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**INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)**

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REFERENCE MATERIAL

**IOC Report to the 33rd Meeting of GEBCO Guiding Committee (GGC33)
on Item 6.1.4: IOC Review into Future GEBCO Engagement**

Item 4.4 of the Provisional Agenda

**REVIEW OF IOC'S ROLE AND INVOLVEMENT
IN THE GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO) PROJECT**

Summary

Further to Assembly Decision IOC-XXVIII/6.2(II) of June 2015, this document contains the results of the review of the International Hydrographic Organization (IHO) – IOC General Bathymetric Chart of the Oceans (GEBCO) project conducted during the intersessional period and recommendations for consideration by this Executive Council prepared by the review group with regard to IOC's role and involvement in the GEBCO project. The responses to a questionnaire survey conducted during the intersessional period are contained in an addendum in English only to the present document.

The Executive Council is invited to consider the recommendations presented in the document for further action.

There are no financial and administrative implications.

The proposed decision is referenced EC-XLIX/Dec.4.4 in the Action Paper (document IOC/EC-XLIX/2 Prov.)

Introduction

1. The Review Group with regard to IOC's Role and Involvement in the GEBCO Project was established following Dec.6.2(II) of the IOC Assembly at its 28th session (Paris, 18–25 June 2015). Accordingly, the review group conducted the review of the GEBCO project during the intersessional period by correspondence. The objectives of the report are described below:

- (i) Generally, consider IOC's role and involvement in the GEBCO project, and specifically identify the user needs in bathymetry from the relevant IOC programmes and regional subsidiary bodies in relation to the GEBCO bathymetric dataset and products;
- (ii) Consider IOC's role and involvement in the GEBCO project, based upon needs identified under (i) above;
- (iii) Recommend key elements for future governing mechanism of the GEBCO project in relation to IOC's role and involvement.

2. In accordance with its terms of reference, which is annexed to Dec.6.2 (II), the Review Group was comprised of representatives of IOC Member States and one expert each from the GEBCO Guiding Committee, and relevant IOC technical and regional subsidiary bodies (namely, GOOS, GLOSS, JCOMM, IODE, TOWS-WG, IOCAFRICA, IOCARIBE and WESTPAC). Fifteen Member States responded to the invitation, sent on 12 August 2015 through IOC [Circular Letter 2589](#), and designated a representative to the intersessional review group (the list is attached in Appendix).

3. Dr Alexander Postnov, IOC Vice-Chair, representing the Working Group on Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS-WG), was elected as Chair of the GEBCO Review Group.

4. A questionnaire was developed by the IOC Secretariat in consultation with some members of GEBCO Guiding Committee, to collect inputs concerning the user needs in bathymetry from the relevant IOC technical and regional subsidiary bodies in relation to the GEBCO bathymetric dataset and products. Member State representatives were also able to provide inputs to part or whole of the questionnaire. The questionnaire and their responses are detailed in the Addendum to this document.

5. Responses to the questionnaire were received from: GLOSS, JCOMM, IODE, TOWS-WG, IOCAFRICA, IOCARIBE, WESTPAC, Argentina, Brazil, China, Colombia, Guinea, Japan, Mauritius, Tanzania and USA.

6. The Review Group summarized the answers with regard to IOC's Role and Involvement in the GEBCO Project as follows:

Relevance of GEBCO project and its existing datasets and products to IOC technical and regional subsidiary bodies (relevant questionnaire items 1-5)

7. All IOC technical and regional subsidiary bodies and 8 of 9 Member States that responded to the questionnaire are aware of the GEBCO products. Many technical and regional subsidiary bodies as well as Member States have contributed data to GEBCO or have utilized GEBCO datasets. The Working Group on Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS-WG) was given a presentation by Vice-Admiral Shin Tani, Chair of GEBCO and expressed its appreciation for the cooperation with GEBCO. TOWS-WG stressed the importance of the development of a comprehensive bathymetric database in particular in the coastal zone for the development of high resolution tsunami inundation modelling. At the same time, whilst GLOSS, JCOMM and IODE have had no direct contacts with GEBCO, these programmes use GEBCO products.

