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IOC-IHO/GEBCO XXVIII Guiding Committee

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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO )

INTERNATIONAL HYDROGRAPHIC ORGANIZATION

# General Bathymetric Chart Of The Oceans (GEBCO)

## Twenty-eighth Meeting of the GEBCO Guiding Committee

**October 7, 2011**

**at**
**Martin Johnson House**
**Scripps Institution of Oceanography**
**La Jolla, California, United States**

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**Chairman's opening remarks**. Chairman Robin Falconer opened the meeting by welcoming all participants, especially Etienne Cailliau who had not attended the Sub Committee meetings earlier in the week. He also thanked the Scripps Institution for Oceanography for hosting the meeting and NOAA for its sponsorship. Falconer reviewed the goals of the meeting and noted that the GGC must proactively direct the progress of GEBCO and must address the issues it faces. The agenda was slightly amended, being mostly a rearrangement of topics. See Annex 1.

**GEBCO organizational issues**.
GEBCO Treasurer. Falconer explained the need for formally naming a Treasurer of GEBCO. Also noted was that the GEBCO financial activities have moved from the University of Southampton to Stockholm University and that the University of New Hampshire has directly assumed the some of the financial activities of the GEBCO Nippon Foundation Student Training Program. David Clark was nominated to act as GEBCO Treasurer by Falconer, duties to be added to his secretarial duties. Discussion and vote on Clark as Treasurer (Clark excused himself from the discussion). Motion carried. Discussion on the Secretary/Treasurer stipend (previously was 5000 Euros for Secretary). GGC approved by consensus that the Secretary/Treasurer stipend will be 8000 EUR or 10,500 USD/year.

Vacancies on Guiding Committee. Falconer began discussion of the current membership of the GGC. He noted that Jose Fias has resigned. He had not been able to participate in the last GGC meeting. Several candidates have been suggested to take his vacancy. Walter Roest, from Ifremer in France, Suzanne Carbotte from Lamont-Doherty Earth Observatory in the USA and Bruce Goleby from Geoscience Australia were all discussed. Falconer reminded the committee of the "rule of national members." Motion made and carried to recommend Bruce Goleby be nominated to replace Fias on the GGC as an IOC representative. Falconer to notify Goleby and then recommend to IOC.

TSCOM membership/succession plan. Walter Smith stated that he has been chairman of the TSCOM (and its predecessor the Sub Committee on Digital Bathymetry) since 2004. It was suggested that Bruce Goleby be asked to serve as Vice Chairman. Falconer tasked Smith to propose a succession plan for the TSCOM.

**GEBCO Financial Report**
(See: http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Clark reported that in July 2011, GEBCO funds were transferred from University of Southampton to Stockholm University which amounted to $677,545USD for the Nippon Foundation Account and 17,823GBP for the GEBCO Operations Account. A portion of the funds from the Nippon Foundation Account will be used to support the Nippon Scholars Program at the University of New Hampshire for the 2010-2011 funding cycle. The Nippon Foundation Special Projects ($415,000) will be supported also from the Nippon Foundation Account at Stockholm University. In addition, for the 2011-2012 cycle, the Nippon Foundation transferred $555,000USD directly to University of New Hampshire to support the Scholars program. Chris Fox commented that the big financial issue for GEBCO will be to identify and secure new funds for the GEBCO Operations Account. Pauline Weatherall noted that funds from selling GEBCO data amounted to about 8000 pounds last year. This should continue, but at a lower level. Fox

suggested that some of the Nippon Funds can be used for NF scholars' travel but the Nippon Foundation does not like to pay overheads. It is speculated that the GEBCO Operations Account will be depleted in one to two years. Fox recommended that we should use whenever possible the Nippon Account and our remaining IHO funds as appropriate. Martin Jakobsson said that GEBCO needs a good scientific proposal as one way to raise GEBCO operations funds. Fox suggested that a proposal related to tsunamis or the deep ocean could be successful because of current interest in these themes. If GEBCO is successful with proposals, they must include a GEBCO Operations Account overhead. Tony Pharaoh noted that regional mapping is also of high interest and that the IOC now emphasizes seafloor mapping in its tsunami activities.

**IHO report**.
(See http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Steve Shipman presented the report from the International Hydrographic Organization on behalf of Captain Hugo Gorziglia who was unable to attend. As of September 2011, thirty-two Governments, out of a required forty-eight, have ratified the Protocol of Amendments to the IHO Convention which was approved by Member States at an Extraordinary International Hydrographic Conference in 2005. Once the Protocol of amendments has been ratified the major change for the IHO will be from a 5-yearly International Hydrographic Conference to a 3-yearly Assembly. A Council will meet annually to monitor the Work Plan and Budget approved by the Assembly. There will also be a much simpler route for States, not yet members, to become members of the IHO. The IHB will become the IHO Secretariat and the Assembly will elect a Secretary-General and two Directors. There has already been a restructuring of the Committees, as this is not dependent on the ratification of the Protocol of amendments. GEBCO now comes under the Inter-Regional Coordinating Committee (IRCC) to which it reports along with the Regional Hydrographic Commissions, the Hydrographic Committee on Antarctica and the World-Wide Navigational Warning Service Sub-Committee (WWNWS). GEBCO is urged to actively participate in the IRCC. There are currently 80 IHO member states with six more having applied to join. Areas of focus for IHO include (related to GEBCO): the availability of the Electronic Navigational Charts on ships; implementation of the S-100; developing and releasing S-101 in 2012; and, the resolving of a few issues with the IHO WG on Publication S-23 – Limits of Oceans and Seas.

Capacity building within IHO is based on the requirements of the RHCs and is overseen by the IHO Capacity Building Sub-Committee. Capacity Building activities are funded by the Capacity Building Fund which receives income from the IHO regular budget as well as some generous support from the Nippon Foundation and the Republic of Korea.

A number of staff changes have taken (or will take) place last year (and this next year.) Dan Costin has taken over as the Information Technology Assistant and Captain Alberto Costa Neves (Brazil) as Professional Assistant - Programme Management (PA-PM). Steve Shipman will retire the end of May 2012 and be replaced by Cdr David Wyatt. *(Post Meeting Note, the title "Professional Assistant" has been replaced by "Assistant Director".)* At the 18th 5-yearly International Hydrographic Conference three new IHO Directors will be elected, with one to be elected as President of the Directing Committee. Admiral Maratos and Captain Gorziglia will stand down, having completed their maximum 2 x 5-year terms. GEBCO is urged to attend the

IHC - XVIII where the immediate past and the next IHO five year plans will be discussed and approved.

Robin Falconer motioned that Steve Shipman be thanked for all of his hard work and tireless efforts in support of GEBCO. The GGC members approved enthusiastically with a round of applause.

**IRCC Report.**
(See http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Chris Fox reported on the Third Meeting of the IHO Inter-Regional Coordination Committee held at Directorate of Hydrography and Navigation (DHN) of the Brazilian Navy, Niteroi, Brazil, 26-27 May 2011. He attended the meeting and presented the GEBCO report.
(See http://www.gebco.net/about_us/presentations_and_publications/#ircc3). Fifty participants from the Regional Hydrographic Commissions provided reports as well as GEBCO. GEBCO's written and oral report included summary of GEBCO recent activities, as well as request to the RHCs to submit data to GEBCO and an offer to partner on tsunami readiness. Fox noted that it is critical for GEBCO contribute to the 2013-2017 IHO Workplan. It was reinforced that GEBCO consider having a representative at each of the relevant RHC meetings. It was suggested that the Nippon Scholars could work in partnership with the relevant RHCs. It should be noted that the IRCC has an active Capacity Building Sub-Committee. Fox especially referenced the Action IRCC03/17 inviting GEBCO and the regional bathymetric Chairs to attend corresponding RHC meetings with the emphasis on improving shallow water bathymetry.

In the discussion that followed the RHC's were matched up with potential GEBCO participants. This is reflected in Annex 3 (recently updated). Tony Pharaoh suggested that GEBCO put in a report to each of the RHC meetings. Jacobs recommended that it include the names of appropriate Nippon scholars as possible participants. Fox thought GEBCO should produce a standard presentation that could be used for the RHC meetings. Shipman said putting in GEBCO capacity building efforts was important. Weatherall pointed out that there is some RHC information on the GEBCO web site. It was suggested that perhaps IHO could support some of the travel to the RHC meetings. Therefore, it was recommended that this be part of the GEBCO IHO 2013-2017 Workplan.

**DCDB Report**
(See http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Lisa Taylor, Director of the IHO Data Center for Digital Bathymetry, gave a brief summary of the current activities of the DCDB. She noted that there is a need to enhance the IHO DCDB web site and this effort will be proposed as part of the GEBCO IHO 2013-2017 Workplan. Current activities include migrating the data at the DCDB from the FGDC to the ISO metadata standard; ensuring that proposed new undersea feature names are contributed to the DCDB; and completion of Phase 1 of the GEBCO Gazetteer Enhancement Project. She noted that new resources are needed to implement Phase 2 of this project, which includes providing the Gazetteer as a web service. If Phase 2 is completed it will optimize use of the Gazetteer in GIS and other digital applications like Google Earth. The new resources could come from Google, ESRI, etc. This has been proposed as part of the IHO GEBCO 2013-2017 workplan also. This

past year the DCDB hosted three Nippon Scholars and continues to work with the Regional Hydrographic Commission to encourage data exchange.

**IOC Report**

Robin Falconer gave a summary for the IOC since the IOC representative could not attend the meeting. Mitrasen Bhikajee, the Deputy IOC Executive Secretary is the new GEBCO contact. Luciano Fonseca, who was the previous IOC GEBCO contact, has left IOC for a position at the Engineering Department of the Federal University of Brasilia. Before leaving IOC, Foncesa attended Arctic-Antarctic Seafloor Mapping Meeting held in Stockholm in May 2011, along with Wendy Watson-Wright, IOC Executive Secretary. Dr. Watson-Wright voiced IOC's strong support for GEBCO. She noted that at the upcoming United Nations Conference on Sustainable Development, Rio +20. She is very keen on emphasizing the oceans and encourages GEBCO's participation. Fox recommended that after the SCRUM Terms of Reference are approved by IHO and IOC, GEBCO should recommend the SCRUM take the official lead in the IOC/IHO International Bathymetric Charting (IBC) projects. Shipman suggested that IHO could actively work with GEBCO to enhance IOC participation in GEBCO. Also noted was that IOC is very interested in Electronic Navigational Charting but does not have funding for it. In summary, Falconer observed because of recent activity, the IOC and GEBCO cooperation should be strengthened by mutual efforts and proactive follow-up.

**Digital Atlas Manager Report**

(See http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html) Pauline Weatherall, GEBCO Digital Atlas Manager, summarized the GEBCO database activities that are hosted at the British Oceanographic Data Center (BODC). Details can be found in her report, Annex 5. In 2010 there were over 9500 downloads for GEBCO data grids. The data grids are also available on DVDs. The GEBCO web site is very active with over 213,000 web pages viewed by 71,000+ visitors to the web site. The most popular web pages are the home page, world map and the GEBCO grids. She said an interesting aspect of the web traffic was that search engines and referring sites accounted as the most popular way to find the GEBCO site. Direct access was the least popular.

