

Reanalysis and short-term forecasting of environmental conditions in the Black Sea using CMEMS and EMODnet



ΔΗΜΟΚΡΙΤΕΙΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ
ΘΡΑΚΗΣ

DEMOCRITUS
UNIVERSITY
OF THRACE

Myrintzou Vasiliki, DUTH
Nikolaos Kokkos, DOMI Dev. P.C.



DOMI Development P.C

17 April 2026, Tbilisi

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Co-funded by
the European Union

NEXT Black Sea Basin



CMEMS is the **Copernicus** **Marine Environment** **Monitoring Service**

It is funded by **EU** and
operated by **Mercator**
Ocean in Toulouse, France



Atmosphere



Marine



Climate Change



Land



Security



Emergency

BSB00193 – EfxINNOs

It is a service providing **full, free and open access marine data** to regular and systematic reference on the state of the **Blue** (physical), **White** (sea ice) and **Green** (biogeochemical) ocean, on a global and regional scale.

 Blue
Ocean

Physical

 White
Ocean

Sea Ice

 Green
Ocean

Biogeochemical

Blue
Ocean

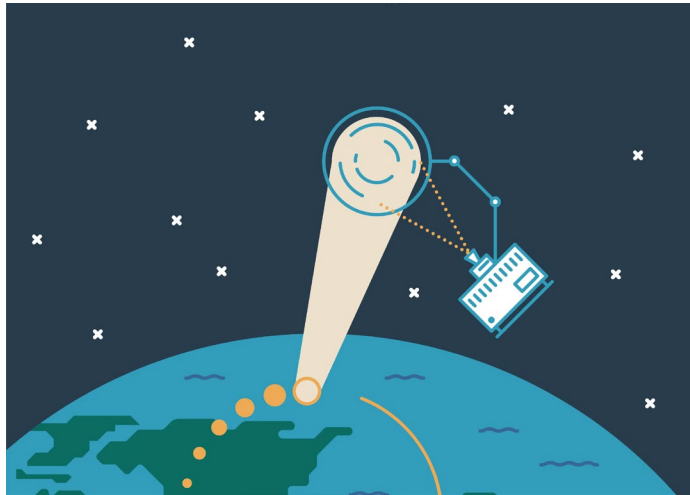
describes the **physical state of the ocean**, such as sea surface temperature, sea level, currents, waves, and winds.

White
Ocean

deals with the **monitoring of the poles** and to the critical life cycle of any kind of floating, melting or freezing sea-ice.

Green
Ocean

describes the **biogeochemical processes**, the transfer of simple chemical substances between ocean life and the ocean environment. Such as chlorophyll-a concentrations, ocean nutrients, and primary production.

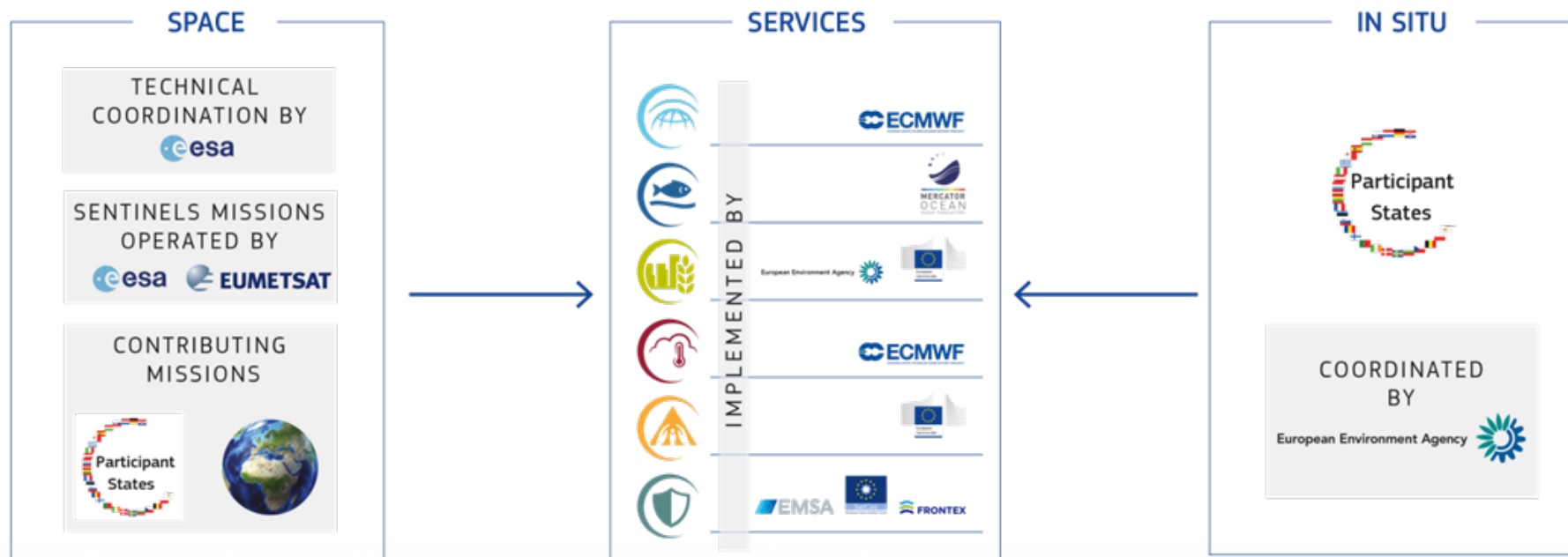


It is **highly dependent** on the timely availability of comprehensive **satellite measurements**, with sufficient space and time coverage of parameters such as surface temperature, ocean color, sea surface height and sea ice,



as well as information from circulation, waves and biogeochemical **models** validated **from measurements received from instruments in the sea (in-situ).**

COPERNICUS marine service encompasses **3 main components:**
SPACE , **INSITU** and **SERVICES**



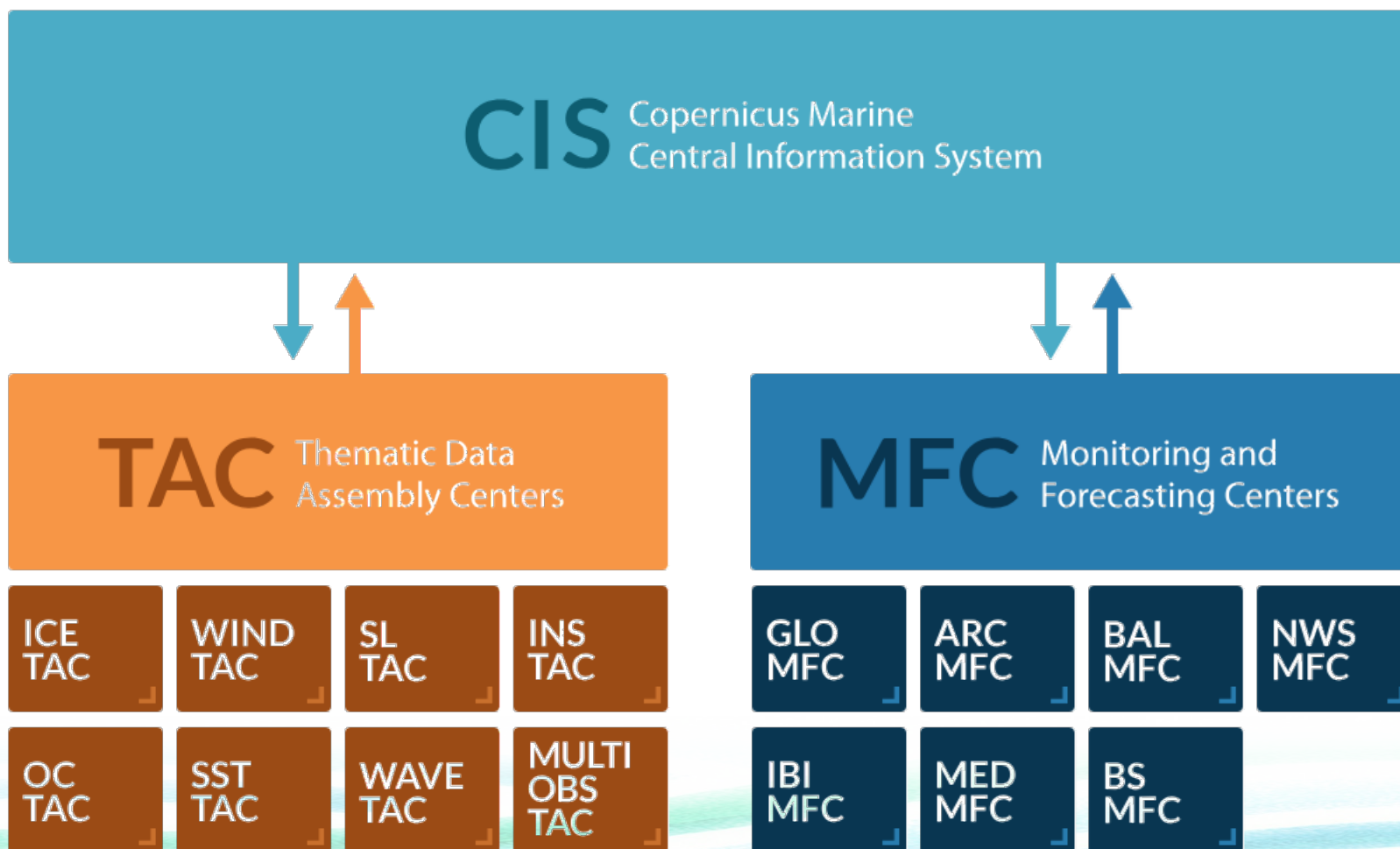
includes the ESA
Sentinels

includes all data products
(reanalysis, forecasts,
satellite data, etc)

includes monitoring
networks as buoys,
drifters, gliders, etc.

CMEMS relies on a distributed architecture of:

- **8 Thematic Data Assembly Centers (TACs)** process data acquired from satellite ground segments and insitu platforms, Satellite and InSitu Observations into real-time (today) and reprocessed (20 years historic) products.,
- **8 Monitoring and Forecasting Centers (MFCs)** run ocean numerical models assimilating the above TAC data to generate reanalyse (20 years in the past), analyse (today) and 10-day forecasts of the ocean
- and a **Central Information System (CIS)**.



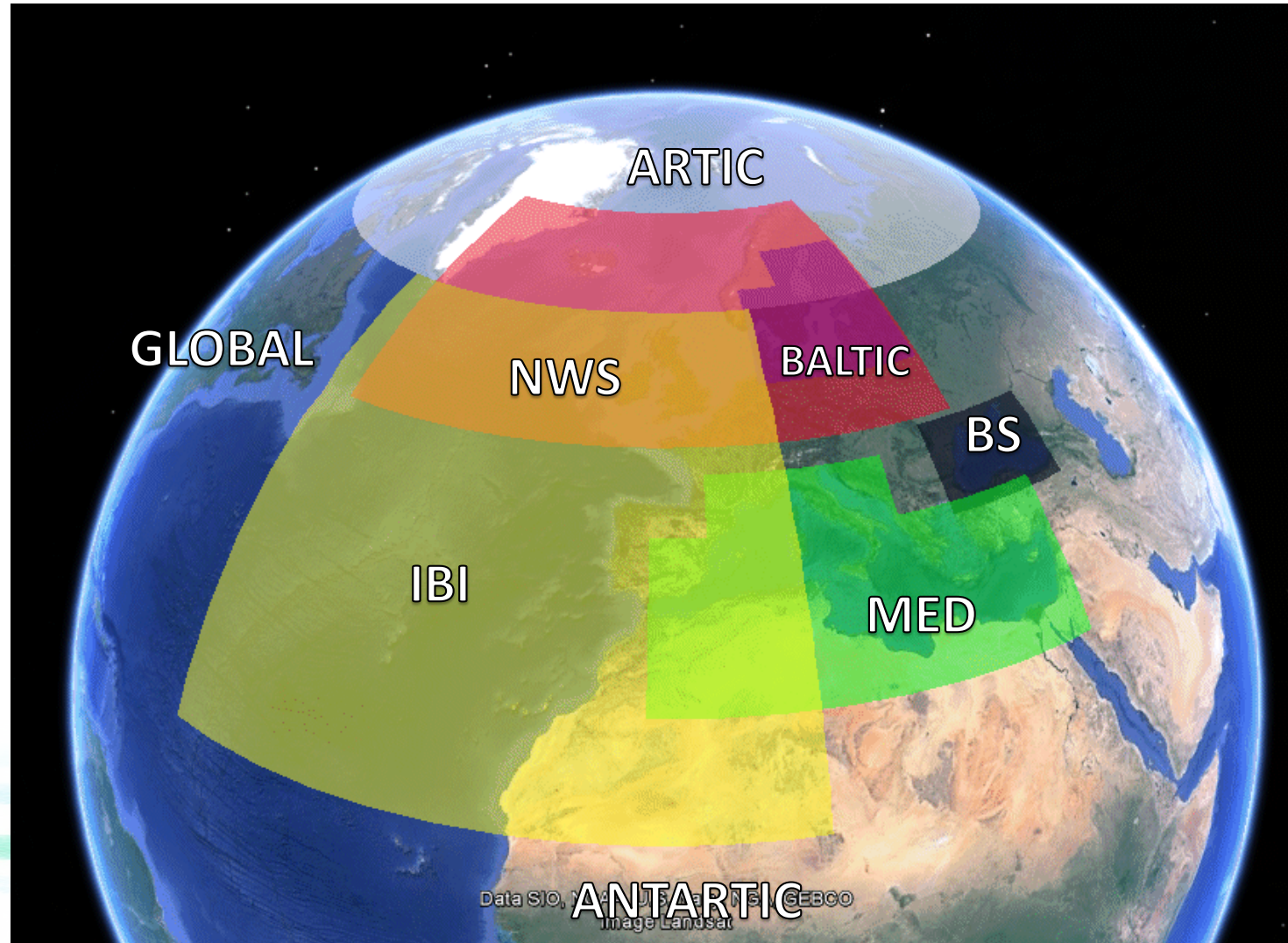
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marine.copernicus.eu

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Type...



