EMODnet Preparatory Actions
Hydrographic and Seabed Mapping

Service Contracts MARE/2008/03 S12.531515 and MARE/2009/07 S12.563144

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Oostende - Belgium, 31st August 2011, ICAN-5 Workshop

Maritime Affairs

EMODnet

- EU has adopted a new Marine Strategy Framework Directive (MSFD) which includes an initiative for an overarching **European Marine Observation and Data Network** (EMODnet)

- EMODnet can be considered as a network of existing and developing European observation systems, linked by a data management structure covering all European coastal waters, shelf seas and surrounding ocean basins'.

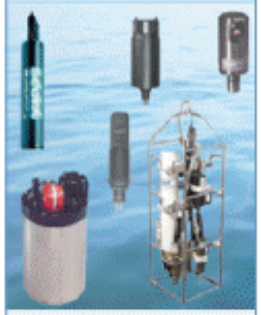
- Part of the implementation trajectory is to undertake preparatory actions by establishing thematic portals.

EMODnet

EMODnet
European Marine Observation and Data Network

Essential Components of an Observation Network

Sensors to measure continuously and automously physical, chemical and biological parameters



- salinity, temperature
- turbidity, oxygen
- chlorophyll, nutrients
- pH, alkalinity
- bathymetry
- primary production

Platforms or structures anchored on the seabed, floating in the water column or drifting at the sea surface, and remote sensing from satellites.

- buoys, floats
- gliders
- mooring
- AUVs, lander
- FerryBox
- cabled networks
- remote sensing
- living Argo

Sampling and consecutive laboratory analyses from research ships, or shore, including water, sediments and biota (phytoplankton, bacteria, zooplankton, fish)

- inorganic trace compounds
- gases, e.g. CO2, CH4, DMS
- organic micropolluants
- abundance & function of biota
- food web
- HABs

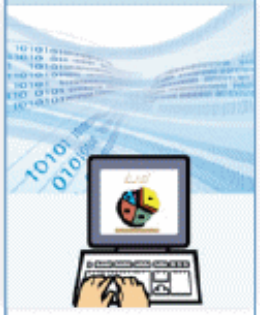
Communication systems to transfer in real-time data from sensors to the network and to the land stations

- satcom
- GSM, GPRS
- fibre optics
- acoustics

Data collection and management system for direct control of data quality, and data storage systems to enable data analysis and use for model applications

- data bases
- quality control
- data standards

Software and web based information tools to analyse data for trends, compliance to EU directives, to distribute and disseminate data to end users



- analysis
- Presentation
- web
- GIS

EMODnet preparatory actions

Establishing thematic portals.

Hydrography	North Sea	Celtic Seas, Channel, Mediterranean sea, Adriatic Sea, NW Atlantic
Geology	North Sea	Baltic and Celtic Seas
Biology	North Sea	Bay of Biscay and the Iberian Coast
Chemistry	North Sea	Black Sea + Med spots
Physics	North Sea	All other European seas
Habitats	North Sea	Baltic, Celtic Seas and the Western Mediterranean

SeaDataNet and EMODnet

- **SeaDataNet** is the leading network in Europe, actively operating and further developing a Pan-European infrastructure for managing, indexing and providing access to ocean and marine data sets and data products, acquired from research cruises and other observational activities in European marine waters and global oceans. It connects the National Oceanographic Data Centres (NODCs), and marine information services of major research institutes, from 35 coastal states bordering the European seas, and also includes IOC-IODE, ICES and EU-JRC in its network.

- SeaDataNet has qualified itself as leading infrastructure for the EMODnet data management component and is undertaking several preparatory EMODnet projects:
  - **Chemistry** – focus on the groups of chemicals required for monitoring the MSFD for establishing Good Environmental Status – cooperation with EEA, ICES and Regional Conventions
  - **Hydrography** – to produce and deliver a higher resolution digital bathymetry for European seas
  - **Physics** – together with MyOcean and EuroGOOS Regions to give wide access to operational metocean data, real-time and archives

- The **Geology** lot is producing harmonised seabed maps (WMS). The SeaDataNet infrastructure is adopted via the Geo-Seas project to give overview and access to the underlying geological and geophysical data sets.
- SeaDataNet is data partner in the **Biology** lot and a closer technical relation is foreseen in the SeaDataNet II project (2011-2015).

Hydrographic and Seabed Mapping – partnership

- Members of the **SeaDataNet** consortium together with other organisations from marine science, the hydrographic survey community, and industry:
  - **MARIS – NL** (Management, DM and IT expertise)
  - **IFREMER – FR** (Research institute)
  - **ATLIS – NL** (IT expertise, DM hydrography)
  - **IEO – ES** (Research institute)
  - **NERC-NOC – UK** (Research institute)
  - **GSI – IE** (HO – Ireland)
  - **SHOM – FR** (HO – France)
  - **UNEP-GRID Arendal – NO** (International Organisation)
  - **OGS – Oceanography department (IT)** (Research Institute)
  - **HCMR (GR)** (Research Institute)

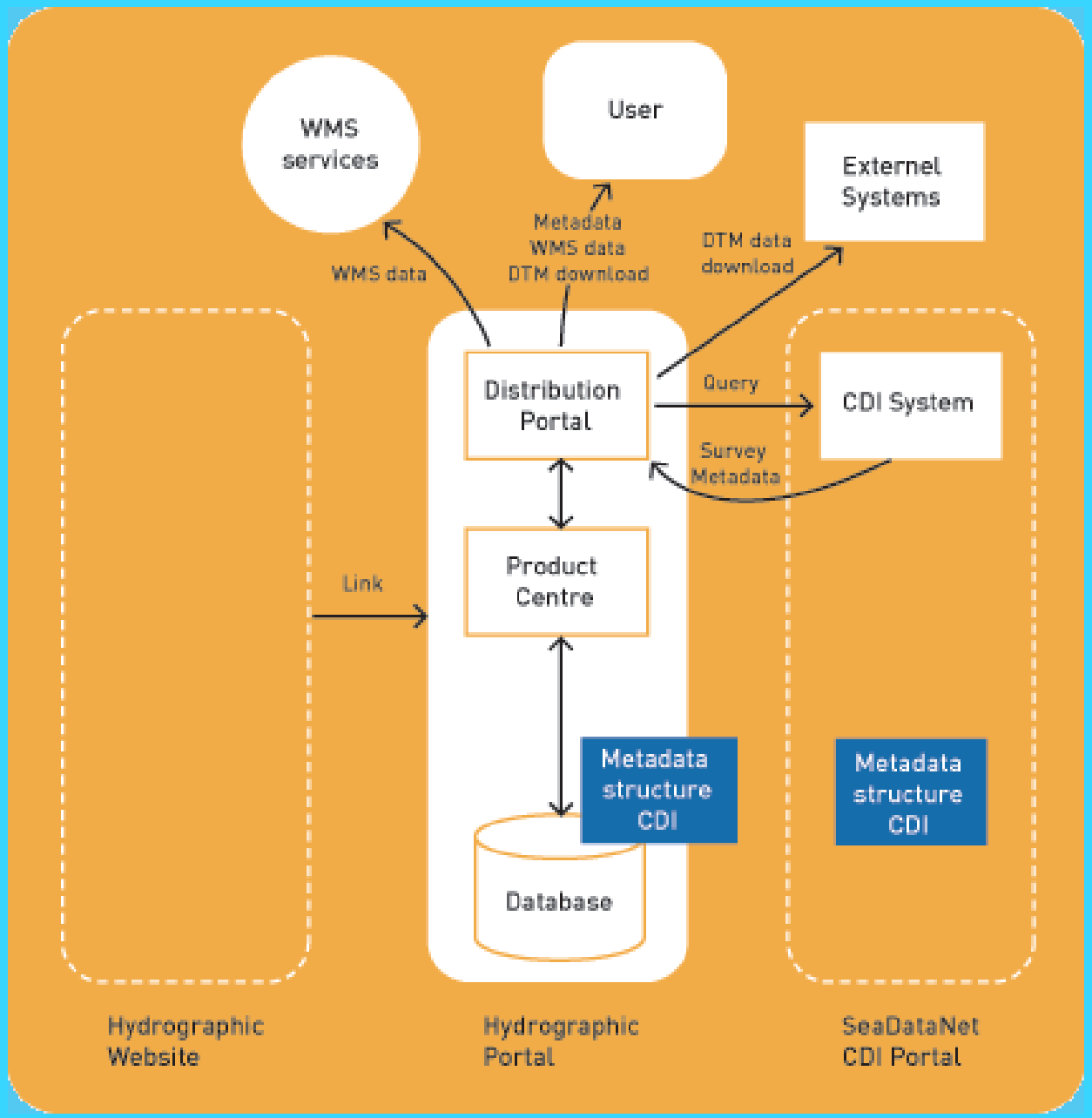
  - Plus Associate partners: **ISMAR-CNR –IT, OGS-RIMA – IT, LNEG – PT, UTM-CSIC – ES, NIOZ - NL** (Research Institutes) + **IHPT – PT** (HO)

  - Plus Data provider agreements with **HO's from Germany, Norway, Denmark, Netherlands and Belgium**

Hydrographic lot – approach

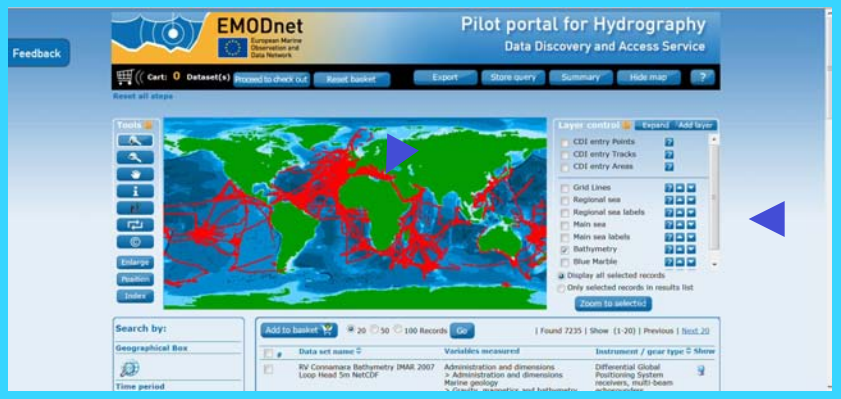
- The following approach has been implemented:
  - Involve research institutes, monitoring authorities, and HO's, in providing hydrographic data sets from which **Digital Terrain Models (DTM)** are produced with resolution of 0,25 * 0,25 minutes for each geographical region and that are loaded and integrated afterwards into a spatial database at the Portal
  - Outfit the spatial database as a **powerful and a high-end Hydrographic data products viewing and downloading service** that is complemented with WMS services (OGC) to serve users and to provide map layers for e.g. the other EMODnet portals, the prototype European Atlas of the Seas, and the broad-scale European Marine Habitats map;
  - Include in the portal a metadata discovery and access service by adopting the **SeaDataNet CDI data discovery and access service** that gives clear information about the hydrographic survey data used for the DTM, their access restrictions and distributors; this also ensures the connection of the Hydrographic portal with the SeaDataNet portal, which includes a shopping mechanism for requesting access to basic measurements data.

Hydrographic lot – system architecture

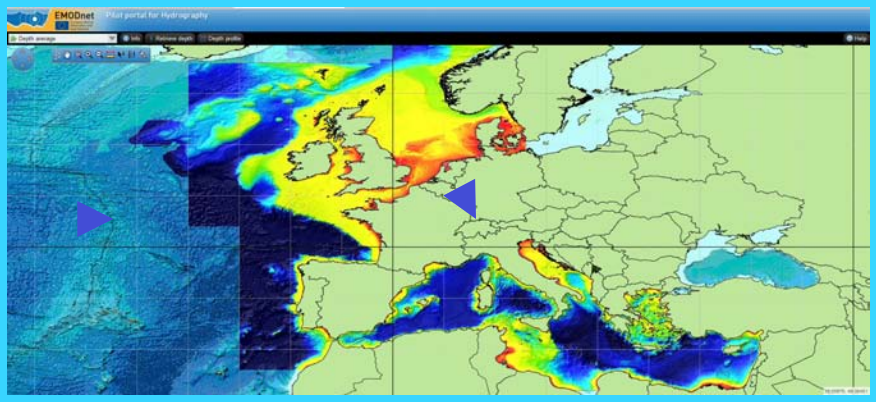


Hydrographic lot – resulting portal

http://www.emodnet-hydrography.eu



CDI metadata service



Data products service

Hydrographic lot – Data access policy

- The CDI metadata in the EMODnet pilot are public domain and freely available for all users.
- The resulting DTM data products (GIS layers) are freely available for all users as OGC WMS service and for downloading in several formats.
- The access to background data sets as detailed in the data inventory and as used for the products respects the data copyrights of owners. The CDI metadata includes a value for data access restriction for every data set it manages as well as a clear indication of the distributor. The SeaDataNet CDI shopping mechanism is fit for dealing with different access restrictions.

Hydrographic lot - Geographical coverage

- The EMODnet Hydrography lot started in 2009 with a focus on:
  - the Greater North Sea, including the Kattegat and stretches of water such as Fair Isle, Cromarty, Forth, Forties,Dover, Wight, and Portland
  - the English Channel and Celtic Seas
  - Western Mediterranean, the Ionian Sea and the Central Mediterranean Sea

- The EMODnet Seabed mapping lot started in 2010 and extends coverage to:
  - Iberian Coast and Bay of Biscay (Atlantic Ocean)
  - Adriatic Sea (Mediterranean)
  - Aegean - Levantine Sea (Mediterranean).

Hydrographic lot - QA/QC and DTM specifications

- **QA/QC specifications** have been prepared. It specifies the DTM to be produced and the QA / QC methodology to be applied. The specifications are finalized in the "Guideline for methodology, metadata and QC standards V1", that can be downloaded from the website.

