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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

INTERNATIONAL HYDROGRAPHIC ORGANIZATION

General Bathymetric Chart of the Oceans (GEBCO)

Twenty-fourth Meeting of the Sub-Committee on Digital Bathymetry

26th -27th May 2008

at

Hydrographic and Oceanographic Department, Japan Coast Guard, Tokyo, Japan

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ANNEXES

1. OPENING OF THE MEETING, WELCOME BY JHOD HOSTS AND INTRODUCTIONS

1 The Twenty-fourth Meeting of the joint IOC-IHO General Bathymetric Chart of the Oceans Sub-Committee on Digital Bathymetry (SCDB XXIV) was held at the Hydrographic and Oceanographic Department (JHOD), Japan Coast Guard, Tokyo, Japan on 26th and 27th May 2008.

2 Those present, in addition to Walter Smith, the Chairman, were Bob Anderson, Muhammad Bashir, James Braud, Juan Brown, Etienne Cailliau, Norman Cherkis, Robin Falconer, José Frias (day 2), Djoko Hartoyo, Colin Jacobs, Shigeru Kasuga, Yasutaka Katagiri, Apolonio Lagonsin, Paolo Lusiani, Dave Monahan, Hugo Montoro, Thanh Nguyen, Tony Pharaoh, Walter Reynoso-Peralta, Hans-Werner Schenke, Shereen Sharma, Shin Tani, Paola Travaglini, Nataliya Turko, Mahale Vasudev, Pauline Weatherall, Bob Whitmarsh, Muhammad Yazid and Tsuyoshi Yoshida. The meeting was also attended by five of the current Nippon Foundation students, Daniela Goncalves, Priyantha Jinadasa, Neil Tinmouth, Mohammad Uddin and Rochelle Wigley. The meeting was assisted by a team led by Mr Hiroki Yajima of JHOD's International Affairs Office.

3 The attendees were welcomed by Mr Shigeru Kasuga, Director Technology Planning and International Affairs, JHOD. He regretted that Mr Shigeru Kato, Director General of JHOD, was unable to greet the participants because he was not available until the afternoon. Mr Kasuga said that JHOD was honoured to host the GEBCO meetings and he was very happy to see so many guests from overseas and wished them an enjoyable stay in Japan.

4 Later, Mr Kato formally welcomed the attendees, and particularly the overseas visitors and Nippon Foundation scholars. He mentioned that it was JHOD's 60th Anniversary. He ended by hoping for lively discussions and a successful meeting.

5 The Chairman, Dr Walter Smith, thanked Mr Kato and Mr Kasuga for their welcome and for all the logistical support provided to set up the meeting. The meeting started at 09.40.

2. CONDUCT OF THE MEETING

2.1 Current status of SCDB/TSCOM

6 The Secretary explained that the Sub-Committee was still formally called the Sub-Committee on Digital Bathymetry (SCDB) but, if the proposed new Terms of Reference, shortly to be presented to the Executive Council of IOC, were to be adopted, then its name would change to Technical Sub-Committee on Ocean Mapping (TSCOM).

2.2 Adoption of the Agenda

7 The Chairman presented an Agenda which was adopted with minor changes (Annex 1).

2.3 Tabling of documents

8 The procedure for tabling documents was agreed.

2.4 Scheduling of oral and poster presentations

9 The programme for the Science Day was agreed.

3. REVIEW OF ONGOING ACTIVITIES AND CURRENT PRODUCT/PROJECT STATUS

3.1 Report of the Digital Atlas Manager

10 Ms Weatherall reported on her work since the SCDB meeting at Lamont-Doherty Earth Observatory in September 2007 (details can be found in Annex 2). Since September 2007 a new page style had been developed for the GEBCO web site prior to the site being migrated from NGDC to the Proudman Oceanographic Laboratory (POL) in UK. It was still under development and feedback would be welcomed. It was hoped that the new site would go live in June 2008. The 1 arc minute grid had been continually updated with the addition of ENC data from Korea, Indonesia and South Africa and data from IBCAO v2.0. Work had also been carried out on the Gazetteer of Undersea Feature Names regarding how names would appear on charts; for example, whether some features required a curved name to follow the shape of the charted feature. A report had been presented to SCUFN. Ms Weatherall reported that she had continued to support the GDA and 87 copies had been distributed. Finally, she was pleased to report that 300 copies of Dr Jakobsson's World Map had been distributed at the Oceanology International exhibition in March 2008.

11 Dr Schenke thanked Ms Weatherall for her work for SCUFN, partly assisted by NGDC, and noted that it was a considerable task to classify the shapes of some two to three thousand features. He also thanked her for providing twelve copies of the GDA to attendees from Indian Ocean coastal states at a training course held at AWI.

12 Ing gen Cailliau asked how data was extracted from the ENCs. Ms Weatherall explained that it was done semi-automatically with software written by Dr Cramer (POL) and provided to individual Hydrographic Offices.

13 Mr Monahan enquired whether Lamont-Doherty Earth Observatory held a KML file of all the names in the Gazetteer to which Dr Schenke replied that the file originated from Mrs Taylor of NGDC.

3.2 Report by the IHO DCDB Director

15 In view of Dr Fox's delayed arrival in Tokyo the Chairman decided that the DCDB Report (Annex 3) would be considered later. [It was presented to the Guiding Committee but for consistency is recorded here]

16 Dr Fox presented a report on activites associated with the IHO Data Center for Digital Bathymetry. The full report is available as Annex 3 of the SCDB Minutes. The principal activites were providing access and interface tools (for data sets such as ETOPO2, deep-water multibeam, coastal relief and shorelines), managing growing databases (e.g. of multibeam and sidescan data), updating trackline geophysical data (latest version dated April 2008), collecting multibeam bathymetry, looking after NOS hydrographic data, carrying out a tsunami inundation gridding project for the USA as well as offering training for foreign coastal states, creating an on-line catalogue of historical tsunamis and tide-gauge data, updating the global model of the Earth's magnetic field, developing a 1 arc minute version of ETOPO, developing a 3 arc second coastal relief model of the USA, creating the Discovery portal of Digital Elevation Models, loading an on-line Gazetteer of undersea feature names, conducing and sub-contracting work related to UNCLOS Article 76, carrying out a large number of international activities and, not least, providing 'in kind'support of GEBCO.

17 Dr Brown asked what was the resolution of the NGDC offshore bathymetry to which Dr Fox replied that the resolution was about 3 arc seconds for coastal waters, 10 m grids in harbours and grids of hundreds of metres further offshore.

3.3 Report by the GEBCO Bathymetric Editor

18 Mr Jacobs started his report (Annex 4) by noting that he worked part-time for GEBCO. He noted that the GDA was based mainly on digitised contours, from the 5th Edition, which badly needed to be updated. To start with he was ingesting only multibeam surveys from UK, French and Spanish sources for the North Atlantic area. These surveys were being re-processed into 0.1, 0.5 and 1 arc minute grids. He also reported that he had received over 400 Gb of gridded data from the Geological Survey of Ireland with a resolution of 0.002 degrees (ca. 220 m). Mr Jacobs sought advice from the Sub-Committee as to how the updated grid could indicate to users where changes had been made. Other data received included some from Fugro. He said he had also been in contact with Olex SA, based in Norway, which owned a huge dataset culled from fishing vessels. He stated that any other relevant data would be added as and when he had time to handle it.

19 Mr Jacobs continued by describing problems encountered in distributing the new World Maps. He pointed out that they were too big to post individually and it was only economic to send 20 at a time. However 'half a pallet' of charts had been given away at the Fall AGU meeting in 2007 and only a handful of charts were left at NOCS.

20 Mr Jacobs summarised his other activities which included attending a workshop in Korea and preparing a proposal to the EU to map the rest of the EU maritime territories.

21 Finally he noted that updating the GDA often introduced artefacts at the edges of new surveys. He urged the Sub-Committee to formulate a policy on edge matching because it was too time-consuming to repeat the original processing of the whole grid every time it was updated. Dr Brown added that edge matching artefacts caused serious problems for circulation modellers and others. When Mr Jacobs suggested that modellers could use a lower resolution grid Dr Brown replied that this was not practical because even so the artefacts could propagate through such models.

22 The Chairman thanked Mr Jacobs and noted his point about updating the grid which had already been discussed at the previous meeting where it was emphasised that GEBCO was now moving to grids being used to generate contours, rather than *vice versa*. He added that there was a need to track changes to the data attributes and to KML and ArcView files. Mr Jacobs responded that if GEBCO was going to track attributes then it needed to decide soon what those attributes would be. Mr Braud commented that as a database grows attributes can assist web technology to decide what to include in an update. He noted that there were ISO19000 series standards for attributes. Dr Brown agreed and Mr Pharaoh stated that a good catalogue of metadata was needed. The Chairman responded that the details needed to be thrashed out by technical experts. It was agreed that Mr Jacobs would initiate an email discussion starting with the attributes that he favoured [Action Mr Jacobs].

23 Mr Monahan requested that the Sub-Committee give Mr Jacobs clear feedback on this issue by the end of the meeting. The Chairman concurred but said that policy should not get in the way of updates.

24 Mr Tani pointed out that eleven UNCLOS submissions had now been made and, in principle, some bathymetric data on which they were based might now be available to GEBCO. It was only a matter of making case-by-case requests. He added that Australia had used GEBCO data in its submission and wanted to become involved in GEBCO. Dr Schenke said that Australian scientists

were keen to contribute data to the IBCSO. Mr Jacobs replied that there would also have to be agreement that the data could be ingested into the GEBCO grid.

25 In answer to a question Mr Jacobs confirmed that he was collecting data from single multibeam tracks as well as from surveys.

26 Dr Schenke suggested that it would be valuable to establish an inventory of multibeam data whereby gaps could be highlighted. Mr Jacobs agreed. Ms Wigley pointed out that the Year 4 Nippon Foundation students were working on just such a project. The Chairman pointed out that in the past people had depended on the IHO DCDB to collect multibeam data and the students would do well to work with Dr Fox's group. Mr Jacobs responded that he was well aware of the NGDC holdings but was trying to locate data not held in the DCDB.

3.4 Report from Mr Pharaoh on IHB data policy

27 Mr Pharaoh noted the different attitudes of Hydrographic Offices. Some HOs wanted GEBCO to label its products 'Not for navigation' whereas others wanted GEBCO to develop better guidelines and policies. The Chairman stressed that the bottom line was GEBCO's desire for HOs to contribute data and to recognise that GEBCO was in no way in competition with them over the production of navigational charts. Mr Pharaoh stated that, even so, some HOs were very concerned about their possible liability. The Chairman said that GEBCO should include an explicit statement on its products; Mr Cherkis reminded him that GEBCO products, at whatever scale, had always been marked 'Not for navigation'.

28 Mr Monahan remarked that there were a number of issues in Mr Pharaoh's presentation that the Sub-Committee should address. Mr Pharaoh ended by saying that 'Not for navigation' was just one of many issues that concerned HOs. Mr Pharaoh's recommendations appear in Annex 5.

3.5 Connections to, and contributions of, NF/GEBCO scholars

29 The Chairman began the discussion by asking how the Sub-Committee could help alumni with their mapping projects when they were back in their home institutions.

30 Mr Lagonsin responded that GEBCO was not very popular or well known in the Philippines although some bathymetric surveys had been conducted since 1999. He thought that it was very important to have a good network. He said he was uncertain how to set about sharing multibeam data with GEBCO but he would start to work with Mr Jacobs. He stated that he had found the GDA to be useful after a multibeam system broke down when working in the Celebes Sea. He concluded that he did not have access to a reliable internet connection although the situation is improving with wireless facilities. The Chairman asked what his Institution wanted to hear from the SCDB regarding data sharing. Mr Lagonsin replied that GEBCO should ask for the data because the HO would not offer it automatically. Mr Anderson recalled that a similar situation had arisen regarding obtaining US Navy data. No one had been opposed to the release of data but it had needed someone to write a formal letter requesting the data for it to be released. He suggested that a formal letter should be sent to Hydrographic Offices from the IHO or IOC. The Chairman noted that that was exactly what Mr Pharaoh's previous Circular Letter had attempted to do.

