

EXPLORING KEY SCIENTIFIC QUESTIONS WITH THE EMSO REGIONAL FACILITIES OR GROUP OF REGIONAL FACILITIES

EMSO EUXINUS BLACK SEA - ROMANIA

Virgiliu Nicolescu & Irina Stanciu – GeoEcoMar, ROMANIA

*EMSO Strategic Workshop
Rome, 11-13th March 2025*

EMSO EUXINUS IN A NUTSHELL

Location: Western Black Sea, ROMANIA

Distance from land: 105 -140km

Water depth: 75 - 90m

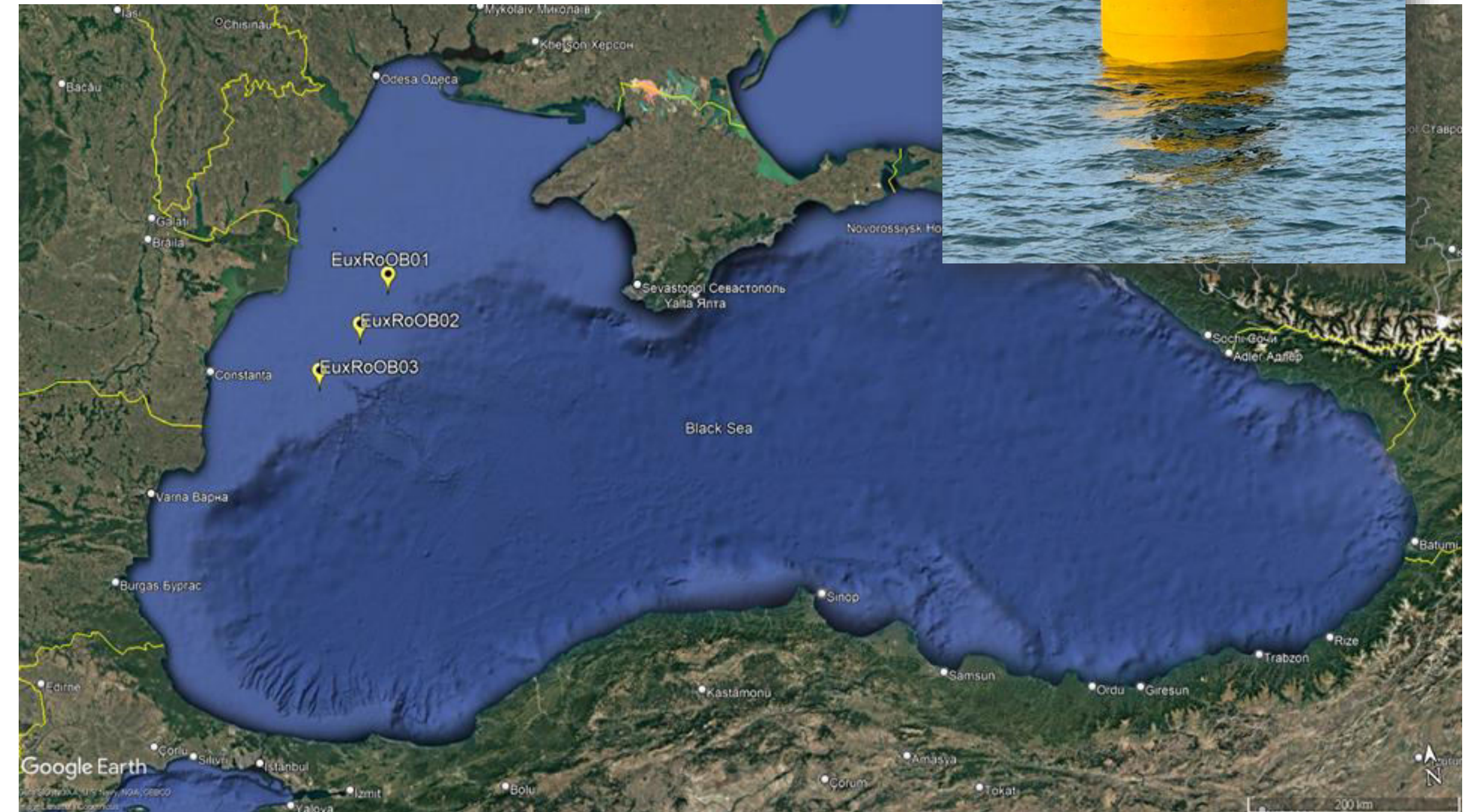
Date of deployment: summer of 2013

Major upgrade: Spring 2024

Supported by: GeoEcoMar ROMANIA

Operated by: GeoEcoMar ROMANIA

Regional Team Leader: Vlad Radulescu



EMSO EUXINUS IN A NUTSHELL

RF SPECIFICITY: Monitoring and supplying real time data

OCEANOGRAPHICAL DATA:

- Chlorophyll-a - 1-hour avg[$\mu\text{g/l}$]
- O2d Concentration - 1-hour avg[$\mu\text{mol/L}$]
- O2d Saturation - 1-hour avg[%]