Starting the discussion, Weatherall asked members to send her new information to put on the web site. She particularly notes that GEBCO now has a Facebook page, a Twitter account and a RSS feed. She encourages their use. She is also interested in suggestions on how to improve all of these GEBCO electronic services. It was noted that this how many users, specially the younger generation, get their information.

Juan Brown, Director of the BODC, offered some insight on the support for these efforts. The host organization, the UK's National Oceanographic Center (NOC), has experienced some severe budget cuts. NOC's GEBCO funding is in two parts, one part to support the GEBCO Digital Atlas Manager activities at BODC and the other part supports the GEBCO Bathymetric Editor activities at NOC-Southampton (NOCS). The GEBCO activities at BODC are safe for at least 18 months, but the activities at NOCS has been completely eliminated. He noted that BODC strongly supports the GEBCO activities and he is actively looking at options for their continuation.

**Bathymetric Editor Report**
Colin Jacobs, the GEBCO Bathymetric Editor, started off the discussion reinforcing Juan Brown's comments noted above. As a result, his activities over the last year have been severely curtailed. He briefly described the Southeast Pacific Mapping Project. The project lead is Hugo Montoro, a former Nippon Scholar. He described briefly that a workshop was held in Cartagena, Columbia, and was very promising for national governments involvement in the project. He also noted some of the other mapping projects including the Indian Ocean mapping project and the Antarctic Mapping Project.

**iSCRUM Report**
(See http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Martin Jakobsson summarized the activities of the iSCRUM. These included kicking off the Indian Ocean Bathymetric Compilation (upcoming soon in 2012); GEBCO presentations at the Arctic and Baltic Hydrographic Commissions meetings; IBCAO and IBSCO presentations at the AGU 2010 Fall meeting; release of the IBSAO version 3.0 grid in 2012; and, the upcoming proposal of the IBSCO for involving a GIS specialist and Nippon Scholars. He noted that the GEBCO presentations at the ARHC and BSRHC recommended close liaisons with GEBCO and encouraged the exchange of high-resolution data for continental shelf areas. He gave special mention to the recent Arctic - Antarctic Seafloor Mapping meeting hosted by Stockholm University.
See: http://www.gebco.net/about_us/presentations_and_publications/#ibcao_ibcso_meeting
He encouraged Nippon Scholar participation in the next Arctic-Antarctic Mapping meeting.

**SCUFN report**
(See http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Hans-Werner Schenke reported on the recent SCUFN meeting held in Beijing, Peoples Republic of China, September 12-16, 2011. There were two vacancies on the subcommittee, one of which (IOC member) was filled by Shaohua Lin of the Peoples Republic of China. The vacancy open is an IHO representative. The meeting was well attended with 10 out of 12 members of the subcommittee present and 12 observers. There were 92 proposals for approval undersea feature names of which 81 were approved, one not approved, six pending and four removed from IHO B-8. For IHO-IOC publication B-6, Standardization of Undersea Feature Names, SCUFN requests approval of new definitions in the new edition, 4.1.0. He referenced the work being done to update IHO B-8, Gazetteer of Undersea Feature Names, and the effort to geospatially enable it. There will be a proposal to continue to fund this work. The next meeting of SCUFN is 24-26 October 2012 in Wellington, NZ.

Discussion of the feature name approval by the GEBCO Guiding Committee. Smith and Jakobsson remarked that in order to get this approval, the GGC would need to know the data behind the feature. Kunio Yashima pointed out the necessity of the flaw check of the Gazetteer, noting that it must be kept up to date accurately. Pharaoh noted that the list needed to be reviewed carefully.

The Guiding Committee recognized Bob Fisher for all of hard work and efforts over the years in chairing and working on the SCUFN. In turn, Dr. Fisher commended the current SCUFN for its dedication and tireless efforts in achieving their goals.

**TSCOM Report**
(See http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Walter Smith started by highlighting the GEBCO Science day. It was a great success and was well attended by the GEBCO meeting participants and the local scientific community. Emphasized in the presentations were some commercial presentations and several presentations on the historical aspects of ocean seafloor mapping. Smith requested that IHO announce the Science Day to the Member States and encourage participation. Discussion issues focused on the funding for Science Day (for invited speakers, etc.); outreach for broadening participation; and expanded effort needed for expanding Science Day.

He also noted the great benefit in having the TSCOM and iSCRUM meet in joint session. It encourages cooperative activities. This was evidenced by the TSCOM/iSCRUM members' interest shown in the breakout sessions on data flow, the GEBCO Cookbook and the regional mapping projects. Also discussed was the TSCOM-SCUFN interface and the need to have bathymetric data associated with a proposed undersea feature. TSCOM proposed several items for the GEBCO IHO 2013-2017 Workplan including mechanisms for working with RHCs; support for Science day and more innovative outreach (Facebook, YouTube, etc.) One aspect of this is the educational presentation about GEBCO and undersea features made by Hyo Hyun Sung. It is in the Korean language but TSCOM members volunteered to extend this to other languages. Since it is in KMZ files, it is easily implemented in Google Earth. Other TSCOM outreach activities include following up on the Marie Tharp book authored by Hali Felt and developing an YouTube video of coastal seafloor hazard assessment from seafloor mapping from the Science day presentations.

**Data Flow Workshop**
(See: http://www.gebco.net/about_us/meetings_and_minutes/gebco_df_workshop.html)
Chris Fox very briefly summarized the GEBCO Data Flow Workshop which was held at NGDC in Boulder, Colorado, USA, in March 2011. Representatives from the TSCOM, iSCRUM, the GEBCO Digital Atlas Manager and Bathymetric Editor and other GEBCO members attended this three-day workshop. The end result was defining organizational roles in a process for the compilation, archiving and publishing of GEBCO bathymetric data.

**Outreach Working Group report**
(See: http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)
Pauline Weatherall presented the GEBCO Outreach Working Group report on behalf of Paolo Lusiani. A major outreach activity this year was the distribution of the A3 size GEBCO world map at the Genoa Boat Show in October 2010. Over 400 maps were sold at a price of two Euros each and the public were very enthusiastic about the maps. Other contacts this year were NATO who is interested adding GEBCO layers to their maps; Museums and aquariums in Genoa, and Google. Future activities include implementing Prof Sung's educational packages, and enhancing GEBCO Facebook and web pages.

Starting off the discussion, Sung noted that UNESCO might be interested in the GEBCO educational packages supported by KHOA(Korea Hydrographic and Oceanographic Administration) and later the focus may be on primary and secondary school education. Falconer suggested that a curriculum could be developed for the GEBCO Globes. Bob Anderson thought

this could be a good project for the young Nippon Scholars. Having a GEBCO-developed curriculum for the globes would answer why globes are meaningful. Falconer noted the abundance of good outreach ideas and recommended that these be coalesced into one group with a plan and budget. Fox added that there should be a strategy to all of this. Smith noted that outreach was discussed at some length in the TSCOM meeting and recent disasters in Japan and Italy could show the public the utility of GEBCO data.

On a more philosophical note, Jakobsson said that in promoting GEBCO, we need say what we do and why we do it. Taylor reminded everyone that GEBCO's mission is to map the sea floor. Jacobs agreed and said we need a story to tell that will hold the public's interest. Taylor added that a handful of consistent stories would be better. Weatherall noted that imagery was very popular on the GEBCO web site so that may be an area of emphasis.

Falconer would like to see from the GEBCO Outreach Working Group a GEBCO Outreach Strategy in six months. It should emphasize the GEBCO mission of mapping the sea floor and what role GEBCO plays. Shin Tani said it should start from something attractive, a good story. Named to the Outreach working Group were: Taylor, Sung, Monahan, Felt, Smith, Lusiani, Travaglini, Tani, Morishita, Weatherall

**Update on the GEBCO Globes**

(See: http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html) *to be added*

Bob Anderson updated the status of the GEBCO Globes. On display were the 62, 32, 14 and 10.5 cm globes. There were produced by a Chinese company, DongXin. The globes were also displayed at the 2010 AGU meeting. The globes were very popular and 10 orders for the 62cm globes from academic institutions have been received as well as orders for the smaller globes.

Anderson discussed some of the issues with the globes. They need some minor revisions and for the smaller globes, the on-globe labels are too small to be read. Therefore, the smaller globes may have an accompanying sheet or a CD. Anderson and Jakobsson may need to go to China to address these and other labeling issues with DongXin. Anderson proposed ordering 60 of the 62cm globes on speculation. Falconer thought that we should hold off on ordering them until we get a good product. Anderson thought we needed to order these now or cancel the order. While he GGC was extremely satisfied with the Globe Project, it was proposed that we should wait until the product is improved. So moved by Falconer, Fox second, motion carried. Jakobsson, Schenke and Anderson were asked to resolved the issues of the globes.

**Outreach at Rio+20**

(See: http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html)

As an addition to the agenda, Dave Monahan described the upcoming UN Conference on Sustainable Development, Rio +20 to be held in Rio de Janeiro, Brazil, June 20-22, 2012. It is the 20th Anniversary of the Earth Summit. Monahan asked if GEBCO has a message to be conveyed at the Earth Summit. As noted in the GEBCO IOC report, IOC intends to have an "ocean" message at the Summit. If GEBCO has a message to convey, it must distinguish between issues e.g., global change, and activities, e.g., weather forecasting. Focusing on the oceans, there are many issues such as coastal development, rising sea level, disappearing fish

stocks, etc. Monahan asked how does GEBCO contribute. He suggested that we partner with the Nippon Foundation and IOC. By matching human activities in the ocean with Nippon Foundation activities then referencing them to ocean issues, are some areas where GEBCO could contribute if we partnered with the Nippon Foundation and IOC. See spreadsheet: http://www.gebco.net/about_us/meetings_and_minutes/ggc_2011_presentations.html) Falconer noted that the Nippon Foundation (Mr. Uno) asked what was GEBCO role in the oceans. Jakobsson asked where does GEBCO fit within the Earth Summit Conference. Fox noted that GEBCO could fit under the Oceans and Disasters themes. Weatherall observed that GEBCO is the definitive provider of bathymetric data for the global oceans.

**NF/GEBCO Training Project Management Committee report**

Falconer reported that the NF/GEBCO project management committee met for one half day on Thursday, October 5th. This was the first formal meeting of the new management committee and was attended by all members. At this meeting the status and directions of the Nippon Scholar Training program was discussed. In addition, each of the Nippon Special Training projects was reviewed in detail. These projects are Antarctic Mapping Project, Indian Ocean Mapping Project, and the Southeast Pacific Mapping Project. New potential projects and areas of emphasis will be post gradate (Doctorial?) programs for Nippon Scholars, proactive involvement of Nippon Scholars in RHCs and regional mapping projects, programs to train the NF Scholars to train other NF Scholars and participation of NF Scholars on ship cruises. Tani noted that the Nippon Foundation would be very pleased to have the NF Scholars working on RM projects and participating in regional hydrographic conferences.

**Discussion/Approval of GEBCO IHO Workplan 2013- 2017**

Chris Fox led this session which was a detailed line-by-line discussion of the draft GEBCO IHO workplan. After a lengthy discussion, it was decided that the GEBCO IHO workplan will consist of eight tasks: 1) Participate in annual meetings of relevant GEBCO bodies; 2) Monitor and advise the IHO Data Center for Digital Bathymetry (DCDB) operators on the operation of the IHO DCDB; 3) Promote and encourage States and authorities to contribute bathymetric data to the IHO DCDB; 4) Contribute to the maintenance and extension of the following IHO standards, specifications and publications; 5) Contribute to outreach and education about ocean mapping; 6) Support to continue to maintain the GEBCO Web site; 7) Development of short course and course material on compiling digital bathymetric models; and 8) Update and enhance the GEBCO Gazetteer.

