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Executive summary

Europe is not equipped yet with a tool able to deliver a complete and accurate view of the status of the Ocean Observing System (OOS) in its seas. This is one of the main conclusions of this report focusing on “Maps and metrics on observing systems and metadata” delivered in the framework of the Work Package 1 in the framework of the EuroSea H2020 project.

Nevertheless, Europe has at its disposal, some useful and efficient tools often used to monitor pieces of the OOS from the operation at sea to the ocean data uptake. EMODNET Physics, Copernicus marine in situ and OceanOPS are the key players in this field, working together since a long time to continuously improve and monitor the services they are providing to the European Ocean Observing community.

Despite this fruitful and efficient collaboration, the services provided by these actors do not answer all the requirements of the stakeholders regarding European Ocean Observing System monitoring and reporting capacity. Three types of OOS stakeholders have been identified, the funders of the OOS, the implementers (e.g., EuroGOOS), and the operators (e.g., observing networks like Argo, HF radar, DBCP…). Each type of stakeholder has its own needs in terms of OOS monitoring and none of the three actors listed above can entirely fulfil it, as none of them have the mandate to do so.

Expansion of the European capacity to monitor and report about OOS has been investigated. Despite some improvements made during this task, the conclusion is that without a clear mission and a long-term vision about this question, monitoring the EOOS, in its entire complexity and along each link of the value chain, from planning to data product delivery, cannot be achieved today. Many networks should engage further in the coordination with European and Regional OOS, and monitoring tools should be developed to serve the multiple stakeholders’ needs.

Even though the collaboration between OceanOPS, EMODNET and Copernicus marine in situ exists, it should be improved to better monitor the EOOS especially for better planning of the EOOS implementation as well as fostering open data for the EOOS observing systems. Although, the networks falling under the scope of EOOS should reinforce their data and metadata policy to comply with the FAIR principles. Essential feedback loops between networks and metadata & data aggregators should be set up to continuously improve the quality of the metadata delivered by the networks.

Metadata must be considered as the fundamental element to report about any OOS. High-quality and large diversity of those elements are essential to deliver the OOS monitoring efficiently and accurately, and reporting services that Europe deserves to better implement and pilot the development of the EOOS.

1. Introduction

Reporting about regional ocean observing systems is not an easy task. First because of the diversity of platforms and instruments involved in a regional ocean observing system. Instruments, platforms, and networks are not always coordinated together and when they are, it is not as simple as it seems to integrate them into a single monitoring tool. Accessing and updating the information, sharing the same vocabularies, tracking the observations, integrating new elements, are some of the challenges that must be overcome to be able to provide a complete view of the system and allow in the future better planning of a European integrated Ocean observing system.

Secondly because of the diversity of user point of views, National focal point, regional Ocean Observing System (OOS) implementers, funders and coordinator are not expecting the same information to report about Ocean Observing.

Third, because the existing tools that we commonly used for reporting are not suited for the diversity of OOS and stakeholders needs.

The assessment of the European OOS monitoring capacities has been made possible in the framework of this task. This report analyses in detail the capabilities and limitations of the existing monitoring tools. It reviews the diversity of needs of the different stakeholders regarding OOS monitoring and reporting capacities.

We also take the advantage of this task to strengthen existing monitoring tools through the integration of new networks and the development of new features inspired by OOS stakeholders' requirements. Evolutions and improvements are described in the annexe 5 and specifications for future development based on collected requirements are also listed.

The deliverable is organised as follows. After this introduction, the second section, definitions, and methodology, clarifies some concepts that must be defined. Indeed, along this task we realised that the definitions of key concepts (OOS, status report, monitoring tools) were not always shared by the different stakeholders, making the general comprehension more difficult. Speaking the same language must be a prerequisite.

The third section, about the challenging task to assess the status of a regional observing system, proposes a typology of stakeholders and reviews their needs. It aims to better define what could be the capacity of an OOS monitoring tool.

The fourth section, about the existing potential to build an integrated OOS monitoring and reporting service in Europe, analyses the strength and weaknesses of the current European OOS monitoring capabilities, deliver guidance to extend the European capabilities to new networks, and provide an original view (schematic and holistic, see annexe 4) of the current situation in Europe.

With this deliverable we aim to demonstrate why reporting about regional OOS is not so easy. We tried to describe the roles and complementarities of existing technical partners and the crucial need for a closer cooperation between global and regional OOS to build a useful OOS reporting capacity in Europe. We finally propose a vision for a European OOS reporting capacity based on the existing tools and a series of requirements.

2. Definitions and methodologies

2.1. Definitions

Ocean Observing Systems - (OOS): In this document, Ocean Observing System refers to a coordinated/governed network of ocean observing platforms (i.e., instruments measuring ocean variables) in a bounded region. OOS can be global (GOOS[1]), regional (European OOS, Baltic OOS, MONGOOS for the Mediterranean Sea, Arctic ROOS), national (Integrated Ocean Observing System (US IOOS), Integrated Marine Observing System (IMOS, Australia), and local or coastal (MOOSE – French instrumentation in the North-western Mediterranean Sea, SOCIB – Balearic Island Coastal Observing and forecasting system, CYCOFOS - Cyprus Coastal Ocean Forecasting and Observing System, POSEIDON - the Monitoring, Forecasting and Information system for the Greek Seas, etc.).

OOS stakeholder: Anyone involved in the management, implementation, coordination, operation, and funding of an OOS and eager to get an integrated view of the system.

OOS monitoring: Is the assessment of the past, present and future status of the ocean observation system. OOS monitoring covers the entire value chain of ocean observation from planning to operation at sea to data uptake.

OOS Status Report: The status report of an OOS provides key information for any OOS stakeholders (i.e., managers, funders, coordinators, implementers, operators) to assess the performance of the OOS in real time and on the long term.

OceanOPS monitoring system[2]: OceanOPS supports the monitoring of the nine Ocean Coordination Group of the Global Ocean Observing System. It includes Argo, OceanGliders, AniBOS, SOT, GO-SHIP, OceanSITES, DBCP, HF radar and GLOSS. OceanOPS monitoring system has a "metadata user oriented" approach. Its information system is updated with metadata from OCG networks that is collected and quality controlled. OceanOPS is also tracking the data operationally on networks data systems and GTS when available. This approach allows to deliver information about integrated system overview and status, network implementation, operations and instrumentation, performance, data flow and delivery, opportunities for deployments…

EMODNET Physics data portal[3]: EMODNET Physics aggregates and makes available (through data services like ERDDAP, data catalogue, THREDDS, data products, etc.) under the same portal, physical and biochemical In-situ ocean data coming from any possible sources. EMODNET Physics is "data oriented". The observations are displayed and served on the EMODNET Physics data portal.

Copernicus Marine in situ monitoring services[4]: Copernicus Marine in situ oversees the delivery of data products to the Copernicus Marine Service. The Copernicus Marine in situ aggregate ocean data from 6 regional centres in Europe. It creates aggregated data products that are assimilated by the Ocean forecasting

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[1] To precise: GOOS is a global system made up of global networks, regional and national systems, like IMOS (national), MONGOOS (regional) are GOOS Regional alliances for example, and also EuroSea.
[2] https://www.ocean-ops.org/
[3] https://portal.emodnet-physics.eu/
[4] http://www.marineinsitu.eu/dashboard/

community or directly served to users. Copernicus Marine in situ IN SITU Ocean TAC has developed a dedicated "data oriented" visualisation and monitoring tools.

ROOS data portal: The three data portals of the Arctic ROOS[5], BOOS[6] (Baltic Sea), MONGOOS[7] (Mediterranean Sea) concerned by this report are visualisation tools aiming to display the observing activity in the region. Arctic ROOS and MONGOOS visualisation tools are directly built from the EMODNET Physics data portals and Copernicus Marine in situ data aggregation. Consequently, the approach is also "data user oriented". This approach allows to deliver information about the data product and data used to create those data products.

2.2. Methodologies and activities

This analysis of the European capacity to monitor OOS and report, is the synthesis of the multiple activities and milestones (described below) that have been carried out in the framework of WP1.

OOS status report in 2020

The first milestone was focusing on the Mediterranean Sea observing system (see annexe 1). The objective was to report about the status of the OOS and identify key stakeholders involved in the OOS in the region. This exercise gives us the opportunity to look at the diversity of expectations and needs regarding the OOS status report.

OOS status reports in 2021

The second milestone was focusing on the Mediterranean Sea, the Baltic Sea, and the Arctic Ocean in 2021. For each region, we discover 3 different "Ocean Observing monitoring tools'' (OceanOPS, EMODNET Physics and EuroGOOS Regional OOS) to monitor the status of the ocean observing system in the regions. We analysed the same sample: "operational platform in 2021" with the three tools in the three regions and we compared the output. We also evaluate the capacity of each tool to deliver the statistics and maps necessary to report about the status of the ocean observing system in the regions. Status reports are available in annexe 2 of this report.

Survey

In parallel, we asked the OOS stakeholders to provide us with their requirements and needs in terms of OOS status report. The result of the survey is available in annexe 3 of this report.

Integration of new observing networks

Integration of new networks in the scope of OceanOPS was one of the objectives of this task. We focused our efforts on 3 networks: Animal Borne Ocean Sensor, an emerging OCG network, a fishing vessels network coordinated by the Berring data collective, and the ferry boxes network already well known in the European landscape of Ocean Observing. In section 4.3 we analysed the integration process of the three networks to provide some "good practices" recommendations on how to approach new networks toward operational monitoring.

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5 https://arctic.emodnet-physics.eu/
6 http://www.boos.org/observations/
7 http://www.mongoos.eu/data-center

Proof of concept of a monitoring and reporting tool for OOS stakeholder

One of the major milestones of this task was to demonstrate the capacity to answer the needs of OOS stakeholders for monitoring OOS and reporting. Therefore, we have been developing, as "proof of concept" new capabilities from the OceanOPS existing dashboard to fit OOS stakeholder requirements. Those developments are detailed in annexe 5 of this report.

3. About the challenging task to assess the status of regional ocean observing systems in Europe

Annexes 1, 2 and 3 provide all the materials that contributed to the production of this section of the report.

Task 1.2 was punctuated with two internal milestones dedicated to reporting about the operational status of the Mediterranean Sea in 2020 (annexe 1) and the Mediterranean Sea, the Baltic Sea, and the Arctic Ocean in 2021 (annexe 2).

Through several meetings with Mediterranean Ocean Observing Systems stakeholders, emails exchanges and questionnaires, we rapidly figured out that the understanding of the concepts of "OOS Status", "OOS monitoring dashboards" and "OOS status report" varied a lot from one stakeholder to another. And the role played by each stakeholder strongly impacted their needs and expectations to this regard (see annexe 1). For instance, the chair of an OCG network is very much interested in the implementation and the performance of his network in the region, while a PI focuses on the platforms and the data, he is responsible for, and a national or regional OOS focal point wants to access an integrated view of the system and assess "his" contribution to the global view.

When the point of view changes, the sample analysed, the type of information collected, and the shape of the statistics requested are strongly impacted. Consequently, the content of the OOS status report cannot be limited to a unique template, and the quality and the amount of information used to fill such a report is becoming essential.

The OOS Stakeholders typologies

Operators

Operators of an OOS are people sharing the responsibility of the platform deployed. This includes the scientist and the operator at sea. They want to see that the platform they have deployed, (or they oversee). Its visibility on the OOS dashboard is mandatory to confirm their contribution to the OOS.

Data aggregators

Data aggregators are harvesting the data acquired by the OOS to facilitate the access to a wider range of users. An accurate description of their data product is key for them. Such description relies on the quality of metadata describing each instrument used to construct their data product. They are also interested in knowing about the existing instruments operating at sea they do not have yet integrated in the data product they deliver.

Implementers

Implementers are the people in charge of the funding, the structuring, the coordination, the implementation, and the development of the OOS. They are looking for an integrated view of the system with many different perspectives (spatial, temporal, national, planning, data flows, operations implementation, etc.)

To cope with this situation, two options are being offered: The first option is to develop multiple specific tools dedicated to each stakeholder's needs. This is almost the situation in Europe that is described below. The second option is to develop a monitoring tool as flexible and integrated as possible to answer most of the OOS stakeholder requirements. This is basically the strategy followed by OceanOPS concerning the GOOS that is also described below.

Finally, this first round of discussions and this internal milestone left us with the impression that the needs for OOS monitoring tools and reports exist but not the means. To confirm this hypothesis, we took the opportunity of the second internal milestone: “Mediterranean Sea, Baltic Sea and Arctic Ocean status report in 2022” (annexe 2) to survey a larger community of stakeholders (annexe 3) and evaluate the existing OOS monitoring capacity in Europe.

In June 2021, we brought together OOS stakeholders from the 3 regions selected for the second internal milestones, the Baltic Sea, the Mediterranean Sea, and the Arctic to answer an online survey about needs and requirements for OOS monitoring tools and reporting capacity. The complete result of the survey is available in annexe 3. We also took this opportunity to demonstrate some of the development, made from the previous analysis, on the OceanOPS monitoring system (see annexe 4).

Users survey outcome

The panel was composed of 11 members (list available in annexe 3), all in charge of regional ocean observing systems with different roles and levels of integration. This panel provided us with a good general overview of the needs and requirements for OOS monitoring tools and reporting capacity. Below are the conclusions of this work.

What has been emphasised by the panellist is that the status report of an ocean observing system must provide an integrated view of the system. Integrated here encompasses the multiple platforms aspect including coastal platforms that receive a strong plebiscite from the panellist, and a vision of the spatial and temporal evolution of the system (past, present, and future). While maps seem to be fundamental for most of the panel, other information seems requested in a standard OOS status report:

Building an Integrated view of the European OOS

- Synthesis on all OO activities,
- Quantitative contribution to the OOS, including data flow monitoring,
- Contribution of different countries,
- Analysis of the OOS based on identified issues and successes (including open data deployment)

From this survey, reporting about the status of an ocean observing system, whether it is global, regional, or national seems to consist of providing integrated information to analyse the current situation and the dynamic of the system through different angles: geographical distribution of the observation, evolution of operations at sea, implementation pace, data flow and quality performance, instrumentation, and variables indicators. It should serve the strategic and operational piloting of the OOS.

It is interesting to note that being able to assess the contribution of the OOS to a wider objective like the Marine Frameworks Strategic Directive, or the Sustainable Development Goals for example is also mentioned in the survey.

To achieve such a report, we asked the panellist their opinion on the requested technical capacity of an OOS monitoring dashboard.

Requirements from OOS stakeholders to monitor European OOS and report.

- A dashboard with multiple filtering capacities: Time, space, region, countries, networks, EOVs.
- A dashboard that delivers dynamical maps to visualise the selection and inspect the different elements easily.
- A dashboard that delivers indicators on data flow, implementation status (i.e., planned, operational, inactive platforms), variables, activity, sampling effort.
- A tool able to notify operators and implementers when event occurs in the system
- A tool able to report automatically and regularly.

In this section we have acknowledged, described, and analysed the different opinions about the concept of OOS monitoring tool. Despite the diversity of expectations, we tried to identify commonalities in the objectives (integrated view, quantitative contribution, comparative perspective, strategic and piloting purpose), and in the means to achieve it. This first fundamental step in the analysis leads us to the conclusion that we should now assess the existing European capacity to monitor EOOS and report.

4. About the existing potential to build an integrated OOS monitoring and reporting service in Europe

The second internal milestone of this task has been shaped to explore the existing OOS monitoring tools (see definitions) and assess the status of the observing system in the Mediterranean Sea, Baltic Sea and Arctic Ocean in 2021 with each tool. The complete status reports are available in annexe 2 of this report.

The first part of the following section aims to review the existing tools and identify the services it provided. In a second time we take a step back and analyse the different approaches with respect to the needs of the final user.

4.1. A review of the existing tools used to monitor and report about the OOS in Europe

The capabilities of the tools used to produce the two internal milestones of this task are summarised in the table below (Table 1).

Table 1: Review of the tools used to monitor a report about OOS in Europe

Tools	Diversity of Ocean data and metadata sources	Metadata visualisation	Metadata access	Statistics	Data visualisation	Data access	OOS monitoring capacity	Reporting capacity
OceanOPS	Focused on OCG networks	yes	yes	yes	yes (some networks only)	no	yes	no
EMODNET Physics	Any physical data sources (BGC data falling under EMODNET Chemistry mandate but also ingested by EMODNET Physics)	yes	no	no	yes	yes	yes (from data product only)	no
Copernicus Marine in situ	Focused on a set of EOVs[8][9] requested by the Copernicus Marine in situ user	yes	no	yes	yes	yes	yes (from data product only)	no
MONGOOS	Any physical and BGC data source	yes	no	no	yes	yes	yes (individual platform only)	no
BOOS	Any physical and BGC data source	yes	no	no	no	no	no	no
Arctic ROOS	Any physical and BGC data source	yes	no	no	no	no	yes (individual platform only)	no

[8] https://archimer.ifremer.fr/doc/00422/53381/

[9] if additional data comes along (such as wind), it is kept in, but no additional QC is performed

This table highlights the diversity of services provided to report about OOS in Europe. None of them completely fulfil the stakeholders' requirements while most of those systems provide useful information to analyse the performance of the OOS. However, except OceanOPS, these systems only provide visibility of OOS that have set up open access services to the acquired metadata & data.

4.2. Different approaches for different needs

Here we are trying to understand the reason for such a diversity and incompleteness of monitoring and reporting services.

Since the ROOSs base their OOS information system on EMODNET physics data services and Copernicus Marine in situ, we only considered the EMODNET Physics data portal, the Copernicus Marine in situ monitoring services and OceanOPS monitoring system.

By ingesting a wide range of data sets, EMODNET Physics offers a good viewing and accessing services on the in situ observations (Physical and BGC) in European regions. The data served by EMODNET Physics covers multiple platforms and variables and the spatial and temporal coverage of the observation served is huge. However, there are limitations to this "harvesting" approach. The first one, regarding OOS status report, is that the metadata associated with the data set falling in the catalogue of EMODNET Physics are not harmonised nor quality controlled by EMODNET physics. This is leading to the inability to provide fit for purpose statistics based on metadata. The second limitation lies in the focus on the "available data set" which does not consider the platform failing in delivering the data or the platform that does not deliver the data yet.

With a strict focus on "some'' data sources, and thanks to a better control of the associated metadata, Copernicus Marine in situ can deliver precise statistics on the observations that constitute their product. Nevertheless, the limitation is that the statistics are built from the endpoint of the data chain (i.e., the operational data product). This approach does not take into consideration the observing platforms that do not reach the final products (platform failure, variables out of the Copernicus Marine in situ scope, low maturity networks, restricted policy data etc.).

