



EMODnet Thematic Lot n° 1

# Bathymetry

EMODnet Phase 2 – Final report

Reporting Period: June 2013 – September 2016

Contract SI2.656767 EMODnet MARE/2012/10 lot 1

Date: 21/11/2016

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## List of abbreviations and acronyms

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Acronyms as used in this report are defined in the following list:

**BSBD**, Baltic Sea Bathymetry Database.

**BSHC**, Baltic Sea Hydrographic Commission.

**CDI**, Common Data Index, provides a highly detailed description of the survey data, answering to the questions: where, when, how and who collected the data, and how to get them. One CDI describes a survey by means of a polygon or survey track. The CDI service also includes a shopping service for requesting access to selected data sets and for downloading as data files, if access has been granted by the data owners.

**CPRD**, Composite DTM data sets, giving a gridded bathymetry. In practice it appears that Hydrographic Offices (HO's) do not want or can not deliver primary surveys but composite data sets from the Digital Terrain Models that they maintain themselves for producing and maintaining their nautical charts following international IHO procedures. Composite DTM's are DTM's that have been generated by the data provider itself at a specific resolution and making use of survey data sets as managed by that data provider. These Composite DTM's might contain grid cells for which no survey data were available and which are then possibly completed by interpolation or other manipulation. Overall the EMODnet project prefers to get access to survey data sets, where possible, and not the derived Composite DTM's. However in practice this is not (yet) always possible and using the Composite DTM's can then be considered as the next best option. In addition, Composite DTM providers are encouraged to describe anyway their survey data sets in the CDI Data Discovery and Access service in order to give better insight in the real survey coverage. This is followed up by an increasing number of providers, but not always possible for historic reasons.

**DTM**, Digital Terrain Model, is a resulting grid data set with attributes for lat, lon, minimum depth, maximum depth, average water depth, standard deviation, number of values, number of elementary surfaces, smoothed average water depth, depth smoothed offset, CDI reference, and Composite DTM reference / GEBCO\_2014 reference.

**GEBCO**, the General Bathymetric Chart of the Oceans (GEBCO) consists of an international group of experts who work on the development of a range of bathymetric data sets and data products, including gridded bathymetric data sets, the GEBCO Digital Atlas, the GEBCO world map and the GEBCO Gazetteer of Undersea Feature Names. GEBCO operates under the joint auspices of the the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) (of UNESCO). GEBCO 30" gridded data is used by the EMODnet project to complete area coverage in case there are no survey data or Composite DTM data sets available to the partners. GEBCO is represented in the EMODnet Bathymetry consortium by means of its editor, NERC-BODC.

**Sextant**, catalogue service used to provide details about Composite DTM data sets. It allows to discover any Composite DTM's as available and used for the EMODnet DTM instead of bathymetry survey data sets. The location is given by a Lat-Lon box in a map and descriptions are given of each Composite DTM with information for what, when, how, and who. The Sextant entries are linked as references in the EMODnet DTM grid cells, where appropriate, to indicate the source data. The Sextant service for EMODnet Bathymetry does not give a shopping service for requesting access to the Composite DTM's.

**SeaDataNet**, is the pan-European infrastructure for ocean & marine data management sponsored within FP7 (grant agreement 283607, 1/10/2011-30/9/2015) connecting at present more than 100 national oceanographic data centres and marine data centres from 35 countries riparian to all European seas.

**WCS**, Web Coverage Service is an OGC standard defining Web-based retrieval of coverages i.e. digital geospatial information representing space/time-varying phenomena.

**WFS**, Web Feature Service is an OGC standard allowing requests for geographical features across the web using platform-independent calls.

**WMS**, Web Map Service is a standard OGC protocol for serving geo- referenced map images over the Internet.

**WMST**, Web Map Tile Service is a standard OGC protocol for serving pre-rendered georeferenced map tiles over the Internet.

## Executive summary

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The European Commission, represented by the Directorate-General for Maritime Affairs and Fisheries (DG MARE) had concluded a service contract with a consortium, coordinated by MARIS, for further developing the EMODnet Bathymetry portal. This contract has been a follow-up of the earlier developments for the EMODnet Hydrography and EMODnet Seabed Mapping projects which have taken place since June 2009 and that had resulted in an initial portal at:

<http://www.EMODnet-bathymetry.eu>.

The EMODnet Bathymetry project has taken place from June 2013 till end September 2016 and has successfully worked on:

- a continuation and upgrading of the earlier portal services
- a geographical extension, achieving a full European coverage of sea basins
- a refinement of the EMODnet Digital Terrain Model (DTM) for the bathymetry of the European seas by upscaling the resolution from  $\frac{1}{4}$  minute \*  $\frac{1}{4}$  minute to  $\frac{1}{8}$  minute \*  $\frac{1}{8}$  minute in a series of releases.

The work has been undertaken by a consortium consisting of organisations from marine science, the hydrographic survey community, and industry. The partners combine expertise and experiences of collecting, processing, and managing of bathymetric data together with expertise in distributed data infrastructure development and operation and providing of discovery, access and viewing services following INSPIRE implementation rules and international standards (ISO, OGC). In total 24 organisations have participated from the start of the project, while during the project 7 additional organisations have joined the consortium. This includes representatives of the General Bathymetric Chart of the Ocean (GEBCO) and the Baltic Sea Hydrographic Commission (BSHC). The consortium has thus more than doubled in size compared to the original group of 14 organisations that had previously undertaken the EMODnet Hydrography and EMODnet Seabed Mapping projects.

Project activities have aimed at:

- gathering more bathymetric datasets that can be used as input for generating a refined Digital Terrain Model (DTM) for all European sea areas;
- describing the gathered datasets with metadata and populating these in SeaDataNet catalogue services, namely survey datasets in the CDI Data Discovery and Access service and composite DTMs in the Sextant Catalogue service;
- refining the methodology and tools for performing QA – QC and generating a harmonised DTM at a resolution of  $\frac{1}{8}$  \*  $\frac{1}{8}$  arc minutes (circa 230 \* 230 meters);
- generating regional DTMs for European sea regions and integrating these into an overall EMODnet DTM, including metadata references to used datasets per gridcell;
- publishing the EMODnet DTM by means of a versatile viewing and downloading service as well as by machine-to-machine services in order to reach out to users;

- further developing and upgrading the EMODnet Bathymetry portal and its services for metadata and access to data and the EMODnet DTM dataproduct;
- undertaking promotion and dissemination to potential additional data providers and users.

These activities have resulted in an upgraded EMODnet Bathymetry portal which provides access by browsing, downloading and web services to a harmonised bathymetry Digital Terrain Model (DTM with grid size 1/8 minute \* 1/8 minute = ca 230 meter \* 230 meter) of all sea basins in European waters. It also gives access by discovery and shopping process to all underlying bathymetric survey data sets in a uniform way. The bathymetric survey data sets originate from hydrographic and research organisations 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:

1. 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. In case of missing data use is made of the GEBCO\_2014 bathymetry which is indicated in the DTM grid cell data. Layers can be shared with other portals by means of the OGC WMS and WCS protocols;
2. The SeaDataNet Common Data Index (CDI) infrastructure with its network of distributed data centres has been adopted and adapted to provide an integrated and harmonised overview and access to bathymetric survey data sets that are gathered by the project. The CDI metadata files describe bathymetric survey measurements, following the ISO19115 – 19139 metadata standards, and are supported by SeaDataNet controlled vocabularies. CDI references are included in DTM grid cells, wherever survey data have been used for the DTM. CDI discovery and browsing services are public, however users need to register in SeaDataNet for a single-sign-on data shopping process to all connected data centres to request access to survey data sets. At present > 14.000 surveys from 27 data centres from 15 countries are indexed in the dedicated **Bathymetry CDI Data Discovery and Access service**;
3. The SeaDataNet Sextant catalogue service has been adopted and adapted as discovery service for providing details about Composite DTMs that are provided by a number of data centres instead of basic survey data sets. The Sextant metadata files also follow the ISO19115 – 19139 metadata standards, and are supported by SeaDataNet controlled vocabularies. Sextant references are included in DTM grid cells, wherever Composite DTMs have been used for the DTM. At present 78 composite DTMs are indexed in the dedicated **Bathymetry Sextant Catalogue service**.

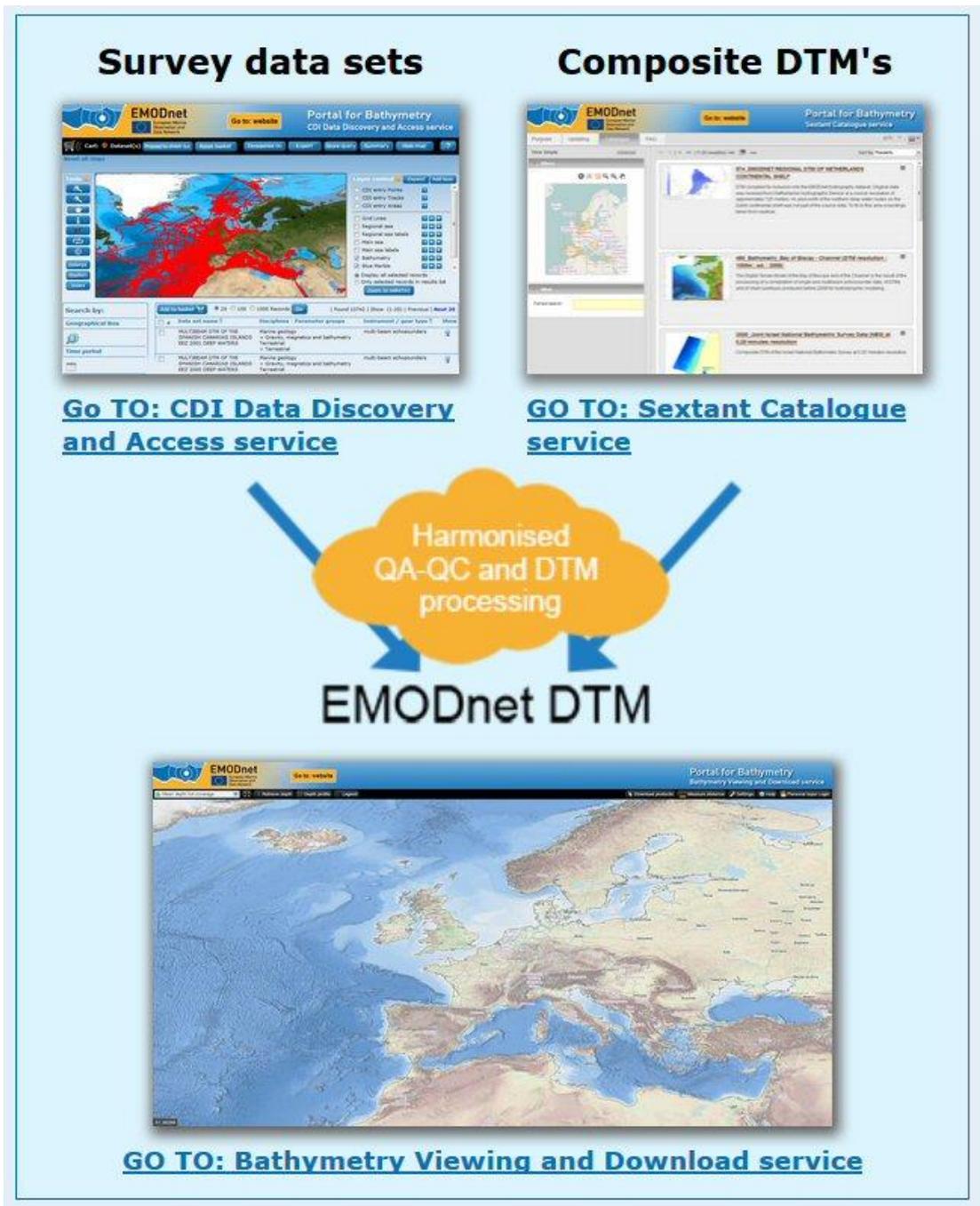


Image: Workflow and 3 interrelated services at the EMODnet Bathymetry portal

**Increased number of available datasets and data providers:**

The operational CDI service for EMODnet Bathymetry now contains **14791** entries from **28** data centres from **15** countries. This has increased from **9127** entries from **15** data centres from **9** countries at the start of the project. Their geocoverage is illustrated below.

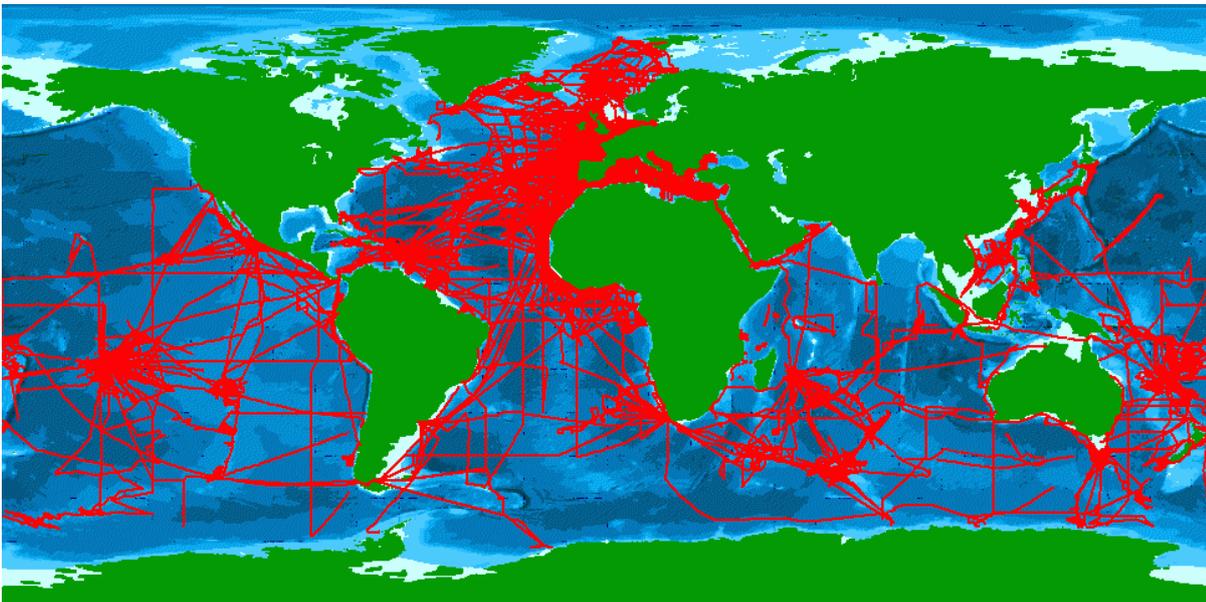


Image 3.1: Overview of geographical coverage of bathymetry CDI entries – end September 2016

The number of CDI entries relevant for European waters have increased from 6323 to 11505 survey entries, while the number of Sextant entries has increased from **32** composite DTMs contributed by **11** data providers from **11** countries to **77** composite DTMs from **19** data providers from **15** countries. Overall combined the total number of data providers has increased from **20** data providers from **13** countries to **34** data providers from **19** countries.

**Upgraded methodology for QA/QC and DTM processing:**

The existing methodology for QA/QC and generation of the EMODnet DTM has been revised and upgraded to be fit for the higher resolution. In addition, a common software tool ‘GLOBE’ has been developed, configured to effectuate the EMODnet methodology, and adopted by the consortium for processing input datasets and generating the DTMs in a harmonised approach. During the project several updates of the software have been released, responding to functional requirements and identified bugs and shortcomings as reported by consortium members. The EMODnet methodology is documented in the ‘**Manual on QA/QC and DTM generation**’ which can be downloaded from the portal.

Data providers are encouraged to provide **survey data** which are to be described by **CDI metadata** and populated into the **CDI Data Discovery and Access service**. The survey data sets must be processed into pre-sampled grid (preferably using the GLOBE software). The choice of the grid cell size is dependent on: survey characteristics, data accuracy, depth range, positioning system, internal data policy. This choice is the responsibility of the data provider. The following table gives a guideline.

Level of resolution	Cell size	Approx size in m	Single beam	Multibeam
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1	1/8'	230	deep sea	deep sea
2	1/16'	115	deep sea and shelf / low density	continental margin
3	1/32'	60	continental shelf	continental shelf
4	1/64'	30	coastal area	coastal area

*Table: Pre-sampled grid resolutions accepted vs. context*

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. Where possible, the composite DTM **should be re-sampled at a resolution** comparable to those given in the Table above. The data provider should give details on the sampling method. The data set attribute content should at least include a water depth value and it is encouraged to include also a reference per gridcell to the used survey data set, preferably by means of CDI reference. One of the issues with supplying data as a composite DTM by data providers is that several attribute layers such as min/max depth, standard deviation and number of soundings might not have been generated. Therefore supplying data as pre-sampled grids or raw soundings is preferred over composite DTMs.

#### **Producing regional DTMs and the integrated EMODnet DTM:**

Following these guidelines, data providers in the project have undertaken processing activities to make their data sets ready for further steps by Regional Coordinators that were responsible for producing regional EMODnet DTMs. A total of 10 regions has been defined to cover all of European seas in an area from 36 degrees West to 43 degrees East and from 85 degrees North to 25 degrees North. For each region a Regional Coordinator has been responsible for producing the regional EMODnet DTM using the GLOBE software, a selection from the available pre-processed survey data and composite DTMs, and using their bathymetric expertise. As part of this process, they have evaluated between available input files as received from data providers for areas and grid cells and selected the ones that were of best quality to their judgement as experienced hydrographer.

The regional DTMs have been validated and integrated by the EMODnet integrator into the EMODnet DTM. Identified quality issues have been discussed with the Regional Coordinators and also with the GLOBE software developer. These feedbacks have resulted over time in improvements of the GLOBE software and extra focus of Regional Coordinators on correcting identified anomalies.

Close cooperation and synergy has taken place with the General Bathymetric Chart of the Oceans (GEBCO) because the GEBCO DTM has been used to fill gaps in data coverage. This has resulted in a method whereby EMODnet DTM releases have been integrated in the next release of GEBCO for improving the bathymetry while vice versa the prevailing GEBCO releases have been integrated into the EMODnet DTM for filling gaps in geographical coverage. This exchange and synergy has resulted in reducing anomalies at boundaries and overall better results for both products.

However still significant discrepancies could be found between GEBCO data (primarily based upon altimetry and at higher resolution of ½ arc minute \* ½ arc minute). Therefore a localized smoothing

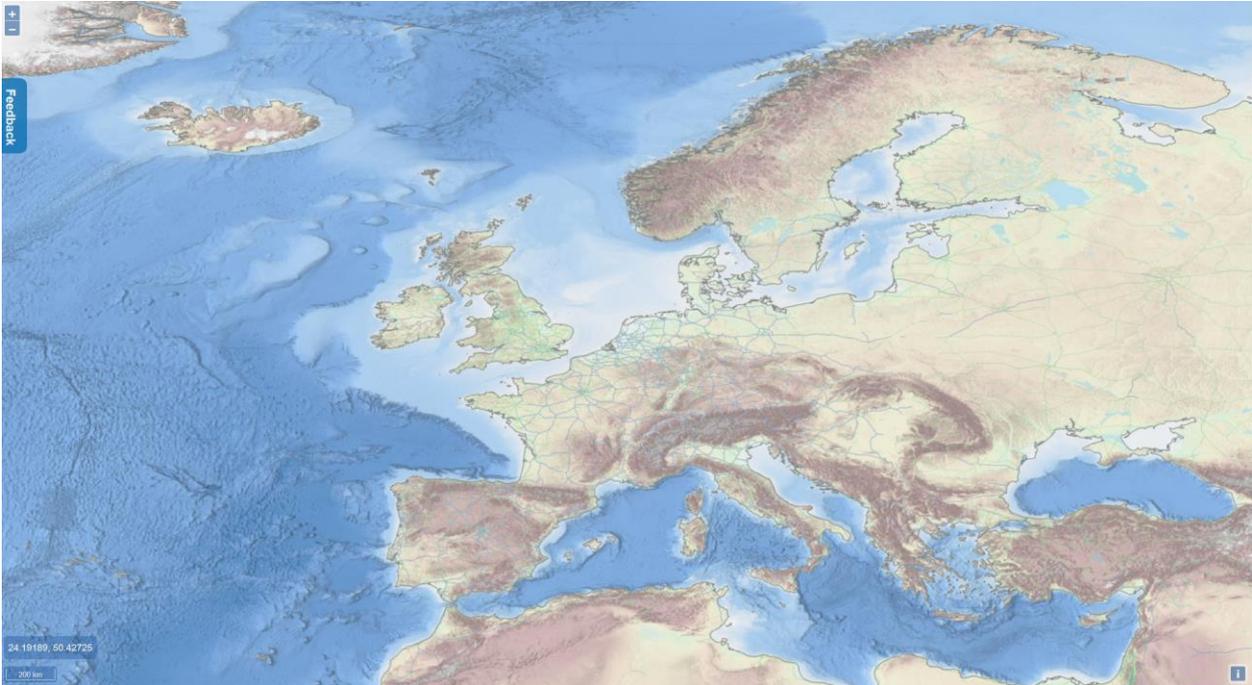
algorithm has been developed and applied by the integrator. This has proven to be very successful in removing such discrepancies. Over time the method has been improved and also the latest GEBCO versions have been provided to Regional Coordinators as part of the GLOBE software facilitating usage during the regional DTM production. Also an overlap has been agreed between the regional DTMs in order to ensure the continuity of the data products.

The first overall compilation and integration of the new EMODnet DTM has been finalised and published at 5th February 2015. It was based upon circa 6850 datasets and GEBCO. This February 2015 DTM meant a significant step forward, because it gave a full coverage of the European seas at a resolution of  $1/8 * 1/8$  arc minutes (circa 230 \* 230 meters); up till then only GEBCO provided a DTM and with a resolution of  $1/2 * 1/2$  arc minutes which is 16 times less resolution. The second release of the EMODnet DTM was published 9th September 2015, including circa 6950 datasets as well as eliminating anomalies as identified in the previous EMODnet DTM version. Furthermore, High Resolution DTMs for 3 pilot regions in Ireland, France and Germany have been released allowing to zoom in to much higher resolution. The third and present version of the EMODnet DTM was released 3rd October 2016, including circa 7800 datasets and 48 composite DTMs and further improved where possible.

Due to the huge size of the integrated product (> 40GB of data at the present target resolution of  $1/8$  arc minute \*  $1/8$  arc minute), the overall central processing has been done on a tiled basis which also makes use of overlaps in order to minimise edge effects. The OpenStreetMap coastline has been introduced for masking the product and to achieve an artificial smooth transition from the water area to the land area, albeit only for viewing purposes (one can only download the bathymetry DTM). The viewing service contains a layer with full European DEM coverage of both the land and the water (the land DEM source is <http://www.viewfinderpanoramas.org> (2014) which is a corrected version of the EU-DEM, based on SRTM and ASTER GDEM).

Each cell in the EMODnet DTM grid gives a direct reference to the used data source by means of a CDI or Sextant or GEBCO reference. The sheer volume of data has increased to 1.092.115.678 data points (28.799 rows x 37.922 columns), which has complications for the computertime needed for validating the DTM cells and rendering the different GIS layers. Note: the worldwide GEBCO contains 933.120.000 data points (21.600 rows x 43.200 columns).

The following image gives the latest EMODnet DTM as released early October 2016. It has been included in the Bathymetry Viewing and Downloading service.



*Image: latest EMODnet DTM – October 2016 release*



*Image: Details of EMODnet DTM for Tyrrhenian Sea and Sicily – Italy – October 2016, including smooth transition to terrestrial DEM*

**The Portal and web technology:**

The EMODnet Bathymetry portal provides a website and 3 interrelated services for users for browsing, viewing and downloading the EMODnet DTM and for identifying and requesting access to the gathered bathymetric survey data sets and Composite DTM data sets for the European waters.

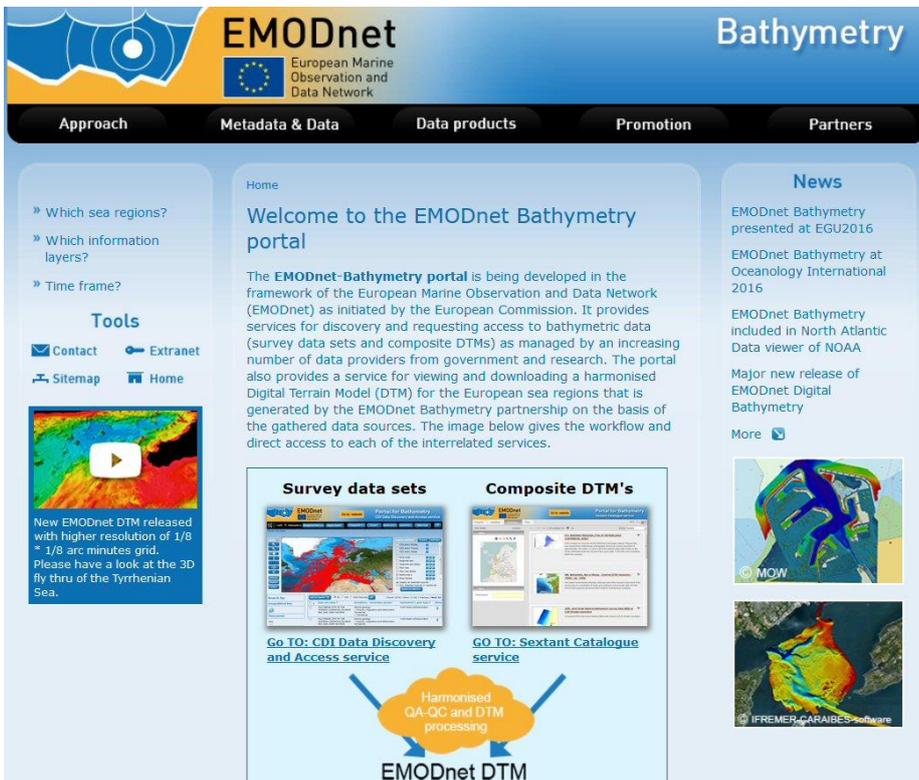


Image: Homepage of EMODnet Bathymetry portal

The portal and services have been kept operational and up-to-date, while also a number of upgrades have taken place during the project. Early in the project, the CDI search facility has been extended by including sea areas and the online Content Management System for the Sextant catalogue service has been upgraded to ease use by data providers. October – November 2014 a major upgrade took place for the EMODnet Bathymetry website. A reshuffling of the website and its navigation was executed, following user feedback from the EMODnet Secretariate. The 1-2-3 principle has been applied as much as possible, giving users access to the services in a minimum of clicks. The naming of services and items has been standardised throughout the website and services. The top banner of services has been harmonised. All texts in the website have been shortened and revised, and references to EMODnet background have been minimised with a direct link to the central EMODnet portal.

Around the release of the first new EMODnet DTM (February 2015) major upgrading was finalised for the Bathymetry Viewing and Downloading service by which the EMODnet DTM can be viewed and interrogated. The database has been migrated from Oracle to PostgreSQL 9.3 RDBMS and for the GIS use is made of the latest version of GeoServer in combination with OpenLayers 3 for developing the user interface. All functions are now included as buttons in the top bar. The buttons are dependent on the

layer which is activated. The new EMODnet DTM has been included together with several other layers. There are several functions for human users such as:

- multiple map layers that each can be switched on / off and each interrogated for their information, when activated
- zoom in – zoom out and panning
- retrieving the DTM cell parameters such as Minimum cell depth, Maximum cell depth, Average cell depth, Standard deviation of the cell depth, Number of depths used for interpolation of cell depth, Number of subcells used for the computation of the average cell depth, Source reference by CDI reference, composite DTM reference or GEBCO where no higher resolution data are available from partners; this is important information for assessing the precision, quality and sources of the calculated bathymetry
- retrieving depth profiles along a track
- adding external WMS map layers as an overlay such as the CDI WMS – WFS service
- activating a source layer indicating for each cell its underlying prevailing data source, which can be survey data sets as documented and retrievable via the CDI catalogue service, composite DTMs as documented and retrievable via the Sextant catalogue service or GEBCO in the case where no higher resolution data are available
- downloading DTM tiles in different formats: ESRI ASCII, XYZ, CSV, NetCDF, GeoTiff and SD for Fledermaus 3 D viewer software

The following images give an illustration of the viewing service.

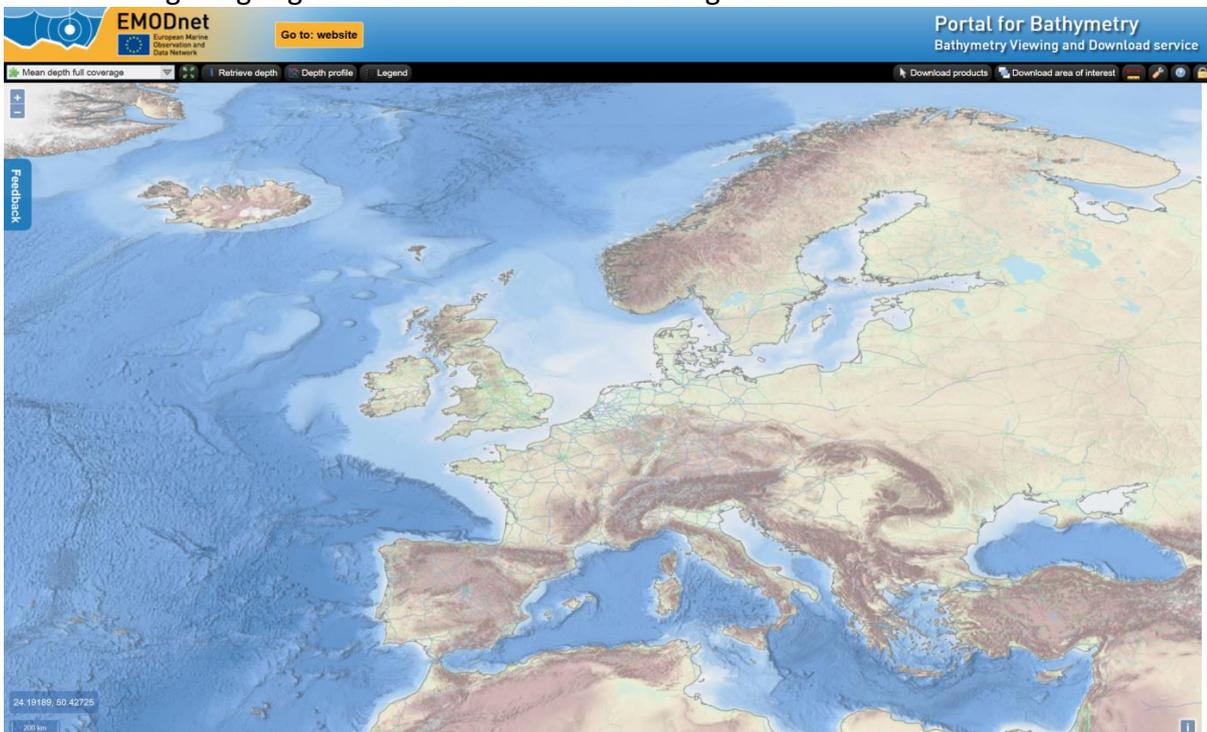


Image: Screen of the Bathymetry Viewing and Download service

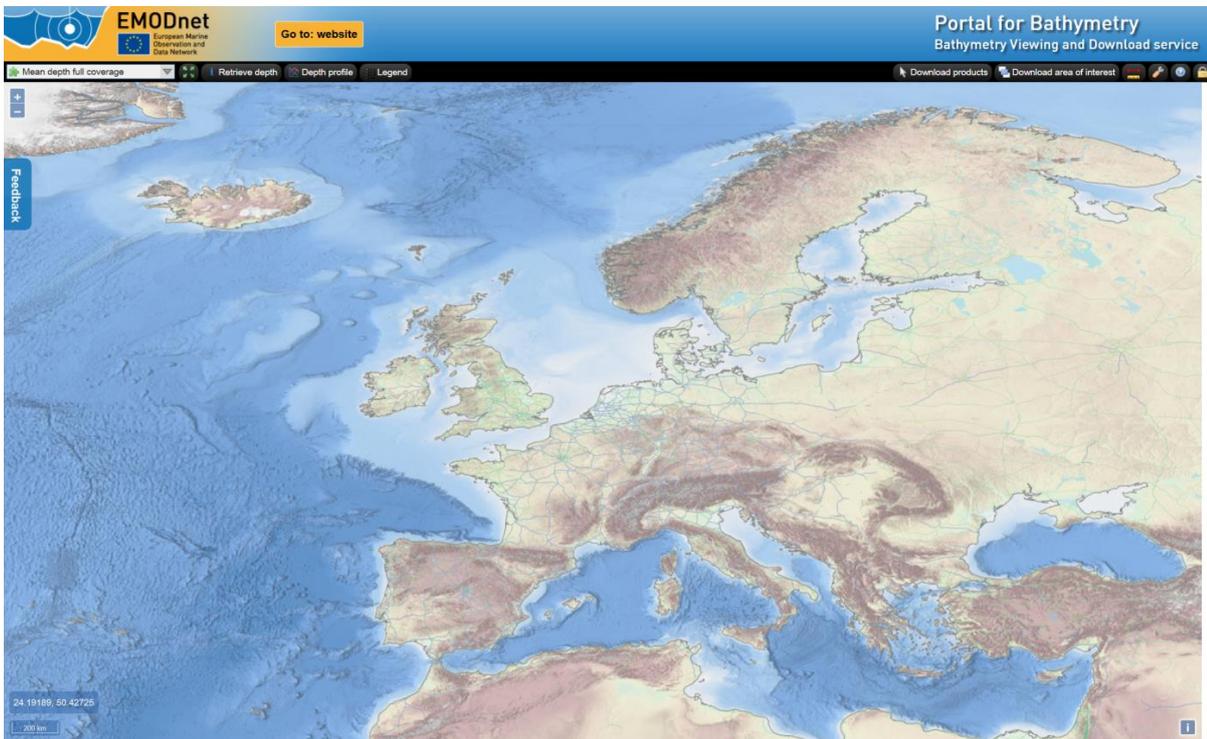


Image: Layer menu

The present layers are:

Layer	Tooltip text
Geographic grid	Geographic grid lines (graticule of latitudes and Longitudes)
Coastlines	Provided by OpenStreetMap 2014
Sea names	Maintained and provided by SeaDataNet
Depth contours	Generalised bathymetric contour lines (50, 100, 200, 500, 1000, 2000, 5000 meter interval).
GEBCO Undersea Features	GEBCO Sub-Committee on Undersea Feature Names (SCUFN) maintains and provides a gazetteer of the names, generic feature type and geographic position of features on the sea floor.
Wrecks	Wrecks from the UKHO database as provided by OceanWise.
Source references	Coverage of individual bathymetric surveys and Composite DTMs that contribute to the EMODnet Bathymetry DTM.
Survey tracks/polygons	Tracks/polygons of all bathymetric surveys which are included in the CDI Data Discovery and Access service.
Land geography and topography	Maintained and provided by OpenStreetMap.

Coastal areas with high resolution bathymetry	Demonstrator for integrating coastal stretches with high resolution
Mean depth in multi colour style (no land data)	Mean depth based on source resolution of 1/8 arc minute (~250 meter). Ocean overlay without land cover in multi colour style.
Mean depth in rainbow colour ramp (no land data)	Mean depth based on source resolution of 1/8 arc minute (~250 meter). Ocean overlay without land cover in rainbow (multi colour) ramp style.
Mean depth full coverage	Mean depth based on source resolution of 1/8 arc minute (~250 meter). Full coverage ocean and land DTM in traditional atlas style colours.
GEBCO bathymetry basemap	Backdrop base map showing the Earth based on satellite imagery (Blue Marble) and GEBCO 2014 bathymetry (General Bathymetric Chart of the Oceans) with source resolution of 1/2 arc minute (~1000 meter).

Table: Menu of layers in Bathymetry Viewing and Downloading service

Also some detailed screens are given to illustrate the use of the service:

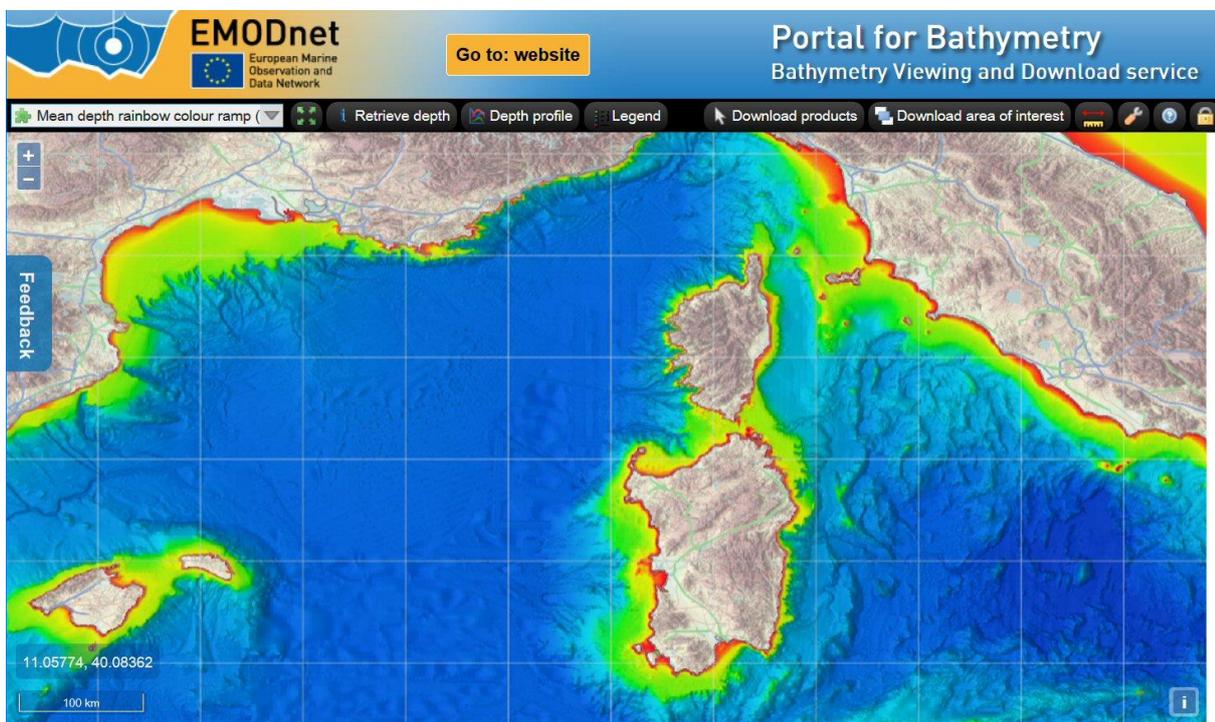


Image: Detail of bathymetry near Corsica in rainbow colour ramp

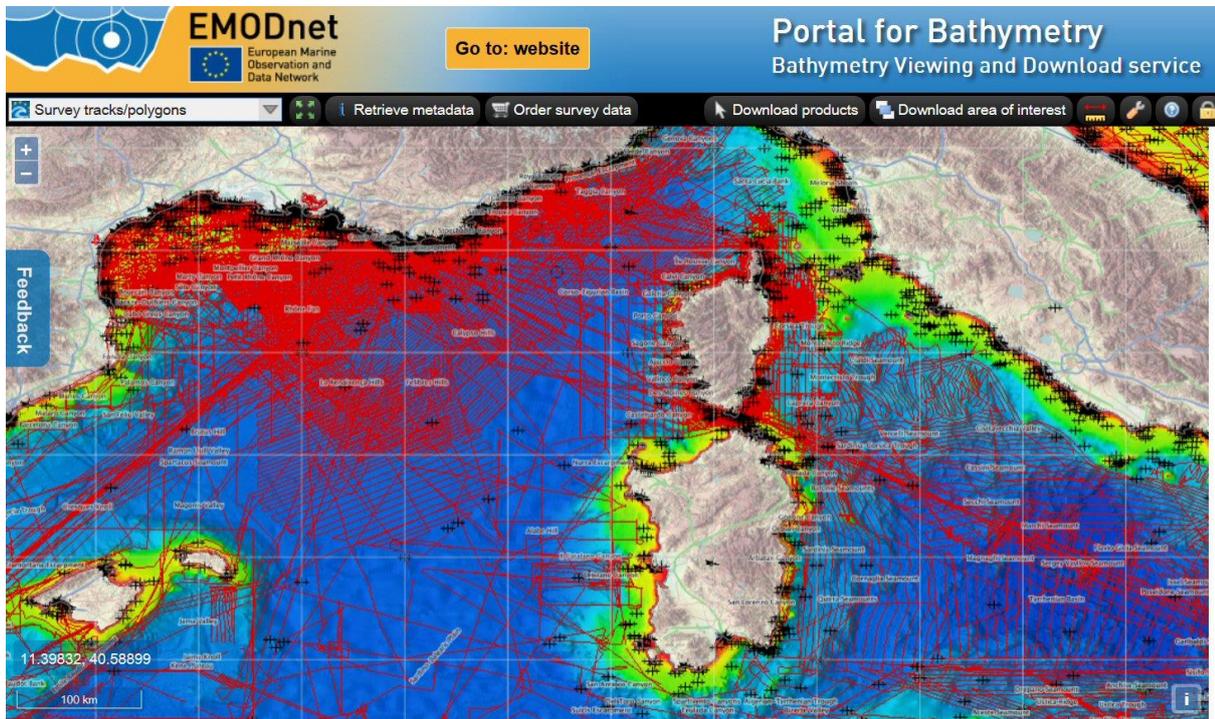


Image: Detail of bathymetry with layers of CDI references, wrecks and underwater features

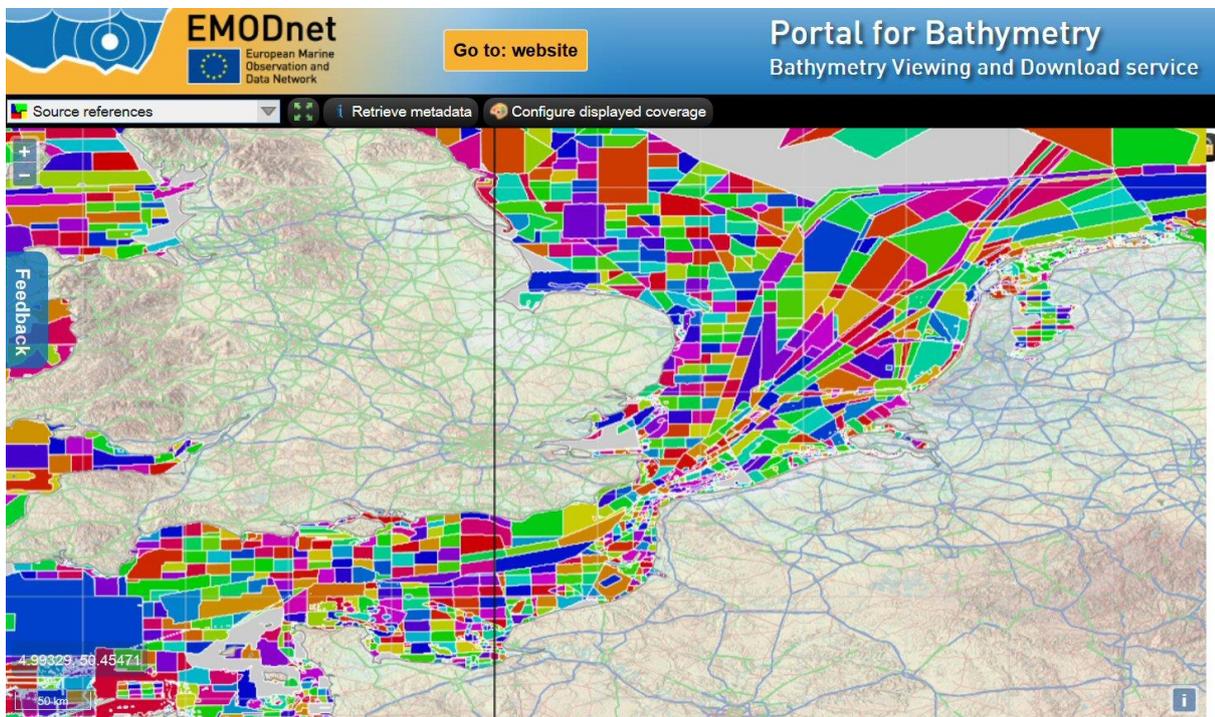


Image: Source references layer; clicking on a polygon gives metadata from CDI or Sextant services

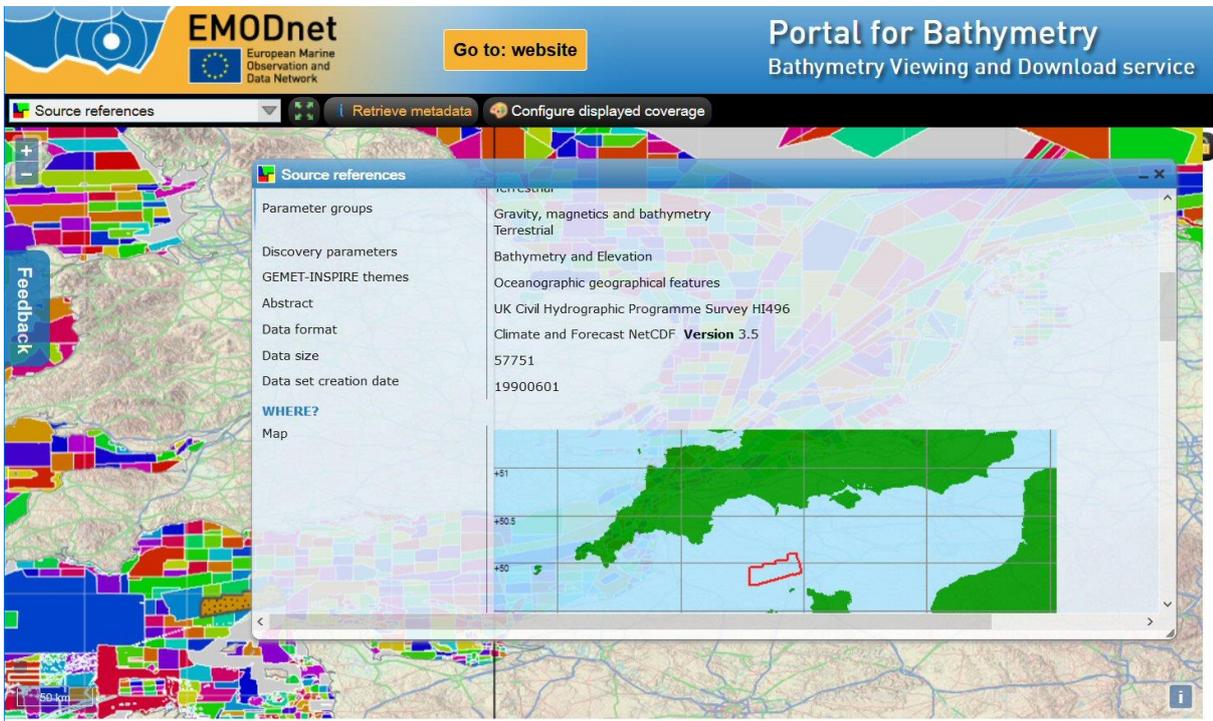


Image: Source references layer with CDI metadata from a survey

The depth profile tool allows users to plot a depth profile along a defined transect. Both the depth and the distance are given. The user can display the computed depth along the line and simultaneously, horizontally along the track line. The plot can be downloaded in various image file formats.

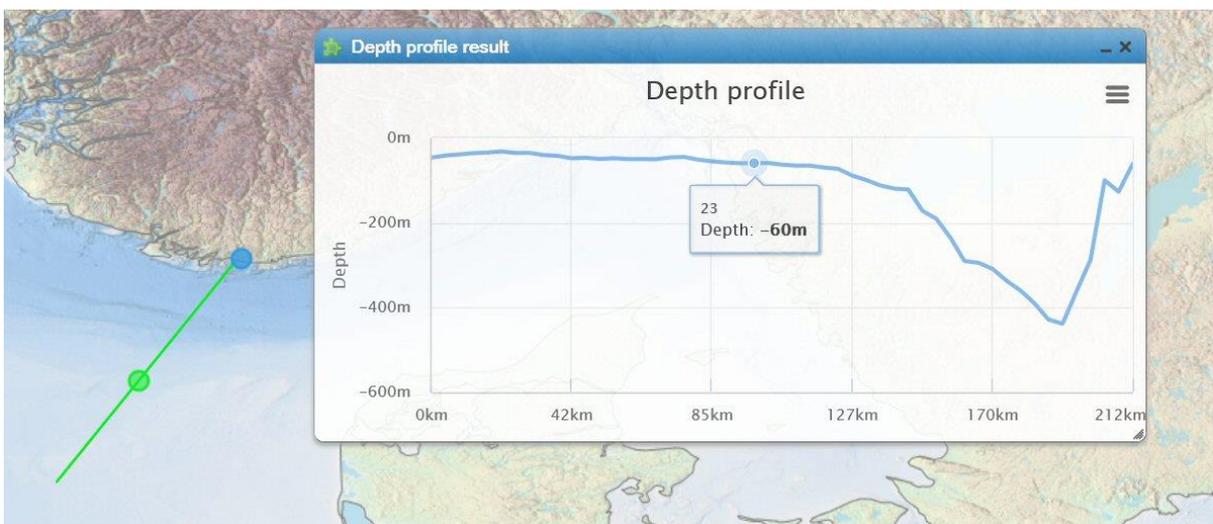


Image: Depth profile function in active waterdepths layer

Users can download the EMODnet DTM in 16 tiles in different formats: ESRI ASCII, XYZ, CSV, NetCDF, GeoTiff and SD for Fledermaus 3 D viewer software. The NetCDF files can be imported into the 3D

visualisation tool (3D Viewer) that has been developed in the EU FP7 Geo-Seas project. This viewer is based on the existing open source NASA World Wind JSK application. This software is freely available via the portal after registration and allows the visualisation of Digital Terrain Models (DTM) in the existing GLOBE NetCDF format and Web Map Service (WMS) which are displayed upon a virtual globe.

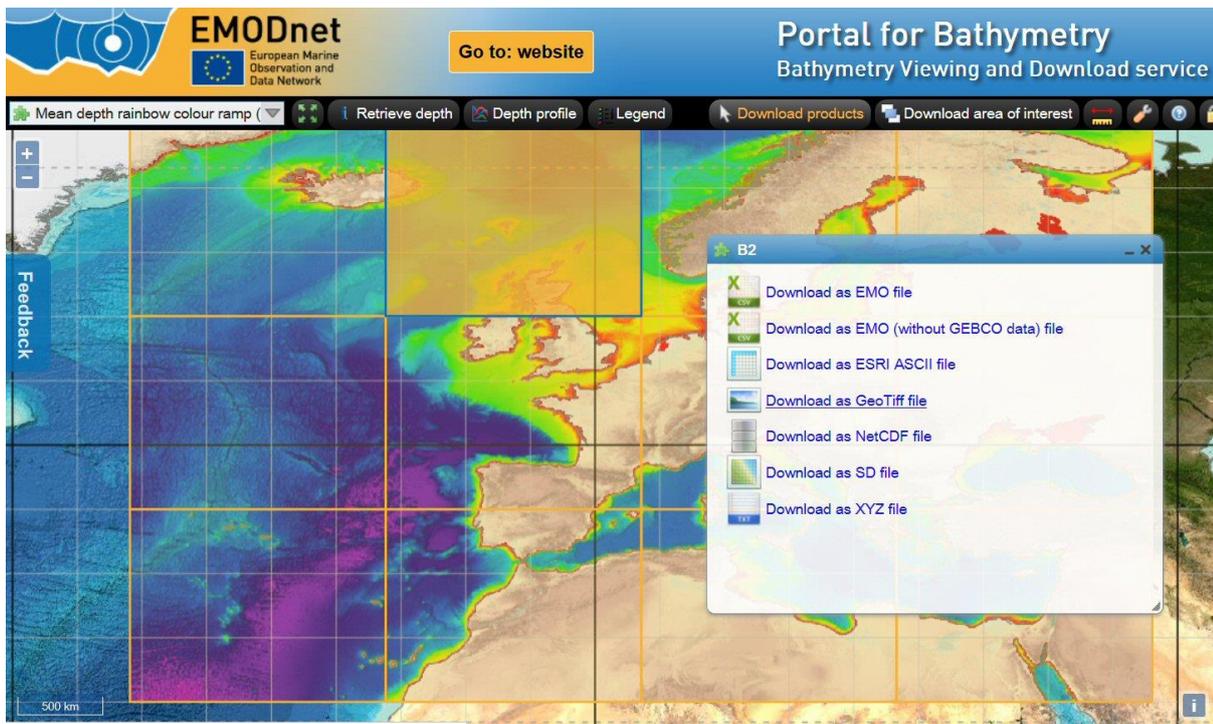


Image: Overview of 16 tiles for downloading DTM in various formats

In addition users can download an area of interest by drawing a lat-lon box and selecting a format. This works as part of the OGC WCS service.

#### Web services and standards:

The GIS layers in the Bathymetry Viewing and Download service can be shared as OGC WMS and WCS services with other EMODnet portals and beyond. Also WMS layers from other EMODnet portals and external services can be added to the Bathymetry Viewer and Download service. The OGC services can be found at the following URLs:

WMS: <http://ows.EMODnet-bathymetry.eu/wms>

WFS: <http://ows.EMODnet-bathymetry.eu/wfs>

WMTS: <http://ows.EMODnet-bathymetry.eu/wmts>

WCS: <http://v7.geosrv.eu/wcs>

The WMS – WFS service for the CDI Data Discovery and Access service can be found at:

[http://geoservice.MARIS2.nl/wms/seadatanet/EMODnet\\_hydrography](http://geoservice.MARIS2.nl/wms/seadatanet/EMODnet_hydrography)

EMODnet Bathymetry has adopted standards for the marine domain that have been developed and are maintained by SeaDataNet. Also several partners in the project are SeaDataNet partners.

SeaDataNet has relations with, follows and contributes to international standards committees such as the Open Geospatial Consortium (OGC), International Organisation *for* Standardisation (ISO) and the World Wide Web Consortium (W3C). And it has an active cooperation and tuning with the INSPIRE community, in particular the INSPIRE team of JRC. The INSPIRE Directive 2007/2/EC aims at establishing an Infrastructure for Spatial Information in the European Community which is supported through legislation and technical guidelines, such as concerning data models (schemas), metadata and network services.

#### **User statistics:**

The number of visitors to the Bathymetry portal has increased during the project from circa 10.000 over the first year to circa 16.000 over the second year to circa 19.000 over the third year. The number of visitors to the Bathymetry Viewing and Download service has risen even more from circa 18.500 over the first year to circa 32.500 over the second year and to circa 42.000 over the third year. This really took off after the February 2015 release and related publicity. The difference in users between the overall portal and the viewing service might be explained by the fact that both URLs are published and used in promotional activities and also mentioned at the overall EMODnet portal. Another significant measure is the number of downloaded DTM tiles. In the first year this amounted to 22400 and decreased in the second year to circa 15000. However it should be noted that these numbers are not directly comparable as EMODnet DTM previously covered a number of European seas and could be downloaded per sea region. Since February 2015 the EMODnet DTM covers all European seas and the downloading has been altered to 16 tiles for a continuous DTM. In the third year the number of downloads has multiplied to circa 40800 tiles.

#### **Conclusion:**

EMODnet Bathymetry has been a very successful project that has performed all its initial objectives. It has delivered a portal with a range of functional services and DTM products that are well appreciated by an increasing number of users from government, research and industry. The portal and services will be maintained, while further development is planned as a next phase of EMODnet.

Visit the portal at: <http://www.emodnet-bathymetry.eu>

# 1. Introduction

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This final report gives the activities undertaken and results achieved during the EMODnet Bathymetry contract for the period from 1<sup>st</sup> June 2013 – 30 September 2016. The project is a follow-up of the earlier developments for the EMODnet Hydrography and EMODnet Seabed Mapping projects which have taken place since June 2009 and that have resulted in an initial portal at: <http://www.EMODnet-bathymetry.eu>.

The EMODnet Bathymetry project has successfully worked on:

- a continuation and upgrading of the portal services
- a geographical extension by achieving a full European coverage of sea basins
- a refinement of the EMODnet Digital Terrain Model (DTM) for the bathymetry of the European seas by upscaling the resolution from ¼ minute \* ¼ minute to 1/8 minute \* 1/8 minute in a series of releases.

The work has been undertaken by a consortium consisting of organisations from marine science, the hydrographic survey community, and industry. The partners combine expertise and experiences of collecting, processing, and managing of bathymetric data together with expertise in distributed data infrastructure development and operation and providing of discovery, access and viewing services following INSPIRE implementation rules and international standards (ISO, OGC). In total 24 organisations have participated from the start of the project, while during the project 7 additional organisations have joined the consortium, 4 as subcontractor and 3 on a cooperation basis. The latter includes representatives of the General Bathymetric Chart of the Ocean (GEBCO) and the Baltic Sea Hydrographic Commission (BSHC). All these organisations are listed in Annex 1. The consortium has more than doubled in size compared to the original group of 14 organisations that had previously undertaken the EMODnet Hydrography and EMODnet Seabed Mapping projects.

## 2. Highlights of the project

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- An overall methodology and tools & services for gathering, preparing and publishing metadata and data entries for hydrographic survey data and Composite DTMs have been adopted by the consortium. Services concern the SeaDataNet Common Data Index (CDI) Data Discovery & Access service and the SEXTANT Products Catalogue service. Tools concern the SeaDataNet MIKADO XML editor for generating CDI metadata entries for survey data sets and the SeaDataNet SEXTANT online CMS for generating SEXTANT metadata entries for Composite DTMs. Customised versions of both services have been made available at the EMODnet Bathymetry portal. The related editing tools are freely available from the SeaDataNet portal;
- The earlier methodology for Quality Assurance and Quality Control (QA – QC) and generation of the EMODnet Digital Terrain Models (DTMs) has been upgraded and refined in the first months of the project in the perspective of increasing the EMODnet DTM resolution from 1/4 minute \* 1/4 minute to 1/8 minute \* 1/8 minute and taking into account lessons learned from the previous projects. The methodology has been documented and can be downloaded from the EMODnet Bathymetry portal as a public document;
- The GLOBE software, developed and maintained by partner IFREMER, has been adopted by the consortium for processing survey data sets, generating EMODnet DTMs for the European regional basins, and for QA - QC to be applied. The GLOBE software has been made available free of costs under a license between individual partners and IFREMER. During the project several updated versions have been released following requirements and bugs identified by partners;
- Two Training Workshops have taken place. The first Workshop took place in January 2014 to introduce and train all consortium members in the use of metadata tools and procedures as well as of the first operational release of the GLOBE software for generating DTMs following the upgraded EMODnet methodology; the second Workshop took place in January 2015 to evaluate the first DTM results and to review the production methodology and upgrading of the GLOBE software;
- A cooperation and synergy has been established, early in the project, with the Baltic Sea Digital Bathymetry (BSBD) project of the Baltic Sea Hydrographic Commission (BSHC), whereby the BSBD coordinator (based at SMA in Sweden) has participated in the EMODnet Bathymetry project meetings and contributed with BSDB to the Regional EMODnet DTM for the Baltic Sea;
- Also close cooperation and synergy has taken place with the General Bathymetric Chart of the Oceans (GEBCO) whereby the EMODnet DTM releases each time have been integrated in the next release of GEBCO for improving the bathymetry while vice versa the prevailing GEBCO releases have been integrated into the EMODnet DTM for filling gaps in geographical coverage. This exchange and synergy has resulted in reducing anomalies at boundaries and overall better results for both products;
- The number of entries in the CDI service and the Sextant Catalogue service have increased steadily and considerably over the project duration from 9127 to 14791 CDIs for survey datasets and from 32 to 77 Sextant entries for composite DTMs. Focusing on European waters the number of CDIs has increased from 6323 to 11505 entries contributed by 15 data providers from 9

countries to 28 data providers from 15 countries. The number of Sextant entries has increased from 32 composite DTMS contributed by 11 data providers from 11 countries to 77 composite DTMs from 19 data providers from 15 countries. Overall combined the total number of data providers has increased from 20 data providers from 13 countries to 34 data providers from 19 countries.

- The first overall compilation and integration of the new EMODnet DTM has been finalised and published at 5th February 2015. This February 2015 DTM meant a significant step forward, because it gave a full coverage of the European seas at a resolution of  $1/8 * 1/8$  arc minutes (circa  $230 * 230$  meters); up till then only GEBCO provided a DTM and with a resolution of  $1/2 * 1/2$  arc minutes which is 16 times less resolution;
- A second release of the EMODnet DTM for all European seas was published 9th September 2015, including many new survey data sets as well as eliminating anomalies as identified in the previous EMODnet DTM version. Furthermore, High Resolution DTMs for 3 pilot regions in Ireland, France and Germany have been released allowing to zoom in to much higher resolution;
- The third and present version of the EMODnet DTM was released 3rd October 2016, including many new survey data sets and further improving where possible; also the High Resolution Coastal DTM for Germany has been updated;
- Each cell in the EMODnet DTM grid gives a direct reference to the used data source by means of a CDI or Sextant reference. The first EMODnet DTM release was based upon circa 6850 datasets; the second release upon circa 6950 datasets and the third release upon circa 7800 datasets, including 48 Composite DTMs.
- The sheer volume of data has increased to 1.092.115.678 data points (28.799 rows x 37.922 columns), which has complications for the computertime needed for validating the DTM cells and rendering the different GIS layers. Note: the worldwide GEBCO contains 933.120.000 data points (21.600 rows x 43.200 columns);
- The EMODnet Bathymetry portal has been considerably revised in January – February 2015 as follow-up to the site review report as received from the EMODnet Secretariate. The 1-2-3 principle has been applied allowing a user to identify, read background and access the three main portal services in 3 clicks. In addition, all texts have been shortened and revised. Also a 3D animation of the DTM for the Tyrrhenian Sea has been posted at the homepage as a clear demonstration of the new DTM product and as invitation to visitors of the portal;
- The Bathymetry Viewing and Downloading service has been upgraded early 2015. The DTM database has been successfully migrated from Oracle to PostgreSQL 9.3 RDBMS and for the GIS use is made of the latest version of GeoServer in combination with OpenLayers for the user interface. The use of these Open Source tools gives more flexibility for adding extra functionality. The Viewing service already supported OGC WMS service for sharing the map layers with external servers and early 2015 this has been expanded with OGC WFS and WMTS services. Furthermore in July 2016 an OGC Web Coverage Service (WCS) has been added to allow users to download subsets of the EMODnet DTM according to their own drawn polygons;
- During the project several new layers have been added to the Bathymetry Viewing and Downloading service, such as:

- a seamless land-sea integration of Open Street Map WMS and inclusion of land topography WMS with comparable resolution as the new DTM (1/8 \* 1/8 arc minutes). This gives the user a much better experience when viewing the EMODnet DTM because the land – sea transition is now smooth, while in the version from the previous projects it was more abrupt and with visible grid edges;
- a source references layer indicating which data sources (survey datasets and composite DTMs) have been used for deriving the depth parameters in each grid cell of the EMODnet DTM; users can retrieve the CDI and Sextant metadata by clicking on the source references map;
- the wrecks layer has been upgraded by including a WMS service provided by partner OceanWise, using the UKHO Wrecks database as source. The previous wrecks layer was derived from ENCs and only covered the wider North Sea. The Wrecks layer now covers all European seas and the level of detail is dependent on the viewing scale;
- an undersea features layer has been added by including a WMS service provided by GEBCO. The GEBCO Sub-Committee on Undersea Features (SCUFN) maintains and provides a gazetteer of the names, generic feature type and geographic position of features on the seafloor;
- The number of visitors to the Bathymetry portal has increased during the project from circa 10.000 over the first year to circa 16.000 over the second year to circa 19.000 over the third year; the number of visitors to the Bathymetry Viewing and Download service has risen even more from circa 18.500 over the first year to circa 32.500 over the second year and to circa 42.000 over the third year. This really took off after the February 2015 release and related publicity. The difference in users between the overall portal and the viewing service might be explained by the fact that both URLs are published and used in promotional activities and also mentioned at the overall EMODnet portal;
- The number of downloaded DTM tiles in the first year amounted to 22400 and decreased in the second year to circa 15000. However it should be noted that these numbers are not directly comparable as EMODnet DTM previously covered a number of European seas and could be downloaded per sea region. Since February 2015 the EMODnet DTM covers all European seas and the downloading has been altered to 16 tiles for a continuous DTM; in the third year the number of downloads has multiplied to circa 40800 tiles;
- The following images give some illustrations of the latest version of the EMODnet DTM.

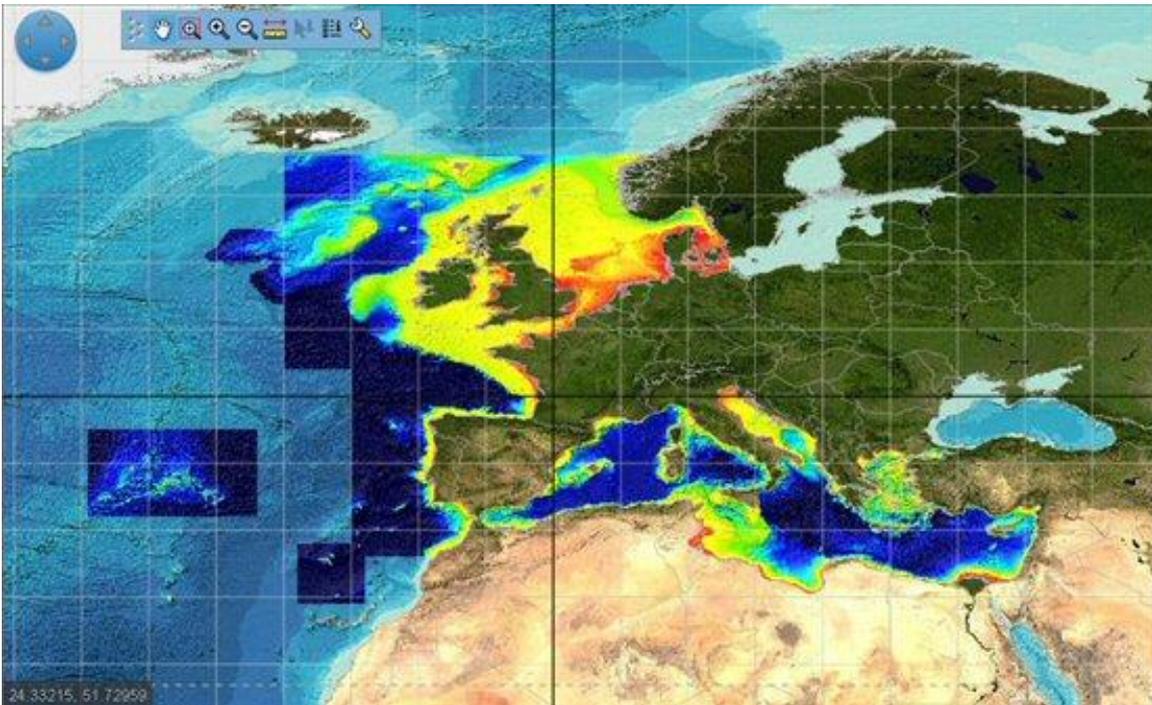


Image 2.1: EMODnet DTM – Version 2013

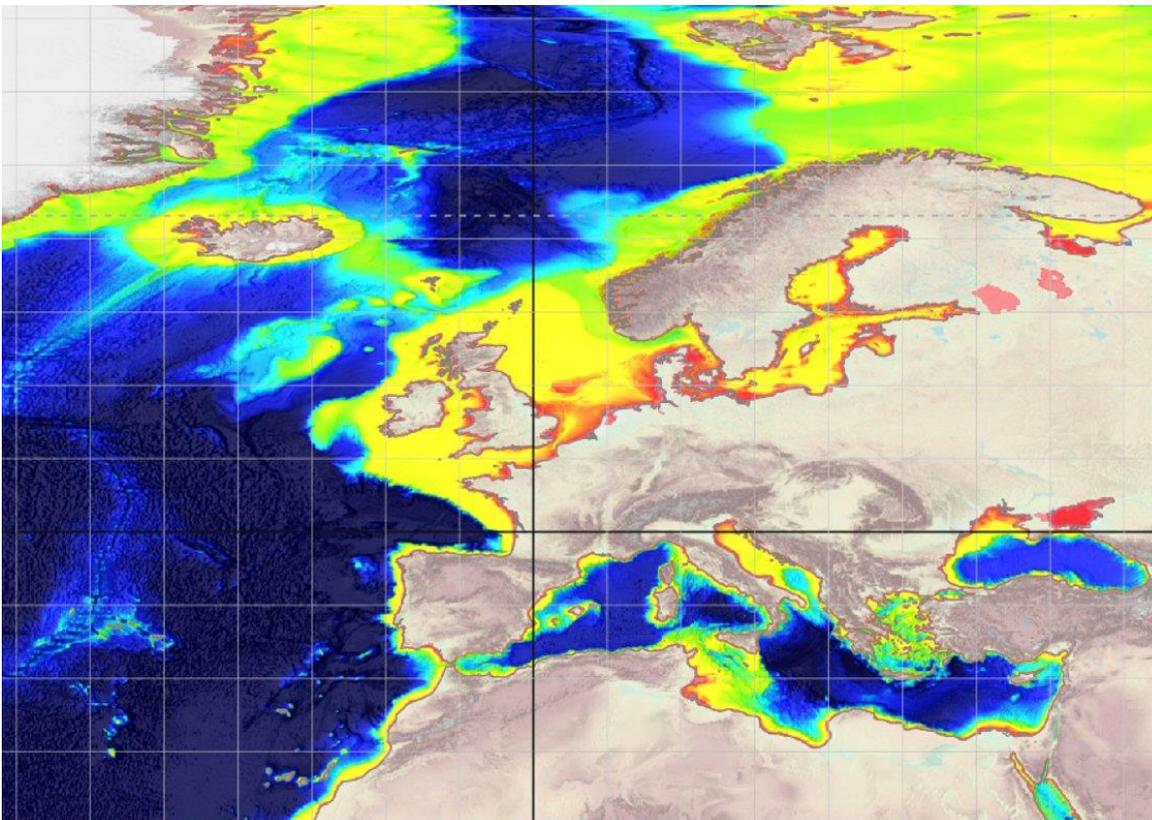


Image 2.2: EMODnet DTM – Version 2016

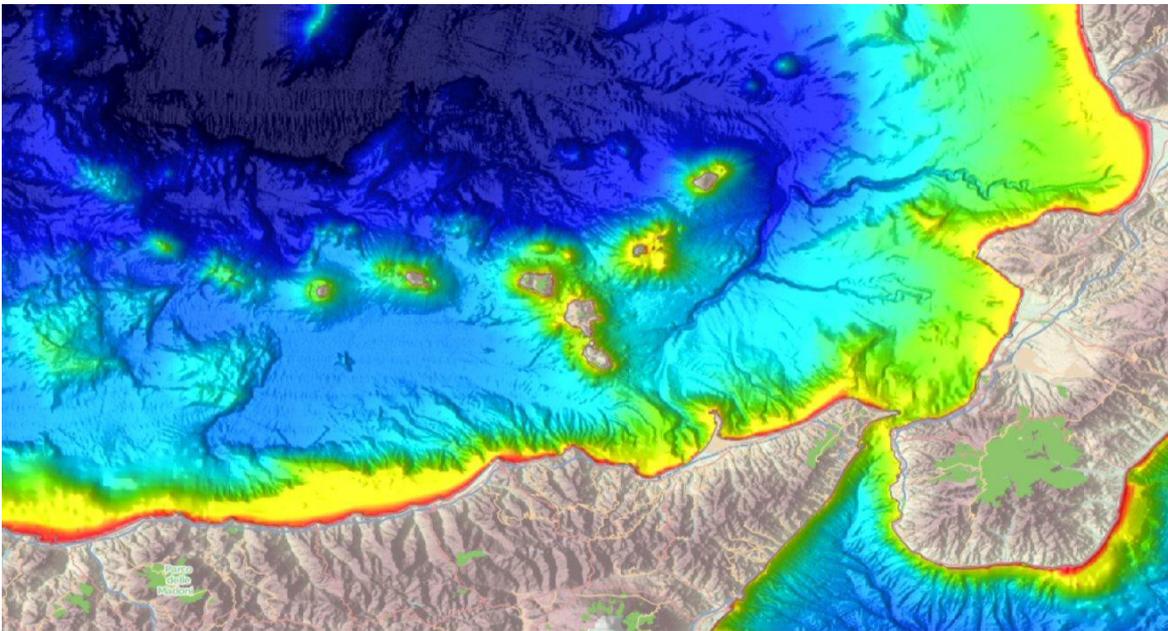


Image 2.3: Detail of EMODnet DTM for Tyrrhenian Sea and Sicily – Italy – Version October 2016



Image 2.4: Further details of EMODnet DTM for Tyrrhenian Sea and Sicily – Italy – Version October 2016 – in Atlas colours style

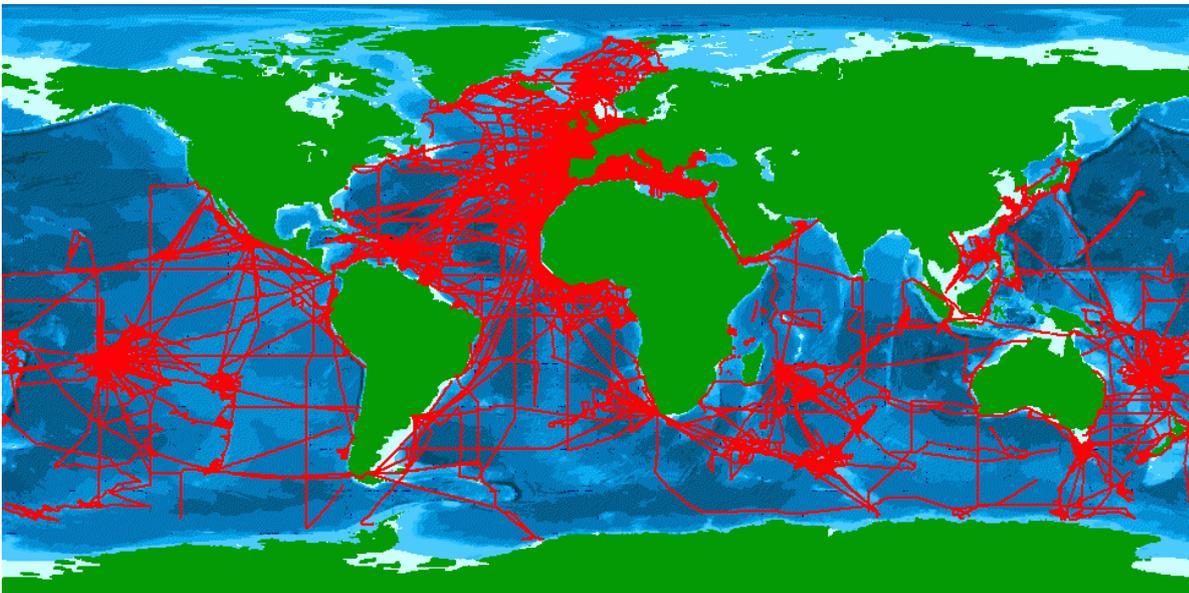


Image 2.5: CDI survey overview per end September 2016

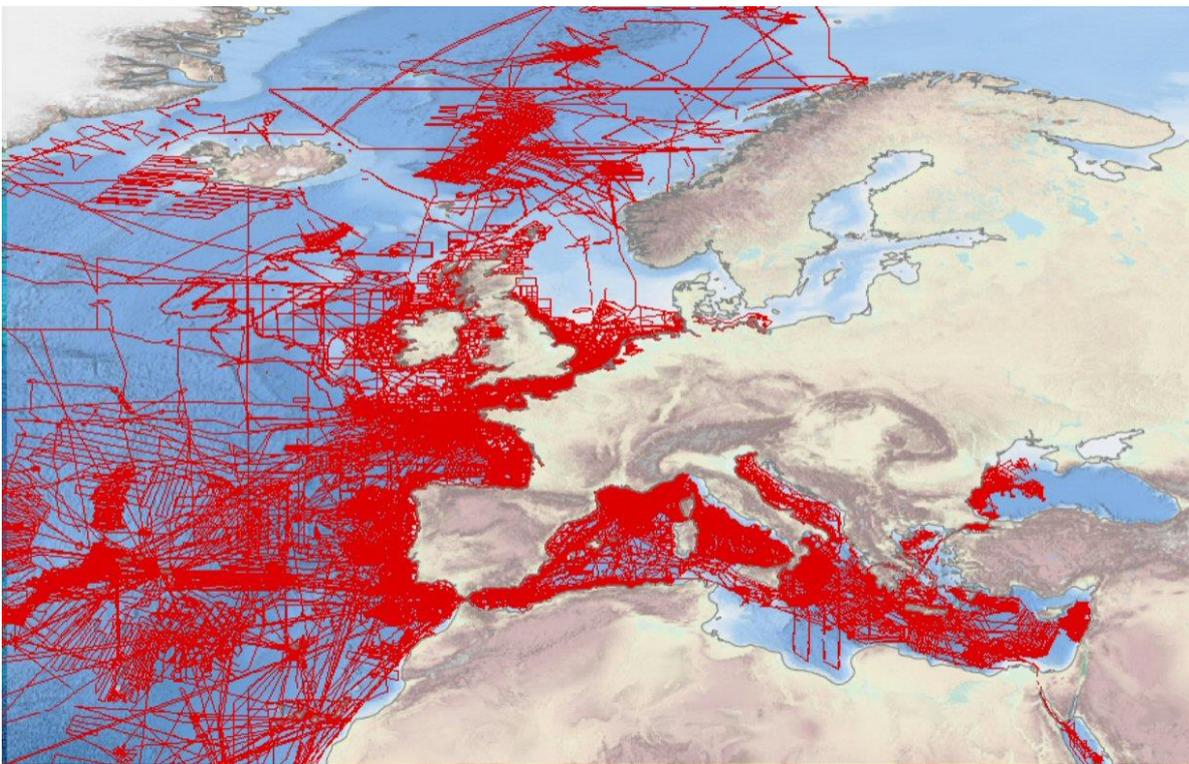


Image 2.6: CDI survey overview per end September 2016 – European waters

## 3. Description of the work done

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### 3.1 WP0: Project Management

The EMODnet Bathymetry consortium at the start consisted of 16 partners and 8 subcontractors. The main contract has been concluded between EU and MARIS as coordinator on behalf of the full consortium. Following the EU contract, the coordinator has drafted and concluded a Consortium Agreement for all partners and individual Subcontracts with the subcontractors. A search for additional data for the Black Sea and the Eastern Mediterranean sea identified a number of possible extra data providers. Negotiations by the coordinator have resulted in four extra subcontracts: GeoEcoMar (Romania), Dokuz Eylul University - Institute of Marine Science and Technology (Turkey), University of Malta (Malta) and MARUM – University of Bremen (Germany). Also SC Marine Research SRL (Romania) and the Swedish Maritime Administration (Sweden) representing the Baltic Sea Hydrographic Commission have joined on a cooperation basis.

