GEBCO Digital Atlas Manager's Report

Submitted by UK / British Oceanographic Data Centre (BODC)

SUMMARY

Executive Summary: This report covers the work carried out at the British Oceanographic Data Centre of the UK National Oceanography Centre (NOC) for GEBCO since the previous GEBCO meetings in October 2015. Annex I includes statistics on the distribution of GEBCO's data sets. Annex II includes information on access to GEBCO's web site.

Action to be taken: See paragraph 6

Related documents: None

1. Updating GEBCO's global bathymetric grid

1.1 Request to IHO Member States to provide ENC data to help in updating the GEBCO global grid

To help improve the GEBCO grid in shallow water areas, a request was made in 2006 by the IHB on behalf of GEBCO, to IHO Member States (MS) to provide bathymetric sounding data held in their Electronic Navigation Chart (ENC) systems (usage bands 2 and 3) to GEBCO. Following this request, 21 MS provided data. This has helped to improve the GEBCO grid in shallower water regions.

A further request was made to MS by the IHB on behalf of GEBCO in March 2016. To date, an additional three data sets have been received from Brazil, Ukraine and Uruguay.

Further details at:
www.gebco.net/data_and_products/gridded_bathymetry_data/shallow_water_bathymetry/

The input and assistance of IHB staff with this work is gratefully acknowledged.

It is recognised that MS also contribute shallow water bathymetry data that are included in the GEBCO grid via regional mapping projects such as EMODnet Bathymetry for European waters and the Baltic Sea Bathymetry Database that is based on data from the Baltic Sea Hydrographic Commission organisations.

1.2 Towards a new release of the GEBCO global grid

The current GEBCO grid is GEBCO_2014 – a global terrain model at 30 arc-seconds. It was originally released in December 2014. The grid is based on the SRTM30_plus v5 data set –

developed from a database of ship-track soundings with interpolation between soundings guided by satellite-derived gravity data. A number of regional grids and additional multibeam data sets have been included on this base grid to generate GEBCO_2014. Full list of data sets included in the grid can be found in the data set documentation and on GEBCO's web site: www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_30_second_grid/

Work is now in progress on updating the GEBCO_2014 Grid with the aim of publishing a new release of the data set in early 2017. It is intended to use the current grid as a base and include new data sets on top of this grid using the 'remove – restore' procedure. The grid interval will be 30 arc-seconds.

In addition to new bathymetric data sets that are made available through international databases, the following data sets have been received for use in updating the global GEBCO grid:

- New Zealand Regional Bathymetry grid – made available by the National Institute of Water and Atmospheric Research (NIWA), New Zealand. The data set is largely based on multibeam and single beam trackline data.
- EMODnet 2016 release – bathymetric grid for European waters supplied by the EMODnet Bathymetry project, based on multibeam, single beam data and some pre-generated grids.
- Global Multi-Resolution Topography Data Synthesis (GMRT) v3.2 - compilation of edited multibeam sonar data collected by scientists and institutions worldwide – provided by the Lamont-Doherty Earth Observatory (LDEO) of Columbia University, USA.
- ENC bathymetric sounding data sets supplied for their coastal waters by Brazil, Ukraine and Uruguay.
- Alaska bathymetry compilations for the Aleutian Islands, Cook Inlet, central Gulf of Alaska and Norton Sound. Made available by the Alaska Fisheries Science Center of the US National Oceanic and Atmospheric Administration's National Marine Fisheries Service.
- Bathymetric grid, based on multibeam data, for a region of the North Pacific, 1,800 km southwest of the Mexican Baja Peninsula. Provided by the DEME group, Netherlands.
- Bathymetric grid for the Israeli EEZ – made available via the Ministry of Energy and Water Natural Resources Administration, State of Israel.

2. GEBCO Web Map Service (WMS)

The GEBCO_2014 Grid and Source Identifier (SID) Grid are made available as a Web Map Service (WMS) – a means of accessing geo-referenced map images over the internet www.gebco.net/data_and_products/gebco_web_services/web_map_service/

The available services have been updated to include:

- Imagery based on the North and South Poles.
- In addition to shaded relief imagery for the GEBCO_2014 Grid, imagery is now available as a 'flat' map, coloured for depth.

