JERICO-S3 DELIVERABLE

Joint European Research Infrastructure for Coastal Observatories

Science, Services, Sustainability

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GLOSSARY

D2PTS:	Data to Product Thematic Service
EuroGOOS:	European Global Ocean Observing System
GoF:	Gulf of Finland
HAB:	Harmful Algae Blooms
HFR:	High Frequency Radar
JERICO:	Joint European Research Infrastructure of Coastal Observatories
JERICO-CORE:	JERICO-Coastal Ocean Resource Environment
JERICO-RI:	JERICO Research Infrastructure
NRT:	Near Real Time
VRE:	Virtual Research Environment
VOS:	Voluntary Observing Ship-lines

1. EXECUTIVE SUMMARY

The JERICO network is constantly working to improve its core functionality, which is the ability to provide comprehensive observations of Europe's coastal seas and oceans. This means integrating new, promising observing technologies that can expand its spatial reach.

JERICO-CORE is the unified central hub of JERICO-RI (Jerico-Research Infrastructure, https://www.jerico-ri.eu/) to discover, access, manage and interact with JERICO-RI resources including services, datasets, software, best practices, manuals, publications, organizations, projects, observatories, equipment, data servers, e-libraries, support, training and similar assets (https://www.jerico-ri.eu/va-services/jerico-core/). JERICO-CORE aims to provide a coastal ocean resources environment of the JERICO Research Infrastructure that facilitates both enhanced (virtual) access to all JERICO-RI related resources and the development of coastal focused services.

Four Data-to-Products Thematic Services (D2PTS) have been proposed as demonstrators of JERICO-CORE capabilities:

- High Frequency Radar (HFR) network D2PTS including interactive inventory map, access to network joint resources and gap-filled surface current products.
- Estimation of sea water masses types and transport monitoring from Gliders D2PTS.
- Biogeochemical state of coastal areas D2PTS.
- JERICO-EcoTaxa D2PTS with coastal plankton monitoring products from ecological imaging sensors.

This report summarizes the developments in each of these areas. Interactions of the four D2PTS into the integrated Coastal Ocean Resource Environment (JERICO-CORE) is a next step which is being addressed through a complementary effort.

2.INTRODUCTION

JERICO Coastal Ocean Resource Environment (JERICO-CORE) is the unified central hub of JERICO-RI (https://www.jerico-ri.eu/va-services/jerico-core/) to discover, access, manage and interact with JERICO-RI resources including services, datasets, software, best practices, manuals, publications, organisations, projects, observatories, equipment, data servers, e-libraries, support, training and similar assets. The JERICO-CORE infrastructure collects information about these resources through the existing providers of data, metadata, software services, documents and videos. The information of these assets is interconnected in a knowledge base catalogue that is at the core of the infrastructure and offers a broad view of the data as well as observation and operation processes and capabilities in JERICO-RI. The JERICO-CORE inventory represents the relation between the virtual and physical assets from the JERICO Research Infrastructures distributed worldwide among scattered systems.

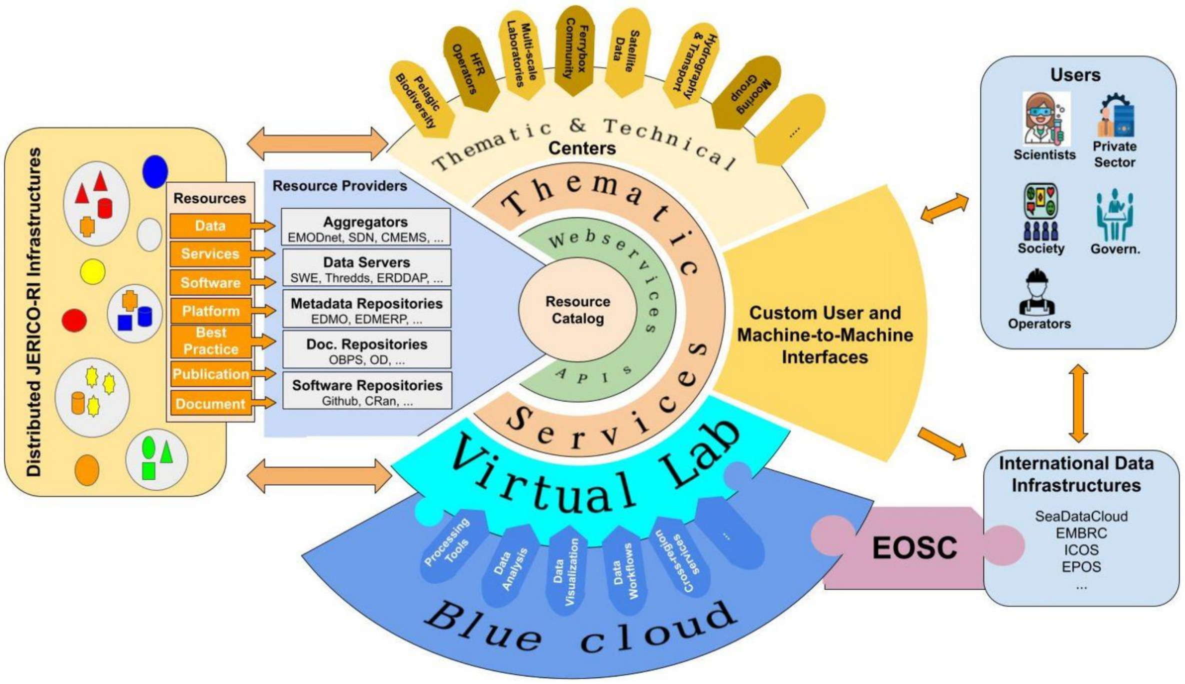


Figure 2.1. Long term concept diagram of the JERICO-CORE ecosystem. This figure focuses on the interaction between the different actors within the JERICO-RI e-infrastructure.

JERICO-CORE provides support to services. These services can be federated among partners or developed in the JERICO Blue Cloud Virtual Research Environment, constituting a key component for developing services in a collaborative manner. These services will provide support from both a thematic and technical points of view. Users and developers can discover and access resources through the machine-to-machine endpoints. Services and associated resources are registered in the JERICO-CORE resource catalogue to provide users the required information to use them.

Four Data-to-Products Thematic Services (D2PTS) have been developed inside JERICO-S3 as demonstrators of JERICO-CORE capabilities:

- High Frequency Radar (HFR) network D2PTS including interactive inventory map, access to network joint resources and gap-filled surface current products.
- Estimation of sea water masses types and transport monitoring from Gliders D2PTS.
- Biogeochemical (BGC) state of coastal areas D2PTS.
- JERICO-EcoTaxa D2PTS with coastal plankton monitoring products from ecological imaging sensors.

A summary of these activities was presented at IMDIS 2021 (Charcos et al., 2021). Some D2PTS focus on creation of observation data, others on evolved models and tools, as described below. Integration of data and tools are both part of evolving and demonstrating the CORE capabilities and providing additional services to the application community.

This report focuses on descriptions of the four D2PTS. Integration of these capabilities will be addressed in the JERICO D7.6 deliverable.

3. Pilot D2PTS demonstration

The four Data-to-Products Thematic Services (D2PTS) are detailed in the next subsections. The ingestion of the corresponding data into JERICO-CORE is still in process at the date of submission of this deliverable. They can be accessed through the JERICO-CORE api (https://api.core.jerico-ri.eu) or the JERICO-CORE site (https://ui.core.jerico-ri.eu)

3.1. HFR D2PTS

HFR is a very effective land-based remote sensing technology to monitor coastal regions all over the world due to its capacity of mapping ocean surface currents and wave fields over wide areas with high spatial and temporal resolution. HFR main applications span research, marine safety and security, pollutant monitoring, tsunami detection, fishery, navigation and renewable energy, thus making HFR technology a powerful tool for the integrated management of coastal zones. Thanks to the efforts carried on by the EuroGOOS HFR Task Team (https://eurogoos.eu/high-frequency-radar-task-team/) , a mature level of homogenization and standardization of operations and products has been achieved by the European HFR Node and community, mainly based on a core of shared best practices (Mantovani et al., 2020), documentation and software tools.

Three main Thematic Services from the HFR are being implemented in JERICO-S3, described in sections 3.1.1, 3.1.2 and 3.1.3:

1. **Inventory Thematic Service**: interactive map showing the inventory of the European HFR network with filters for selecting the stations visible in EMODnet and CMEMS-INSTAC by status (ongoing, future, inactive), with popups listing metadata.
2. **HFR resources Thematic Service**: Best Practices, Catalogue of References, Guidelines, Tools and Data Reports, Outage database, most of which are available via the JERICO-CORE and the rest will be available soon.
3. **HFR Gap-filling Thematic Service**: Gap filled surface current fields will be available in JERICO-CORE. Pilot applications will be implemented in Bay of Biscay IRS and NW-MED PSS

3.1.1. Inventory Thematic Service

The European HFR Node is currently processing data from different data operators and the data from those HFR operators is archived in the HFR Node database.

An interactive shiny app (https://aztidata.es/HFRTT/, last accessed on November 21st, 2022) has been created to offer data users and providers the possibility to see in a unique server (portal), information on all HFR systems connected to the European HFR Node (figure 3.1.1).