Next to contractual affairs, the coordinator has organised 6 projectgroup meetings, including preparing minutes and action lists. Also the coordinator has drafted and submitted to the EU a progress report for the period June 2013 – December 2014, and 15 bimonthly progress reports starting January 2014 till September 2016. In addition, the coordinator has presented progress of the project at several meetings with the EU concerning EMODnet, such as participating in MODEG and in the EMODnet Steering Committee. Furthermore, the project coordinator has maintained the project web portal and the Extranet with all relevant documents and presentations. The project coordinator has monitored, evaluated and controlled the overall progress of the project and its activities towards its objectives. Regular emails have been drafted and circulated to partners to remind them of actions and planning as well as to get information on progress and possible issues, that required solving.

The project coordinator has compiled and submitted to the EU the first, second and final third annual progress reports for the period 1 June 2013 till September 2016. The project coordinator has distributed to the partners and subcontractors the first and second payments as received from the EU for the activities undertaken in the first and second project years.

The following table gives an overview of meetings as organised and/or joined by the project coordinator in the framework of the EMODnet Bathymetry project.

Date	Location	Topic	Short Description
17 - 18 June 2013	Lisbon - Portugal	EMODnet Bathymetry Project kick-off meeting	To start the project, meet the partners, and to communicate the overall approach
4 - 5 July 2013	Copenhagen - Denmark	Marine Observation and Data Expert Group (MODEG), incl WG-	To present results of previous EMODnet Hydrography and

		DIKE members and EMODnet coordinators	Seabed Mapping projects and scope of EMODnet Bathymetry
20 - 21 October 2013	Brussels - Belgium	Marine Observation and Data Expert Group (MODEG),	Discussing plans for the central EMODnet portal, installation of EMODnet Secretariate, and developments by BSHC for Baltic Sea
16 - 17 December 2013	Brussels - Belgium	1st meeting of the EMODnet Steering Committee	Discussing development of the central EMODnet portal, next to proposed procedure for reporting on EMODnet lots.
27 - 30 January 2014	Tenerife - Spain	2nd EMODnet Bathymetry Projectgroup meeting annex Training Workshop	To plan first release of new DTM products and hands-on Training Workshop where the partners were instructed in the EMODnet DTM generation methodology, Quality Assurance, preparation of metadata, and using the various tools as provided by SeaDataNet and the new DTM processing software GLOBE of IFREMER. This Training Workshop has been instrumental in assuring a common approach by all regional groups and a high quality output.
26 – 27 May 2014	Hamburg - Germany	3 <sup>rd</sup> EMODnet Bathymetry Projectgroup meeting	To discuss progress and finetune Workplan for 1 <sup>st</sup> release
4 – 5 June 2014	Rome - Italy	EMODnet SC meeting	Presenting progress and planning
19 October 2015	Brussels - Belgium	MODEG meeting	Progress meeting

21 - 22 January 2015	Brest – France	4th EMODnet Bathymetry Projectgroup meeting annex Training Workshop	To review first release of new integrated DTM and upgrading of portal; to discuss upgrading of methodology and tools.
13 February 2015	Voorburg - The Netherlands	Meeting MARIS - GGSgc	Discussing new release and portal upgrading
30 June – 2 July 2015	Ispra - Italy	EMODnet meetings at JRC	Presentation of EMODnet Bathymetry and discussing progress
July and August 2015	Voorburg - Netherlands	Telephone dialogues between MARIS and GGSgc	Discussing progress of the new EMODnet DTM generation and references consistency
22 <sup>nd</sup> October 2015	Oostende - Belgium	5 <sup>th</sup> EMODnet Bathymetry progress meeting	Discussing progress and planning future activities for the 3 <sup>rd</sup> year. Discussing cooperation with new EMODnet Coastal Mapping project.
19 – 23 October 2015	Oostende - Belgium	EMODnet Jamboree and related meetings	Participation by coordinator in MODEG, EMODnet SC, and Technical meeting. Participation of partners in Jamboree, and synergy meetings.
7 December 2015	Brussels - Belgium	INSPIRE – EMODnet Workshop	Giving guidance on the INSPIRE process and standards and discussing further INSPIRE implementation for EMODnet.
9 – 10 December 2015	Brussels - Belgium	EMODnet Steering Committee meeting	Meeting on progress of different lots and EMODnet perspectives
13 January 2016	Paris - France	Meeting between SHOM and MARIS	Making plans and tuning the approach between MARIS and SHOM for the next phase

23 February 2016	Voorburg – The Netherlands	Meeting between MARIS and GGSgc	Discussing future technical innovations and planning
14 April 2016	Paris, France	Meeting MARIS, SHOM, ATOS and GGSgc	Discussing possible role of ATOS
23-24 May 2016	Bucharest, Romania	6 <sup>th</sup> and Final EMODnet Bathymetry Project Group Meeting	Discussing progress, outstanding activities, and future
21-22 June 2016	Brussels - Belgium	EMODnet Steering Committee	Presenting and discussing progress and central portal relations.

*Table 3.1: Meetings as organised and/or joined by the project coordinator*

### **3.2 WP1: Bathymetric data collection and metadata compilation for all basins**

The objectives are to gather identified bathymetric data sets and to compile metadata for all bathymetric data sets in the SeaDataNet CDI format or alternatively metadata for Composite DTM's in the Sextant format. Guideline documents and presentations have been kept up-to-date and presented at the project meetings and to new data providers, including guidance on standards, procedures and tools. Existing partners have worked on extending their existing collection of CDI and Sextant entries with new and updated entries, while new partners have worked on preparing their initial entries, with support of MARIS (CDI service) and IFREMER (Sextant service). In addition, efforts have been continued for identifying and approaching potential complementary data providers for including also their data sets in the project, especially for the 2 new regions: Baltic Sea and Black Sea. This has resulted in several new data providers which have contributed to the data collection. Also the cooperation with the Baltic Sea Hydrographic Commission (BSHC) has been strengthened and the Baltic Sea Bathymetry Database (BSBD) coordinator from the Swedish Maritime Administration (SMA) has participated as a regular participant in the EMODnet Bathymetry project meetings and project activities.

#### **Metadata compilation and inclusion in the CDI Data Discovery and Access Service:**

For all new gathered bathymetric survey data sets metadata records have been prepared, using the SeaDataNet Common Data Index (CDI) metadata format. The CDI metadata format is supported by Common Vocabularies. The newly gathered data sets and metadata have been converted to the standard formats as in use for the CDI Data Discovery and Access Service. This service gives users a detailed insight of the availability and geographical extent of marine data, archived at the connected data centres. It gives the description of individual data sets and measurements with key fields (what, where, when, how, who etc.). It also provides the link pin from the discovery services towards the delivery services, because it is directly related to the data sets, to which the users can request access. Access is given as downloading services, whereby the data sets can be downloaded by users from the data centres in a number of standard formats.

MIKADO is a versatile XML editor, provided by SeaDataNet, to prepare CDI XML entries. MIKADO runs on a PC and can be operated manually, but also in batch mode to generate automatically CDI XML records from a local metadatabase at a data provider. Beforehand a mapping analysis is required to match the local metadata to the CDI target model and to map the locally used terms to the SeaDataNet Common Vocabularies and the European Directory of Marine Organisations (EDMO) for organisations (data owners, distributors, holding centres). In addition there is a software tool, Ends&Bends, to assist in reducing the number of coordinates, depicting the original survey tracks or polygons, into a GML string that can be used in the CDI to indicate the location of the surveys for discovery purposes.

The new CDI records have been submitted to MARIS for loading into the CDI Data Discovery and Access Service. This is done in a few steps, starting with inclusion in a test CDI service for validating not only the syntax and semantics applied, but also the logical content and quality of the CDI entries. Thereafter attention has been given to the way how the data provider will be connected to the CDI service for giving access to data via the CDI shopping mechanism. Many data providers in the consortium were already operational in the CDI service and have added new entries where possible.

#### **Metadata compilation and inclusion in the Sextant products catalogue service:**

As an alternative to providing direct access for the consortium to their survey data sets, a number of data providers themselves have prepared Composite DTM's at a high resolution (minimum 1/16 minute) that were made available to the consortium. In those cases the data providers were required to prepare metadata entries for the Composite DTM's which should be done online in the Sextant products catalogue service using its Content Management System (CMS) and with support of IFREMER. Furthermore data providers were encouraged to enter also the CDI metadata for the underlying survey data sets in order to have a complete insight.

#### **Results:**

The operational CDI service for EMODnet Bathymetry now contains **14791** entries from **28** data centres from **15** countries. This has increased from **9127** entries from **15** data centres from **9** countries at the start of the project. Their geocoverage is illustrated below.

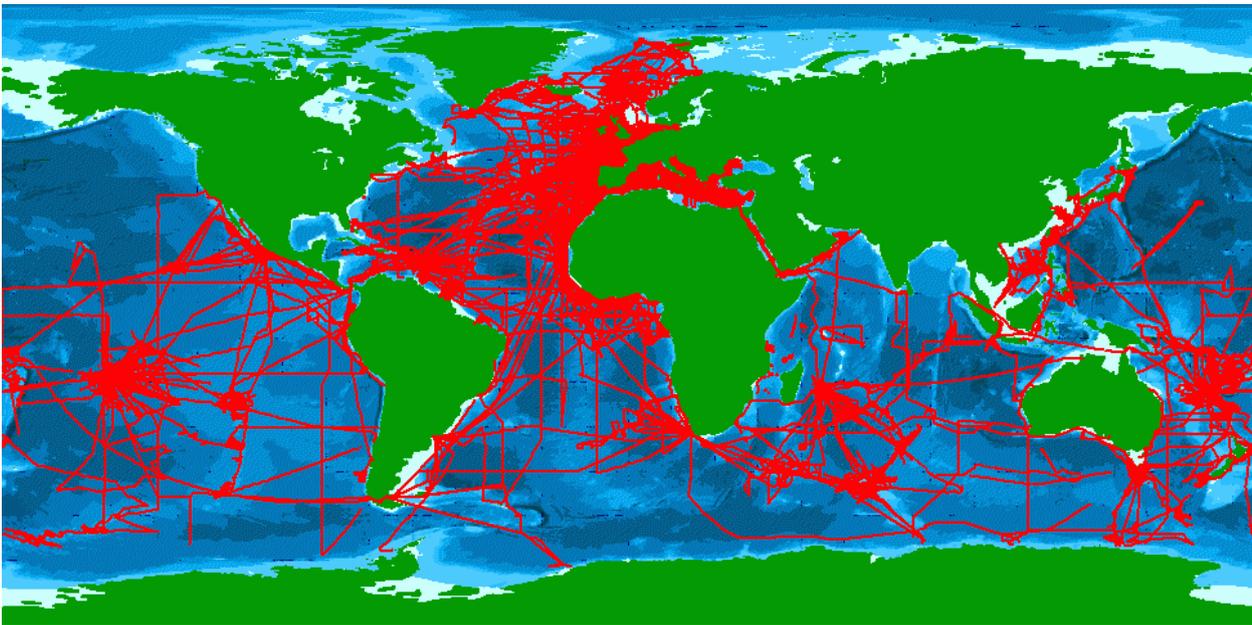


Image 3.1: Overview of geographical coverage of bathymetry CDI entries – end September 2016

The number of Sextant entries has increased from **32** composite DTMs contributed by **11** data providers from **11** countries to **77** composite DTMs from **19** data providers from **15** countries. Overall combined the total number of data providers has increased from **20** data providers from **13** countries to **34** data providers from **19** countries as is illustrated in the following table focusing on coverage for European waters.

Data Centre	Country	CDI Total No now	CDI Total No then	CDI Total increase	Sextant Total No now	Sextant Total No then	Sextant Total increase
Flemish Ministry of Mobility and Public Works; Agency for Maritime and Coastal Services; Coastal Division	Belgium	197	37	160	1	1	0
Management Unit of North Sea and Scheldt Estuary Mathematical Models, Belgian Marine Data Centre	Belgium	93	93	0	0	0	0
Bulgarian National Oceanographic Data Centre(BGODC), Institute of Oceanology	Bulgaria	20	0	20	1	0	1

Danish Maritime Agency	Denmark	0	0	0	1	1	0
Estonian Maritime Administration	Estonia	0	0	0	1	0	1
Jardfeingi, the Faroe Islands Earth and Energy Directorate	Faroe Islands	5	0	5	0	0	0
SHOM (SERVICE HYDROGRAPHIQUE ET OCEANOGRAPHIQUE DE LA MARINE)	France	4650	4128	522	0	0	0
IFREMER / IDM / SISMER - Scientific Information Systems for the SEA	France	716	653	63	1	1	0
German Oceanographic Datacentre (NODC) / BSH	Germany	256	0	256	9	1	8
MARUM	Germany	0	0	0	20	0	20
Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre	Greece	76	48	28	0	0	0
Geological Survey of Ireland	Ireland	223	94	129	0	0	0
Geological Survey of Israel	Israel	0	0	0	4	4	0
Institute of Marine Science (ISMAR) - Bologna	Italy	73	0	73	2	2	0
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Infrastructures Division	Italy	23	4	19	0	0	0
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography	Italy	10	10	0	0	0	0
International Ocean Institute - Malta Operational Centre (University Of Malta) / Physical Oceanography Unit	Malta	4	0	4	0	0	0
Rijkswaterstaat Centrale Informatievoorziening	Netherlands	2165	0	2165	0	0	0

Royal Netherlands Navy, Hydrographic Service	Netherlands	313	0	313	1	1	0
NIOZ Royal Netherlands Institute for Sea Research	Netherlands	30	19	11	0	0	0
GRID-Arendal	Norway	10	0	10	0	0	0
Norwegian Hydrographic service	Norway	0	0	0	5	1	4
IHPT, Hydrographic Institute	Portugal	275	237	38	0	0	0
Portuguese Institute of Ocean and Atmosphere	Portugal	53	0	53	2	0	2
National Laboratory of Energy and Geology	Portugal	0	3	-3	0	0	0
EMEPC	Portugal	0	0	0	1	1	0
National Institute of Marine Geology and Geocology	Romania	9	0	9	0	0	0
SC Marine Research SRL	Romania	3	0	3	2	0	2
IEO/Spanish Oceanographic Institute	Spain	66	66	0	24	18	6
Hydrographic Institute of the Navy	Spain	58	0	58	1	0	1
Marine Technology Unit. Mediterranean Marine and Environmental Research Centre	Spain	6	6	0	0	0	0
Institute of Marine Sciences. Mediterranean Marine and Environmental Research Centre (CMIMA-ICM-CSIC). Department of Marine Geology	Spain	5	0	5	0	0	0
Baltic sea Hydrographic Commission	Sweden	0	0	0	1	0	1
OceanWise Limited	United Kingdom	2066	875	1191	0	0	0
British Oceanographic Data Centre	United Kingdom	100	50	50	0	0	0
<b>TOTAL</b>		<b>11505</b>	<b>6323</b>	<b>5182</b>	<b>77</b>	<b>31</b>	<b>46</b>

*Table 3.2: Overview of data providers and increases in contributions for survey datasets and composite DTMs for European waters between 1 June 2013 and 30 September 2016*

More details can be found in Chapter 10 – Indicators.

### **3.3 WP2: QC/QA and producing Digital Terrain Models for the basins**

The objectives are to select and process the basic bathymetric data sets that then will be used as input for generating a best version Digital Terrain Model (DTM) per region. In the first year the existing QA/QC and DTM generation methodology from the previous EMODnet Seabed Mapping project has been upgraded to be able to deal with the challenges to increase the resolution of the EMODnet DTM from a grid of ¼ minute \* ¼ minute to a grid of 1/8 minute \* 1/8 minute. This has been documented in the amended **Manual on QA/QC and DTM generation** which can be downloaded from the EMODnet Bathymetry portal.

Each grid point in the resulting DTM has a lon-lat / WGS84, a minimum and maximum and average water depth over the cell, and ancillary layers such as statistics of the average waterdepth (standard deviation, number of interpolations, number of elementary surfaces), smoothed average waterdepth determined by a spline function, offset of smoothed waterdepth related to the average waterdepth and also references to the used sources of information. References to hydrographic survey data sets resp. Composite DTM data sets are documented by CDI metadata records resp. Sextant metadata records. In case of use of GEBCO a general GEBCO\_2014 reference is included.

#### **Data providers:**

They should preferably make use of **survey data** which are to be described by **CDI metadata**. The survey data set should be processed into pre-sampled grid (pref using the GLOBE software). The choice of the grid cell size is dependent on: survey characteristics, data accuracy, depth range, positioning system, internal data policy. This choice is the responsibility of the data provider. The following table gives a guideline.

<b>Level of resolution</b>	<b>Cell size</b>	<b>Approx size in m</b>	<b>Single beam</b>	<b>Multibeam</b>
1	1/8'	230	deep sea	deep sea
2	1/16'	115	deep sea and shelf / low density	continental margin
3	1/32'	60	continental shelf	continental shelf
4	1/64'	30	coastal area	coastal area

*Table 3.3 : Pre-sampled grid resolutions accepted vs. context*

In a number of cases Data Providers provided **Composite DTM's** which are described by **Sextant Catalogue references**. These Composite DTM's are DTM's created from multiple datasets from the same provider. If possible, the Composite DTM **should be re-sampled at a resolution** comparable to those

given in the Table above. The Data Provider should give details on the sampling method. The data set attribute content should at least include a water depth value and the CPRD ID for Composite DTM's per gridcell. The main issue with supplying data as a Composite DTM is that several attribute layers such as min/max depth, standard deviation and number of soundings might not be generated. In addition, integration of the data set into the final DTM product by the Basin Coordinator may create some artefacts in the regional basin DTM. Therefore supplying data as pre-sampled grids or raw soundings is preferred over Composite DTM's.

**Note:** raw soundings stands for the data that the data provider is ready to provide in his own internal format, while pre-sampled grids stands for these raw soundings gridded at 1/16 (or better) and provided to the regional basin coordinator prior to integration. This is illustrated in the image on the next page.

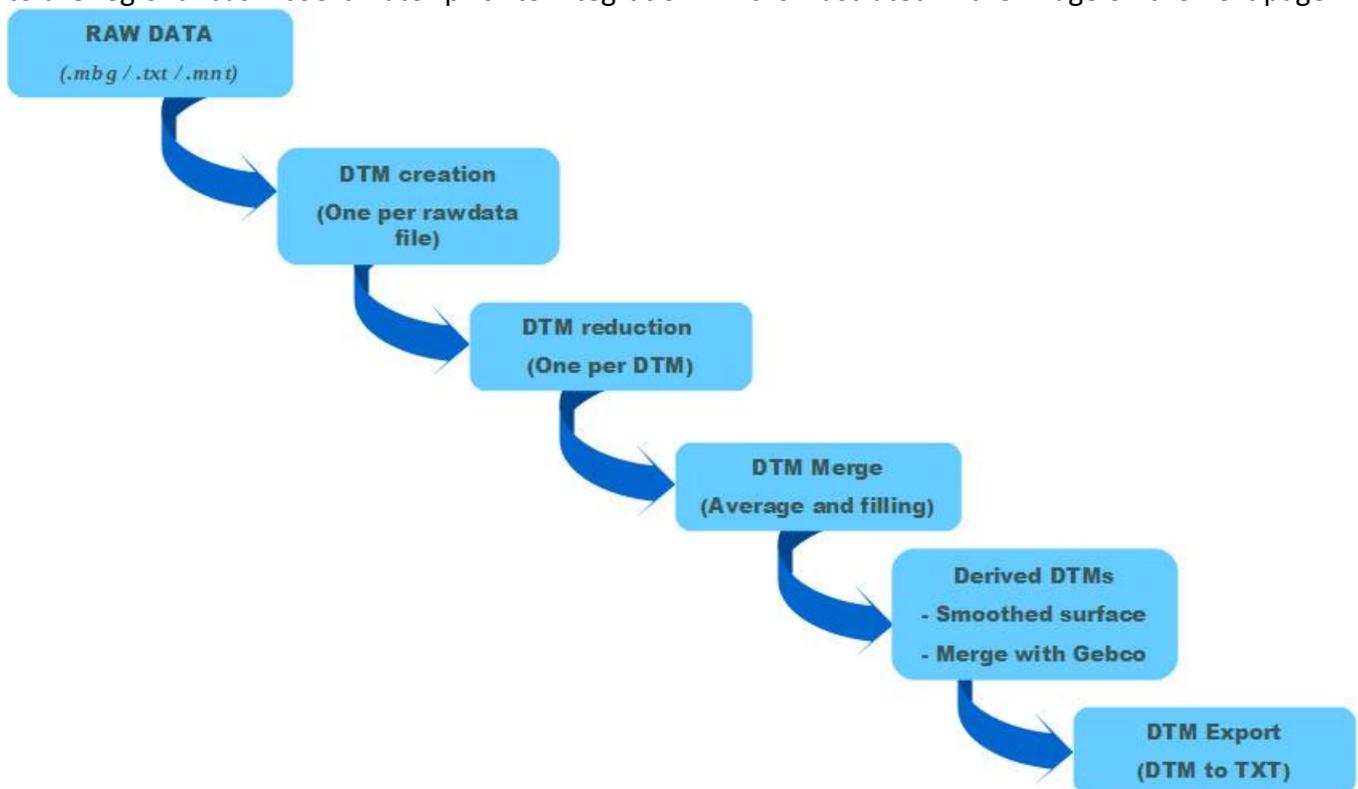


Image 3.2: EMODnet process from raw data to DTM

Following these guidelines, the data providers have undertaken processing activities to make their data sets ready for further steps by the regional coordinators. This work has started in the first year and was continued over the following years. Partly work in the second year was dedicated to re-processing input data sets, because the QA/QC identified structural issues which were due to the GLOBE software. Improved versions of GLOBE gave better results. In between new EMODnet DTM releases the data providers have focused on processing new and additional data sets that had become available as result of WP1 activities.

**A total of 11 regions have been defined to cover all of European seas and all DTMs had Regional Coordinators:**

Next step in the EMODnet processing flow has been to produce a compiled bathymetric product for each of the defined regional sea basin areas from all the data sets contributed by the data providers. This part of the process has been carried out by each of the regional coordinators. As part of this process, regional coordinators evaluate between available input files as received from data providers (see above) for areas and grid cells and select the ones, that are of best quality to their judgement as experienced hydrographer. So the depth value in a grid cell can be derived from one or more input files, which is indicated in the resulting DTM by the attribute 'number of elementary surfaces used to compute the average grid cell depth'. The DTM also has attributes per grid cell for:

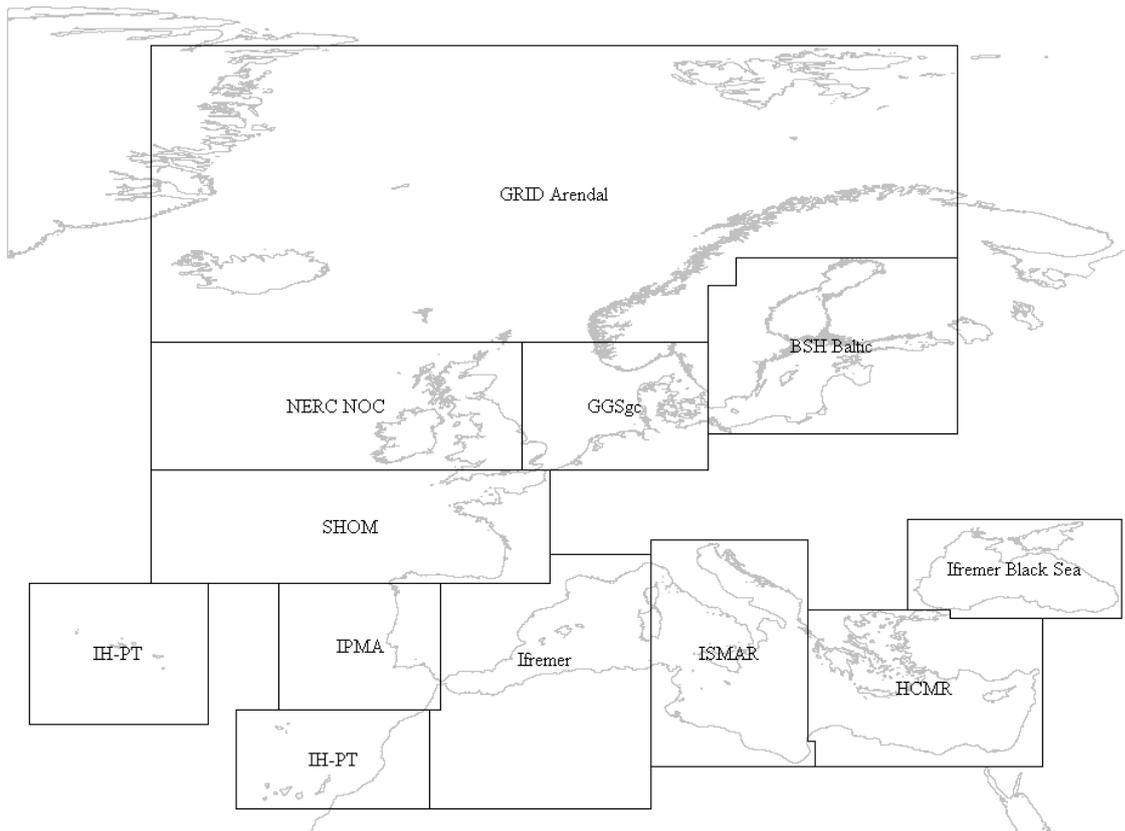
- minimum waterdepth in meters to LAT
- average waterdepth in meters to LAT
- maximum waterdepth in meters to LAT
- standard deviation of waterdepth in meters
- number of values used for interpolation over the grid cell
- average waterdepth smoothed by means of a spline function in meters to LAT
- an indicator of the offsets between the average and smoothed waterdepth as a % of the waterdepth
- reference to the prevailing source of data with metadata by means of CDI or Sextant or GEBCO reference.

Note: these attributes are complete in case of use of surveys as input; in other cases (use of CDTM or GEBCO statistics are missing).

A first release of the regional DTM's was produced in fact already at the end of the first project year, but at that time many anomalies were identified, and therefore it was decided to overhaul the regional DTM's and to postpone publishing of the overall EMODnet DTM. In practice the revision took place in the first half of the second year and this resulted in a public release of the 1st edition of the new EMODnet DTM with full European coverage and higher resolution in February 2015. Thereafter further improvements were undertaken, by further upgrading the GLOBE software, and also including again new data sets. This has resulted in new versions of the regional DTM's in June – July 2015 and a public release of the 2nd edition of the new EMODnet DTM in September 2015. The same process was repeated in the following year and resulted in new versions of the regional DTM's in July – August 2016 and a public release of the 3rd edition of the new EMODnet DTM in October 2016.

The phase of going from local processed data sets to regional DTM's involved 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. During the previous EMODnet projects, the process involved reducing and merging the 1/16 arc-minute DTM's to a 1/4 arc-minute grid. The revised approach involved aggregating "sampled data" grids at different resolutions to produce the final 1/8 arc-minute grid. The regional coordinators have worked on producing their best version, integrating GEBCO\_2014 in their first release and GEBCO\_2015 respectively GEBCO\_2016 (not yet published) in their second and third releases to complete gaps. As part of the approach the regional coordinators have also

performed their QA/QC analyses on the generated regional DTM, following a prescribed QA/QC method as included in the documentation, in order to achieve the best results . The boundaries of the regional DTM’s have been defined as indicated in the following image which also indicates the names of the regional coordinators.



*Image 3.3: Boundaries of regional DTM’s with their regional coordinators*

The current regional DTM’s have been produced using the GLOBE software and with data input from the following data providers:

- **Bay of Biscay, Channel and part Atlantic:** by **SHOM** with data contributions of SHOM, NERC-NOC, IFREMER, NERC-BODC, GSI, IEO, IHM, OGS, OceanWise, and NIOZ.
- **Iberian Coast - Atlantic:** by **IPMA** with data contributions from IFREMER, SHOM, IEO, IHPT, IPMA, EMEPC, IHM, ICM-CSIC, OGS and NIOZ.
- **Macaronesia regions - Azores + Madeira:** by **IHPT** with data contributions IHPT, IFREMER, SHOM
- **Macaronesia regions - Canary Islands:** by **IHPT** with data contributions IHM, IEO, IFREMER
- **Western Mediterranean:** by **IFREMER** with data contributions IFREMER, SHOM, IEO, IHM, ICM-CSIC, OGS and NIOZ.
- **Central Mediterranean:** by **CNR-ISMAR** with data contributions CNR-ISMAR, SHOM, OGS, HCMR, IFREMER, University of Malta, Israel (John Hall), and NIOZ.

- **Eastern Mediteranean:** by **HCMR** with data contributions by HCMR, IFREMER, SHOM, OGS, NIOZ, and Geological Survey of Israel (John Hall).
- **Celtic Seas and part Atlantic and part North Sea :** by **NERC-NOC** with data contributions of NERC-BODC, HO Faroes, GSI, IFREMER, NIOZ, OceanWise, OGS, and SHOM.
- **Channel and part Atlantic:** by **SHOM** with data contributions of SHOM, NERC-BODC, IFREMER, NERC-BODC, GSI, OceanWise, and NIOZ.
- **Greater North Sea region:** by **GGSGC** with data contributions SHOM, NERC-BODC, BSH, HO Belgium, OceanWise, HO Netherlands, NIOZ, HO Faroes, and NPD.
- **Norwegian Sea - Icelandic Sea:** by **GRID-Arendal** with data contributions NHS, HO Faroes, NPD, NIOZ, NERC-BODC, OGS, OceanWise, IFREMER, SHOM, and NGDC.
- **Baltic Sea:** by **BSH** with data contributions of BSH, Estonian Maritime Administration, and BSHC - BSBD project (via SMA)
- **Black Sea:** by **IFREMER** with data contributions of IFREMER, IO-BAS, NIOZ, GeoEcoMar, Marine Research, and MARUM

**Example of production and quality analysis of regional DTM for the Bay of Biscay – Atlantic Ocean:**

The boundaries of the regional DTM for the Bay of Biscay – Atlantic ocean are defined as: N51° to N43° and W26° to E02°. For this area the data contributions as displayed in the following table and images were available.

<b>Data contributor</b>	<b>Country</b>	<b>Type of data</b>
UKHO - OceanWise	United Kingdom	Multibeam, single beam
IEO	Spain	Composite product
IFREMER	France	Multibeam
IHM	Spain	Multibeam, single beam
GSI	Ireland	Multibeam
OGS	Italy	Multibeam
SHOM	France	Multibeam, single beam, lead line

*Table 3.4: Data contributions for Bay of Biscay – Atlantic ocean*

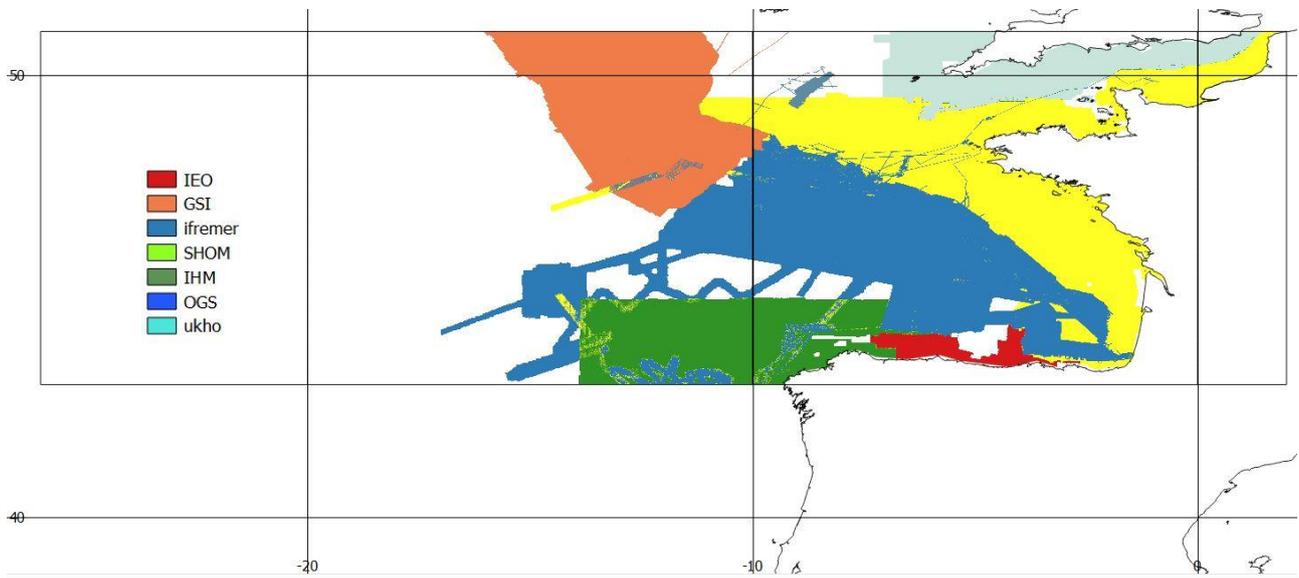
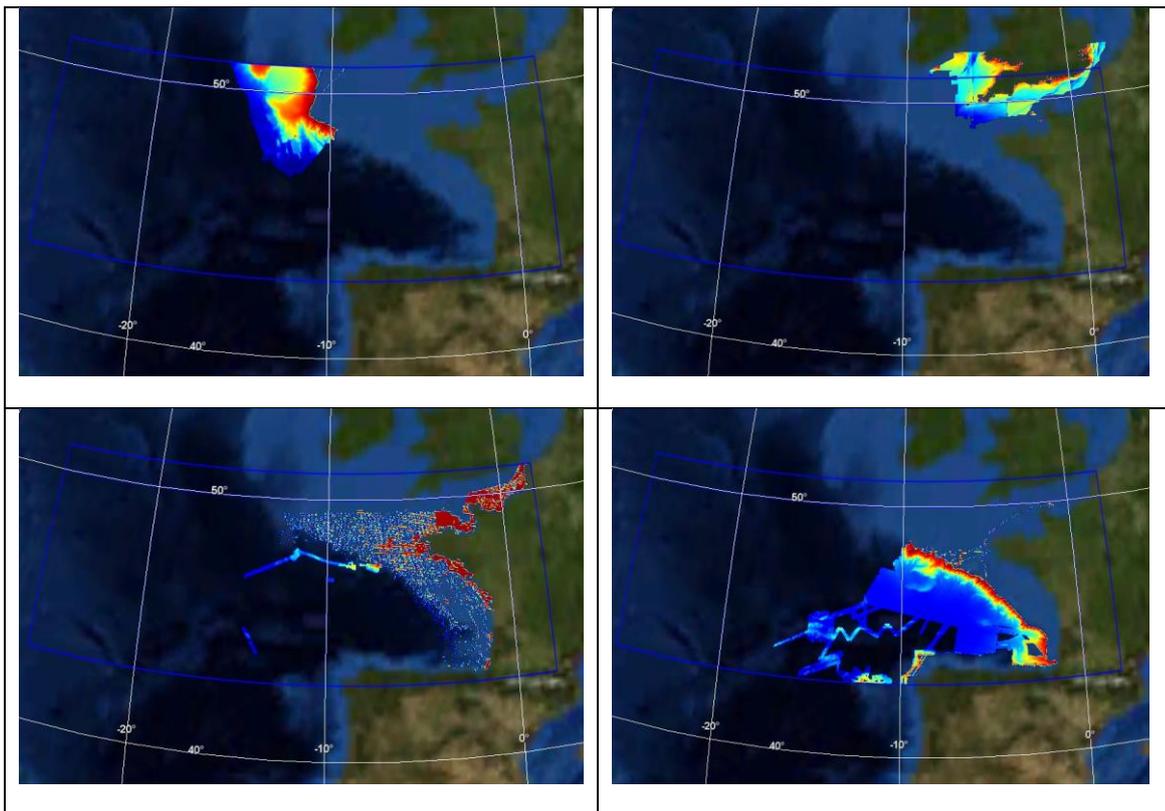


Image 3.4: Distribution of the data provider contributions



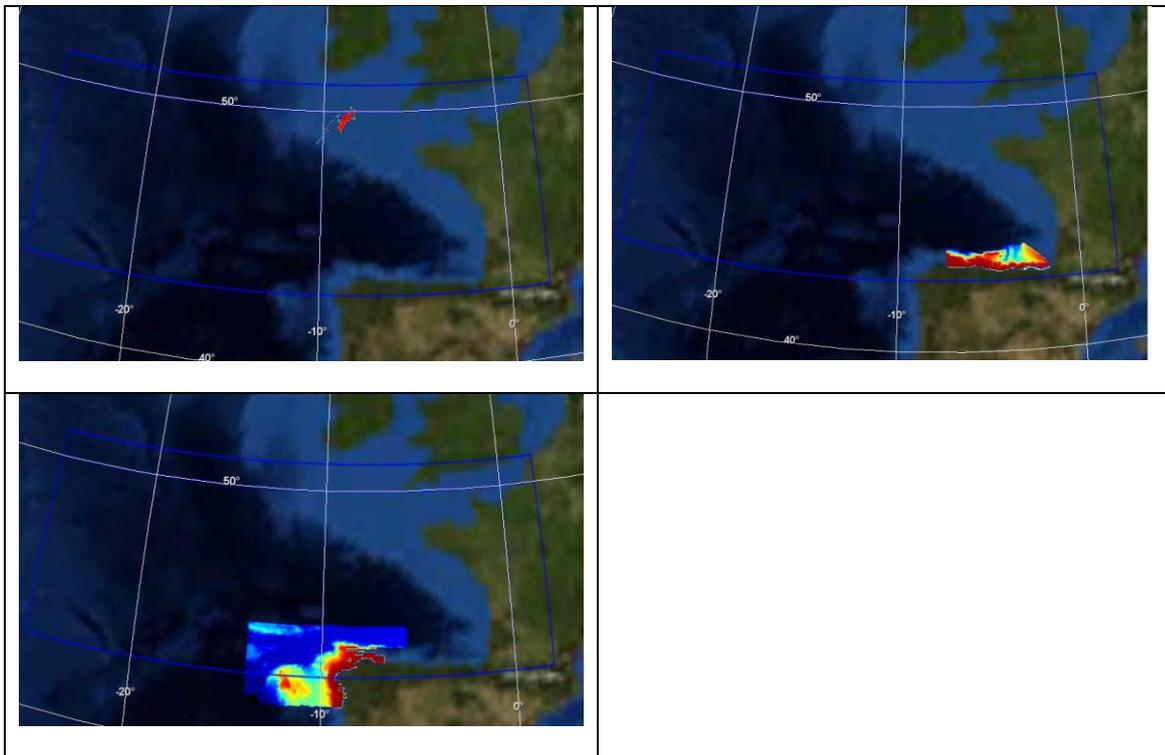


Image 3.5: Distribution of the data provider contributions

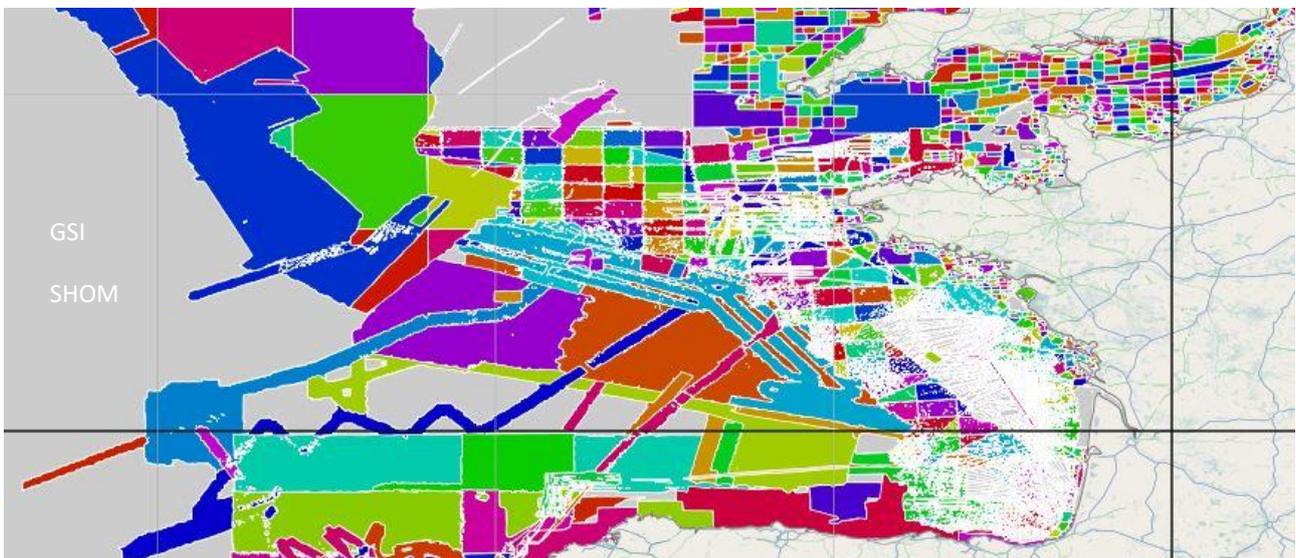


Image 3.6: Source reference layer indicating which datasets were used for the Regional DTM

The image 3.6 indicates the coverage of the datasets that have been selected for composing the Bay of Biscay – Regional DTM. The colour palette indicates the different datasets used and not its contributors. However the interested reader is referred to the EMODnet portal (<http://portal.EMODnet->

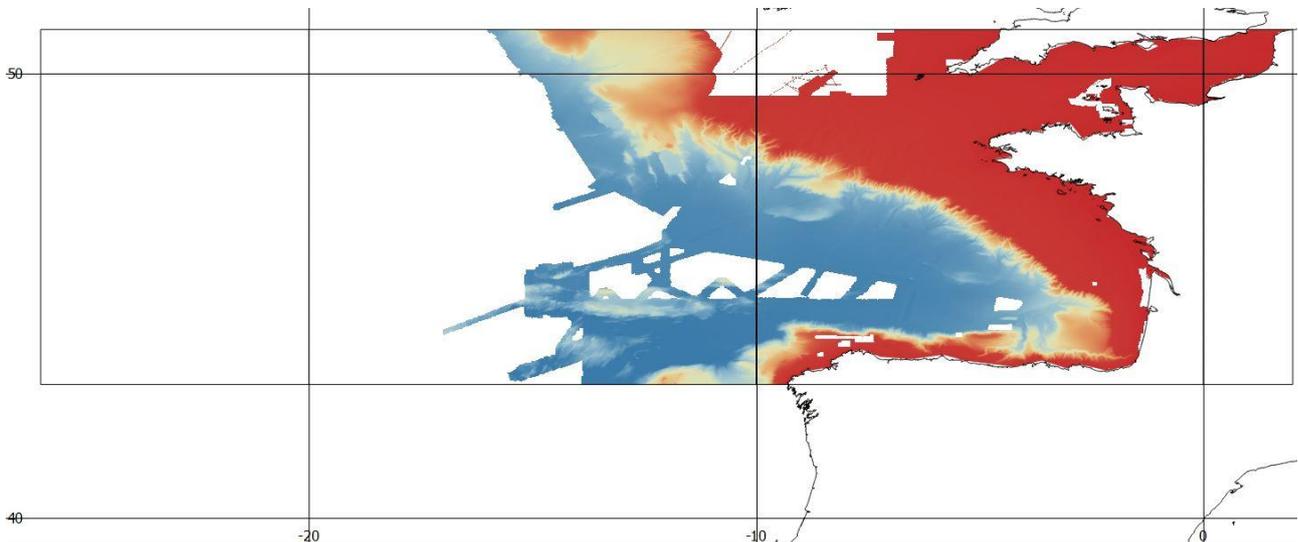
[bathymetry.eu/source-references](http://bathymetry.eu/source-references)) where this information can be retrieved in much more detail from the Source References layer.

Remarks: All these datasets are supposed to have been processed (for erroneous soundings or navigation, tide corrections and sound velocity applied) by each of the data providers. If datasets are overlapping there is no temporal or geographical deconfliction.

The Regional DTM for the Bay of Biscay has been computed using the source data as mentioned. All the processing was done using the GLOBE software (version 1.5.11) by SHOM Windows on a 7 pro i7-4790 CPU @3.6 GHz – 16 Go RAM computer. Each dataset was gridded to a single 1/16 or 1/32 arc minute DTM and the regional DTM was produced according to the following steps:

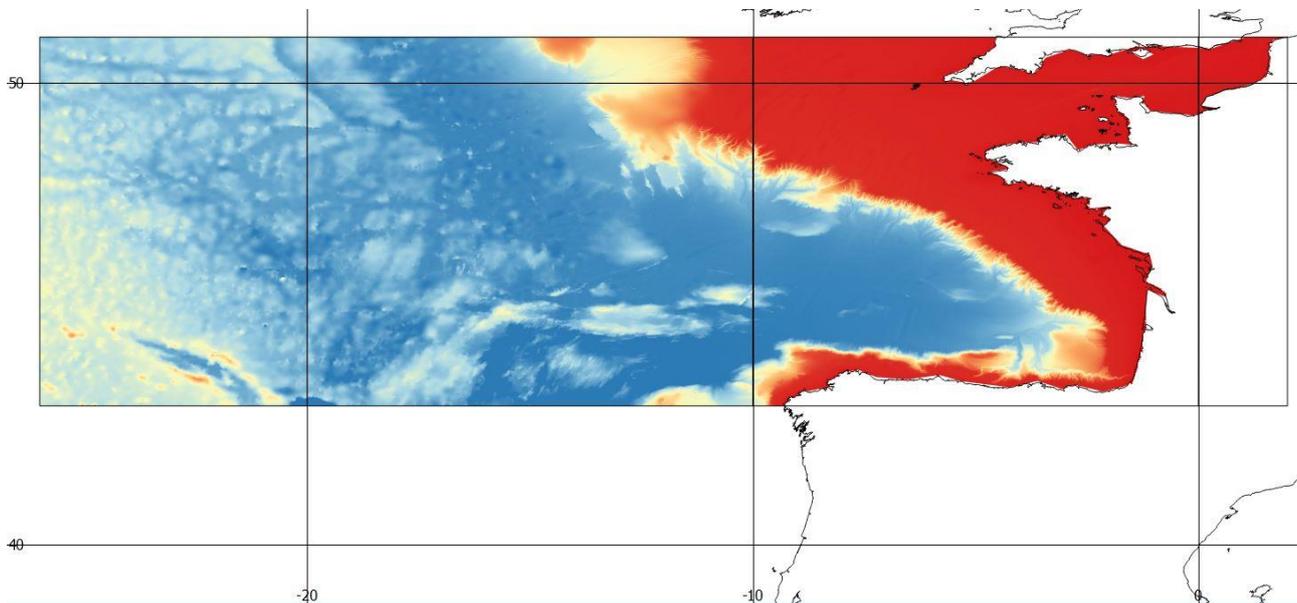
- Reduction of each DTM to a 1/8 arc minute DTM
- Merging IFREMER-SHOM dataset (weighted average depth calculation)
- Fill gap calculation on IFREMER-SHOM DTM
- Merging IFREMER-SHOM DTM with Oceanwise-GSI-OGS-IHM dataset (weighted average depth calculation)
- Merging IEO composite DTM (fill missing value)
- Merging old SHOM dataset on coast (fill missing value)
- fill gap calculation on the DTM without GEBCO

The following image provides the coverage resulting of this compilation.



*Image 3.7: Average depth for the dataset (1/8 th of a minute)*

The GEBCO\_2015 DTM was provided by GEBCO was used to fill the remaining gaps in the DTM coverage. This resulted in the following DTM.



*Image 3.8: Resulting DTM with average depth after GEBCO integration and smoothing*

Along with the computation of the average water depth, other statistics have been computed and can be used to help assessing the quality of the grids:

- Gradient map
- Standard deviation
- Density of soundings per cell

**Gradient** is calculated from the depth surface. This can be considered as a good proxy of the slope. This measurement describes the general morphology of the area and can be used as an indicator of inconsistencies between overlapping datasets. Some of these inconsistencies can be seen in deeper areas of the Bay of Biscay where some transects are crossing surficial datasets. Lineage along survey lines are also seen and can be related to the effect of sound velocity corrections applied on the outer beams of multibeam swathes.

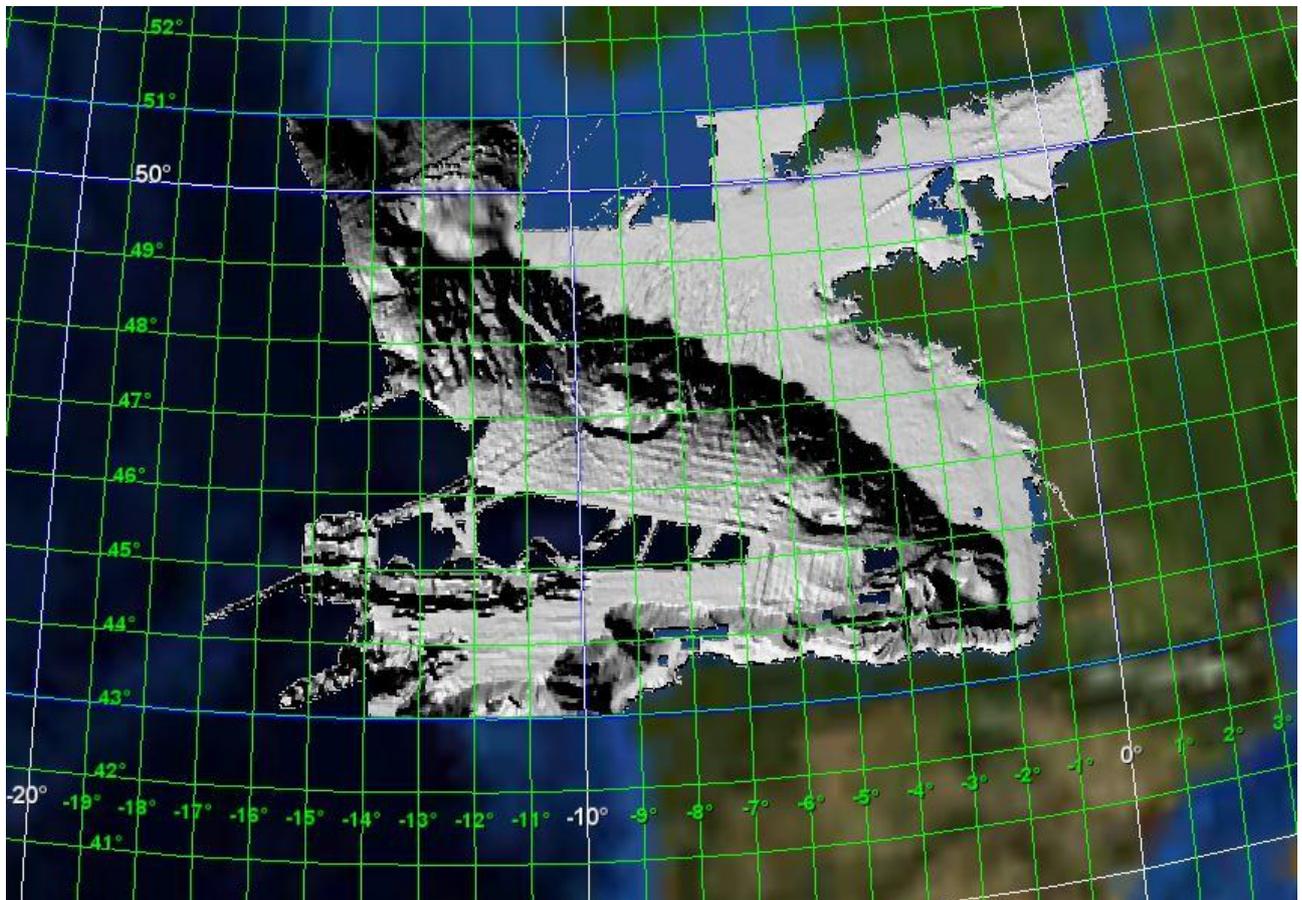


Image 3.9: Gradient map

**Standard deviation** is computed using GLOBE as square roots of the variance to the mean water depth computed in a cell of  $1/8^{\text{th}}$  arc-minute for all the soundings falling in this cell. This statistic is principally driven by the morphology, as expected (see higher values in the canyons of the continental slope). Higher values are also observed where datasets are overlapping. As of the gradient map, some transects in the deeper part of the Bay are highlighted.

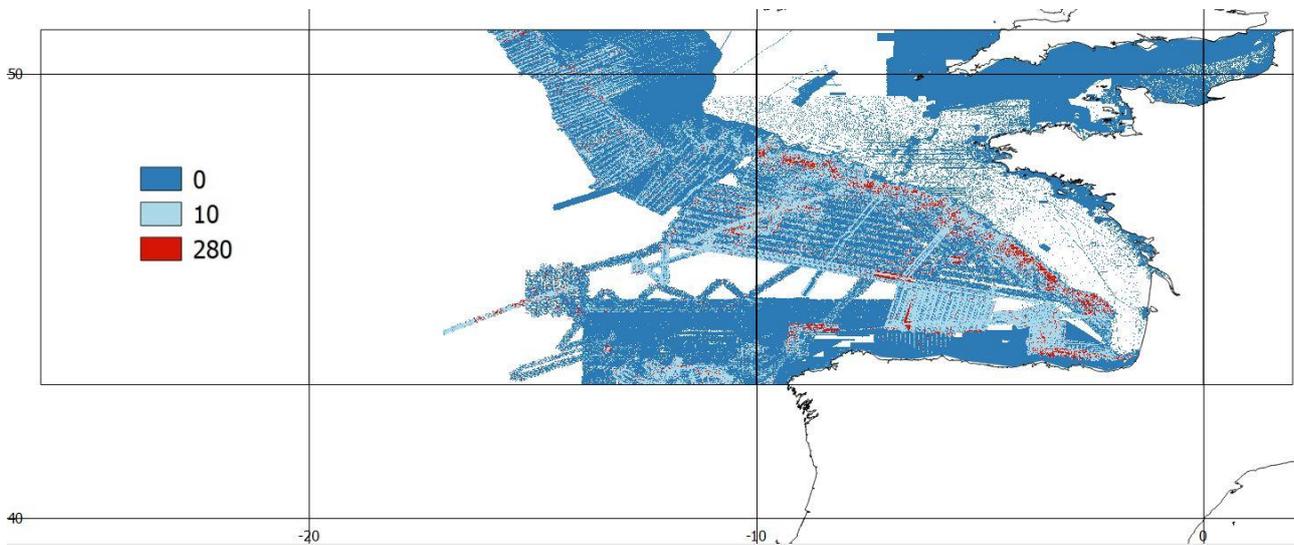


Image 3.10: Standard deviations

The density of soundings per cell are counted per  $1/8^{\text{th}}$  arc-minute node of the Regional DTM. This value provides an estimate of the robustness of the estimation of the water depth. A striking observation is that for a large part of the estimated water depth surface (without GEBCO completion), statistics were calculated with a relatively low number of soundings (red on the map). This is related to the fact that most of the data are generally originating from single beam, sampled multi beam data (SHOM data) or preprocessed product (Oceanwise-UKHO data). The image also shows that few data are available on the continental shelf. Blue areas are associated to multi beam data (unsampled) or overlapping datasets.

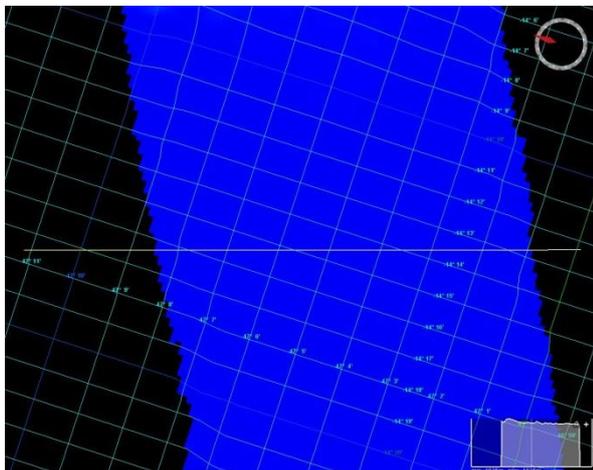
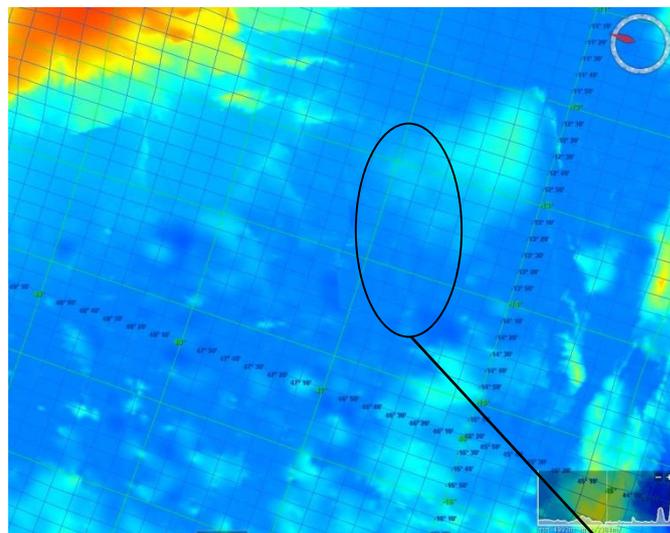


Image 3.11: Number of soundings per  $1/8^{\text{th}}$  of arc-minute nodes

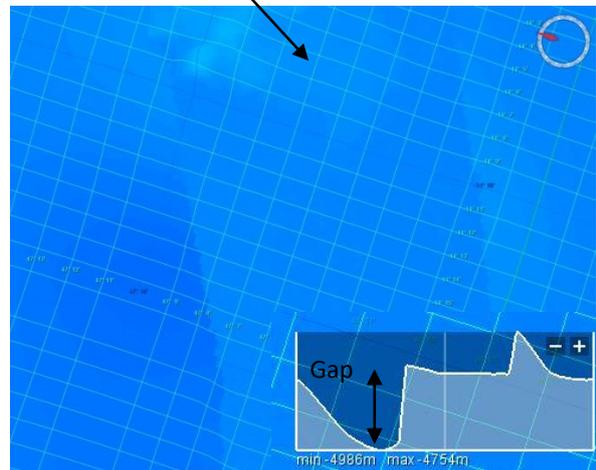
There are a few observed and known artefacts of the Regional DTM. Examples of these artifacts are:

- Limited coverage: some artefacts are caused by single beam surveys, for which gaps in between lines have been completed by GEBCO\_2015. Nevertheless by using the GLOBE function “fill

- gap” this problem can be limited;
- Composite DTM resampling: resampling of GEBCO data and/or composite DTM that have a lower resolution than 1/8<sup>th</sup> minute can lead to some kind of pixelisation.
  - Incoherence between datasets/transects: Minor incoherencies occurred due to some transects as can be seen in the image below (located on abyssal plain). However these incoherencies are minor and differences between the depths measured in the transect and the remaining datasets generally stay within accepted standards.



Multi beam Dataset



Multi beam Dataset and Gebco

Image 3.12: Artefacts related to individual multibeam transects

One case of inconsistency between IHM data and IEO data remains a difficulty. The area concerns the northern coast of Spain. The depth difference between the datasets is about 20 m high (~10% local water depth). IEO had some difficulties with the dataset and will undertake further efforts for improving. For

now the IEO dataset has been included as it is better than GEBCO. However it has been integrated with the GLOBE function “fill missing value” in order to ensure that the IHM dataset is not mixed with the IEO dataset.

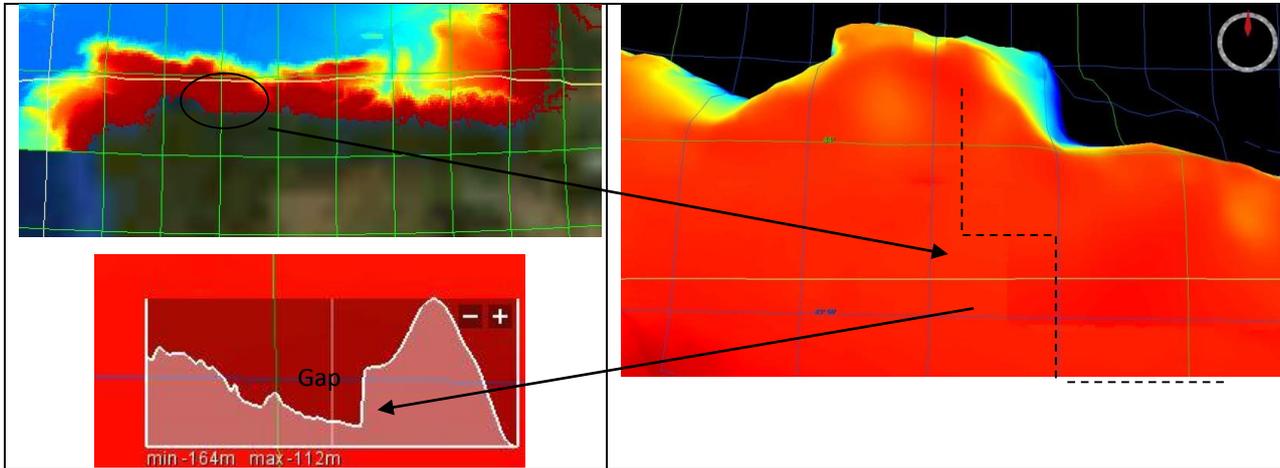


Image 3.12: Inconsistencies between datasets IHM-IEO (along the northern coast of Spain)

### **Inclusion of the EMODnet bathymetric grids into GEBCO and vice-versa:**

Through its Sub-Committee on Regional Undersea Mapping (SCRUM), GEBCO aims to work with regional mapping groups, such as EMODnet, as collaborative partners to help build authoritative regional and global bathymetric models. An updated GEBCO grid will also help to make a better base for future ‘gap filling’ work for EMODnet. As part of the cooperation in the EMODnet Bathymetry project GEBCO has integrated each time the previous EMODnet DTM release into its GEBCO grid with grid size ½ minute which improved considerably. In turn each time the latest GEBCO DTM (not yet publicly released) has been made available to EMODnet for filling gaps in coverage, starting with its first new release in February 2015. The GEBCO DTMs were also improved with other additional sources, such as OLEX and IBCAO. This synergy and two-way exchange between EMODnet and GEBCO leads to better products for both groups and less issues where EMODnet grids based upon survey data and GEBCO grids meet.

### **Development and upgrading of the GLOBE software tool:**

The GLOBE software tool is developed and maintained by IFREMER and has been adopted by the Consortium for QA/QC and DTM processing. The GLOBE software can deal with different data types such as multibeam surveys, seismic surveys, images etc. and provides support for seafloor mapping (elevation, backscatter, gridded, 4D data, water column echoes, rasters and grids). It also includes a 3D viewer, developed as part of the EU Geo-Seas project, on the basis of NASA WorldWind. The GLOBE software can handle data in NetCDF (CF), standard grids and sensor acquisition formats and after processing can make products compliant for WMS, GoogleEarth, and GIS. The GLOBE development has succeeded the earlier Caribes software, that was used in the previous EMODnet Hydrography and Seabed mapping projects by various partners. The new GLOBE software has been made available for

EMODnet partners by IFREMER. Use of the GLOBE software to produce common DTMs has been highly recommended because it has the EMODnet methodology incorporated in its software and results in a harmonised approach between the regions. Therefore most partners have adopted and used GLOBE. But during the project various extra requirements and bugs were identified in the GLOBE software which have led to delays and in some cases to need for re-processing of data sets. However issues have been followed up by IFREMER in a succession of software releases. A number of partners did not use GLOBE, but their own in-house software tools, such as CARIS tools. Based on the analysis of the mid 2014 and the February 2015 EMODnet DTMs end February 2015 a new release of GLOBE (version 1.5.0) was made available. This version introduced various improvements and bug fixes. Noteworthy are the new spline interpolation method and a fix in the algorithm to smooth (single beam) data along the edges. It has solved all issues with the statistical data and the GEBCO data formatting. Also basic data sets are now first re-projected before adding to the regional EMODnet DTMs. A special function has been added in GLOBE for this purpose. This greatly has reduced gridding artefacts in the resulting regional DTMs. It should be noted that not all artefacts have disappeared. Most likely this indicates that the artefacts are already present in the source data. The most recent version of GLOBE is 1.5.13 and has been used by nearly all data providers and regional coordinators for the latest release of the EMODnet DTM of October 2016.

**Production and delivery of high resolution DTMs for coastal regions:**

High Resolution DTMs have been generated for 3 pilot regions in Ireland by GSI, France by SHOM and Germany by BSH. Each prepared a dataset with different characteristics. The table below gives some details:

Data provider	Resolution	Format	Area
BSH (Germany)	~1 meter	GeoTiff	German North Sea coast
GSI (Ireland)	~7 meters	EMO/DTM	Bantry and Dunmanus Bay
SHOM (France)	~25 meters	DTM	French Mediterranean coast

*Table 3.5: High resolution DTM's*

Resolution is given as an approximate number because the datasets use a non-projected grid system based on a grid size in decimal degrees. The grid size in meters varies.

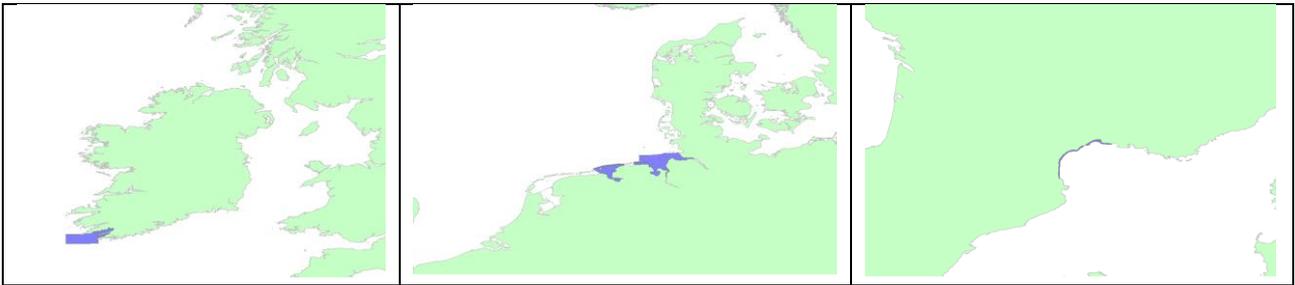


Image 3.13: Pilot areas with high resolution bathymetry

## BSH

The data set provided by BSH is a composite DTM based on available source data held at the Federal Maritime and Hydrographic Agency (BSH). Details of the dataset are registered in the Sextant catalogue. Although the listed resolution is approximately 1 meter, only parts of the dataset are available at the highest resolution. BSH exported most of the North Sea coastal area from their bathymetric database using a fixed resolution, resulting in large up-sampled areas. The differences in detail are clearly visible in the EMODnet portal. It is questionable whether this form of up-sampling is useful for the EMODnet project as it does not provide any more detail but suggests availability of high resolution data. The dataset was provided as a series of 32bit single band GeoTiff files (total 13 GB). No detailed CDI data was made available. In those areas where full resolution is available, the data provides a stunning view of the German North Sea coast and in particular the morphology of the many sand waves and intertidal creeks.

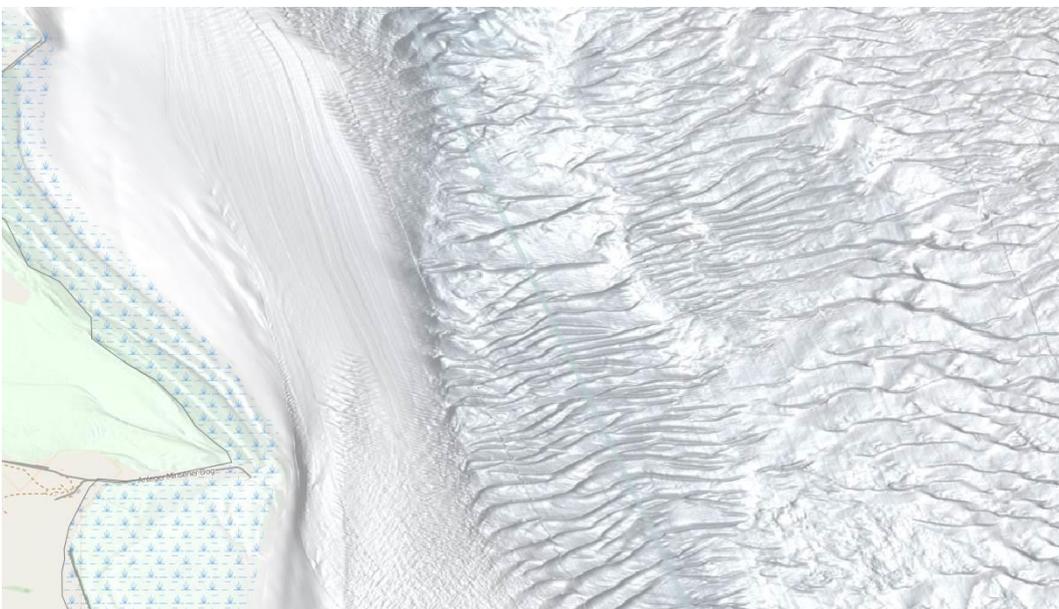


Image 3.14: Stunning details of underwater topography at 1 meter resolution

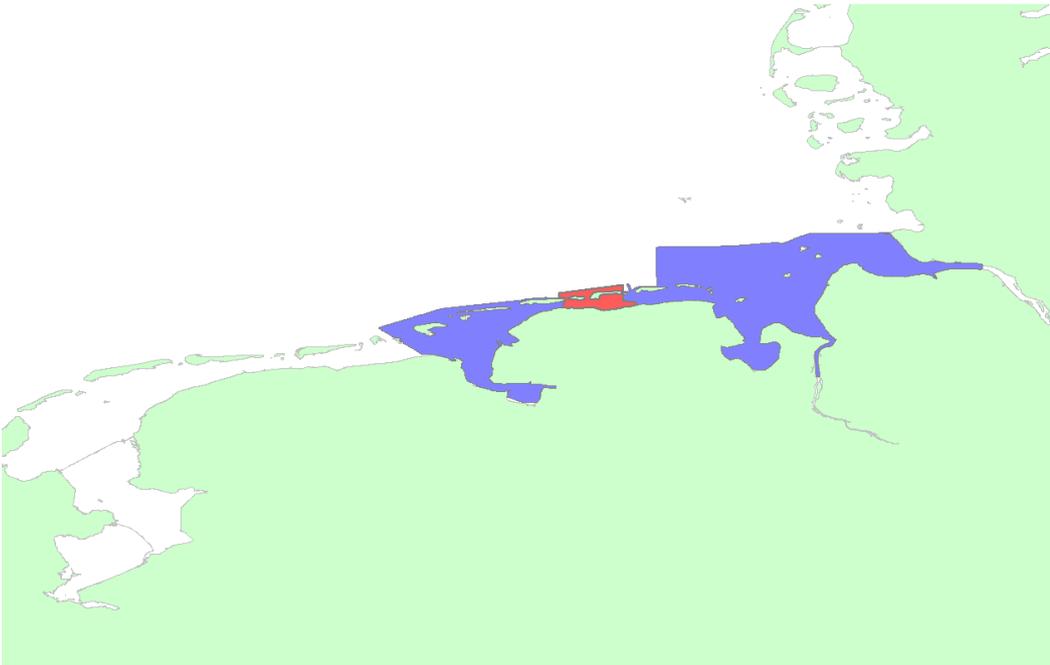


*Image 3.15: Clearly visible dredge marks near Cuxhaven*

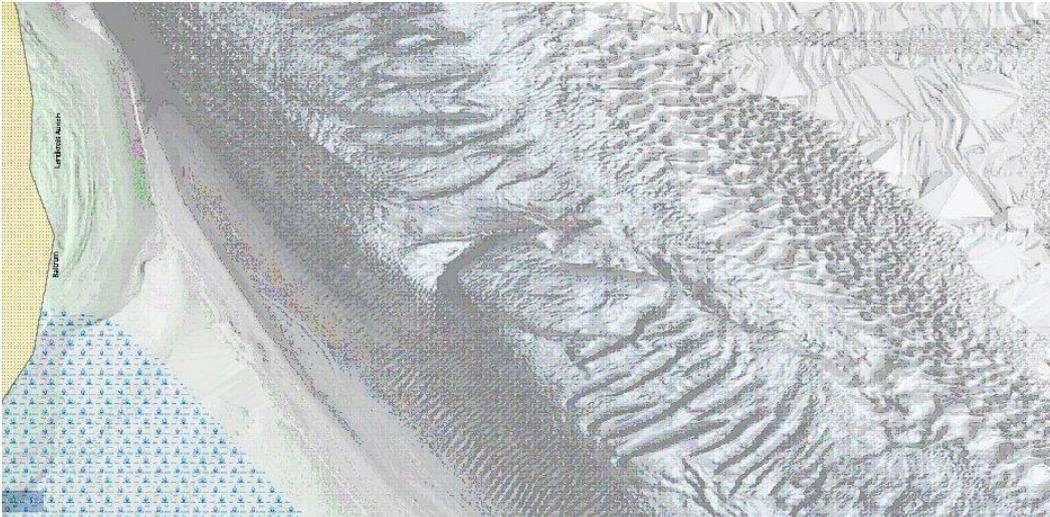


*Image 3.16: Effect of up-sampling of a multi resolution dataset*

In the third year BSH provided an update for its high resolution DTM.