- Each DTM grid cell has the following parameters:
  - Depth average in meters to LAT
  - Depth Min/Max in meters to LAT
  - Number of depth values used for interpolation
  - Depth standard deviation (as percentage of the water depth)
  - Smoothed depth average in meters to LAT
  - Number of elementary surfaces used to compute the average cell depth
  - An indicator of the offsets between the average and smoothed depth (as a % of the depth)
  - Source of data:
    - Surveys: link to Common Data Index (CDI) metadata sheet of most prevailing survey in the cell
    - Composite DTM: link to DTM metadata sheet
    - GEBCO: reference to GEBCO version

Hydrographic lot – Data gathering approach

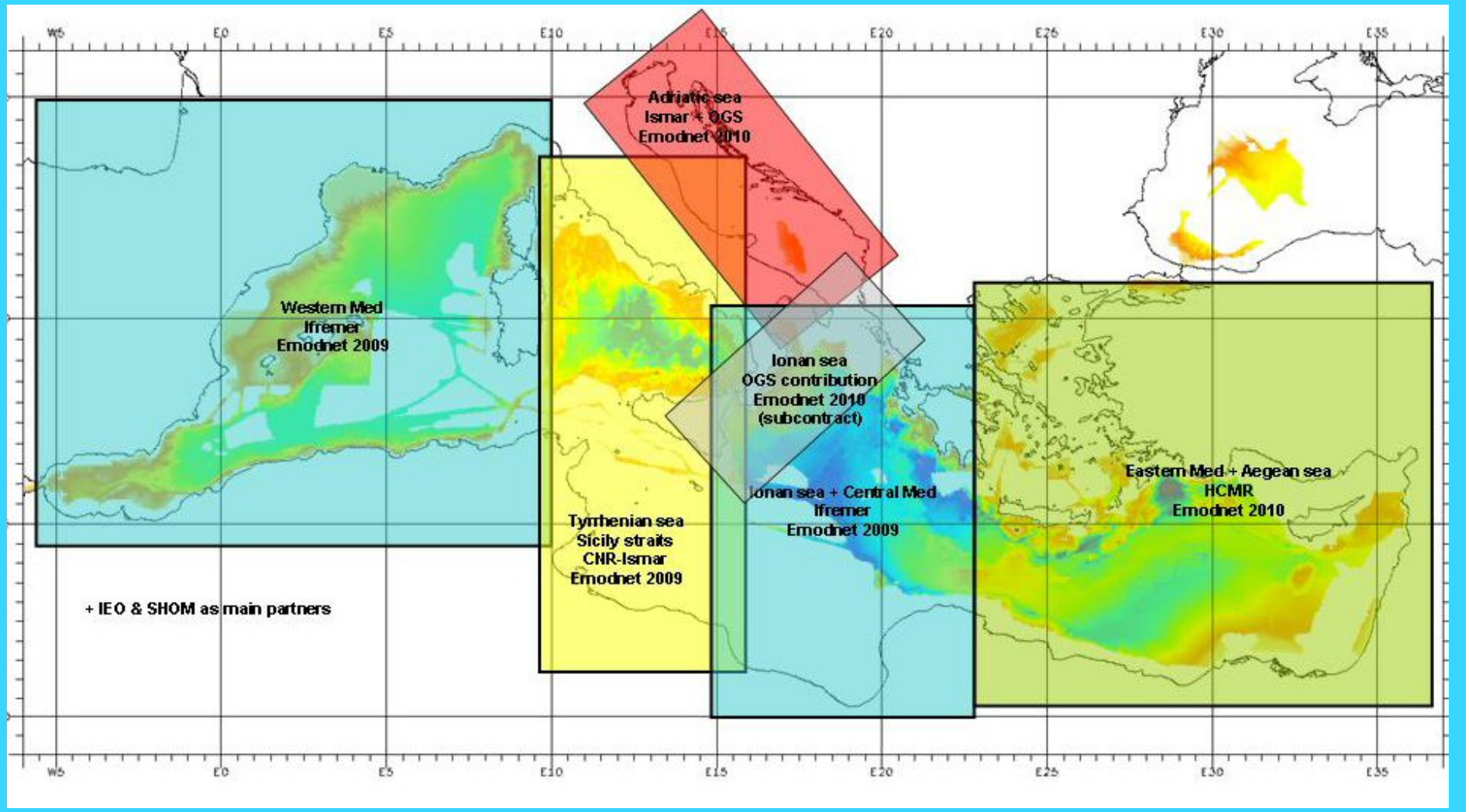
- Various organisations are engaged in the acquisition and provision of hydrographic data and data products. These comprise:
  - **Hydrographic Offices**, that are responsible for surveying the navigation routes, fairways and harbour approach channels and producing from these the nautical charts on paper and as Electronic Nautical Charts (ENC), that are used for navigation.
  - **Authorities**, responsible for management and maintenance of harbours, coastal defences, shipping channels and waterways. These authorities operate or contract regular bathymetric monitoring surveys to assure that an agreed nautical depth is maintained or to secure the state of the coastal defences.
  - **Research institutes**, that collect multibeam surveys as part of their scientific cruises.
  - **Industry**, especially the energy industry, that contracts multibeam surveys for pipeline and cable routes (in case of windfarms) and the telecommunication industry for phone and internet cable routes.

- Cooperation is sought from these organisations for data sets (single and multibeam surveys, sounding tracks, composite products) to support a good geographical coverage and high quality.

Hydrographic lot – Data processing approach

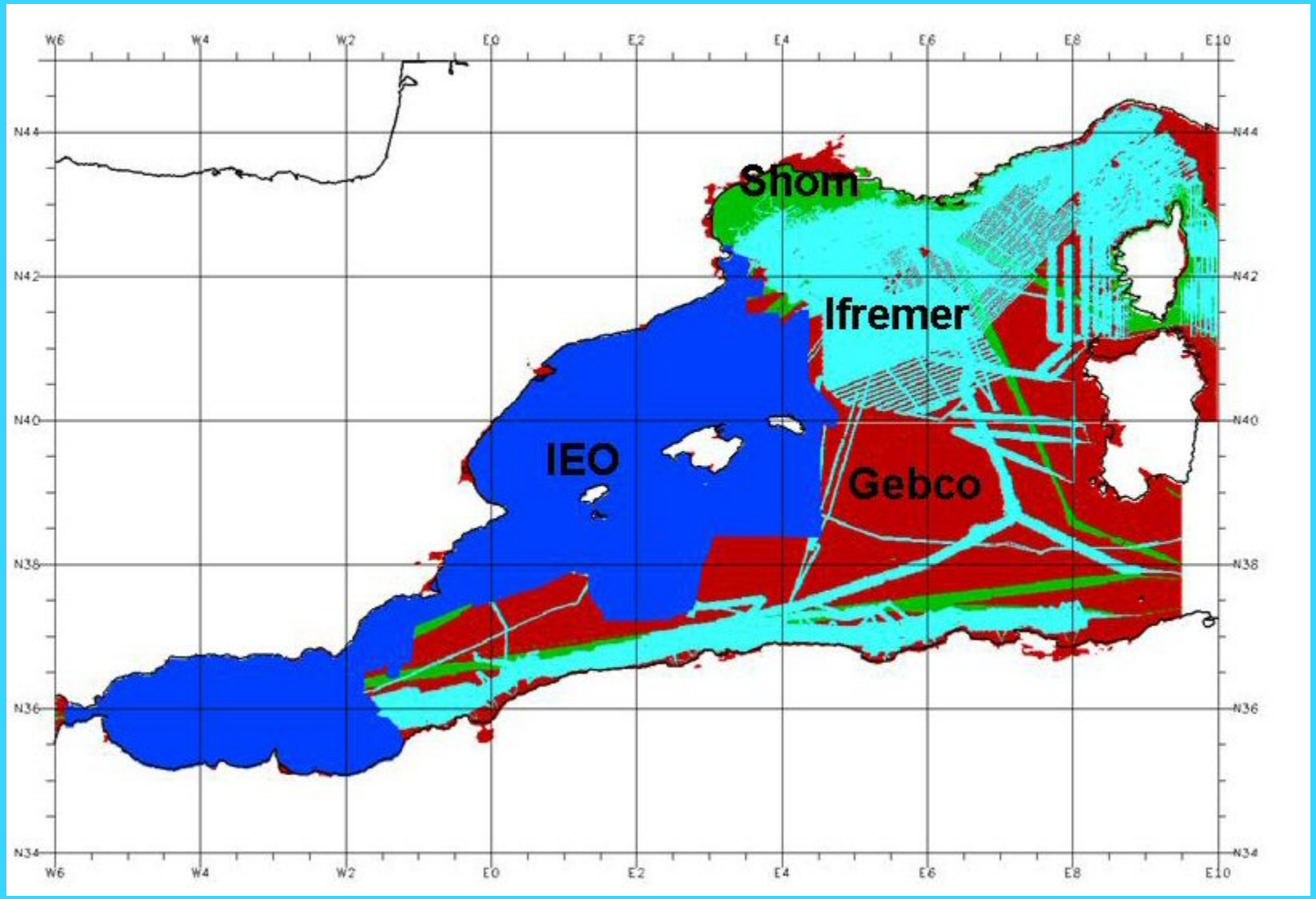
- The data sets are used internally for producing regional Digital Terrain Models (DTM).
- The DTMs are integrated into an overall DTM at the public portal for browsing and downloading
- The survey data sets themselves are not distributed but described in the CDI metadata, giving clear information about the background survey data used for the DTM, and facilitating requests by users to originators.
- The composite DTMs received from some Hydrographic Offices are also not distributed but described in a DTM metadata sheet, giving information about the background and originators of these products.

Hydrographic lot – Data processing coordination



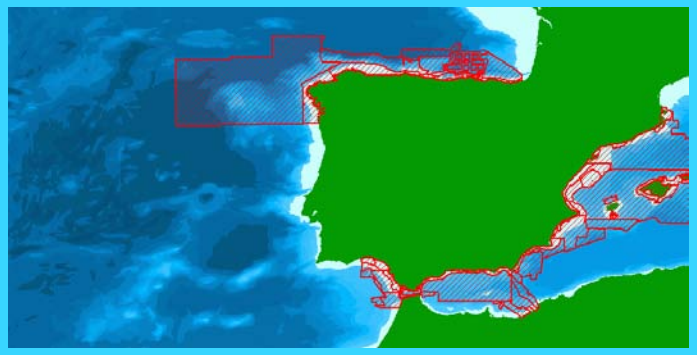
Example for the Mediterranean Sea

Hydrographic lot – Data contributing and coverage

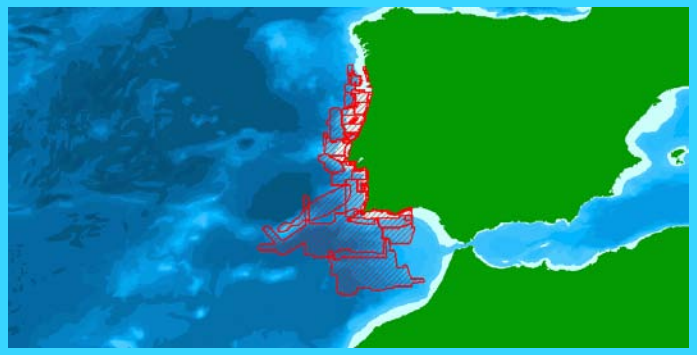


Example for the Western Mediterranean Sea

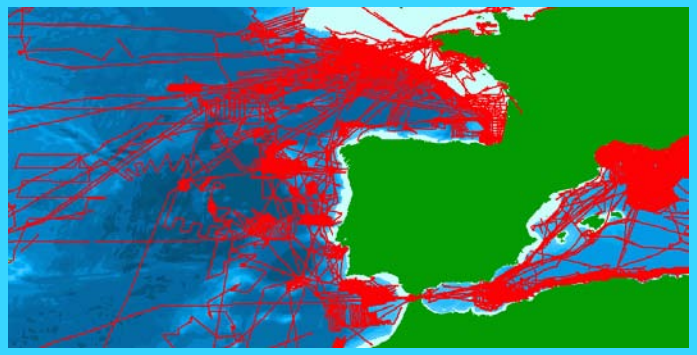
Data gathering – Iberian Coast and Bay of Biscay (Atlantic Ocean)