In the interactive map, the user can filter the HFR sites and system by different selectors:

- Manufacturer
- Time interval
- Frequency Range
- Longitude/Latitude Range
- HFR stations
- HFR networks

The shiny map also offers the possibility to download the information associated with each of the sites and systems, with a simple "click" on the 'Download metadata' tab.

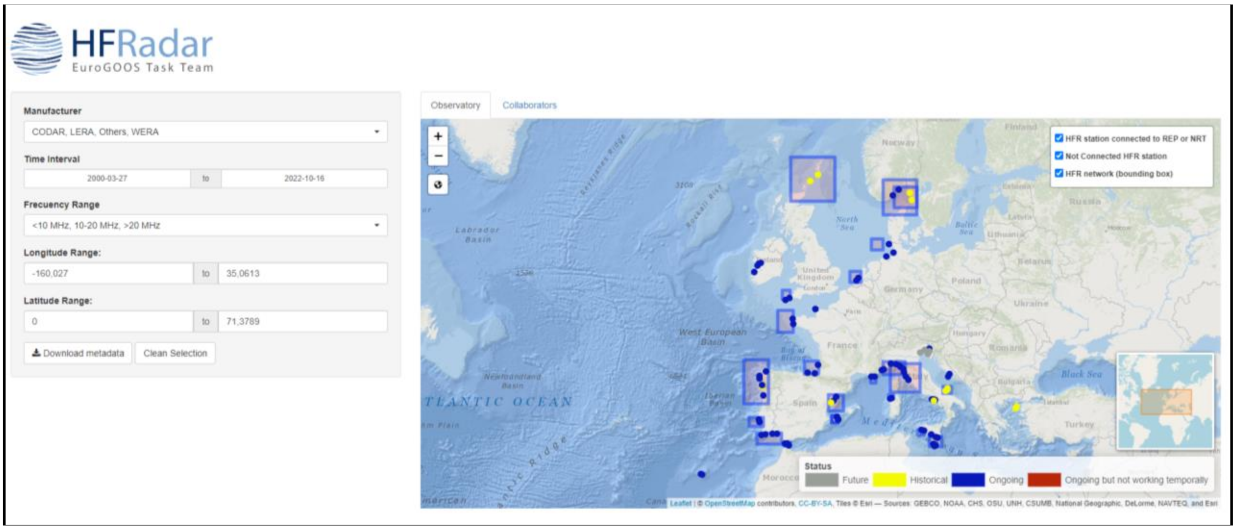


Figure 3.1.1. Screenshot of the inventory thematic service website

3.1.2. HFR resources Thematic Service

EuroGOOS HFR Task Team (https://eurogoos.eu/high-frequency-radar-task-team/) has been working on homogenization and standardisation operations and products in the last years and thanks to these efforts, several HFR resources have been created and shared, mainly based on products, best practices, documentation and software tools.

Most efforts and results developed among EuroGOOS HFR Task Team are dispersed across different repositories under multiple formats (documents, tools, data, etc.). The HFR resources

D2PTS provides an opportunity to centralize the accessibility to previous efforts through JERICO-CORE, to improve coastal data and information findability and accessibility. These resources have been separated in 6 main thematic groups and are being indexed in the JERICO-CORE catalogue. They can be accessed through the JERICO-CORE api (https://api.core.jerico-ri.eu) or the JERICO-CORE site (https://ui.core.jerico-ri.eu):

The 6 main thematic groups are:

1. Community monitoring
2. Tools
3. Data
4. Additional Guidance documentation
5. Training materials
6. Outreach activities and educational resources

Each group includes the resources listed in tables 3.1.1 to 3.1.6.

	HFR Community monitoring resources
1	EuroGOOS HFR Radar Task Team website
2	Inventory thematic service: Shiny HFR
3	European HFR Node data entry web form
4	EuroGOOS HFradar task team Zotero repository
5	European HFR Competence Matrix
6	List of existing and potential users of HFR data
7	Subscription to the HFR biannual newsletter

Table 3.1.1. 'Community monitoring' thematic group resources

	HFR Tools resources
1	HFR data processing tools
2	Guidelines for HFR surface current OMA gap-filling
3	HFRprogs High Frequency Radar Program Suite
4	JRadar software
5	GitHub repository of the HFR-TT EU HFR Node

Table 3.1.2. 'HFR Tools thematic' group resources

	HFR Data resources

1	European HFR Node THREDDS catalog
2	Access to EMODnet Physics
3	Access to NRT and REP CMEMS products
4	HFR dataset reports
5	European HFR Node thredds
6	ERDDAP of the EU HFR Node at

Table 3.1.3. 'HFR Data' thematic group resources

	HFR Additional Guidance documentation resources
1	Ocean Best Practices: recommendation Report 2 on improved common procedures for HFR QC analysis. JERICO-NEXT WP5-Data Management, Deliverable 5.14
2	Ocean Best Practices: Guidelines on how to sync your High Frequency (HF) radar data with the European HF Radar node
3	European HFR Node guidance documentation
4	JERICO-NEXT project deliverable: Report on first methodological improvements on retrieval algorithms and HF radar network design
5	JERICO project deliverable: D2.4: Report on Best Practice in the implementation and use of new systems in JERICO-RI. Part 1: HF-radar systems
6	Data Management Plan examples:

Table 3.1.4. 'Additional guidance' thematic group resources

	HFR Training materials resources
1	ARC NRT product/dataset: managing files (hfradars)
2	Jupyter Tutorial – Arctic Ocean- In Situ data : Managing In Situ data from HF radars
3	DIVAnd package developed by GHER (University of Liège) for the interpolation of HFR data available on github [software]
4	HFR data visualization routines in python [software]

Table 3.1.5. 'HFR Training materials resources' thematic group resources

	HFR Outreach activities and educational resources

1	Ocean Currents
2	HF radars
3	Webinars: HF radars
4	Case studies

Table 3.1.6. 'Ocean outreach activities and educational resources' thematic group resources

3.1.3. HFR Gap-filling Thematic Service (D2PTS)

HFR observations are crucial for applications associated with transport processes, not only addressing the study of marine ecosystems but also for a wide range of coastal activities. These include search and rescue operations (Ullman et al., 2006, Bellomo et al., 2015); predicting and mitigating the spread of oil spill or other pollutants or marine litter (Lekien et al., 2005; Shadden et al., 2009; Declerck et al., 2019); understanding the impact of transport and mixing properties on relevant biogeochemical properties such as the primary productivity of plankton (Cianelli et al., 2017; Hernández-Carrasco et al., 2018); and coastal larval transport or fishery management (Bjorkstedt and Roughgarden, 1997).

Lagrangian diagnoses require complete spatial and temporal velocity data to compute trajectories of synthetic particles. The most widely extended technique for gap-filling with HFR data is the open-boundary modal analysis (OMA) (Kaplan and Lekien, 2007). But other have been also explored and compared, with the support of JERICO-NEXT (Hernández-Carrasco et al., 2018)

Gap-filled NetCDF files that follow standard characteristics are being generated for 2 pilot sites: Bay of Biscay IRS and NW-MED PSS, for 1 year, and they will be published by each of the pilots' providers, following the milestone document "JERICO-DS MS.18 - WP3 - Draft e-JERICO data management plan", annex II, section 3.2. Both datasets will be published through the European HFR Node Repository.

3.2.Glider D2PTS

3.2.1. Introduction

In the frame of the JERICO-S3 project, SOCIB has implemented an open access toolbox for the computation and visualisation of physical/biogeochemical variables from gliders, as well as derived variables and indicators that are relevant for both science and society (Juza and Tintoré, 2021). This work is a contribution to Task 7.5.2: "*Estimation of sea water masses types and transport monitoring D2PTS: will develop physical oceanography products from glider data that may be combined with biogeochemistry observations"*. This report provides some background on the SOCIB sustained endurance lines, the area of application and the tool developed for computation and visualisation of key ocean variables.

3.2.2. Monitoring the Ibiza Channel

The Ibiza Channel (IC) is a well-known biodiversity hotspot (Coll *et al*., 2010) and a choke point of the western Mediterranean Sea (Heslop *et al*., 2012; Juza *et al*., 2013) with complex topography and circulation (Figure 3.2.1). The significant variability of the meridional circulation at the scales of weeks and few kilometres has been explained through the variability of the water masses in the vertical, with very relevant implications on the marine ecosystem (e.g., Bluefin Tuna, jellyfish). SOCIB has been monitoring the IC quasi-continuously through the deployment of gliders along an endurance line since January 2011 (Tintoré *et al*., 2013, 2019). The repeated high-resolution glider sections allow us to describe and understand the ocean processes involved in the ocean circulation variability from daily/weekly to interannual scales. Semi-permanent glider sections are becoming available in different coastal to ocean areas (Boundary Ocean Observing Network), and tools such as the one developed will facilitate understanding the circulation in key ocean areas and its relation to water masses driving these changes that are essential to understand the role of the ocean in climate change.

