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International conference on **Marine Data** and **Information Systems**



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Your gateway to marine data in Europe

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

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On behalf of the EMODnet Bathymetry consortium



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Overall aims

- ① To bring together bathymetric datasets as collected by European organisations and to make these available for discovery and access
- ① To produce the best, harmonised, and higher resolution Digital Terrain Model (DTM) of all European seas on the market
- ① To make this European digital bathymetry (DTM) available for users by means of portal viewing and downloading services and OGC machine to machine services
- ① To generate and publish the best estimate digital European coastlines for LAT, MSL, and MHW



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Standards are instrumental

- ⦿ Adoption of **SeaDataNet** standards and infrastructure
 - ⦿ **Common Data Index (CDI) service** based upon ISO 19115 – 19139 metadata standard for **bathymetric data sets** (surveys)
 - ⦿ **Sextant products catalogue** based upon ISO 19115 – 19139 for **composite DTMs**
 - ⦿ **Controlled vocabularies** for the marine domain (> 160.000 terms and > 60 lists), with international governance and web services
 - ⦿ Common SeaDataNet **Data Policy** and SeaDataNet License
- ⦿ Adoption of OGC WMS, WFS, and WCS services for machine-to-machine services



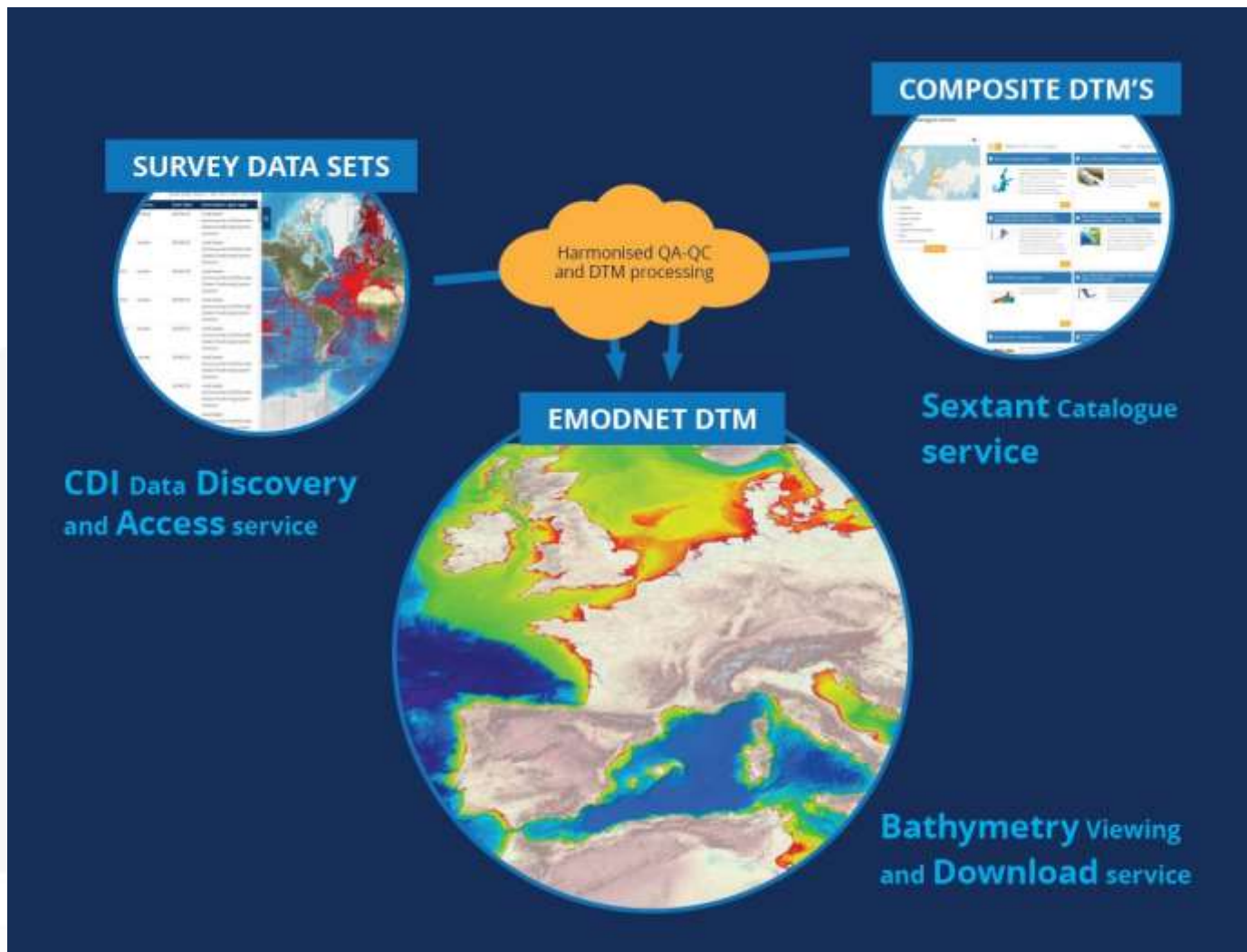


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Set-up of services





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Survey Data sets – CDI Data Discovery & Access service

- > **43.000** survey CDI metadata records from **47** data centres from **23** countries and **330** data originators **from 1816 to 2023** have been collated and imported into the EMODnet Bathymetry CDI data discovery and access service. Of these **60%** are restricted and require negotiation

