Version 2.0 of the GEBCO One Minute Grid

The GEBCO One Minute Grid was originally released in 2003 as part of the Centenary Edition of the GEBCO Digital Atlas (GDA). It is largely based on the bathymetric contours contained within the GDA with additional data used to help constrain the grid in some areas. You can find out more about the development of the grid from the documentation which accompanies the data set (gridhelp.pdf).

Version 2.0 of the GEBCO One Minute Grid was released in November 2008 and includes version 2.23 of the International Bathymetric Chart of the Arctic Ocean (IBCAO) and updated bathymetry for some shallow water areas around India and Pakistan; the Korean Peninsula and South Africa.

Included in version 2.0 of the GEBCO One Minute Grid

- Version 2.23 of the International Bathymetric Chart of the Arctic Ocean
- Shallow water bathymetry updates for:
  waters around India and Pakistan
  waters around the Korean Peninsula
  waters around South Africa
- Updates for some reported bug fixes in version 1.0 of the GEBCO One Minute Grid

Version 2.23 of the International Bathymetric Chart of the Arctic Ocean (IBCAO)

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Data set limits: north of 64°N to 90°N; 180°W to 180°E

The IBCAO was first released in 2000. Since then there have been a number of multibeam surveys in the Arctic Ocean region which have significantly improved our knowledge of the shape of the seafloor in this region. The IBCAO team felt this warranted an update to the IBCAO data set and version 2.23 of the IBCAO was released in March 2008.

Further details about the IBCAO data set along with grids and maps for downloading can be found at: http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/arctic.html.

Shallow water bathymetry data updates

GEBCO has traditionally depicted the bathymetry of the deeper water areas of the world's oceans, i.e. at depths of 200 m and deeper. In order to more adequately represent the shape of the ocean floor in all areas, and to serve a wide range of users, the GEBCO community has recognised the importance of improving the GEBCO One Minute Grid in shallow water areas.

The bathymetry data held collectively by International Hydrographic Organization (IHO) Member States in the Electronic Navigation Chart (ENC) system was recognised as a valuable source of data which could be used to significantly improve the existing and future GEBCO grids in shallow water regions.

Extracting bathymetry data from ENCs

A software application was developed to simplify the extraction of data from ENC files (usage bands 2 and 3). This software package was supplied to IHO Member States on request. This work was co-ordinated by the International Hydrographic Bureau (IHB).

The software extracts data from ENC GEO object classes (SOUNDG, COALNE and DEPCNT) and META object classes (M_VDAT, M_SDAT and M_QUAL) into simple ASCII format files. Further information about object classes and attributes associated with them can be found in the IHO document: IHO Transfer Standard for Digital Hydrographic Data (S57).

Many Hydrographic Offices have already contributed shallow water bathymetry data. Data for three regions have so far been used to update the GEBCO One Minute Grid. This work is described below.

Updating the GEBCO One Minute Grid

Sounding point data extracted from ENCs for the areas around India and Pakistan; the Korean Peninsula and South Africa has been used to update the GEBCO One Minute Grid and have been released as part of version 2.0 of this data set.

Work on the incorporation of shallow water bathymetry data into the GEBCO One Minute Grid was carried out at the British Oceanographic Data Centre (BODC). For further information contact Pauline Weatherall (paw@bodc.ac.uk).

The general method used to update the grid in shallow water regions is described below. Further information about the data provided and the generation of the grid for each of these separate areas is given at the end of this document.

Data source – soundings extracted from ENCs

For each region, sounding points were provided from a number of overlapping ENC data sets. An attempt has been made to edit data from overlap regions. Only those ENC sounding points shallower than 300m were used in the gridding work.

The ENC data are to chart datum - no attempt has been made to adjust the data for the state of the tide.

Data source – original GEBCO One Minute Grid

The aim of this work is to update the existing GEBCO grid in shallow water regions, therefore the ENC sounding point data were combined with the original source data used to generate the GEBCO One Minute Grid, i.e. bathymetric contours from the GEBCO Digital Atlas, additional control used to constrain the grid; World Vector Shoreline and land elevation data from the Global Land One-km Base Elevation (GLOBE) project data set.

