Paper for consideration by IRCC

Data gathering and management, maximizing the use of hydrographic data

Considerations on the development of the General Bathymetric Chart of the Oceans (GEBCO)

Submitted by:	IHB
Executive Summary:	GEBCO aims to provide the most authoritative, publicly-available bathymetry data sets for the world's oceans. This report highlights a number of issues in relation with the objective to improve data gathering and maximize the use of hydrographic data, for IRCC consideration and further guidance of the GEBCO programme.
Related Documents:	GEBCO Grids, B-11, Global Maps and IBC Regional maps.
Related Projects:	GEBCO Guiding Committee, GEBCO Technical Sub-Committee on Ocean Mapping (TSCOM) and Sub-Committee on Regional Undersea Mapping (SCRUM)

Introduction / Background

1. The aim of the General Bathymetric Chart of the Oceans (GEBCO) is to provide the most authoritative publicly-available bathymetry of the world's oceans. The GEBCO products include a variety of regional and world maps, gridded data sets, digital atlases and a gazetteer of undersea feature names. They are provided free of charge and are widely used by the scientific, academic and other communities. In relation with the objective to improve data gathering and maximize the use of hydrographic data, a number of issues are highlighted for IRCC consideration and further guidance of the GEBCO programme.

Analysis / Discussion

GEBCO Data Store

2. For many decades the IHO Member States (MS) have been, and continue to be, primary contributors of bathymetric data covering the world's oceans. The IHO has established the *IHO Data Centre for Digital Bathymetry* (DCDB) hosted by the USA in Boulder, Colorado, as part of its commitment to the system of World Data Centres and in support of the IHO.

3. The IHO DCDB includes a digital bathymetric database and portal through which data can be viewed, interrogated and downloaded. MS have more recently provided shallow water soundings harvested from ENCs, and efforts to collect crowd-sourced bathymetry (CSB) are underway. In spite of these significant efforts, there are still large areas of the ocean where no data exists or where existing data is inadequately documented or unusable for ocean mapping requirements.

4. GEBCO has established a "Data Store" which includes all forms of adjusted / verified bathymetric data (including regional grids and crowd-sourced data) that can be used directly for ocean mapping purposes. The Data Store currently comprises a large number of data sets that are currently made available for download as a (large) compressed file. There are however plans to develop an online portal that will provide data search and download functions. The preliminary design and concept for the Data Store model are provided at Annex A.

5. Meanwhile, the web-based interface portal to the IHO DCDB is being upgraded in order to be compatible with the CSB concept and to provide a global bathymetric data discovery portal. The upgrade has just begun. An appropriate mechanism is now required to ensure that the specifications and implementation of the Data Store and the wider CSB concepts enabled through the IHO and the DCDB are coordinated.

Bathymetric Data Collection Initiatives

6. Figures extracted from the IHO Year Book indicate that, worldwide, the number of government survey vessels has declined by 35% in the last 30 years. Improvements in equipment capability and the use of contract surveys have mitigated this loss, but they have not filled the gap. In light of this marked reduction in survey platforms (especially for the collection of deep ocean bathymetry), it is proposed that GEBCO needs to consider how to facilitate the acquisition of bathymetric data via crowd-sourced data collection and liaising with scientific organizations that conduct ocean surveys.

7. Climate change has spawned an increase in ocean research activities. Ocean research vessels often conduct extensive research missions to collect scientific data but often do not collect bathymetric data. In those cases where bathymetric data are collected, it often does not get sent to IHO DCDB (or similar data centre), and is thus not made available for ocean mapping purposes. The members of the Partnership for Observation of the Global Oceans (POGO)[1] operate a fleet of ocean-going research vessels that undertake scientific cruises in the oceans of the world. These research vessels represent a costly infrastructure that should be used in an efficient and optimal way. POGO recognize that there is a need to improve information sharing on the planning of cruises to enhance awareness of opportunities, and to improve the cost-effectiveness of cruises. It is strongly recommended that GEBCO should liaise with organizations such as POGO to ensure that the collection of bathymetric data is included in their cruise plans. Furthermore, it is proposed that GEBCO should consider mechanisms to ensure that bathymetric data collected by scientific and crowd-sourced cruises are transferred to the IHO DCDB or similar data centre.