The screenshot displays the EMODnet Bathymetry CDI Data Discovery and Access Service interface. The top navigation bar includes the EMODnet logo, the title "BATHYMETRY", and the subtitle "Discovering the topography of the European seas". There are also links for "SeaDataNet", "FEEDBACK", and "SURVEY". A "Login" button and a "DATASET BASKET" icon are visible on the right.

The main content area is divided into several sections:

- NEW SEARCH**, **REFINE SEARCH**, **SEARCH RESULTS** (active), **SUMMARY**, and **TIMESERIES** tabs.
- Filter search** section with buttons for "EXPORT RESULT" and "SAVE QUERY".
- INPUT FIELDS** section with "Free search", "Date search" (From/To), and "Geographic search" (North, West, East, South) options.
- SEARCH RESULTS** table showing three entries:

SELECT	
DATASET NAME	Celtic Explorer Bathymetry CE3701 Kerry 14m Globe dtm
COUNTRY ORIGINATOR	Ireland
START DATE	20070417
INSTRUMENT / GEAR TYPE	multi-beam echosoundersDifferential Global Positioning System receivers
SELECT	
DATASET NAME	Celtic Explorer Bathymetry CE0702 Kerry 14m Globe Dtm
COUNTRY ORIGINATOR	Ireland
START DATE	20070516
INSTRUMENT / GEAR TYPE	multi-beam echosoundersDifferential Global Positioning System receivers
SELECT	
DATASET NAME	Celtic Voyager Bathymetry CV0901 Shannon 14m Globe Dtm
COUNTRY ORIGINATOR	Ireland
START DATE	20090318
INSTRUMENT / GEAR TYPE	multi-beam echosoundersDifferential Global Positioning System

Below the search results is the **SEA REGIONS** section, which lists three regions with their respective record counts:

- Atlantic Ocean (19420)
- North Atlantic Ocean (19346)
- Northeast Atlantic Ocean (40W) (18534)

On the right side of the interface, there is a map showing the Atlantic Ocean region with red bathymetry data points overlaid on a grid. The map includes a scale bar and a "Map" button.



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Composite DTM's – Sextant CPRD Discovery service

- > **270** Composite DTM's from **29** data centres from **17** countries have been collated and imported into the dedicated EMODnet Bathymetry Sextant CPRD catalogue service.
- The data sets are for internal use while metadata is public as part of DTM source references.

The screenshot displays the 'Sextant Catalogue service' interface. At the top, a navigation bar includes 'APPROACH', 'METADATA & DATA', 'DATA PRODUCTS', 'NEWS', 'PROMOTION', 'PARTNERS', and 'HELPDESK'. The main content area is divided into several sections:

- Search:** A search bar with a magnifying glass icon and a dropdown menu for filters. The filter menu includes: Catalogue, Sextant Themes, Inside Themes, Keywords, Contact for the resource, Years, and Associated services.
- Results:** A list of search results. The first result is 'Baltic Sea Bathymetry Database' with a thumbnail map of the Baltic Sea. The second result is '574 EMODNET REGIONAL DTM OF NETHERLANDS CONTINENTAL SHELF' with a thumbnail map of the Netherlands continental shelf.
- Metadata details:** A detailed view for the dataset '574 EMODNET REGIONAL DTM OF NETHERLANDS CONTINENTAL SHELF'. It includes a 'WHAT' section, 'Metadata details' (File identifier: SDN_CPRD_388_291002, Catalogue type: Composite Product Record, Project name: EMODnet Bathymetry, Distribution level: public, Metadata language: English, Date stamp: Mon Jan 29 2018 16:31:26 GMT+0100), 'Identification' (Dataset name: 574_291002-Catalan Margin, Short name of dataset: SDN Local Products: 574_291002), and 'Parameter Discovery Vocabulary (PSD)' (Sea/Oceanic device categories, Sea/Surface device categories, Bathymetry and Seafloor, Multi-beam echosounders, Differential Global Positioning System receivers).
- Data access:** A section with a 'Data access' button and a thumbnail map of the dataset.



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Process flow for generating DTM releases