Harmonizing the data sets

A Geographic Information System (GIS) was used to visualise the relationship between the original grid source data sets and the ENC sounding points. In some areas it was necessary to edit the GEBCO bathymetric contours to harmonize the data sets. The ENC sounding points, GEBCO bathymetric contours, additional grid control data, coastline and land elevation data were then combined into one ASCII XYZ file.

Gridding work

The gridding work was done using routines from the Generic Mapping Tools (GMT) suite of software. The data were first filtered using the 'blockmedian' routine. The gridding was done using the 'surface' routine.

The grids were then checked for any errors or grid artefacts and the gridding process was repeated if necessary.

More detailed information about the generation of the grids for each area follows below.

Please note that although the grid has been improved in shallow water regions the data set is not to be used for navigation or any purpose relating to safety at sea.

Improving the GEBCO One Minute Grid in the area around India and Pakistan

Geographic area: Coastal regions shallower than 300m between 62° 12'E and 87°E
**ENC data set provider:** National Hydrographic Office, India

The data set supplied by the National Hydrographic Office, India consists of 44 separate ENC data files.

Only those ENC sounding points shallower than 300m were used in the gridding work, the resulting data file contains 27,113 points. The image below shows the coverage of the ENC sounding points used to generate the grid.
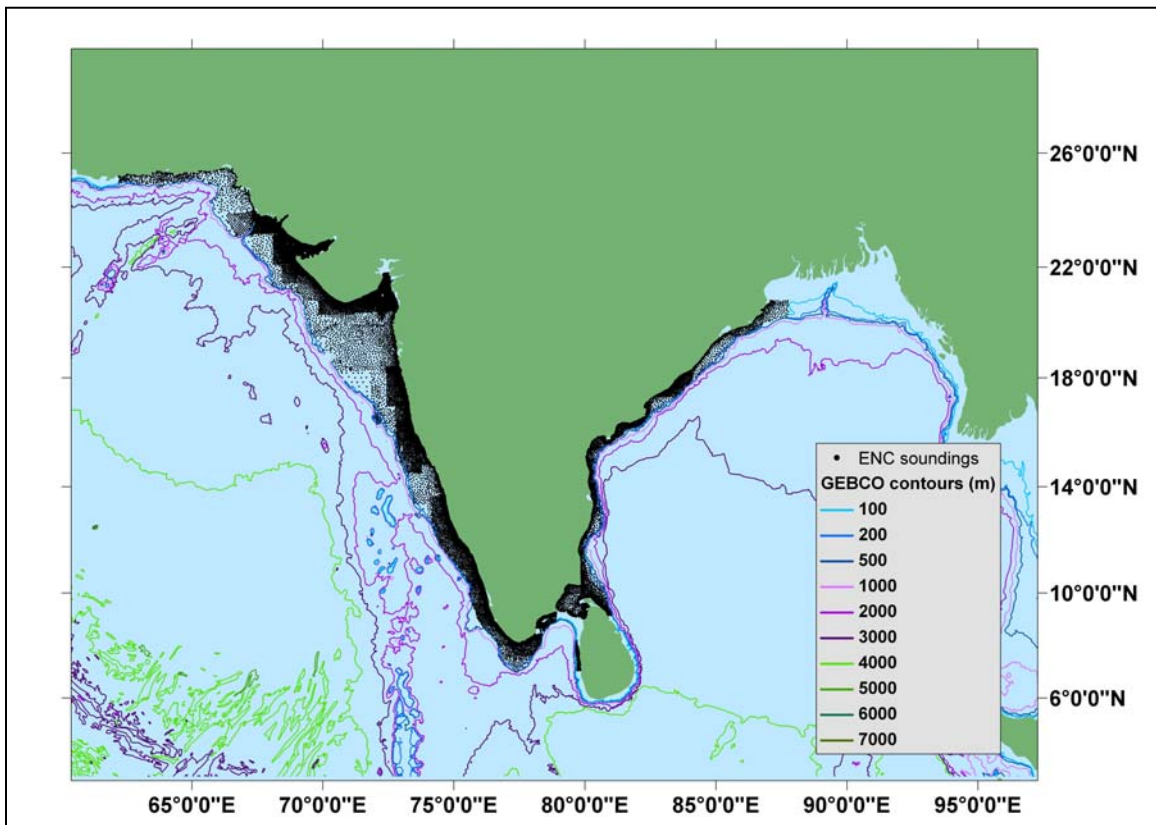
Distribution of ENC sounding points used in the gridding work

