Blue-Cloud 2026 in a nutshell

November 2023

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
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

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

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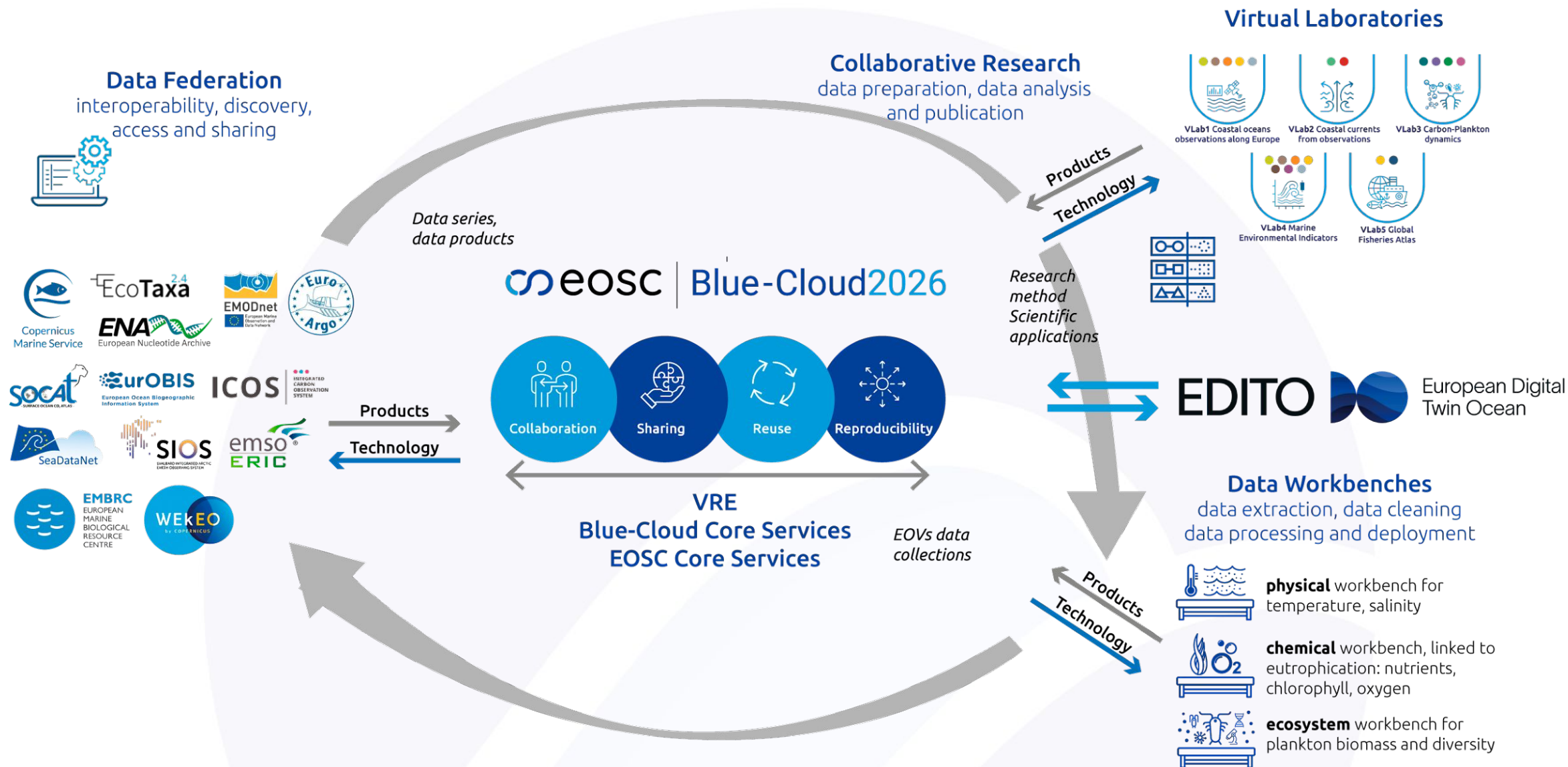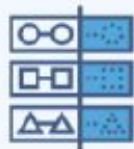
MISSION: To develop further the European federation of marine and inland water data management infrastructures & high quality services