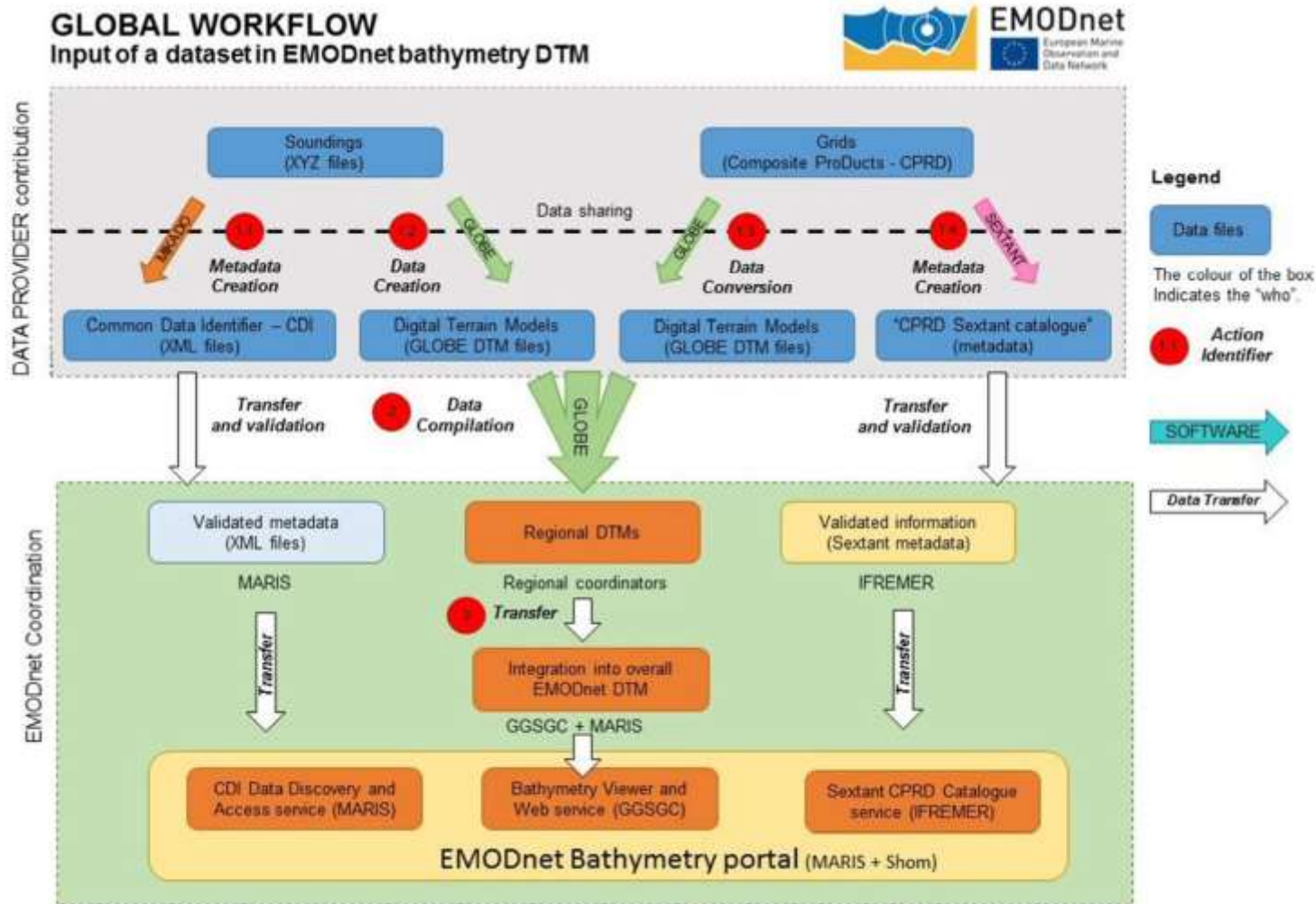


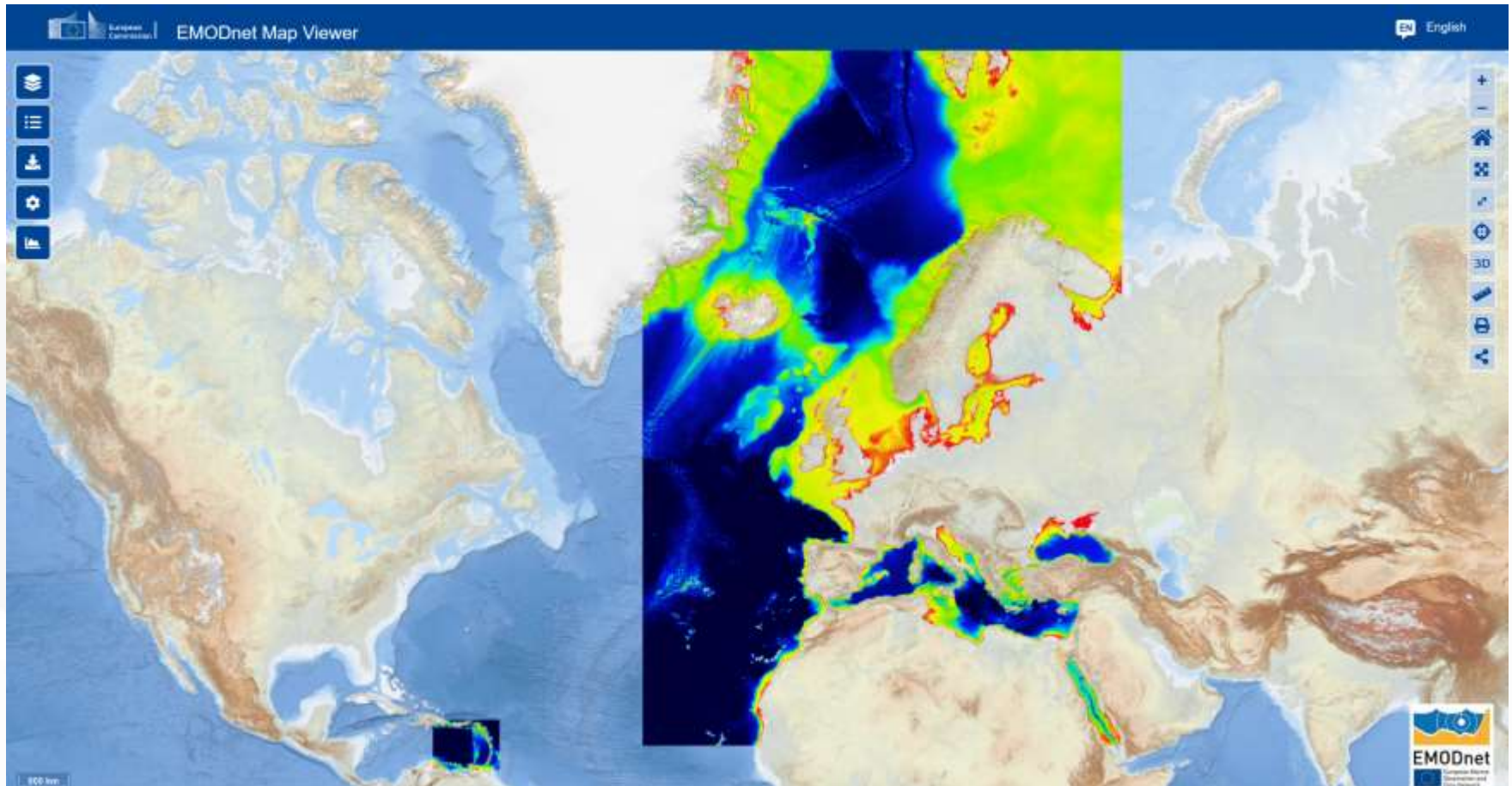
Image: Workflow for EMODnet HRSM2



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Bathymetry in EMODnet Central Portal Map Viewer service