By collecting most of the metadata directly from the observing network operators, OceanOPS can control this information and harmonise it across the networks and the platforms. Thanks to rigorous work on platform identification, OceanOPS can monitor (for some OCG networks) the data flow reaching the networks data systems and the GTS. This approach allows the system to provide the aggregated information requested by a status report. However, this approach also has its limitations. The first one lies in the limited number of networks that are supported and monitored by OceanOPS. The second limitation lies in the need for active coordination (scientific and data management) within the networks. Without coordination, metadata ingestion becomes too costly for OceanOPS.

Three information systems with three fundamentally different approaches.

- EMODNET Physics aggregates Ocean data from ”any sources'' to complete their catalogue and deliver the services they are mandated for.
- Copernicus Marine in situ focuses on data sources with high added value for their operational users. The monitoring service they provide is plugged on the data product they delivered.
- OceanOPS monitoring systems collect information about the observing activity (i.e., metadata) from the OCG networks it oversees despite the availability of the data or not.

These different approaches are some of the reasons for the miss-match between the available tools that are used to monitor and report about the OOS in Europe and the general stakeholder requirements.

4.3. Network integration: lessons learn from 3 use cases

To improve the OOS monitoring capacity in Europe, and in the framework of this task we tried to extend the scope of the networks covered by the monitoring of OceanOPS. We focus our attention on 3 networks. The Fishing vessels network is coordinated by the Berring Data Collective[10], the AniBOS[11] network has recently been endorsed as one of the networks of the GOOS, and the Ferry Boxes[12] network is a network well identified by EuroGOOS.

A key question to answer, to improve the monitoring of OOS in Europe is the assessment of the workload and the identification of good practices to appropriately monitor a network. In this section we report about the status of the integration of those three networks in the OceanOPS system and we analyse the reasons for the successes and failures to provide a set of suggestions to efficiently increase the monitoring capacity of OOS in Europe.

The Berring Data Collective use case

The Berring Data Collective (BDC hereafter) collects ocean data from fishing gear for the benefit of fishermen, science, and maritime industries. This organisation connects existing programs and fleet data collection to a wider user database. In 2021, thanks to the support of EMODNET Physics, OceanOPS engaged with BDC to better monitor some of the ocean data they managed. In less than 6 month the procedures to register the observing programs, the platforms (unique identifier allocation), the sensors and other vocabularies in OceanOPS have been set up and a daily scan of the BDC database is running routinely to ingest data and metadata in the system. In concrete terms we organised multiple calls with BDC, EMODNET and OceanOPS from January 2021 to June 2021 to understand the organisation of fishing vessel observation at BDC and develop the tools and procedures to monitor the activity operationally.

[10] https://berringdatacollective.com/
[11] https://anibos.com/
[12] https://eurogoos.eu/ferrybox-task-team/

The map on the side (Figure 1) displays the location of observations made by the fishing vessel coordinated by BDC in 2020 and 2021.

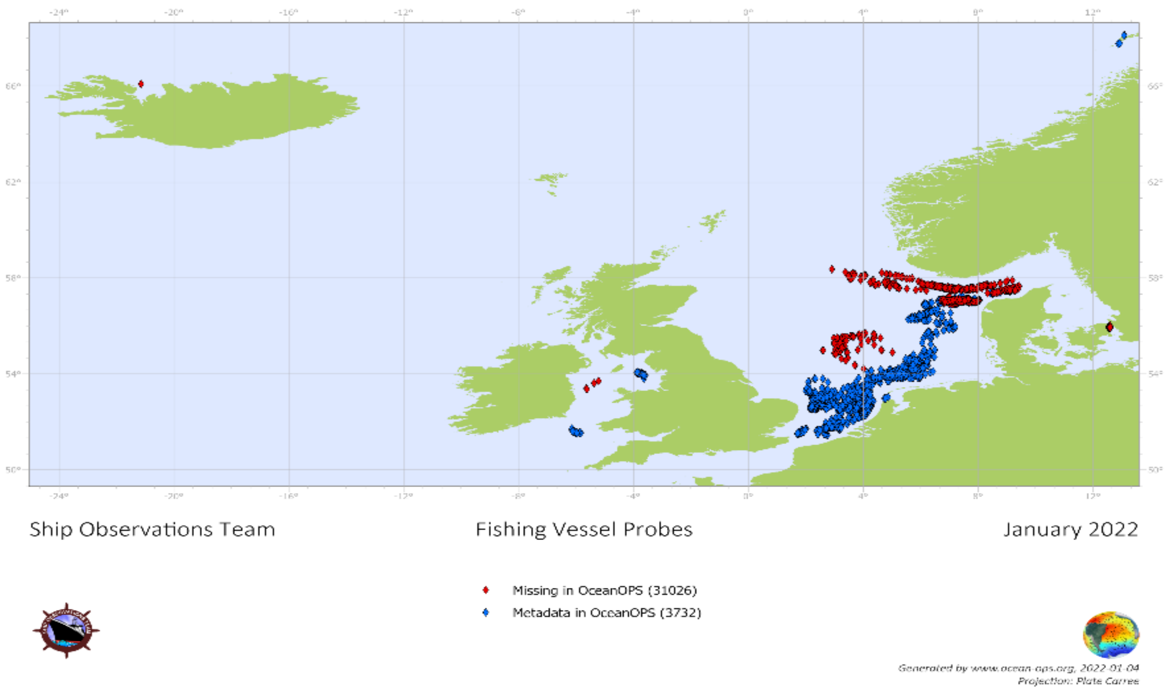


Figure 1: Distribution of fishing vessel observation collected by BDC and monitored by OceanOPS in 2020 and 2021.

The chart below (Figure 2) displays the WMO id allocation in times. It is a measure of the rhythm of implementation of the networks. Since March 2021 no new platforms have been registered and the number of observations parsed by OceanOPS drops to zero from August 2021 to Feb 2022.

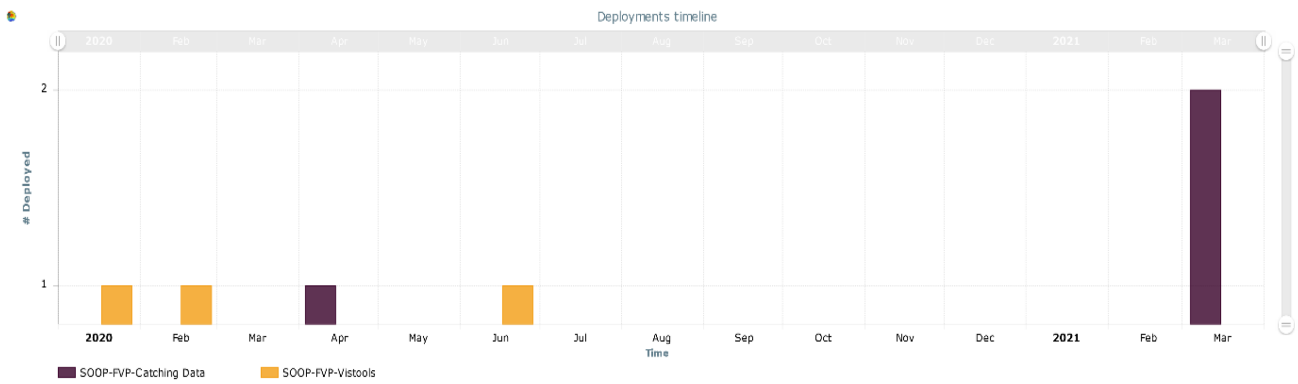


Figure 2: deployment timeline of fishing vessels probes monitored by OceanOPS/BDC (SOOP-FVP-Catching data and SOOP-FVP-Vessels are two different fishing vessels observation programs registered under the Ship Of Opportunity Program)

This example highlights both the capacity of a rapid integration of new data sources when there is active coordination and clear data and metadata policy, but also the need for a stable and long-term connection between the networks and OceanOPS to sustain the monitoring effort. In this case, there is no ship recruitment for more than a year. A machine-to-machine monitoring without regular cooperation is not reliable in the long term.

It is important to note that Copernicus marine in situ was also involved with the fishing vessels observing efforts (BDC, RECOPESCA), collecting real time data to feed their products. In this case, a closer collaboration between OceanOPS, Copernicus marine in situ and EMODNET Physics would be fruitful to improve the monitoring of these networks.

The ANIBOS program use case

ANIBOS has recently been acknowledged as the Animal Borne Sensor observing program of the GOOS. In this respect, OceanOPS has engaged with ANIBOS in the long-term coordination process with OCG networks.

In less than a year of cooperation with this emerging network we have collected the history of the ANIBOS activity and are almost ready to monitor the activity operationally. During monthly meetings, we work to understand the program structure and to define the metadata, the vocabularies, and the procedures to allocate unique identifiers to make sure that everything OceanOPS needs for an operational monitoring will be available and provided by the ANIBOS program. Then, OceanOPS ingested the historical datasets into its monitoring system and started to deliver pieces of statistics to report on the status of the ANIBOS program.

The map (Figure 3) and statistics (Figure 4 and Figure 5) below show the deployment location of the ANIBOS historical activity:

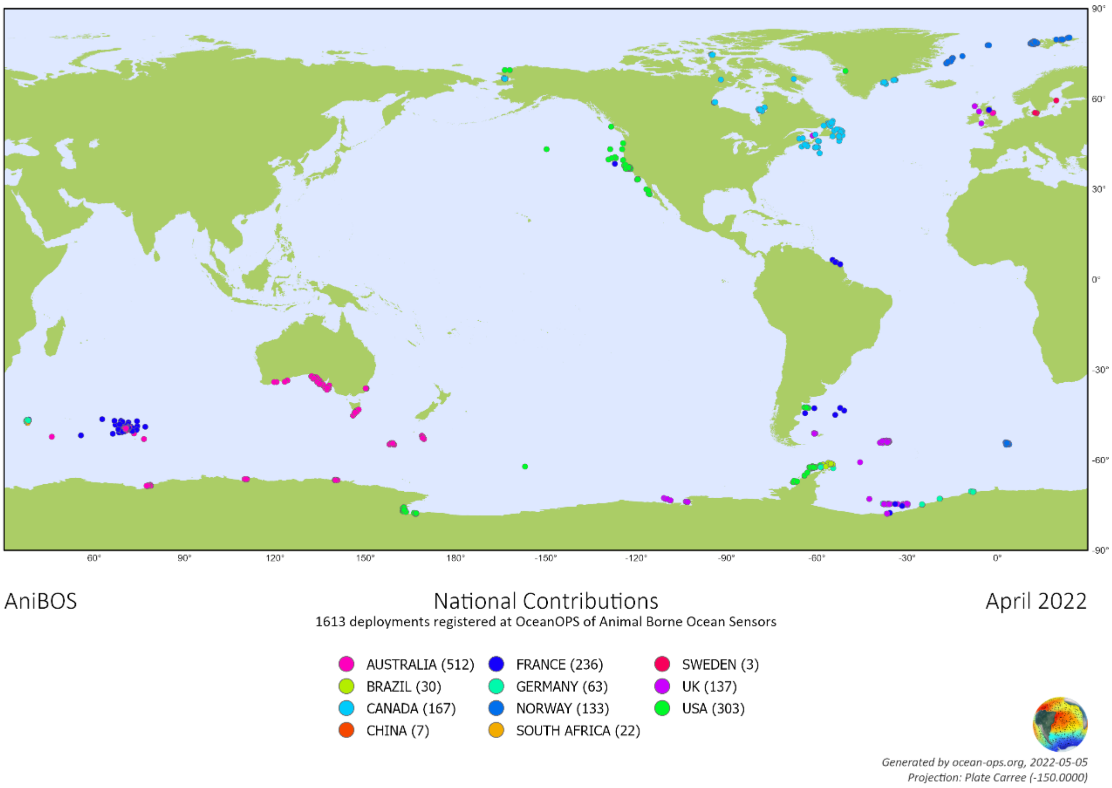


Figure 3: Spatial distribution of the historical deployment of AniBOS (MEOP) registered at OceanOPS.

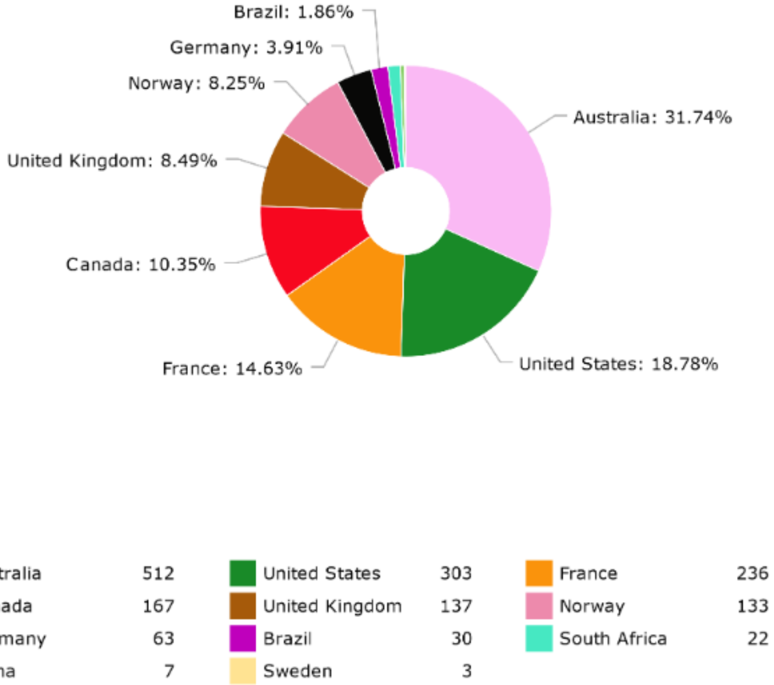


Figure 4: National contribution to the historical deployments of AniBOS (MEOP)

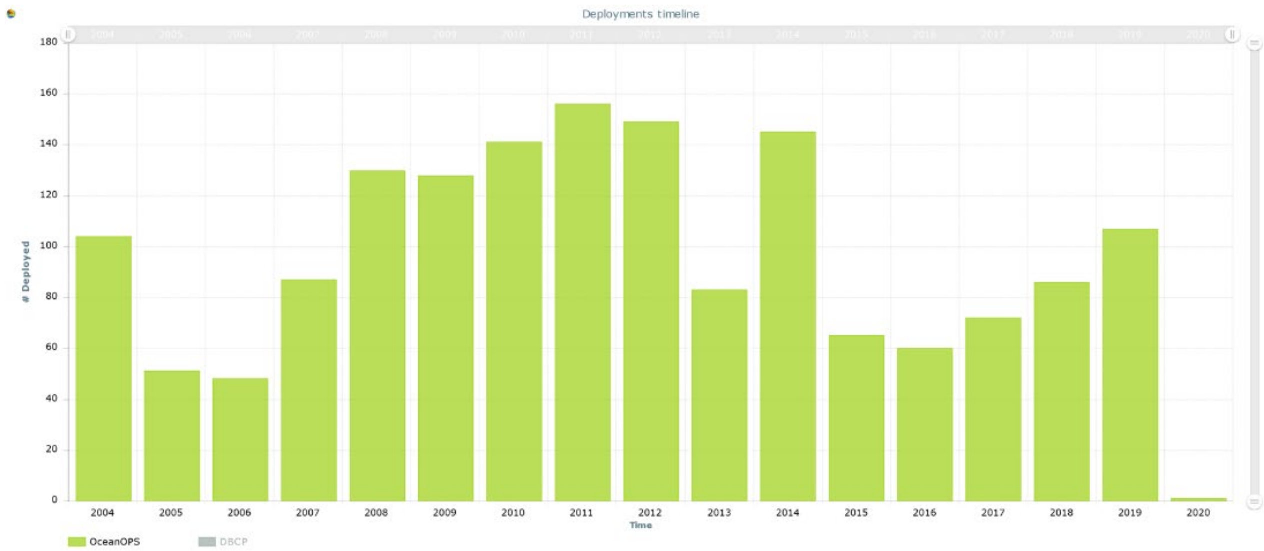


Figure 5: Historical AniBOS (MEOP) deployment timeline

The long-term coordination of the AniBOS program, and the setup of an efficient data and metadata management team was a prerequisite to be endorsed by the GOOS. The continuous cooperation between

OceanOPS and AniBOS will gradually improve the monitoring of the program by developing new indicators and statistics. It will also contribute to improving the integrated vision of the Global Ocean Observing System.

It is relevant to note that a significant number of platforms, collected through the GTS and integrated in CMEMS INSTAC are not displayed in these figures. Stronger collaboration with OceanOPS should help to enhance the quality of the metadata of AniBOS and improve the monitoring the program.

The ferry boxes network use case

Despite several meetings in the framework of EuroSea with the FerryBox chairs and with the support of the Ship Observation Team Technical Coordinator at OceanOPS, we have not achieved any progress in terms of ingestion of metadata and monitoring of the FerryBox networks.

We think that the reasons for such non achievement is due to a lack of interest/time/resources for cooperation on the FerryBox coordination team side. We also note that the data and metadata policy is not compliant with the FAIR principles. Indeed, the European FerryBox database[13] is an obvious example of the difficulty to gather information from this network.

A recipe for an efficient network monitoring

Based on the three use cases described above we can draw a list of the elements that make a network well monitored.

- set up an efficient European coordination that will ensure the link with the Global/region OOS on one end and the Observing System operators in the other hand
- organise network data management at the EU level will allow to develop FAIR metadata and data services (near real time and delayed mode), agreeing at minimum a unique id for a platform and controlled vocabularies for the metadata
- dedicated resource to engage early-stage coordination and cooperation between networks, data and metadata integrators.

4.4. An attempt to describe the status of the OOS monitoring and reporting capacity in Europe

This section of the report aims to highlight some of the reasons why it is so difficult to report accurately about the OOS situation in Europe today. Tools exist, but none of them are dedicated to the European and Regional OOS monitoring and reporting needs. What needs to be stated at this stage is that neither EMODNET Physics nor Copernicus marine in situ are OOS monitoring systems, and therefore they do not cover the functionalities required by a proper OOS monitoring system. This is not the case of the OceanOPS tool that is entirely dedicated to the monitoring of the GOOS OCG networks. But this mandate does not cover all the

[13] http://ferrydata.hzg.de/index.cgi?seite=parameter_plot_plotly;zurueck=-1;cookie=1

networks that compose EOOS. At the same time, while some networks are very well coordinated and monitored, others are less integrated into the bigger picture.