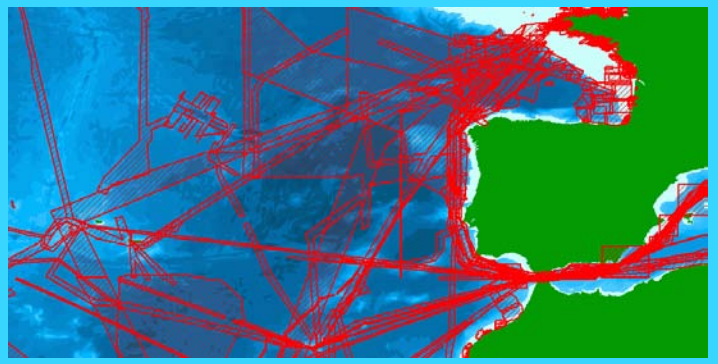
IEO data



IHPT data

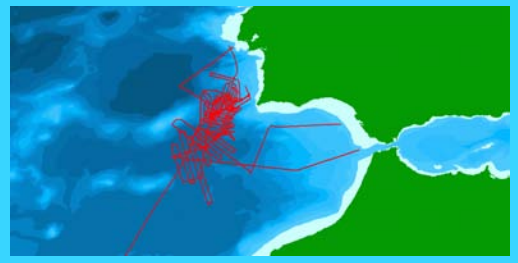


IFREMER data



SHOM data

CNR – ISMAR data



UTM-CSIC data

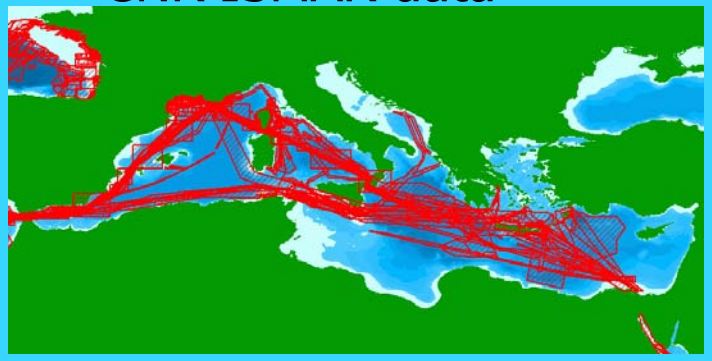
LNEG data

Data gathering – Mediterranean Sea

IEO data

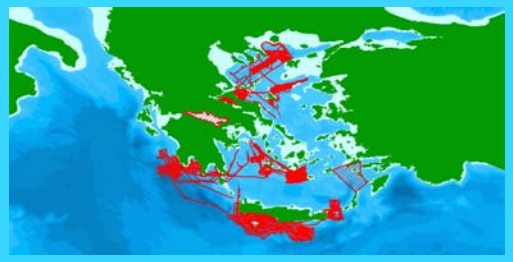
CNR-ISMAR data

IFREMER data



SHOM data

OGS-RIMA data



HCMR data

OGS data

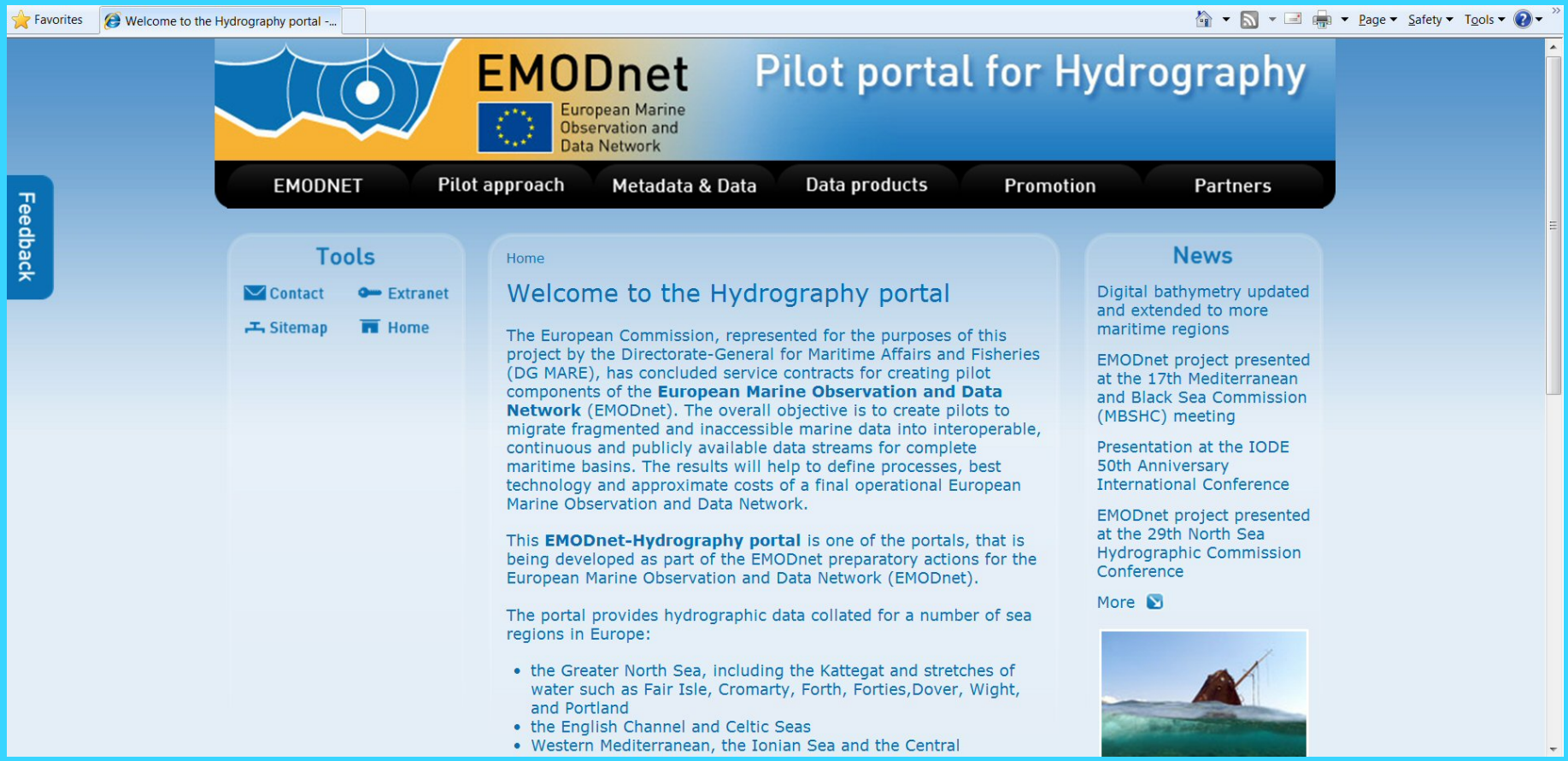
Progress after 24 months

- Data gathered for the 6 maritime regions as surveys, composite DTM's and if missing completed with GEBCO grid
- These have been compiled into multiple subDTM's applying the QA/ QC methodology. Also an intercalibration exercise has taken place between DTM responsible partners for harmonisation.
- Partners have made very good progress with preparing and submitting CDI metadata for the surveys they have compiled
- Gathering additional metadata for composite DTM's of HO's and making these available as factsheets is ongoing

Progress after 24 months

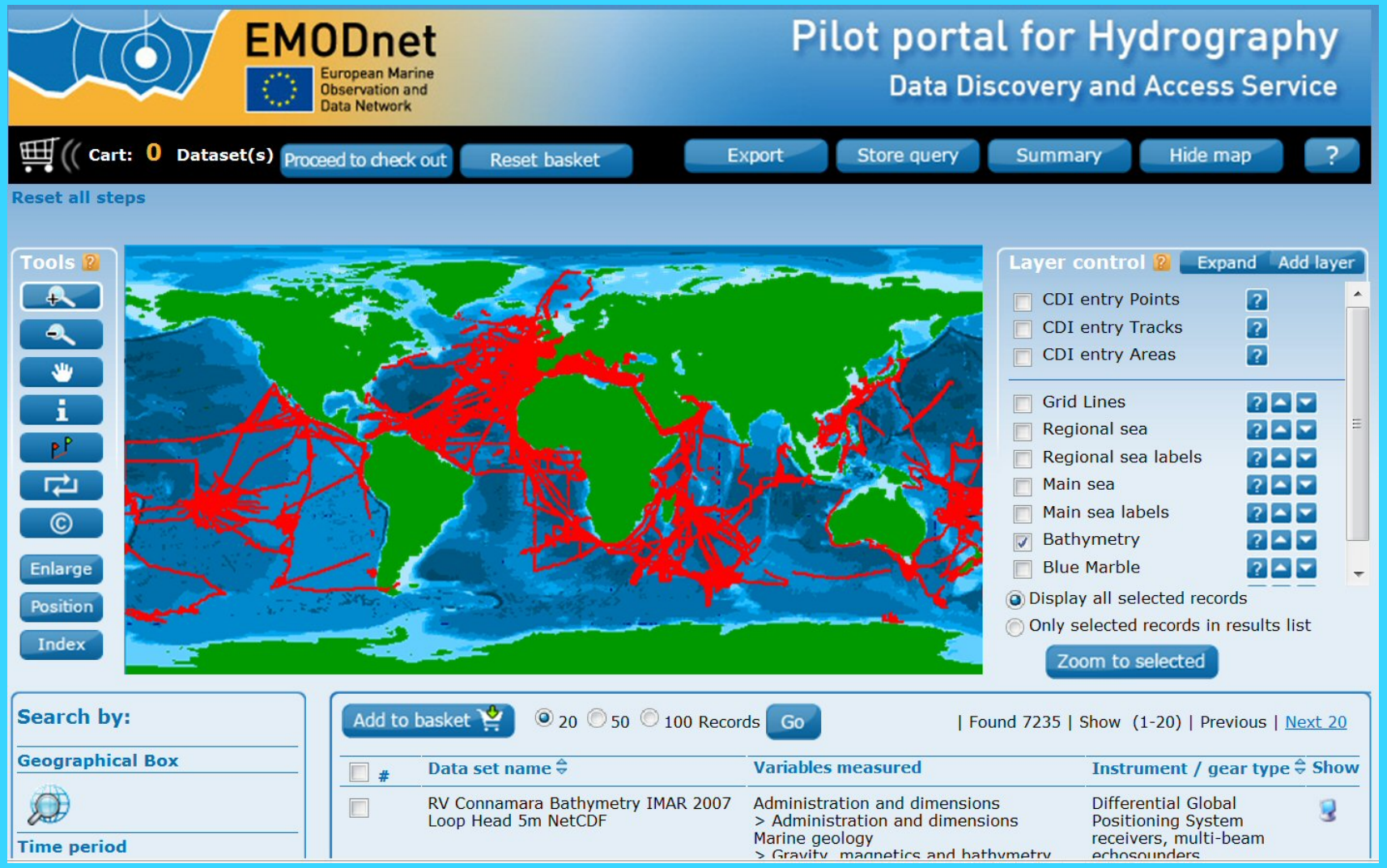
- Up till today, 7235 survey CDI metadata records from 13 data centres and 114 data originators have been collated and imported into a dedicated EMODnet Hydrography CDI data discovery and access service. This service was launched in May 2010 and has been upgraded over time with extra functionality
- The regional DTM's have been imported into the central DTM, the GSHHS coastline and a sample collection of wrecks (North Sea)
- The dedicated EMODnet Hydrography products portal has been launched in May 2010. It sits atop of the central DTM database and interacts with the CDI service and with OGC WMS services
- The Hydrography portal has considerably been upgraded and relaunched in June 2011 in respons to feedback and comments received.

Portal

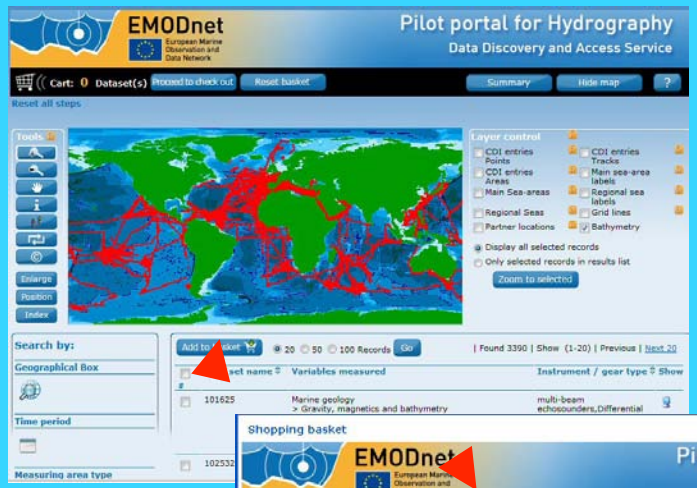


www.emodnet-hydrography.eu

CDI Data Discovery and Access Service



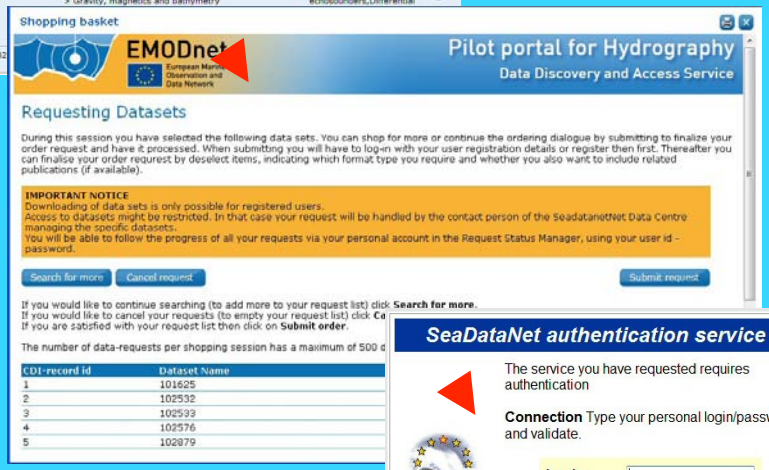
CDI Shopping mechanism to request downloading



