



<http://www.gebco.net>

GEBCO's aim is to provide the most authoritative publicly-available bathymetry of the world's oceans. It operates under the joint auspices of the Intergovernmental Oceanographic Commission (IOC) (of UNESCO) and the International Hydrographic Organization (IHO).

Organisational structure

We are a non-profit making organisation which relies largely on the voluntary contributions of an enthusiastic international team of geoscientists and hydrographers. GEBCO's work is directed by a **Guiding Committee** and supported by **sub-committees on ocean mapping and undersea feature names** plus ad hoc **working groups**.

Outputs from our work

We produce a range of bathymetric [data sets and products](#). This includes global **gridded bathymetric data sets**, a global set of **digital bathymetric contours**; the **GEBCO Gazetteer of Undersea Feature Names**; the **GEBCO Digital Atlas**; the **GEBCO world map** and the **IHO-IOC GEBCO Cook Book** — a reference manual on how to build bathymetric grids.

Contributing data

GEBCO is continually working to improve its gridded data sets with the aim of providing the most authoritative publicly-available bathymetric grids for the world's oceans. We acknowledge the source of contributed data in the documentation which accompanies GEBCO's data sets.

Training a new generation of scientists

The Nippon Foundation of Japan, based in Tokyo, has provided funding for GEBCO to train a new generation of scientists and hydrographers in ocean bathymetry. The 12-month course, leading to a [Postgraduate Certificate in Ocean Bathymetry](#) (PCOB), has been held at the [University of New Hampshire](#), USA since 2004. calls for this year closed on August.

Joint IOC-IHO Guiding Committee for GEBCO

The Guiding Committee oversees the work of the GEBCO sub-committees and working groups.

- ▶ Vice Admiral Shin Tani (Chairman)
- ▶ Prof Martin Jakobsson (Vice Chair)
- ▶ Dr Robin K H Falconer (Immediate Past Chair)
- ▶ Rear Admiral Patricio Juan Carlos Carrasco Hellwig
- ▶ Mr Chrétien Ngouanet
- ▶ Captain Peush Pawsey
- ▶ Dr Marzia Rovere
- ▶ Ms Hyo Hyun Sung
- ▶ Dr Nataliya Turko

- ▶ Dr Hans-Werner Schenke (Chair, Sub-Committee on Undersea Feature Names (SCUFN))
- ▶ Dr Karen M Marks (Chair, Technical Sub-Committee on Ocean Mapping (TSCOM))
- ▶ Ms Lisa A Taylor (Director, IHO Data Center for Digital Bathymetry)
- ▶ Mr David M Clark (Secretary)

Technical Sub-Committee on Ocean Mapping

Formerly the GEBCO Sub-Committee on Digital Bathymetry (SCDB).

- ▶ Dr Karen M Marks (Chair)
- ▶ Ms Jenifer Austin
- ▶ Dr Vicki Ferrini
- ▶ Dr John K Hall
- ▶ Mr Timothy Kearns
- ▶ Dr Marzia Rovere
- ▶ Dr Thierry Schmitt
- ▶ Dr Walter H F Smith
- ▶ Vice Admiral Shin Tani
- ▶ Ms Pauline Weatherall

Scientific advisors to TSCOM

- ▶ Dr Paul Elmore
- ▶ Prof Martin Jakobsson
- ▶ Mr Tony Pharaoh
- ▶ Prof David T Sandwell

Sub-Committee on Regional Undersea Mapping

SCRUM's aim is to build a closer collaboration with regional mapping efforts and coordinate, as well as encourage, the incorporation of their compilations into GEBCO.

- ▶ Prof Martin Jakobsson (Chairman)
- ▶ Ms Pauline Weatherall (Vice Chair)
- ▶ Mr Robert Anderson
- ▶ Dr Suzanne Carbotte
- ▶ Sung Ho Choi
- ▶ Mr Mohammad Zahedur Rahman Chowdhury
- ▶ Dr Boris Dorschel
- ▶ Dr Barry Eakins
- ▶ Dr Paul Elmore
- ▶ Ms Federica Foglini
- ▶ Dr John K Hall
- ▶ Dr Benjamin Hell
- ▶ Mr Serge Levesque
- ▶ Dr Sihai Li
- ▶ Cdr Hugo Montoro
- ▶ Dr Eric Moussat
- ▶ Mr Hans Öiås
- ▶ Vice Admiral Shin Tani
- ▶ Dr Rochelle Wigley

GEBCO's early years

The 7th International Geographic Congress (Berlin, 1899) nominated a Commission on sub-oceanic nomenclature to standardized terminology and underwater feature names, and was also responsible for the publication of a general bathymetric chart. The Commission convened in Wiesbaden (April 15-16, 1903), with Prince Albert I of Monaco in the chair.



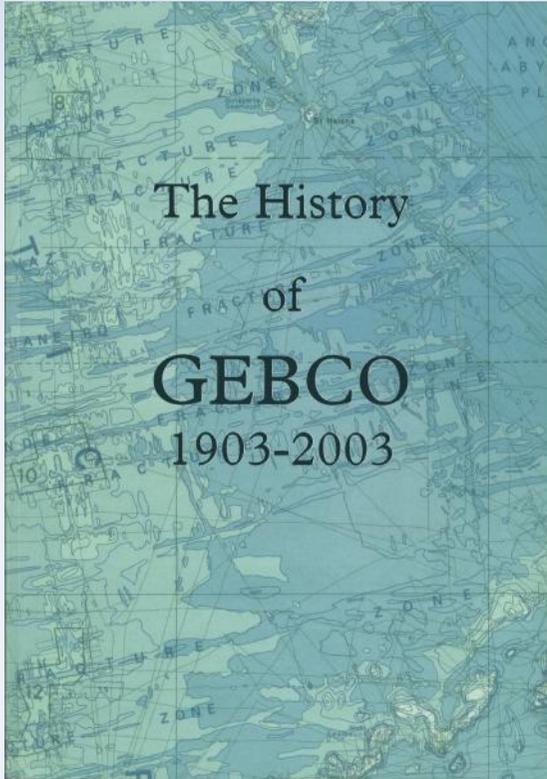
The first 24 sheets of Carte générale bathymétrique des océans were printed in Paris in 1905.

The second edition was printed from 1912 to 1931 with contour lines representing the terrestrial relief and a revised nomenclature.

