



GEBCO Report to the IHO Inter-Regional Coordinating Committee

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GEBCO OVERVIEW

The General Bathymetric Chart of the Oceans (GEBCO) aims to provide the most authoritative, publicly-available bathymetry data sets for the world's oceans. GEBCO is a non-profit organization that relies largely on the voluntary contributions of an international team of geoscientists and hydrographers who work on the development of a range of bathymetric data sets and data products. It operates under the joint auspices of UNESCO's Intergovernmental Oceanographic Commission (IOC) and the International Hydrographic Organization (IHO). GEBCO's work is directed by a Guiding Committee and supported by the Technical Sub-Committee on Ocean Mapping (TSCOM), the Sub-Committee on Undersea Feature Names (SCUFN), the Sub-Committee on Regional Undersea Mapping (SCRUM), and the Nippon Foundation/GEBCO Training Project Management Committee. Additional *ad hoc* working groups are convened as necessary. Through the work of its committees and working groups, GEBCO produces and makes available a range of bathymetric data sets and products, including gridded bathymetric data sets, the GEBCO Digital Atlas, the GEBCO world map and the GEBCO Gazetteer of Undersea Feature Names. GEBCO maintains a comprehensive website at <http://www.gebco.net>

Current GEBCO Officers

Chair, GEBCO: Dr Robin K. H. Falconer (IOC appointed)

Vice-Chair, GEBCO: Dr. Christopher G. Fox (IHO appointed)

Permanent Secretary, GEBCO: Mr. David M. Clark

Chair, Technical Sub-Committee on Ocean Mapping (TSCOM): Dr. Walter H.F. Smith

Chair, Sub-Committee on Undersea Feature Names (SCUFN): Dr-Ing. Hans-Werner Schenke

Director, IHO Data Centre for Digital Bathymetry: Ms. Lisa A. Taylor

GEBCO Bathymetric Editor: Vacant

GEBCO Digital Atlas Manager: Ms Pauline Weatherall

Full information on current membership can found on the GECBO website

GEBCO PRODUCTS

GRIDDED BATHYMETRY DATA

GEBCO develops and delivers regional and global bathymetric data sets for the world's oceans (http://www.gebco.net/data_and_products/gridded_bathymetry_data/). The two global gridded bathymetry data sets currently available are the GEBCO_08 Grid and the GEBCO One Minute Grid.

The British Oceanographic Data Centre (BODC) makes the grids available for download on behalf of GEBCO. Using the BODC web application, users can download the complete global grid files or custom data for a user-defined area. The data are made available in the form of netCDF files and can be used with Generic Mapping Tools (GMT) software system.

THE GEBCO_08 GRID — A GLOBAL 30 ARC-SECOND GRID

This global 30 arc-second grid was largely generated by combining quality-controlled ship depth soundings with interpolation between sounding points guided by satellite-derived gravity data. Where they improve on the existing grid, data sets developed by other methods have been included. Although every effort has been made to reduce the number of errors, the GEBCO_08 Grid is currently a development product, which will undergo periodic update.

The GEBCO_08 Grid is accompanied by a Source Identifier (SID) Grid, this identifies which corresponding cells in the GEBCO_08 Grid are based on soundings or existing grids and which have been interpolated.

THE GEBCO ONE MINUTE GRID — A GLOBAL ONE ARC-MINUTE GRID

The GEBCO global one arc-minute grid was originally released in 2003 and updated in 2008. The grid is largely based on the most recent set of bathymetric contours contained within the GEBCO Digital Atlas.

GRID DISPLAY SOFTWARE

Free software is available to view and access data from GEBCO's gridded bathymetric data sets. It provides the means for displaying the data and accessing the data in netCDF and simple ASCII formats. Version 2.13 of the software was released in April 2010. It includes the option to export the gridded data in ASCII form for conversion to an ESRI raster file.