- Support of 'GetFeatureInfo' requests for the WMS based on the Source Identifier Grid. This allows users to retrieve information on the source data set that the GEBCO grid is based on in each 30 arc-second grid cell. The information retrieved links to the Source Identifier code and related metadata information.

3. Updating GEBCO's web site

GEBCO's web site (www.gebco.net) is maintained and updated at BODC. Recently it has been updated to 'modernise' the look of the site and to improve the site navigation.

Further work needs to be done to look at updating the contents of the site.

Since the GEBCO Guiding Committee meeting in October 2015, we have had over 100,600 sessions on GEBCO's web site, accessing over 279,400 web pages.

We have added 13 news items to GEBCO's web site in 2016:
http://www.gebco.net/about_us/news_and_events/

We have also added over 27 posts to GEBCO's Facebook page in 2016:
http://www.facebook.com/GEBCO on a variety of topics relating to GEBCO, bathymetry and related applications.

See Annex II for further information on web site and Facebook access statistics.

4. Miscellaneous

- On behalf of GEBCO, attended the 32nd North Sea Hydrographic Commission meeting in Dublin in June 2016 and gave a presentation about GEBCO's work.

- Submitted a poster about GEBCO and its data sets (co-authors include Karen Marks and Martin Jakobsson) to the International Conference on Marine and Data Information (IMDIS) 2016, Poland, October 2016.

- As part of SCRUM activities and as a partner in the EMODnet Bathymetry project (www.emodnet-hydrography.eu), I attended the EMODnet Bathymetry meeting in May 2016 in Bucharest, Romania. EMODnet are using the GEBCO grid to 'gap fill' where they do not have high-resolution surveys. I provided a harmonized/merged GEBCO_2014 Grid to EMODnet Bathymetry project colleagues for use in future EMODnet grid updating work.

5. Access to GEBCO's bathymetric data sets and products

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

Since the last GEBCO Guiding Committee meeting in October 2015 to 31st August 2016 there have been **22,973** downloads of GEBCO's gridded data sets.

Downloads of GEBCO's grids from October 2015 to end August 2016, split by grid type:

- GEBCO_2014 Grid: **17,727**
- GEBCO_2014 SID Grid: **3,221**
- GEBCO One Minute Grid: **2,025**

Statistics showing the breakdown of data downloads by grid export format is given in Annex I.

During 2015, 27 copies of the GDA were distributed. This includes 20 copies sold (14 copies sold to one commercial organization at discount price) and seven complimentary copies distributed.

Royalties contributed to GEBCO from the sale of the GDA for 2015 amounted to £960. This money has been transferred to the GEBCO account held at the IHB.

Since the GEBCO Guiding Committee meetings in October 2015 we have answered 89 general email enquiries relating to GEBCO's data sets and products.

Some users provide feedback or ask permission to use our data in their products and services. These uses are varied and include using imagery in publications and maps; imagery as background context to the user's own data sets and using the gridded data in computer modelling work. We also get feedback on our products and about potential errors in GEBCO's grids.

See Annex I for further information on data access statistics and information provided by users on data usage.

Funding for GEBCO activities at BODC

Funding for GEBCO Digital Atlas activities carried out by BODC is provided by the UK Natural Environment Research Council (NERC).

BODC gratefully acknowledges the receipt of funding (5K Euros per annum) for GEBCO web site maintenance work (part of the IHO funding for GEBCO work plan tasks) and the additional 3K Euro for the recent GEBCO web site update work.

6. Action

The Committee is requested to:

a. **note** this report; and
b. **take** any other action deemed appropriate.

Annex I

Distribution of GEBCO's bathymetric data sets and products

This includes:

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

Internet downloads of GEBCO's gridded bathymetric data sets

1st October 2015 – 31st August 2016 – approximate period since the last GEBCO Guiding Committee meeting

Total number of downloads of GEBCO's gridded data sets: **22,973**

- GEBCO_2014 Grid: **17,727**
- GEBCO_2014 SID Grid: **3,221**
- GEBCO One Minute Grid: **2,025**

GEBCO's grids are available to download in netCDF, Esri ASCII raster and Data GeoTiff formats.

