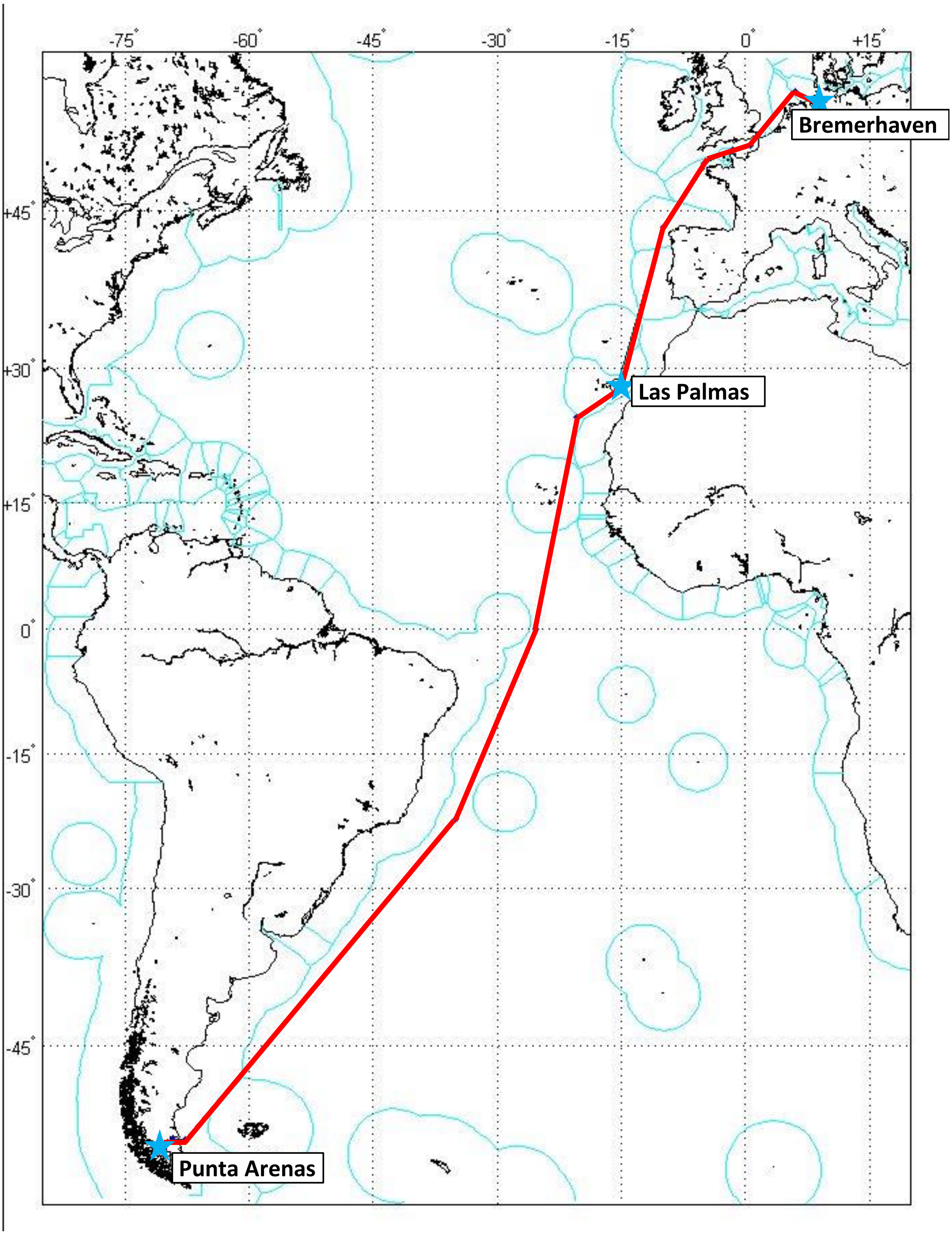

Abb. 1: Fahrtroute des FS Polarstern während der Expedition PS98 von Punta Arenas über Las Palmas nach Bremerhaven

Fig. 1: Planned track of RV Polarstern during expedition PS98 from Punta Arenas via Las Palmas to Bremerhaven