The graphic below (Figure 6), highly simplified from the reality of the European OOS landscape (detailed graphic in annexe 4), aims to describe the current situation and provide tools for understanding how the situation can be improved.

To explain the situation the concept of data level (L0, L1, L2) has been transposed to the metadata. The concept of data level is commonly used in the field of data distribution, while L0 refers to raw data, L1 refers to formatted and qualified data and, L2 refers to data product (e.g., gridded product). If we transpose this classification in the field of metadata (i.e., L0 = raw metadata, L1 = unique identifiers and common vocabularies, L2 = harmonized metadata and metadata product) it is possible to describe the OOS monitoring and reporting capacity in Europe with this graphic (Figure 6).

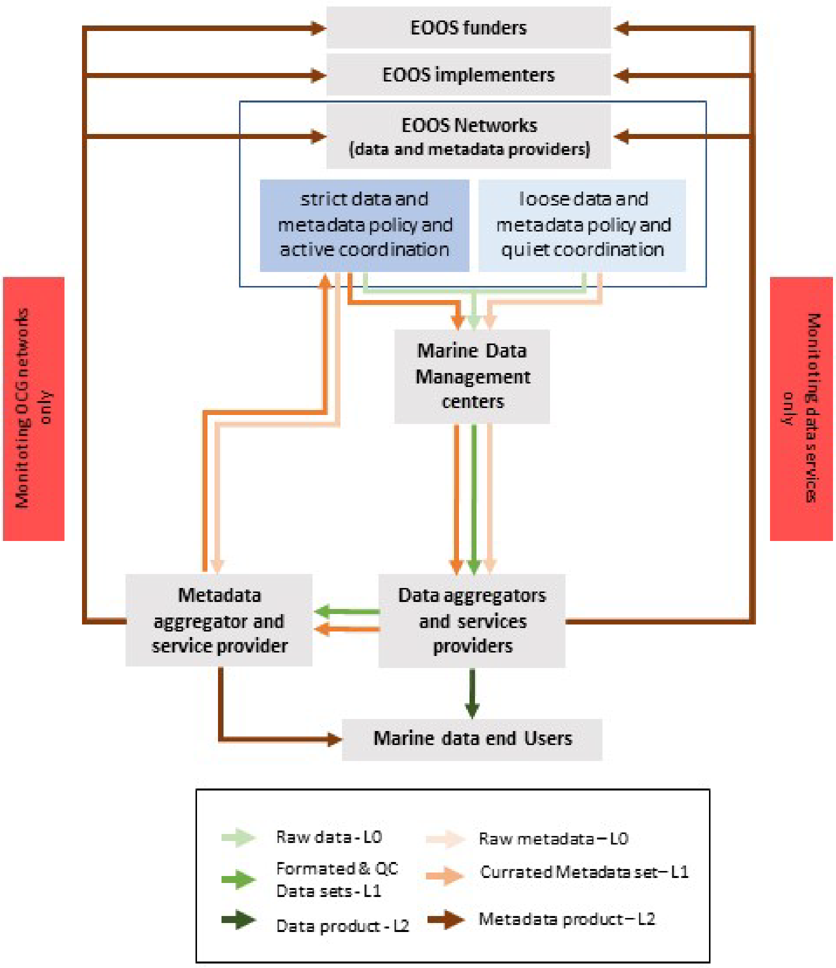


Figure 6: Simplified scheme of the current data and metadata flow in Europe

The detailed graphic in annexe 4 tries to provide a holistic view of this situation and to precisely describe the element of the scheme. It details the role and connection of each element of this complex landscape.

By putting at the same level the data integrators (EMODNET, COPERNICUS InSitu TAC) and the metadata integrators (OceanOPS), we understand that while the data integrators collect L1 data sets from all the EOOS networks to deliver L2 data product, the metadata integrators only collect L1 metadata from a limited number of networks.

The networks with loose data and metadata policy and quiet coordination (i.e., networks who do not engage lots of resources into coordination effort) deliver L0 metadata to the Data Assembly Centre (DAC), while networks with strict data and metadata policy and active coordination, and thanks to metadata feedback from metadata aggregators, deliver L1 metadata to the DAC.

Data and metadata integrators deliver to the EOOS stakeholders metadata products that help to monitor the status of the OOS access. Data integrators are delivering information based on data products. Metadata integrators deliver metadata products from highly reliable metadata provided by networks with strict data and metadata policy and active coordination. Because of the variability in the quality of the metadata coming from some networks and the loose coordination, it is impossible to integrate them in the L2 product delivered by the metadata integrators.

L2 metadata product!

- L2 data products are serving end users, while L2 metadata products are serving also OOS operators, implementers, and funders.
- Curated (platform uniquely identified and controlled vocabularies) metadata is absolutely needed to fully monitor the completed value chain of Ocean Observation.

Conclusion: Towards an OOS monitoring and reporting capacity in Europe

In this report we questioned the European capacity to monitor and report OOS. We first highlighted the discrepancies in the understanding from different OOS stakeholders of the concepts of status report and monitoring tools. We draw a typology of OOS stakeholders (funder, implementers, Operators) to identify their needs and requirements regarding OOS monitoring and status report. We then tried to shape from the outcome of the OOS stakeholder survey, the elementary OOS monitoring capacities that must be included in an efficient and fit for purpose OOS monitoring tool.

In a second time, we analysed the current tools used by stakeholders to monitor and report about OOS in Europe. We established that none of them are fully meeting the demand of OOS stakeholders despite the useful amount of information it provides. We built a schematic and holistic view of the European landscape.

We also understood that even if the current tools are used together, gaps remain to report about European OOS properly and accurately. We tried to explain the reasons for such gaps and tackle them at the levels of network integration and technical development of the monitoring tool.

Finally, we benefit from this long exercise to shape recommendations to fully develop and implement a European capacity to monitor OOS and report that would fit the needs of European OOS stakeholders.

Cooperation and synergies between the existing monitoring systems

Before delivering a list of requirements, the very first consideration would be to strongly rely on the existing to build the future European OOS monitoring and reporting capacity. It is crucial to understand that Europe has already set up efficient systems and tools to monitor different aspects of OOS (ocean data availability, marine data for operational services). Europe has also set up through 1- European Research Infrastructure within the ESFRI roadmap, 2-EuroGOOS task teams, the framework for coordination of some components of the EOOS. Europe is also already benefiting from the network coordination and the monitoring services developed by OceanOPS to pilot the implementation of the GOOS-OCG networks in the European Seas.

OceanOPS collects information at the earliest stage of the operation. This approach allows a deeper monitoring of the networks earlier in the implementation phase but requires coordination with the networks. Such cooperation can set up feedback loops on metadata that serve the general quality of the data set distributed to the Data Assembly Centre.

On its side, EMODNET Physics collects the data set from the more possible sources without restriction on the data and metadata quality. EMODNET already benefits from the cooperation between OceanOPS and networks by collecting data sets with high quality metadata. However, without harmonisation across all the networks EMODNET can only deliver statistics on data availability.

Finally, with higher standards in the data and metadata quality, the Copernicus marine in situ provides high quality information about the data availability on the observing systems, organised or not in networks, that provide the focused list of parameters necessary for operational users either for forecast or reanalysis purposes.

Also, it is important to consider that the tools developed by the three actors are serving their mandate. EMODNET Physics is not an OOS monitoring system per se. Its mandate: “unlocking fragmented and hidden marine data and making them openly available” have led to the development of monitoring tools that provide information about the marine data availability and usage from their catalogue. The role of Copernicus marine in situ is to deliver harmonised data products for operational services. Therefore, they monitor with accuracy the data they are delivering to their users. OceanOPS is the monitoring centre of the GOOS networks. They have developed tools to provide high level information to the GOOS network to support their implementation.

With Copernicus marine in situ, EMODNET Physics and OCEANOPS, Europe already has strong assets in hands to shape an efficient, integrated, and innovative OOS monitoring capacity.

Requirements for an OOS monitoring and reporting capacity in Europe

We finally propose this short list of requirements based on the work done during this task (T1.2) of the EuroSea project that should contribute to the thought about EOOS monitoring capacity.

1) Define the overarching goal of the EOOS monitoring capacity to shape it consequently Example given:
    - *"Monitoring the EOOS data value chain from investment in ocean observations to ocean data uptake."*
    - *"Allow a more efficient design and implementation planning of the EOOS"*
2) Take advantage of the existing, both on technical aspect and knowledge. EMODNET Physics, Copernicus marine in situ, and OceanOPS have strong interest in providing technical supports and guidelines to achieve the objective define previously
3) Focus the effort on the link between the networks and the metadata/data integrators. As demonstrated above, one of the critical gaps in the current European capacity to monitor OOS is the connection between some networks (quiet coordination with Regional OOS and loose data and metadata policy) with the integrated OOS. This should go along with:
    - Encouraging and implementing FAIR data policy for all concerned European ocean observing networks.
    - Investing on coordination and metadata expertise
    - Not relying on machine-to-machine only as open policy and metadata services are not always available
    - Considering technical development to serve stakeholders needs
4) Acknowledge diversity of needs and specify EOOS report content for each type of concerned stakeholders.
5) Invest in the metadata feed-back loop for all networks of the OOS to simplify the monitoring, harmonize the practices and the vocabularies across networks and shape a simple and efficient EOOS monitoring system from operation at sea to data uptake
6) Suggested schematic scheme of for a smooth OOS monitoring capacity in Europe (Figure 7)

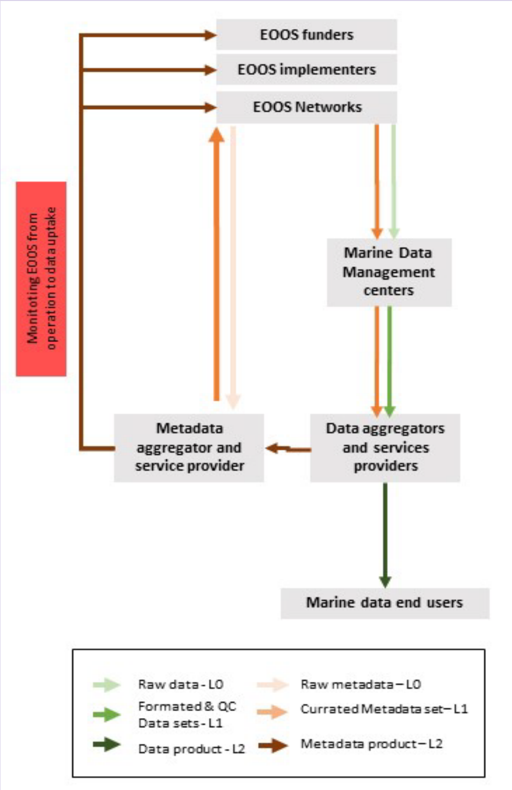


Figure 7: suggested schematic scheme for a smooth OOS monitoring capacity in Europe

Annexes

Annex 1: The Mediterranean Sea Observing System status in 2020

This section reports about the Mediterranean Sea observing system status in 2020. We addressed this question from different 3 point of views: OCG networks, National contributions, and regional Networks. The objective of this approach is to demonstrate how the monitoring of the Mediterranean Sea observing system can differ from a stakeholder perspective to another. We have used the OceanOPS monitoring tool to shape these status reports. Based on this work, we have drawn a strength and gaps analysis of the tool.

Med OOS from an OCG Networks point of view.

The following chart (Fig. 1) shows that 98 platforms (i.e., Argo Float, Glider, Mooring, drifting buoy) were deployed in the Mediterranean Sea in 2020. This indicator gives a good assessment of the activity (i.e., new deployment) in the region but does not provide valuable information about the success or the sampling effort for example.

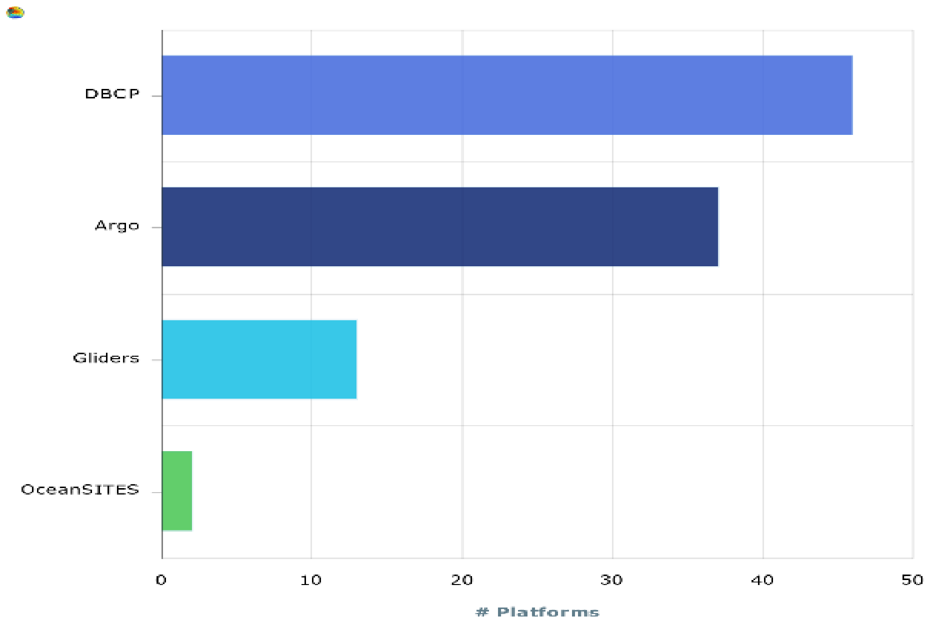


Figure 1 : Platform deployment from OCG networks in the Mediterranean Sea in 2020.

Figure 2 shows the evolution of the national glider activity along the year for each country in the Mediterranean Sea. This time series can be duplicated for each OCG network. This is an example of how to measure the sustainability of a network observing activity. It also provides information on the temporal distribution of the observing effort for this network.

Figure 2: Daily evolution of the cumulated glider days at sea in 2020 in the Mediterranean Sea by Country

Charts measuring the performance of a network and its temporal distribution are well developed in the OceanOPS monitoring tool for each OCG network. However, the access to the displayed information is not straightforward and deserves some training with the online tool.

Requirement: Simplify the access to key charts that monitor OCG networks from OceanOPS monitoring tool.

Med OOS from a national point of view.

Looking at the Mediterranean Observing System from a national point of view can be interesting for GOOS National focal points who need to report to their administration about the national contribution to the global or regional observing effort for example. The OceanOPS monitoring tool can easily compute these kinds of indicators (Fig. 3) to give an overview of national ocean observing activity in the region.

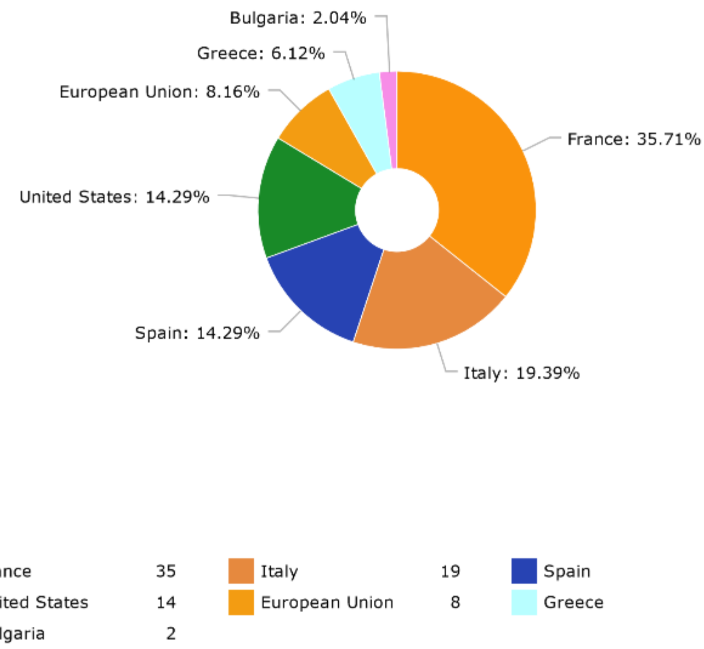


Figure 3: 2020 national efforts to OCG platform deployments

As an example, the following charts show the distribution of the Italian observing effort across the different national and institutional programs (Fig. 4) and across different variables (Fig. 5). These two figures also give an overview of the current capabilities of the OceanOPS monitoring tool.

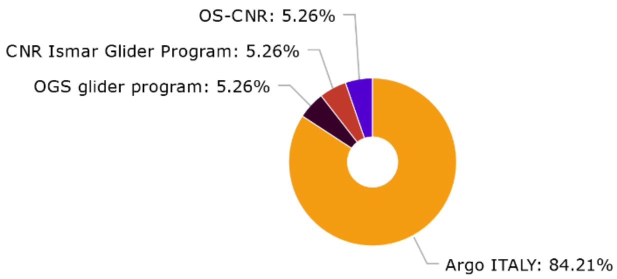


Figure 4: Distribution of the Italian Observing effort by national and institutional programs.

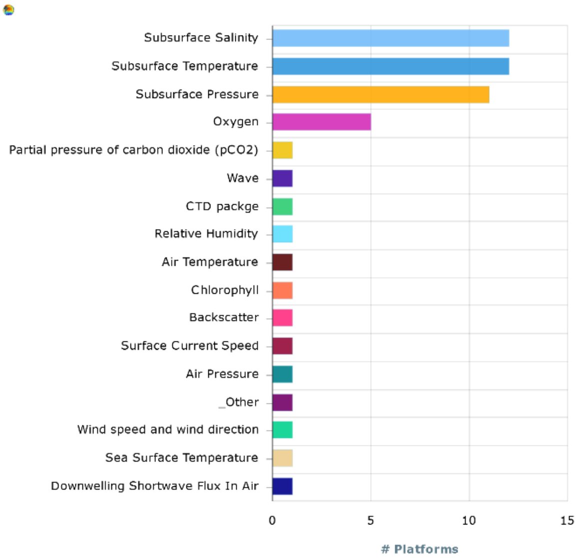


Figure 5: Distribution of the Italian Observing effort by EOVs

Again, measuring the deployments gives a good view of the effort put in ocean observation but does not give a measure of the success of the deployments, that is also useful information for NFP. For instance, if a glider is recovered after only a day of measurement, or if a float does not transmit any data, it is certainly a failure, but it is not visible in such a figure that compute deployments only. To measure the success, we should be able to compute the number of days at sea for example, or the number of data acquired and transmitted by a set of platforms. While this is feasible for a single network (i.e., OCG networks) it is not easy to compute such indicators for multiple platform types at the same time (Argo, Drifting Buoys, Gliders, Mooring, etc.).