3.6 Liaisons with IBCs, regional data centres and SCUFN

31 The Chairman asked the Sub-Committee what else it could do to liaise with relevant organisations.

32 Dr Schenke addressed the Sub-Committee's links with SCUFN. He said that there was a close link between the GDA and the Gazetteer which was updated annually by Michel Huet. He noted that many names had been taken from existing maps and from version 1 of the Gazetteer however now more precise co-ordinates were required. For the first 100 years of GEBCO's existence many co-ordinates were imprecise and did not reflect the shape or extent of features. Now geographical information systems require more exact WGS-84 co-ordinates to display the shape of features on a chart. It was a lot of work to check over 3000 features. This had been started about three months ago for features in Antarctic waters (south of 63°S). Many discrepancies between SCAR co-ordinates and the Gazetteer had been discovered. SCUFN had decided to extend the checks globally at its recent meeting and to require new proposals for feature names to supply as many exact co-ordinates as are required to fully describe a feature. Dr Schenke noted that the US Board of Geographical Names also has a gazetteer. However, there was close co-operation between SCUFN and ACUF, with two members in common, and the Secretary of ACUF was also an ex-officio observer at SCUFN meetings. Dr Schenke concluded by saying that some national organisations and research institutes also held gazetteers of undersea feature names.

33 The Chairman noted that, when new data are patched into the grid, feature coordinates may change. Dr Schenke replied that the Gazetteer is seen as a living product and although today most features are well determined this could happen to features that had been first added some time ago.

34 Dr Schenke thanked Cdr Bashir for his offer to help with checking any names in the northern Arabian Sea.

35 The discussion then move to links with the IBCs.

36 Lt Cdr Montoro reported the situation with the **IBCSEP** which had held a meeting in 2007 at which he had represented Peru; others came from Columbia, Chile and Ecuador. The meetings were funded by the IOC and details of this and future meetings could be found on the web site (http://www.inocar.mil.ec/IBCSEP/english/index.html). It seemed to him that each IBC had its own way of working but it might be useful to adopt some common procedures. He thought that the Sub-Committee could help by researching data sources and by giving advice on how to better process the data. The Chairman commented that the IBCs and GEBCO often appeared to work independently. GEBCO asks for IBC data but there is no flow of data in the opposite direction. Lt Cdr Montoro replied that it wasn't a problem to give data to GEBCO. The IBCSEP incorporated data from nautical charts because the IBCSEP members were all from hydrographic offices. However he thought that the IBCSEP members saw creating the map as the end of the process; there was no talk of creating a grid that could be updated from time to time. The Chairman said that he was glad to hear that progress was being made because bathymetry in the South-east Pacific area needed to be updated.

37 Dr Schenke reported on the **IBCSO,** continuing the report to the Sub-Committee by Dr Ott at its last meeting in 2007, and was pleased to say that very good progress was being made. It had been confirmed that new data were being made available from Australia, Dr Stackpool (New Zealand) was contributing data from the Ross Sea and 5°E - 90°W in the South Atlantic. There was also lots of activity in the Bellingshausen and Amundsen Seas. He noted that the northern boundary of the IBCSO had been changed from 60°S to 50°S to assist circulation modellers. At the suggestion of the Secretary General of IOC extra layers (including gravity and magnetics) were being added to the IBCSO. Dr Schenke advised that he would give a presentation on the IBCSO to the SCAR/IASC Joint Committee in July 2008 in St Petersburg where there would also be a working meeting partly supported by the IOC. He expects the map to be finished in late 2009. He looked for greater support from the IOC after version 1 was published because there was strong interest from the community. He had been assisted by Dr Summerhayes (Executive Director, SCAR) who had

written letters to get financial support and to find delegates. Eventually all the data will find its way into the IBCSO database (SOGIS) and to GEBCO.

38 Ing gen Cailliau asked what role GEBCO played in the IBCSEP; was it a coordinating technical role or did it simply involve the exchange of information? The Chairman responded that in the past there had not been a formal written agreement as to how GEBCO and the IBCs would interact even though many GEBCO people had contributed to them. Cdr Lusiani stated that the real question was how to combine the efforts of GEBCO and the IBCs to generate a single product, instead of two, and to avoid overlap and wasted effort. The Chairman noted that there had been some attempts to coordinate but, other than cooperation at an individual level, it hadn't happened.

39 Cdr Lusiani opined that the problem of a lack of coordination between GEBCO and the IBCs was basically political and was up to IOC to solve. He suggested that the Guiding Committee should come up with a solution and present it to the IOC. The Chairman intervened to say that the problems were sometimes political but also organisational or even personal. On the other hand he noted that GEBCO doesn't get to hear of all relevant IOC-supported meetings but would like to do so. It was important that individuals make an effort to work together.

40 Cdr Bashir reported that Pakistan had finished its surveys to support the extension of the legal continental shelf and planned to send its submission to the UNCLOS before May 2009. He hoped that, once mapping was completed, the data could be shared with GEBCO. He said that GEBCO could assist by informing him about multibeam training courses.

41 The Chairman asked the Year 4 students how the Sub-Committee could support them after they had returned to their institutions and chosen new projects. Ms Wigley replied that she had no strong commitment yet to any particular project but she would now know who to ask for help. She reported that she was unaware of the status of the IBCWIO in South Africa and that surveying the continental shelf was inhibited by problems with internal communications. Ms Weatherall reminded the Sub-Committee that she had shown some hydrographic office data from the shelf off southwest Africa. The Chairman acknowledged that many cruises had visited the area but it was hard to obtain the data. Now, however, through the Nippon Foundation scholars better contacts were being made.

42 Neil Tinmouth enquired whether backscatter data were collected and the Chairman asked whether the IHO DCDB could ingest such data. Dr Brown said he was unsure; at BODC there were data storage problems because the lab was not set up to accept raw multibeam data.

43 The Chairman asked what were the views of the scholars' institutions regarding data policy and expansion of bathymetric grids.

3.7 Tsunami warning system off Indonesia

44 Mr Hartoyo, Project Manager of the Indonesian Tsunami Network (www.idbc.bppt.go.id), gave a short presentation about the plans his country has for installing four different sea-bed systems to monitor tsunamis (called DART (NOAA, USA), GITEWS (Germany), WaveScan and InaBuoy (Indonesia)). Twenty-four buoys will be deployed eventually with bottom pressure sensors with or without an ocean bottom seismometer. Five buoys, 200 km apart, are already deployed about 200 km offshore and ten more will be deployed by the end of 2008. The buoys are linked to land via satellite, either Inmarsat or Iridium. The system can be interrogated by mobile phone. Some moored current meters will also be involved. He reported that in addition a large amount of multibeam data is being collected by four research ships and a team of over 100 scientists and engineers. Three agencies are involved in raising the alarm for coastal populations who are aware

of the procedures to follow. The system allows a window of 6 minutes to decide whether to announce an emergency.

45 Cdr Montoro added that Peru has buoys too and trained people to operate them but piracy is a problem. Some buoys have lasted only 3 months. Mr Hartoyo conceded that damage by fishermen was a problem off Indonesia as well.

46 The Chairman pointed out the difference for tsunami prediction between poor deep-water bathymetry and the best available bathymetry. Deep-water bathymetry affects the angle of approach, and the time of arrival at the coast, of the tsunami. Ideally GEBCO should be able to provide a generalised global model of bathymetry as well as more detailed regional grids. He showed the latest version of a chart based on the so-called MOA grid. He continued that the grid is available in two co-ordinate systems and has encoded information for every depth point including its source. Eventually the source files will also be available.

4. MATTERS ARISING FROM SCDB-XXIII

4.1 Adopting and expanding the MOA grid

47 The Chairman began a discussion of how the MOA grid could be adopted and expanded. He explained that the current MOA grid was a mix of single- and multi-beam track data and satellite bathymetry. Mr Cherkis pointed out that the GEBCO grid contained large areas, such as the SE Pacific, where ship tracks were lacking or sparse. Dr Falconer enquired how the MOA grid matched the IBCSO grid. The Chairman replied that the MOA grid will occupy a web-enabled database so that it would be easy, for example, for SOGIS to query the database over the web. He asked whether the IBCSEP could build on to, and enhance, the MOA grid. Dr Falconer responded that he was trying to get a sense of what was happening to the MOA grid at present.

48 Dr Brown said that he understood that GEBCO wanted to start building a new grid with the MOA but first it had to be reviewed before further updating. GEBCO needed to agree on whether to adopt the MOA. He asked whether there had been any progress on the review procedure. The Chairman answered in the negative. He explained that the Guiding Committee had endorsed the concept of peer review at its November 2007 meeting without the process being defined. Mr Monahan, Chairman of GEBCO, reminded the Chairman that it was up to the Sub-Committee to define the review process as stated in the Minutes of SCDB XXIII ‘6.1 … The SCDB will create mechanisms for continual updates handled under [the] GEBCO framework with a process for peer review.’ The Chairman accepted this comment. He continued that GEBCO used to have regional experts who could review sheets in their area; now, GEBCO included new regional ‘experts’ who were also Nippon Foundation scholars. He asked whether some of the scholars could perform the reviewing task or whether the grid should be posted on the web for people to comment on it within a finite period.

49 Dr Falconer responded by saying that for the review system to work it had to be relatively easy. For example, GEBCO could provide software and identify the areas where data were lacking. Objective statistical tools were required to assess the grid, it was not just a matter of subjective human judgement. If reviewing was too difficult it wouldn’t happen. The Chairman replied that it was planned to incorporate an uncertainty model into the MOA. The problems that remained were how to deal with gaps and how to make use of confidential data.

50 Dr Schenke asked for a technical update on the MOA grid. The Chairman said that it included the latest (May 2008) Smith & Sandwell 1 arc minute satellite bathymetry; a 30" grid was also available. He said that he hoped that eventually GEBCO could take over the grid.

51 Dr Falconer returned to involving the Nippon Foundation scholars and asked the scholars present how they would respond to a request to review the MOA grid. Cdr Montoro responded that he didn't understand why the grid need to be approved; it would be dynamic and constantly changing. Lt Lagonsin said that in the Philippines the Hydrographic Office would assign people to conduct a review if it was an official project but he feared that GEBCO was not suitably official. In that case if he was sent the grid he would have to conduct the review in his own time. Lic Reynoso remarked that Argentina had been collecting a lot of data for UNCLOS purposes and that GEBCO now had a higher profile in his country. Cdr Bashir agreed that, in Pakistan too, work for GEBCO could be done unofficially. Lt Yazid thought that, if asked, the Indonesian Hydrographic Office would delegate someone to conduct the review. Mr Hartoyo said that in his case he was a scientist, and a manager to boot, so that he could be much more flexible so it was no problem for him to help with reviews. Mr Uddin said that because the Indian Hydrographic Office was an IHO member it should only require a formal letter to the Indian HO to request that one of their staff conducts a review.

52 Dr Falconer next asked whether the MOA database could show the source of the data. The Chairman replied in the affirmative; every data point was traceable to its source although if more than one source was used to derive a single grid point only one source could be allocated to each grid point. If one wanted to include metadata about every observation a lot of work might be involved. Mr Braud commented that if one decides that an observation is of poor quality it is rejected but there is no possibility of recording why it was rejected.

53 The Chairman next raised the question of what an agency should do if it is unable to release its raw data. For example, should it average the data over a coarser grid in which case one would be faced with matching averaged values to adjacent unaveraged data.

