A GEBCO Community Vision for Improving the Availability, Discoverability & Accessibility of Bathymetric Data

Proposed Action Plan 2023-2026

Prepared for the GEBCO Technical Sub-Committee for Ocean Mapping (TSCOM)

Introduction

Improving the availability and accessibility of global bathymetry data requires an understanding of the needs of a diverse community of individuals and organizations who create, manage and utilize data for a wide variety of purposes. Sharing data and use-case-driven metadata enables equitable data discovery, access and use, and is the foundation upon which bespoke data and information products can be built. Gathering input from users to understand their data and metadata uses and challenges ensures that standards meet community needs, and reveals opportunities for collaboration, coordination, and knowledge sharing. Enhancing metadata, recommending common format standards and sharing tools and approaches for managing, documenting, curating and assembling data can deliver significant efficiency and will ultimately help our community achieve mutually beneficial goals. Learning from the successful adoption of practices that increase the acquisition and sharing of opportunistic (e.g. transit) data can help deliver critical observational data that serves multiple uses and the common good. This action plan was developed by considering the complementary perspectives of data providers, curators, stewards, consumers and tool developers to identify current needs, and to ensure that data and metadata are future-ready for emerging technical solutions.

Vision

A community of practice centered around sharing data, tools and knowledge to contribute to the acquisition, preservation and multi-purpose (re)use of global bathymetry data to meet current and future needs including the completion of a global map of the seafloor.

Purpose

Avoiding redundant effort with respect to data acquisition, preservation and integration while meeting mutually beneficial goals and providing equitable access to fundamental ocean data and knowledge now and in the future.

Background: Community Engagement Series

A community engagement series consisting of virtual and hybrid events was coordinated to solicit input and develop a vision for improving the accessibility and discovery of bathymetry data. The series was designed and convened by the General Bathymetric Chart of the Ocean (GEBCO) Technical SubCommittee for Ocean Mapping (TSCOM), the International Hydrographic Organization's Data Center for Digital Bathymetry (IHO DCDB), and the Regional Center for the Atlantic and Indian Oceans of the Nippon Foundation - GEBCO Seabed 2030 Project. TSCOM provides technical advice towards the maintenance and improvements of GEBCO products and supporting data. The DCDB, hosted by NOAA National Centers for Environmental Information, is the recognized IHO repository for bathymetric data with the intention of providing preservation, discovery, and access of that data. The Nippon Foundation - GEBCO Seabed 2030 Project has the goal of creating a complete map of the world ocean by 2030, and is actively assembling bathymetric data into the publicly available GEBCO world map.

A series of live webinars and a hybrid working meeting, co-organized in 2023 by TSCOM, IHO-DCDB, and Seabed 2030, served as the basis of this action plan. The events focused on complementary aspects of the data life cycle related to (1) Data Sharing & Archiving, (2) Data Discovery & Data Gaps, (3) Data Processing & Integration and (4) Metadata Enhancements - which can connect and fortify all aspects of data stewardship and access (Fig 1).

Participants in all engagement events included representatives from academia, government and industry, and individuals with perspectives as survey planners, surveyors, data managers, data publisher representatives, applications developers, geospatial data experts, sonar manufacturers, data processors and data consumers.

A detailed summary of these events and feedback gathered from the community are available in the Oceans 2023 Gulf Coast Conference Paper (*to be posted in November 2023 on the IEEE website*) (Ferrini et al., 2023). This action plan serves as a roadmap to deliver the key priorities identified during this series of community events.