*Image 3.17: Update of German North Sea coast HR data coverage (new data in red)*

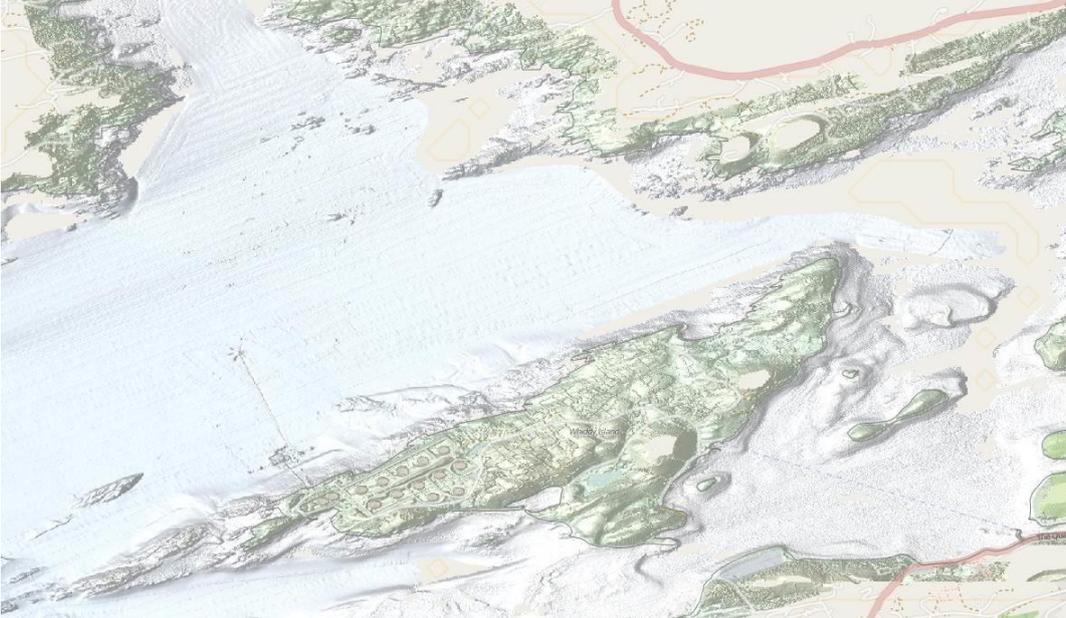


*Image 3.18: New high resolution data between Baltrum and Langeoog*

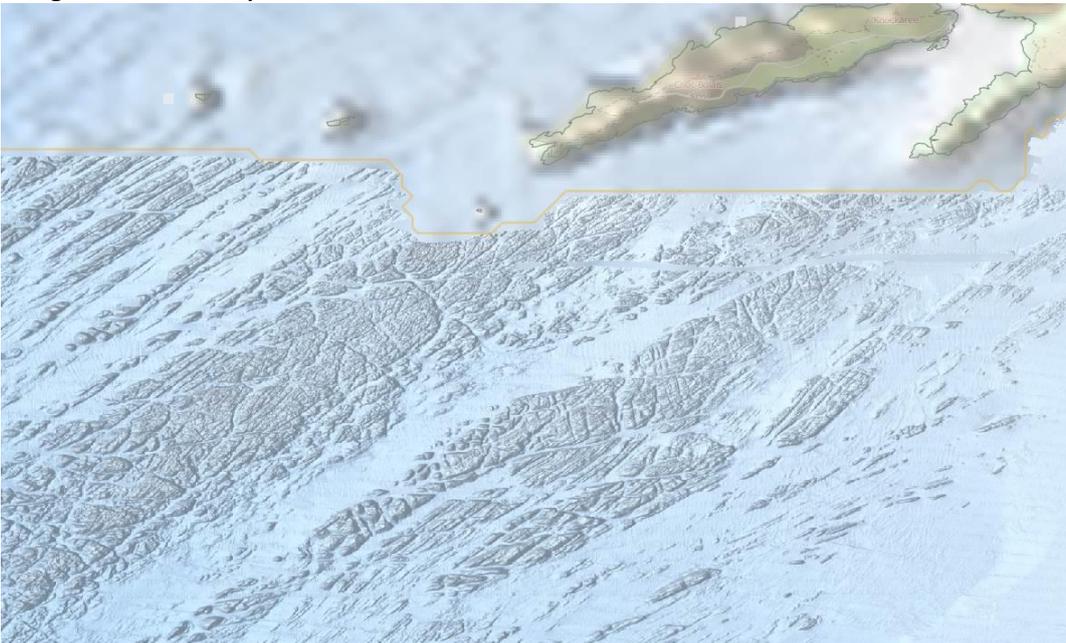
## **GSI**

The Geological Survey of Ireland provided a 7m high resolution dataset of the coastal waters of Bantry and Dunmanus Bay in the south-west of Ireland. The dataset is a compilation of various sources originating from multi-beam and lidar sensors. Both water and land area is covered resulting in clearly visible structures on land. The dataset was delivered both as EMO file and GLOBE DTM file with full reference to the source data using CDI id's per gridcell. Lidar often does not provide full surface coverage

resulting in many small gaps in the data. GSI performed an interpolation on the dataset to fill these gaps. The area covers over 500 square nautical mile.



*Image 3.19: Whiddy Island Oil terminal*



*Image 3.20: Rocky outcrop south west of Dursey Island*

## SHOM

SHOM's contribution to the high resolution coastal pilot consists of a almost 200 km long stretch of the French Mediterranean coast north along the Golfe du Lion. The data was captioned as part of the French Lito3D project in 2009. A total of 560922 soundings were captured for this survey based on bathymetric lidar. The resolution of 25 meter is relatively low compared to the contribution of GSI and BSH but the

dataset provides valuable input for the coastal data pilot as it helps in developing methods for finding the optimal user experience while displaying datasets of various resolutions in a single portal.



Image 3.21: Southern France Mediterranean coast

### **3.4 WP3: Integration and inclusion of the DTM's into the portal**

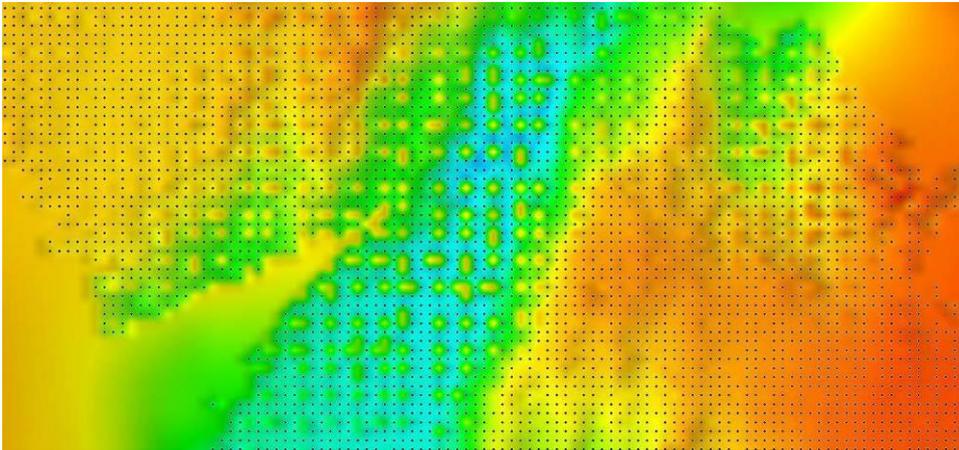
For each release of the EMODnet DTM GGSgc has received all Regional DTMs from the regional coordinators and has undertaken activities for QA – QC and integration into the EMODnet DTM. The QA – QC has identified a number of issues that were discussed with the regional coordinators and also partly could be attributed to issues with the GLOBE software as used by all regional coordinators. These feedbacks have resulted over time in improvements of the GLOBE software and extra focus of regional coordinators on correcting identified anomalies. The following observations can be made concerning the integration process experiences:

- All regional coordinators have used GLOBE to compile their Regional DTMs for the last release. This has resulted in a high level of standardization of the DTM data and in an almost 100% coverage match between the regional contributions. In previous versions there were more gaps and overlaps detected between the regional DTM contributions.
- DTM Data for the last release was received in various formats: EMODnet, Globe, GeoTiff and NetCDF. The fact that various formats are used did not influence the integration of the overall product. GeoTiff was used by BSH for the update of the German North Sea High resolution data.
- Just as with the earlier release, all data sets contained a smoothed value but no use was made of the smoothed value columns as delivered by the regional coordinators. Integrating the various regional DTMs in the overall products requires the whole dataset to be re-smoothed to avoid any edge-effects. The final smoothing using a factor 2 down-sampling following with a spline up-sampling algorithm was done by GGSgc as part of the integration work.
- To overcome edge issues as a result of smoothing (the dataset is processed in parts due to the size), the GGSgc integration software was updated which introduced overlap between the processed areas. As a result the 2015 edge issues are now resolved.



*Image 3.22: 2015 edge issues (shown in picture above) are resolved in the 2016 release*

- Because of various software bugs, field 7, the interpolation flag was not properly encoded in the EMO and netcdf files. This is corrected in the 2016 release. Also because of a software bug, the smooth difference field (field 9) was incorrect in the netcdf files. This has also been corrected for this release.
- In the first year production interpolation issues were found to be present in the complete EMODnet dataset and it turned out that a failing algorithm in GLOBE had an unwanted side effect on the edge of individual data sets resulting in an even stronger discontinuity between data sets. This has been corrected in GLOBE from version 1.5.0 onwards. For the first EMODnet DTM release of February 2015 most of these edge effects were smoothed out by applying a new localized smoothing algorithm.



*Image 3.23: August 2014 interpolation issues (solved in 2015 and 2016 releases)*

- In the first release there were considerable gaps between the DTM and the coastline. In the following version this was corrected and all regional DTMs had a good data match with the OpenStreetMap coastline used for masking the product. This resulted in a better and more smooth continuation of the water into the land area. The viewing service contains a layer with full European DEM coverage on both land and water (The land DEM source is <http://www.viewfinderpanoramas.org> (2014)). This was introduced in the February 2015 release but at that time, due to gaps between the Regional DTMs and the OpenStreetMap coastline resulted in a less smooth interpolation in the coastal zone. The September 2015 and October 2016 releases show a much better result in those areas.
- MARIS and GGSgc together have checked and ensured for each DTM release that all CDI and Sextant references were correct, so that it is possible to retrieve a detailed metadata description of the used dataset for each gridcell.
- The first EMODnet DTM release was based upon circa 6850 datasets; the second release upon circa 6950 datasets and the third release upon circa 7800 datasets. The latest release also includes 48 unique Composite DTM references.

#### **Localised smoothing:**

The GEBCO dataset has a native resolution of  $\frac{1}{2}$  arc minute. This is 4 times 4 less than the EMODnet resolution of  $\frac{1}{8}$  arc minute resulting in a dataset that is 16 times smaller in terms of the number of grid cells. In order to use the GEBCO data set to fill unsurveyed areas in EMODnet, GEBCO data is up-sampled using a spline algorithm within GLOBE. Although the algorithm works fine, the data does not get more detailed in terms of “true” data. In addition, GEBCO uses a “remove restore” algorithm to smooth the GEBCO DEM. As such, GEBCO is a modelled representation of the sea floor and is not a true representation of measured data. Consequently, when trying to combine GEBCO data with detailed source data like multibeam surveys, there will likely be a significant difference between the two sources resulting in strong edge artefacts. In the first EMODnet DTM release these artefacts were removed when possible using an overall smoothing of the dataset, much like the GEBCO remove/restore algorithm. In order to avoid too much deterioration of the original source data the smoothing was carefully balanced. Although the result was better compared to a dataset without smoothing, many artefacts remained

clearly visible. With the increase of the EMODnet resolution from 1/4<sup>th</sup> to 1/8<sup>th</sup> arc minute these artefacts became more prominent due to increased visual detail and a larger gap between the source resolution of GEBCO and EMODnet. To better cope with this situation, GGSgc developed a localized smoothing algorithm that resulted in the best of both worlds. It removes artefacts between GEBCO data and higher resolution CDI/DTM source data in a controlled zone while keeping the detail outside that zone intact. The algorithm is controllable such that the size of the buffer zone and the choice of DTMs being affected are configurable. The illustrations below show the result of the algorithm.

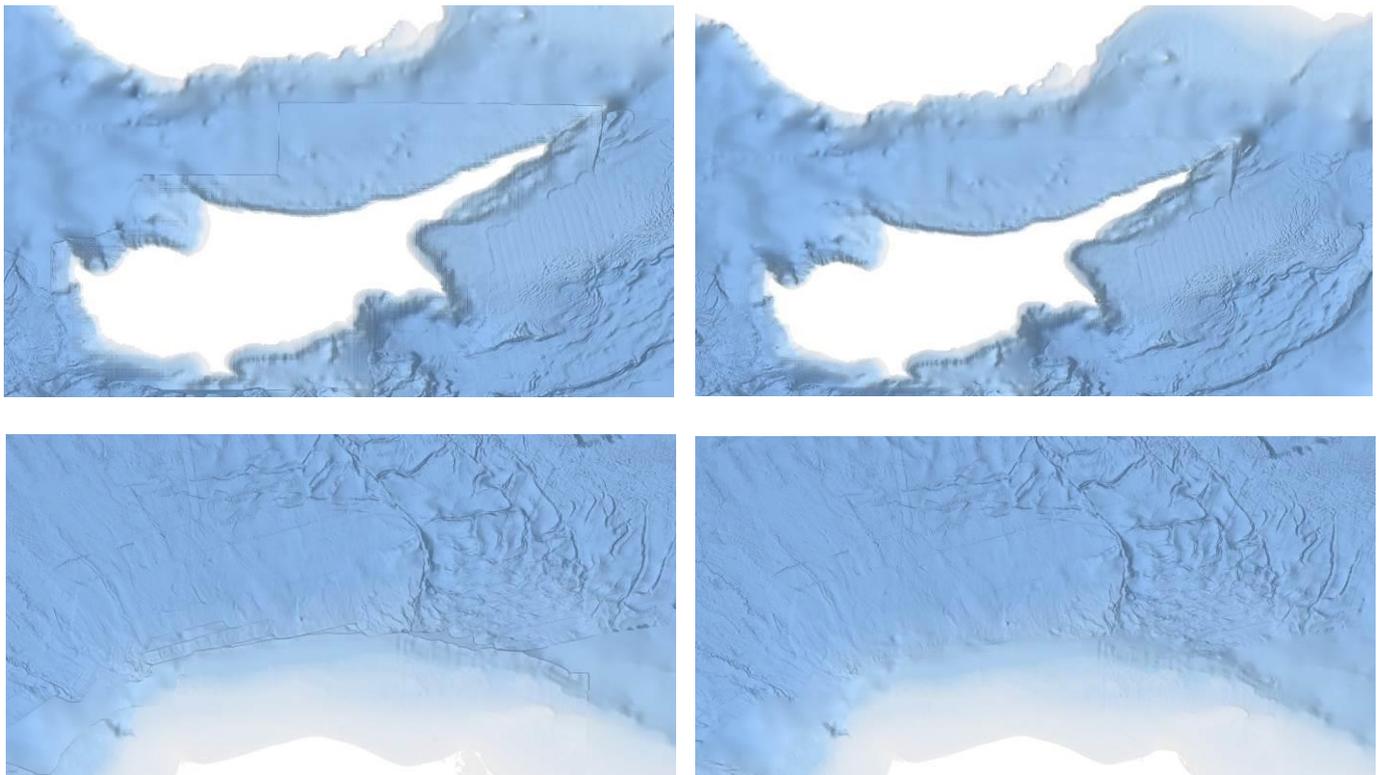


Image 3.24: EMODnet DTM before and after localized smoothing

For each release a list was made of remaining issues that were then to be solved in the next release in a cooperation between the integrator and the regional coordinators. In the last release almost all remaining issues have been solved as can be seen in the following table. The fact that all regional coordinators use the latest GLOBE software has contributed to a very high level of consistency in the regional DTMs.

<u>Region</u>	<u>Issue</u>	<u>Remark</u>
Eastern Mediterranean	Bosporus strait missing	Corrected
	Spike near	Corrected

	Israeli/ Lebanese border	
Western Mediterranean	Spike west of Ibiza	Corrected
Madeira Canarias	Artefacts east of Gran Canary	Not completely solved but improved where data source allowed
Black Sea	Bosporus strait missing	Corrected
Bay of Biscay	Drying heights in Atlantic Ocean North of Spain	Corrected but noted that the data source is of very low quality
	Incorrect min,max and stdev fields	Corrected

*Table 3.6: Remaining issues in the October 2016 DTM release*

**Resulting EMODnet DTM October 2016 version:**

The following image gives the latest EMODnet DTM as released early October 2016. It has been included in the Bathymetry Viewing and Downloading service. This will be described in the next paragraph concerning WP4.

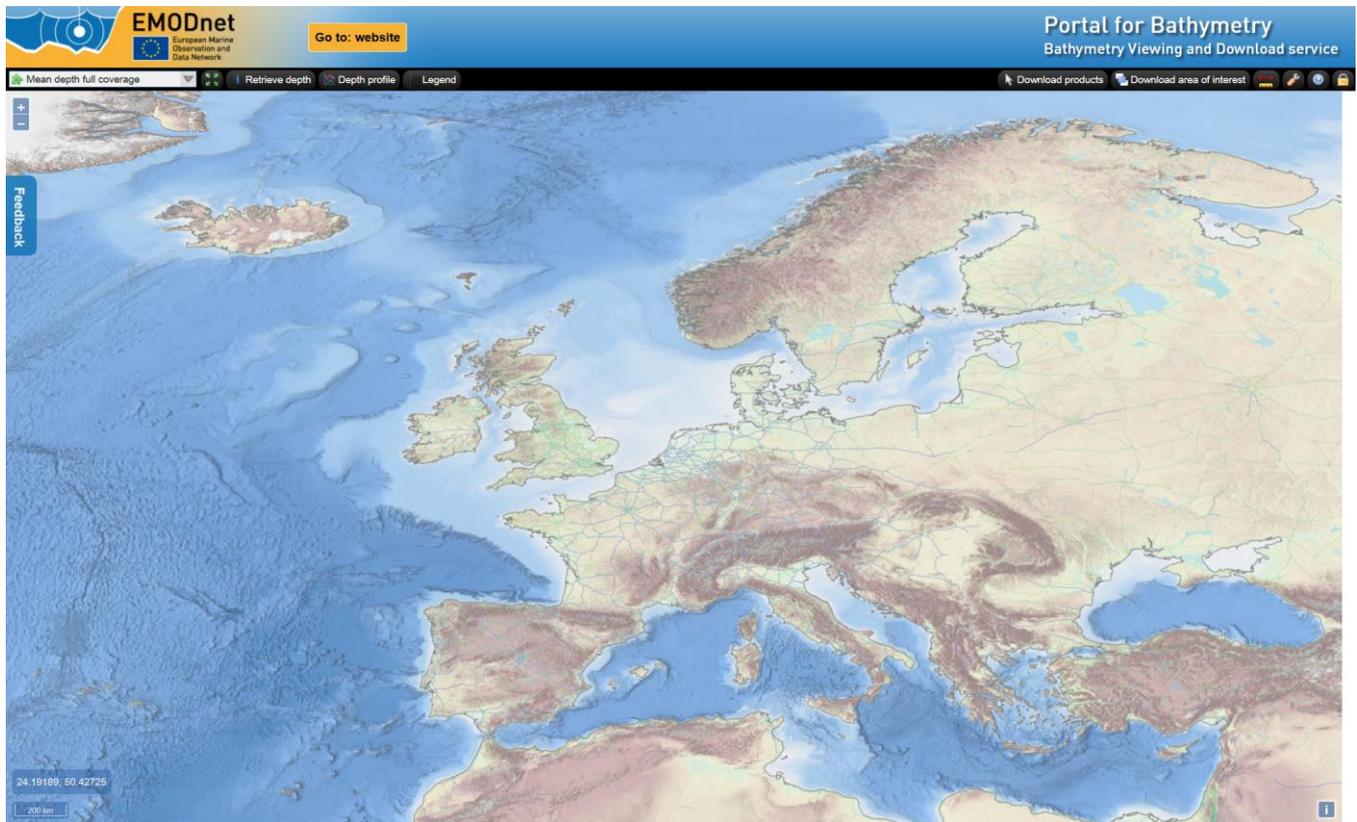


Image 3.25: latest EMODnet DTM – October 2016 release

### **3.5 WP4: Technical Development & Operation of portal**

The EMODnet Bathymetry portal is operational at <http://www.EMODnet-bathymetry.eu> and is managed and operated by MARIS in cooperation with GGSgc and IFREMER. It provides a website and 3 interrelated services for users for browsing, viewing and downloading the EMODnet DTM and for identifying and requesting access to the gathered bathymetric survey data sets and Composite DTM data sets for the European waters. The portal and services have been kept operational and up-to-date, while also a number of upgrades have taken place during the project.

Early in the project, the CDI search facility has been extended by including sea areas and the online Content Management System for the Sextant catalogue service has been upgraded to ease use by data providers.

October – November 2014 a major upgrade took place for the EMODnet Bathymetry website. A reshuffling of the website and its navigation was executed, following user feedback from the EMODnet Secretariate. The 1-2-3 principle has been applied as much as possible, giving users access to the services in a minimum of clicks. The naming of services and items has been standardised throughout the website and services. The top banner of services has been harmonised. All texts in the website have been shortened and revised, and references to EMODnet background have been minimised with a direct link

to the central EMODnet portal. Also a 3D animation of the DTM for the Tyrrhenian Sea has been posted at the homepage as a clear demonstration of the new DTM product and as invitation to visitors of the portal. This upgrading has been finalised in October – November 2014.

Around the release of the first new EMODnet DTM (February 2015) major upgrading was finalised for the Bathymetry Viewing and Downloading service by which the EMODnet DTM can be viewed and interrogated. GGSgc has migrated the database from Oracle to PostgreSQL 9.3 RDBMS and for the GIS use is made of the latest version of GeoServer in combination with OpenLayers 3 for developing the user interface. The earlier floating menu with functions has been taken away and all functions are now included as buttons in the top bar. The buttons are dependent on the layer which is activated. As standard in GIS systems only one layer can be active at the time, while of course multiple layers can be displayed and viewed as overlays at the same time.

The new EMODnet DTM has been included together with several other layers. Compared to the previous version as available in 2014, the following layers have been added (next to the new EMODnet DTM layers):

- a seamless land-sea integration of OpenStreetMap WMS and inclusion of land topography WMS with comparable resolution as the new DTM ( $1/8 * 1/8$  arc minutes). The OpenStreetMap coastline has been introduced for masking the product and to achieve an artificial smooth transition from the water area to the land area, albeit only for viewing purposes (one can only download the bathymetry DTM). The viewing service contains a layer with full European DEM coverage of both the land and the water (the land DEM source is <http://www.viewfinderpanoramas.org> (2014) which is a corrected version of the EU-DEM, based on SRTM and ASTER GDEM). Both items give the user a much better experience when viewing the new DTM because the land – sea transition is now smooth, while previously it was more abrupt and with visible grid edges;
- wrecks layer has been upgraded by a WMS service provided by partner OceanWise and using the UKHO Wrecks database as source. The new layer replaces the previous wrecks layer that was derived from ENCs and only covered the wider North Sea. The new Wrecks layer covers all European seas and the level of detail is dependent on the viewing scale;
- undersea features layer has been added by a WMS service provided by GEBCO. The GEBCO Sub-Committee on Undersea Features (SCUFN) maintains and provides a gazetteer of the names, generic feature type and geographic position of features on the seafloor;
- the earlier GEBCO 2008 WMS has been replaced as baselayer by the latest public GEBCO 2014 WMS.

Following a complaint by the Embassy of Ukraine and consecutive request of EU DG MARE 2 layers have been de-activated since. This concerns: 1) boundaries of EEZs and 2) geographic place names, both of which were derived from the community driven OpenStreetMap service. The latter has wider implications because geographic names are very useful for many purposes. EU is looking into a solution by means of a dedicated geographic names service.

All the HELP texts and tooltips have been edited to be fully in line with the new service, layers and functions.

A Download DTM button has been added in the top menu in case a waterdepth layer is activated. The button gives access to a Download page (dialogue) with a map with the 16 tiles, the types of files and the option to download indicated tiles and files.



Image 3.26: Download products button gives 16 DTM tiles and each can be downloaded in various formats

The layer 'Source Reference' has been altered somewhat. When this layer is activated, it gives a button: 'Configure displayed coverage' in the top bar with 4 options:

- Default option 'All Coverage' is on and displays in the map all types of coverage.
- 2<sup>nd</sup> option 'CDI coverage' displays in the map all coverage by CDI's
- 3<sup>rd</sup> option 'Composite DTM coverage' displays in the map all coverage by CDTM's
- 4<sup>th</sup> option 'GEBCO coverage' displays in the map all coverage by GEBCO
- In any of these options there is the extra button available 'Retrieve metadata' to retrieve the associated CDI or Sextant or GEBCO detail page by clicking on the map
- The 'Configure displayed coverage' also provides a list of all data providers ((name of data provider is derived from SeaDataNet EDMO directory) as included with CDI's, CDTM's or GEBCO. Activating a radio button gives the map with their source references. Clicking on the magnifying glass behind a name centres and adapts the map view to display their coverage on screen

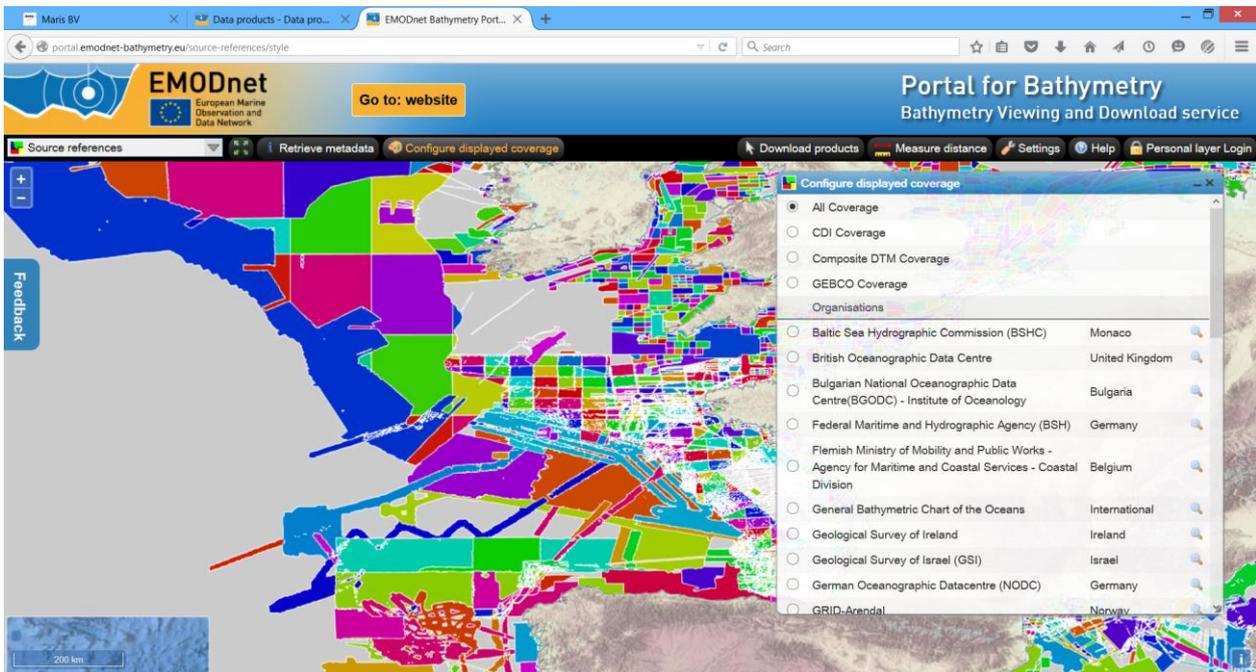


Image 3.27: Source references layer with new 'Configure displayed coverage' menu

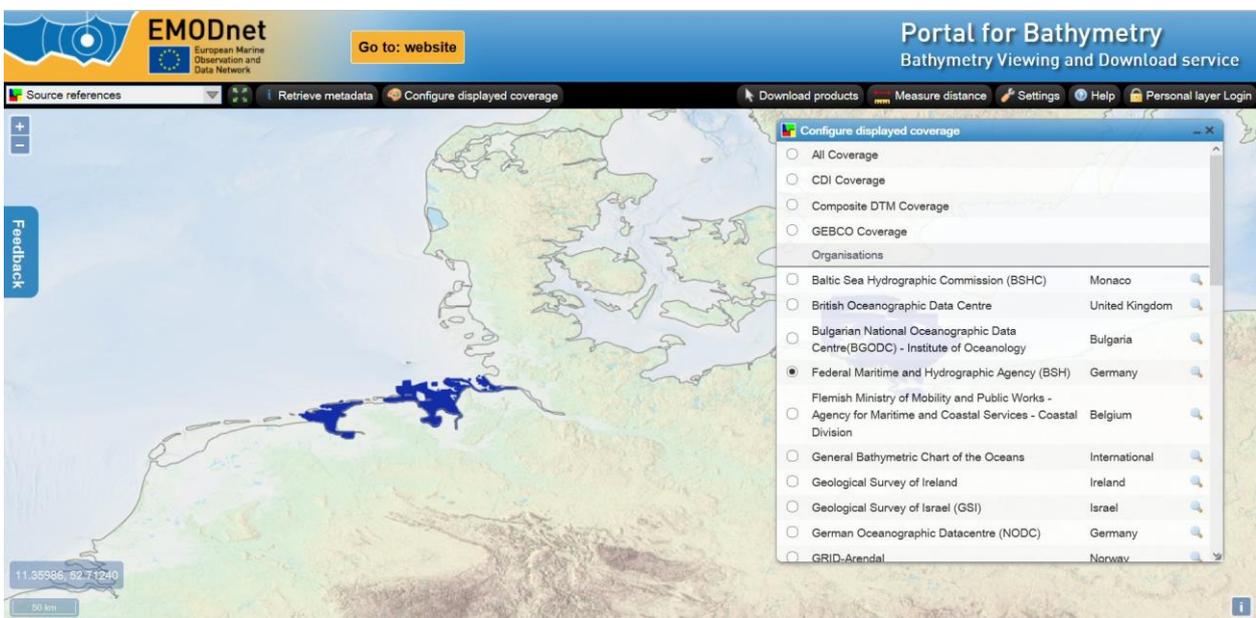


Image 3.28: Source references layer focusing on coverage by selected organisation

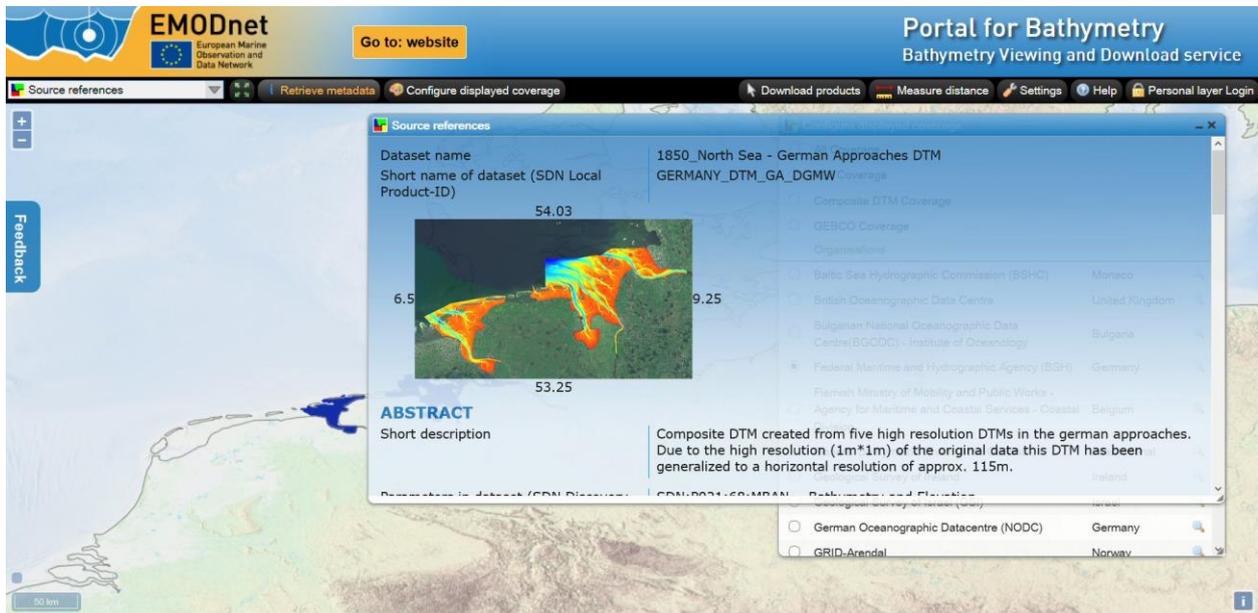


Image 3.29: Source references layer focusing on coverage by selected organisation with retrieve metadata for selected polygon

The layer for Sea names makes now use of standard names for main sea areas and regional sea areas as maintained in the SeaDataNet Common Vocabulary C19, based upon IHB 1953.

Together with the second release of the EMODnet DTM in September 2015 also high resolution DTMs have been added by an extra layer, supported by extra database for facilitating info retrieval, transects, downloading. There is a seamless zoom-in going from coarse layer to fine layer.



Image 3.30: Demarcated polygons around coastal areas with high resolution bathymetry when activating layer 'coastal areas with high resolution'

The depth profile tool has been improved. It allows a user to retrieve a depth profile for a user defined transect. Both the depth and the distance are now given. The user can display the numeric depth on the line and the position of the pointer is also displayed in the transect. And the user can download the transect image as PNG, JPEG, PDF or SVG vector image.



Image 3.31: Depth profile function in active waterdepths layer

In the third year GGSgc has finalised the setting up and integration of the OGC WCS service for the EMODnet DTM in the Bathymetry Viewing and Download service. Users can draw their own lat-lon box (not too large) and download its content, e.g. as a geotiff file.

**Resulting portal and services:**

The present EMODnet Bathymetry portal and its services provide a far better user experience compared to the earlier portal at the start of the project. Navigation is easier and more intuitive. The up-sampling of the data for use in the viewing service now allows the user to zoom in much further without seeing individual pixels. Also the download service has improved. Downloading of all products is now possible using a regular grid of downloadable data cells. A total of 16 cells is defined and for each cells data can be downloaded in a range of (industry) formats. Extra functionality has been added and existing functionality has been refined, where possible. Moreover, machine-to-machine services have been expanded next to the human interfaces. From the statistics (see Chapter 10: evolution of indicators) it can be seen that the portal and its products & services are well appreciated by an already substantial and increasing number of users.

In the following section some more illustrations and explanations are given of the present portal and services, complementing what is already described in the text above. The EMODnet Bathymetry portal can be found at <http://www.EMODnet-bathymetry.eu>.



Image 3.32: Homepage of EMODnet Bathymetry portal

It is hosted and maintained by MARIS using a CMS. The portal provides access to the services and functionalities for users for browsing and viewing the bathymetric data products and for identifying and requesting access to the underlying bathymetric data sets for the European waters. In addition it gives background and documentation on the services, standards and methodologies used.

The primary services are:

- **CDI Data Discovery and Access Service** giving functionalities for searching and retrieving bathymetric data sets (operated by MARIS);
- **Sextant Catalogue Service** giving functionalities for retrieving metadata of composite DTMs as used in the EMODnet DTM (operated by IFREMER) ;
- **Bathymetry Viewing and Download Service** giving functionalities for viewing and browsing individual and combined layers of the EMODnet DTM together with external map layers and for downloading tiles (16) of the EMODnet DTM in a range of formats (operated by GGSGC).

The **CDI Data Discovery and Access Service** is a dedicated version of the SeaDataNet Common Data Index (CDI) service. It is a virtual subset and it provides discovery and access to bathymetric survey data sets that are managed in a distributed way by a network of data providers. The SeaDataNet CDI service connects already > 100 data centres in 34 countries around European seas for all types of marine and oceanographic data sets. Bathymetry entries can be found at 27 data centres. The CDI metadata format is based upon the ISO19115 – 19139 metadata standards, is supported by SeaDataNet controlled vocabularies, and is INSPIRE compliant.

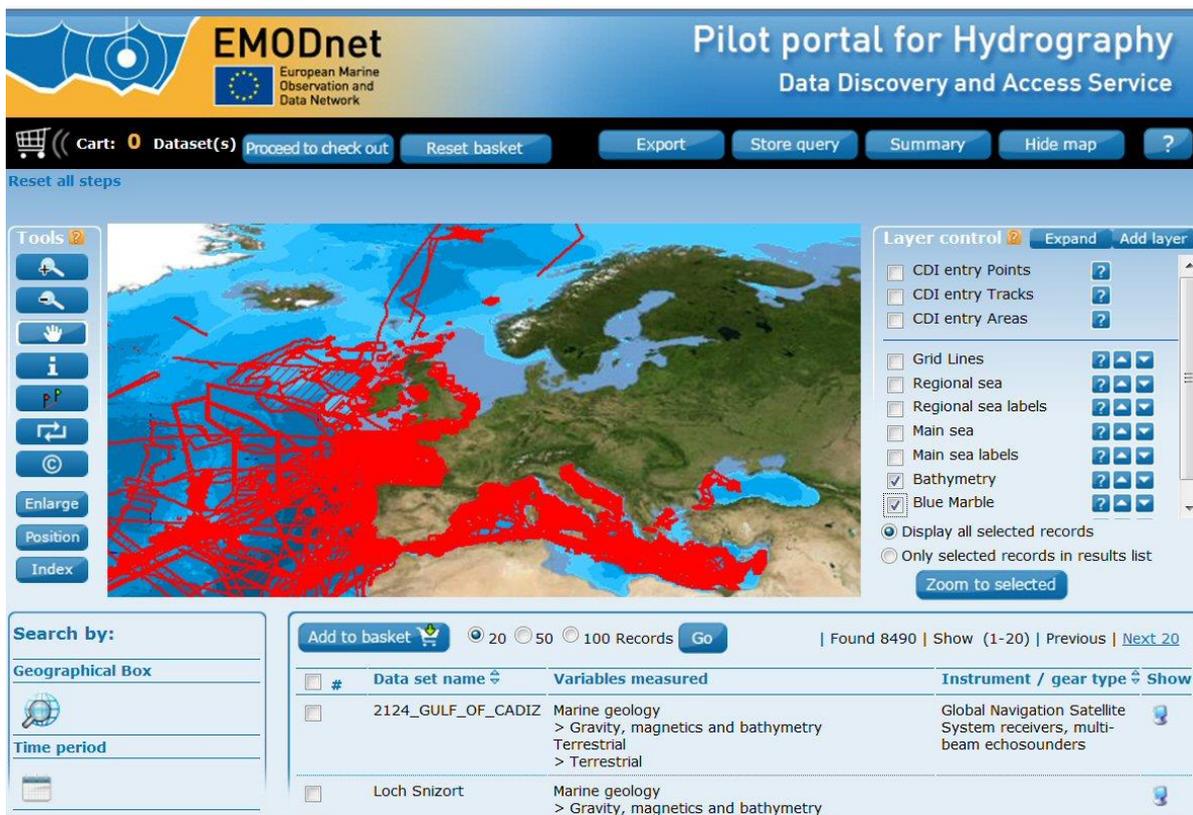


Image 3.33: CDI Quick Search: Overview of all bathymetric surveys on the map and in results lists with various option for drilling down, managing and adding layers, retrieving metadata per survey and shopping basket for requesting access to selected data sets

The CDI User Interface includes a shopping basket and transaction processing mechanism, by which users can request access to selected data sets. Access is given as downloading services, whereby the data sets can be downloaded by users from the data centres in standard data exchange formats. There are also machine-to-machine services, such as OGC WMS and WFS services which facilitate to display CDI entries as a map (WMS) in other portals (such as the Bathymetry Viewing and Download Service) and to retrieve CDI metadata from selected entries by WFS.

The **Sextant Catalogue Service** is a dedicated version of the SeaDataNet Sextant Catalogue service that is used in SeaDataNet and a number of other EMODnet lots to describe and give access to viewing services, where applicable, for **data products**. In the context of EMODnet Bathymetry a virtual subset of the Catalogue is used for indexing composite DTMs that are used as part of the EMODnet DTM. The Sextant metadata format is based upon the ISO19115 – 19139 metadata standards, is supported by SeaDataNet controlled vocabularies, and is INSPIRE compliant.

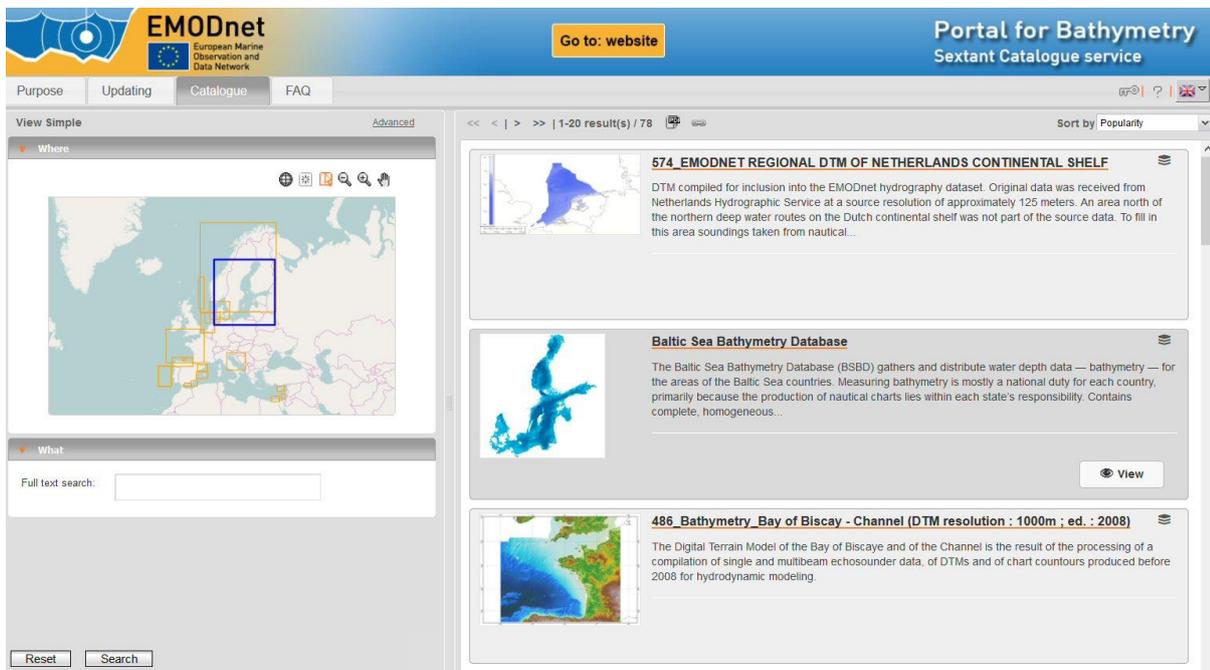


Image 3.34: User Interface of the Sextant Catalogue for Composite DTMs

The **Bathymetry Viewing and Download Service** gives users functions for viewing and interrogating the EMODnet DTM and several other layers. It is based upon a PostgreSQL 9.3 RDBMS and for the GIS use is made of the latest version of GeoServer in combination with OpenLayers 3 for the user interface. Buttons in the top bar are dependent on the layer which is activated and give specific functions. There are several functions for human users such as:

- there are multiple map layers that each can be switched on / off and each interrogated for their information, when activated
- zoom in – zoom out and panning

- retrieving the DTM cell parameters such as Minimum cell depth, Maximum cell depth, Average cell depth, Standard deviation of the cell depth, Number of depths used for interpolation of cell depth, Number of subcells used for the computation of the average cell depth, Source reference by CDI reference, composite DTM reference or GEBCO where no higher resolution data are available from partners; this is important information for assessing the precision, quality and sources of the calculated bathymetry
- retrieving depth profiles along a track
- adding external WMS map layers as an overlay such as the CDI WMS – WFS service
- activating a source layer indicating for each cell its underlying prevailing data source, which can be survey data sets as documented and retrievable via the CDI catalogue service, composite DTMs as documented and retrievable via the Sextant catalogue service or GEBCO in the case where no higher resolution data are available
- downloading DTM tiles in different formats: ESRI ASCII, XYZ, CSV, NetCDF, GeoTiff and SD for Fledermaus 3 D viewer software

The following images give an illustration of the viewing service.

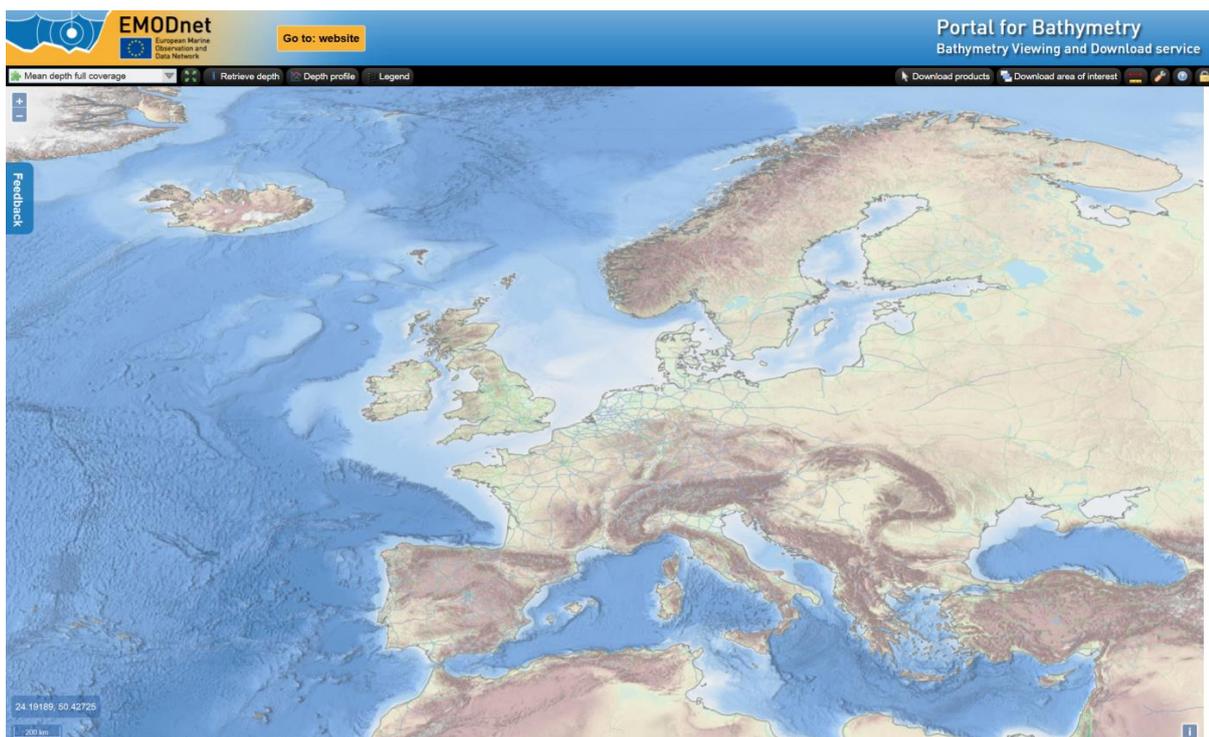


Image 3.35: Screen of the Bathymetry Viewing and Download service

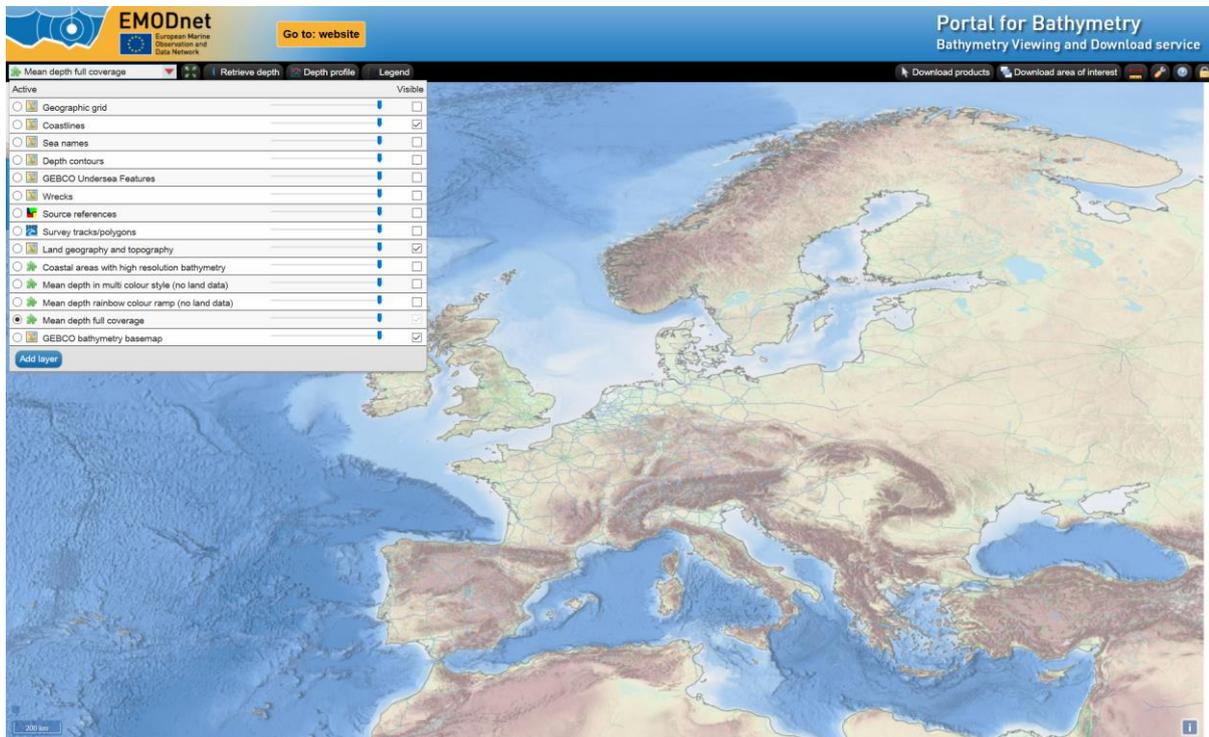


Image 3.36: Layer menu

The present layers are:

Layer	Tooltip text
Geographic grid	Geographic grid lines (graticule of latitudes and Longitudes)
Coastlines	Provided by OpenStreetMap 2014
Sea names	Maintained and provided by SeaDataNet
Depth contours	Generalised bathymetric contour lines (50, 100, 200, 500, 1000, 2000, 5000 meter interval).
GEBCO Undersea Features	GEBCO Sub-Committee on Undersea Feature Names (SCUFN) maintains and provides a gazetteer of the names, generic feature type and geographic position of features on the sea floor.
Wrecks	Wrecks from the UKHO database as provided by OceanWise.
Source references	Coverage of individual bathymetric surveys and Composite DTMs that contribute to the EMODnet Bathymetry DTM.
Survey tracks/polygons	Tracks/polygons of all bathymetric surveys which are included in the CDI Data Discovery and Access service.
Land geography and topography	Maintained and provided by OpenStreetMap.
Coastal areas with high resolution bathymetry	Demonstrator for integrating coastal stretches with high resolution
Mean depth in multi colour style (no land data)	Mean depth based on source resolution of 1/8 arc minute (~250 meter). Ocean overlay without land cover in multi colour style.

Mean depth in rainbow colour ramp (no land data)	Mean depth based on source resolution of 1/8 arc minute (~250 meter). Ocean overlay without land cover in rainbow (multi colour) ramp style.
Mean depth full coverage	Mean depth based on source resolution of 1/8 arc minute (~250 meter). Full coverage ocean and land DTM in traditional atlas style colours.
GEBCO bathymetry basemap	Backdrop base map showing the Earth based on satellite imagery (Blue Marble) and GEBCO 2014 bathymetry (General Bathymetric Chart of the Oceans) with source resolution of ½ arc minute (~1000 meter).

Table 3.7: Menu of layers in Bathymetry Viewing and Downloading service

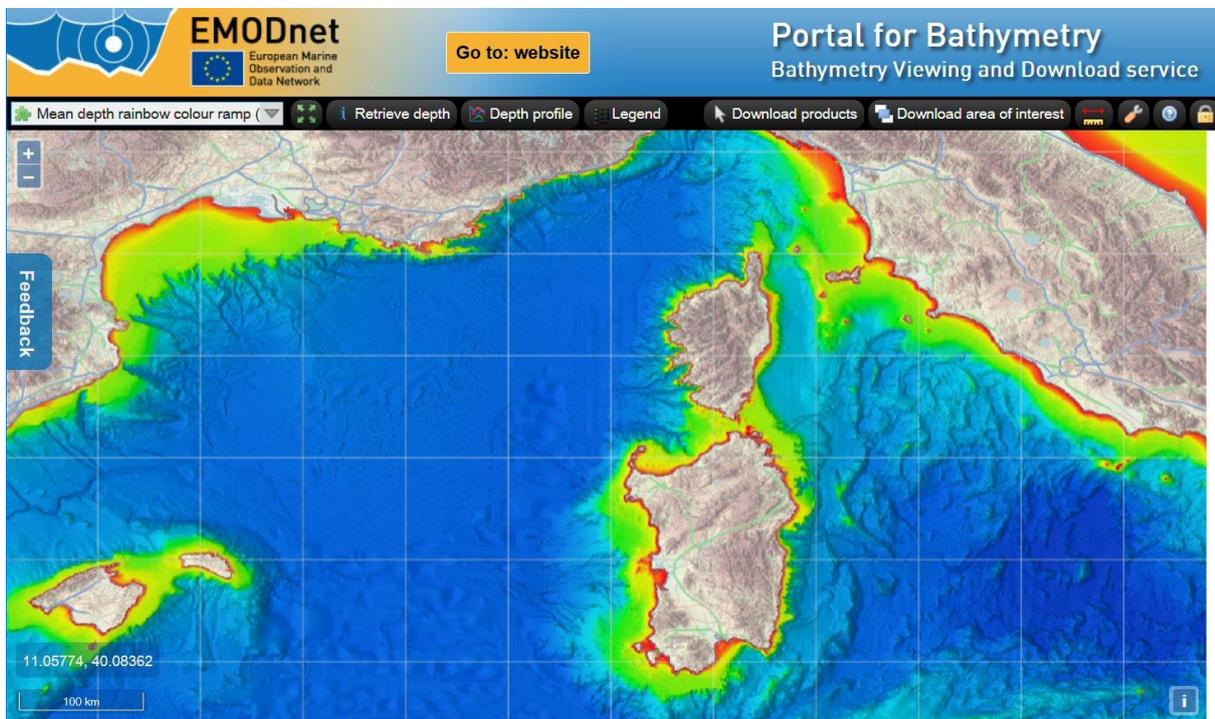


Image 3.37: Detail of bathymetry near Corsica in rainbow colour ramp

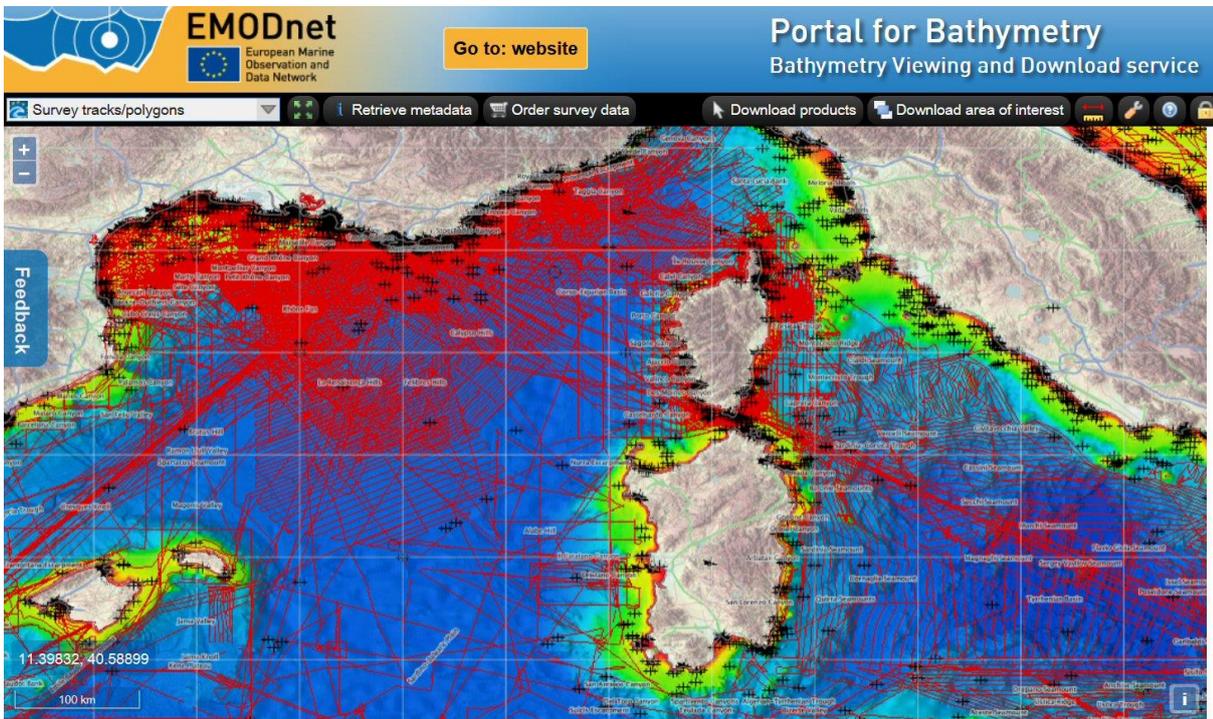


Image 3.38: Detail of bathymetry with layers of CDI references, wrecks and underwater features

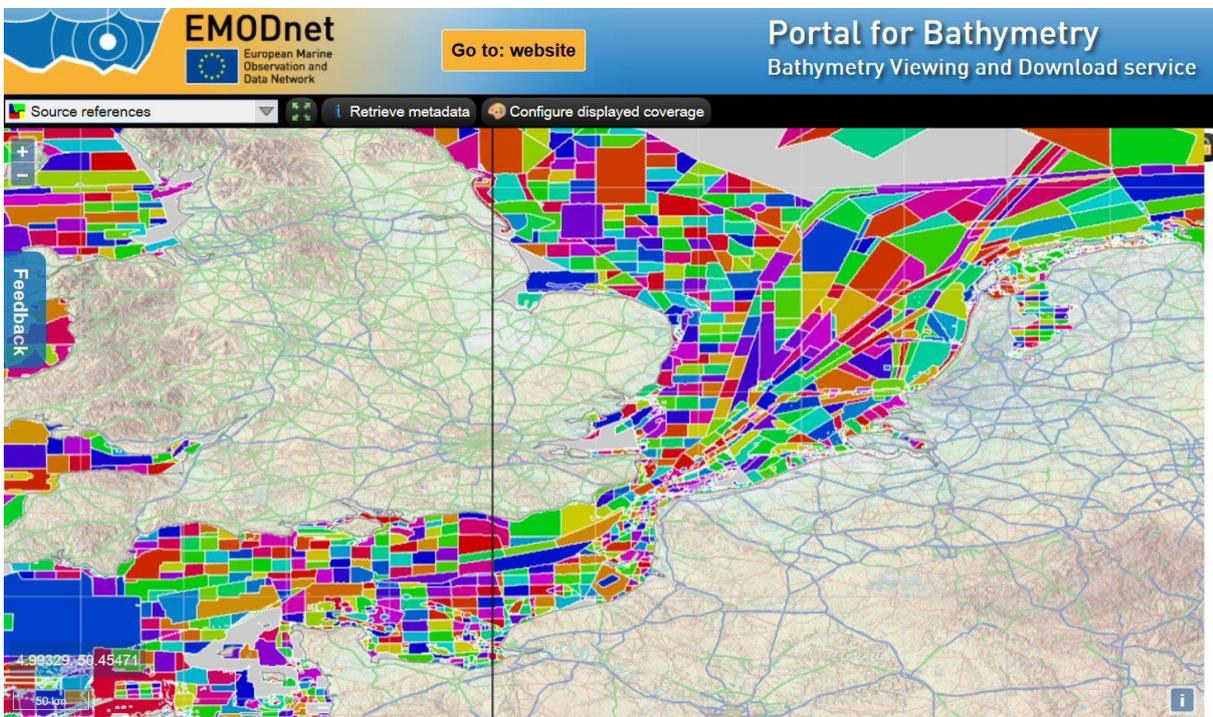


Image 3.39: Source references layer; clicking on a polygon gives metadata from CDI or Sextant services

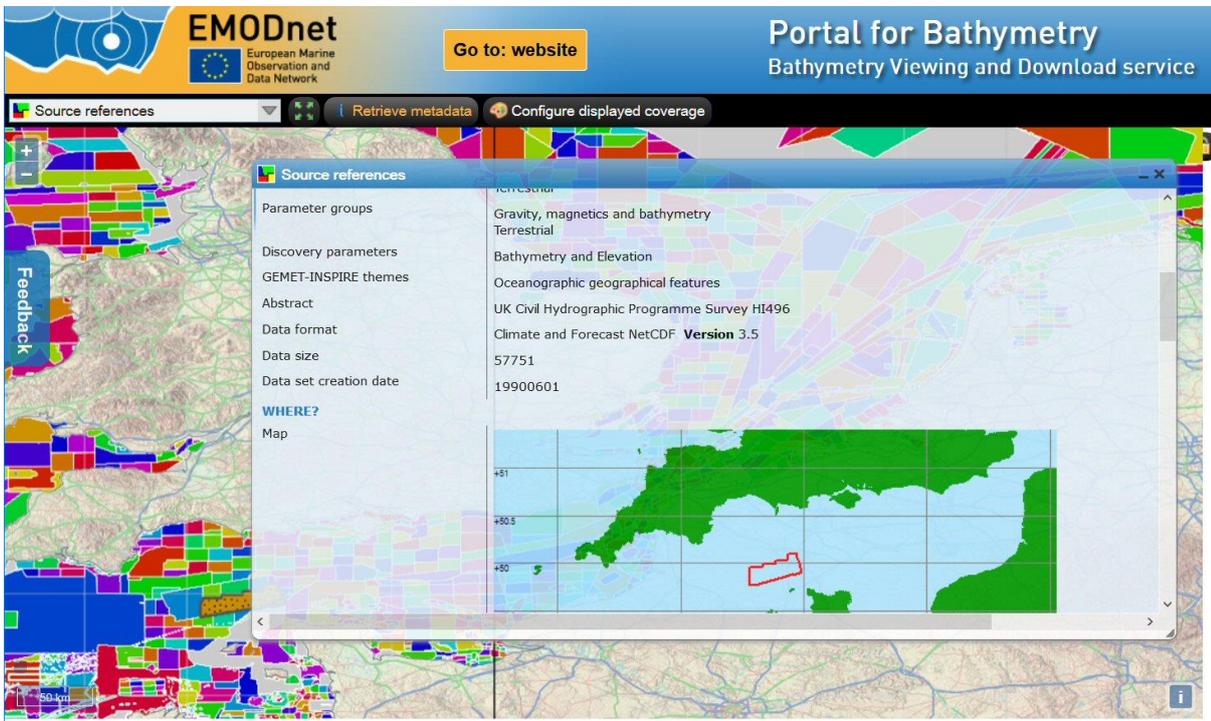


Image 3.40: Source references layer with CDI metadata from a survey

Users can download the EMODnet DTM in 16 tiles in different formats: ESRI ASCII, XYZ, CSV, NetCDF, GeoTiff and SD for Fledermaus 3 D viewer software. The NetCDF files can be imported into the 3D visualisation tool (3D Viewer) that has been developed in the EU FP7 Geo-Seas project. This viewer is based on the existing open source NASA World Wind JSK application. This software is freely available via the portal after registration and allows the visualisation of Digital Terrain Models (DTM) in the existing GLOBE NetCDF format and Web Map Service (WMS) which are displayed upon a virtual globe.

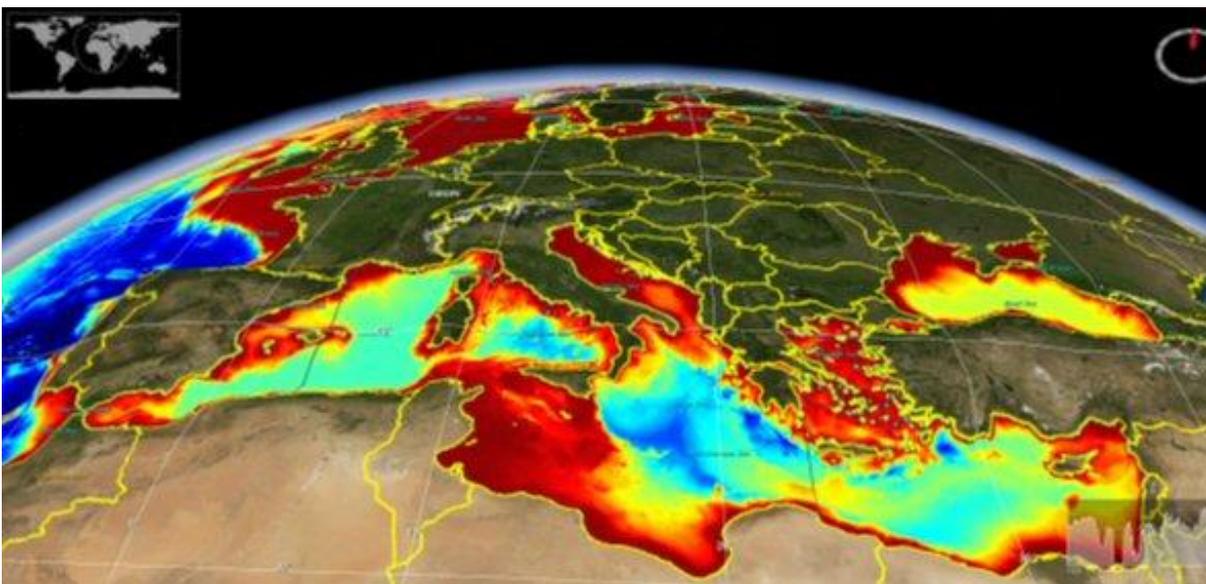


Image 3.41: EMODnet DTM loaded into 3D Viewer

In addition users can download an area of interest by drawing a lat-lon box and selecting a format. This works as part of the OGC WCS service.

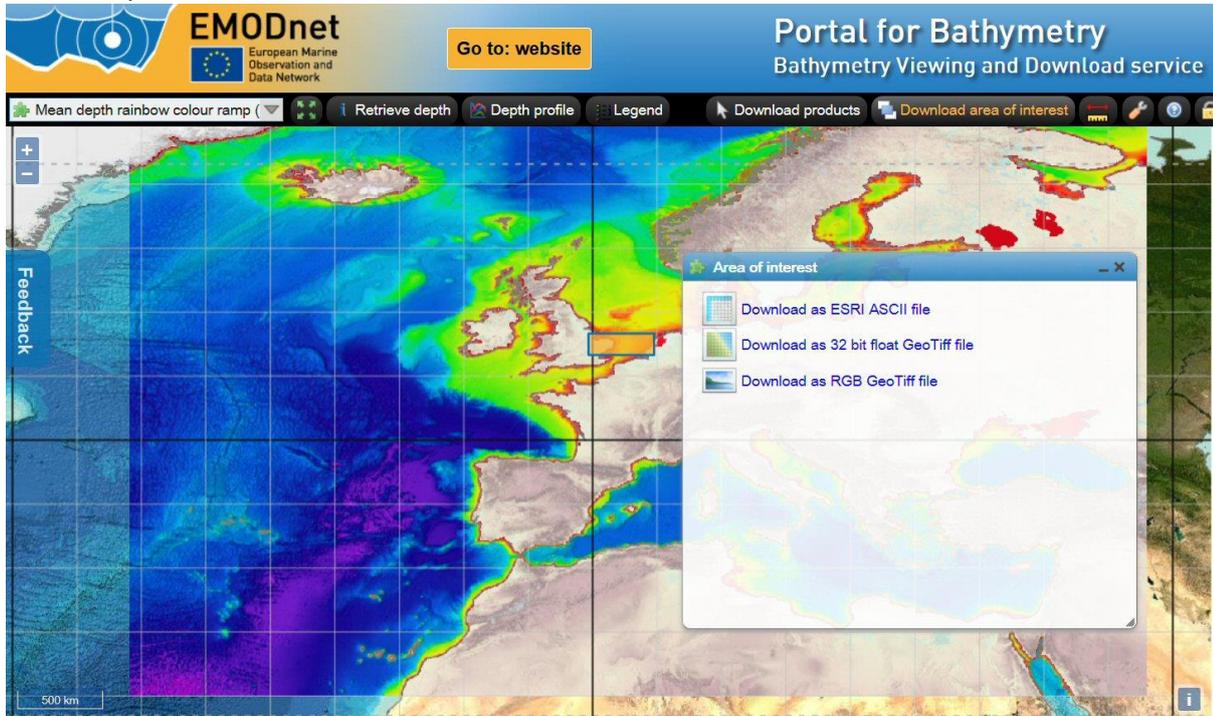


Image 3.42: Draw and download an area of interest in a number of formats, driven by WCS

The GIS layers in the Bathymetry Viewing and Download service can be shared as OGC WMS and WCS services with other EMODnet portals and beyond. Also WMS layers from other EMODnet portals and external services can be added to the Bathymetry Viewer and Download service. The OGC services can be found at the following URLs:

WMS: <http://ows.EMODnet-bathymetry.eu/wms>

WFS: <http://ows.EMODnet-bathymetry.eu/wfs>

WMTS: <http://ows.EMODnet-bathymetry.eu/wmts>

WCS: <http://v7.geosrv.eu/wcs>

The WMS – WFS service for the CDI Data Discovery and Access service can be found at:

[http://geoservice.MARIS2.nl/wms/seadatanet/EMODnet\\_hydrography](http://geoservice.MARIS2.nl/wms/seadatanet/EMODnet_hydrography)

EMODnet Bathymetry has adopted standards for the marine domain that have been developed and are maintained by SeaDataNet. Also several partners in the project are SeaDataNet partners. SeaDataNet has relations with, follows and contributes to international standards committees such as the Open Geospatial Consortium (OGC), International Organisation for Standardisation (ISO) and the World Wide Web Consortium (W3C). And it has an active cooperation and tuning with the INSPIRE community, in particular the INSPIRE team of JRC. The INSPIRE Directive 2007/2/EC aims at establishing an Infrastructure for Spatial Information in the European Community which is supported through

legislation and technical guidelines, such as concerning data models (schemas), metadata and network services.

The EMODnet Bathymetry services are compliant with INSPIRE as follows:

1. applying Discovery – Viewing – Access services for retrieving survey data sets
2. All viewers are based upon OGC WMS standards
3. CDI Metadata profile is based upon ISO 19115 – 19139 standards and marking up is supported by SeaDataNet Common Vocabularies
4. Sextant composite DTM Metadata profile is based upon ISO 19115 – 19139 standards and marking up is supported by SeaDataNet Common Vocabularies
5. Downloadable data sets and data products are available in various formats, including NetCDF (CF) format
6. Bathymetry Viewing service also has WCS for user defined download.

### **3.6 WP5: Analysis & Evaluation**

This activity has focused on analysing and improving the effectiveness of the system in meeting the needs of users. As one measure this has been undertaken by upgrading the set-up and content of the EMODnet Bathymetry portal, applying the 1-2-3 principle for catching the attention of users and leading them in 3 clicks to the actual services and products. In addition great attention has been given to upgrading the Bathymetry Viewing and Download service and adding many new layers and new functions to give users optimal access to the EMODnet DTM and related information for viewing, downloading and sharing by machine-to-machine services. For designing these improvements great use has been made of the findings and suggestions as received from the EMODnet Secretariate that had performed an evaluation of the various EMODnet portals. These upgrading and reshuffling activities are described and illustrated in more detail in paragraph 3.5 on WP4 activities and results.

Another aim of WP5 has been to establish efficient tools to obtain users feedback. This has been successfully implemented by adding a dynamic feedback form on the left site of the portal and also for the associated services. This is illustrated below.