The histogram below shows the number of sounding points from the ENC data set per 50m depth interval used to update the GEBCO One Minute Grid.
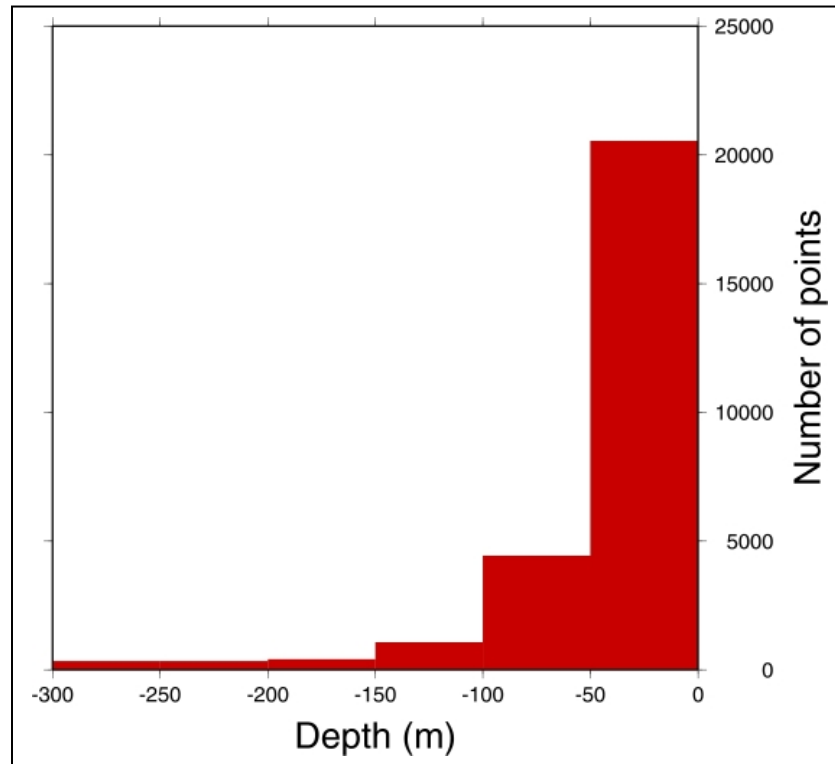
A Geographic Information System (GIS) was used to visualise the relationship between the original grid source data – i.e. bathymetric contours from the GEBCO Digital Atlas and the ENC sounding points. In some areas it was necessary to edit the GEBCO bathymetric contours to harmonize the data sets. The ENC sounding points, GEBCO bathymetric contours, additional grid control data, coastline and land elevation data were then combined into one ASCII XYZ file.