English



Copernicus
Europe's eyes on Earth



Copernicus
Marine Service

Services

Opportunities

Access Data

Use Cases

User Corner

About

Copernicus Marine Service

Providing free and open marine data and services to enable marine policy implementation, support Blue growth and scientific innovation.

DATA

OCEAN PRODUCTS

A robust ocean data catalogue, to download or visualise data including hindcasts, nowcasts and forecasts.

EXPERTISE

OCEAN STATE REPORT

Extensive annual analysis on the state of the ocean over nearly 20 years and severe/notable annual events.

TRENDS

OCEAN CLIMATE TRENDS

Monitoring the health of the ocean.
[Ocean Monitoring Indicators](#)
[Ocean Climate Portal](#)

EXPLORATION

OCEAN VISUALISATION

Dive into our 4D digital oceans through our 3 visualisation tools for beginner, intermediate and advanced users



CMEMS Ocean State Report

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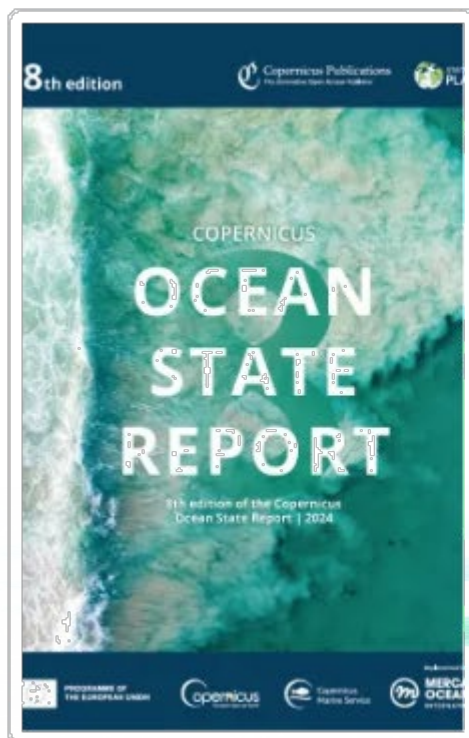
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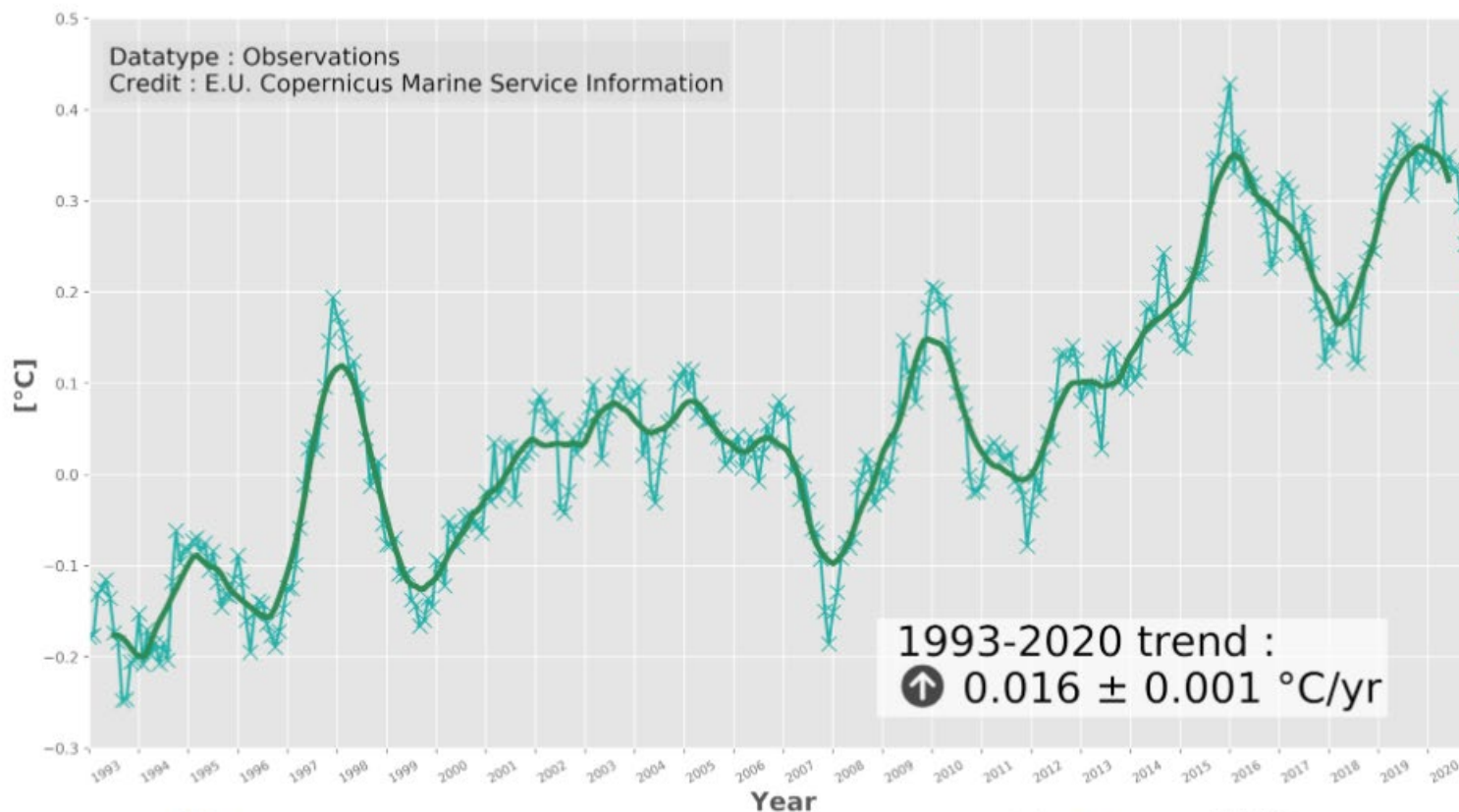
CMEMS Ocean State Report

It provides a **comprehensive assessment of the state of the global ocean and European regional seas** for the ocean scientific community as well as for policy and decision-makers.



CMEMS Ocean State Report

Global Average SST Anomalies



CMEMS Climate Trends

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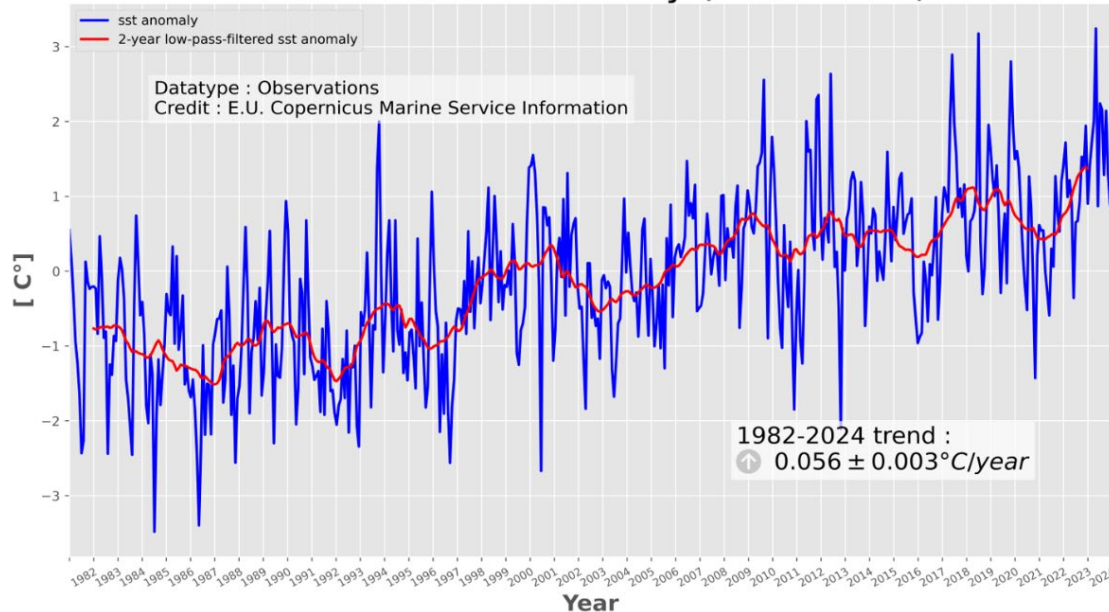
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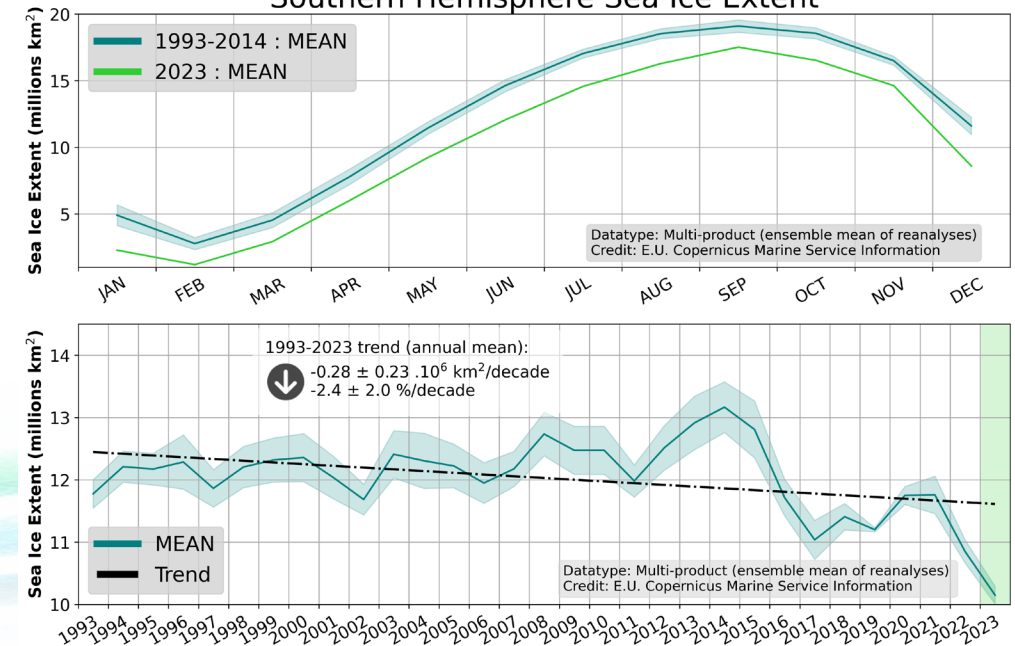
CMEMS Climate Trends

It provides downloadable **trends and data sets covering the past quarter of a century**. These are key variables used to track the vital health signs of the ocean and changes in line with climate change.

Black Sea SST Anomaly (1982-2024)



Southern Hemisphere Sea Ice Extent



CMEMS Ocean Products

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CMEMS Ocean Products



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Marine Service

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Copernicus Marine Data Store



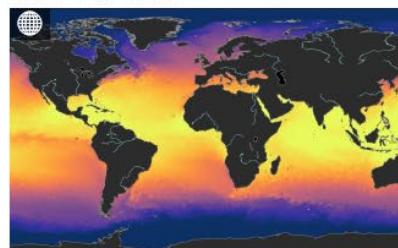
[Home](#) > [Marine Data Store](#)

Filters

Advanced

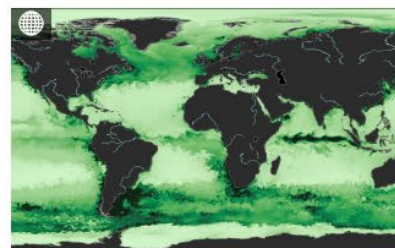
Products 306 in Copernicus Marine Service ▾

MOST POPULAR



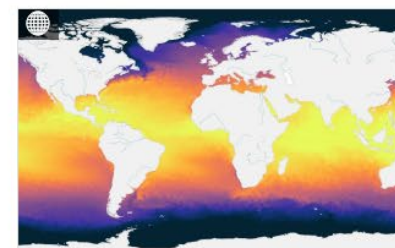
Global Ocean Physics Analysis
and Forecast

GLOBAL_ANALYSISFORECAST_P... 001_024



Global Ocean Biogeochemistry
Analysis and Forecast

GLOBAL_ANALYSISFORECAST_B... 001_028



Global Ocean Physics Reanalysis

GLOBAL_MULTIYEAR_PHY_001_030



Mediterranean
Analysis

MEDSEA_A

CMEMS Ocean Products for the Black Sea

Copernicus Marine Data Store



[Home](#) > [Marine Data Store](#)

Filters [Clear](#) [Advanced](#)

FREE-TEXT SEARCH

Free text

TIME RANGE ▲

mm/dd/yyyy  mm/dd/yyyy 

Covering full interval

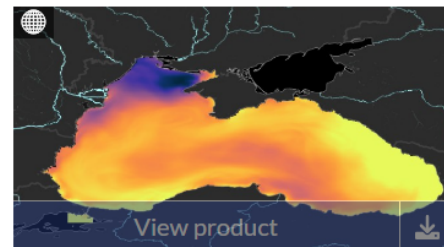
WITH DEPTH 6

DEPTH RANGE ▲

UNIVERSE ▲

Black Sea

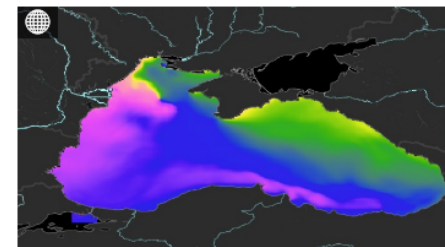
Products 55 in Copernicus Marine Service ▼



