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

THE NIPPON FOUNDATION-GEBCO SEABED 2030

Third CIRCULAR

The Fifth Arctic-Antarctic and North Pacific Mapping Meeting

hosted by Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung

Venue: **Haus der Wissenschaft, Sandstraße 4/5, 28195 Bremen, Germany**

Date/Time: **27 to 29 November 2023 from 10:00 to 17:00**

Type: **Hybrid**

Dear Participants,

The Fifth Arctic-Antarctic and North Pacific Mapping Meeting is just around the corner. Below you will find the final version of the program. The presentations should be about 10 minutes unless otherwise discussed.

For those of you attending virtually, a Webex link will be sent out 24 hours before the start of the meeting.

We look forward to welcoming you with talks and lively discussions ahead.

Best regards,

Boris, Martin, and Larry

THE NIPPON FOUNDATION
General Bathymetric Chart of the Oceans GEBCO
United Nations Educational, Scientific and Cultural Organization
Intergovernmental Oceanographic Commission
IHO International Hydrographic Organization
2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Time Zone: CET (GMT +1), Bremen, Stockholm

MONDAY, 27 NOVEMBER 2023		
9:45	**Registration**	
10:00	Welcome and introduction	Boris, Martin, Larry
10:15	Regional centre status reports	Martin, Larry, Boris
10:30	Presentations: "*New acquisitions*"	Daniela Accettella & Michele Rebesco (OGS) Roberta Ivaldi (Italian Hydrographic Institute) David Amblas (University of Barcelona)* Lara F. Pérez (GEUS) Q&A session
11:30	**Coffee Break**	
12:00	Presentations: "*Data management*"	Georgie Zelenak (CIRES/ NOAA NCEI) Stephen Rump (Fugro Germany Marine) Q&A session Group photo
12:50	**Lunch Break**	
13:50	Plenary: Priority areas for future mapping activity around Antarctica	
15:10	**Coffee Break**	
15:30	Plenary: Priority areas for future mapping activity in the Arctic	
16:50	Closing remarks	
17:00	End of Day 1	

TUESDAY, 28 NOVEMBER 2023		
10:00	Presentations: *"Research"*	Son V. Nghiem (NASA JPL, Caltech) Ali Graham (Cardiff University)* Lebeau Pemha Thina (Association Internationale pour le Partenariat et l'Emergence en Afrique (AIPEA)/AIRGPAIRDAM/AIPIA/ACAEPB) Q&A session
11:00	**Coffee Break**	
11:30	Presentations: *"Mapping initiatives"*	Eric Rignot (UC Irvine) Mary-Lynn Dickson (GSC, NRC) Brian Connon (Saildrone)* Hanne Hodnesdal (NMA, Hydrographic Service)* Mohamed Adel Abdelaziz (OceanSciTech) Q&A session
12:50	**Lunch Break**	
13:50	Plenary: Develop strategies to coordinate and promote new mapping activities	
15:10	**Coffee Break**	
15:30	Plenary: Develop strategies to locate and unlock bathymetric data sets	
16:40	Presentation	Mark Zimmermann (NOAA ASFC)*
16:50	Closing remarks	
17:00	End of Day 2	

WEDNESDAY, 29 NOVEMBER 2023	
10:00	Plenary: Discuss strategies for improved seabed to land transitions
11:10	**Coffee Break**
11:20	Plenary: Assess Crowd Sourced Bathymetry options
12:00	**Lunch Break**
12:30	Trip to AWI for those interested
14:30	**Coffee Break**
16:50	Closing remarks and wrap-up
17:00	End of Day 3

* Virtual presentations

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Further information about Seabed 2030: https://seabed2030.org/

About Seabed 2030's Southern Ocean and Arctic and North Pacific Centres:

