eosc | Blue-Cloud2026

Exploring and demonstrating the potential of Open Science for ocean sustainability

EOSC Collaboration meeting
15 -16 June 2023

Sara Pittonet Gaiarin (Trust-IT), Pasquale Pagano (CNR-ISTI)

Blue-Cloud Coordinators

Funded by the European Union

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** which established a pilot cyber platform, providing researchers access to multi-disciplinary datasets from observations, analytical services, and computing facilities essential for blue science.

Blue-Cloud 2026 aims at a further evolution of 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.

HORIZON-INFRA-2022-EOSC-01 | RIA - Research and Innovation action
https://cordis.europa.eu/project/id/101094227
https://blue-cloud.org

Blue-Cloud2026 in a Nutshell

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-Cloud2026 consortium

A solid, multidisciplinary, committed team of **40** partners from 13 EU countries

SRIA Obj 2: Enable the definition of standards, and the development of tools and services, to allow researchers to find, access, reuse and combine results

Priorities supported by Blue-Cloud2026 are:

European level priorities:

B. *Advance technical specifications to support digital objects to be FAIR and evaluate viable options to adopt the concept for operational data services. The publication of FAIR digital objects should also be promoted and incentivised.(2025)*

C. *Continue to invest in the creation, adoption and governance of community-based metadata and data standards to support the discovery, interoperability and reuse of research data and software.*

D. *Continue to develop and maintain open interfaces, alignments, crosswalks, and APIs that enable interoperability and foster adoption of EOSC. The EOSC Interoperability Framework should facilitate the automated composition of EOSC data and services.*

E. *Evaluate the viable options to provide European and international researchers with a platform for software through development, preservation and reuse, most likely as a federated network of software repositories.*

F. *Focus on community-specific FAIR metrics and data quality constraints (especially on the interoperability of these) by engaging with research clusters to apply FAIR in their contexts*

Institutional level priorities

L. *Support research communities to adopt both general and domain-specific standards to increase adoption of FAIR practices and reuse.*

M*. Develop procedures and support for publishing semantic artefacts through institutional or vocabulary specific thematic repositories.*

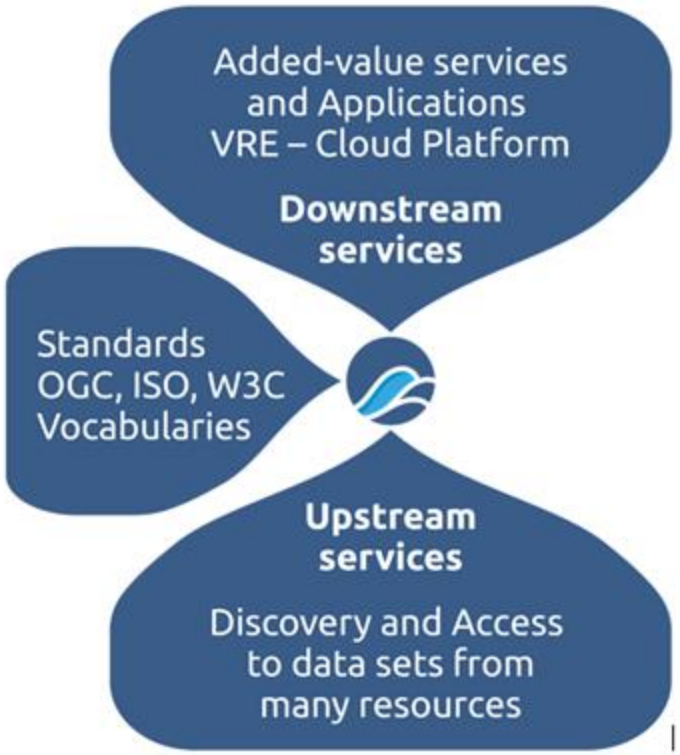
N. *Encourage sharing of software through institutional or thematic repositories.*

Blue-Cloud2026 Key Contributions to EOSC SRIA

SRIA Obj 2: Enable the definition of standards, and the development of tools and services, to allow researchers to find, access, reuse and combine results

Blue-Cloud2026 is

- Developing and deploying a **Virtual Research Environment (VRE)** with an array of services for configuring and running virtual labs for specific analytical workflows, use cases and demonstrators
- Applying **common standards and interoperability solutions** for providing harmonized metadata and data
- Developing and deploying **harmonized discovery and access** to established European marine data management and processing infrastructures



Blue-Cloud2026 Key Contributions to EOSC SRIA

SRIA Obj 2: Enable the definition of standards, and the development of tools and services, to allow researchers to find, access, reuse and combine results