User needs for GEBCO datasets and products within IOC technical and regional subsidiary bodies (relevant questionnaire items 6 and 7)

8. All responding IOC technical and regional subsidiary bodies and Member States aware of GEBCO products do use them, the most popular being Gridded bathymetric data sets and, to a lesser extent, Grid display software. The least applicable GEBCO product for the IOC bodies is the imagery showing the shape of the seafloor. The relevance of particular GEBCO products to particular IOC programme and regional Sub-commission activities shows as follows:

GEBCO products and dataset	GOOS	GLOSS	JCOMM	IODE	TOWS-WG	IOCAFRIKA	IOCARIBE	WESTPAC
Gridded bathymetric data sets		X	X	X	X	X	X	X
Grid display software			X			X		X
GEBCO Digital Atlas			X			X	X	X
IHO-IOC GEBCO <i>Gazetteer of Undersea Feature Names</i>						X	X	X
GEBCO Web Map Service (WMS)			X			X	X	
GEBCO world map			X			X	X	
Imagery showing the shape of the seafloor						X		
Hard copy charts			X			X	X	
The IHO-IOC GEBCO Cook Book						X	X	X

9. The GEBCO traditional products (for areas with a depth exceeding 200 m) are being used for:

- (i) Ocean analysis and short-term forecasts for ocean state and weather;
- (ii) Oil spill, other contaminants, ocean currents analysis and short-term forecasting;
- (iii) Wind waves and storm surges analysis and short-term forecasting;
- (iv) Sea-ice analysis and numerical modelling;
- (v) Ocean state analysis and short-term ocean forecasts;
- (vi) Tsunami propagation modelling;
- (vii) Developing both national and regional atlases;
- (viii) Exchange information to support the development of marine plans to protect the regional marine environment, including the establishment of marine protected areas;
- (ix) Integrating topographic and bathymetric data to support tsunami modelling;
- (x) Maintenance of marine meteorology climatology.

10. Typical grid resolution of the GEBCO products applied for those activities is 30'' - 10''.

11. The GEBCO products focusing on shallow water (less than 200 m in depth) bathymetry are used for a variety of purposes, including those listed below:
- (i) Integrating topographic and bathymetric data to support modelling/forecasting tsunamis, storm surge, denudation of specific coastlines and islands, production of coastal flood maps;
 - (ii) Filling out proposal forms for bottom features located in territorial waters;
 - (iii) Seabed studies, mapping geomorphological features, mapping surface sediments;
 - (iv) Using bathymetry grid as the input source for modelling physical processes and performing the research results on it;
 - (v) Developing up-to-date polar coastlines and ice shelf contours.
12. Typical grid resolution of the GEBCO products for those activities is 5" - 15".
13. GEBCO data are considered by national navigation authorities when they prepare navigation charts for shallow waters.

Capacity-development needs in relation to GEBCO (relevant questionnaire item 8)

14. The Review Members indicated the following capacity-development needs for communities utilizing the GEBCO products:
- (i) Training of scientists in developing countries to use computer-based products;
 - (ii) Training in the use of bathymetry in ocean models for wind waves, ocean currents, sea level; modelling of coastal processes including denudation;
 - (iii) Workshops on standardization of undersea feature names.
15. Some oceanographers in IOC Member States contribute to developing and/or improving GEBCO datasets and products, especially those who are making sedimentary-geomorphological maps, investigating morphodynamics for the vulnerable areas such as subaqueous deltas, river estuaries or tidal river distributaries, and shallow shelves. The following capacity-development measures identified are as follows:
- (i) Training in usage of echo-sounding equipment;
 - (ii) Training courses on software for echo-sounder data processing, including multibeam data processing;
 - (iii) Satellite Derived Bathymetry mapping course;
 - (iv) Workshops on MGD77 and GF3 exchange data formats.

