



SeaDataCloud

Towards a European Blue Cloud for management, discovery, access, and analyses of marine and ocean data

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Oceanology International 2018, London, United Kingdom, 14 March 2018

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Oceans and seas are important



Climate, Energy, Food, Tourism, Shipping, Health,

Marine data relevant for many uses:

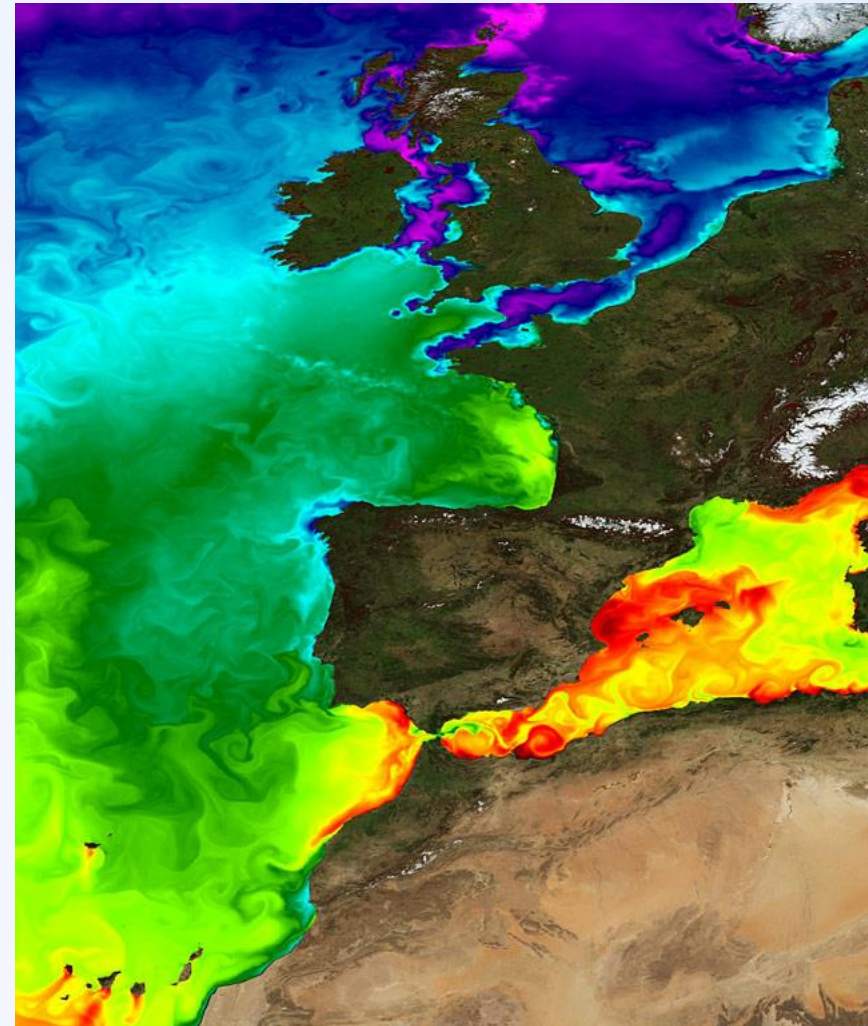
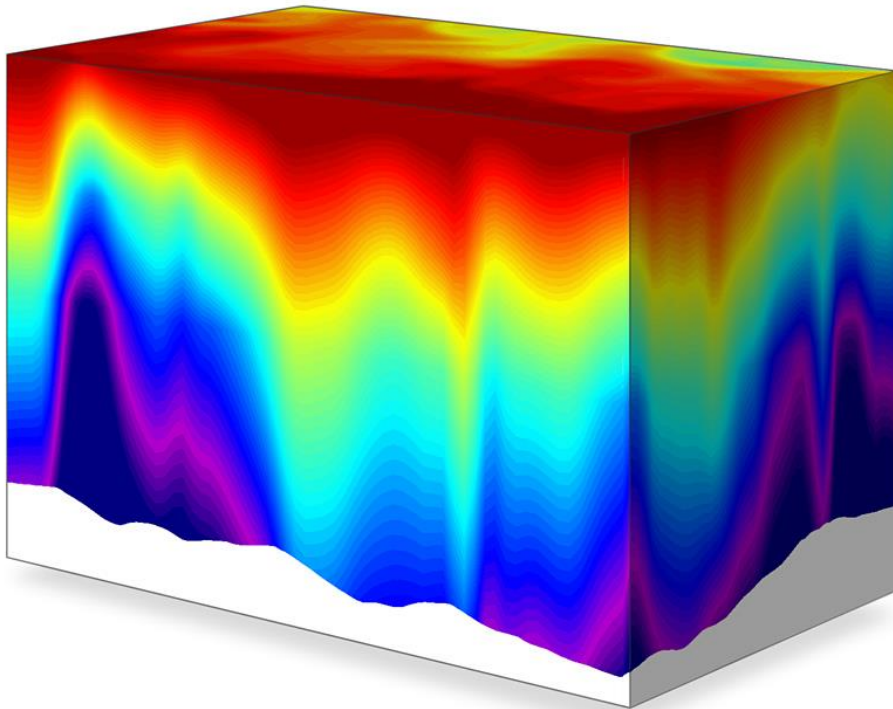
- Scientific Research to gain knowledge and insight
- Monitoring and assessment (water quality, climate status, stock assessment)
- Coastal Zone Management
- Modelling (including hindcast, now-cast, forecast)
- Dimensioning and supporting operations and activities at sea (shipping, offshore industry, dredging industry, ..)
- Implementation and execution of marine conventions for protection of the seas
- Implementation of international Directives, such as in Europe directives for water (WFD), marine strategy (MSFD), coastal zone management



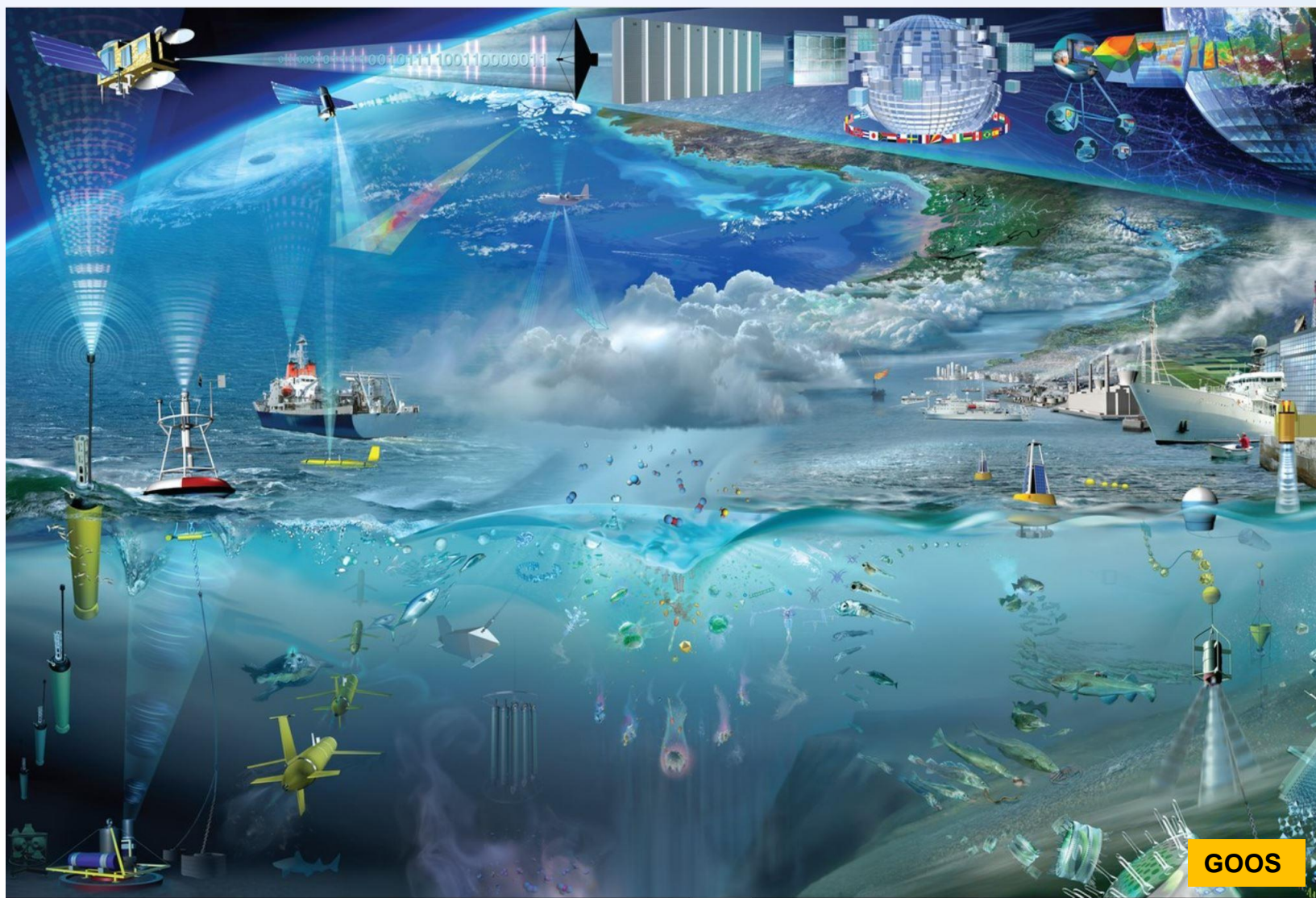
Users originate from government, science sector, and industry, nationally and internationally