The responsibility of the Chart was then transferred to an international organisation: the International Hydrographic Bureau.

Following the death of Prince Albert, his scientific team was disbanded and the International Hydrographic Bureau was invited to take over the project. Following recommendations by the Scientific Committee on Oceanic Research (SCOR), it was then decided to modernize the whole series and bring in the expertise of the scientific community to meet the needs of present day users.

The Intergovernmental Oceanographic Commission (IOC) of UNESCO was invited to cosponsor a 5th Edition. World coverage on the original scale of 1:10 million was completed and published by 1982, followed by a small scale world sheet in 1984.



"The History of GEBCO, 1903-2003" is a 140-page illustrated book. The book was published in April 2003 to commemorate GEBCO's first centenary.

A printed copy of the book is available from the International Hydrographic Bureau (IHB) at a cost of 20 Euros to cover postage and packing.

The International Hydrographic Bureau
4 quai Antoine 1er,
BP 445,
MC 98011 Monaco Cedex,
Principality of Monaco
Fax (+377) 93 10 81 40
Email : info@ihb.mc

Book available as pdf on http://www.gebco.net/data_and_products/history_of_gebco/

The start of the digital era — the GEBCO Digital Atlas

Since the publication of the 5th Edition GEBCO chart series, and largely because of its success, considerable support has been forthcoming for GEBCO's work, and in 1994 the GEBCO Digital Atlas (GDA) on CD-ROM was published. The first release of the GDA was produced by digitising the bathymetric contours, coastline and shiptracks from the printed sheets of the 5th Edition. It represented the first seamless, high-quality, digital bathymetric contour chart of the world's oceans and now provides the base for the regular updating of GEBCO. A second release was published in 1997.

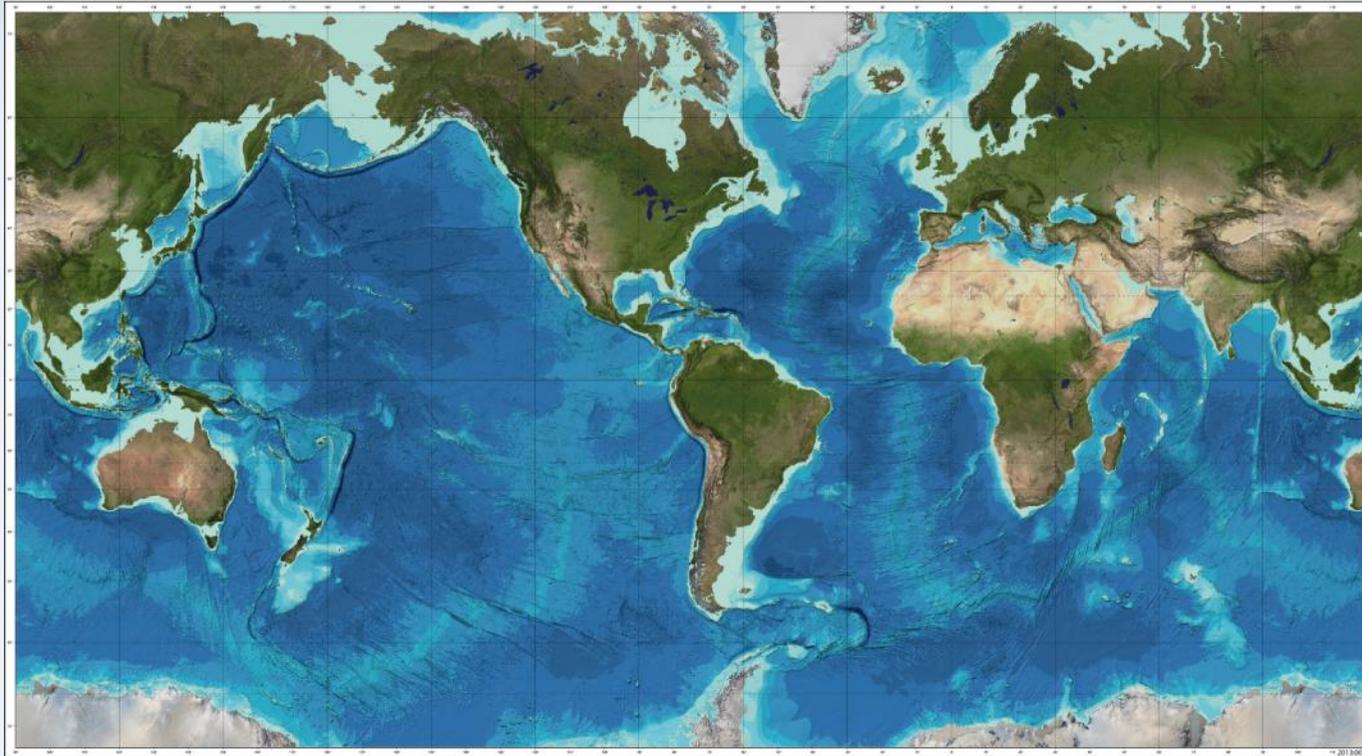
The latest release of the GDA, the **Centenary Edition of the GEBCO Digital Atlas** was published in 2003 and updated in 2010. It is [available](#) from the British Oceanographic Data Centre (BODC). It includes a global set of digital bathymetric contours and coastlines, the GEBCO_08 Grid, GEBCO One Minute Grid and the GEBCO gazetteer of geographic names of undersea features. It is accompanied by software for viewing and accessing the data sets.

Modelling the seafloor in 3D — development of GEBCO's gridded bathymetric data sets

Recognising the importance of the availability of gridded bathymetric data sets for applications such as ocean modelling work, GEBCO released its first global bathymetric grid, the **GEBCO One Minute Grid**, in 2003. This data set is at one arc-minute intervals and is largely based on the bathymetric contours contained within the GEBCO Digital Atlas.

In 2009, GEBCO released the **GEBCO_08 Grid** a global grid at 30 arc-second intervals. The grid was generated by combining quality-controlled ship depth soundings with interpolation between sounding points guided by satellite derived gravity data. An updated version of the grid was released in 2010.

GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)



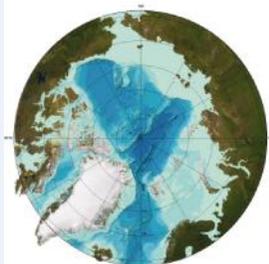
Mercator Projection - Scale 1:35 000 000 at the Equator

Depths in corrected meters



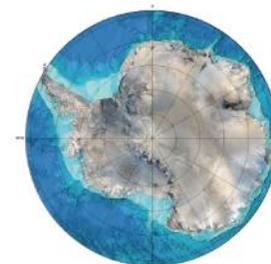
Bathymetric tints

(Depths are in corrected meters below mean sea level)



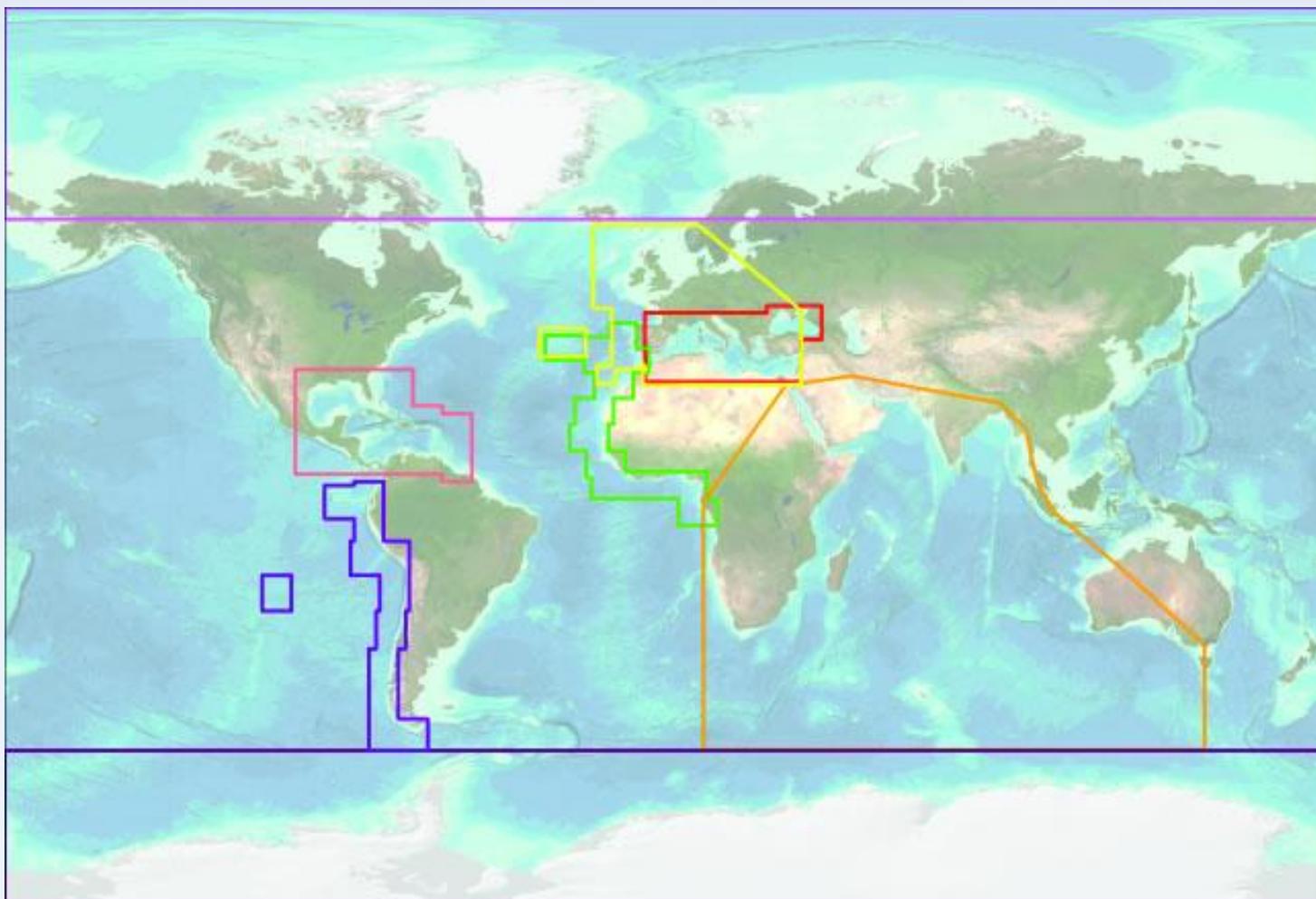
ARCTIC OCEAN
Polar Stereographic Projection
Scale 1:25,000,000 at 75° North Latitude

http://www.gebco.net/data_and_products/gebco_world_map/



ANTARCTICA
Polar Stereographic Projection
Scale 1:25,000,000 at 75° South Latitude

Regional mapping projects



Regional Mapping projects

Through the Sub-Committee on Regional Undersea Mapping (SCRUM), GEBCO is aiming to build on and extend its collaboration with regional mapping groups in order to improve its global bathymetric model.

GEBCO collaborates with:

- [Intergovernmental Oceanographic Commission \(IOC\) Regional Mapping Projects](#)
 - International Bathymetric Chart of the Arctic Ocean ([IBCAO](#))
 - International Bathymetric Chart of the Southern Ocean ([IBCSO](#))
 - International Bathymetric Chart of the Caribbean Sea & Gulf of Mexico ([IBCCA](#))
 - International Bathymetric Chart of the Central Eastern Atlantic ([IBCEA](#))
 - International Bathymetric Chart of the Mediterranean ([IBCM](#))
 - International Bathymetric Chart of the South Eastern Pacific ([IBCSEP](#))
 - International Bathymetric Chart of the Western Indian Ocean ([IBCWIO](#))
 - International Bathymetric Chart of the Western Pacific (IBCWP)

- [International Hydrographic Organization \(IHO\) regional coordination work](#)
 - **The Inter-Regional Coordination Committee ([IRCC](#))**
 - **The Regional Hydrographic Commissions ([RHC](#))**
- [GEBCO/Nippon Foundation Indian Ocean Bathymetric Compilation \(IOBC\) Project](#)