Options for strengthened cooperation between GEBCO and IOC technical and regional subsidiary bodies (relevant questionnaire item 9)

16. The Review Members identified the following options for increased cooperation between the GEBCO producers and users in order to develop and improve the relevance of GEBCO datasets and products for the IOC:
- (i) Collaboration concerning digital terrain model with bathymetry for the purpose of IOC's relevant activities;
 - (ii) Joint development of Web atlases and data products;
 - (iii) Dissemination of the GEBCO products to IOC Member States;
 - (iv) IOC participation in GEBCO specific project reviews;

- (v) IOC participation in the development and implementation of GEBCO training programmes;
- (vi) Development of thematic maps such as, gravimetric, seismic and Essential Climate Variables (ECV) maps.

Proposed mechanism to identify user needs in GEBCO datasets and products and guide the GEBCO project from a view point of IOC technical and regional subsidiary bodies (relevant questionnaire item 10)

17. According to the responding IOC technical and regional subsidiary bodies and Member States, the following mechanisms might be established:

- (i) As a mechanism to identify user needs in GEBCO datasets and products and guide the GEBCO project from the view point of JCOMM, establish GEBCO reporting to concerned JCOMM Expert Teams; develop GEBCO summary (presentation) to JCOMM-V (October 2017) and subsequent JCOMM sessions; develop consolidated JCOMM reports to the GEBCO Guiding Committee;
- (ii) Conducting a survey through IOC Member State and technical body Officers (including the Intergovernmental Coordination Groups for the four regional tsunami warning systems) on user needs in GEBCO dataset and products;
- (iii) Upgrading the existing user interface on relevant GEBCO web pages in order to facilitate the download and access to products and data;
- (iv) Creating a dedicated part of the GEBCO website where the users could ask for information about all products offered by GEBCO;
- (v) Assist GEBCO to assess the number of users and their specific use of the GEBCO website by requesting users, through a quick survey, to identify their intended use of the products before downloading bathymetric data from the GEBCO website. This could be achieved through registration of users.

Conclusion and recommendations

18. The majority of the IOC technical and regional subsidiary bodies is interested in the GEBCO products and finds them useful for their relevant activities. There are a number of IOC activities that require both “traditional” and “shallow water” GEBCO products. The most important are “shallow water” GEBCO products because they are indispensable for such widespread activities as habitat studies, modelling/forecasting tsunamis, storm surge, coastal denudation for specific coastlines and islands, production of coastal flood maps. The required grid resolution of the “shallow water” GEBCO products is 5" - 15". Some oceanographers, especially those involved in making sedimentary-geomorphological maps and investigating seabed morphodynamics are producing their own bathymetric products.

19. Communities utilizing the GEBCO products and producing their own bathymetric products require capacity development which implies training in using the GEBCO products and in using echo-sounding equipment as well as new tools and technologies for plotting bottom topography.

20. Proposed mechanisms to identify user needs in GEBCO datasets and products and to guide the GEBCO project from the view point of IOC technical and regional subsidiary bodies vary from introducing special tools (like questionnaires) on the GEBCO product website to elaborating integrated requirements by Officers of the IOC subsidiary bodies and Member States.

21. Given the indispensable nature of the GEBCO products to IOC activities it is recommended that IOC continues its involvement in the GEBCO project and establishes an IOC Working Group of representatives of the IOC technical and regional subsidiary bodies, tasked to collect and integrate the IOC user requirements to GEBCO products, on a regular basis.

22. Lastly, given that GEBCO project is a joint project of IOC with International Hydrographic Organization, researchers in the IOC community are encouraged to increase cooperation with Hydrographic Offices in their country to promote the GEBCO project.

Proposed decision

23. In light of the foregoing, the IOC Executive Council may wish to consider EC-XLIX/Dec.4.4 proposed in the Action Paper (IOC/EC-XLIX/2 Prov.)

APPENDIX

**Member List of Review Group
with regard to IOC's Role and Involvement in the GEBCO Project**

1. Experts representing IOC technical and regional subsidiary bodies

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