



Blue-Cloud2026



Blue-Cloud 2026 in a nutshell

June 2024

A federated European FAIR and Open Research Ecosystem for oceans, seas, coastal and inland waters

Blue-Cloud 2026 **builds upon the pilot Blue-Cloud project** to further evolve its **pilot ecosystem into a Federated European Ecosystem to deliver FAIR & Open data, analytical services, instrumental for deepening research of oceans, EU seas, coastal & inland waters.**

It develops a **thematic marine extension to EOSC** for open web-based science, & serves needs of the EU Blue Economy, Marine Environment and Marine Knowledge agendas.

Budget: € 8 845 420,00

Funding: [HORIZON-INFRA-2022-EOSC-01 | RIA - Research and Innovation action](https://cordis.europa.eu/project/id/101094227)
<https://cordis.europa.eu/project/id/101094227>

Length: 42 months

Starting date: 1 January 2023

Consortium: 40 partners from 14 countries

Project Information

Blue-Cloud 2026

Grant agreement ID: 101094227

DOI

[10.3030/101094227](https://doi.org/10.3030/101094227)

Start date

1 January 2023

End date

30 June 2026

Funded under

Research infrastructures

Total cost

€ 8 845 420

EU contribution

€ 8 845 420



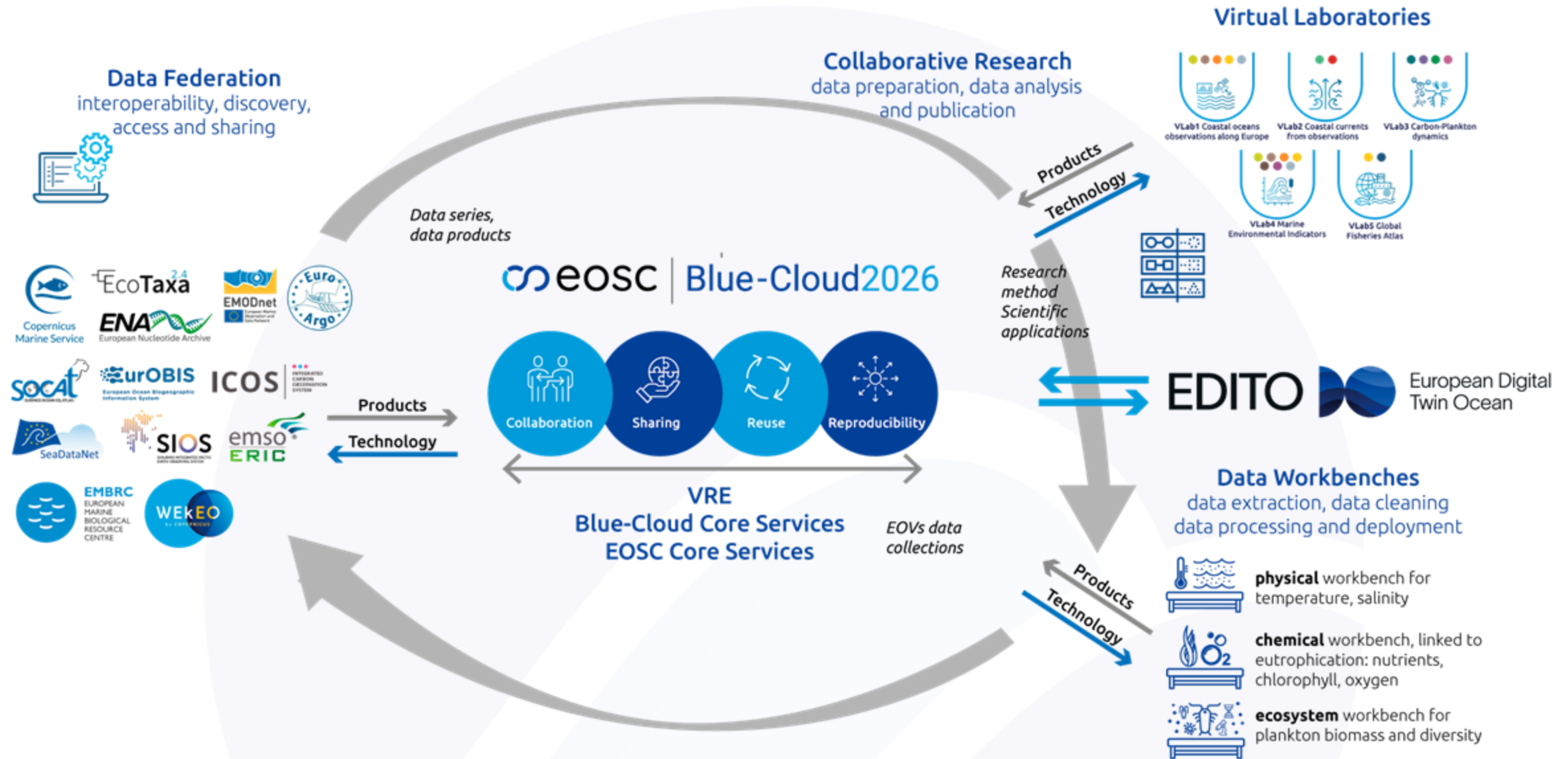
Coordinated by

CONSIGLIO NAZIONALE DELLE RICERCHE

 Italy

Develop a Federated European Ecosystem to deliver FAIR & Open data and analytical services, instrumental for deepening research of oceans, EU seas, coastal & inland waters. It also aims to develop a thematic marine extension to EOSC for open web-based science, serving the needs of the EU Blue Economy, Marine Environment and Marine Knowledge agendas.

All in all, Blue-Cloud 2026 will expand the federated approach of the previous Blue-Cloud, involving more aquatic data stakeholders, and interacting with EOSC developments, in support of the EU Green Deal, UN SDG, EU Destination Earth, and the EU Mission Starfish on healthy oceans, seas, coastal and inland waters, ultimately to provide a core data service for the Digital Twin of the Ocean.



MISSION: To develop further the European federation of marine and inland water data management infrastructures & high quality services



A1. DD&AS

A FAIR compliant Data Discovery & Access Services > access to 10+ million open data sets & products by 13 major BDIs



A2. VRE

An Open Science Virtual Research Environment (VRE) federating multiple e-infrastructures > supporting Analytical Big Data Workbenches & VLabs



A3. EOVs

3 EOVS Workbenches for highly qualified data collections

3.000 DATA ANALYTICS SESSIONS PER MONTH - 5,000 HTC DATA ANALYTICS JOBS PER MONTH

A4. VLABS - FIVE DOMAIN-BASED VIRTUAL LABS



Coastal Ocean observations along Europe



Coastal currents from observations



Carbon-Plankton Dynamics



Marine Environmental Indicators



Global Fisheries Atlas



A7. COMMUNITY

- All EU countries engaged
- 3k+ engaged Blue-Cloud community users
- 5k+ followers across all the platforms
- 10+ External Stakeholders



OUTREACH

- 1 Blue-Cloud Hackathon
- 1 Blue-Cloud TV
- 18 Newsletter issues
- 11 Webinars on Blue-Cloud VRE, DDAS & EOVS Workbenches
- 3 Blue-Cloud Annual Impact Events
- 3 Ocean Literacy Webinars
- Videos & Interviews