**World map**

There was a brief discussion concerning the printing of the world map. The issue was whether GEBCO prints a small scale (large physical format) or another large scale (small physical format) Jakobsson noted that we could print on demand a large physical format version at various facilities worldwide. Discussion on the course of action. Falconer made a motion to print in quantity the small physical format version. Motion carried. The consensus was to try to make it an official IHO publication.

**Update on the status of IHO Publication B-7 "Guidelines for Ocean Mapping"**

Steve Shipman referred to the current version of the B-7, which was circulated before the meeting. Some of the need updates still missing were the IOC contribution, the SCRUM Terms

of Reference, updates on the metadata section (from Pharaoh), TORs for the GEBCO Bathymetric Editor (Jacobs); GEBCO Regional Mapping / Data Sets (Jakobsson) ; GEBCO Globes (Anderson) ; Outreach (Lusiani) and Data Specification (Taylor). Shipman would like everyone to review the acronyms. Nataliya Turko sent some comments to the GGC on the B-7. She asked about the title of the publication. Perhaps it should be titled "Guidelines for the General Bathymetric Chart of the Oceans." Shipman thought this was worthy of discussion at some point in the future. Turko also suggested expanding section 3.1 "Scientific Advisors." Shipman noted that there will not be a 6th printed edition of the GEBCO Chart Series. Also noted since CGOM does not exist in the IOC structure anymore, this reference needs to be changed in the GGC TORs. Shipman noted that a section on the GEBCO Cookbook would be appropriate.

Falconer moved to recognize Steve Shipman for his dedicated hard work on B-7. Motion enthusiastically carried.

**Approval of committee/sub-committee/working group structure**

Falconer made a motion to approve the SCRUM TOR. Motion carried. IHO will send a circular letter to IHO member states for approval. After approval, IHO will send to IOC for their approval. Falconer thanked Martin Jakobsson for his hard work in developing these Terms of Reference.

**Dates and Places of Next Meeting, 2012**

The dates and places for the next GEBCO meeting were discussed. Places discussed were Sweden, Southeast Asia, Columbia, Australia and Monaco (IHO). Since the IHO personnel will be stepping down and new personnel will be coming on board, Shipman recommended that the next meeting be held at IHO in the Principality of Monaco. It was tentatively decided that the first week on October would be a good time. Shipman will confirm and interact with GGC on this date. Falconer recommended that GEBCO send formal invitations to the IOC and the Nippon Foundation.

**Closing**

Robin Falconer thanked Scripps Institution of Oceanography, especially David Sandwell, for the excellent facilities and NOAA, especially Chris Fox, for the sponsorship of the meeting. He also thanked Brian Jackson, UCAR, for his through and efficient meeting support and Walter Smith, Hans Werner Schenke and Martin Jakobsson for their work with the GEBCO Subcommittees.

# Attendees

## Joint IOC-IHO GEBCO Guiding Committee

**IOC**
Dr. Robin Falconer (Chairman)
(Vacancy)
Dr. Martin Jakobsson (Chairman iSCRUM)
Dr. Hans-Werner Schenke (Chairman SCUFN)
Dr. Nataliya Turko (absent)

**IHO**
Ingénieur général Etienne Cailliau
Dr. Christopher Fox (Vice Chairman)
Commander Paolo Lusiani (absent)
Ms. Hyo Hyun Sung
Dr. Kunio Yashima

Mr. David Clark (Permanent Secretary)
Dr. Walter Smith (Chairman TSCOM)
Ms. Lisa Taylor (Director, IHO Data Center for Digital Bathymetry)

## Other Attendees

Juan Brown, British Oceanographic Data Centre, United Kingdom
PaulineWeatherall, British Oceanographic Data Centre, United Kingdom
Rochelle Wigley, Council for Geoscience, Australia
Anastasia Abramova Geological Institute, Russian Academy of Sciences
John Hall, Geological Survey of Israel
Tony Pharaoh, International Hydrographic Bureau, Monaco
Steve Shipman, International Hydrographic Bureau, Monaco
Colin Jacobs, National Oceanography Centre, United Kingdom
Robert Anderson, Science Applications International Corporation, USA
Robert Fisher, Scripps Institution of Oceanography, USA
Taisei Morishita, Secretariat of the Headquarters for Ocean Policy, Japan
Shin Tani, Secretariat of the Headquarters for Ocean Policy, Japan
Dave Monahan, University of New Hampshire, USA

# Annex 1

## Agenda

*DMC - Final 09/29/11*

09:00 – 09:10 Chairman's opening remarks — *R. Falconer*
- Goals of the meeting
- Agenda changes

09:10 – 09:25 GEBCO organizational issues — *R. Falconer*
- Treasurer
- Vacancies on Guiding Committee
- TSCOM membership/succession plan

09:25 – 09:40 GEBCO Financial Report — *D. Clark*
09:40 – 10:00 IHO report — *S. Shipman*
10:00 – 10:15 IHO/IRCC-3 meeting — *C. Fox*
10:15 – 10:30 IHO DCDB report – policy issues only — *L. Taylor*
10:30 – 10:50 IOC report
10:50 – 11:15 Digital Atlas Manager report - policy issues only — *P. Weatherall*
11:15 – 11:35 Bathymetric Editor report - policy issues only — *C. Jacobs*
11:35 – 12:00 SCUFN report — *H-W. Schenke*

12:00 – 13:00 Lunch

13:00 – 13:15 Arctic-Antarctic Seafloor Mapping Meeting — *M. Jakobsson*
13:15 – 13:30 Data Flow Workshop — *C. Fox*
13:30 – 14:00 TSCOM Report — *W. Smith*
14:00 – 14:30 iSCRUM Report — *M. Jakobsson*
14:30 – 14:45 IHO Publication B-7 "Guidelines for Ocean Mapping" — *S. Shipman*
14:45 – 15:15 Outreach Working Group report — *P. Weatherall*
15:15 – 15:30 GEBCO Globes — *R. Anderson*
15:30 – 16:00 NF/GEBCO training project management committee report — *R. Falconer*
16:00 – 16:15 Nippon Projects — *R. Falconer*
16:15 – 16:45 Discussion/Approval of GEBCO IHO Workplan 2013- 2017 — *C. Fox*
16:45 – 17:00 GEBCO Financial Plans/recap — *D. Clark*
17:00 – 17:15 Approval of committee/sub-committee/working group structure — *R. Falconer*
- SCRUM

17:15 – 17:30 Other Business — *R. Falconer*
17:30 – 17:35 Dates and Places of Next Meetings, 2012 and 2013 — *R. Falconer*
17:35 – 18:00 Action item review and wrap up — *Falconer & Clark*

Reference Documents:
1. SCRUM revised Terms of Reference (distributed via email)
2. GEBCO Data Flow Workshop Notes (distributed via email and posted on the GEBCO web)
3. Draft GEBCO IHO 2013 - 2017 Workplan (Initial ideas sent via email)
4. Draft IHO Publication B-7 "Guidelines for Ocean Mapping" (distributed via email)

# Annex 2

## Action Items

| Number | Action | Name | Due Date | Status |
|---|---|---|---|---|
| GGC28 – 01 | Develop, write and submit proposals for funding GEBCO Operations | Fox, Jakobsson, Pharaoh | | |
| GGC28 – 02 | Formerly submit the recommendation of Bruce Goleby as member of the GEBCO Guiding Committee to IOC | Falconer | | |
| GGC28 – 03 | Begin Preparations for GEBCO meeting in Monaco | Clark, Shipman, Falconer | | In progress |
| GGC28 – 04 | Follow-up on a GEBCO booth/exhibit at the 28th International Hydrographic Conference | Falconer, Shipman, Clark | | In progress |
| GGC28 – 05 | Develop a standard GEBCO presentation for use at Regional Hydrographic Conferences (RHC) (Also see T/S28-05) | Fox, Pharaoh, Smith, Jakobsson | | |
| GGC28 – 06 | Compile list of upcoming RHCs integrated with IBCs and potential Nippon Scholar attendees | Clark | 02/1/2011 | Completed |
| GGC28 – 07 | Schenke send list upcoming of RHC to Clark, Clark to distribute to GGC | Schenke, Clark | | Completed |
| GGC28 – 08 | Develop ideas for media involvement in Science day, distribute to GGC | Falconer, Hali Felt | | |
| GGC28 – 09 | Investigate availability of NOAA "print on demand" for GEBCO World Map | Fox | | |
| GGC28 – 10 | Notify B. Goleby that GGC has approved his appointment to the GGC | Falconer, Clark | | In progress |
| GGC28 – 11 | Develop a GEBCO Outreach strategy | Taylor, Sung, Monahan, Felt, Smith, Lusiani, Travaglini, Tani, Morishita, Weatherall | May 2012 | |

# Annex 3

| Potential GEBCO Contacts for IHO Regional Hydrographic Commissions and IOC International Bathymetric Projects. | | | | | | | | D.Clark 03/018/2012 |
|---|---|---|---|---|---|---|---|---|
| IHO Regional Hydrographic Commissions | | Meeting | Location | Date | IOC IBC project | GEBCO participants (to be confirmed) | | Possible other Participants (Nippon Scholars) |
| South West Pacific | SWPHC | 11th Meeting | Brisbane, Australia | 13 - 16 February 2012 | International Bathymetric Chart of the Western Pacific (IBCWP) | Shereen Sharma, Bruce Goleby | | James Daniell |
| South West Atlantic | SWAtHC | 6th Meeting | Montevideo, Uruguay | 15-16 March 2012 | | Walter Reynoso, Izabel Kling Jeck | | Christina Franco de LACERDA |
| North Indian Ocean | NIOHC | 12th Meeting | Colombo, Sri Lanka | 20 - 23 March 2012 | International Bathymetric Chart of the Western Indian Ocean (IBCWIO) | Rochelle Wigley, Colin Jacobs | | Kanlapati Srinivas, Muhammad BASHIR, Vasudev MAHALE, Priyantha Jinadasa, Mohammad Jashim Uddin |
| US Canada | USCHC | 35th Meeting | Niagara Falls, Canada | 14 May 2012 | International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA) | Chris Fox, Paola Travaglini, Lisa Taylor | | |
| Nordic | NHC | 56th Meeting | Copenhagen, Denmark | 21-23 May 2012 | International Bathymetric Chart Of The Arctic Ocean (IBCAO) | Martin Jakobsson | | Neil Tinmouth |
| North Sea | NSHC | 30th Meeting | Ålesund, Norway | 18-21 June 2012 | International Bathymetric Chart Of The Arctic Ocean (IBCAO) | Colin Jacobs | | |
| Baltic | BSHC | 17th Meeting | Helsinki, Finland | 18 - 20 September 2012 | | Martin Jakobsson | | Anastasia Abramova, Yulia Zarayskaya |
| East Asia | EAHC | 11th Conference | Bangkok, Thailand | September 2012 | International Bathymetric Chart of the Western Pacific (IBCWP) | 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 | ARHC | 3nd meeting | Tromsø, Norway | 9-11 October 2012 | International Bathymetric Chart Of The Arctic Ocean (IBCAO) | Martin Jakobsson | | Anastasia Abramova, Yulia Zarayskaya |
| East Atlantic | EAtHC | 12th Meeting | Lisbon, Portugal | 14-16 November 2012 | International Bathymetric Chart of the Central Eastern Atlantic (IBECA) | Colin Jacobs, Etienne Caillau | | Abubakar Mustapha, |
| MESO American & Caribbean Sea | MACHC | 13th Meeting | Antigua, Guatemala | 2012 | International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA) | Dagoberto Uriel David Viteri, Colin Jacobs | | Jorge Luis Heredia BUSTAMANTE, Leonardo TUN Humbert, Guillermo Humberto DIAZ PEÑA, Bernice Geraldine Mahabier |
| Southern Africa and Islands | SAIHC | 9th Meeting | TBD | 2012? | International Bathymetric Chart of the Western Indian Ocean (IBCWIO) | Rochelle Wigley, | | |
| ROPME Sea Area | RSAHC | 5th Meeting | Kuwait (TBC) | February 2013 | | | | |
| South East Pacific | SEPHC | 11th Meeting | Lima, PERU | June 2013 | International Bathymetric Chart of the South East Pacific (IBCSEP) | Hugo Montoro, Colin Jacobs | | Jose GIANELLA, Felipe Rafael BARRIOS Burnett, |
| Mediterranean and Black Sea | MBSHC | 18th Meeting | | 2013 | International Bathymetric Chart of the Mediterranean (IBCM) | John Hall, Paolo Lusiani | | |
| | | | | | | | | |
| IHO Commissions | | | | | | | | |
| IHO Hydrographic Commission on Antarctica | HCA | 12th Meeting | Montevideo or Punta Del Este, Uruguay | 10-12 October 2012 | International Bathymetric Chart of the Southern Ocean (IBCSO) | Hans Werner Schenke, Bruce Goleby | | |

