

Polarstern-Expedition planning 2025-2028

Ralf Tiedemann and Ingo Schewe

Science Workshop 2022
 14 – 15 September 2022 at the University of Bielefeld

Bundling and implementing national polar expedition interests with RV Polarstern

An initiative of:
 National Committee SCAR/IASC
 Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research
 DFG priority programme "Antarctic Research"

POSTPONED

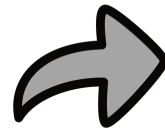
The workshop will be a forum for presenting and discussing ideas and initiating collaborations for new expeditions 2025-2028.

Contents:

- Presentation of the new AWI Antarctic Strategy
- Presentation of project ideas for expeditions
- Discussion of possible overarching, large research projects involving multiple expeditions.
- Ideas for secondary use proposals
- Highlights from previous expeditions
- Info-block US Heincke (expeditions to the far north)

Registration: Letter of interest (1 page)
 Deadline 31 July 2022

Organizing committee:
 Ralf Tiedemann: Ralf.Tiedemann@awi.de
 Ingo Schewe: Ingo.Schewe@awi.de
 Claudia Klages: Claudia.Klages@awi.de



Haus der Wissenschaft

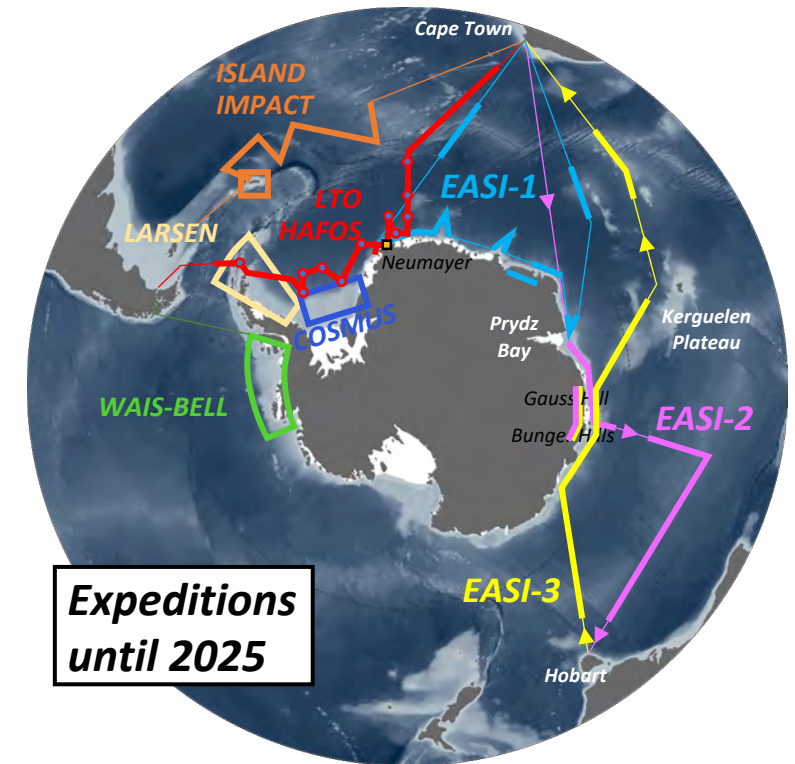


We are now planning the workshop for spring (preferably March) at "Haus der Wissenschaft" in Bremen.

Polarstern-Expedition planning 2025-2028

Why this workshop?

- It will be a forum for the presentation and discussion of ideas and the initiation of cooperations for new expeditions.
- It takes ca 3-5 yrs to plan an expedition until its realization:
 - The integration of common research interests into an expedition should take place ca. 2 yrs before the cruise proposal is submitted.
 - The time from submission to realization can take 1-4 yrs
- It offers an excellent opportunity to develop larger research projects with multiple expeditions (e.g. MOSAIC, EASI).
- AWI will inform about their new long-term Antarctic and Arctic strategy and present rough drafts of expedition proposals.



Polarstern-Expedition planning 2025-2028

Rough drafts of AWI expedition proposals for the Arctic and Antarctic

Arctic drafts

Acronym: ICE EDGES – Wilken-Jon von Appen et al.