Requirement: The "stakeholder oriented" dashboard should give easier access to indicators highlighting the success of multi-platform Ocean Observing systems.

Med OOS from a Regional Network point of view

A Regional Observing Network is an interdisciplinary multi-platform and multi-institute sustained observing network organised in a limited sea area with a well identified governance. Those regional networks are central pieces of the larger ocean observing system in closed seas like the Mediterranean Sea, the Baltic, and the Black Sea for example. Regional Networks also integrate several observing systems that are not yet under the radar of OceanOPS. For those reasons, it has become more and more important to appropriately capture metadata produced by those regional networks and integrate them into the bigger picture that is delivered by OceanOPS.

Six sustained regional observing networks in the Mediterranean Sea have been identified so far. The current OceanOPS system does not provide tools to simply access the integrated view of regional networks even if many of the platforms are registered in the OceanOPS database. The difficulty is to deal with the multiple regional systems and the multi-platform that compose this system.

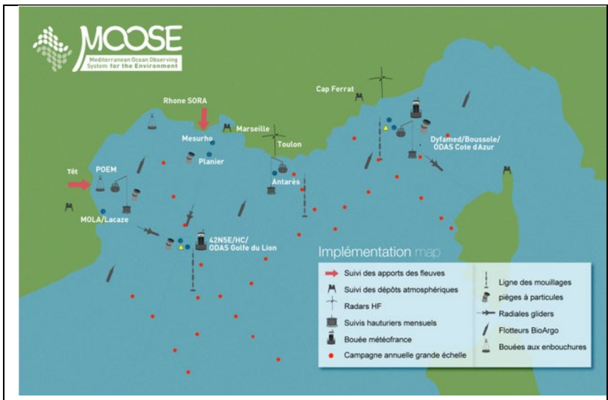


Figure 6 : MOOSE implementation strategy

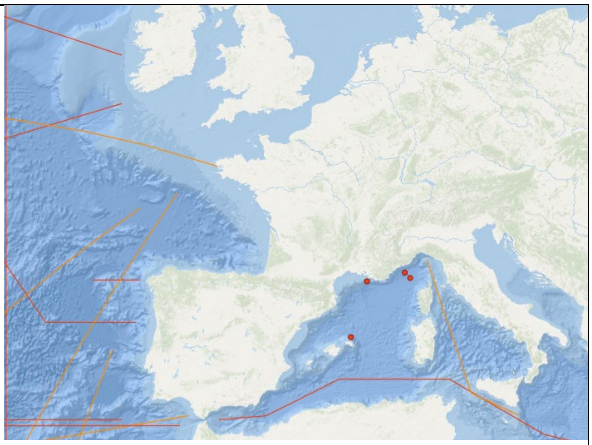


Figure 7 : MOOSE platforms in 2020 at OceanOPS

The example above shows the case of the French Mediterranean Ocean Observing System for the environment (MOOSE). Despite the MOOSE moorings, floats, cruises, and other activities are registered in the OceanOPS system, only the glider deployment in 2020 are visible when "MOOSE network" is filtered in the OceanOPS integrated system. This highlights the difficulty to identify National/Regional OOS across OCG networks.

Requirement: Regional observing systems should be better monitored and displayed by OceanOPS through an approach different from the current "OCG network-oriented" approach.

This section shows that the reporting about the OOS depends on the type of user the reporting is addressed to. Despite the OceanOPS monitoring system covering many reporting requirements, it is not answering all yet and some evolutions are needed to fully answer the needs.

Annex 2: Ocean Observing Systems status report in 2021

In this section, we wanted to compare the different online tools available to monitor the status of the Mediterranean Sea Observing System. In this comparison, we used the OceanOPS monitoring system, the MONGOOS website, the map viewer and the Copernicus Marine in situ monitoring system

The Mediterranean Sea Observing System Status in 2021

Status report from OceanOPS monitoring tool

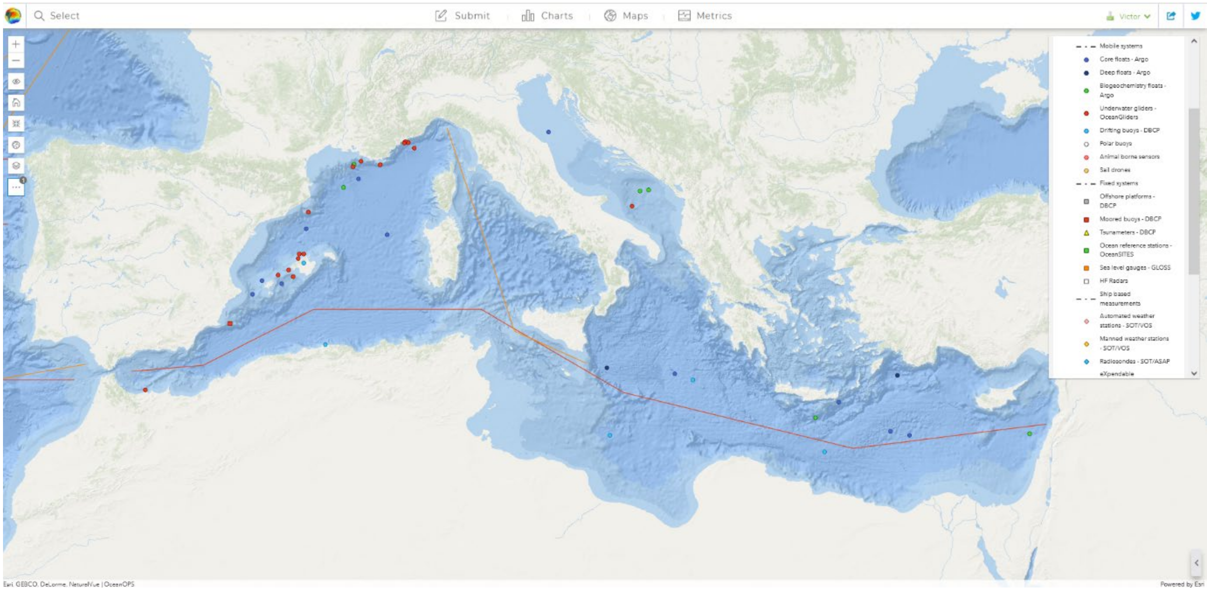


Figure 8: Geographical distribution of the operational platform in 2021 in the Mediterranean Sea from OceanOPS monitoring tool

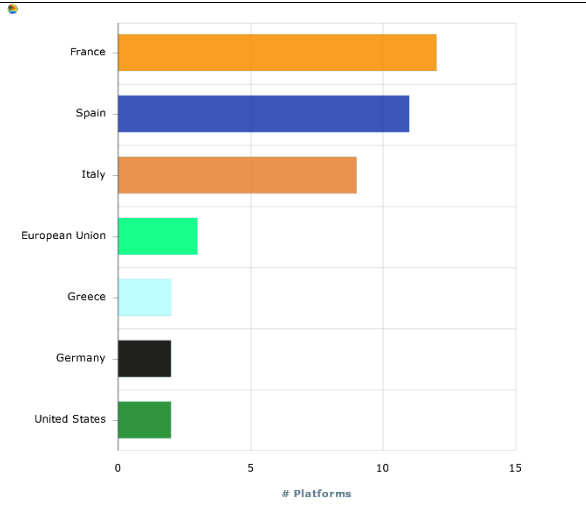


Figure 9 : Operational platform distribution in 2021 sorted by countries

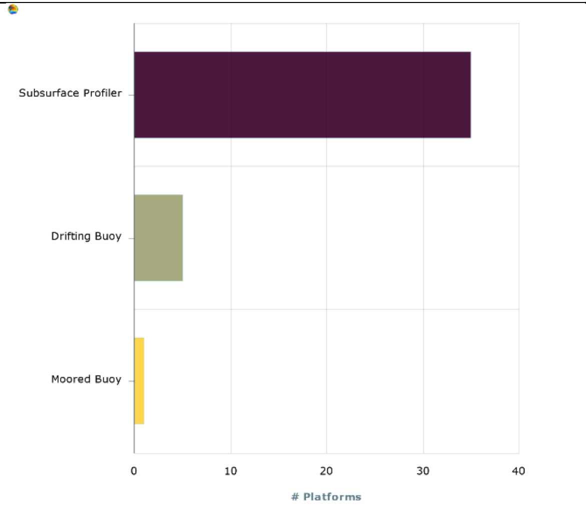


Figure 10 : Operational platform distribution in 2021 sorted by platform family

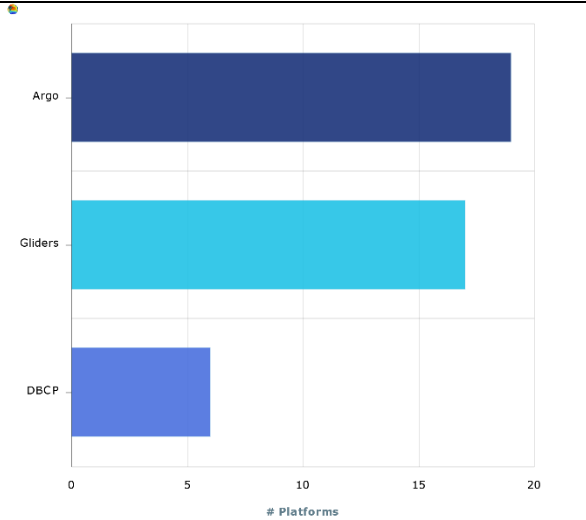


Figure 11 : Operational platform distribution in 2021 sorted by OCG networks

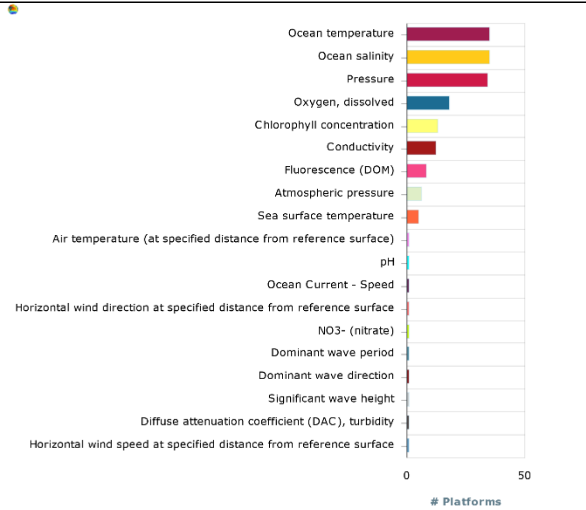


Figure 12 : Distribution of the sampling effort in 2021 sorted by variable

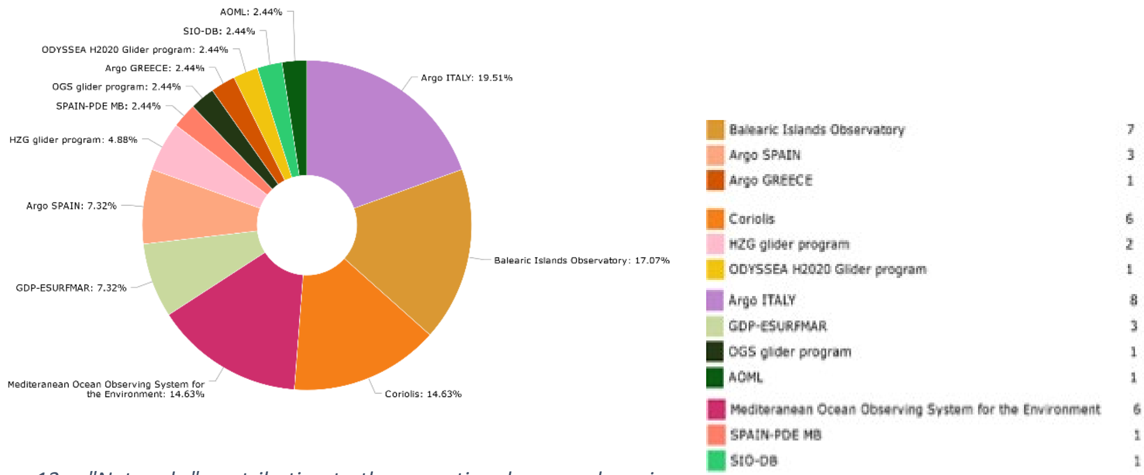


Figure 13 : "Networks" contribution to the operational ocean observing effort in 2021 in the Mediterranean Sea

Results show that 41 platforms (i.e floats, drifting buoys, moorings, gliders) have been operating in the Mediterranean Sea, mostly in the western part of the basin. France, Spain, and Italy are the major providers of platforms in the region in 2021. Most of the platforms are subsurface profilers coming from 3 programs only. Operational fixed stations in 2021 are very limited.

The number of observations delivered by the operational platform is not accessible through the OceanOPS system in one chart.

Observation data cannot be downloaded from the OceanOPS website, metadata can.

The statistics displayed above are easy to access and provide valuable information about the status of the OOS in the region. Data to compute the statistics can be downloaded.

This status report only concerns OCG networks. Other networks are not operationally monitored by OceanOPS.

The quality of the information delivered is high due to the quality control procedure of the metadata registration.

Status report from MONGOOS website

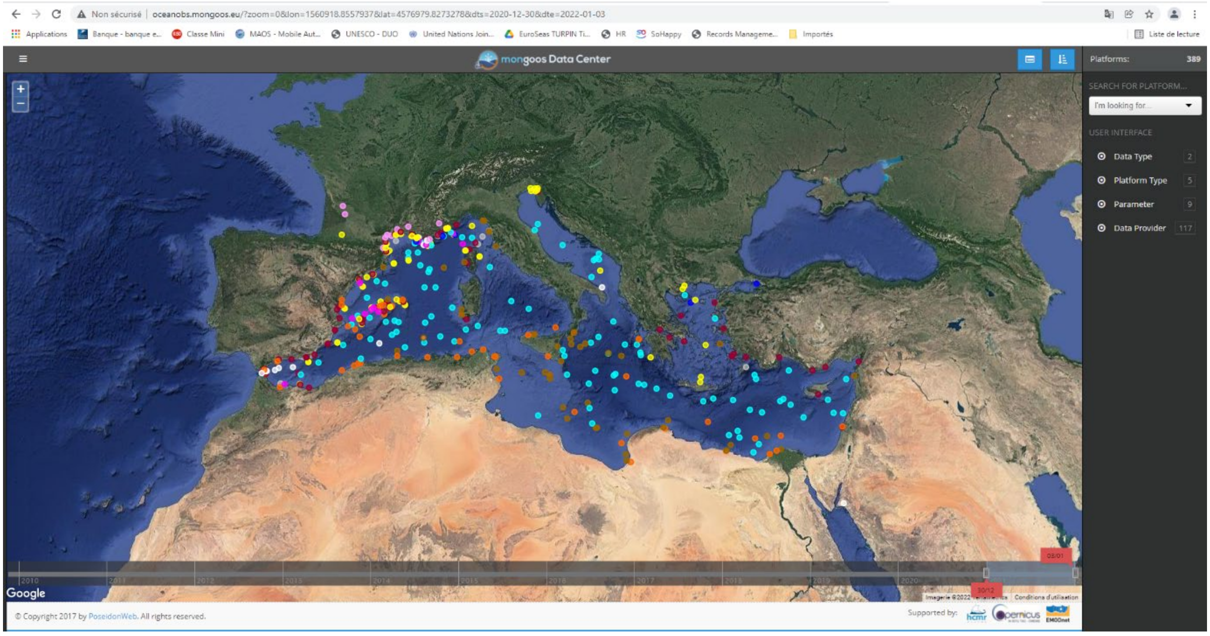


Figure 14: Geographical distribution of the operational platform in 2021 in the Mediterranean Sea from MONGOOS monitoring tool

This map displayed the latest location of the 389 ocean observing platforms in the Mediterranean Sea in 2021. There is a higher density of observing platforms in the western part of the basin but still a good spatial distribution in the central and eastern part of the basin.

There are no simple ways to compute the number of observations.

Data cannot be downloaded from this tool.

The number and diversity of platforms highlighted here is much higher than what is available at OceanOPS. Apart from OCG networks, it includes HF radar, river flows, tide gauges, Animal sensors, TSG, XBT, Drifting current metre, CTD. However, there is not much useful metadata linked to each instrument visible here. This results in the impossibility to assess the status of the Mediterranean Sea Observing System through this tool.

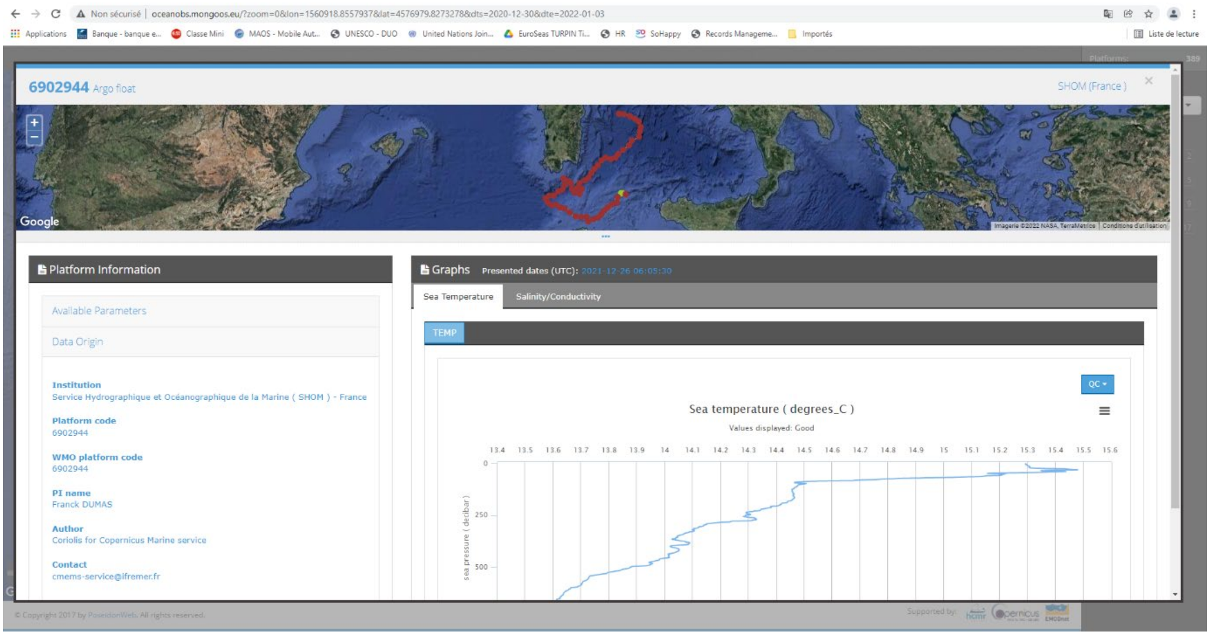


Figure 15: MONGOOS Data visualisation tool

Nevertheless, MONGOOS monitoring tools provide a good data and associated metadata visualisation tool when clicking on a dot on the map.