2. AUTONOMOUS MEASUREMENT PLATFORMS FOR ENERGY AND MATERIAL EXCHANGE BETWEEN OCEAN AND ATMOSPHERE (OCEANET): ATMOSPHERE

B. Pospichal (LIM), S. Bohlmann (TROPOS), T. Doktorowski (LIM), T. Küchler (TROPOS/LIM), M. Radenz (TROPOS), J. Stapf (LIM)
Not on board: A. Macke (TROPOS), R. Engelmann (TROPOS)

Objectives

a) Radiation & microwave remote sensing

The net radiation budget at the surface is the driving force for most physical processes in the climate system. It is mainly determined by the complex spatial distribution of humidity, temperature and condensates in the atmosphere. The project aims at observing both the radiation budget and the state of the cloudy atmosphere as accurate as possible to provide realistic atmosphere-radiation relationships for use in climate models and in remote sensing. While similar experiments have been performed from land stations, only few data from measurements over ocean areas exist. A shadowband radiometer in combination with multi-spectral transmission measurements allows the characterization of water vapour and liquid water clouds. Marine stratocumulus clouds which are widespread over the subtropical Oceans play an important role in the global energy balance and therefore need to be studied in more detailed.

A multichannel microwave radiometer will be applied to continuously retrieve temperature and humidity profiles as well as cloud liquid water path over the ocean. Time series of these profiles will show small scale atmospheric structures as well as the effects of the mean state of the atmosphere and its variability on the co-located measurements of the downwelling shortwave and longwave radiation. The atmospheric profiles will also be used to validate the satellite based profiles from the IASI instrument onboard the new European polar orbiting satellite MetOp. Atmospheric aerosol optical thickness will be measured by means of hand held sun photometer and spectral solar radiometer. Most instruments will be integrated in the container-based atmosphere observatory.

b) Lidar measurements

Since more than 15 years TROPOS has developed and operated advanced lidar systems in order to study optical and microphysical aerosol properties in the troposphere. The system PollyXT, a semi-autonomous multiwavelength polarization Raman lidar will be operated inside a container, together with the radiation and microwave sensing equipment. The lidar is able to measure independently profiles of particle backscatter at three wavelengths and extinction at two wavelengths, which allows identifying particle type, size, and concentration. Additionally particle depolarisation is measured in order to discriminate between spherical and non-spherical particles, e.g. biomass-burning smoke vs. mineral dust or water clouds vs. ice clouds. Recently the lidar was equipped with a measurement channel for atmospheric water-vapour, too. The data are used to characterize long-range transport of aerosol and identify pollution. The determined height-resolved aerosol extinction completes the radiation measurements. In this way, the radiative influence of single lofted aerosol or cloud layers can be calculated with radiation-transport models.

Work at sea

Upon departure the container-based atmosphere observatories will be installed at the observation deck of *Polarstern*. Most measurements will be performed underway and continuously. The following individual instruments are combined:

1) Multichannel microwave radiometer HATRPO. The instrument requires occasional calibrations with liquid nitrogen as well as tipp-calibrations under calm sea and homogeneous atmospheric conditions.
2) Whole sky imager for cloud structure measurements
3) Multiwavelength polarization Raman lidar PollyXT
4) Shadowband radiometer
5) Multi-spectral zenith radiance observation system CORAS

Expected results

1) 2d structure of the clear sky atmosphere and corresponding net radiation budget.
2) Horizontal structure of clouds from microwave and lidar, and its effect on the downwelling shortwave and longwave radiation
3) Vertical structure of temperature and humidity as well as its variability for validation of satellite products
4) Vertical profiles of tropospheric aerosols and their effect on radiation
5) Liquid water cloud properties (effective radius, liquid water content) from passive observations

Data management

Measurement data will be made available through the Pangaea database after the cruise.

3. SURVEY OF CLOUDS AEROSOL AND WATER

S. Bakan (MPI-M), C. Duscha (MPI-M),
not on board: S. Kinne (MPI-M, Hamburg)

Objectives

Transit-voyages, as with the RV *Polarstern* from Europe into the Southern Hemisphere (and vice versa), allow the survey of atmospheric properties. These measurements also offer required ocean reference data for satellite remote sensing from space. The proposed equipment is an Infratec IR-cloud camera and a handheld MICROTOPS-II radiometer (in combination with a GPS unit).

The cloud-camera of the MPI-M is fixed at a ship location where the camera's 30 degree field of view is (mostly) unobstructed. The thermal camera surveys (1) the overhead cloud structure also as a function of time (e.g. daily cycles), (2) the cloud structure movement (by capturing images in regular intervals of ca 10 seconds) and (3) the approximate cloud altitude via the (detected cloud-base) temperature.

