D6.1 - Fact Sheets for cluster projects and other core initiatives (Release 1)

Work Package	WP6 - Blue Cloud Roadmap, Exploitation & Sustainability Measures, and trans-European Liaisons
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1.0	19.04.2021	Sara Pittonet Gaiarin (Trust-IT)	Final version for submission

Executive summary

Since the launch of Blue-Cloud, the project has proactively worked on establishing strong partnerships between a variety of actors, aiming to create long-lasting relationships both for attaining the Blue-Cloud's long-term objectives and for contributing to shaping the strategic Roadmap to 2030.
Blue-Cloud has established synergies in the Open Science, Blue Economy and Marine Research fields as the team believes that through collaboration and cooperation with initiatives operating in the same field, the value of Blue Cloud services increases.

As output of this effort to cluster with related projects and initiatives in Europe and Beyond, this first release of the *Blue-Cloud Factsheets for cluster projects and other core initiatives* presents an overview of all the projects and infrastructures Blue-Cloud has established synergies with in the first year and a half from its launch (M18).
The collaborations span from data integration to joint communication events. Overall, the synergies established have been classified around the main assets of the Blue-Cloud infrastructure: Data Discovery and Access Service, Cyber Infrastructure and Virtual Research Environment, and Demonstrators, plus a categories for those initiatives looking forward to contribute to the BlueCloud Roadmap.

So far Blue-Cloud has established connections with 32 projects and organisations and has started concrete collaboration with 21, greatly surpassing the KPI for M36 (10). The dialogues represent the ground layer for successful collaborations to be pursued in the next months, leveraging on the public availability of the Bluer-Cloud resources, namely the demonstrators and their VREs (launched for public use in March 2021), the Blue-Cloud Discovery and Access services (to be ready in May 2021) and last but not least the unprecedented wealth of data resources of Blue-Cloud.

This document represents a first release of the *Blue-Cloud fact sheets for cluster projects and other core initiatives*.

- **Section 1** presents the approach adopted and an overview of the synergies established in the framework of Blue-Cloud main assets.
- **Section 2** lists the Factsheets for cluster projects and other initiatives, grouped by e-Infrastructures (2.1) , Blue Data infrastructures (2.2) and other projects and initiatives (2.3).

A second release of this report (D6.6) will be produced at the end of the project (M35).

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1. Overview of Blue-Cloud synergies in the Blue Economy and Open Science

Providing a clear case and practical frameworks for closer, long-term collaboration along the marine knowledge value chain by enhancing Blue-Cloud value propositions to shared user communities is one of the pillars of Blue-Cloud user-centric approach to its stakeholders engagement[1]. From its launch Blue-Cloud has established synergies with key actors in the Blue Economy and Open Science focusing on the uptake opportunities around Blue-Cloud three main assets: **Data Discovery and Access Service**, **Cyber Infrastructure and Virtual Research Environment**, and **Demonstrators**. The established synergies aim to strengthen the scientific and economic capacity and exploitation opportunities of the Blue-Cloud services, demonstrators and applications. Last but not least, specific collaboration is foreseen with partners and interested external stakeholders to ensure horizontal contribution and fertilization to the **Blue-Cloud's 2030 Roadmap**.

1.1. The approach

In the framework of the Task 6.2 "Dialogue and clustering with related projects and initiatives", between the project kick-off and March 2021, Blue-Cloud started a continuous engagement with projects and initiatives in the European marine research ecosystem. An inventory of initiatives has been continuously updated and now includes more than 50 potential contacts.

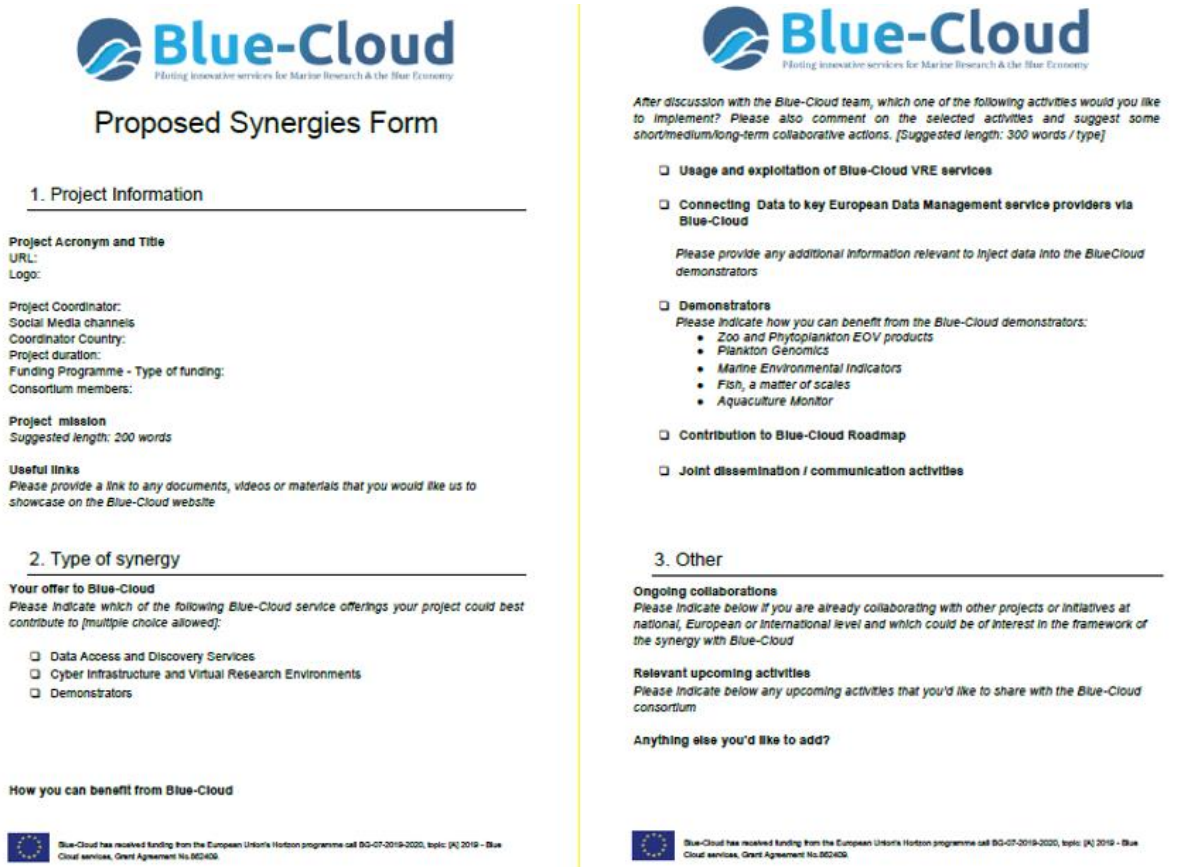
[1] D6.2 Blue-Cloud Strategic Roadmap

Organisation	Stakeholder category	Country	Main area	URL	Contact Point name	Contact Point Email
AtlantECO	EU-funded proje	Italy	microbiomes, plastics, biogeochemistry, ecosystem service	https://cordis.eu	SZN & Stephane PESANT	spesant@marum.de
BeOpen	EU-funded proje	Greece	Open science & transport	https://beopen-p	Afroditi Anagnostopolou	a.anagnostopoulou@certh.gr
CoastObs	EU-funded proje	Hungary	EO-based products	https://coastobs.	Annelies Hommersom	info@coastobs.eu mariana.mata.lara@geonardo.com peters@waterinsight.nl hommersom@waterinsight.nl evangelos.spyrakos@stir.ac.uk
Cos4Cloud	Research & Aca	Spain	Citizen Science	https://cos4cloud	Jaume Piera	jpiera@icm.csic.es
EMODNet	Infrastructure	Pan-European	Marine data & data products	http://www.emod	Jan Bart Calewaert	janbart.calewaert@emodnet.eu
ENVRI-FAIR	Infrastructure	Germany	Environmental s	https://envri.eu/h	Dr. Andreas Petzold Zhiming Zhao	a.petzold@fz-juelich.de z.zhao@uva.nl
EOSC Enhance	Infrastructure	Greece	Enhancement of the EOSC Portal	https://www.eosc	Carmela Asero	asero@efiscentre.eu>
EOSC Pillar	EU-funded proje	Italy	EOSC governance	https://www.eosc	Fulvio Galeazzi	fulvio.galeazzi@garr.it
EOSCsecretariat.eu	EU-funded proje	Belgium	EOSC governance	https://www.eosc	Andrea Grisilla, Technopolis Grou	andrea.grisilla@technopolis-group.com
EUDAT	Infrastructure	Finland	heterogeneous research data management services and storage resources	https://www.euda	Damien Lecarpentier	damien.lecarpentier@csc.fi
Euro-Argo	Infrastructure	Pan-European	Marine data & data products	https://www.euro	Sylvie Pouliquen	Sylvie.Pouliquen@ifremer.fr

Figure 1 - Screenshot of some of the initiatives included in the inventory of initiatives

The first conference call was organised by WP6 Trust-IT and SSBE teams to introduce Blue-Cloud and identify potential collaboration. A summary overview of the contacts established was periodically presented to the Steering Board and further calls organised with representatives of Blue-Cloud WP2, 3 and 4 on a case-by-case basis and according to the interest expressed towards Blue-Cloud services by the projects/initiatives during the call. The interest in contributing to the Blue-Cloud Roadmap was also gathered, and the plan towards the open consultation presented.

In February 2021, a template to collect more detailed information about expressions of interest was circulated to the representatives of the initiatives contacted after the first scoping calls. The feedback provided is being used to produce the information included in the factsheets presented in the following pages.



Blue-Cloud

Piloting innovative services for Marine Research & the Blue Economy

Proposed Synergies Form

1. Project Information

Project Acronym and Title
URL:
Logo:

Project Coordinator:
Social Media channels
Coordinator Country:
Project duration:
Funding Programme - Type of funding:
Consortium members:

Project mission
Suggested length: 200 words

Useful links
Please provide a link to any documents, videos or materials that you would like us to showcase on the Blue-Cloud website

2. Type of synergy

Your offer to Blue-Cloud
Please indicate which of the following Blue-Cloud service offerings your project could best contribute to [multiple choice allowed]:

- ❑ Data Access and Discovery Services
- ❑ Cyber Infrastructure and Virtual Research Environments
- ❑ Demonstrators

How you can benefit from Blue-Cloud

Blue-Cloud has received funding from the European Union's Horizon programme call BG-07-2019-2020, topic (A) 2019 - Blue Cloud services, Grant Agreement No.862409

Blue-Cloud

Piloting innovative services for Marine Research & the Blue Economy

After discussion with the Blue-Cloud team, which one of the following activities would you like to implement? Please also comment on the selected activities and suggest some short/medium/long-term collaborative actions. [Suggested length: 300 words / type]

- ❑ **Usage and exploitation of Blue-Cloud VRE services**
- ❑ **Connecting Data to key European Data Management service providers via Blue-Cloud**

  Please provide any additional information relevant to inject data into the BlueCloud demonstrators
- ❑ **Demonstrators**

  Please indicate how you can benefit from the Blue-Cloud demonstrators:
  - *Zoo and Phytoplankton EOV products*
  - *Plankton Genomics*
  - *Marine Environmental Indicators*
  - *Fish, a matter of scales*
  - *Aquaculture Monitor*
- ❑ **Contribution to Blue-Cloud Roadmap**
- ❑ **Joint dissemination / communication activities**

3. Other

Ongoing collaborations
Please indicate below if you are already collaborating with other projects or initiatives at national, European or International level and which could be of interest in the framework of the synergy with Blue-Cloud

Relevant upcoming activities
Please indicate below any upcoming activities that you'd like to share with the Blue-Cloud consortium

Anything else you'd like to add?