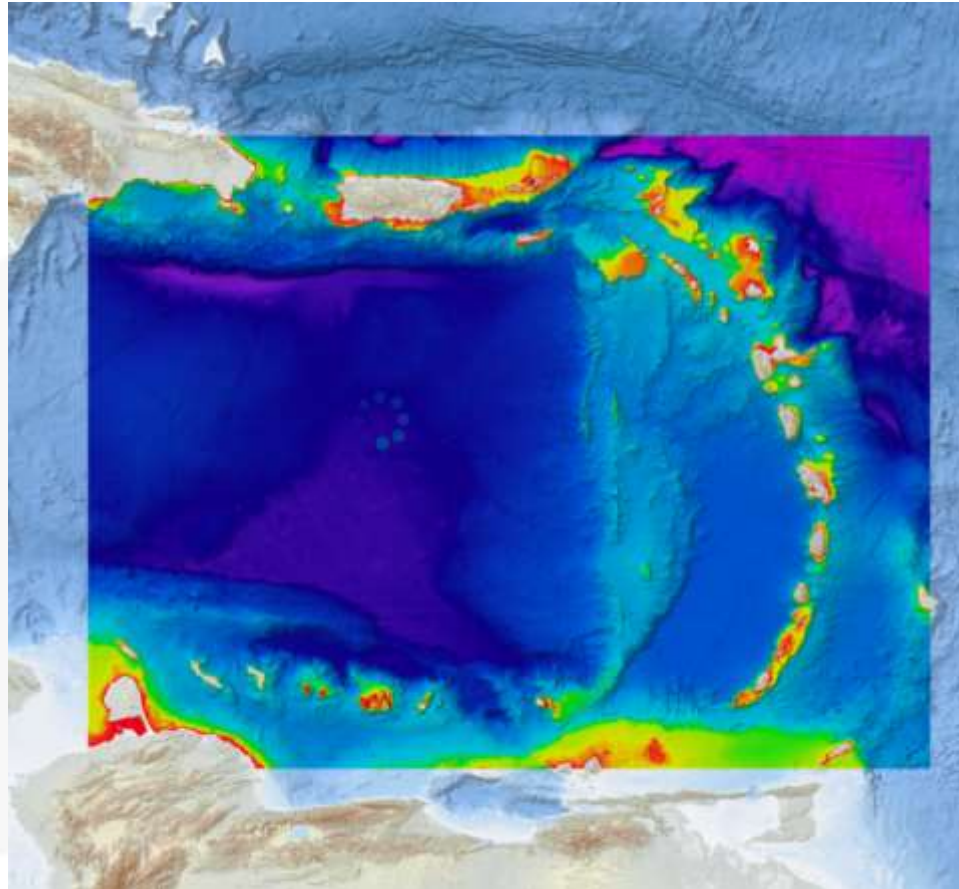
<https://emodnet.ec.europa.eu/en>



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Bathymetry in EMODnet Central Portal Map Viewer service - Caribbean





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Layer menu, integrated with other EMODnet thematics

The screenshot displays the EMODnet Map Viewer interface. The top navigation bar includes the European Commission logo, the text "EMODnet Map Viewer", and a language selector set to "English". On the left side, a vertical toolbar contains icons for home, layers, settings, and a search function. The main interface is split into two panels: "Layers" and "Catalogue". The "Layers" panel is active, showing a search bar and a list of thematic layers with expandable arrows. The "Catalogue" panel is currently empty. The main map area shows a bathymetry map of the Mediterranean Sea and surrounding regions, with colors ranging from blue (deep) to red (shallow). A scale bar at the bottom left indicates 200 km, and the coordinates -1.8888, 44.9582 are displayed. The EMODnet logo is visible in the bottom right corner of the map area.

EMODnet Map Viewer

EN English

Layers Catalogue

Administrative units

EMODnet Bathymetry

Coastlines

Data quality

Depth

DTM Tiles

Source metadata

Topography

EMODnet Biology

EMODnet Chemistry

EMODnet Geology

EMODnet Human Activities

EMODnet Physics

+ Add external layers

Marine regions Search for a region

Change basemap EMODNET World Base Layer

200 km -1.8888, 44.9582

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Source reference layer with metadata from CDI service and Sextant service

EMODnet Map Viewer

EN English

Layers Catalogue

Search layer

- Administrative units >
- EMODnet Bathymetry >
- Coastlines >
- Data quality >
- Depth >
- DTM Tiles >
- Source metadata >
 - Source Reference of the DTM
 - Global Survey Tracks/Polygons
- Topography >
- EMODnet Biology >
- EMODnet Chemistry >
- EMODnet Geology >
- EMODnet Human Activities >

+ Add external layers

Marine regions Search for a region ...