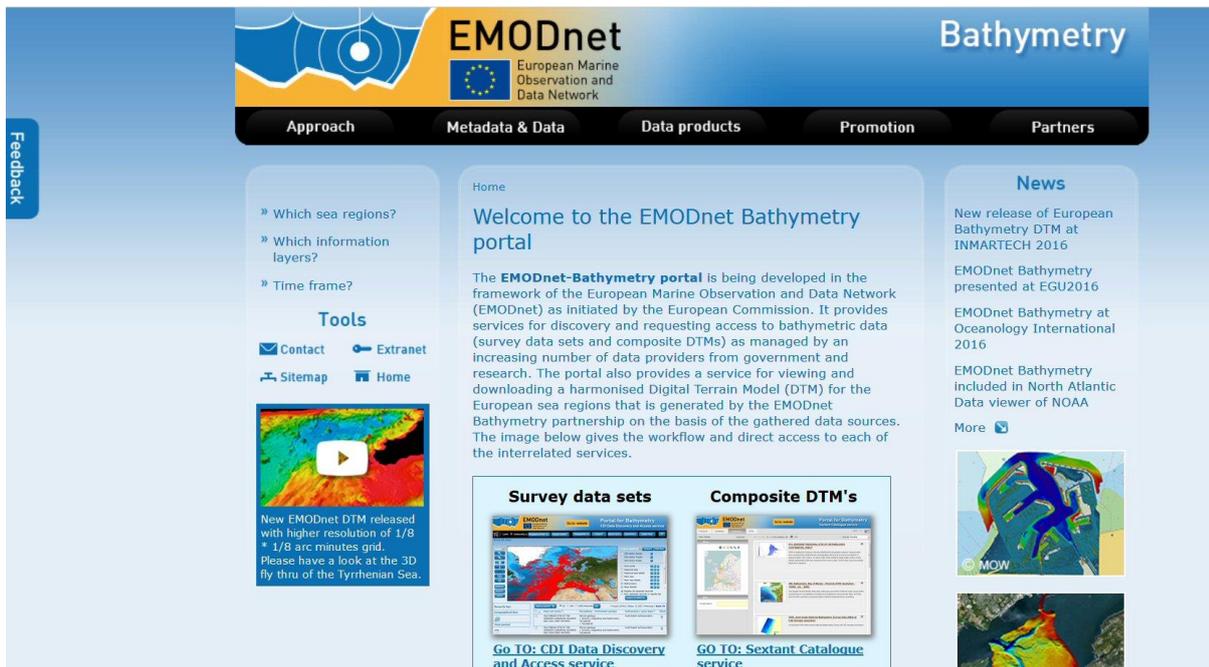


Image 3.43: Feedback button on left side of the screen

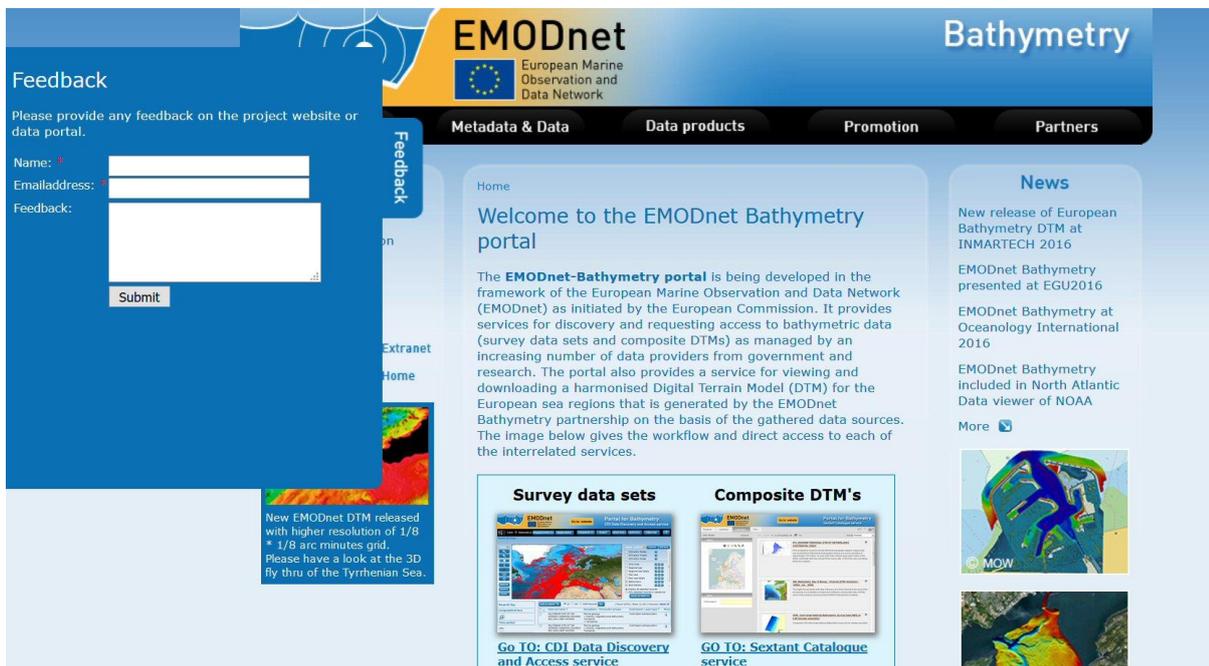


Image 3.44: Feedback opened on left side of the screen

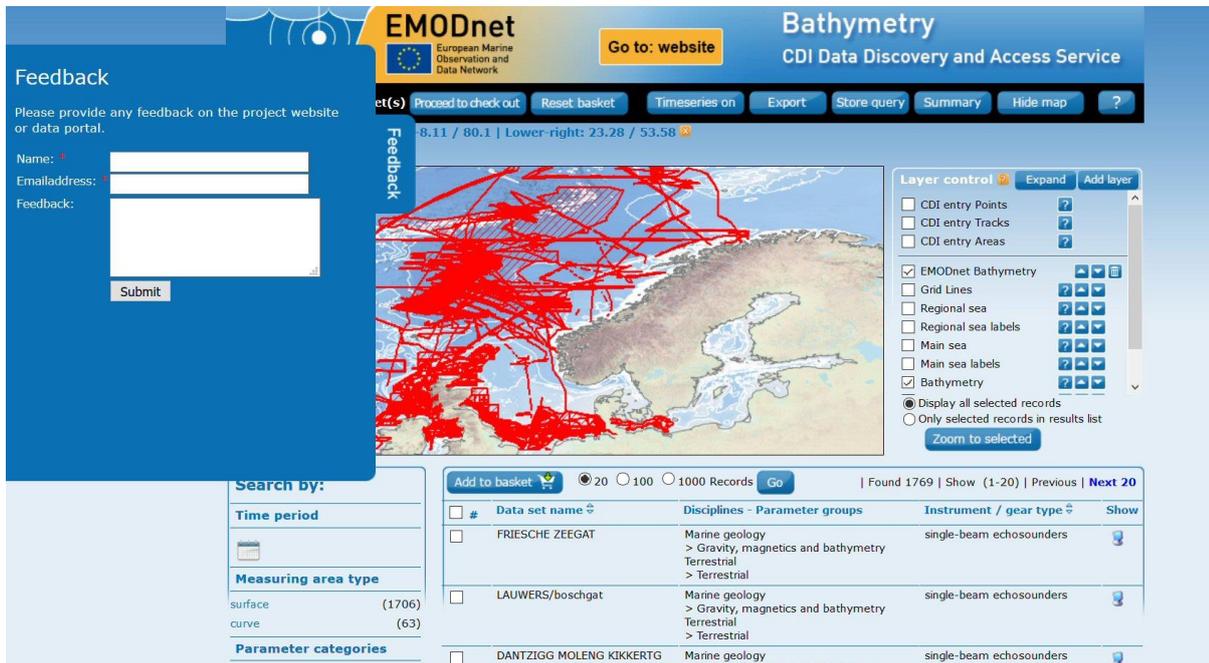


Image 3.45: Feedback opened on left side of the screen for one of the associated services

In practice, this feedback button has been very effective as more than **75** feedback messages have been received over the project period. A number of messages included just positive appraisal of the provided services and encouragement to keep on the good work. Other messages concerned questions about functionality, use of products in publications and suggestions. All messages have been answered within a reasonable time. Most could be answered by the coordinator, but sometimes advice was needed from expert partners. Overall all messages are positive and constructive as can be seen in Chapter 7 and Annex 2 where all feedback messages and answers are listed.

Another way of collecting user feedback has been by maintaining user statistics for the use of the EMODnet Bathymetry portal, including CDI service, the Bathymetry Viewing and Download service, and the web services, using AW Stats. The portal and services have been visited by a large and in time increasing number of users which is further detailed in Chapters 5 and 10.

As part of the dialogue with users and potential extra data providers also many promotion activities have been undertaken, which are described in more detail in Chapter 9.

During the last EMODnet Bathymetry Project Group meeting a brainstorming session was dedicated to analysing the questions as formulated in the tender requirements, concerning lessons learned. The outcome of this analysis is described in the chapters 5 and 6.

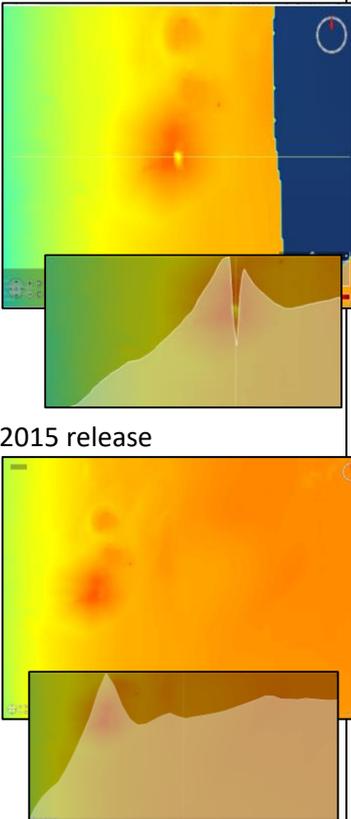
## 4. Challenges encountered during the project

The following challenges have been encountered during the project. These have been discussed between partners and in most cases have been solved as can be seen in the table below.

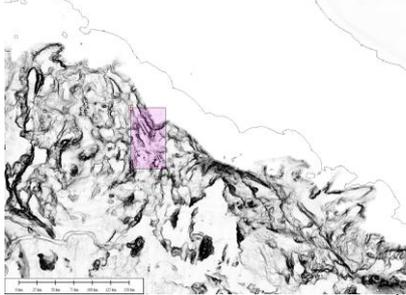
Partner	Challenges encountered	Short description	Measures to address challenges
MARIS, IFREMER	Making sure that all partners adopt the EMODnet Bathymetry approach and methodology	The challenge for EMODnet Bathymetry is to generate and publish a unified and harmonised DTM product supported by metadata	Organise projectgroup meetings and training workshops; production and distribution of extensive minutes and instructions; regular progress checks
MARIS	Populating new surveys and new providers into the CDI metadata service	The CDI service is used to connect data providers and to index their survey data in a standard way using SeaDataNet standards and tools	Providing instructions by presentations and supporting manuals; direct and regular interaction between MARIS CDI support desk and data providers for uptake and guidance
IFREMER	Populating new Composite DTMS and new providers into the Sextant metadata service	The Sextant service is used to index Composite DTMs in a standard way using SeaDataNet standards	Providing instructions by presentations and supporting manuals; direct and regular interaction between IFREMER Sextant support desk and data providers for uptake and guidance
IFREMER	Making sure that all partners can work with the GLOBE software	GLOBE software has been developed to allow the DTM production in accordance with the adopted EMODnet methodology	Training sessions have been organized in January 2014 for instructions and in January 2015 for discussing and formulating requirements for required improvements of GLOBE Software.

			Permanent technical support by IFREMER teams (emails, patches, new releases, documentation).
IFREMER	Agreement to use datasets under the responsibility of non EU countries.	Some datasets, managed at IFREMER, for the Black Sea and Mediterranean Sea have been acquired by non EU countries. Their use requires consent by their owners.	Identifying the right contacts and requesting consent for use as part of the EMODnet DTM product, explaining background. This has not always been successful.
IFREMER	Quality of some datasets	Some datasets are of low quality, comprising uncleaned soundings	Additional cleaning to remove the artifacts (spikes and edge effects), but time consuming; not including the data in the final DTM (for example when another dataset can be used in the same area).
SHOM	Re-generating of all CDI XML files (6964) for updating all existing CDI entries, thereby safeguarding existing references. Re-generating of the CDI coupling table to connect CDIs to the local data files	Following a change of the database system at SHOM for bathymetric surveys all CDI XML files, coupling table and data files had to be re-generated	Adapting and running the local mapping for the SeaDataNet Mikado tool between the new database and the CDI standard. Creating a Python script to create the ODV data files from XML files and XYZ files
SHOM	Regional DTM production	SHOM has been appointed to new regional coordinator for Bay of Biscay / Channel and was faced with data and GLOBE software issues: 1) Some data providers provided their data in a format different than the one used by GLOBE; 2) Issues with timing and completeness of provider data sets; 3) Lack of data for the Channel Islands	GLOBE issues were corrected by IFREMER. Import feature and procedure had to be designed and implemented. Reminders were sent and explanations were given of the new role of SHOM as basin coordinator. GEBCO used to fill gaps.

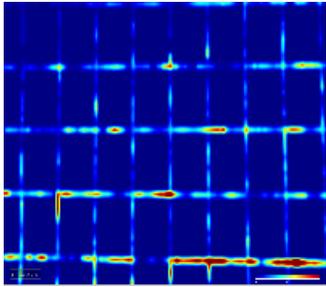
SHOM	GLOBE software issues	Import of large amount of data files (soundings) and inclusion of corresponding CDI references. Initial lack of knowledge with handling basin compilation	Created a python script for support. And experience gained during the compilation
SHOM	GLOBE Software issues	Computation using GLOBE is heavily intensive in memory and hard drive space.	Use of GLOBE 1.5.x which is more robust than previous versions. Experience gained during 1st compilation suggested deleting frequently temporary directories. Allocate more memory.
SHOM	Regional DTM production	Data issues in some areas especially where there are still lack of data (Channel island, bay of Biscay ...) or data quality issues.	GEBCO_2014 update was improved by including 2013 EMODnet results. However some data gaps that are filled with GEBCO still give an unsatisfactory result. The new “interpolation/Fill gap” function of GLOBE 1.5.x strongly helped generating interpolated data.
SHOM	Variable data quality	Some dataset are of low quality or Composite DTM of low resolution	Alleviating local inconsistencies (spikes). Suggest rules and developing a tool to locally edit the DTM.
NERC-NOC	GLOBE software issues	Issues with data handling, data importing, data gridding, data formats, compatibility with EMODnet Hydrography data structures as well as general software/PC compatibility. Due to high resolution required for EMODnet Bathymetry and the extents of regional areas, there was an inability of GLOBE to process all in one batch.	Worked with GLOBE developers to address issues.

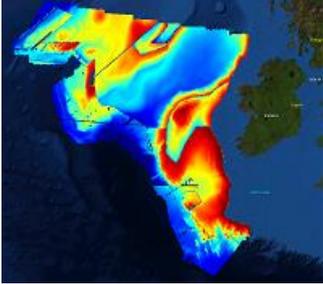
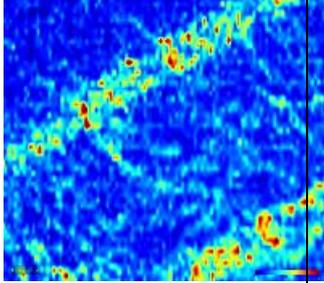
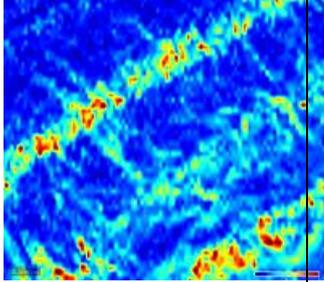
NERC-NOC	Data provision	Each data provider provides data in a format they are familiar with, which can result in timely re-configuring to import into GLOBE. Some data providers provide significantly large data sets that conform to the EMODnet standard, but could not be imported into GLOBE	Worked with data partners to address quality issues. Work with GLOBE developers to find work around
NERC-NOC	Timeline	Some data providers did not respect the timeline for providing data	Worked with data partners to address these issues
NERC-NOC	<p>Interpolation and smoothing of some large "holes" in the DTM of the Celtic Sea to improve the quality of the 2015 release.</p>  <p>2015 release</p> <p>2016 release</p>	<p>A number of large and evident "holes" were present in the 2015 DTM of the Celtic Sea. These errors were probably related to unrealistic bathymetric values, with by far larger depth values compared to the surrounding points.</p>	<p>The larger and most evident "holes" were detected and isolated. To remove the wrong depths, different masks created with the Globe application were created around every single hole, in order to empty the surrounding bathymetry, making sure that only correct depth values were present in the processed DTM. A following interpolation with several iterations and smoothing procedures were eventually applied to refill the voids. The new and final DTM has removed a considerable number of holes (the most striking example is showed in the left figures).</p>
NERC-BODC-GEBCO	Data quality	As part of the merge of the GEBCO and EMODnet grids, checks were carried out on the	Any issues found were reported back to the Regional Co-ordinators

		EMODnet grid to identify and spikes and holes	
CNR-ISMAR	Software Issues	Various issues with GLOBE software including importing source data, merging DTMs and adding or modifying CDI references, missing standard deviation, -32767 values after merging the Composite DTM and the multibeam surveys for the Adriatic Sea area	Worked with software developers (IFREMER) to have issues addressed where possible on short term. Re-processing of the DTMs with the new releases of GLOBE software
CNR-ISMAR	Central Mediterranean Sea region too large for processing as single area in GLOBE	GLOBE software was not able to process the full extent of data in the Central Mediterranean Sea Region in one go	The Central Mediterranean Sea was split into four regions (Adriatic Sea, Ionian Sea, Sicily Channel, Tyrrhenian Sea) for processing. Other software was used to sub-divide the input data so that GLOBE could be used to process the data into the four sub-regional DTMs
CNR-ISMAR	Data Quality	Variable quality of data provided by regional data providers, but in general very good quality data	Bad quality data was not included into the final compilation, because there were enough data from other providers to replace the low quality (noise, sparse soundings) surveys
CNR-ISMAR	Raw data errors, spikes, reported by Pauline Weatherall, GEBCO DTM manager, in ISMAR's DTM's.	Few errors, mainly due to spikes and sparse data at the edges of ISMAR DTM's were reported after a careful check made by the GEBCO DTM manager after ingestion of the EMODnet 2014 DTM into the new GEBCO 2014 release. <i>a) Tyrrhenian Sea</i>	The approach used changed according to the problem encountered. In a) DTM's were imported into CARIS HIPS & SIPS and cleaned with filtering procedures, then reingested into GLOBE. In b) DTM's were cropped at the edges,

		 <p><i>b) Adriatic Sea</i></p>  <p><i>(generated from EMODnet 250 m DTM, created in Global Mapper)</i></p>	<p>where spikes and isolated points were present, in ArcGIS software and then reingested into GLOBE.</p>
<p>CNR-ISMAR</p>	<p>Raw data errors, spikes, reported by Pauline Weatherall, GEBCO DTM manager, in OGS's DTM's.</p>	<p>Several major spikes and errors were reported by the GEBCO DTM manager after ingestion of the EMODnet 2014 DTM into the new GEBCO 2014 release.</p> <p><i>Ionian Sea</i></p>  <p><i>(generated from EMODnet 250 m DTM, created in Global Mapper)</i></p>	<p>OGS was asked to reprocess raw data from scratch, using PDS2000 software, to eliminate the errors due to several spikes as high as 3000 m. Unfortunately data have been acquired in very rough sea conditions and with insufficient overlap, so that problems could not be fully mitigated as desired.</p>
<p>OGS</p>	<p>Coherence of references</p>	<p>Within EMODnet DTMs the references to CDIs are defined</p>	<p>Solved by communication and</p>

		as a concatenation of EDMO_code of data provider and Local_CDI_ID as given by data provider. This was initially misunderstood by the Regional Coordinator for the Central Med	intervention of project coordinator
OGS	Handling of navigation tracks for CDIs	The SeaDataNet CDI import and validation system has been upgraded overtime and this gave issues with provided GML for navigation tracks of surveys	GML revised by developing and applying new decimation software at OGS. SeaDataNet Ends and Bends tool was not able to handle the issue in this OGS case
OGS	Re-processed data with GLOBE 1.4.0	After discovery of bugs in previous version of GLOBE data needed to be reprocessed	All data was reprocessed using GLOBE 1.4.0 and provided again to regional coordinators
IEO	Use of GLOBE software	Some problems with GLOBE software related to data importing, data gridding and software/PC compatibility. These problems have been solved with new versions of the GLOBE software.	Communication with GLOBE developers
IEO	Data provision	Each data provider provides data in a different format.	Communication with data provider
IEO	Metadata	Sometimes it appeared quite difficult to obtain from the original data provider all the relevant information to create the CDI and Sextant metadata	Communication with data providers
GSI	GLOBE Software issues	Various issues arose including: 1) Memory issues relating to file sizes which resulted in GLOBE crashing and hence the need to split files; 2) Issues with gaps occurring (1 raster cell) when you split files; 3) Issue with massive cache generated; 4) Merging issues which resulted in CDI reference disappearing; 5) GLOBE unable to deal with large area extent;	Reported back to IFREMER on each version when issues were encountered. Sent data which outlined the problem. These were mostly resolved and a new version issued

		6) No tool available to clip dtms. (Our area needed to be clipped in 2 for 2 different regional coordinators); 7) Export to .emo command not working correctly; 8) A lot of time was spent trying to find a work around to these issues	
GSI	CDI metadata errors	The CDI abstract field (aka description) for a few of our metadata files was too long	We had to remove some text and resend. It would be very helpful to add error messages relating to field length (or indeed the validation of all fields) and prevent users from saving the file unless valid in Mikado software
GSI	Preparing datasets for high resolution coastal project. All GSI surveys acquired since 2011 are levelled to the same vertical datum “Vertical Offshore Reference Frame” (VORF). VORF is a model which is referenced to the ellipsoid and integrates all vertical sea datum's	4 multibeam surveys had been relevelled to VORF in 2013. However, 1 multibeam survey and the 2 Lidar surveys needed to be relevelled in order to align as best as possible before merging the datasets	The method used was to assess vertical errors by running ‘difference and statistical analysis’ on the base layers. The data was then block shifted in relation to the correctly levelled data. The shift was achieved by manipulating vessels files
GSI	Grid Artifacts - Standard Deviation Square like effects  <i>(generated from 100m grid created in Fledermaus)</i>	Grid Artifacts appearing in several datasets including Zone 3 (GSIs largest dataset – all deepwater area) when viewing Standard Deviation. Pre-processed grid issues. Transfer of datasets between different software – Fledermaus to GLOBE.	Zone 3 Data was exported from CARIS in wgs84 xyz format. Interpolation was carried out in Fledermaus and xyz grids were gridded and exported in 25m resolution (compared to the previously used 100m grids). Although, the square like effect is still visible in the dataset it's an

		 <p>Zone 3</p>	<p>improvement on the previous version.</p>  <p>Zone 3b was reprocessed in CARIS. Removal of data related to erroneous soundings, vessel motion, navigation jumps and sound velocity refraction artefacts. Calibration offsets were also assessed and modified and line-to line mismatches were aligned when required. This was then gridded to 30m and exported to XYZ. Although, the square like effect is still visible the dataset it's an improvement on the previous version.</p> 
GSI	Artifacts identified at the edges of the Donegal GSI dataset	An edge issue caused by pre-processing. Dataset not connecting with OceanWise grid.	All of the Donegal surveys (14) were re-gridded. Previously an 80m grid generated in Fledermaus was used. Survey Line data was

			exported from CARIS in WGS84 xyz format. DTM's were created in GLOBE on a line by line basis (30m). These were then merged into individual surveys. The resulting DTM's in GLOBE are a major improvement.
GSI	Coastal DTM – CDI values	The surveys were processed and merged in CARIS. Unable to assign CDI values in GLOBE based on survey area – only per survey dataset	Individual surveys had to be exported from CARIS. A DTM per survey had to be generated in GLOBE with CDI attached. The surveys were then merged in GLOBE. It would be helpful if CDI's could be attached to DTM's in GLOBE using a shapefile or similar.
IHPT	Software issues	Issues were: 1) Geographic bounds of the DTMs – resulting DTMs shifted; 2) Size of import ascii files; 3) Merging DTMs; 4) Some resulting DTM without CDI values; 5) Depth values on land due to interpolation	Communication with GLOBE software developers for reporting issues and ways for solving issues
IPMA	Software issues	GLOBE was not able to merge the 1/8 DTMs (from individual datasets)	Issues solved after communication with IFREMER and using new GLOBE version
IPMA	Difficulties producing good quality regional DTM due to poor quality of some datasets	Some datasets (in DTM format) present deficient data due to being originated from relatively old multibeam systems or due to insufficient data cleaning. The integration of these datasets with GLOBE produced “spikes” and other artifacts on the regional DTM	Manual editing of the deficient datasets, erasing the most problematic areas (typically “edges of survey”). Erasing large parts of the deficient datasets in areas with better, modern multibeam data. Removing the most problematic datasets

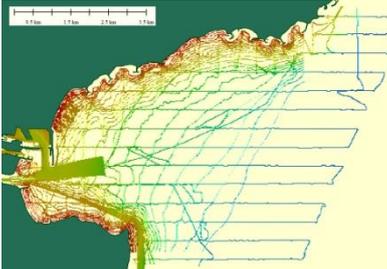
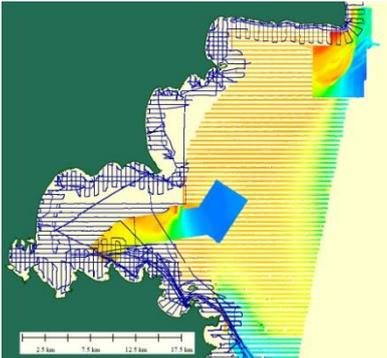
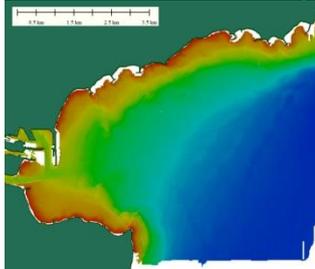
			from the final DTM, where this did not cause significant loss of information. Applying “smooth” tool from GLOBE 1.50 .
HCMR	Software Issues	Various issues with GLOBE software including importing emo format source data, merging DTMs and exporting emo format. Exporting capabilities in various formats such as arc ascii would be useful to be included in GLOBE. Modules like contouring and slope- useful for data analysis and processing - would also be useful to be included.	Contacts with software developers (IFREMER) to solve issues and update the software
HCMR	Data Quality	Questionable data quality in some regional data sets	Cleaning of data sets by manual removal of obvious artefacts
HCMR	Adaption of tools	Incompatibility between versions of Mikado and End&Beds software (CDIs with GML tracks from Ends&beds could not be opened by Mikado)	SeaDataNet End&beds software updated by IFREMER according to the latest CDI-XML format
BSH	Re-generating all the CDI XML files for BSH and include these as updates in the CDI service. Re-generating the coupling table and the data files.	Following the change of database system used for bathymetric surveys at BSH, the CDI XML files, the coupling table and the data files had to be re-generated	Created a workflow to convert BSH-Metadata to CDI format and generate coupling tables
BSH	Regional DTM production	Collecting the datasets from the Baltic Sea providers, create new metadata and merge them to the Baltic Sea model using GLOBE software	Import feature and procedure had to be designed and implemented, polygons were added using Esri ArcGIS
BSH	GLOBE software	Import of large data files failed	BSHC bathymetric data had to be split into smaller parts
BSH	CPRD to CDI	Areas where hydrographic measurements and related metadata are available have to	The Composite DTM’s which were used in the German EEZ have been

		be covered by these surveys and described by CDI's.	separated into single surveys and described with CDI metadata.
BSH	Implementation of the Baltic Sea Bathymetry Database (BSBD) grid	The BSBD grid in the state as it is provided by the Baltic Sea Hydrographic Commission (BSHC) website caused severe artefacts when merged with data from others sources such as GEBCO or BSH.	Upon consultation with GGSgc and the technical representative for BSHC an adjusted grid was provided for the EMODnet Bathymetry project.
CSIC	Use of GLOBE software	Some problems with GLOBE software versions, related to: <ul style="list-style-type: none"> <li>• data importing (XYZ size files)</li> <li>• data gridding (CARAIBES mbg files)</li> <li>• visualization</li> </ul>	Communication with GLOBE developers to address issues.
GRID-Arendal	GLOBE software Issues	Various issues with GLOBE software: 1) importing emo format source data; 2) merging DTMs; 3) adding/modifying CDI references	Dialogue with software developers (IFREMER) to address issues in new upgrades
GRID-Arendal	GLOBE software issues	GLOBE software was not able to process the full Norwegian Sea Region in one go	The Norwegian Sea was split into multiple regions for processing. Other software was used to sub-divide the input data so that GLOBE could be used to process the data into the sub-regional DTMs
GRID-Arendal	Data quality	The data quality from some data providers was of low quality, consisting of uncleaned multibeam data with edge of track issues and depth spikes (both positive and negative).	Three measures were adopted in order to overcome data quality issues. <ol style="list-style-type: none"> <li>1) Work with data providers to provide cleaned data</li> <li>2) Manually clean the data received from the data providers to remove edge effects and depth</li> </ol>

			spikes (time consuming) 3) Not include data in the final DTM
GRID-Arendal	Data providers not meeting milestones in providing data	Some data providers were late in providing their cleaned data. This created a bottle neck in finalising the regional DTM.	Maintain constant dialog with the data providers to emphasise the importance of providing good cleaned data in a timely fashion.
IHM	GLOBE software issues	Some problems with early versions of GLOBE software resulting in wasted time	Issues solved by GLOBE developers in later versions
IHM	Metadata	Hydrographic internal QC criteria were sometimes not compatible with EMODnet recommendations in merging or splitting of surveys	Solved in coordination with MARIS support desk
HO-Belgium	GLOBE software issues	Several problems with the GLOBE software versions resulting in wasted time: 1) data importing; 2) merging DTMs; 3) generation of a 1/16 grid; 4) export of surveys to BAG format; 5) export of surveys to GeoTIFF format; 6) adding or modifying CDI references	Partly solved by GLOBE developers (IFREMER) in later versions. Also we used our cartographic production software to generate the 1/16 grid with the corresponding CDIs in the EMODnet ASCII export format
HO-Belgium	Metadata	Difficulties to integrate the surrounding polygon of the survey as GML in the CDI by using Mikado software. Missing CSR Identifiers for our survey ships in SeaDataNet Common Vocabularies. Converting Metadata from our Bathymetric DataBase to CDI XML format by using coupling table	GML and CSR identifiers solved in cooperation with MARIS support. The generation of the coupling table has been automated
HO-Belgium	Use of in house production software CARIS	The generation of the Composite Grid is done by the cartographic software CARIS. The CARIS Bathy DataBase TRITON has all the necessary tools for making the Composite GRID and associated metadata.	A semi-automated system has been developed on top of the CARIS application for conversion of the bathymetry to the EMODnet ASCII format

		<ul style="list-style-type: none"> <li>• Importing survey data</li> <li>• Merging DTM's of the surveys</li> <li>• Generate a Composite Grid 1/32</li> <li>• Export surveys to BAG, GeoTIFF and ASCII XYZ format</li> <li>• Export metadata of the new surveys.</li> </ul>	by using a powerful text editor together with macro scripts.
HO-Belgium	Metadata	Converting metadata from our Bathymetric DataBase TRITON to CDI XML format.	A semi-automated system has been developed on top of the CARIS application for conversion of the associated metadata CDI's by using Python scripts.
GGGsc	Making sure that all data providers of the Greater North Sea region delivered their data in time and according to the agreed specification	The challenge is to ensure that consistent and up-to-date data sets are delivered, preferably following the agreed EMODnet specification. Data policies and available resources have to be taken into account	Through regular contact and meetings convinced new data providers to make their data available. Organized meetings with those data providers that experience difficulties or have additional questions
GGGsc	Integrate data contributions of data providers for Greater North Sea region and build the regional DTM	This work mainly consists of extensive data quality control and data conversion. Additional software is developed to work with specific formats and data specification as delivered by the providers	Specialized software development and development of QA/QC work procedures.
GGGsc	Create over 2000 CDI XML entries of survey data for the Dutch Hydrographic Service	GGGsc was tasked with the generation of all CDI entries for the Dutch Hydrographic Service	Specialized software has been developed to convert the internal metadata format of the Dutch Hydrographic Service to the agreed SeaDataNet meta data standard

GGSc	Final QA-QC of all data from all regional coordinators and assembly of the overall EMODnet DTM	Extensive QA-QC work was necessary and will provide input for the next version of the EMODnet Bathymetry specifications. In addition a huge data set (40 GB and over 500 million data points) as delivered in regional sets has been combined into a single consistent product	Specialized software has been developed to perform QA-QC on the regional DTMs as received. The new software follows the latest edition of the EMODnet Bathymetry specifications
OceanWise	Acquiring source survey data from authoritative providers in a timely manner	Survey data was made available to OceanWise with a significant delay and infrequently which then delayed processing and delivery to regional basin coordinators	Communicate regularly and apply pressure to relevant authorities and liaise closely with EMODnet project coordinators regarding progress
OceanWise	Generating CDI metadata to the required specification for 2038 separate survey records	The CDI metadata specification has been upgraded between 2013 and 2014 which had to be adapted in the local software. The GLOBE software could only export CDI records one by one, which was not suitable for the volume we needed to produce	Store CDI information within a database, export to CDI (xml) format using a software tool (written by OceanWise). Describe the CDI metadata specification in a configuration file so that the changes could be applied more easily
OceanWise	Exporting model grids to the EMODnet transfer format (.emo)	The EMODnet transfer format specification had changed since 2013. Additionally the GLOBE software could not import files that had been saved to this format	Separate the format specification from our export tool so that specification changes can be applied more easily. Work closely with regional coordinators and IFREMER to modify the GLOBE software to accept the transfer format
NHS	GLOBE software issues	Various problems with GLOBE software, including export and import. Many new versions of GLOBE software were installed. Resulting in need for repetition	GLOBE software developers were very helpful and provided adjusted versions

		of work and thus much wasted time	
NIOZ	GLOBE software issues	Various problems with GLOBE software	Contact with IFREMER developers of the software. Software was adjusted
IOBAS	Limited data coverage in Black Sea	<p>Producing composed grids for Varna bay and broad Burgas bay.</p>  <p><i>(Varna bay - raw data)</i></p>  <p><i>(Burgas bay - raw data)</i></p>  <p><i>(Varna bay - composed grid)</i></p>	<p>Collecting single beam echosounder data from past years surveys, digitizing iso lines from nautical maps in scale 1:25000, and combining these with multibeam data to produce composed grids.</p>
IOBAS	Limited data coverage in Black Sea	Identifying and negotiating third party multibeam data.	<p>A multibeam dataset gathered within Bulgarian EEZ in 2012 was successfully negotiated to be populated in EMODnet. Data was collected by Romanian RV Mare Nigrum with Elac Nautik Seabeam 1050 D on a regular net with 4 km line spacing under the Romania-Bulgaria Crossborder Cooperation Project project MIS ETC641–MARINEGEOHAZARD.</p>

NHS	Software not fitted for far North work with grids generated in UTM and converted to geographical coordinates.	Experience of Moiré-effect in some of the 1*1 degree tiles near central meridian.	New release of the GLOBE software handled this, but needed reprocessing of most of the data.
UoM	Lack of data	The seafloor offshore the Maltese Islands is poorly mapped and there are not many multibeam bathymetric data sets available. There was also lack of response from some Government departments and fellow academics to requests for data.	Available survey data have been processed in EMODnet way and provided to the regional Coordinator.
UoM	Data quality	Data from some data providers was of low quality.	We worked with data providers to provide data sets of better quality. We manually cleaned the data in some occasions or did not use the data altogether.

*Table 4.1: Overview of challenges and solutions as experienced during the project*

## 5. Analysis of performance and lessons learned

### Main barriers to the provision of data

EMODnet Bathymetry has been very successful in motivating data providers and in gathering and populating existing bathymetric datasets in its catalogue services. The number of survey dataset entries in the CDI Data Discovery & Access service service has increased considerably from 9127 to 14791 CDIs for survey datasets and in particular for the European waters from 6323 entries, contributed by 15 data providers from 9 countries, to 11505 entries contributed by 28 data providers from 15 countries. The increase in time is illustrated below.

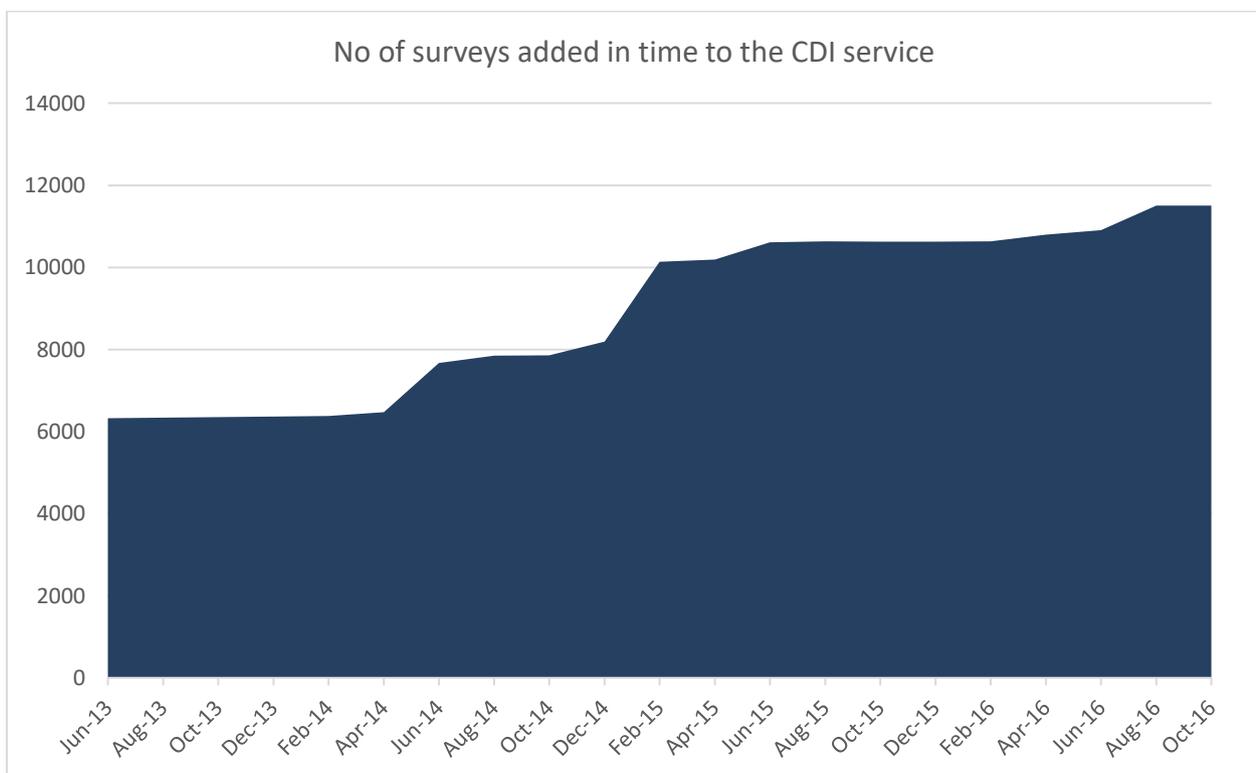


Image 5.1: Increase of Catalogue of CDI Data Discovery & Access service in time for European waters

The following image gives an overview of the number of survey datasets and their year of acquisition. It shows that there are also very historic datasets gathered; moreover it shows that a lot of recent surveys are included, which is very relevant for the quality as recent surveys concern mostly multibeam and other high resolution instruments.

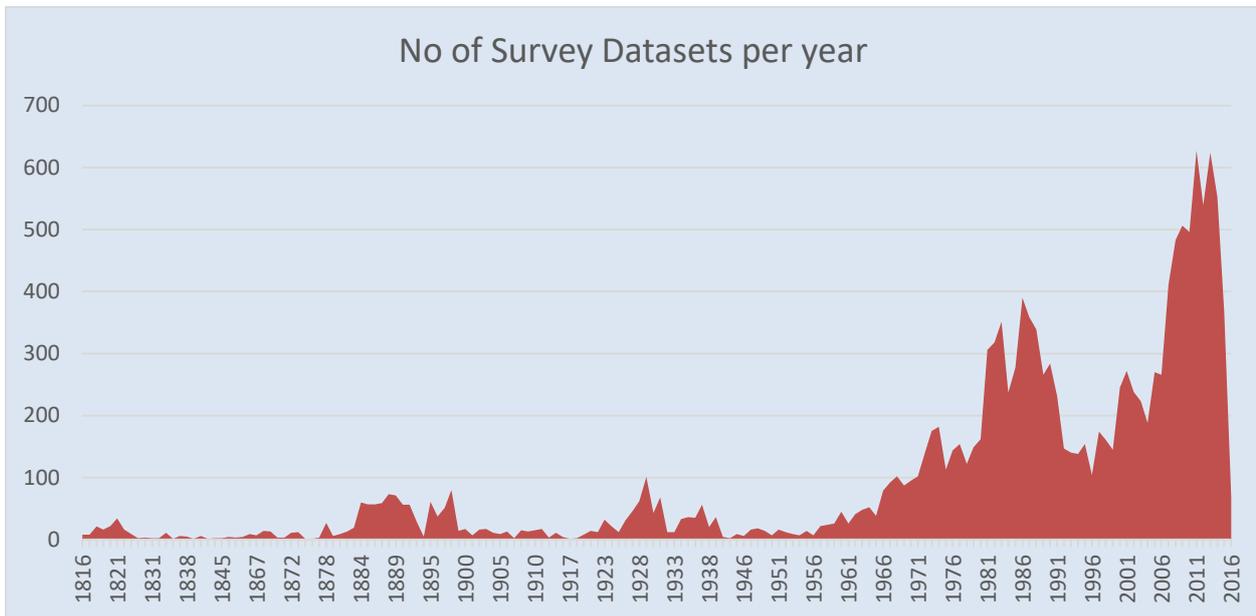


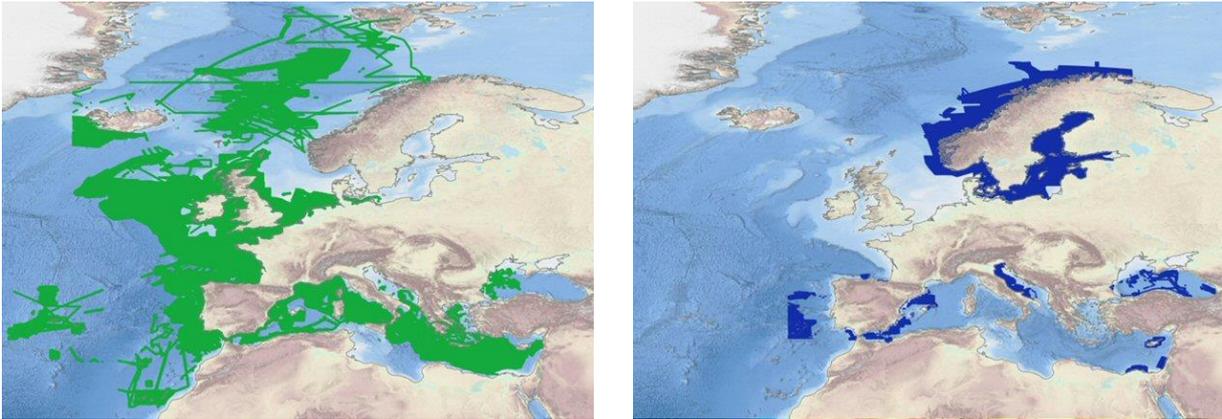
Image 5.2: Overview of number of CDIs for European waters per year of acquisition

Over the project duration also composite DTMs have been gathered and these have been populated in the Sextant Catalogue service. Their number has increased from 32 to 77 Sextant entries over the project. More details about these CDI and Sextant entries, including their data providers and countries can be found in paragraph 3.2 and chapter 10.

It appears that data providers are accepting the SeaDataNet concept that their datasets are described by metadata in the public CDI data discovery and access service, while they can keep control of the access themselves by means of the data access restriction metadata field. The CDI service functions as a shop window to inform users of their data holdings. Especially in the field of bathymetric survey datasets it appears that data providers do not simply want to give open access to their precious datasets, but want to negotiate with potential users about access and use. Therefore most datasets included have been labeled as restricted, only 919 out of 11505 datasets for European waters have open access, leading to a negotiation in case of user requests. Data providers do not object that the generated EMODnet digital bathymetry is made available to users without any constraints for viewing, sharing as web services and downloading as DTM tiles in various formats. The resolution of 0.125 minute by 0.125 minute is considered as a medium resolution and the derived product as a good way to attract potential users. The collated datasets are gathered from consortium members, additional subcontractors and a few associate partners. The subcontracts cover the extra efforts required by data providers for describing their datasets in the CDI metadata format, making their datasets fit for use by the EMODnet consortium, and participating in project meetings. There are no real barriers observed towards making datasets available to the EMODnet project, products and services, as long as access restrictions and use conditions are respected.

Selected survey datasets and composite DTMs have served as input data for generating the Regional

DTMs for the sea areas, which thereafter have been integrated into the EMODnet DTM. The following images are derived from the source references layer for the latest EMODnet DTM (Oct 2016) and can be activated by every user of the Bathymetry Viewing and Download service. The images give the coverage of the European waters with gathered datasets. The non-covered areas have been completed by using the GEBCO DTM.



*Image 5.3: Source references layer giving coverage of European waters with survey datasets (in total circa 7800) and composite DTMs (in total 48) for the latest EMODnet DTM*

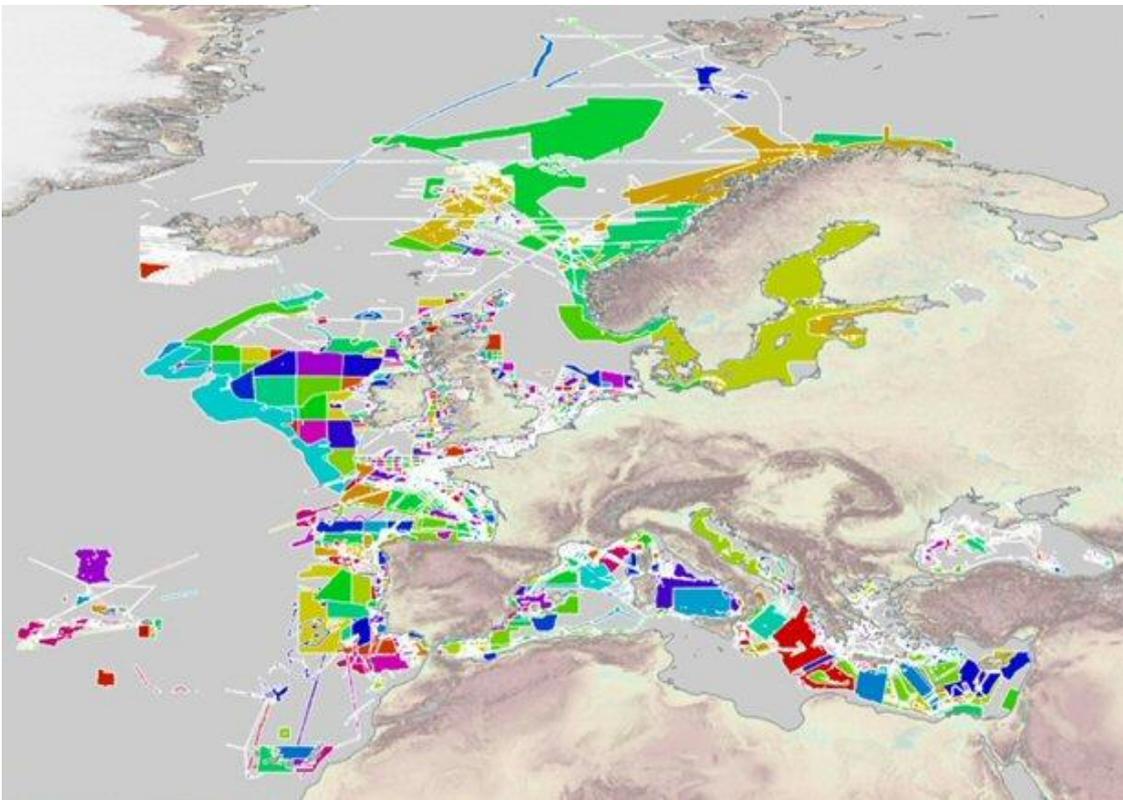


Image 5.4: Source references layer giving coverage of European waters with surveys, composite DTMs and GEBCO (grey) for the latest EMODnet DTM.

A further analysis results in the following geocoverage numbers.

Area coverage	Square meters	Square nautical miles	Percentage
Total sea area	1.78687E+13	5209689.924	
cdi survey coverage	4.30818E+12	1256064.264	24.11
sextant composite DTM coverage	1.10627E+12	322535.5989	6.19
GEBCO coverage	1.24543E+13	3631090.061	69.70
<b>Total coverage</b>			<b>100.00</b>

Table 5.1: coverage of European waters with surveys and GEBCO

This implicates that only circa 30.3 % of the considered sea area (including North East Atlantic ocean) is covered by the datasets that have been gathered and used. For the remaining area (circa 69.70 %) use is made of GEBCO which is largely based upon altimeter data from satellite missions. Considering the type of instruments used for the datasets as can be derived from the CDI and Sextant metadata the following division can be made.

By type of survey	Square meters	Square nautical miles	Percentage
single beam	5.25145E+11	153107.8912	2.94
multi beam	3.63004E+12	1058350.886	20.32
lidar	2211997994	644.9154245	0.01
mixed	1.25705E+12	366496.1706	7.03
<b>Total survey coverage</b>			<b>30.30</b>

Table 5.2: coverage of European waters by datasets divided over collection methods

It is acknowledged that there should be additional bathymetric survey datasets around, for example managed by Hydrographic Offices that are not yet engaged in EMODnet and moreover managed by industry, for instance collected for oil & gas companies and dredging companies. In the scope of EMODnet Bathymetry many new datasets have been gathered; however it has not been achieved to mobilise and get contributions from all potential data providers. Barriers could be data policy issues and considerations of national safety which prevent data owners to share their survey data. There also might

be cases of a scientific moratorium which prevent (hopefully temporarily) the provision of new academic survey data. Other reasons could be costs of data collection which can be considerable for bathymetric surveys which prevent industry parties to share their data with EMODnet and possible competitive users.

Therefore it is recommended to reach out and engage even more data providers in the next phase of EMODnet. Further steps will be made in the next phase of EMODnet Bathymetry for which the tender(s) are being reviewed at present and also in the EMODnet Data Ingestion project which is underway since mid 2016. These projects will facilitate a further mobilising of bathymetric datasets as budgets will be available for the efforts needed for processing and populating datasets. Also positive effects are expected from the further adoption and deployment of the INSPIRE Directive, although so far many public bathymetry organisations do not implement INSPIRE at the granule level, but rather at collection level such as composite DTMs and charts.

### **Challenges to rendering data interoperable**

The SeaDataNet standards have been applied on the bathymetric survey datasets with success. This concerns the Common Data Index (CDI) service for cataloguing and giving access to survey data, and the Sextant service for cataloguing composite DTMs. The SeaDataNet Common Vocabularies have proven to be sufficient for completing the metadata and data records. In addition EDMO (European Directory of Marine Organisations) is used to indicate the organisations involved. This way all gathered datasets have been made interoperable within the project and for users of the portal.

### **Challenges to producing contiguous data**

The existing QA/QC and dataproduct generation methodology from the previous EMODnet Hydrography and Seabed Mapping projects has been upgraded at the start of the project in order to fit the increase in resolution of the target DTM from  $\frac{1}{4} * \frac{1}{4}$  arc minutes to  $\frac{1}{8} * \frac{1}{8}$  arc minutes. In addition, the upgraded GLOBE software tool has been made fit for purpose and introduced to all project members as a common tool. A Training Workshop has taken place to make all members known with the data gathering and catalogues population procedures, tools and services. Moreover to instruct and train all members in the use of GLOBE and the overall procedure for performing QA/QC and generating DTMs at local and regional levels. And regional coordinators have been appointed for European sea areas. A second Training Workshop has taken place a year later to review the procedures and to learn from experiences, also resulting in refined requirements for upgrading the methodology and the GLOBE software, which have been undertaken by the IFREMER GLOBE team. This approach has been successful and has enabled the consortium to generate three releases of a contiguous data product over the European maritime basins from the fragmented and inhomogeneous data. during the project 3 releases of the EMODnet DTM have been produced with a resolution of  $\frac{1}{8} * \frac{1}{8}$  arc minutes (circa 230 \* 230 meters). The DTMs have been released for public use by viewing, downloading and machine-to-machine services in February 2015, September 2015 and October 2015. Each time the number of available and used datasets has increased and each version has been improved by identifying and correcting anomalies, upgrading the overall methodology and used tools (in particular GLOBE software), and have a close synergy with GEBCO. The present EMODnet DTM is without doubt the best bathymetry product covering all European waters and generated in an overall harmonised way. In addition high resolution coastal DTMs have been produced and released for 3 pilot areas as a way to demonstrate what could be done in the next phase.

Further progress has been made with gathering and populating CDI entries, also for areas for which data providers have contributed composite DTMS as primary inputs. For example there is now a good coverage of the North Sea area with CDI entries. However for the Baltic region there is still a challenge. In EMODnet Bathymetry a cooperation was established with the Baltic Sea Bathymetry Database (BSBD) project of the Baltic Sea Hydrographic Commission, which contributed with the BSBD composite DTM. However this cooperation did not allow to engage additional data providers from the Baltic region in order to detail available survey datasets. This challenge should be tackled in the next EMODnet phase.

### **Improving the accuracy, precision and coverage of the data**

As explained above EMODnet Bathymetry has established and adopted from the start a standard methodology for QA/QC and DTM product generation which has been made available to all consortium members as a guideline document, included in the public portal, and by means of a training workshop. The common methodology and the adoption of a common software tool (GLOBE) have been beneficial for establishing a harmonised approach for generating the EMODnet DTM products as the project is dealing with datasets from different acquisition techniques with different accuracies and contributed by 28 data providers from 15 countries. Moreover, there are 10 regional coordinators that each are responsible for the generation of a regional DTM which thereafter are integrated by one integrator, performing additional QA/QC and local smoothing in case of anomalies at edges.

Following Wikipedia accuracy is defined as degree of closeness or trueness of observation versus nature, while precision is defined as the degree to which repeated observations under unchanged conditions show the same results. It should be noted that a system can be precise but not accurate or can be accurate but not precise: for example – an old single beam survey with tidal correction is more accurate and less precise than modern multibeam survey without tidal correction. Accuracy in bathymetry is somewhat difficult to assess as it presupposes that we have a perfect idea where the seabed should be and have reference data to compare with. However most of the time areas have been surveyed once, or not at all.

So far the EMODnet Bathymetry consortium has collected data as they are and has been aiming on improving coverage as there are large gaps. There is a trade off between coverage, usage and qualification: improving accuracy will inevitably lead to filtering out data and imply loss of coverage. The only way to assess accuracy/precision is to rely on appropriate metadata that accurately describe the vertical and horizontal accuracies/precision of all the sensors (GPS, sounder, relative position of the components on the vessel, ...) and processing (tide correction, sound velocity corrections) contributing in the bathymetric solution. Improving accuracy can partly be done through a further improvement of the general data management approach: also adoption of common procedures for survey and survey processing at data providers; however this is an ideal situation which is hardly feasible.

To give an assessment of accuracy and precision for the EMODnet Digital Terrain Model an effort has been undertaken towards formulating a Quality Index. This has been worked out as a pilot by SHOM and use is made of statistical information that can be found in the DTM grid cells. Moreover use is made of metadata content as available in the CDI metadata for survey data, and in the Sextant metadata for composite DTMs. The developed Quality Index is documented in Annex 2 and has been shared with

EMODnet Seabed Habitat Mapping that were in need of such an index for their analyses. The Quality Index in Annex 2 is a good start; however during initial runs it appeared that areas with composite DTMs have most of the times a lower quality index than areas covered by CDI surveys. Also no account is taken of the variability and geologic characteristics of the seabed while this might be a factor. Therefore further research is required, for example in the next phase of EMODnet, to improve the quality index algorithm and also by requesting data providers to improve the metadata in their CDIs and in particular adding CDI references also to composite DTMs as several metadata attributes are relevant for the Quality Index. The ultimate idea is to include the quality index as a value in each grid cell of the EMODnet DTMs. This can then be displayed by colours in a map layer, allowing a user to see at a glance what areas of the DTM have a high quality index.

### **The performance of the chosen portal technology in terms of speed of response and user-friendliness.**

The EMODnet Bathymetry portal has 3 main service components:

- the CDI Data Discovery and Access service for giving overview and access to survey datasets, operated by MARIS
- the Sextant catalogue service for giving overview of composite DTMs, operated by IFREMER
- the Bathymetry Viewing and Download service for the EMODnet DTMs, operated by GGSgc

During the project several upgrades have taken place, as described in paragraph 3.4, for providing integration and functionalities as required and useful for users. The performance of the services has been more than sufficient during the project and no failures have been logged. All systems are continuously monitored and procedures are in place to guarantee a 24 hour 7 day a week operational performance. This is done inter alia by professional hosting of the servers. Statistics are gathered on an operational basis for the EMODnet Bathymetry portal including the CDI Data Discovery and Access service and separately for the Bathymetry Viewing and Download service. Also statistics are maintained for the various OGC webservices that are in place for the CDI service and the Viewing and Download service as detailed in paragraph 3.4 and in Chapter 10.

The performance of the project and the services has been very good as can be seen from the user statistics which are quite impressive. The following images give some overviews while more details are given in chapter 10.

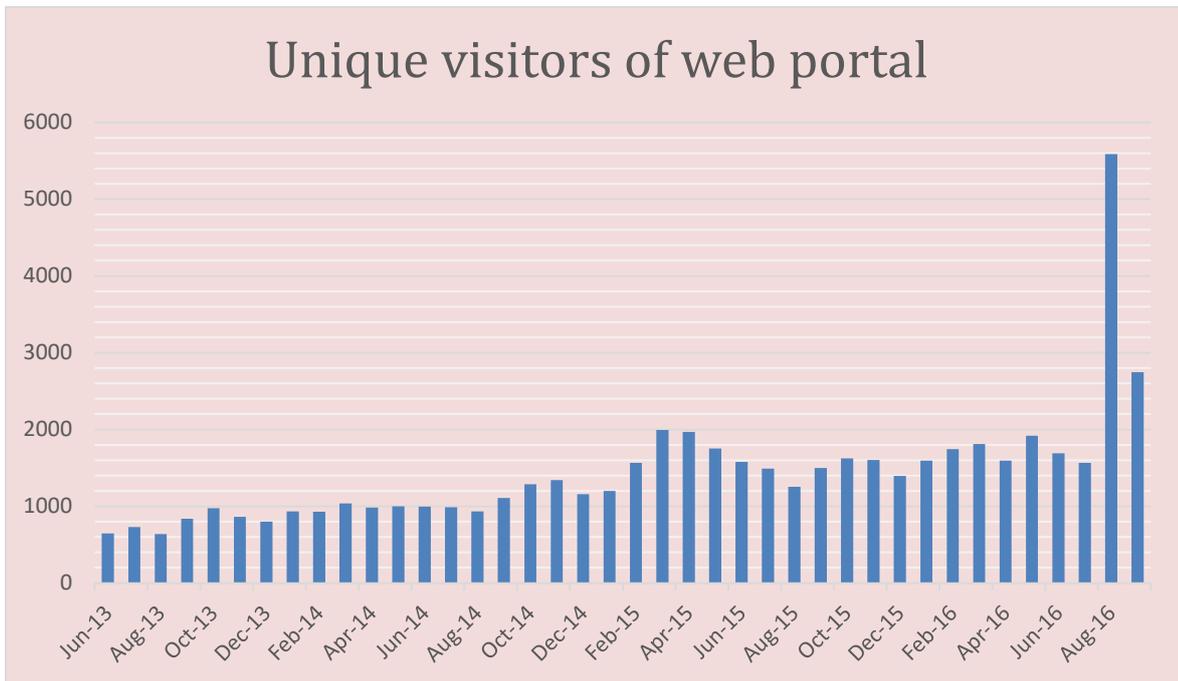


Image 5.5: Number of visitors of the EMODnet Bathymetry portal during the project period

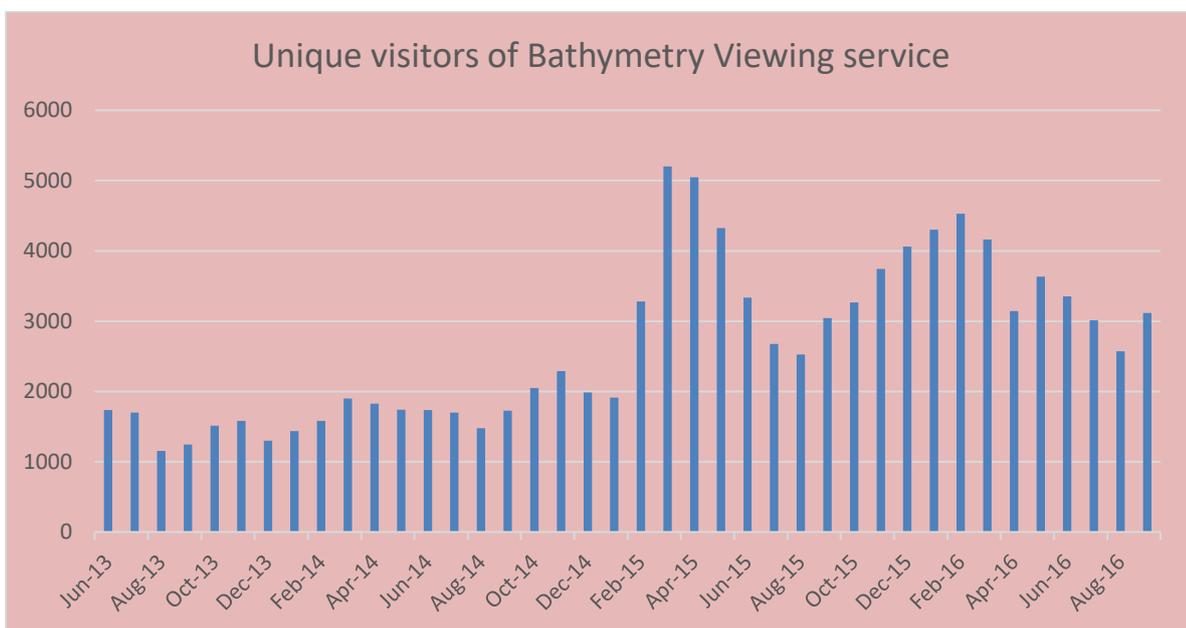


Image 5.6: Number of visitors of the EMODnet Bathymetry Viewing and Download service during the project period

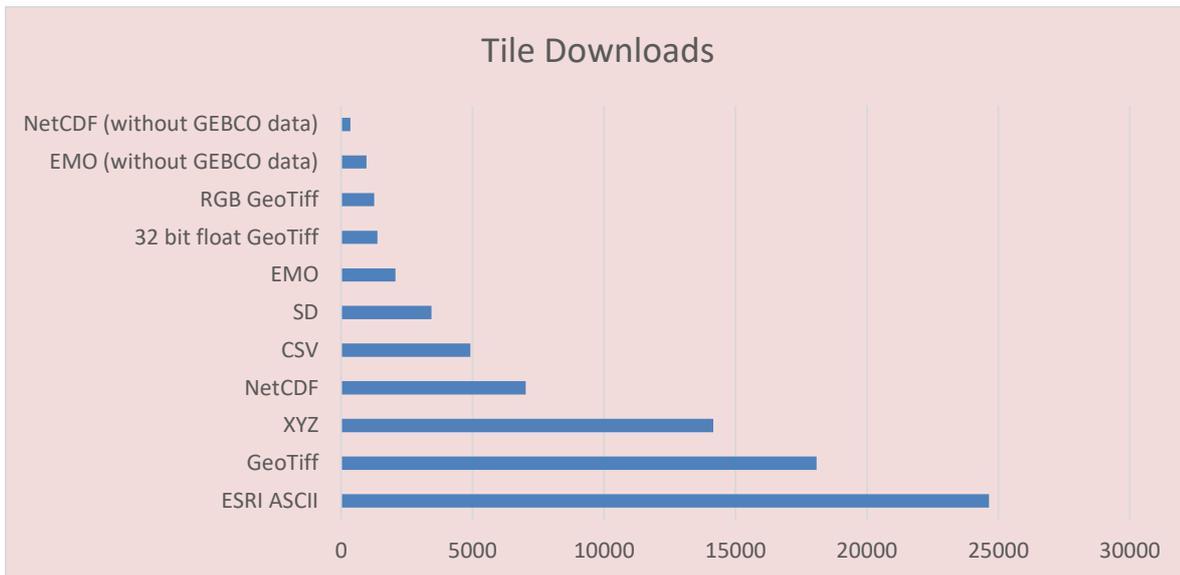
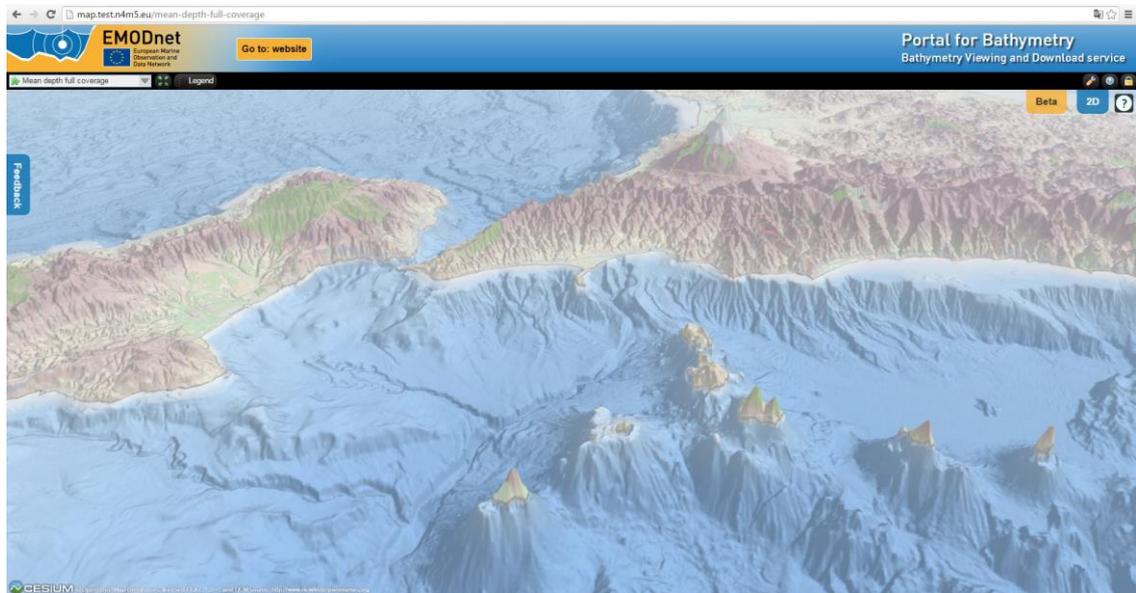


Image 5.7: Number of downloads of DTM tiles during the project period divided over file formats

### Possible improvements for the future

- introducing 3D viewing in the browser:** The DTM tiles can be downloaded as SD files which are fit for use in the Fledermaus 3D software and IVS-3D (free viewer), while the NetCDF download files are fit to use with the 3D viewer, based upon NASA Worldwind which can be freely downloaded from the portal. These are delayed mode 3D visualisations. In a next phase it is considered that 3D visualisation directly in the browser and without plug-ins will give extra attention and be very useful. 3D viewing will contribute to extra analysis capabilities and provide extra insights in the underwater terrain, and in particular also for the coastal areas and interesting underwater features such as canyons and seamounts. Already some test developments have been undertaken, using the WCS service in combination with Cesium (<https://cesiumjs.org/>), an open-source JavaScript library for world-class 3D globes and maps. This gives already quite exciting results. However the performance is not sufficient and robust enough to provide as a service to EMODnet users, because the elevation data is real-time extracted from a geotiff which is very intensive for processing, data handling and bandwidth. Also visual gaps appear at higher resolutions and higher zoom levels. Therefore extra developments are required to improve performance and appearance considerably.



*Image 5.8: 3D in browser using WCS in combination with Cesium – test – land and sea*

- **Making use of the ‘cloud’:** The bathymetric survey data sets are really massive, and processing them to produce seabed surface products (e.g. Digital Terrain Models, maps, thematic layers, mosaics), in particular on a regional and pan-European scales, is very challenging. The number of grid nodes of the present EMODnet Bathymetry DTM is already impressive: 1.092.115.678 grid nodes (28.799 rows x 37.922 columns). This implicates in practice that regional coordinators are already splitting their regional DTMs in tiles during production, because their desktop PC’s can not handle the number of data points. Also production runs take considerable time. The same applies to the integration of all regional DTMs into the overall EMODnet DTM, which is also done by splitting the area to have workable subsets. Not only is this time consuming, but it also increases chances for anomalies at the edges of tiles, which need to be corrected. In addition, the regional coordinators work independently of each other, albeit with agreed overlap zones between the regional DTM areas in order to minimise possible edge effects. Going to higher resolution DTMs in the next EMODnet phase will increase considerably the number of data points. Using the Cloud and High Performance Computing will make it more efficient for regional coordinators and the integrator to retrieve, review and compare bathymetric survey data and composite DTMs from the agreed data providers, and to process these into regional DTMs, preferably without tiling. It also should be possible for regional coordinators to visualise their products in 2D and 3D, and visually compare these with previous releases of the regional DTMs in order to identify spikes or other anomalies, possibly introduced by new data sets. And also to interact with neighbouring regional DTMs for checking and preventing edge issues.

## 6. Analysis of sustainability

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### **Availability of standard procedures facilitating data flow**

The EMODnet Bathymetry approach for data flow is based upon the SeaDataNet philosophy and standards as explained already in depth in the sections above. The data products are made available via OGC based viewing services, which support interoperability and exchange of the mapping layers to other services. Data providers understand and accept the principles. Standard tools and procedures are available from SeaDataNet, which have already been well validated and used.

### **Maintenance.**

The EMODnet Bathymetry system provides an operational set-up for expanding the catalogues and collections of bathymetric surveys as it is based upon the SeaDataNet infrastructure. SeaDataNet is an expanding network of data centres that manage their own data; however they work together to make these datasets discoverable and accessible in a harmonised way through the CDI service. This model can be well maintained as long as member organisations are committed beyond projects and are in agreement with maintaining services because of various benefits. The EMODnet DTMs can be generated on a regular interval, each time incorporating more and new datasets that have come available. The cycle time at present is circa 1 year; however this could be improved and shortened to every 6 months by making the processes more efficient.

### **The model for governance by actors in the system**

For the longer term a sustained EMODnet operation must be achieved in a cooperation between organisations acquiring and managing data, with structured funding from Member States and EU. In practice EU might fund the tip of the iceberg while most funding for the base of the iceberg will be done by the Member States. This will cover both government organisations as well as research institutions. In this model there should also be roles and contributions from the private sector such as the offshore industry, the windfarm industry and others. The governance model should be flexible enough to cope with the different sectors and their interests. This should be subject of further analysis within the scope of the overall EMODnet development process. SeaDataNet – EMODnet is already considered by many stakeholders as an important component of the European infrastructure for marine data management. This means that many organisations are interested and motivated to contribute and to adopt the principles and standards. Also it is considered in EU project proposals as an important reference, which encourages that more data providers participate and more datasets are contributed.

### **Institutional setting**

The EMODnet approach with thematic portals for specific disciplines and communities and with EMODnet concertation meetings is considered as very useful and effective. This way many potential players from a given discipline or theme can be engaged for their own specialism and interest, while the interoperability and cohesion between the thematic portals is achieved by using common standards from OGC for viewing services (WMS, WFS) and SeadataNet standards for data discovery and access services and semantic interoperability in several of the portals. The CDI approach is used in Chemistry,

Bathymetry, Physics, and partly in Geology (via link with Geo-Seas) including its flexible data access restrictions for giving overview and access to basic measurements datasets. Biology uses the EurOBIS standards, and has established an interoperability solution with SeaDataNet for exchanging biological data from the CDI service as many SeaDataNet data centres also manage and populate biology datasets. Geology has an initiative for developing the EGDI infrastructure and it is planned to explore the options for an interoperability scheme between SeaDataNet and EGDI. Further EMODnet initiatives are needed such as the EMODnet Data Ingestion project and the next EMODnet phase to give even more momentum and awareness to EMODnet. This will encourage more data providers to come forward for data sharing and participating in the process of making complete overviews and homogeneous data products. Also this will give wider visibility at the policy and management levels both at EU and Member States that should seek integration of EMODnet output and services in management and policy processes and that will decide upon its future sustained funding. In parallel further RTD work will and must continue on standards and protocols that can be applied as basis for the EMODnet portals. For example the SeaDataCloud project with DG RTD funding will be undertaken in the coming 4 years as successor to SeaDataNet II. This will look at adopting cloud technology and services for making the CDI service more performing for users and for providing a virtual research environment for users to do more with large pools of data and common software applications. These developments will benefit the further development of EMODnet.

**Required resources including cost.**

If the current EMODnet-Bathymetry partners (plus additional organisations) are successful in retaining the project into the next phase, the resources required to maintain the system will be taken from the project budget.

## 7. User Feedback

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A number of feedback forms were received. These were support messages for the project, some questions about technical issues, citation and expected new releases. Messages were answered where needed. The table below gives an overview of feedback events, while details on questions and answers are given in Annex 3.