Input for models: analyses and forecasts :

- Operational oceanography
- Physical and meteorological modelling
- Ecosystem modelling

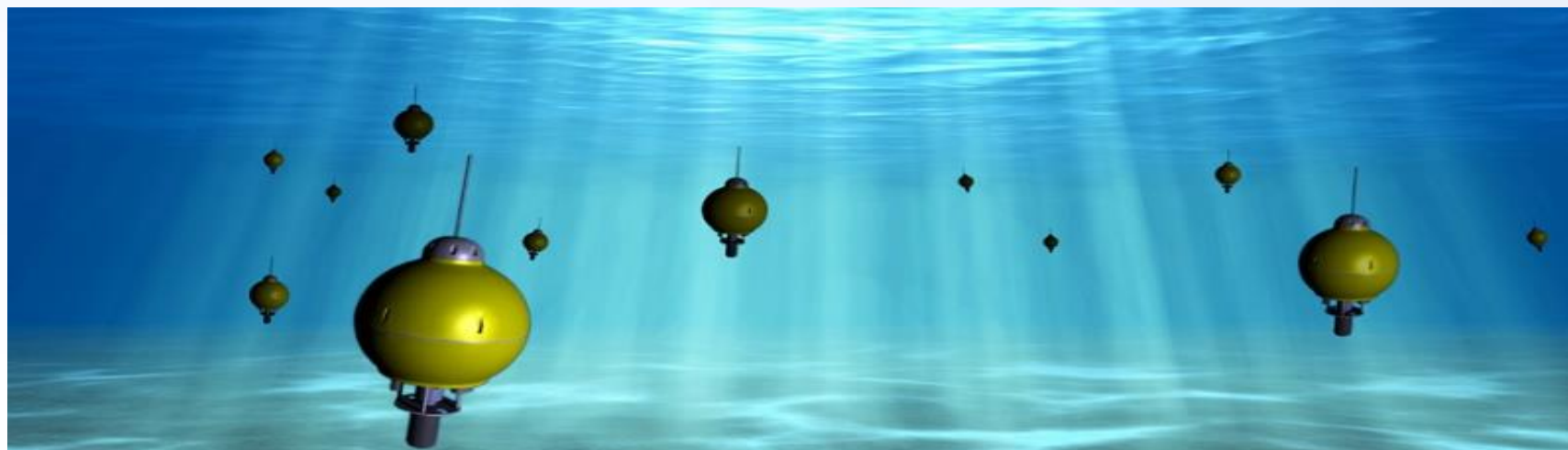


Acquisition of ocean and marine data



Economy of data acquisition

- Data are collected by governments, research institutes, and private industry (in Europe already more than 1.000 organisations)
- Data for physics, geophysics, meteorology, chemistry, biology, geology, bathymetry
- Acquisition of oceanographic and marine data is expensive; annual costs in Europe estimated at **1.4 Billion Euro** (1.0 = in-situ; 0.4 = satellites)



Professional data management is required with agreements on standardisation, quality control protocols, long term archiving, catalogues, and access

What is SeaDataNet?



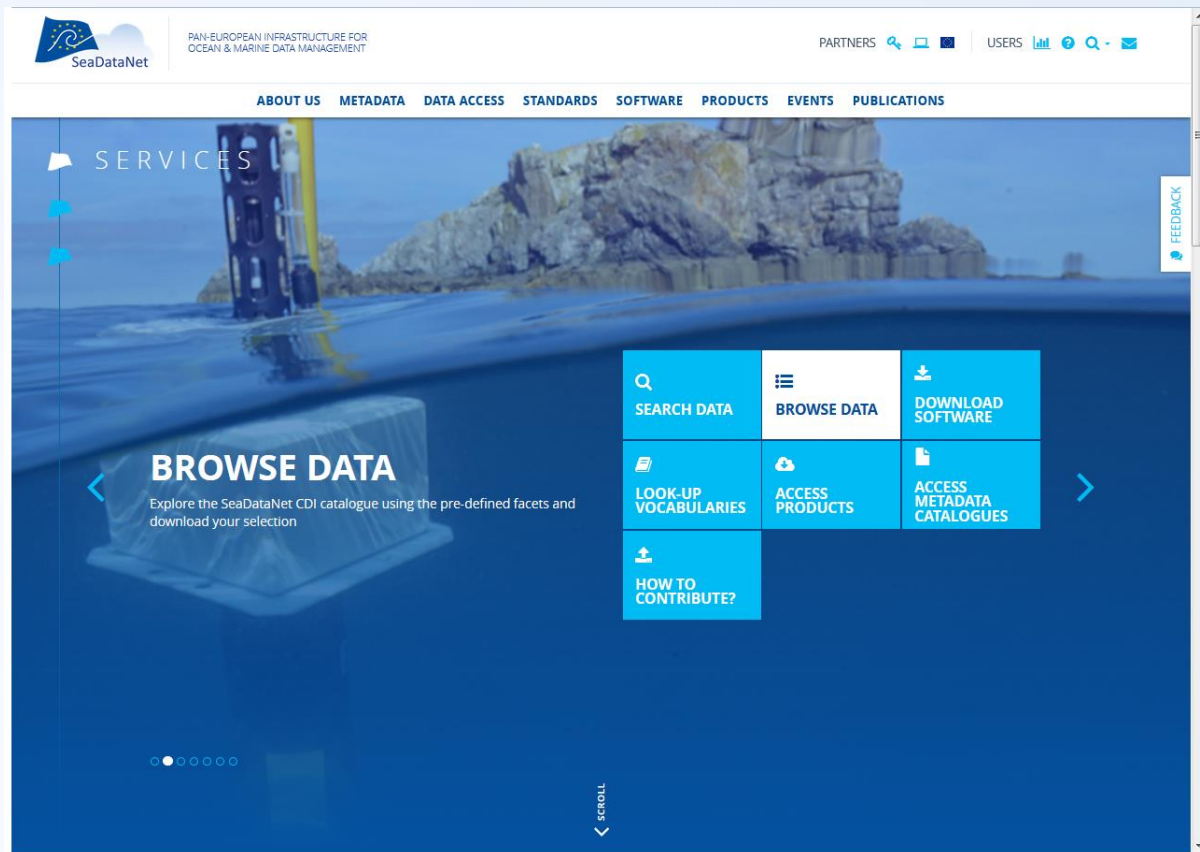
A pan-European infrastructure set up and operated for managing marine and ocean data in cooperation with the NODCs and data focal points of 34 countries bordering the European seas