Change basemap EMODNET World Base Layer

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Source reference layer with metadata from CDI service and Sextant service

The screenshot displays the EMODnet Map Viewer interface. On the left, a 'Layers' panel is visible with a search bar and a list of layers. The 'Source Reference of the DTM' layer is checked and highlighted. Below the layers list, there are options for 'Marine regions' and 'Change basemap'. The main map area shows a colorful bathymetry map of a coastal region. A popup window titled 'Source Reference of the DTM' is open, providing detailed information about the layer. The popup includes a description of the DTM, its attributes, and a service URL. A legend in the popup shows a color-coded square for 'Source reference' and a link to 'Metadata URL'. At the bottom of the popup, there are buttons for 'Access to metadata' and 'Download'. The EMODnet logo is visible in the bottom right corner of the map viewer.

EMODnet Map Viewer

English

Layers Catalogue

Administrative units

EMODnet Bathymetry

Coastlines

Data quality

Depth

DTM Tiles

Source metadata

Source Reference of the DTM

Global Survey Tracks/Polygons

Topography

EMODnet Biology

EMODnet Chemistry

EMODnet Geology

EMODnet Human Activities

+ Add external layers

Marine regions Search for a region

Change basemap EMODNET World Base Layer

Source Reference of the DTM

The EMODnet DTM is comprised of tens of thousands individual datasets that are carefully selected and processed by the EMODnet Bathymetry team. In case datasets overlap the best possible solution is chosen to deconflict the overlap zone. As a result, the resulting EMODnet DTM is a patchwork of deconflicted individual datasets. The EMODnet source reference service is a graphical representation of this patchwork. It is based on a vector representation of all patches brought together in a topological non-overlapping network. The network is created based on a reverse engineering process using the DTM as input. To reduce the amount of noise in this network, the DTM has been reduced by a factor 5 before processing the network. As a result, small overlap with the detailed EMODnet coastline is possible.

The same network is also used for the EMODnet Quality Index service. Each patch in the network defines a number of attributes:

- Dataset name (reference to either SeaDataNet or Sextant)
- Area_type (patch is part of an individual survey or part of a composite DTM)
- Dataset id (internal EMODnet DTM number)

The attributes are used in the EMODnet data portal to derive an URL, that gives access to the metadata service SeaDataNet of Sextant, depending on the Area_type (i.e. the data layer is clickable).

The colours used in the WMS are randomly generated and have no specific meaning other than to differentiate the patches from one another.

The service is available in both WMS and WFS

Service URL:

<https://ows.emodnet-bathymetry.eu/>

The Source Reference layer gives the geographical coverage of the data sets (surveys, Composite DTMs, and GEBCO DTM) that have been used for building the EMODnet DTM. Clicking on each source area retrieves a link to the metadata as available for the identified source dataset.

EMODnet Bathymetry

Source reference

37KHY13418_MeanTrow

Metadata URL

Metadata URL

Access to metadata Download

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Survey tracks and areas layer with metadata from CDI service

The screenshot displays the EMODnet Map Viewer interface. The top navigation bar includes the European Commission logo, the text "EMODnet Map Viewer", and a language selector set to "English". The left sidebar contains a "Layers" panel with a "Catalogue" tab. The "EMODnet Bathymetry" layer is expanded, showing various options:

- Coastlines:** Lowest Astronomical Tide (LAT), Mean High Water (MHW), Mean Sea Level (MSL), OpenStreetMap (OSM)
- Data quality:** (collapse arrow)
- Depth:** Bathymetric contours, High Resolution bathymetry, Mean depth in multi colour (no land), Mean depth natural colour (with land), Mean depth narrow colour (no land)
- DTM Tiles:** (collapse arrow)
- Source metadata:** Source Reference of the DTM, Global Survey Tracks/Polygons
- Topography:** (collapse arrow)

Below the layer list, there is a section for "Marine regions" with a search input and a dropdown menu, and a "Change basemap" section with a dropdown menu set to "EMODNET World Base Layer". The main map area shows a bathymetry map with a color scale from blue (deep) to red (shallow), overlaid with a dense network of red survey tracks. The right sidebar contains standard map navigation tools like zoom in/out, pan, and 3D view.