# Annex 4

## Acronyms

| | |
|---|---|
| ABLOS | Advisory Board on the Law of the Sea |
| AGU | American Geophysical Union |
| BODC | British Oceanographic Data Centre |
| CCOM | Centre for Coastal and Ocean Mapping |
| CGOM | Consultative Group on Ocean Mapping |
| DCDB | Data Center for Digital Bathymetry |
| DHN | Direccion de Hidrografia y Navegacion |
| ENC | Electronic Navigational Chart |
| FGDC | Federal Geographic Data Committee |
| GA | Geoscience Australia |
| GGC | GEBCO Guiding Committee |
| GIS | Geographical information system |
| IBC | International Bathymetric Chart |
| IBCAO | International Bathymetric Chart of the Arctic Ocean |
| IBCSO | International Bathymetric Chart of the Southern Oceans |
| IHB | International Hydrographic Bureau |
| IHO | International Hydrographic Organization |
| IMO | International Maritime Organization |
| IOC | Intergovernmental Oceanographic Commission |
| IRCC | Interregional Coordination Committee |
| iSCRUM | Interim Sub-Committee for Regional Undersea Mapping (GEBCO) |
| LDEO | Lamont-Doherty Earth Observatory |
| NF | Nippon Foundation |
| NGDC | National Geophysical Data Center, Boulder (USA) |
| NOAA | National Oceanographic and Atmospheric Administration |
| NOC | National Oceanographic Center, (UK) |
| NOCS | National Oceanography Centre - Southampton |
| PMEL | Pacific Marine Environmental Laboratory |
| PRC | People's Republic of China |
| RHC | Regional Hydrographic Commission |
| RM | Regional Mapping |
| SCUFN | Sub-Committee on Undersea Feature Names (GEBCO) |
| ToR/RoP | Terms of Reference/ Rules of Procedure |
| TSCOM | Technical Sub-Committee on Ocean Mapping (GEBCO) |
| UNH | University of New Hampshire |
| UCAR | University Corporation for Atmospheric Research |
| WG | Working group |

**Annex 5**

# Report of the GEBCO Digital Atlas Manager (August 2010 – October 2011)

This report covers the work carried out at the British Oceanographic Data Centre (BODC) for GEBCO since the previous GEBCO meetings in September 2010.

In addition, Annex A includes statistics on the distribution of GEBCO's data sets. Annex B includes information on access to GEBCO's web site.

## 1. GEBCO's gridded bathymetric data sets

### Release of an updated version of the GEBCO_08 Grid

The latest version of the GEBCO_08 Grid, a global terrain model at 30 arc-second intervals, was released in November 2010. Originally published in January 2009, this is the third release of the data set and includes new bathymetric grids for the Weddell Sea, Caspian Sea and Black Sea regions. An accompanying updated Source Identifier (SID) Grid was also released.

Further details about this update can be found on GEBCO's web site:

- http://www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_08_update_history/version_20100927/
- http://www.gebco.net/about_us/news_and_events/updated_gebco_08_oct2010.html

### Updating the GEBCO_08 Grid – work in progress

It is aimed that the GEBCO_08 Grid will be updated frequently. The following details the update work currently in progress on some of the planned inclusions for the next release of the grid. Although contributing sources are detailed separately below, there is overlap in coverage between the data sets in some areas. This is taken into account as part of the update process.

This work has been carried out in collaboration with the GEBCO Bathymetric Editor, Colin Jacobs.

#### Waters around Australia

Geoscience Australia's (GA) gridded data set: 'Australian Bathymetry and Topography Grid, June 2009' (www.ga.gov.au/meta/ANZCW0703013116.html) has been supplied to GEBCO by Mr. Bruce Goleby of GA. The data set covers the area 92°E-172°E; 8°S-60°S and is at 9 arc-second intervals.

The bathymetric portion of the grid has been developed from a number of data sources,

including:

- Multibeam data
- Fairsheets (1:250,000 Series)
- Laser Airborne Depth Sounder (LADS) data
- ETOPO2v2g bathymetric grid

The sections of the GA grid based on Multibeam, Fairsheets and LADS data sets, mainly in near-shore regions were extracted and are being used to update the GEBCO_08 Grid.

The initial approach used to include the data in the existing GEBCO_08 Grid is to regrid both data sets together, separated by an interpolation band of three grid cells.

GA has kindly provided helpful feedback on the initial attempts at including data from their grid into the GEBCO_08 Grid.

**Lamont-Doherty Earth Observatory (LDEO) Global Multi-Resolution Topography (GMRT) synthesis**

The Lamont-Doherty Earth Observatory (LDEO) of Columbia University have provided over 9,600 data tiles from their Global Multi-Resolution Topography (GMRT) tile set (400m resolution) for updating GEBCO's grid. The data set contains significant data contributions in all ocean regions. However, some data sets are already included in the GEBCO_08 Grid.

The LDEO GMRT synthesis makes use of sonar data collected by scientists and institutions worldwide, merging them into a single continuously updated compilation of high-resolution seafloor topography. The synthesis began in 1992 as the Ridge Multibeam Synthesis (RMBS), was expanded to include multibeam bathymetry data from the Southern Ocean, and now includes other bathymetry from throughout the global and coastal oceans.

Further information about the source data set can be found on the GMRT web site: http://www.marine-geo.org/portals/gmrt/

Initial work has been done to investigate how to include data from the tile set into the existing GEBCO_08 Grid.

**Multibeam data**

A copy of the multibeam data held at the US National Geophysical Data Center (NGDC) which have been filtered to 500m resolution and then edited has been supplied by David Sandwell and colleagues of Scripps Institution of Oceanography (SIO) for GEBCO grid updating work. The data set consists of over 600 files, identified by their cruise name.

It is intended to look at the overlap between this data set and the LDEO GMRT tile set.

**Olex data**

As reported previously, Olex, a Norwegian company that produces mapping and visualisation software largely based on data collected from fishing vessels, has made available to GEBCO a sub-sample of their global marine soundings database. This data set is largely focussed in shallower water areas, mainly in the North Atlantic Ocean region. Part of the data set, for regions around the UK, has already been included in the GEBCO_08 Grid.

Work is being done to use Olex data to update the GEBCO_08 Grid for the coastal regions

- off the west coast of Africa from approximately 11°N to 33°N
- off Newfoundland and Nova Scotia

**South China Sea region**

As part of the initiative to request shallow water bathymetry data from hydrographic organisations to help improve GEBCO's grids in shallower water regions, bathymetry data extracted from ENCs has been received from the East Asia Hydrographic Commission for part of the South China Sea region (101°E-122°E; 5 22°S-26°N).
Over 12,200 soundings were received. 8,575 of these are in waters of a depth of 200m or shallower. Data for these shallower water regions has been used to update the GEBCO_08 Grid.

**North Atlantic Ocean – Gulf of Cadiz region**

A bathymetric grid, based on multibeam data, has been received for the Gulf of Cadiz region, west of the Strait of Gibraltar. The data set has been developed as part of a study into the fault system at the plate boundary between Eurasia and Africa in the central Atlantic.

Further information about the data set can be found in "The quest for the Africa–Eurasia plate boundary west of the Strait of Gibraltar: Zitellini, N., Gràcia, E., Matias, L., Terrinha, P., Abreu, M.A., DeAlteriis, G., Henriet, J.P., Dañobeitia, J.J., Masson, D.G., Mulder, T., Ramella, R., Somoza, L. and Diez, S. (2009). Earth and Planetary Science Letters, 280, (1-4), 13-50. (doi:10.1016/j.epsl.2008.12.005)".

**Great Lakes bathymetry**

It is intended to include bathymetry data for the Great Lakes (Michigan, Erie, Saint Clair, Ontario and Huron) in the next release of the GEBCO_08 Grid.

The US National Oceanic and Atmospheric Administration (NOAA) have been involved in a programme to compile Great Lakes bathymetric data and make them readily available to the public. This programme was managed by the US National Geophysical Data Center (NGDC) with the cooperation of NOAA/Great Lakes Environmental Research Laboratory, NOAA/National Ocean Service, the Canadian Hydrographic Service, other agencies, and academic laboratories. http://www.ngdc.noaa.gov/mgg/greatlakes/greatlakes.html

## 2. Release of a Web Map Service (WMS) for the GEBCO_08 Grid

An Open Geospatial Consortium (OGC) compliant Web Map Service (WMS) for the GEBCO_08 Grid was released in February 2011. A WMS is a means of accessing geo-referenced map images over the internet, which can be viewed in a web browser or Geographic Information System (GIS) and incorporated into web applications.

The bathymetric part of the WMS is based upon the GEBCO_08 Grid. Imagery for land areas is largely taken from the Blue Marble Next Generation data set produced by Reto Stöckli, the US National Aeronautical and Space Administration's (NASA) Earth Observatory (NASA Goddard Space Flight Center). For the region south of 60°S, coastline information is taken from the Scientific Committee on Antarctic Research's (SCAR) Antarctic Digital Database.

The methods and colour styling used in the generation of the GEBCO WMS image is based on imagery produced from the GEBCO_08 Grid by Dr. Martin Jakobsson.

Further details on how to access the WMS can be found on GEBCO's web site:

- http://www.gebco.net/data_and_products/gebco_web_services/web_map_service/
- http://www.gebco.net/about_us/news_and_events/gebco_08_grid_wms_release_2011.html

To date, there have been over 3,000 visits to the GEBCO WMS web pages hosted on GEBCO's and BODC's web sites.

It is planned that a tile-cached version of the WMS will be released shortly.