54 Mr Braud commented that the foregoing discussion illustrated the difficulty in accepting the MOA as a usable and acceptable grid. He considered that a qualitative assessment was needed which would stimulate others to contribute their own data. It was wrong to get mired in the detail. The Chairman commented that if GEBCO had not agreed to contribute to the MOA then checking the grid would have been a very slow process. The MOA was now on version 10 and a lot of work had gone into its creation. GEBCO could help to show where data are missing. If GEBCO wants to check the MOA extensively then it will have to be done in staff's own time but if the MOA is submitted via hydrographic offices then formal assistance may be forthcoming. Mr Pharaoh agreed and said that that version numbers should be used to keep track of how the MOA had been updated. The MOA should be provided on a CD in a format that makes it easy to use. He suggested that a letter or questionnaire be sent out requesting that specific actions were taken. Mr Braud added his support and suggested that the launch of the new GEBCO web site was an opportunity to request feedback on the MOA within a fixed time limit. The Chairman asked what would be involved in terms of software development, the creation of an uncertainty model and other details. Mr Braud replied that it was more important first to agree the process of adopting and checking the MOA (and worry about the details later).

55 The discussion continued the following morning.

56 Mr Braud tabled a document with his views on how the MOA could be released, peer reviewed and subsequently maintained (Annex 6).

57 The Chairman summarised the previous day's discussion and referred back to the key paragraphs (6.1, 6.2 and 6.3) in the Minutes of the SCDB meeting in September 2007. He queried why

GEBCO had not already adopted the MOA grid and suggested that the actions in paragraphs 6.1 to 6.3 were all part of the same process and could be posted on the GEBCO web site.

58 The Chairman noted that further discussion of the MOA grid could proceed either in detail or on a broader front. It was necessary to make progress otherwise the Guiding Committee will ask why so little progress was being made. He asked for suggestions as to how to make use of the remaining meeting time.

59 Dr Falconer remarked that only a few people with enough technical experience (i.e. SCDB members) for a detailed discussion were actually present but it was possible to have a general discussion. He noted that finally the practical problems of a detailed assessment would have to be faced and asked whether the resources existed to do it. Mr Braud thought that the assessment was doable but it might put a heavy load on Ms Weatherall. Dr Brown replied that he would have to assess her work load first and it was not appropriate to discuss the issue further at this meeting. He asked whether the Guiding Committee would be happy to proceed in stages or would want to wait until the whole MOA grid had been assessed. The Chairman said he wanted to proceed in stages with the first stage ending soon. Mr Braud opined that a full assessment was not yet possible, because not all the source data were to hand, and software had to be written. The Chairman concluded that those involved should establish a time table of activities. He also asked whether the IHB could write a Circular Letter about soliciting data contributions to the MOA grid because such a letter would help GEBCO to obtain the support of hydrographic offices.

60 Subsequently a small group (Jacobs, Braud, Brown, Smith and Weatherall) met informally to discuss a way forward. They agreed to work intersessionally by email on defining a policy of adopting and expanding the MOA grid.

4.2 Soliciting data contributions

61 There was no discussion of this item.

4.3 Web services

62 There was no discussion of this item.

4.4 Data policy

63 The Chairman began by noting that at least one hydrographic office was concerned about what GEBCO would do with data that the HO had donated. He continued that it was clear that GEBCO needed to develop a policy that will not inhibit new contributions. He invited the Sub-Committee to consider whether a policy could be devised that meant that each offer of data didn't have to be treated on a case-by-case basis. Mr Pharaoh responded that he had looked at the policy of Global Map (www.global-map.net) which he read out. He suggested that a policy statement based on other policies operating in similar areas could be added to the GEBCO web site. The Chairman replied that he had the impression that hydrographic office concerns were mostly met by labelling products 'Not for navigation' but Mr Pharaoh was raising other issues. Mr Pharaoh responded by saying that hydrographic offices were primarily concerned with 1) navigation and safety (and other issues too) and 2) what will happen to raw sounding data that they contribute. Therefore GEBCO needed to state, for example, that no data would be distributed without the prior approval of the donating hydrographic office. A policy on gridded data was also needed. Ing gen Cailliau agreed. Navigation was just one aspect. Another was that GEBCO needed to explain why it needed to grid shallow-water data donated by a hydrographic office. The French Hydrographic Office would consider each request for data on a case-by-case basis.

64 Mr Anderson voiced his concern about how shallow-water data was going to be used. Previously he had believed that any data donated to GEBCO would be used in grids and contoured charts for distribution to the public but with caveats attached. But now he was hearing that GEBCO will distribute hydrographic data only with the approval of the donor. Ing gen Cailliau agreed and said that there was a problem only with data from shallow-water (i.e. <200 m). He asked whether GEBCO really needed this data? Mr Pharaoh said that hydrographic offices wanted to know why GEBCO needed shallow-water data, how their data are processed and stored and to what use they are put. It was essential to make clear that GEBCO is in the business of compiling global data and is not in competition with compilers of national grids. Mr Tani noted that ENCs in Japan are for navigational safety only and consequently have a shoal bias. It was never planned that soundings would be extracted from them. There was concern that if shallow-water data were made freely available then others, less competent, could create and publish navigational charts. Mr Cherkis informed the Sub-Committee that NRL holds lots of shallow-water data in a proprietary database which it never releases (to meet a condition of its donation); all enquiries are referred to the original owner of the data. He suggested that GEBCO should take the same approach; it was not in the business of disseminating data. The Chairman noted that the latter point had been discussed at the September 2007 meeting of the Sub-Committee where it had been suggested that the database could direct enquirers to the source of the data. Mr Pharaoh suggested that the users of the GEBCO grid should be asked if they wanted shallow-water data. The Chairman responded that shallow-water is currently GEBCO's weakest area. Shallow-water bathymetry cannot be underpinned by satellite 'bathymetry', because the latter is unreliable where the sediments are relatively thick, and so raw soundings are required.

65 The Chairman opined that because hydrographic offices have local knowledge they should prepare gridded datasets in their area provided that have the capacity to do so. In that case it was up to GEBCO to decide whether to accept the donated grid as it stood. He added that he wanted queries raised by hydrographic offices in response to Mr Pharaoh's Circular Letter to be answered in the right way without putting future activities in jeopardy e.g. adopting a smaller grid size. Ing gen Cailliau warned that this was a difficult and complex problem that could not be solved in just a few minutes. He thought that GEBCO should put pressure on hydrographic offices by saying that the data are needed. Dr Brown said that it was important to say that the data would not be passed on to a third party in a similar way to the constraints imposed on users of the GDA. Mr Braud noted that his tabled document already said that GEBCO will not distribute source data.

66 Finally the Chairman proposed that a small group should look at 1) how the MOA grid should be adopted and subsequently updated by GEBCO and 2) what GEBCO's policy should be for shallow-water data and report back within hours. Mr Braud suggested that policy could be addressed immediately and that the principles of how to treat the MOA grid were agreed but it would take longer to determine the technical details. A small group of volunteers was formed (Action Mr Pharaoh, Dr Brown, Ing gen Cailliau and Mr Braud).

67 Mr Pharaoh reported to the Sub-Committee on behalf of the working group formed earlier. The results of their discussions are given in Annex 5. He started by considering how shallow-water soundings should be handled. There were two possibilities: either A) HOs would agree that their data could be released to the public via a data centre, subject to certain conditions, or B) the data were not released and used only for the purposes of GEBCO (in which case they would only be accessible to those constructing the grid). The conditions under A) might include 1) data not to be used for commercial purposes, 2) data not to be used by third parties, 3) users would inform HOs when their data were used and 4) data would not be used for navigation or safety at sea. He continued that it would be up to the custodian of the data e.g. data centre, to apply the policies and suggested that Dr Fox should be asked for advice. He concluded that the above remarks applied mostly to soundings derived from ENCs and not to multibeam data.

68 The Chairman thanked Mr Pharaoh and said that a statement was needed about the importance of shallow-water data. Ing gen Cailliau pointed out that deep-water and shallow-water data needed different approaches. There was no basic difficulty in general with HOs providing deep-water data without restriction. The Chairman concluded that HOs and national authorities should be asked to provide shallow-water data in a new Circular Letter from the IHB. Ing gen Cailliau and Mr Pharaoh agreed that a new Circular Letter should be drafted which contained GEBCO's proposed policies for handling shallow-water data.

69 Mr Braud commented that GEBCO was not asking HOs for ready gridded data. The letter should ask for, in order of preference, 1) the actual raw data collected in shallow-water, 2) copies of the ENCs or 3) the HO's bathymetric model.

70 The Chairman asked whether, if a grid was being offered, uncertainty information should be requested as well to assist with edge matching to existing data. Mr Braud replied that one could ask but at present there was no standard definition of uncertainty. Mr Pharaoh commented that uncertainty of gridded data could be handled on a case-by-case basis. In any event he expected that most HOs would provide data from their ENCs. He emphasised that the letter needed to say why shallow-water data were important to GEBCO now and to explain the scope and mandate of GEBCO in order to allay fears of duplication in regional mapping. After a short discussion it was agreed that it was better not to explicitly mention the IBCs in the letter. The problem of collaboration between the IBCs and GEBCO was a separate issue. It was also made clear that the policy would apply only to 'upstream' data i.e. data supplied to GEBCO, and not to 'downstream' data i.e. GEBCO's products. The Chairman asked Mr Pharaoh to draft a Circular Letter taking account of the above discussion [Action Mr Pharaoh].

5. ANY OTHER BUSINESS

71 Mr Tani said he wanted the Sub-Committee to discuss grid sizes. He reported that the JHOD was considering the release of its gridded data but it needed some impetus from an international committee. There were some concerns among politicians about national security and confidentiality over deep-sea minerals. It would be helpful if the Sub-Committee could state what was common practice. Mr Braud said that NOAA maintains a 3 arc second (ca. 100 m) grid within the USA EEZ. In his opinion the grid size should be whatever the data could support. Dr Brown noted that the UKHO also maintained a 3 arc second grid. The Chairman said that 100 m was probably about right for coastal waters. Mr Jacobs noted that Ireland has a 0.002° (ca. 200 m) grid in its waters. Mr Tani responded that Japan had been collecting UNCLOS related surveys for 25 years and had submitted 10 arc second (ca. 300 m) gridded bathymetry to NGDC. He concluded that JHOD did not want to release its data without knowing what other countries did. Mr Braud commented that he preferred GEBCO to have a multi-resolution, i.e. variable, grid.

6. CLOSURE OF THE MEETING

72 The Chairman thanked the Japanese hosts of the meeting for their very good logistical arrangements and for arranging such excellent presentations by scientists. There being no other business the Chairman closed the meeting at 1552.

ANNEX 1

Twenty-fourth Meeting of the GEBCO Sub-Committee on Digital Bathymetry

Hydrographic and Oceanographic Department, Japan Coast Guard
Tokyo
26-28 May 2008

AGENDA

1. OPENING, WELCOME, AND INTRODUCTIONS
    - 1.1 Welcome by Mr. Shigeru Kasuga, Director, Technology Planning and International Affairs Division, JHOD (Monday morning); Welcome by Dr. Shigeru Kato, Chief Hydrographer of Japan (Monday after lunch)
    - 1.2 Logistics
    - 1.3 Brief introductions of participants

2. CONDUCT OF THE MEETING
    - 2.1 Current status of SCDB/TSCOM, Terms of Reference, Rules of Procedure
    - 2.2 Adoption of Agenda
    - 2.3 Tabling of Documents
    - 2.4 Scheduling of oral and poster presentations

3. REVIEW OF ON-GOING ACTIVITES AND CURRENT PRODUCT/PROJECT STATUS
    - 3.1 Report of the Digital Atlas Manager
    - 3.2 Report of the IHO DCDB Director
    - 3.3 Report by the GEBCO Bathymetric Editor
    - 3.4 Report from Tony Pharaoh on IHB data policy
    - 3.5 Connections to and contributions of NF/GEBCO scholars
    - 3.6 Liaisons with IBCs, regional data centers and SCUFN
    - 3.7 Tsunami warning system off Indonesia

4. MATTERS ARISING FROM SCDB XXIII
    - 4.1 Adopting and expanding “MOA” grid
    - 4.2 Soliciting data contributions
    - 4.3 Web services
    - 4.4 Data policy

5. ANY OTHER BUSINESS

6. CLOSURE OF THE MEETING

ANNEX 2

Report of the GEBCO Digital Atlas Manager
(September 2007 – May 2008)

This report covers the work carried out at the British Oceanographic Data Centre (BODC) for GEBCO between September 2007 and May 2008.