- Turbidity - 1-hour avg[NTU]
- Water conductivity - 1-hour avg[mS/cm]
- Water salinity - 1-hour avg[PSU]
- Current XY speed - 1-hour avg[m/s]
- Current XY direction - 1-hour avg[°N]
- Current Z speed - 1-hour avg[m/s]
- Water temp. - 1-hour avg[°C]
- Water level - 1-hour avg[m]

METEOROLOGICAL DATA:

- Air Temperature - 1-hour avg[°C]
- Dew Point - 1-hour avg[°C]
- Relative Air Humidity - 1-hour avg[%]
- Wind Main Direction - 1-hour avg[°N]
- Wind Gust Direction - 1-hour avg[°N]
- Wind Average Speed - 1-hour avg[m/s]
- Wind Gust Speed - 1-hour avg[m/s]

EMSO EUXINUS IN A NUTSHELL

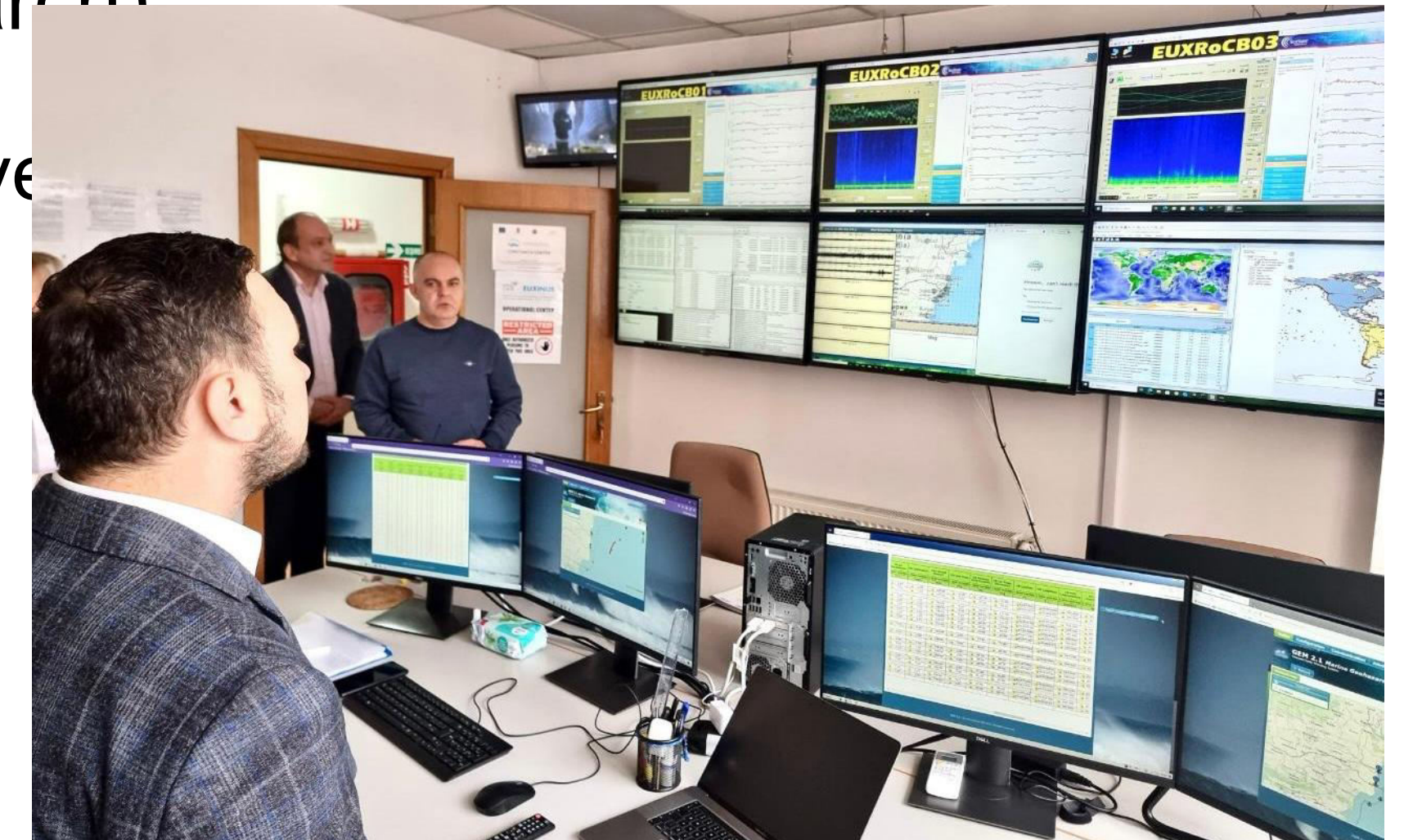
RF SPECIFICITY: Monitoring and supplying real time data to a diverse range of stakeholders (from early warning and emergency inspectorates to academia and research)