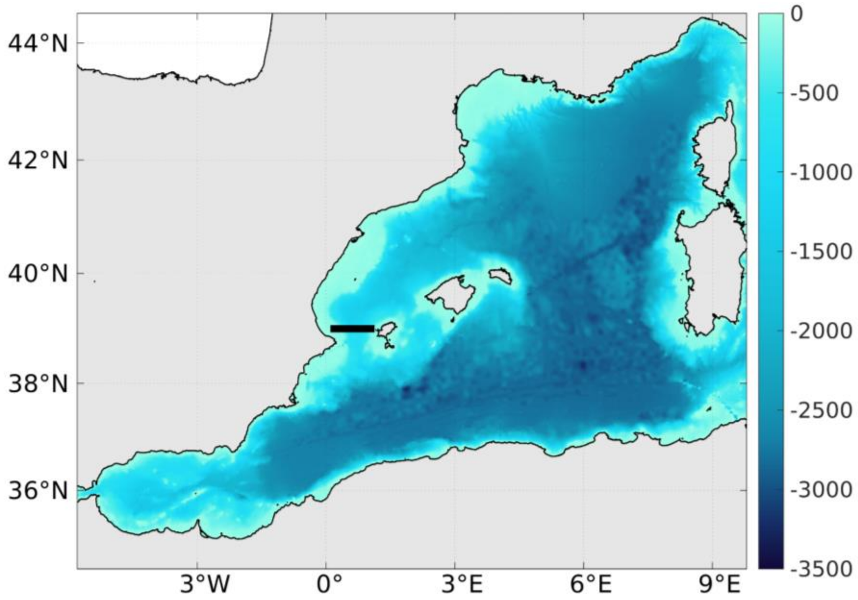


Figure 3.2.1. Bathymetry in the western Mediterranean Sea (in m). The SOCIB glider endurance-line in Ibiza Channel is located at latitude 39ºN and longitudes between 0.1 and 0.15 ºE approximately (black line).

3.2.3. Glider transport toolbox

An effective tool has been developed for the processing of SOCIB glider data to monitor and visualise the ocean circulation and variability as observed by glider measurements. The developed metrics and diagnostics are: (1) vertical sections of temperature (T), salinity (S), density (ρ) and geostrophic velocity (GV), (2) T/S diagrams and water mass identification, and (3) geostrophic transports (total and per water mass).

The tool also allows the use of biogeochemical (BGC) data from glider measurements (chlorophyll-a concentration, oxygen concentration and saturation, and turbidity). The processing applied to BGC data is the same as for the hydrographic variables (T, S) in order to be able to relate BGC values to the GV and associated water mass transports.

Although the tool is linked to the SOCIB data format and services, it exposes a methodology that could be adopted by the ocean science community as a further step. In particular, the BlueCloud2026 project will address these new capabilities through a specific task.

Schematic view

Figure 3.2.2 provides a schematic view of the toolbox from glider data processing to glider transport visualisation.

Visualisation

Figures 3.2.3 and 3.2.4 display the additional figures generated during the data processing and transport calculations. Figure 3.2.5 shows the final figures of geostrophic transport in the Ibiza Channel in the western Mediterranean Sea (NWMED-PSS).

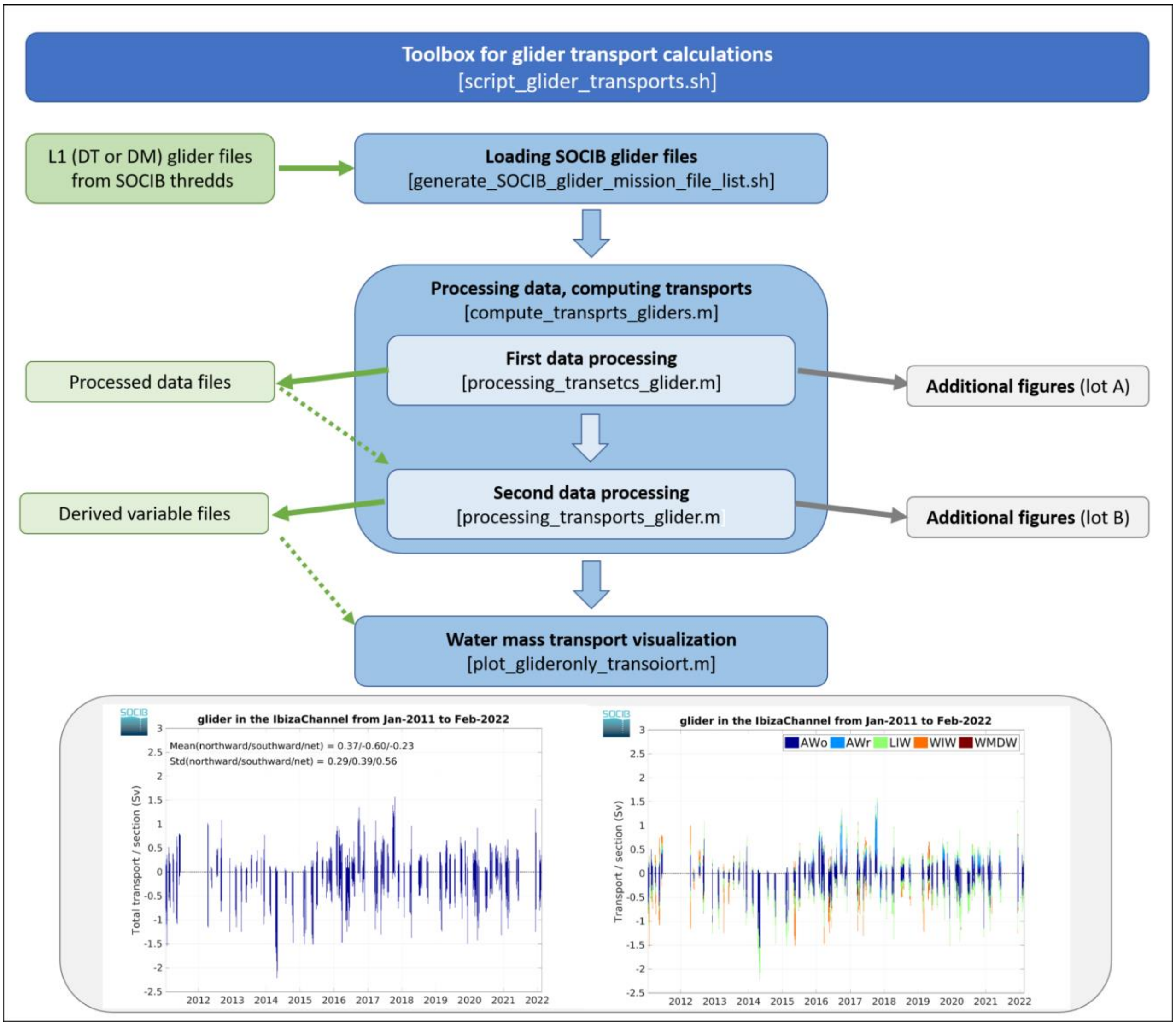


Figure 3.2.2. Scheme of the Glider Transport toolbox.

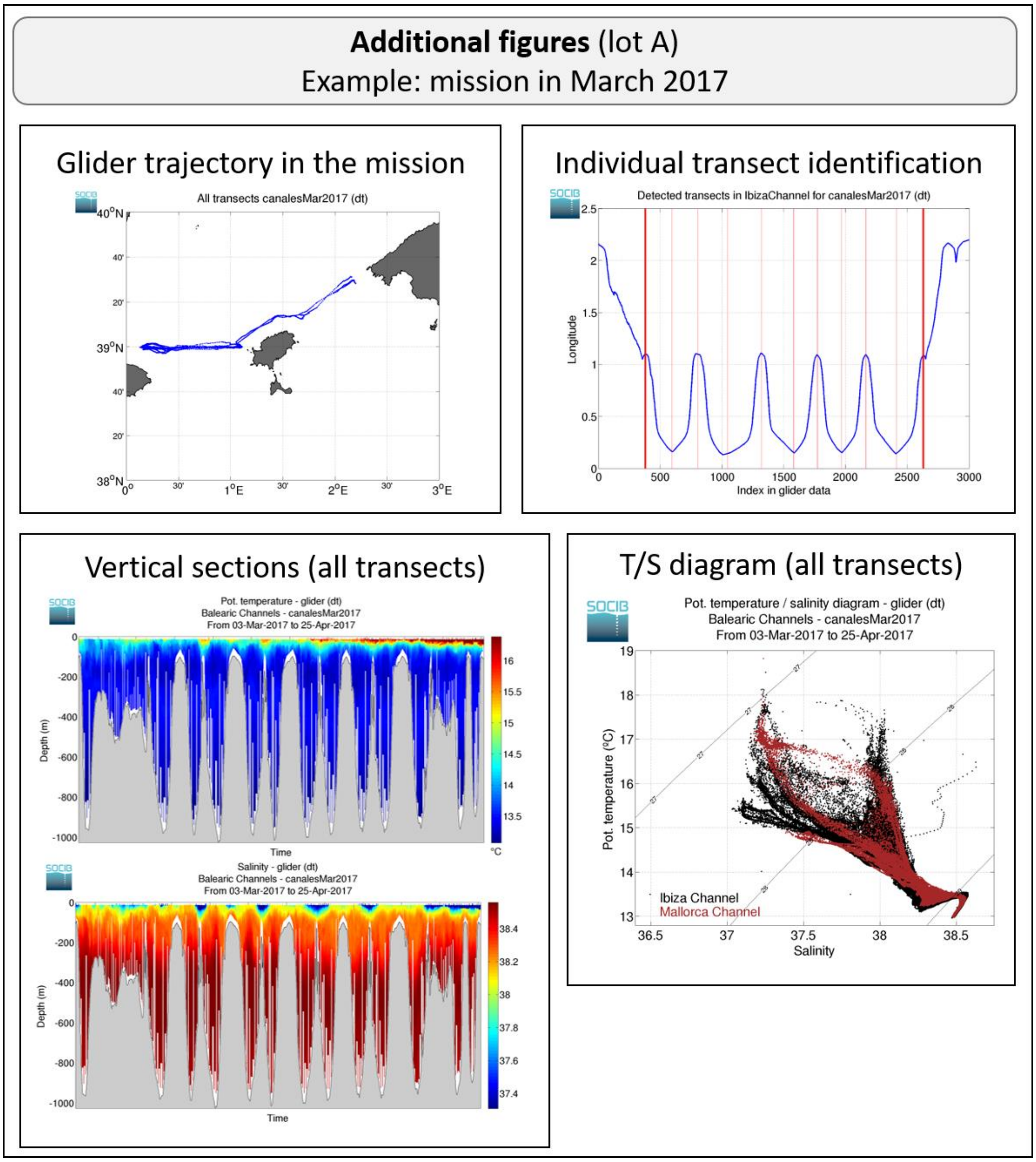


Figure 3.2.3. Additional figures (lot A). Example for the SOCIB glider mission in the Balearic Channels in March 2017.