Date	Name	Organization	Type of user feedback ( <i>e.g. technical, case study etc</i> )	Response time to address user request
2013-06-28	Hamid Mustafa Abdelgahar	Plymouth University	Question about citation and format	3 days later
2013-07-09	Hamid Mustafa Abdelgahar	Plymouth University	Question about files	Same day
2013-11-22	David Harrison	Fugro	Question about using DTM	Same day
2013-11-25	Robin Waldman	Meteo France	Technical question about coordinates	Next day
2013-12-01	Adduladim	Unknown	Encouragement	Not needed
2013-12-02	Borja Aquilo	Unknown	Encouragement	Not needed
2013-12-31	Ruud van Wijk	Unknown	Encouragement	Not needed
2014-01-06	Zohar Gvirtzman	Unknown	Question about citation	Same day
2014-01-09	C. COCHET	Unknown	Question about reference	Same day
2014-01-22	Duncan Fraser	Blueyonder	Question about login	Same day
2014-02-17	Emmanouil I.Konstantinidis	Democritus University of Thrace	Question about citation	Same day
2014-03-24	Borja Aguiló	Unknown	Suggestion	Not needed
2014-04-03	Antoine Patru	ETHZ	Question about login	6 months due to mislaid mail

2014-04-07	Mehran Eskandari	University of Birmingham	Question about citation	Next day
2014-04-10	Boris Espinasse	University of Nordland	Question about releases	Same day
2014-06-03	Felix Schalck	Unknown	Encouragement	Not needed
2014-06-29	Louis Hough	Unknown	Encouragement	Not needed
2014-07-21	Rudy Magne	Meteogroup	Question about releases	2 months due to mislaid mail
2014-07-28	Stavros Stylianou	University of Cyprus	Question about releases	Same day
2014-09-08	Narangerel Davaasuren	Wageningen UR	Question about bathymetric data availability	13 days later
2014-10-25	Sven Blumenstein	RWE Dea AG	Question about availability of data in ESRI compatible format	3 days later
2014- 10-17	Stamatina Nikolopoulou	HCMR	Question over coastline contours	3 months later
2014-10-21	John Siddorn	Met Office Hadley Centre	Questions over EMODnet Bathymetry DTM product	7 days later
2014-11-14	Duvel	Unknown	Question over login in EMODnet Bathymetry Viewing and Downloading service	2 months later
2014-11-25	Sven Blumenstein	RWE Dea AG	Question over the line contours in DTM	3 days later
2014-12-01	John Siddorn	Met Office Hadley Centre	Appreciation	Same day
2014-12-07	Dave Holroyde	Caydale Consulting	Question over login in EMODnet Bathymetry Viewing and Downloading service	Same day
2015-01-26	Fernando Tempera	JRC	Suggestion	Same day
2015-02-09	Lisann Heuer	Unknown	Question over distance in the DTM	Same day

2015-02-21	Gerben Van Ranst	Universiteit Gent	Question over Geo-Seas World Wind plus 3D Viewer usage	2 days later by other partner
2015-03-06	Mercè Labordena	ETH Zurich	Access DTM portal	Same day
2015-03-31	Jérôme OLLIER	NAUSICAA	Question over link to the portal	1.5 months later
2015-04-08	Thomas Pedersen	SSSH! Studio	Availability of the DTM portal	1 day later
2015-04-30	Hagit Weiner	EWRE	Question over the date of the bathymetry survey near Israel coast	2 days later
2015-05-01	Lian Wang	NPL	Question over the download of zip files	Same day
2015-05-01	Daniel Praeg	OGS	Question over data file format	Same day
2015-05-01	Fiona Miller	Abpmer	Question over vertical datum present in DTM	12 day later
2015-05-08	Dr Leigh Howarth	Banghor University	Question over data visualisation	Same day
2015-06-02	Amelia Astley	NOC - University of Southampton	Question over the availability of a shape file data with wrecks	Same day
2015-06-29	Jana Echave	Environmental Hydraulics Institute of the university of Cantabria	Question over the vertical datum in the Spanish coast	Same day
2015-08-27	enrico bonansea	ARPA Piemonte - Italy	Compliments	No question
2015-09-10	Juliana miranda	Metocean – New Zealand	Issue with downloading DTM tiles	Same day
2015-09-17	Jennifer Graham	MetOffice - UK	Issue with unzipping downloaded DTM tiles	4 days later
2015-09-23	Roberto Bozzano	CNR - Italy	Issue with unzipping downloaded DTM tiles	Same day
2015-09-22	Eisse van den Oever	Periplus - NL	Question about wrecks download	Same day
2015-09-23	Johan Sandell	GeoData - Norway	Issue with unzipping downloaded DTM tiles	Same day

2015-09-29	Gerard Perez	?	Issue with unzipping downloaded DTM tiles	Same day
2015-09-28	Jean-Luc Vetter	Total - Norway	Issue with unzipping downloaded DTM tiles	1 week later
2015-10-12	Johan Söderkvist	FCOO - Danmark	Question about use of DTM	1 week later
2015-10-23	Gary Barnes	Bridgeporth - ?	Question about registration	1 week later
2015-10-29	Dominic Fehling	?	Question about isolines layer	Same day
2015-10-26	Krischan Hubert	? - Germany	Question about LAT - MSL	Same day
2015-10-11	Julian Jiménez Solano	? - Spain	Question about downloading data for Strait of Gibraltar	2 weeks later
2015-11-04	Haavard Holm	NTNU - Norway	Question about copyrights	Same day
2015-10-30	Kerry Hayes	Periplus - NL	Issue with downloading of csv files	Same day + 4 days later more details
2015-11-4	Ioannis Mintourakis	NTUA - Greece	Question about access by downloading	Same day
2015-11-12	Andrei Ivanov	Ocean – Russian Federation	Question about wrecks layer	Same day
2015-11-17	Lonneke Godijn	UHI – United Kingdom	Question about downloading parts of tiles	3 days later
2015-11-25	Rut Pedros	UB - USA	Question about citation when using EMODnet DTM	Same day
2015-12-02	Elissalde Peio	Just magic - ?	Question about downloading HR DTMs	1 day later
2015-12-16	Eninna Luli	?	Question about wrecks layer	4 days later
2015-12-14	Juanje Palomeque	?	Not clear	1 week later
2016-01-12	Johannes Oeffner	Fraunhofer - Germany	Question about downloading HRDTMs	Same day
2016-01-13	Guadalupe Bru	UTM-CSIC - Spain	Question about Datum	Same day
2016-01-19	Iris Hinrichs	Uni-Hamburg - Germany	Suggestion about tiles downloading	Same day

2016-11-26	Olivier Gourgue	??	Question about vertical reference	2 months later – catch up
2016-12-7	Pedro Beca	NUI Galway - Ireland	Question about metadata for tiles	1.5 months later – catch up
2016-01-19	Johannes Oeffner	Fraunhofer - Germany	Question about access to HRDTM Germany	One week later via BSH
2016-01-29	Duncan Hume	SGU - Sweden	Questions about Baltic DTRM and BSHD	same day
2016-01-28	John Cartwright	NOAA – NGDC - USA	Questions about WMS – WFS layers for integration in North Atlantic Data viewer	Same day + more mail exchange
2016-02-05	Lidia Bressan	ARPA - Italy	Suggestion about depth indication	Same day
2016-03-03	Jennifer Jencks	NOAA – NGDC - USA	Further communication about the North Atlantic Data viewer and AORAC-SA	Same day + more mail exchange
2016-05-16	Gustav Kagesten	SGU - Sweden	Questions about Baltic Sea bathymetry and comparison with BSBD	Same day
2016-06-30	Ahmed Mansi	Politecnico Milano - Italy	Question about referencing EMODnet Bathymetry	Few days later
2016-08-03	Homayoon Komijani	KU Leuven, Belgium	Question about acknowledgement	Two days later
2016-08-29	Neil Kinniburgh	?	Question about using EMODnet DTM for commercial maps	Two days later
2016-08-31	Lea David	?, France	Question about GEBCO Undersea Features layer	Same day

## 8. Allocation of project resources

The following table gives an indication of the efforts in % of the total project efforts:

- WP0: Project Management
- WP1: Bathymetric data collection and metadata compilation for all maritime basins
- WP2: QC/QA and producing Digital Terrain Models for the basins
- WP3: Integration and inclusion of the DTM's into the portal
- WP4: Technical Development & Operation of portal
- WP5: Analysis & Evaluation

Partner	Country	WP0	WP1	WP2	WP3	WP4	WP5	TOTAL %
MARIS*	NL	5	6	0	1	2	1	15
IFREMER	FR	0	2.9	5	1	1	0.1	10
SHOM	FR	0	2	3.9	0.3	0	0.3	6.5
NERC-NOC	UK	0	1.2	3.5	0.2	0	0.1	5
NERC-BODC		0	0.2	0.8	1	0	0	2
CNR-ISMAR	IT	0	1.2	3.2	0.1	0	0	4.5
OGS	IT	0	1.8	2.2	0	0	0	4
IEO	ES	0	1.45	1.5	0.3	0	0	3.25
GSI	IE	0	1	2	0	0	0	3
IHPT	PT	0	1	1.9	0.1	0	0	3
IPMA	PT	0	1.6	3	0.4	0	0	5
HCMR	GR	0	1.1	3	0.4	0	0.5	5
IO-BAS	BG	0	1	1.5	0	0	0	2.5
BSH	DE	0	1.2	3.5	0.3	0	0	5
UNEP/GRID	NO	0	1.2	3.5	0.3	0	0	5
IHM	ES	0	1.55	1.6	0.1	0	0	3.25
HO Belgium	BE	0	0.4	0.6	0	0	0	1
GGSGC	NL	0	0.5	1.3	1.3	4	0.4	7.5
OceanWise	UK	0	1	1	0	0	0	2
UTM-CSIC-CMIMA	ES	0	0.9	0.6	0	0	0	1.5
HO Norway	NO	0	1	1	0	0	0	2
HO Netherlands	NL	0	0.5	0.5	0	0	0	1
NIOZ	NL	0	0.8	1.2	0	0	0	2
HO Faroes	FAROE	0	0.6	0.4	0	0	0	1
<b>TOTALS PER WP</b>		<b>5</b>	<b>32.1</b>	<b>46.7</b>	<b>6.8</b>	<b>7</b>	<b>2.4</b>	<b>100</b>

\* incl subcontracts, meeting and promotion costs

Table 8.1: Efforts in % of total budget

Activity	% of total efforts
Making data and metadata interoperable and available	<b>32.1</b>
Preparing data products	<b>48</b>
Preparing web-pages, viewing or search facilities	<b>5</b>
Project management	<b>3</b>
Interaction with users	<b>11.9</b>

Table 8.2: Total project efforts for activities in %

**Note:** The WPs correspond with the following activities:

- WP1: Making data and metadata interoperable and available
- WP2 + WP3: Preparing data products
- WP4: Preparing web-pages, viewing or search facilities
- WP0: Project management
- Interaction with users is part of WP0, WP2, WP3, and WP4

## 9. Outreach and communication activities

During the project a range of promotion and dissemination activities have been undertaken towards potential additional data providers, users and decision makers. These activities are listed below.

Date	Media	Title	Short description and/or link to the activity
8-12 July 2013	Conference	Esri International User conference, San Diego	Network activities and briefing on EMODnet activities during the Hydrography Special Interest Group meeting chaired by IHO president Robert Ward. By GGSgc
September 2013	Meeting	annual Baltic Sea Hydrographic Commission (BSHC) meeting	used by BSH to seek synergy between Baltic Sea Bathymetric Database project and EMODnet Bathymetry
17 - 20 September 2013	Conference	MARES 2020, International Conference "Marine Research Horizon 2020" (host IO-BAS)	EMODnet Bathymetry presented by MARIS in session "EMODNET - Achievements and Future" .
23-25 September 2013	Conference	IMDIS 2013, International Conference on Marine Data and Information Systems (host SeaDataNet)	SeaDataNet Technical Coordinator included EMODnet in the IMDIS opening presentation of cooperation.
18 September 2013	Conference	Regional Hydrographic Commission for South Africa and Islands RHC hosted by Portuguese HO, Lisbon	Presentation by OceanWise - The Wider Use of Hydrographic Data; Inclusion of EMODnet programme in context of data access and supply.
September 2013	Poster	Harmonization of DTM production in EU distributed infrastructures	<a href="http://imdis2013.seadatanet.org/content/download/73945/957705/file/S2P39_IMDI_S2013.pdf">http://imdis2013.seadatanet.org/content/download/73945/957705/file/S2P39_IMDI_S2013.pdf</a> <i>Presented at Imdis and Gebco conferences by SHOM</i>
7 - 8 October 2013	Conference	GEBCO Science Day 2013 (host CNR-ISMAR)	EMODnet Bathymetry presented by MARIS and also a final agreement between GEBCO and EMODnet was reached for the release of the new GEBCO bathymetry in which EMODnet is included and cited as a regional effort.
10 October 2013	Conference	INFOMAR Annual Seminar 2013 Limerick, Ireland	GSI presented "INFOMAR and European Projects". Four slides (15-18) were dedicated to: "EMODNET Hydrography 2".

			<a href="http://www.infomar.ie/Annual_Seminar/2013_UL/Irish%20mapping%20&amp;%20EU%20Projects%20_GSI_%20MJ.pdf">http://www.infomar.ie/Annual_Seminar/2013_UL/Irish%20mapping%20&amp;%20EU%20Projects%20_GSI_%20MJ.pdf</a> Poster "EMODNET Hydrography " displayed.
28 - 31 October 2013	Conference	BS-GES 2013, 4 <sup>th</sup> Bi-annual Black Sea Scientific Conference Challenges Towards Good Environmental Status (host NIMRD)	organised by the Black Sea Commission Secretariate together with NIMRD. EMODnet Bathymetry presented by MARIS.
28 October 2013	Exhibition	World Hydrography Day - Southampton	EMODnet slide in rolling OceanWise presentation on exhibition Stand
29-30 October 2013	Conference	Digital Hydrography on the Maritime Web – Solent University	EMODnet slide in rolling OceanWise presentation on exhibition Stand
11 November 2013	Conference	Atlantic Ireland 2013 Dublin, Ireland	Poster "EMODNET Hydrography " displayed on INFOMAR stand by GSI
17 November 2013	Workshop	Welsh Govt. PGA Supplier Day	User experiences with marine mapping – EMODnet as a case in point by OceanWise
Oct / Nov 2013	Magazine	Inshore Ireland (vol 9 nr 5)	GSI article "EMODnet Phase 2 initiatives" <a href="http://issuu.com/inshoreirelandpublishing/docs/inshore_ireland_vol_9_nr_5_oct-nov_/25">http://issuu.com/inshoreirelandpublishing/docs/inshore_ireland_vol_9_nr_5_oct-nov_/25</a> Also, available on INFOMAR's facebook page. <a href="https://www.facebook.com/595185173894900/photos/a.610997545646996.1073741832.595185173894900/612453645501386/?type=3&amp;theater">https://www.facebook.com/595185173894900/photos/a.610997545646996.1073741832.595185173894900/612453645501386/?type=3&amp;theater</a>
26 November 2013	Conference	Geoscience 2013 Dublin, Ireland	GSI presented "INFOMAR 2026" Some slides (18 &19) were dedicated to: "EMODNET Hydrography 2." <a href="http://www.gsi.ie/NR/rdonlyres/D4E4B47F-6963-4F4C-90D6-1B8BEE51ACCO/0/Session51INFOMARArchiveDonovan.pdf">http://www.gsi.ie/NR/rdonlyres/D4E4B47F-6963-4F4C-90D6-1B8BEE51ACCO/0/Session51INFOMARArchiveDonovan.pdf</a> Poster "EMODNET Hydrography " displayed.

06 December 2013	Conference	AGI Cymru Conference 2013	Presentation – uses of marine data included availability of EMODnet as a source for use by OceanWise
12- 13 January 2014	Conference	Coastal Futures 2014	EMODnet slide in rolling OceanWise presentation on exhibition Stand
4 February 2014	Journal Article	Harris, P.T., Macmillan-Lawler, M., Rupp, J. and Baker, E.K. 2014. Geomorphology of the oceans. Marine Geology, 352: 4-24.	The EMODnet bathymetry was used as one source of data in the publication on geomorphology of the oceans. This publication presents a global map of geomorphic features based on interpretation of bathymetric data. By GRID-Arendal
March 2014	Exhibition	Oceanology International 2014	EMODnet Bathymetry presented by MARIS at stand
1 March 2014	Poster		New poster by MARIS, available via the website
10 March 2014	conference	Noth Sea Hydrografic Conference – Resurvey WG Meeting	EMODnet Bathymetry presented by BSH
19 March 2014	Seminar	UK Harbourmasters [UKHMA] Spring Seminar	EMODnet slide in rolling OceanWise presentation on exhibition Stand
April 2014	Congress	European Geophysical Union (EGU)	EMODnet Bathymetry presented by MARIS in session
May 2014	Presentation (s) to University undergrad and MSc students	Use of bathymetry in the United Nations Convention on the Law of the Sea (UNLOS)	Introduction of availability and access to bathymetry within the EU via the EMODnet Hydrography/Bathymetry programmes. By NERC-NOC
11-13 June 2014	Conference	IV Simposio internacional de Ciencias del Mar. Las Palmas de Gran Canaria. Spain.	“European initiatives to disseminate the Geo-information of marine environment: EMODNET. Marine Knowledge 2020. IEO contributions” by IEO
12 – 13 June 2014	Workshop	8TH GEO EUROPEAN PROJECTS WORKSHOP	EMODnet Bathymetry presented by MARIS in session
13-15 June 2014	Meeting	Joint IHO-IOC Guiding Committee for GEBCO meeting, Monaco	Inclusion of information about the GEBCO-EMODnet collaboration work and its status in a report to the GEBCO Guiding Committee. By NERC-BODC-GEBCO

25-27 June 2014	Meeting	31 <sup>st</sup> North Sea Hydrographic Commission meeting, Amsterdam	Inclusion of information about the GEBCO-EMODnet collaboration work in a general presentation given about the work of GEBCO. By NERC-BODC-GEBCO
22 August 2014	Magazine	Geology Matters Issue 16 (GSI Newsletter)	GSI article “EMODNET Hydrography 2 - Producing a high resolution digital bathymetry for European sea basins” <a href="http://www.gsi.ie/NR/rdonlyres/0ED13073-3083-474A-BEC6-0222D348B104/0/Issue_16A.pdf">http://www.gsi.ie/NR/rdonlyres/0ED13073-3083-474A-BEC6-0222D348B104/0/Issue_16A.pdf</a>
27-28 September 2014	Presentation	GEODAY Bologna, University	Posters and presentations displaying the EMODnet bathymetry were given to the audience during this very popular Citizen Science initiative. <a href="http://www.bigea.unibo.it/it/eventi/geoday-2014">http://www.bigea.unibo.it/it/eventi/geoday-2014</a>
6 – 8 October 2014	Conference Presentation	EUROCEAN, Rome, Italy	Participation in EUROCEAN discussion and presentation of EMODnet Bathymetry
20 October 2014	Poster	Conference: Atlantic Ireland Dublin	Poster presentation displaying EMODnet bathymetry, with data download and discovery information
20-24 October 2014	Presentation		Presentation of EMODnet Bathymetry at HCMR, Athens, Greece
22 October 2014	Presentation & Poster	INFOMAR Annual Seminar 2014 Waterford, Ireland	Archie Donovan presented “INFOMAR Supporting Marine Policy Development”. One slide (9) was dedicated to: "EMODnet Bathymetry". <a href="http://www.infomar.ie/Annual_Seminar/2014_WD/presentations/Seminar_Wednesday/Session_3/3_4_INFOMAR-seminar_Presentation-Marine-Policy_2014_AD.pdf">http://www.infomar.ie/Annual_Seminar/2014_WD/presentations/Seminar_Wednesday/Session_3/3_4_INFOMAR-seminar_Presentation-Marine-Policy_2014_AD.pdf</a> Poster "EMODnet Bathymetry" displayed.
05 November 2014	Presentation & Poster	Conference: Geoscience 2014 Dublin	Janine Guinan presented “European Projects summary, EC funded geoscience jobs” which included EMODnet Bathymetry slides. Poster also displayed.

17 – 20 November 2014	Conference Presentations	EastMed symposium in Limassol – Cyprus	Presentation of EMODnet Bathymetry by Dick Schaap and discussing with potential new data providers from Egypt and Israel
21 November 2014	TV	Thalassa France 3	During the French TV programme, centered on submarine volcanoes of the southern Mediterranean Sea, Marzia Rovere illustrated the compiled bathymetry achieved with EMODnet efforts.
15-19 December 2014	Conference + Poster	AGU Fall meeting in San Francisco – USA / GEBCO Science Day 2014	Thierry Schmitt (SHOM) and Pauline Weatherall (BODC) presented a poster entitled <i>GEBCO and EMODnet Bathymetry hands in hands</i> The poster illustrates that GEBCO and EMODnet-Bathymetry are going hand in hand for improving global and regional bathymetric models of European waters Session: New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping <a href="http://www.gebco.net/about_us/gebco_science_day/documents/EMODnet_gebco_agu14_poster.pdf">http://www.gebco.net/about_us/gebco_science_day/documents/EMODnet_gebco_agu14_poster.pdf</a>
December 2014	Digital product	GEBCO_2014 Grid	Inclusion of the 2013 version of the EMODnet grid in the GEBCO_2014 Grid and the publication of the GEBCO_2014 Grid. <a href="http://www.gebco.net/data_and_products/gridded_bathymetry_data/">http://www.gebco.net/data_and_products/gridded_bathymetry_data/</a>
Dec / Jan 2015	Magazine	Inshore Ireland (vol 10 nr 5)	Janine Guinan wrote an article “GSI’s European Marine Projects” <a href="http://issuu.com/inshoreirelandpublishing/docs/inshore_ireland_10.5_dec_2014/26?e=0">http://issuu.com/inshoreirelandpublishing/docs/inshore_ireland_10.5_dec_2014/26?e=0</a>
13 January 2015	Presentation	European Innovation Partnership on Raw Materials Annual Conference, Brussels	Koen Verbruggen (GSI) presented “EuroGeoSurvey role and Commitment” and included EMODnet Bathymetry slide.
15 January 2015	Meeting	EMODnet information Day – Brest, France	Thierry Schmitt (SHOM) presented both the status of improvement of the methodology of production of DTM and the high resolution coastal DTM production

9 February 2015	Press release	Mailed to multiple users and Hydro International	Presentation of the new February 2015 EMODnet DTM release
22 February 2015	Presentation	Conference: The Irish Geological Research Meeting Belfast	Maria Judge (GSI) presented INFOMAR and European projects that included EMODnet Bathymetry data.
04 March 2015	Presentation	Subsea Cables UK Plenary Meeting No. 44 Dublin	Archie Donovan (GSI) presented “Integrating mapping, innovation, and societal needs for sustainable ocean and resource management.”. Two slides (19,20) were dedicated to: "EMODnet Bathymetry”.
10 March 2015	Presentation	EMODnet Geology Meeting Madrid	GSI gave an update on EMODnet bathymetry.
14 <sup>th</sup> – 16 <sup>th</sup> April 2015	Exhibition and Conference	Ocean Business 2015, National Oceanography Centre, Southampton, UK	EMODnet Bathymetry poster printed and displayed on OceanWise stand. EMODnet slide in rolling OceanWise presentation on exhibition Stand. EMODnet base mapping used within OceanWise product demos and referenced.
13 – 16 April 2015	Conference and presentations	EGU 2015, Vienna, Austria	EMODnet Bathymetry presented by Dick Schaap (MARIS) by oral presentation and poster
21 April 2015	Presentation	ODIP Workshop, Liverpool, UK	EMODnet Bathymetry presentation by Dick Schaap (MARIS) for USA and Australian colleagues
21-24 April 2015	Presentation	EMODnet Seabed Habitat meeting	Presentation of EMODnet bathymetry activities and products at the EMODnet EuSeaMap 2 progress meetings by GeoEcoMar, Romania
24 April 2015	Presentation	Meeting MARIS - IOGP Geomatics Committee, Dublin - Ireland	EMODnet Bathymetry presentation by Dick Schaap (MARIS) for oil and gas companies, discussing possible data contributions
30 April 2015	Seminar presentation	EU Seminar on Standards, Brussels, Belgium	Presentation by Dick Schaap on the power of standards, using SeaDataNet and EMODnet Bathymetry as leads
13-17 May 2015	Poster	The bathymetry of the Eastern Mediterranean Sea region in the framework of EMODnet	11th Panhellenic Symposium on Oceanography & Fisheries «Aquatic Horizons: Challenges & Perspectives»

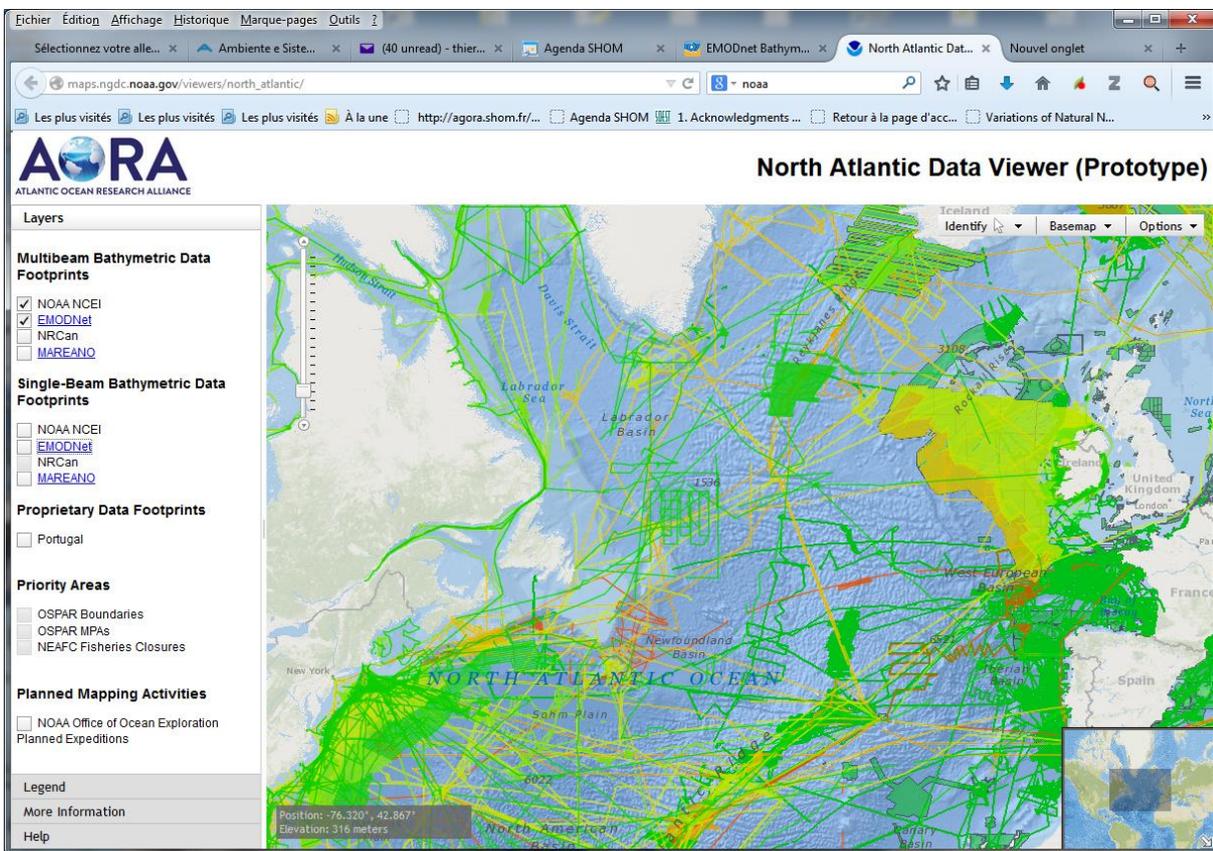
		project - a case study of bathymetric data integration and processing	Mytilene, Lesvos Island, Greece. <a href="http://www.symposia.gr/">http://www.symposia.gr/</a> Presented by HCMR
28 May 2015	Conference	European Maritime Day 2015	The project was presented by Gaël Morvan (SHOM). The presentation had a focus on the approach and achievements up-to-date of EMODnet Bathymetry, the pilot underway for enrichment with high resolution coastal DTMs, the scope of the new Coastal Mapping project, and the EMODnet perspective.
27 <sup>th</sup> – 28 <sup>th</sup> May 2015	Exhibition and Conference	GEO Business 2015, London, UK	EMODnet Bathymetry poster printed and displayed on OceanWise stand. EMODnet slide in rolling OceanWise presentation on exhibition Stand. EMODnet base mapping used within OceanWise product demos and referenced.
04 June 2015	Poster and Presentation	Conference: European Marine Sand and Gravel meeting (EMSAG) Delft, Netherlands	Maria Judge (GSI) presented INFOMAR and European projects that included EMODnet Bathymetry data. Poster also displayed.
15 June 2015	Presentation	EuroGeo 8th, Barcelona	Koen Verbruggen (GSI) presented the opening address and included EMODnet Bathymetry slide.
17 June 2015	Poster	“EMODNET BATHYMETRY”. Recopilación de datos batimétricos en el Margen Atlántico.	WIII SIMPOSIO SOBRE EL MARGEN IBÉRICO ATLÁNTICO – MALAGA. Contribution by IEO.
24 June 2015	Presentation	USGS Visit, GSI, Dublin	Koen Verbruggen (GSI) included EMODnet Bathymetry slide in GSI presentation.
26 June 2015	Presentations	World Hydrography Day, organised by the Hydrographic Society Benelux	Presentations of Dick M.A. Schaap (MARIS) and Marc Roesbeke (HO Belgium)
29 June 2015	Science paper	P. Weatherall, K.M. Marks, M. Jakobsson, T. Schmitt, S. Tani, J.-E. Arndt, M. Rovere, D. Chayes, V. Ferrini, R. Wigley, A New Digital	The article about the new release of the GEBCO 2014 grid references the EMODnet project, of which data are included: <a href="http://onlinelibrary.wiley.com/doi/10.1002/2015EA000107/abstract?campaign=wlytk-41855.4225462963">http://onlinelibrary.wiley.com/doi/10.1002/2015EA000107/abstract?campaign=wlytk-41855.4225462963</a>

		Bathymetric Model of the World's Oceans, Earth and Space Science 10.1002/2015EA000107	
10 September 2015	Hydro International magazine	New EMODnet DTM release	Press release. See: <a href="http://www.hydro-international.com/content/article/EMODnet-bathymetry-dtm-further-expanded">http://www.hydro-international.com/content/article/EMODnet-bathymetry-dtm-further-expanded</a>
20 – 21 October 2015	Conference	EMODnet Jamboree	Presentation in Open Session and participation in follow-up activities
13 December 2015	Conference	AGU 2015 Fall Conference	Presentation at the EarthCube Research Coordination Networks (RCN) meeting
December 2015	Book	Würtz, M. & <u>M. Rovere</u> (eds) (2015). Atlas of the Mediterranean Seamounts and Seamount-like Structures. Gland, Switzerland and Málaga, Spain: IUCN. 276 pages.	The figures of the Atlas illustrating a bathymetric chart of every single seamount have been based on the EMODnet bathymetry. C. Lo Iacono (NOC) contributed to write and edit the Book Chapter: Palomino D., Alonso B., <b>Lo Iacono C.</b> et al., : Seamounts and Seamount-like Structures of the Alborán Sea.
15 – 17 March 2016	Poster	Oceanology International 2016	Poster presentation in MARIS stand at OI2016 in London, UK
20 April 2016	Presentation	EGU 2016	Oral presentation by DMA Schaap at ESS1.1 session of EGU2016 in Vienna, Austria
15 – 17 June 2016	Presentation + Panel member	Forum on Future Ocean Floor Mapping	Organised by GEBCO in Monaco to discuss and formulate a vision for better mapping of the global oceans. Presented EMODnet as member of a panel led by NOAA answering questions and giving suggestions, emphasising potential for international cooperation. Meeting was co-organised by IHO which gave opportunities to strengthen IHO – EMODnet Bathymetry relation. Follow-up will be given to many

			contacts made, also in the frame of the new phase proposal.
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**Cooperation EMODnet – NOAA/NCEI:**

As a result of the efforts put into interoperability, EMODnet Bathymetry and NOAA/NCEI (which manages the world wide bathymetric database DBDB) are collaborating as part of the Atlantic Ocean Research Alliance, an action under the Galway statement of Atlantic Ocean Cooperation between European Union, Canada and United States of America. The figure below illustrates, how the EMODnet WFS service has been combined with the NOAA/NCEI’s WFS service in a prototype North Atlantic Data Viewer ([http://maps.ngdc.noaa.gov/viewers/north\\_atlantic/](http://maps.ngdc.noaa.gov/viewers/north_atlantic/)).



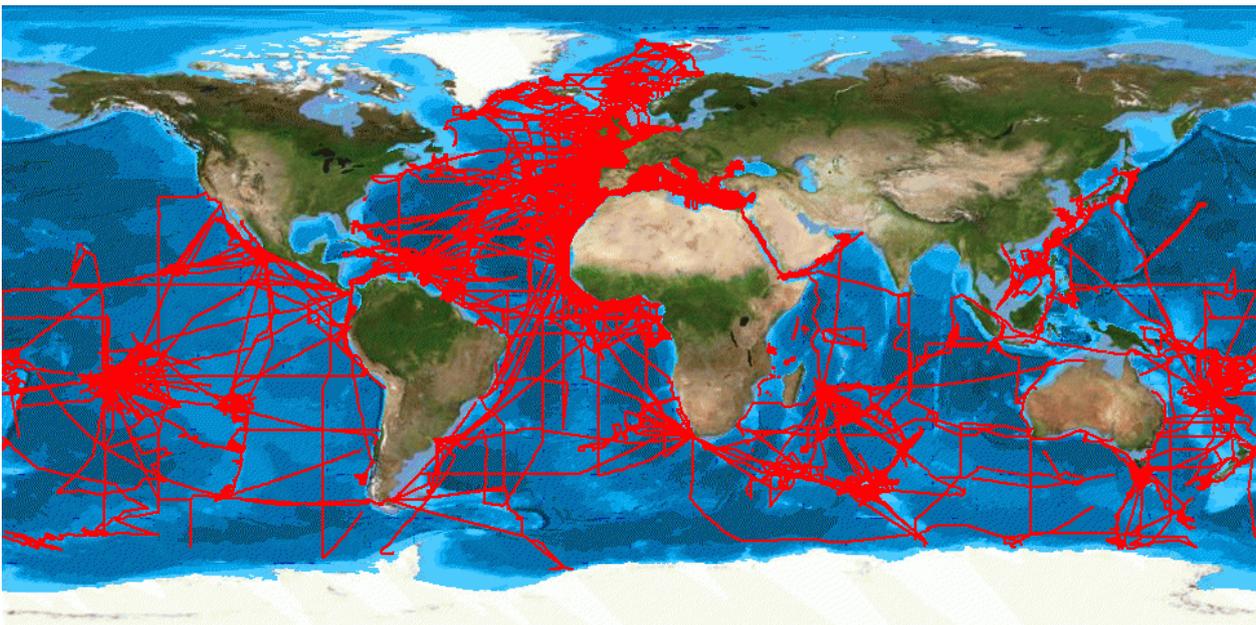
*Image 9.1: Active collaboration between EMODnet Bathymetry and NOAA sharing inventories of bathymetric data, bathymetric DTM products and good practices in interoperability from both USA and Europe.*

## 10. Evolution of Progress Indicators

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### *Indicator 1: Volume of data made available through the portal*

The total number of CDI's for bathymetric survey data sets has increased in the period 1 June 2013 to 30 September 2016 from: **9127 to 14791**



*Image Ind1.1: Overview of CDI's for global waters*

The total in production covers the whole GLOBE. Specifically relevant for European waters has increased from: **6323 to 11505**

Lat Long box: **N80, W-30 ; N20, E45**

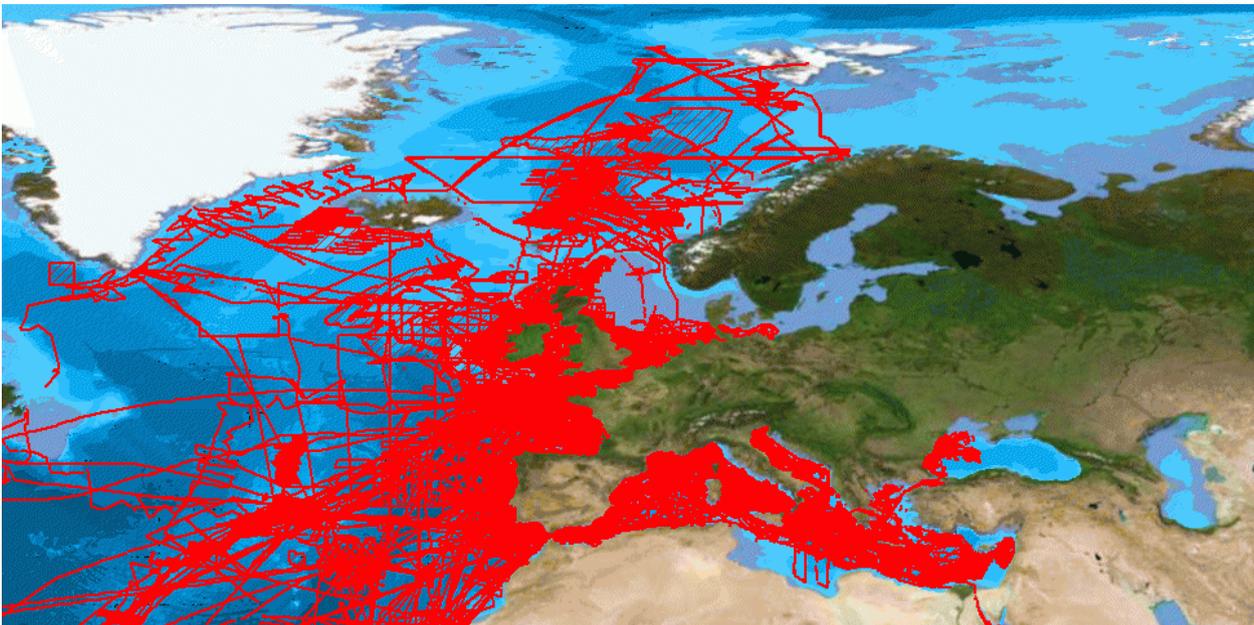


Image Ind1.2: Overview of CDI's for European waters

As can be seen in the image above, the CDI's now also contain entries for the Norwegian Sea, Black Sea and Baltic Sea.

Of these **919** CDI's are unrestricted, while all other require negotiation. Bathymetric survey data are costly to acquire and by most data providers treated with access restrictions which are indicated as part of the CDI metadata. Users can submit requests for access by means of the shopping mechanism in the CDI Data Discovery and Access service. This way data providers are informed about the requests and will contact the users by email or telephone for further discussing their requests. This can lead to positive decisions and delivery of data sets through the CDI Data Discovery and Access service or directly by e-mail by-passing the CDI service. It can also be that no agreement can be reached and then users will not get access to the requested data sets. Anyway the negotiation is an issue between the users and the data providers whereby the CDI service and in particular its Request Status Manager (RSM) service can serve as an instrument, but it can be by-passed. So as EMODnet Bathymetry there is no complete insight in all transactions.

Next to survey data as described in the CDI Data Discovery and Access service, there are also **Composite DTM's** used as source data. These are described with metadata in the Sextant catalogue service. The table below gives a list of the present Composite DTM entries.

Composite DTM	DTM provider	Country	Domain	Type of data	Resolution
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Regional DTM of NL continental shelf	Hydrographic office of NL	Netherlands	Continental shelf	Single beam and multi-beam	125 m
Regional DTM for Norway area	NHS	Norway		Electronic charts NHS	unclear
Regional DTM of Denmark continental shelf	Danish Maritime Agency	Denmark	Continental shelf	Single beam	50 m
Regional DTM of German continental shelf	BSH	Germany	Continental shelf	from German Hydrographic Office	50 m
EMODnet Regional DTM of the Belgium Continental Shelf	Flemish Hydrographic Office	Belgium		single beam and multi-beam	125 m
NHS 50m grid from multi-beam surveys	Norwegian Hydrographic service	Norway	SW Norway	multi-beam	50 m
NHS 50m grid	Norwegian Hydrographic service	Norway	North Norway	multi-beam	50 m
Norway coastal 50 m composite DTM	Norwegian Hydrographic service	Norway	Coasts of Norway	single beam and multi-beam	50 m
Bathymetry_Bay of Biscay	Ifremer	France	from coast to deep ocean	Single beam and multi-beam	1000 m
Adriatic_singlebeam	CNR-ISMAR	Italy	Italian side of the Adriatic Sea	Single beam	200 m
Adriatic_Emia-Romagna	CNR-ISMAR	Italy		Single beam and multi-beam	10 m

West Continental Shelf of Portugal	EMEPC	Portugal		Multi-beam	500 m
EMEPC Central_Continental_Shelf_ Portugal	IPMA	Portugal		Multi-beam (EMEPC sources)	500 m
West Central Continental Shelf Portugal	IPMA	Portugal		(EMEPC sources)	250m
Balear Islands Margin	IEO	Spain	EEZ	Single beam and multi- beam	250 m
Catalan Margin	IEO	Spain		Multi-beam	100 m
Strait of Gibraltar	IEO	Spain		Single beam and multi- beam	100 m
Alboran Sea	IEO	Spain	Alboran Sea	Multi-beam	250 m
Cantabric Sea	IEO	Spain	Cantabric margin	Single beam and multi- beam	200 m
Golfo de Vera (Spain) Margin	IEO	Spain		Multi-beam	200 m
Levante margin	IEO	Spain	Levante margin	Single beam and multi- beam	100 m
South Alboran Sea	IEO	Spain		From IBCM: single beam and multi- beam	unclear
ZEE_GALICIA	IEO	Spain	Galicia margin	multi-beam	460 m
Murcia Margin	IEO	Spain		multi-beam	100 m

Formentera Island South Margin	IEO	Spain	Formentera Island	multi-beam	200 m
ECOMARG	IEO	Spain	Cantabric margin	multi-beam	200 m
Gulf of Cádiz (353_291106)	IEO	Spain		Single beam and multi-beam	200 m
Gulf of Cádiz (353_291219)	IEO	Spain	Gulf of Cadiz	multi-beam	200 m
Gulf of Cádiz (353_291218)	IEO	Spain	Gulf of Cadiz	multi-beam	200 m
Balear Islands South Margin	IEO	Spain		multi-beam	200 m
PAIS_VASCO	IEO	Spain		multi-beam	250 m
Canal Menorca Margin	IEO	Spain	Balear Islands	multi-beam	250 m
MARCONI	IEO	Spain	Cantabric margin	multi-beam	100 m
Catalan margin Coast Brava	IEO	Spain	catalan margin	multi-beam	100 m
Ecocartografia IBIZA - FORMENTERA	IEO	Spain	Balear Islands	multi-beam	225 m
Ecocartografia MENORCA	IEO	Spain	Balear Islands	multi-beam	225 m
Espace-Medit-Continental-Shelf	IEO	Spain	Alboran Sea	multi-beam	225 m
Cyprus-Compilation	Geological Survey of Israel	Israel	Shelf of Cyprus	Composite 25 m grids from single beam	0.25 minutes
Joint Israel National Bathymetric Survey Data	Geological Survey of Israel	Israel	Coast and upper slope	Multi-beam	0,25 minutes

Nile-Delta-UKHO-UKHD-Soundings	Geological Survey of Israel	Israel		Soundings from UKHO – single beam	0.1 minutes
Libya-Italian-HDNO-0.25min	Geological Survey of Israel	Israel	Libyan coast	Italian surveys – single beam	0.25 minutes
Baltic Sea Bathymetry Database	Baltic sea Hydrographic Commission	Sweden		Multiple sources	500 m
Danube Delta marine zone (3339_001)	SC Marine Research	Romania		Side scan sonar	225 m
Baltic Sea – German zone	BSH	Germany		Single beam and multi-beam	.375 arc minutes
DGMW Jade Model A	BSH	Germany		Single beam and multi-beam	1 m
North Sea - German approaches	BSH	Germany		Single beam	115 m
Estonia DTM	Estonian Maritime Administration	Estonia	Estonian territorial waters.	Single beam	50 m
Danube Delta marine zone (3339_002 )	SC Marine Research	Romania		Side scan sonar	225 m
DGMW Baltrum/Langeoog	BSH	Germany	Tidal channel between the German coastal islands Baltrum and Langeoog	single-beam echosounders	1 m
DGMW Elbe Model A	BSH	Germany	German Elbe Approach	single-beam echosounders	1 m

DGMW Ems Model A	BSH	Germany	German Ems Approach	single-beam echosounders	1 m
DGMW Juist/Norderney	BSH	Germany	tidal channel between the German coastal islands Juist and Norderney.	single-beam echosounders	1 m
DGMW Langeoog/Spiekerooog Model A	BSH	Germany	tidal channel between the German coastal islands Langeoog and Spiekerooog.	single-beam echosounders	1 m
DGMW Weser Model A	BSH	Germany	German Weser Approach	single-beam echosounders	1 m
Bulgarian Black Sea South Shore	IO-BAS	Bulgaria	Bulgarian Black Sea South Shore	single-beam echosounders	58 m
Gridded bathymetry from multibeam echosounder ELAC BottomChart MkII data of the cruise POS317/3 (2004)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM120 data of the cruise M72/1 (2007)	MARUM	Germany	Black Sea area Dniepr Canyon	single-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder	MARUM	Germany	Black Sea Palaeo-Dniepr area	multi-beam echosounders	125 m

EM120 data of the cruise M72/2 (2007)					
Gridded bathymetry from multibeam echosounder EM120 data of the cruise M72/3a and M72/3b (2007)	MARUM	Germany	Black Sea areas of Sorokin Trough, the Gudauta Ridge, south of the Kerch Strait, Andrusov Ridge, Gurian Trough	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM120 data of the cruise M72/4 (2007)	MARUM	Germany	Black Sea areas: The Sorokin Trough and Dniepr area	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM120 data of the cruise M72/5 (2007)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM120 data of the cruise MSM15/1 (2011)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM120 data of the cruise MSM15/2 (2011)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM122 data of the cruise M84/2, off Ereğli (2011)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m

Gridded bathymetry from multibeam echosounder EM122 data of the cruise M84/2, off Georgia (2011)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM122 data of the cruise M84/2, off Kerch and the eastern Crimea (2011)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM122 data of the cruise M84/2, off Samsun (2011)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM122 data of the cruise MSM33 (2013)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM122 data of the cruise MSM34/1 (2013)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM122 data of the cruise MSM34/2 (2013)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM122 data of the cruise MSM35 (2015)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder EM12S data of the cruise TTR6/2 (1996)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m

Gridded bathymetry from multibeam echosounder EM710 data of the cruise M72/1 (2007)	MARUM	Germany	Black Sea – Dniiper area west of the Crimea Peninsula	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder HS-DS2 data of the cruise M51/4 (2001)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Gridded bathymetry from multibeam echosounder HS-DS2 data of the cruise M52/1 (2002)	MARUM	Germany	Black Sea	multi-beam echosounders	125 m
Mediterráneo zona MED93S	IHM	Spain	Mediterranean Sea	single-beam echosounders	231.5 m
Svalbard_data_2016	NHS	Norway	Area around Svalbard island	multi-beam echosounders	10 m

Table Ind1.1: Overview of Composite DTM’s as included in the Sextant catalogue service

The number of Sextant entries has increased from 32 composite DTMS from 11 data providers from 11 countries to 77 composite DTMs from 19 data providers from 15 countries. The data providers largely overlap with those contributing with survey datasets as included in the CDI service (see indicator 2).

**Indicator 2: Organisations supplying each type of data based on (formal) sharing agreements and broken down into country and organisation type (e.g. government, industry, science).**

The following table gives an overview of the data providers that have contributed with survey datasets for European waters which are included in the CDI Data Discovery & Access service.

Data Centre	Country	Total No.	No restrictions	Restrictions
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SHOM (SERVICE HYDROGRAPHIQUE ET OCEANOGRAPHIQUE DE LA MARINE)	France	4650	0	4650
Rijkswaterstaat Centrale Informatievoorziening	Netherlands	2165	0	2165
OceanWise Limited	United Kingdom	2066	0	2066
IFREMER / IDM / SISMER - Scientific Information Systems for the SEA	France	716	279	437
Royal Netherlands Navy, Hydrographic Service	Netherlands	313	0	313
IHPT, Hydrographic Institute	Portugal	275	0	275
Flemish Ministry of Mobility and Public Works; Agency for Maritime and Coastal Services; Coastal Division	Belgium	197	0	197
Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre	Greece	76	0	76
Institute of Marine Science (ISMAR) - Bologna	Italy	73	0	73
IEO/Spanish Oceanographic Institute	Spain	66	0	66
Hydrographic Institute of the Navy	Spain	58	0	58
Portuguese Institute of Ocean and Atmosphere	Portugal	53	0	53
British Oceanographic Data Centre	United Kingdom	100	68	32
NIOZ Royal Netherlands Institute for Sea Research	Netherlands	30	0	30
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Infrastructures Division	Italy	23	0	23
Bulgarian National Oceanographic Data Centre(BGODC), Institute of Oceanology	Bulgaria	20	0	20
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography	Italy	10	0	10
GRID-Arendal	Norway	10	0	10

National Institute of Marine Geology and Geoecology	Romania	9	0	9
Marine Technology Unit. Mediterranean Marine and Environmental Research Centre	Spain	6	0	6
Jardfeingi, the Faroe Islands Earth and Energy Directorate	Faroe Islands	5	0	5
Institute of Marine Sciences. Mediterranean Marine and Environmental Research Centre (CMIMA-ICM-CSIC). Department of Marine Geology	Spain	5	0	5
International Ocean Institute - Malta Operational Centre (University Of Malta) / Physical Oceanography Unit	Malta	4	0	4
SC Marine Research SRL	Romania	3	0	3
German Oceanographic Datacentre (NODC)	Germany	256	256	0
Management Unit of North Sea and Scheldt Estuary Mathematical Models, Belgian Marine Data Centre	Belgium	93	93	0
Geological Survey of Ireland	Ireland	223	223	0
<b>TOTALS</b>		<b>11505</b>	<b>919</b>	<b>10586</b>

Table Ind2.1: Overview of data providers for European waters per 30 September 2016

The increase in the period from 1 June 2013 to 30 September 2016 is indicated below.

Data Centre	Country	Total No.	No restrictions	Restrictions
SHOM (SERVICE HYDROGRAPHIQUE ET OCEANOGRAPHIQUE DE LA MARINE)	France	522	0	522
Rijkswaterstaat Centrale Informatievoorziening	Netherlands	2165	0	2165
OceanWise Limited	United Kingdom	1191	0	1191
IFREMER / IDM / SISMER - Scientific Information Systems for the SEA	France	63	209	-146
Royal Netherlands Navy, Hydrographic Service	Netherlands	313	0	313

IHPT, Hydrographic Institute	Portugal	38	0	38
Flemish Ministry of Mobility and Public Works; Agency for Maritime and Coastal Services; Coastal Division	Belgium	160	0	160
Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre	Greece	28	0	28
Institute of Marine Science (ISMAR) - Bologna	Italy	73	0	73
IEO/Spanish Oceanographic Institute	Spain	0	0	0
Hydrographic Institute of the Navy	Spain	58	0	58
Portuguese Institute of Ocean and Atmosphere	Portugal	53	0	53
British Oceanographic Data Centre	United Kingdom	50	51	-1
NIOZ Royal Netherlands Institute for Sea Research	Netherlands	11	0	11
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Infrastructures Division	Italy	19	0	19
Bulgarian National Oceanographic Data Centre(BGODC), Institute of Oceanology	Bulgaria	20	0	20
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography	Italy	0	0	0
GRID-Arendal	Norway	10	0	10
National Institute of Marine Geology and Geocology	Romania	9	0	9
Marine Technology Unit. Mediterranean Marine and Environmental Research Centre	Spain	0	0	0
Jardfeingi, the Faroe Islands Earth and Energy Directorate	Faroe Islands	5	0	5
Institute of Marine Sciences. Mediterranean Marine and Environmental Research Centre (CMIMA-ICM-CSIC). Department of Marine Geology	Spain	5	0	5

International Ocean Institute - Malta Operational Centre (University Of Malta) / Physical Oceanography Unit	Malta	4	0	4
SC Marine Research SRL	Romania	3	0	3
German Oceanographic Datacentre (NODC)	Germany	256	256	0
Management Unit of North Sea and Scheldt Estuary Mathematical Models, Belgian Marine Data Centre	Belgium	0	0	0
Geological Survey of Ireland	Ireland	129	129	0
National Laboratory of Energy and Geology	Portugal	-3	0	-3
<b>TOTALS</b>		<b>5182</b>	<b>645</b>	<b>4537</b>

*Table Ind2.2: Overview of differences for data providers for European waters between 1 June 2013 and 30 September 2016*

*Notes: The data collection of National Laboratory of Energy and Geology (Portugal) has migrated to Portuguese Institute of Ocean and Atmosphere (Portugal); there are a few data providers with no increase, however of those only IEO/Spanish Oceanographic Institute was official partner in the project and they have contributed more composite DTMs which are detailed in the Sextant Catalogue.*

For survey datasets the number of data providers has increased from 15 data providers from 9 countries to 28 data providers from 15 countries.

The following table gives a combined overview of the increase in data providers, countries, and their entries to the CDI and Sextant catalogue services in the reporting period between 1 June 2013 and 30 September 2016. Overall the total number of data providers has increased from 20 data providers from 13 countries to 34 data providers from 19 countries.

Data Centre	Country	CDI Total No now	CDI Total No then	CDI Total increase	Sextant Total No now	Sextant Total No then	Sextant Total increase
Flemish Ministry of Mobility and Public Works; Agency for Maritime and Coastal Services; Coastal Division	Belgium	197	37	160	1	1	0

Management Unit of North Sea and Scheldt Estuary Mathematical Models, Belgian Marine Data Centre	Belgium	93	93	0	0	0	0
Bulgarian National Oceanographic Data Centre(BGODC), Institute of Oceanology	Bulgaria	20	0	20	1	0	1
Danish Maritime Agency	Denmark	0	0	0	1	1	0
Estonian Maritime Administration	Estonia	0	0	0	1	0	1
Jardfeingi, the Faroe Islands Earth and Energy Directorate	Faroe Islands	5	0	5	0	0	0
SHOM (SERVICE HYDROGRAPHIQUE ET OCEANOGRAPHIQUE DE LA MARINE)	France	4650	4128	522	0	0	0
IFREMER / IDM / SISMER - Scientific Information Systems for the SEA	France	716	653	63	1	1	0
German Oceanographic Datacentre (NODC) / BSH	Germany	256	0	256	9	1	8
MARUM	Germany	0	0	0	20	0	20
Hellenic Centre for Marine Research, Hellenic National Oceanographic Data Centre	Greece	76	48	28	0	0	0
Geological Survey of Ireland	Ireland	223	94	129	0	0	0
Geological Survey of Israel	Israel	0	0	0	4	4	0
Institute of Marine Science (ISMAR) - Bologna	Italy	73	0	73	2	2	0
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Infrastructures Division	Italy	23	4	19	0	0	0
OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), Division of Oceanography	Italy	10	10	0	0	0	0
International Ocean Institute - Malta Operational Centre (University Of Malta) / Physical Oceanography Unit	Malta	4	0	4	0	0	0
Rijkswaterstaat Centrale Informatievoorziening	Netherlands	2165	0	2165	0	0	0

Royal Netherlands Navy, Hydrographic Service	Netherlands	313	0	313	1	1	0
NIOZ Royal Netherlands Institute for Sea Research	Netherlands	30	19	11	0	0	0
GRID-Arendal	Norway	10	0	10	0	0	0
Norwegian Hydrographic service	Norway	0	0	0	5	1	4
IHPT, Hydrographic Institute	Portugal	275	237	38	0	0	0
Portuguese Institute of Ocean and Atmosphere	Portugal	53	0	53	2	0	2
National Laboratory of Energy and Geology	Portugal	0	3	-3	0	0	0
EMEPC	Portugal	0	0	0	1	1	0
National Institute of Marine Geology and Geoecology	Romania	9	0	9	0	0	0
SC Marine Research SRL	Romania	3	0	3	2	0	2
IEO/Spanish Oceanographic Institute	Spain	66	66	0	24	18	6
Hydrographic Institute of the Navy	Spain	58	0	58	1	0	1
Marine Technology Unit. Mediterranean Marine and Environmental Research Centre	Spain	6	6	0	0	0	0
Institute of Marine Sciences. Mediterranean Marine and Environmental Research Centre (CMIMA-ICM-CSIC). Department of Marine Geology	Spain	5	0	5	0	0	0
Baltic sea Hydrographic Commission	Sweden	0	0	0	1	0	1
OceanWise Limited	United Kingdom	2066	875	1191	0	0	0
British Oceanographic Data Centre	United Kingdom	100	50	50	0	0	0
<b>TOTAL</b>		<b>11505</b>	<b>6323</b>	<b>5182</b>	<b>77</b>	<b>31</b>	<b>46</b>

Table Ind2.3: Overview of data providers and increases in contributions for survey datasets and composite DTMs for European waters between 1 June 2013 and 30 September 2016

**Indicator 3: Organisations that have been approached to supply data with no result, including type of data sought and reason why it has not been supplied.**

The Danish Geodata Agency (DGA) was a subcontractor in the EMODnet Bathymetry bid, but in practice did not sign the subcontract. Therefore there is no official permission to use the Composite DTM data sets for the Danish waters as earlier used and received in the previous project. The issue has arisen when the Hydrographic Office of Danmark has merged into the Danish Geodata Agency which needs to find part of its funding by charging for geo data, including bathymetry. New negotiations have been successful in the sense that DGA has joined the consortium for the bid for the new phase of EMODnet Bathymetry.

Initially a subcontract has been arranged with DEU – METU from Turkey which manages several survey data sets for the Eastern Mediterranean and the Black Sea. However DEU-METU in practice has not contributed any data sets because permission is required from the Turkish Hydrographic Service (SHODB) which has not cooperated.

Following the EastMed Conference in Cyprus, MARIS has approached the National Institute of Oceanography and Fisheries (NIOF) from Egypt which has survey data in the Nile delta area. This has not worked out because NIOF asked for an unreasonable budget.

A discussion has taken place with OLEX from Norway that collects a lot of bathymetric survey data sets from fishermen in a sort of crowd sourcing mechanism. OLEX already cooperates with GEBCO and thus indirectly with EMODnet Bathymetry as use is made of GEBCO for filling gaps in coverage. However OLEX delivers GEBCO with low resolution bathymetry which is useful anyway for example for covering the central North Sea. SHOM and MARIS have discussed with OLEX to deliver higher resolution bathymetry and to become part of the consortium for the bid for the next EMODnet phase. But OLEX has not accepted the invitation as it feels it might hurt its business model.

As part of the preparation for the bid for the next phase many other hydrographic services and other holders of bathymetry data sets in Europe have been successfully approached.

#### ***Indicator 4: Volume of each type of data and of each data product downloaded from the portal***

Time period 1 June 2013 – 30 September 2016:

##### **CDI – data requests:**

No of CDI basket transactions: **166**

No of CDI's requested: **6701**

Different users: **124**

Different data centres: **24**

**Data products – DTM downloads:**

The EMODnet DTM covers all European seas and can be downloaded as 16 tiles in a number of formats: EMODnet csv, EMODnet excl GEBCO csv, ESRI ASCII, GeoTiff, NetCDF, SD, and XYZ file.



*Image Ind1.3: Overview of tiles for downloading the EMODnet DTM in multiple formats*

**Data products – DTM downloads:**

Tile	Downloads
Greater North Sea	4841
Adriatic-Ionian Sea - C.Meditarrenean	4698
Celtic Seas	4616
Bay of Biscay - Iberian Coast	4484
Aegean-Levantine Sea	4476
West Mediterranean	4452
Madeira	3951
Azores	3923
B3	7042
C3	5096
C4	3381
B2	3185
B4	3081

D4	3042
C2	2855
D3	2187
A4	1105
A3	832
D2	818
A2	772
C1	606
A1	574
D1	540
B1	510
Area of interest	7194
	<b>78261</b>

Table Ind4.1: Overview of downloaded DTM tiles

Format	Downloads
ESRI ASCII	24636
GeoTiff	18084
XYZ	14152
NetCDF	7022
NetCDF (without GEBCO data)	356
CSV	4919
SD	3433
EMO	2065
EMO (without GEBCO data)	959
32 bit float GeoTiff	1380
RGB GeoTiff	1255
	<b>78261</b>

Table Ind4.2: Overview of formats of downloaded DTM tiles

Note: The EMODnet DTM initially covered a number of European seas and could be downloaded per sea region. Since February 2015 the EMODnet DTM covers all European seas and it has been decided to alter the downloading to 16 tiles for a continuous DTM. This comes back in the table. Also a WCS function has been added in June 2016 which enables users to draft and download their own area of interest. This is already quite popular as can be seen from the table.

**Indicator 5: Organisations that have requested and downloaded data sets using the CDI service**

Organisation	Country
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ADCArcheoProjecten	Netherlands
AIR-Worldwide	United States
ANTEA GROUP	France
ASCSA	Greece
Autoritat Portuaria de Balears	Spain
AYESA	Spain
Baker Consultants	United Kingdom
Bundesamt für Seeschifffahrt und Hydrographie	Germany
Cardiff University	United Kingdom
CEFAS	United Kingdom
CNR	Italy
CNRDPA	Algeria
Colorado School of Mines	United States
Cranfield University	United Kingdom
CSIC	Spain
Deltares/Wageningen University	Netherlands
DIHA - Pontificia Universidad Católica de Chile	Chile
Easy Map	Italy
EON	United Kingdom
ESA/ESRIN	Spain
ETHZ	Switzerland
Exeter University	United Kingdom
ExxonMobil	United Kingdom
ExxonMobil	Norway
Fugro	United States
Garmin Italia S.p.A.	Italy
Geological Survey of Ireland	Ireland
Geomar	Germany
Geoxyz	Belgium
Ghent University	Belgium
GMX	Germany
HafenCity Universität	Germany
IEO	Spain
IHM	Spain
IMAR (FCT-UNL)	Portugal

Instituto Português do Mar e da Atmosfera	Portugal
Intacta	Spain
INTECSEA	United States
IRSA-CNR	Italy
Istituto Nazionale di Geofisica e Vulcanologia	Italy
IZOR	France
Knowtra Limited	United Kingdom
Leeds University	United Kingdom
Lynx Informations systems	United Kingdom
Marine Institute	Ireland
MARinha	Aruba
Maritime Zone Solutions Limited	United Kingdom
Mercator Consulting	United States
METEOSIM, SL	Spain
MIRARCO	Cameroon
Mississippi State University	United States
National Oceanography Centre	United Kingdom
NGA	United States
NGDC	United States
Nova Innovation Ltd	United Kingdom
NRL	United States
oceanDTM	United Kingdom
Odyssey Marine	Canada
Periplus Consultancy	Netherlands
Periskal	Belgium
Plymouth University	United Kingdom
private	Switzerland
Private	Spain
private	Spain
private	Spain
private	United States
private	Spain
private	France
private	France
private	France

private	Spain
private	Greece
private	United Kingdom
private	Italy
Royal Netherlands Navy	Netherlands
RVD	Bulgaria
Seascope	United Kingdom
Second Institute of Oceanography, SOA	China
Shell Global Solutions Intl. BV	Netherlands
SHOM	France
Spanish Meteorological Agency	Spain
Swansea University	United Kingdom
TCarta Marine	United States
Technische Universitat Munchen	Germany
Thales	United Kingdom
Tragsatec	Spain
TU Delft	Netherlands
U.S. Geological Survey	United States
ULISES SÁEZ DÍAZ	Spain
ULPGC	Spain
Ulster University	United Kingdom
Universidad de La Coruña	Spain
Universidad de Oviedo	Spain
Università Roma Tre	Italy
Université Rennes 2	France
University of Amsterdam	Netherlands
University of Aveiro	Portugal
University of Cádiz	Spain
University of Cincinnati	United States
University of Kiel	Germany
University of Liverpool	United Kingdom
University of Malta	Malta
University of Sevilla	Spain
University of Southampton	United Kingdom
University of Vigo	Spain
UPC	Spain
UPCT	Spain

UPV	Spain
US Navy	United States
VLIZ	Belgium
Wood Group Kenny	United Kingdom

### **Indicator 6: user statistics**

Time period 1 June 2013 – 30 September 2016:

#### **Bathymetry main portal:**

Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Jun-13	648	1,320	13,381	40,393	2.55 GB
Jul-13	731	1,412	16,485	44,009	3.17 GB
Aug-13	638	1,097	11,742	32,782	1.33 GB
Sep-13	837	1,443	14,158	42,490	3.79 GB
Oct-13	976	1,705	16,857	49,609	4.38 GB
Nov-13	864	1,507	17,665	51,634	4.29 GB
Dec-13	800	1,378	12,119	36,143	2.51 GB
Jan-14	932	1,569	17,827	52,468	3.95 GB
Feb-14	931	1,579	22,536	60,710	3.82 GB
Mar-14	1,039	1,713	19,840	56,544	3.19 GB
Apr-14	984	1,659	20,766	54,708	2.91 GB
May-14	1,002	1,760	18,063	53,529	3.46 GB
Jun-14	995	1,784	17,402	51,169	2.67 GB
Jul-14	988	1,791	15,955	45,079	1.92 GB
Aug-14	933	1,602	12,575	36,651	1.63 GB
Sept-14	1,107	1,954	19,065	52,457	1.70 GB
Oct-14	1,289	2,518	26,742	82,029	3.09 GB
Nov-14	1,343	2,435	19,135	62,204	2.50 GB
Dec-14	1,159	1,950	20,262	62,927	2.32 GB
Jan-15	1,199	2,366	25,138	75,329	2.87 GB
Feb-15	1,567	2,725	28,218	98,671	3.42 GB
Mar-15	1,996	3,246	33,321	113,897	3.36 GB
Apr-15	1,969	3,278	25,305	99,038	2.87 GB
May-15	1,754	2,685	25,470	90,543	2.57 GB
Jun-15	1,578	2,736	23,388	82,184	2.87 GB
Jul-15	1,490	2,595	19,425	72,838	2.56 GB
Aug-15	1,253	2,043	19,949	69,900	1.97 GB

Sep-15	1,499	2,421	22,370	82,108	2.50 GB
Oct-15	1,624	2,599	22,380	89,700	2.68 GB
Nov-15	1,604	2,571	26,905	96,979	2.93 GB
Dec-15	1,397	2,068	21,640	77,783	2.31 GB
Jan-16	1,594	2,298	26,136	86,184	2.50 GB
Feb-16	1,743	2,555	25,091	98,990	3.87 GB
Mar-16	1,811	2,530	26,549	98,548	3.07 GB
Apr-16	1,594	2,287	23,705	90,135	2.69 GB
May-16	1,920	2,856	31,710	108,953	4.34 GB
Jun-16	1,692	2,751	32,316	105,510	3.84 GB
Jul-16	1,565	2,780	24,200	83,669	3.19 GB
Aug-16	5,585	6,821	25,983	76,717	2.48 GB
Sep-16	2,745	4,204	24,454	87,309	3.32 GB
<b>TOTALS</b>	<b>57375</b>	<b>92,591</b>	<b>866,228</b>	<b>2,852,520</b>	<b>117.39 GB</b>

Table Ind6.1: Web statistics for Bathymetry main portal

Note: Unique visitors are users that browse to the portal by internet. The list of visitors is sorted for unique visitors within a monthly period. The number of visits are the number of times that users browse to the portal. Considering the above statistics it seems that visitors browse to the portal on average twice per month. During a visit they browse through various pages of the portal. Again considering the statistics above one could say that circa 10 – 20 pages on average are viewed by the average visitor. Each page can consist of objects such as text and images. These are counted as hits when viewed, so one page can concern multiple hits. Bandwidth indicates the volume of bytes that goes from the server by internet to the webbrowser of the users for displaying the portal pages.

#### Visitors in September 2016:

Hosts (Top 10) - Full list - Last visit - Unresolved IP Address				
Hosts : 1,753 Known, 1,232 Unknown (unresolved ip) 2,745 Unique visitors	Pages	Hits	Bandwidth	Last visit
<a href="#">cable-77-221-24-113.dynamic.vinet.ba</a>	1,067	1,067	16.33 MB	30 Sep 2016 - 10:48
<a href="#">static.ip-031-223-163-117.signet.nl</a>	561	704	6.14 MB	12 Sep 2016 - 11:24
<a href="#">ec2-52-3-127-144.compute-1.amazonaws.com</a>	497	588	9.33 MB	30 Sep 2016 - 13:39
<a href="#">c-76-102-175-67.hsd1.ca.comcast.net</a>	461	1,059	37.48 MB	30 Sep 2016 - 15:23
<a href="#">ec2-52-3-105-23.compute-1.amazonaws.com</a>	404	423	6.13 MB	30 Sep 2016 - 22:42
<a href="#">a83-163-127-252.adsl.xs4all.nl</a>	380	757	11.49 MB	27 Sep 2016 - 12:39
<a href="#">ns3332120.ovh.net</a>	282	282	2.63 MB	30 Sep 2016 - 18:22
<a href="#">31.145.51.13</a>	272	681	24.81 MB	20 Sep 2016 - 14:00
<a href="#">185.27.41.205</a>	270	661	12.45 MB	20 Sep 2016 - 11:56
<a href="#">ns508292.ip-167-114-64.net</a>	259	259	2.41 MB	30 Sep 2016 - 21:10
Others	20,001	80,828	3.19 GB	

#### Bathymetry Viewing and Downloading service:

Activity by Month

Month	Hits	Page Views	Visitors	Bandwidth (KB)
Jun 2013	8,448	3,601	1,736	26,690,251
Jul 2013	7,876	3,403	1,701	16,042,113
Aug 2013	4,909	1,563	1,155	17,711,945
Sep 2013	5,451	1,823	1,245	19,248,883
Oct 2013	4,519	2,256	1,514	40,460,497
Nov 2013	4,965	2,292	1,582	33,138,972
Dec 2013	3,255	1,731	1,302	29,420,103
Jan 2014	3,672	1,826	1,437	25,184,791
Feb 2014	4,100	2,220	1,582	36,013,415
Mar 2014	4,940	2,719	1,898	35,307,821
Apr 2014	4,928	2,472	1,827	36,138,095
May 2014	5,829	2,350	1,742	40,369,840
Jun 2014	5,815	2,484	1,738	57,893,942
Jul 2014	4,761	2,312	1,702	40,943,821
Aug 2014	4,204	1,979	1,478	28,712,019
Sep 2014	5,844	2,881	1,727	38,610,018
Oct 2014	7,242	3,320	2,051	36,249,911
Nov 2014	7,754	3,233	2,292	51,544,505
Dec 2014	9,335	2,911	1,988	34,388,868
Jan 2015	6,907	2,610	1,915	49,199,247
Feb 2015	8,964	4,639	3,279	152,632,203
Mar 2015	13,271	8,478	5,202	163,761,568
Apr 2015	11,613	7,608	5,047	126,096,095
May 2015	9,841	6,625	4,326	100,113,844
Jun 2015	9,343	5,075	3,333	115,090,401
Jul 2015	8,756	4,515	2,678	107,768,584
Aug 2015	8,539	3,956	2,526	112,823,737
Sep 2015	10,057	5,141	3,043	136,748,934
Oct 2015	10,020	5,265	3,265	172,447,131
Nov 2015	15,125	9,407	3,742	197,439,631
Dec 2015	12,309	6,124	4,060	132,575,849
Jan 2016	14,912	7,724	4,303	162,155,290
Feb 2016	14,905	8,313	4,531	166,715,506
Mar 2016	18,959	12,461	4,163	194,868,541
Apr 2016	25,660	17,011	3,145	163,590,089
May 2016	25,105	18,786	3,636	162,368,955
Jun 2016	23,590	17,698	3,355	140,342,278
Jul 2016	16,936	11,715	3,012	89,752,965
Aug 2016	19,857	15,147	2,571	70,145,488
Sep 2016	17,856	13,144	3,118	110,448,476
<b>Total</b>	<b>410,372</b>	<b>238,818</b>	<b>105,947</b>	<b>3,471,154,641</b>

Table Ind6.2: Web statistics for Bathymetry Viewing and Download service

The following tables give more details on origins of users.

Top Hosts

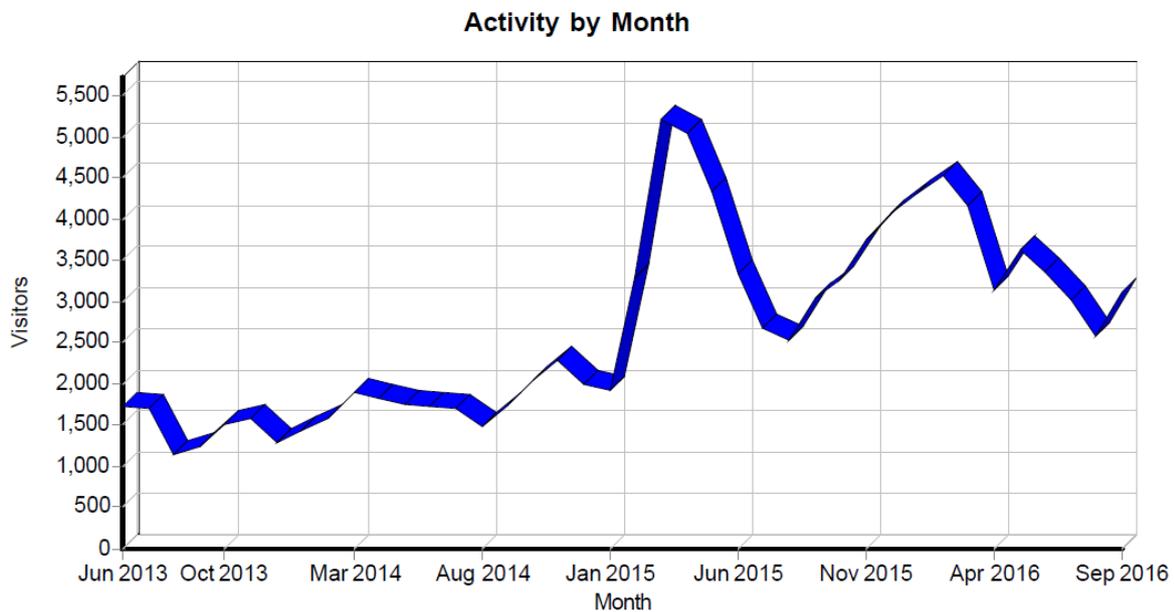
	Host	Country	Hits	Visitors	Bandwidth (KB)
1	static-89-94-157-62.axione.abo.bbox.fr	France	1,119	971	117,932
2	119.63.193.194	Japan	924	924	13,044
3	119.63.193.130	Japan	891	891	12,572
4	119.63.193.132	Japan	872	872	12,280
5	119.63.193.131	Japan	872	872	12,312
6	119.63.193.195	Japan	846	846	11,963
7	119.63.193.196	Japan	811	811	11,445
8	qlx006.quicklynx.nl	Netherlands	2,848	600	0
9	199.19.249.196	United States	1,018	581	184,000
10	unknown.shom.fr	France	1,256	514	29,247,270
11	60.red-192-148-213.customer.static.cogt.telefonica.net	Spain	49,388	469	400,679
12	user.vliz.be	Belgium	1,337	356	5,407,002
13	smtp-out.navionics.com	Italy	936	302	18,239,736
14	ip-166-62-120-219.ip.secureserver.net	United States	2,015	288	362
15	193.182.186.254	Sweden	308	270	1,741,751
16	bolegweb.geof.unizg.hr	Croatia	492	246	4,151
17	static.kpn.net	Netherlands	744	245	9,422,098
18	nat.bo.ismar.cnr.it	Italy	637	237	10,160,537
19	ip-192-169-243-214.ip.secureserver.net	United States	1,463	209	262
20	ip565c1937.direct-adsl.nl	Netherlands	1,071	202	1,939,843
21	ec2-50-18-216-148.us-west-1.compute.amazonaws.com	United States	382	200	3,404
22	a83-163-127-252.adsl.xs4all.nl	Netherlands	500	194	3,062,867
23	bc1.eni.it	Italy	257	190	1,989,853
24	proxy.bsh.de	Germany	374	184	6,174,257
25	91.236.215.6	Netherlands	381	184	7,012,848
26	proxy.ec.europa.eu	Belgium	299	167	1,671,303
27	msnbot-131-253-38-67.search.msn.com	United States	192	160	2,207
28	151.96.254.4	Italy	298	159	3,761,133
29	Nautilus.MathStat.Dal.Ca	Canada	1,110	159	199
30	portal.emodnet-bathymetry.eu	Netherlands	1,184	154	558
31	hercules.ipma.pt	Portugal	643	149	8,626,771
32	sarspam03.dcenr.gov.ie	Ireland	415	146	6,062,218
33	br148-029.ifremer.fr	France	263	144	6,713,997
34	ns516556.ip-192-99-149.net	Canada	412	141	7,426
35	baiduspider-123-125-71-30.crawl.baidu.com	China	142	140	1,340
36	ec2-52-3-105-23.compute-1.amazonaws.com	United States	293	117	1,685
37	baiduspider-220-181-108-105.crawl.baidu.com	China	117	117	1,132
38	85-18-36-49.ip.fastwebnet.it	Italy	337	115	4,380,757
39	baiduspider-220-181-108-108.crawl.baidu.com	China	112	111	1,216
40	baiduspider-220-181-108-77.crawl.baidu.com	China	111	110	1,128
41	ec2-52-3-127-144.compute-1.amazonaws.com	United States	270	106	1,504
42	baiduspider-220-181-108-116.crawl.baidu.com	China	106	105	1,044
43	baiduspider-220-181-108-113.crawl.baidu.com	China	104	103	973
44	garr4.isprambiente.it	Italy	370	103	8,072,050

45	baiduspider-220-181-108-96.crawl.baidu.com	China	102	102	1,008
46	a82-95-67-170.adsl.xs4all.nl	Netherlands	340	101	2,924,363
47	baiduspider-220-181-108-89.crawl.baidu.com	China	101	99	888
48	IP-193-33-2-113.mde.es	Spain	325	99	6,369,381
49	baiduspider-220-181-108-109.crawl.baidu.com	China	99	99	1,005
50	baiduspider-220-181-108-110.crawl.baidu.com	China	98	98	976
<b>Subtotal</b>			<b>79,585</b>	<b>14,762</b>	<b>143,788,751</b>
<b>Total</b>			<b>340,358</b>	<b>105,947</b>	<b>3,459,899,995</b>

**Most Active Countries**

	Country	Hits	Visitors	% of Total Visitors	Bandwidth (KB)
1	China	23,523	19,406	18.32%	17,219,254
2	United Kingdom	36,373	12,126	11.45%	727,184,819
3	United States	25,278	9,592	9.05%	149,006,024
4	Spain	89,593	8,744	8.25%	433,171,047
5	France	17,718	7,581	7.16%	312,219,749
6	Italy	20,625	7,088	6.69%	361,605,531
7	Japan	6,973	6,687	6.31%	6,349,504
8	Netherlands	15,602	4,579	4.32%	188,837,768
9	Germany	12,926	4,063	3.83%	228,114,322
10	Greece	9,124	3,260	3.08%	109,963,676
11	Portugal	7,541	2,412	2.28%	141,009,228
12	Belgium	5,566	1,812	1.71%	86,241,153

13	Sweden	3,706	1,489	1.41%	54,946,528
14	Norway	3,765	1,404	1.33%	105,417,935
15	Ireland	4,222	1,398	1.32%	58,479,684
16	Canada	5,280	1,136	1.07%	27,236,126
17	Turkey	3,630	940	0.89%	33,341,704
18	Denmark	2,737	922	0.87%	54,436,851
19	Russian Federation	2,445	637	0.60%	11,959,199
20	Australia	1,833	592	0.56%	27,693,880
21	Ukraine	1,337	569	0.54%	4,696,672
22	Croatia	1,437	554	0.52%	21,922,333
23	Indonesia	1,126	536	0.51%	1,561,769
24	Romania	1,197	523	0.49%	17,044,530
25	Israel	4,958	502	0.47%	23,511,427
26	Unknown	1,522	467	0.44%	25,653,056
27	Poland	1,132	435	0.41%	13,826,958
28	Cyprus	1,351	420	0.40%	12,953,056
29	India	1,352	410	0.39%	31,311,877
30	Egypt	2,219	383	0.36%	12,426,629
31	Switzerland	970	373	0.35%	10,534,231
32	Brazil	524	336	0.32%	9,520,820
33	Tunisia	1,712	292	0.28%	11,568,195
34	Malta	690	246	0.23%	6,026,751
35	Algeria	5,380	239	0.23%	11,606,866
36	Bulgaria	532	229	0.22%	4,929,005
37	Finland	521	217	0.20%	3,079,641
38	Austria	542	189	0.18%	5,707,874
39	Morocco	1,556	175	0.17%	10,191,940
40	Lebanon	714	147	0.14%	2,998,974
41	Mexico	536	143	0.13%	9,251,323
42	Slovenia	273	133	0.13%	2,203,817
43	Korea, Republic of	352	109	0.10%	2,763,415
44	Lybia	690	104	0.10%	1,773,872
45	Iran	1,546	99	0.09%	3,338,566
46	New Zealand	792	89	0.08%	6,689,072
47	Faroe Islands	172	87	0.08%	4,498,331
48	Saudi Arabia	675	87	0.08%	810,572
49	Iceland	285	86	0.08%	3,204,514
50	Taiwan	187	84	0.08%	508,660
	<b>Subtotal</b>	<b>334,740</b>	<b>104,131</b>	<b>98.29%</b>	<b>3,410,548,754</b>
	<b>Total</b>	<b>340,358</b>	<b>105,947</b>	<b>100.00%</b>	<b>3,459,899,995</b>



***Indicator 7 - List of what the downloaded data has been used for (divided into categories e.g. Government planning, pollution assessment and (commercial) environmental assessment, etc.)***

There is no registration for what purpose users are using the downloaded survey datasets and the downloaded DTM tiles. However generally speaking bathymetry is an important parameter for many applications. Detailed and accurate mapping of the seabed and shallow sub-seabed environment is important for a large number of research, policy, and commercial groups. In particular, the acquisition of swath bathymetry data has become a fundamental dataset for multiple scientific disciplines including physical oceanography, marine geology, and benthic ecology. High-resolution bathymetry data provides an opportunity to characterize the processes which formed and actively govern the physical seabed environment, as well as to provide the necessary boundary conditions for numerical modellers to investigate both active (e.g. oceanographic) and past (e.g. glacial) environmental phenomena. The bathymetry data are also highly complementary to seismic and high-resolution sub-bottom profiler data, together providing a 3-D characterization of the shallow sub-seabed environment.