A6. TRAINING ACADEMY & CATALOGUE

- 3 Online training course on Best Practices for FAIR data principles
- 3 Info session & course on the EOVS Workbenches
- 2 online webinars dedicated to the BlueCloud VRE
- 2 dedicated to the DDAS and the innovations introduced
- A series of training sessions on how to use the VLabs



POLICY

- Scientific papers & articles
- Restoring healthy oceans, seas, coastal & inland waters in Europe
- Strategic Roadmap 2030 **A5. ROADMAP**
- Cross-domain expansion factsheets
- Sustainability Business model



DTO Task Force



Scientific and Administrative Coordinator



Project Coordinator



Technical Coordinator



Assessing Blue-Cloud as an EOSC Node

Blue-Cloud as a pilot thematic EOSC as a role model for the development of other thematic clouds and a best practice for Data federation within the EOSC community

EC Commissioner **Michael Aredtof**, Head of Unit, "Open Science and Research Infrastructures", DG RTD at the 2nd 2023 Coordination meeting of EOSC-related projects funded under Horizon Europe
 June 2023



EOSC Tripartite Event Belgium
 16 April 2024

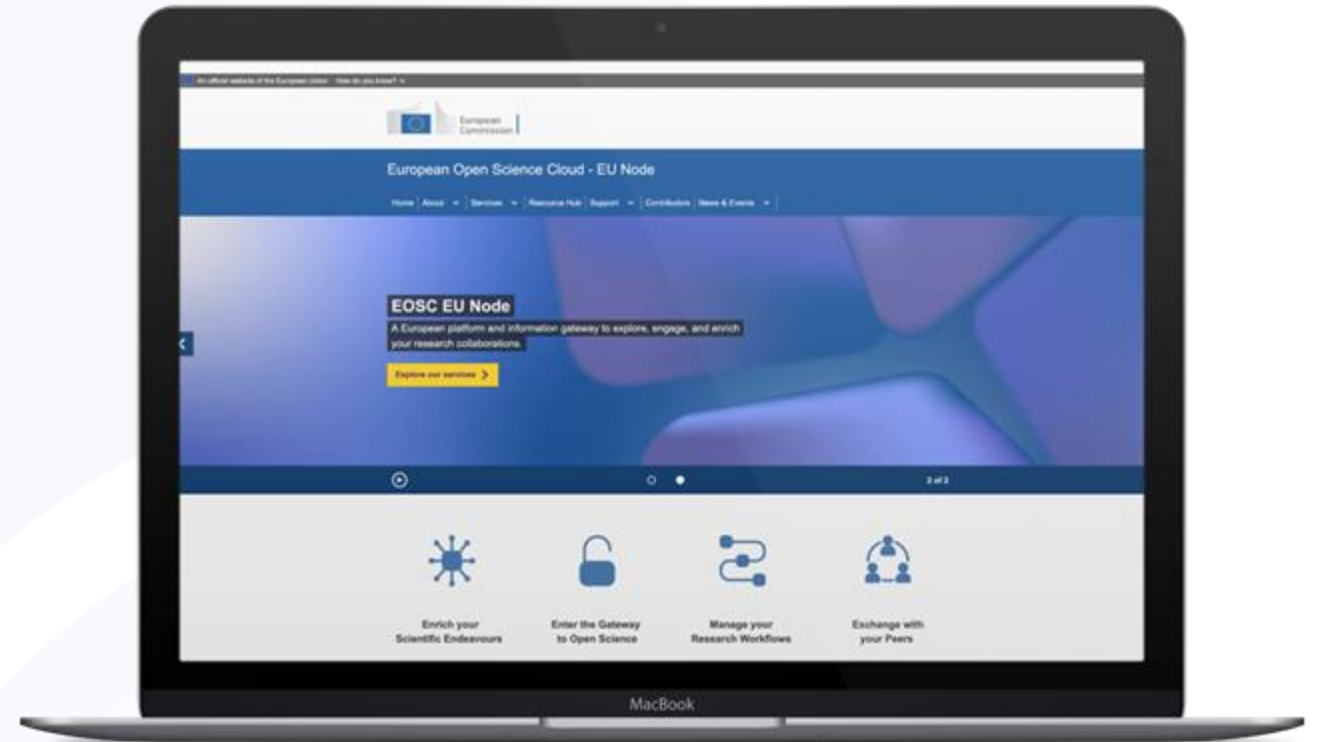


The [European Open Science Cloud \(EOSC\)](#) aims to achieve a federation of infrastructures providing seamless access to interoperable research objects and value-added services for the whole research data cycle, from discovery to storage, management, analysis, and reuse.

The EOSC Procurement is to build and deploy an **operational, secure, cloud-based EOSC EU Node**, that includes both the core and exchange service components, offering high quality managed services and superior user experience for a large number of users, with the functionalities available 24/7.

[The EOSC EU Node](#) will provide access to a rich portfolio of FAIR (Findable, Accessible, Interoperable, Reusable) data and professional quality interoperable services in all relevant domains from data handling to computing, processing, analysis and storing.

The procurement also covers operations, maintenance, and support of the EOSC EU Node for 36 months.



Blue-Cloud Data Lakes

Blue-Cloud 2026 will expand and optimise the DD&AS and its FAIRness by building Blue-Cloud Data Lakes for use by Blue-Cloud WorkBenches and beyond.

Two configurations of data lakes:

- one for all Blue-Cloud VRE users, comprising a series of data lakes for data sets managed by selected Blue Data Infrastructures, engaged in the Blue-Cloud project, and from an international data repository, the World Ocean Database (WOD), managed by NOAA, USA.
- a second configuration for WorkBench 1 (T&S) and for Workbench 2 (Eutrophication), set up by merging and harmonising a number of data collections for selected parameters (EOVs) from multiple BDIs.

New Beacon data lake technology (MARIS) that allows slicing through millions of NetCDF files to give in an instant a homogeneous output file with values that could be used for further analytics or to drive a viewer to show in a sliding way, e.g. temperature in the oceans at selected dates, locations, and depths.



VRE and VLab services illustrate the wide range of subjects that can be addressed using Blue-Cloud resources, from genomics to wildlife as well as environmental data coming from multiple disciplines and repositories, and all together demonstrate Blue-Cloud 2026's potential in different fields of marine research, ranging from biodiversity to environmental science, as well as fisheries and aquaculture.