Black Sea Physics Analysis and Forecast

BLKSEA_ANALYSISFORECAST_PHY_007_001

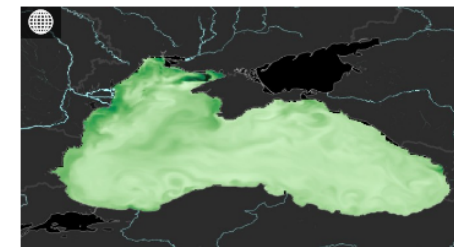
Models



Black Sea Waves Analysis and Forecast

BLKSEA_ANALYSISFORECAST_WAV_007_003

Models



Black Sea Biogeochemistry Analysis and Forecast

BLKSEA_ANALYSISFORECAST_BGC_007_010

Models

CMEMS Ocean Products for the Black Sea

These data products are divided into:

- **Models (13 products)**
 - **Analysis and Forecast** data from numerical models
 - **Reanalysis of historic** data from assimilated numerical models
- **Insitu (12 products)**
 - **NRT** observations from on-site sensors
 - **Delayed** observations from on-site sensors
- **Satellite (31 products)**
 - **NRT** data
 - **Reprocessed** data

How to view available CMEMS parameters and data online

CMEMS Ocean Visualisation

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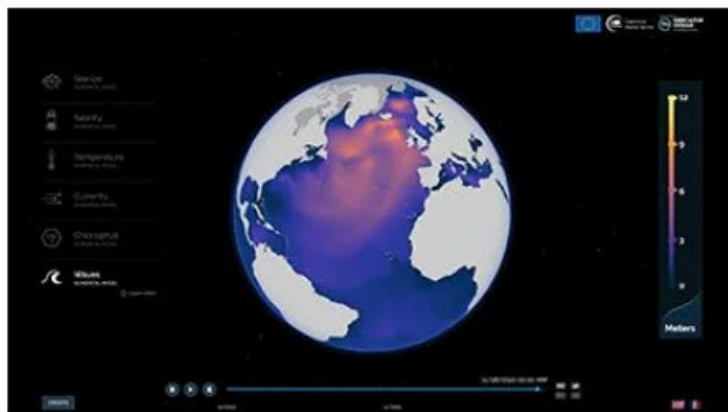
OCEAN VISUALISATION

Dive into our 4D digital oceans through our 3 visualisation tools for beginner, intermediate and advanced users

CMEMS Ocean Visualisation

MYOCEAN LEARN

(BEGINNER) GLOBE

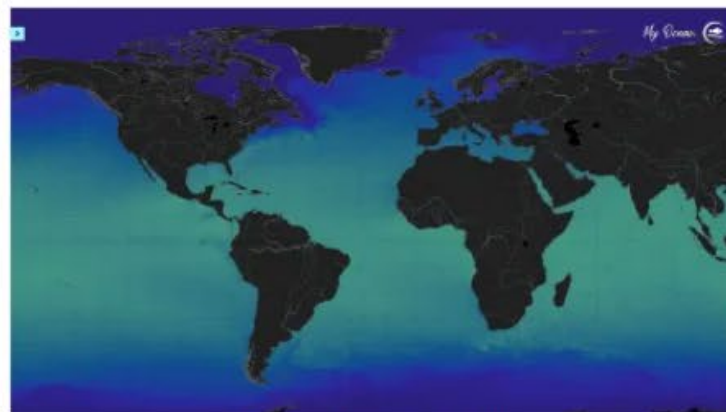


Understand key variables

Explore MyOcean Learn

MYOCEAN LIGHT

(INTERMEDIATE) PLANISPHERE



Access key variables

Explore MyOcean Light

MYOCEAN PRO

(EXPERT) PLANISPHERE



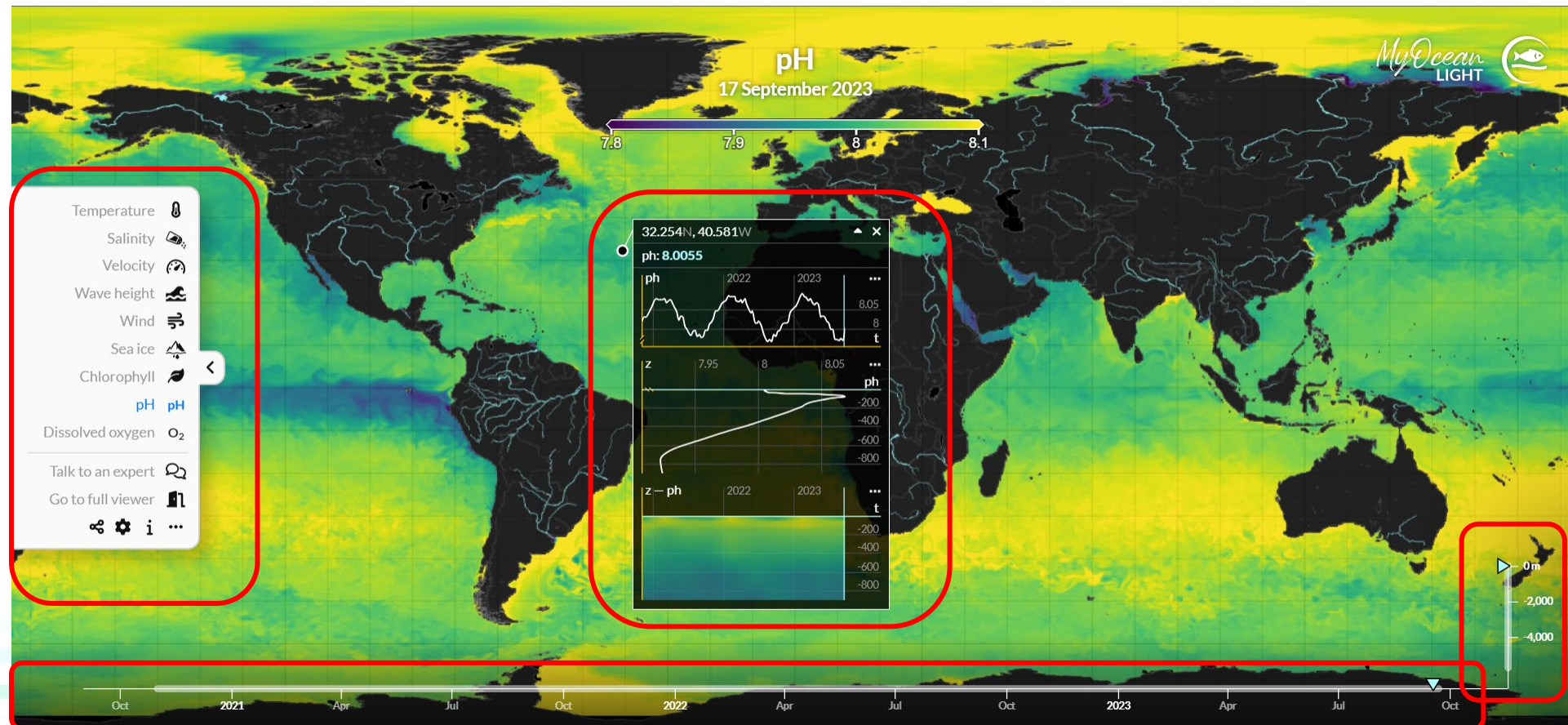
Access full catalogue

Explore MyOcean Pro

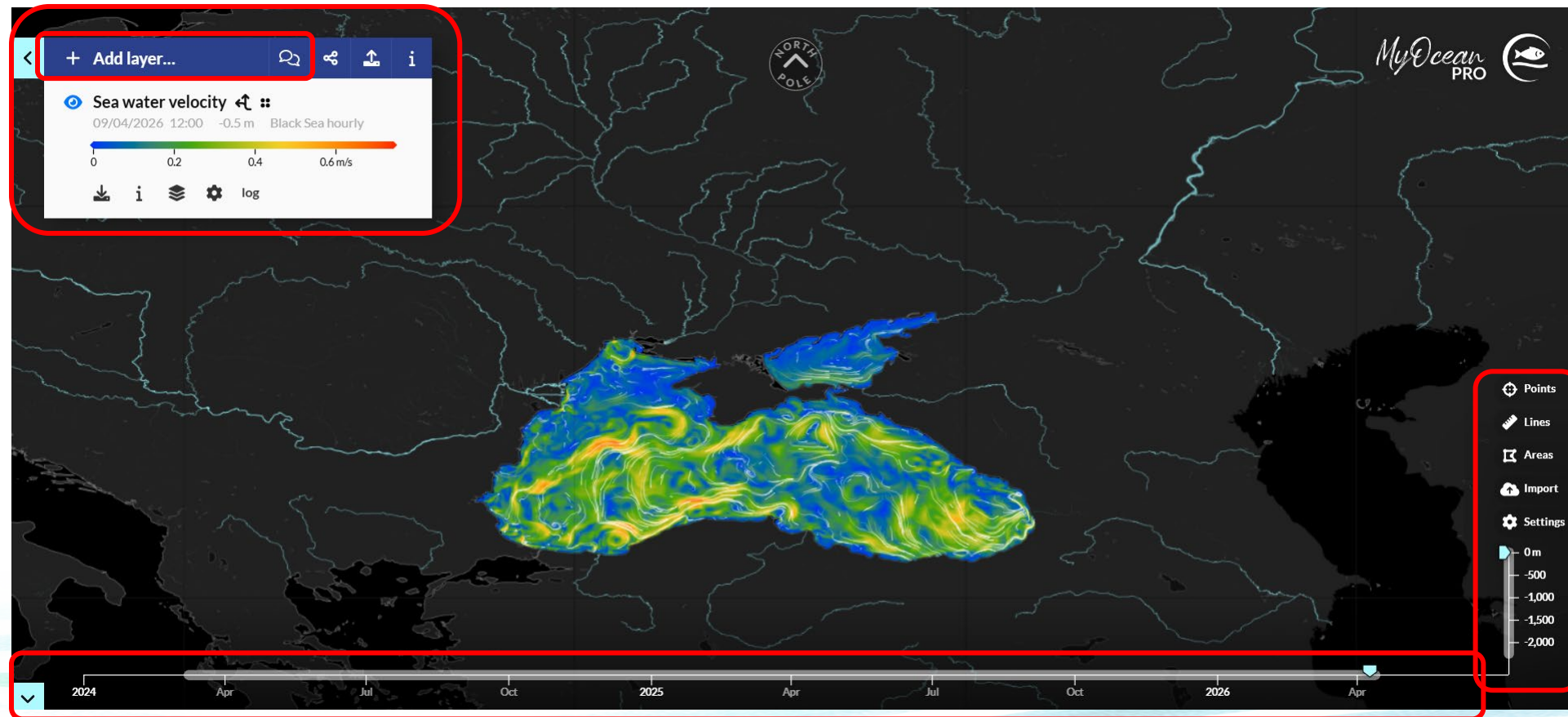
CMEMS Ocean Visualisation - MYOCEAN Learn



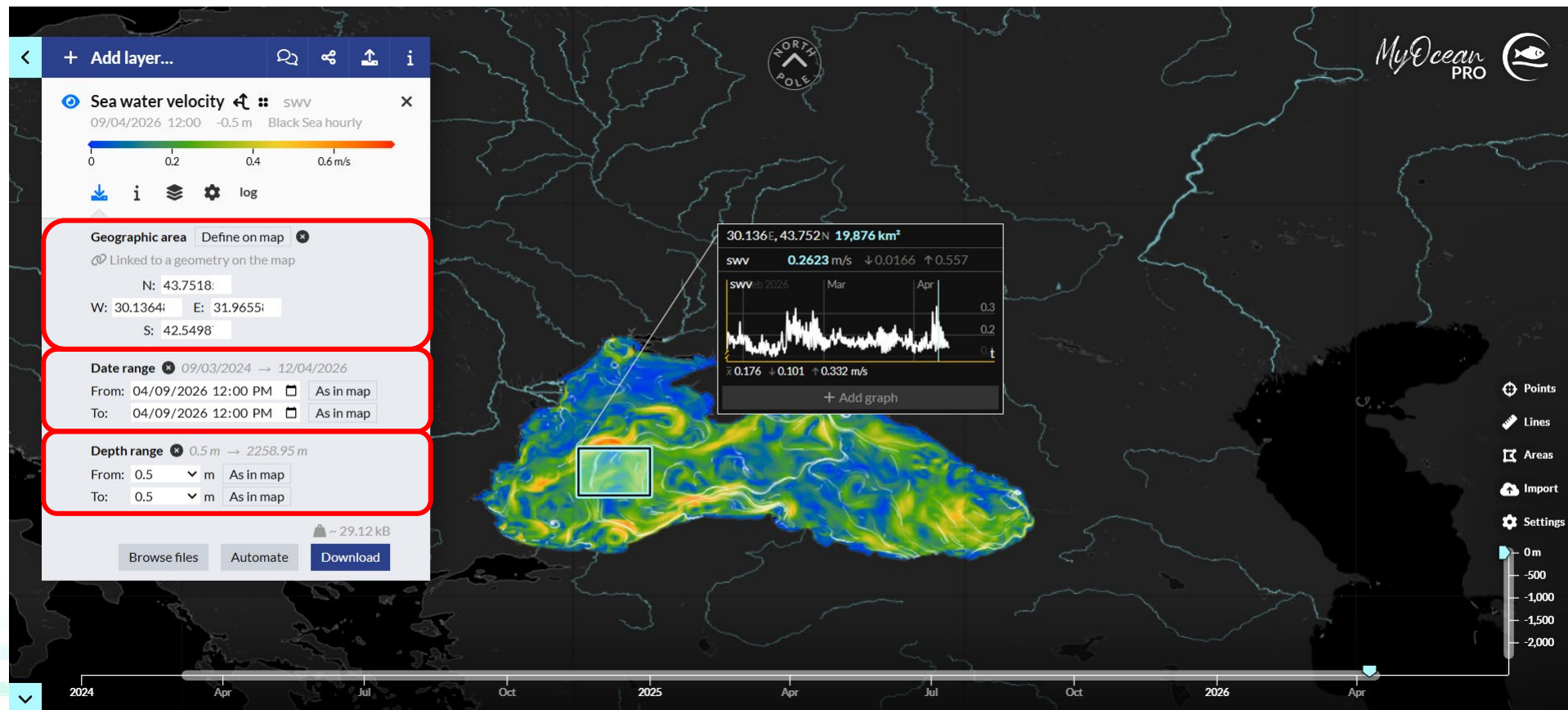
CMEMS Ocean Visualisation - MYOCEAN Lite



