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 2016. 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: 5

Related documents: None

1. Updating GEBCO's global bathymetric grid

The current GEBCO grid is GEBCO_2014 – a global terrain model at 30 arc-seconds; it was 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 is included 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 has been done on updating the GEBCO_2014 Grid. The current grid has been used as a base and new data sets merged on top of this grid using the 'remove – restore' procedure. The grid interval will be 30 arc-seconds.

The following is a list of the bathymetric compilations and data sets that have been used 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.
- Indian Ocean Bathymetric Compilation (IOBC) – supplied by Rochelle Wigley, University of New Hampshire on behalf of the IOBC.

- Bathymetry data collected during the search for flight MH370 in the Indian Ocean, made available by Geoscience Australia.
- 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, Uruguay and Argentina.
- Bathymetry data from the Alaska bathymetry compilations for the Aleutian Islands, 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. The data are provided by Global Sea Mineral Resources NV (GSR), DEME Group, Belgium.
- Bathymetric grid for the Israeli EEZ – made available via the Ministry of Energy and Water Natural Resources Administration, State of Israel.
- A bathymetric and topographic compilation of the South Sandwich Island Volcanic Arc from the British Antarctic Survey (BAS): dx.doi.org/10.5285/b8143952-421c-4544-8437-58f339253d30
- Additional multibeam surveys from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) (http://www.godac.jamstec.go.jp/darwin/e), largely in the Pacific Ocean region
- US Bureau of Ocean Energy Management (BOEM) Northern Gulf of Mexico Deepwater Bathymetry Grid from 3D Seismic (https://www.boem.gov/Gulf-of-Mexico-Deepwater-Bathymetry/)
- Bathymetric grid for part of the Red Sea region: https://doi.org/10.1594/PANGAEA.860374
- Bathymetric grids for the South East Pacific region: https://doi.org/10.1594/PANGAEA.785515
- Bathymetry data from a multibeam cruise off the Antarctic Peninsula (63˚W-62.3˚W; 64.4˚S-64.75˚S) supplied by the Centre for Oceanographic and Hydrographic Research, Colombia
- Bathymetry of Lake Victoria, supplied by John Hall, Geological Survey of Israel (retired) from: Hamilton S.E. 2016 Creation of a Bathymetric Map of Lake Victoria, Africa. http://dx.doi.org/10.7910/DVN/SOEKNR.

2. Maintenance of GEBCO's web sites

GEBCO's web site (www.gebco.net) is maintained and updated at BODC.

From the 1st October 2016 to 30th Sep 2017, the approximate period since the last GEBCO Guiding Committee meeting, over 296,100 web pages have been accessed on GEBCO's web site.

In addition to requests from GEBCO colleagues to add to/update the web site content, we have updated the site to include sections on acknowledgements to contributors to GEBCO's work and a page linking to historical GEBCO chart archive at the IHO.

We have added 14 news items to GEBCO's web site in 2017:
http://www.gebco.net/about_us/news_and_events/

We have also added 18 posts to GEBCO's Facebook page in 2017:
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.

A new web site has been developed for the Nippon Foundation GEBCO Seabed 2030 project: http://seabed2030.gebco.net/. The site includes information about the project and links back to the main GEBCO web site.

3. Access to GEBCO's bathymetric data sets and projects

GEBCO's gridded data sets

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

Since the last GEBCO Guiding Committee meeting in October 2016 to 30th September 2017 there have been **29,150** downloads of GEBCO's gridded data sets.

Downloads of GEBCO's grids from October 2016 to end September 2017, split by grid type:

- GEBCO_2014 Grid: 22,770
- GEBCO_2014 SID Grid: 3,787
- GEBCO One Minute Grid: 2,593

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

Web Map Services (WMS)

On behalf of GEBCO, BODC makes available a number of WMS based on GEBCO's gridded data sets. There have been over **5,315,600** requests to the service from 1st October 2016 to 30th September 2017. This includes request to the services from applications, such as external web sites.