BRUSSELS

EUROPEAN OCEAN DAYS

Oi oceanology international

2024 OCEANICT

12-14 MARCH 2024 | LONDON, EXCEL

EU MISSION RESTORE OUR OCEAN AND WATERS
WHERE NEXT FOR EUROPE'S SEAS?
BLUEINVEST DAY
OCEAN LITERACY IN ACTION





Unravelling plankton dynamics for the conservation of the ocean
Blue-Cloud demo at DOF 2024



<https://blue-cloud.org/events/digital-ocean-forum-2024>

Photo credits: ©Bernal Revert/BR&U

Blue-Cloud 2026 core services

VRE & Data Discovery & Access Services - status today





Facilitates users:

Federated search for discovering interesting data sets (currently more than 10 million) in a two step approach

Federated retrieval of identified data sets using a shopping basket mechanism

Download of data sets or push to Blue-Cloud VRE

Facilitates managers of Blue Data Infrastructures:

Wider outreach to potential users

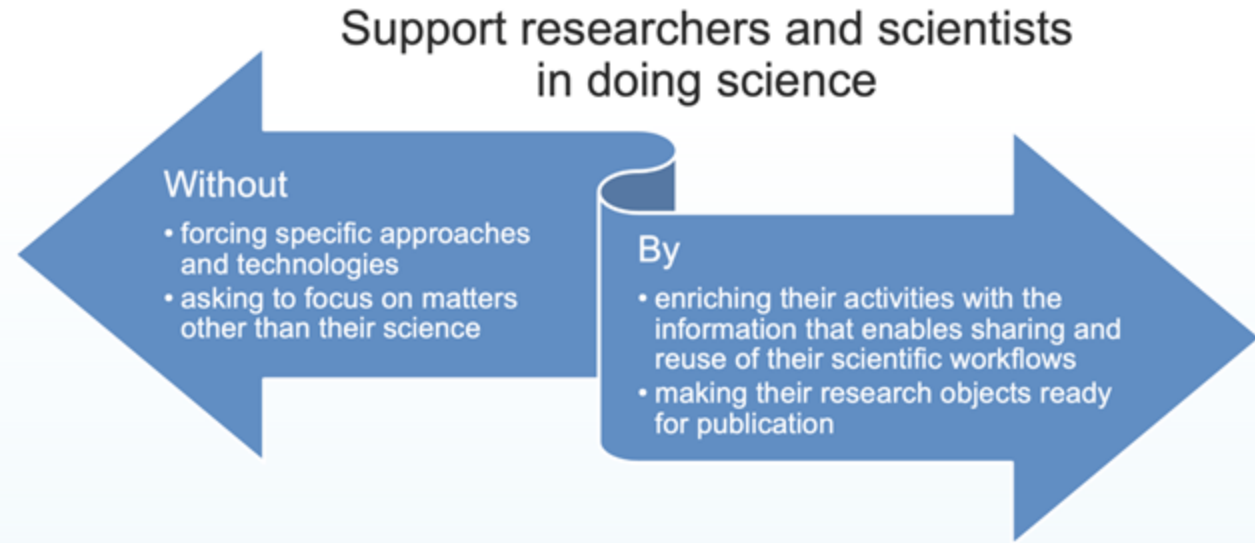
Stay informed about data requests and users for their repository

Periodic reporting of downloads from their repository



Expanding and Optimising the Blue-Cloud Data Discovery & Access service (DD&AS) and its FAIRness by:

- harmonising and expanding functionality of web services as operated by each BDI for discovery and access of managed data resources, and as used in DD&AS, following FAIRness review
- developing and deploying semantic brokering as part of DD&AS interface
- federating additional BDIs into the DD&AS (**EMSO, SIOS, EMODnet Physics, MGnify**)
- reviewing, and if missing, developing and deploying data sub-setting and extracting services, operated by each BDI, for feeding Blue-Cloud 'raw data' Data Lakes,
- developing and deploying Blue-Cloud Data Lakes for storing and maintaining 1) 'raw data' extracted from BDIs and 2) harmonised and validated data collections for selected data types, as resulting from the WP3 EOVS Work Benches



Virtual Laboratories

Data sharing

- Workspace
- Dataspace
- Repositories

Data analytics

- High Throughput Computing
- Notebook
- RStudio

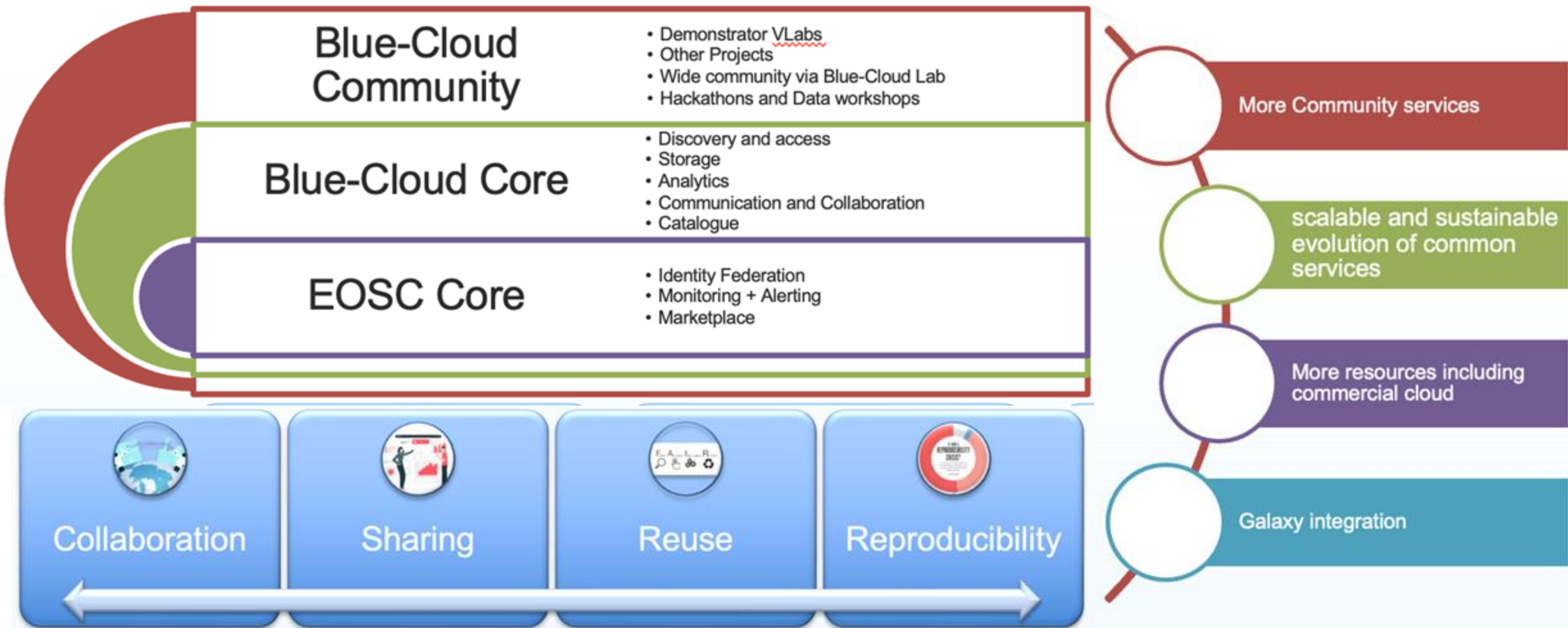
Social networking

- Messages
- Posts and replies
- User profiling

Research Object Publishing

- Catalogue
- Thredds
- GeoNetwork

It is implemented as a System of Systems promoting Open Science



Blue-Cloud 2026 WorkBenches





physical workbench for temperature, salinity



chemical workbench, linked to eutrophication: nutrients, chlorophyll, oxygen



ecosystem workbench for plankton biomass and diversity

The objective is to obtain **highly qualified datasets** for some chosen Essential Ocean Variables (EOVs) combining different and various sources as inputs.