Bathymetric Modelling Initiatives and Requirements

8. Through international initiatives, such as the Group on Earth Observation (GEO) and the United Nations initiative on Global Geospatial Information Management (UN-GGIM) there is a growing acknowledgement and awareness of the relevance and the potential contribution of hydrographic information in the context of global geospatial data infrastructures. This emphasises the importance of GEBCO as a fundamental part of the global geospatial information infrastructure. However, other commercial organizations, such as ESRI and Google are producing global ocean grids which may be competing with or duplicating GEBCO efforts or are being developed independently (see Annex B). This situation needs to be considered and managed carefully by the GEBCO Guiding Committee and appropriate advice provided to its parent organizations IHO and IOC.

9. GEO is coordinating efforts to build a Global Earth Observation System of Systems (GEOSS) in order to exploit the growing potential of Earth observations to support decision making in an increasingly complex and environmentally stressed world. The Global Ocean Observing System (GOOS) developed under the auspices of the IOC is meant to be the oceanographic component of GEOSS. Many functions of GOOS depend on the availability of accurate bathymetry. Yet, the IHB is not aware of any formal connexion between GOOS and GEBCO.

10. Regional initiatives, such as the Transatlantic Ocean Research Alliance launched by the European Commission, Canada and USA, acknowledge also the importance of improved seabed mapping in order to support relevant predictive and forecasting models for sustainable resource development and improved risk management. Yet such initiatives do not spontaneously identify GEBCO as the appropriate competent authority.

11. Considerable effort has been invested in producing the GEBCO grids and the underlying data bases of information. The new GEBCO 2014 Grid comprises a digital bathymetric model of the world ocean floor merged with land topography from publicly available digital elevation models. The global grid, based on a cell size of 30 x 30 arc seconds includes data from new versions of the International Bathymetric Chart of the Arctic Ocean (IBCAO), the International Bathymetric Chart of the Southern Ocean (IBSCO), the Baltic Sea Bathymetry Database, and data from the European Marine Observation and Data Network (EMODnet) bathymetry portal.

[1] See http://www.pogo-oceancruises.org/.

Creation of a Digital Archive of GEBCO Maps and Plotting Sheets

12. Since the inception of the GEBCO Project in 1903, many bathymetric maps, plotting sheets and documents have been produced under its banner. In addition to a comprehensive collection of plotting sheets that document the collection of deep ocean soundings, over many decades, GEBCO has also produced five series of world bathymetric maps that show the progression of ocean mapping over the past 100 years.

13. Copies of most of the ocean map series and a number of the plotting sheets have been stored in the map archive at the IHB. Many of these documents will be of significant interest to hydrographers, ocean scientist, cartographers and other communities. Some of the older maps may also be quite rare.

14. Geo-referenced raster images of the repository of GEBCO ocean maps and plotting sheets that are held within the IHB would safeguard against their loss due to a catastrophic event such as a fire or water damage. Copies could then also be made available for downloading and printing. They could also be made available for viewing as a web resource using simple web Tile Map (TM) format.

Recommendations

15. The development of the GEBCO Data Store should be coordinated with the current upgrade of the IHO DCDB that is intended to improve support for CSB and ocean mapping data discovery.

16. Mechanisms should be developed to promote the collection of bathymetric data from scientific and crowd- sourced cruises and to ensure that the data is made available to GEBCO, accompanied by appropriate metadata, through the IHO DCDB.

17. Methods and initiatives to improve the recognition of GEBCO as the “the most authoritative publicly-available bathymetry of the world’s oceans” in support of global and regional programmes related with Earth observation and monitoring should be identified.

18. Affordable methods to produce geo-referenced raster copies of the repository of GEBCO ocean maps and plotting sheets that are held at the IHB should be further identified and, if appropriate, the relevant specifications should be developed.

Resources and Priorities

19. The priority allocated to each recommendation and the availability of the relevant resources should be considered with the development of the IRCC Work Programme for 2015-2016.