EMSO EUXINUS ROMANIA provides data through an ERDDAPP server (<https://erddap.geoecomar.ro/erddap/index.html>) to EMSO ERIC and:

- National and International Research Institutes and Universities
- National and local Authorities, National Administrations
- Other public or private entities

EMSO EUXINUS ROMANIA

- Manages and maintains EMSO EUXINUS Black Sea infrastructure
- Monitors from onshore on a 24/7 basis the EMSO EUXINUS system via its Operational Centre located in Constanta, Romania
- Offers and supports physical infrastructure access to partners in local and international projects
- Has provided met-ocean data and studies for various European and National research projects, as well as collaboration with the industry (including Oil & Gas sector)



EMSO EUXINUS: SCIENTIFIC CHALLENGES

Key scientific question 1:

How does the temporal variability of open ocean EOVs impact and propagate from local to regional scales?

EMSO EUXINUS team is continuously monitoring a number of 18 EOVs through its 3 buoys placed on the West Black Sea Romanian external shelf. The team performs on-line and near real-time data processing and interpretation.

- Overall comment on EMSO Romania – these are the only such buoys constantly observing EOVs at this scale on the entire Western Black Sea –therefore the provided information is unique, covering a wide geographic range
- The EOV's variations are consistently reflected when extending the observations from local to regional scale
- The observed EOVs support the implementation of unique data in regional hydrodynamic models – supporting also the calibration / validation of EOVs amplitude and time extent
- The local hydrodynamic conditions are defined and influenced by regional weather conditions and currents.

The main factors of influence are:

- Danube's fresh water and sediment supply
- Anthropic activities (industrial pollution, marine traffic, military operations)
- Weather variability

EMSO EUXINUS: SCIENTIFIC CHALLENGES

Key scientific question 2:

What are the spatiotemporal scales and variability of the processes preconditioning and triggering natural hazards events?