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 EOV 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 & EOV 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 EOV 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

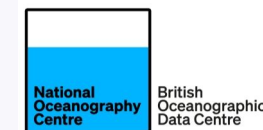**DTO Task Force**

Blue-Cloud 2026 core services
VRE & Data Discovery & Access Services - status today

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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:
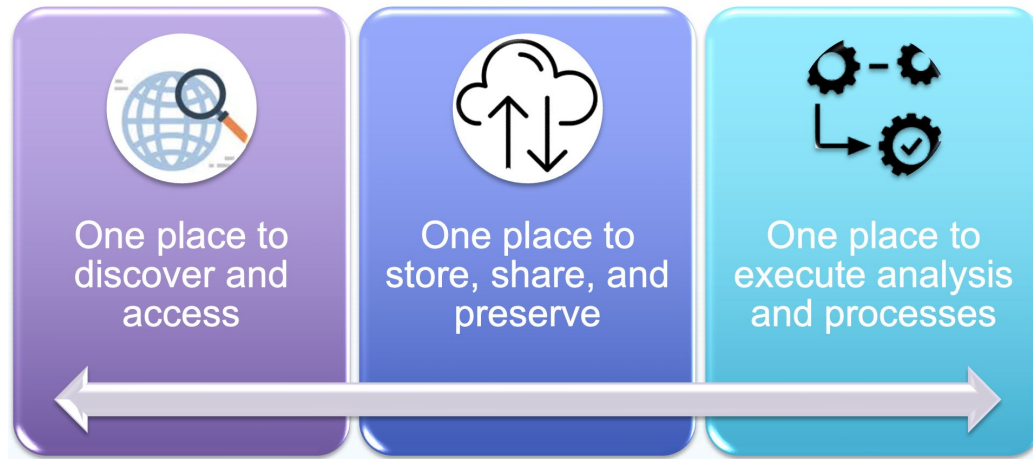 Wider outreach to potential users
  Stay informed about data requests and users for their repository
  Periodic reporting of downloads from their repository

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 EOV Work Benches

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One place to discover and access

One place to store, share, and preserve

One place to execute analysis and processes

Support researchers and scientists in doing science

Without
- forcing specific approaches and technologies
- asking to focus on matters other than their science

By
- enriching their activities with the information that enables sharing and reuse of their scientific workflows
- making their research objects ready for publication

Virtual Laboratories

Data sharing
- Workspace
- Dataspace
- Repositories

Data analytics
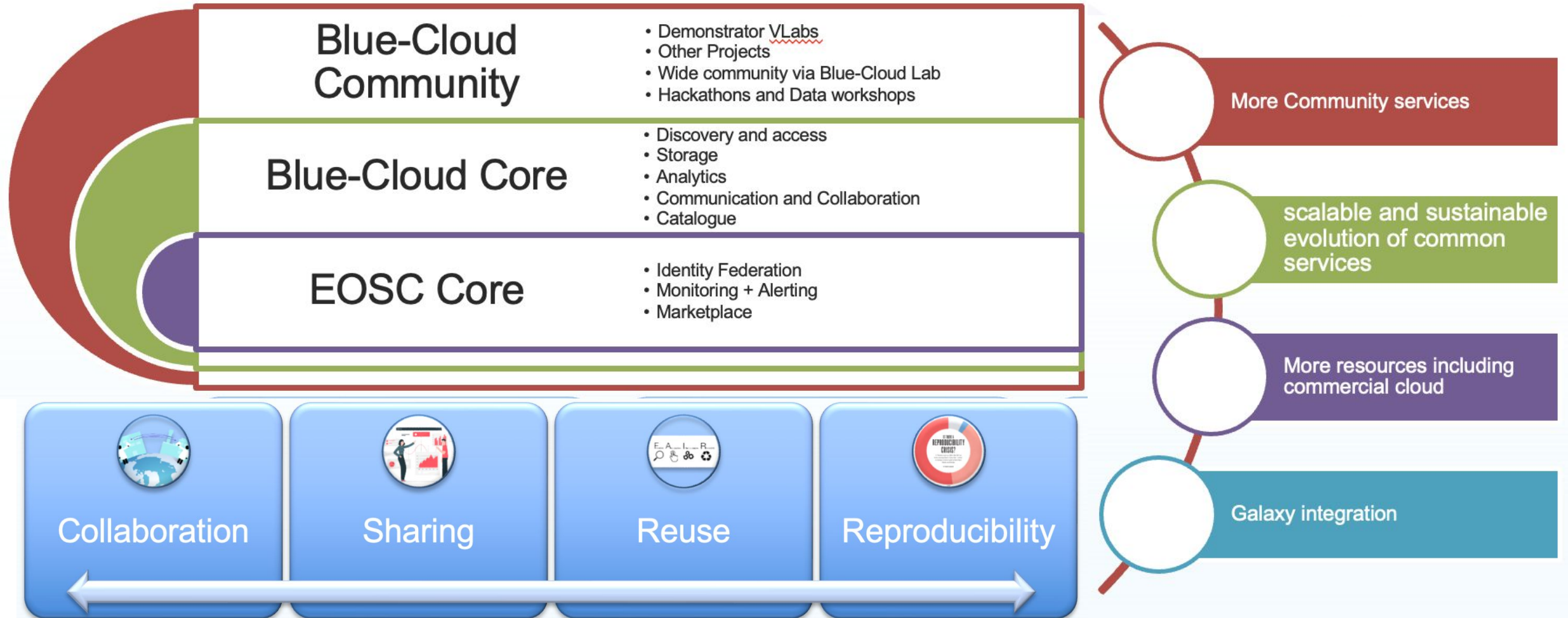- High Throughput Computing
- Notebook
- RStudio