90s	Metadata directories Medar/MedAtlas
2002-2005	Sea-Search (FP5)
2006-2011	SeaDataNet (FP6)
2011-2015	SeaDataNet II (FP7)
2016-2020	SeaDataCloud (H2020)

SeaDataNet portal

Giving access to

- Standards, tools both for data centres and other users
- Data and metadata
- Products



<http://www.seadatanet.org>

SeaDataNet standards

- Set of common standards for the marine domain, adapting ISO and OGC standards and achieving INSPIRE compliance
 - **Adoption of ISO 19115 – 19139 standard for describing metadata** on data sets, research cruises, monitoring networks, and research projects => marine metadata profiles, schemas, schematron rules
 - **Controlled vocabularies** for the marine domain (>65,000 terms in 82 lists), with international governance and web services
 - **Standard data exchange formats** : ODV ASCII and NetCDF (CF) fully supported by controlled vocabularies
- Maintenance and dissemination of standard QA-QC procedures, together with IOC/IODE and ICES

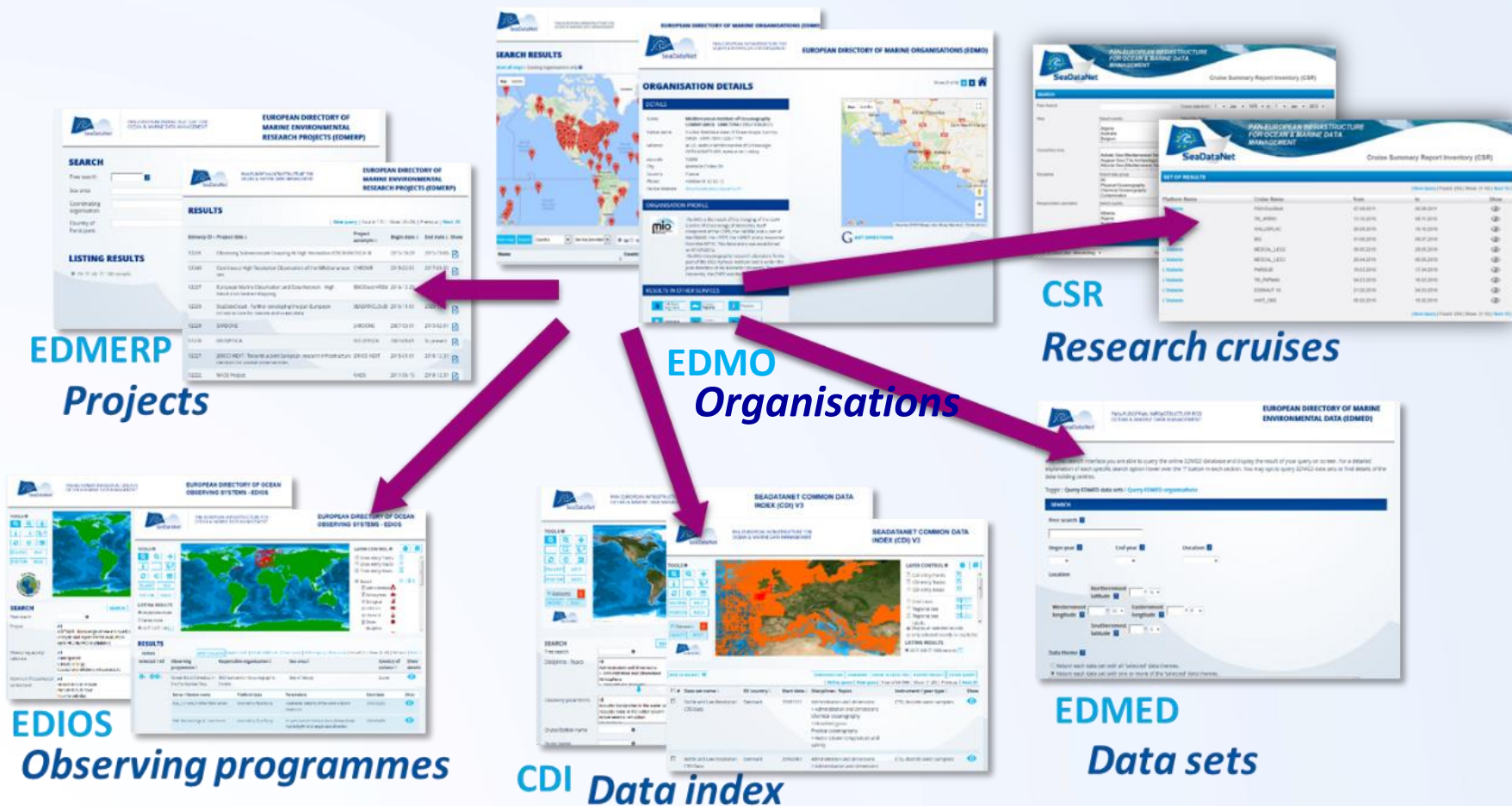


SeaDataNet services and tools

- **Set of tools** to be used each data centre and freely available from the SeaDataNet portal: metadata editor, data conversion software, data analysis software (ODV), data interpolation software (DIVA)
- **Capacity building** by training workshops for uptake of standards and tools by the data centres in order to achieve standardisation
- **Pan-European services** for harmonised discovery, access, visualisation of data and data products
- **Common SeaDataNet Data Policy** and License

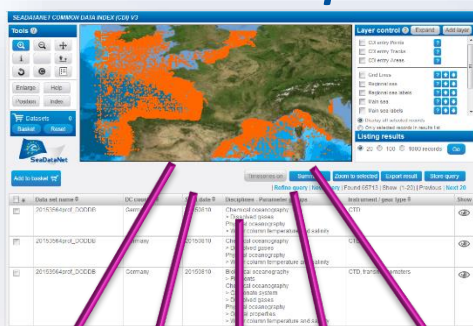


Pan-European metadata directories



CDI Data Discovery and Access service

SeaDataNet portal

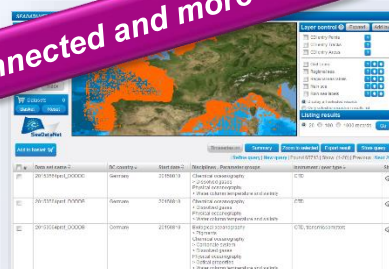


Search
and
Shop



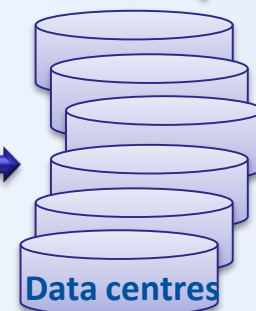
Data
Add

Already 110 data centres connected and more underway




Metadata

+ transaction data



European data sources
data centres ← ≈ 650 originators





CDI Data Discovery and Access service






PAN-EUROPEAN INFRASTRUCTURE FOR
OCEAN & MARINE DATA MANAGEMENT

**SEADATANET COMMON DATA
INDEX (CDI) V3**

TOOLS






[ENLARGE](#)
[HELP](#)

[POSITION](#)
[INDEX](#)

[Datasets](#)
0

[BASKET](#)
[RESET](#)



SEARCH

Free search

Disciplines - Topics

☐ All
☒ Administration and d...
☐ Administration and o...
☐ Atmosphere
☐ Atmospheric observ...