GEBCO DIGITAL ATLAS

The GEBCO Digital Atlas is maintained by BODC on behalf of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO. The Centenary Edition of the GEBCO Digital Atlas (GDA) is a two-volume DVD set containing the GEBCO_08 global bathymetric grid at 30 arc-second intervals, the GEBCO One Minute Grid global bathymetric grid, a global set of digital bathymetric contours and coastlines, the GEBCO gazetteer of undersea feature names, the IHO DCDB trackline inventory of digital echo-sounding data (June 2002), and a software interface for viewing and accessing the data sets. A complete listing of data contained in the GDA is available from the GEBCO GDA website (http://www.bodc.ac.uk/projects/international/gebco/gebco_digital_atlas/).

HARD COPY CHARTS AND PUBLICATIONS

Printed charts and publications include;

- GEBCO World Map
- GEBCO 5th Edition Maps
- Intergovernmental Oceanographic Commission (IOC) International Bathymetric Charts
- International Hydrographic Office (IHO) Publications
- Geological/Geophysical Atlases

HISTORY OF GEBCO

"The History of GEBCO, 1903-2003" is a 140-page illustrated book covering the development of GEBCO in the 20th Century from early bathymetric mapping and data collection techniques through to the development of the GEBCO Digital Atlas.

GEBCO WEB SERVICES

The GEBCO_08 Grid is now available as a Web Map Service (WMS), a means of accessing georeferenced map images over the internet. Web services distribute information, imagery or data, across the internet in such a way that users can control exactly how and when the information is processed and reproduced in their own applications. To define how web services will operate and deliver information in a uniform manner, a set of standards have been developed by the Open Geospatial Consortium (OGC). Access the GEBCO WMS and future Web Feature Service for delivering the IHO-IOC GEBCO Gazetteer of Undersea Feature Names at http://www.gebco.net/data_and_products/gebco_web_services/.

UNDERSEA FEATURE NAMES

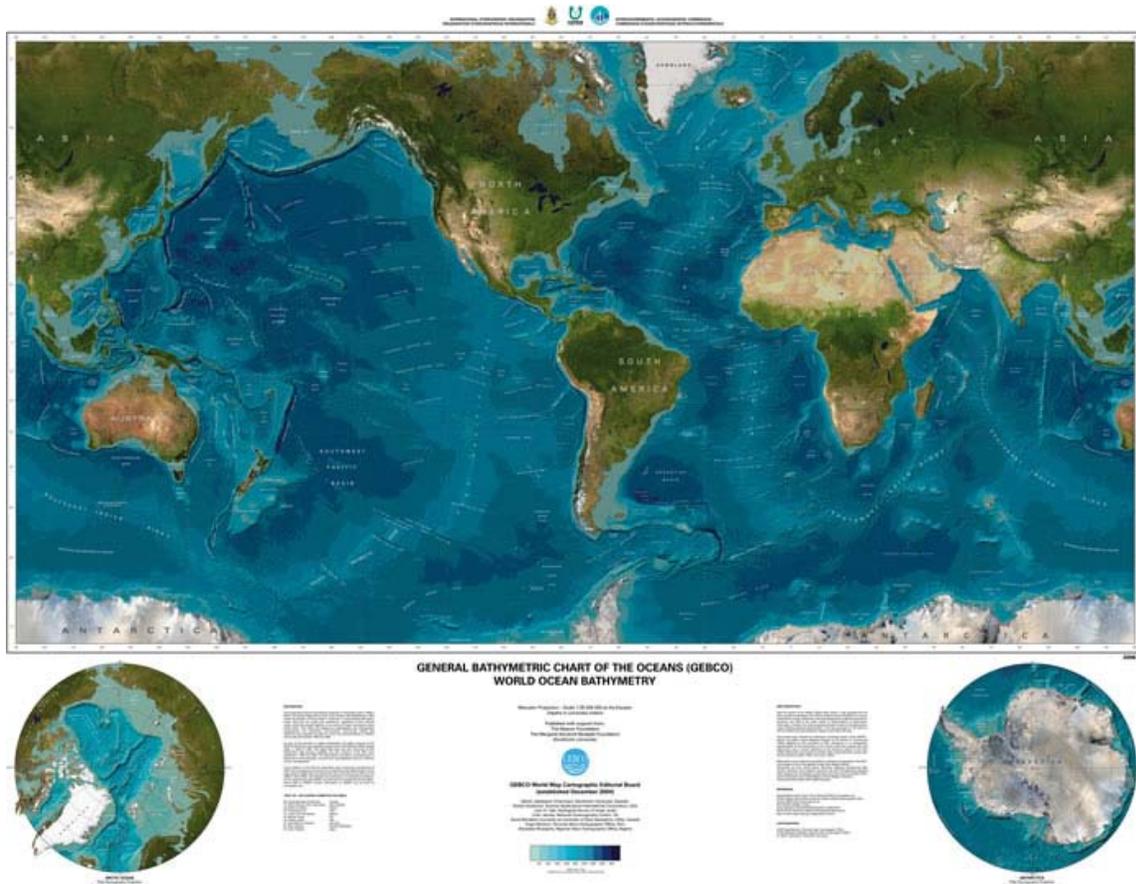
The undersea feature names shown on sheets and products of GEBCO and Regional International Bathymetric Charts (IBC) projects, and on international (INT) nautical charts are selected by the GEBCO Sub-Committee on Undersea Feature Names (SCUFN). All names selected by SCUFN are contained in the IHO-IOC GEBCO Gazetteer of Undersea Feature Names. The most recent version of the digital gazetteer was released in August 2011 and is available to download from the GEBCO website.