Further information is given in Annex I.

GEBCO Digital Atlas (GDA)

During 2016, copies of the GDA were distributed. This includes 14 copies sold.

Answering GEBCO-related enquiries

Since the GEBCO Guiding Committee meetings in October 2016 we have answered 65 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.

4. Miscellaneous

Attended AtlantOS (WP2, task 2.5) Sea Floor Mapping Workshop, Paris, July 2017 and gave a presentation about GEBCO and Seabed 2030. (https://www.atlantos-h2020.eu/project-information/work-packages/wp2/task-2-5/).

Provided some administration support to part of the Nippon Foundation-GEBCO Seabed 2030 Project Director recruitment process.

5. Action

The GGC is requested to note the contents of this report and take action as deemed necessary.

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 2016 – 30th September 2017 – approximate period since the last GEBCO Guiding Committee meeting

Total number of downloads of GEBCO's gridded data sets: **29,150**

- GEBCO_2014 Grid: **22,770**
- GEBCO_2014 SID Grid: **3,787**
- GEBCO One Minute Grid: **2,593**

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	2,484	6,893	7,670	5,723
GEBCO_2014 SID	570	939	1,223	1,055
GEBCO One Minute Grid	917	1,676	-	-

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.

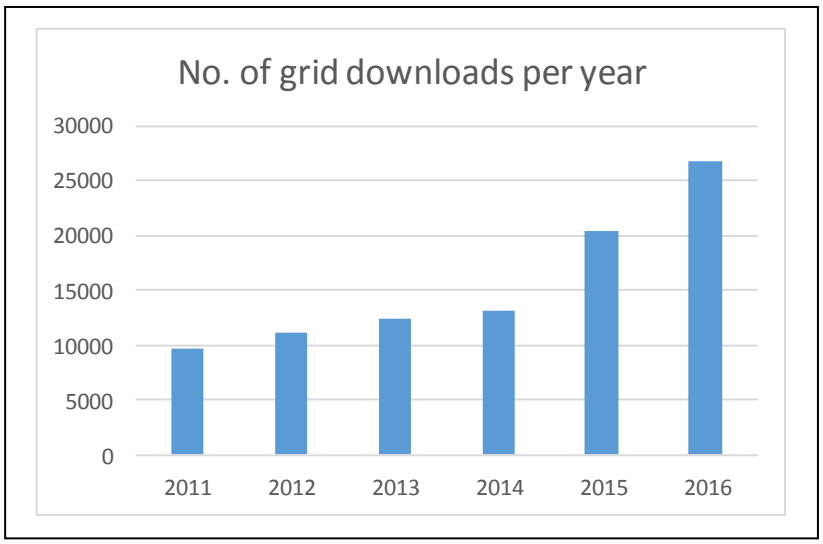
The GeoTiff format contains geo-referencing (geographic extent and projection) information embedded within a Tiff file. The GEBCO_2014 Grid and SID grids are made available as single-channel INT16 (two byte signed integer) data values for user-defined areas in GeoTiff format.

The table below shows the combined number of downloads of GEBCO's grids per month since the last GEBCO meetings.

Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017	Sep 2017
2,160	2,935	2,037	2,264	2,517	2,589	2,345	2,690	2,471	2,244	2,279	2,619

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

The graph below shows the number of downloads per year of GEBCO's global 30 arc-second gridded data set.



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

The software is a 'cut down' version of the GEBCO Digital Atlas software interface. It can be used to view and access data from GEBCO's global gridded data sets.

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

Total number of downloads for the period 1st October 2016 – 30th September 2017: **658**

Access to GEBCO's Web Map Services (WMS)

On behalf of GEBCO, BODC have developed a number of WMS (a means of accessing geo-referenced map images over the internet) based on the GEBCO_2014 Grid: www.gebco.net/data_and_products/gebco_web_services/web_map_service/.

