Blue-Cloud

Piloting innovative services for Marine Research & the Blue Economy

Planned Blue-Cloud 2026 activities towards Digital Twin of the Oceans

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Ocean Best Practices Workshop VI
October 2022

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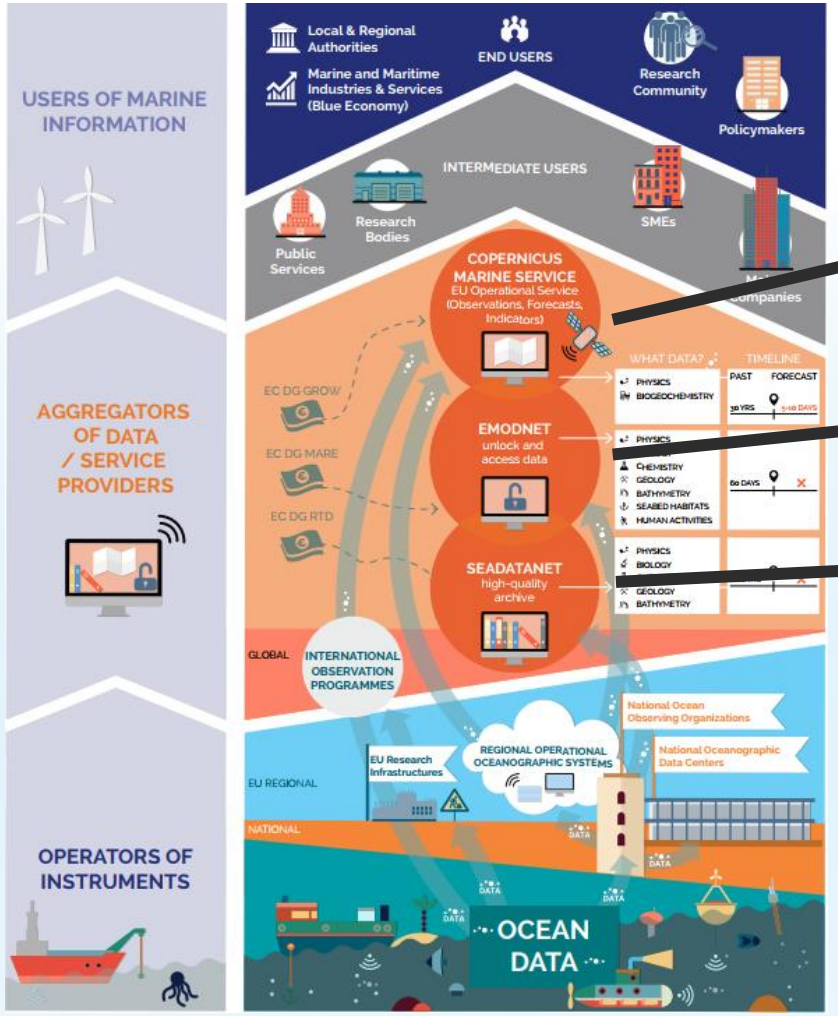
Acquisition of marine and ocean data

Image source: GOOS

- Scientific Research to gain knowledge and insight
- Modelling (including hindcast, nowcast, forecast)
- Economic activities: shipping, offshore industry, dredging industry, fisheries, tourism, engineering ..
- Environmental Management: monitoring and assessment (water quality, climate status, stock assessment)
- Marine Conventions and Directives, in Europe: Water Framework Directive (WFD), Marine Strategy (MSFD), Marine Spatial Planning (MSP), Coastal Zone Management
- EU Strategies, such as Green Deal, Blue Environment, Blue Economy

European landscape marine data management



EuroGOOS European Global Ocean Observing System

EurOBIS European Ocean Biogeographic Information System

Copernicus Marine Service

ICOS Ocean Thematic Centre

emso ERIC

EMODnet European Marine Observation and Data Network

elixir

ICES CIEM

PANGAEA.

SeaDataNet

Euro Argo

ENA European Nucleotide Archive

EGDI

Data aggregators and providers of data products and services

EU H2020 Blue-Cloud project

Blue-Cloud Mission 2022

"to promote the sharing of *data, processes and research findings* in the marine domain by delivering a collaborative web-based environment that enables *open science*, underpinned by simplified access to an unprecedented wealth of marine data resources and interoperable added-value services and products"

Marine thematic contribution to European Open Science Cloud (EOSC)