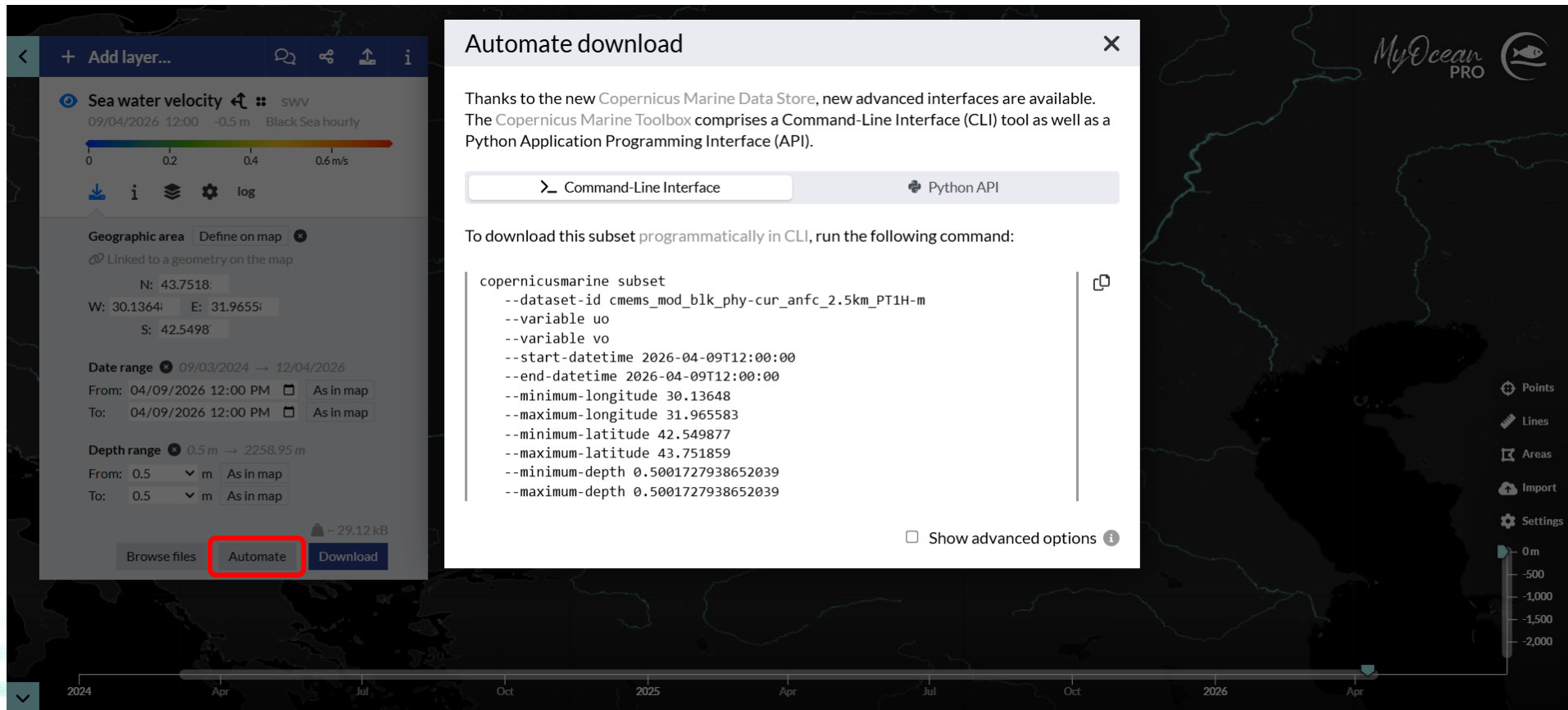
CMEMS Ocean Visualisation - MYOCEAN Pro



CMEMS Ocean Visualisation - Download Data



CMEMS Ocean Visualisation - Download Data - API Request



The screenshot shows the MyOcean PRO interface with a map of the Black Sea. A dialog box titled "Automate download" is open, providing information about the Copernicus Marine Data Store and the Copernicus Marine Toolbox. The dialog includes a section for downloading data programmatically in CLI, showing a specific command to download sea water velocity data for the Black Sea region.

Automate download

Thanks to the new Copernicus Marine Data Store, new advanced interfaces are available. The Copernicus Marine Toolbox comprises a Command-Line Interface (CLI) tool as well as a Python Application Programming Interface (API).

☒ Command-Line Interface ☐ Python API

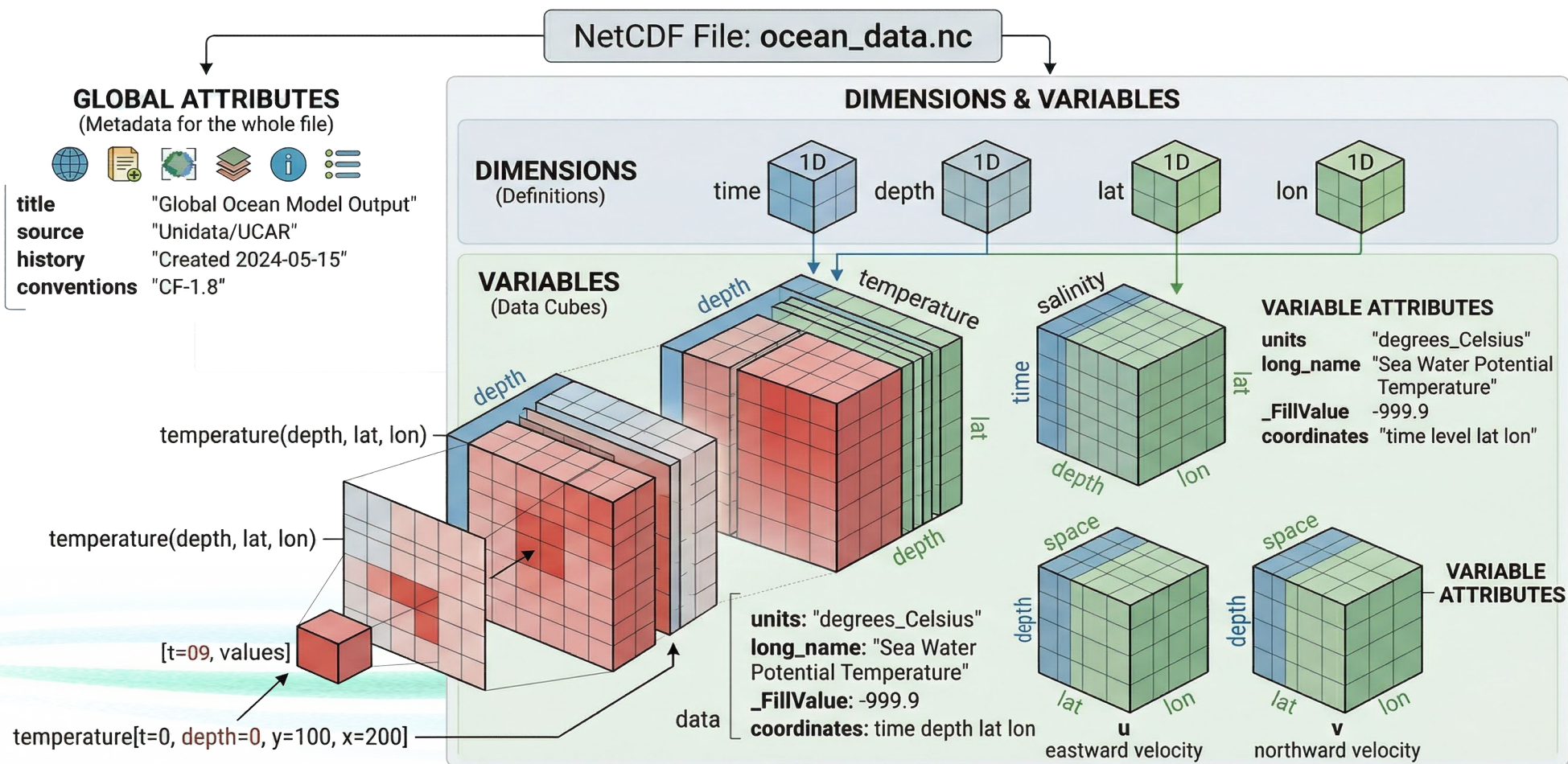
To download this subset programmatically in CLI, run the following command:

```
copernicusmarine subset
--dataset-id cmems_mod_blk_phy-cur_anfc_2.5km_PT1H-m
--variable uo
--variable vo
--start-datetime 2026-04-09T12:00:00
--end-datetime 2026-04-09T12:00:00
--minimum-longitude 30.13648
--maximum-longitude 31.965583
--minimum-latitude 42.549877
--maximum-latitude 43.751859
--minimum-depth 0.5001727938652039
--maximum-depth 0.5001727938652039
```

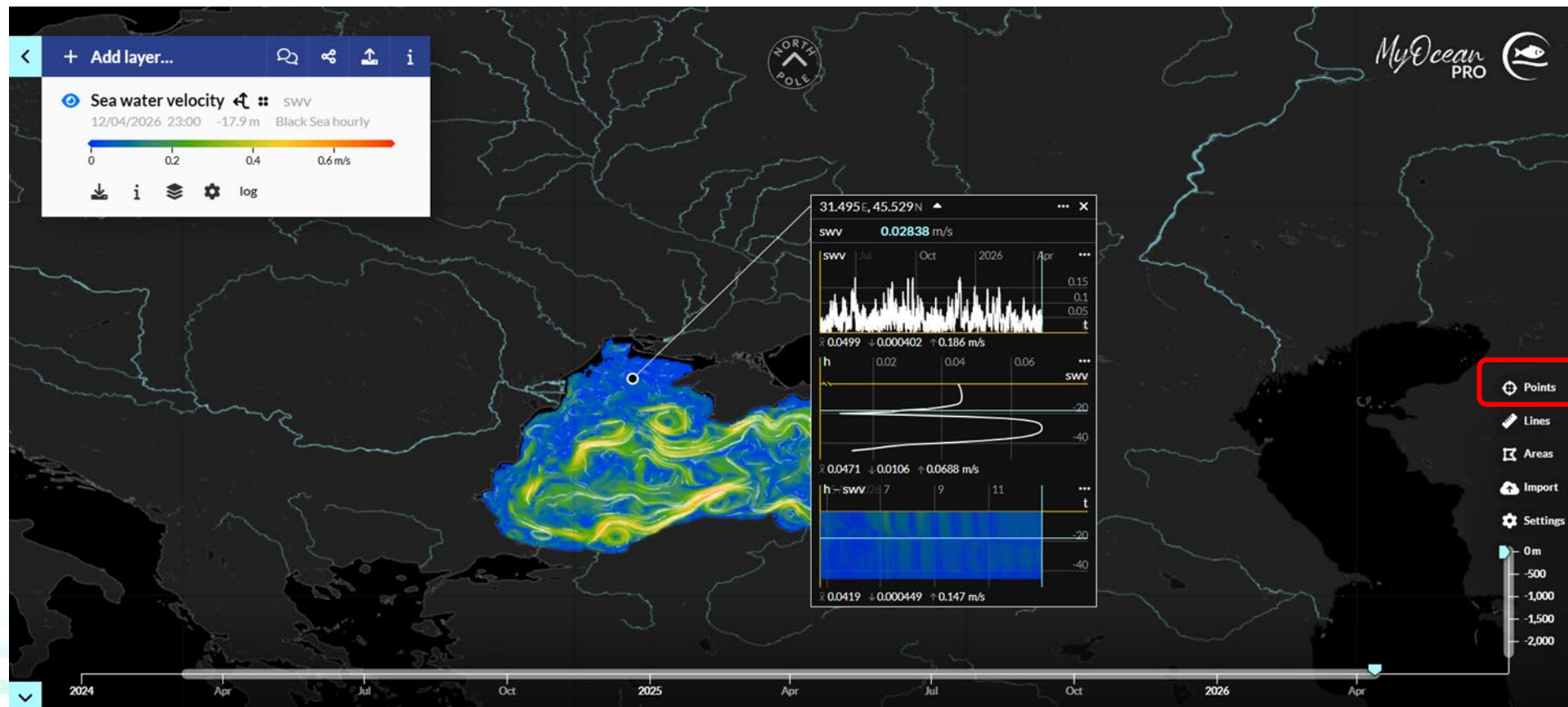
☐ Show advanced options

The background interface shows the "Sea water velocity" layer selected, with a geographic area defined by coordinates (N: 43.7518, W: 30.1364, E: 31.9655, S: 42.5498) and a date range from 04/09/2026 12:00 PM to 04/09/2026 12:00 PM. The depth range is set from 0.5 m to 2258.95 m. The "Automate" button is highlighted with a red box.