Discovery parameters

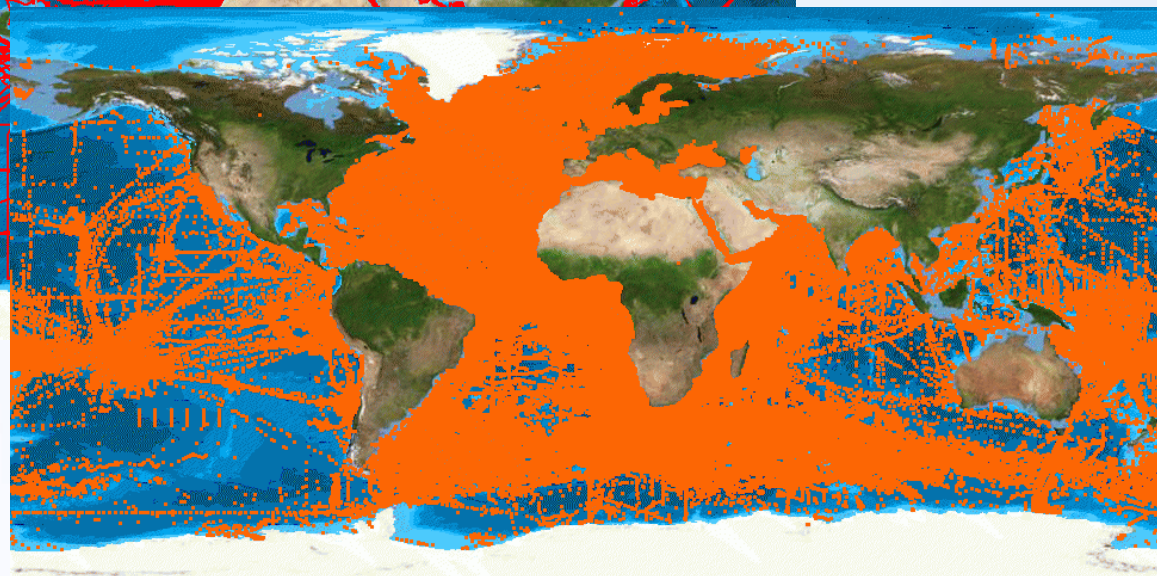
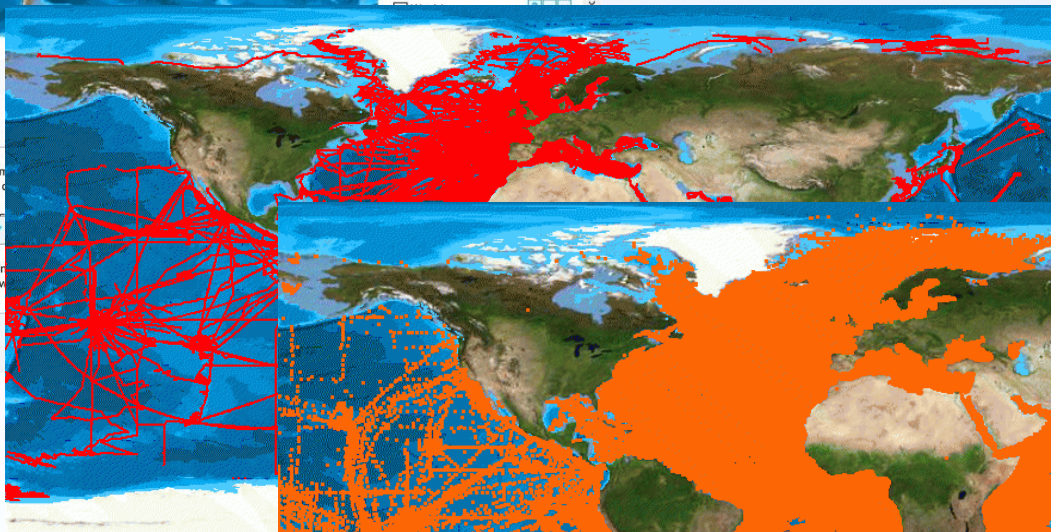
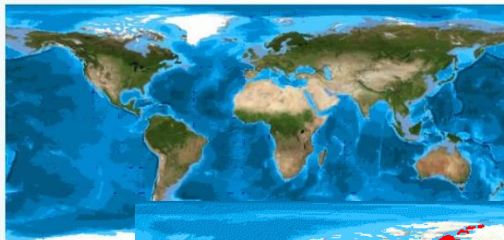
☐ All
☐ Acoustic backscatter in...
☐ Acoustic noise in the v...
☐ Air pressure
☐ Air temperature

Cruise/Station name

Projectname

LAYER CONTROL

☐ Grid Lines
☐ Regional sea
☐ Regional sea labels
☐ Main sea
☐ Main sea labels
☒ Bathymetry
☒ Blue Marble

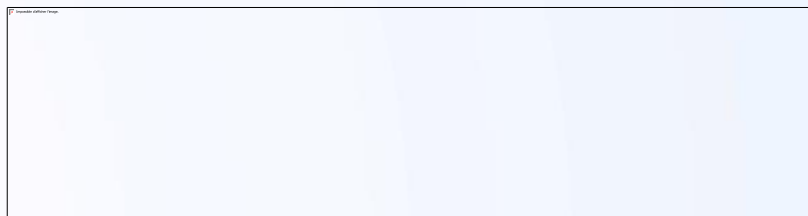


SeaDataNet cooperation

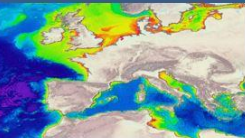



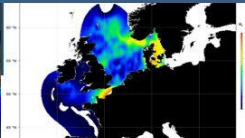


- **Copernicus Marine Environmental Monitoring Services (CMEMS):** providing long-term archives and standards
- **Marine Strategy Framework Directive (MSFD):** providing infrastructure, standards and data collections for several indicators
- **Large ocean monitoring systems (EuroGOOS, AtlantOS, Euro-ARGO, JERICO-Next, ..):** providing standards and validation + long-term archiving services
- **Ocean Data Interoperability Platform (ODIP):** exploring and demonstrating common standards and interoperability with leading data management infrastructures in USA and Australia
- **GEOSS - EuroGEOSS:** Maintaining the GEOSS portal with SeaDataNet in-situ data collections from large community of European data holders (> 100 data centres; >600 data originators)
- **European Open Science Cloud (EOSC):** shaping the pilot Blue Cloud
- **European Marine Observation and Data Network (EMODNet)** driven by Marine Knowledge 2020 and Blue Growth