https://seabed2030.org/centers/arctic-and-north-pacific-ocean-regional-center

https://seabed2030.org/centers/southern-ocean-regional-center

Presentations

Accettella et al.
Title: Advancing Cross-Disciplinary Frontiers in the Southern Ocean through Opportunistic MultiBeam acquisition
Abstract: Preliminary results of the ISOBatA project are presented to demonstrate the benefit of opportunistic multibeam data collection during transits to and from Antarctica onboard international icebreaker vessels in significantly improving our seafloor knowledge in this critical region.
The ISOBatA pilot project, funded by the Italian National Antarctic Research Program (PNRA), spanned a two-year period and aimed to optimize data collection onboard the Italian icebreaker Laura Bassi during its voyages in the Southern Ocean. The project focused on the acquisition of acoustic and magnetometric data, with emphasis on morphobathymetry. ISOBatA used assigned ship time to reduce vessel's speed and navigate along designated corridors to survey unexplored (uncharted) areas.
While we recognize that collected data does not meet the standards set by the International Hydrographic Organization (IHO) due to vessel speed and the many challenges in collecting quality data during transits, we underscore their value. ISOBatA dataset fills significant bathymetric gaps, particularly in regions with unknown tectonic features, providing insights for future research. Extensive use of the International Bathymetric Chart of the Southern Ocean (IBCSO) coverage map in planning along with potential velocity reduction and rerouting when feasible, ensured the effectiveness of data collection. By leveraging valuable metadata from previous PNRA expeditions, ISOBatA significantly increased efficiency.
Presented examples in the areas: Macquarie, Emerald, Italian Mooring Sites, illustrate the importance and effectiveness of the data collection strategy. The project's open access policy enabled meaningful collaboration with other research teams, increasing amount, quality, and scientific value of gathered data underscoring the importance of opportunistic data collection, efficient use of metadata resource and joint research efforts. The project served as platform to involve other onboard scientists in the IBCSO/Seabed2030 initiative. Building on these valuable lessons learned, the ISOBatA team plans to expand through data sharing, international collaboration, leveraging the transits of the icebreaker Laura Bassi in other regions to foster capacity building in marine science and contributing to global ocean exploration.

Accettella
Title: Southern Ocean and adjacent waters to 50°S

Adel
Title: Antarctic Drifting Buoy Data

Amblas
Title: New multibeam bathymetric data from Denmark Strait and Eastern Greenland continental slope (65-66ºN), cruise FARDWO_DS1 During the cruise FARDWO_DS1 in July-August 2023 onboard RV Sarmiento de Gamboa we obtained new multibeam data in the southern region of the Denmark Strait (between Iceland and Greenland) and along the continental slope associated to the Eastern Greenland Shelf (65-66ºN).

Connon
Title: USV Operations in High Latitudes
Abstract: USVs offer great opportunity for bathymetric data collection in higher latitudes. Long endurance uncrewed platforms significantly reduce risk to human life, greatly increase survey capacity, and operate in a more environmentally sustainable manner when compared to traditional ship surveys. This presentation will highlight the advantages of USVs and showcase recent operations in the Northern Pacific Ocean.

Dickson
Title: Future Seabed Mapping in the Central Arctic Ocean: Canada's Extended Continental Shelf (UNCLOS) Program
Abstract: Future plans by Canada's Extended Continental Shelf (UNCLOS) Program to undertake new seabed mapping surveys in the central Arctic Ocean will be presented.

Dickson
Title: Canada's Extended Continental Shelf (UNCLOS) Program: New surveys in the Arctic Ocean
Abstract: Canada is planning new surveys in the Arctic Ocean in the near future. An update of these plans will be shared during a short presentation.

Filippone
Title: To follow
Abstract: To follow

Graham
Title: To follow: Thwaites AUV mapping
Abstract: To follow

Hodnesdal
Title: Status and plans for Mareano mapping program

Ivaldi
Title: Integrated 3D Mapping in Terra Nova Bay (Antarctica) with PROTEUS, Portable RObotic TEchnology for Underwater Surveys – RESTORE Project
Abstract: We present an integrated 3D mapping using innovative methodology and technologies in terms of rapid environmental assessment and marine transient phenomena of the ocean in the UN Ocean Science Decade for Sustainable Development (2021-2030). This mapping is an integrated data product starting from the multisensors data collected by PROTEUS (Portable RObotic TEchnology for Underwater Surveys) a prototype robot developed and used for PNRA RESTORE (Robotic-based invESTigation and mOnitoring Ross sEa) Project. PROTEUS is able to operate in extreme and polar environments, below the sea ice, in order to create a unique processing tool, and to produce a complete and comprehensive depiction of the 3D marine environment. During the PNRA XXXVIII Italian Expedition (2022 – 2023), PROTEUS surveyed a sector of Terra Nova Bay (Western Ross Sea – Antarctica). In particular, PROTEUS collected data of seafloor, ice and water column with different

systems and sensors on portable robotic technology for unmanned survey such as single and multi-beam sonar, CTD probe, and sedimentary sampler. In order to obtain a high-resolution 3D model, the sea surface (water and ice), the water column and seabed data, thanks to an integrated-multidisciplinary approach and harmonization techniques, was been processed. The 3D integrated mapping highlights the undersea features as the drivers of the dynamics of marine processes from the sea surface to the seafloor. The need for a visualization to aid in the comprehensive analysis of all elements of this integrated data collection platform is the main reason behind this research. Consequently, it seeks to integrate in situ and remote sensing measurements in order to provide an integrated mapping of the study area as a one single product. In order to achieve this goal, it is essential to optimize the process by standardizing the file formats so that all data can converge into a complete 3D depiction of the ocean: sea surface, water column and seabed.