This includes imagery based on the GEBCO_2014 bathymetric grid as shaded relief and also as a 'flat map' coloured-coded for depth. The flat-map image also supports 'GetFeatureInfo' requests, allowing users to query the elevation value in each pixel (based on data from the GEBCO_2014 Grid).

The Source Identifier (SID) Grid is also available as a flat-map, coloured coded for SID value. The SID layer also support GetFeatureInfo requests – allowing users to retrieve information on the source data that each 30 arc-second grid cell is based on.

There have been over 5,315,600 requests to the service from 1st October 2016 to 30th September 2017. This includes requests from applications, such as external web sites, that use these services.

The table below shows the number of requests to the services since 2015.

Year	Request to the WMS
2017 (to 1st October)	3,914,300
2016	3,987,500
2015	2,375,100

Distribution of the GEBCO Digital Atlas (GDA)

During 2016, 15 copies of the GDA were distributed. This includes 14 copies sold and one complimentary copy distributed.

Since its release in 2003, 1,788 copies of the GDA have been distributed.

The net income received from sales of the GDA is shared equally between BODC and GEBCO. Royalties owed to GEBCO from the sale of the GDA for 2016 amounted to £1,740.

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
2016 £1,740

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. 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 during 2016.

Key word	Number of occurrences
research	1,408
model	725
map	787
student	214
tsunami	193
education	105
assignment	40
image	26

Annex II

Access to GEBCO's web site (www.gebco.net)

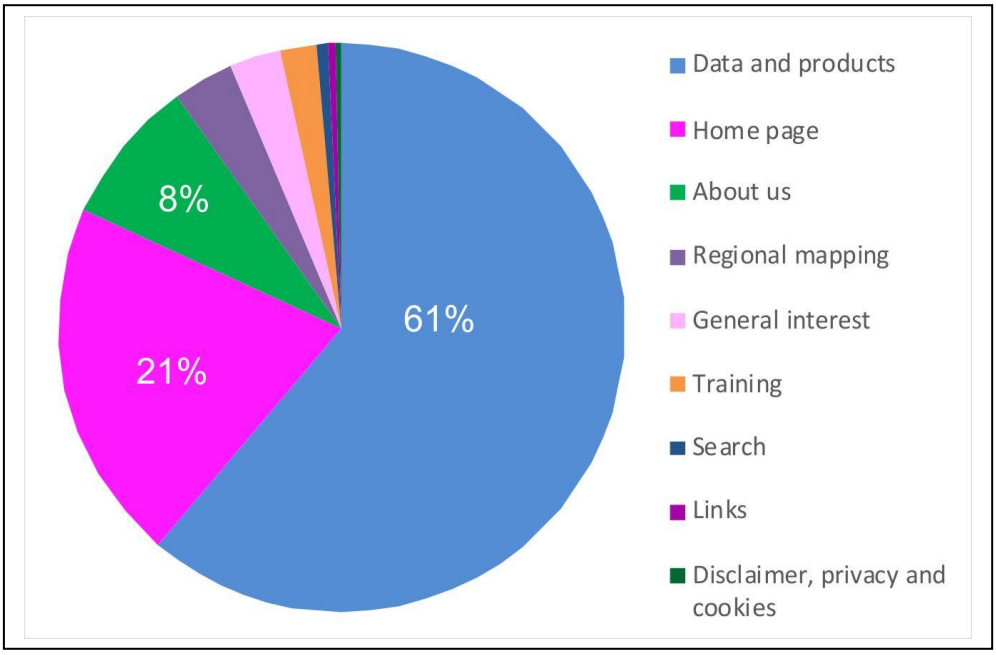
GEBCO's web site is maintained, on behalf of GEBCO, by the British Oceanographic Data Centre (BODC).

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 2016 to 30th September 2017.

In summary, there were over 296,120 web pages accessing to GEBCO's web pages.