Status report from EMODNET Physics data portal

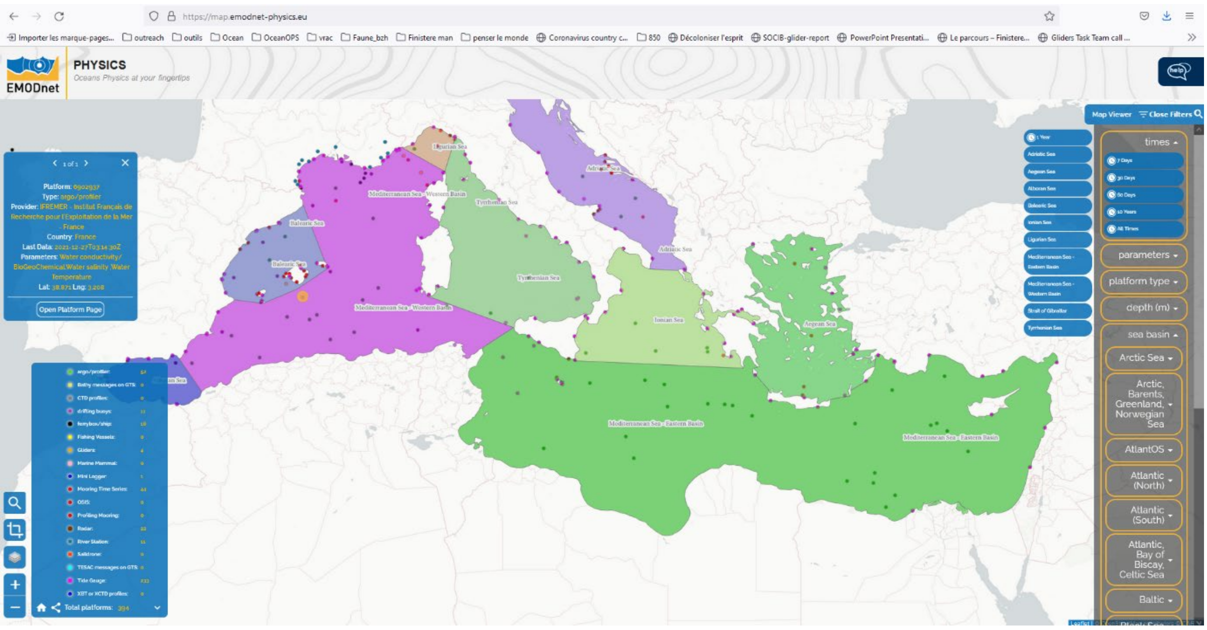


Figure 16: Geographical distribution of the operational platform in 2021 in the Mediterranean Sea from EMODNET Physics data portal

This map displays the latest location of the 393 platforms in the Mediterranean Sea in 2021.

Same as above, the number and diversity of platforms highlighted here is much higher than what is available at OceanOPS. It also includes HF radar, river flows, tide gauges, Animal sensors, TSG, XBT, Drifting current metre, CTD. Both systems (EMODNET and MONGOOS) are very similar.

However, the count of platform types is accessible here, but it is not possible to build other statistics useful for an OOS status report from it. The metadata of each platform is accessible by clicking the dots on the map. The data can be displayed on-line too.

There is no possibility to access other statistics to assess the status of the Observing System from the data portal.

Copernicus Marine in situ monitoring service

The Copernicus Marine in situ centre gives access to data product monitoring services that deliver KPIs related to the data product they produce.

The statistics below, accessible online, gives an accurate and diversified view of their data product for the Mediterranean Sea. This information is crucial to monitor the success of the observing effort in the Mediterranean Sea. Indeed, when data reached the Copernicus Marine in situ data product, it become usable by the operational services.

The data sources list (see figure 17) is controlled and limited to the Copernicus Marine in situ user needs. This is a pretty good reference list of what could be monitored by the future monitoring dashboard.

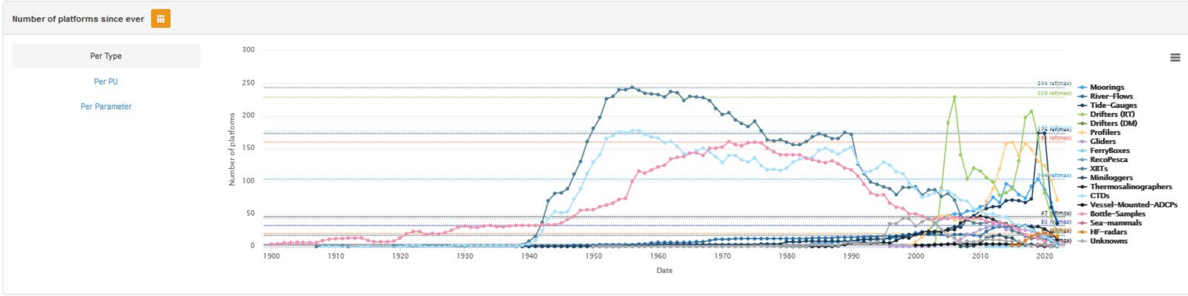


Figure 17 : Number of Mediterranean platforms providing ocean data (since ever) to Copernicus Marine in situ *sorted by platform type.*

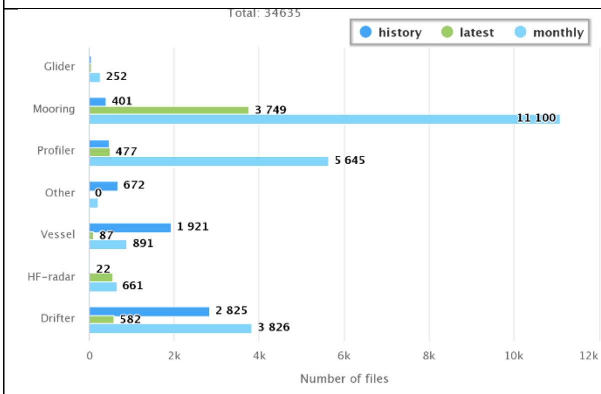


Figure 18: Number of Mediterranean data files, sorted by platform type, available in the Copernicus Marine in situ *data product.*

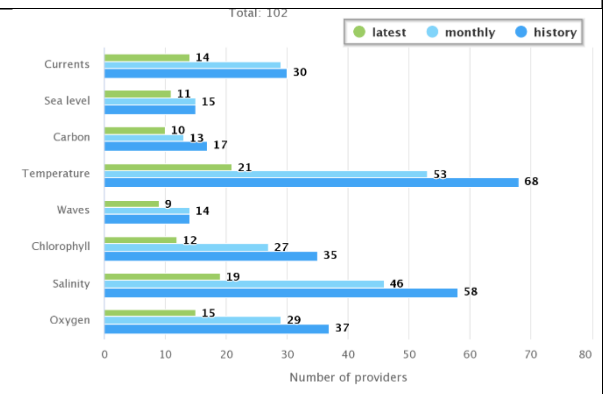


Figure 19: Number of data files provider, sorted by variables, available in the Copernicus Marine in situ *data product for the Mediterranean Sea.*

Nevertheless, those statistics are "static" and cannot be adapted to a specific set of platforms online. It gives a clear integrated view of what is made available in the Mediterranean region but does not inform about what is operating at sea.

The Baltic Sea Observing System Status report in 2021

In this section, we use the online tool available on the OceanOPS website, on the BOOS website, on the EMODNET physics website and on the Copernicus Marine in situ

Status report from OceanOPS monitoring tool

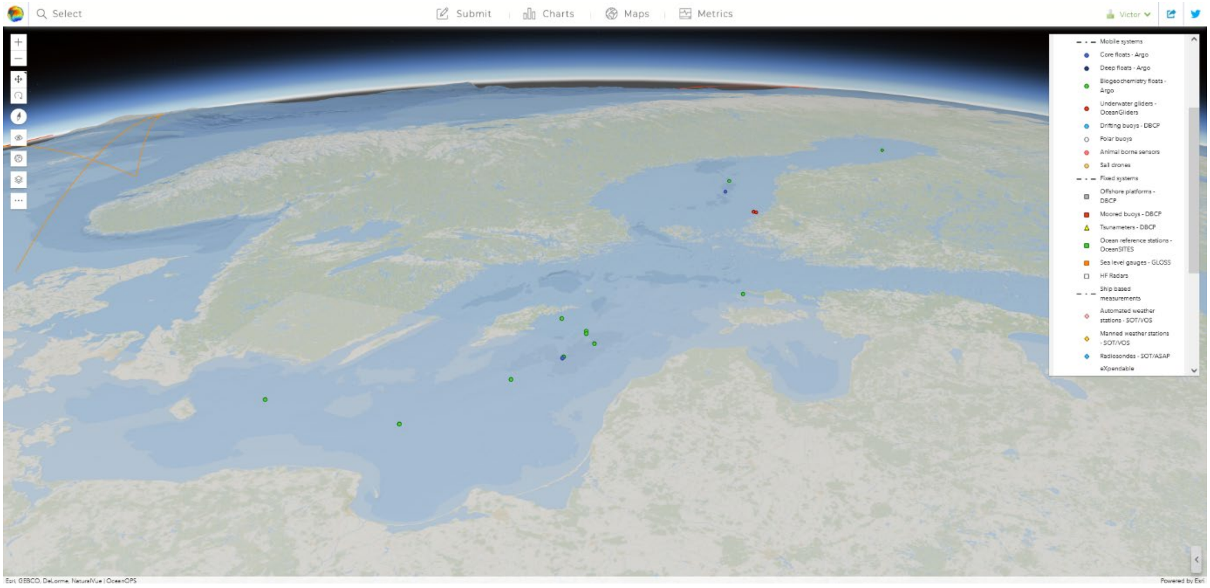


Figure 20: Geographical distribution of the operational platform in 2021 in the Baltic Sea from OceanOPS monitoring tool

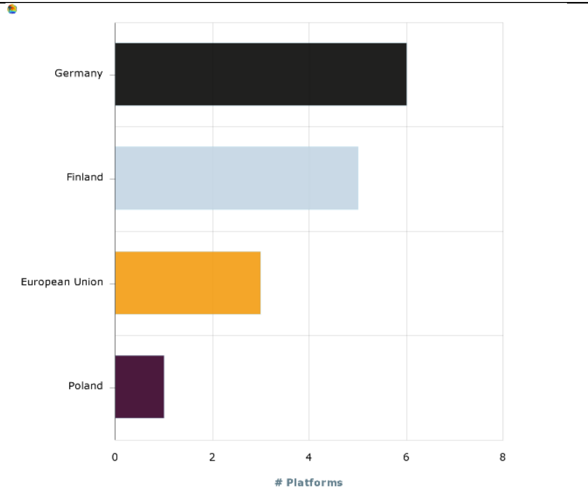


Figure 21 : Operational platform distribution in 2021 sorted by countries

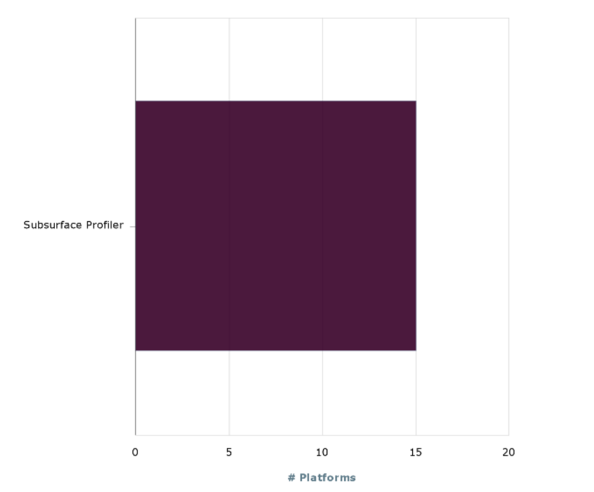


Figure 22: Operational platform distribution in 2021 sorted by platform family

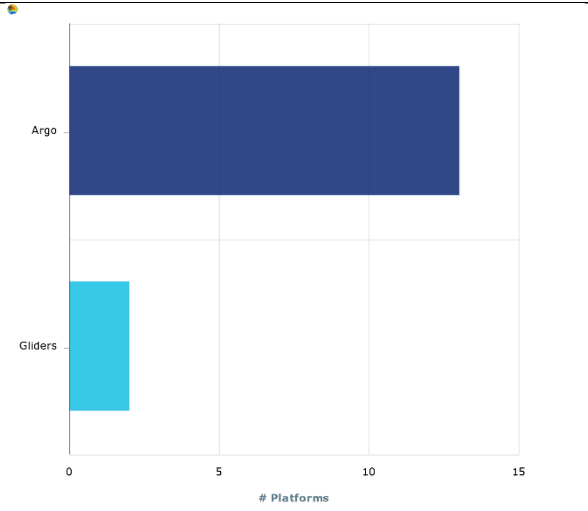


Figure 23: Operational platform distribution in 2021 sorted by OCG networks

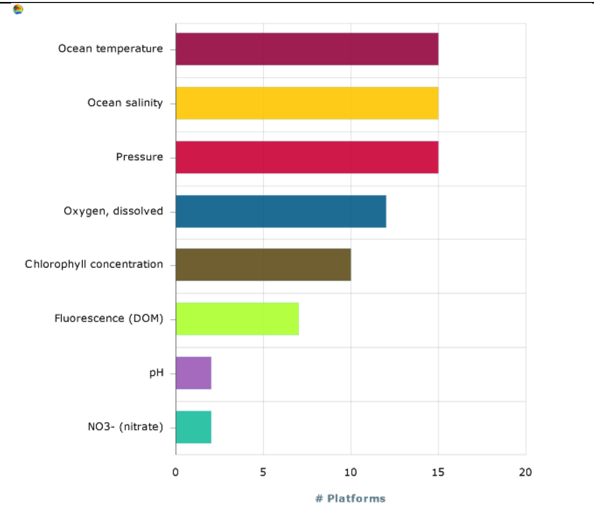


Figure 24: Distribution of the sampling effort in 2021 sorted by variable

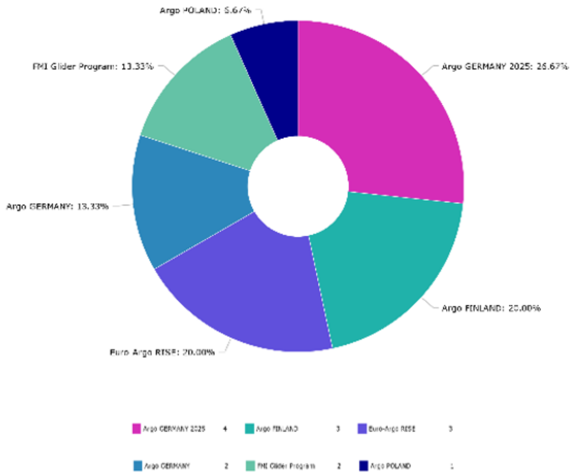


Figure 25: "Networks" contribution to the operational ocean observing effort in 2021 in the Mediterranean Sea

15 operational OCG platforms have been deployed in the Baltic region in 2021. 13 Argo floats and 2 glider missions have been operated by Germany, Finland, Poland, and the Euro Argo ERIC (EU funded floats). This is a measure of the observing activity in the region supported by OCG networks.

28 instruments have operated in the Baltic in 2021 (not shown above) distributed as follows: ,22 Argo floats including 16 BGC floats, 3 National Moored Buoys and 3 glider missions. Platforms were operated by Germany, Finland, EU, and Poland. These statistics show the actual observing effort in the region along the year 2021.

However, the OceanOPS monitoring tool does not provide easy access to the real observing system situation in the past. KPIs and statistics should be built to deliver this kind of information.

Status report from Baltic Ocean Observing System website

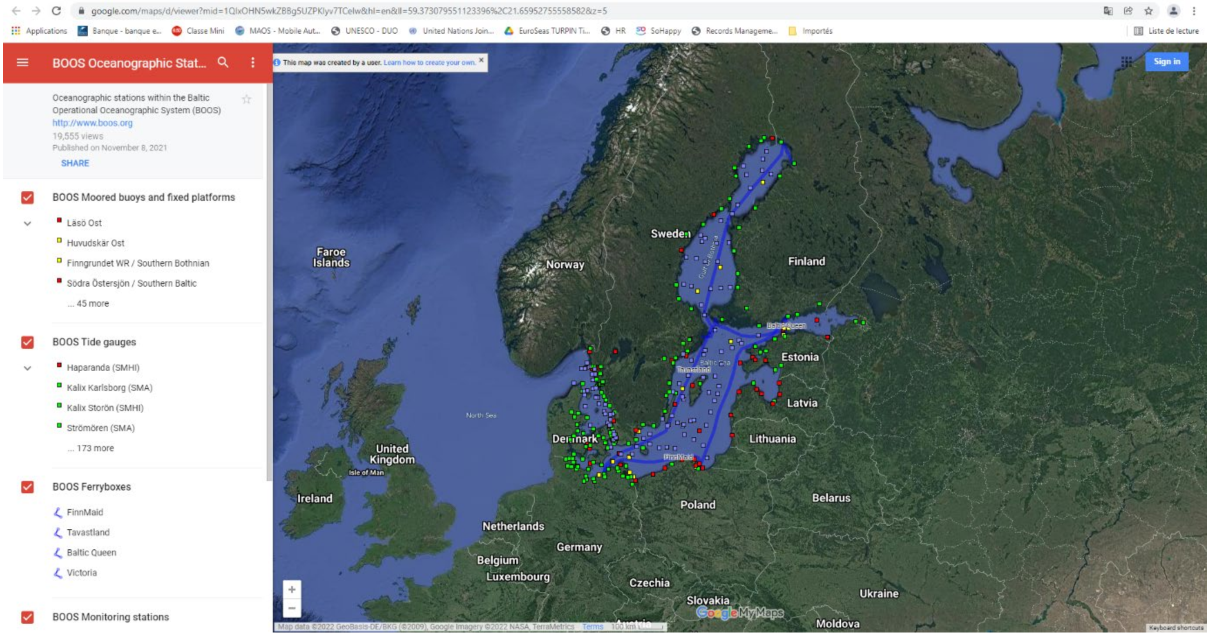


Figure 26: Geographical distribution of the operational platform in 2021 in the Baltic Sea from BOOS monitoring tool

This map displays the distribution of the ocean observing platforms in the Baltic Sea from the Baltic ROOS website. This system does provide counts, time filtering and statistics. However, the counts are not easily usable. Data is not accessible through this system. It seems that BOOS hasn't invested much in any monitoring capability yet.