Bathymetry is also an important parameter next to geological and geophysical parameters for companies involved in the planning and construction of offshore windmill farms which need high resolution geophysical and soil information for calculating the stability of the sea bed conditions. The dredging industry needs high resolution bathymetric, geophysical and soil information of the seabed for quantity and quality of the resources and the presence of obstacles in the sea bed for i.e. deepening and widening of shipping routes, beach nourishment and coastal extensions. The oil- and gas industry needs, besides 3D-multichannel seismics for oil- and gas exploration, bathymetric and geophysical information for the stability of platforms and planning of pipeline routes. Companies involved with ecological issues for the

determination of habitats in the offshore, need images collected with side scan sonar and multibeam for morphological and characterization of the sea bed.

**Indicator 8 -List of web-services made available and user organisations connected through these web-services**

**CDI Data Discovery and Access service:**

The CDI service has WMS and WFS services which are used primarily by the Bathymetry Viewing and Download service for providing a layer of CDI entries and option for retrieving CDI metadata:

WMS and WFS service:

[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography)

GetCapabilities

[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography?service=WMS&request=GetCapabilities](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography?service=WMS&request=GetCapabilities)

Note: Getcapabilities indicates what is available. In CDI case it is both WMS and WFS. Implementing WFS is depending on the client and needs programming. We provide WFS request through WMS:

[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography/?LAYERS=lines&QUERY\\_LAYERS=lines&STYLES=&SERVICE=WMS&VERSION=1.1.1&REQUEST=GetFeatureInfo&BBOX=-25.168107%2C39.506018%2C25.808455%2C64.994299&FEATURE\\_COUNT=10&HEIGHT=290&WIDTH=580&FORMAT=image%2Fpng&INFO\\_FORMAT=text%2Fhtml&SRS=EPSG%3A4326&X=296&Y=129](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography/?LAYERS=lines&QUERY_LAYERS=lines&STYLES=&SERVICE=WMS&VERSION=1.1.1&REQUEST=GetFeatureInfo&BBOX=-25.168107%2C39.506018%2C25.808455%2C64.994299&FEATURE_COUNT=10&HEIGHT=290&WIDTH=580&FORMAT=image%2Fpng&INFO_FORMAT=text%2Fhtml&SRS=EPSG%3A4326&X=296&Y=129)

with BBox as LON,LAT,LON,LAT

for lines

This gives fore example :

CDI-record id	Data set name	CDI-partner	Details
1042015	CH108C_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=1042015">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=1042015</a>
1966304	CH108A_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=1966304">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=1966304</a>
2031067	CH115A_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031067">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031067</a>
2031069	CH119A_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031069">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031069</a>
2031071	CH108B_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031071">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031071</a>

CDI-record id	Data set name	CDI-partner	Details
2031073	CH115B_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031073">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031073</a>
2031075	CH115C_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031075">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031075</a>
2031077	CH117A_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031077">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031077</a>
2031079	CH117A0_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031079">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031079</a>
2031081	CH117B_NAV	British Oceanographic Data Centre	<a href="http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031081">http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031081</a>

Whereby each link points to a CDI detail page :

[http://www.emodnet-hydrography.eu/v\\_cdi\\_v3/print\\_wfs.asp?n\\_code=2031079](http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031079)

And:

[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography/?LAYERS=polygons&QUERY\\_LAYERS=polygons&STYLES=&SERVICE=WMS&VERSION=1.1.1&REQUEST=GetFeatureInfo&BBOX=-25.168107%2C39.506018%2C25.808455%2C64.994299&FEATURE\\_COUNT=10&HEIGHT=290&WIDTH=580&FORMAT=image%2Fpng&INFO\\_FORMAT=text%2Fhtml&SRS=EPSG%3A4326&X=296&Y=129](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography/?LAYERS=polygons&QUERY_LAYERS=polygons&STYLES=&SERVICE=WMS&VERSION=1.1.1&REQUEST=GetFeatureInfo&BBOX=-25.168107%2C39.506018%2C25.808455%2C64.994299&FEATURE_COUNT=10&HEIGHT=290&WIDTH=580&FORMAT=image%2Fpng&INFO_FORMAT=text%2Fhtml&SRS=EPSG%3A4326&X=296&Y=129)

for polygons.

The following images give an illustration of this in the Bathymetry Viewing and Downloading service:

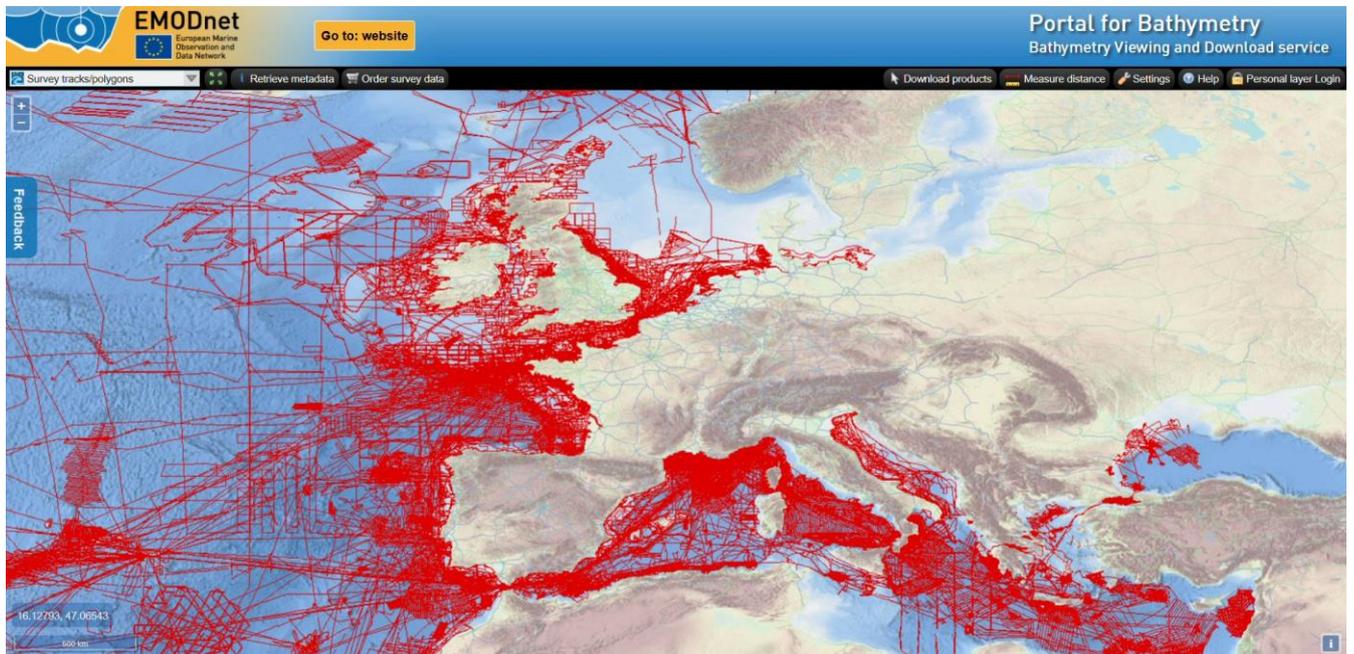


Image Ind8.1: CDI's as WMS layer in Bathymetry Viewing and Downloading service

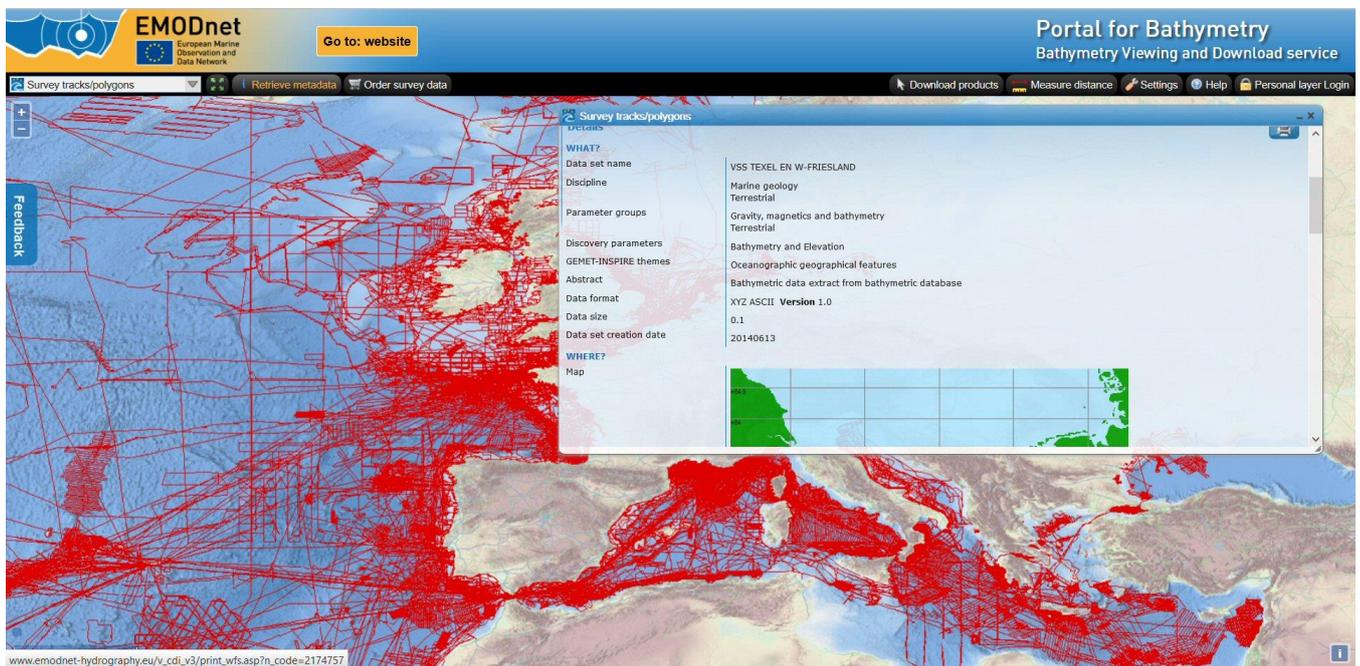


Image Ind8.2: CDI's as WMS layer in Bathymetry Viewing and Downloading service with WFS details

**Bathymetry Viewing and Downloading service:**

There are also OGC compliant web services for various layers in the Bathymetry Viewing and Downloading service which can be found at the following URL's:

WMS: <http://ows.emodnet-bathymetry.eu/wms>

WFS: <http://ows.emodnet-bathymetry.eu/wfs>

WMST: <http://ows.emodnet-bathymetry.eu/wmts>

WCS: <http://v7.geosrv.eu/wcs>

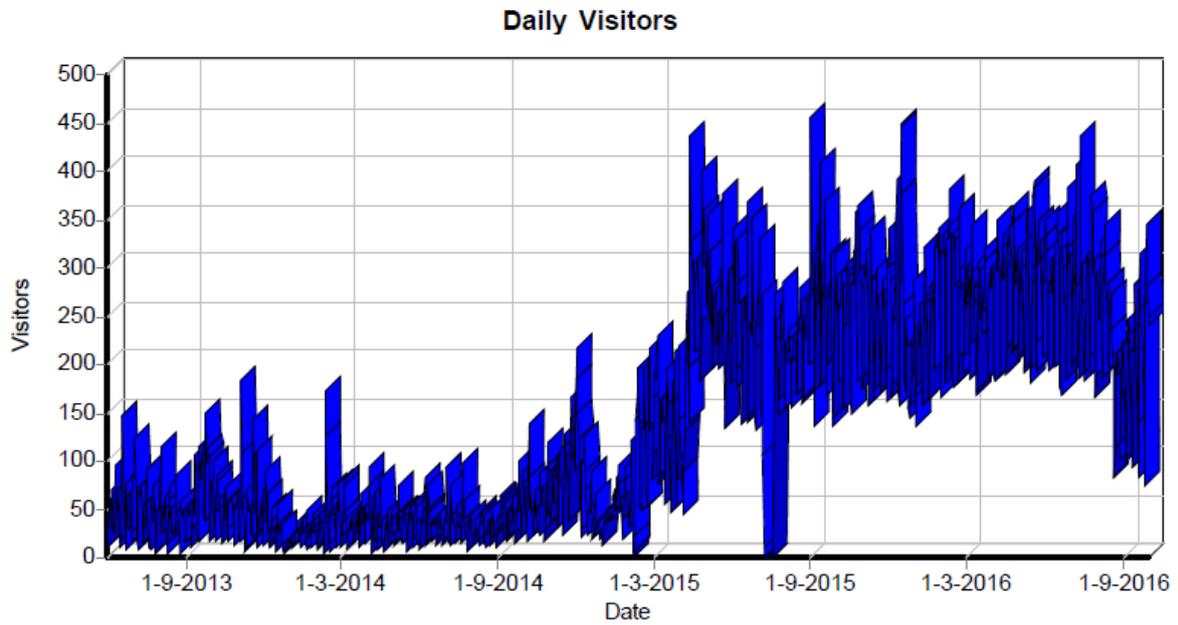
These services concern the following layers:

- Coastlines
- GEBCO undersea features
- Depth contours
- Geographic grid
- High resolution coastal areas (polygons to indicate areas)
- Mean depth full coverage with land
- Mean depth in multi colour
- Mean depth rainbow colour ramp
- Product tiles
- Sea names
- Source references

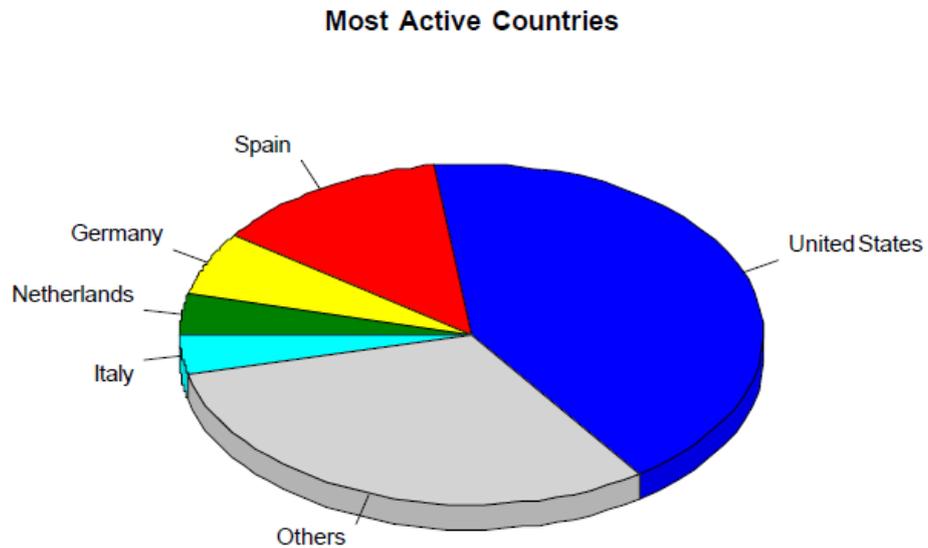
These URLs are advertised in the HELP section and applied by various users. In fact, these services are very popular with more than **170.000** users over the three years as can be seen from the statistics in the tables below.

Page Views	
Total Page Views	42,792,145
Average Page Views per Day	35,133
Average Page Views per Visitor	248.68
Visitors	
Total Visitors	172,078
Average Visitors per Day	141
Total Unique IPs	23,922

The total number of pageviews is more than 42 million, but these is somewhat misleading as a full page can be composed of multiple views. The traffic increased considerably after mid 2015 as can be seen in the graph below.



The top visiting countries and sites are indicated below.

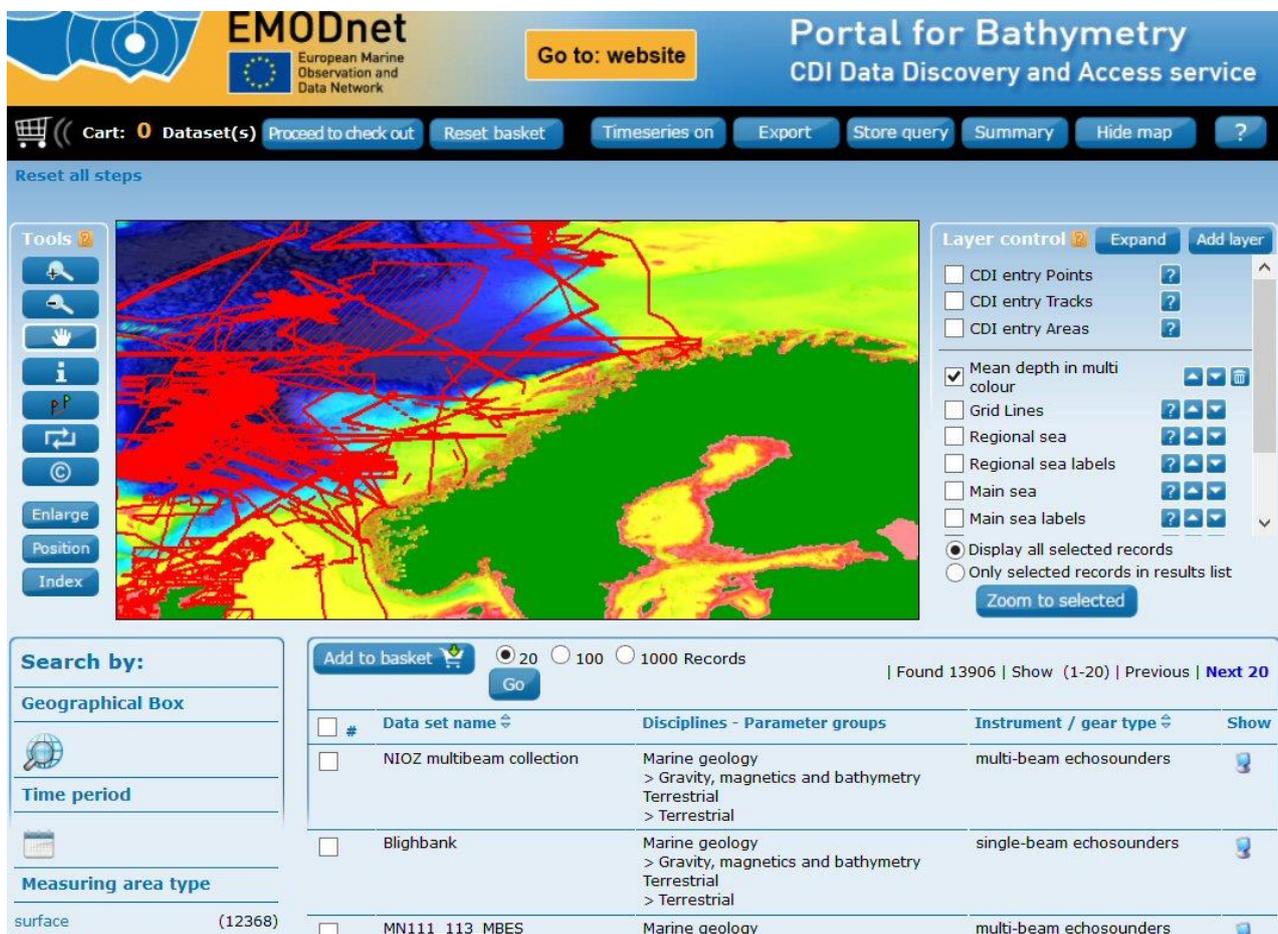


**Top Hosts**

	Host	Country	Hits	Visitors	Bandwidth (KB)
1	82.103.128.63	Denmark	8,681	3,664	131,788
2	130.206.32.66	Spain	2,117,275	3,614	45,970,071
3	178.255.155.2	Italy	7,971	3,281	128,203
4	83.170.113.210	United Kingdom	6,225	3,220	57,073
5	178.255.152.2	Austria	7,917	3,068	51,709
6	94.247.174.83	Sweden	5,164	3,030	15,776
7	46.20.45.18	Germany	5,106	2,676	15,679
8	178.255.153.2	Switzerland	3,379	2,177	10,427
9	178.255.154.2	Czech Republic	6,436	2,119	19,769
10	85.17.156.99	Netherlands	2,023	2,019	169,683
11	95.211.217.68	Netherlands	4,036	2,010	12,319
12	46.165.195.139	Germany	7,365	1,893	22,596
13	130.206.32.226	Spain	443,294	1,768	6,704,631
14	188.138.124.110	Germany	1,915	1,596	58,374
15	37.252.231.50	Ireland	7,024	1,492	21,419
16	208.43.68.59	United States	1,449	1,447	189,100
17	174.34.156.130	United States	1,431	1,428	186,750
18	50.23.94.74	United States	1,104	1,101	109,826
19	184.75.210.186	Canada	1,000	997	130,748
20	213.122.160.70	United Kingdom	11,232	974	19,059,732
21	54.240.150.3	United States	611,315	885	14,237,888
22	76.164.194.74	United States	831	828	108,530
23	188.138.118.184	Germany	4,630	807	108,005
24	188.138.118.144	Germany	805	802	13,301
25	216.137.60.12	United States	528,832	766	8,612,963
26	54.240.156.8	United States	698,927	758	16,909,124
27	95.141.32.46	Italy	2,322	757	24,940
28	216.137.62.96	United States	564,095	727	14,369,973
29	193.144.147.74	Spain	104,388	716	1,538,300
30	216.137.58.42	United States	403,827	701	3,746,848
31	54.240.147.100	United States	330,831	692	3,276,232
32	54.239.166.155	United States	371,049	680	3,611,249
33	54.240.157.54	United States	689,323	679	16,669,987
34	54.240.147.75	United States	548,047	672	13,983,285
35	78.238.210.212	France	492,845	646	1,172,905
36	150.178.42.5	Italy	12,283	643	502,578
37	54.240.145.194	United States	350,619	633	5,684,456
38	184.75.210.90	Canada	628	627	58,651
39	216.137.58.17	United States	417,200	604	9,614,275
40	54.239.166.124	United States	475,124	583	11,770,748
41	54.239.167.79	United States	483,577	581	11,232,015
42	216.137.58.19	United States	485,918	536	9,893,154
43	208.64.28.194	United States	530	530	69,347
44	205.251.208.47	United States	434,188	528	9,542,996

45	205.251.208.142	United States	415,893	520	9,521,124
46	54.240.145.88	United States	214,841	518	2,009,962
47	193.191.134.49	Belgium	6,056	512	551,353
48	216.137.60.17	United States	323,179	500	6,840,369
49	54.240.156.209	United States	228,891	499	2,209,917
50	216.137.62.91	United States	521,399	496	13,165,000
<b>Subtotal</b>			<b>12,372,420</b>	<b>63,000</b>	<b>264,115,173</b>
<b>Total</b>			<b>42,806,294</b>	<b>172,078</b>	<b>963,856,011</b>

Example of the WMS service in another user interface:



The screenshot shows the EMODnet Portal for Bathymetry. The main map displays bathymetry data using a rainbow color ramp (blue for deep, red for shallow) with red tracks overlaid. The interface includes a search bar, a layer control panel on the right with options like 'Mean depth in multi colour' and 'CDI entry Points', and a results table at the bottom. The table lists data sets such as 'NIOZ multibeam collection', 'Blighbank', and 'MN111\_113\_MBES' with their respective disciplines and instrument types.

Image Ind8.3: Mean depth in rainbow colour ramp as WMS layer in CDI Data Discovery and Access service

**RESTful service for Central EMODnet portal:**

Furthermore a special web service has been set up as RESTful service for the EMODnet Central portal to retrieve values and metadata from the Bathymetry Viewing and Downloading service:

[http://rest.n4m5.eu/depth/point?geom=POINT\(-13.11953125%2058.909375\)](http://rest.n4m5.eu/depth/point?geom=POINT(-13.11953125%2058.909375))

with geom is the location in WKT

Please note: %20 is the separator in -13.11953125%2058.909375

This URL retrieves the value table as a JSON:

```
{ "x": -13.11953125, "y": 58.909375, "min": 1528.25, "max": 1530.95, "avg": 1529.63, "stdev": 0.86, "interpolations": 375.0, "elementarySurfaces": 1.0, "smoothed": 1531.91, "smoothedOffset": 0.15, "cdid": "43_1030158", "dtmSou
```

## Annex 1: Composition of the EMODnet Bathymetry consortium

---

No	Organisation	Country
1	Mariene Informatie Service 'MARIS' BV (MARIS)	The Netherlands
2	Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER)	France
3	Service Hydrographique et Océanographique de la Marine (SHOM)	France
4a	Natural Environment Research Council (NERC), National Oceanography Centre (Southampton) (NOC)	United Kingdom
4b	Natural Environment Research Council (NERC), British Oceanographic Data Centre (BODC)	United Kingdom
5	Consiglio Nazionale delle Ricerche - Istituto di Scienze Marine (CNR-ISMAR)	Italy
6	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS)	Italy
7	Instituto Español de Oceanografía (IEO)	Spain
8	Geological Survey of Ireland (GSI)	Ireland
9	Instituto Hidrografico (IHPT)	Portugal
10	Instituto Portugues do Mar e da Atmosfera ( <b>IPMA</b> )	Portugal
11	Hellenic Oceanographic Data Centre-Hellenic Centre for Marine Research (HCMR-HNODC)	Greece
12	Institute of Oceanology Bulgarian Academy of Science (IO-BAS)	Bulgaria
13	Bundesamt für Seeschifffahrt und Hydrographie (BSH)	Germany
14	UNEP/GRID-Arendal (UNEP/GRID)	Norway
15	Instituto Hidrografico de la Marina (IHM)	Spain
16	Maritieme Dienstverlening Kust - Vlaamse Hydrografie (HO Belgium)	Belgium
17	GGG Geo Consultancy (GGSGC)	The Netherlands
18	OceanWise Ltd (OceanWise)	United Kingdom
19	Unitat de Tecnologia - CSIC - CMIMA (UTM-CSIC-CMIMA)	Spain
20	Norwegian Hydrographic Service (HO Norway)	Norway

21	Royal Netherlands Navy - The Netherlands Hydrographic Office (HO Netherlands)	The Netherlands
22	Danish Ministry of the Environment - National Survey and Cadastre - Hydrographic Office (HO Denmark)	Denmark
23	NIOZ Royal Netherlands Institute for Sea Research (NIOZ)	The Netherlands
24	Faroese Earth and Energy Directorate (HO Faroes)	Faroes Islands
25	Dokuz Eylul University, Institute of Marine Science and Technology (DEU-IMST)	Turkey
26	National Institute of Marine Geology and GeoEcology (GeoEcoMar)	Romania
27	University of Malta – MSIDA (UoM)	Malta
28	Marum - Center for Marine Environmental Sciences, University of Bremen (MARUM)	Germany
29	SC Marine Research SRL	Romania
30	Baltic Sea Hydrographic Commission, represented by the Swedish Maritime Administration (SMA)	Sweden
31	General Bathymetric Chart of the Oceans (GEBCO), represented by NERC-BODC	United Kingdom

## Annex 2: Generating a data quality indicator for EMODnet Bathymetry

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### Introduction

The EMODnet Bathymetry DTM is composed of a multitude of datasets from a multitude of data providers. Users of the resulting grid, and more precisely the EMODnet Seabed Habitat Mapping Community needs to be able to evaluate the precision of their prediction based on an evaluation of the quality of the representation of the morphology/bathymetry at the grid node level. The main philosophy of EMODnet is to remain close to the source data. Therefore, data contributors are encouraged to provide a sampling of their source data (see the QA/QC and DTM production guideline). In this document this type of data is referred as “CDI data”. However, some of the data are consisting of composite DTMs for which information relative to the source of the data, the type of sounder, the processing is unknown (or has been globalized to the complete surface of the composite DTM). This type of dataset will be referred as “CPRD data”. This paper gives a framework for the generation of a Quality Indicator that should be homogeneous between the different types of data, relatively easy to implement (with respect to the metadata and statistical attributes readily available), meaningful to the users and coherent with the expert knowledge that members of the EMODnet Bathymetry have. A certain number of hypotheses are being made to implement the “Quality Indicator” and are discussed herein.

### Main orientations

Different approaches can be considered to compute an indicator of the quality for EMODnet Bathymetry. One of them would be to use the CATZOC (Category Zone of Confidence) which is commonly used by Hydrographic Offices to provide an evaluation of the cartographic quality of the data that they put on maps. Although the idea has been suggested and seems reasonable, it is practically impossible to implement it since not all the requested metadata are available. Driven by the available metadata, another approach might be to use the classification of sounders/positioning system as a proxy of quality. In other words, the hypothesis is made that improvements in technology are leading to better precision. Image 1 gives the result of such a study.

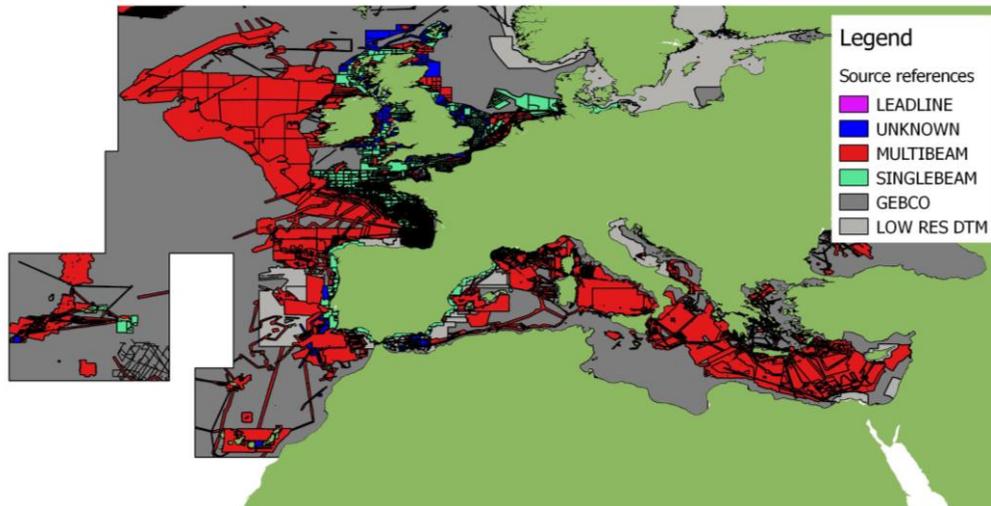


Image 1: type of sources

The acquisition system approach presented above presents an interesting and valuable classification, but might appear to suffer from several limitations:

- It is based on qualitative description of the incoming dataset and provides a qualitative assessment of the complete grid (its interpretation and classification might be subject to discussion in between experts);
- It relates directly to the quality of the metadata themselves (for the acquisition method, they are provided in textual format and might not be describing exhaustively the acquisition system);
- It provides rather a qualitative than a quantitative value enabling to compare at the grid node level;
- It separates CPRD and CDI.

An improvement of this first approach is to take quantitative information that are readily available alongside the EMODnet DTM product. Such information are:

- The age of the dataset (which generally does not suffer from a bias (see below for the case of the CPRDs) and can be considered as correlated with the evolution of the technologies;
- The number of soundings per grid node, which clearly relates to the sampling effort.

In order to combine these two pieces of information, the following equation is proposed as Quality Indicator:

$$quality = \frac{Current\_year - year\_of\_survey}{MAX(Current\_year - year\_of\_survey)} \times \left( 1 - \frac{\log(nbr\_of\_soundings + 1)}{\log(\max(nbr\_of\_soundings + 1))} \right)$$

**The first term** gives a notion of the relative age of the data. Note that this formulation has the advantage that it takes into account new datasets and a new production. **The second term** gives a relative notion

of sampling effort normalized on the local EMODnet grid cell. The log function has been used to artificially “compress” the variability in the number of soundings (0 to several tens of thousands). Note that within the log operator 1 has been added in order to prevent the case where the number of soundings is between 0 and 1 (see below for the case of the CPRDs). The quality indicator is therefore a value ranging from 0 to 1. A low value is considered to be of highest quality while a value close to 1 is considered to be of worst quality. Proxies of the year of the survey and the number of soundings can be approximated for the CPRD DTM (see below).

### Practical steps undertaken to generate the Quality Indicator

1. **Getting access to the spatial coverage of the source references composing the EMODnet DTM.**  
This is done by using the following WFS service <http://ows.emodnet-bathymetry.eu/wfs>. The layer source\_references describes the coverage of individual bathymetric surveys (CDI) and composite DTM (CPRD) that contribute to the final product. Note that only the major contributor is identified while the average depth can be computed from more than one contributor.
2. **Getting access to the Metadata form of all the individual contributions to the EMODnet inventory.** This can be found in the CDI Data Discovery and Access Service ([http://www.emodnet-hydrography.eu/v\\_cdi\\_v3/browse\\_step.asp](http://www.emodnet-hydrography.eu/v_cdi_v3/browse_step.asp), click on Export). This CSV sheet complements the attributes found in the WFS. Both source of information are joined following the local\_CDI field.
3. **Export in .shp file**
4. **Edition of the attributes of the shape file.** In order to ease the comprehension of the content of the attributes, the following fields are preserved in the resulting shapefile: local\_cdi\_Id, type of survey, start or end date. In order to keep only the year of the survey a new attribute called year is added and filled by using the function substr( "cdi\_expo\_4" ,1,4) for the case of the CDI (note that this way the choice was made to use the end date). For the case of the CPRD the year value is added manually and a resolution field had to be added.
5. **Getting access to the number of soundings grid.** This is done by downloading one of the tiles which are part of the EMODnet grid with the .mnt extension. When opening the tile in QGIS, the VSOUNDING layer must be loaded (number of soundings per grid node).
6. **Updating the Vsoundings grid.** This is done in order to take into account the resolution of the CPRDs (see below). To do that the gdal\_rasterize function is used to generate the Vsounding component for the CPRD. Then both of these layers are combined into an improved Vsounding layer.
  - To fill the CPRD Vsoundings like layer (assuming the resolution field in the shp file has been properly filled):  

```
gdal_rasterize.exe -a resolution -tr 0.00225 0.00225 -l emodnet_metadata_ogr "D:/Documents/projet/Encours/_EUROPE/EMODNET/uncertainty_quality/emodnet_metadata_ogr.shp" -te -16.2520833333333350 39.9979166666666686 3.5020833333333314 55.0020833333333314 -tr 0.0020833333333333 0.0020833333333333 -of -where "N3"='DTM' -of netCDF d:\B3_CPRD_resolution.nc
```
  - To merge the CPRD Vsounding with the initial Vsounding (use of GMT command Grdmath, no equivalent found in QGIS raster calc)  

```
Grdmath B3_CPRD_resolution.nc ISNAN Vsoundings.nc B3_CPRD_resolution.nc IFELSE = B3_CDI_CPRD_soundings.nc
```
7. **Generating the year of survey raster layer.** The same gdal\_rasterize function is used on the year attribute layer.

```
gdal_rasterize.exe -a year -tr 0.00225 0.00225 -l emodnet_metadata_ogr "D:/Documents/projet/Encours/_EUROPE/EMODNET/uncertainty_quality/emodnet_metadata_ogr.shp" -te -16.252083333333350 39.99791666666666686 3.502083333333314 55.002083333333314 -tr 0.0020833333333333 0.0020833333333333 -of -where "N3"='DTM' -of netCDF d:\B3_year.nc
```

**8. Computing the Quality Indicator.** The GMT grdmath function is used as follows:

```
Grdmath 2015 B3_year.nc SUB 2015 1829 SUB DIV = B3_relative_age.nc
Grdmath 1 B3_CDI_CPRD_soundings.nc 1 ADD LOG 32768 LOG DIV SUB = B3_intensity_num_soundings.nc
Grdmath B3_relative_age.nc B3_intensity_num_soundings.nc MUL =B3_confidence.nc
```

**Considerations for the CPRDs**

In the case of the CPRDs a further approximation must be made. This must be considered because CPRD DTMs are constituted of multiple sources of data blended together. Therefore, the metadata that were readily accessible for the CDI are not available for the different constituents of the composite DTM. **In the case of the numbers of soundings per node** the following relation is computed:

$$number\_sounding = \left( \frac{res\_EMODNET\_grid}{res\_cprd\_grid} \right)^2$$

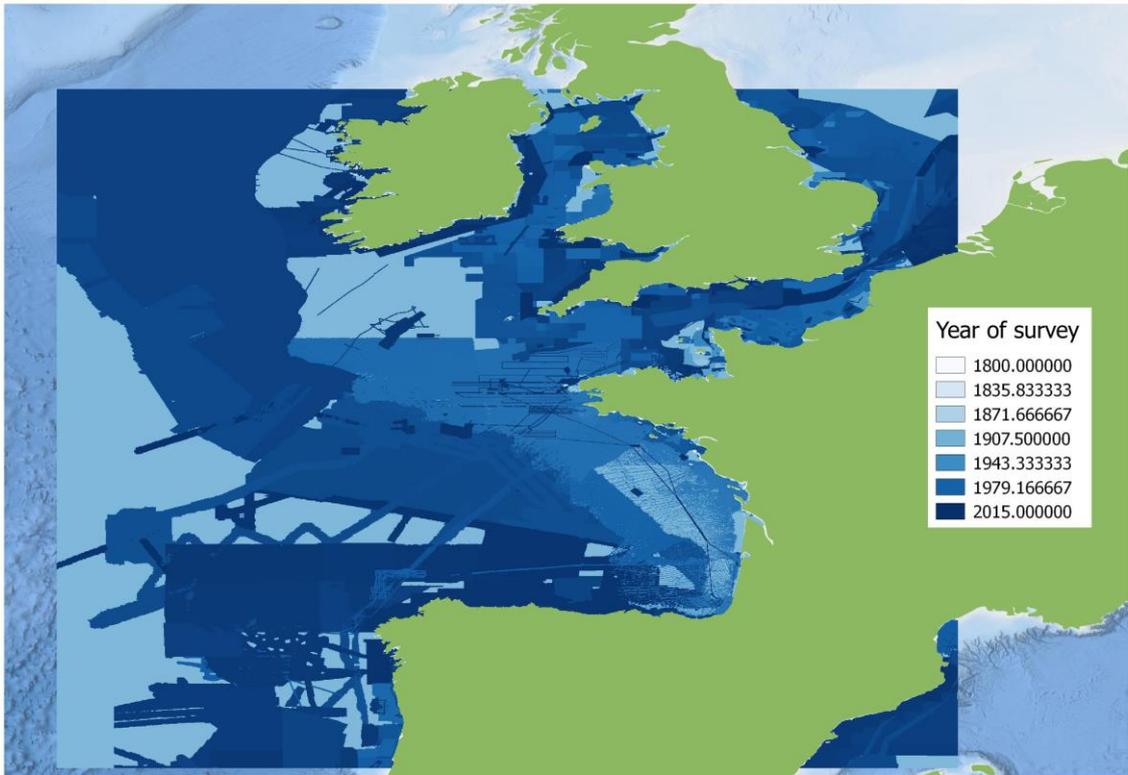
This might lead to decimal values (from 0.26, and sometime below 1. This explains the fact that 1 is added in the log term in the Quality Index equation given earlier in the document) such as for the examples given in the following table.

Composite Grid	Resolution in m	Number of soundings per node
GEBCO_2014	30'' (950m)	0.0.6925
BSBD	500	0.25
DTM_CNR-ISMAR-51	25	100

**The spatial resolution of the CPRD** composite DTM was generally found in the abstract (or sometimes in the Spatial Resolution field, if it exists or has been filled) of the CPRD associated metadata as included in the Sextant catalogue. **In the case of the age of the survey**, it was decided to take the creation date of the DTM (although it does not take in count the fact that the data composing the CPRD DTM are older than this date). This temporal information is the one that is the most commonly filled. However, 1900 is used in the case of the Nile DTM, because the information was not available. For GEBCO also 1900 is used (arbitrary, though 1900 is roughly the beginning of the GEBCO compilation -- note that this artificially dilutes the Quality Index value for the grid nodes filled with GEBCO, but this is reasonable as GEBCO is considered to be of low precision/resolution as it results from inversion of altimetric measurements). While processing the data it was noticed that other temporal information could be used such as the revision date if it exists, and the start/end dates. However those information are not filled homogeneously (missing for some of them, or inconsistent such as start = end date). Formally a way of progress might be to strengthen the robustness of the metadata, and use the start date, as it should give the oldest data in the CPRD dtm, hence giving conservative but consistent temporal information for the quality assessment of the corresponding DEM.

**Results**

Figure 2 illustrates the spatial coverage of the Year of survey raster grid for the B3 tile (including the CPRD and GEBCO). This is the result of point 7 of the method above.



*Figure 2: Example of the repartition of the attribute "year of survey" for the English Channel*

Figure 3 gives the example of the number of soundings per grid node for the B3 tile. This is the result of point 6 of the method. Note the dynamic distribution of this parameter and decimal values related to the computation for CPRD. Note also that both the grids from Fig 2 and 3 are rigorously collocated so that grid computation can be done. This is done by constraining the rasterizing process through the `-te` `-tr` flags in the `gdal_rasterize` command line (`te` for grid extension and `tr` for grid node resolution).

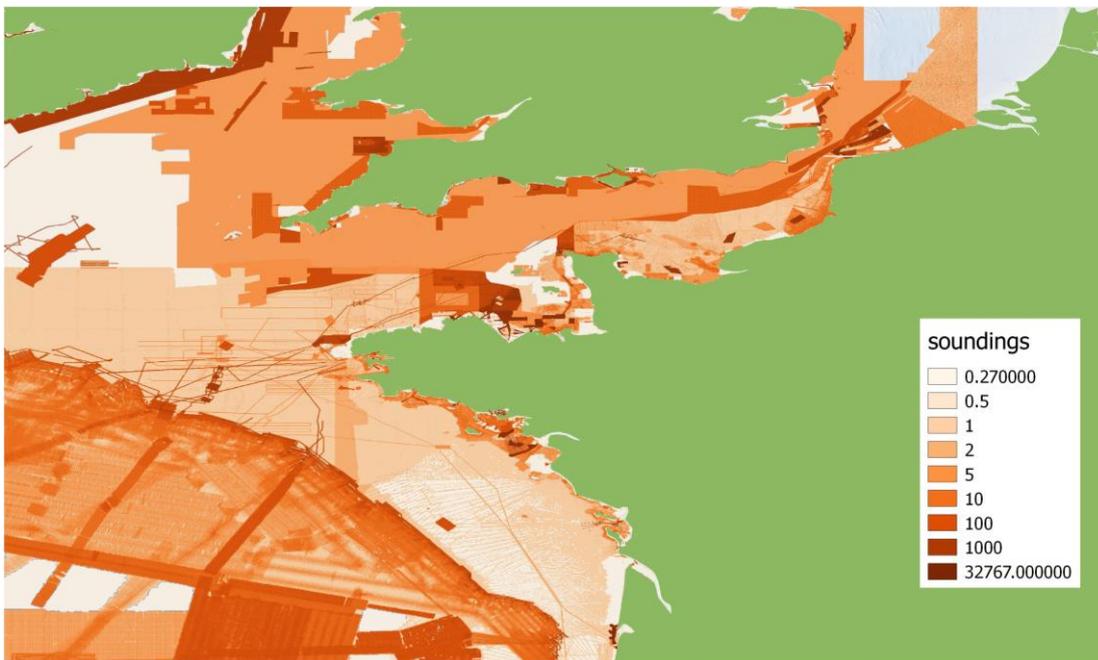


Figure 3: Number of soundings per grid node

Using the equation of the Quality Index given above, implemented through point 8 of the previous section, gives the resulting distribution for tile B3 (Fig4).

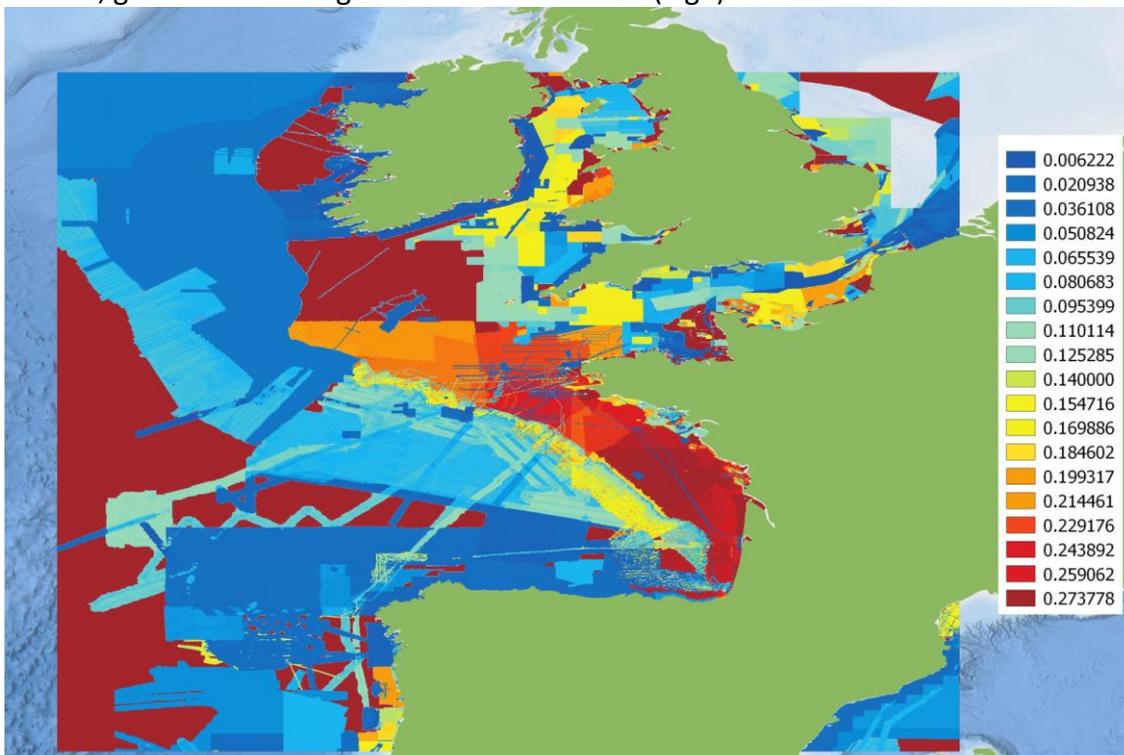


Figure 4: Quality index map

Results are coherent in the fact that they range between 0-1 (actually 0.006 and 0.27). Globally it appears to be consistent with what could be expected:

- GEBCO has a High Quality Index (meaning low quality)
- Modern high resolution Multibeam survey has a low quality Index (meaning of higher quality)

### Generalization to the full EMODnet coverage

From the methodology developed above, a python script has been generated to generalise the procedure on the 16 tiles which compose the EMODnet Bathymetry DTM. This script is given below. It is relatively easy to run as long as QGIS (>2.8) incorporating OSGEO/GDAL library and GMT (>5.1) are available. In the present case it has been run on a LINUX Debian Wheezy machine, within the Ipython framework. Point 6 (vsounding/density wise) is treated as a function. Point 7 (age of the survey) is also the object of a function. From the result of these two function the Index quality layer is computed.

```
#!/usr/bin/ipython
```

```
from osgeo import gdal
import os
import zipfile
```

#### def compute\_vsoundings(tile):

```
# POINT 6 IN THE METHODOLOGY
#Update Vsoundings with CPRD information from the metadata
cprd_resolution_output_file= output_directory+tile+"_CPRD_resolution.nc"
output_CDI_CPRD_soundings= output_directory+tile+"_CDI_CPRD_resolution.nc"
gdal_rasterize_command_line='gdal_rasterize -a resolution -tr '+grid_spacing+' '+grid_spacing+' -l
emodnet_metadata_ogr -te "+ grid_W_border +" " +grid_S_border+ " "+grid_E_border+" "+grid_N_border + ' -where
\'N3=\'DTM\'\' -of netCDF '+ shp_file + ' '+ cprd_resolution_output_file
os.system(gdal_rasterize_command_line)
grdmath_command_line="grdmath -V "+cprd_resolution_output_file+" ISNAN "+original_vsoundings_file_name+"
"+cprd_resolution_output_file+" IFFELSE = " + output_CDI_CPRD_soundings
os.system(grdmath_command_line)
```

#### def compute\_year(tile):

```
#POINT 7 IN THE METHODOLOGY
#get the year of survey proxy field
year_output_file=output_directory+tile+"_year.nc"
gdal_rasterize_command_line='gdal_rasterize -a YEAR -tr '+grid_spacing+' '+grid_spacing+' -l emodnet_metadata_ogr -
te "+ grid_W_border +" " +grid_S_border+ " "+grid_E_border+" "+grid_N_border + ' -where \'N3=\'CDI\'\' OR
N3=\'DTM\'\' -of netCDF '+ shp_file + ' '+ year_output_file
os.system(gdal_rasterize_command_line)
```

#### def compute\_quality\_index(tile):

```
#POINT 8 IN THE METHODOLOGY
#compute the Quality indicator from the year and resolution proxies
#FILE IN
year_output_file=output_directory+tile+"_year.nc"
output_CDI_CPRD_soundings= output_directory+tile+"_CDI_CPRD_resolution.nc"
#FILE OUT
relative_age=output_directory+tile+"_relative_age.nc"
relative_sounding_intensity=output_directory+tile+"_relative_num_sounding.nc"
confidence_layer=output_directory+tile+"_confidence_layer.nc"
#Perform the math
```

```

grdmath_relative_age="grdmath 2015 "+year_output_file+" SUB 2015 1829 SUB DIV = "+relative_age
os.system(grdmath_relative_age)
grdmath_intensity_sounding="grdmath 1 "+output_CDI_CPRD_sounding+" 1 ADD LOG 32768 LOG DIV SUB =
"+relative_sounding_intensity
os.system(grdmath_intensity_sounding)
grdmath_confidence="grdmath -V "+relative_age+" "+relative_sounding_intensity+" MUL = " +confidence_layer
os.system(grdmath_confidence)

```

```

##### MAIN
#####

```

#Specification of the input, output directories

```

src_nc_dataset="/usr/site/data/MIP/BATHY/DEV/MNT/emodnet_quality/data/"
output_directory="/usr/site/data/MIP/BATHY/DEV/MNT/emodnet_quality/result_quality/"
shp_file="/usr/site/data/MIP/BATHY/DEV/MNT/emodnet_quality/projet_QGIS/emodnet_metadata_ogr.shp"

```

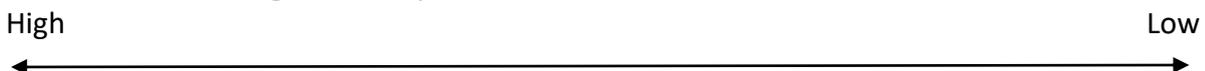
```

for row in 'ABCD':
    for line in '1234':
        tile =row+line
        print(tile)
        #extract data
        nc_zip_file_name=tile+".mnt.zip"
        z=zipfile.ZipFile(src_nc_dataset+nc_zip_file_name,'r')
        z.extractall(output_directory)
        #Access the Vsounding from the NC file
        nc_file_name=output_directory+tile+".mnt"
        original_vsoundings_file_name=output_directory+"VSOUNDING_"+tile+".nc"
        gdal_translate_command="gdal_translate -of netCDF NETCDF:'"+nc_file_name+"':VSOUNDINGS
"+original_vsoundings_file_name
os.system(gdal_translate_command)
        #getting the metadata
        vsoundings_raster=gdal.Open('NETCDF:'+nc_file_name+'VSOUNDINGS')
        #getting the east, west, north, south limits and the grid spacing
        grid_spacing=vsoundings_raster.GetMetadata()["NC_GLOBAL#Element_y_size"]
        grid_N_border=vsoundings_raster.GetMetadata()["NC_GLOBAL#Latitude_TR"]
        grid_S_border=vsoundings_raster.GetMetadata()["NC_GLOBAL#Latitude_BL"]
        grid_W_border=vsoundings_raster.GetMetadata()["NC_GLOBAL#Longitude_BL"]
        grid_E_border=vsoundings_raster.GetMetadata()["NC_GLOBAL#Longitude_TR"]

        compute_vsoundings(tile)
        compute_year(tile)
        compute_quality_index(tile)

```

A better and more adapted color range has to be defined. So far, from a brief analysis of the distribution of the different values of quality, the following color ramp has been generated. All the figures below refer to the following color ramp.



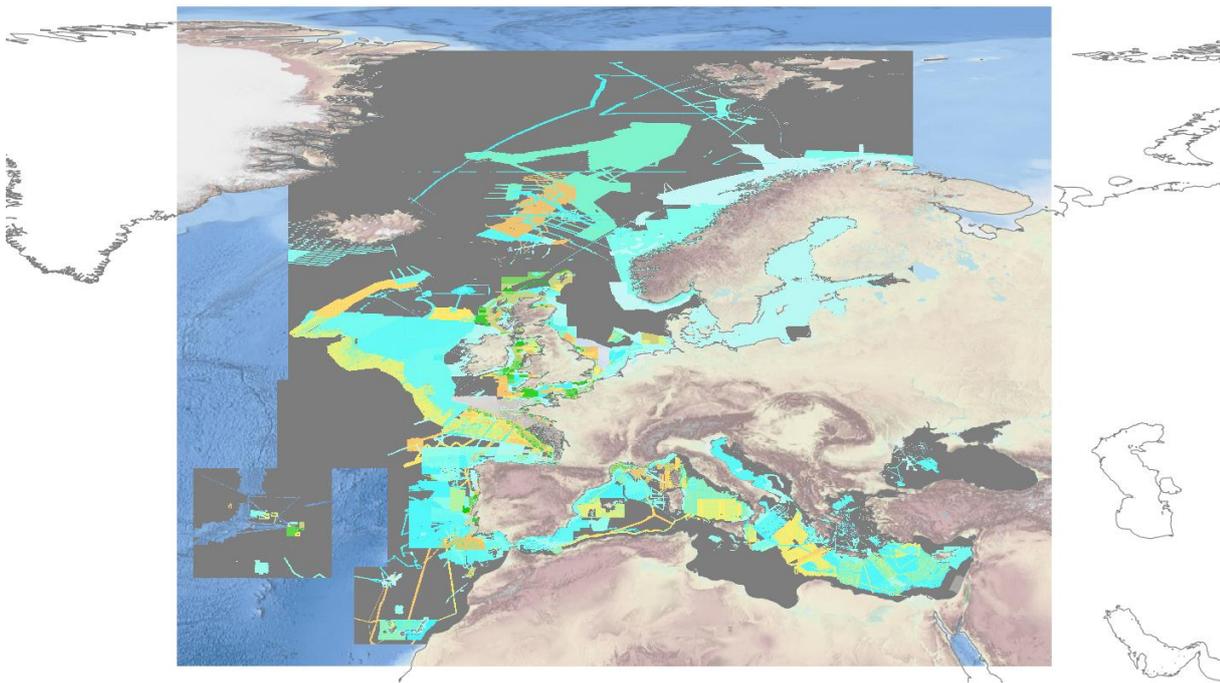
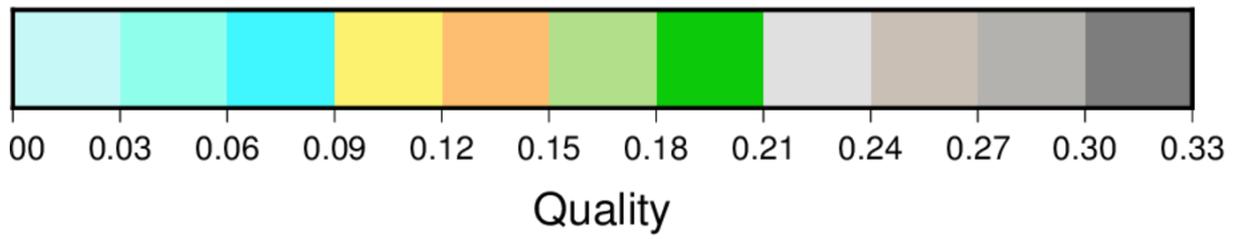


Figure 5 : Quality index for the overall EMODnet coverage.

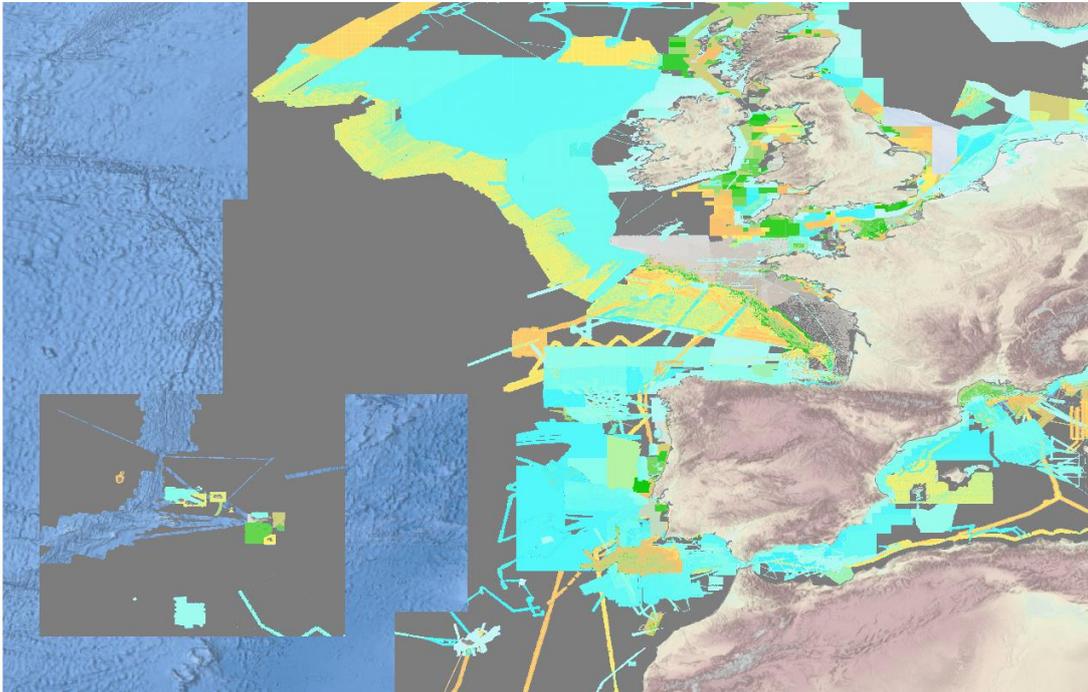


Figure 6: Quality index for the Bay of Biscay/Celtic Sea/Channel/South North Sea areas. (Note the lack of information along the Medio-Atlantic Ridge and at the vicinity of the South East coast of UK)

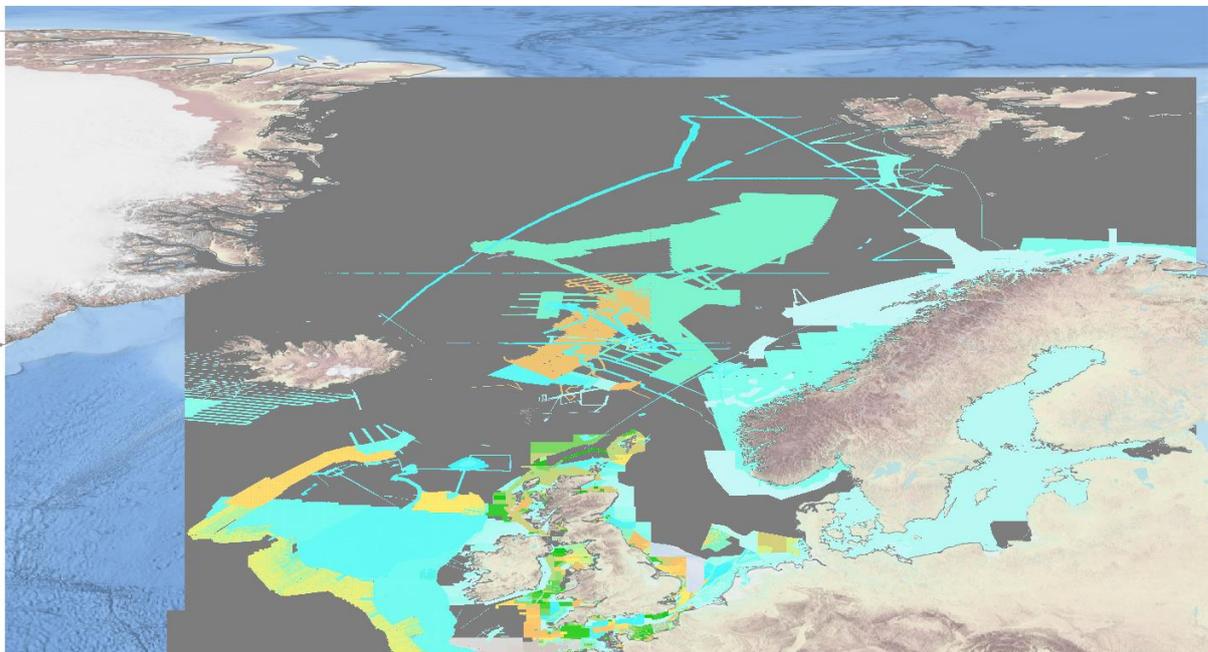
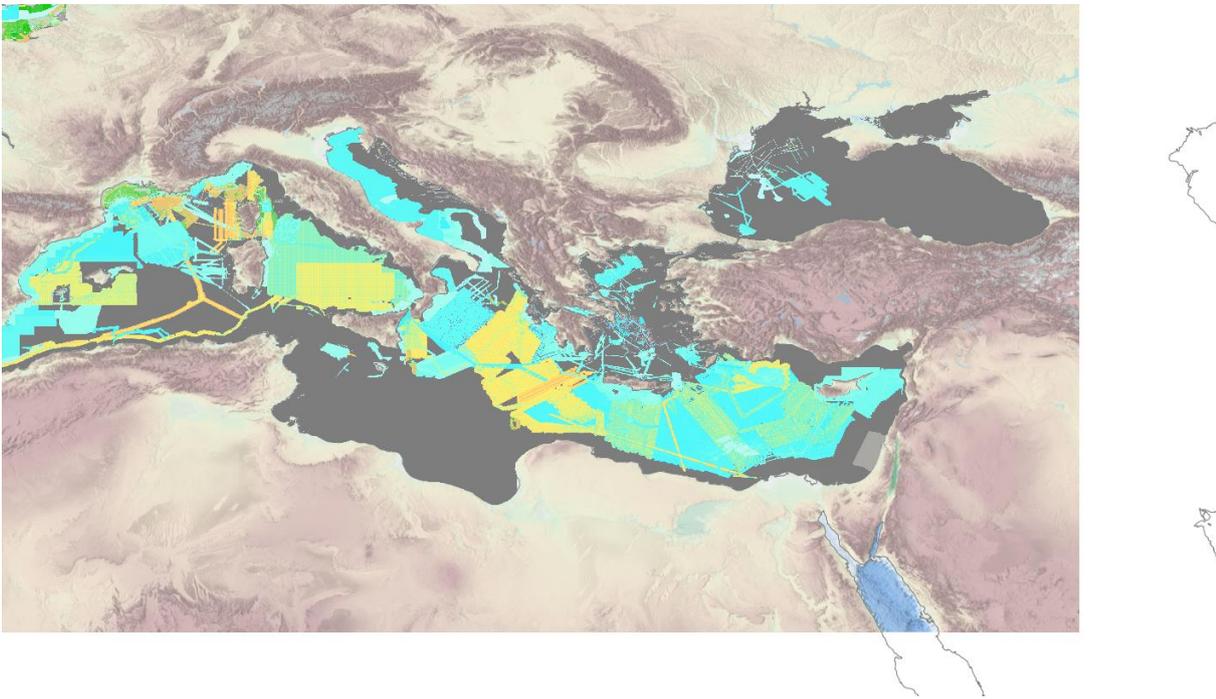


Figure 7: Quality index for the Sub Arctic, Baltic, North Sea, Celtic sea.



*Figure 8 : Quality Index for the Mediterranean/Black Sea area.*

### **Discussion – improvements to be considered**

The Quality Indicator value computed must be interpreted with caution. Actually, what it describes is a gradation between “best data” (0) to “worst data” (1) over the overall coverage. This value does not say anything about precision and accuracy of the source dataset. It is also important to note that there is no consideration in this value related to the different processing stages (tide, vertical datum, flagging of erroneous soundings ...). No matter the way the quality index will be computed or categorized, the confidence in this layer will be intimately related to the quality of the information given in the metadata and in the statistic layer related to the DTM. The following figure illustrates the fact that improper filling of some information, either in the number of soundings or in the metadata is leading to discrepancies. In the case described in Figure 9 (and Figure 6), it appears that there might be an issue in the number of soundings information for the area pointed by the arrow. This might lead to the inability to compute the Quality Index for this area (sea corresponding area in Figure 4). Investigations are undertaken to correct this. Another area with the same issue is located in the Azores area. This also clearly illustrates that a thorough verification of the metadata and the results of the Vsounding layer is needed to further improve the accuracy of the Quality Index.

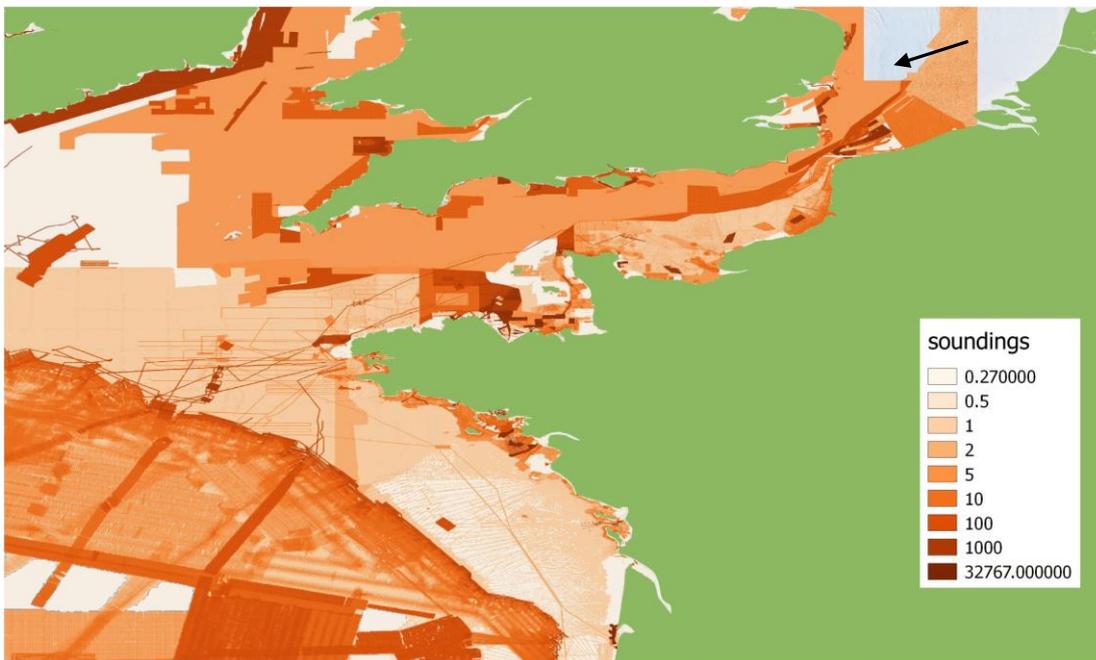


Figure 9: major issue in the computation of the number of soundings

Note that computing the Quality Index for the overall EMODnet coverage might modify substantially the value expressed in Figure 4, considering the fact that datasets may exist that are older than 1829 or with an amount of sounding per grid node above 32767. For practicality, the Quality Index could be reversed. 0 would be low quality and 1 high quality.

**History of the document**

Thierry Schmitt SHOM	25/02/2016	Initial document
Thierry Schmitt SHOM	10/03/2016	Revision following comments from J. Populus, E. Manca, G. Spoelstra and implementation of the analysis of the CPRD.
Thierry Schmitt SHOM	26/04/2016	Correction of the methodology to better take into account the resolution (number of CPRD samples per Emodnet grid). Report on the generalization to all the tiles.

## Annex 3: User feedback and follow-up

---

---

Date: 2013-06-28

Name: Hamid Mustafa Abdelgahar

E-mail: eng-7amed@hotmail.com

Feedback: I am intending to use the Bathymetric data of the English Channel (GeoTIFF) for my dissertation (Desk study for submarine cable routing between England & France). My enquiries are firstly, how can I find information about the equipment used for the bathymetric survey, contractor, date of the survey, resolution (grid size) of the bathymetric data, and IHO standard. Secondly, Is there any copy right statement set by EMODnet that I have to incorporate into my dissertation where ever I use the data. Regards, Hamid

-----

### Reply:

---

----- Original Message -----

**Subject:** Fwd: EMODnet contact form

**Date:** Mon, 01 Jul 2013 12:19:22 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** eng-7amed@hotmail.com

Dear Hamid,

Please include the attached Acknowledgement in your dissertation.

Information about the data collection, such as organisation, instrument etc. is included in the CDI Data Discovery & Access service which you can interrogate in the Data & Metadata section of the portal. It does not give highly detailed metadata, but so-called discovery metadata. We do not have more details, but of course individual data centres as indicated might have additional metadata.

The CDI references (about survey data used) and Sextant references (about composite DTMs used from HOs) are also included in the Grid cells of the DTMs. In case we had no survey data nor composite DTM we refer and used GEBCO info.

Kind regards

Dick M.A. Schaap

Coordinator

---

Date: 2013-07-09

Name: Hamid Mustafa Abdelgahar

E-mail: eng-7amed@hotmail.com

---

Feedback: I have downloaded the ascii XYZ data for the English Channel but when I added the data to ArcGIS, the file comes up empty..would you please help me on that..Kind regards, Hamid

----- Original Message -----

**Subject:** Re: EMODnet contact form

**Date:** Tue, 09 Jul 2013 07:00:28 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** eng-7amed@hotmail.com

Dear Hamid,

First make sure that you have downloaded the full ZIP file, which is indicated in your browser. Depending on



your connection this might take several minutes, because the Celtic Sea XYZ zip file is ca 100 Mb. Thereafter you have to unzip it which releases an xyz file of ca 1.3 Gb. I have just downloaded it myself, and it opens ok.

The file format description with its attributes can be found in:

[http://www.emodnet-hydrography.eu/documents/emodnet\\_hydrography/html\\_page/euco-0901-002\\_dtm\\_exchange\\_format\\_specification\\_v1.5.pdf](http://www.emodnet-hydrography.eu/documents/emodnet_hydrography/html_page/euco-0901-002_dtm_exchange_format_specification_v1.5.pdf)

For loading it into ArcGIS please check the ArcGIS manual or speak to a fellow student with ArcGIS experience.