Action Requested of IRCC

20. The Committee is invited to consider the recommendations outlined in paragraphs 15 to 18 and provide guidance to its relevant subordinate bodies.

Annex A

Notes on the DCDB Data Store (DDS) Model

The DCDB Data Store (DDS) will be located at the US National Center for Environmental Information (NCEI) and run on behalf of the IHO. The aim of the Store is to hold or identify publically-accessible data sets that have been or will be used to build GEBCO's and regional (International Bathymetric Charts) IBC's grids. The DDS data holdings will be publicly available subject to acknowledging the source in any derived grid, work or publication.

Data will be flagged as part of the DDS and it is anticipated that the data will be searchable, displayable and downloadable via a revised IHO DCDB web application and interface. This will include the option to view the extent and location of data sets through a web map service. It is proposed to provide an interface for inputting metadata for data sets not physically included in the Store (i.e. available at other data centres).

The DDS will be able to accommodate datasets submitted in the form of grids, point soundings, single beam and multi-beam data. The DDS will require certain business rules; for example multi-beam echo sounder data sets should be appropriately decimated and averaged or gridded rather than being submitted in a raw format; and grids that have cells that are interpolated or constrained by soundings need to be identified as such.

The primary difference between the DDS and other sources of bathymetry is that the DDS data will be identified as: 'data included in the GEBCO grid' and/or 'submitted data' – i.e. data identified by the contributor as cleaned and ready to be used to build grids from.

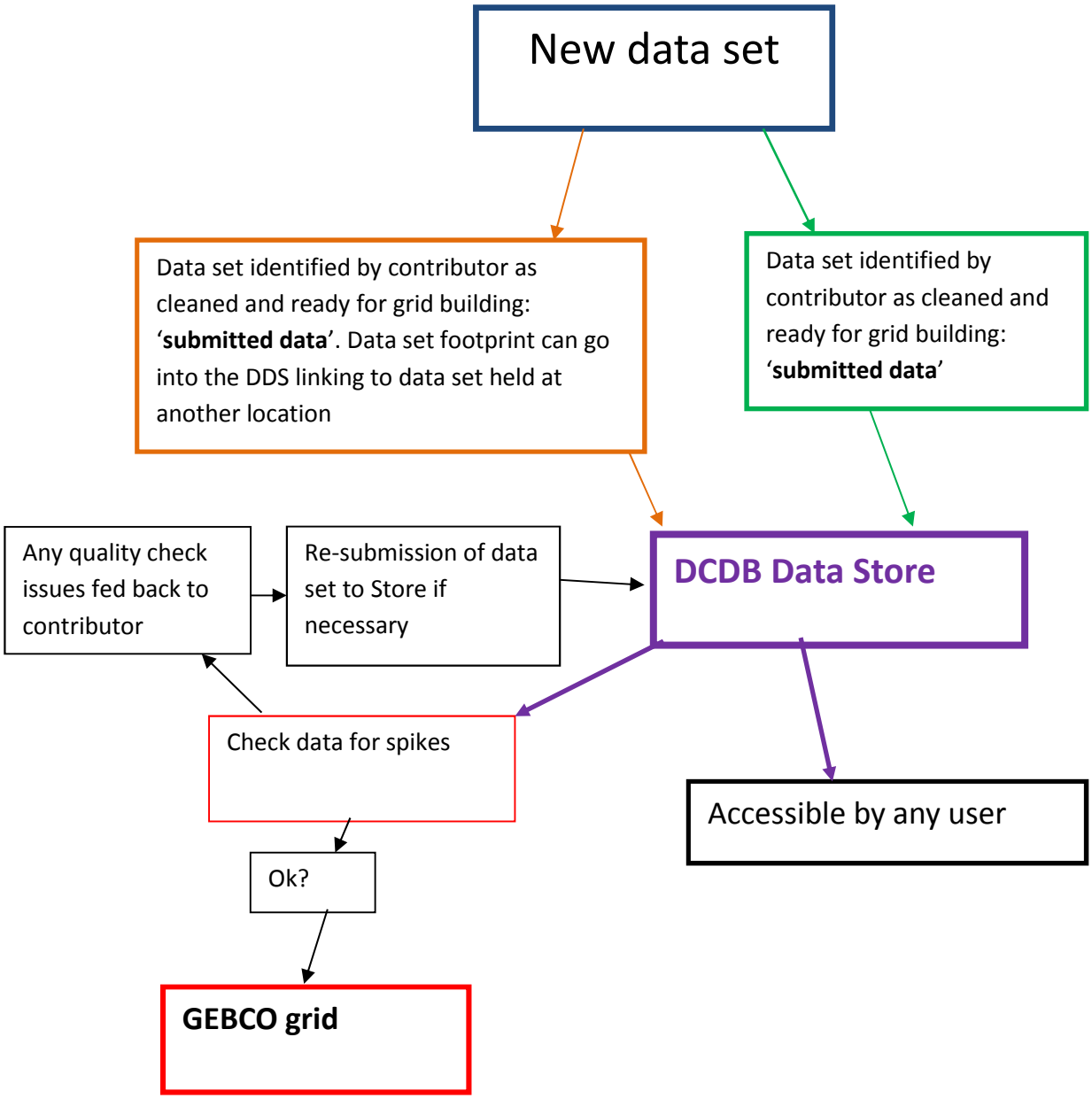
Guidelines on submitting data and conditions of use will be included in the appropriate IHO publications (B-4 - *Information Concerning Recent Bathymetric Data*, B-7 - *GEBCO Guidelines*, or B-11- *GEBCO Cook Book*).