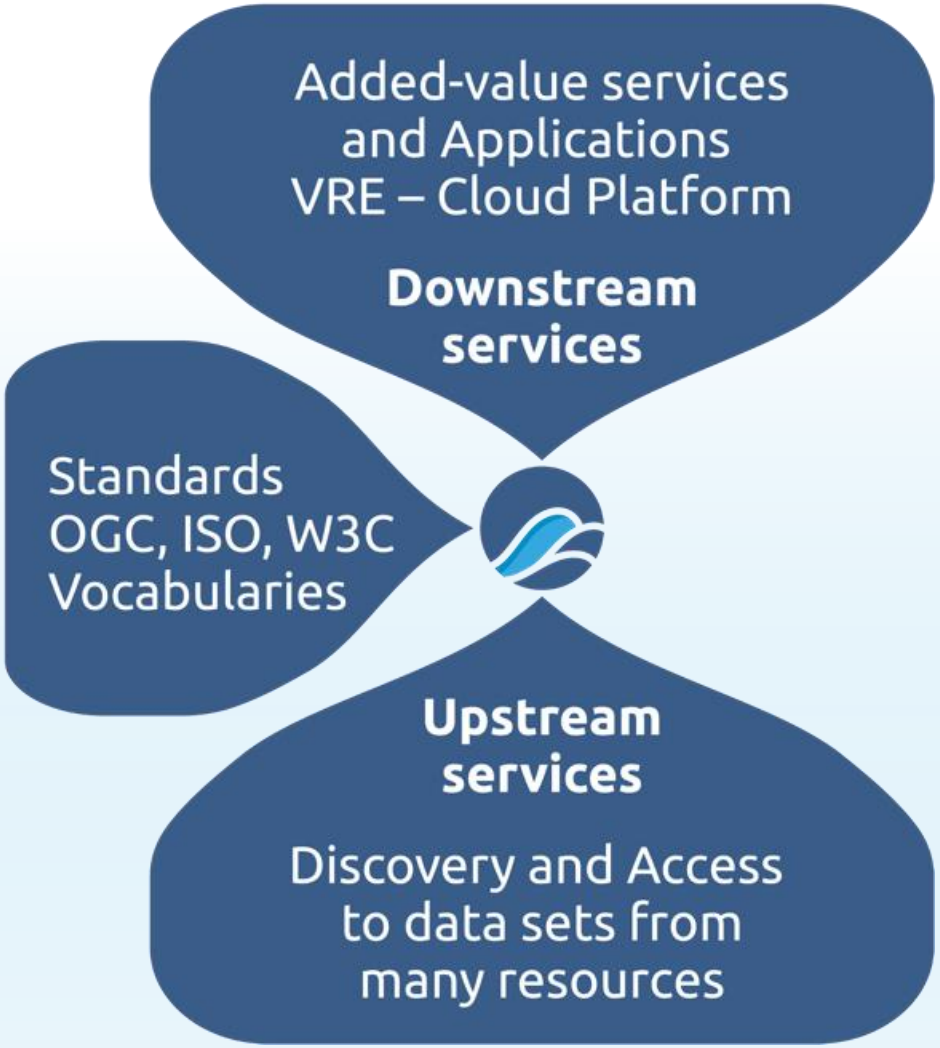
October 2019 – March 2023; 20 partners

Blue-Cloud overarching concept

- Developing and deploying 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-Cloud federation of major infrastructures

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EurOBIS
European Ocean Biogeographic Information System

WEkEO by COPERNICUS

SeaDataNet

EMODnet
European Marine Observation and Data Network

elixir

Euro Argo

EURO-BIOIMAGING

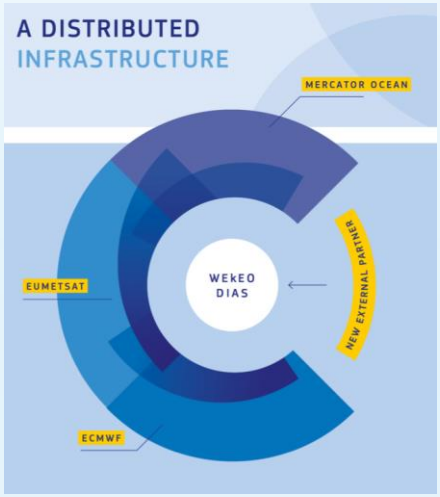
ENA
European Nucleotide Archive

ICOS Ocean Thematic Centre

EcoTaxa ßETA

Blue Data infrastructures

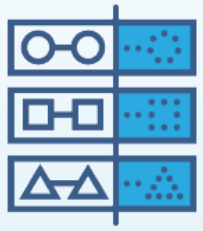
D4SCIENCE INFRASTRUCTURE



EUDAT

E-infrastructures

Key products and services



- **Blue-Cloud Data Discovery & Access service**, federating key European data management infrastructures, to facilitate users in finding and retrieving multi-disciplinary datasets from multiple repositories
- **Blue-Cloud Virtual Research Environment infrastructure** to provide a range of services and to facilitate orchestration of computing and analytical services for constructing, hosting and operating Virtual Labs for specific applications
- **Blue-Cloud Virtual Labs**, configured with specific analytical workflows to serve as **Demonstrators,** which can be adopted and adapted for other inputs and analyses