SeaDataNet and EMODnet

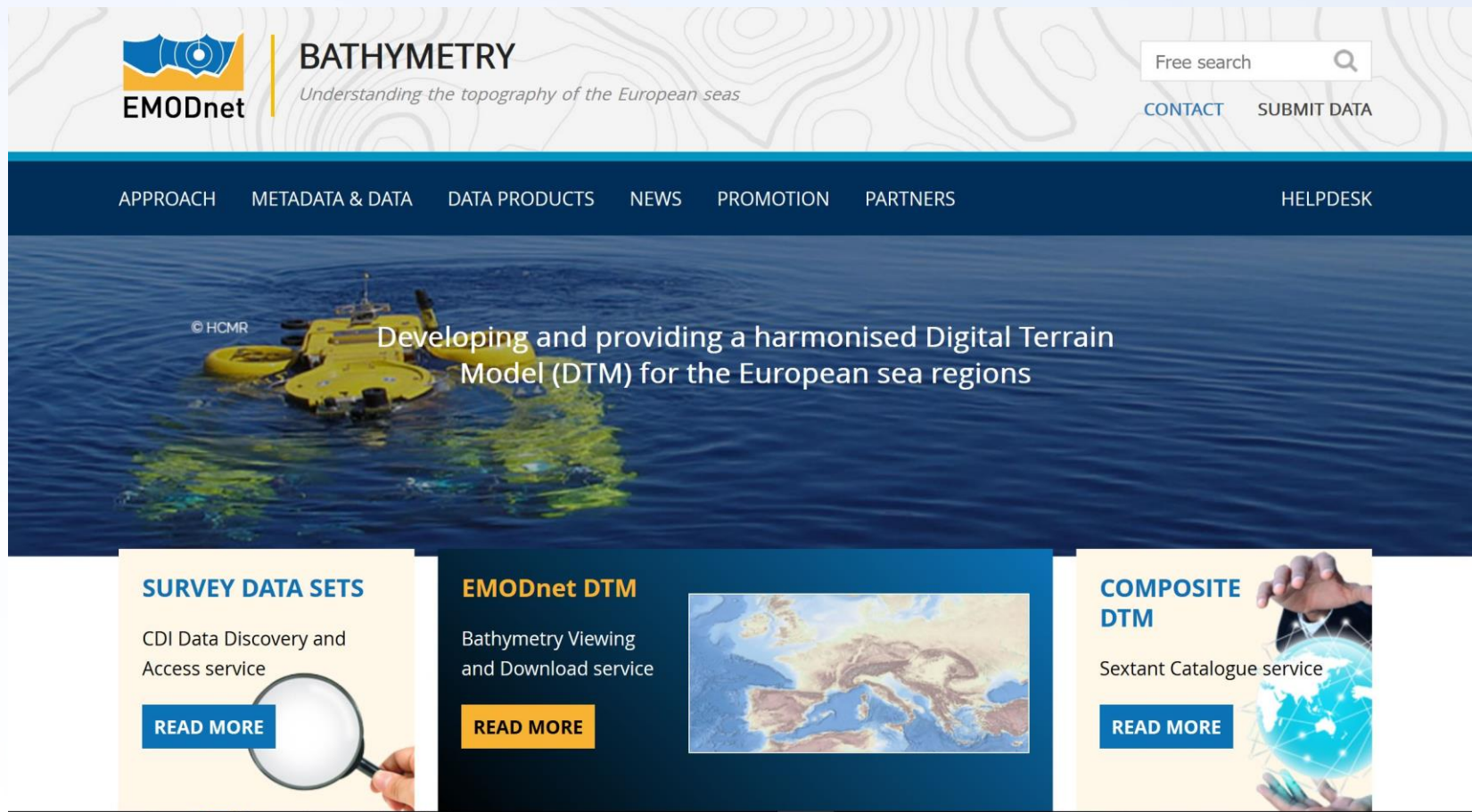
- EU initiative for an overarching **European Marine Observation and Data Network (EMODNet)** driven by Marine Knowledge 2020 and Blue Growth
- SeaDataNet qualified as a leading infrastructure for the EMODnet data management component and is driving several thematic portals from the start in 2008
- *‘Bottom-up meets top-down’*
- This synergy has resulted in many more data centres adopting SeaDataNet standards and connecting to the CDI Data Discovery and Access service while it gave a flying start to EMODnet



EMODnet thematic portals


Bathymetry	Geology	Seabed Habitats	Chemistry	Biology	Physics	Human activities
						
<p>Minimum cell water depth</p> <p>Maximum cell water depth</p> <p>Average cell water depth</p> <p>Standard deviation of cell water depth</p> <p>Number of values used for interpolation of cell water depth</p> <p>Horizontal coordinate reference system</p> <p>Depth reference system</p> <p>Lowest Astronomical Tide</p>	<p>Seabed substrate</p> <p>Sediment accumulation rate</p> <p>Sea-floor geology</p> <p>Seabed lithology</p> <p>Stratigraphy</p> <p>Coastline migration</p> <p>Aggregate resources</p> <p>Geological events</p>	<p>Data on modelled seabed habitats (depth, seabed substrate, broad scale biological zone, T, S, light, oxygen, energy due to waves & current)</p> <p>Broad-scale physical habitat map</p> <p>Detailed habitat maps from surveys</p> <p>Individual habitat modelling outputs</p> <p>Habitat point data</p>	<p>Pesticides & Biocides</p> <p><u>Antifoulants</u></p> <p><u>Pharmaceuticals</u></p> <p>Heavy Metals</p> <p>Hydrocarbons</p> <p>Radionuclides</p> <p>Fertilizers</p> <p>Acidity</p> <p>Dissolved Gasses</p> <p>Plastics</p> <p>Marine Litter Beach litter Seafloor litter Micro litter</p> <p>Chlorophyll Silicates Organic Matter</p>	<p>Biomass</p> <p>Abundance</p> <p>Gridded Abundance maps</p> <p><i>species groups:</i></p> <ul style="list-style-type: none"> • phytoplankton • zooplankton • angiosperms • macro-algae • invertebrate bottom fauna • birds • mammals • reptiles • Fish 	<p>Waves</p> <p>Water temperature</p> <p>Water salinity/conductivity/density</p> <p>Currents</p> <p>Light attenuation/fluorescence</p> <p>Sea level</p> <p>Atmospheric parameters</p> <p>Wind</p> <p>Underwater noise</p> <p>Rivers</p> <p>Ice</p>	<p>Aggregate Extraction Dredging</p> <p>Fisheries</p> <p>Hydrocarbon Extraction Main Ports</p> <p><u>Mariculture</u></p> <p>Ocean Energy Facilities</p> <p>Pipelines and Cables</p> <p>Protected Areas</p> <p>Waste Disposal</p> <p>Wind Farms</p> <p>Other Forms of Area Management / Designation</p>

EMODnet Bathymetry portal



The banner features a background image of a yellow autonomous underwater vehicle (AUV) operating in the ocean. The text '© HCMR' is visible in the upper left of the image. The main heading 'BATHYMETRY' is in large blue letters, with the tagline 'Understanding the topography of the European seas' in a smaller, italicized font below it. The EMODnet logo is on the left, and a search bar with the text 'Free search' and a magnifying glass icon is on the right. Below the search bar are links for 'CONTACT' and 'SUBMIT DATA'. A dark blue navigation bar contains links for 'APPROACH', 'METADATA & DATA', 'DATA PRODUCTS', 'NEWS', 'PROMOTION', 'PARTNERS', and 'HELPDESK'. The main content area is divided into three columns. The first column, 'SURVEY DATA SETS', describes the 'CDI Data Discovery and Access service' and includes a 'READ MORE' button with a magnifying glass icon. The second column, 'EMODnet DTM', describes the 'Bathymetry Viewing and Download service' and includes a 'READ MORE' button with a map of Europe showing bathymetry. The third column, 'COMPOSITE DTM', describes the 'Sextant Catalogue service' and includes a 'READ MORE' button with a globe icon.