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 Community
- Demonstrator VLabs
- Other Projects
- Wide community via Blue-Cloud Lab
- Hackathons and Data workshops

Blue-Cloud Core
- Discovery and access
- Storage
- Analytics
- Communication and Collaboration
- Catalogue

EOSC Core
- Identity Federation
- Monitoring + Alerting
- Marketplace

More Community services

scalable and sustainable evolution of common services

More resources including commercial cloud

Galaxy integration

Collaboration

Sharing

Reuse

Reproducibility

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)

WOD

Copernicus Marine Service

EMODnet

SeaDataNet

metadata info
dataset 1

metadata info
dataset 2

metadata info
dataset n

- interactive data navigation and visualization
- metadata harmonization
- Integration of data
- duplicates detection removal
- further Quality Control

webODV   jupyter   ML/AI

added value T and S datasets

WP2
WP5

Implementation, Testing and Optimization

test region   global

Integrated dataset

duplicate detection and QC

Machine learning/AI

T&S data product

collaboraborative framework

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**
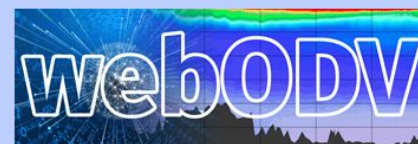
Blue Cloud Eutrophication data products

