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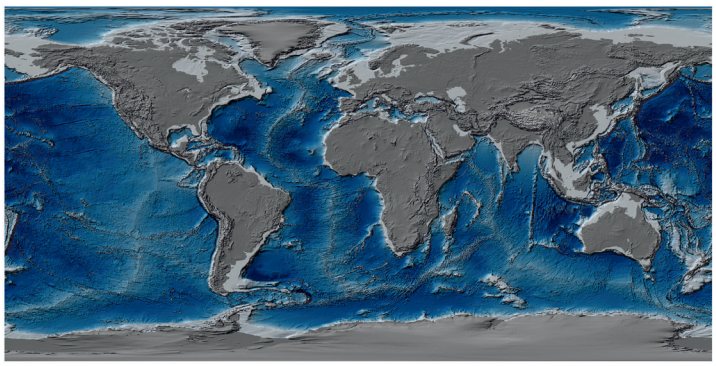
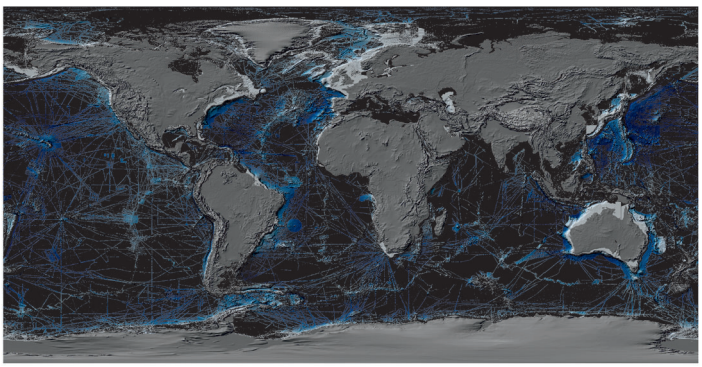
Opportunistic collection of bathymetric transit data during Expeditions PS123 and P127 with RV Polarstern

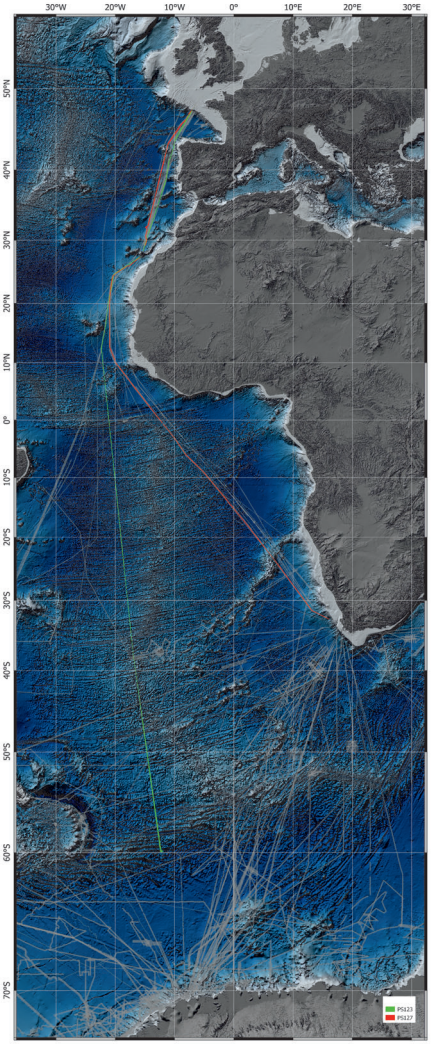
World maps give the impression that the global seabed is fully mapped. This is misleading as, according to the General Bathymetric Chart of the Oceans (GEBCO), the authoritative map of the oceans, only about a quarter of the global seabed is constrained by direct measurements (Fig. 1 and 2) . This means that the depth of the seabed is charted with modern echosounders resulting in resolutions of tens to hundreds of metres. In unmapped areas, often referred to as “the gaps in the map”, depth information for the seabed are interpolated from satellite derived predicted bathymetry with corresponding low resolutions of several kilometres.



The GEBCO 2023 grid as shaded relief illustration with 12 times vertical exaggeration. The terrain model is constrained by measured data and by satellite derived bathymetry.



The GEBCO 2023 grid as shaded relief illustration with 12 times vertical exaggeration. The terrain model only shows areas constrained by measured data. Areas constrained by satellite derived bathymetry, the so-called gaps-in-the-map are shown in black.

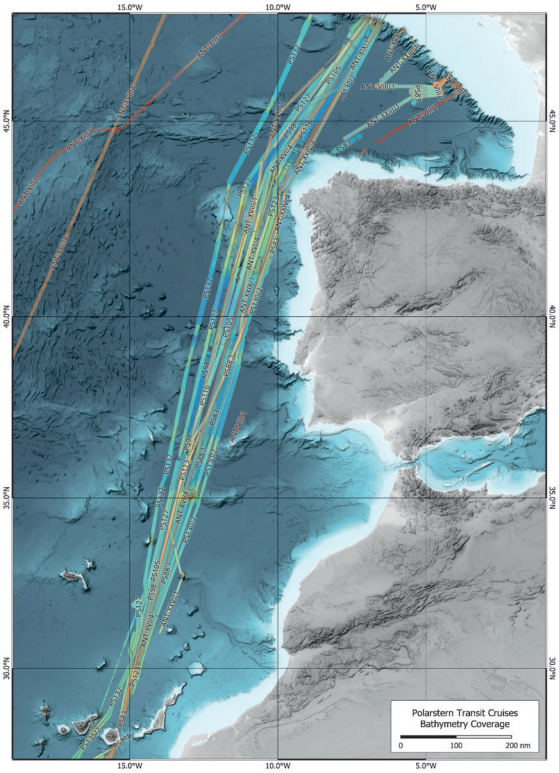


Coverage of the multibeam data collected during the expeditions PS123 and Ps127 with the RV Polatstern. Pre-existing coverages are shaded in gray.