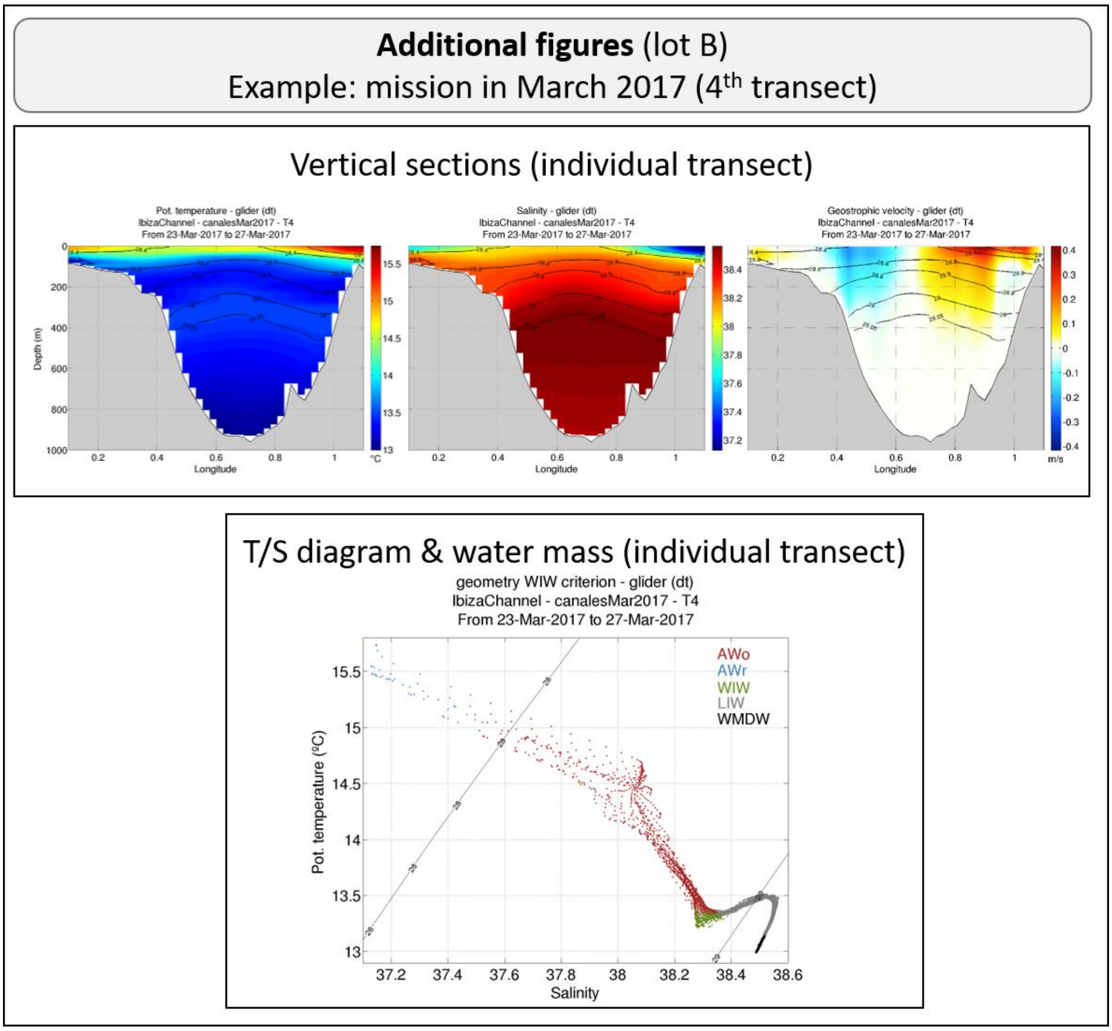
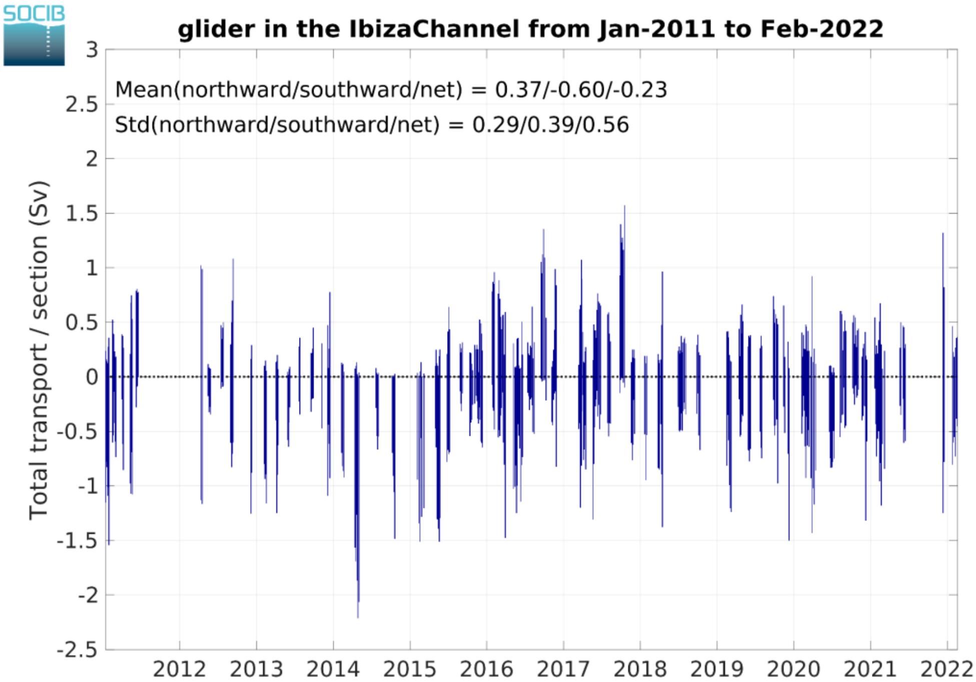


Figure 3.2.4. Additional figures (lot B). Example for the 4th transect of the SOCIB glider mission in the Balearic Channels in March 2017.



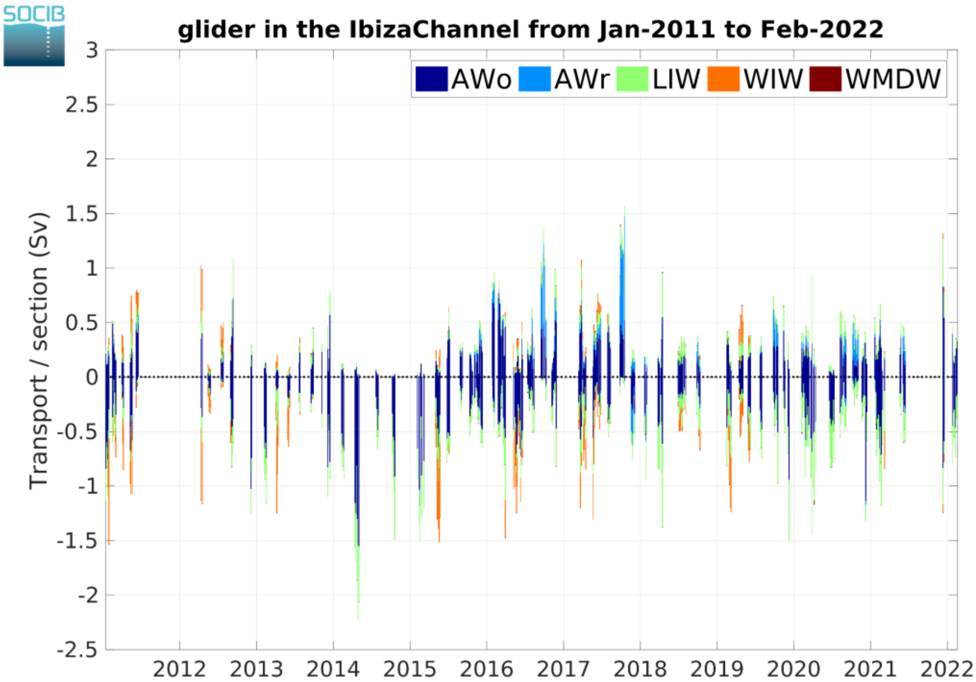


Figure 3.2.5. Total (top) and water mass (bottom) geostrophic transports in the Ibiza Channel from glider observations since January 2011.