The Blue-Cloud Data Discovery & Access service is a one-stop-shop with a common interface to data sets and data products from many leading Blue Data Infrastructures , which has potential for further expansion. It facilitates discovery and retrieval of data sets and data products for external users in stand-alone mode, and for users of the VRE through connectivity.
These data sets are managed in the blue data infrastructures that are connected to the Blue-Cloud service to serve federated discovery and access.
The currently federated Blue Data Infrastructures are: EMODnet Chemistry, EurOBIS, SeaDataNet, EuroArgo and Argo GDAC, ELIXIR-ENA, EcoTaxa, ICOS-Marine and SOCAT. More will be federated by 2026 (SIOS, EMSO-ERIC, WEkEO, EMBRC)

Blue-Cloud2026 Key Contributions to EOSC SRIA

SRIA Obj 2: Enable the definition of standards, and the development of tools and services, to allow researchers to find, access, reuse and combine results

- **Benefits for 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
- **Benefits for 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

WP2

Blue-Cloud2026 Key Contributions to EOSC SRIA

SRIA Obj 2: Enable the definition of standards, and the development of tools and services, to allow researchers to find, access, reuse and combine results

Compose and submit shopping request at the granule level

Retrieve the datasets by downloading from the Dashboard

Push datasets to the Blue-Cloud VRE Data Pool

SRIA Obj 3: Establish a sustainable and federated infrastructure enabling open sharing of scientific results

Priorities supported by Blue-Cloud2026 are:

European level priorities:

A. *By the end of 2025 a sustainable initial EOSC Core should be up and running and thereafter further enhanced and extended to support emerging and challenging use cases. The new technologies implemented need to be continually tested to ensure EOSC is fit-for-purpose.*

B. *Enhance the federation model of EOSC by defining a harmonised operational and legal framework to facilitate the sharing and the access of data and services across European countries.*

C. *Develop a user driven mechanism to determine a selection of most needed horizontal and thematic services (2025) which can serve as a pilot for the centrally financed service portfolio for the period after Horizon Europe.*

D. *EOSC should continue to utilise and build on existing AAI, as provided by national and regional AAI Federations. From 2027 onwards, EOSC will remain a major stakeholder in the pan-European AAI for research and education and will actively contribute with requirements, use cases and participation in standardisation activities.*

E. *Continue to maintain and enhance the EOSC common search and access engine for FAIR research objects, including multilingual functionality and Search Engine Optimisation.*

F. *Develop a maturity model for cross-domain semantic interoperability and support for semantic artefact catalogues.*

G. *Dependable semantic artefact catalogues should be part of the EOSC core, akin to how vocabularies are published by the EC publications Office at EU Vocabularies.*

H. *Compliance monitoring of the EOSC Rules of Participation shall be machine-actionable as much as possible to facilitate the scalability as well as reducing the cost of implementing and monitoring the rules.*