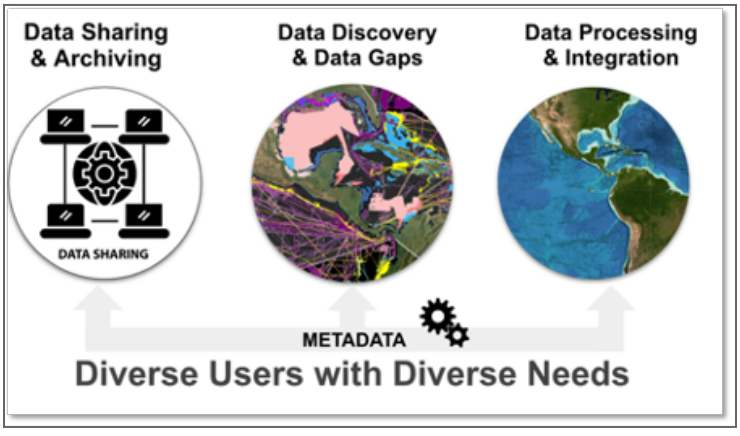

Figure 1: The complementary aspects of the bathymetry data life cycle

Strategic Goals to Improve the Availability, Discovery & Access of Bathymetric Data

Goal 1: Increase data availability: Transit mapping

Increasing data availability can be accomplished through two mechanisms: (1) the contribution of existing data, and (2) the acquisition of new data. This strategic goal addresses both, by focusing on increasing and normalizing opportunistic data acquisition during transits and establishing routine pathways for contributing those data to the IHO DCDB public archive.

Within different organizations and groups, sharing of survey data presents a variety of political and cultural challenges. Getting past these cultural impediments often stands in the way of establishing and/or adopting technical solutions for data sharing. Highlighting success stories and sharing the tools and approaches to encourage transit data acquisition has the potential to not only increase the availability of data at little cost to vessel operators while also establishing data contribution pathways that may eventually lead to increased data contributions overall.

Encouraging transit mapping as a routine operational mode for acquiring new data and using this data to help establish mechanisms and cultural norms for sharing more data has the potential to greatly increase bathymetry data in public archives. There are many commonly perceived technical challenges, as well as cultural impediments to acquiring transit data, and this strategic goal aspires to confront those challenges through a coordinated community strategy. Such a strategy needs to highlight existing tools that can help support transit mapping, the tools for data submission, and will need to emphasize incentives for different stakeholder groups.

Goal 2: Enhance metadata and improve web services

Web services have become one of the primary ways users discover, evaluate and assess available bathymetric data and data products. Even though the data embedded in these web services is 'generally available', it does not necessarily mean that the data is accessible to those who discover it. The strategic intent of this theme is to define and document the clear steps necessary (e.g. specific data coverage web service modifications) to enhance web services to better meet user needs, and to increase usability and accessibility for downstream geospatial analysis and integration.

At present, although multiple web services can be integrated into a single map viewer such as the one at the DCDB, many web services are lacking some core metadata that would make them more useful to both casual users and those interested in leveraging them programmatically. Differences in services and available metadata also precludes the development of an easy and efficient way to search across services offered by different providers.

Metadata describing realistic data accessibility and reusability (e.g. a clear data license), sensor type, and year of acquisition are not universally available in all services. Updating web services to include this type of information would go a long way to making bathymetric data more usable. Not all types of web services can be leveraged directly in geospatial analysis and the geospatial representation of data coverage varies significantly. Making simple changes to the existing web services can make them infinitely more usable and useful.

Improvements to metadata and standardization of the types of web services being published would allow for more easy downstream integration. To date, there is no single global planning layer that definitively shows seabed mapping coverage and availability, referred to here as a "Data-No-Data Layer" or "DnD Layer". Evaluating areas left to be mapped for proposal presentations, funding requests, planning, and at-sea opportunistic mapping involves finding and navigating multiple data layers, a task that is overly complex for the majority of users and cumbersome in practice for proficient data users. Limited internet access during survey operations adds to that complexity. A critical component to this layer is ensuring an update frequency that supports real-time decision making and mitigated redundant mapping efforts. As no single synthesis, database, or archive-published web service will ever show all of the existing and/or available data in a region (due to update rates, differing regions of interest, differing agreements with those acquisition data, etc.), downstream integration of multiple layers will continue to be necessary to provide a full picture of what we know has been mapped. Improvements to web services are necessary to facilitate this integration.