The MICROTOPS is calibrated unit of NASA-GSFC and is lent to the MPI-M as part of AERONET's MAN effort http://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html. For each sample (of many measurements) the instrument's solar spectral sensors are pointed for a few seconds directly into the sun-light at assured cloud-free conditions. From the sensed atmospheric solar sub-spectral attenuation (as the incoming radiation at the top of the atmosphere [defined by time and latitude] is reduced by solar atmospheric scattering and absorption processes) the atmospheric column load for aerosol and water vapor is derived. Since the aerosol attenuation is determined at different wavelengths also information on the characteristic aerosol size is offered, indirectly also pointing to the dominant aerosol type.

Work at sea

The instruments are placed (cloud-camera) and manually operated on the ship's upper deck to assure unobstructed views of the sky and of the sun.

The cloud camera records automatically in a freeze frame mode. However exposure to direct sun-light must be avoided to avoid damage to the optics. Thus, at higher sun-elevations the instrument's optics needs to be covered. Also a protective foil on top of the optics (to prevent water damage or signal contamination) needs to be regularly cleaned or/and replaced. After extended measurement periods (ca 14 hours) the data need to be downloaded on a storage facility (e.g. external hard-drive) and data need to be converted from an instrument internal format into (jpeg) images and (ascii) data-files.

The MICROTOPS measurements are labor-intensive. Not only a correct pointing into the sun is required (if possible in 15min block of 10 consecutive samples), but also any contaminations by clouds need to be avoided. This is particular important and difficult in events of hardly visible cirrus clouds. Thus, a continuous monitoring of the sky near the sun-disk is required (which also for documentation should be supported by video-images). Due to the limited storage capability of a MICROTOPS (max 500 samples) data need to be downloaded (at least daily) onto a laptop and sent via e-mail to Dr. Smirnov at NASA-GSFC (Alexander.Smirnov-1@nasa.gov), who will provide immediate feedback on data quality and who will upload the data onto http://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html.

Data management

The data for the cloud-camera are collected and archived immediately after the cruise at the Max-Planck Institute for Meteorology (Hamburg). These data can also be copied to a data-server related to that cruise. Output is offered both as images and as digital data, which can be quite voluminous (on the order of 500 GB).

The data of the MICROTOPS-II are send to a NASA (-GSFC) archive where the (preliminary) aerosol and water-vapor measurements become visible and accessible via the web with days. After a past-voyage re-calibration of the MICROTOPS at NASA, a higher quality data version of the cruise data will be offered in addition.

References

Smirnov, A., B. N. Holben, I. Slutsker, D. M. Giles, C. R. McClain, T. F. Eck, S. M. Sakerin, A. Macke, P. Croot, G. Zibordi, P. K. Quinn, J. Sciare, S. Kinne, M. Harvey, T. J. Smyth, S. Piketh, T. Zielinski, A. Proshutinsky, J. I. Goes, N. B. Nelson, P. Larouche, V. F. Radionov, P. Goloub, K. Krishna Moorthy, R. Matarrese, E. J. Robertson, and F. Jourdin (2009), **Maritime Aerosol Network as a component of Aerosol Robotic Network**, *J. Geophys. Res.*, 114, D06204, doi:10.1029/2008JD011257.

4. MARINE BIOLOGY, INTEGRATIVE ECOPHYSIOLOGY

Animal transport for studies on temperature and hypoxia tolerance of various live stages of Lithodid crabs

F. V. Moraleda (AWI), M. Rachnik (AWI), C. Peter (AWI), R. Lorenzo (CADIC)
not on board: D. Storch (AWI), A. Wittmann (AWI)

Objectives

The main aim of this cruise is to transport living king crabs (egg-carrying females and males) from Punta Arenas to Bremerhaven, that will be used in experiments in the framework of DFG Project STO 857/2-1 "Climate driven Antarctic invasion? Physiological impacts of temperature and hypoxia on life stages of reptant decapod crustaceans and implications for distribution shifts".

In Bremerhaven, the animals will be used in order to test the temperature and hypoxia tolerance in varying life stages and its implications for Antarctic invasion. The following working hypotheses are proposed using the southern king crab *Lithodes santolla* and the Chilean snow crab *Paralomis granulosa* as model species:

1) The thermal tolerance window of eggs, measured from the cellular to the organismic level, is smaller in comparison to larvae, males and egg carrying females. Therefore, the life stage "egg" will determine the distribution limits of the species.
2) The thermal tolerance of eggs and larvae will be decreased by low DO in sea water
3) The parental investment is temperature dependent and low DO levels negatively affect the development and fitness of hatching larvae.