EMSO EUXINUS continuously monitors the variability of the processes occurring in the proximity of the 3 buoys and provides the relevant data to entities & authorities; the data is shared through a ERDDAPP server (<https://erddap.geoecomar.ro/erddap/index.html>) to EMSO-ERIC.

- Spatial scale – hundreds of km²

Continuous observation of processes occurring at different time scales:

- Seconds : earthquake generated waves, wind and storm generated waves
- Days -months: continuous covering for wind and storm generated waves
- Seasonal: impact of riverine inputs (Danube floods and droughts – with the impact of the water mix processes)
- Seasonal: surface water temperature (from very high to very low)
- Seasonal: suspended discharge – turbidity variance

EMSO EUXINUS: SCIENTIFIC CHALLENGES

Key scientific question 3:

What are the impacts of geophysical dynamic events, climatic and anthropogenic changes on open ocean benthic and pelagic ecosystems?

EMSO EUXINUS monitors and records relevant parameters from the 3 buoys proximity, thus identifying dynamic climatic or other events affecting the local area – that can be extrapolated to a regional dimension

EMSO EUXINUS system is located in the Western Black Sea area. Black Sea is locked and anoxic. Considering EMSO EUXINUS role, the buoys' locations and the specificity of the area, no benthic or pelagic analysis has ever been performed by the direct EMSO EUXINUS team, but data is available for the GeoEcoMar research staff as well as to the international research community through direct access.

EMSO EUXINUS: SCIENTIFIC CHALLENGES

Key scientific question 4:

How does climate change affect the carbon storage in the open ocean along the water column?

EMSO EUXINUS monitors the carbon contents as well as the oxygen contents, looking also at the possibility of anoxia processes at the lower layers of water.

All the information and data provided supports the open ocean carbon fluxes and storage observation.

EMSO EUXINUS: SCIENTIFIC CHALLENGES

Key scientific question 5:

How to develop innovative observation technologies and strategies for the open ocean and increase EMSO observatory capabilities?

EMSO EUXINUS supports met-ocean observation and data recording, processing and interpretation and provide met-oceanic data.

In order to increase the proficiency of its role, EMSO EUXINUS has been recently upgraded (2024), all buoys being provided with top of the range sensors.

In the near future, EMSO EUXINUS foresees the adding of a new research component (radioactivity sensors) trying to respond to the recent challenges due also to the current circumstances (war in Ukraine).

EMSO EUXINUS: LOOKING AHEAD

	Hydrodynamics and hydrology	Biochemistry, ecology	Geology and Geophysics
Future objectives	<p>EMSO EUXINUS' role and main objective is recording of the met-oceanic data and supplying it to designed users in the agreed format.</p> <p>The data is shared in accordance to established requests and agreements supporting national and international projects.</p> <p>So far, no additional information has been required by stakeholders to EMSO EUXINUS system.</p>		
Challenges/Technology that EMSO ERIC may provide to support	<p>EMSO EUXINUS looks forward to testing new scientific and technological challenges regarding the study of the Black Sea, being open to any collaboration on further tests of new sensors / technologies in the specific conditions of the Black Sea.</p> <p>Besides joining the EMSO ERIC community in dealing with new scientific challenges, specific support and know-how will be needed in case of future plans to extend the buoy network and / or the list of scientific services offered</p>		

EMSO EUXINUS DATA IN BLACK SEA

Black Sea observation and data infrastructure capacity

Explore below the existing data aggregators and Marine Research Infrastructures providing ocean observations and marine data in the Black Sea in the domains of Physics, Chemistry and Biology.