Information is also provided at the end of this section on access to the Seabed 2030 sub web (http://seabed203.gebco.net) and GEBCO's Facebook page.

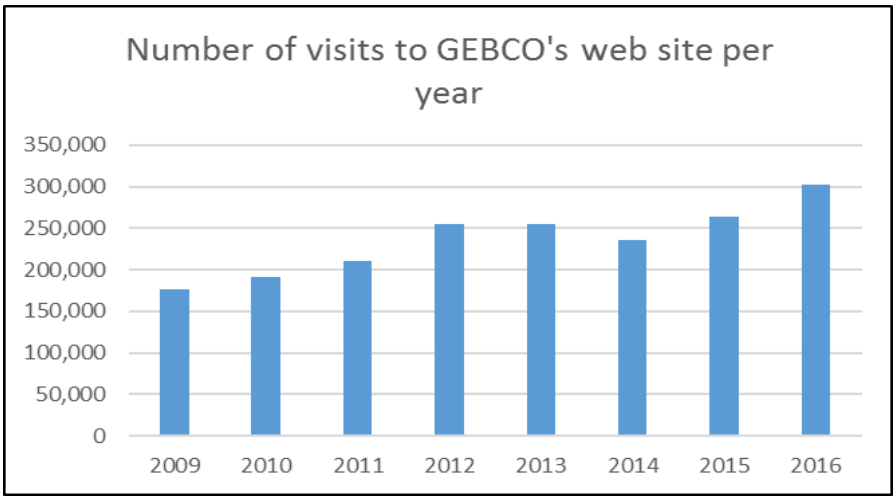
The image below shows the frequency of visits to the various areas of GEBCO's web site.



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

Year	Number of pages viewed
2009	176,759
2010	191,037
2011	210,188
2012	255,241
2013	254,804
2014	235,273
2015	263,689
2016	302,252
2017 (up to end September)	223,664

The figure below shows the number of visits to GEBCO's web site per year since 2009.



Number of visits to individual web pages

The following table details the number of visits to the 'top 20' most popular pages on GEBCO's web site from 1st October 2016 to 30th September 2017 (approximately since the last GEBCO Guiding Committee meeting in October 2016).

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	77,520	03:41
GEBCO home page www.gebco.net/index.html	61,052	01:12
Information about the GEBCO_2014 Grid www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_30_second_grid/index.html	23,361	01:13
Web map service page www.gebco.net/data_and_products/gebco_web_services/web_map_service/index.html	15,223	02:35
GEBCO's data and products www.gebco.net/data_and_products/index.html	13,242	00:32
Undersea feature names www.gebco.net/data_and_products/undersea_feature_names/index.html	6,805	04:07
GEBCO Digital Atlas www.gebco.net/data_and_products/gebco_digital_atlas/index.html	6,062	01:29

GEBCO world map www.gebco.net/data_and_products/printable_maps/gebco_world_map/index.html	6,001	02:23
Regional mapping projects overview www.gebco.net/regional_mapping/mapping_projects/index.html	5,523	02:33
GEBCO grid display software www.gebco.net/data_and_products/grid_display_software/index.html	4,568	02:25
NF/GEBCO Training project page www.gebco.net/training/training_project/index.html	4,353	04:32
Information about the GEBCO One Minute Grid www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_one_minute_grid/index.html	4,286	00:41
Imagery index page www.gebco.net/data_and_products/imagery/index.html	3,797	00:42
General interest – FAQ page www.gebco.net/general_interest/faq/index.html	3,438	02:54
Gridded Bathymetry data - export formats www.gebco.net/data_and_products/gridded_bathymetry_data/data_formats/index.html	2,970	02:13
Contact information www.gebco.net/about_us/contact_us/index.html	2,935	03:01
Visualisations of bathymetry data www.gebco.net/general_interest/bathymetry_visualisations/index.html	2,837	01:08
Imagery based on the GEBCO global grid www.gebco.net/data_and_products/gridded_bathymetry_data/grid_plots/index.html	2,614	01:56
Printable maps www.gebco.net/data_and_products/printable_maps/index.html	2,392	00:21
About GEBCO www.gebco.net/about_us/index.html	2,190	00:51