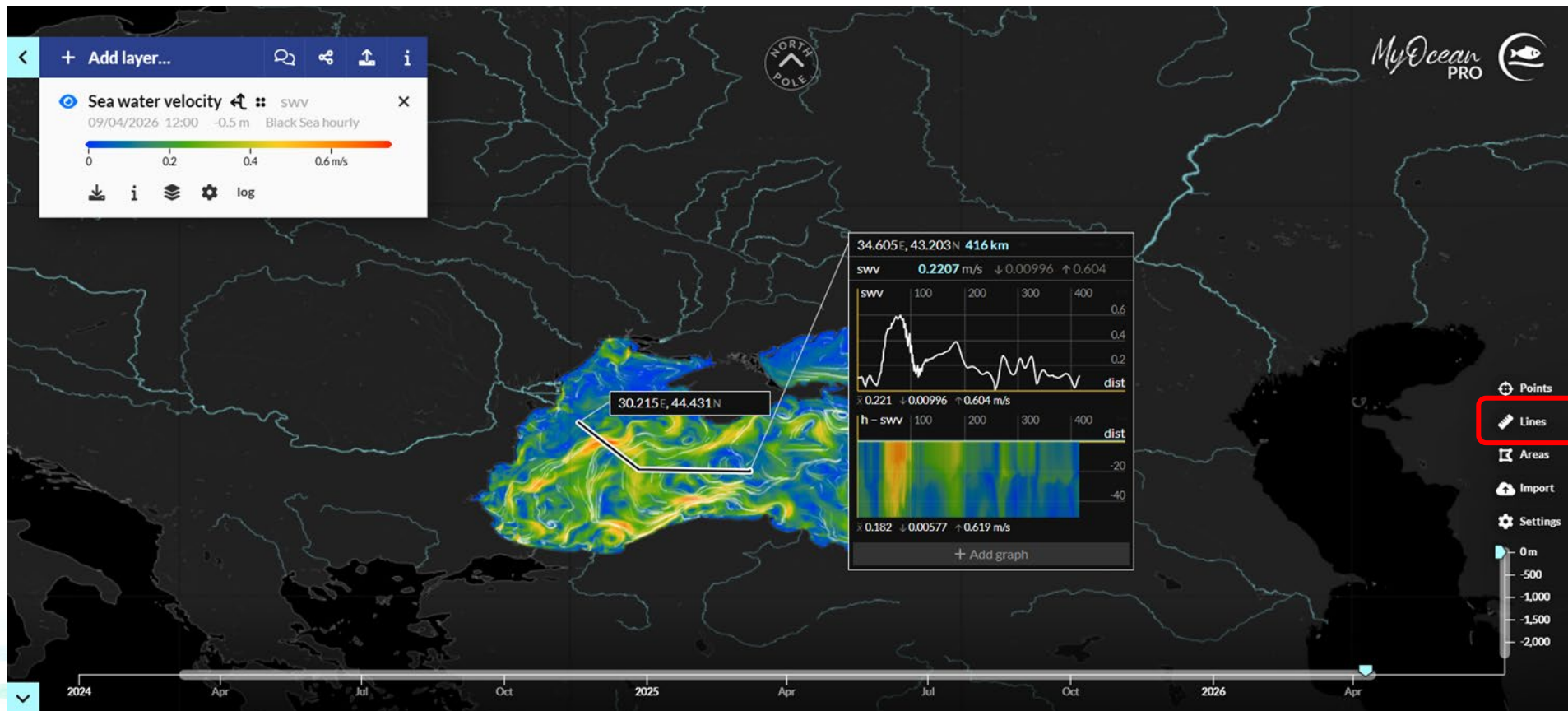
CMEMS Ocean Visualisation - Download Data - netCDF files



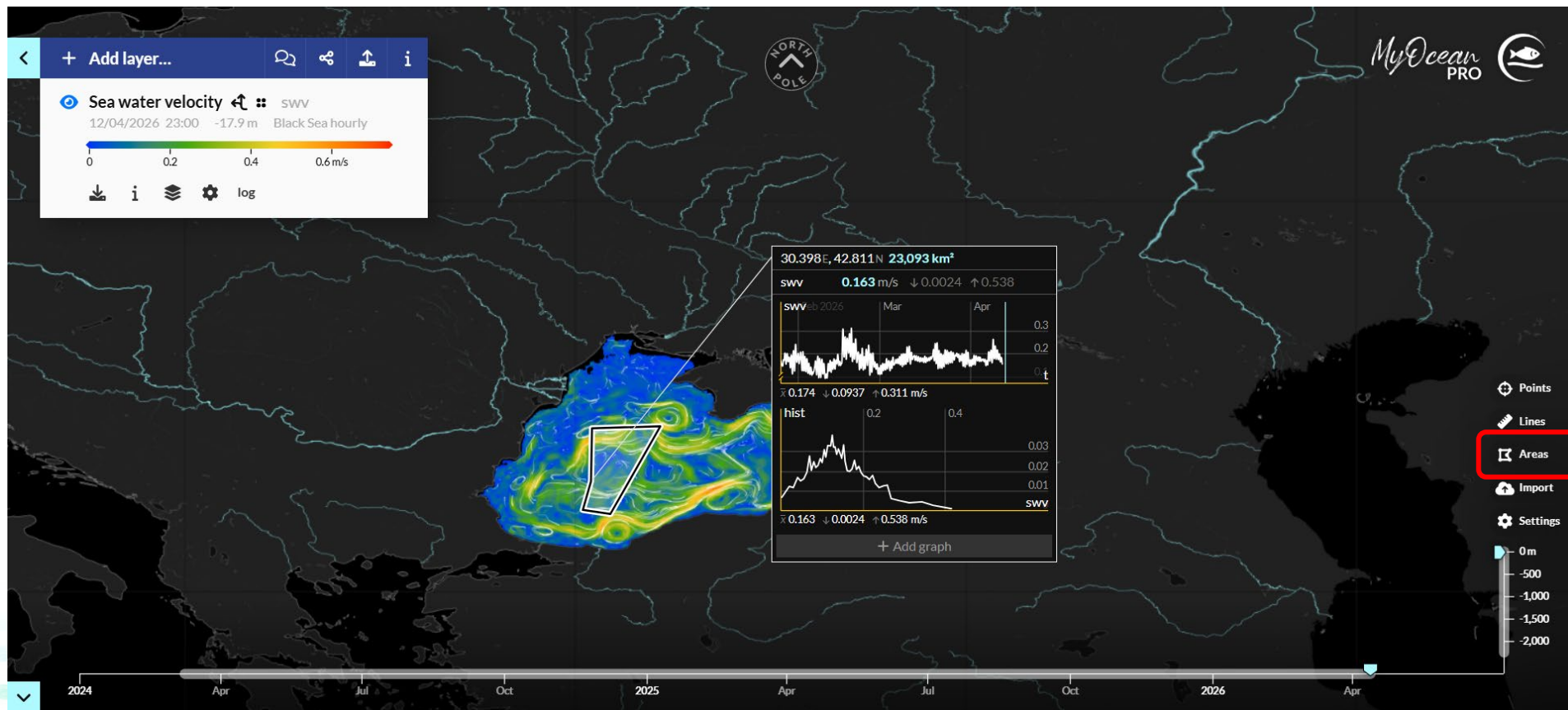
CMEMS Ocean Visualisation - Point Graph



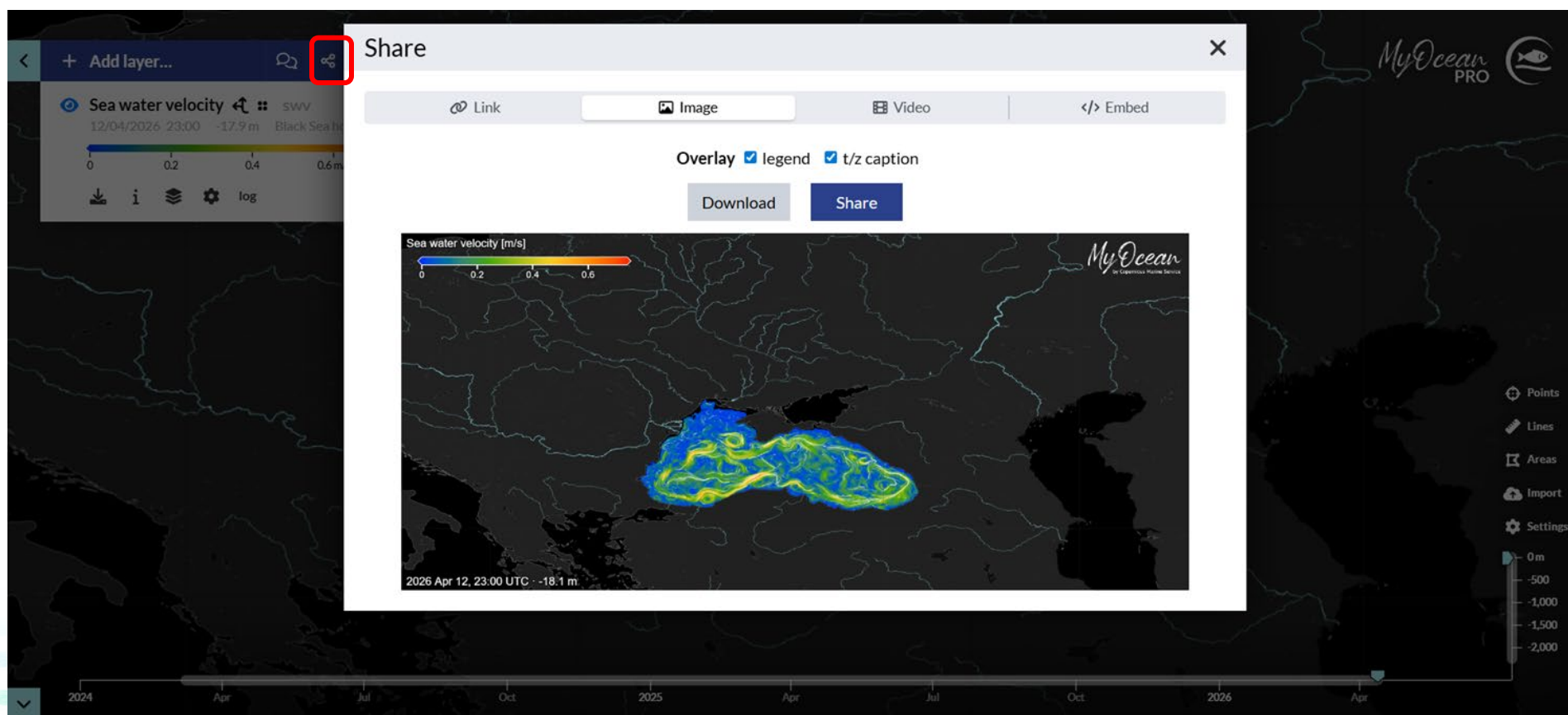
CMEMS Ocean Visualisation - Line Graph



CMEMS Ocean Visualisation - Area Graph



CMEMS Ocean Visualisation - View Export

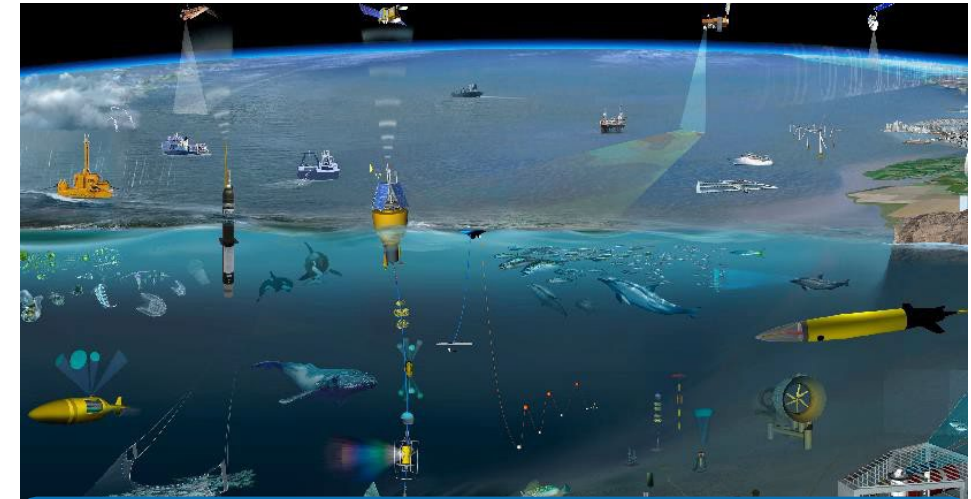


What is EMODnet?

The Challenge in marine data sharing and exchange

- **Reliable** and **accessible marine data** are key to supporting good research, and EU ocean policies, initiatives, and sustainable Blue Growth.
- The costs of marine data collection by European organizations is circa 1.4 billion Euro per year: ~ 1.0 billion for in-situ; ~ 0.4 billion for remote sensing.
- Existing marine data management infrastructures (SeaDataNet, EurOBIS, EGD, ICES, CMEMS, and others) connected to EMODnet, already make a substantial amount of marine data **discoverable**, **accessible**, and **reusable**.
- However, still, a lot of valuable marine data **does not arrive in these infrastructures**, **preventing its distribution through EMODnet** and **limiting its use**.

Ocean Observation



In Europe, we spent circa 1.4 Billion Euro a year in marine data acquisition (1.0 BE in-situ; 0.4 BE remote sensing)

Published in Frontiers in Marine Science 2020 (source: Glynn Gorick and the NeXOS project)
Future Vision for Autonomous Ocean Observations



EMODnet



European Marine
Observation and
Data Network

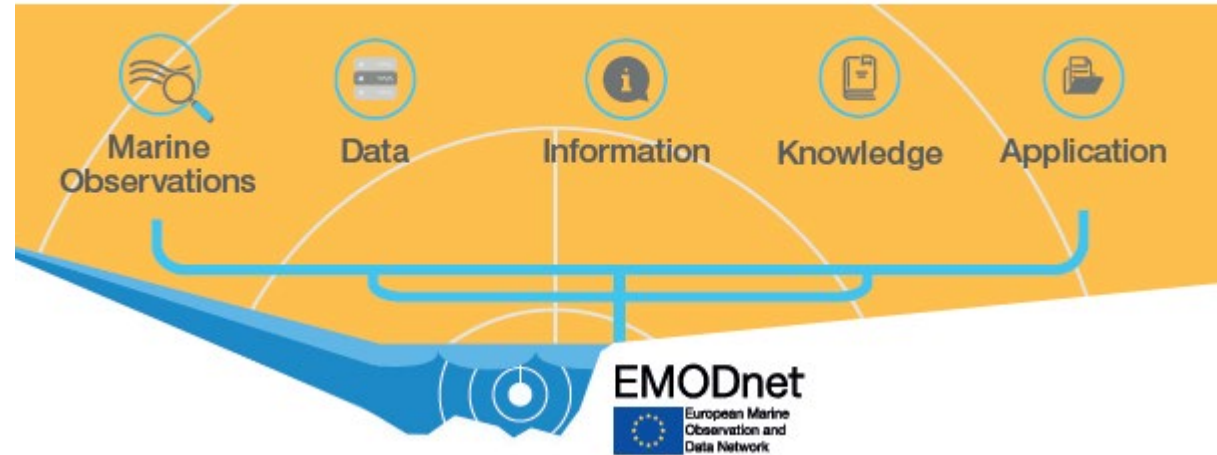
EMODnet comes where Copernicus fails

- An **EC marine data service**, funded by the European Commission 16 years ago,
- Become **European authority and regional best practice** in the marine data domain,
- **Specializes in the insitu data**, all of the ocean observations that are collected in or around the water (it can involve the seabed and below or the air just above the water),
- **Delivered by a network of > 120 leading organisations**, working in collaboration with national, regional and EU marine data management initiatives and infrastructures;
- It is a **key marine knowledge initiative** working with Copernicus Marine Service **provides the back-bone for the European marine data space**, the European Digital Twin Ocean and a key contributor to the Global Ocean Data Ecosystem and digital commons.