GOALS:

- Document small scale (submesoscale) physical processes taking place along different types of ice edges (compared to open water ice edge, and distant ice edge) and their impact on nutrient fluxes
- Measure direct and indirect effects of ice edges on nutrient fluxes
- Understand the implications for biogeochemical and sea ice fluxes
- Quantify the role of zooplankton
- Support the monitoring efforts (Subarctic Current) and in the future

LAMEX 1+2: Evolution of Arctic ridge systems and their impact on paleoceanography and natural climate variability – Deboare et al. (LAMEX 1); Müller et al. (LAMEX 2)

GOALS:

- Decipher the role of ridge systems for ocean current development and associated climate and environmental changes
- Elucidate central Arctic Ocean environmental conditions during warming climates (e.g. Miocene and Pliocene climate optima)
- Investigate the onset and variability of (1) Arctic sea ice and (2) Eurasian ice sheets in respect to paleo-sea level change
- Unravel ice-ocean-atmosphere interactions that controlled the Cenozoic climate transition (Cenozoic to holocene)
- Identify interconnections between Arctic and Southern Ocean cryosphere development

Acronym: Winter Flux – Torsten Kanzow et al.

GOALS:

- Impact of energetic winter time flows from vertical exchanges of water masses and biogeochemical tracers
- Role of convection and frontal activity in driving the subsidence of Atlantic waters when entering the Arctic Ocean (Atlantification) and its role for downstream carbon transport

Acronym: ArcticWitch 3 – Contrasting properties and environments in the Arctic (Nicolaus et al.)

GOALS:

- Study the different key ice characteristics
- Characterize the key physical, oceanic, atmospheric, and biological processes in association with ice
- Improve process understanding by emerging ice motion

Acronym: ArcticWitch 4 – Trans-Arctic Changes in ocean/sea-ice circulation and ecosystem structure (Gelbert,Rabe,Floras,Haas,Metzler,Peeken,Torres,Wenzhöfer)

GOALS:

- Assess the quasi-synoptic state of the Eurasian Arctic Ocean, sea-ice and atmosphere
- Characterize decadal-scale changes in the Arctic Ocean through physical and biogeochemical observations, as part of the central Arctic Oceanography LTO, FRAM and GEDTRACEs
- Investigate the changing interaction between the environment, biogeochemistry and biogeochemical fluxes in the coupled cryosphere system
- Repeat a core set of strategic observations carried out during ArcticWitch 1-3 to assess changes in the 2020s

Acronym: EGC-Sources – Torsten Kanzow et al.

GOALS:

- Document source water branches separating the export of polar surface water and Atlantic Water within the East Greenland Current
- Study interaction of these branches with the marine biogeochemical system in the North and Northeast Greenland
- Study link between heat and salt transport, sea ice melt and biogeochemical cycling and carbon export within Polar Surface Water and Atlantic Water
- Process studies supporting air-sea interactions of sea ice melt and thinning
- Study lithosphere formation in the deep water IFR systems of Fram Strait
- Elucidation history of Greenland Shelf and lithosphere formation in Fram Strait
- Quantify the lateral carbon transport from global melt-water and its contribution to shelf sedimentation and deep ocean carbon sequestration

Antarctic drafts

Sea Mice: South Eastern Scotia Arc- Marginal Ice zone study – Klaas, et al.

GOALS:

- Impact of sea-ice, iron (sources and distribution) and mixing on productivity in the marginal ice zone and ocean interior of the Southern Ocean

ISPOL20 – Christian Haas, and team of international collaborators

GOALS:

- Study atmosphere-ice-ocean-ecosystem interaction in the ice zone during the intensive melting season (Dec. 1-15)
- Shed light on underexplored Antarctic oceanic ice systems
- Key interactions include: Snow and gas layer melt, freshwater sublimation, trophic coupling between ice, biota, and pelagic carbon pump; BOC processes, aerosols, and cloud formation
- Support long-term observations of water masses, ice thickness
- Improve and validate numerical models (e.g. FESOM, RESM) and remote sensing algorithms
- Collaborate with South Africa and Norway to organize a multi-strip project (Agulhas 1, 2P Habitat) to extend regional and/or tropical scope

SPACED: Sediment budgets and paleoceanography across the SW Pacific Southern Ocean – Lamy et al.

GOALS:

- Improve knowledge of Southern Ocean (SO) sedimentation patterns, presently primarily based on few isolated sediment cores
- Obtain a quasi-areal quantification of oolite and carbonate-dominated sedimentary regimes in relation to the biological pump
- Generate realistic models (Holocene and last ACC sediment)

EWOS - II: Eastern Weddell Sea Observation System – Mark et al.