Product user manual

The toolbox for the glider transport calculations is described in the associated SOCIB Product User Manual (https://doi.org/10.25704/RBZS-V023).

Open access toolbox (GitHub)

The free and open access toolbox is available at:
https://github.com/socib/glider-transport-toolbox.

3.2.4. Thematic Service Resources: JCORE integration

Integration with JERICO-CORE requires identification of the resources related to the D2PTS. Indexing of resources in the JERICO-CORE catalog facilitates the discoverability and accessibility of the assets related to the thematic service. These assets are of different types including documents, datasets, software, services, people and organizations. The following assets and their relations were identified (Figure 3.2.6):

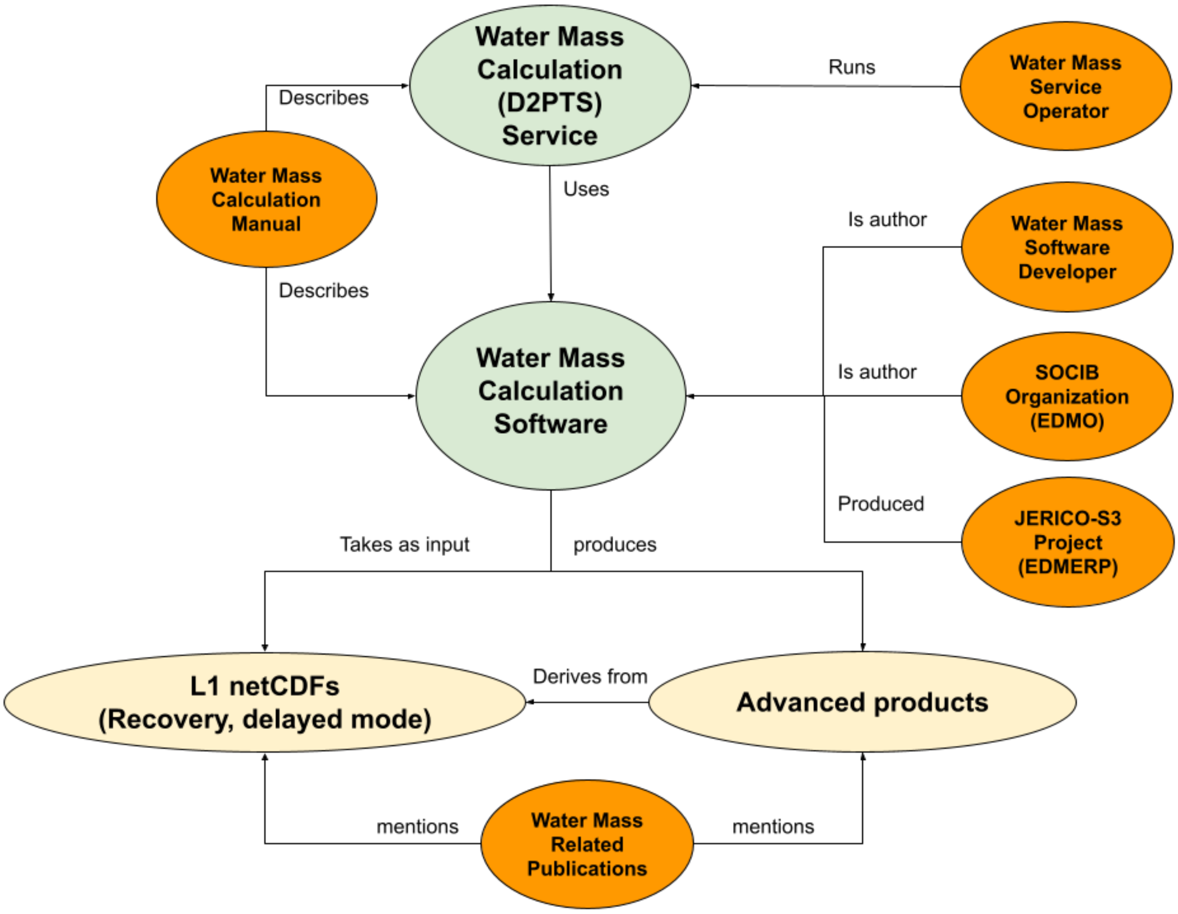


Figure 3.2.6. Identification of the assets and their relation

3.3.BGC D2PTS

3.3.1. Introduction

This thematic service combines near-real-time (NRT) observations on the Gulf of Finland (GoF) providing regional, combined multiplatform observations products. These observations include physical, biological and chemical observations done with three VOS-lines (Voluntary Observing Ship - lines) (Helsinki-Travemünde; Helsinki-Stockholm; Helsinki-Tallinn) and two fixed stations (Utö Island; Keri Island) (Fig. 3.3.1.).

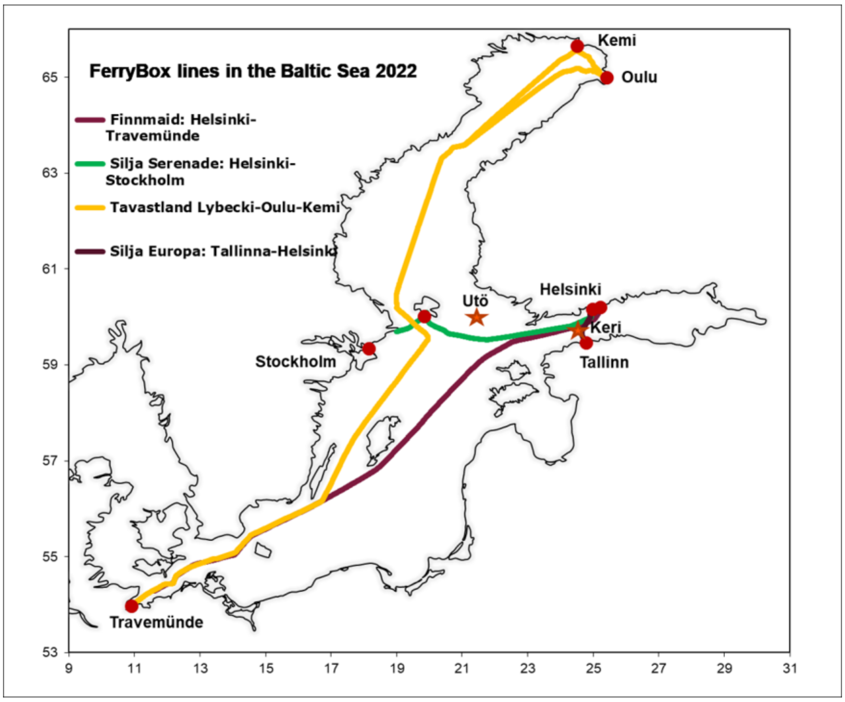


Figure 3.3.1. Study area for BGC D2PTS, including FerryBox lines Helsinki-Travemünde; Helsinki-Stockholm; Helsinki-Tallinn and fixed stations at Utö and Keri (red stars).

Demonstration includes the combined data products for two purposes:

1) Information on Harmful Algae Blooms.

In the Baltic Sea, cyanobacteria form Harmful Algae Blooms (HABs) annually during a period from June to August (Haraguchi et al. 2021). These HABs impact many of the coastal activities by the GoF, like fisheries and recreation, and they also impact the value of coastal properties. To inform the public on the development of these blooms during summer, the Finnish Environment Institute gives out a weekly harmful algal bloom situation review.

This demonstration provides near real time data on the cyanobacteria abundance to be used in weekly algae reviews and a visual display of data to the public and scientists.

2) Remote sensing reference.

Satellite remote sensing is widely used to detect anomalies in the Baltic Sea, e.g. related to algae blooms, physical phenomena, and river loads. To verify the satellite data, ground truthing measures are required. Often such ground truth is provided during research cruises, with conventional sampling, and the results are available only after tedious laboratory analysis has been done, often after several weeks or months.

In this demonstration, we provide an overlay of continuous measurements on top of satellite images to provide an immediate proof of the events. Data products are available for managers, scientists and the public.

Both demonstrations lay the foundation for the creation of consistent regional datasets and the needs for having online data available.

3.3.2. Information on Harmful Algae Blooms

The NRT observations of HAB are available for the users on a web site at https://swell.fmi.fi/hab-info/ (Fig. 3.3.2). The web site currently includes observations from the Utö station, and two VOS-lines: Helsinki-Stockholm (Silja Serenade) and Helsinki-Travemünde (Finnmaid). Observations from the Tallinn-Helsinki VOS-line will be included in the future.

Ferrybox data include measurements of phycocyanin fluorescence, among other variables like salinity, temperature, chlorophyll and coloured dissolved organic matter. Similar results are obtained from Utö station. Phycocyanin is a pigment primarily found in the cyanobacteria and it works as a proxy of filamentous cyanobacteria abundance in the Baltic Sea (Seppälä et al. 2007). Fluorometers are annually inter calibrated and despite some modest baseline drift of sensors they can provide comparable data on the bloom occurrence (Seppälä et al. 2021). Fluorometer data go through basic steps of automatic quality control, to flag data points with out of range and missing values. In this website, *(https://swell.fmi.fi/hab-info/)*, the data from ferries are updated hourly. The website also provides visualization of previous years, allowing timewise comparisons (Figure 3.3.2).