Nghiem
Title: Bathymetry in Cryospheric Science across Polar Oceans
Abstract: A regime shift has occurred in the Arctic where multi-year sea ice has reduced drastically leaving the Arctic dominated by the younger and saltier sea ice with thinner snow cover. In a stark contrast, Antarctic sea ice has been stable with some decrease and increase in different areas, bringing up a paradox that the International Panel on Climate Change (IPCC) has been struggling to explain with a low confidence. With the Arctic regime shift and the Antarctic paradox, it becomes crucial to understand sea ice geophysical processes in polar regions. We hypothesize that bathymetry plays a key role that profoundly influence sea ice change to explain at once both the enhancement of Arctic sea ice reduction and the stability of Antarctic sea ice. The method includes satellite observations together with IBCAO/IAPSO/GEBCO bathymetry data and other ancillary measurements and field verifications. Latest results from the Operation IceBridge and TanDEM-X Antarctic Science Campaign (OTASC) show that 3D surface elevation of sea ice has directional features that align around an offset angle of 27 degrees with respect to the bathymetry gradient lines in the Western Weddell seafloor. It is still unclear whether such offset is due to sea ice geophysical interactions or due to uncertainty in bathymetry data, and future campaigns need to be conducted to resolve this science issue.

Pemha Thina
Title: New Satellite Strategy of the ocean Arctic/Antarctic

Pemha Thina
Title: The world durability and innovation strategy of the governance

Pérez et al.
Title: The SEAMS 2022 expedition to SE Greenland: new swath-bathymetric data from the Ammassalik Basin
Abstract: The 'SurvEy of the AMmassalik Basin Sediments', hereafter SEAMS expedition, recorded high quality bathymetry data at the Ammassalik Basin located in the continental shelf of Southeast Greenland. The SEAMS expedition took place during the summer of 2022, starting in Nuuk (Greenland) on August 1 and finishing in Reykjavik (Iceland) on August 28. In total, 12 days of surveying on board HDMS Lauge Koch were carried out. The survey focused on seabed mapping in parallel swaths around

a commercial seismic reflection profile where subcropping Mesozoic sediments and presumed Paleogene basaltic sills are imaged. In addition, four profiles were collected into deep water for the Continental Shelf Project of the Kingdom of Denmark. The scientific driver of the expedition was to assess the seabed conditions and determine the thickness of glacial overburden. Eventually, the seabed mapping will serve to determine the most suitable locations to deploy a coring system to recover Mesozoic sediments. Multi-beam echo-sounder data were acquired with the Teledyne RESON SeaBat 7160 hull-mounted on the ship. Depth profiles of seawater temperature and sound velocity were obtained using a Valeport RapidSV. In addition, sub-bottom profiles were acquired with an Innomar SES-2000 Deep. The quality of the multibeam data is generally very good in Ammassalik Basin. The swath bathymetry has been subsequently processed with NaviPac and Qimera resulting in high quality seabed mapping where tectonic and glacial related morphologies are currently under investigation.

Rebesco et al.

Title: Recently acquired (and forthcoming data) bathymetry data within the Italian Program for Antarctic Research (PNRA)

Abstract: New morphobathymetry data were collected within the Southern Ocean during the 2022-2023 expedition of the Italian Program for Antarctic Research (PNRA) in the frame of various scientific projects listed below:

Isobata (P.I. Accettella, see specific abstract), 33,590 km2;

Boost (P.I. Crispini), offshore North Victoria Land (Pennell Coast), ca. 3,500 km2 crossing the continental shelf and the ice grounding-zone;

Collaps (P.I. De Santis), offshore Cook Ice shelf and Ninnis Glacier, ca. 10,350 km2 on the continental slope-rise;

Disgeli (P.I. Gasperini), offshore Italian Base MZS, Adelie Cove and Thetis Bay; between 1 and 150 meters of water depth.

Lasagne (P.I. Langone), Edisto Inlet, 158 km2, coastal embayment;

Greta (P.I. Tesi), Joides Basin, 80 km2, shelf basin;

Nautical Cartography (P.I Langellotto), Terra Nova Bay, >2,000 km2 in 2 years

Most bathymetric swaths were acquired on board Laura Bassi, with hull mounted EM 304 Kongsberg multibeam echosounders. An exception is the shallow-water data collected in Adelie Cove using a Klein Hydrochart 3500 multibeam echosounder mounted on an Autonomous Surface Vehicle of the SWAP class.

