

EMODnet Bathymetry - High Resolution Seabed Mapping – increasing the resolution of the digital bathymetry for European seas

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Access to marine data is a key issue for the **EU Marine Strategy Framework Directive** and the **EU Marine Knowledge 2020 agenda** and includes the **European Marine Observation and Data Network (EMODnet)** initiative. EMODnet aims at assembling European marine data, data products and metadata from diverse sources in a uniform way.

The EMODnet Bathymetry project is active since 2008 and has developed Digital Terrain Models (DTM) for the European seas, which are published at a regular interval, each time extending coverage, improving quality and precision, and expanding functionalities for viewing, using, and downloading. The DTMs are produced from survey and aggregated data sets (Composite DTMs) that are referenced with metadata adopting the SeaDataNet Catalogue services. SeaDataNet is a pan-European infrastructure for marine and ocean data management, developed and operated by NODCs in Europe, and connecting already more than 110 major oceanographic data centres around the European seas. Bathymetry survey data sets are gathered and populated by national hydrographic services, marine research institutes, and companies in the SeaDataNet CDI Data Discovery & Access service. This amounts to more than 27.500 datasets, while more than 190 composite DTMs and Satellite Derived Bathymetry products are included in the SeaDataNet Sextant catalogue service. The SDB data are based upon Landsat-8 and Sentinel-2 satellite images and fill gaps in coverage of the coastal zones, in particular in several Mediterranean countries. The number of data providers amounts to 51 from 24 countries. Further gathering is on-going and a major selection of these datasets will be used for preparing a new release of the EMODnet Digital Terrain Model (DTM) for all European waters, which is planned for end 2020.

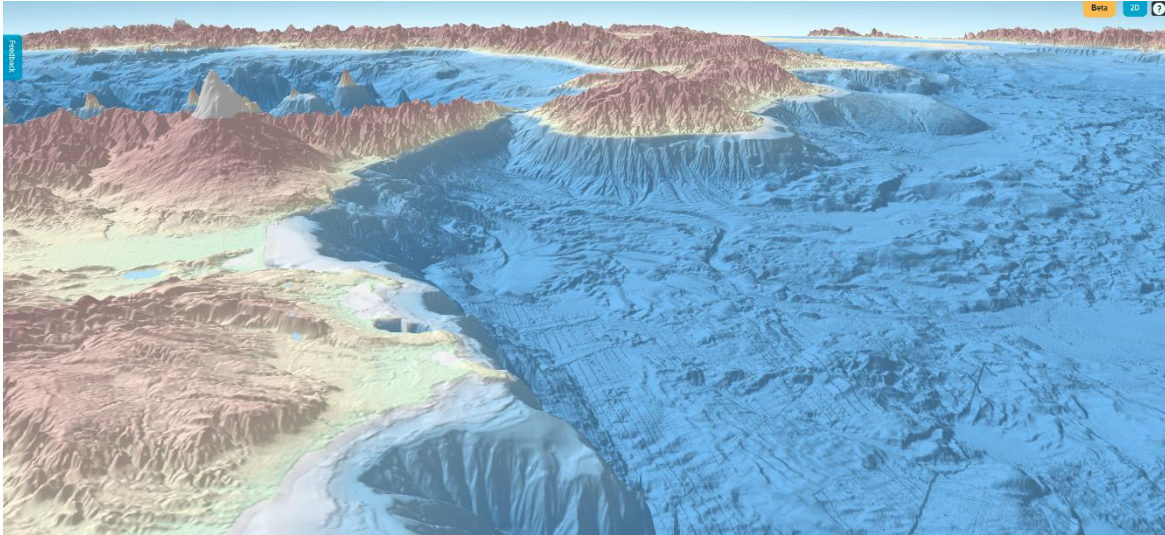


Figure 1: 3D View from the South along Sicily and the Southern part of mainland Italy

The current EMODnet Digital Terrain Model (DTM) was released in September 2018 and has a grid resolution of $1/16 * 1/16$ arc minutes (circa $115 * 115$ m²), covering all European seas including part of the Arctic Ocean and Barents Sea. This DTM is based upon circa 9,400 in situ datasets and composite DTMs. Overall, this DTM contains approximately 12.3 billion grid nodes. The DTM and other relevant layers can be viewed in the Bathymetry Viewing and Download service, which also includes 3D viewing capability, based upon Cesium. However, current open source implementations of Cesium all make use of a height map (raster based) tile structure. Although workable, the performance on an average computer is not optimal and in areas below sea level, artefacts (tile joints) may be visible. Therefore, to overcome these issues EMODnet Bathymetry developed a data structure based on a triangulated irregular network (TIN). This enables faster representation of the complexity of the map. As there was no open-source tool available for creating tiles in quantized mesh format out of a raster format such as used in EMODnet, this software has been developed by the project and is now available by GitHub.

Next to the DTM, EMODnet Bathymetry provides access to: 1) a layer with digital Satellite Derived Coastlines for the Lowest Astronomical Tide (LAT), the Mean Sea Level (MSL) and the Mean High Water (MHW) tidal reference levels; 2) a layer with High Resolution hotspots, consisting of a collection of circa 200 high resolution composite DTMs for selected areas. Their resolution varies between $1/32$ and $1/512$ arc minutes, depending on the local data policy of data providers; 3) a layer with Digital Terrain Model Quality Indicators for vertical and horizontal precision, survey age, purpose of the survey, and combined quality; and 4) an inventory of national baselines and coastlines collected from 21 national authorities. EMODnet Bathymetry is also managing the European contribution to the international Seabed 2030 project.

The EMODnet DTM can be freely viewed and downloaded (by 64 tiles), and shared by OGC web services. The EMODnet Bathymetry portal and its DTM viewing and download service are very popular and in 2019 more than 50.000 portal visitors were counted, of whom circa 4.000 users from 2.100 organisations from 115 countries have downloaded altogether 38.000 EMODnet DTM tiles in 11.000 transactions. The user community roughly consists of 20% industry, 20% research, 40% universities, and 20% others. In 2019 a major milestone was reached of more than 200.000 DTM tile downloads since the start of EMODnet Bathymetry in 2008. These statistics together with many direct contacts and received mail feedbacks indicate that EMODnet Bathymetry serves a large number of users and use cases and is very much appreciated by all sectors. This is amplified by the intense use of the OGC web services (machine-to-machine) as many users also apply the EMODnet DTM and its various information layers as base layers in their own portal and applications.

The presentation will highlight key details of the EMODnet Bathymetry process, results and the ongoing activities for further improving the digital bathymetry and services.