NOAA's National Geophysical Data Center (NGDC) and co-located IHO Data Center for Digital Bathymetry (DCDB) worked with the SCUFN Secretariat at the International Hydrographic Bureau to complete phase one of the GEBCO Gazetteer Enhancement Project. The full project includes reviewing, correcting, and updating the Gazetteer as well as enhancing feature geometries and transferring the Gazetteer from a spreadsheet to a geospatially enabled on-line database with multiple format download options. Phase one included a thorough review and documentation of what needs to be corrected updated and enhanced. Map viewers were generated to display proposed geometry changes for review by SCUFN members.

NGDC and IHO DCDB will begin managing Phase Two of the project in June of 2012 with funding from Google. This phase will include making all necessary updates and corrections to the feature descriptions and updating feature geometries to more accurately reflect feature shapes. Any changes to feature geometries that revise feature extents will be approved by SCUFN through correspondence. When completed, the new Gazetteer database will allow graphical display of the names and corresponding geometric representations in multiple applications including GIS systems and Google Earth. It will be searchable by name, location, feature type, discoverer, etc. via on-line text and map interfaces and will be downloadable from the GEBCO website in multiple formats, including web service, shape files and KML files.

GEBCO WORLD MAP

The GEBCO world map began as a laboratory workshop project of the Nippon Foundation/GEBCO Training Project at the Center for Coastal and Ocean Mapping of the University of New Hampshire, USA. The bathymetry data shown on the map is based upon the GEBCO One Minute Grid, a global bathymetric grid with one arc-minute spacing, as contained within the Centenary Edition of the GEBCO Digital Atlas (published in 2003). The land imagery is taken from the US National Aeronautics and Space Administration's (NASA) Blue Marble data set. The coastline is taken from the World Vector Shoreline. The map is on a Mercator projection at a scale of 1:35,000,000 at the Equator.



GEBCO RECENT AND UPCOMING EVENTS

GEBCO 2011 MEETINGS, OCTOBER 2011 IN LA JOLLA, CALIFORNIA, USA

The GEBCO Guiding Committee, Technical Sub-Committee on Ocean Mapping (TSCOM), Interim Sub-Committee on Regional Undersea Mapping (iSCRUM) and Nippon Foundation/GEBCO Training Project Management Committee met in La Jolla, California from 3 - 7 October 2011. The meeting was sponsored by The NOAA National Geophysical Data Center and was hosted by Dr. David Sandwell and the Scripps Institution of Oceanography of the University of California, San Diego. Over 60 hydrographers, oceanographers, engineers and scientists from numerous countries attended the general sessions on TSCOM and SCRUM. Meeting minutes and reports of this event can be found on the GEBCO website; http://www.gebco.net/about_us/meetings_and_minutes/