Blue-Cloud VRE

Collaboration

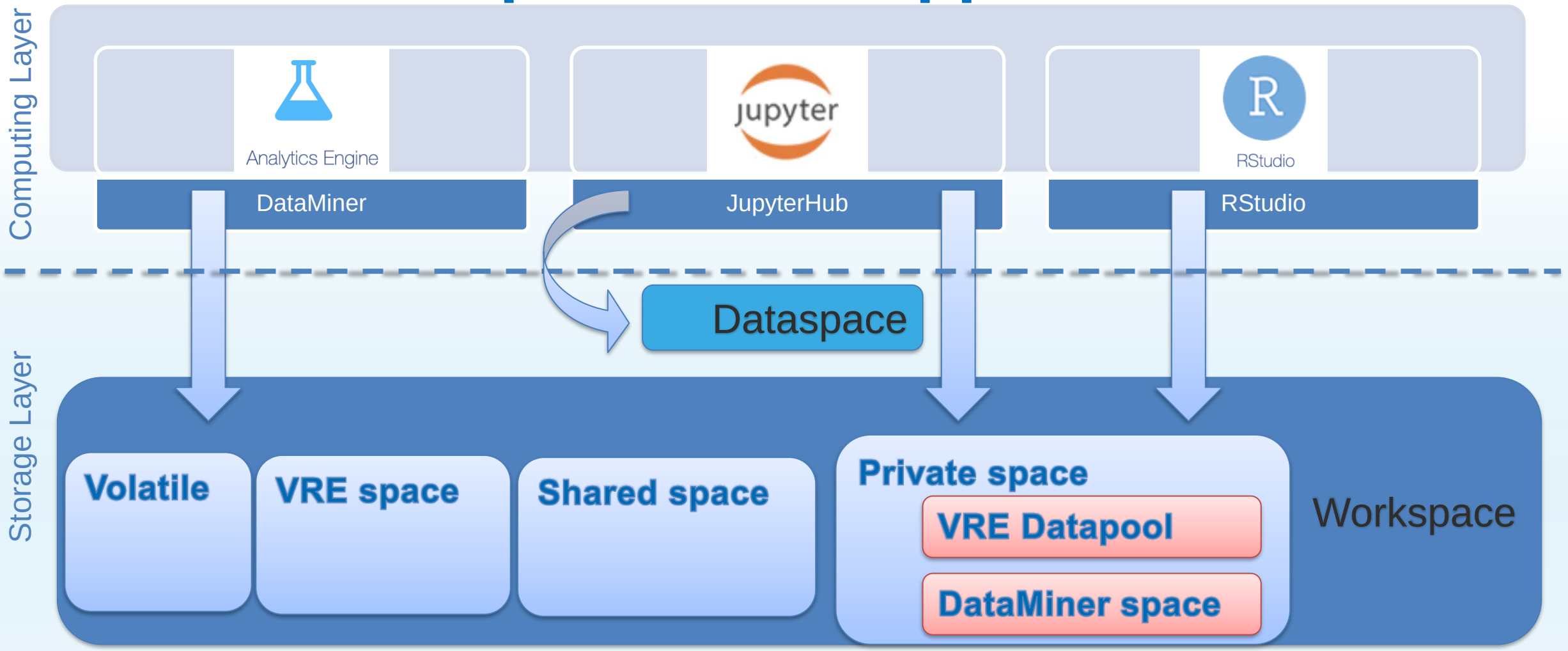
Sharing

Reuse

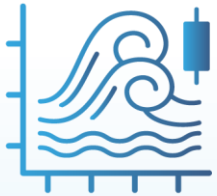
Reproducibility

Blue Cloud VRE promotes Open Science

Data Analytics Options and Opportunities

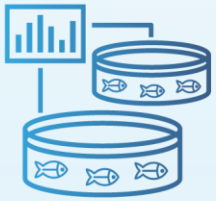


5 Virtual Labs at the VRE



Marine Environmental Indicators

Zoo & Phytoplankton EOV products



Aquaculture Monitor

Fish a matter of scales

Plankton Genomics

Blue Cloud Discovery and Access service

Blu loud

- **Facilitates users**:
  - Federated search for discovering interesting data sets (currently more than 10 million) in a common way
  - 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
- Built and operated by MARIS, CNR-IIA, and CINECA (EUDAT)