The table below shows the number of downloads per export format for each data set during the reporting period.

Data set	1D NetCDF	CF NetCDF	Esri ASCII raster	Data Geotiff
GEBCO_2014	1,908	4,875	6,020	4,924
GEBCO_2014 SID	483	786	1,003	949
GEBCO One Minute Grid	716	1,309	-	-

Explanation of formats:

In netCDF format, GEBCO's grids are available in the form of both two-dimensional (2D) and one-dimensional (1D) arrays of signed 2-byte integers. The 2D gridded data set uses the netCDF Climate and Forecast (CF) Metadata Convention. The 1D array grids are, primarily, for use with GEBCO's Grid Display and GEBCO Digital Atlas (GDA) software packages and so are only available as a global grid.

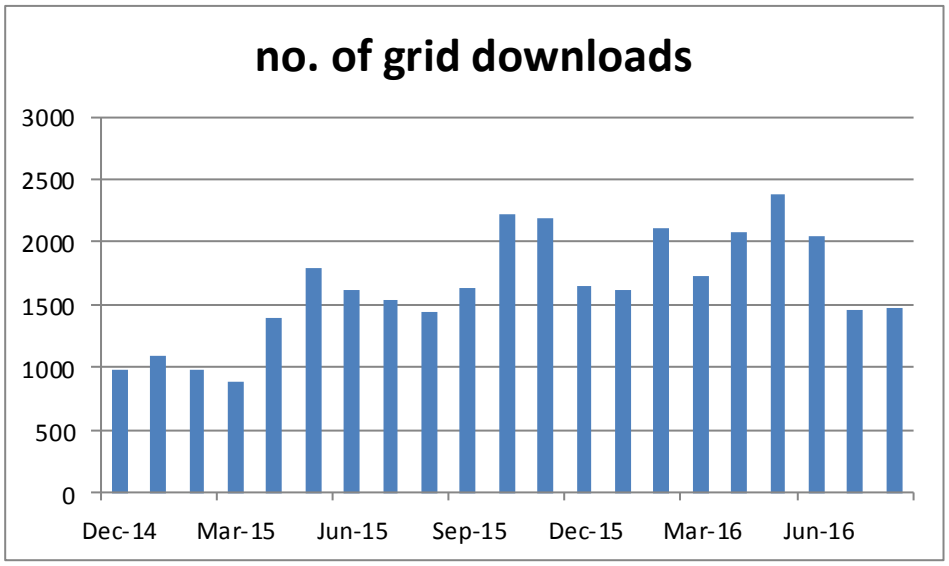
Esri ASCII raster format is an ASCII format developed for the export/exchange of Esri ARC/INFO rasters, it is used as an input format for a number of software packages.

The GeoTiff format contains geo-referencing (geographic extent and projection) information embedded within a Tiff file. The GEBCO_2014 Grid and SID grids are made available as single-channel INT16 (two byte signed integer) data values for user-defined areas in GeoTiff format.

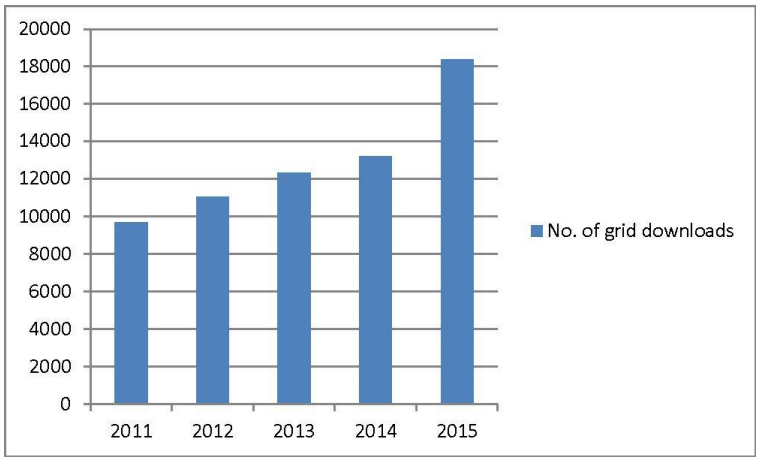
The table below shows the combined number of downloads of the GEBCO_2014 Grid and SID Grid per calendar month since the last GEBCO meetings.

Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016
2,229	2,186	1,644	1,610	2,110	1,736	2,085	2,383	2,043	1,455	1,467

The graph below shows the number of downloads of the GEBCO_2014 Grid and SID Grid since the launch of the data set in December 2014.



Comparisons of number of downloads of GEBCO's gridded data sets per year



The graph above shows the number of downloads of GEBCO's gridded data sets per year.

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

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

Total number of downloads for the period 1st October 2015 - 31st August 2016: **719**

Internet downloads of Adobe PDF documents from GEBCO's web site

GEBCO's web site contains a link to the GEBCO world map and other imagery and documents that are available to download in Adobe PDF format. The following are statistics on the number of downloads of these products during the period, 1st October 2015 – 7th September 2016.

Document	Total number of downloads
GEBCO world map	1,917
Image of the bathymetry of the Southern Ocean	1,111
Image of the bathymetry of the Arctic Ocean	480
Image of the bathymetry of the Atlantic Ocean	375
Image of bathymetry of the Atlantic Ocean	334
Image of the bathymetry of the Arctic Ocean	273
History of GEBCO Book	272
Image of bathymetry of the Eastern Pacific	246
Image of the bathymetry of the Western Pacific	229
IBCAO printable map	221

Distribution of the GEBCO Digital Atlas (GDA)

During 2015, 27 copies of the GDA were distributed. This includes 20 copies sold and seven complimentary copies distributed.

Since its release in 2003, 1,773 copies of the GDA have been distributed.

The net income received from sales of the GDA is shared equally between BODC and GEBCO. Royalties contributed to GEBCO from the sale of the GDA for 2015 amounted to £960. This makes a total of £90,970 since the re-release of the GDA in 2003. So far for 2016, the number of copies of the GDA distributed is 12.

Royalties contributed to GEBCO for the sale of the GDA per year:

Year	Amount
2003	£10,222
2004	£9,053
2005	£8,474
2006	£12,433
2007	£8,754
2008	£8,216
2009	£11,580
2010	£5,720
2011	£3,174
2012	£3,900
2013	£5,617
2014	£2,867
2015	£960

Usage of GEBCO's data sets

The following summarises information provided by users on what GEBCO's data sets are used for.

To note: to download GEBCO's data sets you need to register – we ask users to supply their name, organisation and an email address. However, it is not compulsory to provide an organisation name.

Once registered users need to login to download data. During login we ask users to consider providing information on what the data will be used for. Again, this is not compulsory in order to access the data. The information is stored as free text.

The following are searches, using presumed useful key words, on the information provided by users. This covers downloads of GEBCO's data sets since the release of GEBCO_2014 in December 2014.

Key word	Number of occurrences
research	8,758
model	2,727
map	2,517
student	835
tsunami	830
education	748
assignment	177
image	120

The following are some of the data usage information provided by users.

1. Storm surge modelling
2. Dataset for introductory GIS class at local community college
3. Master's Thesis project
4. For planning biological surveys
5. Investigation about methane hydrates and submarine landslides
6. Wave propagation
7. PhD student interested in producing bathymetric maps
8. Tides model (academic)
9. The data will be used to simulate biophysical processes in the Mozambique Channel, using an ocean model system.
10. Hobbyist woodworking (contour world maps)
11. PhD seabird analyses
12. Study the relationship between plankton and depth in tropical sea
13. 3D printing a tiled topographical map which includes water areas
14. To be used for the study of Indonesian throughflow
15. Mapping the distribution of fish abundance
16. Significant wave height prediction
17. Making maps for scientific publications looking at Southern Hemisphere/Polar oceanography/climate change research questions.
18. Ocean circulation modelling of the Mediterranean Sea
19. To estimate wave parameters and check our results
20. For ocean dynamic simulation

Some users provide information about their use of GEBCO's data sets via email. The following is a selection of this information.