EMODnet – Added Value



From raw data to real-life applications

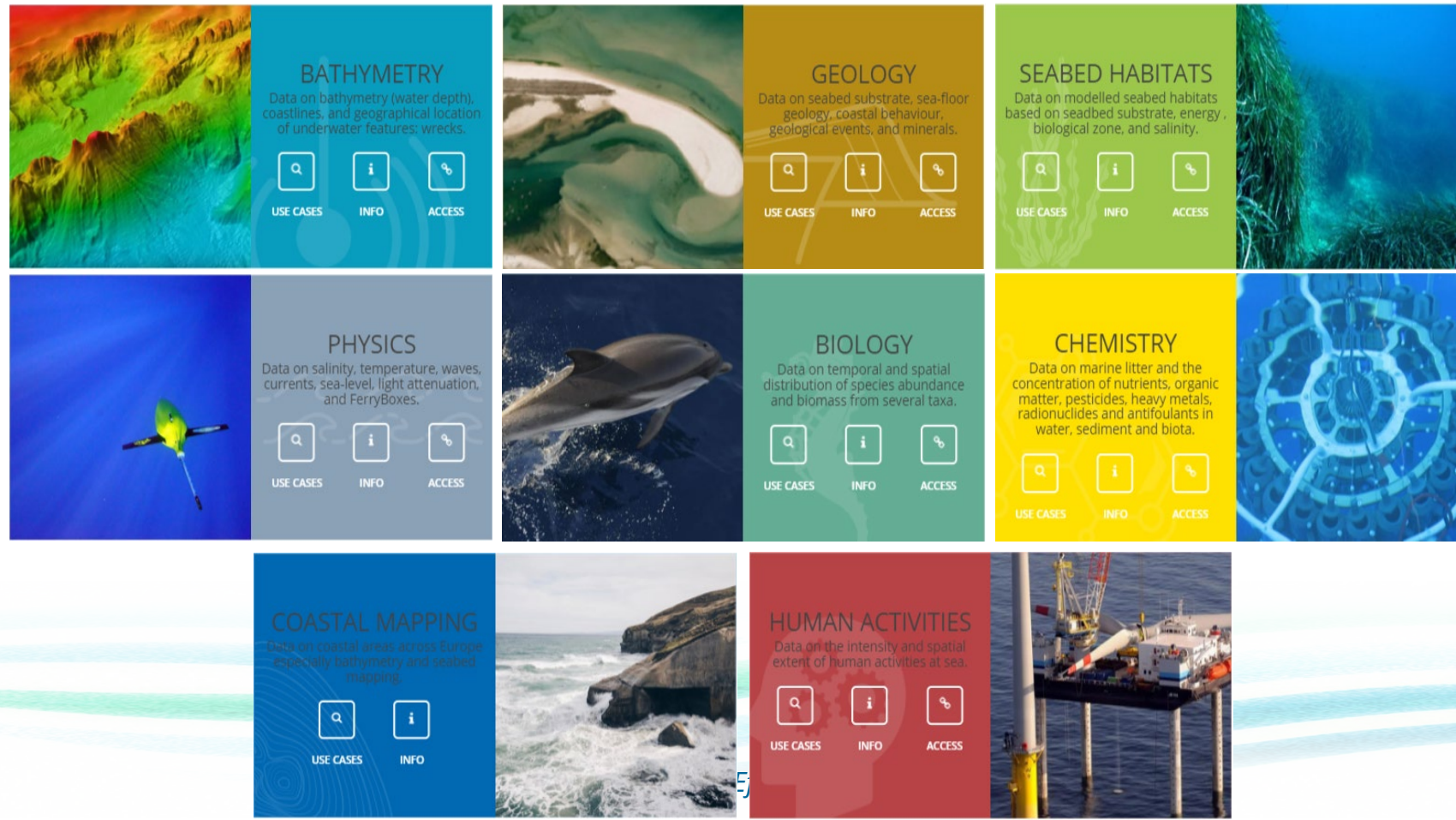


Offers:

- FAIR pan European data
- data products like maps, High Res. DTMs that can be used anywhere
- ☐ Collect data once, use many times.
- ☐ Assemble, standardise, harmonise, quality control, integrate.
- ☐ Visualize and make data come alive.
- ☐ reduce uncertainty;
- ☐ increase productivity and cost effectiveness;
- ☐ add value and impact to your data;
- ☐ stimulate innovation.

EMODnet themes-portals

Until recently EMODnet provided access to European marine data across **7 discipline-based themes-portals**:



One single portal

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

1 OCEAN 1 EMODnet

One single portal

One central map viewer

to visualise all EMODnet data



One central metadata catalogue

to enhance data search and discovery



140 partners

Discover, visualise and
download marine data and products
across 7 thematics and hundreds of parameters

+100 use cases



BATHYMETRY



HUMAN ACTIVITIES



PHYSICS



GEOLOGY



SEABED HABITATS



CHEMISTRY



BIOLOGY

EMODNET.EC.EUROPA.EU



The European Marine Observation and Data Network (EMODnet) is financed by the European Union under regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund

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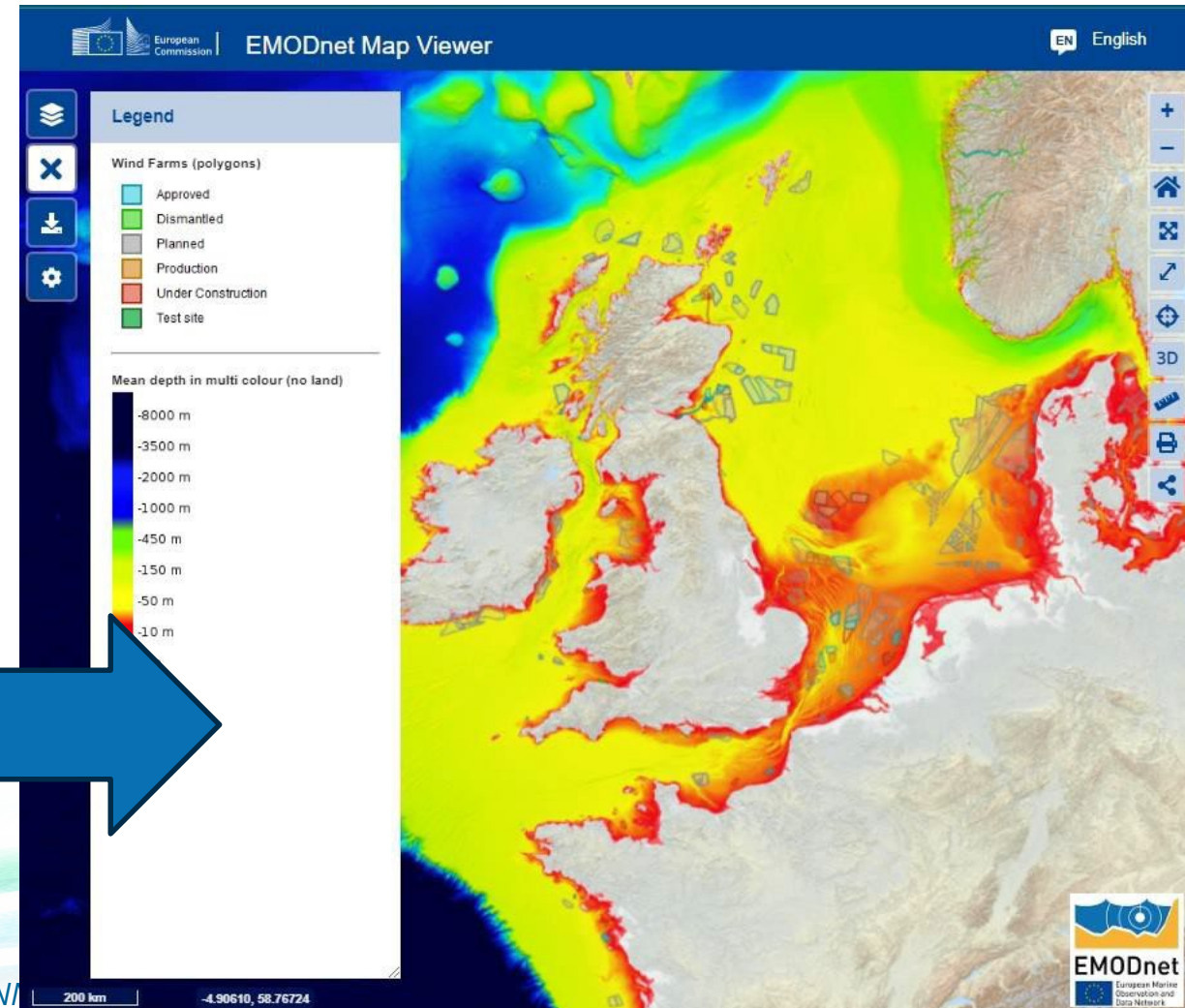
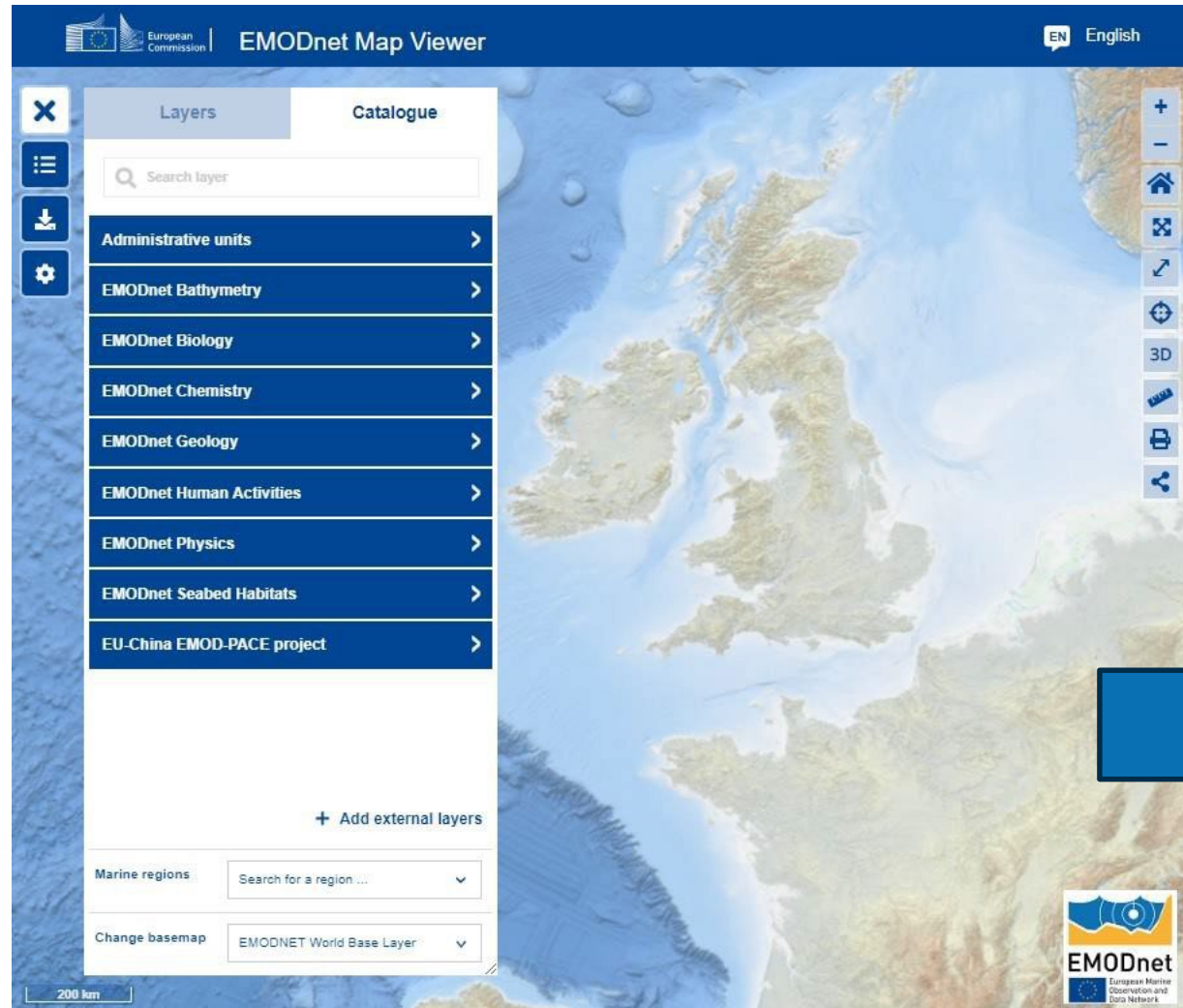
YOUR GATEWAY TO *IN SITU* MARINE DATA IN EUROPE AND BEYOND



EMODnet
European Marine
Observation and
Data Network



One central map viewer



One central metadata catalogue

EMODnet Product Catalogue

Search ...