The gridding work was done using Generic Mapping Tools (GMT) software routines.
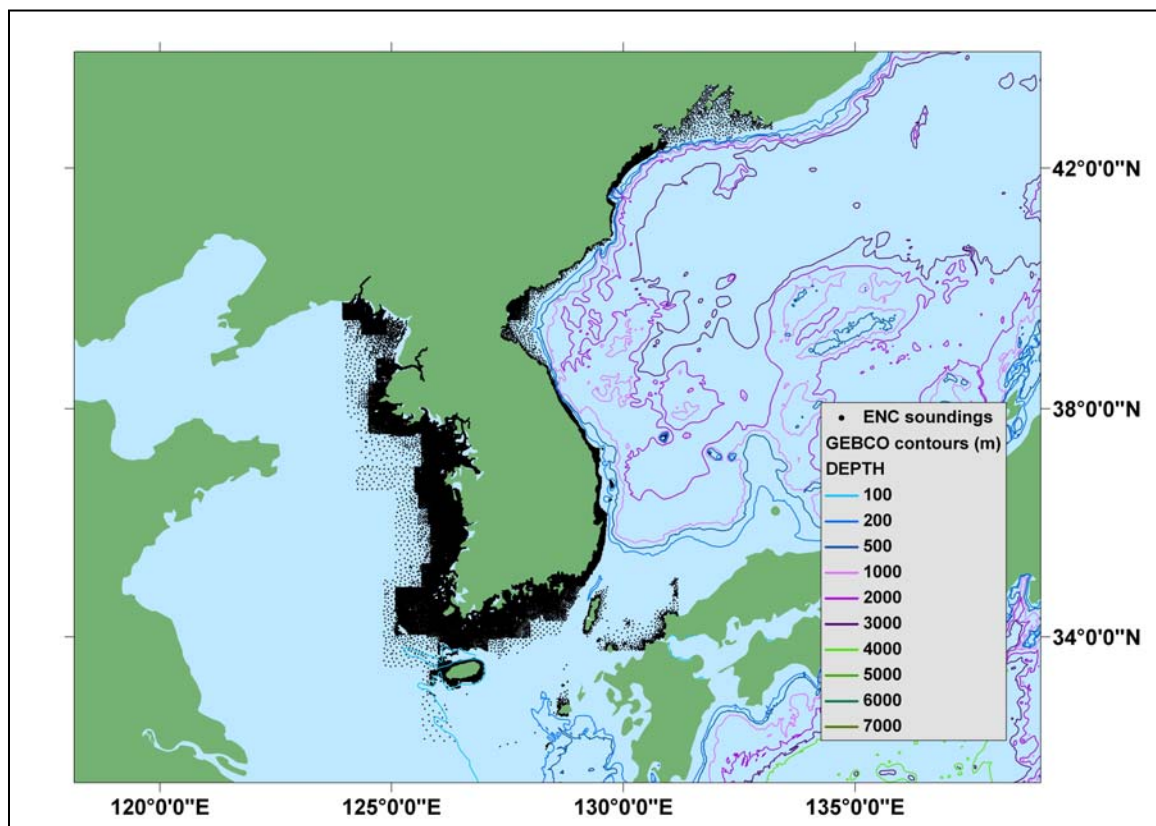
Improving the GEBCO One Minute Grid in the area around the Korean Peninsula

Geographic area: coastal areas shallower than 300m between 123° 56'E and 132°E
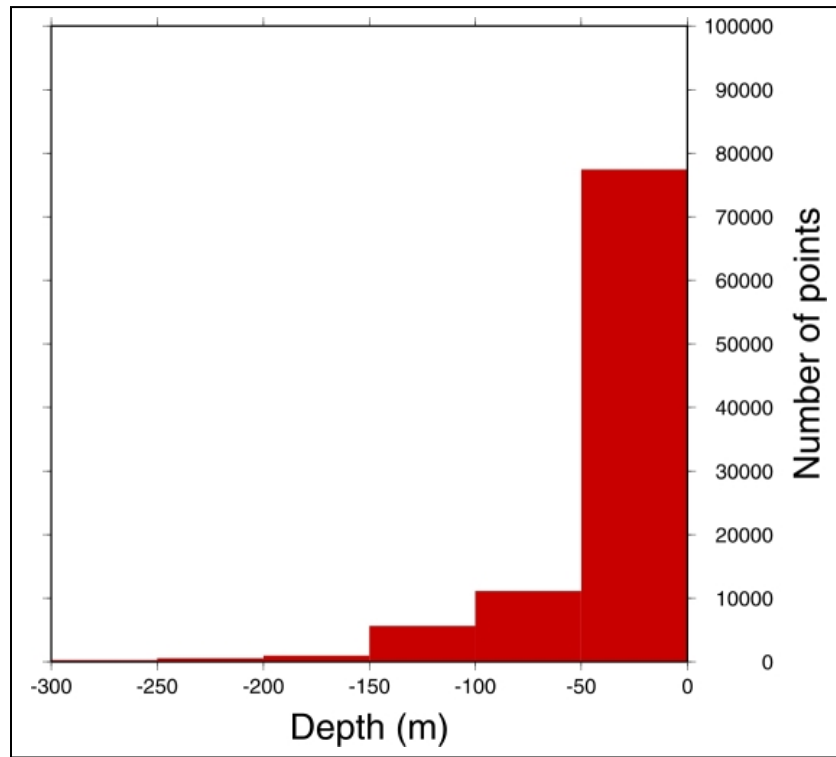**Data provider:** National Oceanographic Research Institute (NORI), Republic of Korea