→ The results will be 1 highly qualified dataset per EOV

Workbenches or pipelines will be built to obtain the highly qualified datasets that can use other data sources or be adjusted depending on expert needs

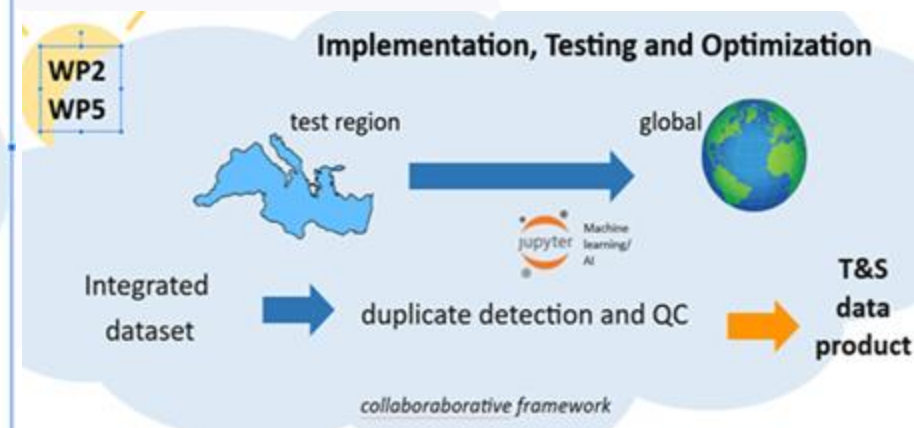
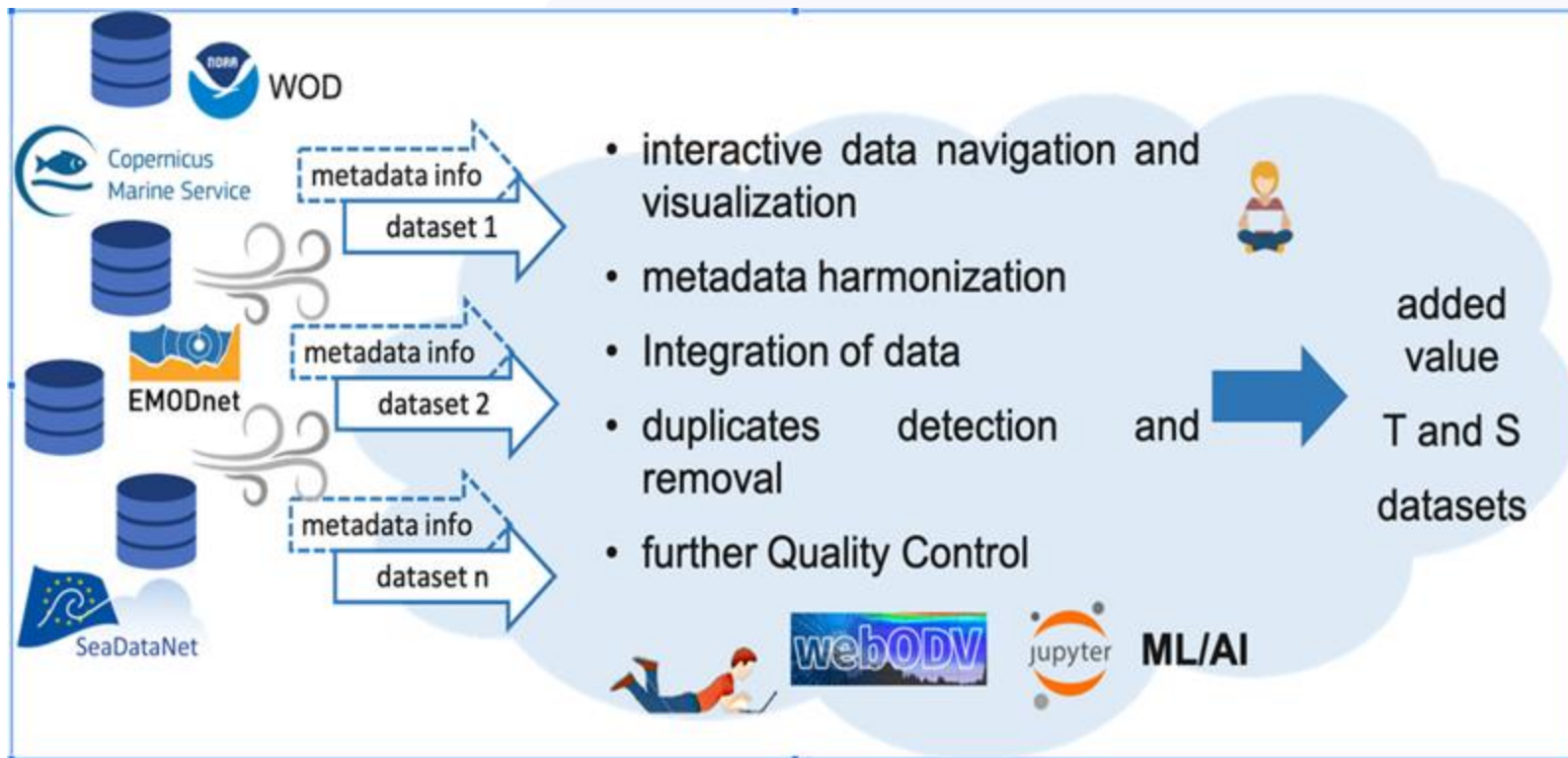
The challenge is to deal with large in situ datasets, i.e. to both access the relevant data and make developments on it. Blue Cloud 2026 will allow this thanks to the high level performance D4science VRE based on cloud computing associated with big data technology, a large datasets repository (datalake) and an expert data management.

Example for the physical workbench:



physical workbench for temperature, salinity

Speed up the process of * interactive data navigation/visualisation, * metadata harmonisation, * integration of data, * duplicate detection and * further QC thanks to IT technological advancement (cloud computing, VRE, big data)



Example for the chemical workbench:



chemical workbench,
linked to eutrophication:
nutrients, chlorophyll,
oxygen

- **workflow that will merge multi-source datasets to obtain an integrated and most complete dataset for the North East Atlantic to the global ocean; provide a set of QC procedures and handling of potential duplicate observations**



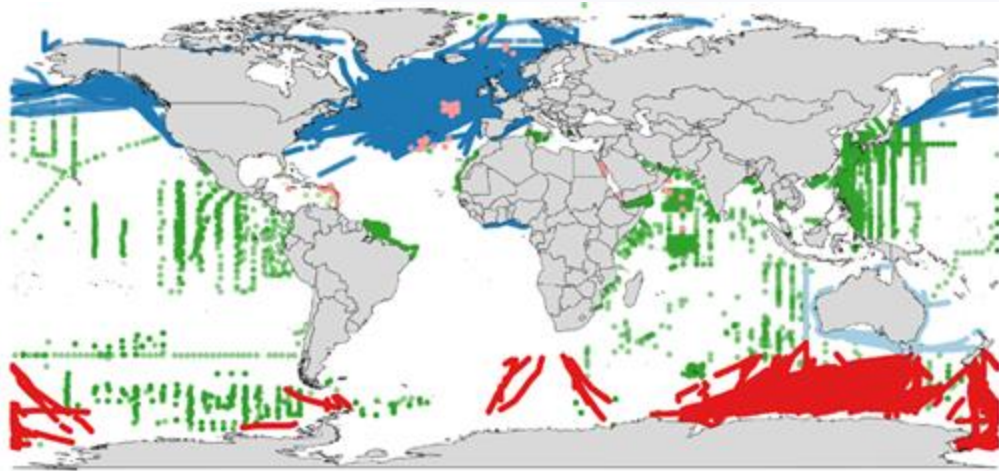
**Blue Cloud
Eutrophication
data
products**