1. GEBCO's web site

BODC has offered to host and maintain GEBCO's web site. Since December 2007 we have been working on designing and implementing a new page style and web site navigation structure.

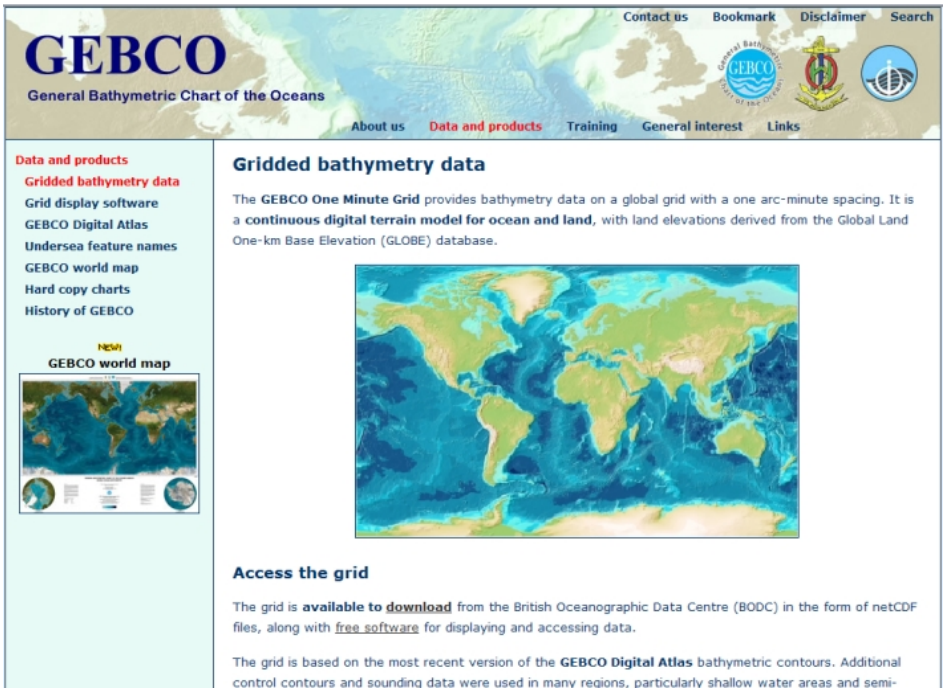
Working largely with the content of the original web site, we have organised the information into five main sections, i.e. 'About us', 'Data and products', 'Training', 'General interest' and 'Links'. Web pages under these sections are found from 'drop-down' menus available from a main menu bar on each page.

The 'General interest' section is aimed at providing information to the public on topics of interest relating to the shape of the seafloor and bathymetry data in general. This section is under development; any contributions for content are welcome.

A new 'GEBCO overview' page has been added, providing information on GEBCO's aims and organisational structure.

The new web pages can be accessed from: gebco.bodc.ac.uk

Sample of the new style GEBCO web pages



Once the site is ready to go live we will use the domain name: www.gebco.net.

Thanks are given to Carla Moore at the US National Geophysical Data Center (NGDC) for her help during the transfer of the web site.

Work on setting up the new web page templates and site navigation structure was carried out by BODC's Web Master, Dr. Richard Downer.

2. Updating the GEBCO One Minute Grid

Improving the GEBCO One Minute Grid in shallow water areas

As reported at the last GEBCO Sub-Committee on Digital Bathymetry meeting, work has been done on updating the existing GEBCO grid in shallow water regions using data extracted from Electronic Navigation Charts (ENC). These shallow water data sets have been supplied by IHO Member States, following a Circular Letter sent out by the IHB in March 2006. To date, 19 data sets have been received. This work has been led by Tony Pharaoh at the IHB.

Preliminary grids have been produced using this data for the areas around South Africa, the Korean Peninsula and India.

No attempt has been made to adjust the data for the state of the tide.

The grids, in netCDF form, along with accompanying documentation, are available for comment via BODC's ftp site.

Copies of the grids for the areas around the Korean Peninsula and India have been supplied to an organisation who intend to use the data in model runs with the aim of improving altimetry data in coastal areas.

The International Bathymetric Chart of the Arctic Ocean (IBCAO)

Work has been done on incorporating version 2.0 of the IBCAO grid into the existing GEBCO One Minute Grid.

3. Building a database from the IHO/IOC Gazetteer of Geographic Names of Undersea Features data set

The GEBCO Gazetteer of Undersea Feature Names is an integral part of GEBCO's data sets. We have been working with the gazetteer data set with a view to:

- Providing the data set as a web feature service
- Making the data set available to users in more Geographic Information System (GIS)-friendly formats such as Shapefile and Keyhole Markup Language (KML)
- Creating a gazetteer file for use with the GEBCO Digital Atlas

As part of this work we have created a database to hold the gazetteer data from which we plan to generate the outputs listed above. The database was created from the spreadsheet version of the gazetteer using software developed in-house by Dr. Ray Cramer. During the database creation we have carried out a number of quality control checks on the data set and investigated if additional points are needed to help define the shape and extent of some features.

A report has been created for the GEBCO Sub-Committee on Undersea Feature Names (SCUFN) to provide information on the progress with this.

We have also discussed collaborating with colleagues at the US National Geophysical Data Center (NGDC) concerning the display of the gazetteer data set on the web.

In April, Ray and I and visited the Alfred Wegener Institut für Polar und Meeresforschung (AWI) to discuss our progress with this work with the chairman of SCUFN, Dr. Hans Werner Schenke. During our visit we met Ralf Krocker who is working at AWI with the Composite Gazetteer of Antarctica (CGA).

4. GEBCO Digital Atlas user support and data set distribution

At BODC we maintain and distribute the GEBCO Digital Atlas (GDA) and provide support to users of the GDA and its data sets.

Downloads of the GEBCO One Minute Grid from the web

The GEBCO One Minute Grid is available for free via the web from the following link:

http://www.bodc.ac.uk/data/online_delivery/gebco/

Through this web application, the user can select to download the complete global grid file or select an area - either via an interactive map or by defining co-ordinates in a dialog box.

Since the release of this application in June 2006 there have been 6,271 downloads of data from the GEBCO One Minute Grid. This includes 2,188 downloads of the full global grid file and 4,083 downloads of sections of complete grid file.

This web application improves on an earlier version, released in January 2004, which allowed access to the grid in the form of 20 degree square tiles.

Free software is available from the web for viewing and accessing data from the GEBCO One Minute Grid; this is a 'cut-down' version of the GDA software interface. Since its release in January 2007, there have been over 1,570 downloads of the software. It is available from the following link:

http://www.bodc.ac.uk/products/software_products/gebco_grid_display/

Distribution of the GDA

Since September 2007, 87 copies of the GDA CDROM have been distributed. This includes 28 commercial sales and 22 complimentary copies. Complimentary copies of the GDA were supplied to participants on a training program (COAST-MAP-IO) held at the Alfred Wegener Institute and to students on the GEBCO/Nippon Foundation Training Programme.

Since the launch of the Centenary Edition of the GDA CDROM in 2003, 1,226 copies of the data set have been distributed.

The royalties owed to GEBCO from the sale of the GDA CDROMs for 2007 amounted to £8,754. Since the launch of the Centenary Edition of the GDA in 2003, royalties have amounted to £48,936.

Data enquiries

We have dealt with 40 enquiries concerning the GEBCO Digital Atlas (GDA) and the availability of bathymetric data sets since September 2007.

5. Miscellaneous

Distribution of the GEBCO world map at Oceanology International 2008

At the request of Colin Jacobs, GEBCO Bathymetric Editor, copies of the GEBCO world map were distributed from BODC's exhibition stand at Oceanology International 2008, held in London during March 2008. Over 300 copies of the map were distributed during the three days of this event.

The maps caused a great deal of interest and were a 'must-have' item for visitors.

Producing web map and feature services for GEBCO's data sets

I have been investigating the use of GeoServer and MapServer software to create web map and feature services from GEBCO's data sets, i.e. the GEBCO One Minute Grid, bathymetric contour vectors and the GEBCO Gazetteer of Undersea Feature Names.

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ANNEX 3

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

Reports to
the
Sub Committee on Digital Bathymetry
of the

May 2008
Hydrographic and Oceanographic Department
Japan Coast Guard
Tokyo, Japan

Table of Contents

Appendices

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

I-A. Bathymetric Data Holdings and Global Database Management

Since the September 2007 Meeting of the General Bathymetric Chart of the Oceans (GEBCO) Sub-Committee on Digital Bathymetry (SCDB), the National Geophysical Data Center (NGDC) has responded to 21 international requests for marine geology and geophysics data from 12 countries all of which are International Hydrographic Organization (IHO) Member States. These numbers are slightly less than the numbers reported for last year's report. This contrasts with 177 total sales requests within this category from the United States over the same time. The overall number of requests continues to drop, as is expected due to NGDC placing more data online for direct download.

Version 5.0.11 of the global Marine Trackline Geophysics dataset became available April 2008 on a single Digital Versatile Disc (DVD). The new release contains an additional 137,000 nautical miles of bathymetry, magnetics, and gravity from 73 cruises added since Version 5.0.10, released in July 2007. Also provided on the DVD is Geophysical Data System (GEODAS) search and retrieval software, which runs under Microsoft Windows®. NGDC's global Marine Trackline Geophysics database now includes 44.6 million soundings from 4,686 cruises. This DVD is available online at http://www.ngdc.noaa.gov/mgg/fliers/03mgg02.html.

Over the reporting period, NGDC received a total of 172 gigabytes of deep-water multibeam bathymetric data from 38 surveys. The National Oceanic and Atmospheric Administration (NOAA) collected the majority of the data, 20 surveys (154 gigabytes). Other significant contributions include nine surveys from the United States Geological Survey (USGS) and six surveys from Lamont-Doherty Earth Observatory (LDEO). Scripps Institution of Oceanography (SIO), the University of Rhode Island (URI), and the University of New Hampshire (UNH) each contributed one survey of multibeam data. The Multibeam Bathymetric Database now provides 1.112 terabytes of data from 1,019 cruises.

NGDC continues to offer online access to its multibeam bathymetric data holdings using an interactive mapping tool with query capabilities at http://map.ngdc.noaa.gov/website/mgg/multibeam/. In addition, NGDC has provided an interactive website, which allows the user to generate color relief maps - with contours, if desired, and grids of the data using NOAA's Pacific Marine Environmental Laboratory (PMEL) AutoChart, Generic Mapping Tools (GMT), and MB-System software. The maps and grids output formats are in Postscript and GMT, respectively, and users have the option to download the source data. Most of these datasets have associated Federal Geographic Data Committee (FGDC) metadata files, viewable online through a link in the survey listing of a search or downloaded with the full resolution data. NGDC is in the process of finalizing submission agreements with LDEO, which will automate most of the process from collection to online delivery.