1. Use by a company developing a software tool for voyage optimization based on environment data
2. Use by a company offering numerical modelling and other data services to commercial clients.
3. Use of the GEBCO grid as general background information in maps and report figures
4. Using GEBCO 2014 as a base-map for a series of non-commercial maps
5. Use by an offshore engineering consultancy in their GIS department
6. Use in software to conduct acoustic range prediction simulations

Annex II

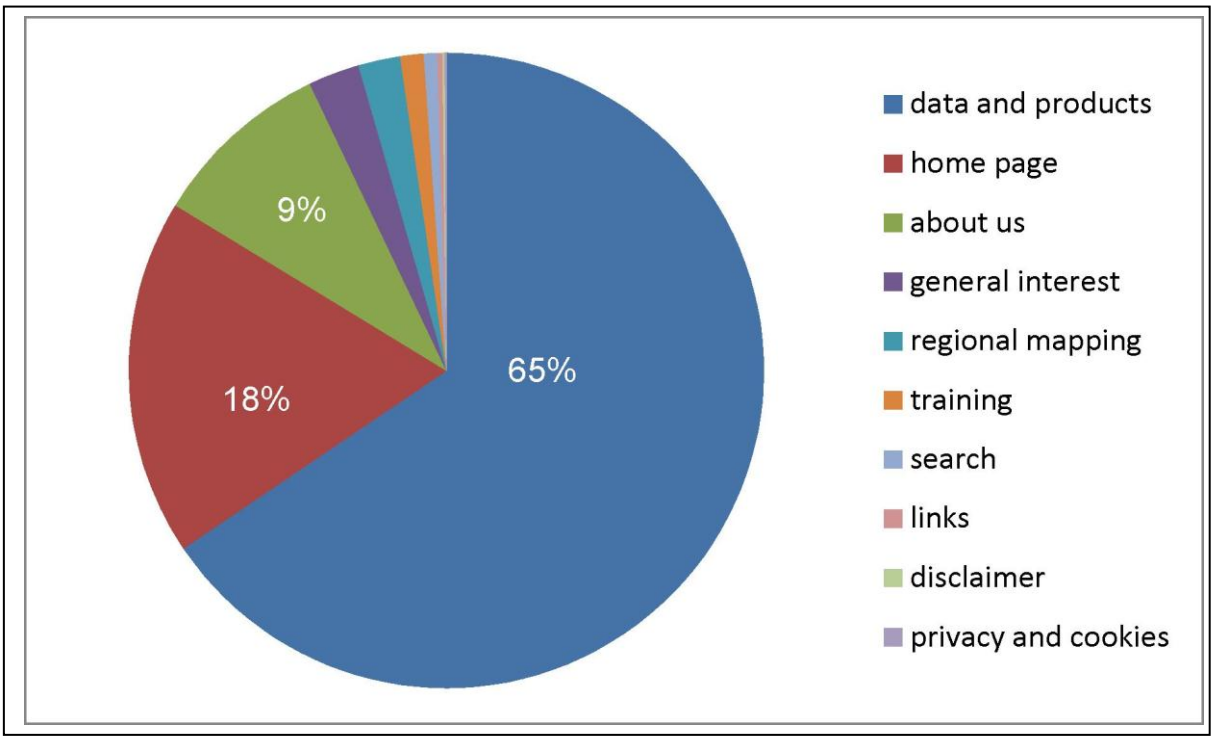
GEBCO's web site is maintained, on behalf of GEBCO, by the British Oceanographic Data Centre (BODC).

The following tables and images provide information and statistics about access to GEBCO's web site (www.gebco.net) for the reporting period 1st October 2015 to 7th September 2016.

In summary, there were 100,600 sessions on the site, accessing 279,400 web pages.

Information is also provided at the end of this section on access to GEBCO's Facebook page.

The image below shows the frequency of visits to the various areas of GEBCO's web site.



The table below shows the pages viewed and number of visitors per calendar year.