EMSO ERIC

Euro-Argo ERIC

LifeWatch ERIC

EMBRC ERIC

DANUBIUS RI

SeaDataNet



EMODnet Physics

EMODnet Chemistry

EMODNet Biology

CMEMS INSTAC

OceanOPS

EuroFleets+

JERICO RI



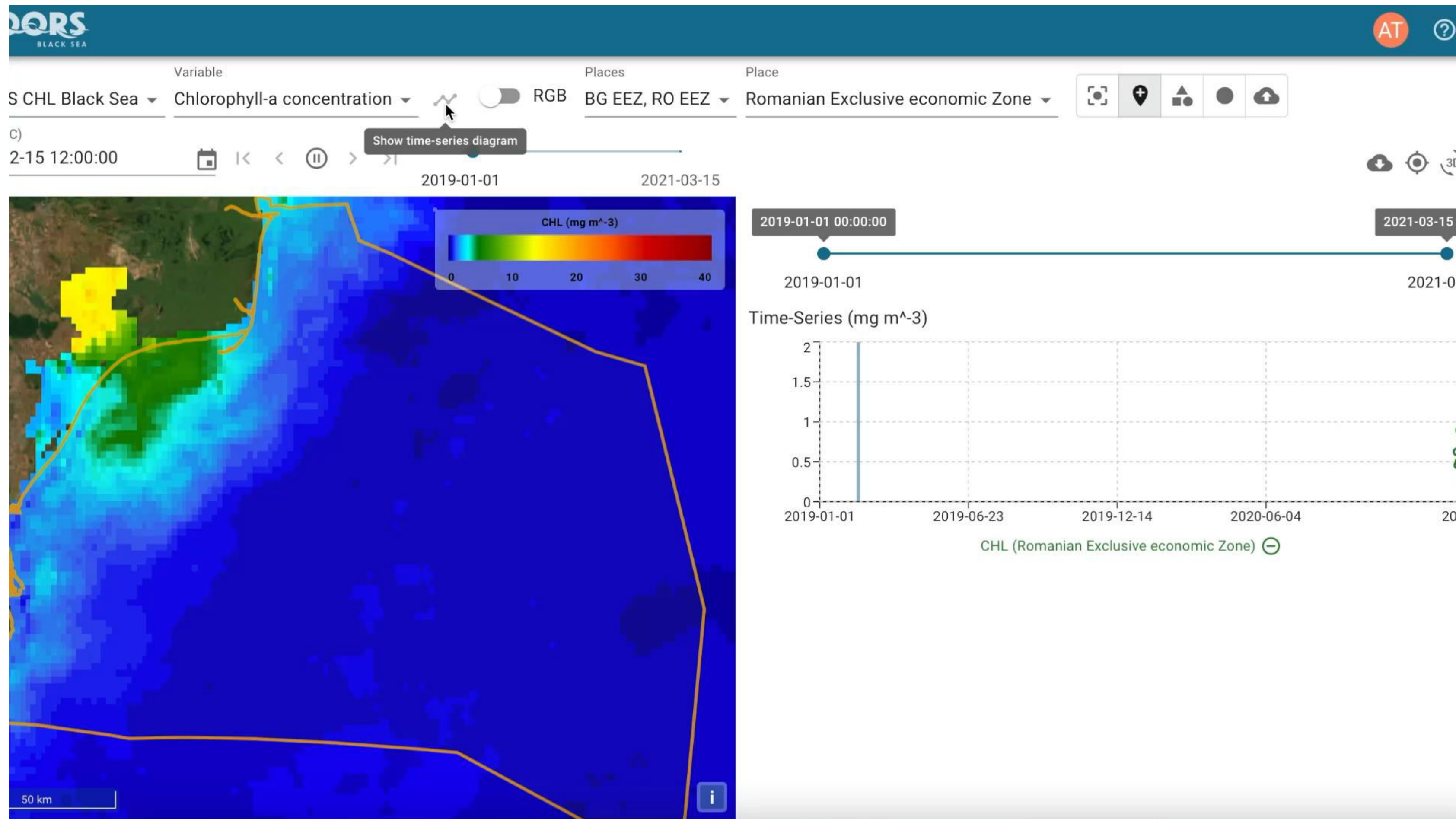
European research infrastructure to provide key data on the sea and climate change



Understanding Change



EMSO EUXINUS DATA IN DOORS BLACK SEA



Improving Data Products: Trust in Data

DOORS System of Systems

BLACK SEA

A one-stop-shop for standardised data and model outputs for the Black Sea

Uses latest technology to bring complex data together
Brings together heterogeneous data streams into analysis (or even interpretation) - ready data cubes using the same (meta)data standard and format