## 3. Development work

### CF compliant netCDF - developing versions of GEBCO's grids that use the climate and forecast (CF) metadata conventions

As reported previously, work has been done on developing a version of the GEBCO_08 grid that uses the conventions for climate and forecast (CF) metadata (http://cf-pcmdi.llnl.gov/). This work has been extended to include all GEBCO's gridded data sets.

The CF conventions have been designed to promote the processing and sharing of netCDF files. They define metadata that provide a description of what the data in each variable represents, and their spatial properties.

These conventions have been adopted by a number of projects and groups and are designed to be backward compatible with the Cooperative Ocean/Atmosphere Research Data Service (COARDS) conventions.

One of the requirements of the CF conventions is to use a 'standard name' to define the data set variables. A list of standard names is provided.

http://cf-pcmdi.llnl.gov/documents/cf-standard-names/

For GEBCO's gridded bathymetric data sets, as they use the convention of negative values for depths, it is intended to use the standard name: 'height_above_reference_ellipsoid'.

It is hoped that GEBCO's grids will shortly be made available in CF netCDF-compliant form.

## Delivering metadata for the GEBCO_08 Source Identifier (SID) Grid

The GEBCO_08 SID grid provides information on which cells in the GEBCO_08 Grid are based on soundings or existing grids and which have been interpolated. Currently, the grid is of the form of a 'yes/no' grid, i.e. cells are either labeled as 'constrained' (by soundings or existing grids) or 'interpolated'.

It is aimed to extend this so that metadata is delivered for the constrained grid cells – providing attribution to data providers and some quality assurance to users regarding the source of the contributed data.

Through email discussions with the GEBCO Metadata Working Group and GEBCO colleagues, a set of standard attribute fields for the SID file have been identified that would provide helpful metadata to users. Two sets of fields were defined, that is for survey data sets and for contributed grids.

Proposed SID file attribute fields for survey data sets:

- Cruise ID
- Chief Scientist or Investigator
- Contributing organisation
- Country
- Platform
- Device Type e.g. multibeam, singlebeam
- Device name (if known)
- Cruise Dates (start date and end date)
- URL to original dataset at repository (can be multiple)
- URL to the original metadata

Proposed SID file attribute fields for contributed grids:

- Originating Bathymetric Compilation and version number
- Additional metadata pertaining to the compilation
- Contributing organisation (if applicable)
- Contributing country (if applicable)
- URL to the original data set

- URL to accompanying metadata
- DOI or reference

It is suggested that, where possible, the content of the attribute fields should be described using published controlled vocabularies.

As a means of allowing users to view and interrogate the SID file and its accompanying metadata, it is aimed to develop a queryable Web Map Service for the SID Grid. This would allow individual grid cells/pixels within the WMS image to be queried and metadata associated with the corresponding grid cell in the GEBCO_08 SID Grid to be viewed and retrieved.

## 4. Making GEBCO's bathymetric data sets available

GEBCO's bathymetric data sets are made available, on behalf of GEBCO, by BODC via the internet and on DVD as part of the GEBCO Digital Atlas.

### Internet access

Through a web application, GEBCO's grids can be downloaded from the internet. Users can download global grid files or data for a user-defined geographic area.

Since its release in January 2009, there have been over 11,760 downloads of data from the GEBCO_08 Grid and over 20,260 downloads of data from all GEBCO's gridded data sets (i.e. GEBCO_08 Grid, SID Grid and GEBCO One Minute Grid).

GEBCO's grids can be accessed from:

- http://www.gebco.net/data_and_products/gridded_bathymetry_data/
- https://www.bodc.ac.uk/data/online_delivery/gebco/

Statistics detailing access to GEBCO's gridded data sets from the internet can be found in Annex A of this report.

### GEBCO Digital Atlas (GDA)

The GEBCO Digital Atlas is a collection of GEBCO's digital bathymetric data sets. The data sets can be viewed and accessed through a software interface. It is distributed on DVD.

The GDA was updated in November 2010 to include the latest release of the GEBCO_08 Grid.

Since its release in 2003, 1,624 copies of the GDA have been distributed. Further statistics about the distribution of the GDA can be found in Annex A of this report.

## 5. GEBCO's web site

Since July 2008, GEBCO's web site has been maintained and updated at BODC on behalf of GEBCO. It can be accessed at the domain www.gebco.net.

The web page content has been updated to reflect the release of new data sets and/or on request for content update by GEBCO colleagues.

During the year the following pages have been added to the site:

- Contributing data to GEBCO - http://www.gebco.net/about_us/contributing_data/
- Access to presentations and publications http://www.gebco.net/about_us/presentations_and_publications/
- GEBCO Web Map Service http://www.gebco.net/data_and_products/gebco_web_services/web_map_service/
- 3D globe images of the GEBCO_08 Grid http://www.gebco.net/data_and_products/gridded_bathymetry_data/grid_plots/
- Update and version history information for the GEBCO_08 Grid http://www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_08_update_history/version_20100927/
- Information for GEBCO's meetings http://www.gebco.net/about_us/meetings_and_minutes/gebco_science_day_2011/
- GEBCO data flow workshop http://www.gebco.net/about_us/meetings_and_minutes/gebco_df_workshop.html

The 'news and events' web pages (www.gebco.net/about_us/news_and_events/) are regularly updated during the year. Users can be kept informed about the release of news items via a Really Simple Syndication (RSS) feed.

Since the web site's re-launch in July 2008, there have been over 569,000 web pages viewed. Further statistics concerning access to GEBCO's web site can be found in Annex B of this report.

## 6. Data set user support

We have dealt with 153 email enquiries concerning GEBCO's data sets and products since September 2010. A number of these enquiries include requests for use of GEBCO's data sets in products.

Further information concerning some of these requests can be found in Annex A.

## 7. Contributing to the GEBCO Cookbook

The GEBCO Cookbook Working Group is developing a technical reference manual on methods for creating and evaluating bathymetric grids.

A draft section, concerning the use of ESRI ArcGIS Desktop software products for gridding and grid evaluation work, was submitted to the Working Group for use as part of the Software Overview chapter.

# Annex A

## Distribution of GEBCO's bathymetric data sets and products

This includes:

- Downloads of GEBCO's gridded data sets from the Internet
- Downloads of the Grid Viewing Software
- Distribution of the GEBCO Digital Atlas on DVD
- Enquiries received concerning the use of GEBCO's data sets

## 1. Internet downloads of GEBCO's gridded bathymetric data sets

### GEBCO_08 Grid

#### Since 01 September 2010

- Full global grid: 1,817
- User-selected sub-regions of the global grid: 3,795

#### Since release, 29 January 2009

- Full global data set: 3,939
- User-selected sub-regions of the global grid: 7,823

### GEBCO_08 Source Identifier Grid

#### Since 01 September 2010

- Full global grid: 825
- User-selected sub-regions of the global grid: 846

#### Since release, 27 November 2009

- Full global data set: 1,210
- User-selected sub-regions of the global grid: 1,150

### GEBCO One Minute Grid

#### Since 01 September 2010

- Full global data set: 997
- User-selected sub-regions of the global grid: 1,308

#### Since 01 January 2009

- Full global data set: 3,041
- User-selected sub-regions of the global grid: 3,100

## 2. Internet downloads of viewing software for displaying and accessing data from GEBCO's grids

- Total number of downloads since January 2009: 7,079
- Total number of downloads since September 2010: 3,227

## 3. Distribution of the GEBCO Digital Atlas (GDA)

Since 01 September 2010, 97 copies of the GDA have been distributed. This includes copies sold to commercial companies and complimentary copies given, for example, to participants on training courses.

Since its release in 2003, 1,624 copies of the GDA have been distributed.

## 4. Use of GEBCO's data sets in products

Data from the GEBCO_08 Grid and GEBCO Undersea Feature Names Gazetteer are being used in ESRI's online mapping system Ocean Basemap: http://www.arcgis.com/home/

The GEBCO_08 Grid is being used as background imagery in deeper water regions OpenSeaMap – a web-based mapping application:
http://openseamap.org/index.php?id=openseamap&L=1

# Annex B

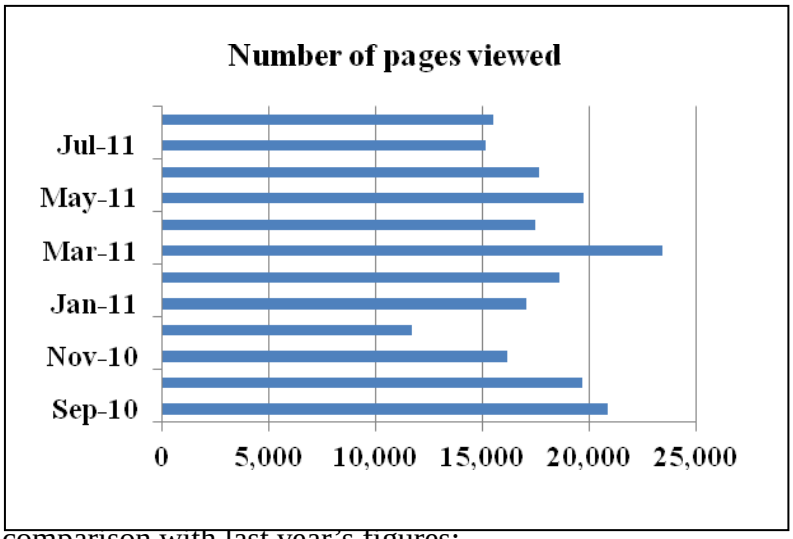
GEBCO's web site was relaunched in July 2008; since then there have been over 569,000 visits to the web site. The web site is maintained, on behalf of GEBCO, by the British Oceanographic Data Centre (BODC).

## 1. Visits to GEBCO's web site

The following tables and diagrams provide statistics about access to GEBCO's web site (www.gebco.net) for the period 1st September 2010 to 13th September 2011.

In summary, there were over 71,700 visitors to the site, viewing over 213,000 pages.

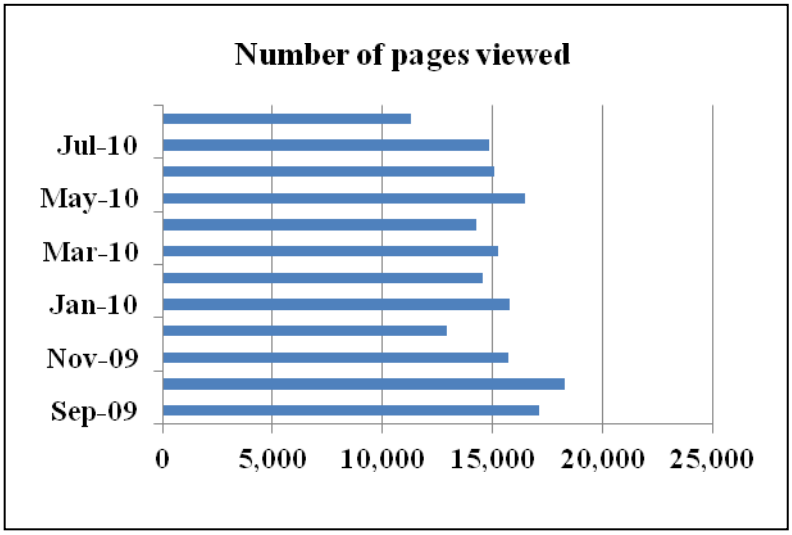
| Month | Number of pages viewed |
|---|---|
| Sep-10 | 20,863 |
| Oct-10 | 19,682 |
| Nov-10 | 16,144 |
| Dec-10 | 11,685 |
| Jan-11 | 17,082 |
| Feb-11 | 18,618 |
| Mar-11 | 23,450 |
| Apr-11 | 17,485 |
| May-11 | 19,769 |
| Jun-11 | 17,639 |
| Jul-11 | 15,166 |
| Aug-11 | 15,492 |




For comparison with last year´s figures:

| Month | Number of pages viewed |
|---|---|
| Sep-09 | 17,132 |
| Oct-09 | 18,307 |
| Nov-09 | 15,733 |
| Dec-09 | 12,946 |
| Jan-10 | 15,788 |
| Feb-10 | 14,578 |
| Mar-10 | 15,264 |
| Apr-10 | 14,270 |
| May-10 | 16,468 |

| | |
|---|---|
| Jun-10 | 15,098 |
| Jul-10 | 14,850 |
| Aug-10 | 11,282 |




## 2. Number of visits to individual GEBCO web pages

The following table details the number of visits to the most popular pages on GEBCO's web site.