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DTM tiles – download service

58 DTM tiles from 2022 release in multiple data formats can be downloaded via the tile grid in the Map Viewer service

DTM tiles from all DTM releases (2016, 2018, 2020, 2022) are documented with metadata and downloadable from the Central Portal Products Catalogue

The screenshot shows the EMODnet Map Viewer interface. The main map displays bathymetry data over Europe and Africa with a yellow grid overlay. On the left, the 'Layers' panel is open to the 'Catalogue' tab, showing various layers like 'Administrative units', 'EMODnet Bathymetry', 'Coordinates', 'Data quality', 'Depth', 'DTM Tiles', 'Source metadata', and 'Marine regions'. The 'DTM Tiles' section is expanded, showing 'Tile structure and download' as selected. On the right, a popup window titled 'Tile structure and download (2 of 2)' displays a table of DTM tiles for the year 2022.

DTM Release	DTM Tile	Product format	Download URL
2022	00	3D bath GeoTIFF	Download
2022	01	EMO	Download
2022	02	EMO-network/EMO2022-0202	Download
2022	03	EMO-2022	Download
2022	04	EMO-2022-Mean-Sea-Level	Download
2022	05	EMO-GeoTIFF	Download
2022	06	EMO-DEM	Download
2022	07	EMO	Download
2022	08	EMO	Download



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High Resolution – DTMs – download service

- > **308 HR-DTMs** from **35** data centres from **16** countries are available with metadata for public downloading using the Products Catalogue



EMODnet Bathymetry World Base Layer

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A gridded representation of worldwide bathymetric and topographic coverage
Based on EMODnet DTM, GEBCO grid and for land ASTER GDEM, SRTM3, and EU-DEM.
See: <https://tiles.emodnet-bathymetry.eu/wmts/1.0.0/WMTSCapabilities.xml>



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International collaboration with IHO and GEBCO



IHO

International
Hydrographic
Organization

Data Centre for Digital Bathymetry Viewer

Layers

▶ IHO DCDB/NOAA NCEI ?

▼ EMODnet

EMODnet Multibeam Surveys ?

MAREANO Multibeam Surveys ?

MAREANO Multibeam Shaded Relief ?

EMODnet Single-Beam Surveys ?

MAREANO Single-Beam Surveys ?

EMODnet Digital Terrain Model (DTM) ?