GOALS:

- Drivers of ecosystem processes and fluxes: Study key variables of carbon, nutrient, and trace element fluxes and cycling within and between the main oceanic compartments like ice, water column, and sea floor, as well as key species responsible for the carbon and nutrient transfer, seawater residence time, drivers
- Organisms and ecosystems: Determine the abundance, biomass, diversity, phylogenetic diversity and relative capacity of (free) prokaryotes and benthic fauna in relation to organic carbon availability, habitat, and hydrographic features through integrative surveys (e.g. trawls, nets, central methods, grab, etc.) as a baseline to monitor climate change-induced shifts in the Antarctic ecosystem
- Carbon sequestration: Quantify the carbon sink, its drivers and temporal change and the role of the study region for carbon sequestration by analyzing the biogeochemistry and physically-mediated transport of carbon to the subsurface. Gain process understanding from stratigraphy/high-resolution data for model evaluation and validation

Acronym: HAFOS – Boebel et al.

GOALS:

- LTO section along transect
- Deploy floats and PIES
- Capture (micro)planktonic water masses with regard to S. structure
- Quantify dense water column

Acronym: KRIHIS: Impact of key species on the biological carbon pump – Meyer, et al.

GOALS:

- Quantifying the role of microorganisms and other planktonic organisms for carbon flux
- Revealing the impact from behavior interaction (dependence on seasonality) between: (i) key species, amphipods for trace nutrient and micronutrient remineralization, primary production and carbon flux
- Evaluate the niche partitioning of large benthic species in relation to food availability and niche differentiation
- Evaluate how a potential future shift from ice to shelf will affect distribution and biogeochemistry of the KRIHIS region
- Investigate the regional distribution of trace and micronutrient levels and the management of the shelf by CCAMLR

Evolution of the Antarctic Ice Sheet (EvoAIS) – J.P. Klages et al.

GOALS:

- Revealing both the timing of and sea level fall, during, and after initial A boundary, i.e. A transition from present-day to the mid-Miocene climate
- Identifying ice-proximal conditions and during the mid-Miocene climate
- Constraining potential WAIS collapse: Pleistocene super-interglacials and A boundary
- Assessing the multi-proxy data from the ACC history as reliable target values
- Improving numerical ice-sheet models

IECAP: Integrative Ecophysiological Circum-Antarctic Peninsula observation and process study – Lucassen, et al.

GOALS:

- Comparative macrobenthic community and biodiversity study along latitudinal cross on either side of the Peninsula
- Dynamic of benthic ecosystem functioning in response to environmental shifts and disturbance
- Proxy genomes to ecophysiology: integrative assessment of selected key species from several taxonomic groups and different trophic levels in response to climate gradients and local adaptation
- Transfer of water and energy between trophic levels and assessment of the (local) genetic diversity coupling

All were evaluated and ranked in an AWI internal process:

- Program-relevance and ambition
- Implementation of expedition goals
- Scientific excellence and productivity of the applicants.

AWI sets the framework program for future expeditions in the Arctic and Antarctic, which is supplemented by external main and secondary user proposals.

PS-Expedition planning 2025-2028

YEAR	2024																																																													
MONTH	12	12	12	12	12	01	01	01	01	02	02	02	02	03	03	03	03	04	04	04	04	04	05	05	05	05	06	06	06	06	07	07	07	07	07	08	08	08	08	08	09	09	09	09	09	10	10	10	10	11	11	11	11	12	12	12	12	12	01	01	01	01
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	EASI-2 Gutjahr et al. GEOMAR										EASI-3 Schneider et al. Uni Kiel										Transit				Logistics				FRAM/ HG Wenzhöfer Long-Term Observatory								ARCWATCH-2 Rabe (GPF 20-2_070)								Shipyards 6 weeks						Transit											

YEAR	2025																																																													
MONTH	12	12	12	12	12	01	01	01	01	02	02	02	02	03	03	03	03	04	04	04	04	04	05	05	05	05	06	06	06	06	07	07	07	07	07	08	08	08	08	08	09	09	09	09	09	10	10	10	10	11	11	11	11	12	12	12	12	12	01	01	01	01
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	SWOS Peeken (Haas) 64 days at sea Ant. Peninsula										HAFOS - COSMUS-2 Boebel - Janout 75 days at sea Weddel-Sea										Transit				Logistics				FRAM/ HG Wenzhöfer LTO 19 work-d.								supplem. expedition to FRAM								Shipyards						Transit											

YEAR	2026																																																													
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	Neumayer supply																				Transit				Logistics				FRAM/ HG Wenzhöfer LTO 19 work-d.								supplem. expedition to FRAM								Shipyards 6 weeks						Transit											