NGDC's United States coastal database has migrated to a spatially enabled Oracle Relational Database Management System (RDBMS). This migration aids data managers in maintaining data consistency across other National Ocean Service (NOS) databases. It increases overall data quality and ability to search the data. Over the reporting period, the database grew by 88 surveys including 1,704,318 soundings. The database now contains over 84 million soundings and features from 7,041 surveys, providing valuable input to bathymetric base maps, Geographic Information Systems (GIS), geophysical exploration, coastal engineering studies, and seafloor habitat mapping. This database is the primary data source for NGDC's Coastal Relief Model efforts.

NGDC continues to archive digital sidescan sonar data and imagery collected as part of NOS survey operations. These data contain digital files of sidescan sonar data and cleaned, mosaicked imagery of the seafloor. NGDC offers these mosaic images for download over the Internet and continues work to develop products derived from these data. Current NOS sidescan sonar holdings exceed 15 terabytes; the shear volume of the data is providing Information Technology (IT) challenges in the areas of data archive, access, and product generation.

NOS hydrographic survey data is accessible to the public through an interactive map service maintained at http://map.ngdc.noaa.gov/website/mgg/nos_hydro/. The NOS Hydrographic Survey Data Map Service is a data discovery and download tool that allows the user to quickly and easily make spatial or textual searches for surveys of interest, then download survey-related data products. NGDC is now archiving numerous digital data files of survey data, including Extensible Markup Language (XML) metadata documents files, survey plots, sounding data in XYZ and the Hydrographic Surveys Data Exchange Format (HYD93), sidescan sonar mosaics, shaded-relief images, gridded data in text format and Bathymetric Attributed Grid (BAG) file format. For more information about the BAG format and the Open Navigation Surface Working Group (ONSWG), please see http://www.opennavsurf.org.

Additionally, over 8,900 NOS Descriptive Reports containing detailed survey metadata are currently available, as well as over 23,400 final smooth sheet images scanned from original plots of the survey area using corrected hydrographic data. The map service enables NGDC to deliver these products, including high-resolution multibeam and sidescan sonar data, over one interactive, web-based system. The site gained in popularity over the last year, receiving an average of 47,000 hits per quarter.

I-B. GEODAS Software Development

NGDC continues to enhance the Geophysical Data System (GEODAS) software management system. Originally developed to manage marine geophysical trackline data, GEODAS is now a universal software management tool, which can handle a variety of data formats and types including single-beam/multibeam, trackline/survey, and gridded bathymetric/topographic data. The software serves users both as a desktop application on various NGDC DVD products, and as an online search, display, and retrieval system. The window driven interfaces simplify data searches, guide users with a context-sensitive help system, and support color postscript and screen plotting capabilities.

The GEODAS Grid Translator page at http://www.ngdc.noaa.gov/mgg/gdas/gd_designagrid.html offers output using various grid parameter options to several formats. The latest development in GEODAS is automated output of GEODAS data, meta-data, and inventory positions to Oracle-ready table data. These output files are being used in the new RDBMS-based Marine Trackline web access system. Online users can create and download custom grids of NGDC gridded datasets ETOPO2v2, Coastal Relief Model, and Great Lakes Bathymetry.

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), Boulder, 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 International Hydrographic Organization Data Center for Digital Bathymetry (IHO DCDB), GEBCO, and the Intergovernmental Oceanographic Commission (IOC) Regional Mapping Projects. Although the WDC-GMG, Boulder, manages all types of data from

the ocean floor, including descriptions and analyses of seafloor samples, deep drilling data, underway geophysical measurements, and derived gridded data sets. This report will only mention those areas dealing with bathymetry.

II-A. Tsunami Research and Training Activities

The data center has been actively involved in a number of tsunami-related activities, supporting both research and mitigation efforts.

II-A-1. Elevation Modeling for the NOAA Tsunami Forecasting and Warning System

NOAA has primary responsibility for providing tsunami warnings and information to United States coastal communities, operates the Pacific Tsunami Warning System, and has a worldwide leadership role in tsunami observations and research. Detailed bathymetry is crucial to forecasting the potential effects of a tsunami and for the protection of life and property. NGDC is building high-resolution digital elevation models (DEMs) for select United States coastal regions to support tsunami forecasting and modeling efforts at the NOAA Center for Tsunami Research, PMEL. These combined bathymetric–topographic DEMs are part of the tsunami forecast system Short-term Inundation Forecasting for Tsunamis (SIFT) currently being developed by PMEL for the NOAA Tsunami Warning Centers, and are used in the Method of Splitting Tsunami (MOST) model developed by PMEL to simulate tsunami generation, propagation, and inundation.

Bathymetric, topographic, and shoreline data used in DEM compilation are obtained from various sources, including NGDC, NOAA's NOS, the USGS, the United States Army Corps of Engineers (USACE), the Federal Emergency Management Agency (FEMA), and other federal, state, and local government agencies, academic institutions, and private companies. Reference datums used by the DEMs are the vertical tidal datum of Mean High Water (MHW) and horizontal datum of World Geodetic System 1984 (WGS84). Cell sizes for the DEMs range from 1/3 arc-second (~10 meters) to 3-arc-seconds (~90 meters). The DEMs are available to the public via NGDC's Tsunami Inundation Gridding Project web site at http://www.ngdc.noaa.gov/mgg/inundation/. Web site visitors may view planned DEMs, and download completed DEMs with corresponding metadata and documentation. Between September 2007 and May 2008, NGDC completed six coastal DEMs, all of which are available to the public online. Since the start of the project in 2006, NGDC has developed 31 DEMs covering all of Puerto Rico and portions of the United States' East, West, Gulf, Hawaiian, and Alaskan coasts.

II-A-2. Online Catalog of Tsunami Events

The Global Historic Tsunami Event and Runup database can be searched, displayed, and downloaded online via web forms, interactive ArcIMS maps, and Keyhole Markup Language (KML), which is an XML-based language schema for expressing geographic annotation and visualization on Google Earth. This database contains information on the data and location of the tsunami source and runups, as well as deaths, damages, and monetary impact. The service is an important component of worldwide efforts to mitigate against the tsunami threat and is available at http://www.ngdc.noaa.gov/hazard/tsu_db.shtml.

II-B. World Magnetic Model Crustal Anomaly Analysis

Researchers at the World Data Center (WDC) developed a 720 order geomagnetic model that is of sufficient detail and accuracy to begin showing the magnetic reversal crustal anomalies derived from satellite data. This represents a significant improvement over the previous models and a new and emerging avenue to continued analysis and mapping of the global seafloor.

II-C. United States–Canada Cooperation on New Bathymetry for the Great Lakes

NGDC/WDC has been involved in a long-term international cooperative effort with NOAA's Office of Oceanic and Atmospheric Research (OAR) Great Lakes Environmental Research Laboratory (GLERL), and the Canadian Hydrographic Service. NGDC maintains web pages at http://www.ngdc.noaa.gov/mgg/greatlakes/ for Great Lakes bathymetry. These pages provide direct links to the web of related external organizations, and an online, interactive map service featuring the Great Lakes. The map includes a coastline for the entire Great Lakes as well as bathymetric contours for Lakes Ontario, Michigan, Erie, St. Claire, and Huron. The Great Lakes websites received an average of 31,500 hits per month and 6.0 gigabytes a month of data downloaded during this reporting period.

II-D. United States–Japan Cooperative Program in Natural Resources

NGDC presented a report and presentation on activities of NGDC/WDC related to sea bottom surveys and a technical presentation on NGDC's Tsunami Inundation Digital Elevation Model Development at the 35th annual United States-Japan Cooperative Program in Natural Resources (UJNR) Sea-Bottom Surveys Panel Meeting held in Honolulu, Hawai'i on December 4-6, 2007. This panel continues to be one of the principal mechanisms by which Japan and NGDC exchange technologies and marine geophysical data, including bathymetry.

II-E. 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, collocated with those of the NGDC's Marine Geology and Geophysics Division, averaged nearly 4-million hits per month, during the period from August 2007 through April 2008, up nearly 25% from the last reporting period of May 2006 through July 2007. Over this period, users from more than 1-million distinct hosts downloaded an average of 2.79 terabytes of data each month. The WDC-GMG website is at http://www.ngdc.noaa.gov/mgg/wdc/wdcgmg.html.

II-F. ETOPO

The ETOPO2 Global Relief Model, available at http://www.ngdc.noaa.gov/mgg/global/global.html, is a static database that will not be undergoing any further revisions. NGDC is the now in the process of gathering regional and global bathymetric and topographic datasets to support the development of a refined 1-arc-minute ETOPO1 Global Relief Model. A NOAA Hollings Scholar will spend the summer of 2008 evaluating and integrating national and international elevation data, with an eye towards improving shallow-water accuracy to support ocean-circulation modeling. As with ETOPO2, the 1-arc-minute ETOPO1 will be rigorously tested and peer-reviewed, available in multiple data formats, accessible by multiple web tools, such as GEODAS Design-a-Grid and Google Earth, and utilized for calculating ocean areas and volumes, and Earth's hypsographic curve.

II-G. NOAA National Ocean Service Bathymetric Fishing Maps

The NOS Bathymetric Fishing Maps continue to be a popular product. Over the reporting period, the online map service averaged 109,000 hits per quarter. There were no major changes to the web page featuring an Arc Internet Map Server (ArcIMS) interface with links to preview map images. Map layers include state boundaries, shaded relief, all maps, or map types individually as bathymetry, fishing, preliminary, and topography/bathymetry. All full resolution map images are available online in Portable Document Format (PDF) format. Customers can order paper copies of the maps and scanned images on Compact Disk (CD). For more information about these products, please visit the Web site http://www.ngdc.noaa.gov/mgg/bathymetry/maps/nos_intro.html.

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

III-A. IOC Regional Mapping Projects

In addition to participation in GEBCO, NGDC staff continues to take an active role in the IOC regional bathymetric mapping projects. Most recently, NGDC has been involved with the following mapping projects.

III-A-1. International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico

NGDC is using the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA) contours and other bathymetric data to construct topographic/bathymetric grids for use in tsunami modeling at the NOAA Center for Tsunami Research, Pacific Marine Environmental Laboratory (PMEL). The IBCAA contours contributed to the development of a 9-arc-second grid of the Caribbean Sea and the Gulf of Mexico and were used in the compilation of a 3-arc-second inundation grid for Puerto Rico in deep water areas. IBCAA maps suitable for plotting are available for downloading at http://www.ngdc.noaa.gov/mgg/ibcca/ibcca.html.

III-A-2. International Bathymetric Chart of the Arctic Ocean

NGDC posted the new International Bathymetric Chart of the Arctic Ocean (IBCAO) grid, version 2.0 on April 4, 2008, along with maps that are suitable for plotting available for downloading at http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/. This new update is the most comprehensive since the first release of IBCAO in 2000 and includes recent multibeam surveys and an increase in the resolution of the polar stereographic grid from 2.5 kilometers to 2.0 kilometers. The Geophysical Research Letter contains an article describing the compilation of IBCAO Version 2.0:

Jakobsson, M., Macnab, R., Mayer, M., Anderson, R., Edwards, M., Hatzky, J., Schenke, H-W., and Johnson, P., 2008, An improved bathymetric portrayal of the Arctic Ocean: Implications for ocean modeling and geological, geophysical and oceanographic analyses, v. 35, L07602, Geophysical Research Letters, doi:10.1029/2008GL033520.