Contributors will be able to submit data to the Store directly themselves. If contributors prefer to make data available through their own web site then they can provide a footprint of their data set and a link to where it can be accessed from. In both cases, data will be flagged as 'submitted data' in the Store.

It is anticipated that DDS will have its own dedicated webpage on the IHO website which will include guidelines on submitting data and conditions of use. It is also proposed to provide information on the existing GEBCO's web site http://www.gebco.net/about_us/contributing_data/ (or provide a link to the relevant section of the DDS webpage.

Contributors may also be given the option to provide data that will be exclusively for GEBCO use. In such cases an attribute will be used to indicate that the data was used as a source in building the GEBCO grid but the data will not be made available, i.e. **this would be outside of and separate to the DDS model**. In such cases it might also be appropriate to encourage the contributor to simultaneously provide a version of the data in a density or format that the contributors might be comfortable making available for public use, and inclusion in the DDS.

Preliminary DCDB Data Store (DDS) Model Work Flow



Annex B

Examples of references to bathymetric products and services apparently comparable with GEBCO

Press release from the European Space Agency – CryoSat reveals secrets of the deep - 3 Oct. 2014

(…)

The new map will also provide the foundation for the upcoming new version of Google's ocean maps to fill large voids between shipboard depth profiles.

Reference:
http://www.esa.int/Our_Activities/Observing_the_Earth/CryoSat/CryoSat_unveils_secrets_of_the_deep

ESRI World Ocean Base

The map was compiled from a variety of best available sources from several data providers, including General Bathymetric Chart of the Oceans GEBCO_08 Grid version 20100927 and IHO-IOC GEBCO Gazetteer of Undersea Feature Names August 2010 version (http://www.gebco.net), National Oceanic and Atmospheric Administration (NOAA) and National Geographic for the oceans; and DeLorme, HERE, and Esri for topographic content. For details on the users who contributed bathymetric data for this map via the Community Maps Program, view the list of Contributors for the Ocean Basemap. The basemap was designed and developed by Esri.

Reference: http://www.arcgis.com/home/item.html?id=1e126e7520f9466c9ca28b8f28b5e500

Global Seafloor Geomorphic Features Map

The new global map of seafloor geomorphology is based on the analysis and interpretation of the SRTM (Shuttle Radar Topography Mission) 30 arc-second (~1 km) global bathymetry grid. The new map includes 29 categories of geomorphic features, as defined by the International Hydrographic Organisation. This map represents a major advance in scientific knowledge, since the previous global scale mapping was completed over 30 years ago.

Reference: http://www.bluehabitats.org/?page_id=206