Harmonises data

Deliver harmonised spatial and temporal data products (sampling, cruises, fixed & mobile oceanographic platforms, EO observations and models)

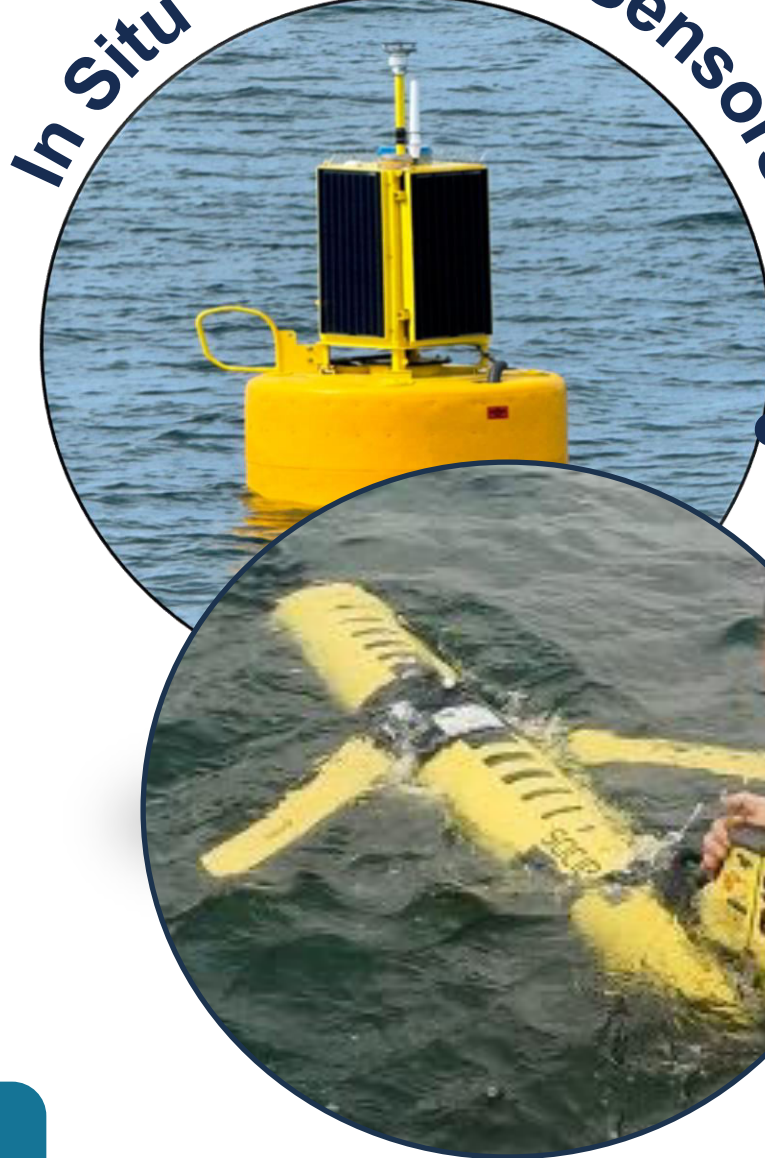
A single smart intuitive portal

Tailored to the needs of stakeholders, using FAIR principles

Support knowledge transfer

Building a common understanding, opportunities for growth and collaboration for sustainable growth and prosperity