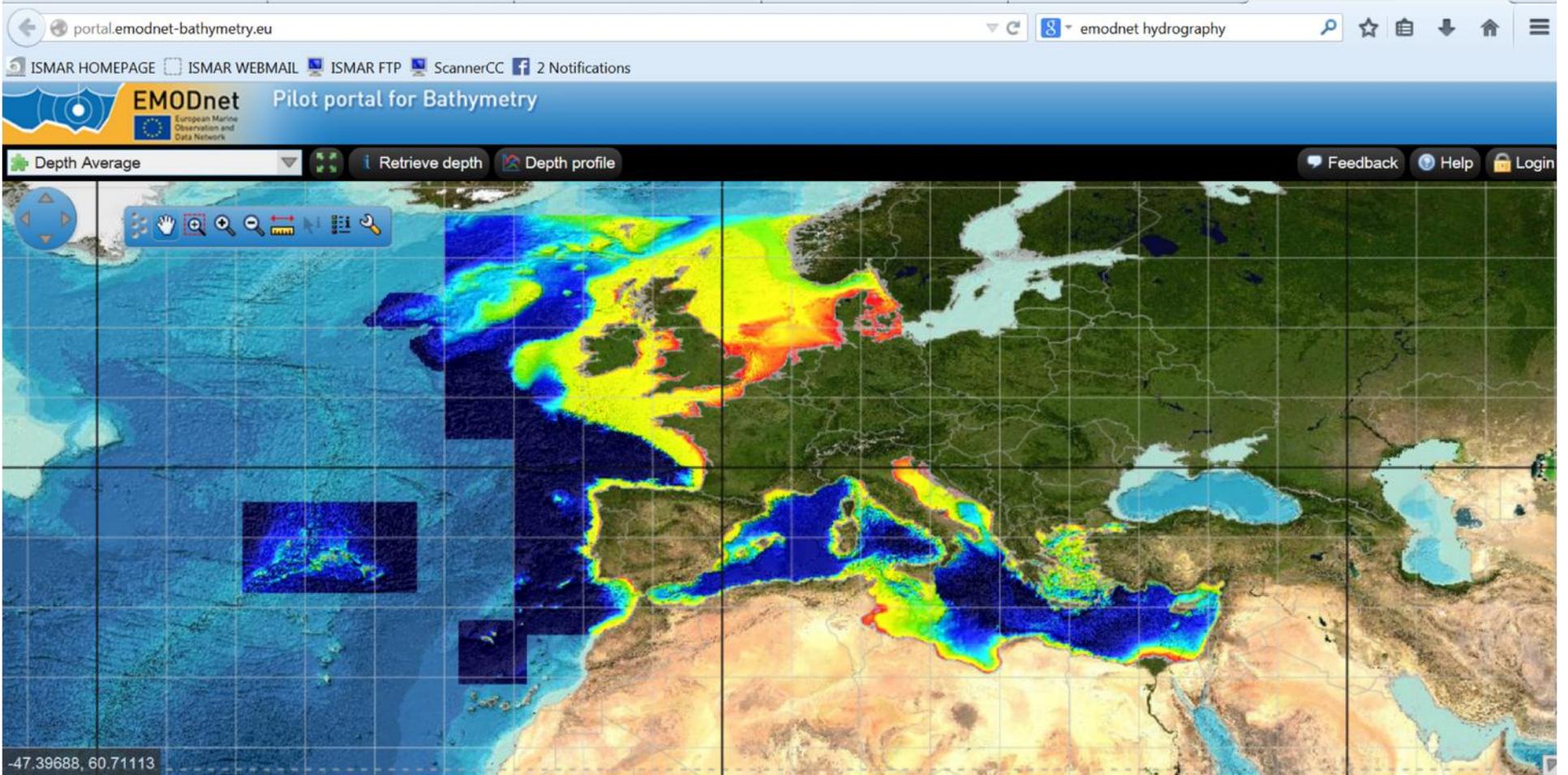
Indian Ocean (north of 60° S)

- [European Marine Observation and Data Network \(EMODnet\) Hydrography](#)

EMODnet is a project, funded by the European Commission, to bring together marine data into interoperable, continuous and publicly available data sets for complete maritime basins in European waters. In regions where high resolution DTMs are not available, bathymetry data is taken from the GEBCO_08 Grid to provide a complete bathymetric model for the region.

Through a collaboration with the EMODnet Hydrography team, it is aimed that future releases of GEBCO's global bathymetric grid will include bathymetry data from the DTMs provided through the EMODnet Hydrography portal.

EMODNet Portal

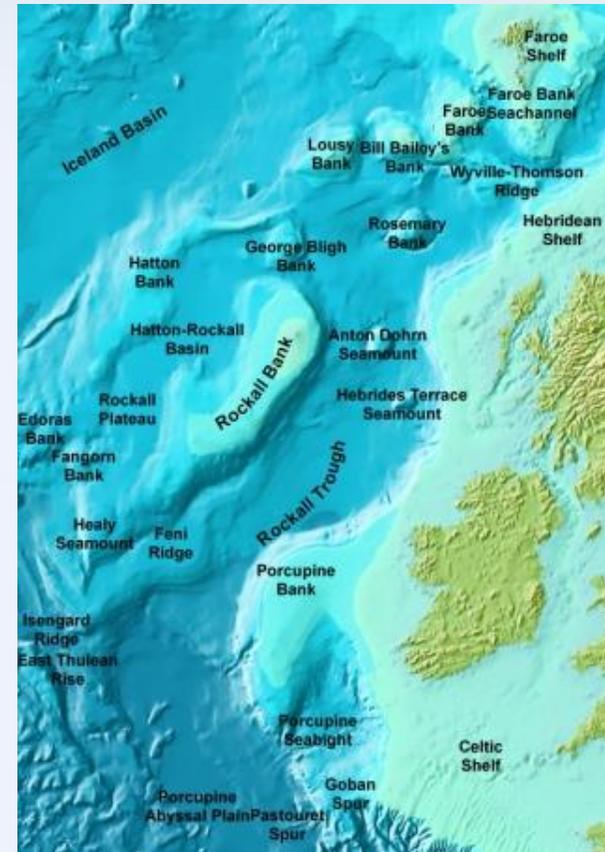


Naming features on the seafloor - outcomes from SCUFN's 2014 meeting

The GEBCO Sub-Committee on Undersea Feature Names (SCUFN) works to maintain and update a gazetteer of names of features on the seafloor. The group meets once a year to consider submitted name proposals for newly-discovered seafloor features. Through this review process, SCUFN ensures that features are given unique and appropriate names, reducing the possibility of confusion.