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Figure 2 – Synergy template

By March 2021 (M18), there are a total of 32 projects and organisations interested in cooperating with Blue-Cloud, which exceeds the KPI for M36 (10). Online pages have been created and published on the Blue-Cloud website to inform the project stakeholders about their offer and how they relate and collaborate with Blue-Cloud. For some of them, downloadable versions of the factsheet will be also available.

1.2. Collaborations that contribute to the implementation and evolution to Blue-Cloud Cyber Infrastructure and Virtual Research Environment

The "Blue-Cloud technical framework" is where leading marine data management infrastructures are federated with horizontal e-infrastructures to maximise the exploitation of **data resources available from different sources**. The Blue-Cloud framework consists of two major technical components: a **Blue-Cloud Data Discovery and Access** service to serve federated discovery and access to blue data infrastructures, and a series of **Blue-Cloud Virtual Laboratories embedded on the Blue-Cloud Virtual Research Environment** (VRE) to provide computing resources, analytical services and interaction with multidisciplinary data resources facilitating web-based science and collaboration between researchers.

The Virtual Research Environment (VRE) delivers an innovative computing service for the integration and deployment of analytical algorithms and software tools. The synergical partnerships established contribute to the implementation and connection of computing platforms and truly interoperable services across partners. In addition, input from partnerships helps Blue-Cloud to deliver an innovative approach for the publication of results that respects ownership, provenance, and controlled access.
Examples of synergies between Blue-Cloud and other European and International initiatives to integrate applications and software into the Blue-Cloud VREs include those initially engaged in Blue-Cloud, such as **WekEO, ENA, SeaDataNet, EMODnet, EurOBIS, Euro-Argo, ELIXIR-ENA, EuroBioImaging, EUDAT**, as well as new-ones onboarded during this first reporting period such as **ENRI-FAIR, OpenCoasts, or FNS-Cloud.**

1.3. Expressions of interest towards Blue-Cloud Demonstrators and VREs

Blue-Cloud is developing 5 real-life demonstrators covering topics related to Biodiversity, Genomics, Marine Environmental Indicators, Fisheries and Aquaculture. Each demonstrator delivers services accessible through the Virtual Laboratories powered by the Blue-Cloud VRE. Synergies in this area contribute to better shaping the demonstrator's analysis, to increasing the amount of data included in the database and to the preparation of joint webinars, seminars and events.
Each Virtual Lab provides access to datasets, products, and computations to analyse datasets and re-generate products. This is at the core of the Open Science that is a pillar of the Blue-Cloud platform. Each Virtual Lab (operational service accessible online) that provides the documentation, examples of use, and the technology to exploit the service.
In Blue-Cloud Virtual Labs scientists can contribute, find, develop, test, use and publish Blue-Cloud methods, execute them on high-performance backend, and implement scientific workflows.
Synergies have been established with FNS-Cloud, Odyssea, Be-Open, Jonas and EuroSea, initiatives that have expressed the interest in using the extending the current Virtual Labs or creating new ones for specific research purposes on the Blue-Cloud VRE.

1.4. Data Discovery and Access Service

The Blue Cloud Data Discovery and Access Service architecture is based on a combination of the GeoDab metadata broker service of CNR-IIA, and the SeaDataNet CDI service modules as developed by MARIS, IFREMER, and EUDAT in the framework of the EU SeaDataCloud project.
The Blue-Cloud Data Discovery and Access Service will follow a 2-step approach to discover, at first, interesting data collections at the connected blue data infrastructures[2] and then to drill down to individual data sets which can be downloaded through a common shopping mechanism. For the 1st step, use is made of harvesting of metadata at data collection level and bringing these into a common catalogue with universal query operators. While the 2nd

[2] https://www.blue-cloud.org/data-infrastructures

step includes dynamic querying at datasets granule level, incorporating additional criteria on earlier identified blue data infrastructures. The harvesting and dynamic queries are deployed, interacting with web services or APIs as operated and provided by the blue data infrastructures. This service can be expanded towards an even broader array of key marine infrastructures. The Blue-Cloud infrastructure already supports the discovery and access to data sets from various disciplines and fields of science, which in combinations can serve many uses and applications in society. The direct use of the machine-to-machine services and synergic cooperation with several partners, operating those blue data infrastructures, contributes to optimising those services and the further development of FAIRness of the services, which will facilitate the delivery of a stronger infrastructure.

The Blue-Cloud Data Discovery and Access service will help marine data users:

- to search and discover relevant data sets;
- to complete and submit a shopping basket with the required data sets;
- to stay informed about the progress of the shopping request;
- to download the data sets;
- to ingest data sets into the VRE for use in applications.

It will also support managers of blue data infrastructures in:

- staying informed about the shopping requests and associated users for their repository;
- preparing periodic management reports about the requests for their data sets.

2. Factsheets for cluster projects and other initiatives

This section shows practical details about the research infrastructures, data infrastructures and EU-funded projects Blue-Cloud has established a dialogue with by M18.

2.1. E-Infrastructures

2.1.1. D4Science

About

The D4Science e-infrastructure is at the core of the Blue-Cloud VRE's. D4Science core services are used for building and running Virtual Labs, which are VRE's that are dedicated to specific research objectives. The D4Science e-infrastructure implements proven solutions for connecting to external services and orchestrates distributed services, which will be instrumental for smart connections to other e-infrastructures in Blue-Cloud, including EUDAT and DIAS (WekEO). Each VLab enables services and data exploitation to its authorized users.

Type & number of data sets

D4Science serves different domains in 50+ countries worldwide. D4Science hosts more than 150 Virtual Research Environments (VREs) to serve the biological, ecological, environmental, social mining, culture heritage, and statistical communities world-wide.

Core Services

D4Science Security: D4Science.org provides access to a set of services hosted by different organisations in the EU. The connection between the sites is secured through Transport Level Security (TLS), which provides communication security over the computer network.

D4Science.org ensures privacy and data integrity between two communicating computer applications. In particular, any connection between a client (e.g., a web browser) and a D4Science.org server has the following properties:

- Private (or secure) connection through the adoption of symmetric cryptography, which encrypts the data transmitted. The keys for this symmetric encryption are uniquely generated for each connection and are based on a shared secret (negotiated at the start of the session). The server and client negotiate the details about which encryption algorithm and cryptographic keys shall be used before data are transmitted. The negotiation of a shared secret is both secure, as it is unavailable to eavesdroppers (and even not to attackers who place themselves in the middle of the connection). For this reason, D4Science is reliable, as no attacker can modify the communications during the negotiation without being detected.
- Authentication of communicating parties happens by using public-key cryptography. This authentication can be made optional on the client's side; however, it is ensured on the server's side.

- Integrity of the connection is ensured as each information transmitted is linked to a message authentication code to prevent undetected loss or alteration of the data during the transmission.
- Forward secrecy ensures that a future disclosure of encryption keys cannot be applied to decrypt any TLS communications recorded in the past.

Function in Blue-Cloud

VRE Management	Service to enable authorized users (i.e. VRE Managers) to dynamically create VLabs and manage their users. VRE Managers can (i) authorize users to access VLabs, (ii) assign or withdraw roles to users, (iii) remove users, and (iv) send communications to the current users.
Collaboration Framework	Set of social tools to share data, updates and messages with others and to keep abreast of new data, prospects, services, users.
Workspace	Service to enable every user to store and organise the information objects he/she is interested in working with. In addition to that, the user is allowed to collaborate with other users by sharing objects and messages. 100 GB storage volume is guaranteed to every user.
Secure File Sharing and Storage	Service to enable secure and controlled file sharing.
Accounting Framework	Service enabling accounting resource usage and usage control via quota mechanisms.
Data Analytics Framework	A set of data analytics services including: (i) the DataMiner engine (a rich array of ready to use analytical methods ranging from data clustering methods to geospatial data analytics, occurrence data management, and species distribution maps generation); (ii) the Software and Algorithms Importer (SAI) (an interface allowing any user to easily and quickly import scripts into DataMiner); (iii) the RStudio suite allowing its users to perform online statistical analyses with R; (iv) the JupyterHub, a web-based interactive development environment for Jupyter notebooks, code, and data. It allows users to configure and arrange the user interface to support a wide range of workflows in data science, scientific computing, and machine learning.
SDI	The SDI (Spatial Data Infrastructure) provides users with the capability to store, discover, access, and manage vectoral and raster georeferenced datasets. The SDI exploits the following technologies: GeoServer equipped with PostGresql and PostGIS, GeoNetwork, Thredds. All the exploited technologies are fully integrated and

	deployed to ensure fault-tolerance, load-balancing, controlled and secure access, monitoring and accounting.
Publishing Framework	The Publishing Framework includes a set of services and components enabling their users to document and make "public" (made available online) any generated product. Its primary component is the VRE Data Catalogue. The VRE Data Catalogue service is a catalogue service built on open-source technology for data catalogues (CKAN ckan.org), but extended to (a) be integrated with D4Science services, (b) support a rich, community-defined, and extensible set of catalogue item typologies, and (c) manage publications for each VLab and automatic integration at Blue-Cloud VRE.

Table 1 – D4Sciece role in Blue-Cloud

URL: D4Science.org
Partners involved: Consiglio Nazionale delle Ricerche (CNR)

Factsheet available at https://www.blue-cloud.org/e-infrastructures/d4science

2.1.2. WEkEO - DIAS

About

WEkEO is one of the 5 Copernicus DIAS (Data and Information Access Services). The overarching objective of DIAS is to enhance access to Copernicus data and information for further use in an efficient computing environment implementing the paradigm of "bringing the user to the data", as one condition for unlocking the potential value of Copernicus for innovation, science, new business, implementation of public policies and economic growth. Considering the well-structured user communities and the strong relationship existing between EUMETSAT, Mercator-Océan and ECMWF, Copernicus ClimateChange Service, the organisations have joined their efforts to implement one instance of DIAS in partnership, namely WEkEO. WEkEO is the service for marine environmental data, virtual environments for data processing, and skilled user support. WEkEO will have a public and free part for discovery and access to data and data products, while it will also have a commercial part with various analysis applications and cloud space. It is supported by EU DG GROW.

Type & number of data sets

The Harmonized Data Access (HAD) will have a single access protocol (REST API) whereby scaling and evolution of codes will be made easy. It will provide easy & fast access to sub setting attributes in hundreds of datasets from difference Copernicus sources and allow

uniform access to the whole WEkEO catalogue, including sub setting and downloading functionalities. The HAD will provide discovery and access to:

- All the Sentinel satellite data sets: S1, S2, S3 Marine, S3 Land, S5P
- Main Copernicus Service Data products from:
    - Copernicus Marine Service: CMEMS
    - Copernicus Atmospheric Service: CAMS
    - Copernicus Climate Service: C3S
    - Copernicus Land Service: CLMS

Core Services

The Data and Information Access Services (DIAS) WEkEO service for marine and climate domains. The DIAS platforms are built to facilitate and standardise access to data. Funded by European Commission, the DIAS are five cloud-based platforms providing centralised access to Copernicus data and information, as well as to processing tools. All DIAS platforms provide access to Copernicus Sentinel data, as well as to the information products from Copernicus' six operational services, together with cloud-based tools (open source and/or on a pay-per-use basis).