Example for the ecosystem workbench:

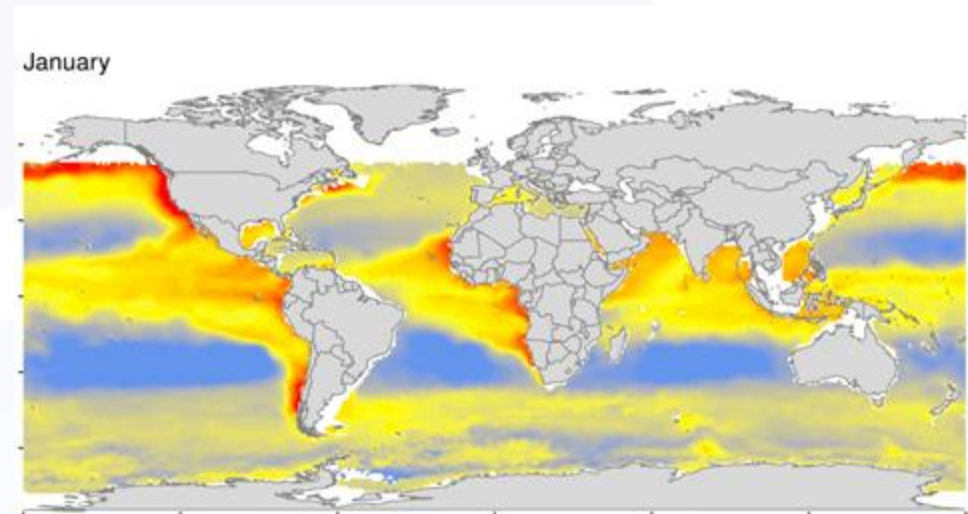


ecosystem workbench
for plankton biomass
and diversity

A rigorously quality-controlled, automatized modelling (machine learning) pipeline that integrates data from multiple European data repositories to produce **phyto- and zooplankton biomass and biodiversity products for the past, present and future ocean**



Data
(raw foraminifera biomass observations, multiple sources)




Knowledge
(integrated, quality- and bias-corrected biomass fields)

Blue-Cloud 2026 Virtual Labs



Coastal Ocean observations along Europe



new!
Coastal currents from observations



Carbon-Plankton Dynamics



Marine Environmental Indicators



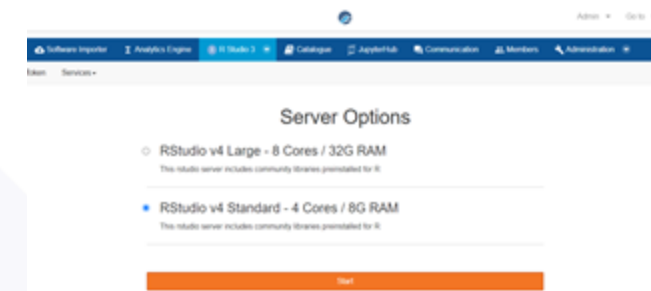
Global Fisheries Atlas

Blue Data Infrastructures



Copernicus Marine Service
 SeaDataNet
 EMODnet
 Socat
 EcoTaxa 2.5
 MGnify
 ENA European Nucleotide Archive
 emso ERIC
 SIOS
 EuroArgo
 JERICO RESEARCH

Blue Cloud VRE



Server Options

- RStudio v4 Large - 8 Cores / 32G RAM
- RStudio v4 Standard - 4 Cores / 8G RAM**



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Home /

Data Catalogue

eosc



DEMONSTRATING OPEN SCIENCE VIA VIRTUAL LABS

MARIS, Consiglio Nazionale delle Ricerche, VLIZ, cmcc, FORTH, hidrografico, IEEE France Section, IRD, OGS, LIÈGE université, SOCIB

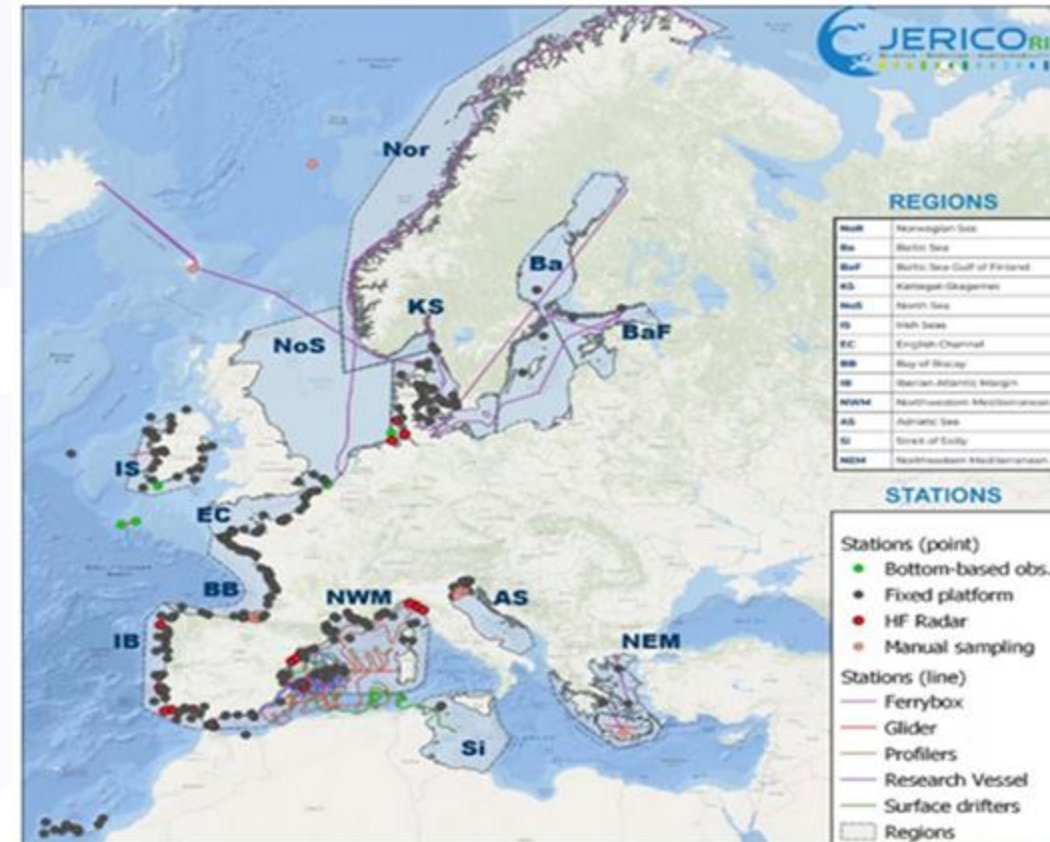




Integration of European coastal observations in 3 thematic services: **Transboundary Processes and Connectivity**, Extreme Events & Ocean Glider