Status report from EMODNET Physics data portal

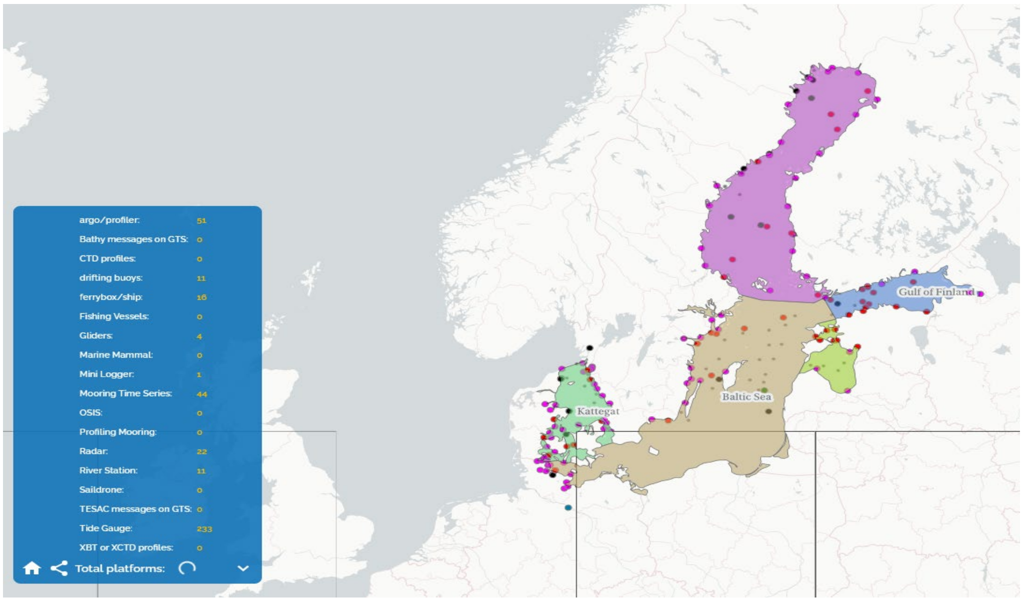


Figure 27: Geographical distribution of the operational platform in 2021 in the Baltic Sea from EMODNET Physics data portal

399 platforms are visible on this visualisation tool. This is much more than on the OceanOPS system. The counts by platform type are available but the list is not harmonised. It mixes messages on the GTS, platforms, data logger, ctd profiles, etc. that makes the whole picture not exploitable Metadata are visible when selecting the platform, but no harmonisation or control is made on the metadata. Data can be downloaded from this system

Copernicus Marine in situ monitoring service

Copernicus Marine in situ system for the Baltic is the same as for the Mediterranean with the same capacities, functionalities, and limitations.

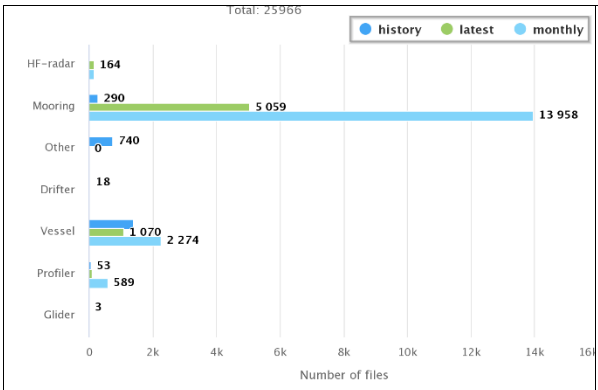


Figure 18: Number of Balitc data files, sorted by platform type, available in the Copernicus Marine in situ *INSTU Ocean TAC data product.*

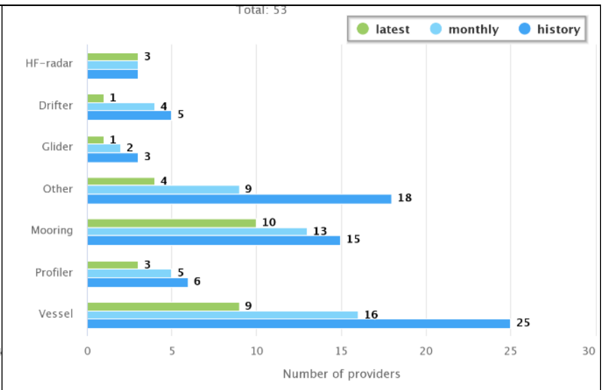


Figure 19: Number of data files provider, sorted by variables, available in the Copernicus Marine in situ *data product for the Baltic Sea.*

The Arctic Ocean Observing System status in 2021

In this section, again, we use the online tool available on the OceanOPS website, the Arctic ROOS website , the EMODNET physics website and the Copernicus Marine in situ.

Status report from OceanOPS monitoring tool

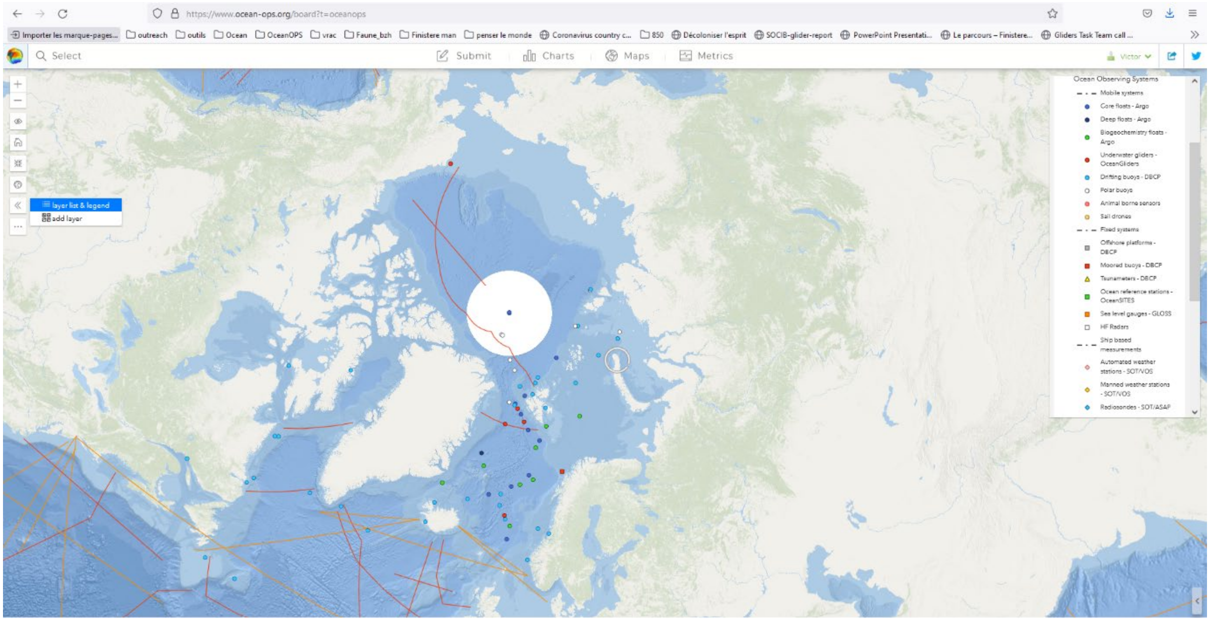


Figure 28: Geographical distribution of the operational platform in 2021 in the Arctic Ocean from OceanOPS monitoring tool

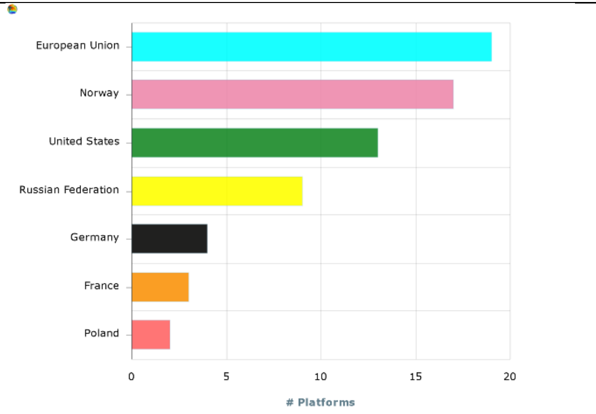


Figure 29: Operational platform distribution in 2021 sorted by countries

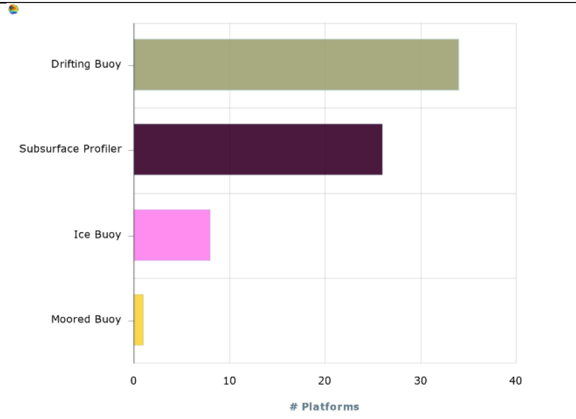


Figure 30: Operational platform distribution in 2021 sorted by platform family

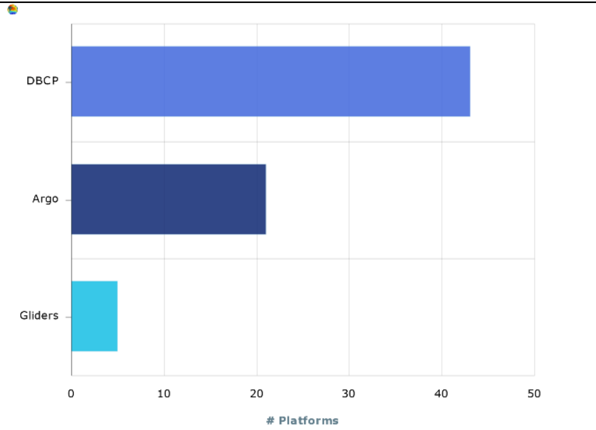


Figure 31: Operational platform distribution in 2021 sorted by OCG networks

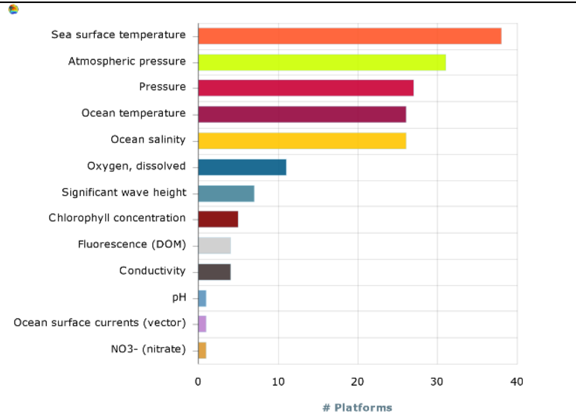


Figure 32: Distribution of the sampling effort in 2021 sorted by variable

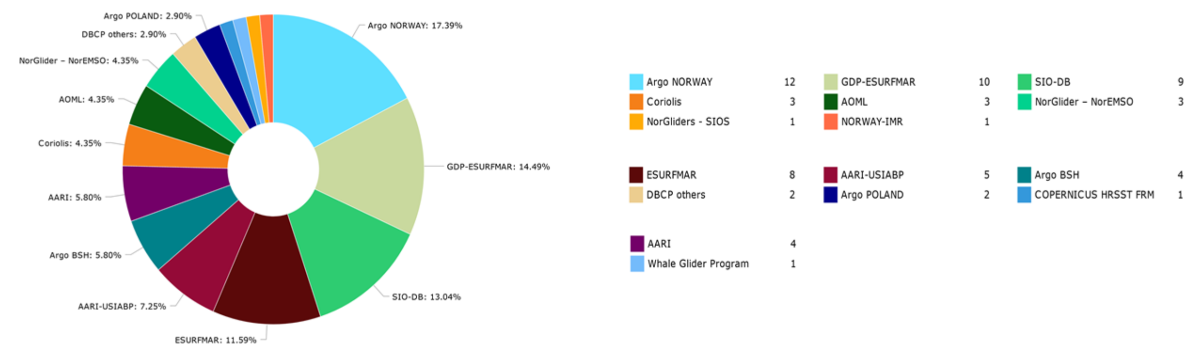


Figure 33: "Networks" contribution to the operational ocean observing effort in 2021 in the Arctic Ocean

70 operational OCG platforms have been deployed in the Arctic Ocean in 2021. 34 drifting buoys, 26 profiling platforms, 8 ice buoys and 2 moorings. Germany, France, Russia, Norway, USA, Poland, and the EU have

operated platforms in the region in 2021. This is a measure of the observing activity in the region supported by OCG networks.

The same information can be easily observed under different angles (Networks contribution, variable distributions, OCG networks distribution, etc.).

Status report from Arctic Regional Ocean Observing System website

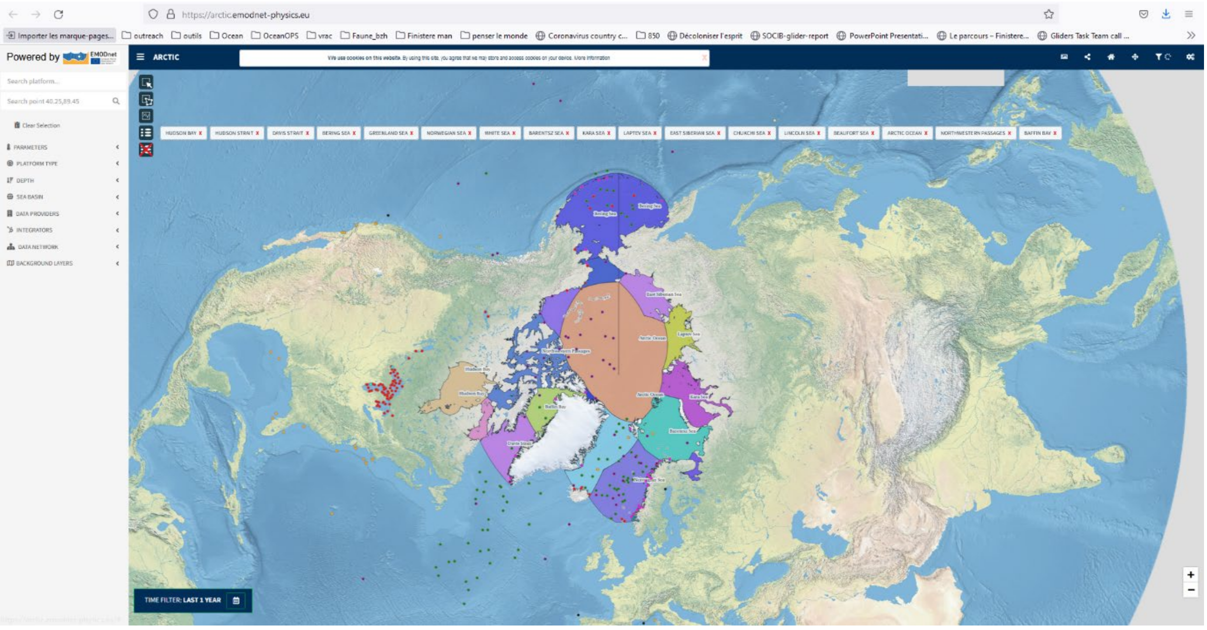


Figure 34: Geographical distribution of the operational platform in 2021 in the Baltic Sea from Arctic GOOS monitoring tool

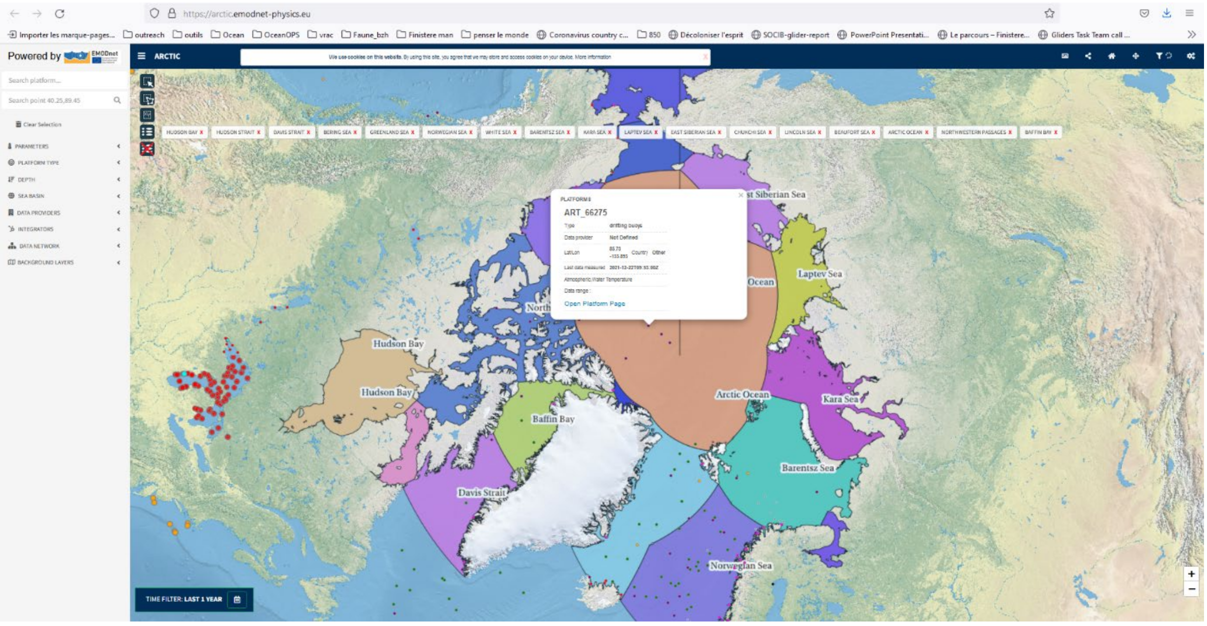


Figure 35: Arctic ROOS Data visualization tool

Status report from EMODNET Physics data portal

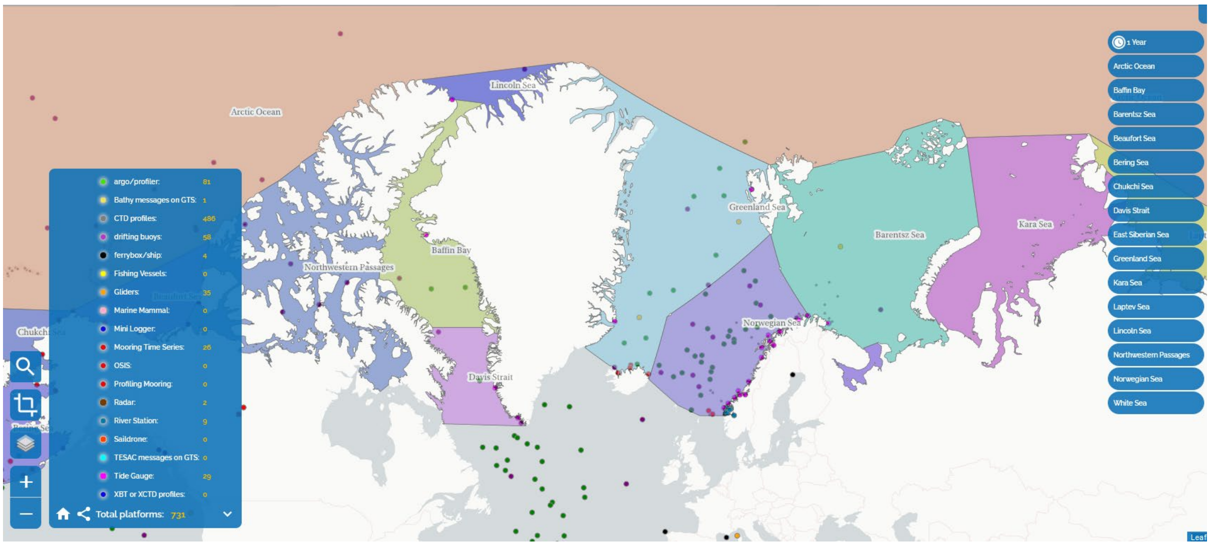


Figure 36: Geographical distribution of the operational platform in 2021 in the Arctic Ocean from EMODNET Physics data portal

Arctic ROOS and EMODNET Physic portal are similar. EMODNET Physic portal for the Arctic has the same capacities and limitations as described previously for the Mediterranean and the Baltic.