COPERNICUS is progressing with the development of its DIAS whereby CMEMS (led by Mercator Ocean International) and ECMWF work together in the DIAS-WEkEO service for marine and climate domains. WEkEO offers discovery and access services for Sentinel data and forecast & data products from CMEMS and ECMWF, and also cloud computing facilities for analysing satellite images. Thanks to a single access point for the entire Copernicus data and information, DIAS allows the users to develop and host their own applications in the cloud, while removing the need to download bulky files from several access points and process them locally.

Function in Blue-Cloud:

- Multi-Source viewer (free access): Viewer able to present Satellite Imagery, in-situ data, and model-based data. Capability to handle information from different height and depth layers, and information in changing in time (past-present-future), from model. Data discovery is enabled by connection of the viewer to WEkEO Catalogue, enabling browsing and selection of datasets and their associated metadata.
- Access to information pages (free access): Tutorials, wiki, forums.
- Access to the WEkEO helpdesk (free access).
- Access to Jupyter Notebooks (free access): provide computing resources and a virtual environment for launching processing on data.
- Build and deploy your own front office and hosted processing (with subscription).
- Access to VM catalogue with preinstalled applications and optimized networking to the data storage layer (with subscription).
- Access to additional storage and cloud services for hosting of your data and making it available to your tenants or to a wider audience through tailored means (with subscription).
- Access to Morpheus cloud management interfaces and manage all your tenants (with subscription).

- Access to the WEkEO Market Place and benefit from extra functionalities from community developers (with subscription).

URL: https://www.wekeo.eu/
Partners involved: Mercator Ocean

Factsheet available at https://www.blue-cloud.org/e-infrastructures/wekeo-dias

2.1.3. EUDAT

About

EUDAT offers heterogeneous research data management services and storage resources, supporting multiple research communities, through its network of academic computing and data centres across 15 European nations, whereby data is stored alongside some of Europe's most powerful supercomputers. European researchers can preserve, find, access, and process data in a trusted environment, as part of the EUDAT Collaborative Data Infrastructure. One of EUDAT's main ambitions is to bridge the gap between research infrastructures and e- Infrastructures through an active engagement strategy. It is supported by EU DG RTD and EU DG CONNECT.

Type & number of data sets

In principle, there is no limit to the number of files that can be added to each service (although there is a finite amount of storage currently associated with each service). In terms of file sizes, there are limitations for some services as described below. Data from different fields can be added to each service (see some use-cases of EUDAT services):

- B2DROP: 2GB per file, with a maximum of 20GB per user.
- B2SHARE: Currently the maximum file size is 10 GB and the maximum size for a record is 20GB. You can add an unlimited amount of data records as long as each size does not exceed 20 GB.
- B2SAFE: unlimited, but very large file transfers are subject to network stability.

Core Services

EUDAT has developed a service stack that forms the Collaborative Data Infrastructure (CDI). The services are as follows:

- B2SAFE, Replicate Research Data Safely.
- B2STAGE, Get Data to Computation.
- B2FIND, Find Research Data.
- B2SHARE, Store, Share and Publish Research Data.
- B2DROP, Sync and Exchange Research Data.

In addition, a set of EUDAT core operational services, essential for the management of the CDI, have been defined as follows:

- B2ACCESS (identity and authorisation), easy-to-use and secure Authentication and Authorisation platform.
- B2HANDLE (Persistent IDentification (PID) management), a service to register persistent identifiers called Handles to data objects and retrieve data objects via these identifiers, serving a purpose similar to DOIs for papers. Research data in B2SHARE also get a DOI in addition to PID.
- B2HOST, a Service Hosting Framework that allows communities to deploy and operate their own applications and data-oriented services on machines next to the data storage.

Function in Blue-Cloud: The horizontal e-infrastructure EUDAT (together with DIAS and D4Science) aim to capitalise on what exists already and to develop and deploy the "Blue Cloud" framework.
EUDAT leveraging its suite of B2SERVICES (B2ACCESS, B2SAFE, B2STAGE, B2HOST, and B2DROP) and expertise to create an extensive and versatile data cache and api to foster the following:

- To facilitate data discovery and access to the Blue-Cloud data infrastructures.
- To make Blue-Cloud data available and accessible to researchers.
- To make available the Blue-Cloud data to the Blue-Cloud VRE for computing, analytical and visualization services.
- Making the Blue-Cloud data and service catalogues interoperable and accessible via the EOSC portal.
- Make available Blue-Cloud metadata from the individual Blue-Cloud Data & Access infrastructures, using OAI-PMH protocols.

URL: https://eudat.eu/
Partners involved: Trust-IT, CINECA, DKRZ, CSC

Factsheet available at: https://www.blue-cloud.org/e-infrastructures/eudat

2.2. Blue Data Infrastructures

2.2.1. EcoTaxa

About

EcoTaxa is a web application dedicated to the visual exploration and the taxonomic identification of images of plankton. EcoTaxa was born from the experience developed at Laboratoire d'Océanographie de Villefranche (LOV) regarding the quantitative, high-throughput imaging of plankton and of the Oceanomics project which exploited the data collected during the Tara Oceans cruise, including quantitative imaging. It is now developed mainly through the WWWPIC project funded by the Belmont Forum and as part of the Blue-Cloud project.

The aim of EcoTaxa is to centralise images of plankton, to allow their collaborative classification along a universal taxonomy and to accelerate this process through machine learning. It produces ecological data in the form of concentration and biovolume of organisms in a given taxon, at a given point in latitude, longitude, depth and time. Visitors have free access to the specimens that have been already identified by taxonomist experts. They can explore the database by navigating along a taxonomic tree. Then images can be filtered according to several sampling criteria (location, time, etc.). For operators, easy-to-use tools are provided to suggest a classification for each image over large datasets, through supervised machine learning.

Type & number of data sets

Currently, EcoTaxa contains circa 150 million images of which circa 63 million have been annotated in over 2000 datasets. Of these, circa 30 million images concern living organisms. The growth rate is circa 4 million new images per month. Not all of these datasets will be accessible for Blue-Cloud, because this depends on the data policy of data providers, who come from circa 350 organisations worldwide. Some of those datasets (in particular the Tara Oceans ones, needed by the demonstrators) will be sent from EcoTaxa to EMODnet Biology and be harvested by the Blue-Cloud data discovery service from there. Then, Blue Cloud users will be able to browse them in finer details through the EcoTaxa API.

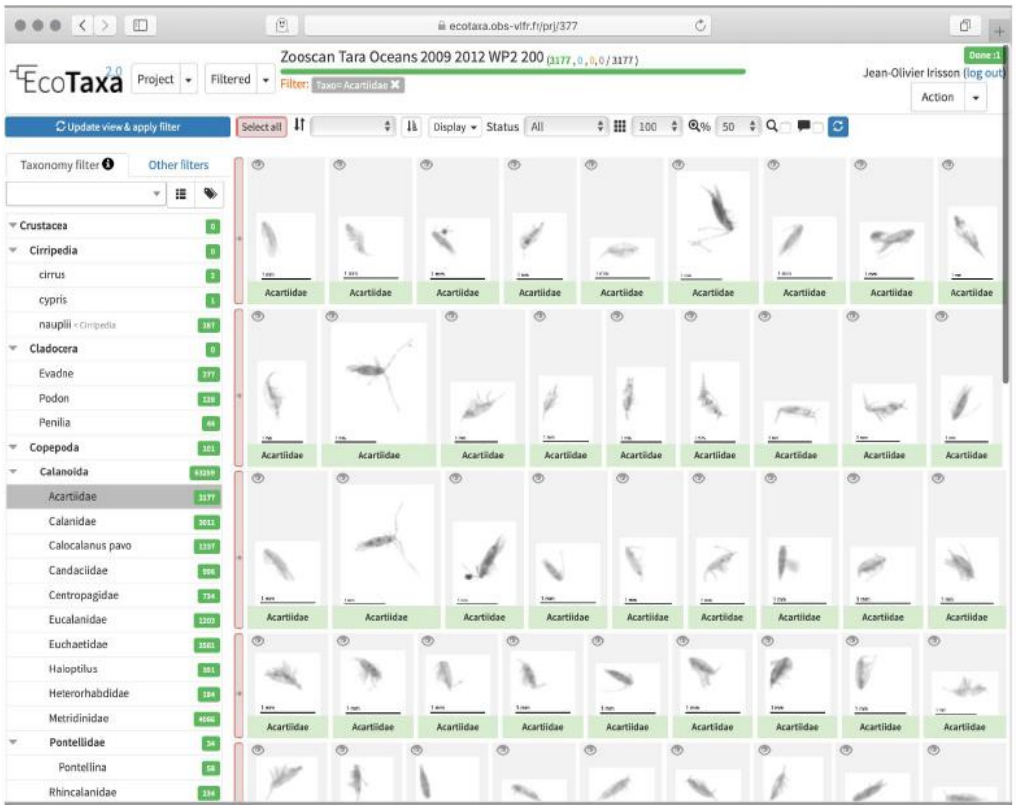

Figure 3 – The image classification page of EcoTaxa

Core Services

The core of EcoTaxa is the rapid identification of large numbers of images by a combination of machine learning and human validation. The resulting data can be browsed and downloaded once access to the dataset is granted by the dataset owner.

Data discovery used to be manual. Validated data from all public datasets can be browsed at https://ecotaxa.obs-vlfr.fr/explore//. As part of the WWWPIC and Blue-Cloud projects an Application Programming Interface was built to allow programmatic browsing of public datasets that were uploaded to EMODnet Biology.

Function in Blue-Cloud. Thanks to the collaboration within Blue-Cloud, EcoTaxa can accelerate data processing and sharing for the "Zoo & Phytoplankton EOV Products" and "Plankton Genomics" Demonstrators. Within the goal of Blue-Cloud to federate information from different databases at EU level, EcoTaxa contributes data to EMODnet Biology, which is then aggregated in Blue-Cloud's data discovery service, and also provides finer scale data as a second level of query.

URL: http://ecotaxa.obs-vlfr.fr/

Partners involved: Sorbonne University

Factsheet available at https://www.blue-cloud.org/data-infrastructures/ecotaxa

2.2.2. EMODnet

About

The European Marine Observation and Data network (EMODnet) was initiated in 2008 and it is a long-term marine data initiative funded by the European Maritime and Fisheries Fund (managed by EU DG MARE).

EMODmet, together with the Copernicus Earth Observation programme and the Data Collection Framework for fisheries, implements the EU's Marine Knowledge 2020 strategy. The EMODnet network connects to over 150 organisations supported by the EU's Integrated Maritime Policy who work together to observe the sea, process the data according to international standards, and make that information freely available as interoperable data layers and data products. For this purpose, EMODnet works closely together with other existing infrastructures, such as the EuroGOOS ROOS's for operational oceanography data exchange, the ICES international data centre, and European research infrastructures, such as SeaDataNet, EurOBIS, EGDI, and others to bring together data sets from hundreds in-situ data collectors from science, government, and industry. A major added-value of EMODnet is the generation and free publishing of a range of European wide derived data products that serve many user communities. Moreover, the EMODnet initiative has and is mobilising many data collectors to get connected to the data exchange infrastructures for sharing their data with EMODnet, contributing to better data products. To that end, EMODnet also operates EMODnet Ingestion as a service and network of experienced data centres to identify, convince, and provide support to data collectors to join the European marine data exchange, both for Near Real-Time and delayed mode data types. It has been estimated that this kind of integrated marine data policy will save off-shore operators at least one billion Euro per year, as well as opening up new opportunities for innovation and growth. EMODnet provides easy and free access to marine data, metadata and data products and services spanning seven broad disciplinary themes: bathymetry, geology, physics, chemistry, biology, seabed habitats and human activities. The aim of EMODnet is to increase productivity in all tasks involving marine data, to promote innovation and to reduce uncertainty about the behavior of the sea. This will lessen the risks associated with private and public investments in the blue economy, and facilitate more effective protection of the marine environment.