Year	Number of pages viewed	Number of visitors
2009	176,759	47,494
2010	191,037	58,617
2011	210,188	49,639
2012	255,241	65,918
2013	254,804	56,315
2014	235,273	57,349
2015	263,689	64,327
2016 (up to end August)	204,273	50,114

Number of visits to individual GEBCO web pages

The following table details the number of visits to the 'top 20' most popular pages on GEBCO's web site since the last GEBCO Guiding Committee meeting in October 2015.

Explanation of terms used:

Page title and URL	Title of the GEBCO web page viewed with URL
No. page views	The total number of pages viewed during the reporting period
Average time on page (minutes)	The average amount of time that visitors spent viewing this set of pages or page.

Page title and URL	No. of page views	Avg. time on page (minutes)
Gridded bathymetry data* www.gebco.net/data_and_products/gridded_bathymetry_data/index.html	77,749	03:16
GEBCO home page www.gebco.net/index.html	50,390	01:08
Information about the GEBCO_2014 Grid www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_30_second_grid/index.html	22,413	01:08
Web map service page www.gebco.net/data_and_products/gebco_web_services/web_map_service/index.html	15,369	02:52
GEBCO Digital Atlas www.gebco.net/data_and_products/gebco_digital_atlas/index.html	8,601	01:02
GEBCO's data and products www.gebco.net/data_and_products/index.html	8,108	00:35
GEBCO world map www.gebco.net/data_and_products/printable_maps/gebco_world_map/index.html	7,647	02:23
Undersea feature names www.gebco.net/data_and_products/undersea_feature_names/index.html	6,289	03:58
GEBCO grid display software www.gebco.net/data_and_products/grid_display_software/index.html	5,829	02:10
Information about the GEBCO One Minute Grid www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_one_minute_grid/index.html	4,719	00:36
Imagery index page www.gebco.net/data_and_products/imagery/index.html	4,422	00:39
Regional mapping projects overview www.gebco.net/regional_mapping/mapping_projects/index.html	3,792	02:34
General interest – FAQ page www.gebco.net/general_interest/faq/index.html	3,660	02:50
Web map service overview page www.gebco.net/data_and_products/gebco_web_services/index.html	3,550	00:31
NF/GEBCO Training project page	3,494	05:17

www.gebco.net/training/training_project/index.html		
Contacts information www.gebco.net/about_us/contact_us/index.html	3,058	03:42
Printable maps http://www.gebco.net/data_and_products/printable_maps/index.html	2,875	00:19
World ocean bathymetry visualizations www.gebco.net/general_interest/bathymetry_visualisations.html	2,818	01:36
Data export formats http://www.gebco.net/data_and_products/gridded_bathymetry_data/data_formats/index.html	2,576	02:01
News item www.gebco.net/about_us/news_and_events/gebco_and_sandy_island.html	2,146	05:00

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

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

The table below details the geographic distribution by country (top 20 'number of visits' listed) of IP addresses accessing GEBCO's web site.

Explanation of terms used:

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

Country / Territory	Visits	Pages / visit	Average visit duration (minutes)
United States of America	17,035	2.56	02:44
United Kingdom	8,552	3.21	04:33
France	5,281	2.59	02:35
China	5,001	3.11	04:07
India	4,394	2.73	03:47
Japan	4,012	2.94	03:27
Indonesia	3,293	2.92	05:20
Germany	3,281	3.07	03:46
Canada	3,223	2.66	03:05
Russia	2,976	2.57	02:49
Italy	2,776	3.09	03:24
Spain	2,686	3.20	03:55
Brazil	2,295	2.54	03:20
Australia	2,175	2.52	03:17

Mexico	2,061	2.64	03:52
Netherlands	1,426	2.82	03:13
South Korea	1,412	3.62	03:53
Malaysia	1,305	2.64	03:47
Norway	1,093	2.92	03:15
Portugal	969	3.46	04:48