Hope you succeed.

Kind regards

EMODnet Bathymetry coordinator

=====  
Date: 2013-11-22

Name: David Harrison

E-mail: [d.harrison@fugro.co.uk](mailto:d.harrison@fugro.co.uk)

Feedback: Good morning, My name is David Harrison and I work for a geological consultancy company called Fugro GeoConsulting based in Wallingford in the UK. I was wondering whether you allow for companies to reproduce the bathymetric data, that is downloadable from your map portal, in reports that we issue to our clients? When no site-specific data is available, we often rely on GEBCO data, however for Europe the data you present is of much greater resolution.

Look forward to hearing from you,

David

---

----- Original Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Fri, 22 Nov 2013 09:25:40 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [d.harrison@fugro.co.uk](mailto:d.harrison@fugro.co.uk)

Dear David,

You can use it. However you need to include an acknowledgement which you can find at:

[http://www.emodnet-hydrography.eu/content/content.asp?menu=0360000\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0360000_000000)

We are happy that you like it. We are preparing for wider European coverage and higher resolution to be launched around summer 2014.

Kind regards

Dick M.A. Schaap

Coordinator

=====  
Date: 2013-11-25

Name: Robin Waldman

E-mail: [robin.st.waldman@meteo.fr](mailto:robin.st.waldman@meteo.fr)

Feedback: Hello, I am extracting bathymetry data from the Western Mediterranean sea in netcdf format. I have a doubt on the conversion from x - y coordinate to degree as longitude and latitude are in meters. I didn't find any mention of the meter unit for coordinates. I divide longitude and latitude by 40,000/360 km to have degrees, but I still observe a slight offset on my result (about 0.05°). How should I convert longitude and latitude from meters in x - y projection to degrees ? Thanks in advance, best regards, Robin Waldman, PhD student at CNRM / Météo France

---

----- Original Message -----



**Subject:** Re: Fwd: EMODnet contact form  
**Date:** Tue, 26 Nov 2013 17:18:22 +0100  
**From:** Eric MOUSSAT <[Eric.Moussat@ifremer.fr](mailto:Eric.Moussat@ifremer.fr)>  
**Organization:** IFREMER  
**To:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>  
**CC:** LOUBRIEU <[benoit.loubrieu@ifremer.fr](mailto:benoit.loubrieu@ifremer.fr)>, Jean-Marc SINGUIN <[jean.marc.singuin@ifremer.fr](mailto:jean.marc.singuin@ifremer.fr)>

Hi Dick,

I contacted Robin by phone because mails are returned by Meteo France. He found by himself the solution because he has in the header of NetCDF the bounding box of the grid. The present format is the temporary one using metric coordinates equivalent to lat lon using the value of an arc of latitude of GRS80/WGS84 (I say latitude and not longitude) of 1mn = 1855.4m with a regular grid with square cell. Robin is verifying the conversion. Benoit and I will update the doc By the way, Robin mentioned some problem on the portal when trying to download the grid using other format (altered display of the portal). I asked him to detail the problems. By the way too, he is very happy with the resolution and accuracy of the grid...

Kind regards

I keep you informed anyway

Eric

-----  
 Le 25/11/2013 22:57, Dick M.A. Schaap a écrit :

- > Dear Benoit or Eric,
- >
- > Can anyone of you help and answer this person?
- >
- > Thanks

=====  
 Date: 2013-12-01  
 Name: abduladim  
 E-mail: al\_maitig@yahoo.com  
 Feedback: thanks million its a useful map

**No reply given, because seen as encouragement .**

=====  
 Date: 2013-12-02  
 Name: borja  
 E-mail: baguilo@gmail.com  
 Feedback: First of all I would like to thank the people involved in the development of this fantastic tool. I would like to just comment how useful would be the ability to donwload certain data by defining two coordinate locations. This will reduce the amount of data to be downloaded and would accelerate the postprocess of it.

Thanks again!

Best regards,

Borja Aguiló

**No reply given, because seen as suggestion.**

=====  
 Date: 2013-12-31  
 Name: ruud  
 E-mail: ruud.vanwijk@upcmail.nl



Feedback: perfect project thanks for using it.  
Ruud (Netherlands)

---

**No reply given, because seen as encouragement**

---

Date: 2014-01-06

Name: Zohar Gvirtzman

E-mail: [zohar@gsi.gov.il](mailto:zohar@gsi.gov.il)

Feedback: I downloaded bathymetry of the Easternmost Mediterranean. How do I cite it? Thanks. Zohar

---

**Reply:**

----- Original Message -----

**Subject:**Re: EMODnet contact form

**Date:** Mon, 06 Jan 2014 11:04:55 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [zohar@gsi.gov.il](mailto:zohar@gsi.gov.il)

Dear Zohar,

Please use the acknowledgement as available at the portal:

[http://www.emodnet-hydrography.eu/content/content.asp?menu=0360000\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0360000_000000)

Kind regards

Dick M.A. Schaap

Coordinator

=====  
Date: 2014-01-09

Name: C. COCHET

E-mail: [cochetc@gmail.com](mailto:cochetc@gmail.com)

Feedback: Hello, This tool could prove very useful. Could specify the reference taken for the bathymetric data (depth): is Chart Datum or Mean Sea Level or another reference?

Best regards,

C. C.

---

**Reply:**

----- Original Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Thu, 09 Jan 2014 14:15:58 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [cochetc@gmail.com](mailto:cochetc@gmail.com)

It is LAT

=====  
Date: 2014-01-22

Name: Duncan Fraser

E-mail: [dunacn.fraser@blueyonder.co.uk](mailto:dunacn.fraser@blueyonder.co.uk)

Feedback: login details you provided tonight are invalid

-----  
**Reply:**

----- Original Message -----

**Subject:**Re: Fwd: Registration request for SeaDataNet

**Date:** Wed, 22 Jan 2014 13:43:24 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>



**To:** Duncan Fraser <duncan.fraser@blueyonder.co.uk>

Dear Duncan,

You have registered and received the LOGIN details from SeaDataNet and these are valid for requesting access to data sets as managed in the so-called CDI Data Discovery and Access service. You can find this service at the EMODNet Hydrography portal at:

[http://www.emodnet-hydrography.eu/content/content.asp?menu=0280000\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0280000_000000)

and then:

[http://www.emodnet-hydrography.eu/v\\_cdi\\_v3/browse\\_step.asp](http://www.emodnet-hydrography.eu/v_cdi_v3/browse_step.asp)

The LOGIN details are relevant, once you have identified relevant data sets, included these in your shopping basket and then want to submit your data request to the related data centres. Moreover you need the LOGIN details for checking by the RSM service the progress of your requests.

[http://www.emodnet-hydrography.eu/content/content.asp?menu=0300000\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0300000_000000)

and then:

<http://seadatanet.maris2.nl/request/welcome.html>

I have checked the validity of your LOGIN and it works fine.

So please try again.

Regards

Dick M.A. Schaap

PS: for downloading the Bathymetry DTMs you do not need any LOGIN, but simply can do that from the Data Products page using the Bathymetry Viewer and its functions:

[http://www.emodnet-hydrography.eu/content/content.asp?menu=0310000\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0310000_000000)

then

[http://www.emodnet-hydrography.eu/content/content.asp?menu=0310019\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0310019_000000)

On 22-1-2014 13:31, Duncan Fraser wrote:

as requested

Begin forwarded message:

**From:** Duncan Fraser <[duncan.fraser@blueyonder.co.uk](mailto:duncan.fraser@blueyonder.co.uk)>

**Subject: Re: Registration request for SeaDataNet**

**Date:** 21 January 2014 23:05:45 GMT

**To:** "[noreply@seadatanet.org](mailto:noreply@seadatanet.org)" <[noreply@seadatanet.org](mailto:noreply@seadatanet.org)>

The login is invalid

Sent from my iPhone regards Duncan

On 21 Jan 2014, at 22:30, [noreply@seadatanet.org](mailto:noreply@seadatanet.org) wrote:

Welcome to SeaDataNet

Your personal identification is :

Login : df312e9

Passwd : rh751RHD

Please, note this identification is strictly individual and provided within the terms of SeaDataNet data licence.

You can check/change your personal information :

<https://www.ifremer.fr/AAARegistration/faces/UserPersonalInformation.jsp>

=====  
Date: 2014-02-17

Name: Emmanouil I.Konstantinidis



E-mail: ekonstan@pme.duth.gr

Feedback: Dear Sirs/Madame, I would like to use one of your maps in a paper that will be published in a scientific journal. Could you please provide me with written permission to do so?

Thank you in advance

Emmanouil I. Konstantinidis

-----  
**Reply:**

----- Original Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Mon, 17 Feb 2014 22:51:20 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** ekonstan@pme.duth.gr

Dear Emmanouil,

It is ok, but please make use of the EMODNet acknowledgement. See:

[http://www.emodnet-hydrography.eu/content/content.asp?menu=0350000\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0350000_000000)

Also I will appreciate a PDF of your publication / paper.

Regards

Dick M.A. Schaap

Coordinator

=====  
Date: 2014-03-24

Name: Borja Aguiló

E-mail: borja.aguilo-portulas@power.alstom.com

Feedback: I would make the color scale adaptable to what is actually being shown in the screen. Otherwise when you zoom-in you don't see an appreciable change in depth for example.

Thank you very much for the great data and website.

**No reply given, because seen as suggestion.**

=====  
Date: 2014-04-03

Name: Antoine Patru

E-mail: apatru@ethz.ch

Feedback: I've registered under SeaDataNet User Register but I can't access the login in the interactive tool with bathymetric data! How can I proceed?

-----  
**Reply**

----- Original Message -----

**Subject:** Re: EMODnet contact form

**Date:** Fri, 19 Sep 2014 17:25:48 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** apatru@ethz.ch

Dear Antoine,

Sorry for the delay in answering. However access to the bathymetry viewer service and downloading of the DTMs is free and requires no logon.

The SeaDataNet user register is applicable if you want to request access to data by the CDI data discovery and access service.



Hope this helps.  
Regards  
Dick M.A. Schaap  
Coordinator

=====  
Date: 2014-04-07  
Name: Mehran Eskandari  
E-mail: mxe043@bham.ac.uk  
Feedback: Dear Sir/Madam, I am a PhD student at University of Birmingham and I am preparing a journal paper to be submitted to the Energy Policy Journal. Therefore can I ask for your permission to include a map from your on line service please.  
Regards  
Mehran Eskandari

-----  
**Reply:**  
----- Original Message -----  
**Subject:**Re: Emodnet-Hydrography Feedback form  
**Date:** Tue, 08 Apr 2014 18:02:31 +0200  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** mxe043@bham.ac.uk

Dear Mehran,  
That is fine, but please include an acknowledgement as specified here:  
[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0360000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0360000_000000)  
Kind regards  
D.M.A. Schaap  
Coordinator

=====  
Date: 2014-04-10  
Name: Boris  
E-mail: [Boris.espinasse@uin.no](mailto:Boris.espinasse@uin.no)  
Feedback: Hei, I am very interested by the bathymetry data in Norway sea, especially to use it with Ocean Data View I see on the website that you mention an availability date around mi-2014, have you more information?

-----  
**Reply:**  
----- Original Message -----  
**Subject:**Re: EMODnet contact form  
**Date:** Thu, 10 Apr 2014 14:03:15 +0200  
**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>  
**To:** [Boris.espinasse@uin.no](mailto:Boris.espinasse@uin.no)  
Dear Boris,  
We are working on this together with GRID-Arendal, Norwegian Hydrographic Service and Norwegian Petroleum Directorate and hope to be publish the 1st version of the DTM by end June - mid July 2014.  
Regards  
DMA Schaap  
Coordinator



Date: 2014-06-03  
Name: Felix Schalck  
E-mail: felix.schalck@gmail.com  
Feedback: Awesome job! Would love to see the whole thing vectorized. Continue the great work, Felix

-----  
**No reply given, because seen as encouragement.**

=====  
Date: 2014-06-29  
Name: Louis Hough  
E-mail: nancy244@centurytel.net  
Feedback: I truly appreciate the work you have done in assembling this data base. Am also interested in how soon you will complete the new additions.

-----  
**No reply given, because seen as encouragement**

=====  
Date: 2014-07-21  
Name: Magne  
E-mail: [rudy.magne@meteogroup.com](mailto:rudy.magne@meteogroup.com)  
Feedback: Dear Emodnet team, I have seen on the website that a new bathymetry dataset will be released around June 2014. Do you know when you plan to make these new data available? By the way, thanks for this EMODNET initiative to make accurate hydrographic data available. Best regards Rudy Magne

-----  
**Reply:**

----- Original Message -----

**Subject:** Re: EMODnet contact form  
**Date:** Fri, 19 Sep 2014 17:08:52 +0200  
**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>  
**To:** [rudy.magne@meteogroup.com](mailto:rudy.magne@meteogroup.com)

Dear Rudy,  
Very good to hear that you appreciate our efforts. Unfortunately we have some delay with the release of the higher resolution version with wider geo coverage, but hope to have it public before the end of the year or rather earlier.  
Kind regards,  
Dick M.A. Schaap  
Coordinator

=====  
Date: 2014-07-28  
Name: Stavros Stylianou  
E-mail: [stylians@ucy.ac.cy](mailto:stylians@ucy.ac.cy)  
Feedback: Hello, I have downloaded the bathymetry for Aegean-Levantine Sea in NetCDF file format and when I open it with ArcMAP as raster I see that there is something wrong with the bathymetry around Cyprus. There is something like a square around the island ... I would have sent images but I cannot through this contact form.  
Best Regards Stavros Stylianou

-----  
**Reply:**

----- Original Message -----

**Subject:** Re: EMODnet contact form  
**Date:** Mon, 28 Jul 2014 14:11:57 +0200



**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [stylians@ucy.ac.cy](mailto:stylians@ucy.ac.cy)

Dear Stavros,

We are aware of this issue and it will be repaired in the next release, planned around end August 2014.

Regards,

Dick M.A. Schaap

Coordinator

---

**Feedback received via EMODnet Secretariate at 11th June 2014 from users at the EMD in Bremen – Germany :**  
**Case Study 1: Dr. Gianandrea Mannarini (CMCC)**

Region: Sicily channel area

Contact:

CMCC - Centro Euro-Mediterraneo sui Cambiamenti Climatici

post address : Via Augusto Imperatore 16, piano 1, 73100 Lecce (Italy)

tel. : [+39-0832-6710-35](tel:+39-0832-6710-35)

e-mail : [gianandrea.mannarini@cmcc.it](mailto:gianandrea.mannarini@cmcc.it)

web : <http://www.cmcc.it/website/people/mannarini-gianandrea>

I send attached a comparison of EMODnet (15 arcsec) with GEBCO\_08 (30 arcsec) and MedOneMin (stemming from NOAA, 60 arcsec) bathymetry in the Sicily channel area.

As you will notice, multibeam artifacts are visible in the EMODnet field, especially close to Malta island.

**Case study 2: Dr. Marco Zavatarelli (Bologna University)**

Region: Croatian island region (Northern adriatic region)

Downloaded: July 2013

Please find attached the following two files containing the Northern adriatic bathymetry:

Bathy\_NAdri\_REA: here you can find the northern Adriatic bathymetry described in the attached paper.

Bathy\_emodnet. the corresponding N Adri Bathymetry using data downloaded from EmoDnet. The download was carried out in July 2013

---

**Reply via Italian partner CNR-ISMAR**

----- Original Message -----

**Subject:**Fwd: Bathymetry product -user review

**Date:** Wed, 11 Jun 2014 17:31:04 +0200

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [marzia.rovere@bo.ismar.cnr.it](mailto:marzia.rovere@bo.ismar.cnr.it)

Dear Marzia,

See attached message. Could you possibly contact the 2 Italian colleagues and see whether you could take on board their remarks as part of the present upgrade for Central Mediterranean sea?

Please keep me posted because I will have to report back to the EMODNet secretariate.

-----  
Hope to hear from you.

Regards

Dick

----- Original Message -----

**Subject:**Bathymetry product -user review



**Date:** Wed, 11 Jun 2014 13:55:30 +0100  
**From:** Liesbeth Renders <[liesbeth.renders@seascopeconsultants.co.uk](mailto:liesbeth.renders@seascopeconsultants.co.uk)>  
**To:** Dick Schaap <[dick@maris.nl](mailto:dick@maris.nl)>, Jan Bart Calewaert <[janbart.calewaert@seascopeconsultants.co.uk](mailto:janbart.calewaert@seascopeconsultants.co.uk)>

Dear Dick,

As outlined in the steering committee, we have been conducting user reviews on the different thematic portals. I am in the process of finalizing the document for the bathymetry, which contains summaries of the information received, focused mainly on navigation and user functionality.

In the meanwhile I have now received additional feedback from users that I met at the EDM in Bremen, which I have attached to this email, as these are assessments of a particular region of the bathymetry dataproducts. Both researchers have indicated that they can be contacted for additional information if required.

As you are aware we are very keen to promote user feedback on all aspects of EMODnet to ensure it is 'fit for purpose'. So it would be much appreciated if you could follow up with them and provide any update or information you may hold on their regional findings.

Thank you very much,

Liesbeth

**Reply CNR-ISMAR**

----- Original Message -----

**Subject:**Re: Fwd: Bathymetry product -user review  
**Date:** Thu, 12 Jun 2014 13:02:52 +0200  
**From:** Marzia Rovere <[m.rovere@ismar.cnr.it](mailto:m.rovere@ismar.cnr.it)>  
**To:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>  
**CC:** Federica Foglini <[federica.foglini@bo.ismar.cnr.it](mailto:federica.foglini@bo.ismar.cnr.it)>

Dear Dick,

My answers:

Could you possibly contact the 2 Italian colleagues and see whether you could take on board their remarks as part of the present upgrade for Central Mediterranean sea?

No problem Dick, Federica will contact Marco Zavatarelli for the northern Adriatic Sea to see if they have relevant new data especially in the Croatian coastal waters which are the only areas significantly different from the GEBCO/Emodnet compilation. It is possible that they only manipulated already existing grids to fit with the oceanographic/rapid assessment models. She will also contact Gianandrea Mannarini for the Sicily channel area, but I can anticipate you that the so-called artifacts are due to the multibeam coverage compared to the "smoother" GEBCO or MedOneMin compilations, which not include multibeam data. The question is: do we want a smooth and "nice looking" compilation similar to the ones already available or do we want to show where actual sparse (especially in areas like the Sicily channel) data exist? Federica will keep you posted during the various communications. I am leaving for my cruise now, so it will be easier for her to maintain the contacts, but I feel that part of the answer is already contained in this message.

Regards

marzia

---

**Further reply CNR-ISMAR:**

----- Original Message -----  
**Subject:**Adriatic Bathymetry - EMODNET Project  
**Date:** Thu, 10 Jul 2014 11:51:14 +0200  
**From:** Federica Foglini <[federica.foglini@bo.ismar.cnr.it](mailto:federica.foglini@bo.ismar.cnr.it)>  
**To:** [rsignell@usgs.gov](mailto:rsignell@usgs.gov)



**CC:** Anna Correggiari <anna.correggiari@bo.ismar.cnr.it>, "Dick M.A. Schaap" <dick@maris.nl>, "marzia.rovere@ismar.cnr.it" <marzia.rovere@ismar.cnr.it>

Dear Richard Signell,

I am Federica Foglini and I am working at CNR-ISMAR with Anna Correggiari and Marzia Rovere. We are involved in the EMODNET Hydrography project (<http://www.emodnet-hydrography.eu/>) for producing a compilation of bathymetric data for the Central Mediterranean Sea. In particular we are in charge of a providing data for the Adriatic sea. Since 2003 we collected huge amount of data, both single beam and multi beam and we produced a new bathymetric map of the Adriatic Sea for the Italian water (please find attached the publication describing the bathymetry).

We are missing data from the western side and we were wondering if it is possible to include the bathymetry you produced in order to merge the data.

There is a procedure in EMODNET for data merging and the results is freely available from the EMODNET portal ([http://www.emodnet-hydrography.eu/content/content.asp?menu=0310019\\_000000](http://www.emodnet-hydrography.eu/content/content.asp?menu=0310019_000000)). As you can see in this version of the DTM the western side is covered by GEBCO data but in the new release, that we will produce by the end of august, it would be nice to include real data for the western side

All bathymetric data are linked to a metadata acknowledging the data source and data provider. The metadata are stored in a metadata catalogue system called Sextant and managed by IFREMER (<http://sextant.ifremer.fr/fr/?jsessionid=F2C752BD35158B2D97E19E9B0BD1F3A0>). If you agree to take part to this compilation with your bathymetry I will kindly ask you to provide the DTM as .xyz and to create a metadata using Sextant. I will provide you all necessary instruction and credential.

It could be a good chance for producing together a new bathymetry for the entire Adriatic Basin including new available data.

I am looking forward to hearing from you

My Best Regards

Federica

-----  
**Further reply of CNR-ISMAR:**

**Date:** Wed, 23 Jul 2014 13:57:35 +0200

**From:** Marzia Rovere <m.rovere@ismar.cnr.it>

**To:** Dick M.A. Schaap <dick@maris.nl>

**CC:** Federica Foglini <federica.foglini@bo.ismar.cnr.it>

Dear Dick,

Signell never answered to the request of including his bathymetry elaboration into the Emodnet compilation of the Adriatic Sea. I am ready with the Central Med DTMs (one version with and one version without Signell). They still present the problem of anomalous values of -32767 in the composite DTM I have mentioned before, there are no ways for me to solve it, although while visualizing the DTM with Globe , everything seems OK and, according to Benoit, there are no problems. I have re-processed all with the ultimate version of Globe.

Regards

Marzia

=====  
**Question:**

From: Davaasuren, Narangerel <narangerel.davaasuren@wur.nl>

Date: 8 September 2014 11:51

Subject: information request multi-beam and single beam data for the North Sea

To: "liesbeth.renders@emodnet.eu" <liesbeth.renders@emodnet.eu>

Dear Liesbeth

I have request concerning data for the North Sea. I have been asking from my colleagues at NIOZ, Royal Netherlands Institute for Sea Research about availability of multi-beam data and or single beam data in high resolution covering the North Sea and they recommended me to ask from EMODNET data portal. Please let me know, if such data is available and can be obtained from your portal? Many thanks in advance for your time and your any assistance

With kind regards Narangerel (Nara).

---

**Answer:** EMODnet Bathymetry Question

**Subject:**

**Date:** Sun, 21 Sep 2014 04:49:48 -0400

**From:** dick@maris.nl <dick@maris.nl>

**Reply-To:**dick@maris.nl

**To:** narangerel.davaasuren@wur.nl

**CC:** liesbeth.renders@emodnet.eu

Dear Nara,

Thank you for your question. Please go to the portal at: <http://www.emodnet-bathymetry.eu>

There you will find a number of services including full explanation. One of the relevant services for your question is the CDI Data Discovery and Access service which gives you a catalogue for discovering bathymetric survey data as acquired by many research institutes, including NIOZ and hydrographic services from Europe for all oceans and sea areas in the world, including the North Sea. The CDI service also gives options for requesting access to selected survey data sets. Thereby negotiation with data providers might be required. In addition, the portal also provides a bathymetry viewing service to browse a DTM for European seas at a grid size of 1/4 \* 1/4 minute. This service also include options for downloading the DTM as tiles in various formats on a free basis. Have a look at the portal:

<http://www.emodnet-bathymetry.eu>

Kind regards

Dick M.A. Schaap

Coordinator

---

**Question:**

**From:** Blumenstein, Sven [<mailto:Sven.Blumenstein@rwe.com>]

**Sent:** dinsdag 25 november 2014 16:09

**To:** [info@EMODnet.eu](mailto:info@EMODnet.eu)

**Subject:** Request for EMODnet bathymetry layer file

Hi, I've found your fantastic bathymetry dataset and downloaded the complete tile collection. Great work! We are working on the ArcGIS platform, hence my request for symbolizing the dataset: Could you provide a layer file (.lyr) containing the stretched color ramp symbology as used in your web portal?

Thanks in advance and best regards,

Sven

Freundliche Grüße / Best regards / Med vennlig Hilsen / Met vriendelijke groeten / وتفضلوا بقبول فائق الاحترام

**Sven Blumenstein, Dipl.-Geol.**

GIS Specialist



RWE Dea AG  
Geo Support Center  
Geo Data & Applications / Geo Projects  
Ueberseering 40, 22297 Hamburg, Germany  
T +49 40 6375-2214  
F +49 40 6375-3108  
E <mailto:sven.blumenstein@rwe.com>  
I [www.rwe.dea.com](http://www.rwe.dea.com)

**Answer:**

----- Original Message -----

**Subject:**Re: FW: Request for EMODnet bathymetry layer file

**Date:** Fri, 28 Nov 2014 00:05:44 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Sven.Blumenstein@rwe.com

**CC:** Francisco Souza Dias <francisco.souzadias@vliz.be>, Simon Claus <simon.claus@vliz.be>

Dear Sven,

Good to hear you like it. Unfortunately we have no Esri .lyr file with this colour model. ArcGIS has an option to design your own color ramp but that option is not really suited for bathymetry because our scale is non-linear for depth.

Attached is an ASCII file with the colour values and related depths. The values are interpolated in a linear way between the depths. Possibly you can use this to prepare your own color ramp using Esri tools?

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry coordinator

PS: we are working on a new release with higher resolution where possible and covering all European seas.

**Question:**

----- Original Message -----

**Subject:**EMODNET Bathymetry

**Date:** Fri, 21 Nov 2014 16:03:59 +0000

**From:** Siddorn, John <john.siddorn@metoffice.gov.uk>

**To:** 'dick@maris.nl' <dick@maris.nl>

**CC:** 'Wehde Henning' <Henning.Wehde@imr.no>, Jan-Bart Calewaert <janbart.calewaert@emodnet.eu>

Dear Dr Schaap,

A recent meeting with Jan-Bart at the EuroGOOS meeting reminded me that I haven't heard any recent news on the EMODNET bathymetry. You may remember I contacted you a couple of years ago requesting more details on the plans for the EMODNET bathymetry as it presently does not meet our needs. According to Lesley Rickard who I spoke with at the time there were plans to improve upon the bathymetry, and that common referencing of the different input data sources was imminent. This still does not appear to have happened.

I would really appreciate hearing more about how the EMODNET project plans to improve upon the bathymetry data being provided.