And another exception is the Singlebeam bathymetric data collected last year by the Hydrographic Institute in the area of competence (while in the last year with Multibeam systems). In accordance with the International Hydrographic Organization – Hydrographic Commission for Antarctica, the Italian Hydrographic Office is in charge to produce the nautical chart of a specified area of the Ross Sea, in collaboration with other Hydrographic Office and the Scientific Entities.

Additional data are expected to be acquired in the forthcoming Antarctic PNRA expeditions within various proposal under approval.

Rignot

Title: Circumpolar bathymetry from inversion of gravity data constrained by other data.

Abstract: We present a 3D inversion of a circumpolar compilation of gravity anomalies (ANTGG2022) to infer the bathymetry around Antarctica, including all ice shelf cavities. The 3D inversion is constrained by BedMachine Antarctica on land (which combines ice thickness soundings and ice velocity vectors using mass conservation) and IBCSOv2 at sea (multibeam echo sounding and seismic data were available) to insure a continuity of the bathymetric solution across the ice-ocean boundary as required for ice sheet and ocean modeling. The result will be part of BedMachine Antarctica. In most areas, we find deeper cavities with greater water column height than in prior compilations and the data reveals previously unknown pathways for warm water to intrude on the continental shelf and reach grounding lines. The inversion provides the first circumpolar view of the continental shelf and cavities, already useful for models on its own, but also a reference to guide future in-situ data collection by the scientific community so we can keep improving the product.

Rump

Title: TBC - Fugro´s SB2030 contribution focusing on automated workflow and data dissemination

Zelenak

Title: IHO DCDB and IHO Crowdsourced Bathymetry Initiative Updates

Abstract: The International Hydrographic Organization's Data Center for Digital Bathymetry (IHO DCDB) is the recognized IHO repository for all bathymetric data. The DCDB archives and shares seafloor depth data contributed by hydrographic, oceanographic, industry and other organizations and promotes discovery and access through standard web services and viewers. The DCDB works closely with the Seabed 2030 Project to provide long term preservation, discovery and access of bathymetric source (raw) data. The DCDB also engages heavily with the IHO Crowdsourced Bathymetry Working Group (CSBWG) in addition to accepting CSB contributions through a network of trusted data providers.

This presentation will provide an update on DCDB data holdings in the region and support for Seabed 2030 and other mapping initiatives. Updates on the Crowdsourced Bathymetry Initiative will be shared, including highlights of new trusted data providers and updates from the two CSBWG meetings held in 2023.

Zimmermann

Title: Gateway to the arctic: Defining the eastern channel of the Bering Strait

Abstract: The Bering Strait is the sole gateway and an oceanographic bottleneck for the seasonally warm and comparatively fresh and nutrient-rich Pacific waters to flow into the Arctic, melting ice, lowering salinity, and feeding bird, mammal, and fish populations. The Diomede Islands split this small strait into two main channels, both with northward flow (in the annual mean). The eastern channel, in U.S. waters, also seasonally carries the warmer, fresher Alaskan Coastal Current. Year-round in situ mooring observations (in place since 1990 with annual servicing) show a significant flow increase in the (northward) throughflow, along with seasonal and annual fluctuations. To help with measuring and modelling water flow estimates, we created the first detailed shore-to-shore bathymetric surface of the Bering Strait's eastern channel, located its narrowest cross-section (1.8 km2) as occurring 5–10

km south of the moorings, and quantified the cross-section across the moorings (2.0 km2), both slightly larger than previously estimated (1.6 km2). Overlaps between older (~1950) and newer (~2010) bathymetry data sets identified clear areas of erosion and deposition, with much of the eastern channel having eroded by > 1 m. Since the depth is uniformly ~ 50 m across much of the eastern channel, the 1 m of erosion that we quantified would only slightly (2 %) increase the sizes of the cross-sections. Much of the seafloor is hard substrate and probably composed of cobbles, but we hypothesize that friction from strong (~1 + knot) seafloor currents is the most likely explanation for the erosion that we observed. A previously undescribed (~1 to 2 km wide, ~4 m deep) seafloor channel of unknown origin occurred along a linear north/south axis for the full 75 km extent of the bathymetric surface. The southern end of this seafloor channel was near the end of three larger seafloor channels extending westerly out of nearby Norton Sound, suggesting a common origin. These Norton Sound channels may be paleodrainages, as their eastern ends point toward Seward Peninsula inlets with large drainages where paleoglaciers were reported to have existed, but the morphology of these channels is also consistent with tidal channels.