The EMODnet offerings:

EMODnet develops interoperable services that simplify the interaction between different machines and promote the exchange of European seas and ocean data and metadata. Both data and data products are available. The data products are free to download and are published under Open Data licences. These data products are derived from the data that is also available through EMODnet. Much of this data is also freely available. However, in some situations restrictions to access and use may apply. EMODnet makes data and data products available via web services, which enable machine to machine communication. In general, the web services conform to two architectural approaches:

- Geospatial web services that conform to Open Geospatial Standards (OGC):
    - Web mapping services (WMS), widespread usage in EMODnet
    - Web feature services (WFS), limited usage in EMODnet
    - Web catalog service (CSW), limited usage in EMOdnet
- Restful web services for subsetting and downloading data. These Restful web services conform to the OpenDAP standard. They are mainly used with gridded data (NetCDF files) and data from sensors. These web services also offer data conversion via web processing services.

Core Services:
EMODnet offers the following data and products via web services:

- Temperature and Salinity in the water column
- Sea Surface Currents
- River Runoff Data
- Total Suspended Matter
- Impulsive Noise Event Registry
- Sound Maps
- Ice Extent and Ice-type
- Wave and winds – Sea State
- Water quality data collections and derived maps
- Marine Litter data collections and derived maps
- Bathymetry by means of a Digital Terrain Model of the European seas
- Geology by means of a series of geological maps
- Human activities with topical maps
- Seabed habitat maps
- and many more

Function in Blue-Cloud. Some EMODnet portals are already exploring the use of Virtual Research Environments for speeding up product generation chains, for validating and harmonizing the processing of large collections of data sets and for generating derived data products. Therefore, EMODnet has an interest in the VRE activities of the Blue-Cloud, next to providing access to its harmonised data collections through the Blue-Cloud Data Discovery & Access service and for use in the Blue-Cloud Virtual Research Environment (VRE) and its demonstrators.
In particular, Blue-Cloud demonstrators are going to integrate diverse data from EMODnet. For example, biodiversity and environmental data (relevant for Plankton Genomics), physics, biology, chemistry data (relevant for Marine Environmental Indicators), biology and coastlines data (relevant for Fish, a matter of scales), and in-situ environmental data for ground-truthing and European marine topography (relevant for Aquaculture Monitor).
Moreover, the EMODnet potential will be exploited to create a bridge between the Blue-Cloud and the EU-funded projects the consortium has established synergies with (e.g. AQUA-Lit, ENVRI-FAIR).

Partners involved: MARIS, IFREMER, SSBE, VLIZ
URL: http://www.emodnet.eu/

Factsheet available at https://www.blue-cloud.org/data-infrastructures/emodnet-central-portal

2.2.3. ENA

About

The European Nucleotide Archive (ENA) provides a comprehensive open record of the world's nucleotide sequencing information and a platform for the management and analysis of sequence and related data for a wide range of applications in ocean science. Elixir is the coordinating research infrastructure for life science data in Europe. The ENA system contains many data types / classes and a huge volume of data, which are only partly marine-related. Blue-Cloud focuses on data and information relevant for the marine domain and on data types such as samples and their analyses. Moreover, the ENA system offers several algorithms/pipelines for processing data, which might be used in a 'smart' way for the Blue-Cloud.

Type & number of data sets

ENA covers many data types in a number of interlinked database tables. A list can be found at https://www.ebi.ac.uk/ena/portal/api/results?dataPortal=ena
Data can be retrieved in different formats and with easy file download options through RESTful services: EMBL Flatfile format, FASTA format for sequences and XML Format. Details about formats: https://ena-browser-docs.readthedocs.io/en/latest/browser/search/advanced.html#downloadena-records
Through programmatic tools, data access services can be downloaded and installed locally and, because the data are made available freely and openly, many users mirror the site, so that other users provide services on these data too.

Core Services

The ENA browser brings together a set of services via web interfaces, build upon underlying APIs. Of relevance for Blue-Cloud are two services:

- ENA Data Discovery (https://www.ebi.ac.uk/ena/browser/advanced-search)
- ENA Data Retrieval (https://www.ebi.ac.uk/ena/browser/home)

How to use the API's and build machine-to-machine services can be found in the documentation of the ENA Portal API: https://www.ebi.ac.uk/ena/portal/api/doc

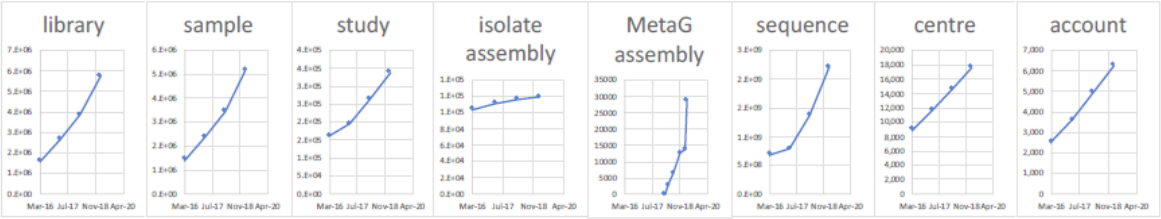

Figure 4 – ENA Portal API

Function in Blue-Cloud: EMBL-EBI operates APIs for ENA discovery and ENA data retrieval, which seem very suitable endpoints for connecting to the Blue-Cloud data discovery and access service. The ENA system contains many data types / classes and a huge volume of data, which are only partly marine-related.
ENA stands to benefit from the Blue-Cloud project because the project allows it to connect to all these different data types and allows scientists to access in an interdisciplinary way all these data.

Particularly contributing to the development of the Plankton Genomics demonstrator, the data provided by ENA allow the demonstrator team to pull out individual organisms and signatures of organisms in the sequence from different environments, and then to correlate them with the environmental factors that come with these data sources.

Partners involved: EMBL
URL: https://www.ebi.ac.uk/ena/browser/about

Factsheet available at https://www.blue-cloud.org/data-infrastructures/ena

2.2.4. Euro-Argo ERIC

About

The Euro-Argo ERIC allows active coordination and strengthening of the European contribution to the international Argo program. Its main objectives are to provide, deploy and operate the European contribution to the global array of Argo floats (currently around 800 floats, ¼ of the global array) and an enhanced coverage of European seas, to expand towards biogeochemistry, greater depths and high latitudes and to provide access to quality-controlled data and derived products.
The Euro-Argo ERIC also provides access to quality-controlled data and derived products: Core-Argo array and BGC-Argo array.
Core-Argo array. The broad-scale global array of temperature/salinity profiling floats, known as Argo, has already grown to be a major component of the ocean observing system. Argo is a standard, which is an example for other developing ocean observing systems. Argo provides good examples on various topics such as how to collaborate internationally, how to develop

a data management system, and how to change the way scientists think about collecting data. Argo float deployments began in 2000 and currently there are circa 4000 Argo floats active.

BGC-Argo array. Biogeochemical-Argo aims at developing a global network of biogeochemical sensors on Argo profiling floats. The concept of global robotic biogeochemical measurements was articulated in a Community White Paper (Gruber et al., 2007) that was supported by the International Ocean Carbon Coordinating Project (IOCCP) and the US Ocean Carbon and Biogeochemistry Program (US-OCB).

Target for the global array is to have 1000 fully equipped BGC-Argo active floats with a uniform spatial distribution. Euro-Argo aims at contributing to ¼ of the global effort, which represents 250 active BGC floats. These will collect next to the regular Temperature, Salinity and Depth the following BGC parameters: Oxygen concentration; Nitrate concentration; pH; Chlorophyll a concentration; Suspended particles; and Downwelling irradiance.

The EuroArgo portal features a dashboard which provides a facet search including dynamic map for discovery of Argo floats and open access to its data sets. Also, it is possible to retrieve the whole Argo data collection by a DOI and associated landing page with descriptive metadata about the collection. Note: In the framework of ENVRI-FAIR and EOSC-hub, a development is underway for an additional data discovery and access service.

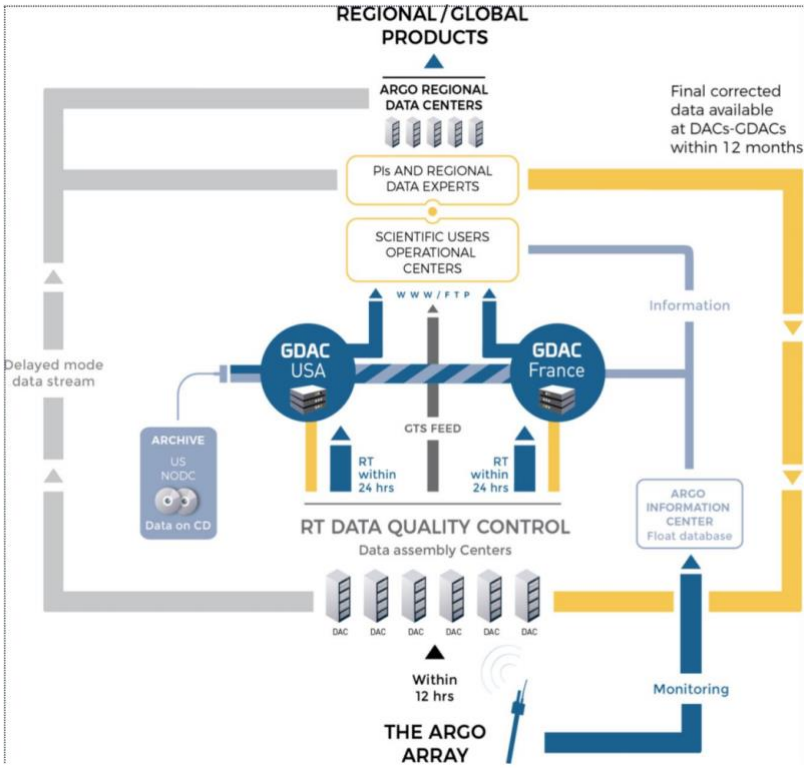

Figure 5 – Overview of Argo organisation

Type & number of data sets:

Argo collects salinity/temperature and biogeochemical profiles from an array of robotic floats that populate the ice-free oceans that are deeper than about 2000m. They also give information on the surface and subsurface currents. Most profiles are made up of about 200 (Argos) to 1000 (Iridium) data points (vertical resolution). In total, there are currently 16.000

Argo floats which generated more than 2 million files. Metadata and data for profiles and trajectories, including technical information are made available as NetCDF (CF) files.
In addition, Argo products are generated and made available as gridded fields.