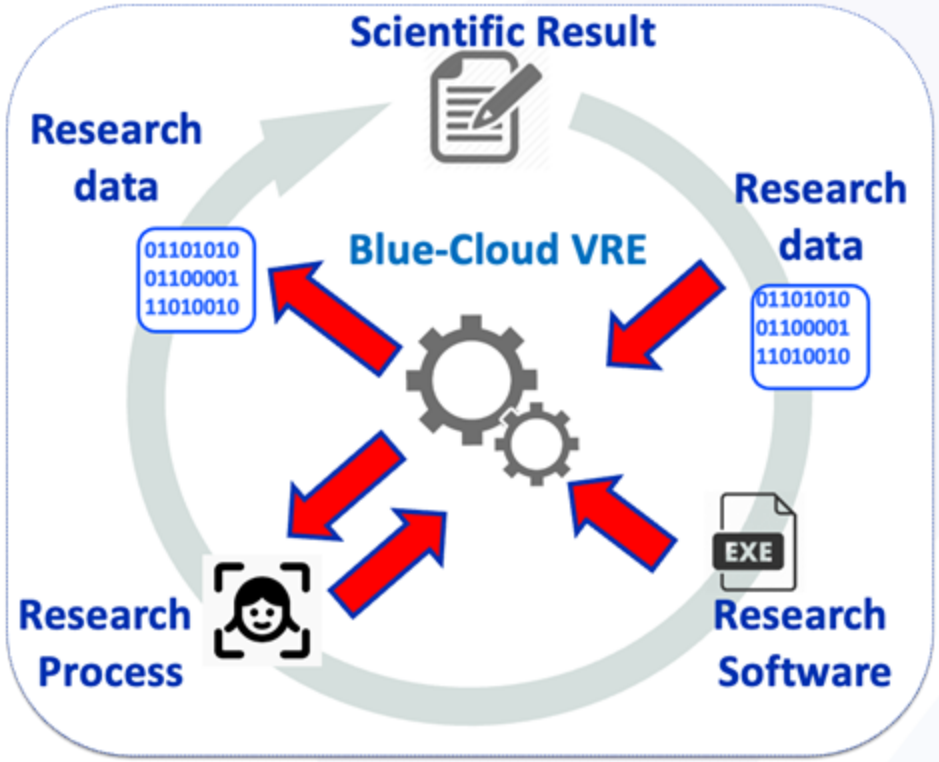
Institutional level priorities

T. *Encourage institutional repositories to become machine-actionable and recommend that research communities deposit data in machine-actionable repositories.*

SRIA Obj 3: Establish a sustainable and federated infrastructure enabling open sharing of scientific results

The Blue-Cloud Open Science platform is introducing a “de facto” federation taking place at 3 levels: the data, the computing resources and the analytical services.
For each of them Blue-Cloud orchestrates mechanisms that successfully establish interoperability and resulted in a Data Discovery and Access Service, the Virtual Research Environment and Virtual Laboratories & Data Workbenches providing access to different data services.

SRIA Obj3: Establish a sustainable and federated infrastructure enabling open sharing of scientific results



The **Blue-Cloud VRE** federates infrastructures as a ***System of Systems*** and enables open sharing of scientific results through the ***support and promotion of Open Science practices*** for Data Driven Science

The Blue-Cloud **Open Science platform** enables

- Repeatability, Reproducibility, Reusability
- Active collaboration
- Effective sharing
- Automatic generation of Provenance and Attribution information
- Sustainability ensured by D4Science eInfrastructure

WP5

Blue-Cloud2026 Key Contributions to EOSC SRIA

SRIA Obj3: Establish a sustainable and federated infrastructure enabling open sharing of scientific results

- To **expand** and **further develop** the functionalities of the Blue-Cloud VRE by federating more analytical services and more e-infrastructures
- To stimulate further **uptake and utilisation** of the Blue-Cloud VRE services and capabilities for developing Virtual Labs by Blue Data Infrastructures
- To **ensure long-term EOSC integration**, alignment and growth of the EU digital ecosystem required to support research of Oceans, seas, coastal & inland waters via sustained mechanisms for community dialogue

SRIA Obj3: Establish a sustainable and federated infrastructure enabling open sharing of scientific results