- HF Radar Currents
- Current Profile in MP Buoys
- T in Wave Buoys
- T,S in MP Buoys
- T,S Glider profiles
- SSH at coastal tide gauges
- SST fields
- NEMO 3D T,S, SSH, Current
- ERA5 Surface Meteo Params
- Physics, BGC, Biology
- Physics, Chemistry, Biology, Bathymetry
- Bathymetry

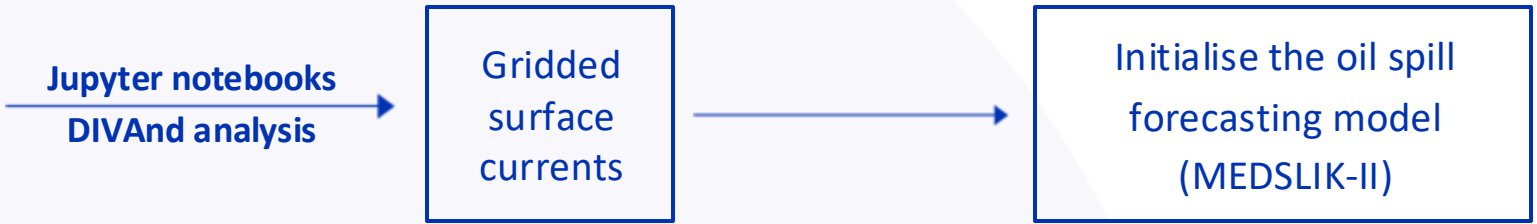




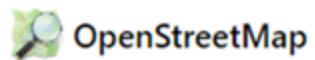
Integration of direct and indirect currents data from different sources, and application to run an oil spill model



In Situ - Global Ocean-Delayed Mode Observations of surface (drifters, HFR) and satellite altimetry



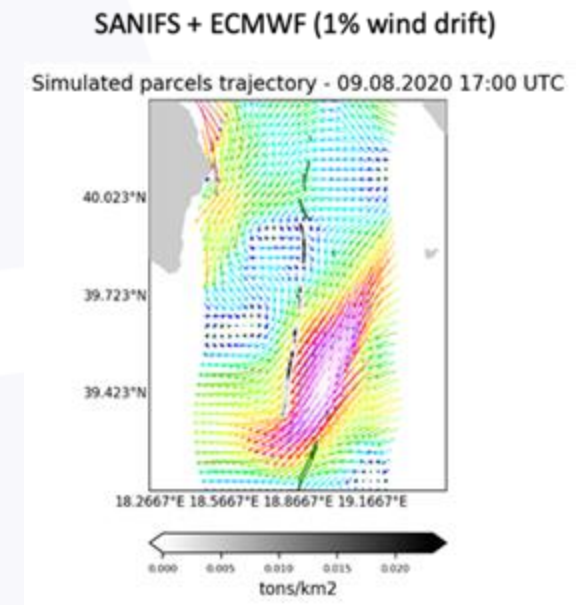
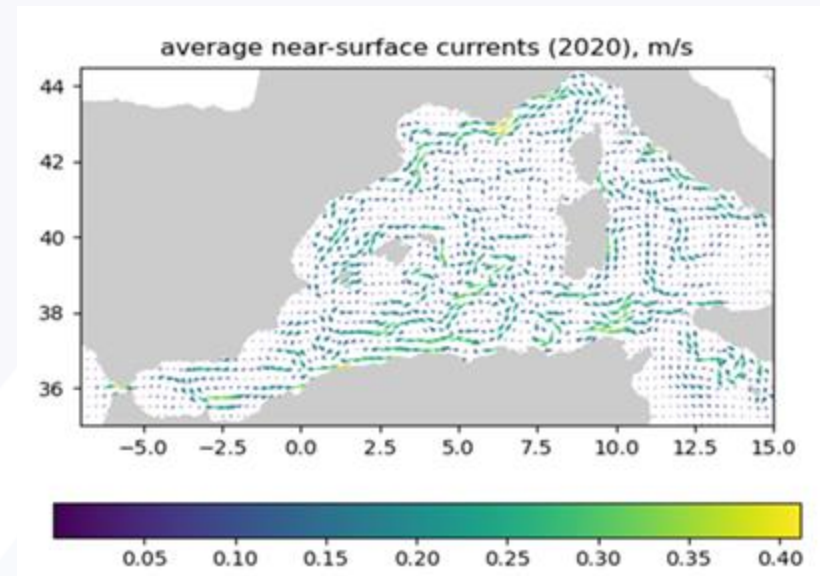
Bathymetry