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

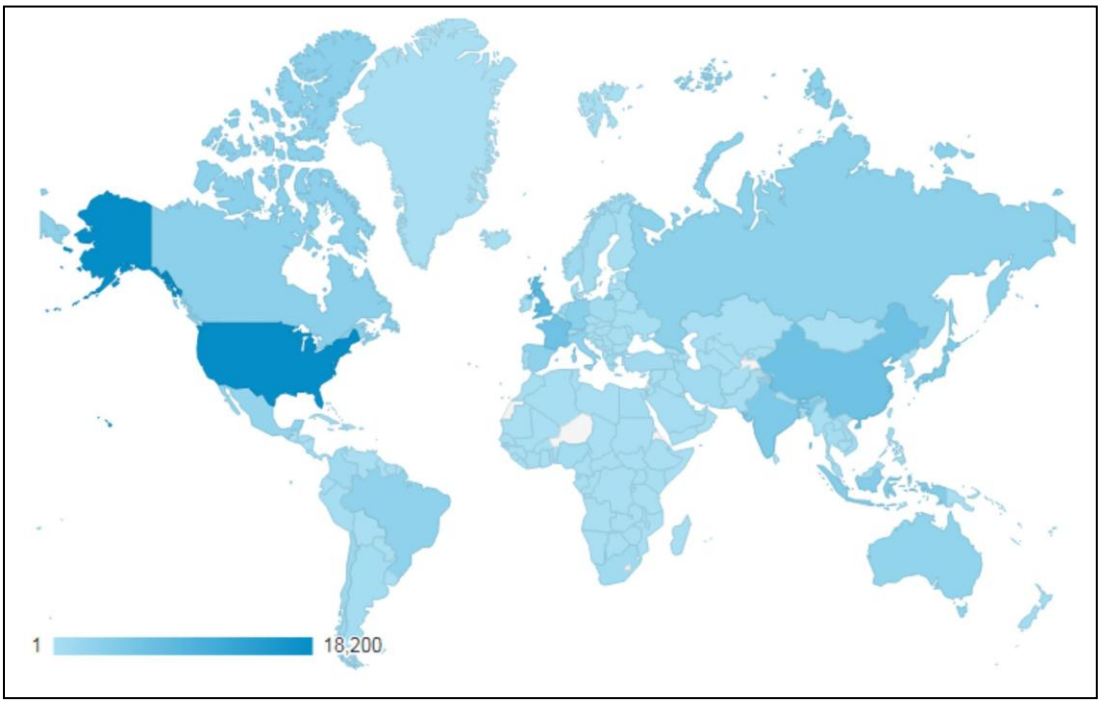
Geographic distribution of Internet Protocol (IP) addresses accessing GEBCO's web site

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	18,200	2.44	02:41
United Kingdom	8,773	2.93	04:13
China	6,540	2.97	02:12
France	6,363	2.29	02:35
Japan	5,084	2.98	03:41
India	4,722	2.52	03:26
Indonesia	3,978	2.89	05:41
Germany	3,388	2.97	03:29
Canada	3,311	2.84	03:29
Russia	3,183	2.75	03:07
Spain	2,846	3.08	03:37
Brazil	2,827	2.33	03:01
Italy	2,780	3.21	03:54
Australia	2,492	2.49	02:56
Mexico	2,333	2.61	04:13
South Korea	1,662	3.15	03:50
Chile	1,489	2.6	04:23
Netherlands	1,483	2.8	02:59
Norway	1,368	2.79	03:27
Colombia	1,172	3.2	06:40