YEAR	2027																																																													
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	Neumayer supply																				Transit				Logistics				FRAM/ HG Wenzhöfer LTO 19 work-d.								supplem. expedition to FRAM								Shipyards 6 weeks						Transit											

End of AWI research Program "Changing Earth – Sustaining our Future"

YEAR	2028																																																													
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	HAFOS Long-Term Observatory 45 work days Weddel-Sea										supplem. exped. to HAFOS										Transit				Logistics				FRAM/ HG Wenzhöfer LTO 19 work-d.								supplem. expedition to FRAM								Shipyards 6 weeks						Transit											

Possible parallel operation PS + PSII

AWI Homepage: Polarstern schedule until 2025

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Heincke

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YEAR	12	12	12	12	12	01	01	01	02	02	02	03	03	03	04	04	04	05	05	05	06	06	06	07	07	07	07	08	08	08	09	09	09	10	10	10	10	11	11	11	11	12	12	12	01	01	01	01													
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Stations

Aircraft

PS141; Project: EASI-3 (GPF 20-2_069)

Goals:
Ice sheet fluctuations in East Antarctica are known to have direct impact on global sea level, but also on the global heat balance and the environmental conditions in and above the Southern Ocean. Research on the ice sheet variability on different time scales has mainly focused on the West Antarctic Ice Sheet (WAIS). In contrast, little is known about how the East Antarctic Ice Sheet (EAIS) responds to climate change. This is particularly true for the interaction between the marine grounded margin at the connection to the continental ice sheet and the adjacent shelf seas. During the proposed cruise we intend to collect new field data and samples for a better understanding of EAIS interactions with the ocean during the Neogene with one focus on the last 50,000 years, the last glacial-interglacial transition, and the other covering time scales of the relevant warmer-than-present interglacials between the Middle and Oligocene. The study area proposed is the coast and continental shelf between 115°E (from Wilhelm II to Wilkes Land), which is poorly investigated. It is known for its partial ice-free conditions during the last glacial. Our approach is multidisciplinary and includes marine as well as land-based activities. Sediment records from the continental shelf as well as coastal lagoons and lakes will be cored, following bathymetric and shallow seismic surveys, in order to decipher the lateral extent and timing of glacial advances and retreats along with changes in oceanography, sea-ice and lake-ice cover, and limnology. In addition, GPS measurements and relative sea-level data from terrestrial key locations are combined to derive mass changes of the EAIS during the late Pleistocene. Deeper seismic surveys will form the second focus on investigating subbottom sedimentary bedforms and glaciotectonic structures in order to imply on the Eocene/Oligocene to Late Quaternary development of the EAIS.

Principal Investigator:
Ralph Schneider (Uni Klet)
E-Mail

Participants: 53
Free berths: 5

Period:
February - March 2024

Workdays at sea (add. transit-time):
70(-)

Working Area:
Southern Ocean

Disciplines: Marine geology, Marine geophysics, Land geology, Land geodesy geochemistry, sedimentology, palaeoceanography, palaeoclimatology, seismics palaeolimnology, geomorphology, glaciology

International/national collaboration:
Australian National University; University of Tasmania, Hobart; AARL, Russia; Macquarie University, Australia; GEUS, Denmark.

PS146; Project: SWOS (GPF 20-2_005)

Goals: The western Weddell Sea (wS) along the northward branch of the Weddell Gyre is a region of major outflow of various water masses of global importance, thick sea ice, and biogeochemical matter, linking the Antarctic continent to the world oceans. It features a deep shelf and the second largest ice shelf (Larsen C) in the wS, and its perennial sea ice cover is among the thickest on Earth. The region is, therefore, among the least explored areas on the planet. Ice-ocean interactions shape the water column and control the sea ice extent and benthic components. The goal of the Summer Weddell Sea Outflow Study (SWOS) is to collect multidisciplinary information on the western WS continental slope, shelf, and near-shore in order to i) understand sea ice/ice shelf/ ocean processes and to assess their impact on the benthic and nutrient properties as well as on carbon fluxes from the surface to the deep, ii) collect region-scale measurements of sea ice thickness distribution and snow properties, iii) characterize oceanographic water masses and understand their formation, dispersion, and mixing processes, iv) understand and map cryo-pelagic, and pelagic ecosystem parameters and gradients in dependence of sea ice conditions. The region is being surveyed at a critical time when the Antarctic marine climate system may enter a period of accelerated sea ice loss and ocean warming. Results are urgently needed to understand the influence of the break-up of the Larsen ice-shelves on the overall marine system. They are further required for the improvement and validation of Antarctic components of Earth System Models, and SWOS contributes strongly to the topics of 'Ocean and Cryosphere in Climate', and 'Marine and Polar Life: Sustaining Biodiversity, Biotic Interactions and Biogeochemical Functions' of AWI's PoF-IV research program 'Changing Earth - Sustaining our Future'.