Illustrations of data coverage

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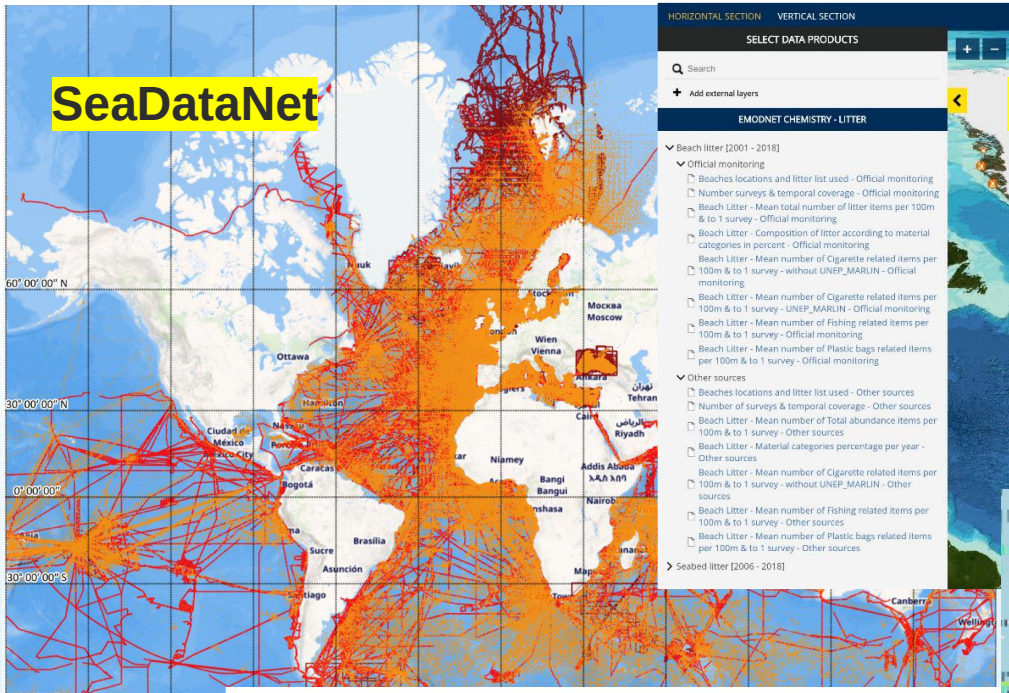
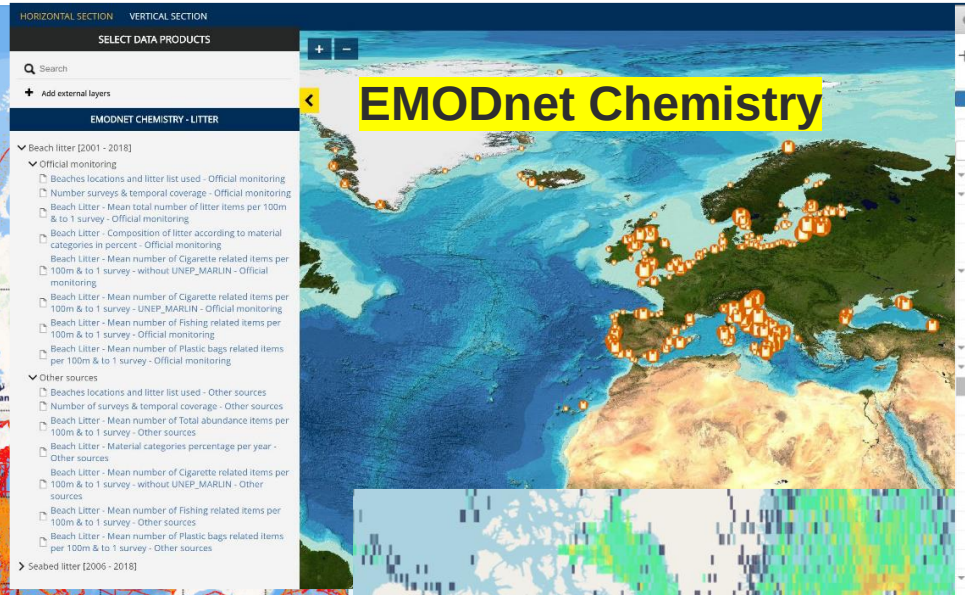