III-B. GEBCO Reviewers' Reports

III-B-1. North-East Pacific Ocean

There are no major, regional mapping programs underway for the Northeast Pacific. However, there are a number of small-scale mapping efforts resulting from focused studies of specific regions. There are three sites of research interest. Two are Ridge 2000 (R2K) Integrated Study Sites (ISS), one on the Explorer segment of the Juan de Fuca Ridge (roughly 1° x 1.5°) and one on the East Pacific Rise from 8° to 11° North, (roughly 4° x 3°). The third is a study at the University of Washington (UW) of Endeavor Ridge bathymetry. With the absence of regional mapping, keen interest has grown in the methodology of Smith and Sandwell (1997) and ongoing enhancements to combine satellite altimetry derived gravity anomalies with acoustically measured bathymetry to predict regional seafloor topography within the theoretical resolution limits of the process.

III-B-2. Caribbean Sea and Gulf of Mexico

The USGS, in collaboration with NOAA, has conducted numerous multibeam swath sonar surveys around Puerto Rico in the past several years. These surveys support seafloor scientific research and tsunami inundation studies in the region, contributed to NGDC's multibeam bathymetry database, which the public may access at http://www.ngdc.noaa.gov/mgg/bathymetry/multibeam.html. Recent data are still proprietary and will be publically available in the near future; however, NGDC utilized all of the survey data to build high-resolution coastal inundation DEMs of the Island of Puerto Rico for tsunami inundation forecasting and modeling.

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

III-C-1. GEBCO Online Activities

III-C-1-a. GEBCO Web Pages

Changes to the GEBCO webpages, located at http://www.ngdc.noaa.gov/mgg/gebco/gebco.html, included updates to the alphabetical contacts list and the committee and working group membership lists. Access to the GEBCO webpages averaged 30,683 hits per month from August 2007 through April 2008, which is a decrease from the 37,902 hits per month reported during the previous period. NGDC served 26,805 distinct hosts during this reporting period, including web crawlers and robots.

III-C-1-b. 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	**Updates**	**Average Hits/Month**
IBCAO	Postings/Redesign	19,679
IBCCA	None	12,942
IBCM	Postings	2,473
IBCEA	None	2,005
IBCWIO	None	1,166

NGDC completely rewrote the IBCAO web pages at http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/ to incorporate a new design by Mr. Martin Jakobsson, who also provided a new version of the IBCAO one-minute grid and corresponding Google Earth objects. Additionally, NGDC augmented the IBCM web pages at http://www.ngdc.noaa.gov/mgg/ibcm/ with new geo-referenced images provided by Mr. John Hall.

III-C-1-c. 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 on how we can improve or enhance 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)
- Sub-Committee on Digital Bathymetry (SCDB)
- Sub-Committee on Undersea Feature Names (SCUFN)
- GEBCO Guiding Committee

III-C-2. Coastal Relief Model Development

Between 1999 and 2004, NGDC completed the 3-arc-second Coastal Relief Model (CRM) for the contiguous United States, Hawaii, and Puerto Rico by integrating available digital land topography and NOS bathymetry. All grids are available online at http://www.ngdc.noaa.gov/mgg/coastal/coastal.html or on a single DVD or ten CD volumes. Users may download subsets of the CRM using the GEODAS Design-a-Grid tool for their particular region of interest. NGDC will begin work in 2009 on the next-generation of CRM, which will include improving resolution to 1-arc-second, expanding seafloor coverage to the United States Exclusive Economic Zone (EEZ) boundary, incorporating the latest hydrographic and multibeam swath sonar surveys and land elevation data, and utilizing a forthcoming common vertical datum (NAVD88). NOAA's VDatum Transformation Tool, version 1.06, available at http://nauticalcharts.noaa.gov/csdl/vdatum.htm, developed jointly by NOAA's Office of Coast Survey (OCS), National Geodetic Survey (NGS), and Center for Operational Oceanographic Products and Service (CO-OPS). NGDC uses VDatum to transform coastal elevations between 28 different vertical datums consisting of tidal, orthometric, and ellipsoidal datums to NAVD88. This five-year effort will update the ten existing CRM volumes, and include the development of a new 27-arc-second Southern Alaska CRM.

III-C-3. Online IHO B-4 Production

The IHO DCDB has historically been responsible for providing content for the IHO Publication B-4, Information Concerning Recent Bathymetric Data. The bathymetric trackline plots that the IHO DCDB has assembled for the B-4 were a special product that utilized GEODAS to create small plots and manipulate data stored in the Marine Geophysical Data Exchange Format (MGD77). In order to increase the functionality of GEODAS for IHO users, the IHO DCDB offers the capability to search and select bathymetric trackline data using 5th edition GEBCO or British plotting sheet limits as a spatial reference. These data may then be displayed and downloaded free of charge over the internet, available at http://www.ngdc.noaa.gov/mgg/gdas/iho/gd_sys.html. Metadata for the area of interest is also available from GEODAS. Contrasted with prefabricated and static PDF forms, GEODAS allows the user to perform custom queries, and ensures that the most recent data are available.

III-C-4. Online Gazetteer of Undersea Feature Names

The British Oceanographic Data Center (BODC), in collaboration with NGDC and the International Hydrographic Bureau (IHB), is continuing to populate and will maintain a geospatially enabled Oracle database of the Sub-Committee on Undersea Feature names (SCUFN) Gazetteer of Undersea Feature Names initiated by NGDC. This will benefit the GEBCO Digital Atlas, and allow for the expansion of NGDC developed prototypes of a web-based interactive map to display undersea feature names, interfaces for remote data management and on-line feature name submittal, and a 'network link' to display undersea feature names in Google Earth. The IHB will continue to maintain the Gazetteer in its current format, and send updates and changes to the BODC on a regular basis. Inclusion of the undersea feature names in the heavily visited Google Earth site has the potential to give broad exposure to the Gazetteer and the work of SCUFN. As the view in Google Earth is changed, Oracle database server receives new window extents from the user's panning or zooming activities and the server extracts point features falling within that window and returns them to Google Earth for display.

III-C-5. DEM Discovery Portal

NGDC's DEM Discovery Portal map service, available at http://www.ngdc.noaa.gov/mgg/dem/, is an online catalog for spatially locating DEMs that are publicly available via the web. The portal provides metadata on the DEMs – source, cell size, datums, units, etc. – color images, and links to web sites where they are downloadable. Currently, indexed DEMs include those from NOAA, GEBCO, and the USGS, and range from 2-arc-minutes (ETOPO2v2 Global Relief) to two meters (Crater Lake Bathymetry.) NGDC invites the scientific community to submit metadata on web-available DEMs for indexing and linking in the portal (Barry.Eakins@noaa.gov).

III-C-6. United States Extended Continental Shelf

The United States Extended Continental Shelf (ECS) Task Force recently delegated to NGDC, the responsibility for establishing and maintaining a central repository of data and metadata for ECS scientific information that is accessible, robust, and effectively promotes ECS analysis and interpretation. Additionally, NGDC will take the lead in constructing and maintaining the data system, linking it where appropriate with other existing databases, and work with other Task Force agencies in developing standards and protocols for database and metadata as part of the overall system for preserving the critical analyses and decisions made in support of the United States continental shelf delimitation.

NGDC has worked with the Nations Environment Programme's (UNEP) Global Resource Information Database (GRID) and the United States Department of State to identify data coverage for developing states that have ratified with deadline approaching in 2009. UNEP/GRID has obtained seismic data from NGDC to provide aid to the People's Republic of Bangladesh, Brunei Darussalam, the Republic of Chile, the Republic of Kenya, the Republic of Madagascar, and the Islamic Republic of Pakistan. The Republic of the Philippines and the Republic of South Africa have contacted NGDC directly to identify data coverage for their regions.

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
Japan Oceanographic Data Center (JODC)	30
New Zealand, Institute of Geological and Nuclear Sciences (GNS Science)	4
Oregon State University (OSU)	3
New York University (NYU)	1
Total	**38**

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
Commonwealth of Australia	1
Canada	5
French Republic	1
Federal Republic of Germany	2
Italian Republic	1
Japan	3
Republic of Korea	1
New Zealand	1
Kingdom of Norway	3
Kingdom of Spain	1
Kingdom of Sweden	1
Republic of Turkey	1
Total	**21**

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
United States Geological Survey (USGS)	9
National Oceanic and Atmospheric Administration (NOAA) Office of Oceanic and Atmospheric Research (OAR) Pacific Marine Environmental Laboratory (PMEL) Ocean Environment Research Division (OERD)	9
National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) Pacific Island Fisheries Science Center (PIFSC)	7
Scripps Institution of Oceanography (SIO)	6
University of New Hampshire (UNH) Center for Coastal and Ocean Mapping (CCOM) Joint Hydrographic Center (JHC)	1
University of Rhode Island (URI)	1
Total	**44**

Appendix D. Multibeam Bathymetric Cruises Received

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

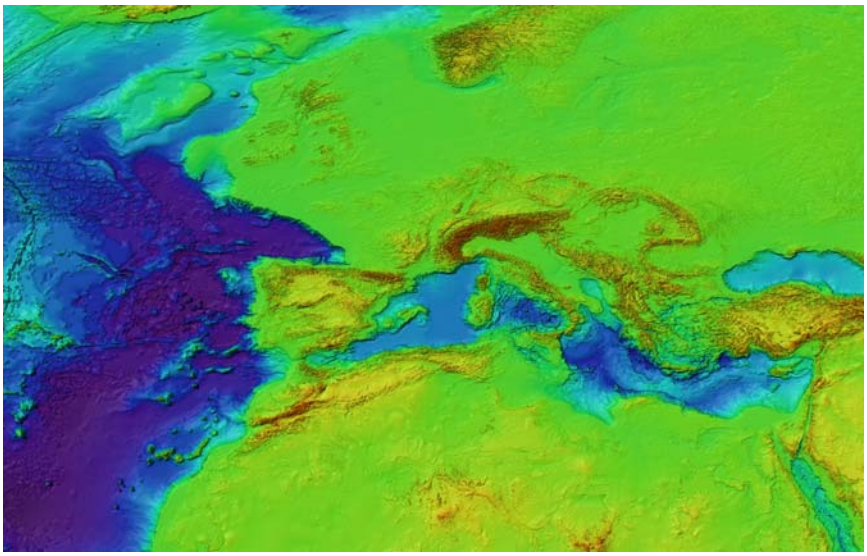
Institution	Nº Cruises
USA	38
Non-US	0
Total	**38**

ANNEX 4

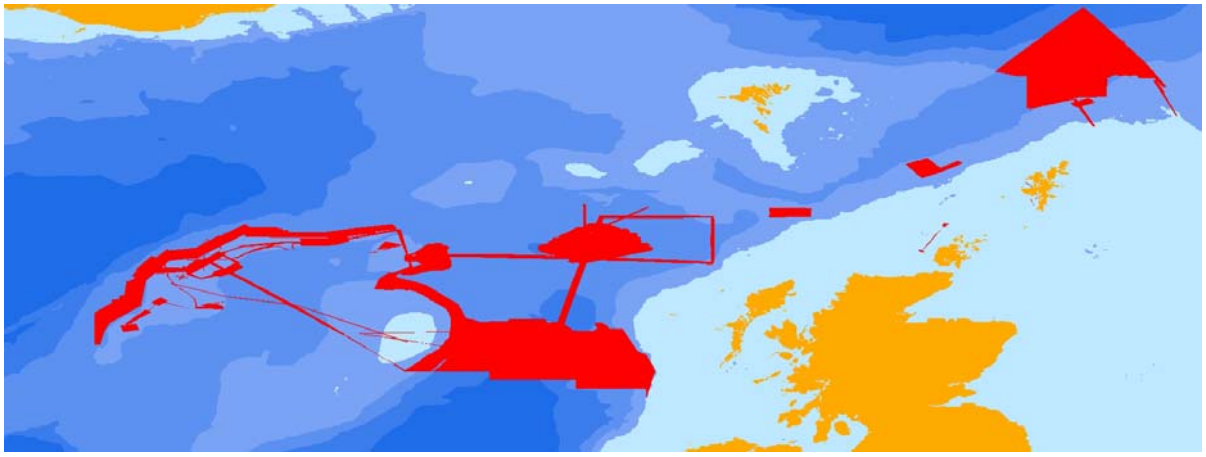
Bathymetric Editor Report

GEBCO Digital Grid

Updates - Data compilation is underway for N E Atlantic. I am ONLY looking for multibeam data!



