

EMODnet Bathymetry – a new release of the digital bathymetry of the European seas

In September 2018 the eight release of the EMODnet Digital Terrain Model for the European seas was published. This is the result of a cooperation in EMODnet Bathymetry (www.emodnet-bathymetry.eu) between major marine research institutes, national hydrographic services, survey companies, and experts in data management and IT, which started in 2008 and matured over time with an expanding partnership.

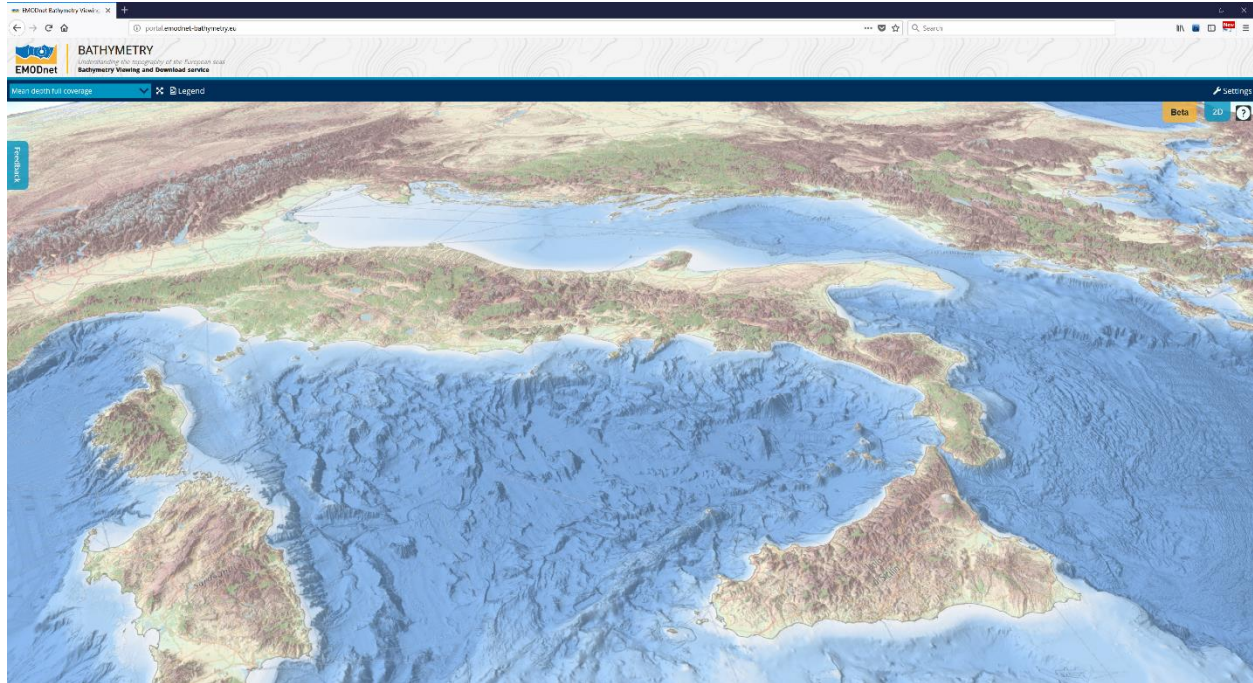


Image: perspective on the Tyrrhenian sea near Italy

The first EMODnet DTM was released in May 2010 with a grid resolution of 1/4 arc minute * 1/4 arc minute and for a selected number of European seas. The latest DTM covers all European seas including the Arctic and has a common resolution of 1/16 arc minute * 1/16 arc minute (circa 115 * 115 meters).

The bathymetric survey data sets originate from 48 data providers and are used as input for generating the EMODnet DTM product. Agreed standards and common vocabularies, based upon SeaDataNet (see <http://www.seadatanet.org>), have been adopted for data, data product and metadata formats. The portal follows INSPIRE and OGC standards for providing discovery, viewing, downloading and wider interoperability services. The portal provides 3 interrelated operational services:

- The **Bathymetry Viewing and Downloading service** gives users functionalities for viewing individual and combined layers of the EMODnet DTM together with external map layers and for downloading components of the EMODnet DTM in a range of formats; each cell in the DTM gives a reference to the prevailing data set or data product as used as input for the DTM generation
- The **CDI Data Discovery and Access service** as adopted and adapted from SeaDataNet for providing an integrated and harmonised overview and access to bathymetric survey data sets

that are gathered by the project. At present > 27.000 surveys from 42 data centres from 20 countries are indexed;

- The **Sextant catalogue service** has been adopted and adapted from SeaDataNet as discovery service for providing details about Composite DTMs that are provided by a number of data centres instead of basic survey data sets. At present 142 composite DTMs from 28 data providers from 17 countries are indexed.

The overall EMODnet DTM is produced following an established and regularly updated methodology and making use of a common software tool 'GLOBE'. The methodology is documented in the 'Manual on QA/QC and DTM generation (latest version November 2017)' which can be downloaded from the portal.