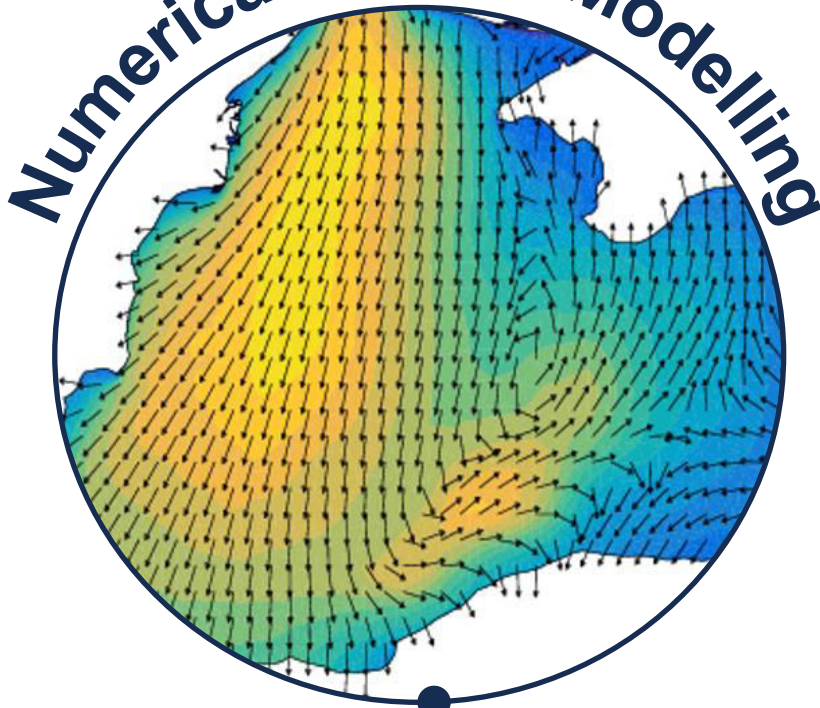
In Situ & Robotic Sensors



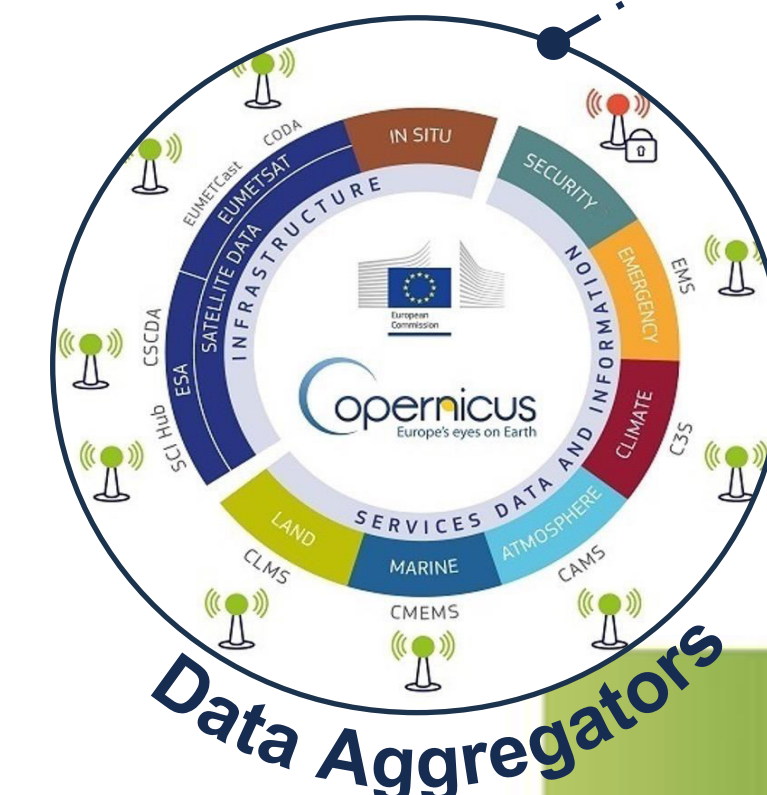
Earth observation



Numerical & Data Modelling



Research Cruises



Digital observatory
combining data from sensors, satellites & models



A vertical chain of metal links is centered in the frame. The background is a vibrant green, filled with numerous small, out-of-focus bubbles, creating a textured, underwater-like effect. The chain consists of several interlocking links, with a prominent link in the middle showing a dark, circular opening.

Thank you for your attention!



Observing the ocean to save the earth