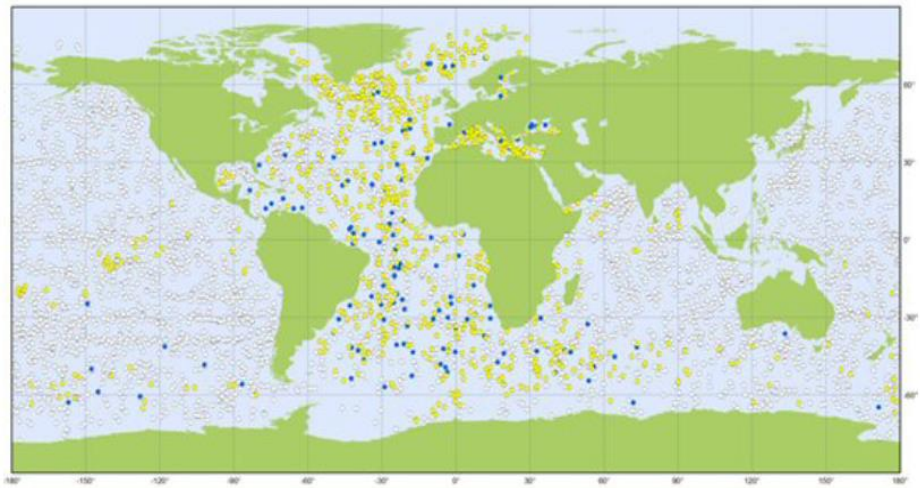

Figure 6 – Overview map of EuroArgo floats – January 2020

Core Services

Euro-Argo ERIC provides the following services:

- GDAC synchronization service
- GDAC Thredds server API
- GDAC ERDDAP data server API
- GDAC OpenSearch API
- GDAC data API and metadata API

Function in Blue-Cloud:

Euro-Argo explores machine learning for data quality assessment to capitalise on what already exists and to develop and deploy the Blue-Cloud as a platform bringing together and providing access to:

- multidisciplinary data from observations and models,
- analytical tools,
- computing facilities that are essential for key blue science use cases.

Euro-Argo contributes to the development of the Blue-Cloud Data Discovery and Access service as one of the blue data infrastructures giving access to the Argo data sets. Moreover, Euro-Argo implements a workflow to apply big data analysis and machine learning (e.g. neural networks) methods on the multi-source data sets, which is an interesting input for the Virtual Labs.

Moreover, Euro-Argo is involved in exploiting the Blue-Cloud demonstrators providing access to salinity, oxygen, chlorophyll data (relevant for Zoo and Phytoplankton EOV products), environmental data (relevant for Plankton Genomics) and salinity, oxygen, chlorophyll data (relevant for Marine Environmental Indicators).

Partners involved: Ifremer
URL: https://fleetmonitoring.euro-argo.eu/dashboard

Factsheet available at https://www.blue-cloud.org/data-infrastructures/euroargo-argo

2.2.5. Eurobis

About

EurOBIS is the European Node of the international Ocean Biodiversity Information System (OBIS), is an online marine biodiversity database compiling data on all living marine creatures. The principle aims of EurOBIS are to centralize the largely scattered biogeographic data on marine species collected by European institutions and to make these data freely available and easily accessible.

The EMODnet biology is a thematic portal of EMODnet providing free access to data on temporal and spatial distribution of marine species and species traits from all European regional seas. From 2009 EurOBIS became the backbone of the European Marine Observation and Data Network Biology (EMODnet Biology), allowing a flow of EurOBIS data through its portal. In 2014, EurOBIS became part of the central Species Information Backbone of LifeWatch, which aims at standardizing species data and integrating the distributed biodiversity data and taxonomic repositories and operating facilities as well as filling the gaps in our knowledge. The EurOBIS data management team is supported by LifeWatch Belgium, part of the European LifeWatch E-Science Infrastructure for Biodiversity and Ecosystem Research. EurOBIS is hosted at the Flanders Marine Institute (VLIZ), Belgium.

Type & number of data sets

EurOBIS brings together biogeographic data collected within European marine waters, or by European researchers and institutes outside Europe. It focuses on taxonomy and distribution records in space and time and offers a number of online tools to query and visualise the data.

Provided by more than 150 institutes, EurOBIS currently holds 1.077 datasets, representing 75.658 species and 26 million distribution records. With more than 6 million distribution records, fish are the most common in the database, followed by (sea) birds and marine mammals.

Over the years, the EurOBIS database structure has evolved, making it possible to not only capture presence or abundance of species, but also biomass data and length measurements in a standardised and structured way. Remarkably, even 'blubber thickness in marine mammals' is part of the EurOBIS information system, with 247 measurements made on the beach, in species such as harbour porpoise, grey seal, harbour seal, white-beaked dolphin or bottlenose dolphin.

Core Services

The data can be discovered and accessed through the EMODnet Biology Portal by means of the EMODnet Data Catalog, the Data Download Toolbox or web services. These download tools offer a high functionality for selecting and querying the data.

- Data Catalog
- Data Download Toolbox
- Web service documentation

The data and metadata of the individual datasets can also be accessed through the EurOBIS Integrated Publishing Toolkit (IPT).

The data flow of the EurOBIS – EMODnet Biology system is illustrated in :

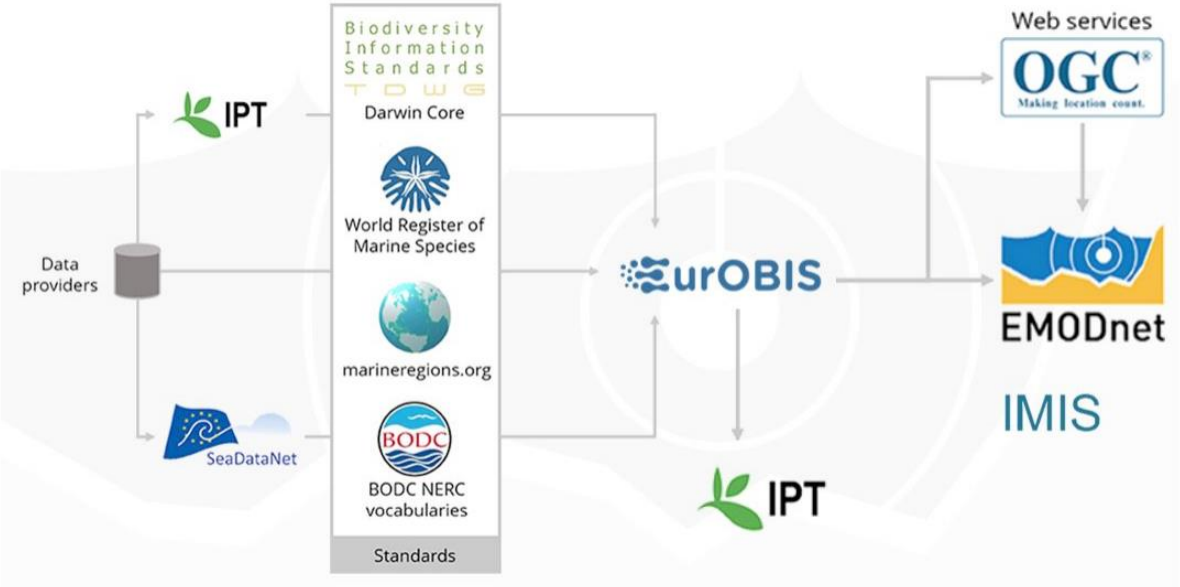

Figure 7 – EurOBIS – EMODnet Biology system architecture and metadata – data flow

This could be very suitable as catalogue / discovery service endpoint for the Blue-Cloud data discovery and access service

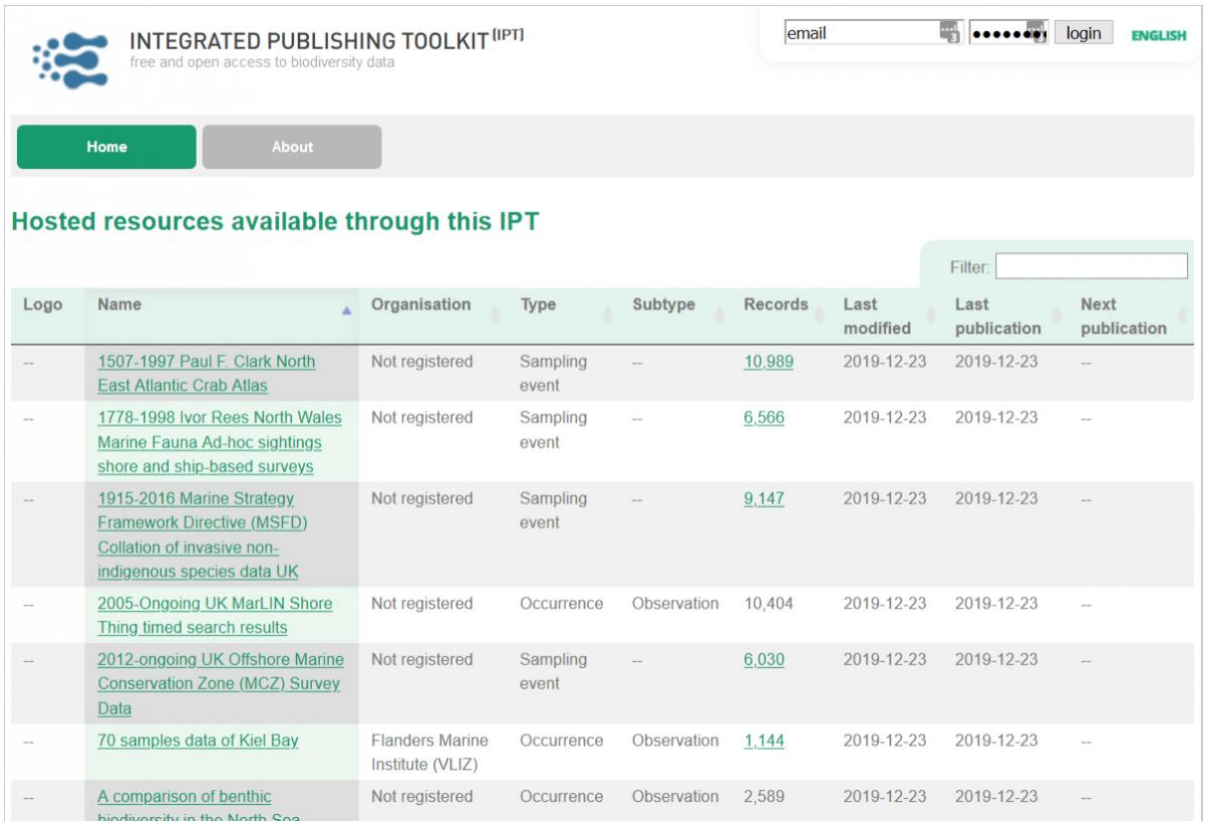

Figure 8 – EurOBIS – EMODnet Biology IPT service

Figure 9 – EMODnet Biology website

Function in Blue-Cloud: The EurOBIS data, in particular the Continuous Plankton Recorder dataset from the UK Marine Biological Association, will be used in the pilot Blue-Cloud Demonstrator "Zoo and Phytoplankton EOV products". This Blue-Cloud demonstrator aims to obtain phytoplankton, zooplankton, and nutrients EOV products that contribute to improving our knowledge and reduce uncertainty regarding the state of marine plankton ecosystems, as well as their response to ongoing and future climate change.
The collaboration with Blue-Cloud allows to search for EurOBIS biodiversity data in the Blue-Cloud Discovery and Access Service, and to use the data in the Blue-Cloud VRE.

Partners involved: VLIZ
URL: http://www.eurobis.org/

Factsheet available at https://www.blue-cloud.org/data-infrastructures/eurobis-%E2%80%93-emodnet-biology

2.2.6. ICOS

About

The Integrated Carbon Observation System (ICOS) is a distributed research infrastructure operating standardized, high-precision, and long-term observations, facilitating research to understand the carbon cycle, providing necessary information on greenhouse gases. ICOS-based knowledge supports policy and decision-making to combat climate change and its impacts. ICOS is an ESFRI Landmark and is the European pillar of a global GHG observation system. It promotes technological developments and demonstrations related to GHGs by the linking of research, education and innovation.