Explanation of terms used:

| | |
|---|---|
| **Page title and URL** | Title of the GEBCO web page viewed with URL |
| **Page views** | The total number of pages viewed. Repeated views of a single page are counted. |
| **Average time on page (minutes)** | The average amount of time that visitors spent viewing this set of pages or page. |

| Page title and URL | Page views | Average time on page (minutes) |
|---|---|---|
| **GEBCO World map**<br><br>www.gebco.net/data_and_products/gebco_world_map/index.html | 37,357 | 01:18 |
| **GEBCO home page**<br><br>www.gebco.net/index.html | 36,750 | 01:04 |
| **GEBCO's grids***<br><br>www.gebco.net/data_and_products/gridded_bathymetry_data/index.html | 34,323 | 01:33 |
| **GEBCO Digital Atlas**<br><br>www.gebco.net/data_and_products/gebco_digital_atlas/index.html | 12,630 | 00:55 |
| **GEBCO's data and products**<br><br>www.gebco.net/data_and_products/index.html | 8,867 | 00:22 |

| | | |
|---|---|---|
| **External link to grid data download page*** www.bodc.ac.uk/data/online_delivery/gebco/index.html | 8,448 | 05:50 |
| **Grid display software** www.gebco.net/data_and_products/grid_display_software/index.html | 5,731 | 01:17 |
| **Undersea Feature Names Gazetteer** www.gebco.net/data_and_products/undersea_feature_names/index.html | 5,332 | 01:32 |
| **Contact details** www.gebco.net/about_us/contact_us/index.html | 3,340 | 02:03 |
| **GEBCO world map JPEG image** www.gebco.net/data_and_products/gebco_world_map/images/gda_world_map_large.jpg | 3,196 | 04:09 |
| **Hard copy charts** www.gebco.net/data_and_products/hard_copy_charts/index.html | 3,196 | 00:56 |
| **3D globe images of the GEBCO_08 Grid** www.gebco.net/data_and_products/gridded_bathymetry_data/grid_plots/index.html | 3,014 | 01:08 |
| **GEBCO Nippon Foundation Training Project** www.gebco.net/training/training_project/index.html | 2,938 | 03:13 |
| **GEBCO WMS release news item** www.gebco.net/about_us/news_and_events/gebco_08_grid_wms_release_2011.html | 2,915 | 01:04 |
| **Mapping projects** www.gebco.net/regional_mapping/mapping_projects/index.html | 2,881 | 01:17 |
| **Regional mapping overview** www.gebco.net/regional_mapping/index.html | 2,754 | 00:18 |
| **GEBCO_08 Grid release news item** www.gebco.net/about_us/news_and_events/updated_gebco_08_oct2010.html | 2,408 | 01:01 |
| **GEBCO Web Map Service** | 2,219 | 02:42 |

| | | |
|---|---|---|
| www.gebco.net/data_and_products/gebco_web_services/web_map_service/index.html | | |
| **Training overview web page**<br><br>www.gebco.net/training/index.html | 1,796 | 00:42 |
| **Committees and groups**<br><br>www.gebco.net/about_us/committees_and_groups/index.html | 1,686 | 01:52 |
| **Adobe PDF of GEBCO_08 Grid documentation**<br><br>www.gebco.net/data_and_products/gridded_bathymetry_data/documents/gebco_08.pdf | 1,574 | 04:13 |
| **GEBCO overview**<br><br>www.gebco.net/about_us/overview/index.html | 1,571 | 01:23 |
| **GEBCO web services overview**<br><br>www.gebco.net/data_and_products/gebco_web_services/index.html | 1,530 | 00:18 |
| **Annual GEBCO Science Day**<br><br>www.gebco.net/about_us/gebco_science_day/index.html | 1,484 | 01:26 |

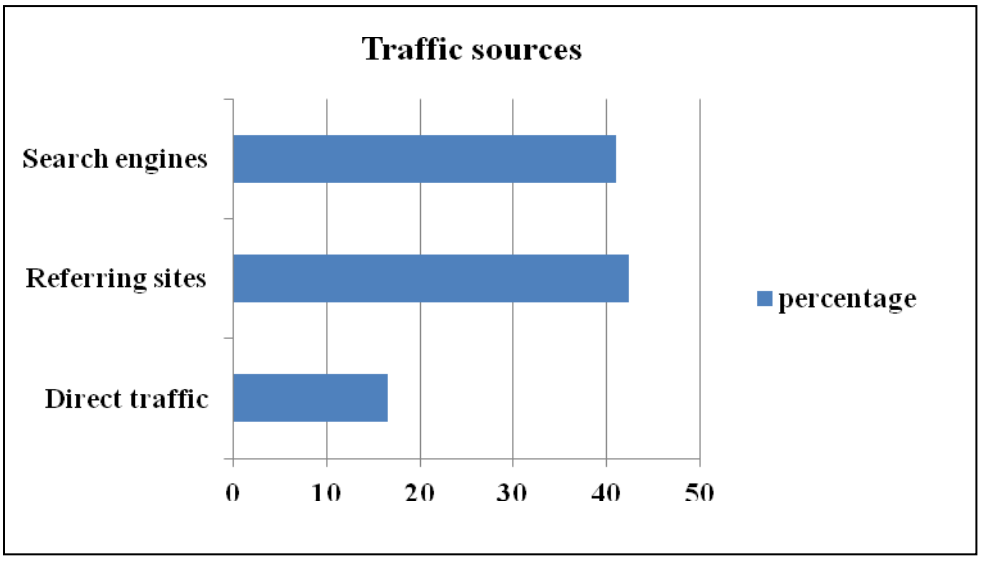
*See Annex A for details on Internet downloads of GEBCO's gridded bathymetric data sets.

## 3. Traffic sources to GEBCO's web site

The following section details the routes used to find GEBCO's web pages.

Explanation of terms used:

| | |
|---|---|
| Direct traffic | The user has entered the URL of a GEBCO web page directly |
| Search engines | Web pages found by searching using a keyword in a search engine such as Google or Yahoo etc. |
| Referring sites | Web page found by following a link from another web site |




The table below details how users are finding GEBCO's web site, either directly, using keywords in a search engine or from referral sites. The 'top 24' traffic sources are listed.

Explanation of terms used:

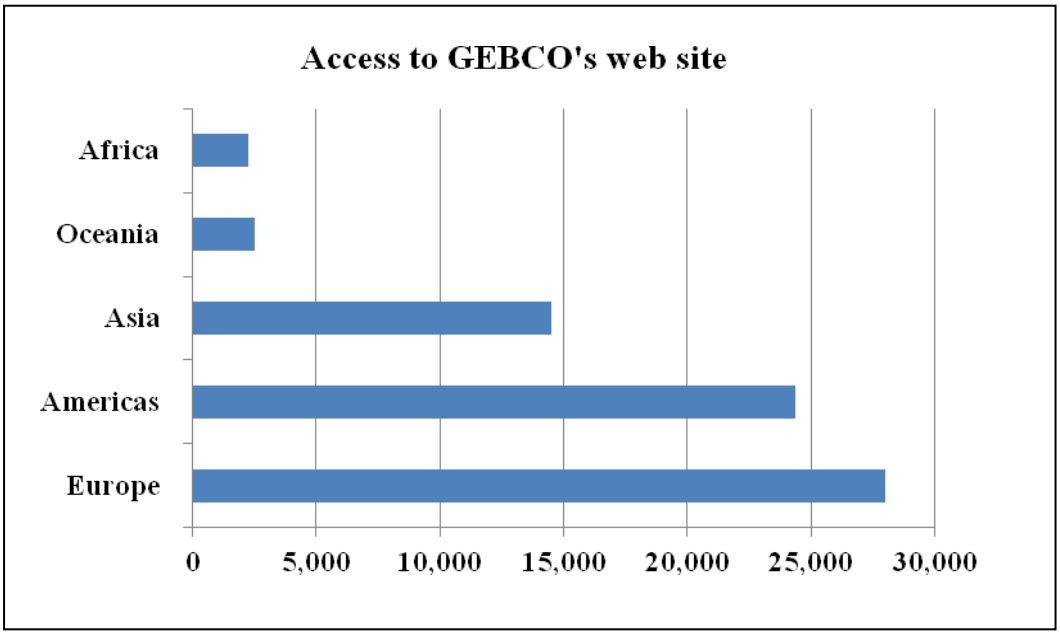
| | |
|---|---|
| **Source** | The source of traffic to the site, e.g. the name of the referral site or search engine: |
| **Medium** | The type of traffic:<br>Organic = search engine<br>Referral = from an external web link<br>(none) = direct – i.e. the user has entered the URL of a GEBCO web page |
| **Visits** | The number of visits to the site |
| **Pages/visit** | The average number of pages per visit |
| **Average time on site (minutes)** | The average amount of time spent on the site in minutes |

| Source/Medium | Visits | Pages/visit | Average time on site (minutes) |
|---|---|---|---|
| google / organic | 26,039 | 3.39 | 03:27 |
| (direct) / (none) | 11,942 | 2.64 | 02:46 |
| google.com / referral | 6,325 | 1.60 | 00:50 |
| ngdc.noaa.gov / referral | 4,370 | 4.14 | 04:07 |
| en.wikipedia.org / referral | 1,615 | 4.07 | 03:41 |
| google.co.uk / referral | 1,523 | 1.58 | 00:42 |
| bing / organic | 1,309 | 2.18 | 01:49 |
| yahoo / organic | 931 | 2.43 | 01:46 |
| google.co.in / referral | 890 | 1.50 | 00:54 |

| | | | |
|---|---|---|---|
| bodc.ac.uk / referral | 761 | 4.04 | 03:59 |
| iho-ohi.net / referral | 701 | 3.88 | 04:20 |
| google.ca / referral | 599 | 1.61 | 00:59 |
| de.wikipedia.org / referral | 411 | 4.38 | 03:20 |
| google.com.au / referral | 411 | 1.52 | 00:51 |
| google.fr / referral | 369 | 1.61 | 01:16 |
| google.de / referral | 305 | 1.90 | 01:01 |
| iisee.kenken.go.jp / referral | 305 | 2.12 | 02:10 |
| arcgis.com / referral | 301 | 3.16 | 03:12 |
| ime.nu / referral | 262 | 1.50 | 00:28 |
| images.google.com / referral | 249 | 1.55 | 00:50 |
| google.com.br / referral | 248 | 1.73 | 01:33 |
| jmc.or.jp / referral | 240 | 2.32 | 01:26 |
| google.nl / referral | 230 | 1.76 | 00:54 |
| openseamap.org / referral | 215 | 4.37 | 02:31 |

## 4. Geographic distribution of Internet Protocol (IP) addresses accessing GEBCO's web site

The diagram below outlines the numbers per continent of IP addresses accessing GEBCO's web site.