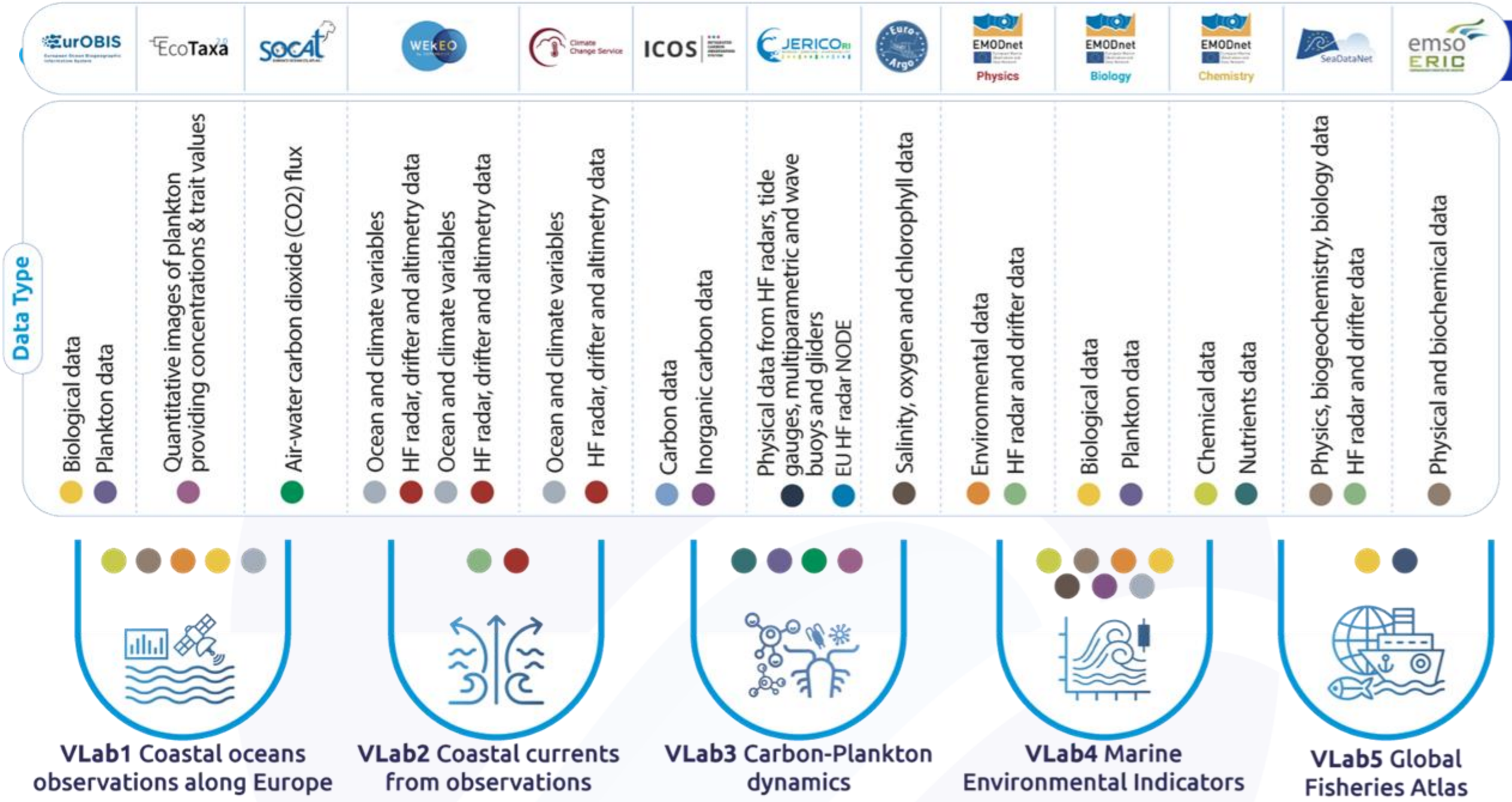
Blue-Cloud 2026 is rolling-out ***cross-domain, strategic use cases*** under the VLabs: a) **ICOOE: Unlocking the potential for integration of Coastal Ocean Observations along Europe; b) Coastal currents from observations; c) Carbon-Plankton Dynamics; d) Marine Environmental Indicators; e) Global Fisheries Atlas.**

- VLabs become available in the **EOSC portal & integrated with EOSC core services**.
- Vlabs make use of **marine multidisciplinary data** from BDIs and other resources, offering **innovative data products** and **analytical tools** in the Blue Cloud VRE, demonstrating the added-value of FAIR web-based open science.
- The demonstrators that can actively contribute to the UN SDGs, their services and datasets have been used and integrated in products part of the **offer of long-term Blue Data Infrastructures such as EMODnet Biology/EurOBIS, CMEMS, SeaDataNet, GEBCO, the World Ocean Atlas.** Products can be accessed from **external platforms** to maximise the exploitation of the results (Copernicus, IRD and FAO)

WP3 & WP4

Blue-Cloud 2026 is developing, validating, and documenting new analytical Big Data **WorkBenches**

- to be adopted by **EMODnet, CMEMS,** and selected RIs for producing at a regular interval a set of harmonised and validated **data collections** for a selection of **Essential Ocean Variables (EOVs)** in physics, chemistry, and biology,
- resulting in high quality EOV collections, instrumental for analysing the state of the environment as undertaken by EMODnet and Copernicus Marine, use by wider research community, and numerical simulations as planned by the Digital Wins of the Oceans (DTO).


EurOBIS
EcoTaxa
SOCAT
WEKEO
Climate Change Service
ICOS
JERICO RI
Euro-Argo
EMODnet Physics
EMODnet Biology
EMODnet Chemistry
SeaDataNet
emso ERIC
Data Type
Biological data
Plankton data
Quantitative images of plankton providing concentrations & trait values
Air-water carbon dioxide (CO2) flux
Ocean and climate variables
HF radar, drifter and altimetry data
Ocean and climate variables
HF radar, drifter and altimetry data
Ocean and climate variables
HF radar, drifter and altimetry data
Carbon data
Inorganic carbon data
Physical data from HF radars, tide gauges, multiparametric and wave buoys and gliders
EU HF radar NODE
Salinity, oxygen and chlorophyll data
Environmental data
HF radar and drifter data
Biological data
Plankton data
Chemical data
Nutrients data
Physics, biogeochemistry, biology data
HF radar and drifter data
Physical and biochemical data
VLab1 Coastal oceans observations along Europe
VLab2 Coastal currents from observations
VLab3 Carbon-Plankton dynamics
VLab4 Marine Environmental Indicators
VLab5 Global Fisheries Atlas