This year SCUFN met in June at the offices of the International Hydrographic Bureau (IHB) in Monaco and considered name proposals for 102 new features.

As part of the review process, SCUFN accepted the names submitted by AWI scientists for 'Madiba Seamount', named in honour of Nelson Mandela and 'Nachtigaller Shoal', named for an explorer from fiction.

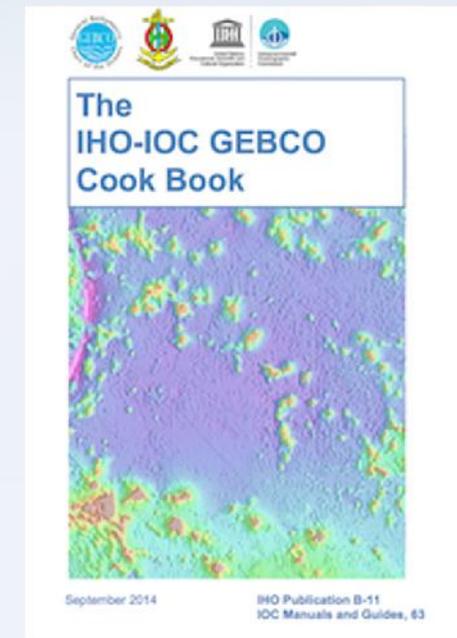


The IHO-IOC GEBCO Cook Book

The Cook Book is divided into three main sections "Gridding Examples" written for beginning users desiring to straightaway 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 more experienced users may find useful.

With this document, "The IHO-IOC GEBCO Cook Book," we hope to enable more people to contribute data and gridded compilations to GEBCO.

[Karen Marks](#), Chairperson of the GEBCO Cook Book Working Group



http://www.star.nesdis.noaa.gov/sod/lisa/GEBCO_Cookbook/index.php

GEBCO Science Day at AGU 2014

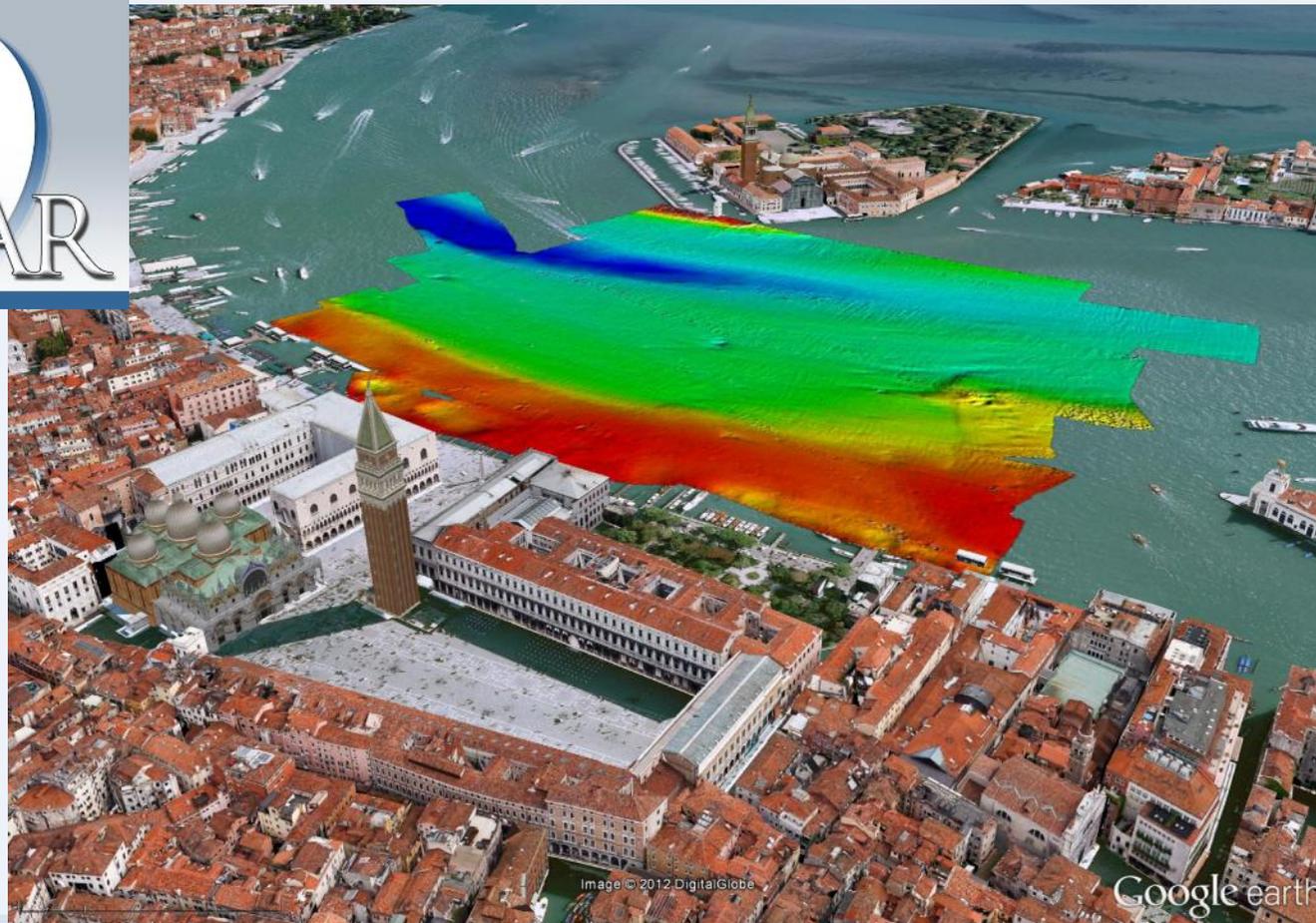
The GEBCO Bathymetric Science Day is held every year and consists of oral presentations and poster displays on topics relating to ocean-floor mapping and its applications. Attendance is open to all.

This year, **Science Day, will be held as a scientific session at the American Geophysical Union (AGU) 2014 Fall Meeting**. The date of the session is yet to be confirmed but will be sometime between 15-19 December.

The session title is **“New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping”**.