The table below details the geographic distribution by country (top 25 'number of visits' listed) of IP addresses accessing GEBCO's web site.

Explanation of terms used:

| | |
|---|---|
| **Country/Territory** | The name of the country or territory of the origin of the IP address accessing GEBCO's web site |
| **Visits** | The total number of visits to the site from this country/territory |
| **Pages/visit** | The number of pages viewed per visit |
| **Average time on site (minutes)** | The average amount of time that visitors spent on the site |

| Country/Territory | Visits | Pages/visit | Average time on site (minutes) |
|---|---|---|---|
| United States | 16,345 | 2.62 | 02:10 |
| United Kingdom | 6,642 | 2.61 | 02:06 |
| Germany | 3,669 | 3.50 | 03:01 |
| France | 2,912 | 3.59 | 03:07 |
| Canada | 2,750 | 2.99 | 03:05 |
| Japan | 2,353 | 2.98 | 02:50 |
| India | 2,258 | 2.50 | 02:16 |
| Italy | 2,235 | 3.18 | 02:50 |
| Spain | 2,210 | 3.46 | 02:56 |
| Australia | 1,841 | 2.71 | 02:47 |
| Russia | 1,630 | 3.70 | 03:55 |
| Indonesia | 1,571 | 2.73 | 03:39 |
| Brazil | 1,437 | 3.00 | 03:36 |
| China | 1,275 | 3.26 | 04:28 |
| Norway | 1,128 | 2.46 | 02:06 |
| Mexico | 946 | 3.44 | 04:26 |
| Netherlands | 939 | 3.03 | 02:37 |
| Portugal | 906 | 3.10 | 02:40 |
| Philippines | 863 | 1.92 | 02:03 |
| South Korea | 834 | 3.88 | 03:46 |
| Chile | 722 | 3.58 | 04:07 |
| Thailand | 635 | 2.55 | 02:46 |
| New Zealand | 599 | 2.92 | 02:56 |
| Turkey | 570 | 3.05 | 02:54 |
| Malaysia | 565 | 2.34 | 03:18 |

## 5. GEBCO and social media web sites

In order to engage the general public in GEBCO's work, GEBCO has accounts on the social media sites Facebook and Twitter. GEBCO's news items and additional information have been

posted on the sites. To date, GEBCO's Facebook profile has 158 friends and we have 36 Followers on Twitter. Access to GEBCO's profile on these sites is as follows:

- Facebook: www.facebook.com/GEBCO
- Twitter: http://twitter.com/#!/gebcobathymetry

P. Weatherall (paw@bodc.ac.uk) 30th September 2011

**International Hydrographic Organization**
**Data Center for Digital Bathymetry**
**World Data Center for Geophysics and Marine Geology at Boulder**
**And**
**United States Department of Commerce**
**National Oceanic and Atmospheric Administration**
**National Environmental Satellite, Data, and Information Service**
**National Geophysical Data Center**

# Report to the Technical Sub-Committee on Ocean Mapping of the


**October 2011**
**La Jolla, California USA**

# Table of Contents



### Appendices

# I. REPORT OF THE INTERNATIONAL HYDROGRAPHIC ORGANIZATION DATA CENTER FOR DIGITAL BATHYMETRY

The National Geophysical Data Center (NGDC) in Boulder, Colorado, USA, operates a digital data bank of global ocean soundings on behalf of the 80 member countries of the Monaco based International Hydrographic Organization (IHO). In 1988, NGDC offered to host a bathymetry data center on behalf of the IHO, which led to the formal establishment of the IHO Data Centre for Digital Bathymetry (DCDB) in June 1990. The IHO DCDB has made substantial progress toward establishing itself as the focal point for digital hydrographic data services for IHO member states.

Since the September 2010 Meeting of the General Bathymetric Chart of the Oceans (GEBCO) Technical Sub-Committee on Ocean Mapping (TSCOM), NGDC has responded to 9 international requests for marine geology and geophysics data, and 82 sales requests from 7 countries. All requests were from IHO member states. During the reporting period, NGDC received 58% fewer requests than were received last year. Printed materials used by educators and bathymetric maps used by the fishing industry continue to be the bulk of products shipped by NGDC, as most digital data is available online free of charge.

## I-A. IHO DCDB Website

NGDC stands ready to coordinate with the IHO to update and restructure the IHO DCDB website. NGDC used custom software from the U.S. Extended Continental Shelf Project to make several website enhancements this year. The improvements feature interactive displays and search functions, and user-friendly tools for data and metadata search, display, and submittal. Users can access multibeam sonar data, track line geophysical data, and bathymetric/topographic digital elevation models (DEM), as well as point soundings archived at NGDC, and metadata not archived at NGDC from one web page. The website restructuring is part of a larger IHO effort to encourage Regional Hydrographic Commission members to submit data and metadata to the IHO DCDB. Continuation of website update and outreach efforts will require dedicated financial support from the IHO.

## I-B. Bathymetric Data Holdings

Over the reporting period, NGDC received 1.1 terabytes of deep-water multibeam data from 201 surveys. Significant contributions included surveys from the Lamont-Doherty Earth Observatory (26), the National Science Foundation Rolling Deck to Repository program (114), Scripps Institution of Oceanography (8), NOAA (20), the University of New Hampshire (3), and the Brazilian Navy (2). The Multibeam Bathymetric Database now contains 6.0 terabytes of data from 1,761 cruises. Since the start of the National Science Foundation Rolling Deck to Repository program, NGDC has downloaded and archived 11 terabytes of associated raw ship sensor data.

NGDC multibeam data can be accessed using two online interactive mapping tools. The first is a multibeam dataset map with query capabilities located at http://maps.ngdc.noaa.gov/viewers/multibeam/. The second is a bathymetry map containing all NGDC bathymetric data located at http://maps.ngdc.noaa.gov/viewers/bathymetry/. In addition, NGDC also provides an interactive website that allows users to generate color relief maps and bathymetric grids using NOAA's Pacific Marine Environmental Laboratory (PMEL) AutoChart, Generic Mapping Tools (GMT), and MB-System software. Maps and grids are output in Postscript and GMT formats, respectively. Most datasets have associated Federal Geographic Data Committee (FGDC) metadata files that users can view online. Users can also download metadata with the described full resolution source data.

During the reporting period, NGDC made publicly available 322 hydrographic surveys representing 66TB of data, as well as 3,929 binary Bathymetric Attribute Grid (BAG) files. For users not familiar with the BAG file format, NGDC provides an online tool that translates BAG files into an XYZ text file that contains depth and uncertainty data. For more information about the BAG file format and the Open Navigation Surface Working Group (ONSWG), please visit http://www.opennavsurf.org.

NOAA National Ocean Service (NOS) hydrographic survey data is accessible to the public through an interactive map service at http://maps.ngdc.noaa.gov/viewers/nos_hydro/. Data available through the map service includes over 9,724 NOS Descriptive Reports and associated metadata, 23,483 final smooth sheet images scanned from original corrected survey area plots, and high resolution multibeam and sidescan sonar files. Map service data may be in many forms, including Extensible Markup Language (XML) metadata documents, survey plots, American Standard Code for Information Interchange (ASCII) XYZ sounding data, files in Hydrographic Surveys Data Exchange Format (HYD93), sidescan sonar mosaics, shaded-relief images, and gridded data in text and BAG file formats.

### I-C. Marine Trackline Geophysics Dataset

During the reporting period, 3.3 million soundings from 17 cruises were added to the global Marine Trackline Geophysics database, which now contains 54.1 million soundings from 4884 cruises. Users can access the Marine Trackline Geophysics Database by visiting http://maps.ngdc.noaa.gov/viewers/geophysics/ and http://www.ngdc.noaa.gov/mgg/gdas/ims/trk_cri.html.

### I-D. Global Database Management and GEODAS Software Development

The GEODAS Grid Translator, located at http://www.ngdc.noaa.gov/mgg/gdas/gd_designagrid.html, offers translation of GEODAS gridded databases to several formats using various grid parameter options. Users can create and download custom grids of the NGDC ETOPO1, U.S. Coastal Relief Model, and (U.S.) Great Lakes Bathymetry gridded datasets.

NGDC's domestic single-beam, multi-beam, and sidescan sonar databases have been migrated to a spatially enabled Oracle Relational Database Management System (RDBMS) to aid data managers in maintaining data consistency across other NOS databases, and to increase overall data quality and search ability. This migration has led to development of an alternative tab-delimited format, MGD77T, which overcomes some of the limitations of the fixed length MGD77 records. NGDC currently provides data in both MGD77 and MGD77T formats. Users can learn about this new data format at http://www.ngdc.noaa.gov/mgg/dat/geodas/docs/mgd77.pdf

## II. REPORT OF THE WORLD DATA CENTER FOR GEOPHYSICS AND MARINE GEOLOGY, BOULDER

NGDC, in its capacity as the World Data Center for Geophysics and Marine Geology (WDC-GMG), promotes excellence in archiving, managing, and exchanging data obtained from measurements of the seafloor. NGDC works with national and international groups on many projects outside the scope of the IHO DCDB, GEBCO, and Intergovernmental Oceanographic Commission (IOC) Regional Mapping Projects. Although the WDC-GMG manages all types of ocean floor data, including descriptions and analyses of seafloor samples, deep sea drilling data, ship trackline geophysical measurements, and derived gridded data sets, this report focuses exclusively on bathymetric data.

### II-A. Tsunami Research and Training Activities

NGDC is actively involved in several activities that support Tsunami research and mitigation.

## II-A-1. Digital Elevation Models of U.S. Coastal Zones

NGDC builds high resolution digital elevation models (DEMs) for select coastal regions to support tsunami forecasting and modeling efforts at the NOAA Center for Tsunami Research, Pacific Marine Environmental Laboratory (PMEL), the National Tsunami Hazard Mitigation Program, the Hurricane Forecast Improvement Program (HFIP), and NOAA's National Ocean Service (NOS). DEMs are useful for coastal process modeling, ecosystem management and habitat research, coastal and marine spatial planning, and hazard mitigation and community preparedness.

Bathymetric, topographic, and shoreline data used in DEM compilation are obtained from various sources, including NGDC, NOS, the U.S. Geological Survey (USGS), the U.S. Army Corps of Engineers (USACE), the U.S. Federal Emergency Management Agency (FEMA), and other federal, state, and local government agencies, academic institutions, and private companies. DEM construction utilizes North American Vertical Datum of 1988 (NAVD 88), or mean high water (MHW), tidal datum, and World Geodetic System 1984 geographic (WGS 84), or North American Datum of 1983 (NAD 83), horizontal datum. DEM cell sizes range from 1/3 arc-second (~10 meters) to 3-arc-seconds (~90 meters).