English

Nothing in basket

Filter

TYPE OF RESOURCES

- ☐ Dataset (570)
- ☐ Series (19)

AVAILABLE ACTIONS

- ☐ Viewable (463)
- ☐ Downloadable (58)

TOPICS

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- ☐ Biota (203)
- ☐ Oceans (99)
- ☐ Geoscientific information (25)
- ☐ Imagery base maps earth cover (2)

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- ☐ EMODnet Seabed Habitats (43)

PROVIDED BY

- ☐ EMODnet Seabed Habitats (584)
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YEARS

- ☐ 2022 (5)
- ☐ 2021 (15)
- ☐ 2019 (16)
- ☐ 2018 (10)
- ☐ 2017 (27)

FORMATS

Categories

North East Atlantic Ocean - Contaminants aggregated datasets 1970/2017 v2018

EMODnet Chemistry aims to provide access to marine chemistry data sets and derived data products concerning eutrophication, ocean acidification and contaminants. The chemicals chosen reflect importance to the Marine Strategy Framework Directive (MSFD). This regional aggregated dataset contains all unrestricted ...

North Sea - Contaminants aggregated datasets 1970/2017 v2018

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Black Sea - Contaminants aggregated datasets 1974/2017 v2018

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Baltic Sea - Contaminants aggregated datasets 1972/2017 v2018

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Mediterranean Sea - Contaminants aggregated datasets 1974/2017 v2018

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Habitat Map of "Capo Milazzo" marine protected area

Data were collected in the framework for the establishment of the Capo Milazzo AMP. The study was founded by MATTM. The map was constructed by using acoustic data, direct observations by ROV and satellite images.

EMODnet Product Catalogue

Search ...

English

Back to search

Previous

Next

Download

Display mode

North Sea - Contaminants aggregated datasets 1959/2019 v2021

EMODnet Chemistry aims to provide access to marine chemistry data sets and derived data products concerning eutrophication, ocean acidification and contaminants. The chemicals chosen reflect importance to the Marine Strategy Framework Directive (MSFD). This regional aggregated dataset contains all unrestricted EMODnet Chemistry data on contaminants, and covers the North Sea with 34978 CDI records divided per matrices: 1460 biota, 24740 water profiles, 6000 sediment profiles and 261 sediment time series. For water, the temporal range is from 1959-10-03 to 2019-12-30. For sediment, the temporal range is from 1970-07-11 to 2019-12-18 for profile data and from 1993-09-16 to 2015-05-15 for the time series. For biota, the temporal range is from 1979-02-26 to 2018-02-28. Data were aggregated and quality controlled by Aarhus University, Department of Bioscience, Marine Ecology Roskilde from Denmark. Regional datasets concerning contaminants are automatically harvested. Parameter names in these datasets are based on P01, BODC Parameter Usage Vocabulary, which is available at: http://seadatanet.maria2.nl/bandit/browse_step.php. Each measurement value has a quality flag indicator. The resulting data collections for each Sea Basin are harmonised, and the collections are quality controlled by EMODnet Chemistry Regional Leaders using ODV Software and following a common methodology for all Sea Regions. Harmonisation means that: (1) unit conversion is carried out to express contaminant concentrations with a limited set of measurement units (according to EU directives 2013/39/UE; Comm. Dec. EU 2017/848) and (2) merging of variables described by different "local names", but corresponding exactly to the same concepts in BODC P01 vocabulary. Detailed documentation is available at: <https://doi.org/10.6092/8b52e8d7-dc02-4305-9337-7834a5cae3f4> Explore and extract data at: <https://emodnet-chemistry.webodv.awi.de/contaminants%3ENorthSea> The harmonised dataset can also be downloaded as ODV spreadsheet (TXT file), which is composed of metadata header followed by tab separated values. This worksheet can be imported to ODV Software for visualisation (More information can be found at: <https://www.seadatanet.org/Software/ODV>). The same dataset is offered also as XLSX file in a long/vertical format, in which each P01 measurement is a record line. Additionally, there are a series of columns that split P01 terms in subcomponents (measure, substance, CAS number, matrix...). This transposed format is more adapted to worksheet applications users (e.g. LibreOffice Calc). The original datasets can be searched and downloaded from EMODnet Chemistry Download Service: <https://emodnet-chemistry.maria2.nl/search>

Overviews

Water

Sediment timeseries

Sediment profiles

Biota

Identification

Content

ReferenceSystem

Quality

DomainConsistency

Distribution format

Ziped file (ODV spreadsheet and transposed spreadsheet) (Version: 1.0)

Distributor

Organisation name	National Institute of Oceanography and Applied Geophysics - OGS, Division of Oceanography
Delivery point	Borgo Grotta Gigante 42/c
City	Sgonico (Trieste)
Postal code	34010
Country	Italy
Electronic mail address	nodc@ogs.trieste.it
Linkage	http://www.ogs.trieste.it/
Role	Distributor: Party who distributes the resource

EMODnet Geonetwork

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

European Marine Observation and Data Network (EMODnet)

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Home > Data Services > Products Catalogue

EMODnet Product Catalogue English ▾

Search **2443** data sets, services and maps, ...

Browse by topics

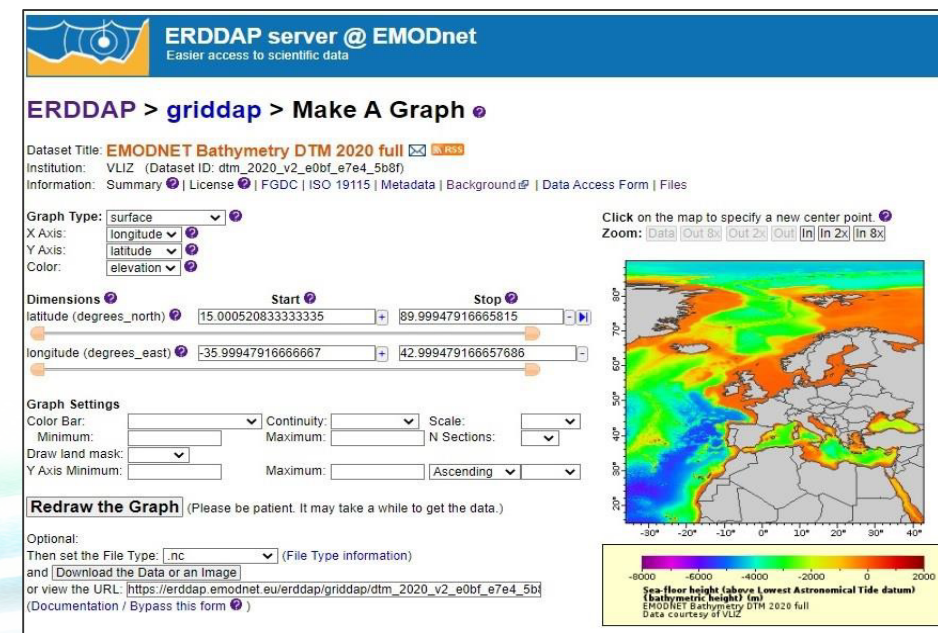
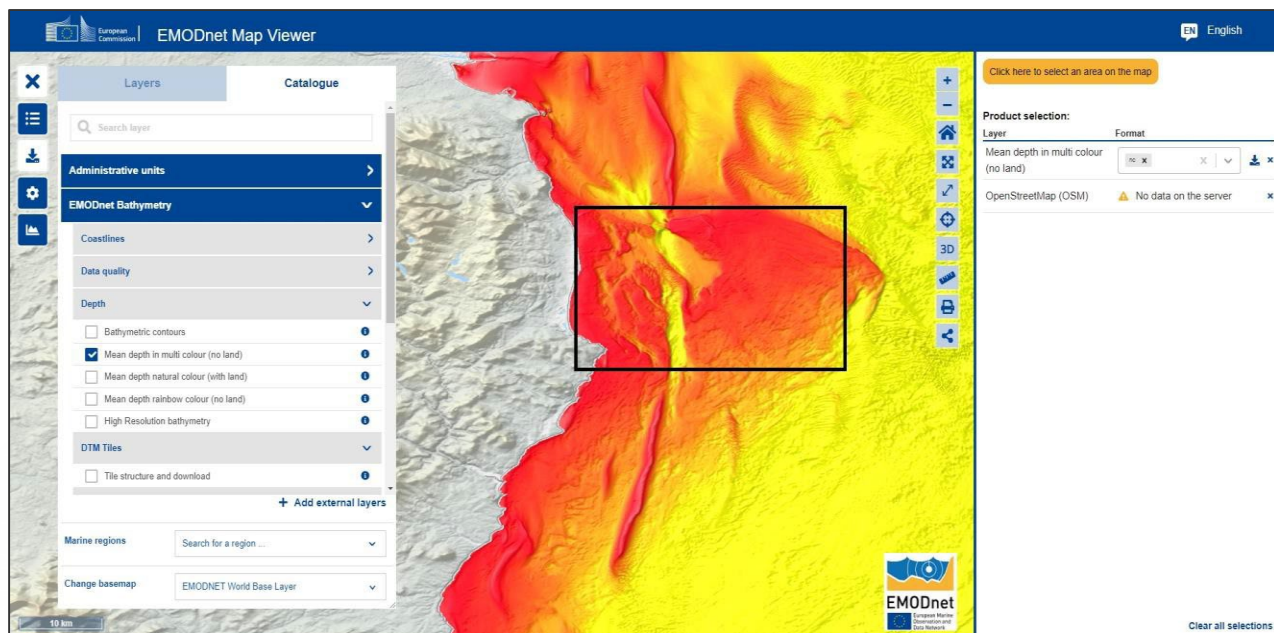
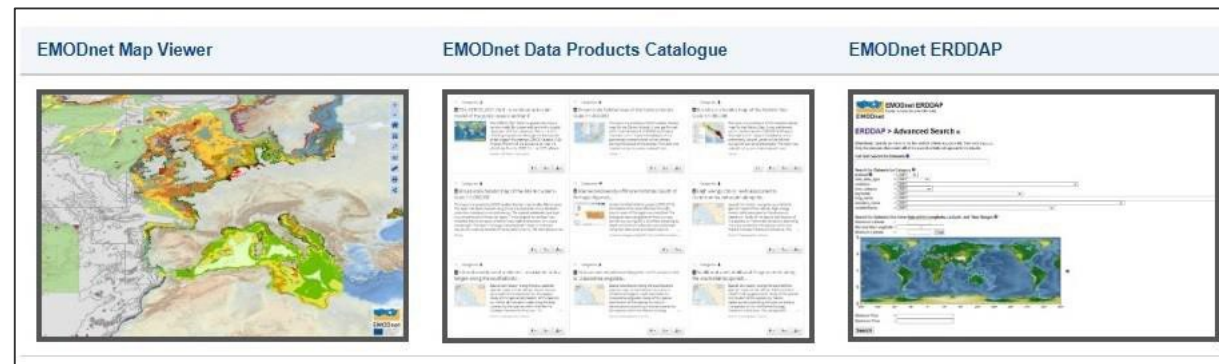
- Oceans 1273
- Elevation 199
- Utilities communication 17
- Biota 616
- Geoscientific information 166
- Location 14
- Environment 591
- Boundaries 54
- Economy 6

Browse resources

- Dataset 2122
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Integrated data services

Data Services directly accessible
from EMODnet landing page



EMODnet Web Services

List of the base url's of all thematic portals:

- Ⓔ) **Bathymetry** <https://ows.emodnet-bathymetry.eu/ows>
- Ⓔ) **Biology** <https://geo.vliz.be/geoserver/Emodnetbio/ows>
- Ⓔ) **Chemistry** https://geo-service.maris.nl/emodnet_chemistry/ows
- Ⓔ) **Geology** <https://drive.emodnet-geology.eu/geoserver/EMODnetGeology/ows>
- Ⓔ) **Human Activities** <http://www.emodnet-humanactivities.eu/geoserver/emodnet/ows>
- Ⓔ) **Physics** <https://prod-geoserver.emodnet-physics.eu/geoserver/emodnet/ows>
- Ⓔ) **Seabed Habitats** https://ows.emodnet-seabedhabitats.eu/geoserver/emodnet_view/ows