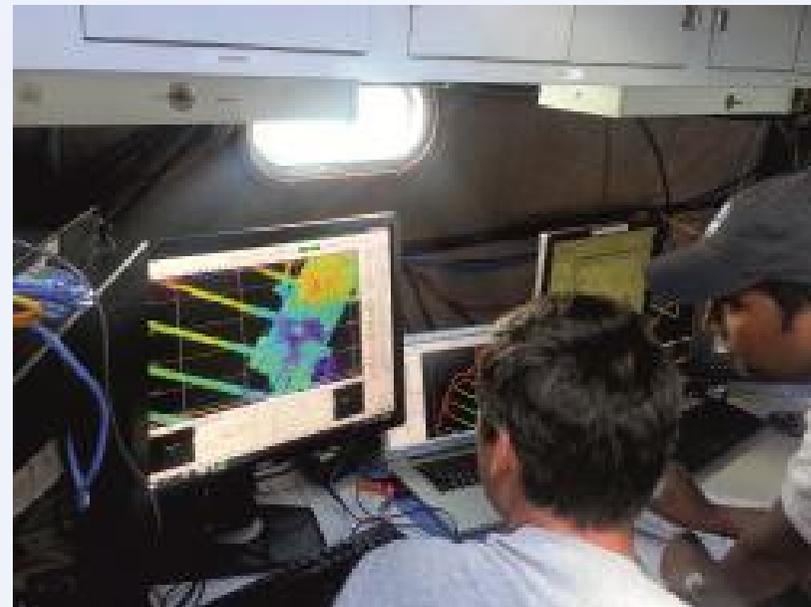
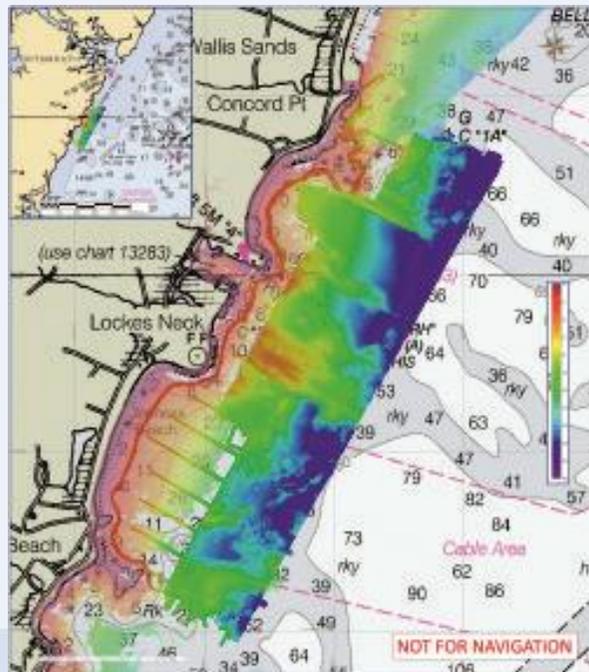
AGU’s submission deadline was 06 August 2014

In 2013 the GEBCO Science Day and annual meetings have been held in Venice at ISMAR's headquarters



Nippon Foundation/GEBCO Training Programme - Summer Hydrographic Field Course – July 2014

As well as being a significant part of the Nippon Foundation/GEBCO Training Programme, the field course also allows the students to gain a "Category A" certificate in hydrographic surveying – an internationally recognised standard in that field. This year's field course carried out hydrographic survey operations off the east coast of the USA, near Portsmouth Harbour. A multibeam echo sounder was used to collect bathymetric data and map the survey area.



GEBCO field training course

Eos Feature Article



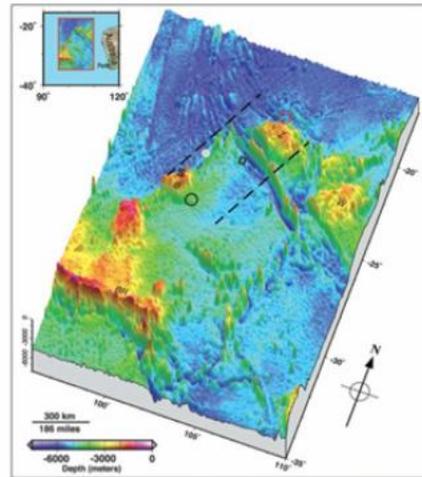
IN THIS ISSUE:
 News: Formal Declaration of Anthropocene Needs Rigorous Examination, p. 175
 In Memoriam: Ted Irving (1927–2014), p. 175
 Meeting: Unexpected Sink for Deepwater Horizon Oil and Future Response, p. 176
 Meeting: The Frontiers of Uranium-series Research, p. 178
 About AGU: Celebrating Leaders for Contributions to Policy, Public Awareness, p. 178
 Research Spotlight: Ozone Trends, Erosion Rate, Yellowstone, and More, p. 180

VOLUME 95 NUMBER 21 27 MAY 2014

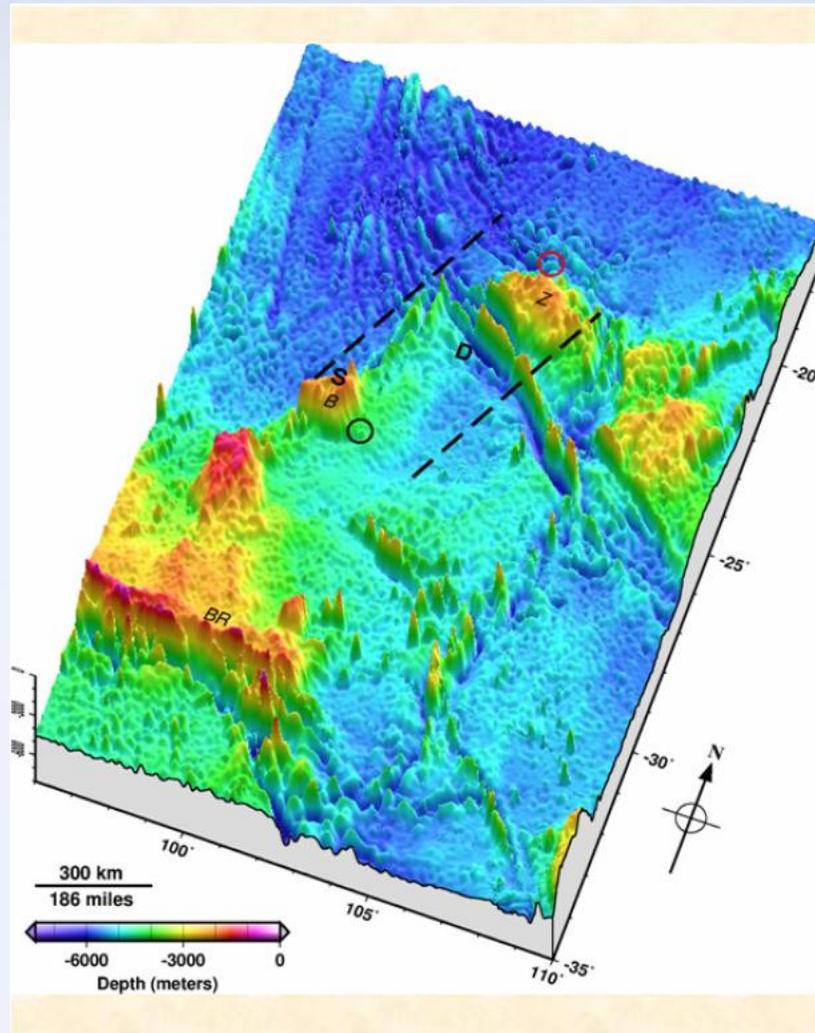
Seafloor in the Malaysia Airlines Flight MH370 Search Area