Data providers are strongly encouraged to provide survey data which are to be described by CDI metadata. The survey data sets must be processed and pre-gridded using the GLOBE software and following the EMODnet grid. All data providers are requested to deliver their survey data sets at a grid resolution of at least 1/32 or rather 1/64 arc minutes, unless not allowed due to their local data policy. Data providers alternatively might provide composite DTMs which are to be described by Sextant Catalogue references. These are DTMs created from multiple datasets from the same provider. The composite DTM must be re-sampled at a resolution comparable to those given for survey data sets: at least 1/32 or rather 1/64 arc minutes, unless not allowed. The Composite DTMs must also be processed and pre-gridded using the GLOBE software and following the EMODnet grid. Following these guidelines, all data providers have to undertake processing activities to make their data sets ready for further steps by regional coordinators that are responsible for producing regional EMODnet DTMs.

The generation of Regional DTMs is divided over regional sea basin subgroups, each with a Regional Coordinator. Each is responsible for producing a regional EMODnet DTM using the GLOBE software, a selection from the available pre-processed survey data and composite DTMs and applying their bathymetric expertise. The regional DTMs are produced at the target resolution of 1/16 minute * 1/16 minute while available data sets might have higher resolution. The phase of going from local processed data sets to regional DTMs involves three steps: 1) aggregating the provided data sets, 2) generating a continuous bathymetry surface, sometimes called "smoothed depth layer" from the input data sets, and 3) DTM QA-QC. In case of data gaps, use is made of GEBCO to fill the gaps which might give anomalies that need to be corrected.

The final step is done by the integrator. This is not only an integration but also a final QA – QC to achieve a high quality bathymetry product that can be made public by the Bathymetry Viewing service at the portal for viewing and for downloading. It starts with a number of QA - QC actions on the received regional DTMs. It includes ensuring the consistency of CDI and composite DTM references that are named in the regional DTMs. This is followed by integrating the various regional DTMs in the overall products which requires activities for spotting and avoiding edge-effects by local smoothing and other activities.

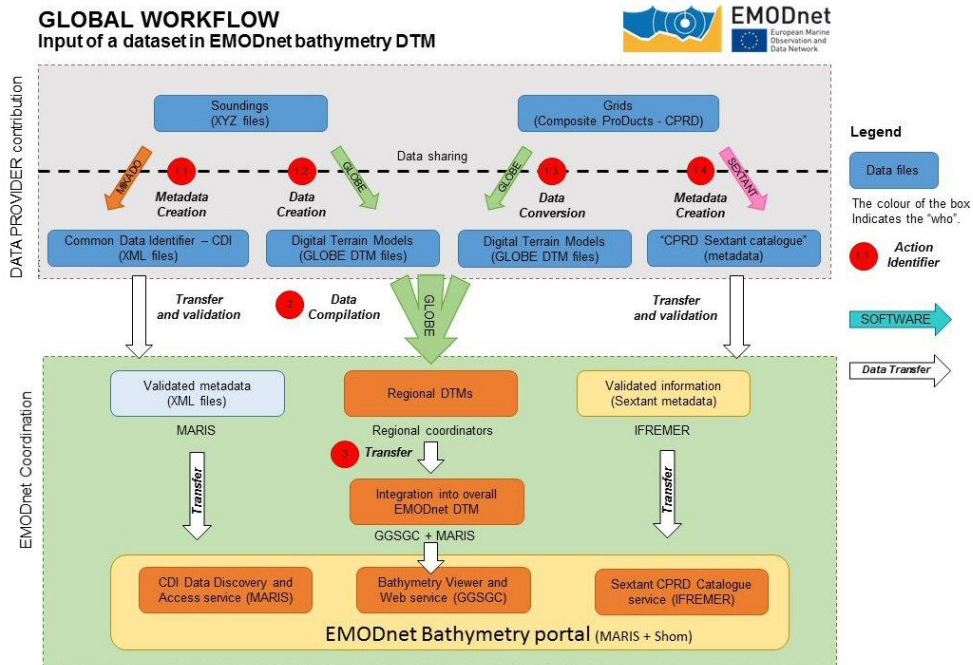


Image: DTM Workflow for EMODnet Bathymetry

The latest EMODnet DTM offers many benefits to users:

- A resolution increased from $1/8 * 1/8$ arc minutes to $1/16 * 1/16$ arc minutes (circa $115 * 115$ meters). Altogether the EMODnet DTM contains $113892 * 108132 =$ circa 12.3 billion data points;
- A powerful 3D visualisation functionality of the bathymetry that can be used in the browser without the requirement of plugins;
- A faster representation of the complexity of the map;
- An expanded coverage including all European seas as well as the European part of the Arctic Ocean and Barents Sea;
- The number of bathymetric survey data sets and composite DTMs, used as data sources, has increased from about 7.200 to about 9.400. These come from 48 data providers. All related metadata can be retrieved through a source reference layer;
- The inclusion of Satellite Derived Bathymetry data products, in particular for coastal stretches of Spain and Greece.

The latest DTM offers higher resolution, powerful 3D visualisation functionality and extended coverage of Europe's seas. It is available free of charge for viewing and downloading, and sharing by OGC web services from the [EMODnet Bathymetry portal](#).