Copernicus Marine in situ

Copernicus Marine in situ system for the Baltic is the same as for the Mediterranean with the same capacities, functionalities, and limitations.

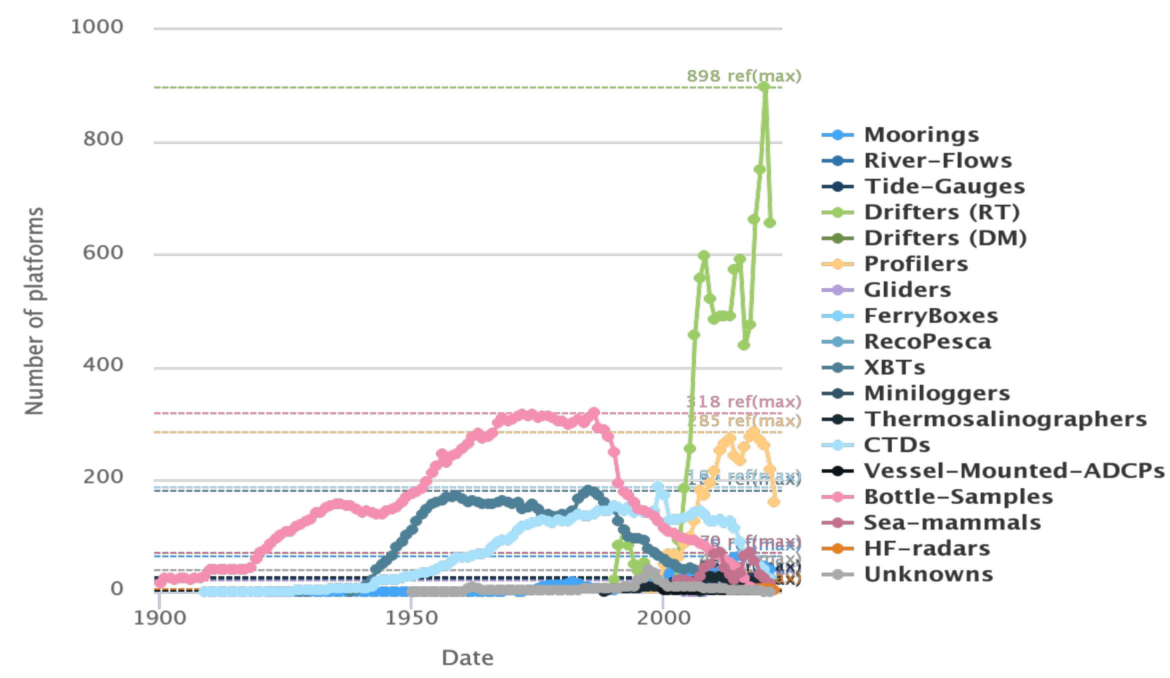


Figure 17: Number of Arctic platforms providing ocean data (since ever) to Copernicus Marine in situ *sorted by platform type.*

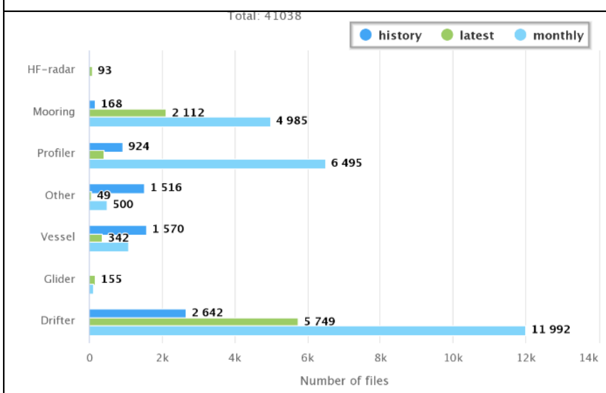


Figure 18 : Number of Arctic data files, sorted by platform type, available in the Copernicus Marine in situ *data product.*

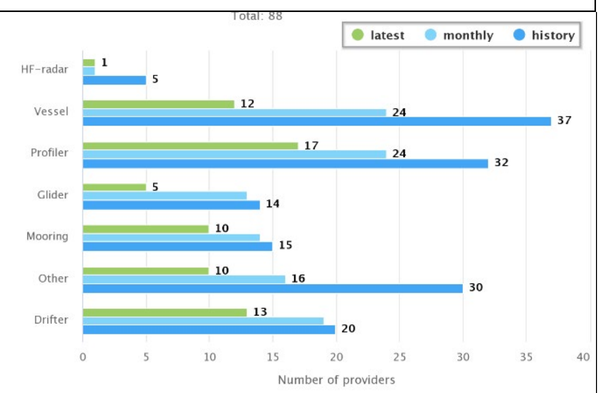


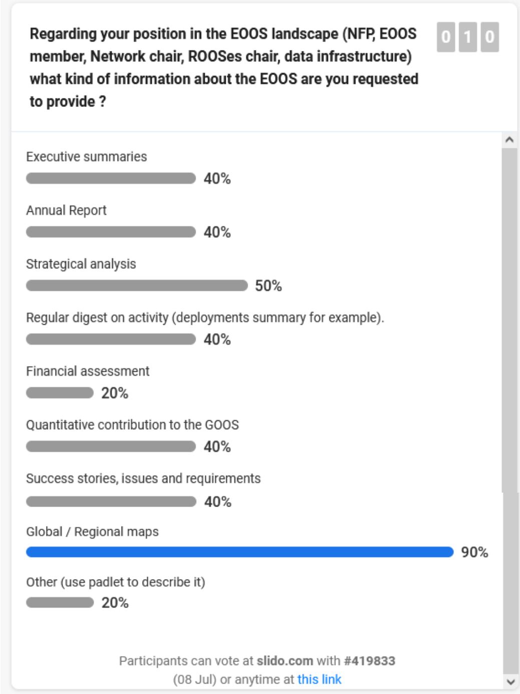
Figure 19 : Number of data files provider, sorted by variables, available in the Copernicus Marine in situ *data product for the Arctic Ocean.*

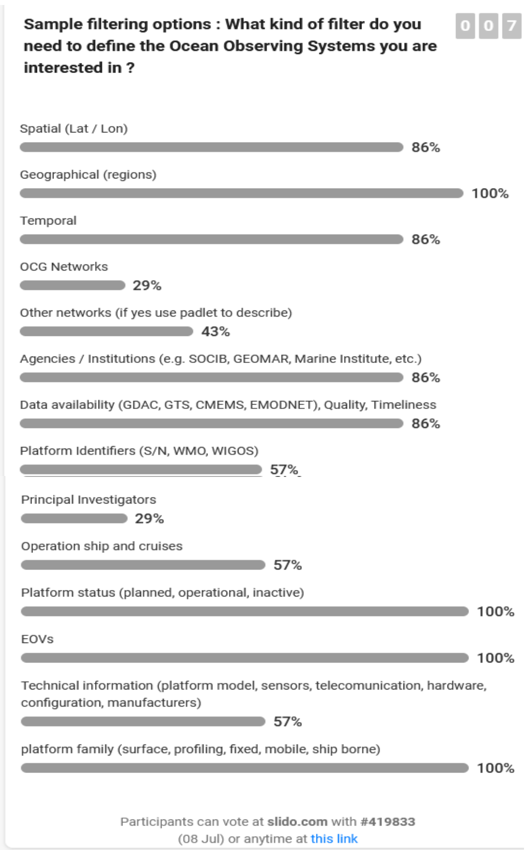
Annex 3: OOS stakeholders survey

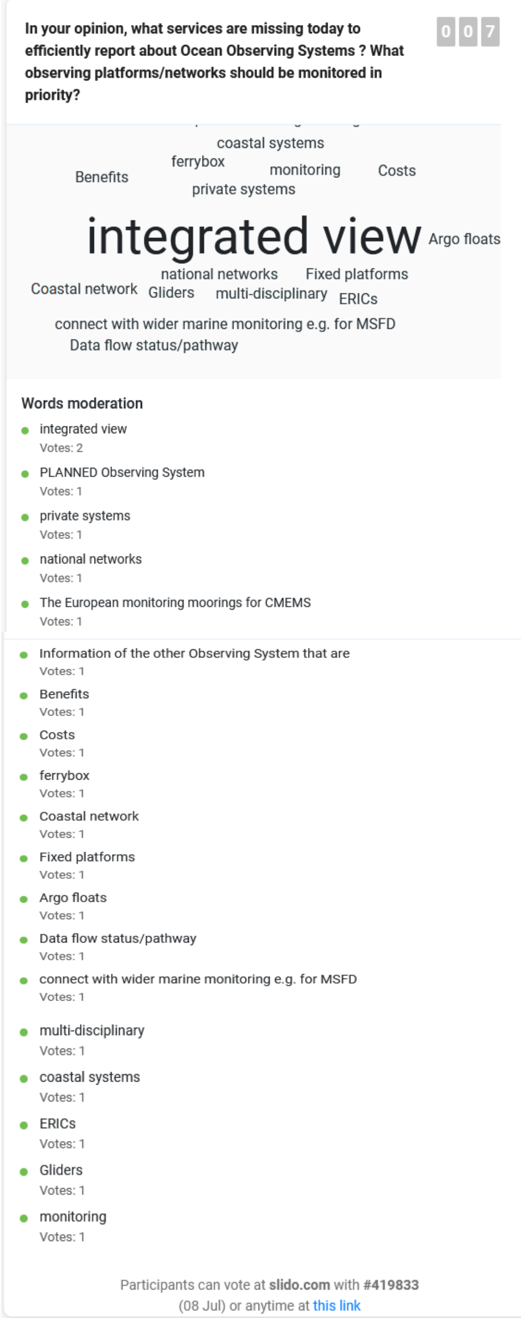
List of the people and affiliation joining the survey:

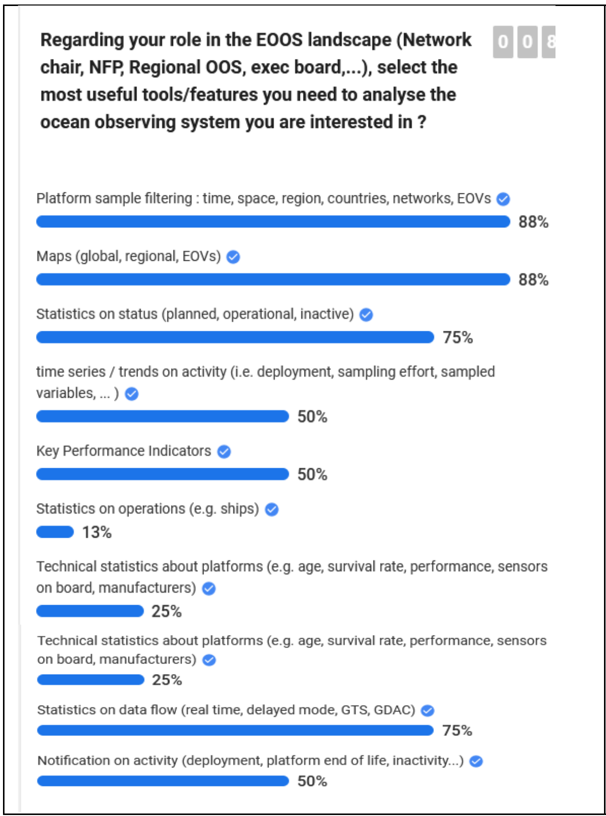
Antonio Novellino	EMODNET
Alejandro Orfila	MONGOOS
Patrick Gorringe	EMODNET
Kate Larkin	EMODNET
Sylvie Pouliquen	EuroArgo, Copernicus INSTAC
Henrik Steen Andersen	Copernicus INSTAC
Sebastien Legrand	NOOS – Belgium NFP
Sandra Ketelhake	AtlantOS
Pierre-Yves Le Traon	French NFP
Johannes Karstensen	OceanSites
Laurent Delauney	EOOS
George Pethiakis	EuroGOOS
Inga Lips	EuroGOOS
Sabrina Speich	EuroSea
Ana Lara-Lopez	EuroSea
Vanessa Cardin	MONGOOS Chair

Survey results:

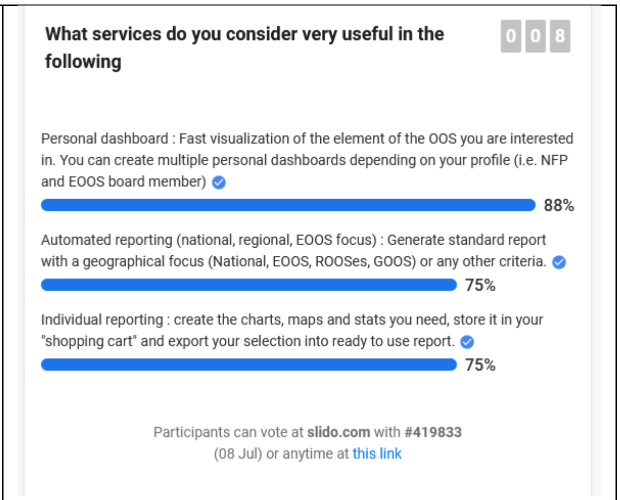

Regarding your position in the EOOS landscape (NFP, EOOS member, Network chair, ROOSes chair, data infrastructure) what kind of information about the EOOS are you requested to provide ?
0 1 0
Executive summaries
40%
Annual Report
40%
Strategical analysis
50%
Regular digest on activity (deployments summary for example).
40%
Financial assessment
20%
Quantitative contribution to the GOOS
40%
Success stories, issues and requirements
40%
Global / Regional maps
90%
Other (use padlet to describe it)
20%
Participants can vote at slido.com with #419833
(08 Jul) or anytime at this link


Sample filtering options : What kind of filter do you need to define the Ocean Observing Systems you are interested in ?
0 0 7
Spatial (Lat / Lon)
86%
Geographical (regions)
100%
Temporal
86%
OCG Networks
29%
Other networks (if yes use padlet to describe)
43%
Agencies / Institutions (e.g. SOCIB, GEOMAR, Marine Institute, etc.)
86%
Data availability (GDAC, GTS, CMEMS, EMODNET), Quality, Timeliness
86%
Platform Identifiers (S/N, WMO, WIGOS)
57%
Principal Investigators
29%
Operation ship and cruises
57%
Platform status (planned, operational, inactive)
100%
EOVs
100%
Technical information (platform model, sensors, telecomunication, hardware, configuration, manufacturers)
57%
platform family (surface, profiling, fixed, mobile, ship borne)
100%
Participants can vote at slido.com with #419833
(08 Jul) or anytime at this link


In your opinion, what services are missing today to efficiently report about Ocean Observing Systems ? What observing platforms/networks should be monitored in priority?
0 0 7
coastal systems
ferrybox
Benefits
monitoring
Costs
private systems
integrated view
Argo floats
national networks
Fixed platforms
Coastal network
Gliders
multi-disciplinary
ERICs
connect with wider marine monitoring e.g. for MSFD
Data flow status/pathway
Words moderation
integrated view
Votes: 2
PLANNED Observing System
Votes: 1
private systems
Votes: 1
national networks
Votes: 1
The European monitoring moorings for CMEMS
Votes: 1
Information of the other Observing System that are
Votes: 1
Benefits
Votes: 1
Costs
Votes: 1
ferrybox
Votes: 1
Coastal network
Votes: 1
Fixed platforms
Votes: 1
Argo floats
Votes: 1
Data flow status/pathway
Votes: 1
connect with wider marine monitoring e.g. for MSFD
Votes: 1
multi-disciplinary
Votes: 1
coastal systems
Votes: 1
ERICs
Votes: 1
Gliders
Votes: 1
monitoring
Votes: 1
Participants can vote at slido.com with #419833
(08 Jul) or anytime at this link