On the morning of 8 March 2014, Malaysia Airlines flight MH370, from Kuala Lumpur to Beijing, lost contact with air traffic control shortly after takeoff and vanished. While the world waited for any signs of the missing aircraft and the 239 people on board, authorities and scientists began to investigate what little information was known about the plane's actual movements. As days and weeks passed, the search began to focus on the Indian Ocean to the west of Australia—far from the flight's intended path. Clues to how the plane got so far off course may be in the plane's "black boxes"—its flight data and cockpit voice recorders. Finding the recorders is therefore a top priority. Little is known about the seafloor from ship-borne echo sounder measurements in the region where flight MH370 is believed to have crashed. Available depth measurements cover only 5% of the 2000 by 1400 kilometer area in Figure 1 (a high-resolution copy of this figure may be found in the additional supporting information in the online version of this article), and only a very few of them were acquired with modern acoustic and navigational systems. This lack of data makes the search for MH370 all the more difficult. It also highlights how most seafloor features are very poorly resolved. However, satellite altimeter measurements provide global bathymetry estimates at a

aircraft and the satellite while Doppler shifts in the handshake allowed a rough estimate of the aircraft's velocity away from the satellite. This analysis, completed about 10 days after the disappearance, was combined with estimates of when the plane might have run out of fuel. Together they suggested that the aircraft might be anywhere in a large area of the Indian Ocean west of Australia. MH370's black boxes were equipped with "pingers" programmed to emit acoustic signals if the boxes fell into the sea. The expected battery life of these pingers was approximately 1 month, so there were only a few days of expected pings left when it was reported that the Chinese vessel *Haiyan 01* had detected pings on 4 and 5 April in the water above the east flank of the Batavia Plateau (see black circle in Figure 1). Over the next 3 days the Australian vessel *Ocean Shield* reported three other contacts, one contact apparently hearing pings emitted by two distinct devices, in an area above the north flank of the Zenith Plateau (see red circle in Figure 1). The Batavia and Zenith contact locations are approximately 600 kilometers apart, and it seems unlikely that pingers at the end of their battery life could be heard over such distances, yet sound propagation in the ocean is quite complex. Nonetheless, Chinese and Australian authorities seemed confident that the carrier frequency, duration,



- GEBCO data used in Eos Feature Article on seafloor in the MH370 search area (Smith and Marks, Eos, 27 May 2014)
- In this area:
 - Only 5% of seafloor depths constrained by soundings
 - Remainder are depths estimated from satellite altimetry



Science Magazine News Article

- GEBCO data used in Science Magazine News article figure ("Lost at Sea," Science, 30 May 2014)
- Illustration shows seafloor in Malaysia Airlines flight MH370 search area



Figure 1. 14cm, 32cm, and 68cm GEBCO World Ocean Bathymetry globes

Status of GEBCO's global 30 arc-second interval grid (GEBCO_2014) by Pauline Weatherall (BODC)

The new release of the GEBCO 30 arc-second grid has been delayed to include the following updates:

- EMODnet Bathymetry grid (2013 edition) for waters around Europe (www.emodnet-hydrography.eu)
- Grid produced by the Japan Hydrographic and Oceanographic Department (JHOD) for the Northwestern Pacific Ocean region (17° N-43° N; 126° E-168° E), supplied by JODC.
- Baltic Sea Bathymetric Database from the Baltic Sea Hydrographic Commission (<http://data.bshc.pro>).
- ENC sounding point data supplied by the Chilean Navy Oceanographic and Hydrographic Service for coastal waters off Chile and extended the coverage of Olex data for the Iceland-Faeroe Rise area and area south of Iceland (South of IBCAO region).

Grid made available for review for possible release in September 2014.

New updates since the release of latest version of GEBCO 08 in 2010:

- International Bathymetric Chart of the Arctic Ocean (**IBCAO**) V3
- International Bathymetric Chart of the Southern Ocean (**IBCSO**) V1
- Waters around Australia: Australian Bathymetry and Topography Grid, June 2009
- EMODnet Bathymetry grid (2013) for waters around Europe
- Bathymetry data for all ocean regions: From the Global Multi-Resolution Topography (GMRT) synthesis, provided by the Lamont-Doherty Earth Observatory at Columbia University
- South China Sea region: update based on sounding data extracted from Electronic Navigation Charts (ENC), provided by the East Asia Hydrographic Commission
- Waters around Japan from a grid supplied by JHOD/JODC
- Baltic Sea region from the Baltic Sea Bathymetric Database supplied by the Baltic Sea Hydrographic Commission
- North American Great Lakes: Bathymetric grids provided by the US National Oceanic and Atmospheric Administration (NOAA), US National Geophysical Data Center (NGDC)
- North Atlantic Ocean, Gulf of Cadiz region: Bathymetric compilation produced under the European Social Fund (ESF) EuroMargins SWIM project “Earthquake and Tsunami hazards of active faults at the South West Iberian Margin: deep structure, high-resolution imaging and paleoseismic signature”
- Indian Ocean, region off Sumatra: Bathymetric survey carried out by HMS Scott in 2005
- Waters off the West Coast of Africa: update based on bathymetry data from Olex AS (between 8° N and 34° N)
- Northwest European Continental Shelf area: update based on bathymetry data from Olex AS.
- The Iceland-Faeroe Rise area and area south of Iceland: update based on bathymetry data from Olex AS.
- South Pacific Ocean, Coral Sea region, data supplied by Geoscience Australia and Australian Hydrographic Service
- Coastal waters off Chile - based on ENC sounding data supplied by the Chilean Navy Oceanographic and Hydrographic Service

Making GEBCO's grids available

The new grid will be made available via the internet and also as part of the GEBCO Digital Atlas. The existing web application for delivering GEBCO's grids will also be included on GEBCO's web site. The GEBCO grid will be made available in netCDF formats for the 2D grids.