The rudimentary state of resolution and coverage of global bathymetric data is outlined in Mayer et al. (2018) and the associated challenges addressed by Wölfl et al. (2019). At the same time, there is an increasing need for high-quality bathymetric information for e.g. cruise planning, for the interpretation of point measurements in a spatial context, and for conservation and management planning. In this regard, high-resolution bathymetric data support are key basic information for numerous research activities.

Collected over years, bathymetric data can also form the basis for regional bathymetric compilations. Examples are the International Bathymetric Chart of the Arctic Ocean (Jakobsson et al., 2020), the International Bathymetric chart of the Southern Ocean (Dorschel et al., 2022), the Southwest Indian Ocean Bathymetric Compilation (Dorschel et al., 2018), and the Digital Bathymetric Model of the Drake Passage (Bohoyo et al., 2019). These compilations are widely used in various scientific disciplines, are cited in numerous publications, and nicely illustrate the benefit of continuously collected high-quality bathymetric data.

Raw and processed bathymetric datasets from the Expeditions Ps123 and Ps127 are publically available in Pangaea (Dreutter et al., 2022, 2023; Hehemann et al., 2023a, b). Furthermore, polygons of the data coverages are provided to the IHO Data Centre for Digital Bathymetry (DCDB) as a web feature service for better findability of the bathymetric data in accordance with the FAIR principles as outlined by Wilkinson et al. (2016). Furthermore, processed datasets are deliverd to the Nippon Foundation – GEBCO Seabed 2030 project, thus supporting the international effort of mapping the entire global seabed by 2030.



Since 1984, the Alfred Wegener Institute collects bathymetry data with RV Polarstern (Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeres-forschung, 2017) in polar regions and during transit expeditions. Moreover, since 2017, during transit expeditions, cruise tracks are shifted to collect bathymetric transit data with offsets to existing data coverages thus allowing for the collection of bathymetric data from previously uncharted seabed. In this way, expeditions PS123 and PS127 added to the ever-increasing stripe of mapped seafloor along the transit route from Bremerhaven to Cape Town.

References
Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Polar Research and Supply Vessel POLARSTERN Operated by the Alfred-Wegener-Institute, Journal of large-scale research facilities 2017, 3, A119, https://doi.org/10.17815/jlsrf-3-163.
Bohoyo F, et al., Morphological and geological features of Drake Passage, Antarctica, from a new digital bathymetric model, Journal of Maps 2019, 15(2), 49-59, https://doi.org/10.1080/17445647.2018.1543618.
Dorschel B, et al., The International Bathymetric Chart of the Southern Ocean Version 2, Scientific Data 2022, 9(1), 275, https://doi.org/10.1038/s41597-022-01366-7.
Dorschel B, et al., The Southwest Indian Ocean Bathymetric Compilation (swIOBC), Geochemistry, Geophysics, Geosystems 2018, https://doi.org/10.1002/2017GC007274.
Dreutter S, et al., Multibeam bathymetry raw data (Atlas Hydrosweep DS 3 echo sounder entire dataset) of RV POLARSTERN during cruise PS123, 2022, https://doi.org/10.1594/PANGAEA.948590.
Dreutter S, et al., Multibeam bathymetry processed data (Atlas Hydrosweep DS 3 echo sounder entire dataset) of RV POLARSTERN during cruise PS123, Atlantic Ocean, 2023, https://doi.org/10.1594/PANGAEA.954624.
Hehemann L, et al., Multibeam bathymetry processed data (Atlas Hydrosweep DS 3 echo sounder entire dataset) of RV POLARSTERN during cruise PS127, Atlantic Ocean, 2023a, https://doi.org/10.1594/PANGAEA.954699.
Hehemann L, et al., Multibeam bathymetry raw data (Atlas Hydrosweep DS 3 echo sounder entire dataset) of RV POLARSTERN during cruise PS127, 2023b, https://doi.org/10.1594/PANGAEA.949989.
Jakobsson M, et al., The International Bathymetric Chart of the Arctic Ocean Version 4.0, Scientific Data 2020, 7(1), 176, https://doi.org/10.1038/s41597-020-0520-9.
Mayer LA, et al., The Nippon Foundation—GEBCO Seabed 2030 Project: The Quest to See the World's Oceans Completely Mapped by 2030, Geosciences 2018, 8(2), 63, https://doi.org/10.3390/geosciences8020063.
Wilkinson MD, et al., The FAIR Guiding Principles for scientific data management and stewardship, Scientific Data 2016, 3(1), 160018, https://doi.org/10.1038/sdata.2016.18.
Wölfl A-C, et al., Seafloor Mapping – The Challenge of a Truly Global Ocean Bathymetry, Frontiers in Marine Science 2019, 6(283), https://doi.org/10.3389/fmars.2019.00283.

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