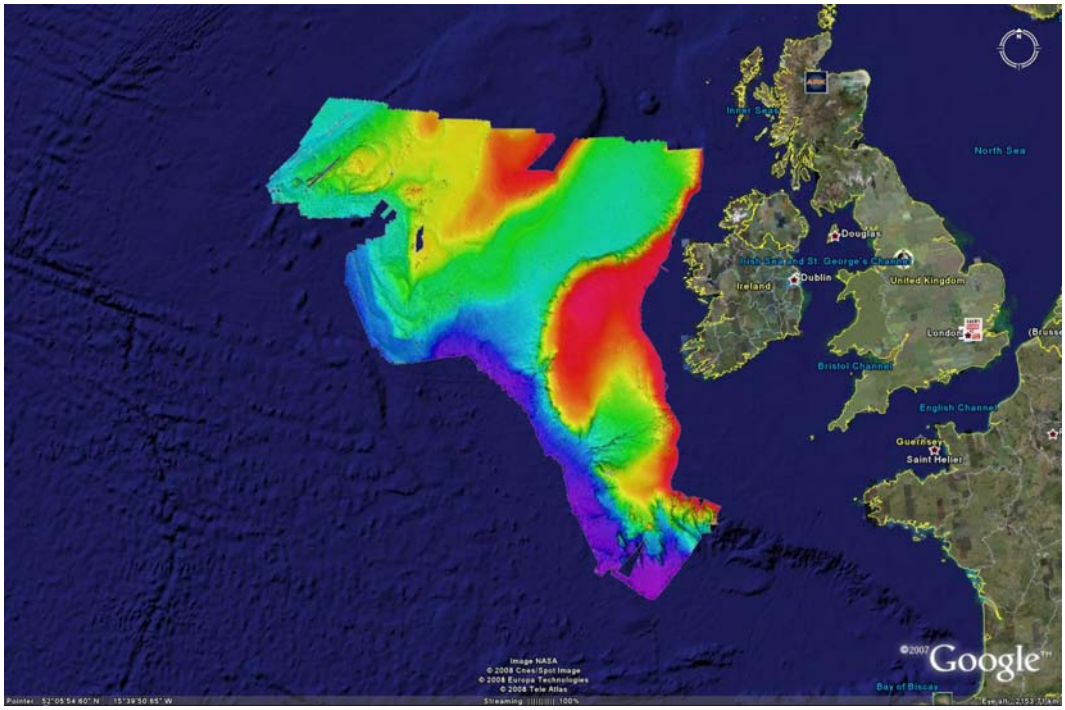
Data so far obtained is focused around the UK (as it's easiest for me to get) from British, French and Spanish sources (though they – the Spanish - don't seem to want to give anything away) .



Where data allows, I am processing to 0.1, 0.5 and 1-minute lateral resolution.

I will come back to this work at the end of this presentation.

Plus > 400Gb from the Geological Survey of Ireland Which needs to be processed



Late Note: the day before I left the UK I was given a GIS Raster file of this dataset at 0.002 degree grid resolution (~220 m) !

I believe that we should show when/where the contour-based GDA has been updated with multibeam, thus I am also looking at ways to present summary overviews of each multibeam data set used in GEBCO updates.

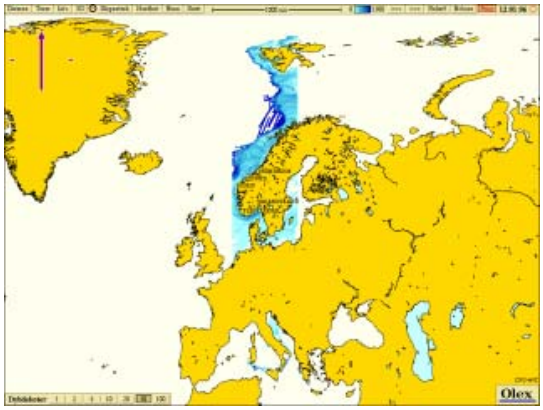
At present my thoughts are to produce ArcGIS shapefiles and use their Attribute tables to give web-browsers information on each specific survey such as Proprietor, Equipment, Year, Higher-resolution availability etc. in an interactive manner.

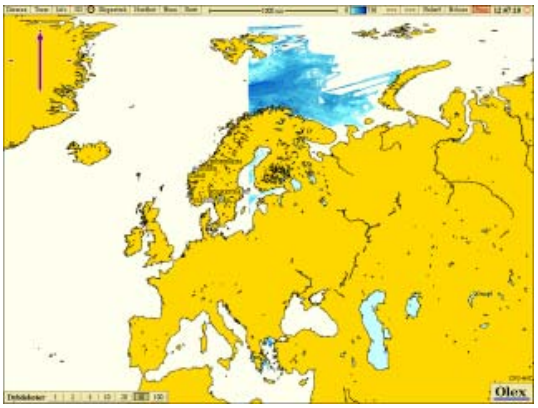
Before I get too far down this road in terms of expending my time – what does TSCOM think about this approach and how or will it be manifest on the MOA grid when that is released?

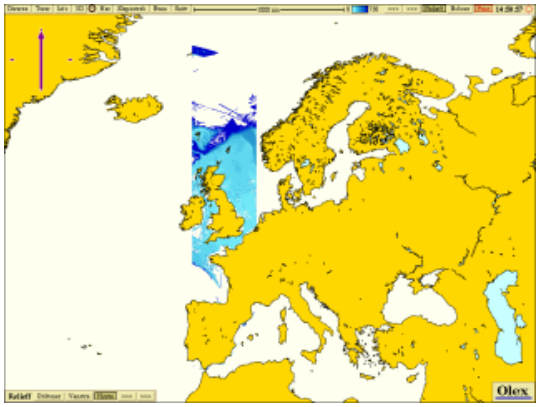
I have received a limited amount of data from Fugro. I am working with the company to see what else GEBCO may be able to access – but believe that at this time this will be achieved by personal friendships with individual contractors rather than company policy…..

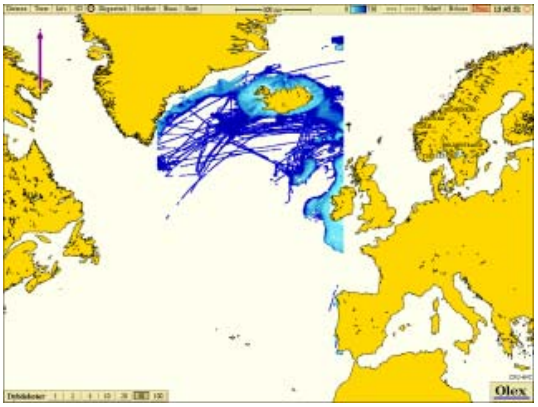
I have also been in touch with a Norwegian company called OLEX who have said that GEBCO can have access to their data – I will be visiting OLEX in Trondheim in June.

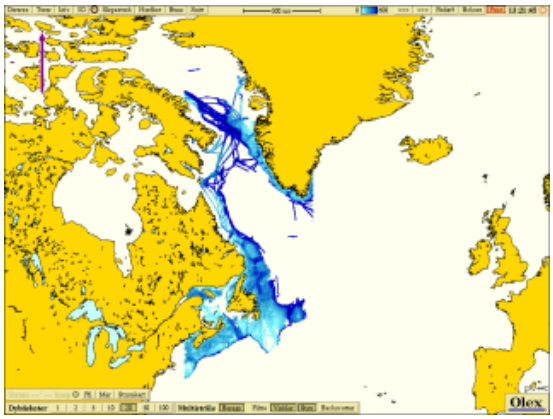
Examples of OLEX data holdings from their website

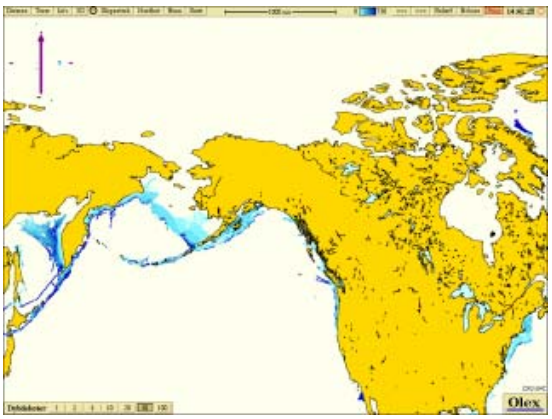












Other data will be added as-and-when by download from as many free sources as I can find, initially by internet trawl.

Printed Global Bathymetry Maps

Arrived at the end of May 2007.

Copies sent to all, Guiding Committee Members, TSCOM Members.
Too expensive to send individual copies (~US $50 per map tube).
Maps distributed at AGU in December 2007 and at Oceanology International, London March 2008. Currently just a handful left (that I am distributing to my visitors)!

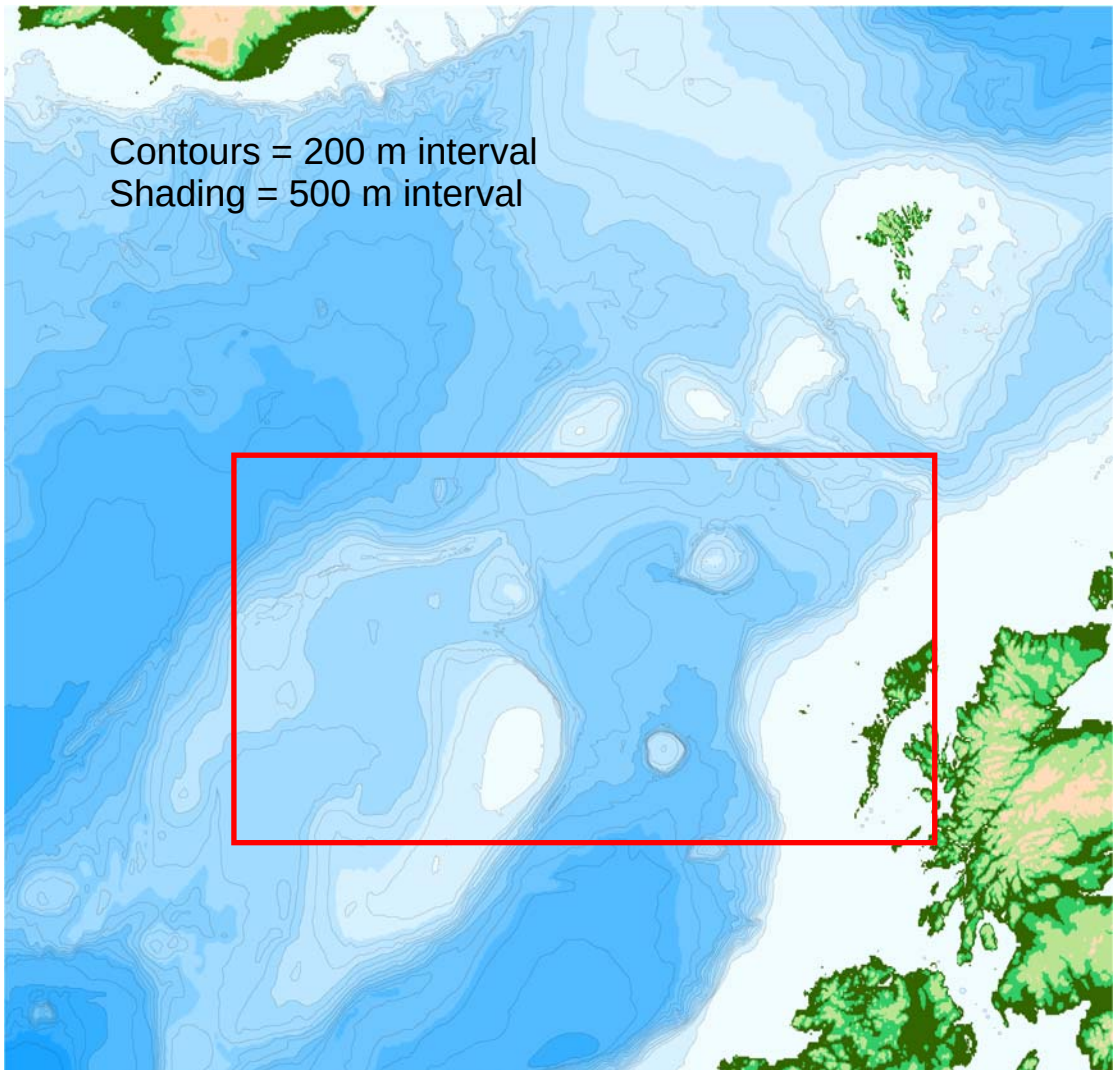
Other GEBCO-related Activities

In October 2007 I gave a presentation on behalf of Dave Monahan at the Second International Symposium on Application of Marine Geophysical Data and Undersea Feature Names on the "History and Activities of the GEBCO Guiding Committee"

I am also involved in an OUTLINE proposal to the European Union to "test the waters" and see if they will support an effort to map the remaining EU maritime territories that have yet to be systematically mapped.