Search

Results

Include in Basket

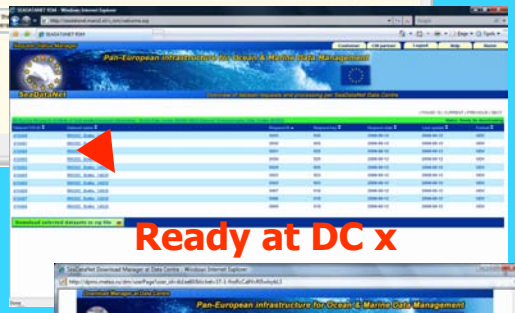


Shopping list

Submit + Authentication

Request Confirmed

Check Status In RSM



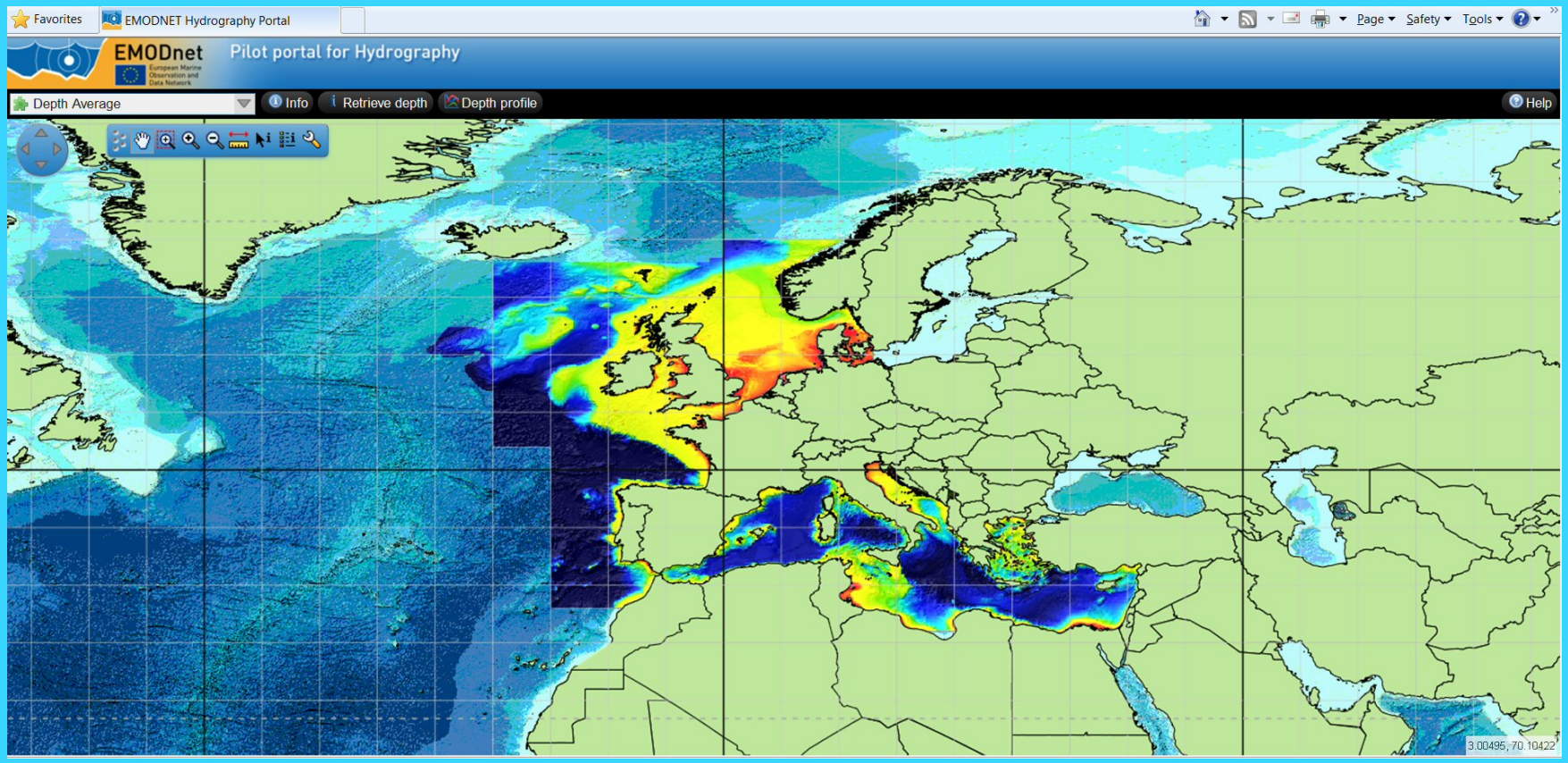
Ready at DC x

Download

Data

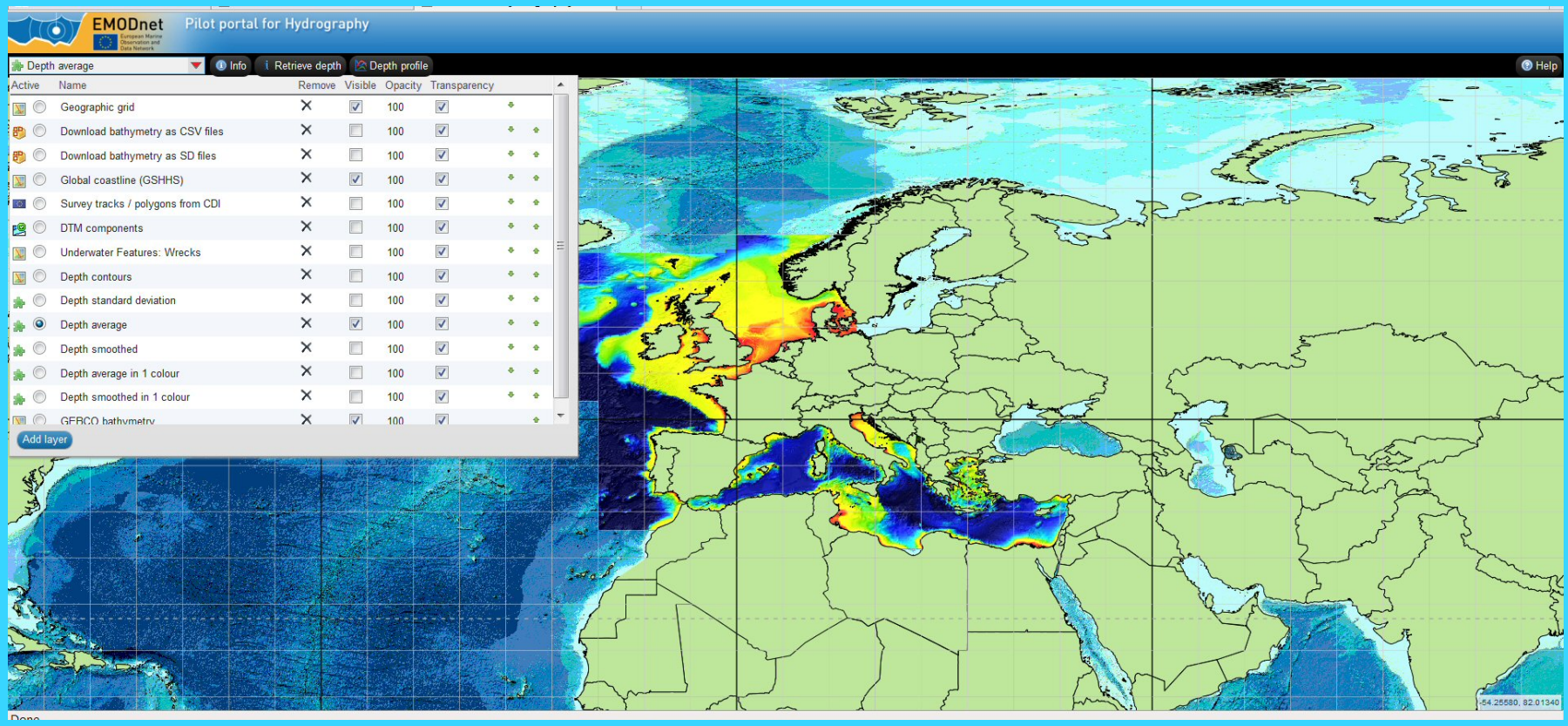
SDN format

Hydrographic Data Products viewing service



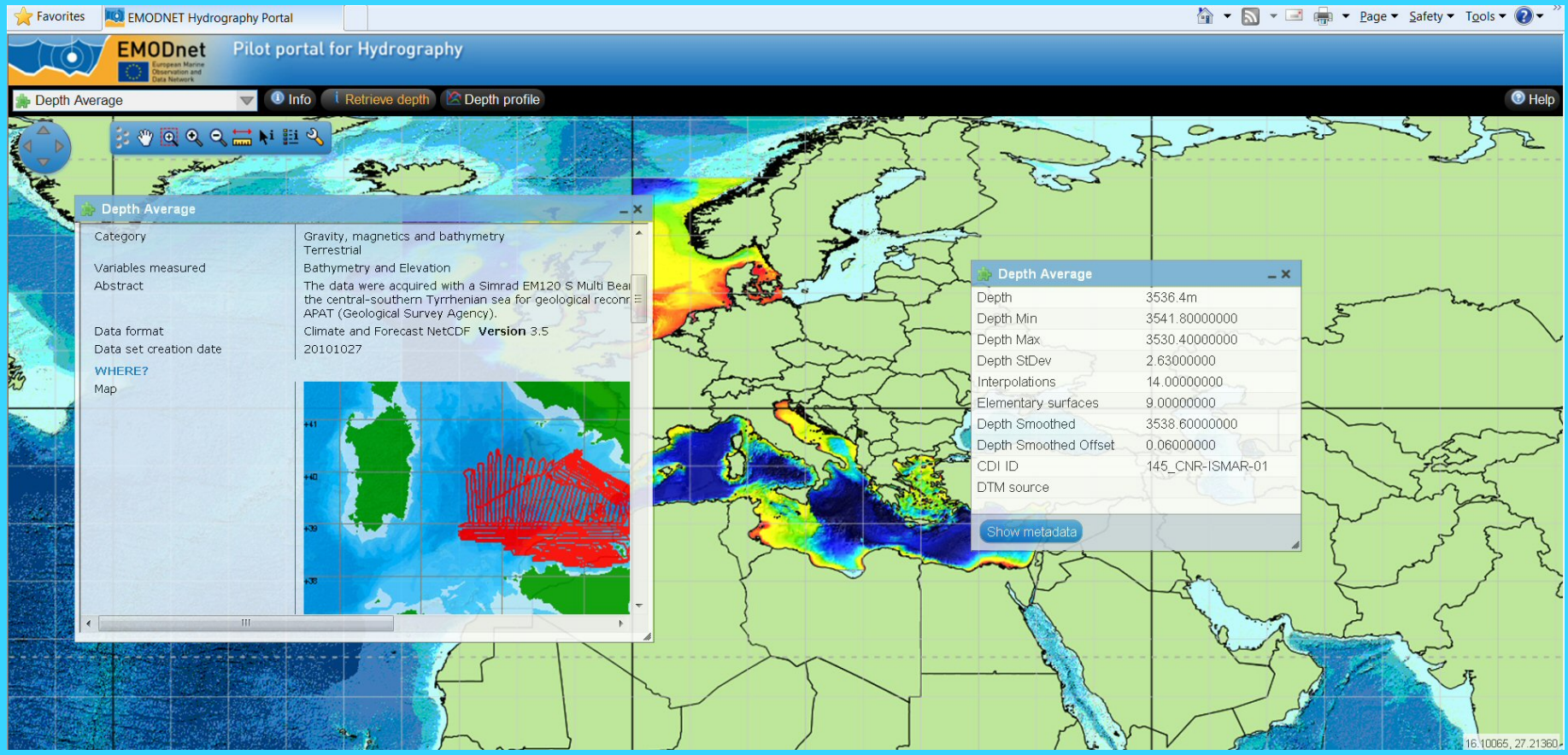
- *Start page of the upgraded Data Products Viewing Service with GIS layers of digital bathymetry and other information*

Hydrographic Data Products viewing service



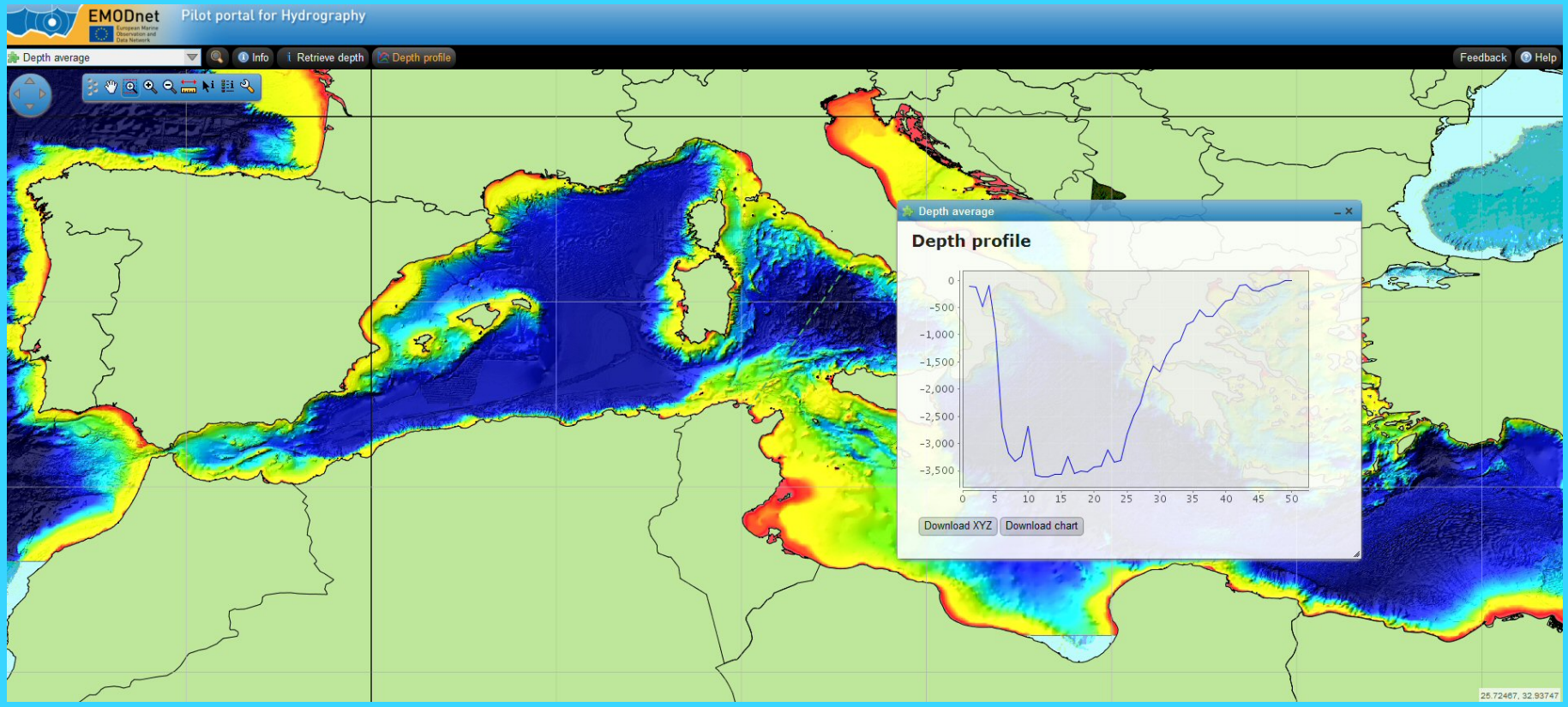
- *Pull down menu with GIS layers and options for viewing and requesting extra information*