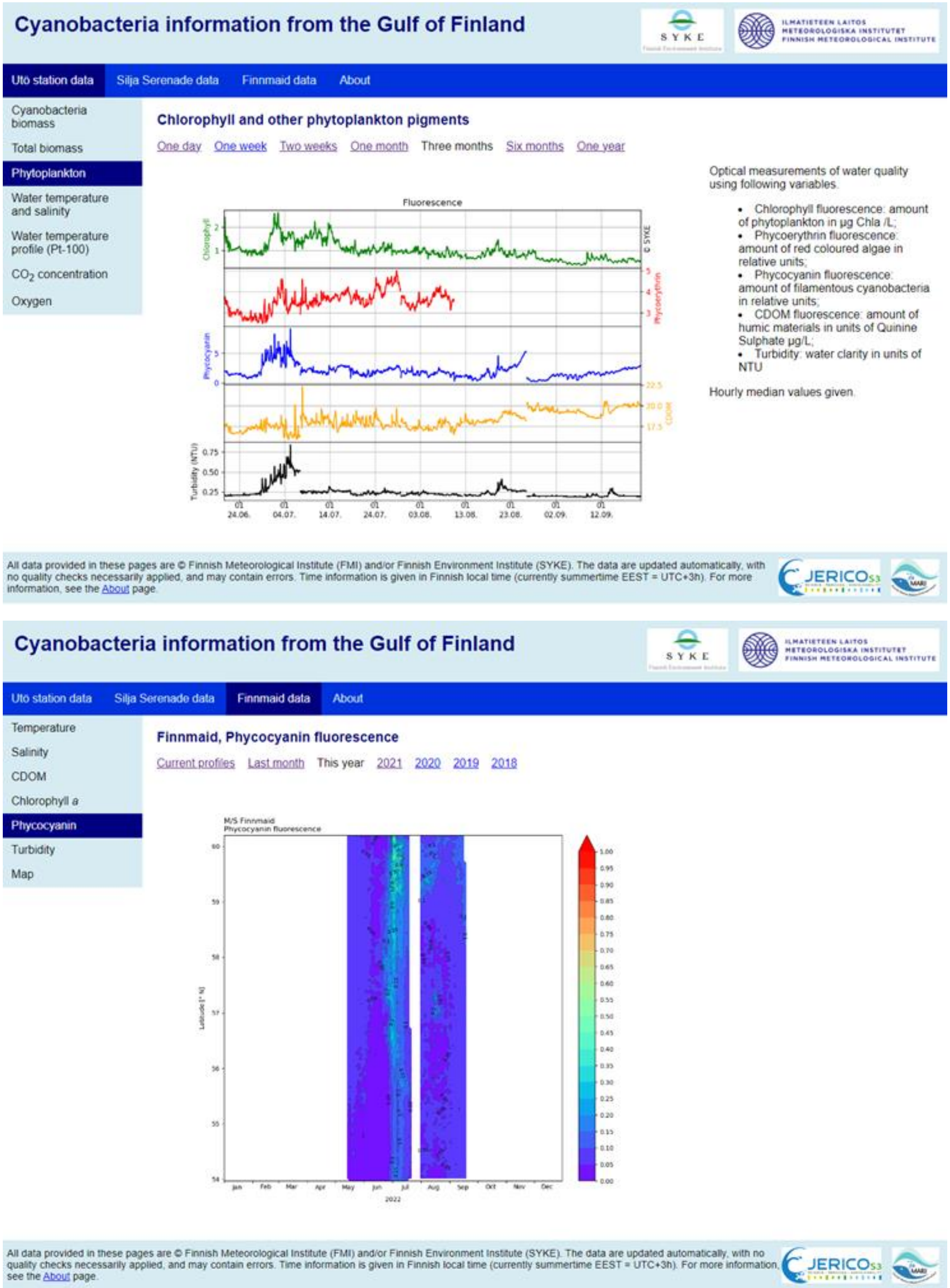


Figure 3.3.2. A screenshot of the cyanobacteria information web site (https://swell.fmi.fi/hab-info/), showing a NRT time series of the cyanobacteria distribution as phycocyanin fluorescence at Utö (up) and across Baltic Sea (down).

Utö station data (Laakso et al., 2018) include results from imaging, using Imaging FlowCytobot (IFCB) (Kraft et al 2021). It collects a 5 mL water sample each 20 min and takes images of the particles containing chlorophyll a. Images taken are transferred to hpc-cloud object storage and they are classified using a pre-trained Convolutional Neural Network model (Figure 3.3.3). Biovolumes of the labelled images are calculated and contributions of main bloom forming filamentous cyanobacteria are calculated in this demonstration. Classified species data is available in near real time, 2-3 hours after images have been acquired. Details of the data processing and modelling are given by Kraft et al. (2021, 2022), (Figure 3.3.4).

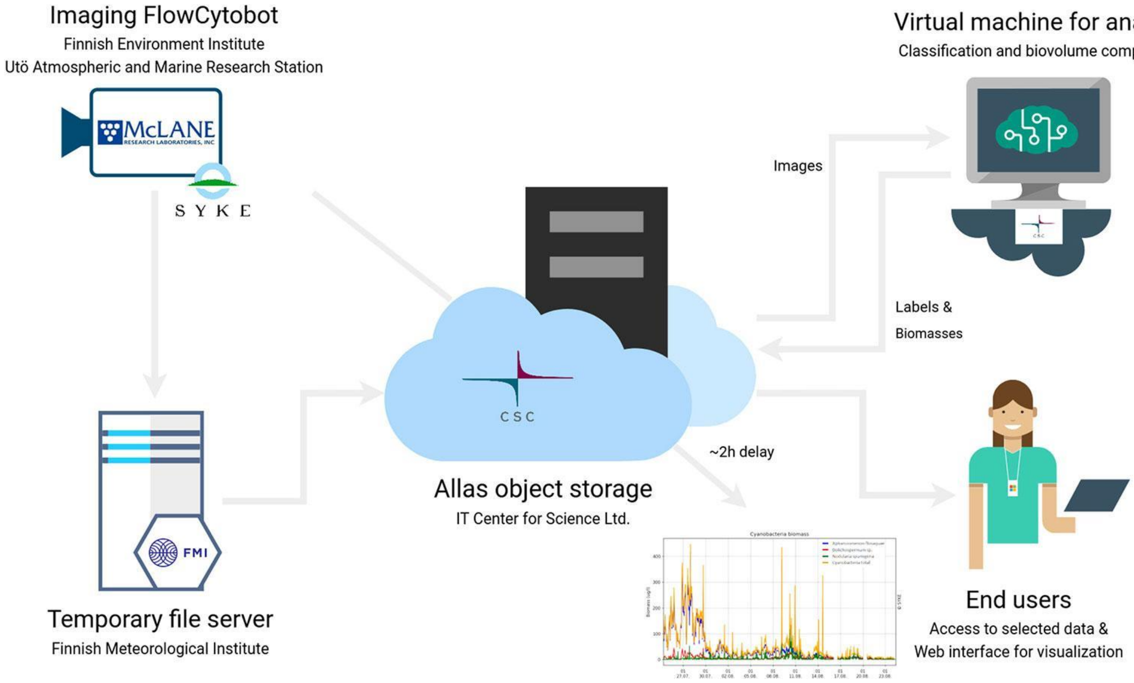


Figure 3.3.3. A schematic of the processing of the phytoplankton images obtained at Utö station with an Imaging FlowCytobot. The cyanobacteria species information obtained is presented on a web site and can be used to aid in the weekly HAB reviews. (Kraft et al. 2022)