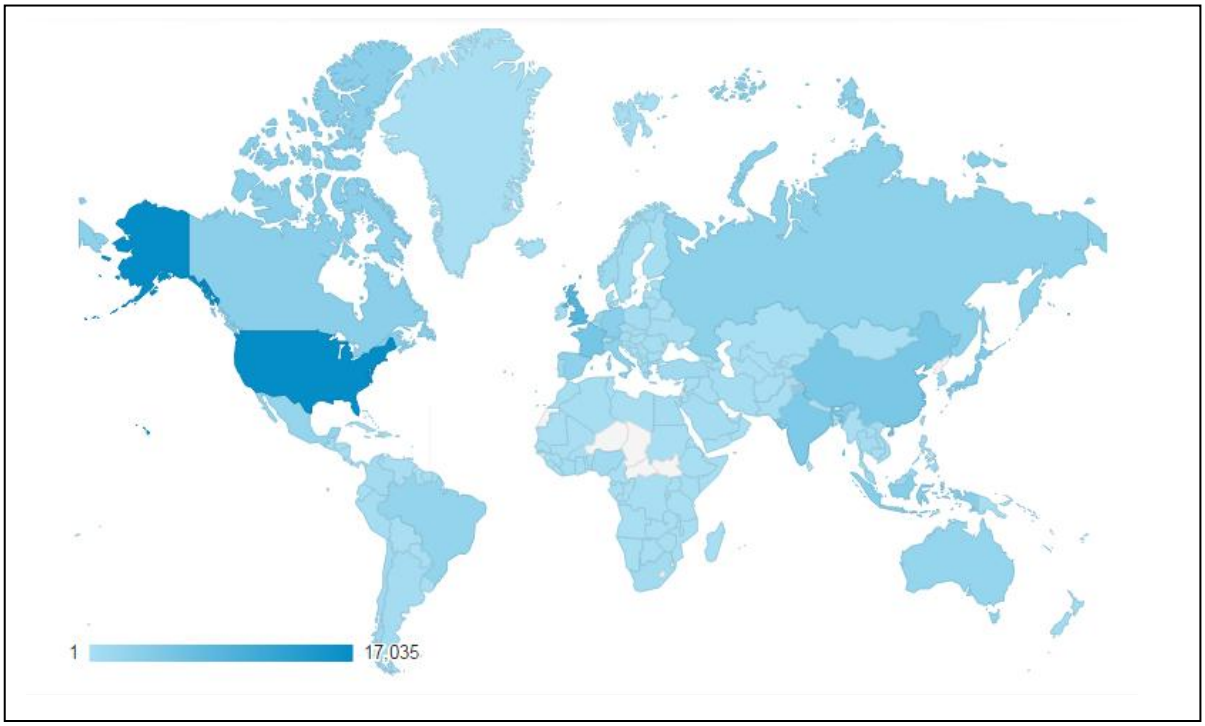
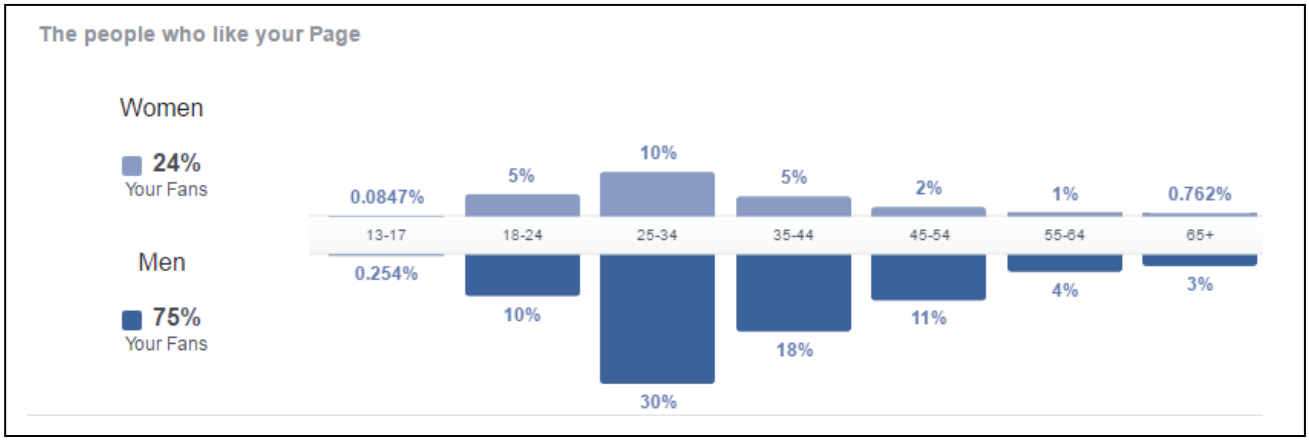