Hydrographic Data Products viewing service



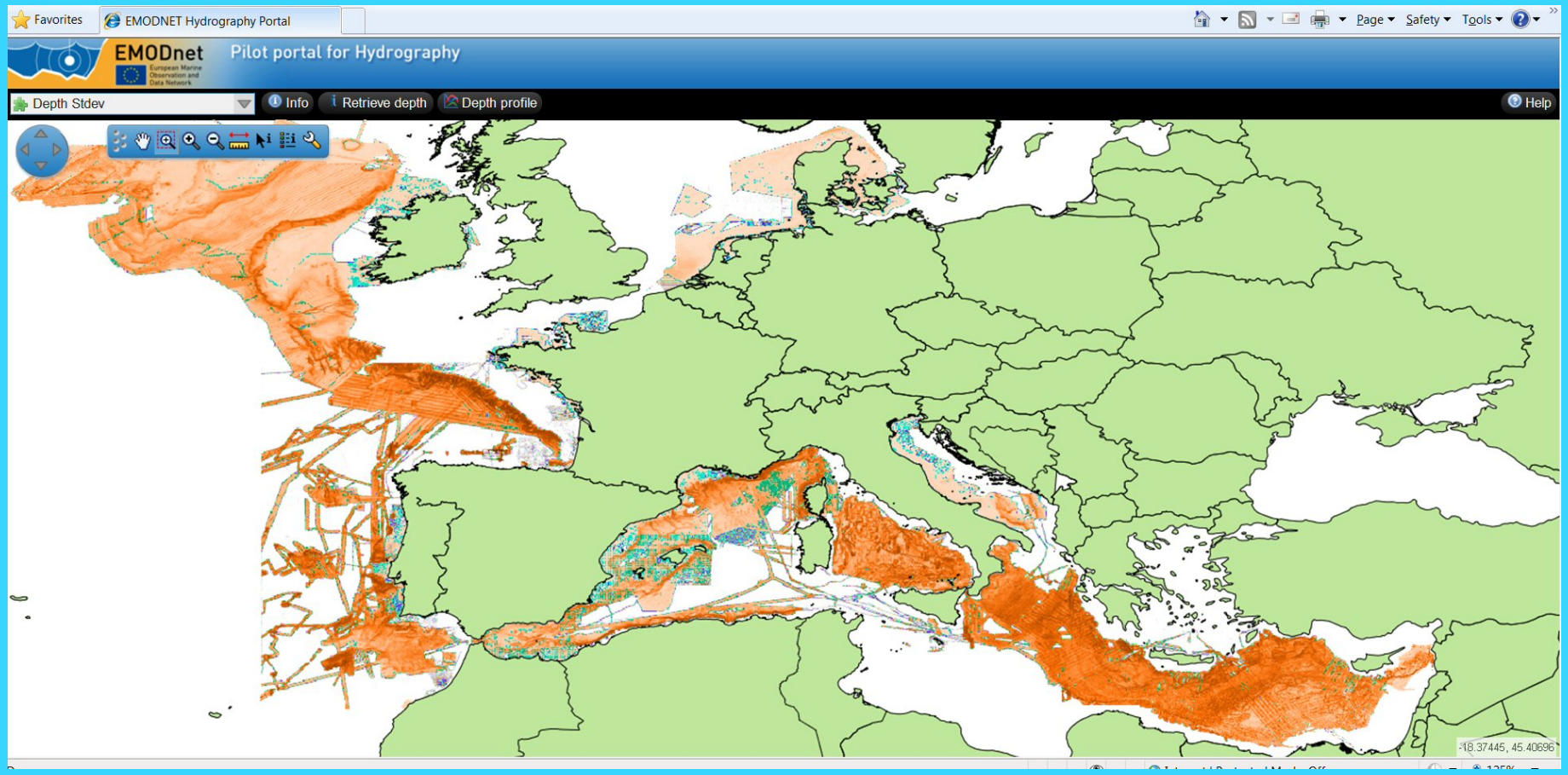
- *Retrieving parameters of an individual grid cell and retrieving CDI metadata of associated prevailing survey*

Hydrographic Data Products viewing service



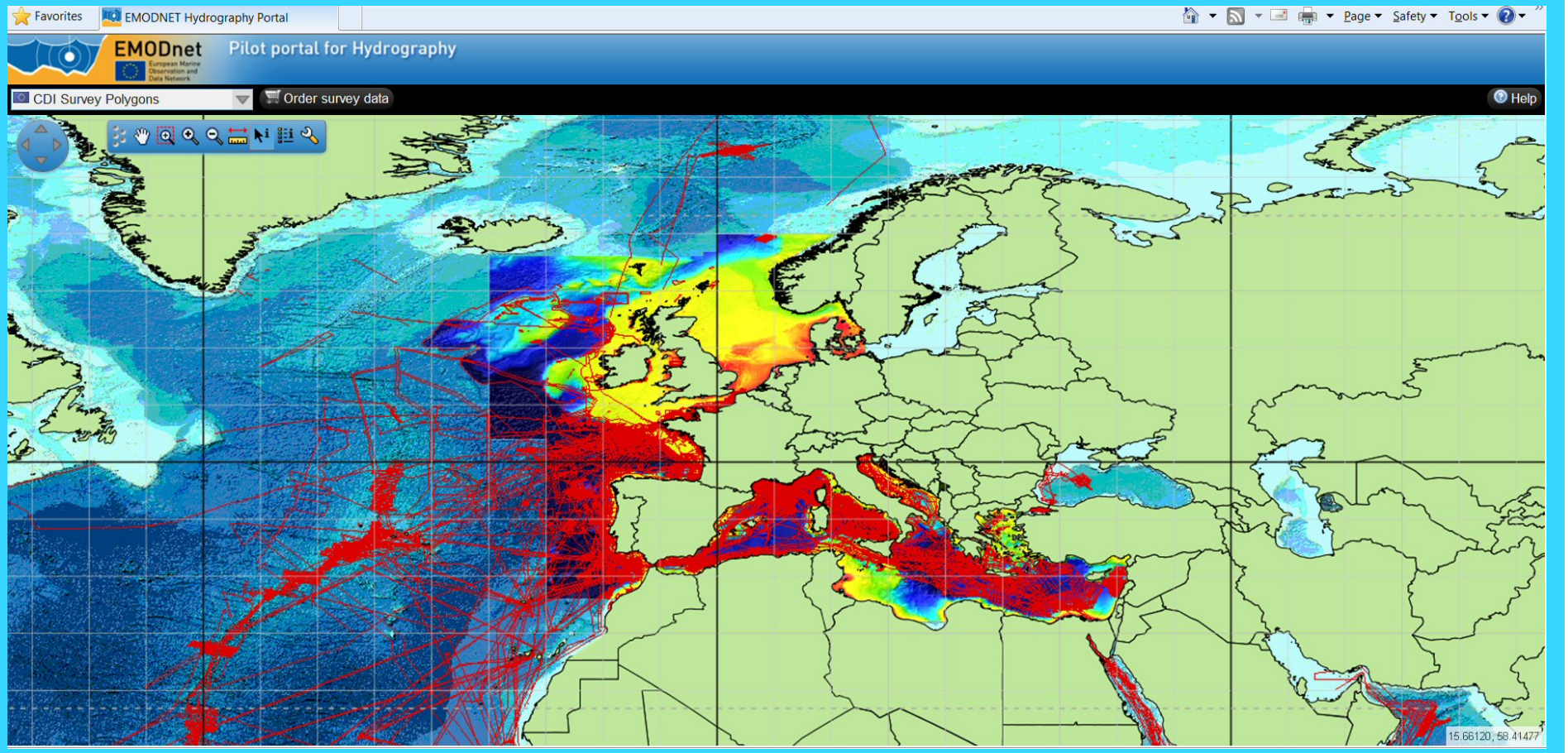
- *Retrieving depth profile along a user defined transect*

Hydrographic Data Products viewing service



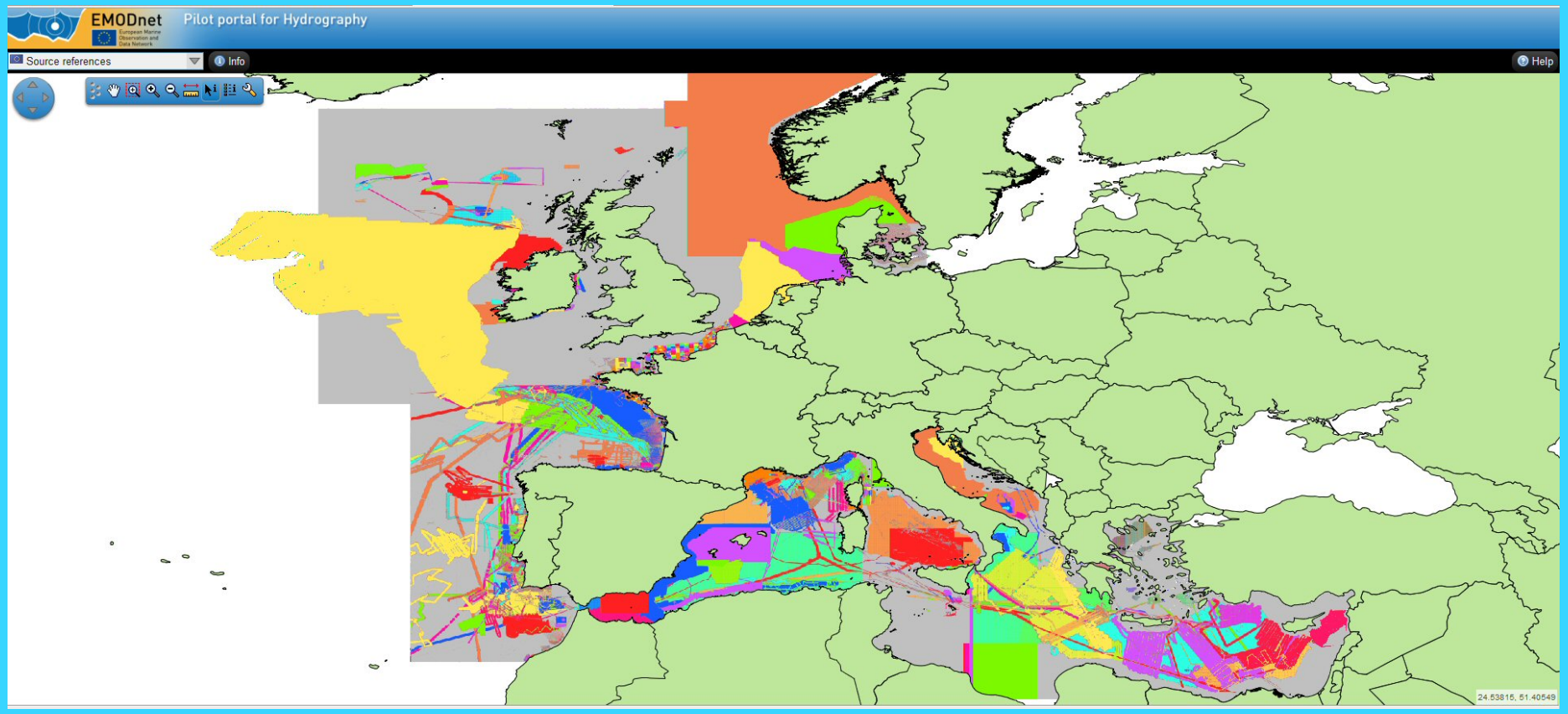
- *Depth standard deviation layer, also giving good insight in where surveys and composite DTMs (if provided with St Dev) have been used to cover the area.*

Hydrographic Data Products viewing service



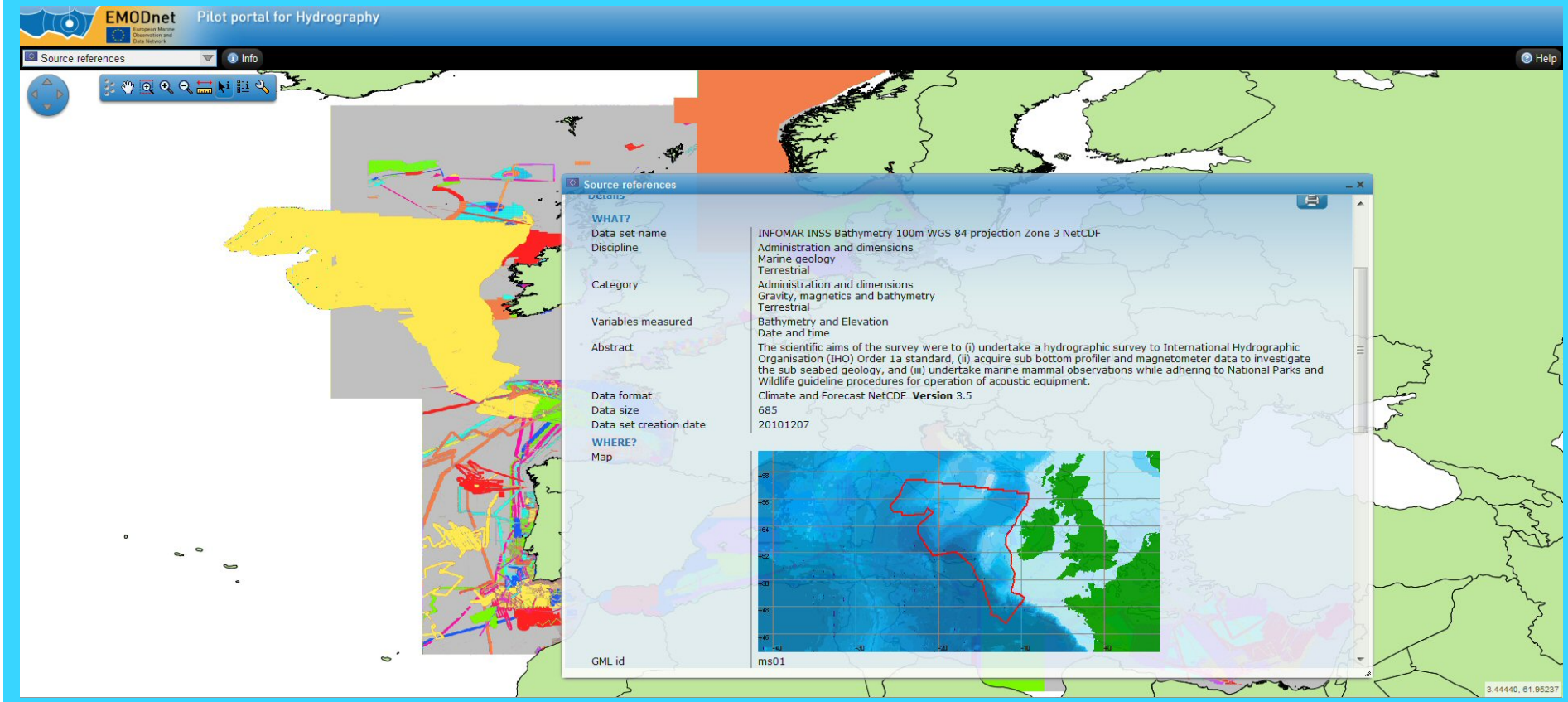
- *CDI survey tracks and polygons layer, provided as OGC WMS service by the CDI service, and facility for polygon search with direct switch to the CDI service*