<https://emodnet.ec.europa.eu/en/emodnet-web-service-documentation>

WMS

GetCapabilities
GetMap
Getfeatureinfo

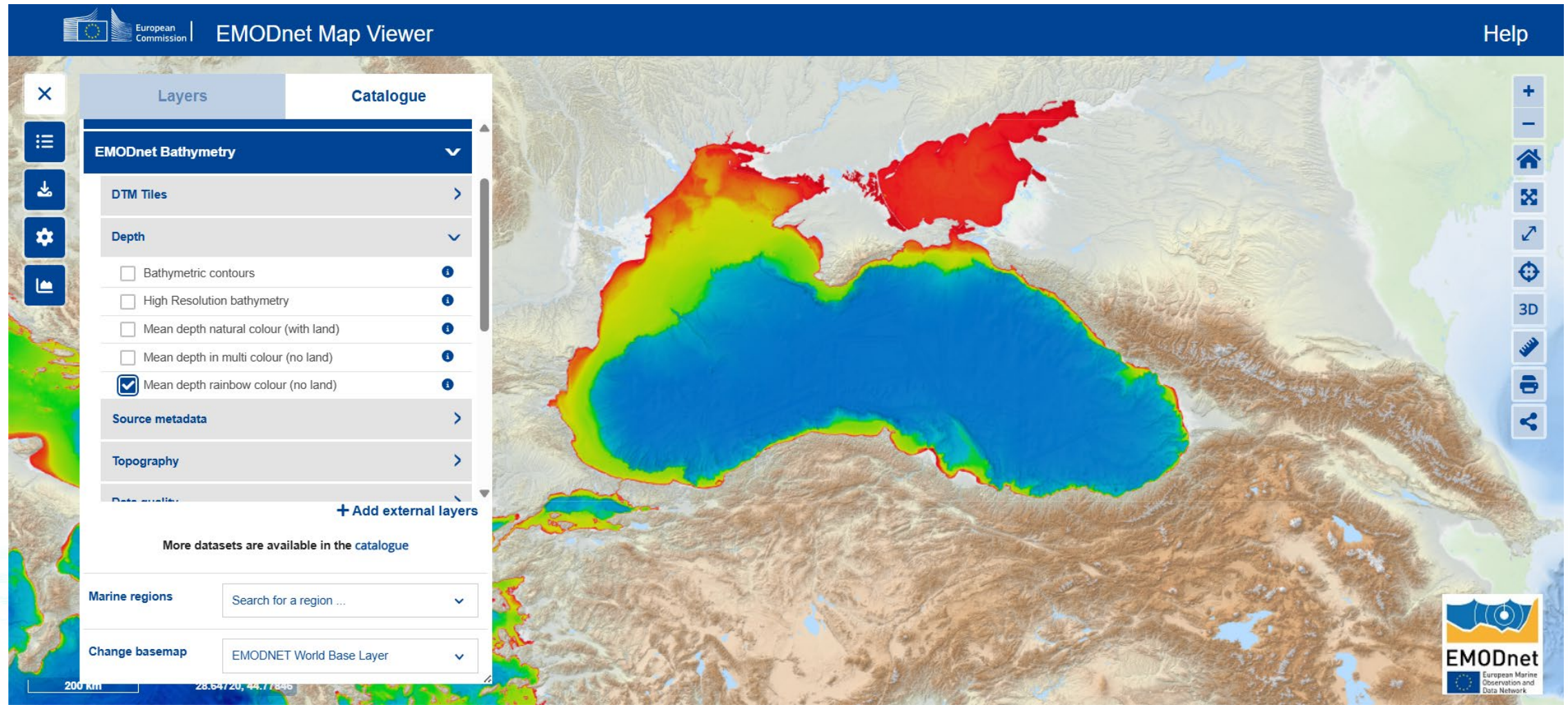
WFS

GetCapabilities
DescribeFeatureType
GetFeature

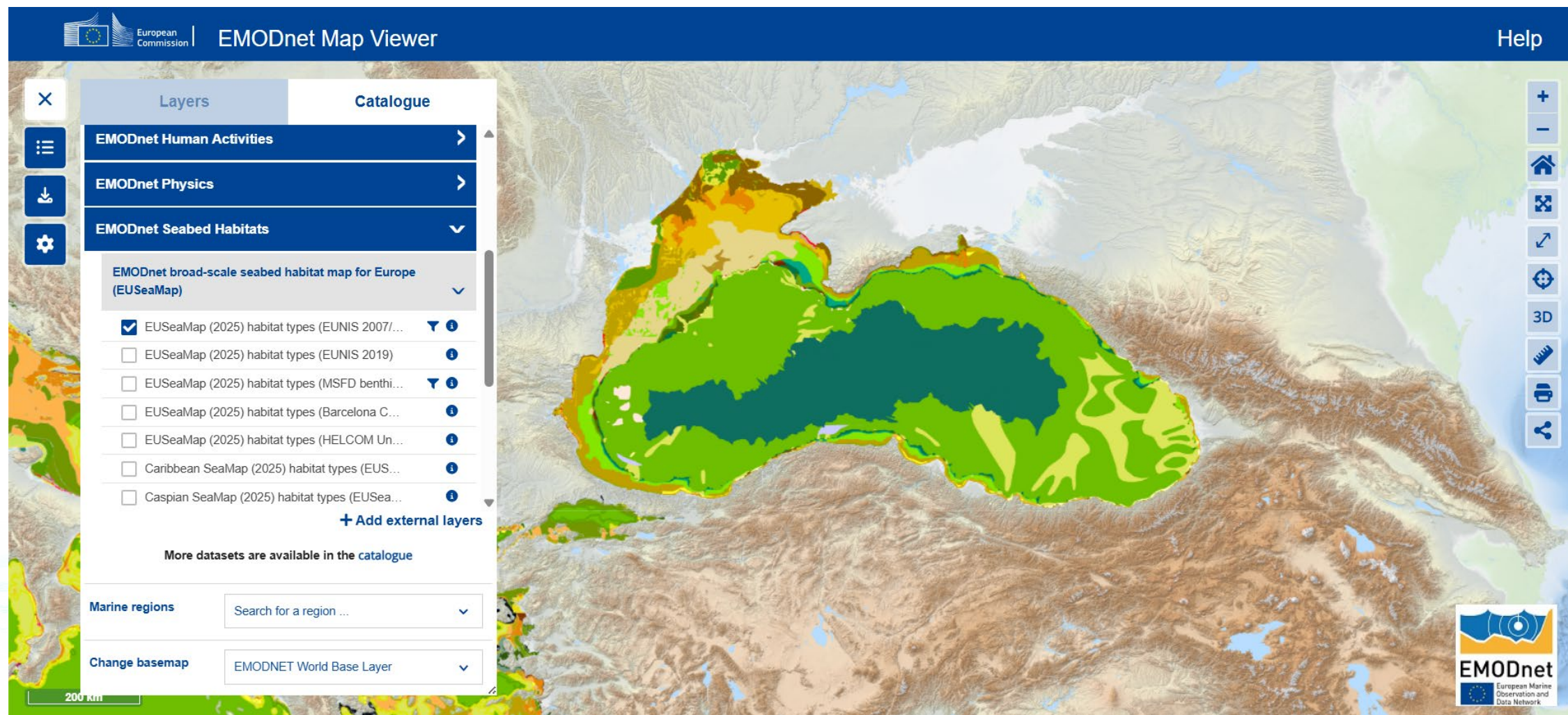
WCS

GetCapabilities
DescribeCoverage
GetCoverage

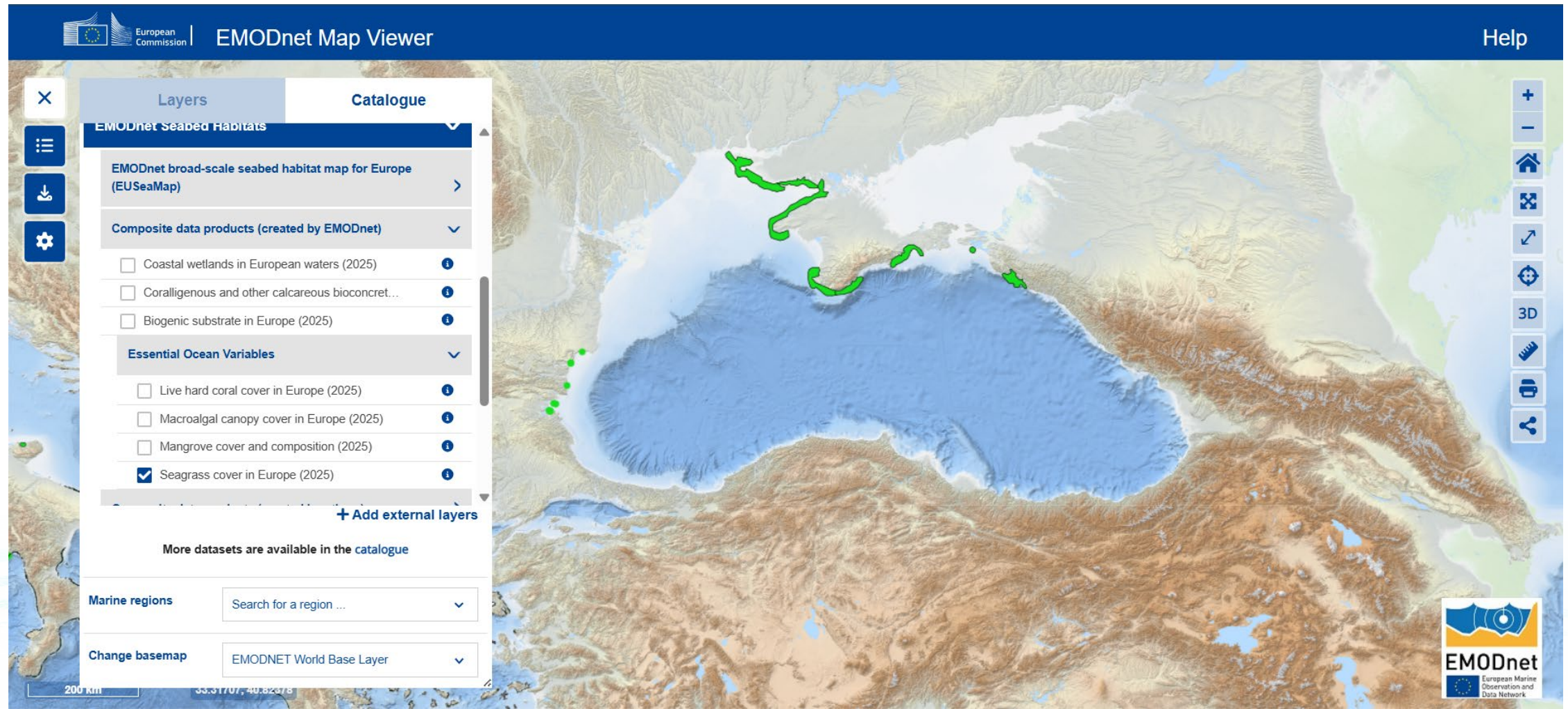
Black Sea - Bathymetry



Black Sea – Seabed Habitats



Black Sea – Seagrass cover



EMODnet Ingestion Ambassadors

Network of 50 National Data Centres, specialized marine centres, and all EMODnet thematic coordinators ensuring provision of trustable data and products.

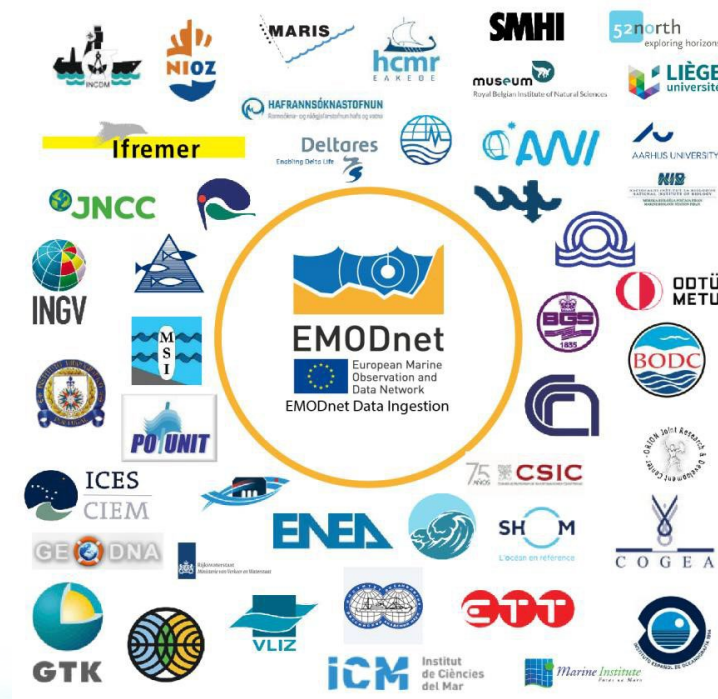
BATHYMETRY



BIOLOGY



CHEMISTRY



GEOLOGY



HUMAN
ACTIVITIES



PHYSICS

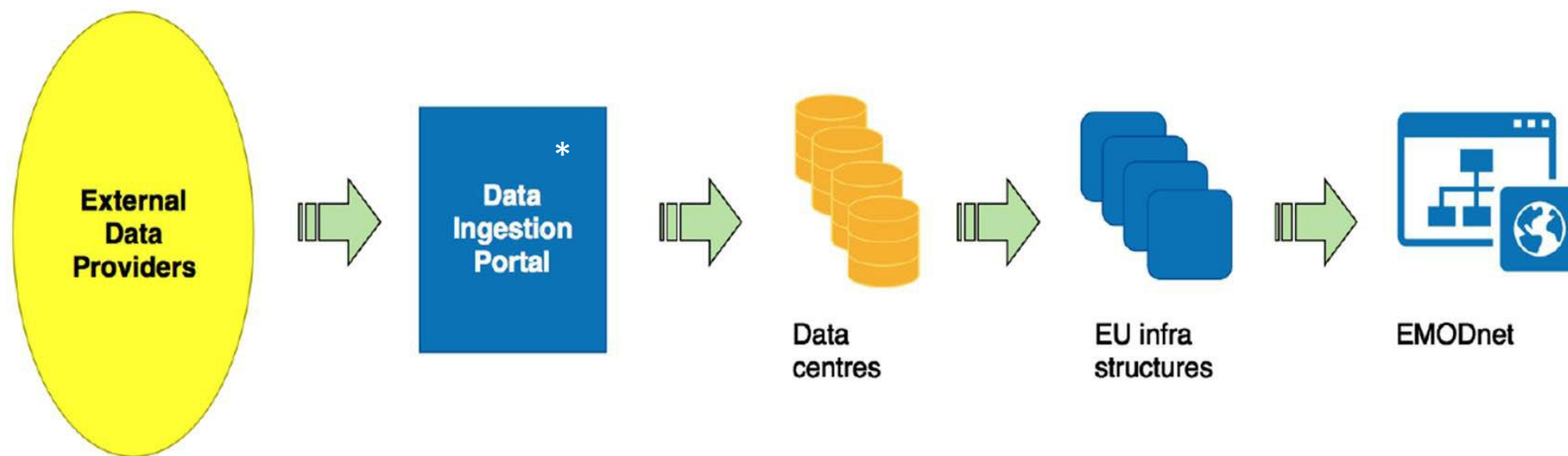


SEABED
HABITATS



Data Ingestion process

Use is made of standards, best practices, and existing marine data management infrastructures, data centres and pathways towards the EMODnet



Workflow from submission to elaborating and processing for publishing in EMODnet

* Migration to Central Portal, 2024

Interreg



Co-funded by
the European Union



NEXT Black Sea Basin
NEXT Black Sea Basin

Thank you!