Goal 3: Encourage the use of a common generic sonar format for bathymetry

GSF or generic sensor format is a sensor - and software - agnostic format for storing swath bathymetric data that can store processing flags as well as important early-stage processing information such as the applied sound speed information. As we increase the sharing of raw data, to be efficient we must also focus on coordinating data processing efforts. This means not only avoiding duplication of effort, but being able to leverage the work that has been done to clean data files without having to return to raw data. Sharing data in a processed swath file format enables down-stream users to conduct additional data processing steps without having to revert to raw data. Encouraging the adoption of a GSF standard would increase efficiency and ensure that existing data can be fully utilized for a broad range of use-cases. Current adopters of GSF, however, have often faced frustrations with interoperability of GSF files between software manufacturers and even within versions/modules of the same software, leading to distrust of the format. Encouraging its broader use would involve discussions with the users, format originators, and downstream software companies utilizing the format library to improve user experience and increase trust in the format. The primary action associated with this strategic goal is to develop foundational documentation that can be used to work with to take to software companies to resolve ongoing GSFx issues that inhibit interoperability across software packages.

Goal 4: Unify an approach for disseminating information & outcomes

Given the overlapping nature of the three primary goals, it is important that all three move forward together. Although target audiences may differ for each of these priorities, a unified messaging and communications approach will promote efficiency of effort while ensuring transparency and communication among stakeholders driving the work to deliver each of the priorities.

Actions to Improve the Availability, Discovery & Access of Bathymetric Data

Below are actions that will help the GEBCO community achieve the goals introduced above. These actions are classified as:

a) Ongoing, meaning the action is already being undertaken;
b) New Action, meaning the action can be accomplished without dedicated funds; or
c) Funding Requested, meaning the action will require funds to accomplish.

Together, these actions will strengthen and expand improvements towards the availability, discovery and access of bathymetric data in collaboration with the growing GEBCO community invested in the completion of a global map of the seafloor.

Goal 1: Increase data availability: Transit mapping

Objective A. Develop the message *- clear request and motivation - to participate in transit mapping.*

A.1. Identify target audiences (role and sector) to customize messaging about requests and incentives, and to identify distribution and communication mechanisms. Confirm initial list of roles (funders, operators, technicians, scientists, others) and sectors (academic, industry, government) to be targeted in 2024. ***(2024, New Action)***

A.2. Identify and articulate the incentive(s) for each sector within the community. ***(2024-25, New Action)***

Objective B. Develop documentation *that addresses known fears and concerns preventing participation in transit mapping and address where able to.*

B.1. Gather and document the technical and financial information necessary to address cultural and financial concerns related to transit mapping. Determine and break down the true costs of running the multibeam (permitting, people/time, storage, speed of transit, data packaging/transfer, data quality, SVPs, instrumentation, degradation/life-span concerns (with sensor manufacturers), hardware/physical infrastructure costs, etc. ***(2024, New Action)***

B.2. Clearly identify information necessary to address data quality concerns related to transit mapping, especially in the deep sea. ***(2024, New Action)***

B.3. Develop a series of success stories that can be used to help with the messaging campaign, focused on solutions for addressing different perceived problems. ***(24-26, New Action)***

Objective C. Develop best practices and workflows

C.1. Define metadata ("want" and least) ***(2024, New Action)***

C.2. Consolidate known tools and links (connect to DND, GapFiller, etc.) ***(2024, New Action)***

C.3. Enhance transit content on Ocean Mapping Wiki; include mechanism for accepting community feedback ***(23-24, New Action)***

C.4. Recognize contributions as a means of incentivizing. Consider engaging with GEBCO parent organizations to identify potential ***(24-25, New Action)***

Goal 2: Enhance metadata and improve web services

Objective A. Develop the message *- clear request and motivation - that can be relayed, expanded, and spoken encouraging various communities to enhance and extend metadata and web services.*

A.1. Develop a vision statement. ***(2023, New Action)***

A.2. Summarize user needs articulated through TSCOM engagement series with regards to data access and discovery, and opportunistic mapping. ***(2023, New Action)***

Objective B. Develop documentation *that defines what is needed.*

B.1. Define the service and metadata changes that will be required ***(2023, New Action)***