On 4 October, GEBCO sponsored the Sixth Annual GEBCO Bathymetric Science Day. It included 12 oral presentations and 11 posters. Copies of the presentations and abstracts can be accessed at http://www.gebco.net/about_us/gebco_science_day/

GEBCO 2012 SCUFN MEETING BEIJING, CHINA

The 24th Sub-Committee on Undersea Feature Names Meeting was held in Beijing, China, 12–16 September 2011. Ten out of the twelve SCUFN members and 20 invited guests and observers attended the meeting hosted by the National Marine Data and Information Service of the State Oceanographic Administration of China. The Sub-committee considered 140 undersea feature names, 97 of which were accepted for inclusion in the GEBCO Gazetteer of Undersea Feature Names.

GEBCO PERSONNEL CHANGES

GEBCO Bathymetric Editor: Due to a loss of funding, Mr. Colin Jacobs has left the GEBCO program. No decision has been made regarding his possible replacement.

GEBCO SCHOLARS PROGRAM

At the 100th year celebrations of GEBCO in 2003 we acknowledged that most of those active in ocean mapping were of an older generation. Since then, with funding from the Nippon Foundation of Japan, we have trained a new generation through a special GEBCO-designed course in ocean mapping at the University of New Hampshire (UNH). The GEBCO Nippon Foundation course at UNH is a one year Master's level course. Students are taught theoretical and practical aspects of ocean mapping, work on a team project, undertake a working visit to another ocean mapping institute and participate in a deep sea mapping cruise. The Nippon Foundation funding for the UNH program, about US\$540,000 per year, pays all tuition and expenses for the students and provides them a stipend. There are now -40 course graduates working in their home country organizations, two in

international industry and six currently at UNH. A new group begins in September. Scholars are from 26 countries bounding on all the world's major oceans. Existing scholars are active members on GEBCO subcommittees and working groups and increasingly are in influential positions in their organizations and internationally as a result of their training.

To continue the development of the scholars and GEBCO, Nippon Foundation granted additional funding for projects that will give the scholars experience at higher levels of responsibility and strengthen and widen the person-to-person networking on which GEBCO's successes depend.. In addition to participation in the regional mapping programs described above, a new regional map of the Indian Ocean has been launched. Scholars will also take part in specialized short courses on new ocean mapping developments and other international collaboration initiatives. A new lab visit at NGDC will be focused on developing high-quality digital elevation models will be offered to a maximum of two scholars per year.

Opportunities and issues

- The Nippon Foundation funding provides significant capacity building
- IOC, IHO and other agencies also do significant capacity building
- Linking efforts could provide strength to programs

IHO DATA CENTER FOR DIGITAL BATHYMETRY (DCDB)

The National Geophysical Data Center (NGDC) in Boulder, Colorado, USA, operates a worldwide digital data bank of oceanic soundings on behalf of the Member Countries of the [International Hydrographic Organization \(IHO\)](#). In 1988 NGDC offered to host and operate a worldwide digital oceanic bathymetry data centre on behalf of the IHO Member States. This led to the official establishment (in June 1990) of the IHO Data Centre for Digital Bathymetry (DCDB). Since that time, the IHO DCDB has made substantial progress toward establishing itself as the focal point for digital hydrographic data services for IHO Member States.

The following services are provided by the NGDC on behalf of the IHO:

1. Operation of the data center with a focus of activity on oceanic regions with depths greater than 100 meters.
2. Provision, free of charge to the IHO for use by its Member Countries, of the data needed for their national or international projects. IHO Member Countries' Hydrographic Offices are requested to provide the IHO DCDB with digital bathymetric data collected by their nation's institutions in oceanic regions.
3. Maintenance of a quality control facility whereby data provided to the IHO DCDB are checked for violation of physical principles (*e.g.*, instantaneous changes in ship position, high ship speeds) and completeness of metadata for contributed cruises.
4. Maintenance of inventories in digital form of all digital bathymetric data held in the data center.

5. Collaboration with various international organizations in the developments of exchange formats and standards to expedite bathymetric data exchange.