The data set supplied by NORI consists of bathymetric soundings, bathymetric contours, coastline data and quality of data information polygons. The bathymetric sounding point data set were used for the gridding work. The data are taken from 82 separate ENC data files.

Only those sounding points shallower than 300m have been included for the gridding work. The resulting data file used for gridding contains 96,061 points.

Distribution of ENC sounding points used in the gridding work

The histogram below shows the number of sounding points from the ENC data set per 50m depth interval used for gridding.

A Geographic Information System (GIS) was used to visualise the relationship between the original grid source data – i.e. bathymetric contours from the GEBCO Digital Atlas and the ENC sounding points. In some areas it was necessary to edit the GEBCO bathymetric contours to harmonize the data sets. The ENC sounding points, GEBCO bathymetric contours, additional grid control data, coastline and land elevation data were then combined into one ASCII XYZ file.

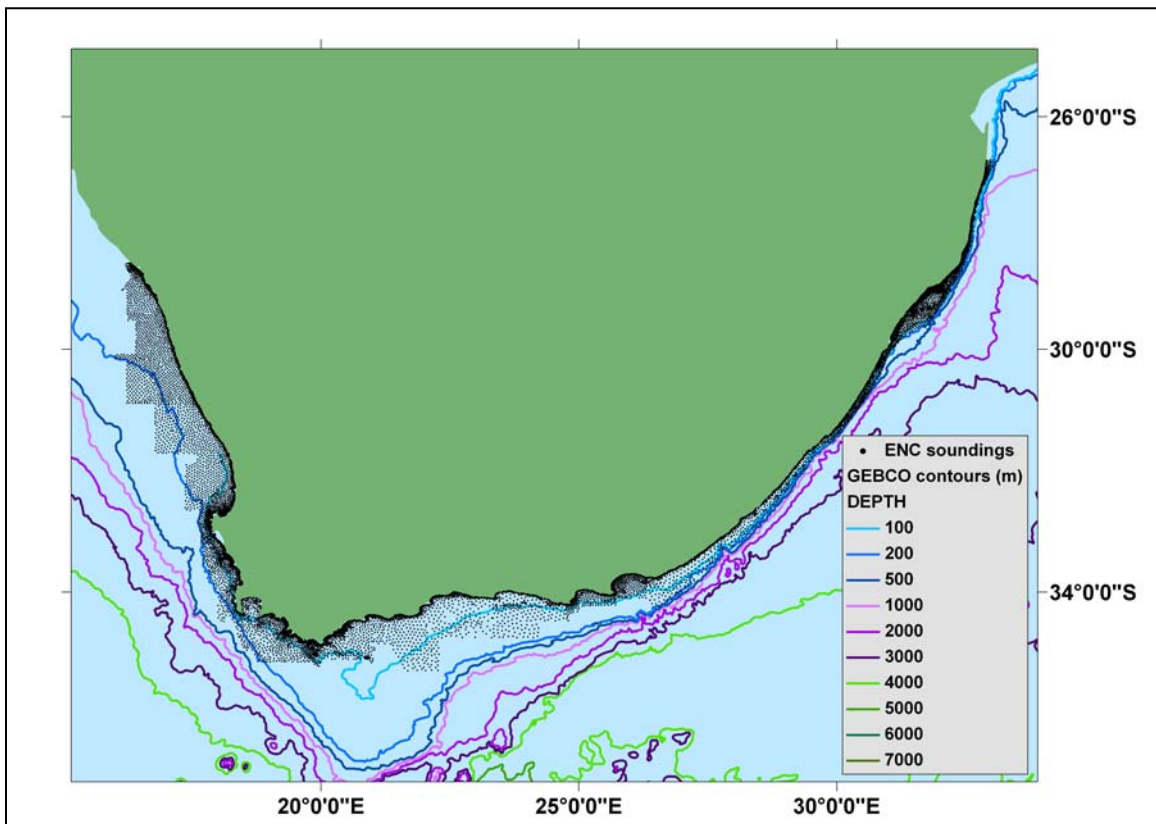The gridding work was done using routines from the Generic Mapping Tools (GMT) system.