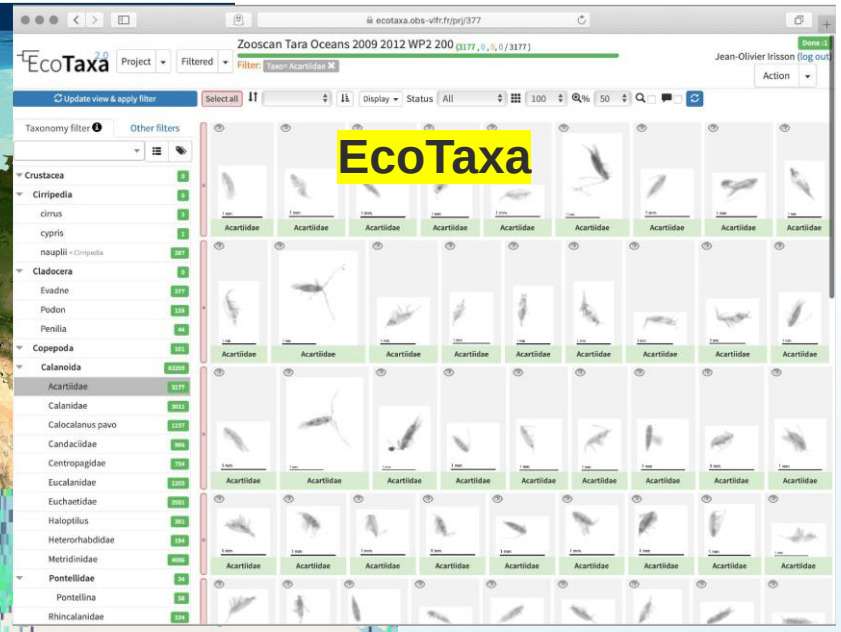
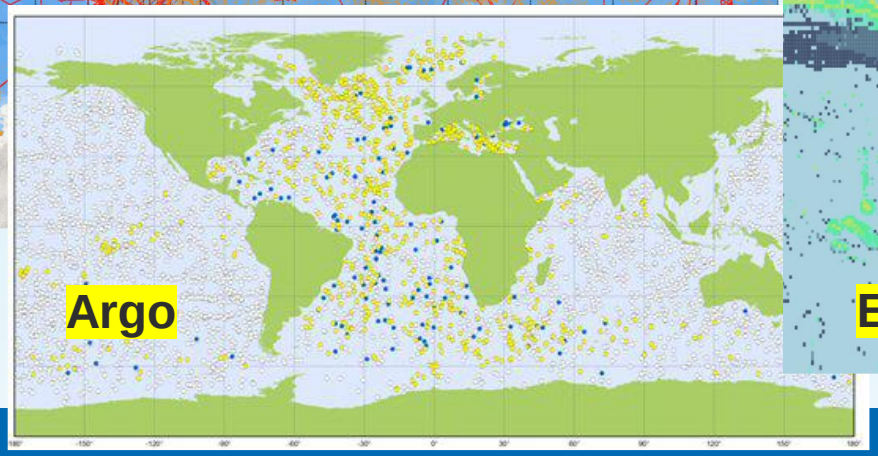
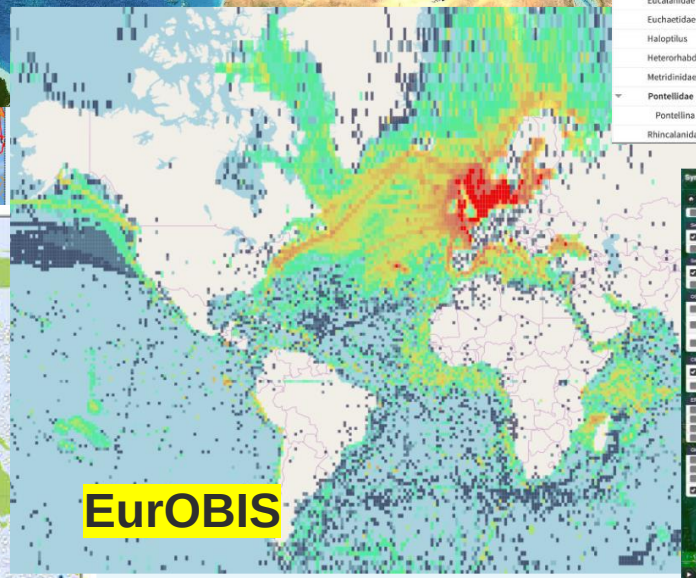
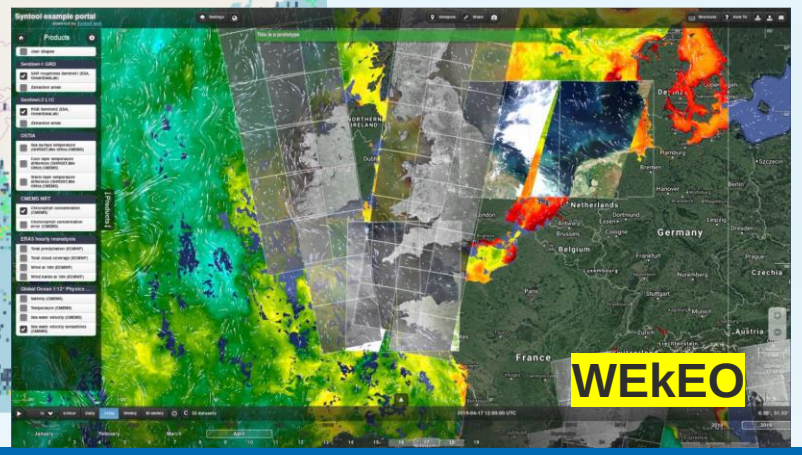