GEBCO Web Services

A new version of the GEBCO Web Map Service (WMS)

http://www.gebco.net/data_and_products/gebco_web_services/web_map_service/, based on the GEBCO_2014 Grid, will be made available.

For the 2014 release of the GEBCO Grid, the GEBCO Source Identifier (SID) grid will be made available as a WMS. This may help to assist in showing that some areas of the oceans have been poorly mapped.

During the Gebco GGC, held last June in Monaco, 28 actions have been identified to be taken

Number	Action	Name	Due Date	Status
GGC31-01	Provide GEBCO input to IRCC report to EIHC by end of June, covering last two years.	*Clark, Tani	June 31	
GGC31-02	Review proposal 4 for EIHC on provision of guidance for crowd source bathymetry	Taylor, Tani,		
GGC31-03	Write letter to NGDC complementing the exceptional work done developing the digital gazetteer	Clark, Tani, Schenke		
GGC31-04	Submit request for web support at BODC under Task 3.8.6	Clark, Weatherall		
GGC31-05	Draft up certificates for NF Scholars at UNH for review.	Wigley		
GGC31-06	Determine how to track data using DOI	Taylor		
GGC31-07	Develop spending rules for the other GEBCO accounts at IHB	Clark, Wyatt		
GGC31-08	Write and formalize the GEBCO secretary job description	Clark, Tani, Jakobsson		

GGC31-09	Draft GEBCO 2014 financial report and budget	Clark, Wyatt		
GGC31-10	Develop a crowd source project proposal to NF Program Management Committee	Wigley, Taylor, Falconer, Wyatt		
GGC31-11	Provide input to the 2015-2016 GEBCO Work Programmes for GGC endorsement	Clark, Jakobsson, Marks, Taylor, Schenke, Sung, Weatherall		
GGC31-12	Investigate printing and distributing the GEBCO World Map	Taylor, Iptes, Jakobsson		
GGC31-13	Send out request for proposals to the NF Special Project fund.	Falconer, Clark		
GGC31-14	Write letter to Chrétien Ngouanet requesting an update on his ability to serve on the GGC	Tani and Clark		
GGC31-15	Draft the evolution of the GEBCO 10 year plan	Falconer, Wigley, Ferrini,	July/Oct	
GGC31-16	Propose improvements to GDA	Taylor		
GGC31-17	Write letter to IHB informing them of the IHO-GGC vacancies created by the retirement of one member and decision to enforce the ToRs with respect to Peush Pawsey's attendance record.	Clark, Tani		

GGC31-18	Write letter to IHB informing them of vacancies on the GGC	Clark, Tani		See GGC-17
GGC31-19	Ask for participation in the EAtHC (Casablanca, Morocco, 16-18 Sept 2014)	Clark, Tani	June 31	
GGC31-20	Propose date for 2016 GEBCO meeting in Valparaiso, Chile	Carrasco, Tani		
GGC31-21	Report on the feasibility to implement a monetary donation capability on the GEBCO web pages, consider methodology	Clark, Wyatt, Weatherall		
GGC31-22	Nominate and select NF Scholars for participation in the EIHC	Wigley, Falconer, Iptes		
GGC31-23	Send revised ToR/RoP to IOC and GGC Secretary	Ward		Completed
GGC31-24	Send revised ToR/RoP and explanation to IOC to be considered by IOC Exec Comm	Clark		Completed
GGC31-25	Develop Master Plan for Education and Outreach road map	Sung, Weatherall		
GGC31-26	Develop plan and implement it for the NF 10 year celebration	Falconer, Wigley, Iptes, , Clark, Rovere		
GGC31-27	Provide details on participation and what expected of NF scholars at the EIHC	Iptes		
GGC31-28	Draft a description/proposal for scanning and archiving historical maps at IHB	Pharaoh		

The GEBCO ten-year vision Group 1

Participants:

Felipe Barrios Burnett (Chilean Hydrographic Service, currently at UNH)

Boris Dorschel (Alfred Wegner Institute, Bremerhaven)

Vicki Ferrini (LDEO - Columbia University, New York)

Francis Fletcher Freire (University of Southeastern Philippines, currently at University of Stockholm)

Timothy Kearns (Clipcard, Seattle)

Eunice Nuerkie (National Oceanographic Centre, Ghana)

Marzia Rovere (ISMAR CNR, Bologna)

Thierry Schmitt (SHOM, Brest)

Rochelle Wigley (CCOM/JHC - UNH, New Hampshire)

Coordination through GEBCO is recognized as having tremendous potential for helping our community address several important challenges including:

- Identifying and filling gaps in global data coverage
- Raising public awareness about relevance of seafloor mapping, and about sparse global data coverage. GEBCO should be the authoritative source of information on how much of the ocean has been mapped.
- Ensuring proper attribution of data contributors and modern terms of use (e.g. free non-commercial use) that promote data sharing and are consistent with the needs of data contributors
- Continuing to grow broader international community of seafloor mapping experts
- Improving accreditation of GEBCO data usage.

Group 1 sees a dual role for GEBCO into the future - producing 1) comprehensive global bathymetry dataset, and 2) a supporting dataset including only measured bathymetry. Raising global awareness around the reality of the lack of seafloor measurement coverage is essential. GEBCO should be the authority on the statistics of seafloor data measurement coverage (and the identification of data gaps) and online material should be developed to support this. In addition, GEBCO has the potential to develop educational material on the nature and appearance of the seafloor by publishing images using a variety of social media formats.