Improving the GEBCO One Minute Grid in the area around South Africa

Geographic area: coastal areas shallower than 300m between 16° 20'E and 32° 54'E
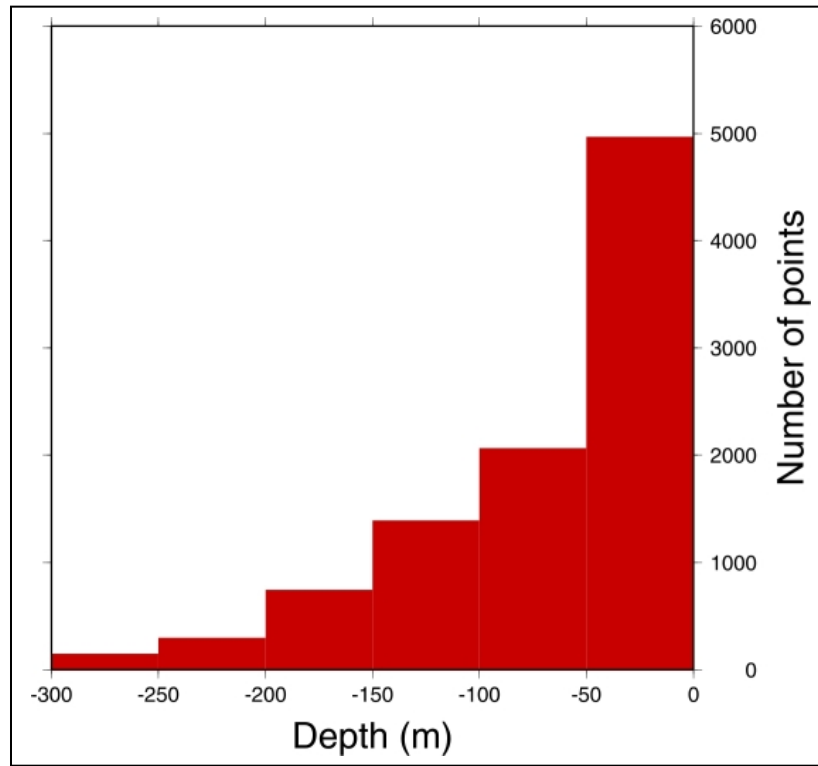**Data provider:** South African Hydrographic Office

The data set supplied by the South African Hydrographic Office consists of bathymetric soundings, bathymetric contours, coastline data and quality of data information polygons. The bathymetric sounding point data set were used for the gridding work. The data are taken from 23 separate ENC data files.

Only those ENC sounding points shallower than 300m were used in the gridding work, the resulting data file contains 9,622 points. The image below shows the coverage of the ENC sounding points used to generate the grid.

Distribution of ENC sounding points used in the gridding work

The histogram below shows the number of sounding points from the ENC data set per 50m depth interval used for gridding.

A Geographic Information System (GIS) was used to visualise the relationship between the original grid source data – i.e. bathymetric contours from the GEBCO Digital Atlas and the ENC sounding points. In some areas it was necessary to edit the GEBCO bathymetric contours to harmonize the data sets. The ENC sounding points, GEBCO bathymetric contours, additional grid control data, coastline and land elevation data were then combined into one ASCII XYZ file.

The gridding work was done using Generic Mapping Tools (GMT) routines.

Updates for reported bugs in version 1.0 of the GEBCO One Minute Grid

Version 2.0 of the GEBCO One Minute Grid includes updates for reported bugs in the Hudson Bay area and off the west coast of Africa.

A list of reported bugs in the GEBCO One Minute Grid can be found on the following web site: http://www.bodc.ac.uk/help_and_hints/errata/gebco.html