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**

January
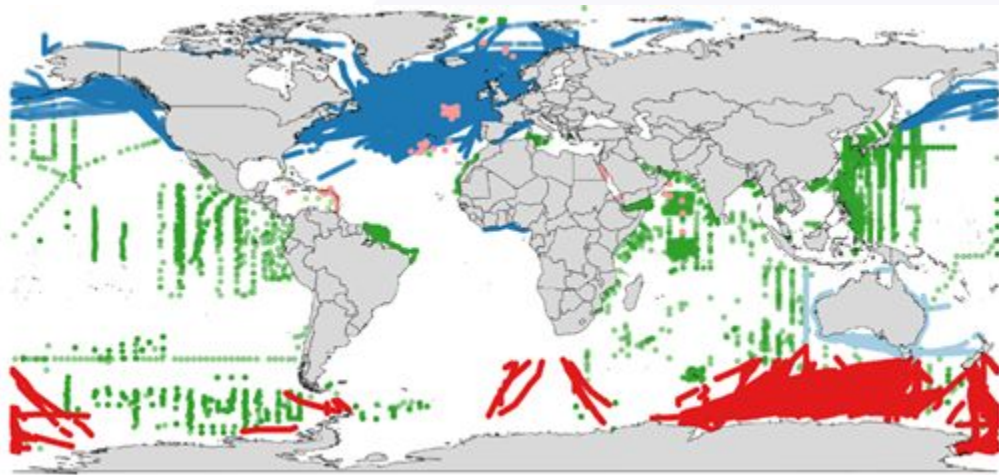
Data
(raw foraminifera biomass observations, multiple sources)
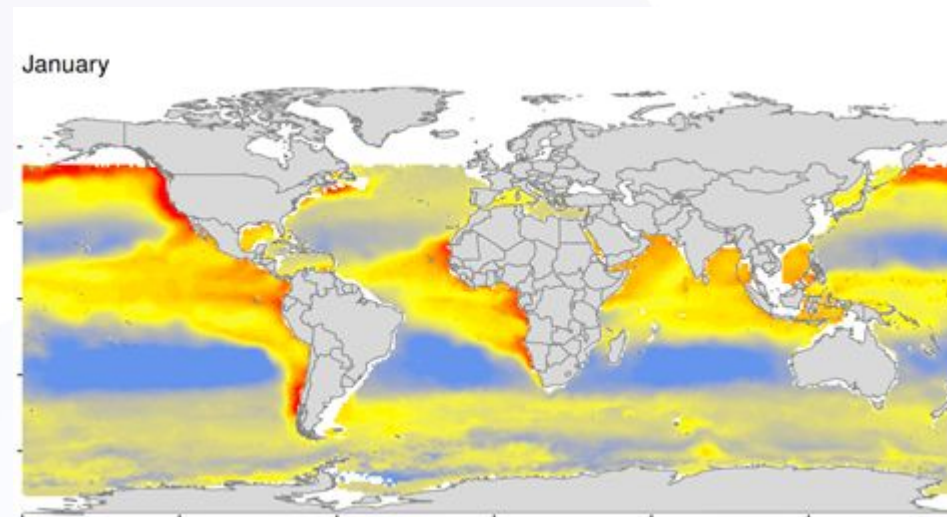
Knowledge
(integrated, quality- and bias-corrected biomass fields)

Blue-Cloud 2026 Virtual Labs

Coastal currents from observations

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

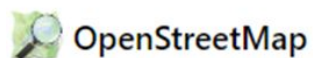Copernicus Marine Service

Jupyter notebooks
DIVAnd analysis

Gridded surface currents

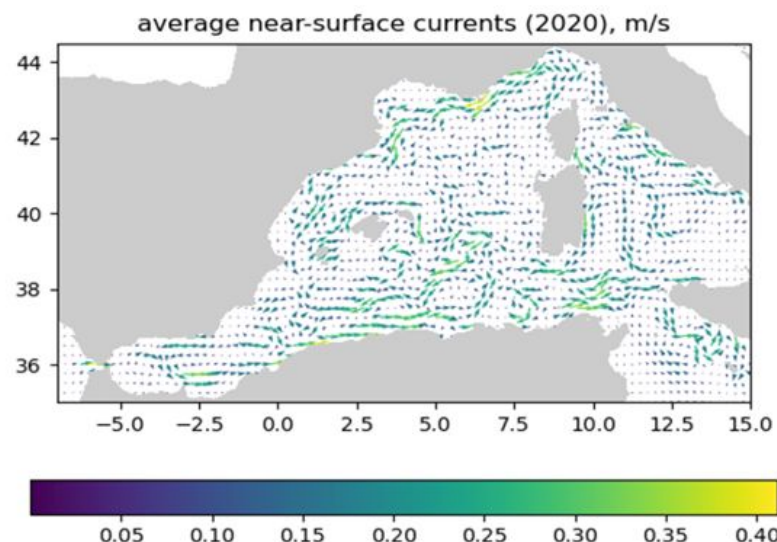Initialise the oil spill forecasting model (MEDSLIK-II)
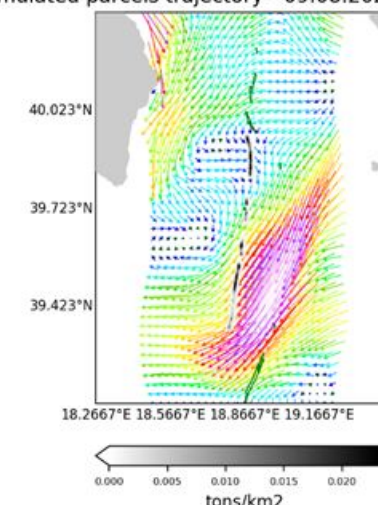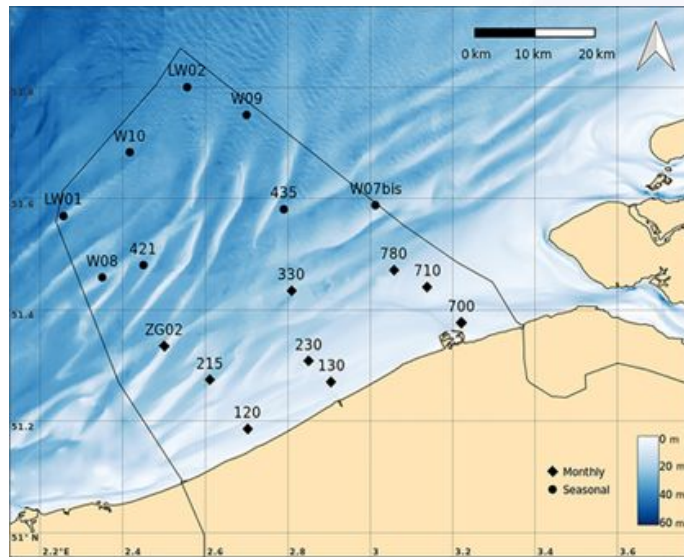
EMODnet
GEBCO — Bathymetry