EMODnet | **BATHYMETRY**
Understanding the topography of the European seas

Free search 

[CONTACT](#) [SUBMIT DATA](#)

[APPROACH](#) [METADATA & DATA](#) [DATA PRODUCTS](#) [NEWS](#) [PROMOTION](#) [PARTNERS](#) [HELPDESK](#)

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Developing and providing a harmonised Digital Terrain Model (DTM) for the European sea regions

SURVEY DATA SETS
CDI Data Discovery and Access service
[READ MORE](#)


EMODnet DTM
Bathymetry Viewing and Download service
[READ MORE](#)

COMPOSITE DTM
Sextant Catalogue service
[READ MORE](#)

Bathymetry CDI data discovery and access service



BATHYMETRY
Understanding the topography of the European seas
CDI Data Discovery and Access Service

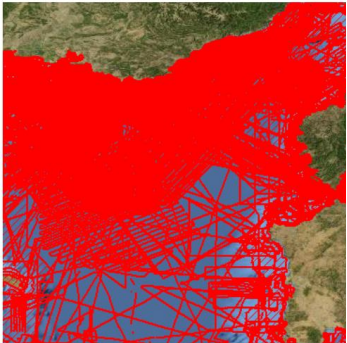
 Dataset(s) 0 [Proceed to basket](#) [Reset basket](#)

[Reset all steps](#)

Layer control

- ☐ CDI entry Points
- ☐ CDI entry Tracks
- ☐ CDI entry Areas
- ☐ Coastlines
- ☐ Mean depth full coverage with land coverage
- ☐ Grid Lines
- ☐ Regional sea
- ☐ Regional sea labels
- ☒ Display all selected records
- ☐ Only selected records in results list

[Zoom to selected](#)



Search by:

Geographical Box


Time period

Measuring area type

- surface (25232)
- curve (1829)
- point (5)



Parameter categories

- Gravity, magnetics and bat... (27066)
- Terrestrial (27066)

 **ADD TO BASKET** ☐ 20 ☐ 100 ☐ 1000 Records

<input type="checkbox"/> #	Data set name
<input type="checkbox"/>	S196900100-016
<input type="checkbox"/>	S196900100-014

Details | [Results](#) | Found 27066 | Show 26501 | [Previous](#) | [Next](#)

[XML](#)  

WHAT?

Data set name

Discipline

Parameter groups

Discovery parameters

GEMET-INSPIRE themes

Abstract

TIR96

Marine geology
Terrestrial

Gravity, magnetics and bathymetry
Terrestrial

Bathymetry and Elevation

Oceanographic geographical features

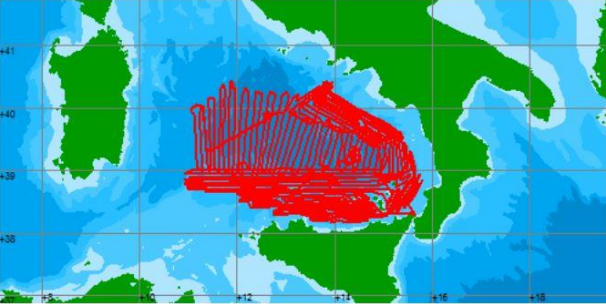
The data have been acquired with a Simrad EM120 S Multi Beam echosounder aboard the Russian R/V Gelendzhik in order to survey the Tyrrhenian sea for geological and seafloor mapping in the framework of an Italian project funded by CNR and APAT (Geological Survey Agency). Sea state was rough at times. Results, maps can be found in the book: Marani M. P., Gamberi F., Bonatti E. (2004). Editors: From seafloor to deep mantle: architecture of the Tyrrhenian backarc basin. Memorie Descrittive Della Carta Geologica d'Italia, (pp. 1-194).

Data format
Climate and Forecast NetCDF **Version 3.5**

Data set creation date
20170831

WHERE?

Map



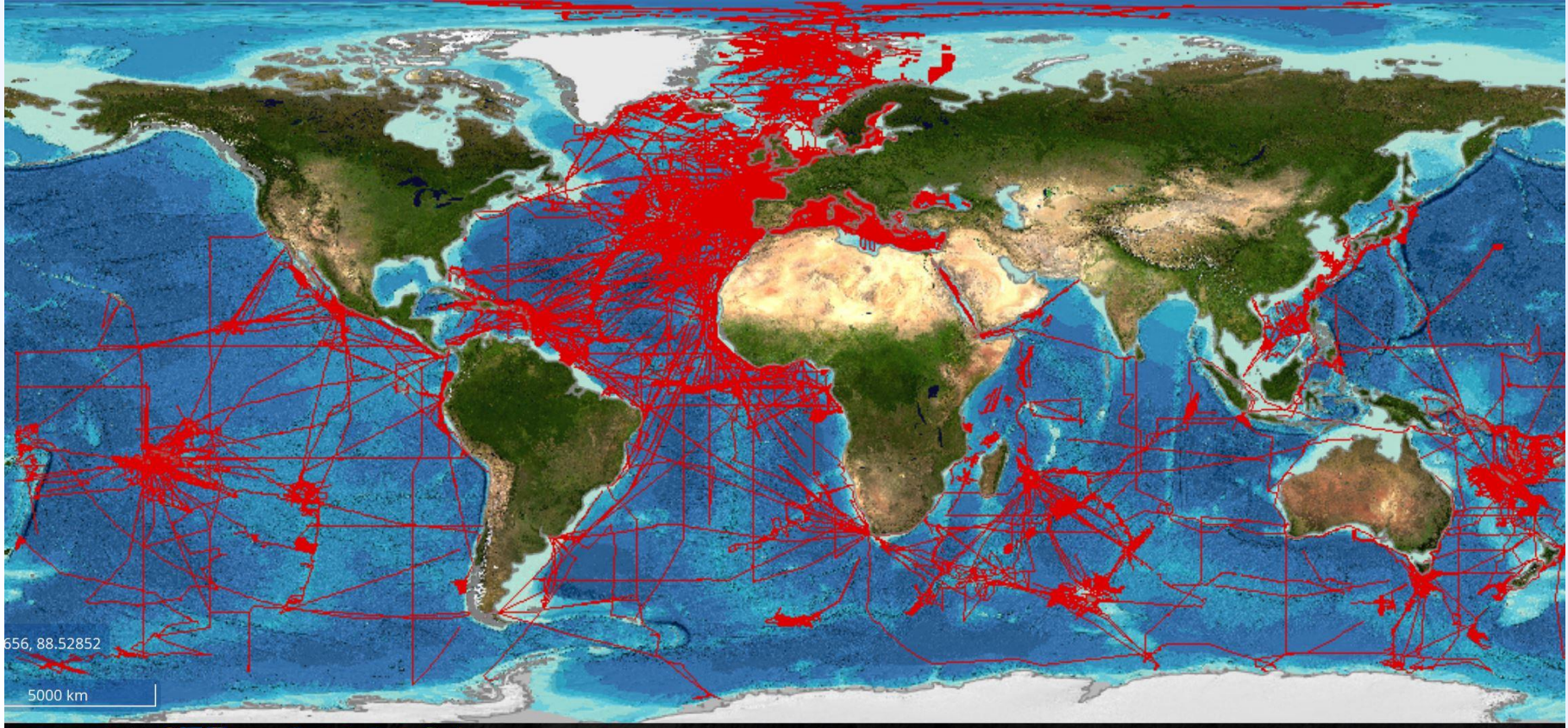
GML id

GML objects

mc01

Name	Description
Track T960016 for TIR96	Track T960016 for TIR96
Track T960017 for TIR96	Track T960017 for TIR96