Many thanks

John

~~~~~  
John Siddorn Head Ocean Forecasting R&D

Met Office FitzRoy Road Exeter Devon EX1 3PB United Kingdom

Tel: +44 (0)1392 886824



Mobile: +44(0)7880 475924

Email: [john.siddorn@metoffice.gov.uk](mailto:john.siddorn@metoffice.gov.uk) Website: [www.metoffice.gov.uk](http://www.metoffice.gov.uk)

OF&D are part of the [National Centre for Ocean Forecasting](#) and the [MyOcean Marine Service](#)

**From:** Siddorn, John  
**Sent:** 03 December 2012 16:19  
**To:** dick@maris.nl  
**Cc:** 'Wehde Henning'; O'Dea, Enda; Rickards, Lesley  
**Subject:**

Dear Dr Schaap,

I am writing to you concerning the EMODNET project and specifically the bathymetry datasets in it. I am manager of the ocean modelling group at the Met Office and a steering committee member of NOOS ([www.noos.cc](http://www.noos.cc)), a collaboration of marine service providers and researchers for the North-West European continental shelf. NOOS members, not least the Met Office, have a dependence upon the quality of the bathymetries available to us for providing good quality surge and other marine forecasts or assessments. In the past we have expended considerable effort to collate available bathymetries. This is a major task as you will of course appreciate, and one we cannot do on a frequent basis.

We started looking at this problem again a few years ago and were pleased to see that the EMODNET project would be collating bathymetries. So far however we have found it difficult to make much use of the data available via EMODNET for two reasons. Firstly the data is not combined into one unique product, which makes it difficult to apply as source input for our models. Secondly the reference levels for each of the datasets is not consistent so doing a merging of the datasets is not straightforward.

For this reason I spoke with Lesley about the future plans for EMODNET, and was extremely pleased to learn that you have an extension to the project and that there are plans to generate a product that combines all the available datasets (and as I understand it merged with GEBCO where there are no other data available).

I would like to emphasise the importance this work has in making the EMODNET data useful for modellers such as myself. Is there a known timescale for release of a merged dataset and do you have plans for early release to beta users for comment and testing? I would be happy for I or a colleague to be engaged in some way as a user if that is appropriate.

Yours

John Siddorn

John Siddorn, Manager Ocean Modelling Group

**Met Office Hadley Centre** FitzRoy Road Exeter Devon EX1 3PB United Kingdom

Tel: +44 (0)1392 886824

Email: [john.siddorn@metoffice.gov.uk](mailto:john.siddorn@metoffice.gov.uk) Website: [www.metoffice.gov.uk](http://www.metoffice.gov.uk)

See our guide to climate change at <http://www.metoffice.gov.uk/climate-change/guide/>

**Answer:**

----- Original Message -----

**Subject:** Re: EMODNET Bathymetry

**Date:** Fri, 28 Nov 2014 00:27:18 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Siddorn, John <john.siddorn@metoffice.gov.uk>

**CC:** 'Wehde Henning' <Henning.Wehde@imr.no>, Jan-Bart Calewaert <janbart.calewaert@emodnet.eu>

Dear John,

We are finalising a new release of the EMODnet DTM which will have a resolution of  $1/8 * 1/8$  arc minute and for all European seas. This will be released in a few weeks from now. The DTM will be based as much as possible on survey data sets, but unfortunately for almost 30 - 40 % of the sea areas we have no surveys yet. In those cases we will use the new GEBCO\_2014 DTM which has a lesser resolution of  $1/2 * 1/2$  arc minute.

However in practice GEBCO introduces steps between survey based DTM and GEBCO based DTM cells, because GEBCO uses satellite altimetry for non surveyed areas and this can give serious differences in precision. Sometimes this gives large thresholds / vertical steps between the more detailed data and the GEBCO which we can not smooth away. Also we do not want to smooth it too much because then it looks like all is perfect and known, while we also want to underpin gaps in data and that these should be filled by new surveys. Also near and in the coastal zone we are not very good yet because we are not yet dealing with this. In the next round there will be pilots for coastal zones from deeper water to inland combining multibeam and LIDAR data. Those pilots should be followed up by more extensive focus on the European coastlines.

BTW: the EMODnet DTM is using LAT as a common reference.

I can understand that you would prefer a complete smoothed version for use in mathematical models. We have a project meeting in January 2015 and I will discuss whether we can also make such a side product to serve modellers.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry coordinator

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**Question:**

**From:** Blumenstein, Sven [<mailto:Sven.Blumenstein@rwe.com>]

On 11/28/2014 9:17, Blumenstein, Sven wrote:

Dear Dick,

thanks a lot – I'll try to build something. In ArcGIS you can play around with histogram curves on stretched color ramps, and I guess I'll only be able to build a similar but not equal look of the map. However, great work.

Looking forward to the forthcoming new release...

By the way, are you also maintaining and providing cleaned contour lines of the model? When I create them from the original grid, I get a lot of artefacts due to tile breaks or linear sounding points.

Thanks again and best regards,

Sven

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**Answer:**

----- Original Message -----

**Subject:**Re: AW: Request for EMODnet bathymetry layer file

**Date:** Fri, 28 Nov 2014 09:34:48 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Blumenstein, Sven <Sven.Blumenstein@rwe.com>

**CC:** Francisco Souza Dias <francisco.souzadias@vliz.be>, Simon Claus <simon.claus@vliz.be>, George Spoelstra <g.spoelstra@casema.nl>

Dear Sven,

Concerning breaking isolines:

The EMODnet DTM is based as much as possible on survey data sets, but unfortunately for almost 30 - 40 % of the sea areas we have no surveys yet. In those cases we use the GEBCO DTM which has a lesser resolution of

1/2 \* 1/2 arc minute. However in practice GEBCO introduces steps between survey based DTM and GEBCO based DTM cells, because GEBCO uses satellite altimetry for non surveyed areas and this can give serious differences in precision.

Sometimes this gives large thresholds / vertical steps between the more detailed data and the GEBCO which we can not smooth away. Also we do not want to smooth it too much because then it looks like all is perfect and known, while we also want to underpin gaps in data and that these should be filled by new surveys.

Also near and in the coastal zone we are not very good yet because we are not yet dealing with this. In the next round there will be pilots for coastal zones from deeper water to inland combining multibeam and LIDAR data. Those pilots should be followed up by more extensive focus on the European coastlines.

So it is not a perfect smooth product and that is why you will have difficulty with your isolines encountering those steep differences.

I can also understand that you might prefer a complete smoothed version as we have heard also from developers of mathematical models. We have a project meeting in January 2015 and I will discuss whether we can also make such a side product to serve modellers and other users.

Regards

Dick

=====

**Client feedback:**

----- Original Message -----

**Subject:** RE: EMODNET Bathymetry

**Date:** Mon, 1 Dec 2014 09:05:44 +0000

**From:** Siddorn, John <john.siddorn@metoffice.gov.uk>

**To:** Dick M.A. Schaap <dick@maris.nl>

**CC:** 'Wehde Henning' <Henning.Wehde@imr.no>, Jan-Bart Calewaert <janbart.calewaert@emodnet.eu>, "Iain.SHEPHERD@ec.europa.eu" <Iain.SHEPHERD@ec.europa.eu>, George Spoelstra <g.spoelstra@casema.nl>

Thanks Dick,

I hadn't appreciated you had already included GEBCO in your source data within the north sea region. That explains the issues more clearly, and gives some hope that your plan to smooth between the datasets will make something usable. That is fantastic, thank you.

John

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**Answer to feedback:**

**From:** Dick M.A. Schaap [mailto:dick@maris.nl]

**Sent:** 01 December 2014 08:47

**To:** Siddorn, John

**Cc:** 'Wehde Henning'; Jan-Bart Calewaert; Iain.SHEPHERD@ec.europa.eu; George Spoelstra

**Subject:** Re: EMODNET Bathymetry

Dear John,

Together with an expert colleague we had a further look at the issues you pointed out for the Southern North Sea. For that purpose we also had a look at the so-called 'source reference layer' in the layer menu of the EMODnet Bathymetry viewing service. See attached powerpoint. The gray areas are GEBCO. All issues you refer to in your screenshot are within these GEBCO areas or are caused by the differences between GEBCO and measured data. so not between surveys. Especially the "grid lines" are present in the 2008 GEBCO data just like a line that we found at OE.



GEBCO data is often displayed with a color scale suitable for global use. The EMODnet color scales are non linear and designed to give more visual details in shallow waters. In most applications GEBCO appears very smooth in the North Sea as a result of the global scale but the EMODnet colors proof the opposite and bring the issues more to the foreground.

Of course GEBCO is doing a tremendous job in building the global data set. And for the new EMODnet Bathymetry release we will be using the new GEBCO\_2014 which has integrated / emulated the present EMODnet Bathymetry DTM, and in particular for the Southern North sea has included a rich set of OLEX data. GEBCO\_2014 should have improved considerably compared to the older version that you see here. But also GEBCO can not invent data where it is not measured and using satellite derived bathymetry is then the only way to get global coverage.

We are sure that we may find also differences between two adjacent surveys if we look carefully. This may have different reasons. Especially in the southern North Sea the morphology is very dynamic. Two surveys that have 10 years difference in time will certainly not match. Also surveys that have undergone shoal based processing with safe navigation in mind (by Hydrographic offices) will differ from scientific surveys in the same area due to this safety biasing effect. The difference will be less but can still be visible.

As I have indicated, we will continue to improve the data set and will also continue the dialog with all stakeholders how to treat these differences with the different applications of the dataset in mind. As a direct step I have put it on the agenda for our coming EMODnet Bathymetry projectgroup meeting in January 2015 to discuss a possible alternative product.

Hope this help clarifying things a bit more.

Kind regards

Dick

=====  
**Question:**

12/7/2014 21:34, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Dave Holroyde

**Email address:** [dholroyde@caydaleconsulting.co.uk](mailto:dholroyde@caydaleconsulting.co.uk)

**Feedback:** Good evening. I am having problems with the login. I have registered and received a personal id. from SeaDataNet (Login dh31444) and passwd but when I try to use this to login on the Bathymetry Viewing and Download service the system returns a message id 'not valid'. With thanks. Dave

=====  
**Answer:**

**Subject:**Re: Emodnet-Hydrography Feedback

**Date:** Sun, 07 Dec 2014 22:00:14 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [dholroyde@caydaleconsulting.co.uk](mailto:dholroyde@caydaleconsulting.co.uk)

Dear Dave,

You do not need a logon for the Bathymetry Viewing service. You can browse and also download the DTM without user - password.

The SeaDataNet user - pass is needed for requesting access to the underlying survey data which are included in the CDI service.

The logon on the Bathymetry Viewer is somewhat misleading; it is planned for making your own personal layer

as explained in the Help of the viewer. However at present it does not work with the user-password of SeaDataNet.

We are planning to alter this and make it more straight forward.

Hope this helps

Kind regards

Dick M.A. Schaap

Coordinator

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**Client feedback:**

----- Original Message -----

**Subject:**RE: Emodnet-Hydrography Feedback

**Date:** Sun, 7 Dec 2014 21:28:20 -0000

**From:** Dave Holroyde <dholroyde@caydaleconsulting.co.uk>

**To:** 'Dick M.A. Schaap' <dick@maris.nl>

Dear Dick

Many thanks for the prompt response. I see my error and I am pleased to say it is now working fine.

Kind regards.

-----  
Dave Holroyde

**Caydale Consulting Ltd**

Phone: +44 (0)1330 820600

Mobile: +44 (0)7876 272527

Email: [dholroyde@caydaleconsulting.co.uk](mailto:dholroyde@caydaleconsulting.co.uk)  
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**Question:**

On 11/17/2014 22:16, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Duvel

**Emailaddress:** [duvel29@free.fr](mailto:duvel29@free.fr)

**Feedback:** subscribe on 14/11/14. can't login on <http://portal.emodnet-bathymetry.eu/> but connection on <https://www.ifremer.fr/AAARegistration/faces/UserPersonalInformation.jsp> is OK, so ident and pwd are ok. what's wrong please ? ThX

**Answer:**

----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback

**Date:** Thu, 15 Jan 2015 17:15:32 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** [duvel29@free.fr](mailto:duvel29@free.fr)

Dear Duvel,

Sorry for late response!

You do not need a logon for the Bathymetry Viewing service. You can browse and also download the DTM without user - password.

The SeaDataNet user - pass is needed for requesting access to the underlying survey data which are included in the CDI service.



The logon on the Bathymetry Viewer is somewhat misleading; it is planned for making your own personal layer as explained in the Help of the viewer. However at present it does not work with the user-password of SeaDataNet.

We are planning to alter this and make it more straight forward.

Hope this helps

Kind regards

Dick M.A. Schaap

Coordinator

**Question:**

On 10/17/2014 11:01, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Stamatina Nikolopoulou

**Emailaddress:** [snikolo@hcmr.gr](mailto:snikolo@hcmr.gr)

**Feedback:** Dear Sir/Madam hello, I would like to ask few things concerning the bathymetry. I have download it and I made the contours via gis but it seems that for each coastline that I use the zero contour never touches the coastline and there are also some positive values, does it mean that it has elevation also? Thank you in advance

**Answer:**

----- Forwarded Message -----

Subject: Re: Emodnet-Hydrography Feedback

Date: Thu, 15 Jan 2015 17:25:35 +0100

From: Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

To: [snikolo@hcmr.gr](mailto:snikolo@hcmr.gr)

Dear Stamatina,

Thank you for using the EMODnet DTM. However be aware that we are not yet covering the coastal zone. Due to this it might happen that the DTM is not correct close to the coastline and possibly providing impossible positive or negative (extreme) values. Sorry for this inconvenience. In the coming year we will look into a pilot with a few areas covering the transition zone from sea to land using a combination of multibeam and LIDAR, but not for all European coasts. There is a project in the pipeline for extending this coastal pilot to at least 2500 nm of European coast but unfortunately the real coast is much longer. And there are no full coverage of data available.

Kind regards

Dick M.A. Schaap

Coordinator

PS: Sorry for the late response.

=====

**Question:**

**Name:** Fernando Tempera

**Email address:** [fernando.tempera@jrc.ec.europa.eu](mailto:fernando.tempera@jrc.ec.europa.eu)

**Feedback:** I repeat a suggestion I have made some time ago. Please make the Source Reference layer available for download. I would simply like to estimate the percentage of coverage of the dataset derived from multibeam surveys and this is not achievable with the downloadable information. For a dataset like

this, documenting the survey technique should be an associate metadata layer.

**Answer:**

**From:** Dick M.A. Schaap [<mailto:dick@maris.nl>]

**Sent:** 26 January 2015 21:33

**To:** [fernando.tempera@jrc.ec.europa.eu](mailto:fernando.tempera@jrc.ec.europa.eu)

**Subject:** Re: Emodnet-Hydrography Feedback

Dear Fernando,

On short term we will release a new EMODnet DTM and as part of that we are improving also the Source References layer by giving separate overview layers for coverage by CDIs (surveys), CPRDs (composite DTMs) and GEBCO. Those layers will have polygons. See attached overview.

Some time later we will outfit these overviews also with WFS facilitating retrieving these polygons by services. The attributes will include coverage (nm2), EDMO-code data provider, and CDI / CPRD no. Whether it is multibeam or otherwise can not provided directly from the viewer but can be restored by users through the CDI service:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000_000000)

giving all survey CDIs and then EXPORT => csv with necessary details.

One question from my side: what is your interest in bathymetry?

Kind regards,

Dick M.A. Schaap

Coordinator EMODnet Bathymetry

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**Client feedback:**

On 1/27/2015 10:21, Fernando Tempera wrote:

Dear Dick,

Thanks for your reply.

As a professional user of the information, I would argue that the easier the link between the polygons and the CDI metadata is established the better. In my opinion, the integration of a field providing a minimal reference to the bathymetry acquisition methodology in the EMODNET coverage polygon layers should be standard, rather than requiring "post-processing".

One of the justifications is that it immediately conveys a sense of the resolution and dependability/confidence of the information for interpreting it or extracting DTM derivatives. I came across this type of issues whilst previously working in EU projects MeshAtlantic and CoralFish. In MeshAtlantic, knowing the methodological provenance of the information was crucial to assess confidence and create a specific layer for it. In CoralFish, whilst modelling the regional distribution of corals, knowing the methodological provenance of the information was important to establish the reliability of DTM-based derivatives (slope, aspect, rugosity, etc). Having multibeam, singlebeam or satellite-derived bathymetry creates huge differences in a truthful representation of the terrain, introducing modelling artifacts and constraining the models to adequately predict the presence of corals. Using acquisition methodology masks to customise models to different types of base data would be a very significant improvement to this type of modelling.

The other reason is that of gap analysis. For instance for planning H2020 proposals, Marine Knowledge 2020 activities, Blue Growth initiatives, or implementing the Transatlantic Galway Statement (TGS), one would like to adequately assess the task facing you. Recently, for a presentation I made under a seabed-mapping workshop related to the TGS, I simply wanted to try and provide some figures like the the percentage of EU waters that have been already covered by multibeam surveys and the area that remains to be surveyed. With the

information available on the EMODNET portal I simply couldn't. This motivated me to repeat my comment on your portal which I had submitted one or two years ago already and remained unanswered.

Presently, I am using bathymetry for two purposes:

- In the scope of my work to map marine ecosystem services throughout Europe, I use bathymetry to segment the seafloor in biological depth zones; They are particularly important in areas for which there isn't still an EMODNET Seabed Habitats layer (Adriatic, Eastern Mediterranean, Macaronesia, Black Sea).

- In a coral-distribution model I am finishing for the Azores Plateau, I use the best available medium-resolution bathymetry (including EMODNET) to derive a series of terrain variables and use them as explanatory variables.

Looking forward to the new EMODNET bathymetry release,

Best regards,

Fernando

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FERNANDO TEMPERA

Post-Doc Researcher

European Commission

Joint Research Centre (JRC)

Institute for the Environment and Sustainability (IES)

Water Unit, 27/035

TP 270

21027 Ispra (VA), Italy

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Ph: +39 033278 5001

<http://www.linkedin.com/profile/view?id=118963715>

[https://www.researchgate.net/profile/Fernando\\_Tempera](https://www.researchgate.net/profile/Fernando_Tempera)

Disclaimer: "The views expressed are purely those of the writer and may not in any circumstances be regarded as stating an official position of the European Commission."

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**Answer to feedback:**

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback

**Date:** Mon, 09 Feb 2015 11:18:18 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Fernando Tempera <fernando.tempera@jrc.ec.europa.eu>

Dear Fernando,

The new release of the EMODnet Digital Bathymetry (DTM) is now online at <http://www.emodnet-bathymetry.eu>. It covers all of European seas, including also the Baltic Sea, Black Sea, Norwegian - Icelandic Seas and waters around the Canary Islands. Moreover the resolution of the DTM has been increased from 1/4 \* 1/4 arc minutes to a grid with 1/8 \* 1/8 arc minutes (circa 230 metres). The new DTM is based upon circa 6000 gathered survey data sets and composite DTMs as provided by 29 data providers from 17 countries. It contains 1.092.115.678 data points (28.799 rows x 37.922 columns) which are divided over 16 tiles which can be downloaded freely in various formats. In addition, several upgrades have been applied to the Bathymetry Viewing and Download service for viewing and browsing the new EMODNet DTM.

When trying the service, please first clear your browser cache.

The next release of the EMODnet DTM is planned for summer 2015 by incorporating even more surveys and further improvement of the digital bathymetry. The present DTM still has some spikes - the next summer

version will take care of that too.

Please be aware that the OGC services have been altered to the following addresses:

WMS: <http://ows.emodnet-bathymetry.eu/wms>

WFS: <http://ows.emodnet-bathymetry.eu/wfs>

WMST: <http://ows.emodnet-bathymetry.eu/wmts>

Please have a good look at the new EMODnet DTM and also present it to your colleagues!

Regards

Dick M.A. Schaap

EMODnet Bathymetry coordinator

**Question:**

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On 2/9/2015 12:11, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Lisann

**Emailaddress:** [lisannheuer@posteo.de](mailto:lisannheuer@posteo.de)

**Feedback:** Our Measuring Tool is not working correctly. It shows a distance of 45.000km between Gent and Brugge in Belgium which is not possible of course. But the data is coming fast! Really nice! :)

**Answer:**

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback

**Date:** Mon, 09 Feb 2015 12:40:45 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [lisannheuer@posteo.de](mailto:lisannheuer@posteo.de)

Dear Lisann,

The distance is correct. Please be aware that it is giving in km with a decimal point. So 45.000 km means 45 km.

Regards

Dick M.A. Schaap

EMODnet Bathymetry coordinator.

**Question:**

----- Forwarded Message -----

**Subject:** Emodnet-Hydrography Feedback

**Date:** Sat, 21 Feb 2015 17:06:27 +0100

**From:** [noreply@maris.nl](mailto:noreply@maris.nl)

**Reply-To:** [gerben.vanranst@ugent.be](mailto:gerben.vanranst@ugent.be)

**To:** [dick@maris.nl](mailto:dick@maris.nl)

**Name:** Dear Mr/Mrs

**Email address:** [gerben.vanranst@ugent.be](mailto:gerben.vanranst@ugent.be)

**Feedback:** Dear Mr/Mrs, I have a problem downloading the NetCDF file for the Geo-Seas viewer. In stead of a .nc, the download produces a .mnt. Changing

the extension to .nc does not work, leaving the file 'invisible' for the viewer. What can I do to solve this? Best regards, Gerben

**Answer:**

Le 21/02/2015 19:28, Dick M.A. Schaap a écrit :  
Dear Benoit and Jean-Marc,

Can you help. Have you tried to read the EMODnet Bathy DTM file in the Geo-Seas World Wind viewer?  
I tried myself but only could see the DTM but not manipulate the parameters for vertical distortion, shadows etc  
Will hear from you.

Regards  
Dick

**Further reply from IFREMER:**

**Van:** Jean-Marc SINQUIN [<mailto:Jean.Marc.Sinquin@ifremer.fr>]

**Verzonden:** maandag 23 februari 2015 10:31

**Aan:** [gerben.vanranst@ugent.be](mailto:gerben.vanranst@ugent.be)

**CC:** Dick M.A. Schaap; Benoit LOUBRIEU

**Onderwerp:** Re: Fwd: Emodnet-Hydrography Feedback

Dear Gerben

Could you rename .nc to .dtm under an empty session and reload the file ?

Best regards  
Jean-Marc

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**Client feedback:**

Dear Jean-Marc,

Thank you for your response. The problem is that I can't load the file in Geo-Seas 3D viewer, neither when I change the .mnt extension to .nc or .dtm.

I downloaded the B2 file under 'download NetCDF' from EMODnet Bathy, which delivers a zip/rar file. After unzipping this with WinRAR, I received a folder containing the file B2.mnt (Type: MNT). When I click the 'import' option in 3Dviewer, the only visible file type is SonarScope data files. It is thus not possible to 'see' and load the .mnt file I downloaded. Also after changing the extension, the file remains MNT type.

Kind regards,  
Gerben

**Answer to feedback:**

----- Forwarded Message -----

**Subject:** Re: Fwd: Emodnet-Hydrography Feedback

**Date:** Mon, 23 Feb 2015 22:02:51 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Gerben Van Ranst <gerben.vanranst@ugent.be>, 'Jean-Marc SINQUIN' <Jean.Marc.Sinquin@ifremer.fr>

**CC:** 'Benoit LOUBRIEU' <Benoit.Loubrieu@ifremer.fr>

See attached the just downloaded B2 mnt file in the 3D viewer.

**Further reply:**

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On 2/23/2015 21:57, Dick M.A. Schaap wrote:

Dear Gerben,

Did you read the manual of the 3D viewer. You have to start by creating a 'new project'. Activate the new project via its checkbox and thereafter you should 'open' the mnt file and NOT by import. This should work to

open the downloaded DTM on the digital globe.

Please try.

Regards

DMA Schaap

EMODnet Bathymetry coordinator

On 2/23/2015 18:22, Gerben Van Ranst wrote:

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**Question:**

On 3/6/2015 10:23, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Merce Labordena

**Emailaddress:** [merce.labordena@usys.ethz.ch](mailto:merce.labordena@usys.ethz.ch)

**Feedback:** Dear Sir or Madam, At ETH Zürich we are doing some research that implies the deployment of transmission lines from North Africa and the Middle East to Europe through the Mediterranean Sea. I am interested in a DTM/DEM for the Mediterranean Sea at the finest resolution to be imported in ArcGIS. However, in your web page the -Visit the Bathymetry Viewing and Download service- is not available. Would you be so kind as to provide us directly with the data that we need? Kind regards, Merce Labordena

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**Answer:**

**To:** Mercè Labordena Mir <[merce.labordena@usys.ethz.ch](mailto:merce.labordena@usys.ethz.ch)>

**Subject:** Re: Emodnet-Hydrography Feedback

Dear Merce,

Thanks for your email. However I do not understand why you could not find the ' Bathymetry Viewing and Download service' in our website.

Go to: <http://www.emodnet-bathymetry.eu> and then go to: Data products and click on the MAP or the title underneath.

That should bring you to: <http://portal.emodnet-bathymetry.eu>

Please keep me informed whether it works. And inform me whether you tried to reach it in a different way?

Regards

Dick M.A. Schaap

Coordinator

**Client feedback:**

On 3/6/2015 11:15, Labordena Mir Merce wrote:

Dear Dick,

Yes, I followed exactly those steps. However the problem appears when I try to open the last link <http://portal.emodnet-bathymetry.eu>, as it does not open.

I am trying to open it all the morning and it does not work. I have waited because I thought that maybe there was a problem with the server, but still this link is down, or at least a full white page with no content appears in my Safari.

Kind regards,

Mercè Labordena



ETH Zürich, Human-Environment Systems Group  
Universitätstrasse 22, CHN J73.1  
8092 Zürich, Switzerland  
email: [merce.labordena@usys.ethz.ch](mailto:merce.labordena@usys.ethz.ch)  
mobile: (+41) 76 319 69 40  
office: (+41) 44 633 83 71  
web: [www.hes.ethz.ch](http://www.hes.ethz.ch)

On 3/6/2015 12:25, Labordena Mir Merce wrote:

**Answer to feedback:**

**From:** "Dick M.A. Schaap" <[dick@maris.nl](mailto:dick@maris.nl)>  
**Date:** Friday 6 March 2015 11:50  
**To:** Mercè Labordena Mir <[merce.labordena@usys.ethz.ch](mailto:merce.labordena@usys.ethz.ch)>  
**Subject:** Re: Emodnet-Hydrography Feedback

Dear Merce,

We also tried it with a Apple Mac and an Iphone, both with Safari and there seems to be no problem. Same for IE and Firefox browsers.

So the issue has to be somewhere at your university network.

Can you try yourself with an Iphone? or with your Mac outside the University network?

Or talk to your IT department and ask them to look in.

Are you using one of the latest versions of Safari?

Regards

Dick

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**Client feedback:**

**To:** "Dick M.A. Schaap" <[dick@maris.nl](mailto:dick@maris.nl)>  
**Date:** Friday 6 March 2015 11:09

Dear Dick,

I tried in Firefox and received the following message at the screen:

The connection to the server was reset while the page was loading.

The site could be temporarily unavailable or too busy. Try again in a few moments.

If you are unable to load any pages, check your computer's network connection.

If your computer or network is protected by a firewall or proxy, make sure that Firefox is permitted to access the Web.

Then I switched again in Safari. Turned Cookies off and disconnected from ethernet (just running in wifi). Now seems that works (maybe some permission restrictions from this University).

I have accessed to the *Portal for Bathymetry. Bathymetry Viewing and Download service*. I have activated GEBCO Bathymetry base map but it seems not possible to do a selection of a region, and then download it. In fact, I press download products and nothing happens. How could I select the Mediterranean sea region, and then download it?

Kind regards,

Mercè Labordena

ETH Zürich, Human-Environment Systems Group  
Universitätstrasse 22, CHN J73.1  
8092 Zürich, Switzerland  
email: [merce.labordena@usys.ethz.ch](mailto:merce.labordena@usys.ethz.ch)



mobile: (+41) 76 319 69 40  
office: (+41) 44 633 83 71  
web: [www.hes.ethz.ch](http://www.hes.ethz.ch)

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**Further reply:**

From: Dick M.A. Schaap [dick@maris.nl](mailto:dick@maris.nl)  
To: Labordena Mir Merce [merce.labordena@usys.ethz.ch](mailto:merce.labordena@usys.ethz.ch)  
Date: 6 March 2015

Dear Merce,

You can download the DTM in 16 tiles. This is the DTM that has been produced by the project and not the GEBCO DTM. GEBCO is only included in the layer menu as a background layer and to show you the difference in resolution (GEBCO = ca 1km \* 1 km and EMODnet DTM - ca 230 meters \* 230 meters).

So activate one of the EMODnet DTM layers in the layers menu on the left:

\* Mean depth in multi colour OR Mean depth in rainbow OR Mean depth full coverage

by switching on the layer (right tick box) and activate it for interrogation via the Radio button on the left.

Now the Download Dataproducts is activated and you can click on it => you will see 16 tiles. Click on each tile to download it in specific format.

Please also read the HELP text which gives you much more info about all functionality. See

<http://portal.emodnet-bathymetry.eu/help/help.html> and read down this page:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000_000000)

which gives you the option to download 3D software which can be combined with the downloaded DTM tiles for 3D visualisation:

\* SD files with Fledermaus software

\* NetCDF files with 3D Viewer

Note: these 2 softwares also have a HELP text to better understand how it works.

Will hear from you.

Regards

Dick

**Question:**

On 4/8/2015 19:09, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Thomas Pedersen

**Emailaddress:** [thomas@sssh.no](mailto:thomas@sssh.no)

**Feedback:** Hi Is the EMODnet DTM viewing and download service down? or does it require registration?. [http://emodnet-bathymetry.eu/content/content.asp?menu=0040000\\_000000](http://emodnet-bathymetry.eu/content/content.asp?menu=0040000_000000) This just loads the top bar but not any maps etc. All settings/help/drowpdowns are non functional. Tested in IE, Chrome and Firefox.

=====  
**Answer:**

From: Dick M.A. Schaap [dick@maris.nl](mailto:dick@maris.nl)

To: [thomas@sssh.no](mailto:thomas@sssh.no)

Date: 9 April 2015

Dear Thomas,

We had a maintenance update which had not been done properly. Sorry for this issue, but hope it is functioning

now ok for you again.

Regards  
Dick M.A. Schaap  
Coordinator

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**Question:**

**Name:** Lian Wang  
**Emailaddress:** [lian.wang@npl.co.uk](mailto:lian.wang@npl.co.uk)  
**Feedback:** I am not able to download bathymetry data after few attempts. There is no response when I click any files listed in the pop-up window with a selection of download file types.

**Answer:** Re: Emodnet-Hydrography Feedback  
**Subject:**  
**Date:** Fri, 01 May 2015 17:11:06 +0  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** Lian Wang <lian.wang@npl.co.uk>

Dear Lian,

Then please try at another computer in another network. Most probably your firewall does not allow for .zip files to download.

Good luck!

Regards

Dick

**Client feedback:**

On 5/1/2015 17:05, Lian Wang wrote:

Dear Dick,

Thank you very much for your reply. I have tried again with no luck.

It might be firewall thing, I'll try again later with a different computer.

Regards,

Lian

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**Answer to feedback:**

**From:** Dick M.A. Schaap [<mailto:dick@maris.nl>]

**Sent:** 01 May 2015 15:32

**To:** Lian Wang

**Subject:** Re: Emodnet-Hydrography Feedback

Dear Lian,

I tested it with various browsers and have no problems. You click on the button 'Download products', then click on one of the 16 tiles and chose from the formats menu. Thereafter you have to be somewhat patient depending on your internet connection. In my case it takes 10 seconds to open a pop-up window to save the selected tile in its selected format.

Please try again and let me know if it is ok

Regards

EMODnet Bathymetry coordinator

**Question:**

5/1/2015 21:07, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Daniel Praeg

**Email address:** [dpraeg@ogs.trieste.it](mailto:dpraeg@ogs.trieste.it)

**Feedback:** I am trying to download products (from B3), for import into Global Mapper. When I ask to download a netCDF file, instead I receive a .mnt file that I cannot open (and is not explained in the help pages). Out of interest, when I download a Fledermaus .SD file, I am told it is not valid. Could you please tell me how I can download a file in netCDF format, as is indicated to be possible? Many thanks.

**Answer:**

On 1 May 2015, at 22:56, Dick M.A. Schaap wrote:

Dear Daniel,

Unfortunately NetCDF has many 'dialects'. I will forward your question to one of our technicians who might help you, but that will be next week.

We will stay in touch.

Kind regards

Dick M.A. Schaap

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**Client feedback:**

On 5/1/2015 22:43, Daniel Praeg wrote:

Hello, many thanks for your reply.

I do not wish to view (visualise) the data, I wish to use it within an existing GlobalMapper project containing other data files.

The .mnt file does not appear to be a netCDF file, at least to GlobalMapper, which gives the following error on attempting to load it as such:

Error loading Y:\Desktop\Active\Glacial\GLAMARous\Global Mapper data\data\EMODnet\B3\_no\_gebco.mnt  
Unable to determine data position information

NetCDFOverlay.cpp - 1385

Version: v13.00

The same file does load if indicated to be a CDF file, but at the end of a long processing GlobalMapper told me it contained no data.

If this is a netCDF file, I would be grateful to know how I might use it as such; if not, how I might convert it to something that can be used in GM.

Many thanks,

Daniel

**Answer to feedback:**

On 1 May 2015, at 21:36, Dick M.A. Schaap wrote:

Dear Daniel,

The .mnt files are NetCDF files which are compatible for the Geo-Seas 3D viewer, which is also advertised at the website. Go to:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000_000000)

where you can download the free Geo-Seas 3D viewer, based upon NASA World Wind

The same page also provides a link to the free Fledermaus 3D viewer (iView4D) which works with the SD files.

Hopes this helps.  
Kind regards,  
EMODnet Bathymetry coordinator

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**Further client feedback:**

**Subject:** Re: Emodnet-Hydrography Feedback

**Date:** Sun, 3 May 2015 20:01:45 +0200

**From:** Daniel Praeg <[dpraeg@ogs.trieste.it](mailto:dpraeg@ogs.trieste.it)>

**To:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

Dear Dick,

just to say that I managed to load the B3 data into Global Mapper as an ESRI ascii file. So my problem is solved. For information regarding other formats offered on the portal:

- I downloaded the .xyz file, but was not able to grid it - it was too big for Global Mapper (running via Parallels on my dear old Mac), so I tried GMT, which refused as the data columns are separated by semi-colons (as for the .emo file); I don't know if there is a way to flag those to GMT.
- thinking to convert it, I tried to scan the .mnt file using GMT, using simple routines (minmax, grdinfo), but it was not readable.
- I was not able to view the SD file using iView3D or iView4D, it was said not to be a valid file.
- somewhere along the way I tried a GeoTiff, but that link does not result in a download.

That is my (slightly frustrating) experience, as a not particularly digitally literate user.

Best wishes,  
Daniel

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**Question:**

On 4/30/2015 13:15, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** hagit

**Emailaddress:** [hwiener@ewre.com](mailto:hwiener@ewre.com)

**Feedback:** Hi Great work! I'm using the DTM data from D4 for an EIA near Israel. When was the data (X, Y, Z) collected?

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**Answer:**

**Subject:** Re: Emodnet-Hydrography Feedback

**Date:** Fri, 01 May 2015 16:47:10 +0200

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [hwiener@ewre.com](mailto:hwiener@ewre.com)

Dear Hagit,

You can identify which data sources were used for the DTM by switching on the Source references layer in the Layer menu, also activating the radio button. That will give a button: Retrieve metadata in the top bar. Switch this function on and then click on each polygon in the area of your interest. That will retrieve the metadata of individual data that underpin the DTM.

Regards

EMODnet Bathymetry coordinator

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**Question:**



On 5/1/2015 12:09, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Fiona Miller  
**Email address:** [fmiller@abpmer.co.uk](mailto:fmiller@abpmer.co.uk)  
**Feedback:** Morning, would it be possible to discuss with someone the vertical datum of the composite DTM. I notice that it says its to LAT and that GEBCO data has been included in the data. GEBCO is to MSL and when I compare EMODnet and GEBCO there is very little difference where I would expect a difference due to the difference in vertical datum? Thanks

**Answer:**

**Subject:** Re: Emodnet-Hydrography Feedback  
**Date:** Wed, 13 May 2015 13:16:28 +0200  
**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>  
**To:** [fmiller@abpmer.co.uk](mailto:fmiller@abpmer.co.uk)

Dear Fiona,

To correctly analyze the effects of vertical reference levels when merging datasets, a thorough understanding of the underlying methodologies and processes uses for the preparation of the source data sets is vital. GEBCO has described these processes in the GEBCO cookbook. The most common method used to compile GEBCO as a continuous and smooth model with a relatively coarse resolution of 30 arc seconds is called the "Remove Restore" algorithm (See GEBCO cookbook chapter 8.2.11). Given the huge challenge the GEBCO community faces this is a very effective and clever algorithm that allows GEBCO to publish a global data set based on scarce and disparate datasets.

As a result of the "heavy processing" of GEBCO data, GEBCO has a rather broad definition of its vertical datum: "GEBCO's global elevation models are generated by the assimilation of heterogeneous data types assuming all of them to be referred to mean sea level. However, in some shallow water areas, the grids include data from sources having a vertical datum other than mean sea level. We are working to understand how best to fully assimilate these data." (GEBCO website)

Trying to convert assumed GEBCO MSL data at a resolution of 1/2 min to LAT data at 1/8 min as used for EMODnet using known but theoretical (separation) models therefore does not lead to more accurate data. In fact more variables are added to the data that "hide" or dilute the actual accuracy. For that reason EMODnet has chosen to use GEBCO as is and to apply automatic local smoothing algorithms that make GEBCO better fit the measured data contributed by our EMODnet partners and for which all metadata is known through the use of the CDI metadata catalogue.

In previous releases the local smoothing between GEBCO and contributed EMODnet data was not applied which led to major discontinuities in the model and resulted in a "not fit for purpose" model for many scientific applications. As a result of many requests we have now applied localized smoothing. Using the source reference layer of the portal the exact location of the GEBCO data can be visualized and therefore the location of the localized smoothing remains known in the model.

Hope this helps you.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry coordinator

**Question:**

On 5/8/2015 11:15, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Dr Leigh Howarth



**Email address:** [l.m.howarth@bangor.ac.uk](mailto:l.m.howarth@bangor.ac.uk)

**Feedback:** Hi there, I downloaded your fantastic depth data as a netcdf. However, when I import it into ArcGIS and overlay my existing layers (using WGS84), they are hundreds of miles apart? Can you help me by any chance?

=====

**Answer:**

**From:** Dick M.A. Schaap [mailto:dick@maris.nl]

**Sent:** 08 May 2015 10:58

**To:** Leigh Howarth

**Subject:** Re: Emodnet-Hydrography Feedback

Dear dr Howarth,

The NetCDF file (.mnt extension) has a special dialect and is fit for use in the 3D Viewer software which you can download from the portal. See:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000_000000)

In the lower half under: 3D Viewer

Most probably it is better that you download the DTM tiles in ESRI ASCII file which should fit ArcGIS (ESRI).

Hope this helps.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry coordinator

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**Client feedback:**

**Subject:** RE: Emodnet-Hydrography Feedback

**Date:** Fri, 8 May 2015 10:19:18 +0000

**From:** Leigh Howarth <l.m.howarth@bangor.ac.uk>

**To:** Dick M.A. Schaap <dick@maris.nl>

All sorted Dick!

Nothing a bit of “googling” can’t solve.

Thanks again,

Leigh

**Dr Leigh Michael Howarth**

Research Officer

School of Ocean Sciences

Bangor University

Isle of Anglesey, LL59 5AB

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**Question:**

On 3/31/2015 13:58, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Jérôme OLLIER

**Email address:** [webmaster@nausicaa.fr](mailto:webmaster@nausicaa.fr)

**Feedback:** Madam, Sir, NAUSICAÄ - French National Sea Experience Center, in Boulogne-sur-Mer (Northern France), is a Science Center entirely dedicated to the relationship between Mankind and the Sea. Its goal is to incite the general public to discover the sea and to love it, while raising its awareness on the need for a better management

of marine resources. Within the scope of this mission, NAUSICAA gives access, on its web site, to a database containing links to web sites concerning the sea-related topics and marine activities (<http://www.nausicaa.co.uk/annuaire-sites-internet-marins.html>). This marine directory is currently listing over 6,000 websites. We would like to include a free link to your web <http://www.emodnet-bathymetry.eu/> in this database. Of course, this link will open in a new window. We are therefore asking for your official authorization to create that link. If you wish to provide your own description for your web site, we will, of course, use it for this database. Looking forward to your answer, Best Regards, Jérôme OLLIER Webmaster NAUSICAA - Centre National de la Mer BP 189 Boulevard SAINTE-BEUVE 62203 BOULOGNE-SUR-MER CEDEX FRANCE <http://www.nausicaa.fr/> <http://www.facebook.com/#!/profile.php?id=672039672> <http://www.facebook.com/#!/pages/Boulogne-Sur-Mer-France/NAUSICAA-Centre-National-de-la-Mer/64991257416?ref=ts> <http://twitter.com/PlaneteNAUSICAA>

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**Answer:**

**Subject:** Re: Emodnet-Hydrography Feedback

**Date:** Wed, 13 May 2015 13:26:10 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** [webmaster@nausicaa.fr](mailto:webmaster@nausicaa.fr)

Dear Jérôme,

Sorry for the delay in answering. Please feel free to include a link to [www.emodnet-bathymetry.eu](http://www.emodnet-bathymetry.eu) and include the following description, if possible:

"This portal was initiated by the European Commission as part of developing the **European Marine Observation and Data Network** (EMODNet). The overall objective of EMODnet is to create pilots to migrate fragmented and inaccessible marine data into interoperable, continuous and publicly available data streams for complete maritime basins. The Bathymetry portal development started in June 2009 and now provides a range of options for freely browsing and downloading a harmonised Digital Terrain Model (DTM) for all European sea regions. The downloadable tiles are freely available in a number of formats. The EMODnet digital bathymetry has been produced from bathymetric survey data and aggregated bathymetry data sets collated from public and private organizations. These are processed and quality controlled. A further refinement and expansion is underway, by gathering additional survey data sets and where possible, upgrading the DTM grid resolution, and will result in new releases in time. The portal also includes a metadata discovery service that gives clear information about the background survey data used for the DTMs, their access restrictions, originators and distributors."

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry Coordinator

**Question:**

On 6/2/2015 12:14, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Amelia Astley

**Email address:** [a.astley@noc.soton.ac.uk](mailto:a.astley@noc.soton.ac.uk)

**Feedback:** Is the wreck features shapefile available for download? Many thanks, Amelia

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**Answer:**



**Subject:** Re: Emodnet-Hydrography Feedback

**Date:** Tue, 02 Jun 2015 12:47:08 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** a.astley@noc.soton.ac.uk

Dear Amelia,

I am sorry, but the wrecks layer is not available for download. It is provided to us via OceanWise. If you are interested, you might contact them: [richard.farren@oceanwise.eu](mailto:richard.farren@oceanwise.eu)

Regards

Dick M.A. Schaap

Coordinator

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**Question:**

On 6/29/2015 9:13, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Jana Echave

**Email address:** [jana.echave@alumnos.unican.es](mailto:jana.echave@alumnos.unican.es)

**Feedback:** Dear Sir/Madame: My name is Jana Echave and I work ant the environmental hydraulics Institute of the university of Cantabria (<http://www.ihcantabria.com/en/>). We are starting to work with emodnet bathymetry database and we have a couple of doubts. I am sure you will be able to help us. We are working at national scale (Spain) and we want to use all the bathymetry layers you have in your viewer for our country but we have some problems with the vertical reference. The bathymetry close to the coast is referred to LAT, and we need to have it referred to the mean sea level. We wonder if you have some tools already prepared to change the data to the mean sea level. Thanks in advance for your help Jana

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**Answer:**

**Subject:**Re: Emodnet-Hydrography Feedback

**Date:** Mon, 29 Jun 2015 10:04:46 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** jana.echave@alumnos.unican.es

Dear Jana,

I have forwarded your request to our Spanish partner (IEO) who will provide a response.

Kind regards

DMA Schaap

EMODnet Bathymetry coordinator

**Reply from IEO:**

**De:** Olvido Tello Antón

**Enviado el:** lunes, 29 de junio de 2015 12:58

**Para:** 'jana.echave@alumnos.unican.es'

**Asunto:** Emodnet-Hydrography Feedback

Dear Jana, my name is Olvido Tello and I am working for the Spanish Institute of Oceanography.

I am going to consult about this issue, and answer you as soon as possible.

Best regards.



Olvido Tello.

**Further reply from IEO:**

**Subject:**RE: Emodnet-Hydrography Feedback

**Date:** Tue, 7 Jul 2015 18:11:56 +0200

**From:** Olvido Tello Antón <olvido.tello@md.ieo.es>

**To:** jana.echave@alumnos.unican.es

**CC:** Dick M.A. Schaap <dick@maris.nl>

Dear Jana,

I have checked the metadata for our data in EMODNET, and the vertical reference is referred to the mean sea level or unknown, but we have not data referred to LAT. The information referred to LAT in Spanish coastal is elaborated for the [Hydrographic Institute of the Navy](#).

Best regards.

Olvido Tello

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----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Tue, 15 Sep 2015 21:23:17 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Juliana Miranda <j.miranda@metocean.co.nz>

Dear Juliana,

That is a great relief. We are happy that we can share the full potential of EMODnet Bathymetry with you.

Kind regards

Dick

On 9/15/2015 4:18, Juliana Miranda wrote:

Hi Dick,

Sorry for the late reply.

I was trying to get help from our System Administrator.

It was an issue with our network and provider. Problem solved, I can now access all the features in the EMOD website, tiles, and I'm able to download data.

Thank you very much for your help.

Regards,

Juliana.

On Fri, Sep 11, 2015 at 10:25 PM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear Juliana,

It appears to be a firewall issue. The bathymetry portal makes use of multiple servers for specific WMS and WFS services. It seems you have access to one but not the other.

1) can you try to ping the server directly on [ows.emodnet-bathymetry.eu](http://ows.emodnet-bathymetry.eu) and <http://ows.emodnet-bathymetry.eu/wms>

2) can you try the portal at a different location and possibly a different machine.

3) another test is to see if you connect to the server using a WMS/WFS viewer (e.g. in Q-GIS or ArcGIS):

WMS:



WFS:

<http://ows.emodnet-bathymetry.eu/wfs>

WMST:

<http://ows.emodnet-bathymetry.eu/wmts>

If you can use these, see if the sources references layer is now visible.

Hope you can try and keep us informed. We think it is a firewall issue, but your test will help us.

Regards

Dick

On 9/11/2015 4:23, Juliana Miranda wrote:

Hello Dick, thanks for your feedback.

I tried to do what you suggested, but when I click the 'Download products', I don't get a yellowish overlay with 16 tiles. Nothing appears actually.

I see the layers on the left drop-down menu, I can switch/overlay some of them (I can't see 'Source references' when I select it), but nothing happens when I click 'Download products'.

I've tried using Windows Explorer 11, Firefox 36 and Chrome 45 (this I tried in Windows 7 and Linux).

Regards,

Juliana.

On Thu, Sep 10, 2015 at 7:54 PM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear Juliana,

We have tested it and it works with all our browsers.

Please go to: <http://www.emodnet-bathymetry.eu/>

Click on the depicted MAP or choose the navigation option: Data Products

Click on the MAP and you will go to: <http://portal.emodnet-bathymetry.eu/>

You will then open the Bathymetry Viewing and Download service with many layers and options

For downloading: click on the button in the top menu ' Download Products'

This gives a yellowish overlay of 16 tiles and the button must also be yellowish

Then click on a Tile and a menu appears with data formats

Choose 1 and wait a little bit , because the files are quite large.

The save the selected file which takes a while

Please confirm it works now?

Regards

Dick M.A. Schaap

Coordinator

On 9/10/2015 4:20, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Juliana

**Emailaddress:** [j.miranda@metocean.co.nz](mailto:j.miranda@metocean.co.nz)

**Feedback:** Hi, I've been trying to download the bathymetry data, but the portal is not displaying the tiles. I tried in different computers and web browsers. Any suggestion on what could be happening? Thanks.



----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Mon, 21 Sep 2015 11:56:30 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** jennifer.graham@metoffice.gov.uk

Dear Jennifer,

The files are quite large and therefore we tried to make the downloadable files as compact as possible. For that purpose we use RAR to pack the files. You can find free version of Winrar is gratis te downloaden using Google. Using Winrar should solve your problem.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry Coordinator

On 9/17/2015 13:16, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Jennifer Graham

**Emailaddress:** [jennifer.graham@metoffice.gov.uk](mailto:jennifer.graham@metoffice.gov.uk)

**Feedback:** I have just tried to download the updated bathymetry data (nc files), but unfortunately am not able to extract the data on my system (incompatible zip versions). So, is there any way of obtaining the data either in unzipped formats, or with a back-compatible compression? Thank you.

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 23 Sep 2015 13:35:53 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** roberto.bozzano@cnr.it

Dear Roberto,

The files are quite large and therefore we tried to make the downloadable files as compact as possible. For that purpose we use RAR to pack the files. You can find free versions of Winrar using Google. Using Winrar should solve your problem.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry Coordinator

On 9/23/2015 12:27, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Roberto Bozzano

**Emailaddress:** [roberto.bozzano@cnr.it](mailto:roberto.bozzano@cnr.it)

**Feedback:** Dear Sirs, I was trying to download data (in any format) from <http://portal.emodnet-bathymetry.eu/>. However, unzipping every downloaded zip file provides an error (unknown method). Is there any suggest tool for decompress the provided data file? Thanks in advance for your kind cooperation and availability. Best regards. Roberto Bozzano

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form



**Date:** Wed, 23 Sep 2015 13:41:29 +0200  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** e.v.d.oever@periplus.nl

Dear Eisse,

I am sorry, but the wrecks layer is not available for download. It is provided to us via OceanWise. If you are interested, you might contact them: [richard.farren@oceanwise.eu](mailto:richard.farren@oceanwise.eu)

Regards

Dick M.A. Schaap  
Coordinator

On 9/22/2015 8:19, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Eisse van den Oever

**Emailaddress:** [e.v.d.oever@periplus.nl](mailto:e.v.d.oever@periplus.nl)

**Feedback:** Dear EMODnet, I've tried to substract a geotiff containing wreck locations from the server but these are not exported. Could you please check if this can be improved?  
Kind regards, Eisse

----- Forwarded Message -----

**Subject:**R: Emodnet-Hydrography Feedback form

**Date:** Wed, 23 Sep 2015 15:05:32 +0200

**From:** Roberto Bozzano <roberto.bozzano@cnr.it>

**To:** 'Dick M.A. Schaap' <dick@maris.nl>

Dear Dick,

thanks for the suggestion.

I used WinRAR version 3...now I moved to version 5 and everything is ok...

Thanks again for the help.

Best regards.

Roberto

**Da:** Dick M.A. Schaap [mailto:dick@maris.nl]

**Inviato:** mercoledì 23 settembre 2015 13:36

**A:** roberto.bozzano@cnr.it

**Oggetto:** Re: Emodnet-Hydrography Feedback form

Dear Roberto,

The files are quite large and therefore we tried to make the downloadable files as compact as possible. For that purpose we use RAR to pack the files. You can find free versions of Winrar using Google. Using Winrar should solve your problem.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry Coordinator

Consiglio Nazionale delle Ricerche (CNR)

Via de Marini 6, 16149 Genova – ITALIA

Tel. +39.010.64.75.656

Fax. +39.010.64.75.600

Email roberto.bozzano@cnr.it

<http://www.odas.ge.issia.cnr.it>



----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Wed, 23 Sep 2015 17:01:41 +0200  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** johan.sandell@geodata.no

Dear Johan,

The files are quite large and therefore we tried to make the downloadable files as compact as possible. For that purpose we use RAR to pack the files. You can find free versions of Winrar using Google. Using Winrar should solve your problem. [WinRar version 5](#)

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry Coordinator

On 9/23/2015 16:27, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Johan Sandell  
**Emailaddress:** [johan.sandell@geodata.no](mailto:johan.sandell@geodata.no)  
**Feedback:** Hi I tried to download some of the files from your website but when I tried to unzip the files I got an expected error 0x80004005. I tried it both at home and at work. Can there be a problem on your side when zipping the data?

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Fri, 9 Oct 2015 16:43:23 +0200  
**From:** gerard perez <gerard.gpg@gmail.com>  
**To:** Dick M.A. Schaap <dick@maris.nl>

Dear Dick,

I have downloaded it again and all of them have worked.

Thank you so much.

Gerard

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Wed, 7 Oct 2015 11:31:01 +0200  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** gerard perez <gerard.gpg@gmail.com>

Dear Gerard,

Please try downloading again. We have rezipped all downloadable tiles with a more common packing tool, which should work for most users.

Let us know, if it is ok now.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry coordinator



On 9/29/2015 9:11, gerard perez wrote:

Dear Dick,

I just downloaded the file B3.wyx from the Portal from Bathymetry, Bathymetry Viewing and Download service:

<http://portal.emodnet-bathymetry.eu/mean-depth-rainbow-colour-ramp-no-land-data>

When I have B3.xyz file and I try to unzip it with winrar, two errors appear, I attach a picture/pdf of them:

1- Unkonwn metodology on B3.xyz

2- There is no files to be unzipped.

Am i doing somthing wrong?

Thank you in advance.

Gerard

2015-09-29 8:54 GMT+02:00 Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>:

Dear Gerard,

We do not fully understand what might have happened. Can you therefore describe in more details your configuration and the steps you followed?

Thanks

Dick M.A. Schaap

Coordinator

On 9/25/2015 12:53, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Gerard

**Emailaddress:** [gerard.gpg@gmail.com](mailto:gerard.gpg@gmail.com)

**Feedback:** Hello, I am downloading you data for section B3 and I have problemes whan I try to unzip the file. It says ther is not any file to be unzipped. Can you help me? Tank you, Gerard

----- Forwarded Message -----

**Subject:**RE: Emodnet-Hydrography Feedback form

**Date:** Mon, 12 Oct 2015 07:54:49 +0200

**From:** Jean-Luc VETTER <[jean-luc.vetter@ep.total.no](mailto:jean-luc.vetter@ep.total.no)>

**To:** 'Dick M.A. Schaap' <[dick@maris.nl](mailto:dick@maris.nl)>

Hi Dick,

I have downloaded a set of data and it seems to work fine.

Thank you.

Kind regards

Jean-Luc

----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 7 Oct 2015 11:34:23 +0200

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [jean-luc.vetter@ep.total.no](mailto:jean-luc.vetter@ep.total.no)

Dear Jean-Luc,

Please try downloading again. We have rezipped all downloadable tiles with a more common packing tool, which should work for most ussers.

Let us know, if it is ok now.



Kind regards  
Dick M.A. Schaap  
EMODnet Bathymetry coordinator

On 9/28/2015 13:07, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Jean-Luc Vetter  
**Emailaddress:** [jean-luc.vetter@ep.total.no](mailto:jean-luc.vetter@ep.total.no)  
**Feedback:** Hi, I am trying to download the C2 dataset in XYZ. I got it on my PC but as I try to extract it locally I got an Error msg and the extracted folder is empty.

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Thu, 29 Oct 2015 11:34:14 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** jos@fcoo.dk

Dear Johan,  
Please see:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000_000000)

Kind regards  
Dick M.A. Schaap  
Coordinator

On 10/12/2015 9:27, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Johan Söderkvist  
**Emailaddress:** [jos@fcoo.dk](mailto:jos@fcoo.dk)  
**Feedback:** Can the EMODnet bathymetry data be shared with external partners? Best regards  
Johan

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Thu, 29 Oct 2015 11:39:38 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** gary.barnes@bridgeporth.com

Dear Gary,

The EMODnet DTM can be viewed and downloaded as tiles without any registration.

See: [http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000_000000)

The underlying survey data sets can be discovered through the CDI Data Discovery and Access service.

See: [http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000_000000)

This requires registration as a user, once you want to request access for downloading of survey data sets from selected data providers. This is explained at the given page.

Regards  
Dick M.A. Schaap  
Coordinator

On 10/23/2015 17:42, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Gary Barnes



**Emailaddress:** [gary.barnes@bridgeporth.com](mailto:gary.barnes@bridgeporth.com)

**Feedback:** The website looks very interesting and I would like to obtain some data to evaluate, however I cannot see any way to register etc. Please can you advise? Many thanks, Gary Barnes, Bridgeporth UK

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Thu, 29 Oct 2015 11:41:21 +0100  
**From:** Dominic Fehling <dominic.fehling@gmx.net>  
**To:** Dick M.A. Schaap <dick@maris.nl>

Thanks Dick,  
the import in QGIS worked flawlessly.  
Have a nice day,  
Dominic

**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Thu, 29 Oct 2015 11:30:44 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** dominic.fehling@gmx.net

Dear Dominic,  
Thanks for your positive feedback.  
I am sorry but we do not offer downloading of the depth contours layer. However it is included as a layer in the WMS services, which might help you otherwise?  
The EMODnet Bathymetry layers are also available as OGC compliant web services:

- WMS: <http://ows.emodnet-bathymetry.eu/wms>
- WFS: <http://ows.emodnet-bathymetry.eu/wfs>
- WMST: <http://ows.emodnet-bathymetry.eu/wmts>

Regards  
Dick M.A. Schaap  
Coordinator

On 10/29/2015 11:23, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Dominic Fehling

**Emailaddress:** [dominic.fehling@gmx.net](mailto:dominic.fehling@gmx.net)

**Feedback:** Hi, first and foremost: Thanks for this service, its greatly appreciated. As to my question: Is it possible to extract just the depth contours, if possible in a vector format (e.g. shapefile, svg or eps)? I'd appreciate if you find the time to reply.  
Thanks in advance, Dominic

=====  
**Subject:** Re: AW: Emodnet-Hydrography Feedback form  
**Date:** Wed, 4 Nov 2015 09:44:56 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** N32\_1, Praktikant <Praktikant.N32\_1@nlwkn-ny.niedersachsen.de>



Dear Krischan,

I received the following information from the Netherlands Hydrographic Office:

"The LAT-data set that the article of Cornelis Slobbe describes is available through the Netherlands Hydrographic Office. An email to [geo@hydro.nl](mailto:geo@hydro.nl) will do. It is important to note that this data is a proof of concept for an innovative way of calculating differences between the GRS80 ellipsoid (the internal reference of GPS) and LAT – it has not been released for operational use."

Kind regards

Dick

**Subject:**AW: Emodnet-Hydrography Feedback form

**Date:** Thu, 29 Oct 2015 11:29:44 +0000

**From:** N32\_1, Praktikant <[Praktikant.N32\\_1@nlwkn-ny.niedersachsen.de](mailto:Praktikant.N32_1@nlwkn-ny.niedersachsen.de)>

**To:** 'Dick M.A. Schaap' <[dick@maris.nl](mailto:dick@maris.nl)>

Hello Dick,

thanks a lot for the information!

Concerning the german EEZ, I have already received data for differences between LAT and NHN from the BSH. I have also seen quite an interesting simulation of LAT relative to the EGG08 geoid made by TU Delft and Delftares ([http://proceedings.utwente.nl/272/1/Slobbe\\_etal\\_hydro12.pdf](http://proceedings.utwente.nl/272/1/Slobbe_etal_hydro12.pdf)).

Although it does not represent the real LAT, it might be a sufficient approximation.

Thanks again for your kind help.

Best regards

Krischan Hubert

----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Thu, 29 Oct 2015 11:55:14 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** Praktikant.N32\_1@nlwkn-ny.niedersachsen.de

Dear Krischan,

In spite of several initiatives, most notably the EU Interreg IVb BLAST project, there is no shared set of reference surfaces for the entire North Sea, not to mention for all European seas. Therefore, it is not feasible at this moment to provide transformation values for the entire area of interest of EMODNet Bathymetry.

However at national level differences between LAT and other vertical datums (Mean Sea Level, Chart Datum, national terrestrial vertical references, ETRS89, etc) might be available. They are mostly managed on a national level, by the hydrographic office. In your case this would be BSH in Hamburg. In sea areas without appreciable tides, levels close to MSL is in use. For the German Baltic Sea area, the Baltic Sea Hydrographic Commission has defined EVRS (the "European Vertical Reference System") at sea. However, EVRS has not been defined for most other sea areas!

BSH has a Differential-DTM between GRS80, LAT and NHN (German Height Level DHHN92) for the german EEZ.

Our contact person from BSH will send you soon an email with further information.

Kind regards,

Dick M.A. Schaap

Coordinator

On 10/26/2015 14:18, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Krischan Hubert

**Emailaddress:** [Praktikant.N32\\_1@nlwkn-ny.niedersachsen.de](mailto:Praktikant.N32_1@nlwkn-ny.niedersachsen.de)



**Feedback:** Good afternoon, as the bathymetrie is given in meters to LAT, I was wondering, if there is a chance to get additional data with the difference between LAT and datum line, in order to transform the depth on an even niveau? Many Thanks Best regards  
Krischan Hubert

=====  
**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Fri, 30 Oct 2015 07:38:35 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** julianjimenezsolano@hotmail.com

Dear Julian,

My Spanish colleagues of IHM have prepared an instruction for you how to register and to request access to a copy of the multibeam data sets.

Please be aware that you have to register yourself and that the shown login details in the instruction document can not be used by you!

Regards

Dick M.A. Schaap  
Coordinator

On 10/11/2015 18:53, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Julian Jiménez Solano

**Emailaddress:** [julianjimenezsolano@hotmail.com](mailto:julianjimenezsolano@hotmail.com)

**Feedback:** Deseo la carta batimétrica del Estrecho de Gibraltar. Si me facilitan sus instrucciones, me daría de alta como usuariode su servicio. Soy antiguo oficial de complemento de la marina de Guerra Española. Gracias

=====  
----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 4 Nov 2015 12:19:25 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** haavard.holm@ntnu.no

Dear Haavard,

The Data Products of EMODnet Bathymetry (= DTM tiles) are freely available for use. However it will require an acknowledgement. See:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000_000000)

Also see our Disclaimer at:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0330000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0330000_000000)

The underlying data sets are property of the respective data providers and can be requested using the CDI Data Discovery & Access service. See:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000_000000)

Data providers have their own data policy.

Kind regards

Dick M.A. Schaap  
Coordinator

On 11/4/2015 11:47, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Haavard Holm  
**Emailaddress:** [haavard.holm@ntnu.no](mailto:haavard.holm@ntnu.no)  
**Feedback:** Hello, I have a question regarding copyrights. I am interested in bathymetry data from your site: [http://portal.emodnet-bathymetry.eu/?menu=0310000\\_000000](http://portal.emodnet-bathymetry.eu/?menu=0310000_000000) My question is whether you reserve copyrights or can I use the data for free ? Best regards Håvard Holm

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**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 4 Nov 2015 12:27:48 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Kerry Hayes <kerry.hayes@mttidal.com>

Dear Kerry,

Do you mean the DTM tiles from:

<http://portal.emodnet-bathymetry.eu/>

and if so which one? B2 / B3 / ....

and which file format? EMO / XYZ/ ..?

or do you mean underlying survey data sets from the CDI Data Discovery & Access service:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000_000000)

and what is your exact problem?

We can help you better if we understand your problem.

Will hear from you again

Regards

Dick M.A. Schaap

Coordinator

On 11/2/2015 10:46, Kerry Hayes wrote:

Hi there,

I am trying to download bathymetry data for the UK and Ireland so that I can interrogate it in arc GIS.

Thanks

Kerry

**From:** Dick M.A. Schaap [<mailto:dick@maris.nl>]

**Sent:** 30 October 2015 21:47

**To:** Kerry Hayes <[kerry.hayes@mttidal.com](mailto:kerry.hayes@mttidal.com)>

**Subject:** Re: Emodnet-Hydrography Feedback form

Dear Kerry,

Can you please be more precise which csv file you are dealing with?

regards

Dick M.A. Schaap

Coordinator

On 10/30/2015 15:44, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Kerry Hayes  
**Emailaddress:** [kerry.hayes@mttidal.com](mailto:kerry.hayes@mttidal.com)



**Feedback:** The csv file will not download as a csv - is there a problem with it?

=====

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Wed, 4 Nov 2015 12:40:41 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** mintioan@survey.ntua.gr

Dear Ioannis,  
Have you already visited the website: <http://www.emodnet-bathymetry.eu>  
because it is all explained there in a quite straight forward way.  
Please let me know if you experience issues.  
Regards  
Dick M.A. Schaap  
Coordinator

On 11/4/2015 12:36, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Ioannis Mintourakis  
**Emailaddress:** [mintioan@survey.ntua.gr](mailto:mintioan@survey.ntua.gr)  
**Feedback:** I am a PhD student and researcher on satellite altimetry and marine geodesy. How can I have access to the EMODnet bathymetric data (survey data sets and composite DTMs) and especially the final Digital Bathymetric grid (1/8 deg. resolution)? Kind Regards, Ioannis Mintourakis

---

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Wed, 4 Nov 2015 13:25:23 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** mintioan@survey.ntua.gr

Dear Ioannis,  
There is a button 'Download Products' in the top bar of the Bathymetry Viewing and Download service.  
Click on it and you can choose from 16 tiles to download in various formats.  
Also there is a HELP button which gives further explanation on the functionality of the Viewer service.  
Regards  
Dick

On 11/4/2015 12:56, mintioan@survey.ntua.gr wrote:

> Dear D.Schaap,  
> Thank you for immediate support!  
> As explained in:  
> ([http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000\\_000000#sextant](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000_000000#sextant)):



> "Important remark: the CDI and Sextant ..... European marine regions.  
> The DTM itself is available without any restriction from the Bathymetry  
> Viewing and Download service."  
> thus I move with mozilla browser to Bathymetry Viewing and Download service:  
> [http://portal.emodnet-bathymetry.eu/?menu=0310000\\_000000](http://portal.emodnet-bathymetry.eu/?menu=0310000_000000)  
> where, as far sa I can see, there is no option for downloading the DTM itself.  
> How can I download the above mentioned DTM?  
> Kind regards,  
> Ioannis Mintourakis  
> "Dick M.A. Schaap" <dick@maris.nl> said:  
>> Dear Ioannis,  
>> Have you already visited the website: <http://www.emodnet-bathymetry.eu>  
>> because it is all explained there in a quite straight forward way.  
> Please let me know if you experience issues.  
>> Regards  
>> Dick M.A. Schaap  
>> Coordinator

>> On 11/4/2015 12:36, noreply@maris.nl wrote:  
>>> \*Name:\* Ioannis Mintourakis  
>>> \*Emailaddress:\* [mintioan@survey.ntua.gr](mailto:mintioan@survey.ntua.gr)  
>>> \*Feedback:\* I am a PhD student and researcher on satellite altimetry  
>>> and marine geodesy. How can I have access to the EMODnet bathymetric  
>>> data (survey data sets and composite DTMs) and especially the final  
>>> Digital Bathymetric grid (1/8 deg. resolution)? Kind Regards, Ioannis  
>>> Mintourakis

>=====

----- Forwarded Message -----  
**Subject:** Re: Emodnet-Hydrography Feedback form  
**Date:** Thu, 12 Nov 2015 09:30:27 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** [ivanoff@ocean.ru](mailto:ivanoff@ocean.ru)

Dear Andrei,  
I am sorry, but the wrecks layer is not available for download. It is provided to us via OceanWise. If you are interested, you might contact them: [richard.farren@oceanwise.eu](mailto:richard.farren@oceanwise.eu)  
Kind regards  
Dick M.A. Schaap  
Coordinator

On 11/12/2015 8:29, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Andrei Ivanov  
**Emailaddress:** [ivanoff@ocean.ru](mailto:ivanoff@ocean.ru)  
**Feedback:** Is it possible to download data on ship-wrecks in any GIS format? If yes, please tell me how. Thank you in advance.

=====

----- Forwarded Message -----



**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Fri, 20 Nov 2015 20:09:01 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Lonneke.goddijn-murphy@uhi.ac.uk

Dear Lonneke,

At present you can download the EMODnet DTM only as the 16 tiles. We are considering a possible alternative, but that will not be implemented in the coming 6 months.

Concerning the NetCDF files, it may happen, because of different ways of reading Netcdf files that software packages will look for layers named "latitude" and "longitude". Be aware that in the EMODnet DTM we have used "lines" and "columns".

However while checking again, we found that both variables are not always correctly filled. Therefore we have rewritten all the NetCDF files and all 16 have been replaced at the portal.

So please download the NetCDF again and see if all goes ok.

Kind regards

Dick M.A. Schaap

Coordinator

On 11/17/2015 16:00, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Lonneke

**Emailaddress:** [Lonneke.goddijn-murphy@uhi.ac.uk](mailto:Lonneke.goddijn-murphy@uhi.ac.uk)

**Feedback:** Hi, I am trying to download bathymetry data from an area a lot smaller than a "tile". The file for one "tile" is too big for Matlab to read. Can I select a smaller area and how? Also, in the netcdf file is no latitudes and longitudes. How are the rows and columns created? Thanks for your help

=====

----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 25 Nov 2015 15:05:49 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** rutpedrosa@ub.edu

Dear Rut,

Please see: [http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000_000000)

Kind regards

Dick M.A. Schaap

Coordinator

On 11/25/2015 15:01, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Rut

**Emailaddress:** [rutpedrosa@ub.edu](mailto:rutpedrosa@ub.edu)

**Feedback:** Dear, I want ask you which citation I have to include if I use the bathymetry of your portal. Thank you very much for your attention, Greetings, Rut

=====

----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form



**Date:** Thu, 3 Dec 2015 00:58:01 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** peio@justmagic.com

Dear Elissalde,

The high resolution DTMs can not be downloaded, but only viewed.  
Downloading can be done for the 16 tiles of the medium resolution overall EMODnet DTM for Europe.

Kind regards  
Dick M.A. Schaap  
Coordinator

On 12/2/2015 11:46, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Elissalde  
**Emailaddress:** [peio@justmagic.com](mailto:peio@justmagic.com)  
**Feedback:** Hello, I try to download High resolution bathymetry for the French Mediterranean coast and Dunmanus bay in Ireland. But I can't manage to download some xyz file relative to this data. Could you help me please ? Many thanks. Best regrads. --Peio

=====  
----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form  
**Date:** Mon, 21 Dec 2015 10:26:42 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** eninnaluli@gmail.com

Dear Eninna,

I am sorry, but the wrecks layer is not available for download. It is provided to us via OceanWise. If you are interested, you might contact them: [richard.farren@oceanwise.eu](mailto:richard.farren@oceanwise.eu)

Regards  
Dick M.A. Schaap  
Coordinator

On 12/16/2015 4:27, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Eninna Luli  
**Emailaddress:** [eninnaluli@gmail.com](mailto:eninnaluli@gmail.com)  
**Feedback:** Hello, How can I download the shipwreck layer on the map in this link:  
<http://portal.emodnet-bathymetry.eu/> Thank you

=====  
----- Forwarded Message -----

**Subject:**Re: Emodnet-Hydrography Feedback form  
**Date:** Mon, 21 Dec 2015 10:41:08 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** jjpalomeque@batitopsl.com

Dear Juanje,

Can you explain some more. It is now not clear to me whether you are asking a question or telling us something.  
Will hear from you.

Regards



Dick M.A. Schaap  
Coordinator

On 12/14/2015 20:40, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** juanje Palomeque  
**Emailaddress:** [jjpalomeque@batitopsl.com](mailto:jjpalomeque@batitopsl.com)  
**Feedback:** interested in to put backgrounds for wreck multibeam data adquisition in Valencia coast

**Subject:** Re: Emodnet-Hydrography Feedback form )

**Date:** Tue, 12 Jan 2016 16:44:37 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** johannes.oeffner@cml.fraunhofer.de

Dear Johannes,

So far it is only possible to download the common resolution layer with the 16 tiles. We are considering extending this to the HR bathymetry DTMs, but not on a short term.

Kind regards

Dick M.A. Schaap  
Coordinator

On 1/12/2016 11:27, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Johannes Oeffner  
**Emailaddress:** [johannes.oeffner@cml.fraunhofer.de](mailto:johannes.oeffner@cml.fraunhofer.de)  
**Feedback:** Dear Ladies and Gentleman, I was wondering if it is also possible to download the coastal high resolution bathymetry data. I was only able to download the coarse data using <http://portal.emodnet-bathymetry.eu/> Thanks and kind regards,  
Johannes Oeffner

=====  
**Van:** "Dick M.A. Schaap" <[dick@maris.nl](mailto:dick@maris.nl)>  
**Datum:** 13 januari 2016 19:33:45 CET  
**Aan:** "<[guadalupe.bru@igeo.ucm-csic.es](mailto:guadalupe.bru@igeo.ucm-csic.es)>" <[guadalupe.bru@igeo.ucm-csic.es](mailto:guadalupe.bru@igeo.ucm-csic.es)>  
**Onderwerp:** Antw.: Emodnet-Hydrography Feedback form

Dear Guadalupe

Yes correct

Regards

Dick MA Schaap  
Coordinator

Verstuurd vanaf mijn iPhone

Op 13 jan. 2016 om 16:42 heeft <[noreply@maris.nl](mailto:noreply@maris.nl)> <[noreply@maris.nl](mailto:noreply@maris.nl)> het volgende geschreven:

**Name:** Guadalupe Bru  
**Emailaddress:** [guadalupe.bru@igeo.ucm-csic.es](mailto:guadalupe.bru@igeo.ucm-csic.es)  
**Feedback:** Hi, I've downloaded an A4 sheet data from the Bathymetry Viewing and Download service. In which datum is the data provided? D\_WGS\_1984?



=====

**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Tue, 19 Jan 2016 16:37:34 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** iris.hinrichs@uni-hamburg.de

Dear Iris,

Thanks for your feedback which also a lot of other people have mentioned. We are exploring using OGC-WCS for downloading user defined polygon from the DTM. Most probably that will be provided in the next phase of the EMODNet Bathymetry project.

Kind regards

Dick M.A. Schaap

Coordinator

On 1/19/2016 16:13, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Iris Hinrichs

**Emailaddress:** [iris.hinrichs@uni-hamburg.de](mailto:iris.hinrichs@uni-hamburg.de)

**Feedback:** Would be nice if users could define regions for download themselves instead of choosing the pre-defined tiles. I would like to download the bathymetry data for the Baltic Sea only.

=====

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Tue, 19 Jan 2016 16:54:46 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** ogourgue.web@gmail.com

Dear Olivier,

It is indeed LAT.

In spite of several initiatives, most notably the EU Interreg IVb BLAST project for the North Sea, there is no shared set of reference surfaces for the North Sea, not to mention for all European seas. Therefore, it is not feasible at this moment to provide transformation values for the entire area of interest of EMODNet Bathymetry.

However at national level differences between LAT and other vertical datums (Mean Sea Level, Chart Datum, national terrestrial vertical references, ETRS89, etc) might be available. They are mostly managed on a national level, by the hydrographic office. Eg for the German Baltic Sea area, the Baltic Sea Hydrographic Commission has defined EVRS (the "European Vertical Reference System") at sea. However, EVRS has not been defined for most other sea areas!

There is also a quite an interesting simulation of LAT relative to the EGG08 geoid made by TU Delft and Deltares ([http://proceedings.utwente.nl/272/1/Slobbe\\_etal\\_hydro12.pdf](http://proceedings.utwente.nl/272/1/Slobbe_etal_hydro12.pdf)).

Although it does not represent the real LAT. We received the following information from the Netherlands Hydrographic Office:

"The LAT-data set that the article of Cornelis Slobbe describes is available through the Netherlands Hydrographic Office. An email to [geo@hydro.nl](mailto:geo@hydro.nl) will do. It is important to note that this data is a proof of concept for an innovative way of calculating differences between the GRS80 ellipsoid (the internal reference of GPS) and LAT – it has not been released for operational use."



Hope this gives you more insight.

Kind regards

Dick M.A. Schaap

Coordinator

On 11/26/2015 11:56, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Olivier Gourgue  
**Emailaddress:** [ogourgue.web@gmail.com](mailto:ogourgue.web@gmail.com)  
**Feedback:** What is the vertical reference datum of the EMODnet DTM? There is one mention that it is LAT on that webpage: [http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040000_000000) If it the case, how can it be converted to mean sea level?

----- Forwarded Message -----

**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Tue, 19 Jan 2016 17:07:18 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [pedropersiobk@hotmail.es](mailto:pedropersiobk@hotmail.es)

Dear Pedro,

I do not fully understand what goes wrong in your idea. Can you download the 2 tiles, which are DTMs? If so, look inside of the DTMs and you will see that each grid cell has a reference to the CDI metadata or the Composite DTM metadata. The details of these are included in the CDI Data Discovery and Access Service OR the Sextant Data Products Catalogue, both of which you can find at the EMODNet portal at [www.emodnet-bathymetry.eu](http://www.emodnet-bathymetry.eu). More info about the DTM format is given in:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040017\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0040017_000000)

Hope this helps.

Kind regards

Dick M.A. Schaap

Coordinator

On 12/7/2015 18:14, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Pedro Beca  
**Emailaddress:** [pedropersiobk@hotmail.es](mailto:pedropersiobk@hotmail.es)  
**Feedback:** To whom it may concern, My name is Pedro Beca, I am a PhD student at NUI Galway, Ireland. I write you because I would like to use data related with bathymetry, for the areas B2 and B3 from the layer (mean-depth-in-multi-colour-style-no-land-data). I am trying to obtain the metadata, however, I am not able to download. I will so grateful if you can explain how to obtain that or if you can send through my email. Look to hearing from, thanks in advance, Regards, Pedro

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----- Forwarded Message -----

**Subject:** AW: AW: Emodnet-Hydrography Feedback form

**Date:** Thu, 28 Jan 2016 09:00:17 +0000

**From:** Bernd Vahrenkamp <[Bernd.Vahrenkamp@bsh.de](mailto:Bernd.Vahrenkamp@bsh.de)>



**To:** 'Dick M.A. Schaap' <dick@maris.nl>

Dear Dick,

I am in contact with Johannes and will try to help him directly.

Kind regards,

Bernd Vahrenkamp

Bundesamt für Seeschifffahrt und Hydrographie

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**Von:** Dick M.A. Schaap [mailto:dick@maris.nl]

**Gesendet:** Mittwoch, 27. Januar 2016 08:06

**An:** Bernd Vahrenkamp; Lars Obermöller

**Betreff:** Fwd: AW: Emodnet-Hydrography Feedback form

Dear Bernd and Lars,

Can you help Johannes? Please keep me informed.

Kind regards

Dick M.A. Schaap

Coordinator

----- Forwarded Message -----

**Subject:**AW: Emodnet-Hydrography Feedback form

**Date:** Thu, 21 Jan 2016 11:51:43 +0000

**From:** Oeffner, Johannes <Johannes.Oeffner@cml.fraunhofer.de>

**To:** Dick M.A. Schaap <dick@maris.nl>

Dear Dick,

Thanks for the information. I was wondering if there is a chance that you email (or upload) the HR bathymetry data for the German North Sea coast? It could be very helpful for research project of us.

Thanks and best regards,

Johannes Oeffner

--

M.Sc. Johannes Oeffner

Fraunhofer Center for Maritime Logistics and Services

Am Schwarzenberg-Campus 4, Gebäude D, 21073 Hamburg, Germany

Telephone: +49 40 42878-4379, Telefax -4452

[johannes.oeffner@cml.fraunhofer.de](mailto:johannes.oeffner@cml.fraunhofer.de)

<http://www.cml.fraunhofer.de>

**Von:** Dick M.A. Schaap [mailto:dick@maris.nl]

**Gesendet:** Dienstag, 19. Januar 2016 16:45

**An:** Oeffner, Johannes

**Betreff:** Re: Emodnet-Hydrography Feedback form

Dear Johannes,

So far it is only possible to download the common resolution layer with the 16 tiles. We are considering extending this to the HR bathymetry DTMs, but not on a short term.

Kind regards

Dick M.A. Schaap

Coordinator

On 1/12/2016 11:27, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:



**Name:** Johannes Oeffner  
**Emailaddress:** [johannes.oeffner@cml.fraunhofer.de](mailto:johannes.oeffner@cml.fraunhofer.de)  
**Feedback:** Dear Ladies and Gentleman, I was wondering if it is also possible to download the coastal high resolution bathymetry data. I was only able to download the coarse data using <http://portal.emodnet-bathymetry.eu/>  
Thanks and kind regards, Johannes Oeffner

----- Forwarded Message -----

**Subject:** Re: Emodnet Bathymetry Issues  
**Date:** Fri, 29 Jan 2016 14:01:42 +0100  
**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** 'Duncan Hume' <Duncan.Hume@sgu.se>  
**CC:** info@emodnet.eu <info@emodnet.eu>, 'Gustav Kågesten' <Gustav.Kagesten@sgu.se>, 'Eva Jirner' <Eva.Jirner@sgu.se>

Dear Duncan,  
Thanks for sending me your questions by 2 different pathways which both have found me. So I will give you 1 answer email.

Concerning downloading: both Firefox and Chrome work without any issue at our end. When you are in the <http://portal.emodnet-bathymetry.eu> site, you can activate the button in the top bar 'Download products' This gives a 16 tile grid. Click on a tile and you can chose a file format. Click on the format and the downloading should start. The files are quite large, so be patient.

Using Internet Explorer we noticed a small hurdle which is beyond our control, but has to do with the safety settings of IE. When you follow the steps as above in IE, at the last step nothing seems to happen, except that the browser will show a little icon in its top window. See attached capture1.jpg. Then click on this icon and you will see the pop-up window of Microsoft: see capture2.jpg. Activate the ActiveX filtering and the downloading will start.

The EMODnet Bathymetry DTM in general has a grid resolution of 1/8 arc minute (ca 230 meter) ; however is based upon available survey data and otherwise composite DTMs which determine the actual resolution. For instance as you can see in the source layer, we make use of GEBCO in many places, which ahs a resolution of 1000 meter grid. So EMODnet has there the same actual resolution, but it is given at the 230 meter grid by interpolation. Considering the Baltic. For large parts the source is the Baltic Sea Hydrographic Database Composite DTM which has a base resolution of 500 meters. However in parts of EMODnet for the Baltic we make use of surveys and composite DTMS with higher resolution (in particular for German waters) => EMODnet is then having an actual higher resolution in those parts as BSHD. Therefore we recommend to make use of the EMODNet DTM for the Baltic, also because we are continuing with gathering more surveys and Composite DTMs from countries around, which will improve the overall EMODnet DTM overtime.

Hope these answers will help you.

Kind regards

Dick M.A. Schaap

Coordinator EMODnet Bathymetry

On 1/29/2016 10:59, [info@emodnet.eu](mailto:info@emodnet.eu) wrote:

Dear Duncan:

Thanks very much for your message.



I am putting in copy the coordinator of EMODnet Bathymetry (Dick Schaap), who will be able to address your request.

Best regards,

**From:** Duncan Hume [<mailto:Duncan.Hume@sgu.se>]

**Sent:** 29 January 2016 10:36

**To:** [info@emodnet.eu](mailto:info@emodnet.eu); [bathymetry@emodnet.eu](mailto:bathymetry@emodnet.eu)

**Cc:** Gustav Kågesten; Eva Jirner

**Subject:** Emodnet Bathymetry Issues

Hello,

Please can you give me some advice about the data on the Emodnet Bathymetry data for the Baltic. I am specifically interested to access the best available public bathymetry dataset for Sweden (and ideally surrounding countries).

We have already downloaded bathymetry data from the Baltic Sea Hydrographic Commission <http://data.bshc.pro/#7/58.564/18.339> but I note that the BSHD is gridded to 500m but the Emodnet data is gridded to 250m. So before i download the Emodnet dataset I have a couple of questions: Firstly can you please advise if the data for the Emodnet product is more detailed than the BSHD dataset (i.e. is there more source data used) or is it this product using the same data but upsampled to a 250m grid? Secondly can you advise if there is a problem with the download function on the emodnet bathymetry portal. I tried to download in both chrome and in internet explorer but the download button does nothing.

Many thanks

Duncan Hume

Duncan Hume, MSc

Maringeologi

Sveriges geologiska undersökning (Geological Survey of Sweden)

Guldhedsgaten 5A, Göteborg SE-41320

+46 317082652, [duncan.hume@sgu.se](mailto:duncan.hume@sgu.se)

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**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 10 Feb 2016 09:42:26 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** John Cartwright - NOAA Federal <john.c.cartwright@noaa.gov>

**CC:** Jesse Varner - NOAA Affiliate <jesse.varner@noaa.gov>, Jennifer Jencks <Jennifer.Jencks@noaa.gov>

Dear John,

AGG is an output format of MapServer (MMS). Unfortunately this works only from version 7.0 while we are still at version 6.0.

However in the coming months we will upgrade to Version 7.0 because of another project and INSPIRE Compliance.

So I guess you will have to wait for now. Hope this is not a real issue.

Kind regards

Dick

On 2/9/2016 18:13, John Cartwright - NOAA Federal wrote:

Thanks for the fast response, I think this change will work fine for us to separate the single/multibeam surveys into separate layers. I do have a separate question for you please:

I'm using an external stylesheet to change the symbology and having trouble getting the polygon fill opacity to work. I understand that MapServer only supports this for the AGG driver - are you using this driver?

Sample request:

[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography?REQUEST=GetMap&SERVICE=WMS&BGCOLOR=0xFFFFFF&TRANSPARENT=TRUE&WIDTH=256&HEIGHT=256&reaspect=false&CRS=EPSG:900913&LAYERS=EMODnet\\_Bathymetry\\_multi\\_beams\\_polygons&VERSION=1.3.0&FORMAT=image/png&BBOX=0,8766409.899970049,1252344.2714243066,10018754.17139431&sld=http://maps.ngdc.noaa.gov/viewers/emodnet.sld](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography?REQUEST=GetMap&SERVICE=WMS&BGCOLOR=0xFFFFFF&TRANSPARENT=TRUE&WIDTH=256&HEIGHT=256&reaspect=false&CRS=EPSG:900913&LAYERS=EMODnet_Bathymetry_multi_beams_polygons&VERSION=1.3.0&FORMAT=image/png&BBOX=0,8766409.899970049,1252344.2714243066,10018754.17139431&sld=http://maps.ngdc.noaa.gov/viewers/emodnet.sld)

Thanks again for your help!

--john

On Tue, Feb 9, 2016 at 4:55 AM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear Jesse and colleagues,

We have amended the CDI Bathymetry WMS somewhat so that it has now separate layers to distinct between single beam and multibeam surveys.

The split is done via the CDI attribute field and the controlled vocabulary for the instrument / gear type (L05) of the survey.

The L05 vocab can be found at: [http://seadatanet.maris2.nl/v\\_bodc\\_vocab\\_v2/search.asp?lib=l05&screen=0](http://seadatanet.maris2.nl/v_bodc_vocab_v2/search.asp?lib=l05&screen=0)

Split criteria:

Single beam => all instrument/geartype = 156 or 359 or FFES or 999 except when occurring in combination with 157

Multibeam => all instrument/geartype = 157 or 310 or 312

The URLs have stayed the same:

URL to getcapabilities

[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography?service=WMS&request=GetCapabilities](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography?service=WMS&request=GetCapabilities)  
WMS URL

[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography)

The attached document explains how you can get the feature info from each CDI object in the WMS.

Hope this is what you are looking for.

Will hear from you.

Kind regards

Dick M.A. Schaap

EMODnet Bathymetry Coordinator

On 2/3/2016 9:43, Dick M.A. Schaap wrote:

Dear Jesse,

Getting the difference between single and multibeam and others will not be so easy. We have this in the metadata by instrument type from a controlled vocab; however the WMS is giving all surveys and then the metadata can be retrieved by pulling the CDI Id.

However I can discuss with my colleagues to set up some differentiated WMS services, depending on the instrument type, which then will help you. Thereafter the WFS stays the same principle, but the it is already separated beforehand.

I will come back to you on this.

Regards

Dick



On 2/3/2016 2:01, Jesse Varner - NOAA Affiliate wrote:

Hi Dick,

Thank you for the information, that's very helpful.

I am looking for a way to differentiate between single-beam and multibeam tracklines in the emodnet\_hydrography WMS. We are thinking about assigning different colors to single-beam and multibeam, using a WMS stylesheet. Do you know of a way to do this by directly using the WMS? Or, do we need to query the other service to get any additional metadata, i.e. [http://www.emodnet-hydrography.eu/v\\_cdi\\_v3/print\\_wfs.asp?n\\_code=2031079](http://www.emodnet-hydrography.eu/v_cdi_v3/print_wfs.asp?n_code=2031079)?

Can we use the "Data Set Name" to split the lines between single-beam and multibeam? One idea I had: I'd expect that all dataset names containing the string "MGD77" would be single-beam... but I'm not sure if that query would get all of the lines.

I cc'ed my colleagues John Cartwright and Jennifer Jencks who are also working on this project with me. We are beginning to set up a prototype "North Atlantic Data Portal" which will include this EMODNet service.

Best regards,

Jesse

On Fri, Jan 29, 2016 at 2:16 PM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear Jesse,

Very good. I have attached a document in which I explain how we have the WMS - WFS services arranged. For the WFS you need to undertake some programming, but as you have seen in the <http://portal.emodnet-bathymetry.eu> you can get nice results as well structured CDI metadata print pages.

Please read the attached doc and let me know if it is clear. Of course I am interested in your results.

I also included the WMS of the Bathymetry Viewing service which gives the bathymetry. Right now we are extending this with a WCS service by which users should be able to retrieve DTM data as a subset following a user defined polygon. This is still under development.

Keep me posted on progress.

Kind regards

Dick

On 1/29/2016 21:52, Jesse Varner - NOAA Affiliate wrote:

Hi Dick,

Thanks for fixing the WMS link -- looks like it's working now!

I'll describe a bit of what we're doing here at NOAA's National Centers for Environmental Information (NCEI), formerly National Geophysical Data Center (NGDC). We're looking at possibly adding your Survey Tracks/Polygons layer to one of our map viewers. I'm able to successfully display the EMODNet lines on our map, which is great.

I'm looking at the attributes available in the WMS:

CDI-record, Data set name, CDI-partner, Details

I was wondering, is there any way to get more information directly from the WMS, such as the start/end date, platform name, etc.? I see this information is available when you use the "Retrieve Metadata" tool.

Is there another service available that provides this additional metadata information? Such as a WFS?

Thanks and best regards,

Jesse

Jesse Varner

Cartographer/GIS Specialist

Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado  
and



NOAA National Centers for Environmental Information (NCEI)  
formerly NOAA's National Geophysical Data Center  
Boulder, CO  
[\(303\)497-7893](tel:(303)497-7893)  
[Jesse.Varner@noaa.gov](mailto:Jesse.Varner@noaa.gov)

On Fri, Jan 29, 2016 at 6:28 AM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear Jesse,  
Thanks for pointing this out to us. It has been corrected now. Please try again and tell me if it works.  
Sorry for the inconvenience.

Kind regards  
Dick M.A. Schaap  
Coordinator EMODnet Bathymetry

On 1/28/2016 23:59, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Nam** Jesse Varner

**e:**

**Emai** [jesse.varner@noaa.gov](mailto:jesse.varner@noaa.gov)

**laddr**

**ess:**

**Feed** Hi, I'm having a problem viewing the "Survey Tracks/Polygons" layer in the EMODNet map viewer:  
**back:** <http://portal.emodnet-bathymetry.eu/>. The lines are not showing up on the map. I see an error when I try to view one of the WMS requests, i.e.:  
[http://geoservice.maris2.nl/wms/seadatanet/emodnet\\_hydrography/?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&FORMAT=image%2Fpng&TRANSPARENT=true&LAYERS=points%2Clines%2Cpolygons&EDITION=20150905&CRS=EPSG%3A4326&WIDTH=2880&map;HEIGHT=876&BBOX=32.3931884765625%2C-19.3963623046875%2C37.2052001953125%2C-3.5760498046875](http://geoservice.maris2.nl/wms/seadatanet/emodnet_hydrography/?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&FORMAT=image%2Fpng&TRANSPARENT=true&LAYERS=points%2Clines%2Cpolygons&EDITION=20150905&CRS=EPSG%3A4326&WIDTH=2880&map;HEIGHT=876&BBOX=32.3931884765625%2C-19.3963623046875%2C37.2052001953125%2C-3.5760498046875) This is the error message I get: msSetErrorFile(): General error message. Failed to open MS\_ERRORFILE e:/system/logfiles/mapserver/cdi\_seadatanet\_emodnet\_hydrography.log Thanks, Jesse Varner NOAA National Centers for Environmental Information

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**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Fri, 5 Feb 2016 22:28:32 +0100

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [lbressan@arpa.emr.it](mailto:lbressan@arpa.emr.it) <>

Dear Lidia,

Thanks for your suggestion. However that functionality is already provided.  
Switch on one of the layers with 'mean depth .....'. Make it active for interrogation by switching also the radiobutton in front of the layer title.

Then in the top menu you will see a number of buttons appear:

- \* Retrieve depth
- \* Depth profile
- \* Legend

Click on 'Retrieve depth' to activate it. Then click with the mouse on the map and you will see a pop-up with depth, lat, lon and other details.

See the attached image.  
Please try it out and let me know it worked.  
Kind regards  
Dick M.A. Schaap  
EMODnet Bathymetry Coordinator

On 2/5/2016 16:24, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Lidia Bressan  
**Emailaddress:** lbressan at arpa.emr.it  
**Feedback:** A personal suggestion: it would be interesting to show the depth of the sea together with lgon,lat pointed by the mouse on the map.

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**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Thu, 3 Mar 2016 08:16:25 +0100

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Jennifer Jencks - NOAA Affiliate <jennifer.jencks@noaa.gov>

**CC:** John Cartwright - NOAA Federal <john.c.cartwright@noaa.gov>, Jesse Varner - NOAA Affiliate <jesse.varner@noaa.gov>, Alan Stevenson (agst@bgs.ac.uk) <agst@bgs.ac.uk>, Iain Shepherd <Iain.SHEPHERD@ec.europa.eu>

Dear Jennifer,

Thanks. I have made the change. In fact I should have known because I have good contact with Margarita Gregg who is a NCEI deputy director. She is in the Advisory Board of SeaDataNet which is a pan-European network of NODCs that is also involved in several EMODnet lots, including Bathymetry.

Cheers

Dick

On 3/3/2016 0:42, Jennifer Jencks - NOAA Affiliate wrote:

Hi Dick,

That's great! Might I make one minor suggestion? We're no longer NGDC, but NCEI (National Centers for Environmental Information). Doesn't exactly roll off the tongue yet...but we're working on it.

Cheers

Jennifer

On Wed, Mar 2, 2016 at 9:45 AM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear Jennifer,

The GEBCO link was also my initial thought why you asked.

Anyway we have cleared the misunderstanding, also at our European side, and now look forward to further cooperation.

I have also just posted a news item at the [www.emodnet-bathymetry.eu](http://www.emodnet-bathymetry.eu) website about your viewer prototype and our cooperation.

Kind regards

Dick

On 3/2/2016 17:26, Jennifer Jencks - NOAA Affiliate wrote:

Hi Dick,



We began this work back in October after I met and discussed the vision for the viewer with Thierry Schmitt at the fall GEBCO meeting. He was John and Jesse's initial point of contact for ingesting your map services. Moving forward I believe we're all on the same page and again, I apologize for the lack of clarity up front. I look forward to continuing to work with you and your team. Your assistance to John and Jesse has been much appreciated!

Cheers  
Jennifer

On Tue, Mar 1, 2016 at 11:53 PM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear Jennifer,

Thanks for your explanation which is very clear. I also agree that the present viewer gives a very impressive overview and very good credits also to the results of Emodnet Bathymetry.

The misunderstanding originated most probably because our group was approached by NOAA through our response form and without giving context while somebody in the working group could have given you my contact details and/or informed me from the European side.

Anyway we responded immediately and your team turned it into a great viewer which will earn us both credits. Happy to continue our cooperation and looking forwards.

Kind regards

Dick

Coordinator EMODnet Bathymetry

Op 2 mrt. 2016 om 01:02 heeft Jennifer Jencks - NOAA Affiliate <[jennifer.jencks@noaa.gov](mailto:jennifer.jencks@noaa.gov)> het volgende geschreven:

Hello Dick,

I have a feeling I am to blame for a lot of the confusion here regarding the purpose of the North Atlantic Data Portal.

At present, the Portal's main purpose is to serve as a tool for the North Atlantic Seabed Mapping International Working Group which, as you noted, just met last week in New Orleans. Alan Stevenson, who is also a coordinator for EMODnet, is the Working Group chair. I have cc'd him here.

One of the goals of the Working Group is to identify priority mapping areas in the North Atlantic - preferably areas that do not already contain data. To do this we have to know where data already exists. I have been working with members of the working group to identify web map services, shapefiles...anything that can be included in our Portal to show existing data coverage. We are not asking for the data themselves. We are not trying to discourage anyone from populating EMODnet Bathymetry.

Our future goal is to display as many web map services as we can and for those services to include URLs back to the source (eg: EMODnet) to access the data or at the very least, information about that data.

Now to address your specific concerns:

1. Irish data - we too archive and host the Irish data. So that dataset will be visible in both WMS.
  2. Portugal - a working group member received permission to let us include the data coverage shapefile. It is classified as "proprietary" in the portal. We have not requested their data and understand that when it is released, it will go to you.
  3. Norway - Jesse located and ingested the Norwegian WMS because the polygon coverage was not a 1:1 match with EMODnet - it included more data and is therefore also beneficial to the Working Group.
- Again, we are not encouraging anyone to submit data to NGDC instead of to EMODnet. Our Working Group is encouraging our participants to work with their countries to submit data to the appropriate data centers. Our goal is simply to show all data holdings (public and proprietary) that exist in the North Atlantic.



I hope this helps to clarify the work that we're doing here. If you have any additional questions I'm happy to try and answer them!

And thank you for your contributions to the Portal so far! Everyone was quite impressed at the meeting last week!

Jennifer

On Tue, Mar 1, 2016 at 3:15 PM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear John,

Maybe I have to study it some more. Of course many European data providers have submitted and are free to keep on submitting their data to NGDC in their own right.

I only want to include and use their data also in and for EMODnet Bathymetry because we have this pretty project going on for 7 years now and getting more European providers on board. Also we have some plans for going 3-D and improving resolution where possible, most probably as part of a new round for the coming 3 years, which will also include keeping searching for additional relevant survey data.

Therefore we maybe should expand our cooperation which might include NGDC informing us of European entries in NGDC that we can check and if needed, also follow-up.

Will hear from you. Now going to sleep because I have an early trip in the morning.

Kind regards

Dick

PS: The viewer is very nice and fast!

On 3/1/2016 23:00, John Cartwright - NOAA Federal wrote:

Not sure I understand your point re: Ireland - the only data I see for Ireland is indeed coming from EMODnet. I too want to ensure that we eliminate or at least minimize any data duplication.  
--john

On Tue, Mar 1, 2016 at 2:53 PM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear John

Thanks for the quick feedback and the further plans.

Indeed I also hope to hear from Jennifer, because I was somewhat embarrassed towards my client EU hearing afterwards about the purpose and demonstration. Guess you know the feeling.

For us it is important that other European providers still keep on populating EMODnet Bathymetry, because that is our objective and to use their data for enriching the CDI catalogue and the EMODnet DTM.

Concerning your layer of Ireland. That is already included in EMODnet. For Portugal you show the data from IPMA which is still under embargo for us but promised as IPMA is a partner in EMODnet Bathymetry. The Norwegian Hydrographic Service is also our partner so their data should be included EMODnet as well. I am bringing this forward not to create a situation that European data providers start choosing between NGDC and EMODnet Bathymetry.

Kind regards

Dick

On 3/1/2016 22:34, John Cartwright - NOAA Federal wrote:

Hello Dick,

We're using EMODnet layers in the prototype viewer ([http://maps.ngdc.noaa.gov/viewers/north\\_atlantic/](http://maps.ngdc.noaa.gov/viewers/north_atlantic/)). We worked around the the SLD opacity problem by setting the opacity in the ArcGIS JS API layer which uses your WMS service rather than try to handle it in the SLD.

The next step for us is to incorporate the WMS GetInfo requests on your service into our viewer.

Not sure if that addresses the question you had in mind. Jennifer may have more to add based on her meetings.

-john

On Tue, Mar 1, 2016 at 2:22 PM, Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)> wrote:

Dear John,

Any progress?

Also I was made aware of the following article - see below. Did you include our services for that purpose? I am asking because I got questions from the EU that are funding EMODnet Bathymetry and had no answers! Hope to hear from you soon.

Regards

Dick

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### **Flash Note - Galway Statement Implementation Meetings**

#### **New Orleans, 24-26 February 2016**

The context of this mission was provided by the 2016 Ocean Sciences Meeting which took place in New Orleans. It was a good opportunity to further promote and advance the implementation of the Galway Statement on Atlantic Ocean Cooperation.

#### **Meeting of the Atlantic Seabed Mapping International Working Group**

The 4<sup>th</sup> meeting of the Atlantic Seabed Mapping International Working Group took place on 24 February in New Orleans in the Audubon Aquarium of the Americas.

One year after its first meeting in Brussels, the group met to discuss the recommendations paper to the Tri-Lateral Galway Statement Implementation Committee, and other issues including data acquisition and management and the connections with ocean literacy.

It was agreed that Sigi's initial mandate for the group: "mobilise the scientific community" is already a fact. It was also reconfirmed that the creation of jobs through the generation of knowledge about the Atlantic is the overarching objective for the group.

The activity of this group is already well known by the oceanographic community, and Alan Stevenson, the Chair of the group, and other members of the group have done impressive work to promote it.

Craig McLean, NOAA's Head of Research, spoke on behalf of the 3 co-chairs of the trilateral EU-US-Canada Galway Statement Implementing Group. He commended the progress made by the group in the last year, including the recent transect from Guadeloupe to the Azores on-board IFREMERs research vessel *L'Atalante*. This was the third opportunistic survey carried out by the group in less than one year. More opportunistic surveys are currently being planned.

The three opportunistic surveys accomplished by the group have had a structuring effect and mobilised the community. They have brought a lot of visibility for the group and the Galway Statement implementation. These are very important steps towards a broader seabed mapping campaign in the Atlantic.

The seabed mapping WG recommends that:

*all bathymetric data that currently exists is identified and made accessible to the public through the establishment of a North Atlantic Data Portal.*

During the meeting, Jennifer Jencks (NOAA) presented a prototype North Atlantic Data Viewer, already available at [http://maps.ngdc.noaa.gov/viewers/north\\_atlantic/](http://maps.ngdc.noaa.gov/viewers/north_atlantic/).

*an appropriate planning mechanism to gather information from all collaborative seabed mapping network initiatives is developed and resourced to underpin future plans and activities.*

The role of AORAC-SA and its seabed mapping work package will be extremely important. The project will also facilitate communication of the group through an intranet page under its webpage.

*a Research Vessel Co-ordinator (RVC) is appointed and resourced, to liaise with the multitude of research institutions and organisations that operate scientific and survey vessels equipped with multibeam echosounder systems.*

There are already some signals that one Member State is willing to host and fund a Research Vessel Co-ordinator.

*an Atlantic Seabed Mapping Pilot Project is scoped, incorporating targeted sites, minimum data requirements, standards and formats, technology & innovation considerations (with industry collaboration), desired products and outputs, and citizen value proposition.*

The first draft of the Atlantic Seabed Mapping Pilot Project to be issued by the group in the next six months.

*high-resolution elevation data made possible by multibeam echosounder systems (MBES) should be collected as the foundation dataset for all others.*

The idea of a code of conduct for the oceanographic community, including such principles was discussed.

The above recommendations are presented in a detailed document which were discussed and finalised during the meeting. The recommendations are also supported by several White Papers drafted by the members of the group.

Colin Devey (GEOMAR) announced a breakthrough in convincing the German vessel operators to keep their multibeam systems on to collect information during their transects. Technicians are already on-board the vessels so there would be no extra costs related to that, only costs related to data storage and the subsequent data processing. It was agreed that other members of the group (FR, ES, PT) have the same approach in their respective countries. The AORAC-SA project will prepare a short paper to facilitate these contacts.

The Canadian government purchased a number of multibeam systems, which will be installed on all Canadian vessels shortly. The change of government in Canada brought many seabed mapping proposals on the table. The UK will also increase its investments in seabed mapping as the private sector demands more data. Private stakeholders demand it in order to be able to save money and expand their businesses (survey companies, maritime industries, etc).

Ireland has confirmed its commitment of 1 million Euro per year for seabed mapping.

Portugal is making progress in opening access to their seabed mapping data to join the other Atlantic countries that have already done this. Portugal will have a new research vessel as of 2017. A multibeam system still needs to be purchased (~ 3 M Eur).

In the coming weeks, the group will start working on a communication plan in close cooperation with the ocean literacy trilateral working group.

The next two meetings of the working group will take place in Galway on 30 June, back to back with SeaFest, and Monaco on 9/10 November, coinciding with a meeting of the IHO Crowd-Sourced Bathymetry WG.

Full support from the Galway Implementation committee was expressed by Craig McLean: "if you make jerseys, I'll buy one".

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**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Tue, 10 May 2016 19:12:59 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** <V.Venugopal@ed.ac.uk> <V.Venugopal@ed.ac.uk>

Dear Venki

I am sorry but we only support downloading following the given 16 tiles

In a later stage we will introduce also WCS services for user defined polygons but not now

Kind regards

Dick M.A. Schaap  
Coordinator

Op 10 mei 2016 om 14:46 heeft <[noreply@maris.nl](mailto:noreply@maris.nl)> <[noreply@maris.nl](mailto:noreply@maris.nl)> het volgende geschreven:

**Name:** Venki Venugopal  
**Emailaddress:** [V.Venugopal@ed.ac.uk](mailto:V.Venugopal@ed.ac.uk)  
**Feedback:** Dear Sir/Madam, The bathymetry data portal would be very useful to my research, however, the problem I have now is downloading the data in small windows rather than as very big windows as A1 and B1 etc. Could you inform me how to download data for small areas.  
Thanks Venki

**Subject:** Re: Emodnet-Hydrography Feedback form

On 5/11/2016 10:29, Sergio Ortega Acosta wrote:

Dear Dick,

You are right. I needed to download some bathymetry data and I thought it was necessary to register for it.  
Thanks so much for your help.

Regards,  
Sergio

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**Sergio Ortega Acosta**  
Técnico responsable del  
Laboratorio de Métodos Numéricos  
Edificio SCAI  
Universidad de Málaga  
29071 Málaga  
Spain

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**Subject:** Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 11 May 2016 09:03:48 +0200

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [sergio.ortega@uma.es](mailto:sergio.ortega@uma.es)

Dear Sergio,

Can you be a little bit more precise. For what service did you tried to register? The Bathymetry viewer and download service do not require any registration.

Will hear from you.

Kind regards

Dick M.A. Schaap  
Coordinator

On 5/8/2016 13:18, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Sergio Ortega Acosta  
**Emailaddress:** [sergio.ortega@uma.es](mailto:sergio.ortega@uma.es)  
**Feedback:** I tried to register to your web, but I haven't received the code in my email, so I cannot enter the system. Thanks in advance, Sergio



**Subject:** Re: Vb: Ang. Re: Emodnet Bathymetry Issues

**Date:** Mon, 16 May 2016 13:28:26 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** Gustav Kågesten <Gustav.Kagesten@sgu.se>

**CC:** Duncan Hume <Duncan.Hume@sgu.se>

Dear Gustav,

Thanks for persisting in your efforts. Happy it works fine now.

Kind regards

Dick

On 5/16/2016 10:39, Gustav Kågesten wrote:

Hi Dick,

I located the problem. When I moved off a non governmental laptop it worked just fine.

Looking forward to work with the data!

Best,

Gustav

Gustav Kågesten

Marin miljö och planering

Sveriges geologiska undersökning

Box 670, 751 28 Uppsala

018-17 90 15

[gustav.kagesten@sgu.se](mailto:gustav.kagesten@sgu.se)

Geological Survey of Sweden

Box 670, SE-751 28 Uppsala, Sweden

+46 18 17 90 15

----- Vidarebefordrat av Gustav Kågesten/SGU på 2016-05-16 10:38 -----

Från: Gustav Kågesten/SGU

Till: "Dick M.A. Schaap" <[dick@maris.nl](mailto:dick@maris.nl)>

Kopia: Duncan Hume/SGU@SGU

Datum: 2016-05-16 09:23

Ärende: Ang. Re: Emodnet Bathymetry Issues

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Hello Dick,

I just tested the downloading function for EMODNET Bathymetry (Baltic Sea region).

I cant seem to get any reaction from the downloading function, is the website still running as it should? Any other way to get hold of the data?

Best,

Gustav

Gustav Kågesten

Marin miljö och planering

Sveriges geologiska undersökning

Box 670, 751 28 Uppsala

018-17 90 15

[gustav.kagesten@sgu.se](mailto:gustav.kagesten@sgu.se)

Geological Survey of Sweden

Box 670, SE-751 28 Uppsala, Sweden

+46 18 17 90 15

Från: "Dick M.A. Schaap" <[dick@maris.nl](mailto:dick@maris.nl)>  
Till: 'Duncan Hume' <[Duncan.Hume@sgu.se](mailto:Duncan.Hume@sgu.se)>  
Kopia: "[info@emodnet.eu](mailto:info@emodnet.eu)" <[info@emodnet.eu](mailto:info@emodnet.eu)>, 'Gustav Kågesten' <[Gustav.Kagesten@sgu.se](mailto:Gustav.Kagesten@sgu.se)>, 'Eva Jirner' <[Eva.Jirner@sgu.se](mailto:Eva.Jirner@sgu.se)>  
Datum: 2016-01-29 14:06  
Ärende: Re: Emodnet Bathymetry Issues

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Dear Duncan,

Thanks for sending me your questions by 2 different pathways which both have found me. So I will give you 1 answer email.

Concerning downloading: both Firefox and Chrome work without any issue at our end. When you are in the <http://portal.emodnet-bathymetry.eu> site, you can activate the button in the top bar 'Download products' This gives a 16 tile grid. Click on a tile and you can chose a file format. Click on the format and the downloading should start. The files are quite large, so be patient.

Using Internet Explorer we noticed a small hurdle which is beyond our control, but has to do with the safety settings of IE. When you follow the steps as above in IE, at the last step nothing seems to happen, except that the browser will show a little icon in its top window. See attached capture1.jpg. Then click on this icon and you will see the pop-up window of Microsoft: see capture2.jpg. Activate the ActiveX filtering and the downloading will start.

The EMODnet Bathymetry DTM in general has a grid resolution of 1/8 arc minute (ca 230 meter) ; however is based upon available survey data and otherwise composite DTMs which determine the actual resolution. For instance as you can see in the source layer, we make use of GEBCO in many places, which ahs a resolution of 1000 meter grid. So EMODnet has there the same actual resolution, but it is given at the 230 meter grid by interpolation. Considering the Baltic. For large parts the source is the Baltic Sea Hydrographic Database Composite DTM which has a base resolution of 500 meters. However in parts of EMODnet for the Baltic we make use of surveys and composite DTMS with higher resolution (in particular for German waters) => EMODnet is then having an actual higher resolution in those parts as BSHD. Therefore we recommend to make use of the EMODNet DTM for the Baltic, also because we are continuing with gathering more surveys and Composite DTMs from countries around, which will improve the overall EMODnet DTM overtime.

Hope these answers will help you.

Kind regards

Dick M.A. Schaap

Coordinator EMODnet Bathymetry

On 1/29/2016 10:59, [info@emodnet.eu](mailto:info@emodnet.eu) wrote:

Dear Duncan:

Thanks very much for your message.

I am putting in copy the coordinator of EMODnet Bathymetry (Dick Schaap), who will be able to address your request.

Best regards,

**From:** Duncan Hume [<mailto:Duncan.Hume@sgu.se>]

**Sent:** 29 January 2016 10:36

**To:** [info@emodnet.eu](mailto:info@emodnet.eu); [bathymetry@emodnet.eu](mailto:bathymetry@emodnet.eu)



**Cc:** Gustav Kågesten; Eva Jirner  
**Subject:** Emodnet Bathymetry Issues

Hello,

Please can you give me some advice about the data on the Emodnet Bathymetry data for the Baltic. I am specifically interested to access the best available public bathymetry dataset for Sweden (and ideally surrounding countries).

We have already downloaded bathymetry data from the Baltic Sea Hydrographic Commission <http://data.bshc.pro/#7/58.564/18.339> but I note that the BSHD is gridded to 500m but the Emodnet data is gridded to 250m. So before i download the Emodnet dataset I have a couple of questions: Firstly can you please advise if the data for the Emodnet product is more detailed than the BSHD dataset (i.e. is there more source data used) or is it this product using the same data but upsampled to a 250m grid? Secondly can you advise if there is a problem with the download function on the emodnet bathymetry portal. I tried to download in both chrome and in internet explorer but the download button does nothing.

Many thanks

Duncan Hume

[Duncan Hume, MSc](#)

[Maringeologi](#)

[Sveriges geologiska undersökning \(Geological Survey of Sweden\)](#)

[Guldhedsgaten 5A, Göteborg SE-41320](#)

[+46 317082652, \[duncan.hume@sgu.se\]\(mailto:duncan.hume@sgu.se\)](#)

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**Subject:**Re: Vb: Ang. Re: Emodnet Bathymetry Issues  
**Date:** Mon, 16 May 2016 15:17:03 +0200  
**From:** George Spoelstra (Casema) <[g.spoelstra@casema.nl](mailto:g.spoelstra@casema.nl)>  
**To:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

Dear Gustav,

There are 32 bit Geotiffs available for download. If you need grids, also Esri grids can be downloaded. the BSBD is resampled by SMA to align with the non projected 1/8 minute EMODnet grid. No new data has been added. To improve the user experience in the portal, the RGB tiffs used in the WMS have been upsampled somewhat. The downloadable data follows the EMODnet specs of 1/8 arc minute.

Kind regards

George Spoelstra

(Sent from my iPhone)

----- Forwarded Message -----

**Subject:**Re: Vb: Ang. Re: Emodnet Bathymetry Issues  
**Date:** Mon, 16 May 2016 13:41:58 +0200  
**From:** Gustav Kågesten <[Gustav.Kagesten@sgu.se](mailto:Gustav.Kagesten@sgu.se)>  
**To:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

One or two additional questions.. I only found rgb tiffs. Do you have the gridded data in geotiff format with real depth values so i don't have to regrid from xyz? Also, how did you upsample the bshc data? It looks much more refined in Swedish waters in the emodnet data

Best, Gustav

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**Subject:**Re: Emodnet-Hydrography Feedback form  
**Date:** Tue, 5 Jul 2016 08:16:53 +0200



**From:** Dick M.A. Schaap <dick@maris.nl>  
**To:** ahmed.hamdi@polimi.it

Dear Ahmed,

Please have a look at the following page:

[http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0350000_000000)

Kind regards

Dick M.A. Schaap  
Coordinator

On 6/30/2016 16:50, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Ahmed Mansi

**Emailaddress:** [ahmed.hamdi@polimi.it](mailto:ahmed.hamdi@polimi.it)

**Feedback:** Dear Sir/Madam, How can I cite (reference) your data as I have used it in one of the Geoid determination projects. There is a publication in the preparation phase. Thanks a lot for your time.

=====  
**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Fri, 5 Aug 2016 15:08:06 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** homayoon.komijani@kuleuven.be

Dear Homayoon,

The official acknowledgement can be found at the following URL: [http://www.emodnet-bathymetry.eu/documents/emodnet\\_hydrography/html\\_page/acknowledgement-emodnet-bathymetry-v2.doc](http://www.emodnet-bathymetry.eu/documents/emodnet_hydrography/html_page/acknowledgement-emodnet-bathymetry-v2.doc)

Maybe you can include: Acknowledgement to EMODnet Bathymetry: and then copy the URL?

Kind regards

Dick M.A. Schaap  
Coordinator EMODnet Bathymetry

On 8/3/2016 14:49, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** homayoon komijani

**Emailaddress:** [homayoon.komijani@kuleuven.be](mailto:homayoon.komijani@kuleuven.be)

**Feedback:** Dear, I have used some bathymetry data from emodnet website, i would like to know how to cite the product. i did find an acknowledgement text which was rather long. in case i am expected to include the acknowledgement is there ashorter version of a citation form? Bests, Homayoon Komijani

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**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 31 Aug 2016 14:54:10 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** mail@kinniburgh.net

Dear Neil,

The EMODnet Bathymetry DTMs are in principle public data products which can be used also in publications, when mentioning acknowledging the EMODnet Bathymetry initiative. See: [http://www.emodnet-bathymetry.eu/content/content.asp?menu=0360000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0360000_000000)



The downloadable DTM Data Products are based upon bathymetric data from data originators and their references can be found in the data products by means of CDI and Sextant references. See the page explaining the metadata catalogues: [http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000_000000) Everybody can use the DTMs, but I have seen in practice that data originators might object to commercial uses in mapping products such as navigation software and electronic maps. This goes beyond the EMODnet Bathymetry project responsibility.

Therefore I advice you to look up and to contact the data providers (originators) for your areas of interest. You can do this by switching on the Source References layer in the EMODnet Bathymetry Viewing and Download service. Then also switch on the button 'Configure displayed coverage' which shows the data providers by area. The full address of each of these data providers can be found at the Partners page: [http://www.emodnet-bathymetry.eu/content/browse\\_partners.asp?menu=0060000\\_000000](http://www.emodnet-bathymetry.eu/content/browse_partners.asp?menu=0060000_000000)

Contact those relevant and explain them what you intend to do.

Hope this helps.

Kind regards

Dick M.A. Schaap

Coordinator EMODnet Bathymetry

On 8/29/2016 15:18, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Neil Kinniburgh

**Emailaddress:** [mail@kinniburgh.net](mailto:mail@kinniburgh.net)

**Feedback:** Hi, I'm considering using the bathymetric data in artworks (small 3D maps) which would be sold commercially. Can you confirm if there are any restrictions on this data which would prevent this type of use? I found the user registration page on the portal which says that the data is public domain, but the SeaDataNet policy says that I may need written permission from the data source. If that's the case, can you tell me who I need to contact for this. Many thanks for your help, Neil Kinniburgh

=====  
**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 31 Aug 2016 14:03:07 +0200

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [lea.david2@wanadoo.fr](mailto:lea.david2@wanadoo.fr)

Dear Léa,

As part of the EMODnet Bathymetry map viewer we also have a layer with the names of canyons, seamounts etc. This layer is named: GEBCO undersea features.

However this layer is not produced by EMODnet but derived from GEBCO as a WMS service.

Please have a look at the GEBCO pages where you can find more information about this layer and how you might use it for your purpose:

[http://www.gebco.net/data\\_and\\_products/undersea\\_feature\\_names/](http://www.gebco.net/data_and_products/undersea_feature_names/)

Hope this helps.

Kind regards

Dick M.A. Schaap

Coordinator EMODnet Bathymetry

On 8/31/2016 10:04, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Léa David

**Emailaddress:** [lea.david2@wanadoo.fr](mailto:lea.david2@wanadoo.fr)

**Feedback:**

I am Léa DAVID from France, member of the Scientific Committee of ACCOBAMS (International Agreement for the protection of cetacean in the Mediterranean Sea). I am in charge of helping to develop a webmapping tool for the network of cetacean's experts around the Mediterranean and Black Sea. For that purpose we would like to put some information about cetacean sightings, environmental factors, and human activities for the Mediterranean and Black Seas. I am looking at map only for illustration or information, not as data to be use (<http://accobams.geo2i.com/>). I already download your bathymetric maps (.tiff) and I was looking for the layer with the names of all canyons and seamounts, as these underwater features maybe important key areas for cetaceans. Will you help me for that please ? Sincerely, Léa

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**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 7 Sep 2016 14:15:37 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** ayferilbay@gmail.com

Dear Ayfer,

Most probably you tried to register for the Personal Layer in the EMODnet Bathymetry Viewing and Download Service at: <http://portal.emodnet-bathymetry.eu/>.

The Personal Layer function is temporarily not active (as mentioned in the HELP section). However for browsing and downloading the Bathymetry DTMs it is not necessary that you register, because these are all public services.

Should you require access to the underlying bathymetric survey data, then you will have to make use of the CDI Data Discovery and Access service. And this will require you to register as a SeaDataNet user as is explained at the related webpages. See: [http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000\\_000000](http://www.emodnet-bathymetry.eu/content/content.asp?menu=0030000_000000)

This should work.

Kind regards

Dick M.A. Schaap

Coordinator EMODnet Bathymetry

On 9/5/2016 13:31, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Ayfer Karli

**Emailaddress:** [ayferilbay@gmail.com](mailto:ayferilbay@gmail.com)

**Feedback:** Dear Sir/Madam, Although I registrated to your website properly, I could not log in to the data network. When I tried, I got a warning stating that the "temporary disabled, please chack back later". Coul you please help me to solve this problem. I am looking forward to hearing from you soon. Best regards, Ayfer Karli ilbay

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**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 7 Sep 2016 15:01:35 +0200

**From:** Dick M.A. Schaap <dick@maris.nl>

**To:** hemantbist@gmail.com

Dear Hemant,

Sorry for the delay in answering due to holidays.

At present the HRDTMS as presented in EMODnet Bathymetry are not (yet) available for downloading. This policy might change in the next phase of EMODnet Bathymetry which is planned to start during 2017. However in this specific case for France I advise you to contact its data provider - SHOM and to ask them to consider delivering you the HRDTMs for your purposes. A good contact for your request and possible negotiation is: Gaël Morvan <[gael.morvan@shom.fr](mailto:gael.morvan@shom.fr)> Inform him of EMODnet Bathymetry and your request.

Kind regards

Dick M.A. Schaap

Coordinator EMODnet Bathymetry

On 8/5/2016 0:10, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Hemant

**Emailaddress:** [hemantbist@gmail.com](mailto:hemantbist@gmail.com)

**Feedback:** Access to "High resolution bathymetry for selected coastal regions in France and Germany" Hi, I would really appreciate if you could clarify how can we access to high resolution bathymetry data for France coast that is a separate layer in your portal. These areas are shown at this url in your portal : <http://portal.emodnet-bathymetry.eu/coastal-areas-with-high-resolution-bathymetry>We are able to download 1/8 arc minute grid data for all the regions covered by Emodnet, but are not able to get access to the high resolution data you created for some coastal areas. I am co-founder of a company that creates fishing maps, and this data would be extremely valuable to fishermen. Best regards, Hemant Bist.  
<http://gpsnauticalcharts.com>

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**Subject:**Re: Emodnet-Hydrography Feedback form

**Date:** Wed, 21 Sep 2016 12:45:55 +0200

**From:** Dick M.A. Schaap <[dick@maris.nl](mailto:dick@maris.nl)>

**To:** [marine.devienne@edf-en.com](mailto:marine.devienne@edf-en.com)

Dear Pierre,

In EMODnet Bathymetry we have input data from Hydrographic Offices (HOs) and also from research institutes. Data from HOs are globally referenced to a LAT measured at a local tide station (generally from harbours). For the other sources it is not 100% the same case. It happens that it is assumed that Mean Sea Level and Lat are the same for water depths greater than 200 m and in most parts of the Mediterranean sea, because of minimum tides. Moreover for deep areas the impact of the tide precision generally will fall well below the level of variability of the morphology of the seafloor per grid cell and thus the precision of the given waterdepth. Vorf bathylli or other tide level surface are held nationally and might be used in the future.

Hope this helps.

Kind regards

Dick M.A. Schaap

Coordinator

On 9/15/2016 16:23, [noreply@maris.nl](mailto:noreply@maris.nl) wrote:

**Name:** Pierre MENSAN

**Emailaddress:** [marine.devienne@edf-en.com](mailto:marine.devienne@edf-en.com)

**Feedback:** Hello, I would like to know which LAT your are talking about for the metering of the bathymetry. Is it based on a VORF or on a specific point ? Thanks.