Coastline



Wind speed

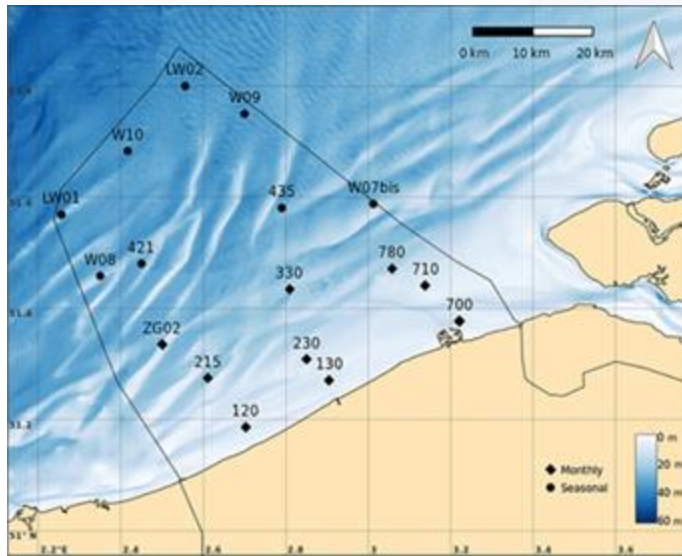


Carbon-Plankton Dynamics

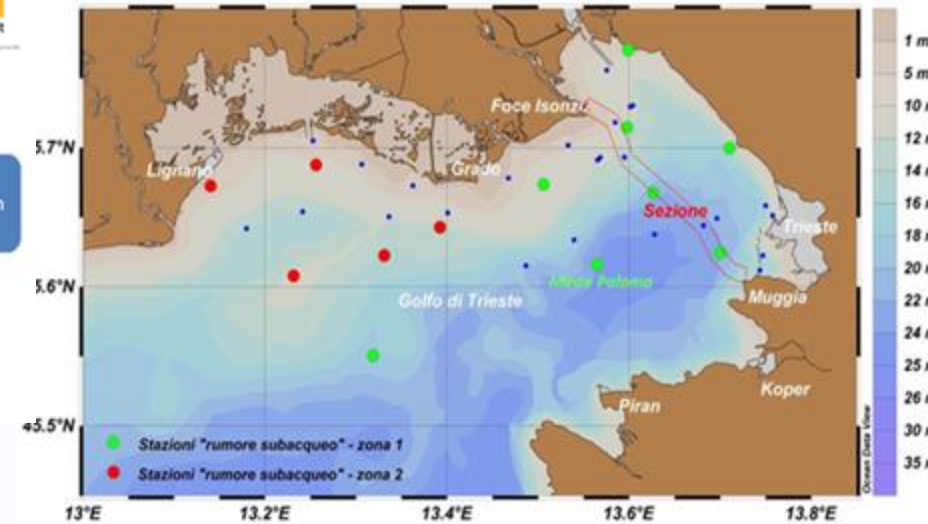
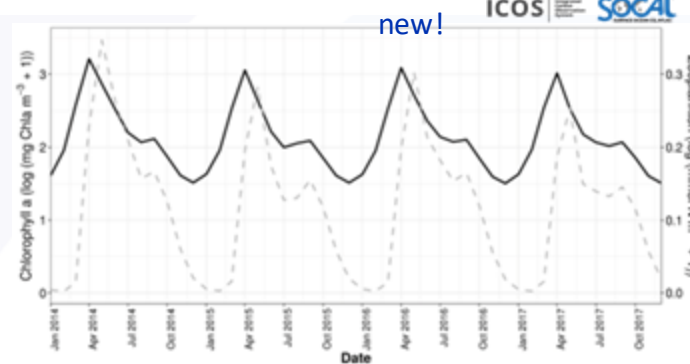
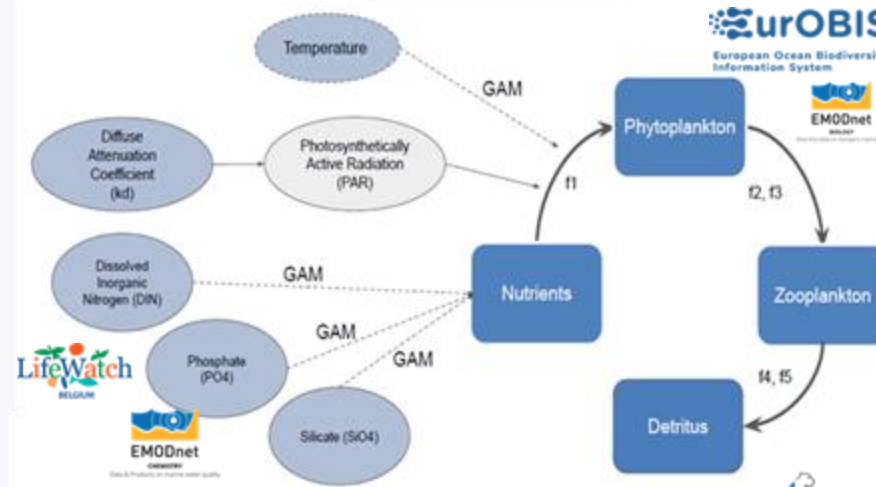
Seasonal and monthly records from 2011-2022

Nutrient-Phytoplankton-Zooplankton-Detritus (NPZD) Model, i.e. a mechanistic model, to identify the contribution of the drivers in phytoplankton dynamics and carbon dynamics.

Train and validate the NPZD model for the Adriatic



Mortelmans et al. (2019)



ogs.it





Web app for cloud computation of new added-value data to monitor the environmental status of marine areas.



SERVICES

new!

- Marine Environmental indicator (MEI) generator
- Ocean patterns and ocean regimes indicators
- Storm severity index
- Easy access to carbon data
- Ocean heat content
- Enhance Storm Severity Index (SSI v2)
- Trophic Index (TRIX)
- Marine heat wave
- Temperature and salinity Historical Data
- Mediterranean Sea Physics Reanalysis
- Global Ocean Physics Reanalysis
- Wind speed
- Wind (ERA5) reanalysis
- Global in-situ observation
- Other environmental variables



Cloud Computing Platform (CCP)



Method	Creation time	End time	Data source	Output Type	Area [lon,lat]	Depth [m]	Time range
Ocean Climate	2022-05-19T08:57:05Z	2022-05-19T09:00:18Z	MEIOSEA_MULTYEAR_PHY_D06_D04_BC	annual climatology map - Sea Water Salinity	[2,34]-[20,42]	[0.5, 1000]	1982/1990

sea water salinity (PSU), annual climatology map
1987 - 1990, lon: 23, 30, 36, 42, lat: 0.5, 1000 m

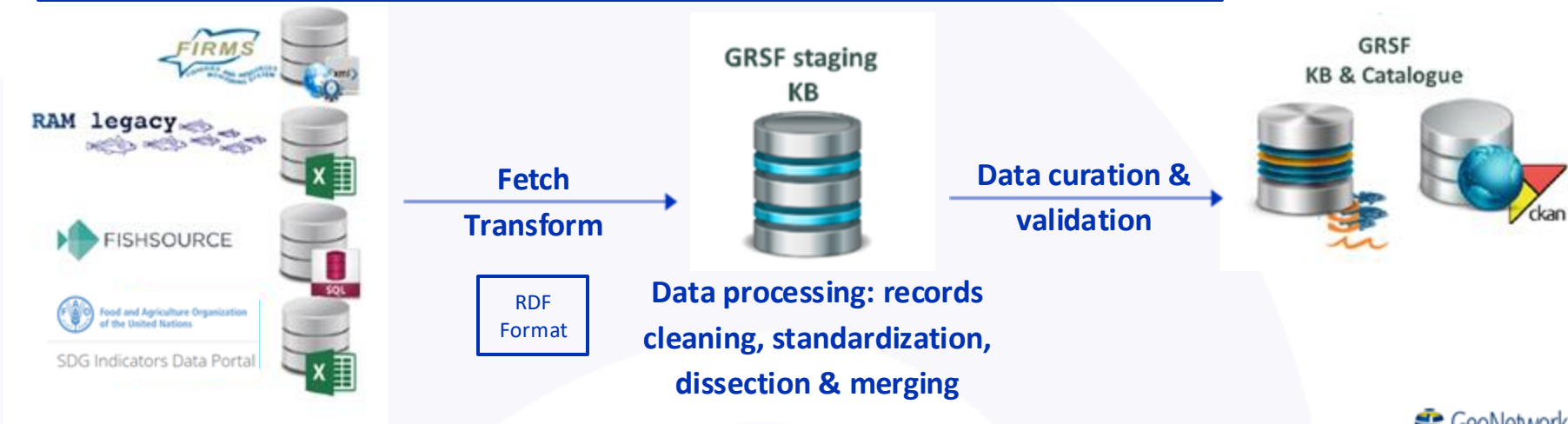
Download range | Download Data | Download (Jupyter Log) | Download Log



Discovery & Access of Global Record of Stocks and Fisheries, and Fisheries Atlas datasets

