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Blue-Cloud 2026, services to deliver, access and analyse FAIR & Open marine data

Dick M. A. Schaap¹, Tjerk Krijger¹, Sara Pittonet², and Pasquale Pagano³

¹Marine Information Service MARIS. B.V, Nootdorp, Netherlands (dick@maris.nl)

²Trust-IT Srl, Pisa, Italy (s.pittonet@trust-it-services.com)

³CNR-ISTI, Pisa, Italy (pasquale.pagano@isti.cnr.it)

The pilot Blue-Cloud project as part of 'The Future of Seas and Oceans Flagship Initiative' of EU HORIZON 2020 combined interests of developing a thematic marine EOSC cloud and serving the Blue Economy, Marine Environment and Marine Knowledge agendas. It deployed a versatile cyber platform with smart federation of multidisciplinary data repositories, analytical tools, and computing facilities in support of exploring and demonstrating the potential of cloud based open science for ocean sustainability, UN Decade of the Oceans, and G7 Future of the Oceans. The pilot Blue-Cloud delivered:

- **Blue-Cloud Data Discovery & Access service (DD&AS)**, 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 (VRE)** providing a range of services and facilitating orchestration of computing and analytical services for constructing, hosting and operating Virtual Labs for specific applications
- **Five multi-disciplinary Blue-Cloud Virtual Labs (VLabs)**, configured with specific analytical workflows, targeting major scientific challenges, and serving as real-life **Demonstrators**, which can be adopted and adapted for other inputs and analyses.

Since early 2023, Blue-Cloud 2026 aims at a further evolution into a Federated European Ecosystem to deliver FAIR & Open data and analytical services, instrumental for deepening research of oceans, EU seas, coastal & inland waters.

The DD&AS already federates leading Blue Data Infrastructures, such as EMODnet, SeaDataNet, Argo, EuroArgo, ICOS, SOCAT, EcoTaxa, ELIXIR-ENA, and EurOBIS, and facilitates common discovery and access to more than 10 million marine datasets for physics, chemistry, geology, bathymetry, biology, biodiversity, and genomics. It is fully based on machine-to-machine brokering interactions with web services as provided and operated by the Blue Data Infrastructures. As part of Blue-Cloud 2026 it will expand by federating more leading European Aquatic Data Infrastructures, work

on improving the FAIRness of the underpinning web services, incorporating semantic brokering, and adding data subsetting query services.

The Blue-Cloud VRE, powered by D4Science, facilitates collaborative research offering computing, storage, analytical, and generic services for constructing, hosting and operating analytical workflows for specific applications. Blue-Cloud 2026 will expand the VRE by federating multiple e-infrastructures as provided EGI, Copernicus WEkEO, and EUDAT. This way, it will also open the connectivity to applications as developed in other EU projects such as iMAGINE (AI applications for marine domain), and EGI-ACE (applications for ocean use cases).

During EGU we will share insight in the solutions regarding semantics supporting interoperability and harmonised data access. This will be especially illustrated via developments of new Blue-Cloud analytical Big Data “WorkBenches” that are generating harmonised and validated data collections of Essential Ocean Variables (EOVs) in physics (temperature and salinity), chemistry (nutrients, chlorophyll, oxygen) and biology (plankton taxonomy, functions and biomass). The access to harmonised subsets of the BDI’s data collections will be supported by new tools like BEACON and the I-Adopt framework. The EOv collections are highly relevant for analysing the state of the environment. This way, Blue-Cloud 2026 will provide a core data service for the Digital Twin of the Ocean, EMODnet, Copernicus, and various research communities.