Hydrographic Data Products viewing service



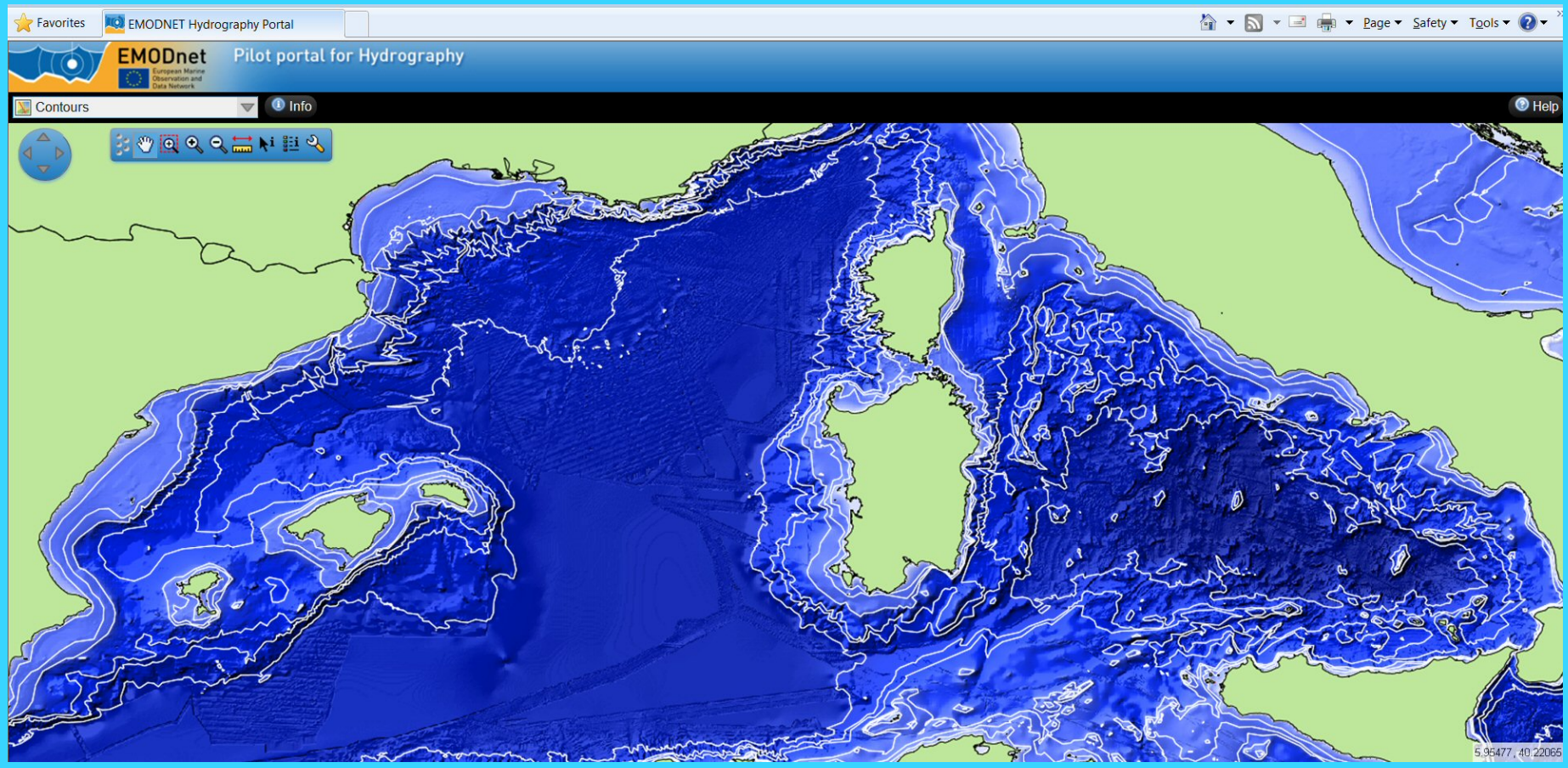
- *Sources reference layer, indicating which source data (surveys or composite DTMs) were used as prevailing for DTM grid cells. Including identification of related source and associated metadata.*

Hydrographic Data Products viewing service



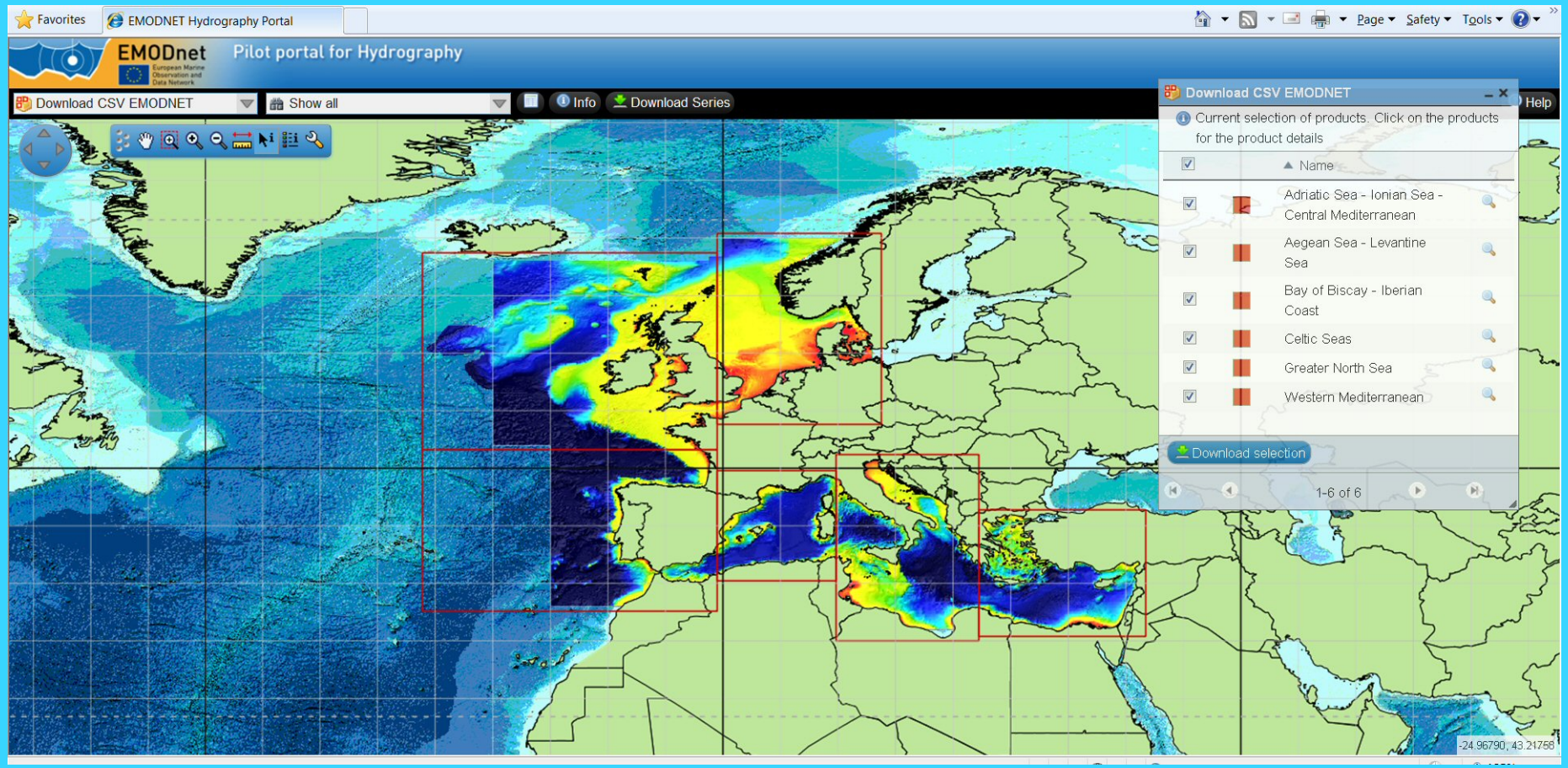
- *Sources reference layer, indicating which source data (surveys or composite DTMs) were used as prevailing for DTM grid cells. Including identification of related source and associated metadata.*

Hydrographic Data Products viewing service



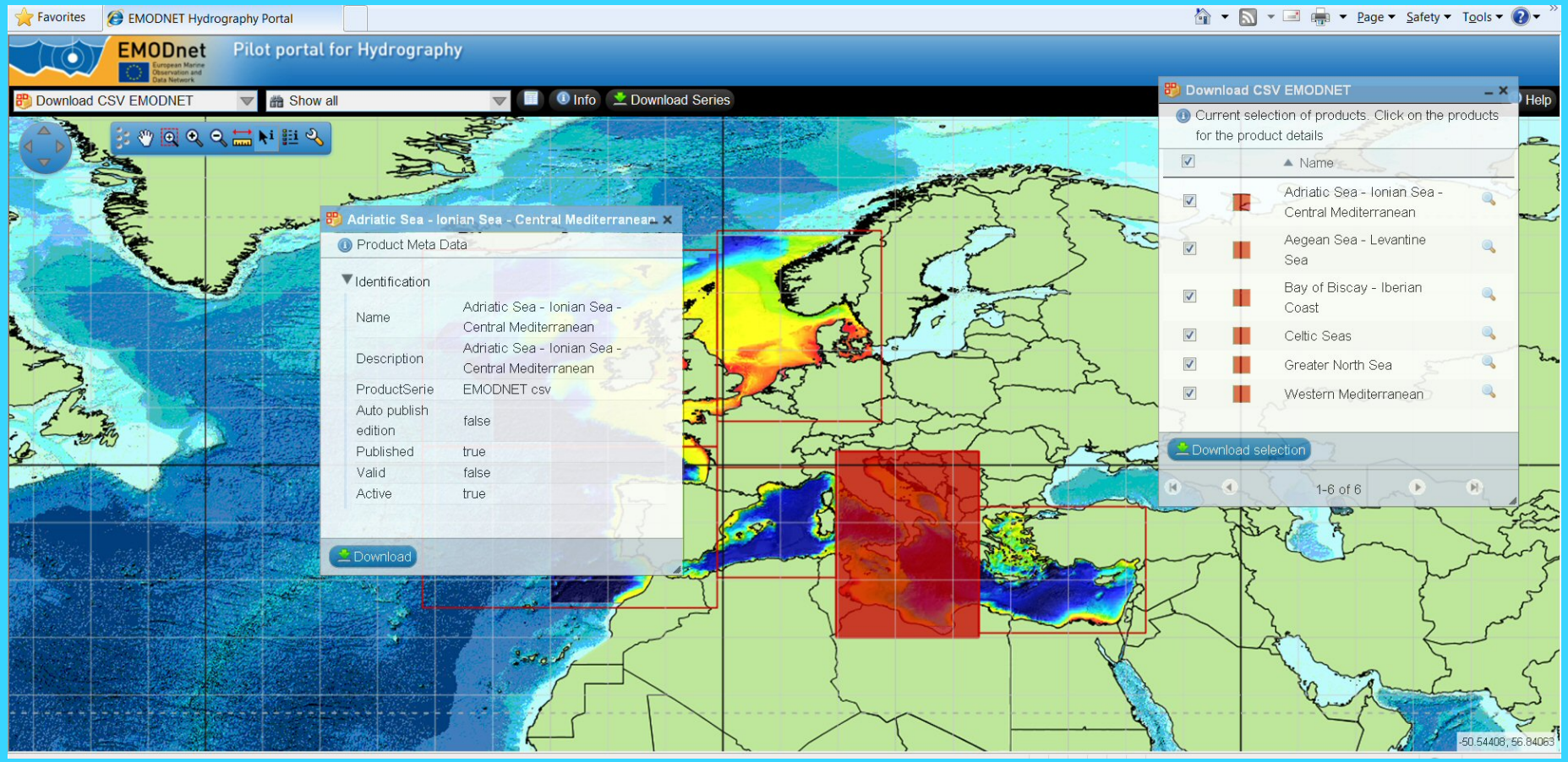
- *Contours*

Hydrographic Data Products viewing service



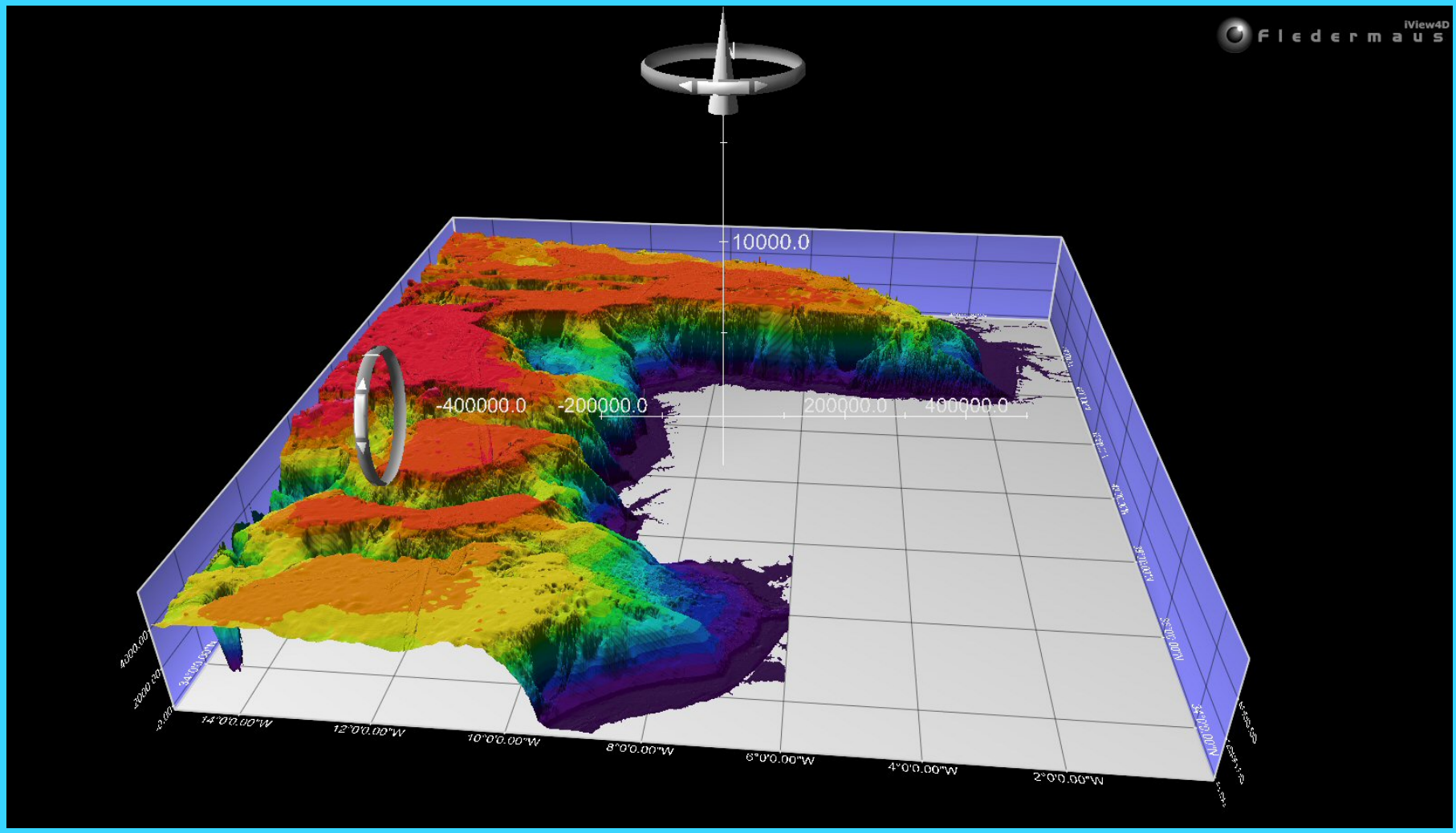
- *Downloading DTM grid as tiles in various formats (for now CSV and Fledermaus SD formats; underway are ESRI ASCII, NetCDF (CF) and Geotiff)*