Bathymetry – gathered data



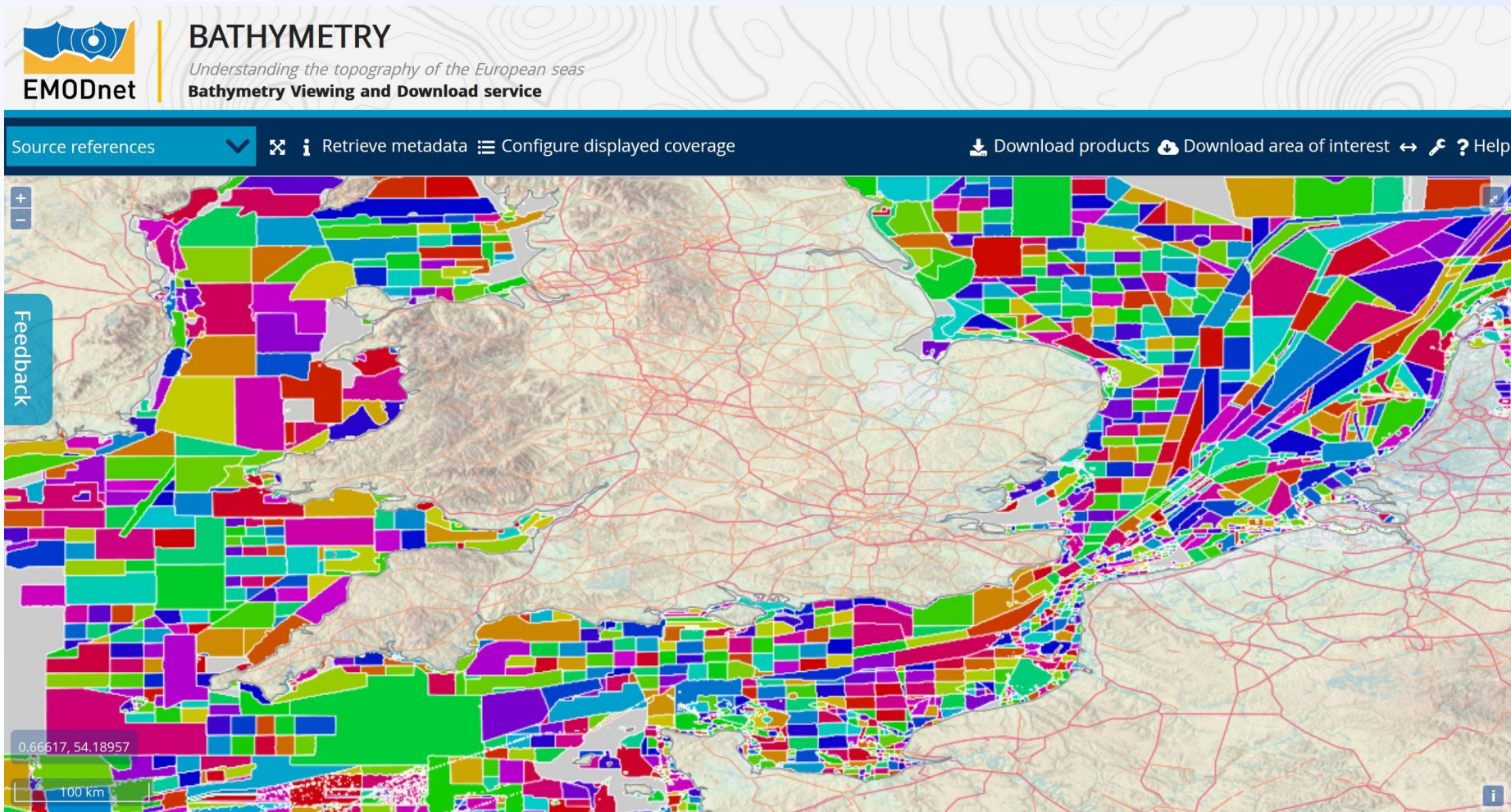
> 25.000 survey data sets from European data providers indexed in the CDI data discovery and access service

EMODnet Bathymetry DTM



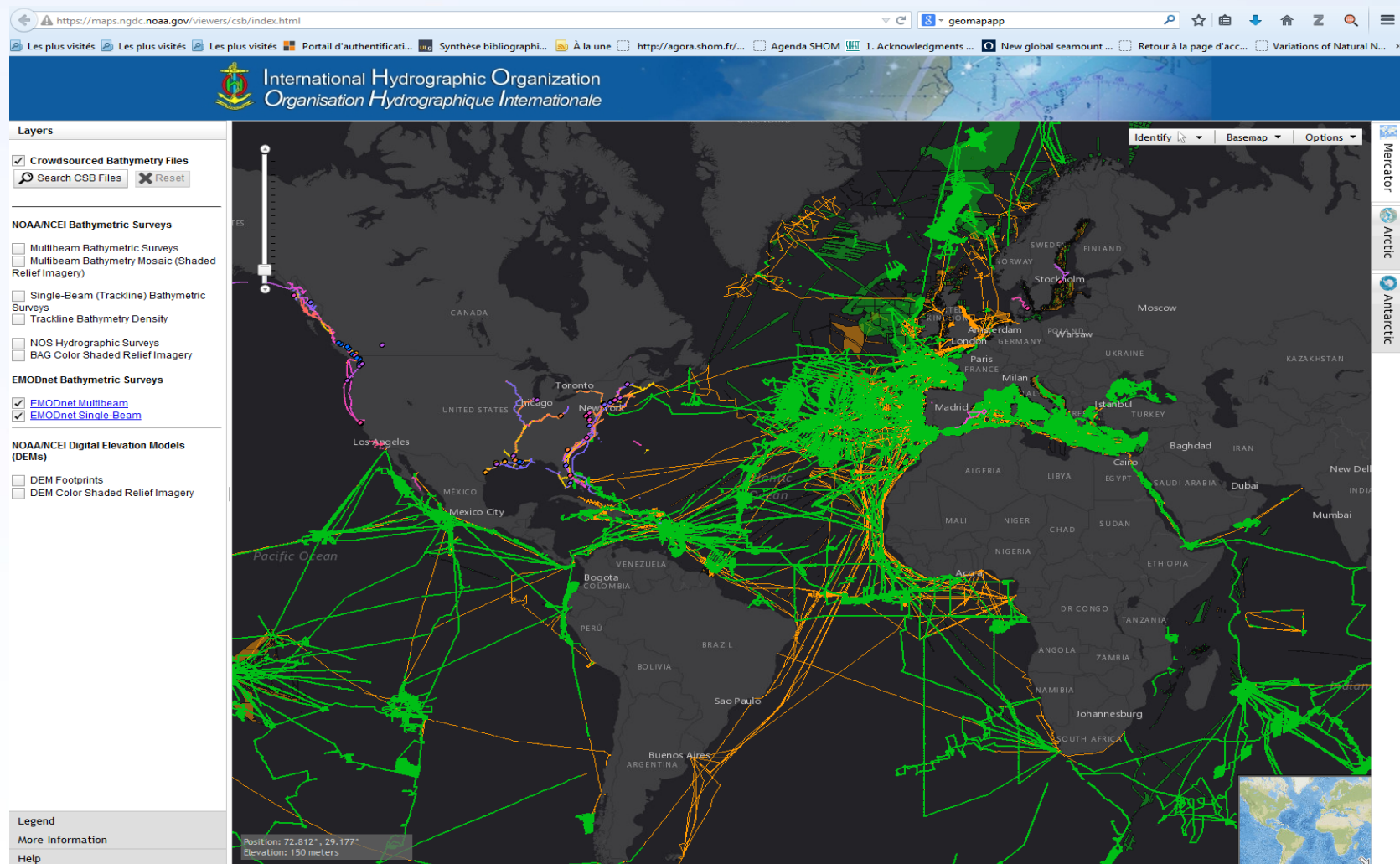
> 7000 survey data sets used to generate and provide a harmonized and higher resolution digital terrain model for all European seas – comparison with GEBCO

Bathymetry – Source reference map



Indicating which survey data sets were used for each DTM grid cell, including links to the full metadata

Cooperation with USA (NOAA – NCEI)