SRIA Obj1: Ensure that Open Science practices and skills are rewarded and taught, becoming the 'new normal

Institution level priority P. "Define and implement training and procedures to select data, software, and other research outputs that retain the value necessary to be preserved via EOSC"

The Blue-Cloud Data Discovery and Access service makes use of web services and APIs, following protocols such as CSW, OAI-PMH, ERDDAP, or otherwise, as provided and maintained by the BDIs. These are used to deploy machine-to-machine interactions for harvesting metadata, submitting queries, and retrieving resulting metadata, data sets and data products

WP2

SRIA Obj1: Ensure that Open Science practices and skills are rewarded and taught, becoming the 'new normal'

High level contribution to OS practices and Skills:

Blue-Cloud Training Academy

- gather, prepare, and publish **guidance** documents and training materials, aimed at informing and training original data providers on how to make best use of RIs and other data repositories in the European marine landscape for long term stewardship and for providing access of their original data sets for wider use, increasing the FAIRness of data submissions and potentially expanding the RI networks of structural data providers.
- providing **online modules on training in the use of the Blue-Cloud 2026 data services, VLabs, and VRE**
- In collaboration with Ocean Best Practices (OBPS), IODE OceanTeacher, and EuroGOOS.

WP6

Blue-Cloud Hackathons

- Interesting and engaging events for data scientists and marine researchers as the new generation of scientists and data professionals

Key Impacts and deliverables

- **FAIR compliant DD&AS, with 14 Blue Data Infrastructures federated via DD&AS**
- **Open Science VRE federating multiple e-Infrastructures** via the federation of multiple e-infrastructures and integrating more analytical services, also in cooperation with other EOSC projects (e.g. EGI-ACE, iMAGINE, FAIR-EASE).
- **3 EOV WorkBenches in** physics, chemistry, and biology
- **5 Virtual Labs:**
  - ICOOE: Unlocking the potential for integration of Coastal Ocean Observations along Europe
  - Coastal currents from observations
  - Carbon-Plankton Dynamics
  - Marine Environmental Indicators
  - Global Fisheries Atlas
- **Training academy** gathering documentation from BDIs on standards and services, and preparing various training modules around FAIR Practices, and use of BDIs and Blue-Cloud platform and services.
- **Blue Strategic Roadmap**
- **DTO Task Force**

Dependencies and Collaborations

Data discovery & VRE

Copernicus Marine Service
EcoTaxa 2.5
EMODnet
ENA European Nucleotide Archive
Euro-Argo
SOCAT
EurOBIS European Ocean Biodiversity Information System
ICOS Integrated Carbon Observation System
SeaDataNet
FAIR-EASE
EGI-ACE
iMagine

Virtual labs, data services & data streams

PLOCAN consorcio PLATAFORMA OCEÁNICA DE CANARIAS
Gobierno de Canarias
FAIR-EASE
JERICO-CORE
PHIDIAS
ICOS Integrated Carbon Observation System
DITTO Digital Twins of the Ocean
LifeWatch BELGIUM
DIGITAL TWIN OCEAN

Synergies

MoU AQUA-LIT
MoU jonas Joint Framework for Ocean Noise in the Atlantic Seas
MoU JERICO RI
MoU EuroSea
Cos4Cloud
DOORS BLACK SEA
FNS-Cloud Food Nutrition Security
AtlantECO Atlantic Ecosystems Assessment, Forecasting & Sustainability
CoastObs
ENVRI FAIR
BUILDING AN ALL ATLANTIC OCEAN COMMUNITY Implementing the Belém Statement
FAIR-EASE
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The Marine Thematic EOSC

Blue-Cloud 2026 aims at a further evolution of this pilot ecosystem into a **Federated European Ecosystem** to deliver FAIR & Open data and 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, serving the needs of the EU Blue Economy, Marine Environment and Marine Knowledge agendas.

Blue Cloud 2026 will contribute by mobilising and making available major additional data resources next to those already managed by CMEMS and EMODnet. The **Blue-Cloud Data Lakes** will be instrumental for the planned dynamic data exchanges between the Blue-Cloud ecosystem of federated Blue Data Infrastructures and the DTO under development.

The expectation is for Blue-Cloud to become an essential component in the European marine data landscape, ensuring a **long-term sustainable eInfrastructure (VRE**) coupled with interoperable data services, at disposal of other thematic communities.

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Data Spaces

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