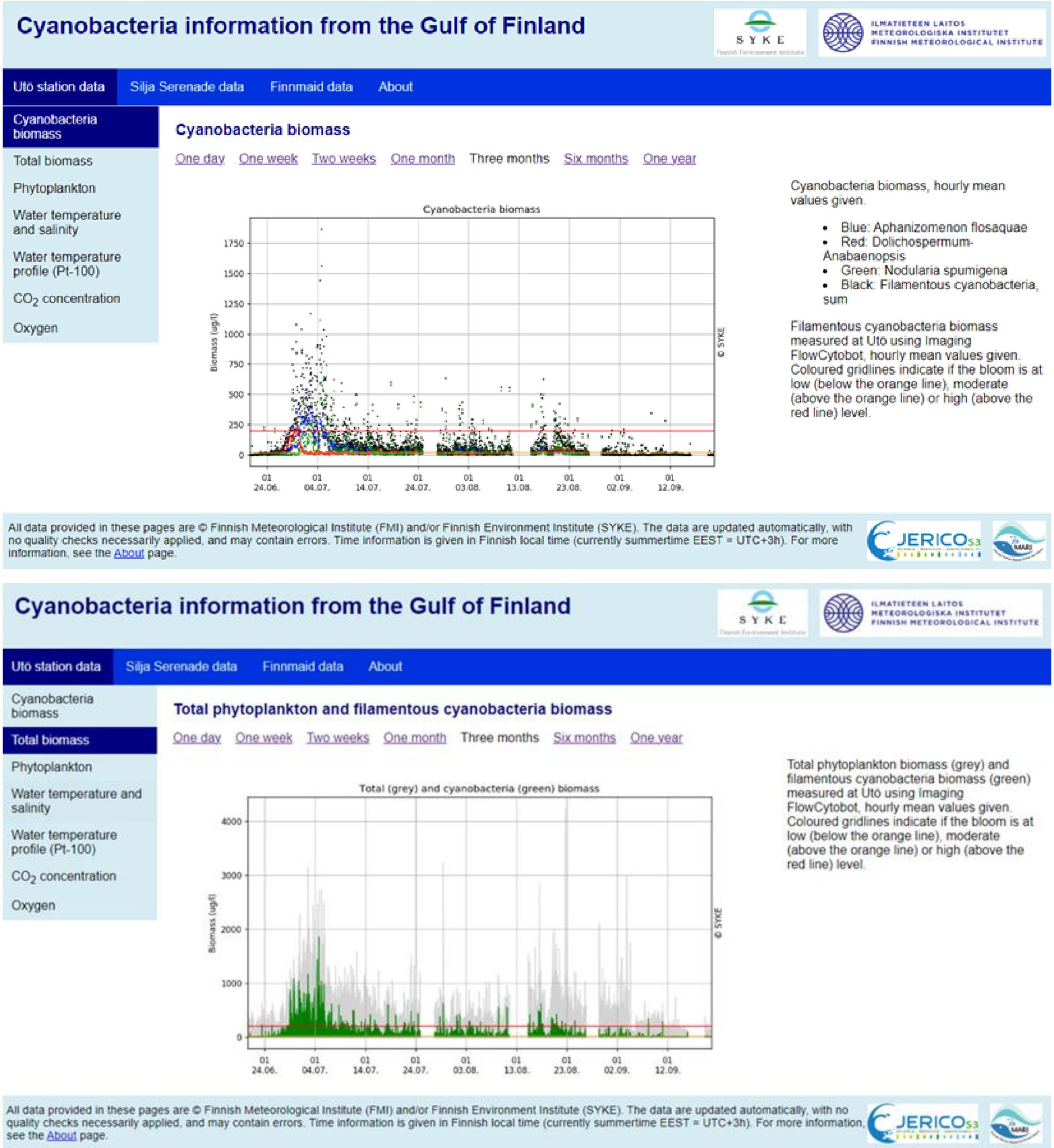


Figure 3.3.4. A screenshot of the cyanobacteria information web site (https://swell.fmi.fi/hab-info/), showing a NRT time series of the biomasses of different cyanobacteria species (up) and the contribution of cyanobacteria to the total phytoplankton biomass (down), estimated using a neural network based automated classification algorithm (Kraft et al. 2022).

3.3.3. Remote sensing reference

Satellite remote sensing allows detection of some specific marine events, like algae blooms in this demonstration. Often, to verify the event or to provide additional quantitative data for ground truthing, auxiliary information is required. Finnish Environment Institute SYKE has a public service where one can browse and view SYKE's open satellite data, at https://wwwi4.ymparisto.fi/i4/eng/tarkka.

In Tarkka service, users can select to view high-resolution and medium resolution satellite data for Baltic Sea region, and overlay it with other datasets. In the beginning of 2022 SYKE's FerryBox data (Alg@line data) was added to the system. At the moment, FerryBox data from Silja Serenade and Finnmaid can be visualised on top of satellite images. Variables to be viewed include Chlorophyll a fluorescence, Phycocyanin fluorescence, salinity, temperature and turbidity (Fig.3.3.5).

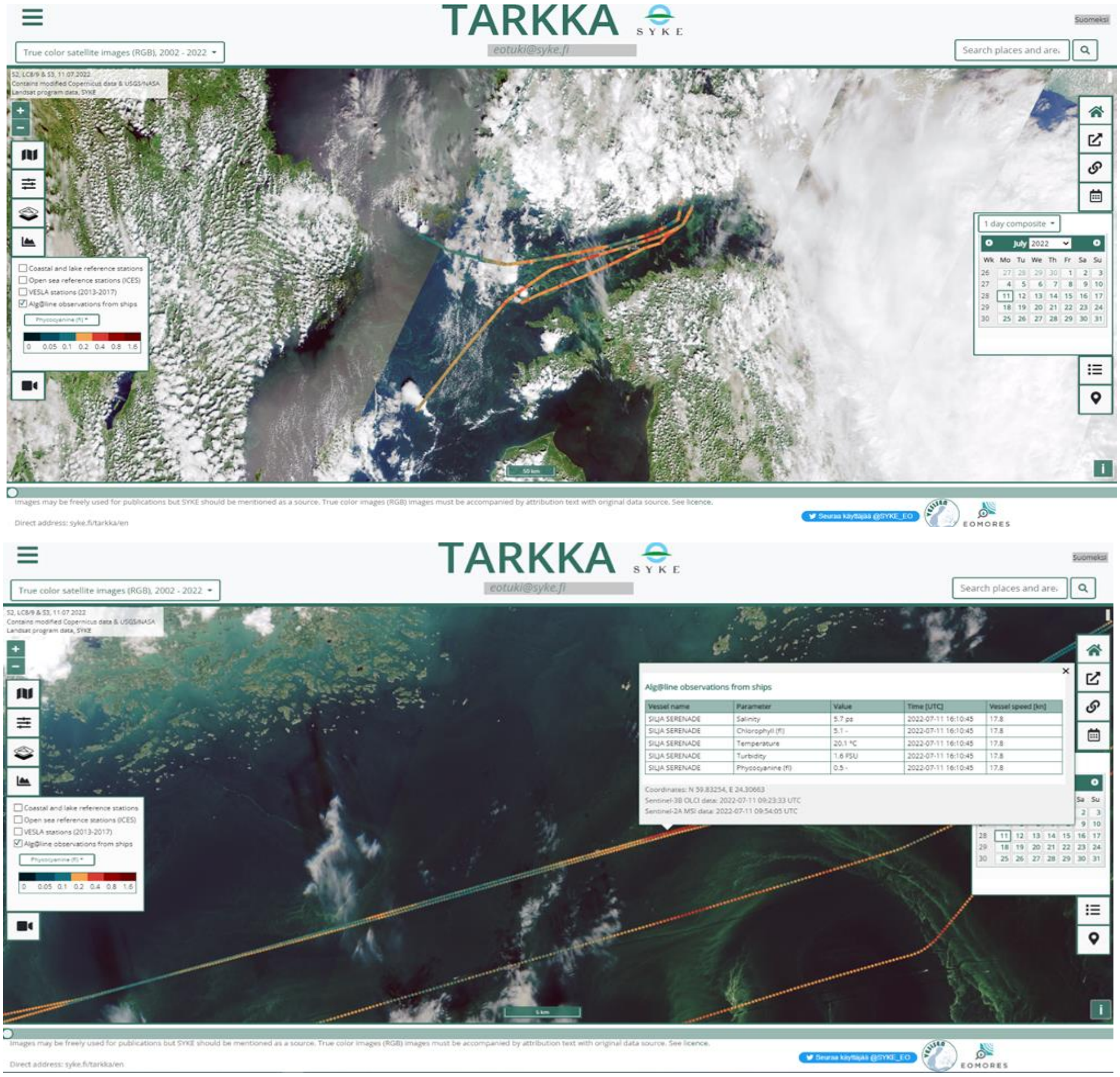


Figure 3.3.5. (UP and DOWN) Examples of the use of FerryBox-line data as remote sensing reference: overlay of the ship data on a satellite image of an algal bloom in the 11 July 2022 at the whole basin scale (up) and scaling to km-scale for fine details, also viewing the actual measurement data (down). Images from the SYKE Tarkka service: https://wwwi4.ymparisto.fi/i4/eng/tarkka/.

3.3.4. Use of information

Besides making data visualisations available at websites, we have created an API for Alg@line transect measurements with metadata description at https://ckan.ymparisto.fi/dataset/%7bA0948CD3-35F3-49B6-B433-A082A47A581F%7d. This API-service contains flow-through water quality measurements starting from 1998, accessible by OGC-compliant WMS and WFS-requests. The service is updated hourly.

Services created in this D2PTS are used by SYKE in their weekly national cyanobacteria reviews in 2021 and 2022 (Finnish Environment Institute > Summary of the national cyanobacteria review June–August 2022: Abundant cyanobacteria observed at sea this summer, cyanobacterial situation in lakes remained at the level of recent years). These reviews provide a comprehensive overview of the state of cyanobacterial blooms throughout Finland's inland and coastal waters and the Baltic open sea area. Information on the cyanobacterial situation in the sea areas near Finland was gathered from satellite images, the Finnish Border Guard, marine research vessel Aranda, the species, biomass, and pigment results of cyanobacteria at the Utö Atmospheric and Marine Research Station, and cruise and merchant ships equipped with Alg@line measuring equipment. The Oceanographic Services of the Finnish Meteorological Institute provided up-to-date information on sea surface temperatures, and the drift forecasts for cyanobacterial rafts were also prepared in cooperation with the Finnish Meteorological Institute.