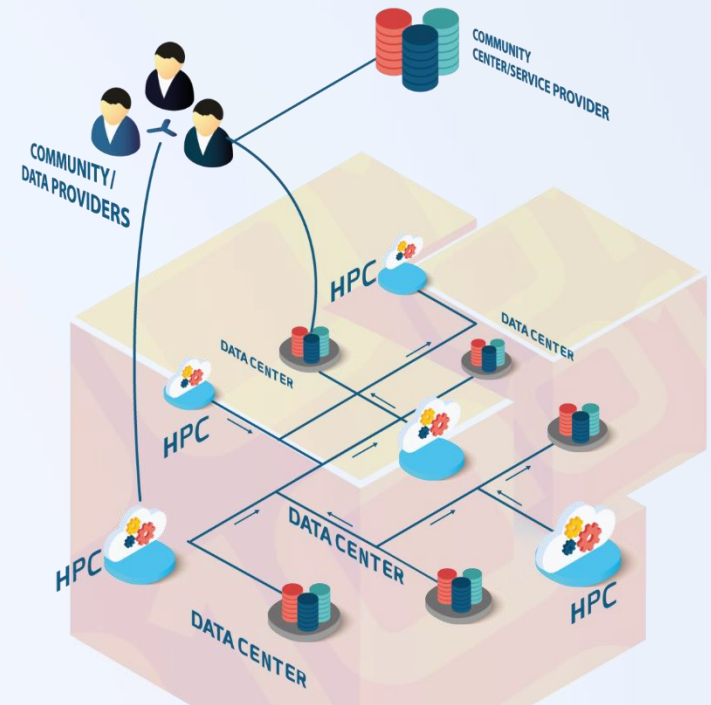
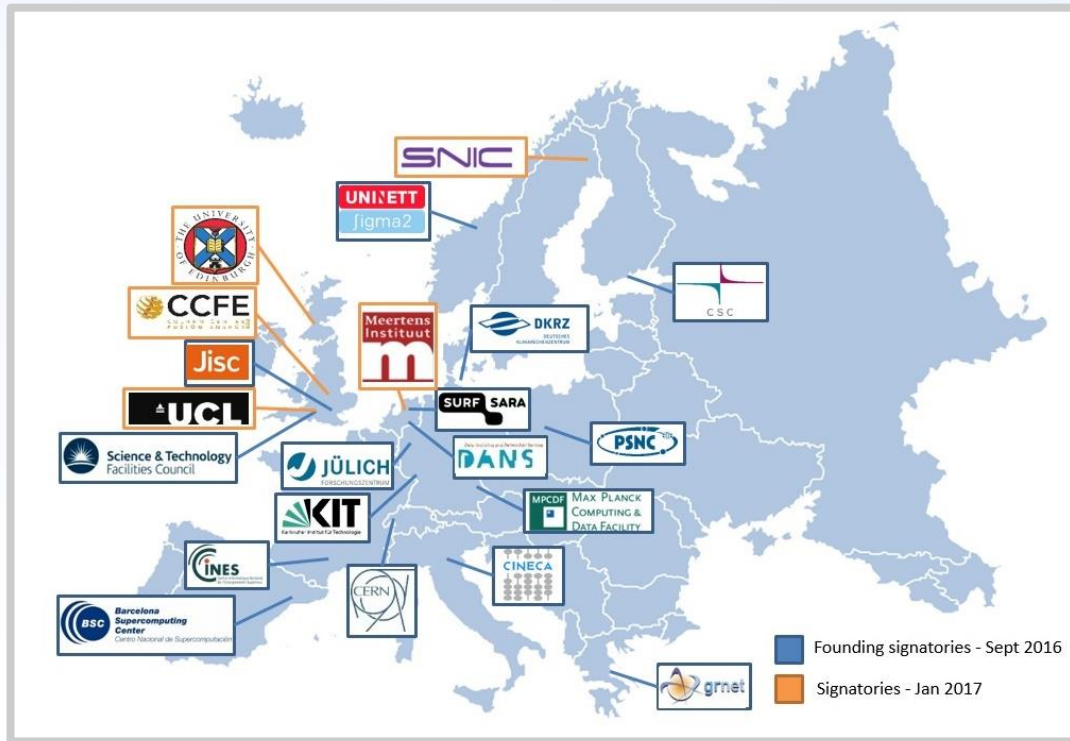




SeaDataCloud a new opportunity

- Standards and information technology are always evolving, there is a move towards cloud storage and cloud computing, and the SeaDataNet infrastructure must stay up-to-date to maintain and further expand its services to its leads customers and major stakeholders
- SeaDataCloud project, started Nov 2016 with 4 year run and 10 Meuro funding
- A strategic and operational cooperation between the SeaDataNet consortium of marine and ocean data centres and the EUDAT consortium of e-infrastructure service providers

Cooperation with EUDAT

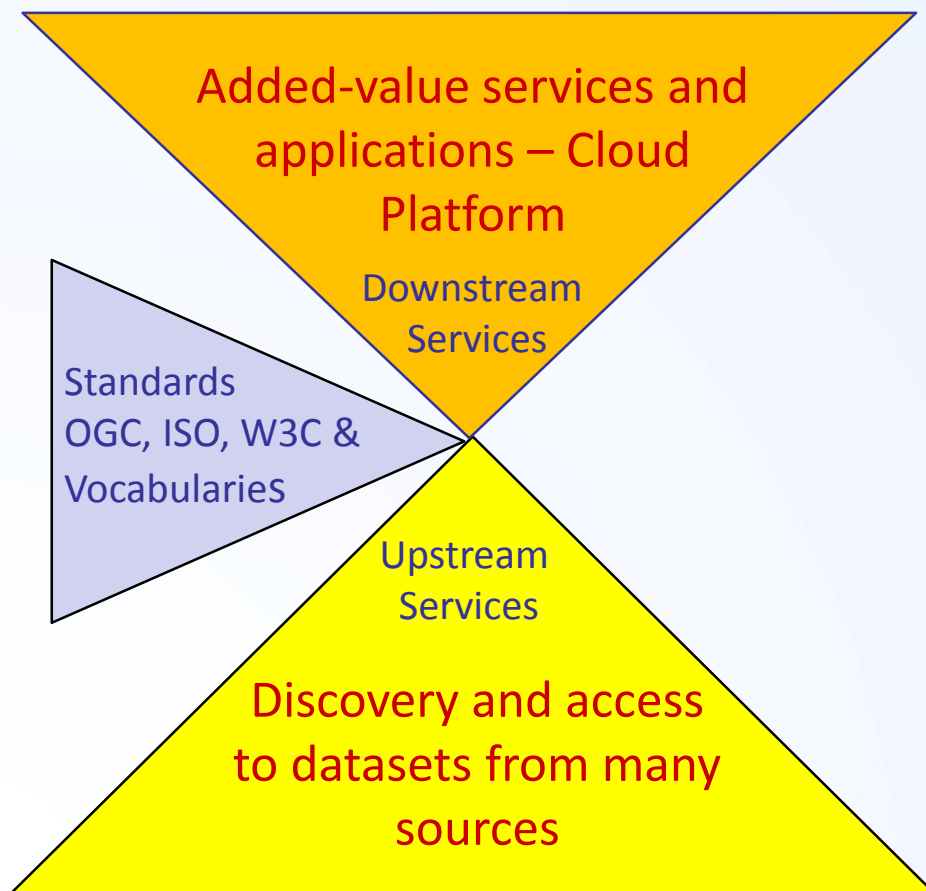


5 EUDAT members are partners of SeaDataCloud :
CINECA, CSC, DKRZ, GRNET and STFC

What is it about?

- SDC is about **updating and further developing standards**
- SDC is about improving and innovating services & products
- SDC is about adopting and elaborating new technologies
- SDC is about giving more attention to users and putting the user experience in a central position
- SDC is also about developing a **Virtual Research Environment (VRE)** bringing data and applications together in the cloud and serving users

Towards a Blue Cloud as blue print for the European Open Science Cloud (EOSC)



- Cloud platform with common services for data pre-processing, analyses, visualizations, publishing, DOIs...
- Applying common standards and interoperability solutions for providing harmonised data and metadata
- Providing harmonised discovery and access to data output from multiple sources, European and international