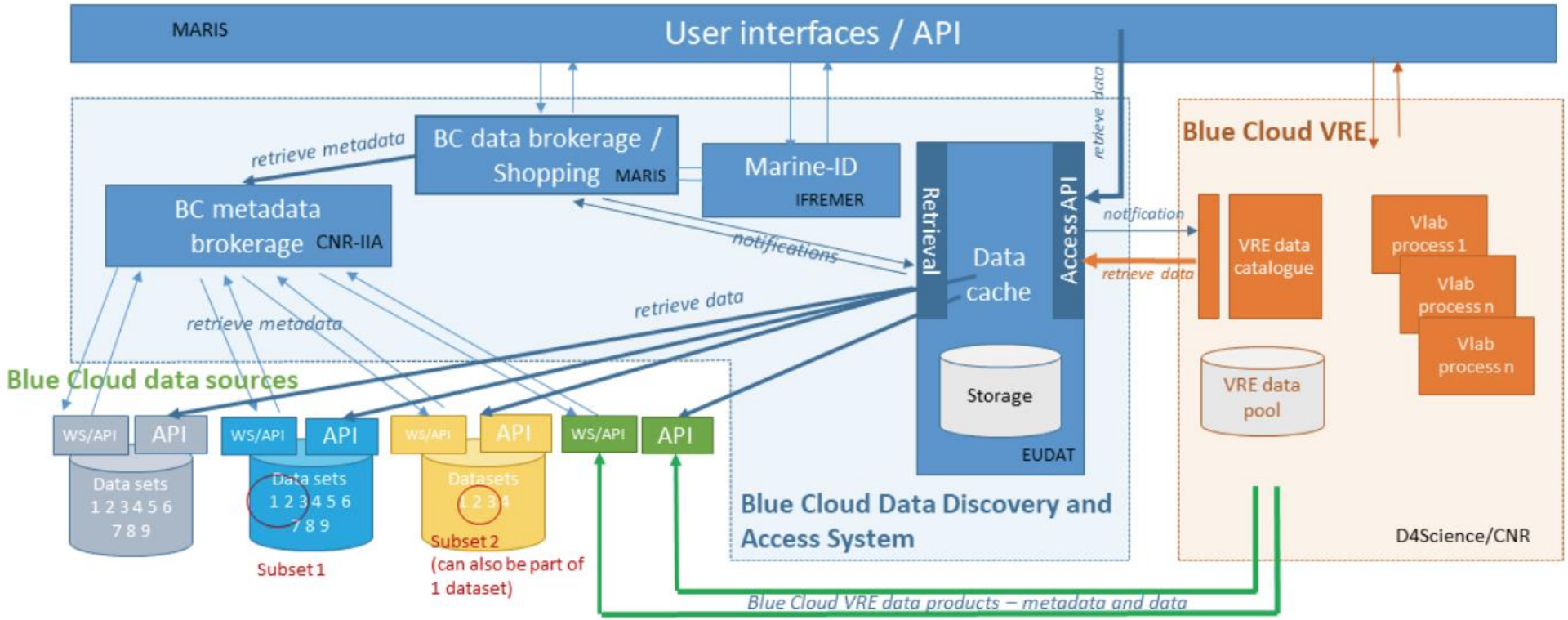
Approach

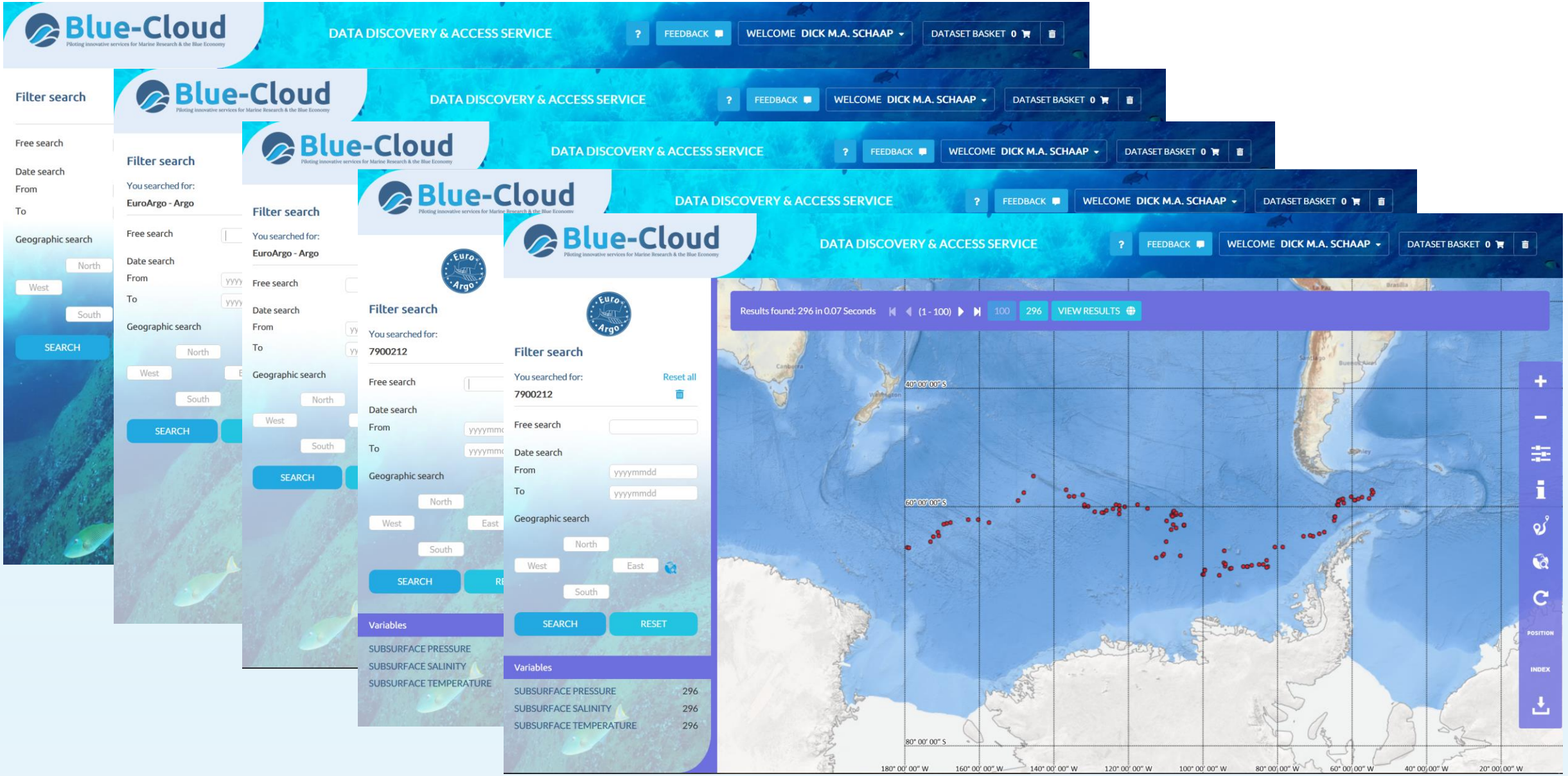
- **Federated discovery and retrieval** of data sets and data products from the Blue Data Infrastructures

- **Concept of two-step search approach**:
  - First step: identifying interesting data collections and products with few criteria
  - Second step: drilling down with more criteria to select specific data at granule level, where possible, otherwise at collection/products level

- Metadata and Data Brokerage services interacting **Machine-to-Machine** with web services and APIs as provided and operated by the Blue Data Infrastructures

Architecture





https://data.blue-cloud.org

Level 2 Interfacing - Protocols

SeaDataNet	Dedicated API
SeaDataNet Products	OGC CSW service
EMODnet Chemistry	OGC CSW service
EuroArgo - Argo	Dedicated API
EurOBIS – EMODnet Biology	DCAT service
Ecotaxa	Dedicated API
ELIXIR - ENA	Dedicated API
ICOS Marine	SPARQL service
SOCAT	ERDDAP service

Successor project: Blue-Cloud 2026 Starting 1 January 2023

Blue-Cloud 2026

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

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 mission

To achieve a further evolution of the Blue-Cloud infrastructure into a Federated European Ecosystem to deliver FAIR & Open data, analytical services, instrumental for deepening research of oceans, EU seas, coastal & inland waters. This will provide a core data service for the Digital Twin of the Ocean (DTO), mobilising and making available major additional data resources as validated and harmonised in-situ data by means of Data Lakes.