▶ Australia

▶ Canada

▶ France

▶ Japan

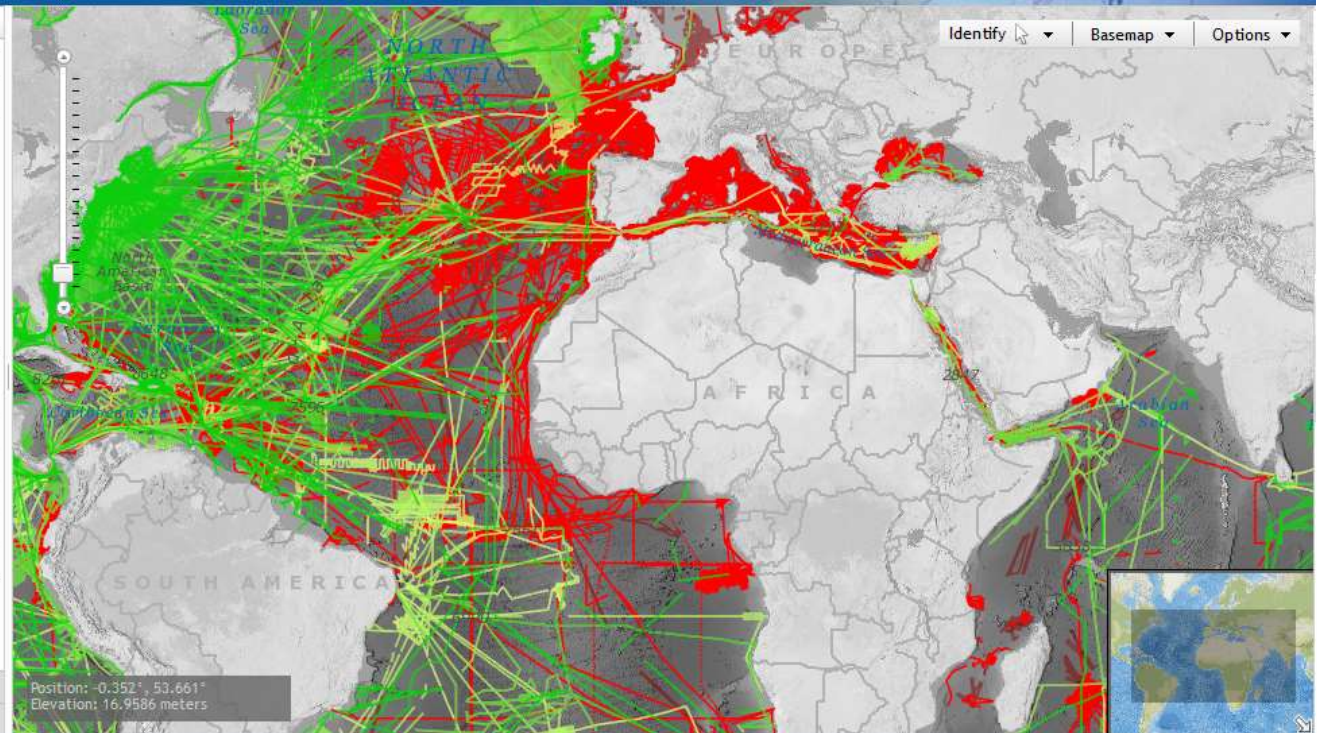
▶ Netherlands

▶ Known Non-Public Data ?

▶ Bathymetric Coverage Maps

More Information

Help



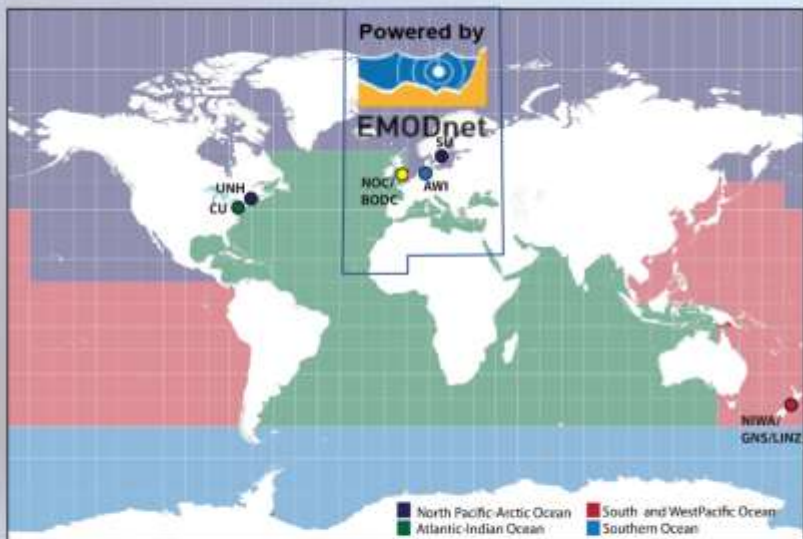


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International collaboration with SeaBed

The Network of Centers



North Pacific –Arctic Ocean

Stockholm University & University of New Hampshire
(SU & UNH)

Southern Ocean

Alfred-Wegener-Institut (AWI)

Atlantic-Indian Ocean

Lamont-Doherty Earth Observatory,
Columbia University (CU)

South-West Pacific Ocean

National Institute of Water & Atmospheric Research (NIWA)
Land Information New Zealand (LINZ)
GNS Science (GNS)

Global Center

British Oceanographic Data Centre,
National Oceanography Centre (NOC/BODC)





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Conclusions

- EMODnet Bathymetry is the leading project in Europe for bathymetry and active cooperator with global GEBCO and Seabed 2030 initiatives
- EMODnet Bathymetry generates and publishes every 2 year a new release of the highly popular EMODnet DTM and associated data products
- The EMODnet DTM has thousands of regular users from government, research, education, and industry with circa 40.000 DTM tiles downloaded every year and millions of OGC web services requests
- EMODnet Bathymetry World Base Layer OGC WMTS service is used as base layer for many portals worldwide
- EMODnet Bathymetry maintains the leading Discovery and Access service for bathymetry data sets from European data providers



www.emodnet.eu

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