Objective 1: Evaluate the thermal tolerance windows of eggs, larvae, males and egg carrying females, measured from the cellular to the organismic level to identify the "bottleneck stage" in life history of the species (preferred model species will be the sub-Antarctic *Lithodes santolla* and *Paralomis granulosa*. Lower and upper pejus and critical temperatures will be evaluated for the above life stages. To meet this goal, males and ovigerous females will be kept in the aquarium at constant temperature, according to their environmental temperature, and acute thermal tolerance windows will be determined by measuring (1) oxygen consumption rates in eggs and early larvae; (2) heart beat (3) ventilation rates and (4) anaerobic end products in all stages (4) swimming activity of larvae and (5) haemolymph pO_2 in adults.

Objective 2: Evaluate if and how low DO decreases thermal tolerance in eggs and larvae. Long-term accumulative effects of low DO on embryonic development and larval fitness will be evaluated. To meet this goal, ovigerous females will be kept in the aquarium at constant temperature and low DO. Acute thermal tolerance windows will be determined for eggs and the hatching larvae as indicated under objective 1. Subsequently, thermal tolerance windows of eggs and larvae of objective 1 will be compared with the results of objective 2.

Objective 3: Evaluate the parental investment at the temperature extremes of the species and low DO levels and its impact on the development and fitness of hatching larvae. Exposure experiments of females will be conducted to determine differences in parental investment by measuring (1) lipid/protein contents of gonads, eggs and hatching larvae and (2) brooding behaviour at varying temperature and oxygen tensions. Development and fitness of eggs and hatching larvae will be followed by monitoring (1) loss of eggs, (2) development of the eggs and first larvae, (3) hatching rates from egg masses, (4) swimming activity and (5) mortality of larvae.

Work at sea

Animals will be purchased in Punta Arenas. In Punta Arenas, re-circulating systems will be installed in the Biolaboratory containers located on Deck F of *Polarstern*. The systems containing of 4-5 big tanks will be filled with seawater and will be cooled down to a temperature of 4-5°C. The animals will be maintained in these systems for the entire cruise. Water parameters (Ammonium, Nitrit, temperature and salinity) will be controlled on a daily basis and seawater will be exchanged as soon as the water quality decreases. Animals will be fed and dead animals will be removed.

Data management

Data taken during lab experiments back in Bremerhaven will be made available after validation through the PANGAEA database. Results will be included in a Master thesis and will be published in international journals.

5. ECHOUSOUNDING TRAINING COURSE (POLMAR-TRAIN 2016)

C. Hanfland (not on board), G. Kuhn (AWI), F. Niessen (AWI)
total: 5 lecturers, 20 students

Abstract: On the cruise section between Las Palmas / Canary Islands and Bremerhaven, Master students and doctoral candidates will be jointly trained to operate the echosounding systems of RV *Polarstern*. Participants will be responsible for the watches, process and edit the data and learn some simple trouble-shooting. They will get familiar with the relevant software and learn to create maps from the acquired data. Discussion of case studies from literature is a further focus of the training.

Objectives

The project POLMAR-TRAIN 2016 is a course jointly run by the AWI-based Helmholtz Graduate School for Polar and Marine Research (POLMAR) and University of Bremen. It offers Master and PhD students from geosciences a hands-on training in operating the hull-mounted echosounding systems of RV *Polarstern* (multibeam echosounder Atlas Hydrosweep DS3 and sediment echosounder Parasound P70). Both systems will be operated continuously between Las Palmas and Bremerhaven. The course is part of the programme “Master of Sciences Marine Geosciences” at the University of Bremen as well as of the scientific programme of POLMAR. Both programmes involve ship-based field-work. Lecturers are affiliated with both institutions and jointly offer this training. Students will be trained in data evaluation and interpretation with published and on-route collected examples.

This training format was already successfully carried out in autumn 2014 and received excellent feedback from by the participants.

In the future, the transit times of RV *Polarstern* are planned to be subject to regular ship-based trainings, hence experience from this (and previous) cruises will help to build future proposals, e.g. for future EUROFLEET ship-based training courses in related sciences.