IHO DCDB WEBSITE

NGDC is coordinating with the IHO to update and restructure the [International Hydrographic Organization Data Center for Digital Bathymetry \(IHO DCDB\) website](#) to allow IHO member states easier access to hydrographic and bathymetric data through interactive graphical display and search capability. The new site will also provide user-friendly data and metadata submittal through a custom on-line interface and editor. NGDC is leveraging custom infrastructure developed for the U.S. Extended Continental Shelf Project to search, display and upload data and metadata. The website will provide users with all unrestricted multibeam swath sonar data, track line geophysical data, bathymetric and bathymetric/topographic digital elevation models, and point soundings archived at NGDC as well as metadata for locating data which is not archived at NGDC. The website restructuring is part of a larger IHO effort to engage the Regional Hydrographic Commission members in contributing data and metadata to the IHO DCDB.

RECENT ACTIONS AND ISSUES

ACTIONS TAKEN ON SCRUM

The International Hydrographic Board assisted GEBCO in gaining approval from a majority of IHO Member states for the establishment of the Sub-Committee on Regional Undersea Mapping (SCRUM). GEBCO is currently working to obtain the approval of the IOC to make SCRUM a permanent subcommittee.

ACTIONS TAKEN ON IRCC3 ACTION 17

ACTION: IRCC03/17: (RHCs/GEBCO): Invite GEBCO Guiding Committee / Bathymetric Regional Project Chairs to attend corresponding RHCs meetings, aiming at strengthening collaboration with a priority on improving high resolution shallow water bathymetry at the regional level.

At the 2011 GEBCO meetings in La Jolla, the GEBCO Guiding Committee developed a strategy for providing GEBCO attendance at Regional Hydrographic Commission meetings. Ideally, at least one primary member and one Nippon Scholar would attend every Regional Hydrographic Commission meeting, and either the Chair or Vice-Chair would attend the annual Inter-Regional Coordinating Committee meeting. Due to the small number of GEBCO members, limitations in travel budgets, and the complex schedules of GEBCO members, this ideal is not practically possible. The Guiding Committee is committed to placing GEBCO members at as many meetings as possible. The following table resulted from the Guiding Committee discussions, with additional input provided following the meeting:

IHO Regional Hydrographic Commissions and International Bathymetric Projects

IHO RHC	Location	Date	GEBCO participants	Nippon Scholars
South West Pacific	Republic of Vanuatu	November 2013	Shereen Sharma, Bruce Goleby	James Daniell
South West Atlantic	Argentina	2013	Walter Reynoso , Izabel King Jeck	Christina Franco de Lacerda
North Indian Ocean	Myanmar (to be confirmed)	2013	Rochelle Wigley	Karlapati Srinivas, Muhammad Bashir, Vasudev Mahale, Priyantha Jinadasa, Mohammad Jashim Uddin
US Canada	Niagara Falls, Canada	14 May 2012	Chris Fox , Paola Travaglini, Lisa Taylor	
Nordic	Copenhagen, Denmark	21-23 May 2012	Martin Jakobsson	Neil Tinmouth
North Sea	Ålesund, Norway	18-21 June 2012		
Baltic	Helsinki, Finland	18 - 20 September 2012	Martin Jakobsson	Anastasia Abramova, Yulia Zarayskaya
East Asia	Bangkok, Thailand	September 2012	Hyo Hyun Sung, Shin TANI	Taisei Morishita, Djoko Hartoyo, Apolonio Lagonsin, Tsuyoshi Yoshida, Nguyen Duy Thanh, Katagiri Yasutaka, Muhammad Yazid, Koji Ito, Kentaro Kaneda, Anastasia Abramova, Rachot Osiri, Francis Fletcher Freire, Athur Yordan Herwindya, Yulia Zarayskaya, Naoto Ujihara
Arctic	Tromsø, Norway	9-11 October 2012	Martin Jakobsson	Anastasia Abramova, Yulia Zarayskaya
East Atlantic	Lisbon, Portugal	14-16 November 2012	Etienne Cailliau	Abubakar Mustapha,
MESO American & Caribbean Sea	Antigua, Guatemala	2012	Dagoberto Uriel David Viteri , Colin Jacobs	Jorge Luis Heredia Bustamante, Leonardo Tun Humbert, Guillermo Humberto Diaz Pena, Bernice Geraldine Mahabier
Southern Africa and Islands	Mauritius	September 2012	Rochelle Wigley	
ROPME Sea Area	Kuwait (TBC)	February 2013	Rochelle Wigley	Muhammad Bashir
South East Pacific	Lima, PERU	June 2013	Hugo Montoro	Jose Gianella , Felipe Rafael Barrios Burnett,
Mediterranean and Black Sea		2013	John Hall , Paolo Lusiani	
IHO Commissions				
IHO Hydrographic Commission on Antarctica	Montevideo or Punta Del Este, Uruguay	10-12 October 2012	Hans Werner Schenke, Bruce Goleby, Walter Reynoso	
IHO Committees				
Inter-Regional Coordination Committee	Singapore	07-08 June 2012	Chris Fox, Robin Falconer	Jose Gianella