Between August 2010 and July 2011, NGDC completed 19 coastal DEMs. Since the start of the DEM development project in 2006, NGDC has developed 90 DEMs covering all of Puerto Rico and portions of the U.S. East, West, Gulf, Hawaiian, and Alaskan coasts, as well as several Pacific Islands. Users may view planned DEMs and download completed DEMs with corresponding metadata and documentation at http://www.ngdc.noaa.gov/mgg/coastal/coastal.html.

## II-A-2. Online Access to Tsunami Data

As an important component of the global effort to mitigate tsunami impacts, NGDC provides long-term archive, data management, and access to global tsunami data. Archived data includes a global historical tsunami database, a tsunami deposits database, bottom pressure recordings (temperature and pressure from BPR and Deep Ocean Assessment and Reporting of Tsunamis – DART® buoys), U.S tide gauge data, and related hazards. Tsunami data is stored in spatially enabled Oracle tables and are accessible online through web forms, interactive maps, map services, and KML files at http://www.ngdc.noaa.gov/hazard/tsu.shtml.

## II-B. United States & Canada Cooperation on Great Lakes Bathymetry

NGDC/WDC collaborated with NOAA's Office of Oceanic and Atmospheric Research (OAR) Great Lakes Environmental Research Laboratory (GLERL) and the Canadian Hydrographic Service (CHS) in a long-term international effort to produce bathymetric contours for Lakes Ontario, Michigan, Erie, St. Clair, and Huron. NGDC maintains web pages for Great Lakes bathymetry at http://www.ngdc.noaa.gov/mgg/greatlakes/. During the reporting period, the Great Lakes websites received an average of 35,765 visits per month, and users downloaded approximately 4.0 gigabytes of data per month.

## II-C. United States & Canada Develop Tsunami Propagation and Inundation Models

NGDC and NOAA's Pacific Marine Environmental Lab (PMEL) are collaborating with the Canadian Hydrographic Service (CHS) to create Digital Elevation Models (DEMs) to enhance tsunami forecast models and warnings issued by the West Coast Tsunami Warning Center. The CHS provided NGDC with digital bathymetry files and gridded bathymetric data for the west coast of Canada. NGDC compiled these data into high resolution DEMs for use by both nations. A data sharing agreement is in place to formalize this collaboration between the three partners. NGDC used the data provided by the CHS to develop the Port Townsend, Washington, and San Juan Islands DEMs.

## II-D. World Data Center for Geophysics and Marine Geology, Boulder, Online Activities

The web pages of the World Data Center for Geophysics and Marine Geology (WDC-GMG), Boulder, averaged 3.9 million visits, and users downloaded an average of 4.9 terabytes, for each month of the reporting period. Compared to 2010 metrics, website visits and data downloads decreased by 17% and 2.8%, respectively. The WDC-GMG website is at http://www.ngdc.noaa.gov/mgg/wdc/wdcgmg.html.

# III. REPORT OF NGDC ACTIVITIES IN SUPPORT OF IOC/GEBCO

## III-A. GEBCO Reviewers' Reports

### III-A-1. Assessment of Gridding Techniques

NGDC developed a computer program to quantify the effects of different gridding algorithms (e.g., spline, kriging, inverse distance weighting) and near-shore morphologic features on the vertical accuracy of integrated bathymetric-topographic digital elevation models (DEMs). The program utilizes a split-sample methodology in which a percentage of the XYZ points are omitted, a gridding algorithm is applied, and the interpolation errors are quantified as the differences between the interpolated elevations and the omitted elevations. Products generated by the program include a grid of the interpolation errors, a histogram of these errors, and statistical measurements such as the minimum, maximum, mean, and root-mean-square error (RMSE). NGDC is using these products to assess the effects of different gridding algorithms and near-shore morphologic features on the vertical accuracy of DEMs in areas with varying relief and data density. The split-sample computer program is also useful for determining the optimal gridding algorithm parameters based on surface relief and data density in order to minimize DEM interpolation errors.

NGDC is using quantification of the relationships between interpolation error, seafloor morphology, and data density to aid in modeling DEM vertical uncertainty created by the gridding process. This process will enhance understanding of the spatial variability of DEM uncertainty introduced by gridding algorithms, and the propagation of uncertainty into the modeling of tsunami inundation. The impacts on coastal inundation that result from tsunami modeling on divergent DEMs developed from various gridding algorithms are currently being assessed at Crescent City, California.

## III-B. Related Activities Supporting IOC/GEBCO Programs and Projects

### III-B-1. GEBCO Online Activities

#### III-B-1-a. IOC Regional Bathymetric Chart Web Pages

The following table shows the web activity over this reporting period for the International Bathymetric Chart web sites hosted by NGDC.

| Web Activity for Regional Mapping Project Sites | |
|---|---|
| **IBC** | **Average Hits/Month** |
| IBCAO | 15,149 |
| IBCCA | 6,264 |
| IBCM | 2,895 |
| IBCEA | 2,024 |
| IBCWIO | 1,214 |
| IBCSEP | 2,373 |

### III-B-1-b. GEBCO List Servers

NGDC continues to maintain the GEBCO Folk List Server to facilitate communication between members of the GEBCO personality list at gebco_folk@mailman.ngdc.noaa.gov. NGDC welcomes comments from the GEBCO community regarding improvement of these services. NGDC also maintains the following GEBCO list servers:

- International Bathymetric Chart of the Arctic Ocean (IBCAO)
- International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA)
- International Bathymetric Chart of the Eastern Atlantic Ocean (IBCEA)
- International Bathymetric Chart of the Mediterranean (IBCM)
- International Bathymetric Chart of the South East Pacific (IBCSEP)
- International Bathymetric Chart of the Southern Ocean (IBCSO)
- International Bathymetric Chart of the Western Indian Ocean (IBCWIO)
- Technical Sub-Committee on Ocean Mapping (TSCOM)
- GEBCO Guiding Committee

### III-B-2. Coastal Relief Model Development

NGDC is developing the first of the next-generation CRMs, and anticipates completion of a CRM for Southern California in late 2011. Characteristics of the improved CRMs include 1 arc-second (~30m) resolution, expanded seafloor coverage to the United States Exclusive Economic Zone (EEZ) boundary, a common vertical datum (NAVD 88), and incorporation of the latest hydrographic and multibeam swath sonar surveys and land elevation data. NGDC will also create conversion grids for development of MHW and MLLW versions to support tsunami inundation modeling. NGDC will use NOAA's VDatum tool (http://nauticalcharts.noaa.gov/csdl/vdatum.htm) for conversion of bathymetric measurements to NAVD 88, and creation of the conversion grids. NGDC is collaborating with other NOAA offices, the National Geospatial-Intelligence Agency, the U.S. Navy, U.S. Geological Survey, universities, state and local agencies in California, and commercial companies to complete this effort. NGDC expects to update the other nine existing 3 arc-second CRM volumes over the next five years.

### III-B-3. Online Geospatially Enabled Gazetteer of Undersea Feature Names

The IHO DCDB completed Part I of the GEBCO Gazetteer Enhancement Project with a comprehensive review and update of the GEBCO Gazetteer of Undersea Feature Names (SCUFN24-07.2A). Pending additional resources, Part II of this project will include correcting and enhancing feature geometries and providing the Gazetteer as a web service accessible via an on-line interface. Completion of this project is critical to insure that the Gazetteer is available and used consistently in GIS systems and other applications such as Google Earth. Additionally, due to continuous, real time database updates, successive versions of the Gazetteer will no longer be required. A future effort will focus on creation of a secure administrative interface to give the Sub-Committee on Undersea Feature Names (SCUFN) Secretary remote database management ability. SCUFN members will also have password protected remote access to submit features for consideration and edit existing feature names (e.g., add metadata or better define feature geometries).

### III-B-4. United States Extended Continental Shelf

The United States Extended Continental Shelf (ECS) Task Force designated NGDC as the Data Management and Integration lead for the U.S. ECS Project and the data stewards and archival location for all data related to this project. NGDC is responsible for establishing and maintaining a central repository of data and metadata that is accessible, robust, and effectively promotes ECS regional analyses. NGDC has started design and construction of the Information Management System (IMS), linking it with other

databases, and working with other Task Force agencies in developing standards and protocols for data and metadata as part of the overall system for preserving the critical analyses and decisions made in support of the United States ECS submission.

During the past year, NGDC developed the ECS Data Catalog tool as part of the IMS to track data, metadata, and products used in the ECS analysis. The ECS Data Catalog provides critical links between original data and derived products. For example, a foot of slope point can be linked back to a grid, and then back to the original survey data. In February, NGDC hosted an ECS Dry Run meeting and used U.S. west coast data to demonstrate use of the ECS Data Catalog to select foot of slope points and "back step" through the work flow to arrive at the original source data. This process enabled NGDC and interagency collaborators to identify additional data elements needed to support the final ECS submission to the Commission on the Limits of the Continental Shelf (CLCS). The ECS Data Catalog will support completion of the ECS submission through generation of sections from stored data and existing products. This feature will help to maintain consistency and accuracy across all regions.

Common metadata supports discovery, understanding, and long-term archival of data that will contribute to ECS regional analyses. Scientists and data experts from several U.S. federal agencies and academic data centers met to agree on common metadata vocabularies, documentation rules, best practices, and possible routes to federal and international metadata standards. As a step toward common metadata for the ECS project, NGDC completed metadata templates for marine seismic reflection, multibeam bathymetric data, bottom geologic samples, and cruise level data. These metadata templates and the ECS Data Catalog tool were provided to NGDC scientific staff who participated on the Gulf of Alaska, Bering Sea, and Necker Ridge ECS cruises. The resultant feedback regarding the metadata templates and the ECS Data Catalog tool will be used to update and improve the products.

# Appendix A. Single Beam Bathymetric Data

**Sources of single beam bathymetric data and number of cruises contributed to the NGDC during this reporting period:**

| Institution | Nº Cruises |
|---|---|
| Brazilian Naval Directorate of Hydrography and Navigation | 11 |
| **Total** | **11** |

# Appendix B. Marine Geology and Geophysics Data Requests

**Number of NGDC Marine Geology and Geophysics data requests fulfilled by country during this reporting period:**

| Country | Nº Requests |
|---|---|
| Canada | 2 |
| China | 1 |
| Federal Republic of Germany | 1 |
| Indonesia | 1 |
| Japan | 1 |
| Republic of Korea | 1 |
| United Kingdom | 2 |
| **Total** | **9** |

# Appendix C. Multibeam Bathymetry Database

**Number of cruises with multibeam bathymetry added to the Multibeam Bathymetry Database this reporting period:**

| Institution | Nº Cruises |
|---|---|
| Lamont-Doherty Earth Observatory (LDEO) | 11 |
| National Oceanic and Atmospheric Administration (NOAA) | 20 |
| Brazilian Navy | 2 |
| Scripps Institution of Oceanography (SIO) | 8 |
| University of New Hampshire (UNH)<br>Center for Coastal and Ocean Mapping (CCOM)<br>Joint Hydrographic Center (JHC) | 3 |
| National Science Foundation Rolling Deck to Repository Program | 114 |
| **Total** | **158** |

# Appendix D. Multibeam Bathymetric Cruises Received

**Number of cruises with multibeam bathymetry received during this reporting period:**

| Institution | Nº Cruises |
|---|---|
| USA | 156 |
| Non-US | 2 |
| **Total** | **158** |