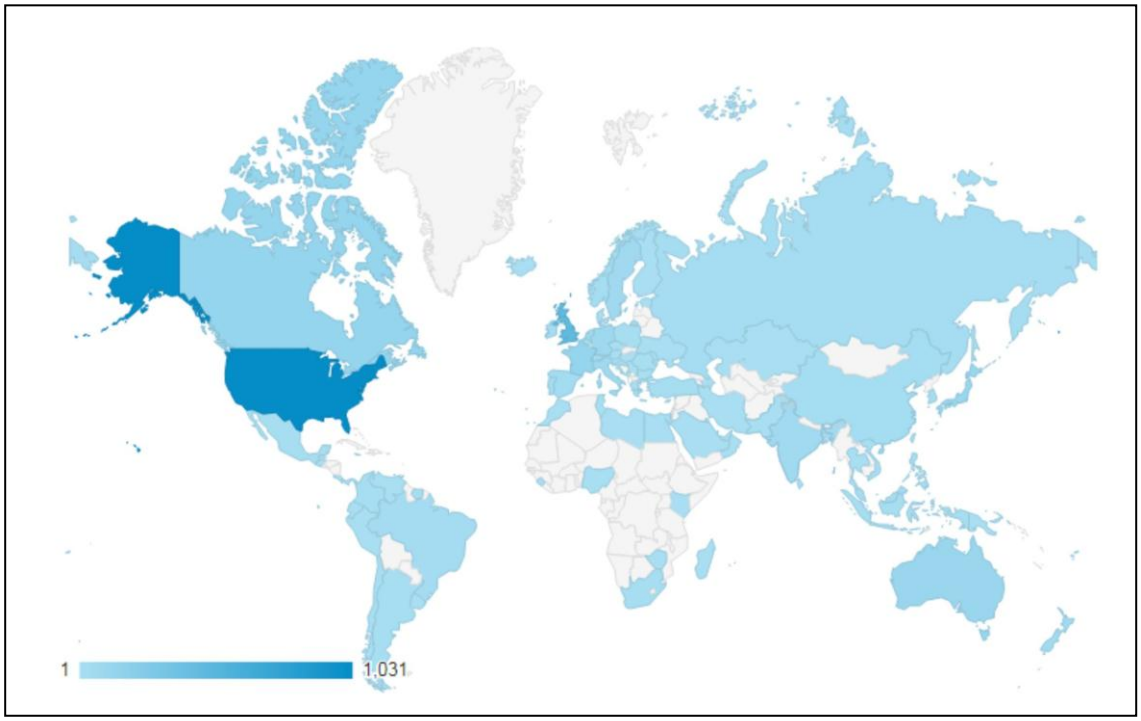


Geographic distribution of IP addresses accessing GEBCO's web site. The colouring indicates the number of web site visits for a particular country, from 0 (white) to 18,200 (dark blue).

Access to the Seabed 2030 web site (http://seabed2030.gebco.net)

The Seabed 2030 web site was setup to provide information specifically related to this project and to provide links back to the main GEBCO web site.

The web site went live on June 6th 2017, since then there have been over 8,080 visits to the site. The image below shows the geographic distribution of IP addresses accessing the site.