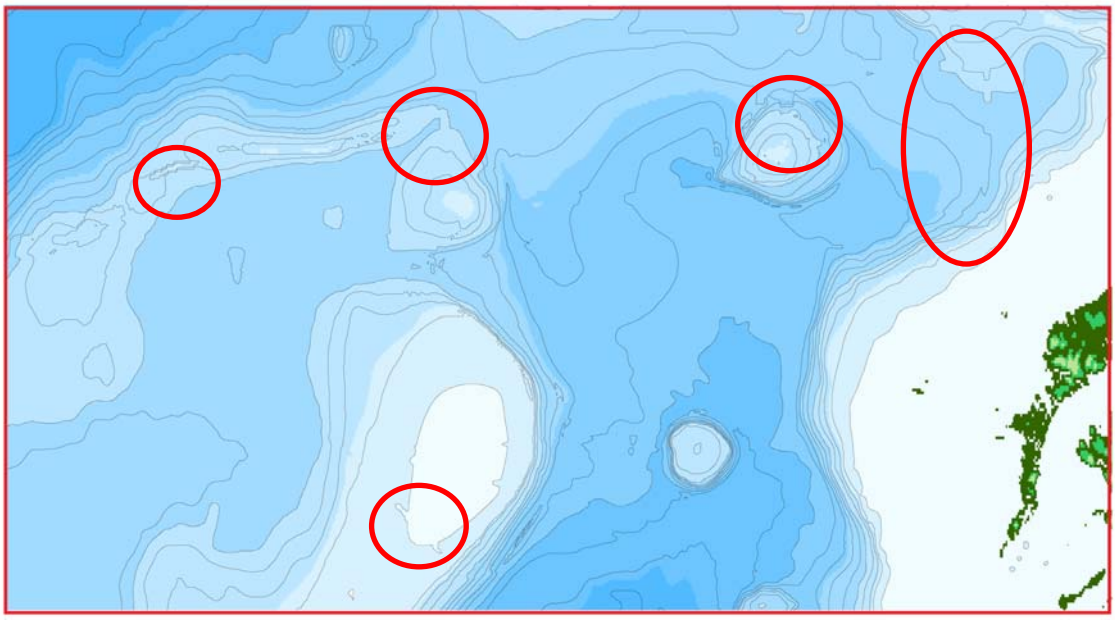
I do anticipate significant opposition from some agencies who may see this as choking off some of their revenue sources….. I guess we'll have to wait and see.

GEBCO Digital Grid Update



I am producing a GRID UPDATE and NOT worrying about a “good-looking” map !

To illustrate some of the issues that GRID UPDATING is bringing to the fore, I will use Fledermaus to drive around one of the updated areas (which is not yet published) and hopefully this will stimulate discussion as to what, if anything should be done….



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ANNEX 5

Clarification of GEBCO's need for, and intended use of, shallow water data contributed by volunteering hydrographic offices

In order to improve GEBCO's generalized global bathymetric model, hydrographic offices were asked, in IHB CLs 36/2006 and 14/2007, to volunteer to contribute shallow water data to GEBCO. This document is intended to clarify why GEBCO needs the data, how GEBCO shall use the data, whether or not GEBCO shall pass those data on to third parties, and what restrictions shall attach to the use of those data.

GEBCO does not deal with maritime safety.

GEBCO produces, maintains and updates a generalized bathymetric model of the global ocean. Products of this model distributed by GEBCO may include grids, contours, and paper maps. GEBCO recognizes that production of nautical charts, in analogue or digital form, is a specific task of the Hydrographic Offices, as established by IMO within SOLAS chapter V. GEBCO never has, does not now, and will not in the future produce navigational charts or any products intended for purposes of maritime safety. It has always been GEBCO's policy that GEBCO models and products are not to be used for navigation. There is no change in this policy.

Why does GEBCO need shallow water data?

Historically, GEBCO's bathymetric model was in the form of contours only, and the shallowest contour was 200 m; GEBCO had no need for data in water shallower than 200 m. However, there are scientific, educational and other human needs for a generalized bathymetric model of the oceans that extends seamlessly from shore to shore. Tsunamis, currents and other ocean phenomena move between deep and shallow water. Modeling of these phenomena is facilitated by GEBCO's global grid products, which inevitably include grid points in shallow water. GEBCO would like its model to be as accurate as is possible. To that end, GEBCO asks hydrographic offices to volunteer to contribute data to GEBCO to improve GEBCO's generalized global bathymetric model.

What data does GEBCO need?

IHO Member States collectively hold vast amounts of shallow water bathymetric data that could make a significant improvement to the IHO-IOC GEBCO product and other similar products such as the International Bathymetric Chart (IBC) series. In order for this data to be useful for gridding purposes, however, it needs to be in a digital format, and must be consistent in structure and content (e.g data format, projection and density). A number of Hydrographic Offices have provided significant amounts of data covering their coastal zones, however there is still a pressing requirement for improved shallow water bathymetry in most coastal areas.

Policy for "Upstream" Data, that is, data input to GEBCO to enable improvement of GEBCO's bathymetric model

On occasion a GEBCO data centre (IHO DCDB or BODC) receives requests for the data it has used to compile its products. It is with this in mind that data contributors will specify if their data are already publicly available, are to be made available through a GEBCO data center, or are given to GEBCO with the restriction that they are to be used only by GEBCO to build its model.

1. If the data are already publicly available, then the data policy already attached to public distribution of the data shall apply. GEBCO shall not change in any way the terms of use attached to those data.

2. If the data may be released by a GEBCO data centre then the centre will specify the following when the data is released:
   - the data are not to be used for commercial purposes unless authorized by the data originator
   - are not passed on to third parties
   - in any use of the data, the source provider shall be acknowledged
   - THE DATA MUST NOT BE USED FOR NAVIGATION OR FOR ANY OTHER PURPOSE RELATING TO SAFETY AT SEA.

3. If the data contributor restricts the supplied data to the use of constructing and improving the GEBCO bathymetric model:
   - GEBCO shall make the data available only to those who are involved in constructing and updating the GEBCO model.
   - GEBCO shall inform those persons of the restrictions attached to the data, and in particular, that the data are not to be released to third parties.

Policy for "Downstream" Data, that is, digital bathymetric models built by GEBCO from contributed data ("models" includes grids and contours derived from the model)

GEBCO will specify that;
- the data are not used for commercial purposes without specifically authorization
- are not passed on to third parties
- in any use of the data, GEBCO shall be acknowledged
- THE DATA MUST NOT BE USED FOR NAVIGATION OR FOR ANY OTHER PURPOSE RELATING TO SAFETY AT SEA.

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PRINCIPALITY OF MONACO

ANNEX 6

GEBCO Bathymetric Model Grid Release, Peer Review, and Maintenance Process

The official release cycle will be initially established on an annual basis with the hopes that shorter release cycles will be obtained at some point in the future. Six months prior to an official release, a beta release will be established. A mailing list of interested parties will be maintained by GEBCO and these parties will be notified upon the release of the beta version. The beta version will be available to the public but will not be officially sanctioned by GEBCO until a peer review by interested parties has taken place. The data sources used to generate the model will be place on-line and will be retrievable by the public. The software used to generate the model using those sources will also be made available on-line such that any parties interested in re-generating the bathymetric models should be able to generate duplicate results given the same data sources. The software and data shall be made available via a DVD copy at a modest distribution cost.

The generation of the bathymetric models is an automated repeatable process based on the source input and therefore problems with the model cannot be fixed without modifying the source input in some way. There are 2 major means of modifying the source. The first method is to clean or edit the existing source in order to select the best and most appropriate soundings for each grid cell. This is where an enormous effort has taken place over the past year. The second, and perhaps more obvious method, is to include new source, particularly in areas where only satellite altimetry data is all that existed previously. The beta copy of the bathymetric models will include an index to the source from which the grid cell was derived. The sources can then be reviewed and suggestions for further cleaning or source selection may be made by the reviewer to help correct problems with the model. In many cases the source index will indicate that the source of the data is satellite altimetry, and therefore represent areas that are in the most need of additional source. The peer reviewer should be able to easily identify these areas and compare against coverage of their data holdings. If a data reviewer determines that he is holding public releasable data that could improve the model in these areas, these data should be made available for inclusion in the final release. As problems are resolved and new source data becomes available, additional beta releases with notifications to interested parties will be made during the 6 month review cycle.

After the 6-month review cycle the official bathymetric models will be released and work will start on the next release by the gathering of new sources and/or improvement of existing sources and processes.

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ANNEX 7

Acronyms

ACUF	Advisory Committee on Undersea Features (USA)
AGU	American Geophysical Union
AWI	Alfred Wegener Institute (Germany)
CD	compact disk
DART	Deep-ocean Assessment and Reporting of Tsunamis
DCDB	Data Center for Digital Bathymetry
EEZ	Exclusive Economic Zone
ENC	Electronic Navigational Chart
EU	European Union
GDA	GEBCO Digital Atlas
GITEWS	German Indonesian Tsunami Early Warning System
HO	hydrographic office
IASC	International Arctic Science Committee
IBC	International Bathymetric Chart
IBCAO	International Bathymetric Chart of the Atlantic Ocean
IBCSEP	International Bathymetric Chart of the South East Pacific
IBCSO	International Bathymetric Chart of the Southern Ocean
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
IHO	International Hydrographic Organization
IOC	Intergovernmental Oceanographic Commission
ISO	International Organization for Standardization
JHOD	Japan Hydrographic and Oceanographic Department
KML	Keyhole Markup Language
MOA	Memorandum of Agreement
NF	Nippon Foundation (Japan)
NGDC	National Geophysical Data Center, Boulder (USA)
NOAA	National Oceanic and Atmospheric Administration (USA)
NRL	Naval Research Laboratory (USA)
POL	Proudman Oceanographic Laboratory (UK)
SCAR	Scientific Committee on Antarctic Research
SCDB	Sub-Committee on Digital Bathymetry (GEBCO)
SCUFN	Sub-Committee on Undersea Feature Names (GEBCO)
SOGIS	Southern Ocean Geographic Information System
TSCOM	Technical Sub-Committee on Ocean Mapping (GEBCO)
UNCLOS	United Nations Law of the Sea
WGS	World Geodetic System