Hydrographic Data Products viewing service



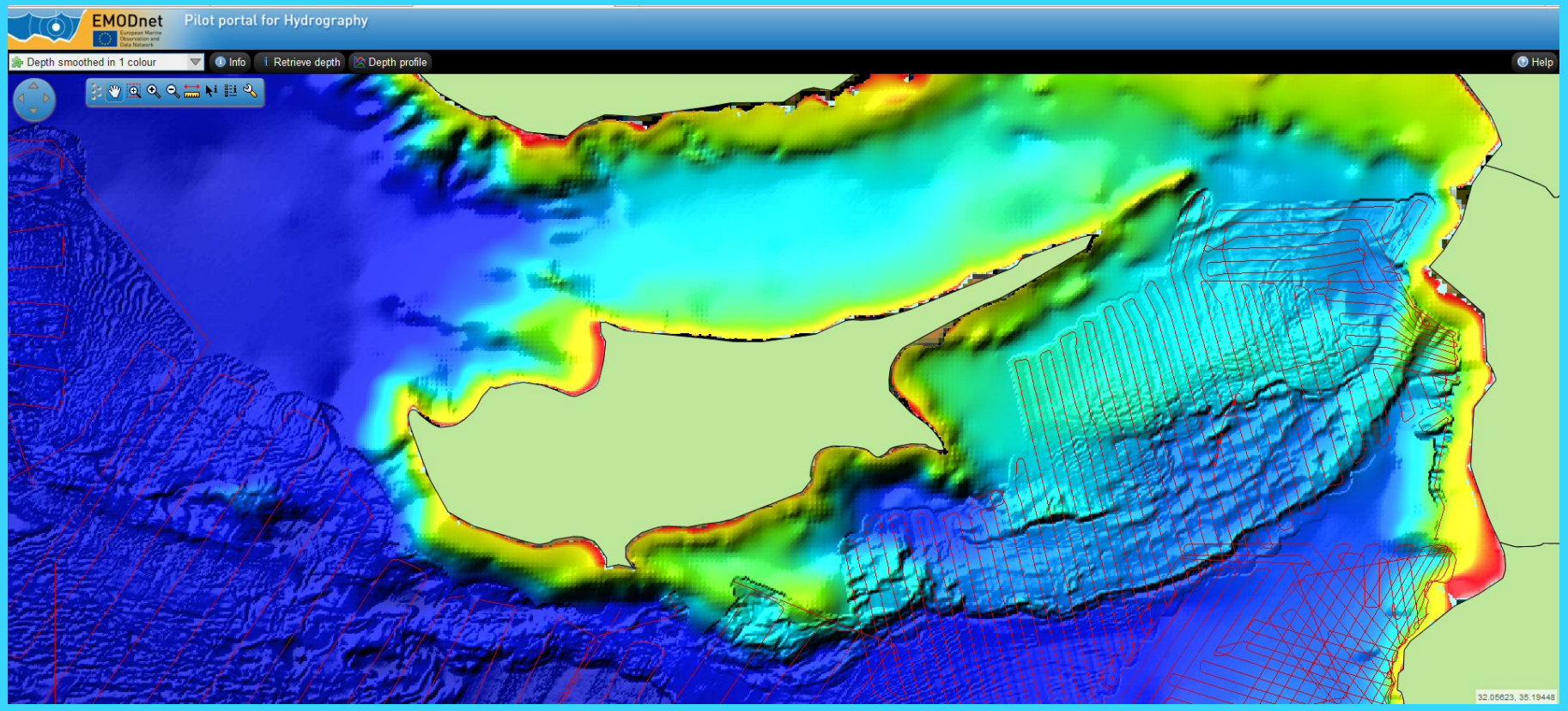
- *Selected tile for downloading including extra information*

Hydrographic Data Products viewing service



- *3D Visualisation of Fledermaus SD file with free Fledermaus viewer*

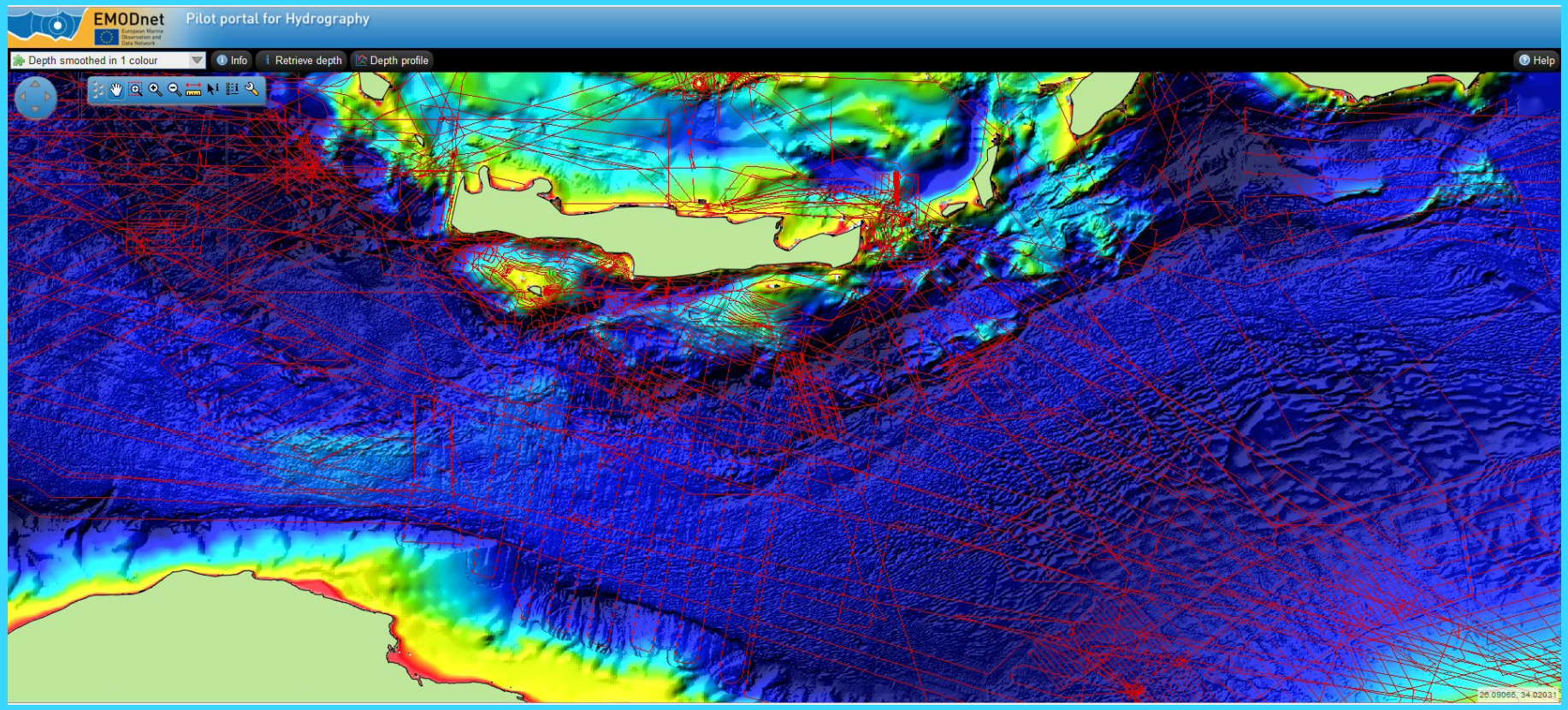
Hydrographic Data Products viewing service



Around Cyprus

- *Detailed zoom of digital bathymetry - examples*

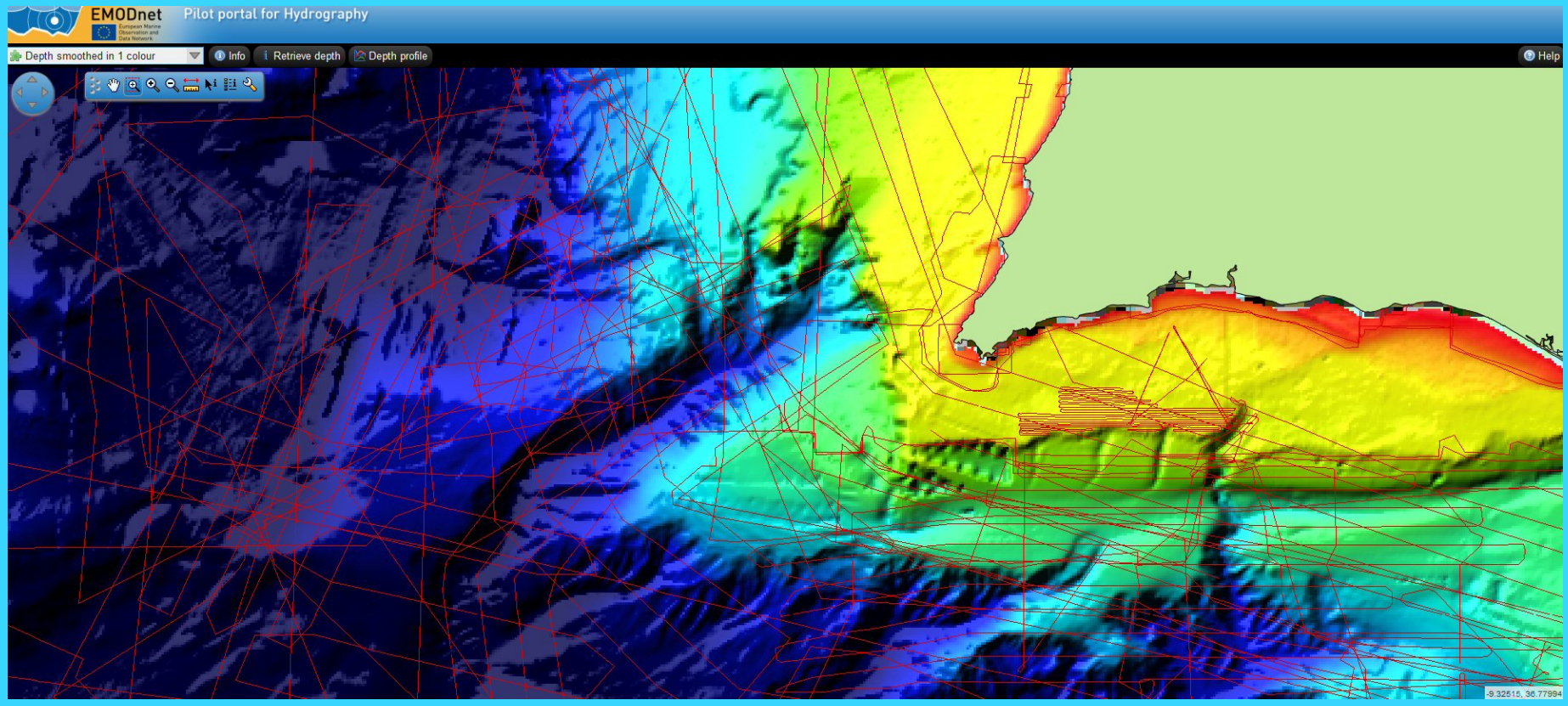
Hydrographic Data Products viewing service



Near Crete

- *Detailed zoom of digital bathymetry - examples*

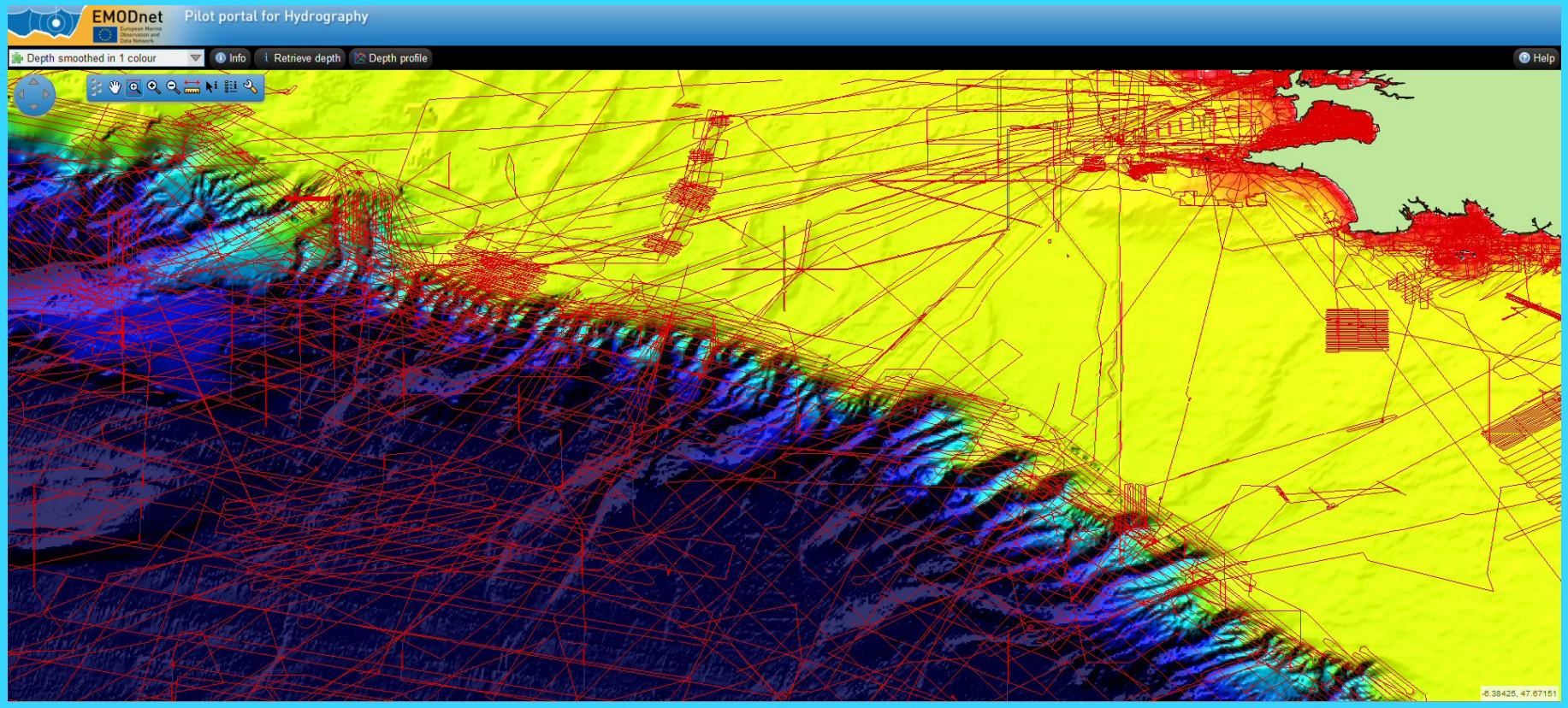
Hydrographic Data Products viewing service