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

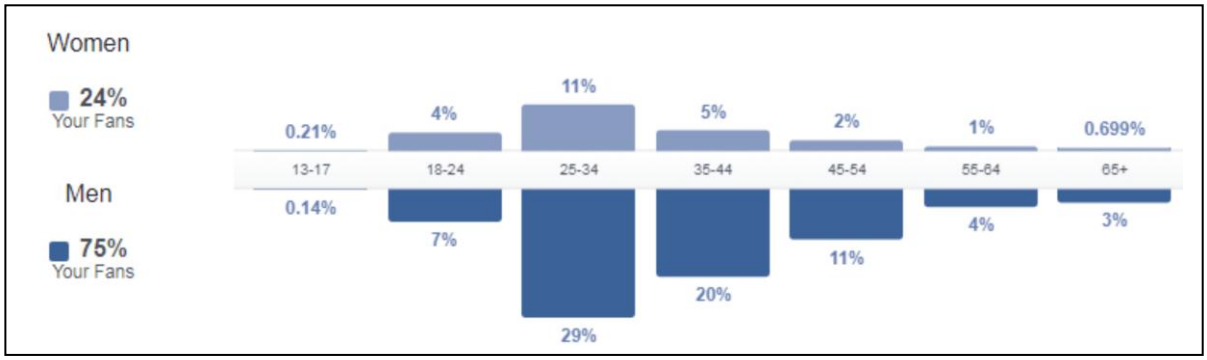
In 2017 we have posted 18 news items to GEBCO's Facebook page relating to GEBCO, bathymetry data and sea floor-related research.

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
19/09/2017	http://www.nautiluslive.org/blog/2017/09/12/seafloor-mapping-alon	587
13/09/2017	http://news.rice.edu/2017/08/21/hidden-river-once-flowed-beneath-antarctic-ice/	263
23/08/2017	http://noc.ac.uk/news/high-resolution-mapping-deep-sea-vertical-walls-using-ocean-robots	846
15/08/2017	https://www.sciencenewsforstudents.org/article/cool-jobs-science-deep-beneath-waves	875

20/07/2017	http://www.ga.gov.au/news-events/news/latest-news/the-data-behind-the-search-for-mh370-phase-one-data-released	1,400
03/07/2017	https://eos.org/project-updates/new-volcanic-island-unveils-explosive-past?utm_source=eos&utm_medium=email&utm_campaign=EosBuzz063017	256
27/06/2017	https://eos.org/project-updates/a-1-4-billion-pixel-map-of-the-gulf-of-mexico-seafloor	2,100
18/04/2017	http://www.ga.gov.au/news-events/news/latest-news/coming-in-from-the-cold-three-successful-antarctic-surveys-return-home	430
05/04/2017	http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_31-3-2017-12-15-59	279
28/03/2017	https://eos.org/opinions/airline-flight-paths-over-the-unmapped-ocean	535
16/03/2017	https://eos.org/project-updates/geological-insights-from-malaysia-airlines-flight-mh370-search	2,700
08/03/2017	http://news.mit.edu/2017/underwater-mountains-turbulence-ocean-circulation-0306	1,500
23/02/2017	http://oceanexplorer.noaa.gov/okeanos/explorations/ex1702/welcome.html	161
20/02/2017	http://www.bbc.co.uk/news/world-asia-39000936	1,600
08/02/2017	https://www.jcu.edu.au/news/releases/2017/february/largest-undersea-landslide-revealed-on-the-great-barrier-reef	1,400
30/01/2017	http://www.gebco.net/about_us/news_and_events/exploring_seafloor_video.html	857
16/01/2017	http://www.sciencemag.org/news/2017/01/expedition-probes-ocean-trench-s-deepest-secrets	396
09/01/2017	https://schmidtocean.org/unexplored-ocean-depths-bustling-life-despite-extreme-conditions/	193

The graphic below gives information from Facebook's insights statistics on the gender and age range of people who 'liked' GEBCO's Facebook page in 2017.



The table below gives information on the countries where people who 'liked' GEBCO's Facebook pages (in 2017) are from.

Country	No. of GEBCO's Facebook page 'fans'		Country	No. of GEBCO's Facebook page 'fans'
United States of America	183		France	29
Indonesia	89		Australia	25
India	83		Chile	24
Malaysia	82		Argentina	23
United Kingdom	63		Spain	23
Egypt	57		Turkey	21
Brazil	48		Colombia	21
Mexico	40		Vietnam	21
Bangladesh	39		Peru	19
Italy	36		Thailand	19
Philippines	35		Portugal	18
Canada	34		Taiwan	18