B.2. Identify subset of service providers and confirm willingness to prototype changes and focus on the DnD concept as the initial target. ***(23-24, Ongoing)***

B.3. Review and confirm specifications - metadata needs/wants, web service types, preferred geometries with service providers. ***(23-24, New Action)***

Objective C. Implement prototype *and develop supporting documentation.*

C.1. Implement changes in the services listed above. ***(2024, New Action)***

C.2. Develop guidance on how the requested changes can be implemented by others. ***(2024, New Action)***

C.3. Work with opportunistic mapping application and integrated layer providers to test fitness for use. ***(2024, New Action)***

C.3.1 Bathy Globe (UNH) ***(2024, New Action)***
C.3.2 Esri ***(2024, New Action)***
C.3.3 GeoMapApp ***(2024, New Action)***

Goal 3: Encourage the use of a common generic sonar format for bathymetry

Objective A. Develop the message *- clear request and motivation - that can be relayed, expanded, and spoken encouraging various communities focused around the importance of preserving and sharing processed swath formats in addition to products.*

A.1. Write a short paper describing why a processed swath file format standard is needed and what it enables ***(2024, New Action)***

A.2. Develop a presentation with messaging aimed at groups who are processing data to provide processed swath data in GSF format. ***(2024, New Action)***

A.3. Determine venues/communication mechanisms ***(2024, New Action)***

Objective B. Develop documentation *articulating (1) value of GSF and (2) the current known issues/limitations and emerging software solutions (e.g. QPS, Caris, MBSystem, TileDB), based on input from the community.*

B.1. Identify and bring together members of groups promoting the use of GSF (e.g. GMRT, AusSeabed, OER, etc) to discuss experiences and perspectives. ***(24-25, New Action)***

B.2. Come to consensus if GSF is the right solution or if something else would be more appropriate/efficient. ***(24-25, New Action)***

B3. Write a white paper and presentation that includes a recommendation that can be taken to software developers. ***(24-25, New Action)***

Objective C. *Meet with software providers (commercial and open source) to push format ahead.*

C.1. Circulate white paper to software providers/developers. ***(24-25, New Action)***

C2. Convene meeting(s) with software providers to discuss the need to maintain compatibility with evolving GSF to meet community needs. ***(2024, Funding Requested)***

Goal 4: Unify an approach for disseminating information & outcomes

Objective A. Develop messaging campaigns *to increase reach of information gathered and written for Goals 1-3.*

A.1 Lead authors of various messaging categories for Goals 1-3 to reconvene to discuss, review and finalize short drafts ***(23-24, New Action)***
A.2. Develop the call to action and messaging campaign strategy. ***(2024, New Action)***
A.3 Write articles, announce availability of information, highlight enhancements ***(23-26, Funding Requested)***

Objective B. Distribute information

B.1. Map potential "representatives" to pass the message(s) in different arenas that considers also reaching early career scientists and students. ***(2024, New Action)***

B.2. Coordinate communication via collaboration with GEBCO partners. ***(2024, New Action)***

B.3. Investigate and identify new distribution formats. ***(2024, New Action)***

B.4. Determine where documentation and how-to guidance will live (eg: website(s), GEBCO cookbook, instructional video, etc). ***(24-25, New Action)***

B.5. Develop plan for showcasing success stories in collaboration with GEBCO partner organizations. ***(2024, New Action)***

B.6 Organize annual hybrid meeting to revisit status and plans, consider revisions and consider impact of approach and efforts. ***2024, Funding Requested)***

Conclusion

Improving the accessibility of global bathymetry data requires an understanding of the needs of a diverse community of individuals and organizations who create, manage and utilize data for a wide variety of purposes. An action plan for developing *A GEBCO Community Vision for Improving the Availability, Discoverability & Accessibility of Bathymetric Data* identifies needs and goals within the community and serves as a living document to better promote ongoing and future collaboration efforts. TSCOM, together with Seabed 2030, the IHO DCDB and the greater GEBCO community, will strive to support, implement and further promote the activities described above.

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