Near Gulf of Cadiz

- *Detailed zoom of digital bathymetry - examples*

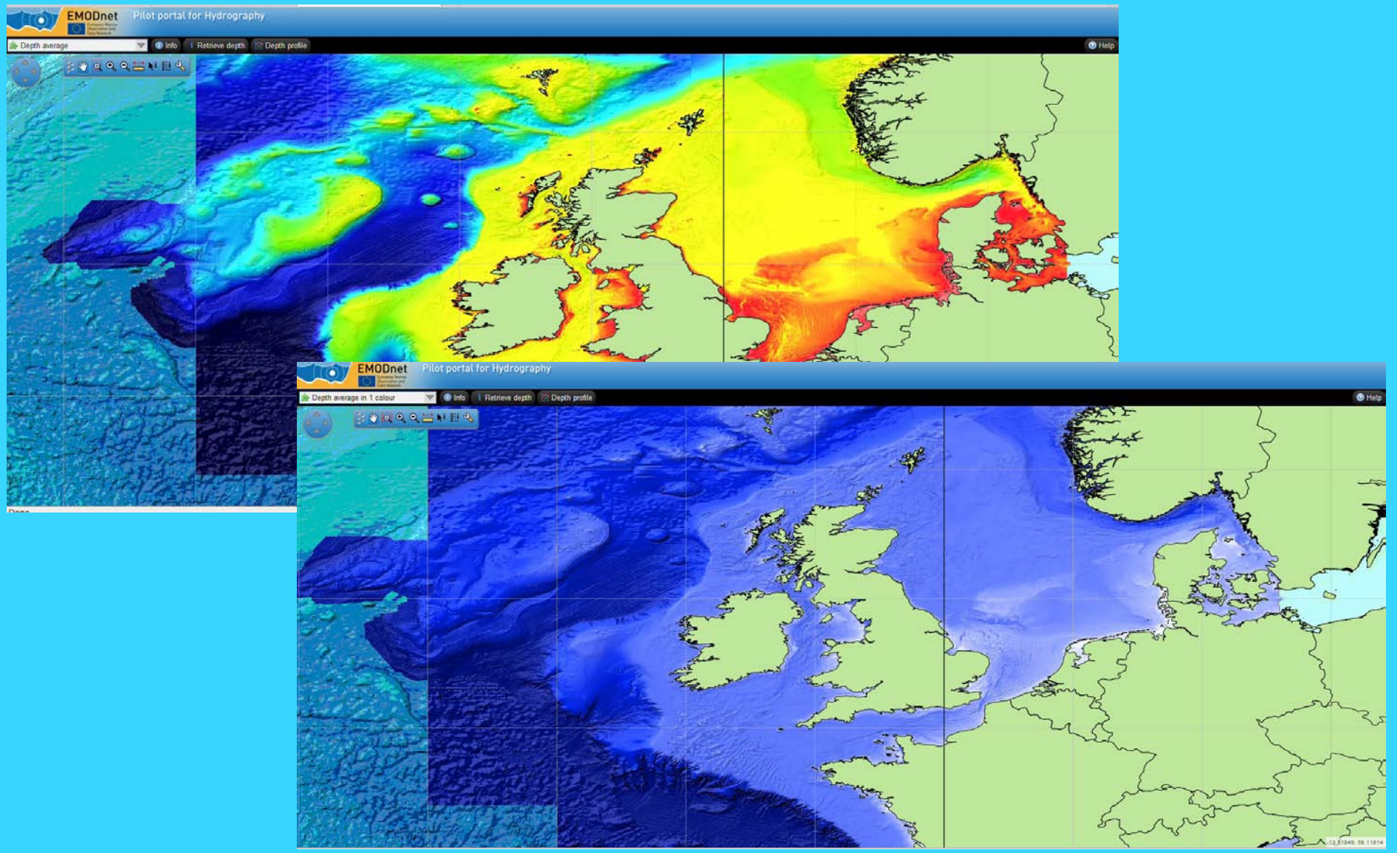
Hydrographic Data Products viewing service



Dropping off the shelf

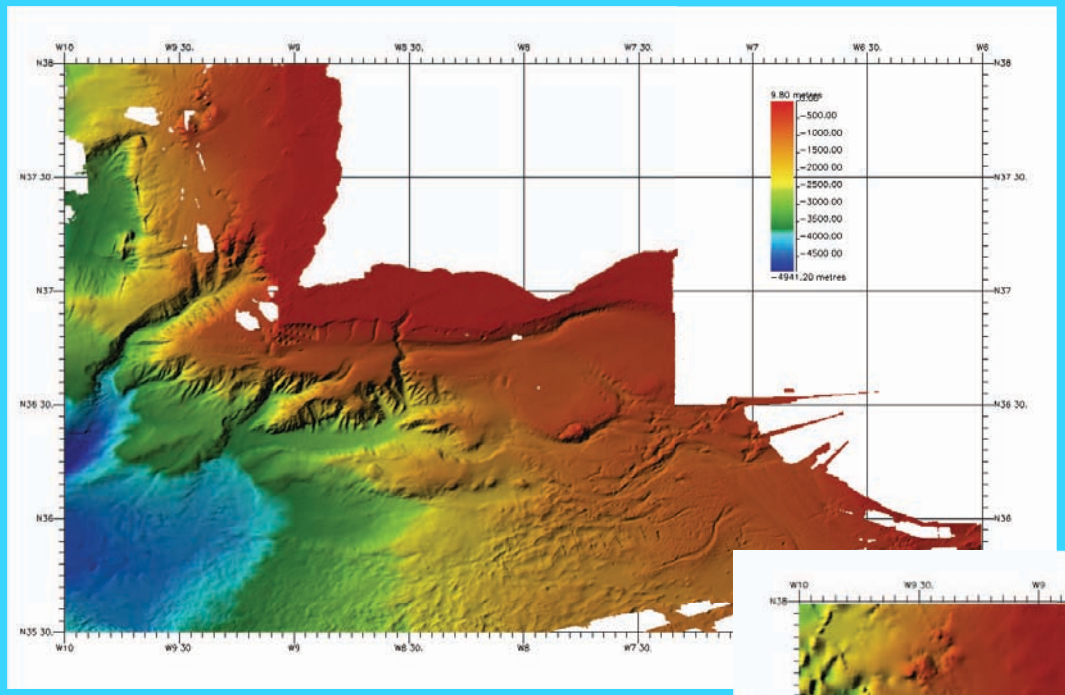
- *Detailed zoom of digital bathymetry - examples*

Hydrographic Data Products viewing service

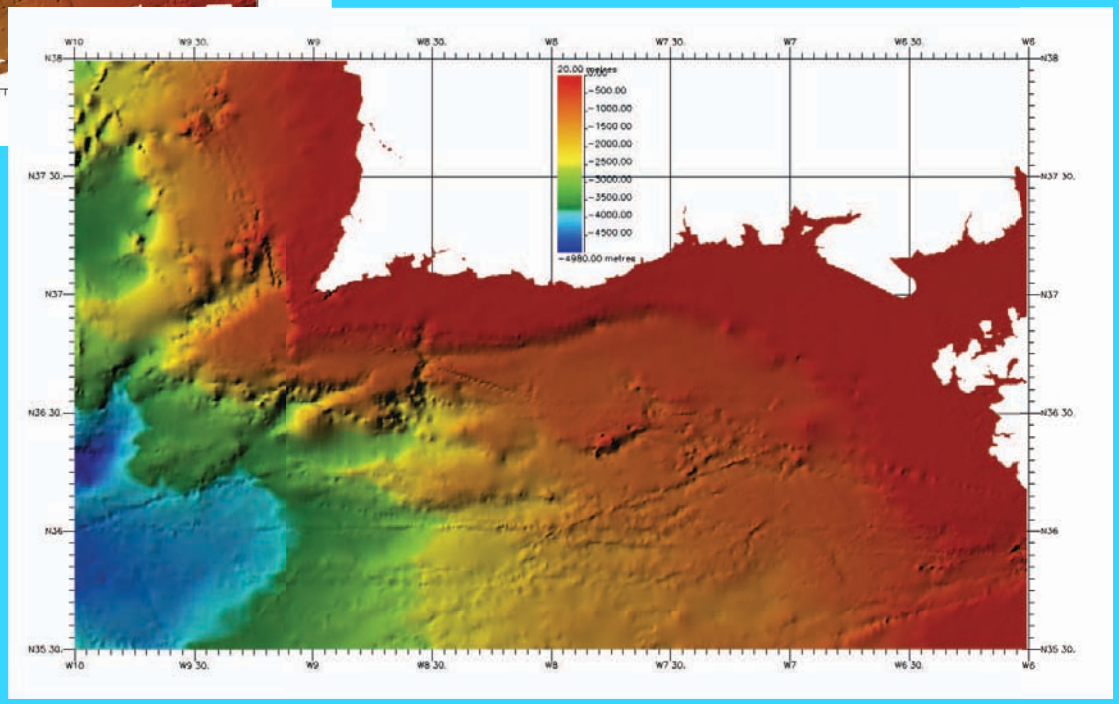


- *Celtic Sea – North Atlantic in 2 colour palettes*

Quality – comparison with GEBCO - example



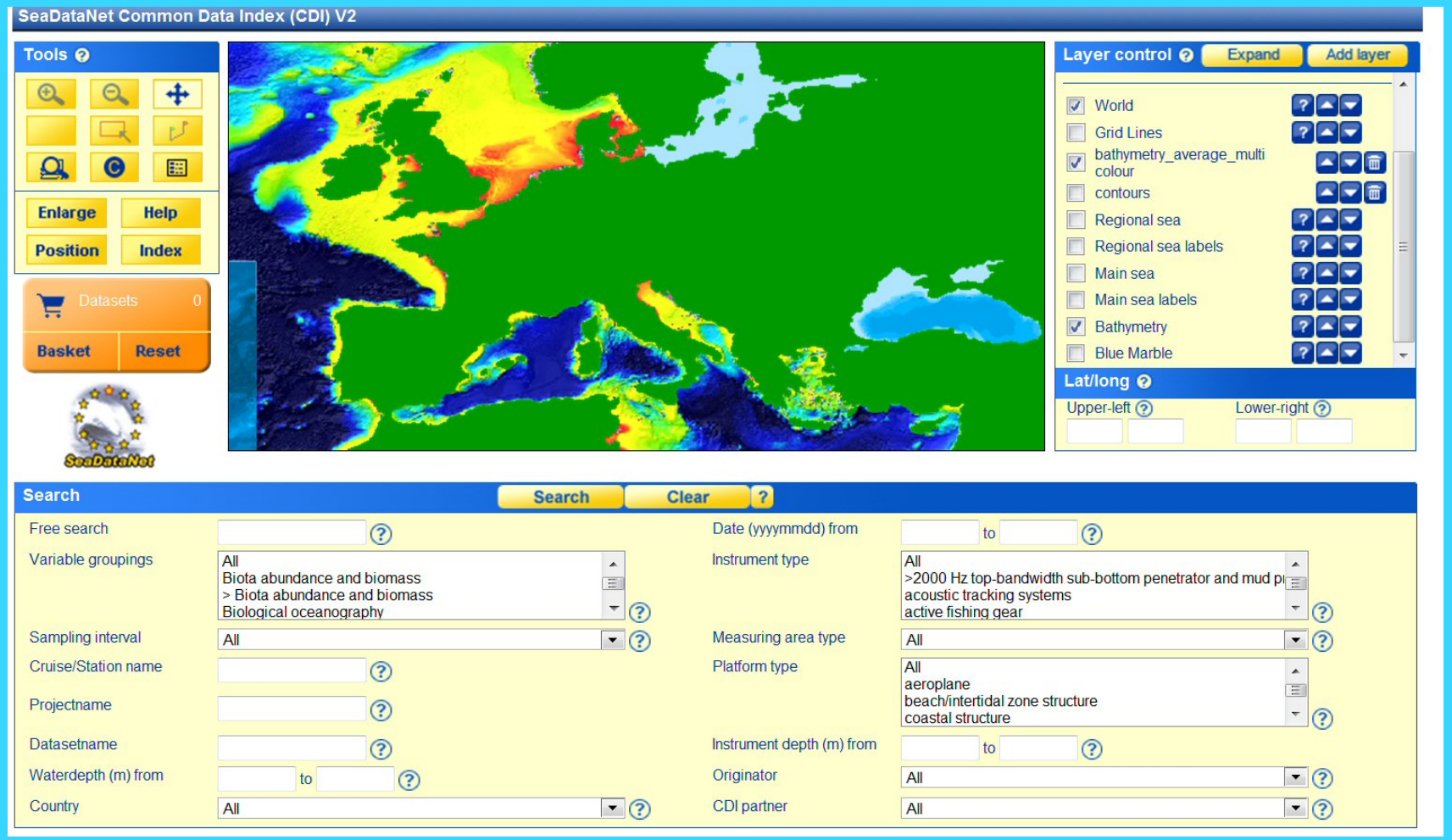
EMODnet
bathymetry



GEBCO
bathymetry

Gulf of Cadiz

Interoperability



- The Hydrography DTM WMS layers can be shared with other EMODnet portals and beyond (e.g. WISE-Marine, European Atlas of the Seas, SeaDataNet)
- Example: DTM WMS added to SeaDataNet CDI service

www.emodnet-hydrography.eu