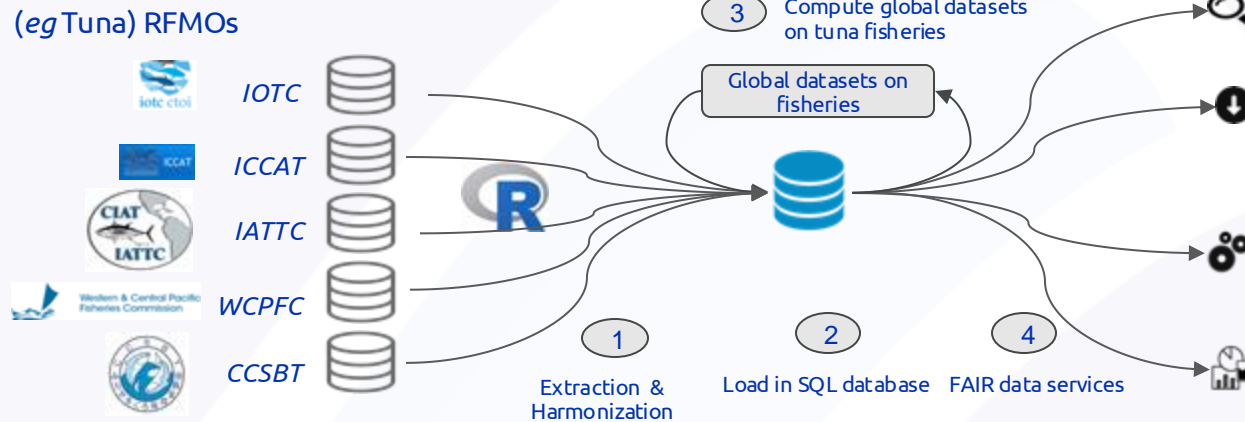


GRSF Catalog
(Knowledge level)



new! Workflows merging

Fisheries Atlas
(data level)



Discover available data
*What datasets exist?
How they were built?*

Access the data and code
Different protocols and formats?

Process the data
How to customize a fisheries atlas?

Visualize the data
How to easily create maps, plots?





Blue-Cloud 2026 Training Academy & Outreach

Our network is further expanding beyond Europe and the Atlantic, with an increased presence at events and via new synergies.

Key events

- 9-12 November 2023 - DITTO Summit **China**
- 14-15 November 2023 - EU-Caribbean Workshop on Marine Scientific Cooperation **Barbados**
- 29-30 November 2023- EMODnet Open Conference **Belgium**
- 11-15 December - AGU 2023 **USA**
- 10-12 April 2024 - Ocean Decade Conference **Spain**
- 14-19 April 2024 - EGU 24 **Austria**
- 27-29 May 2024 - IMDIS **Norway**
- 30-31 May 2024 - EMD **Denmark**



The **Training Academy** offers comprehensive lessons and materials that guide users and marine researchers in utilising Blue-Cloud services. In addition, a dedicated series of webinars focuses on FAIR data management for marine science.

Also thanks to new international partners, our content is reaching specialist audiences in extra-EU countries more than in the previous project.

26 September - 16:00 CEST

Webinar 1 - FAIR Data Principles 1: Foundational components, best practices and standards

6 December – 10.00 CET

Webinar 2 - Optimising FAIRness of federated Blue Data Infrastructures webinar



Past webinars

- 17 March - Blue-Cloud VRE
 - 127 registrants
 - 160 views on YT
- 8 June - Blue-Cloud VLabs
 - 99 registrants
 - 77 views on YT

blue-cloud.org/training-academy

KEY ACHIEVEMENTS

- **online webinars:**
 - 5 organised as open events focused on data FAIRness, Blue-Cloud services
 - 12 as closed meetings for the development of the WBs
- **140+ participants to the 2 latest webinars**
- **47 countries represented**

Webinar FAIR Data Principles 2 Making Marine Data FAIR: FAIR assessment of marine data & information 23 April 2024 16:00-17:45 Online	Ocean Data Quality Assessment through Outlier Detection-enhanced Active Learning 29 January 2024 11:00-12:00 Online	Optimising FAIRness of federated Blue Data Infrastructures webinar 6 December 2023 10:00-12:00 Online
FAIR Data Principles 1: Foundational components, best practices and standards 26 September 2023 16:00-17:00 Online	Copernicus Marine In Situ TAC QC procedure and duplicate check 11 July 2023 11:00-12:00 Online	IOuOD 2023 Workshop 10 July 2023 09:00 - 11 July 2023 17:00 Potsdam, Germany & Online
Machine Learning to Improve and Support Ocean Data Quality Control Training Academy event	webODV for the Physical WorkBench (PWB) Training Academy event	Blue-Cloud VLABs for demonstrating open science - Info session Training Academy event



The training academy webinars organisation is on track with our planned activities

Recent agreement by the Steering Board to structure future Blue-Cloud2026 webinars including VRE webinars as Training Courses.

The migration of **already presented** webinars to an online course structure and self-paced format is also being considered.

Ocean Teacher Global Academy (OTGA) with IEEE will facilitate the planning and structure using OTGA guidelines and standards, to deliver courses fit-for-purpose and with learning resources that can be easily reused.

OTGA is a global network of Regional and Specialised Centres delivering training on ocean sciences, services, and management using the a common e-learning platform.



The OTGA e-Learning Platform will host and deliver the courses under the Blue-Cloud2026 Community and OTGA will use its communication and alumni network (+12.000 learners) to provide additional visibility and increase training impact.

The BC2026 courses will be accessible from the BC2026 Training Academy and UNESCO IOC OceanExpert webpages .



All OceanTeacher content is freely and openly available and is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

The UNESCO/IOC Project Office for IODE is an ISO certified Learning Service Provider.

A [list of training materials](#) has been recently prepared. It contains:

- Factsheets
- Guidelines
- Videos

The development of these materials helps achieve our **KPIs**:

- **Number of use-case scenarios** supported by the prototype implementation >5
- **VLabs Implementation guidelines, technical requirements, VLabs user Handbook** downloaded >200 times



Soon available from the Blue-Cloud Catalogue & website

Potential synergies

Ongoing activities

- The identified synergies help Blue-Cloud strengthen its position in the DTO, Mission Ocean, EOSC and Ocean Observation environments.
- Focus on establish synergies with players outside Europe (e.g. JAMSTEC).
- The Blue-Cloud team is in the process of developing MoUs with the most strategic initiatives (e.g. AquaINFRA, FAIR-EASE).



Useful materials for sharing & distribution

About Blue-Cloud 2026

- [Poster](#)
- [Rollup](#)
- [Blue-Cloud Virtual Labs in support of Sustainable Development Goals](#)
- [Flyer](#)

For dissemination & social media share

- [Communication kit](#)
- [Twitter channel](#)
- [LinkedIn page](#)
- [Youtube account](#)
- [ZENODO account](#)

Blue-Cloud Services

- [In EOSC Marketplace](#)
- [Virtual Research Environment](#)
- [Data Discovery Access](#)
- [Data Catalogue](#)
- [Training Academy](#)

Blue-Cloud Readings

- [Strategic Roadmap](#)
- [Position Paper on EOSC](#)
- [Interfacing Blue Cloud Data Discovery and Access with EOSC](#)
- [Generic publications](#)
- [Newsletters](#)

Blue-Cloud Virtual Labs

- [Plankton Genomics](#)
- [Marine Environmental Indicators](#)
- [Zoo and Phytoplankton EOV products](#)
- [Fish, a matter of scales](#)
- [Aquaculture](#)
- [Carbon-Plankton Dynamics](#)
- [Global Fisheries Atlas](#)
- [Coastal currents from observations](#)
- [Integration of coastal ocean observations along Europe](#)

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[blue-cloud org](https://www.linkedin.com/company/blue-cloud-org)



Funded by
the European Union