Names in **Bold** either have attended or have announced their intention to attend.

IHO-DCDB OPPORTUNITY FOR THE GEBCO/NIPPON FOUNDATION TRAINING PROGRAMME

The IHO Data Center for Digital Bathymetry, hosted at NOAA's National Geophysical Data Center (NGDC), invites one or two GEBCO/Nippon Foundation students each summer to work at NGDC in Boulder, Colorado, for a three-week period building coastal digital elevation models (DEMs) of international communities of interest. The goal is for students to learn techniques for building and evaluating high-quality, integrated bathymetric-topographic DEMs that are suitable for modeling of coastal processes (including tsunami inundation), ecosystems management and habitat research, or hazard mitigation and community preparedness. The products of this collaboration include both accurate, publically-available Digital Elevation Models for IHO member states as well as trained experts in DEM generation in those countries. The IHO can support this effort by assisting the Nippon students in obtaining the necessary hydrographic data to produce the DEMs before their arrival in Boulder.

PUBLICATION OF THE "IHO-IOC GEBCO COOK BOOK"

To encourage bathymetric and hydrographic experts around the world to submit compiled grids in a consistent manner, GEBCO developed the "IHO-IOC GEBCO Cook Book." The Cook Book is divided into three main sections: "Gridding Examples", written for beginning users desiring to quickly produce a grid from xyz data; "Fundamentals", which gives a more in-depth look at topics related to preparing, processing, and gridding xyz data; and "Advanced Topics", which contains discussions that more experienced users may find useful. The Cook Book was approved for publication by IHO member states and is now available as IHO Publication B-11.

CONTROVERSY OVER GEOGRAPHIC NAMING ON GEBCO PRODUCTS

The GEBCO Guiding Committee decided during the 2011 meetings to submit the GEBCO World Map (p 5) as an IHO publication. In producing the GEBCO World Map, GEBCO used the IHO Standard S-23 Limits of Oceans and Seas (1953) as the naming convention for non-seafloor features. The use of the "Japan Sea" label was protested by the Republic of Korea and the request to IHO for a publication number was withdrawn.

2012 GEBCO MEETINGS

The GEBCO Guiding Committee, Technical Sub-Committee on Ocean Mapping (TSCOM), Sub-Committee on Regional Undersea Mapping (SCRUM) and Nippon Foundation/GEBCO Training Project Management Committee will meet at the International Hydrographic Board in Monaco October 1-5, 2012. The meeting site and dates were selected to meet the new newly appointed IHB Directors and to fit with the Advisory Board on the Law of the Sea (ABLOS) meetings taking place on October 3 – 5. GEBCO attendees are invited to the first day of the ABLOS sessions, and ABLOS attendees are invited to participate in the GEBCO Bathymetric Science Day on October 2.

The GEBCO Sub-Committee on Undersea Feature Names (SCUFN) will hold its annual meeting in Wellington, New Zealand on October 22 – 26, 2012. Further information of these upcoming events can be found on the GEBCO website: http://www.gebco.net/about_us/meetings_and_minutes/ .