ICOS is a research infrastructure with 13 European member countries and more than 140 measuring stations providing high-quality observations using state-of-the-art technologies that integrate highly standardized networks from multiple domains (atmosphere, terrestrial ecosystems, and oceans) and connect different carbon reservoirs in Europe and neighbouring regions.

ICOS data is made available at the Carbon Portal, a one-stop shop for all ICOS data and data products. The Ocean Thematic Centre is one of four central facilities within the European research infrastructure Integrated Carbon Observation System (ICOS).
The marine element of ICOS led by the Ocean Thematic Centre provides long-term oceanic observations, which are required to understand the present state and better predict future behaviour of the global carbon cycle and climate relevant gas emissions.
The objective is to ensure high-quality measurements of greenhouse gas concentrations that are independent, transparent and reliable. In turn, this monitoring system will support

governments in their efforts to mitigate climate change, as well as holding them accountable for reaching their mitigation targets.

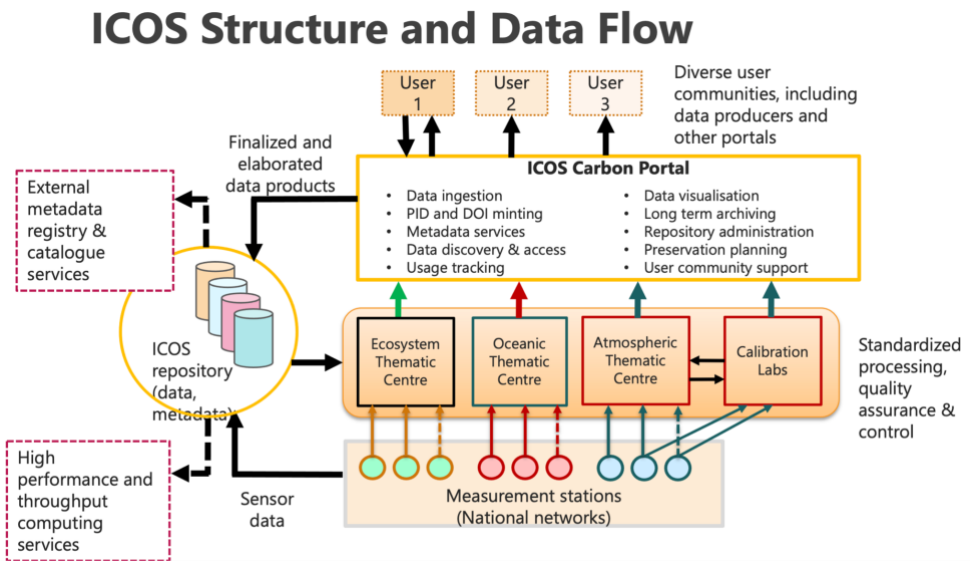

Figure 10 – ICOS Structure and Data Flow

Type & number of data sets

The ICOS Carbon Portal provides observation data from over 140 greenhouse gas measurement stations. Through the SOCAT portal there are more than 6000 trajectories available from 1957 to 2020 with more than 28 million data carbon dioxide observations on a global scale.

Core Services

This concerns two relevant portals:

- ICOS Carbon Portal with data discovery and access
  - https://data.icos-cp.eu/portal/
  - https://meta.icos-cp.eu/sparqlclient/
- SOCAT portal with data products
  - https://www.socat.info

Several services are available for both. Data from official certified ICOS stations can be accessed at the ICOS Carbon Portal and on an international scale, including non ICOS data at the SOCAT Portal. Web services for discovery are existing, but it might be needed to specify and develop API's for data access as part of the Blue-Cloud activities.

Function in Blue-Cloud: ICOS is one of the ten complementary data infrastructures, and serves as the pillars of the initial Blue-Cloud framework. The University of Bergen is contributing, with other partners of the project, to the Blue-Cloud Demonstrator "Marine Environmental Indicators".

This pilot Demonstrator aims to showcase an online service with an associated cloud-based analytical computing framework and a dedicated web interface to provide and display

indicators and information on the environmental quality of the ocean, for the benefit of both researchers and policymakers.

Partners involved: ICOS Ocean Thematic Partner University of Bergen
URL: https://www.icos-cp.eu/

Factsheet available at https://www.blue-cloud.org/data-infrastructures/icos-%E2%80%93-marine

2.2.7. SeaDataNet

About

SeaDataNet is a major pan-European infrastructure for managing, indexing and providing access to marine data sets and data products, acquired by European organisations from research cruises and other observational activities in European coastal marine waters, regional seas and the global ocean.
SeaDataNet develops, governs and promotes common standards, vocabularies, software tools, and services for marine data management, which are freely available from its portal and widely adopted and used in the European marine data community and beyond.
SeaDataNet has been established since the nineties as the network of the National Oceanographic Data Centres (NODCs) in Europe and has developed and expanded into a pan-European infrastructure for marine data management through a series of consecutive EU RTD projects for developing standards, skills, tools, and services. In addition, it has been and is involved in many EU application projects, adopting and adapting the SeaDataNet standards and services to multiple disciplines, and increasing the number of connected data centres from research and monitoring departments, increasing the data volumes managed and available through SeaDataNet. Since the inception of EMODnet in 2009, SeaDataNet is also a key partner and infrastructure for several EMODnet thematics as it interacts with more than 850 in-situ data collectors from 34 countries around the European seas to bring their data sets in a structured and harmonised way towards EMODnet. This synergy between SeaDataNet and EMODnet and also CMEMS provides a win-win situation for all involved as it allows to work together and cover the full workflow from in-situ collection to data management to data products generation to serving many users from various sectors in society.

Type & number of data sets

The CDI (Common Data Index) service provides online unified discovery and access to vast resources of data sets, managed by more than 110 connected SeaDataNet data centres from 34 countries around European seas. Currently, it gives access to more than 2.55 million data sets, originating from more than 850 organisations in Europe, covering physical, geological,

chemical, biological and geophysical, and bathymetry data, acquired in European waters and global oceans.

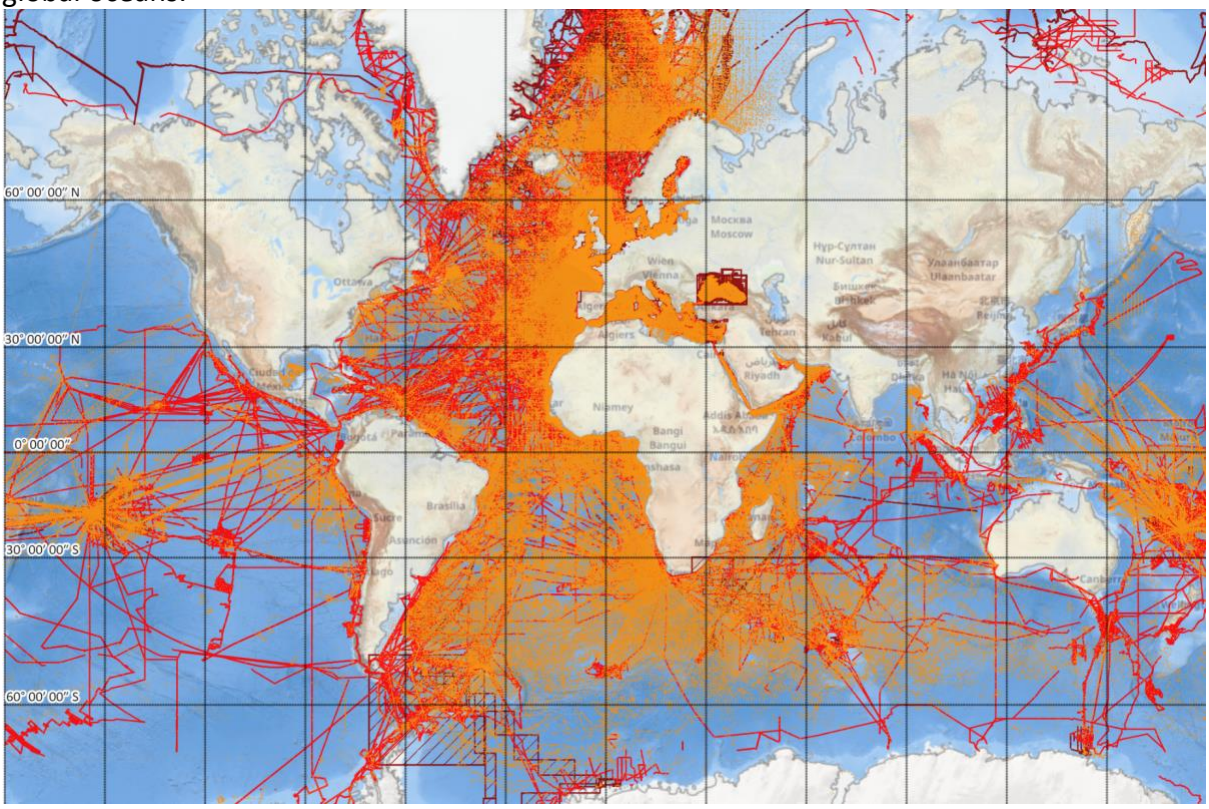

Figure 11 – Overview of current SeaDataNet data holdings

Core Services

A core SeaDataNet service is the Common Data Index (CDI) data discovery and access service which provides harmonized discovery and access to a large volume of marine and ocean data sets, both from research and monitoring organisations, which increasingly are major input for developing added-value services and products that serve users from government, research and industry, such as developed and published by EMODnet and CMEMS.

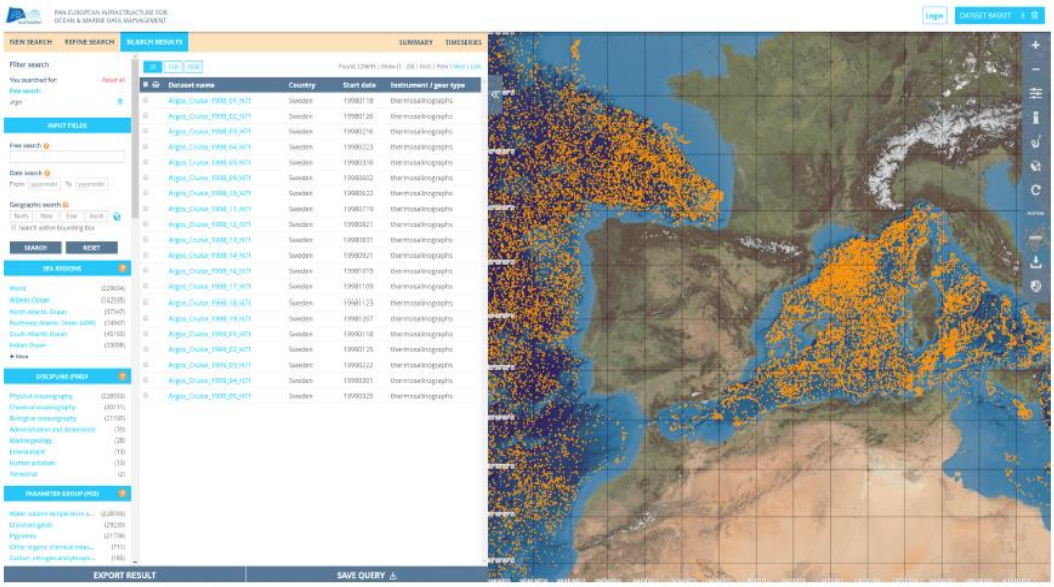

Figure 12 – New dynamic user interface of the upgraded CDI data discovery and access service

The online CDI User Interface gives users powerful search options, and a highly detailed insight into the availability and geographical spreading of marine data sets that are managed by the connected data centres. After granted access, it's possible to download data sets from all connected data centres.