OpenStreetMap — Coastline

ECMWF — Wind speed

average near-surface currents (2020), m/s

SANIFS + ECMWF (1% wind drift)
Simulated parcels trajectory - 09.08.2020 17:00 UTC

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

Seasonal and monthly records from 2011-2022

Train and validate the NPZD model for the Adriatic

Mortelmans et al. (2019)

new!

ogs.it

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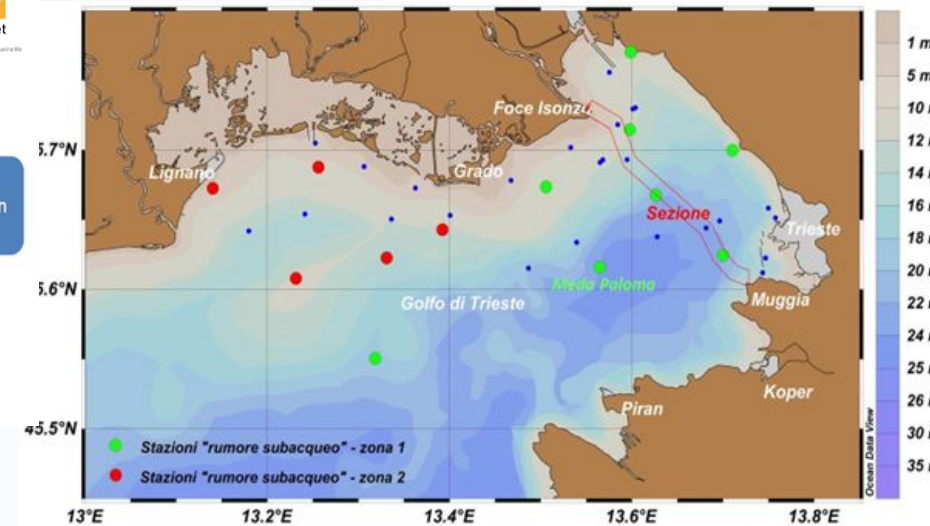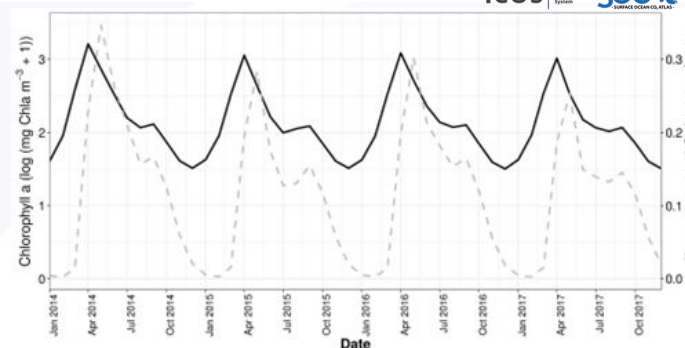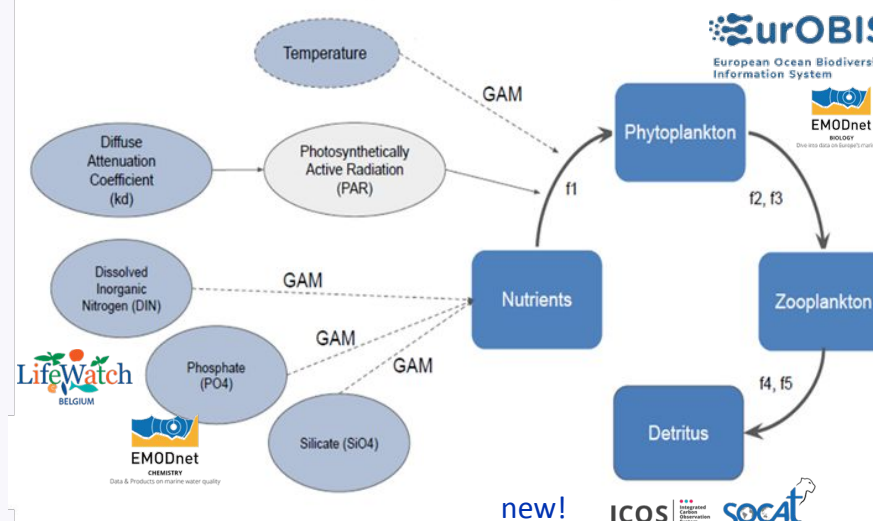
Marine Environmental Indicators