Figure 1 – Geographic distribution of IP addresses accessing GEBCO's web site. The colouring indicates the number of web site visits for a particular country, from 0 (white) to 17,035 (dark blue).

GEBCO's Facebook page (https://www.facebook.com/GEBCO)

In 2016 we have posted 27 news items to GEBCO's Facebook page relating to GEBCO, bathymetry data and sea floor-related research and news items.

The graphic below gives information from Facebook's insights statistics on the gender and age range of people who 'like' GEBCO's Facebook page.



The table below gives information on the date of posts, a link to information about the post and the number of people that the post has reached.

Date of post	Link to posted item	Number of people reached
01/09/2016	https://www.oceannews.com/news/2016/08/29/vast-reef-discovered-behind-great-barrier-reef	887
25/08/2016	http://polarforskningsportalen.se/en/arctic/expeditions/arctic-ocean-2016	272
19/08/2016	http://www.bbc.co.uk/news/science-environment-36806038	244
17/08/2016	http://www.bbc.com/earth/story/20160808-the-volcanoes-hiding-in-the-ocean	239
09/08/2016	http://www.hydro-international.com/content/article/mountains-in-the-sea-ii	1,100
04/08/2016	http://www.hydro-international.com/content/article/ocean-floor-to-be-mapped-by-2030	284
07/07/2016	https://www.awi.de/nc/en/about-us/service/press/press-release/plattentektonik-ohne-ruckeln.html	473
20/06/2016	Why Haven't We Explored the Ocean Like Outer Space?	2,100
20/06/2016	Nasa-style mission needed to map ocean floor	444
17/06/2016	GEBCO Forum for Future Ocean Floor Mapping	892
17/06/2016	The Forum brings together over 150 senior representatives, scientists and scholars from major ocean-related and international organisations to discuss the importance of understanding the shape of the ocean floor. The Forum culminates in the development of a Roadmap for Future Ocean Floor Mapping.	936
26/05/2016	Titanic wreck discoverer speaks at Ocean Floor Forum	1,100
26/05/2016	http://www.hydro-international.com/content/article/from-the-coast-to-the-deepest-trench	51
12/05/2016	http://www.atlanticresource.org/aora/trasna	166
27/04/2016	http://oceanexplorer.noaa.gov/okeanos/explorations//ex1605/welcome.html	360
15/04/2016	http://blogs.agu.org/geospace/2016/04/12/bringing-seafloor-focus/	555
11/04/2016	http://www.geomar.de/en/news/article/vulkan-puzzle-im-sued atlantik/	261
05/04/2016	http://www.nasa.gov/image-feature/jpl/pia20476/nasas-omg-mission-maps-sea-floor-depth-off-greenlands-coast	1,200

07/03/2016	http://www.gebco.net/about_us/news_and_events/gebco_overview_video.html	346
07/03/2016	http://www.jamstec.go.jp/e/about/press_release/20160209/	900
15/02/2016	http://www.gebco.net/about_us/news_and_events/gebco_nf_training_2016.html	97

The table below gives information on the countries where people who 'like' GEBCO's Facebook pages are from.

Country	No. of GEBCO's Facebook page 'fans'		Country	No. of GEBCO's Facebook page 'fans'
United States of America	141		France	24
Indonesia	78		Chile	23
Malaysia	75		Philippines	22
India	71		Turkey	21
United Kingdom	64		Argentina	20
Egypt	57		Spain	18
Brazil	39		Colombia	16
Mexico	33		Portugal	16
Italy	30		Vietnam	16
Bangladesh	29		Germany	15
Canada	27		Peru	14
Australia	26		Thailand	14