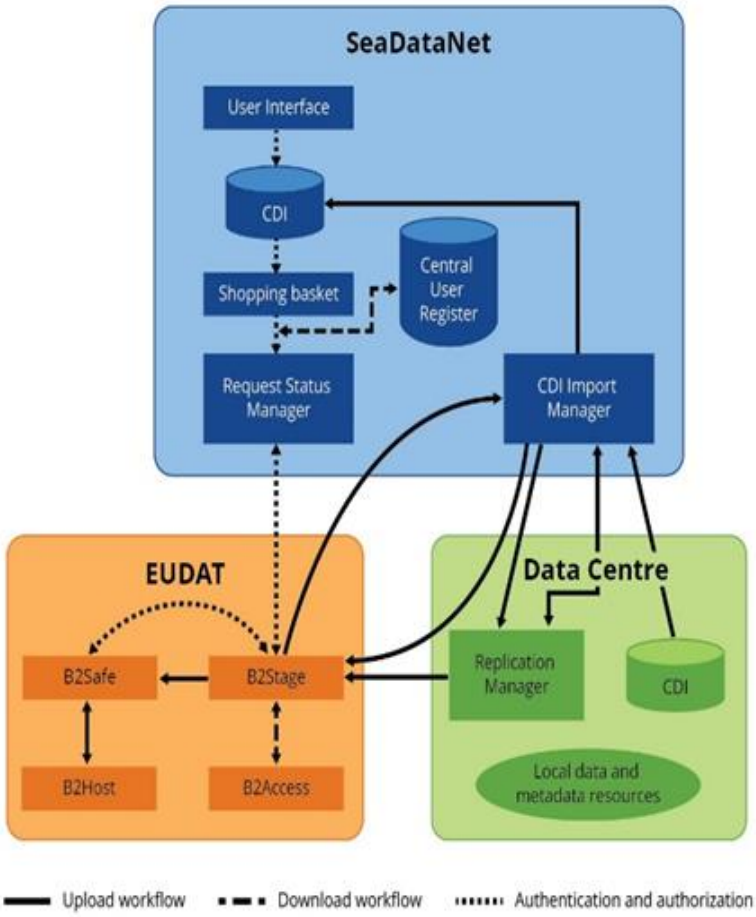

Figure 13 – CDI system architecture

Function in Blue-Cloud: SeaDataNet is one of the blue data infrastructures, and serves as one of the pillars of the initial Blue-Cloud framework. Furthermore, use is made of the experiences and system components as developed by SeaDataNet for the upgraded CDI data discovery and access service.
Partners involved: MARIS, Ifremer, CSC, CINECA, DKRZ, VLIZ
URL: https://cdi.seadatanet.org/search

Factsheet available at https://blue-cloud.org/data-infrastructures/seadatanet

2.3. Ongoing synergies with projects and initiatives

2.3.1. Aqua-Lit

Project Information
Aqua-lit: Preventive measures for averting the discarding of litter in the marine environment from the aquaculture industry
URL: www.aqua-lit.eu
Project Coordinator: Geonardo Environmental Technologies
Coordinator Country: Hungary
Project duration: 01.09.2019 - 28.02.2021
Funding Programme: EASME/EMFF/2017/1.2.1.12 - Sustainable Blue Economy

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Project Mission
The project AQUA-LIT has worked together with the aquaculture stakeholders from the Mediterranean Sea, the Baltic Sea and the North Sea, to develop a toolbox of solutions, measures and recommendations to better handling marine litter from a prevention to a recycling state, further aiming to make the aquaculture industry a leading sector on addressing this global and escalating issue.

Type of synergy with Blue-Cloud
Usage and exploitation of Blue-Cloud VRE services: AQUA-LIT's data on marine litter, coming from aquaculture activities, can be integrated to the Blue-Cloud Aquaculture VRE, or if possible, to a new VRE linked to marine litter data. The connection with Blue-Cloud allows AQUA-LIT's data to be further disseminated and accessible to other stakeholders and researchers also after the termination of the AQUA-LIT project (February 2021).
Connecting Data to key European Data Management service providers via Blue-Cloud: AQUA-LIT data sources can be integrated in the Blue-Cloud dataset through the EMODnet Chemistry infrastructure.
Contribution to Blue-Cloud Roadmap: AQUA-LIT project developed 58 policy recommendations that could be useful to shape the Blue-Cloud roadmap. AQUA-LIT policy is a ready-document that highlights what is needed in terms of policies, governance, support, responsibility, and many other points, to achieve the SDGs goals by 2030.
Joint dissemination/communication activities: Blue-Cloud and AQUA-LIT are planning to organise joint events and dissemination activities to share the projects' results and reach a broader community.

Factsheet available at www.blue-cloud.org/synergies/aqua-lit

2.3.2. BeOpen

Project information
BeOpen (European forum and oBsErvatory for OPEN science in transport)
Url: www.beopen-project.eu
Project Coordinator: Centre for Research and Technology Hellas / Hellenic Institute of Transport
Coordinator Country: Greece
Project duration: 01/01/2019 - 30/06/2021
Funding Programme - H2020-EU.3.4. - SOCIETAL CHALLENGES - Smart, Green And Integrated Transport

Project mission
The overarching vision of BE OPEN is to create a common understanding on the practical impact of Open Science and to identify and put in place the mechanisms to make it a reality in transport research. Openness, transparency, fairness, reproducibility of science are key aspects around which BE OPEN seeks to establish the ground rules for the transport research communities, ultimately creating a community of transport research organizations willing to work on the basis of a commonly agreed "Open Science Code of Conduct".

Type of synergy
Usage and exploitation of Blue-Cloud VRE services: BEOPEN has developed the TOPOS (Transport Observatory/fOrum for Promoting Open Science) tool, which aims to showcase the status and progress of open science in transport research. The transport modes data developed by BE-OPEN may be linked to the Blue-Cloud VRE and further exploited in the dataset. Moreover, BE-OPEN acts as a data provider to Blue-Cloud thanks to the access to the water and maritime transport modes data that can be included in the Marine Environment Indicators demonstrator.
Joint dissemination/communication activities: The projects are planning to organise joint webinars and events to share the projects' results and reach a broader community.

Factsheet available at www.blue-cloud.org/synergies/be-open

2.3.3. CoastObs

Project information
CoastObs (Commercial service platform for user-relevant coastal water monitoring services based on Earth observation)
Url: www.coastobs.eu
Project Coordinator: Water Insight B.V.,
Coordinator Country: Netherlands

Project duration: 01/11/2017 - 30/04/2021
Funding Programme - H2020-EU.2.1.6.3. - Enabling exploitation of space data & H2020-EU.2.1.6.1.2. - Boost innovation between space and non-space sectors

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Project mission
CoastObs aims to develop innovative EO-based products (monitoring of seagrass and macroalgae, phytoplankton size classes, primary production, and harmful algae) and higher-level products (indicators and integration with predictive models).
CoastObs aims also to establish sustainable supply chains that can be directly integrated into the users' systems. The CoastObs consortium aims to define user groups with common requirements, so tailored products can be developed at highly reduced costs per user. Setup of efficient data structures (array database) for smart (re)processing of data is part of this ambition.

Type of synergy
Connecting Data to key European Data Management service providers via Blue-Cloud: CoastObs can provide test data linked to its main research (seagrass, macroalgae, phytoplankton, primary production, and harmful algae). The data provided by CoastObs can be integrated through the development of the Blue-Cloud catalogue of services.

Factsheet available at www.blue-cloud.org/coastobs

2.3.4. Cos4Cloud

Project Information
Cos4Cloud (Co-designed citizen observatories for the EOS-Cloud)

URL: www.cos4cloud-eosc.eu
Project Coordinator: Agencia Estatal Consejo Superior de Investigaciones Scientificas
Coordinator Country: Spain
Project duration: 1/11/2019- 28/2/2023
Funding Programme H2020-EU.1.4.1.3. Development, deployment and operation of ICT-based e-infrastructures

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Project mission
Cos4Cloud is addressing the challenge of providing data quality to citizens by developing ten technological services to improve citizen science platforms, also known as citizen observatories, to help them boost the quantity and the quality of observations and ensure their long-term viability. Cos4Cloud makes these services available in the new European Open Science Cloud (EOSC), a virtual space aimed at the European scientific community, in order to make them available to anyone interested in creating or improving their citizen observatory. Moreover, the cutting-edge technologies help improve interoperability, networking, data quality and secure management of data in citizen observatories, with a very user-friendly focus.

Type of synergy
Connecting Data to key European Data Management service providers via Blue-Cloud: Cos4Cloud data can be integrated to the Blue-Cloud infrastructure through the support of the D4Science Infrastructure.
Contribution to Blue-Cloud Roadmap: Cos4Cloud plays a relevant role in shaping the strategic Blue-Cloud Roadmap as it provides support in better outlining the Blue-Cloud community, integrating EOSC systems and scaling up Blue-Cloud demonstrators.
Joint dissemination/communication activities: Jaume Piera, Cos4Cloud coordinator, is a member of the Blue-Cloud ESEB team. Thanks to his expertise, he has been invited to join the Blue-Cloud workshop on open science and its thematic demonstrators on 23 March 2021. Blue-Cloud is planning to involve Cos4Cloud in other public events in order to disseminate and communicate their research results to the interested communities.

Factsheet available at www.blue-cloud.org/synergies/cos4cloud

2.3.5. ENVI-FAIR

Project Information
ENVI-FAIR (ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research)
URL: www.envri-fair.eu
Project Coordinator: Forschungszentrum Juelich
Coordinator Country: Germany
Project duration: 01/01/2019 - 31/12/2022
Funding Programme: H2020-EU.1.4.1.1. - Developing new world-class research infrastructures

Project mission
The overarching goal of ENVRI-FAIR is to implement FAIR (Findable, Accessible, Interoperable, Re-usable) principles in the ENVRI (European Environmental and Earth System Research Infrastructures) community and connect it to the European Open Science Cloud. ENVRI-FAIR targets the development and implementation of both technical frameworks and policy solutions that make sub-domain boundaries irrelevant for environmental scientists and prepare Earth system science for the new Open Science paradigm and truly interdisciplinary science.

Type of synergy
Usage and exploitation of Blue-Cloud VRE services: the ENVRI-FAIR marine domain catalogue can be integrated and used directly in the Blue-Cloud VRE. In the long term, the aim is to connect also other kind of data (and not only the marine ones) such as coastal application and air-sea interaction. Moreover, ENVI-FAIR data can be integrated and enhance the Blue-Cloud VREs linked to Marine Environmental Indicators and Plankton Genomics.
Connecting Data to key European Data Management service providers via Blue-Cloud: the ENVRI-FAIR services can be used by Copernicus Services production centers and EMODNnet for their product and indicators elaboration. Both EMODnet and Copernicus are data infrastructures cooperating with Blue-Cloud. This makes the data accessible to the Blue-Cloud users, too.
Contribution to Blue-Cloud Roadmap: ENVRI-FAIR supports the development of the Blue-Cloud roadmap from a strategic point of view, providing insights into the EU Digital Twin Ocean.
Joint dissemination/communication activities: ENVRI-FAIR and Blue-Cloud aim to organise joint activities to further disseminate their project results to relevant stakeholders.