Phytoplankton image data, used to create and validate Convolutional Neural Network model have been published as follows:

- Data set 1: http://doi.org/10.23728/b2share.abf913e5a6ad47e6baa273ae0ed6617a, Eudat b2share data repository, Record number: ABF913E5A6AD47E6BAA273AE0ED6617A, Data set name: SYKE-phytoplankton_IFCB_2022.
- Data set 2: http://doi.org/10.23728/b2share.7c273b6f409c47e98a868d6517be3ae3, Eudat b2share data repository, Record number: 7C273B6F409C47E98A868D6517BE3AE3,Data set name: SYKE-phytoplankton_IFCB_Utö_2021

The code implementing the CNN model can be found at https://github.com/veot/syke-pic

Selection of phytoplankton images from Utö station has been imported to EcoTaxa (ecotaxa.obs-vlfr.fr), as part of EcoTaxa D2PTS, using a project-tag "IFCB Utö 2021 JERICO-RI Gulf of Finland Pilot Supersite".

All these services should be available through JERICO-CORE in the near future.

3.4.EcoTaxa D2PTS

Plankton and marine particles are ubiquitous components of the water column (Stemmann and Boss, 2012). They have been identified as Essential Ocean Variables (EOVs) by the Global Ocean Observing System and as Essential Climate Variables (ECVs) under GCOS (Global Climate Observing System) (Lombard et al., 2019). The goal of the EcoTaxa D2PTS in JERICO is to provide access to the EcoTaxa application as a service so that JERICO members can process their plankton and particle data and allow these data to flow to the appropriate EU databases where they become available in agreement with the EU data policy.

EcoTaxa is a web application dedicated to the efficient taxonomic sorting of plankton and particles images (Figure 3.4.1). Its user interface allows users to quickly scan through thousands of images and a machine learning engine suggests identifications for new images. Thanks to the combination of these two aspects, the throughput of a trained operator is 10,000 images per day on average (although it varies considerably from one image type to another).
Once the images have been identified in EcoTaxa, these human-qualified data are ready to be exported, including to external databases (Irisson et al., 2022). The biodiversity databases of relevance are EurOBIS/EMODnet Biology at EU level and OBIS at global level. These databases accept a single format as input: a DarwinCore Archive (DwCA). This format is a collection of files, organised hierarchically, with information on the dataset, the event (i.e. a sample at sea, a week in a time series), and the occurrence of one organism. EcoTaxa can produce DwCA files with the appropriate summaries and metadata fields for some instruments (Zooscan, FlowCam, …). The necessary metadata fields in the case of images are documented in JERICO-S3 deliverable D6.4.

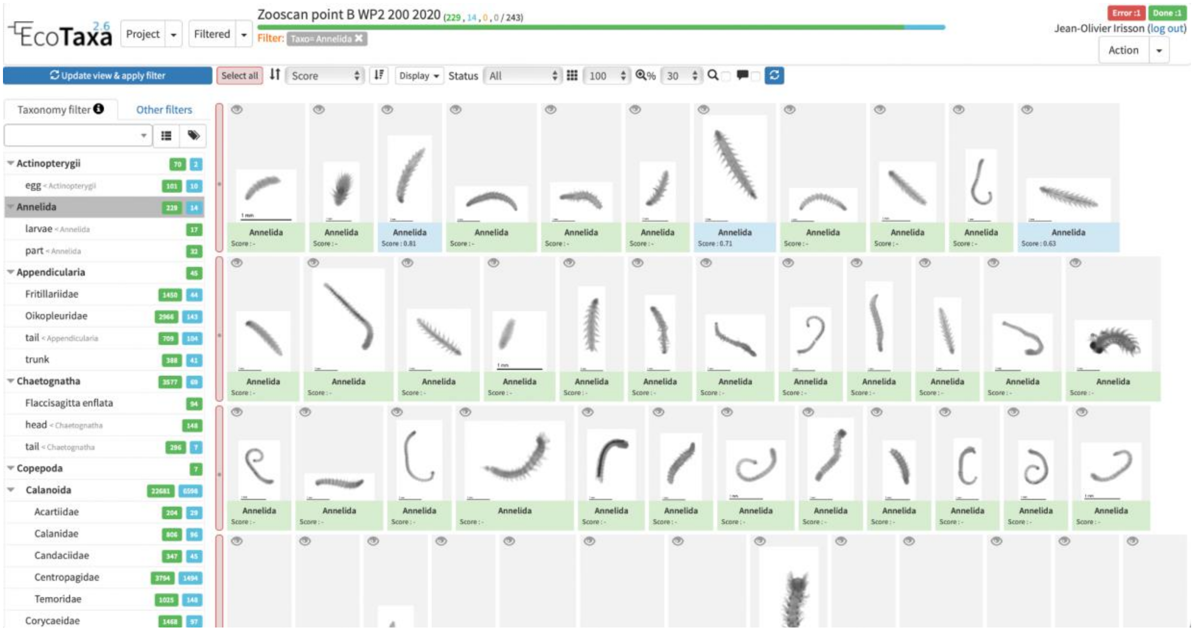


Figure 3.4.1: The classification interface of EcoTaxa. Classes from the tree of life used in the dataset are presented on the left. Images are presented on the right. The green ones have already been validated by the operator. The blue ones are the ones suggested by the machine learning algorithm to be in the same class (and all are right in this case). The operator can quickly accept the suggestions, correct them, filter the data etc.

Because it is important that data collected from projects flows through such international databases, it was decided that the recommended data flow of JERICO would be through them. Therefore, JERICO-CORE in particular will not query EcoTaxa directly but rather EurOBIS/EMODnet Biology. Then, a backlink to EcoTaxa is provided to access the full information, including the images, where the data are extracted from. This is what is also done in the Blue-Cloud project and JERICO could even directly leverage this work (Figure 3.4.2)

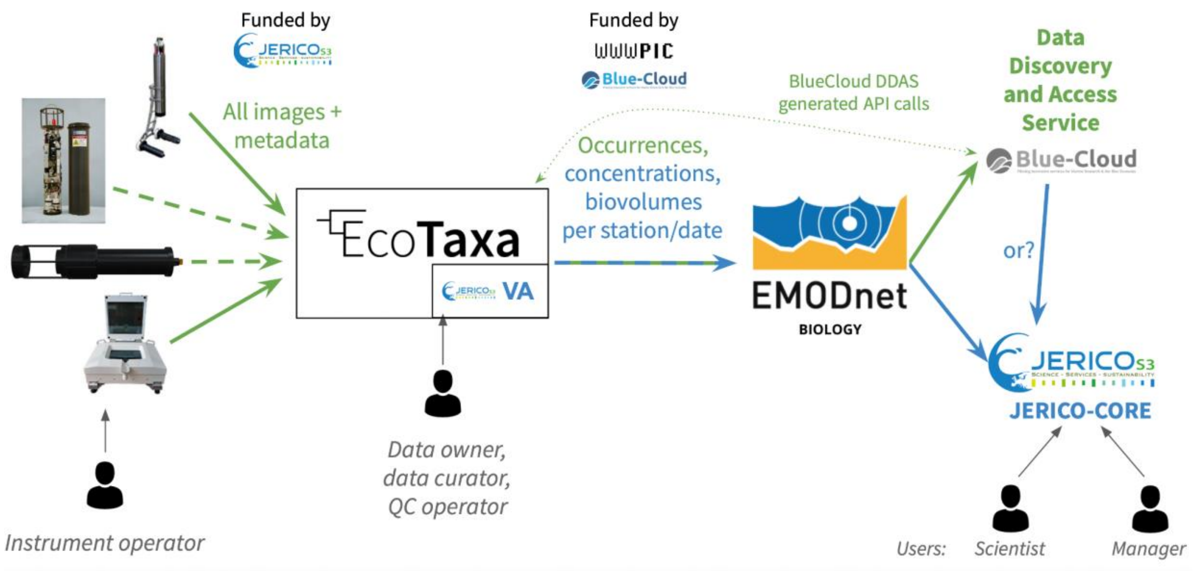


Figure 3.4.2: Data flow of the EcoTaxa D2PTS: data acquired from instruments flows to EcoTaxa thanks to dedicated input pipelines (some functional, some still in progress -- dashed), EcoTaxa is used through pre-provisioned VA access, data flows from EcoTaxa to EMODnet Biology, queried by JERICO-CORE (directly or through Blue-Cloud).

This D2PTS provides the JERICO community with efficient means to process biological data that contribute to the monitoring of several Essential Ocean Variables and Essential Biodiversity Variables.

4. CONCLUSIONS

The present deliverable shows the updated picture of the D2PTS pilots that are being developed in JERICO-S3 project. All the D2PTS are showcases of products created from observed datasets.

BGC and EcoTaxa D2PTS are related to water conditions and biological activities: BGC presents NRT observations of physical, biological and chemical observations on the Gulf of Finland while EcoTaxa is a web application dedicated to the efficient taxonomic sorting of plankton and particle images. On the other hand, Glider D2PTS is a toolbox for the computation and visualisation of physical/biogeochemical variables from gliders that looks at water masses that will certainly impact the biology and chemistry analyzed by the BGC and EcoTaxa. In fact, BGC notes in one of their references that the cycle of HAB is dependent on the mixing of waters and the surface temperatures. Finally, the gap-filled products of the HFR D2PTS also provide surface currents in two different study areas.

As explained in the previous paragraph, the four D2PTS can contribute to a wider understanding of the occurring processes in the waters. Could the glider D2PTS contribute to understanding dynamics in other areas if the glider line is appropriately placed? Could the HFR gap filled surface currents contribute to this understanding too if the radars are located in the same study area? Those are the questions that should be discussed as a next step in the global project future discussions.

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