Work at sea

After embarkation, students will start with a half-day introduction to get familiar with the principles of hydro-acoustic data acquisition, to learn how to use the required software and to know how to operate the echosounding systems. Participants will be trained in all parts of the systems and go on watches in 2-hours shifts at day and 4-hours shifts at night. They will learn about sediment properties, reflector horizons, bottom topography and the principles of sediment acoustics. One key objective is the study of the spatial and temporal morphological variability of the huge sea-floor sand dunes in the English Channel.

Practical training on the systems will be complemented through plenary lectures and software training in smaller groups to discuss published case studies. Being able to combine and interpret sediment core and multibeam-bathymetric data with Parasound profiles is a further learning outcome.

Participants will also be introduced to survey planning, data handling, editing, and visualization with different kind of profiling and GIS mapping software. Being able to produce a map from originally raw data will be one of the outcomes participants can "take home".

Besides the watch duties, students will give a 15 min presentation on their individual research project (Ms or PhD) and the relevance of the course content for their project. Given the composition of participants (both Master and PhD students), participants will greatly benefit from each other. By experience we know that peer-teaching is an added value in every course. Working on a ship will foster this exchange. Master students can further clarify their motivation for their next career step, e.g. whether following a PhD is an option for them.

Data management

Hydro-acoustic data (multibeam and sediment echosounder) collected during the expedition will be stored in the PANGEA data repository at the AWI. Furthermore, the data will be provided to mapping projects and included in regional data compilations such as IBCSO (International Bathymetric Chart of the Southern Ocean) and GEBCO (General Bathymetric Chart of the Ocean).

6. TEILNEHMENDE INSTITUTE/ PARTICIPATING INSTITUTIONS

	Adresse/Address
AWI	Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- undMeeresforschung Am Handelshafen 12 Postfach 120161 27515 Bremerhaven/Germany
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DWDWD	Deutscher Wetterdienst Bernhard-Nocht-Str. 76 20359 Hamburg/Germany
FIELAX	FIELAX Gesellschaft für wissenschaftliche Datenverarbeitung mbH Schleusenstr. 14 D-27568 Bremerhaven Germany
HafenCity Uni Hamburg	HafenCity Universität Hamburg Überseeallee 16 20457 Hamburg/Germany
Instituto Antartico Argentino	Instituto Antártico Argentino 25 de Mayo 1143, San Martín Provincia de Buenos Aires Argentina
MPI-M	Max Planck Institute for Meteorology Bundesstrasse 53 20146 Hamburg/Germany

TROPOS Leipzig	Leibniz-Institut für Troposphärenforschung e.V. Permoserstraße 15 04318 Leipzig/Germany
Uni Bremen	Universität Bremen Bibliothekstraße 1 28359 Bremen/Germany
Uni Leipzig (LIM)	Universität Leipzig Leipziger Institut für Meteorologie Stephanstr. 3 04103 Leipzig/Germany
University of Bergen	University of Bergen P.O.Box 7800 5020 Bergen, Norway

7. FAHRTTEILNEHMER/ CRUISE PARTICIPANTS

Name/ Last Name	Vorname/ First name	Institut/ Institute	Beruf/ Profession
Bakan	Stephan	MPI Hamburg	Meteorologist
Bohlmann	Stephanie	TROPOS / Uni Leipzig	MSc student, Meteorology
Doktorowski	Tobias	TROPOS / Uni Leipzig	MSc student, Meteorology
Duscha	Christiane	MPI Hamburg	MSc student, Meteorology
Küchler	Tobias	TROPOS / Uni Leipzig	MSc student, Meteorology
Lensch	Norbert	AWI	Technician
Lorenzo	Rodrigo	CADIC-CONICET	PhD student, Biology
Machnik	Marcel	AWI Biologie	Technician, Biology
Peter	Corina	AWI Biologie	MSc student, Biology
Pliet	Johannes	FIELAX GmbH	
Pospichal	Bernhard	Uni Leipzig	Meteorologist
Radenz	Martin	TROPOS / Uni Leipzig	MSc student, Meteorology
Stapf	Johannes	TROPOS / Uni Leipzig	MSc student, Meteorology
Rohleder	Christian	DWD	Meteorologist
Sonnabend	Hartmut	DWD	Technician, Meteorology
Walter	Andreas	AWI Rechenzentrum	

Ab Las Palmas:

Adhikari	Dilip	HafenCity Uni Hamburg	MSc Student, Geosciences
Bagheri	Saeid	Uni Bremen	MSc Student, Geosciences
Daskevic	Tim	Uni Bremen	MSc Student, Geosciences
Dorschel	Boris	AWI Bremerhaven	Scientist, Lecturer
Dreutter	Simon	HafenCity Uni Hamburg	Scientist, Lecturer
Dvornikov	Yuri	AWI Potsdam	MSc Student, Geosciences
Fall	Johanna	University of Bergen, NOR	MSc Student, Geosciences
Gebhardt	Catalina	AWI Bremerhaven	Scientist, Lecturer
Höpker	Sebastian	Uni Bremen	MSc Student, Geosciences
Ibrahim	Amr	HafenCity Uni Hamburg	MSc Student, Geosciences

Name/ Last Name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**
Ibrahim	Islam	HafenCity Uni Hamburg	MSc Student, Geosciences
Katlein	Christian	AWI Bremerhaven	Postdoc, Geosciences
Köster	Male	Uni Bremen	MSc Student, Geosciences
Kuhn	Gerhard	AWI Bremerhaven	Scientist, Lecturer
Lindeman	Margaret	AWI Bremerhaven	PhD Student, Geosciences
Lirio	Juan Manuel	Instituto Antarctico Argentino	PhD Student, Geosciences
Manograsso	Tamara	Instituto Antarctico Argentino	PhD Student, Geosciences
Marinkovic	Henning	Uni Bremen	MSc Student, Geosciences
Mengert	Melissa	Uni Bremen	MSc Student, Geosciences
Niessen	Frank	AWI Bremerhaven	Scientist, Lecturer
Schmid	Florian	AWI Bremerhaven	PhD Student, Geosciences
Schüürman	Jan	Uni Bremen	MSc Student, Geosciences
Sprengel	Claudia	AWI Bremerhaven	Postdoc, Geosciences
Steinbrink	Lara	Uni Bremen	MSc Student, Geosciences
Tang	Jiawei	Uni Bremen	MSc Student, Geosciences

8. SCHIFFSBESATZUNG / SHIP'S CREW

	Name	Rank
01.	Schwarze, Stefan	Master
02.	Spielke, Steffen	1.Offc.
03.	Farysch, Bernd	Ch. Eng.
04.	Langhinrichs, Moritz	2. Offc.
05.	Hering, Igor	2.Offc.
06.	Ohne 2.Offc.	
07.	Schmidt, Rüdiger	Doctor
08.	Fröb, Martin	Comm.Offc.
09.	Grafe, Jens	2.Eng.
10.	Krinfeld, Oleksandr	2.Eng.
11.	Holst, Wolfgang	3. Eng.
12.	Redmer, Jens	Elec.Tech.
13.	Christian, Boris	Electron.
14.	Hüttebräucker, Olaf	Electron.
15.	Lehnert, Lars	Electron.
16.	Himmel,Frank	Electron
17.	Loidl, Reiner	Boatsw.
18.	Reise, Lutz	Carpenter
19.	Sandmann, Rainer	A.B.
20.	Wittek, Sönke	A.B./Tr.
21.	Scheel, Sebastian	A.B.
22.	Hagemann, Manfred	A.B.
23.	Winkler, Michael	A.B.
24.	Brück, Sebastian	A.B.
25.	Wende, Uwe	A.B.
26.	Bäcker, Andreas	A.B.
27.	Schulz, Fabian	A.B./Tr.
28.	Preußner, Jörg	Storek.
29.	Teichert, Uwe	Mot-man
30.	Rhau, Lars-Peter	Mot-man
31.	Lamm, Gerd	Mot-man
32.	Schünemann, Mario	Mot-man
33.	Pinske, Lutz	Mot-man
34.	Redmer, Klaus-Peter	Cook
35.	Silinski, Frank	Cooksmate
36.	Kluge, Wilfried	Cooksmate
37.	Czyborra, Bärbel	1.Stwdess
38.	Wöckener, Martina	Stwdss/KS
39.	Dibenau, Torsten	2.Steward
40.	Silinski, Carmen	2.Stwdess
41.	Arendt, Rene	2.Steward
42.	Grigull, Elke	2.Stwdess
43.	Sun, Yong Shen	2.Steward
44.	Yu, Kwok Yuen	Laundrym.