Factsheet available at www.blue-cloud.org/synergies/envri-fair

2.3.6. EuroSea

Project Information
EuroSea (Improving and Integrating European Ocean Observing and Forecasting Systems for Sustainable use of the Ocean)

URL: https://eurosea.eu/
Project Coordinator: Geomar
Coordinator Country: Germany
Project duration: 01/11/2019 - 31/12/2023
Funding Programme - H2020-EU.3.2.5.1. - Climate change impact on marine ecosystems and maritime economy

Project mission
EuroSea aims to co-design a new approach that could improve European ocean observing and forecasting services and products by building the community needed for a system that delivers services and products on the ocean, ocean climate, marine ecosystems and their vulnerability to human impacts.

Type of synergy
Usage and exploitation of Blue-Cloud VRE services: EuroSea is primarily looking at data delivery from the observing activities in the ocean observing networks to data integrators.
EuroSea is also developing two demonstrators: the *Coastal Resilience and Operational Services Demonstrator* that is advancing the collection, quality control, interpretation and use of sea level data to deliver a spatially complete picture of sea level changes, and the *Ocean Health Demonstrator* working with users in Aquaculture, Fisheries, Tourism, and Environmental Agencies to co-create products that help identify and foresee Extreme Marine Events. Due to the similarities of topics, the aim is to integrate the EuroSea data with the Blue-Cloud infrastructure in order to complement data that the projects might miss from their data value chain and, consequently, improve the quality of the dataset.
EuroSea is also willing to scope out to what extent the activities by GOOS on mapping the data flow could benefit from cooperation between the EuroSea and Blue-Cloud.
Contribution to Blue-Cloud Roadmap: Toste Tanhua, EuroSea coordinator, is one the members of the Blue-Cloud ESEB team and is highly involved in shaping the future of the Blue-Cloud Roadmap from a strategic point of view.
Joint dissemination/communication activities: Blue-Cloud and EuroSea have been involved in events in which the projects were giving presentations and providing relevant inputs (e.g. Annual EuroSea meeting, All-Atlantic Ocean Research Forum 2020). Moreover, EuroSea is taking part in the Horizon Results Booster (HRB) in the project group in which Blue-Cloud is involved too. The HRB provides opportunities to create policy briefs about ocean observing.

Factsheet available at www.blue-cloud.org/synergies/eurosea

2.3.7. FNS Cloud

Project Information
FNS Cloud (Food Nutrition Security Cloud)
URL: www.fns-cloud.eu
Project Coordinator: RTDS ASSOCIATION
Coordinator Country: Austria
Project duration: 01/10/2019 - 30/09/2023
Funding Programme: H2020-EU.3.2.2.3. - A sustainable and competitive agri-food industry

Project mission
FNS-Cloud aims to develop an on-demand, federated network (cloud infrastructure), supporting access and exploitation of FNS resources, integrated with other thematic clouds and the European Open Science Cloud (EOSC). In addition, FNS-Cloud fosters advanced methods and Services for user communities, making FNS data more FAIR (Findable, Accessible, Interoperable, and Reusable) and adding-value to publicly funded research for citizens.

Type of synergy
Usage and exploitation of Blue-Cloud VRE services: FNS-Cloud supports the development of the new FAO uFish dataset, a widely used and cited reference table of Food Composition values of aquatic products. The data are taken from selected publications and undergo a thorough review and validation process that must be replicated in this application. The collaboration between Blue-Cloud and FNS-Cloud brings twofold benefits. On one side, the uFish dataset benefits from EU supported API's, like FOODEX2, available in the FNS-Cloud dataset. On the other side, through uFish, FNS-Cloud will be able to find fully referenced records on Food Composition of aquatic products.
The uFish dataset is going to enrich the Blue-Cloud Fishery VRE in terms of GRSF description of fish items in the food-value chain and can contribute to a better understanding of the nutritional contribution of fish to food systems. The data connection can be guaranteed through the exploitation of the D4Science Infrastructure.
Contribution to Blue-Cloud Roadmap: Karl Presser is one the ESEB members, fully involved in supporting the strategic mission of Blue-Cloud.
Joint dissemination/communication activities: FNS-Cloud and Blue-Cloud are going to organise joint dissemination and communication activities and prepare joint articles in order to raise awareness of their project results.

Factsheet available at www.blue-cloud.org/synergies/food-nutrition-security-cloud-fns-cloud

2.3.8. Forcoast

Project information
Forcoast (Earth Observation Services for Fishery, Bivalves Mariculture and Oysterground Restoration along European Coasts)
URL: www.forcoast.eu
Project Coordinator: Stiching Deltares
Coordinator Country: Netherlands
Project Duration: 01/11/2019 - 30/04/2022
Funding programme:H2020-EU.2.1.6.1. - Enabling European competitiveness, non-dependence and innovation of the European space sector & H2020-EU.2.1.6.3. - Enabling exploitation of space data

Project mission
FORCOAST aims to develop novel Copernicus-based downstream information services to that offer high-resolution water quality and met-ocean indicators in coastal and near-shore areas, to improve operation, planning and management of different marine activities in the sectors of wild fisheries, oyster grounds restoration, and bivalve mariculture. FORCOAST information services are co-designed with stakeholders, thereby ensuring that these services are tailored to meet their needs.

Type of synergy
Contribution to Blue-Cloud Roadmap: Forcoast can support the future of the Blue-Cloud project, through advice on how to build the roadmap from industrial and commercial viewpoints.

Factsheet available at www.blue-cloud.org/forcoast

2.3.9. Jonas

Project information
Jonas (Joint Framework for Ocean Noise in the Atlantic Seas
URL: www.jonasproject.eu
Project Coordinator: MaREI
Coordinator Country: Ireland
Project Duration: 01/01/2019 - 30/06/2022
Funding programme: 2014 - 2020 INTERREG VB Atlantic Area

Project mission
JONAS project addresses the issue of underwater noise and the threats it poses to sensitive species in the northeast Atlantic by streamlining ocean noise monitoring and risk management on a transnational basis.
JONAS aims to harmonise technical approaches to the Marine Strategy Framework Directive (MSFD) requirements, promote quieter operational practices among users of the North Europe Atlantic marine space, support adoption of regional-scale approaches that benefit biodiversity and the MSFD implementation, and develop an innovative noise-monitoring visualisation platform supporting adaptive management of sensitive marine areas.
Type of synergy
Usage and exploitation of Blue-Cloud VRE services: Jonas is implementing a VRE to solve the issue linked to underwater noise. Jonas and Blue-Cloud are evaluating the opportunity to bridge their VREs and standardise them.
Contribution to Blue-Cloud Roadmap: Jonas project aims to contribute to shape the strategic Blue-Cloud Roadmap 2030, providing contributions from technical point of view.
Joint dissemination/communication activities: Blue-Cloud and Jonas are planning to jointly organise events to disseminate the project results to a wider audience.

Factsheet soon available at www.blue-cloud.org/jonas

2.3.10. NEANIAS

Project information
NEANIAS (Novel EOSC services for Emerging Atmosphere, Underwater and Space Challenges
URL: www.neanias.eu
Project Coordinator: ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON
Coordinator Country: Greece
Project Duration: 01/11/2019 - 31/10/2022
Funding programme: H2020-EU.1.4.1.3. - Development, deployment and operation of ICT-based e-infrastructures

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Project mission
NEANIAS promotes Open Science practices and plays an active role in the materialization of the EOSC ecosystem by efficiently engaging large scientific and professional communities. It also actively contributes to the technological, procedural, strategic and business development of the EOSC. NEANIAS drives the co-design and delivery of innovative thematic services, derived from state-of-the-art research assets and practices in three major sectors: Underwater research, Atmospheric research and Space research, each engaging multitudinous academic and business groups, numerous researchers, professionals and governmental entities.

Type of synergy
Usage and exploitation of Blue-Cloud VRE services: The NEANIAS data can be integrated and stored in the Blue-Cloud virtual environment for analysis and re-use purposes, and enrich the thematic dataset for Fisheries, Aquaculture and Environmental Marine Indicators demonstrators.
Joint dissemination/communication activities: The collaboration between Blue-Cloud and Neanias is planned to develop joint dissemination and technical activities focused on Underwater and Atmospheric research (Neanias) and Fisheries, Aquaculture and Environmental Marine Indicators demonstrators (Blue-Cloud).
The main closer action of dissemination and communication activity is the setting of the “Blue Research and Innovation Days” event with the involvement of projects and initiatives in the field to present the “Blue ecosystems” in terms of Data access and services to an audience of researchers and marine data/data infrastructure managers.

Factsheet soon available at www.blue-cloud.org/synergies/neanias

2.3.11. Odyssea

Project information
Odyssea (OPERATING A NETWORK OF INTEGRATED OBSERVATORY SYSTEMS IN THE MEDITERRANEAN SEA)
URL: http://odysseaplatform.eu
Project Coordinator: Professor Georgios SYLAIOS
Coordinator Country: Greece
Project duration: 01/06/2017 - 30/11/2021
Funding Programme - H2020-EU.3.2.5. - Cross-cutting marine and maritime research

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Project mission
The ODYSSEA project has developed an interoperable and cost-effective platform that fully integrates networks of observing and forecasting systems across the Mediterranean basin, addressing both the open sea and the coastal zone. The platform collects the data from the many databases maintained by agencies, public authorities, and institutions of Mediterranean EU and non-EU countries, integrating existing earth observation facilities and networks in the Mediterranean Sea building on key initiatives such as Copernicus, GEOSS, GOOS, EMODNet, ESFRI, Lifewatch, Med-OBIS, GBIF, AquaMaps, Marine IBA e-atlas, MAPAMED and others with marine and maritime links.
Type of synergy
Connecting Data to key European Data Management service providers via Blue-Cloud: Odyssea and the Blue-Cloud data can be integrated thanks to the development of the Odyssea's Marinomica application. Marinomica is able to provide bidirectional data transfer and integration via API and more 'traditional' methods and seeks to connect to services to extract data as well as providing access to data, models and derived products produced by the ODYSSEA consortium.
Joint dissemination/communication activities: The Blue-Cloud and Odyssea consortium are planning to organise joint communication activities to disseminate their project results to the academic and private sectors.

Factsheet soon available at www.blue-cloud.org/synergies/odyssea

3. Conclusions

The first release of the *Blue-Cloud Fact Sheets for cluster projects and other core initiatives* shows how a thematic EOSC project is able to create strong partnerships with both research infrastructures and other EU-funded projects and research initiatives in the marine as well as in other sectors. Moreover, the synergic initiatives presented in this document demonstrate how relevant it is to create connections with similar projects operating in the same research field due to the opportunity to share joint results to a wider community, paving the way towards the exploitation of the BlueCloud results in the medium run.

In the first 18 months from its launch, Blue-Cloud has established a dialogue mainly with European players. The aim for the second reporting period is to strengthen the synergies established so far and continue looking for new ones in an International dimension.

The impact and outputs generated thanks to the collaboration with the projects and initiatives reported in this D6.1 will be collected and expanded in the second release of the *Blue-Cloud Fact Sheets for cluster projects and other core initiatives (D6.6*) expected in M35. Online versions of these factsheets are maintained up-to-date in the Blue-Cloud website, too.