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

SERVICES

- 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) *new!*
- 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

Copernicus Marine Service

WEkEO
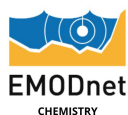
EMODnet
CHEMISTRY
Data & Products on marine water quality

jupyter
Cloud Computing Platform (CCP)

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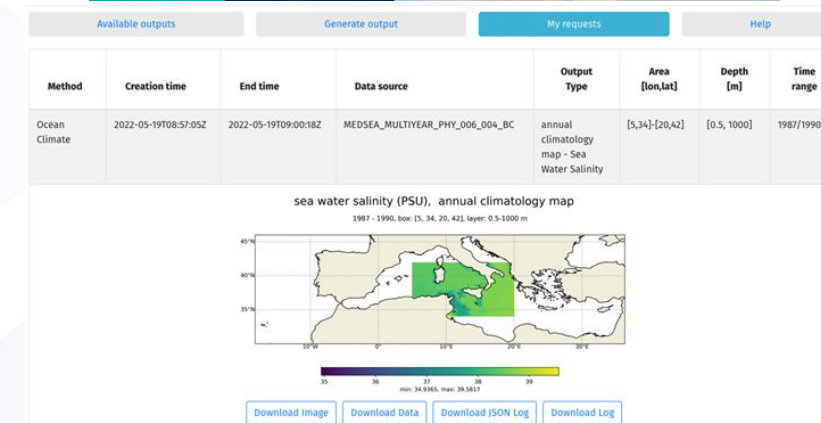
Discovery & Access of Global Record of Stocks and Fisheries, and Fisheries Atlas datasets

GRSF Catalog (Knowledge level)

FIRMS

RAM legacy

FISHSOURCE

FAO Food and Agriculture Organization of the United Nations

SDG Indicators Data Portal
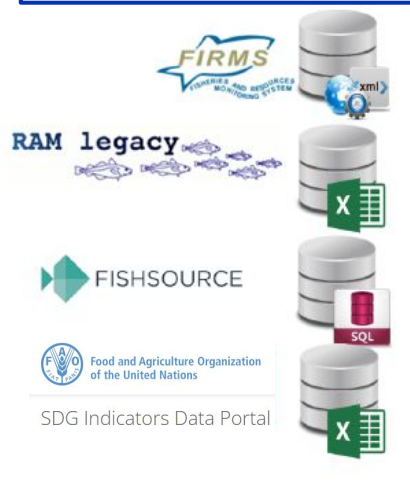
Fetch Transform