Principal Investigator:
Ilika Peeken (AWI)
E-Mail

Participants: 40
Free berths:

Period:
February - March 2025

Workdays at sea (add. transit-time):
53 (6 - 4)

Working Area:
The working area is located in the western Weddell Sea

Disciplines: Physical Oceanography, Sea Ice Geophysics, Sea Ice Ecology, Biological Oceanography and Biogeochemistry, Pelagic biology, Top predators, Benthic Ecology and Diversity, Bathymetry/ Paleo-Oceanography

International/national collaboration:
University of Bremen, GEOMAR, British Antarctic Survey, Woods Hole Oceanographic Institution, University of Siena, The Royal Belgian Museum for Natural Sciences (RBINS), Federal University of Rio Grande, Institute of Oceanography

YEAR	12	12	12	12	12	01	01	01	02	02	02	03	03	03	04	04	04	05	05	05	06	06	06	07	07	07	07	08	08	08	09	09	09	10	10	10	10	11	11	11	11	12	12	12	01	01	01	01													
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2022

EASI-1 - PS128 (GPF 20-2_066) Tiedemann Cpt	HAFO5 - PS129 (GPF 20-1_042) Hoppema Punta	Transit PS130 Cpt - Bhv	Shipyards 4 Weeks	ATWAICE - PS131 (GPF 20-1_011) Kanzow Bhv.	Logistics Bhv. - Cpt	Island Impact - PS133-1 & PS133-2 (GPF 20-1_051) Klaas / Kasten Cpt.	Stanley	Cpt.
to be realized by another ship								
FRAM (GPF 20-1_021) Soltwedel Bhv								

2023

WAIS-BELL (GPF 20-1_028) Gahl Cpt	Transit NN Punta	Shipyards 6 Weeks	FRAM (GPF 20-1_011) Soltwedel Bhv Tromsø	ALOIS (GPF 20-1_009) Schindwein Tromsø	ArcWatch 1 (GPF 20-1_029) Boetius Tromsø	Logistics Bhv.	Transit NN Bhv - Cpt	EASI-2 (GPF 20-2_011) Gutjahr Cpt	Hobart
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2024

EASI-3 (GPF 20-2_069) Schneider Hobart	Transit NN Cpt	Logistics Cpt - Bhv	ArcWatch 2 (GPF 20-2_070) Rabe Tromsø	Shipyards 6 Weeks	Transit NN Bhv - Punta	SWOS (GPF 20-2_005) Peeken Punta
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2025

State of planning: 30.03.2021

This info might be important for secondary user proposals (leadtime 1.5 yrs)

Polarstern-Expedition planning 2025-2028

Contents of the workshop (1.5 days)

- **Overview lectures: GPF evaluation and review process of cruise proposals; the fit of expeditions to scientific programs and overarching themes (A. Boetius)**
- **Presentation of AWI's new long-term Antarctic and Arctic strategies**
- **Short presentations of ideas for future polar expeditions (oral, 5 min) with extended discussions on small associated posters (during IceBreaker).**
- **Open questions and discussions:**
 - Can we combine expeditions?
 - Are there devices to be tested that are of outstanding importance for polar marine research?
 - Do we have the right infrastructure in Germany to support polar science and university participation?
 - Where do we have thematic gaps? Where do we lack expertise?
 - How can we best use Polarstern I and II when they operate overlapping for one to two years?
 - What are the grand challenges for larger research projects?
- **Info block FS Heincke (expeditions to the Far North)**



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- **Short presentations of ideas for future polar exped extended discussions on small associated posters (**
- **Open questions and discussions:**
 - Can we merge new ideas and themes into expeditions
 - Are there devices to be tested that are of outstanding importance for polar marine research?
 - Do we have the right infrastructure in Germany to support polar science and university participation?
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Travel
reimbursement
for young
PostDocs



Polarstern-Expedition planning 2025-2028

Tuesday

9:20-9:40 am

Logistics ZiF (chair: Angelika Graiff)

Ingo Schewe (Bremerhaven)

Access for external users to AWI's infrastructure:
RV Polarstern, Polar 5 & 6, Neumayer-Station III, Kohnen Station, Dallmann Laboratory