- Consortium expanded from 20 to 40 partners
- More Blue Data Infrastructures on board: + EMSO, EMBRC, SIOS, EMODnet-Physics, and JERICO-CORE
- More e-infrastructures: + EGI

Planned developments for data access

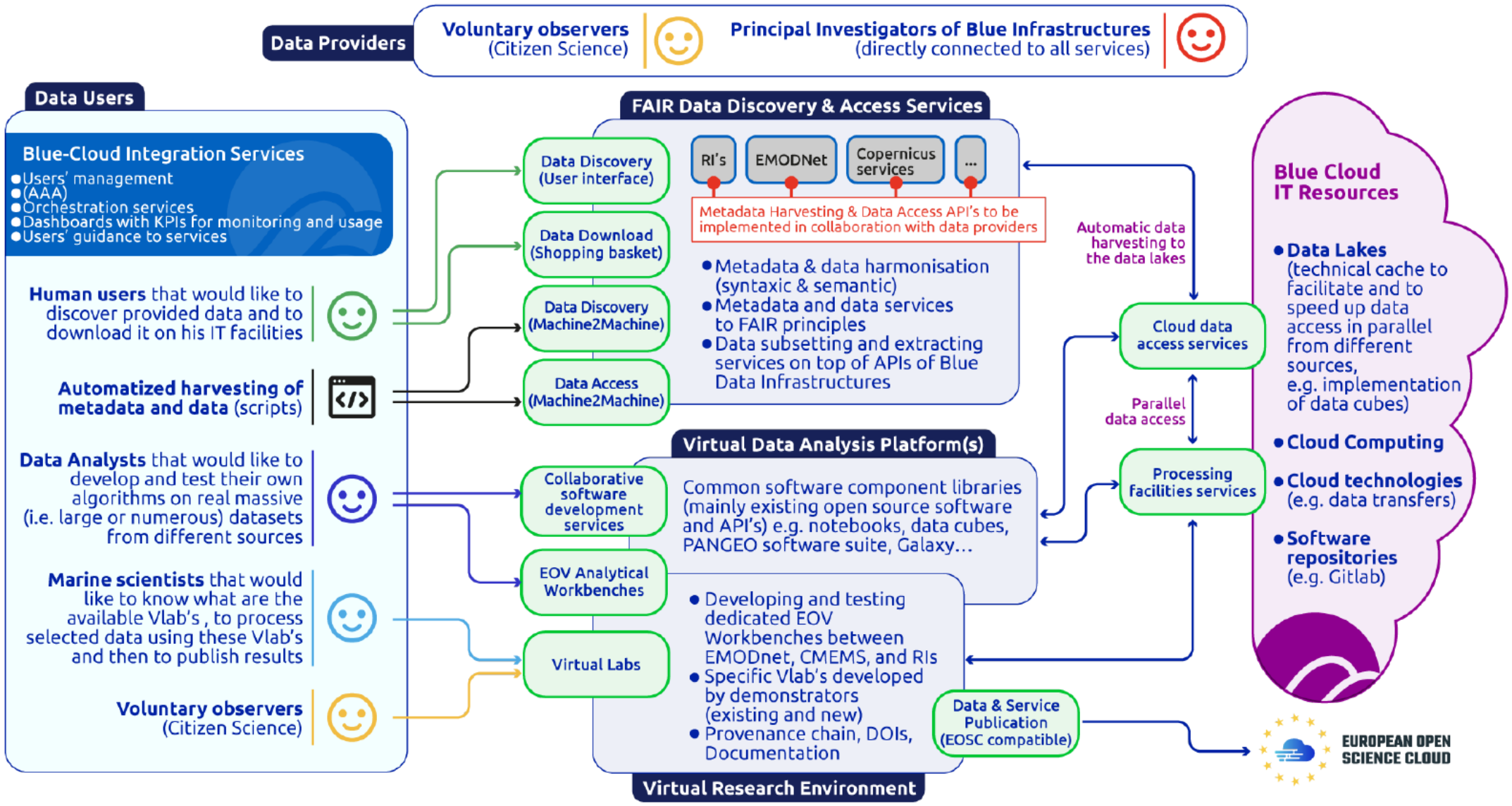
- Expanding the DD&AS service coverage with more Blue Data Infrastructures

- Adding semantic brokerage for harmonising terminologies as used for parameters, platforms, devices, and others by mapping between vocabularies used in Blue Data Infrastructures

- Adding data subsetting functionality to facilitate querying and extracting data sets for specific data criteria, like all temperature values at specific depth range and geographic area and with specific quality flags

- Building semi-automatic workbenches for compiling data sets and elaborating these into validated and aggregated data collections of selected data types (EOVs), that will be managed in data lakes, serving Blue-Cloud Virtual Labs, research communities, and also feeding the Digital Twins of the Ocean (DTO)

Blue-Cloud 2026 ecosystem



Join us 8 December 2022

See: https://blue-cloud.org/events


Blue-Cloud
Piloting innovative services for Marine Research & the Blue Economy
www.blue-cloud.org