RDF Format

GRSF staging KB

Data processing: records cleaning, standardization, dissection & merging

Data curation & validation

GRSF KB & Catalogue

ckan

new! Workflows merging

Fisheries Atlas (data level)

(*eg* Tuna) RFMOs

IOTC

ICCAT

IATTC

WCPFC

CCSBT

3 Compute global datasets on tuna fisheries

Global datasets on fisheries
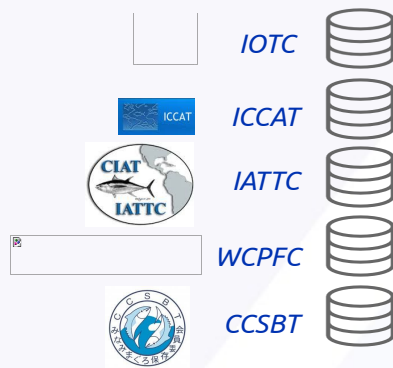
1 Extraction & Harmonization

2 Load in SQL database

4 FAIR data services

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?

GeoNetwork

GeoServer

zenodo

GitHub

RStudio

doi

OpenLayers

Shiny

Blue-Cloud 2026 Training Academy & Outreach

Expanding the Blue-Cloud online and offline presence. Consolidating Blue-Cloud's role in the EOSC community as an example for younger projects.

Key indicators

- **14300+** sessions on the website
- **2700+** combined followers on social media (target 3000 by December 2023)
- **900+** newsletter contacts - Newsletter client moved to EU-based Mailjet
- **28** events were Blue-Cloud was involved
- **8** new video interviews and **1** promotional video published in 2023

Key actions

- Launched **new website** in July 2023
- Taking part in **monthly meetings** on communications with EOSC Focus and other EOSC HE projects
- Active member of the official **EOSC Forum** online platform to promote news and events
- Presented Blue-Cloud 2026 **poster** at EOSC National Tripartite Event in Italy
- Presenting a Blue-Cloud 2026 **printed brochure** at the OSFAIR 2023
- Preparing Blue-Cloud presence at events **spread worldwide**
- Communication, Dissemination & Outreach plan delivered by March 2023

Where we have been…till October 2023 (sample)

1. AquaINFRA Kick-off Conference and Open-day - **Copenhagen, Denmark**
2. Economist Impact - World Ocean Summit & Expo - **Lisbon, Portugal**
3. From data interoperability to data spaces in the aquaculture domain - **Online**
4. EGU 2023 - **Vienna, Austria**
5. European Maritime Day EMD 2023 - **Brest, France**
6. EOSC National Tripartite Event Italy - **Rome, Italy**
7. Copernicus Marine General Assembly 2023 - **Brussels, Belgium**
8. OCEANS 2023 - **Limerick, Ireland**
9. Science – Industry workshop on Ocean Biodiversity Data - **Online**
10. EGI Conference 2023 - **Poznan, Poland**
11. The Ocean Race Grand Finale / Ocean Data Week - **Genova, Italy**
12. IQuOD 2023 Workshop - **Potsdam, Germany**
13. FNS-Cloud Final Event - **Brussels, Belgium**
14. EOSC Symposium 2023 - **Madrid, Spain**
15. EuroSea Symposium on Ocean Observing and Forecasting - **Paris, France**
16. Open Science FAIR 2023 - **Madrid, Spain**
17. EuroGOOS Conference 2023 - **Galway, Ireland**

Presentations, Posters, Panel discussions

Reached different stakeholders across Europe (10 different countries)

Presence at Marine/Blue Economy, Open Science & Technical Events

Leveraring on partners network and established synergies

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

Key upcoming events…

- 9-12 November - DITTO Summit **China**
- 14-15 November - EU-Caribbean Workshop on Marine Scientific Cooperation **Barbados**
- 29-30 November - EMODnet Open Conference **Belgium**
- 11-15 December - AGU 2023 **USA**

Preparing presence for…
- 10-12 April 2024 - Ocean Decade Conference **Spain**
- 14-19 April 2024 - EGU 24 **Austria**
- 27-29 May 2024 - IMDIS **Norway**

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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.

Blue-Cloud
Training
Academy

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

Findable **A**ccessible **I**nteroperable **R**eusable

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

- 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