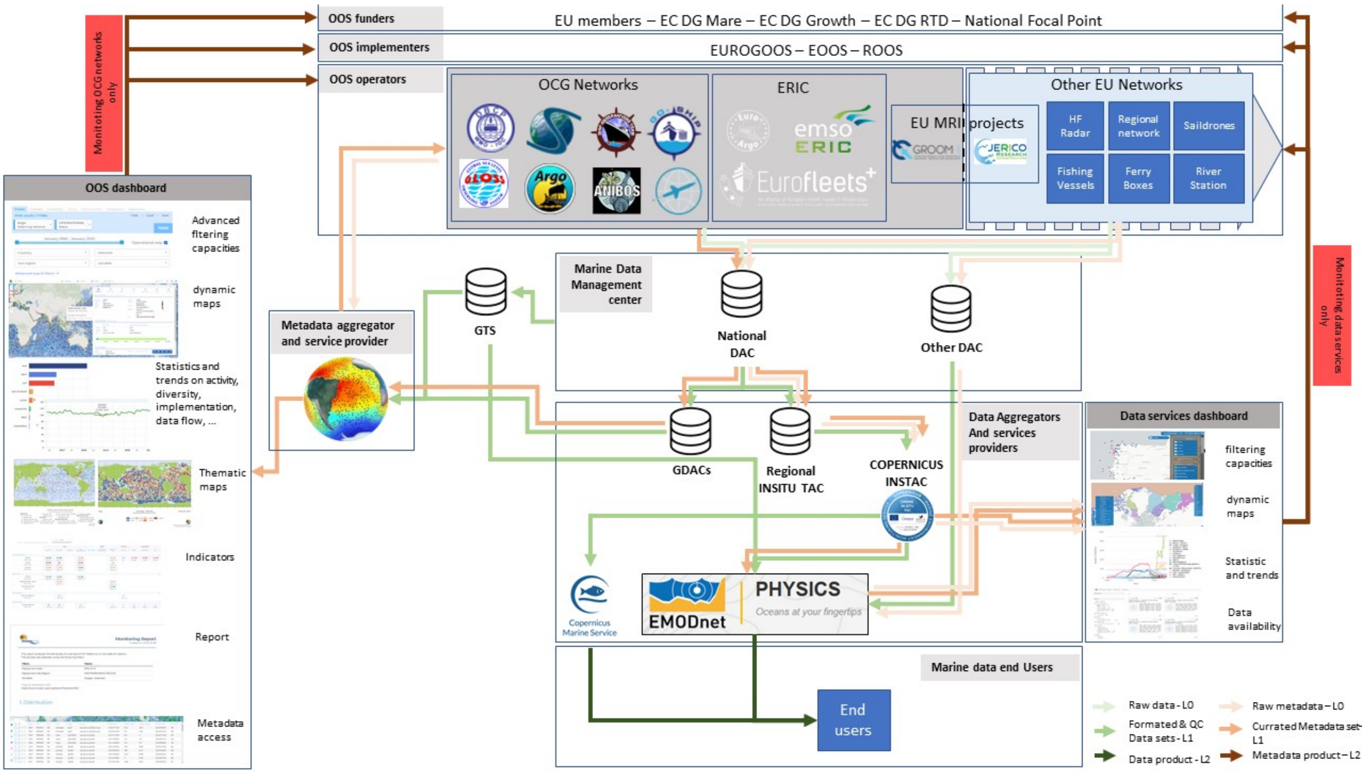


Regarding your role in the EOOS landscape (Network chair, NFP, Regional OOS, exec board,...), select the most useful tools/features you need to analyse the ocean observing system you are interested in ?
Platform sample filtering : time, space, region, countries, networks, EOVs
88%
Maps (global, regional, EOVs)
88%
Statistics on status (planned, operational, inactive)
75%
time series / trends on activity (i.e. deployment, sampling effort, sampled variables, ...)
50%
Key Performance Indicators
50%
Statistics on operations (e.g. ships)
13%
Technical statistics about platforms (e.g. age, survival rate, performance, sensors on board, manufacturers)
25%
Technical statistics about platforms (e.g. age, survival rate, performance, sensors on board, manufacturers)
25%
Statistics on data flow (real time, delayed mode, GTS, GDAC)
75%
Notification on activity (deployment, platform end of life, inactivity...)
50%



What services do you consider very useful in the following
0 0 8
Personal dashboard : Fast visualization of the element of the OOS you are interested in. You can create multiple personal dashboards depending on your profile (i.e. NFP and EOOS board member)
88%
Automated reporting (national, regional, EOOS focus) : Generate standard report with a geographical focus (National, EOOS, ROOSes, GOOS) or any other criteria.
75%
Individual reporting : create the charts, maps and stats you need, store it in your "shopping cart" and export your selection into ready to use report.
75%
Participants can vote at slido.com with #419833
(08 Jul) or anytime at this link

Annex 4: A holistic view of the EOOS monitoring and reporting capacity



This scheme tries to offer a holistic view of the OOS reporting and monitoring capacity in Europe. Each box (blue line and white background) represents a type of stakeholder (highlighted in light grey). Members are identified with their names, or logos or in a bleu box (dark blue background).

The two dashboards on the side are highlighted in darker grey than the stakeholder type. They both deliver different services and information to the high-level stakeholders based on metadata management approach and scope. Those services are described in the dashboard boxes and summarized in the red box along the L2 metadata arrows.

Arrows represent the transfer of data (green) and metadata (orange). The intensity of the colours represents the level (L0 raw, L1 formatted/curated, L2 product).

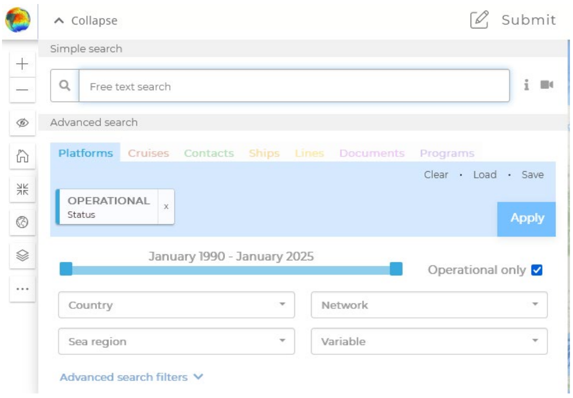
The Marine data user box has not been detailed much as it is not our topic here.

In the OOS operator box, the networks have been separated in two sub boxes. The OCG networks, the ERICs, the Marine Research Infrastructure project (MRI) and the "other networks". This latest box is incomplete. Gray and Blue background separate the networks pushing L1 metadata to the National data centres and the Metadata aggregators with the networks pushing L0 metadata to the DAC and National data centres.

Annex 5: Dashboard “proof of concept”, review of the technical developments made during EuroSea

The requirement expressed along this task by the OOS stakeholders have motivated the improvement of the OceanOPS dashboard and the development new capabilities. The developments detailed hereafter have been triggered by the idea of a wider use in Europe and improved user experience. They all have been tested and implemented in a proof-of-concept tool available online (see end of this section). Finally, in the description of each evolution, we have identified potential improvement to continue to upgrade this OOS monitoring and reporting tool.

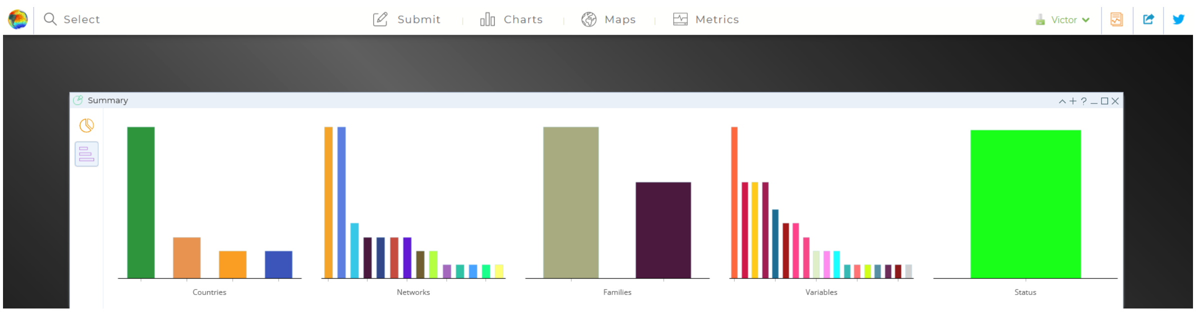
Facilitate sample selection



Most of the stakeholders base their selection on a limited number of criteria (country, time, sea region, variables, and platform (i.e., float, gliders, etc.). We put those filtering option more easily accessible on the website to facilitate the selection of the sample to study. Beforehand, there was no hierarchy in the filtering option. That was a hurdle for beginners’ users to handle the tool.

Improve display of statistics

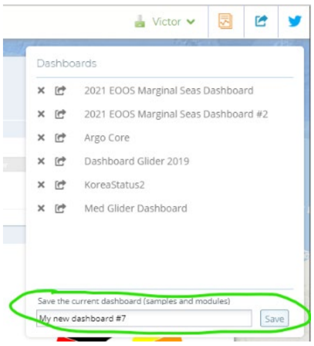
One of the remarks we had from the users was about the difficulty to have a complete view of the sample statistics. Indeed, in the operational version of the OceanOPS system you need to discover the website and look for several statistics to build your view on the OOS.



This evolution aims to aggregate some statistics together in one single display to deliver a better overview of the selected sample. This evolution needs some adjustment regarding the vocabulary used and the display of the legend. Also, the list of statistic is static, but a future evolution would be to allow a complete management of this display (i.e., ability to choose the statistics displayed).

Saving personal dashboards

This evolution is echoing with the previous feature. To facilitate access to the requested information it is now possible to save your preselected dashboard. This mean, when the sample is well defined and the metric have been selected, the user can save his personal dashboard to access next time without re-doing the selection and display process.



In the future we anticipate developing more individualisation capacity of the dashboard by including routine (i.e., yearly edition, increased display feature like KPI, implementation statistics, data flow statistics, editable title, etc.)

Automated reporting tool

Reporting about Ocean Observing System is not an easy task and, as demonstrated along this report, will depend on individual or professional requirements.

The idea behind this evolution is to offer users, independently of its needs, the capacity to structure and edit online an OOS monitoring report.

Currently, the structure of the report is pre-set based on the sample selection. It can be edited but the statistics displayed are always the same.

Future evolution are already consider. Select the statistic, maps, kpi to be displayed in the report. This model is inspired by the online shopping tool of any manufacturer. User select the article that fall into a virtual shopping trolley. When finished the user pay the content of the trolley. In our case, the articles would be the statistics, KPI, maps and the trolley would become the editable report.

The second evolution of this reporting capacity would be to routinely produce the report. For example, EOOS national focal point could receive, every year, trimester, month the report they may have design online (or with the support of the OceanOPS team).

Proof-of-concept demonstration

Finally, we have set up a demonstration exercise to learn on how to handle the monitoring and reporting tool of OceanOPS.

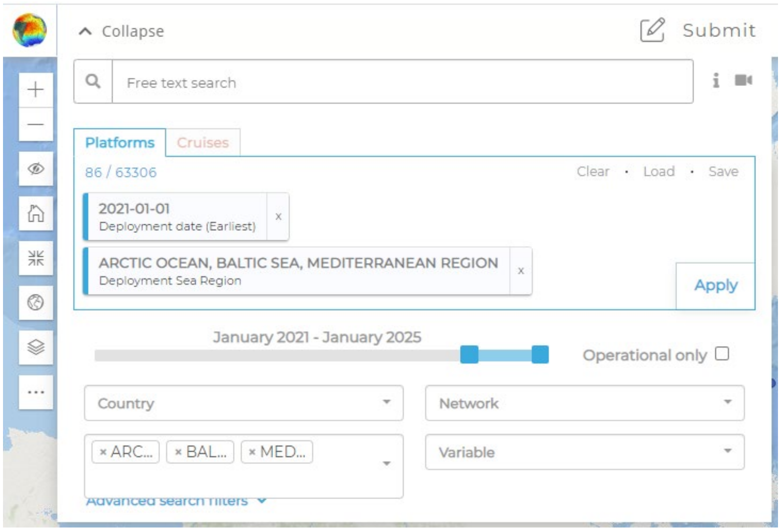
<u>Example of "EOOS exercise" on the simplified dashboard:</u>

Build the "2021 Arctic and European marginal seas" dashboard.

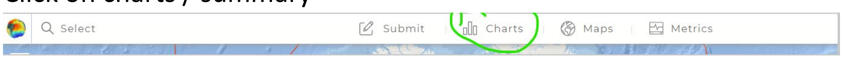
- Access the simplified dashboard: https://www.ocean-ops.org/board?t=oceanops&light=
- Log in by using your ids (email / welcome or your password)

- Select the integrated dashboard

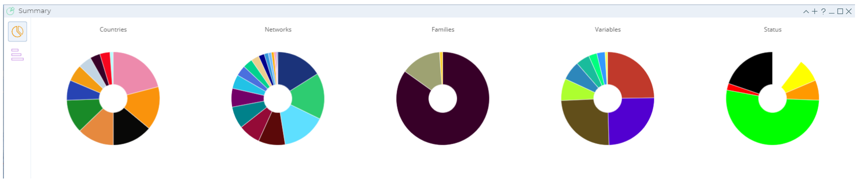
- Click on the select button (top left) to unfold the filtering options.
- Display all platform deployment in the European Marginal Seas and Arctic Ocean since January 2021. (Do not forget to validate your selection with a click on "**apply**")



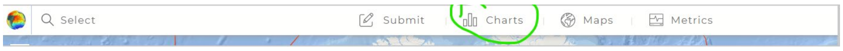
- Display a rapid summary of the selected sample
  - Click on charts / summary



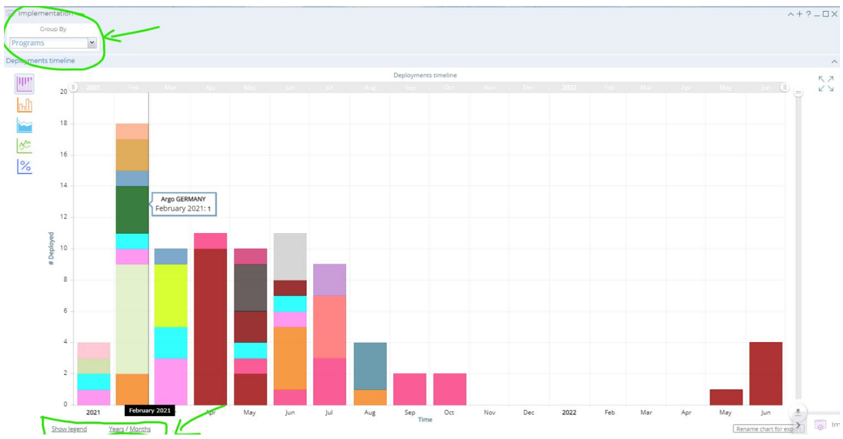
Choose the pie chart visualisation and explore the results passing the mouse on the charts.



- Display the monthly deployment timeline sorted by variables.
    - Click on charts / implementation



    - Select Variables in the group by selection box and click on “month” and “show legend” at the bottom on the chart to display it appropriately.

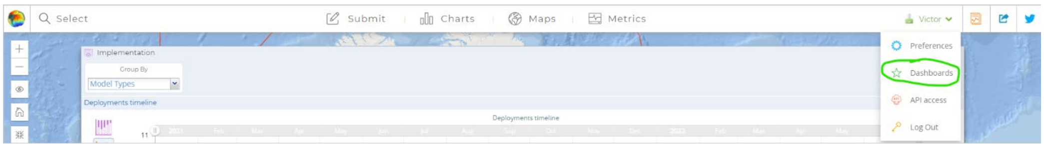


- Display the monthly deployment timeline sorted by platform model type.

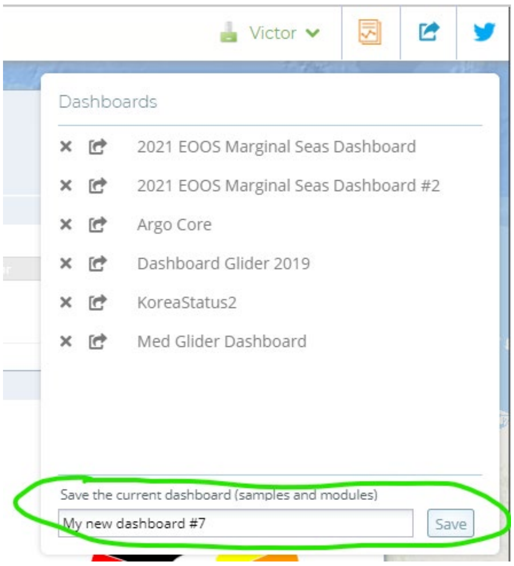
- Do not hesitate to explore the different functionalities of the dashboard

- Save the dashboard for later use

- Click on your profile and select dashboard



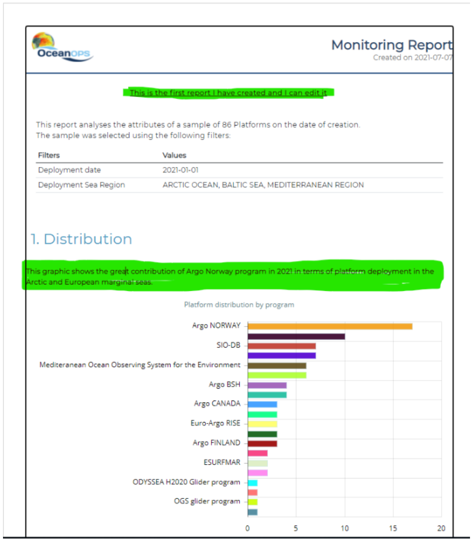
- Save the dashboard (you can save multiple dashboards).



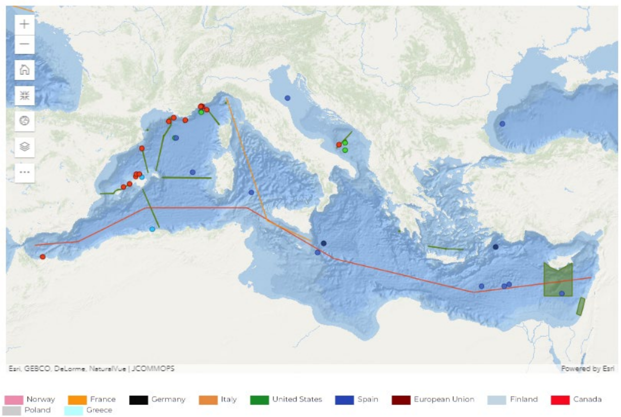
- Create a report
  - Click on the report icon (top right)

  - Wait about 20 seconds to be redirected to a report web page.

  - Edit the report by typing comments



- Adjust the charts and maps as you like (focus on the Mediterranean Sea for example). Just zoom in and out the map or use the side ruder to adjust the axis of the charts.



- Print the report.