AtlantOS

Project	AtlantOS – 633211
Deliverable number	D9.1
Deliverable title	Web based monitoring tool of the Atlantic ocean observing system (international)
Description	A web-based service tool to monitor data flow and key performance indicators of the Atlantic observing system, with a focus on AtlantOS networks.
Work Package number	9
Work Package title	System evaluation and sustainability
Lead beneficiary	IOC
Lead authors	M. Belbéoch & A. Lizé (JCOMMOPS)
Contributors	WP9 partners
Submission data	29.05.2017 – first version of online tool 15.09.2017 – first version of this text report
Due date	31.03.2017
Comments	Deliverable D9.1 is a web-based monitoring tool: (http://www.jcommops.org/board/?t=atlantos). This report includes a detailed description of the web page capabilities and of the key performance indicators. There was procedural delay in hiring additional staff for this deliverable.

Last updated: 14 September 2017

Executive Summary

JCOMMOPS has adapted its web based monitoring system to the needs of the AtlantOS project. Deliverables include the following elements (use links to browse on-line):

- Real-time monitoring dashboard
- Dedicated monthly authoritative monitoring maps
- Interactive maps
- Performance Indicators
- Various statistic and monitoring tools (exportable, customizable, embeddable)

AtlantOS is taking benefit of regional monitoring capacities from JCOMMOPS while building its new generation of Information System and web based services. It will have a real-time and persistent monitoring system that will remain up to date after the AtlantOS project ends.

Introduction

JCOMMOPS Background

The Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology Observing Programmes Support Centre provides technical coordination at the international level for the sustained elements of the Global Ocean Observing System. The Centre monitors, in real-time, the status of the observing networks and provides a toolbox to evaluate their performance and optimize their implementation and data flow.

Currently, JCOMMOPS monitors the Argo profiling floats, the DBCP surface drifters, coastal and tropical moorings, ice buoys, tsunami buoys, the OceanSITES moorings time-series, the GO-SHIP hydrographic reference lines, the SOT met/ocean ship based observations, and the GLOSS sea level tide gauges. A number of other observing systems are gradually being added, including ocean gliders, polar systems, marine mammals and, potentially, HF radars.

One of the specificities of JCOMMOPS, an added value regarding information management, is that it allows all platform operators to register their metadata on the website; JCOMMOPS experts quality control these metadata and enrich them through synchronisation with different data and metadata sources.

One should note that not all observing systems have the same level of maturity in implementation design or metadata management, so JCOMMOPS participates in defining and harmonizing these requirements, targets, metadata format and vocabulary, before enabling a wide set of monitoring statistics.

JCOMMOPS experts, technical coordinators of the above-mentioned observing systems, act at the heart of observing system implementer community.

AtlantOS Work Packages

JCOMMOPS activities for AtlantOS primarily target WP9, and Task 9.1 in particular, and the realization of a web-based monitoring tool for the Atlantic Ocean observing system. Its expertise is also consulted in other tasks, however, including WP1 (requirements) and WP7 (data flow).

JCOMMOPS Dashboard

The recently released JCOMMOPS' website (early 2016), can be considered more as a single webpage application than a regular website. Indeed, the aim of developing a new web interface was to take advantage of cutting-edge technologies and the increasing power of current computers, in order to provide a new, unique, and more interactive web experience to monitor the performance of the ocean observing systems.

Based on this idea, a desktop-like application was designed and released. Through this interface, the user can query the system's database in order to define samples (*e.g.* platforms or cruises) and monitor them thanks to a set of tools (*e.g.,* cartographic viewer or statistics computation). The user experience (including defined samples and opened monitoring tools) can be saved in order to be set automatically on the next visit. This is particularly useful for users with recurrent activities, such as a program manager monitoring its fleet activity.

Each observing system monitored and coordinated through JCOMM has its own dashboard (e.g., Argo, DBCP, OceanSITES, GO-SHIP, GLOSS), and an integrated dashboard is also available for a global perspective. This integrated dashboard was adapted to AtlantOS monitoring needs.
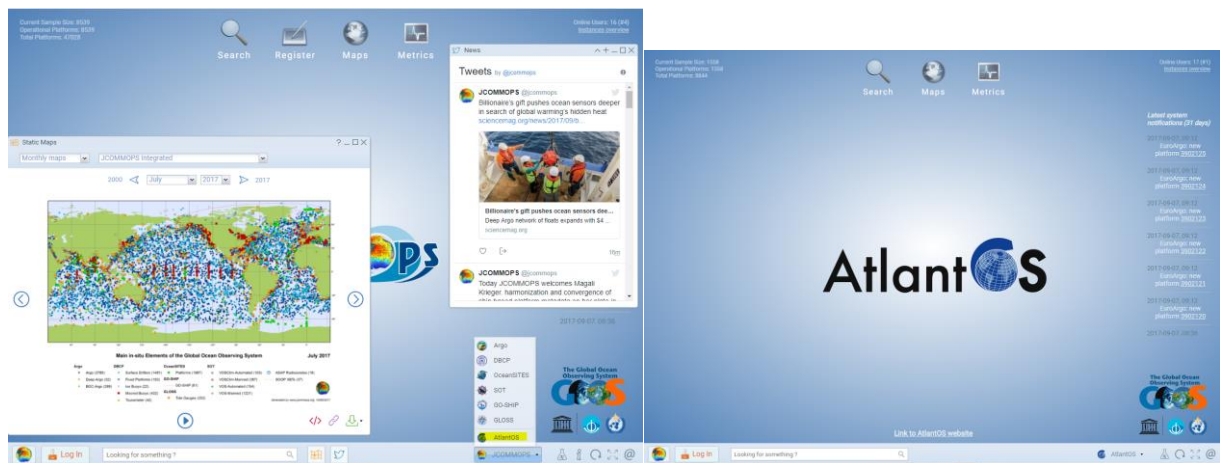
JCOMMOPS and AtlantOS dashboard

Many elements ("widgets") of this dashboard can be embedded on external websites such as the Atlantos portal. JCOMMOPS will soon enable the https protocol on its servers to technically support this embedding.
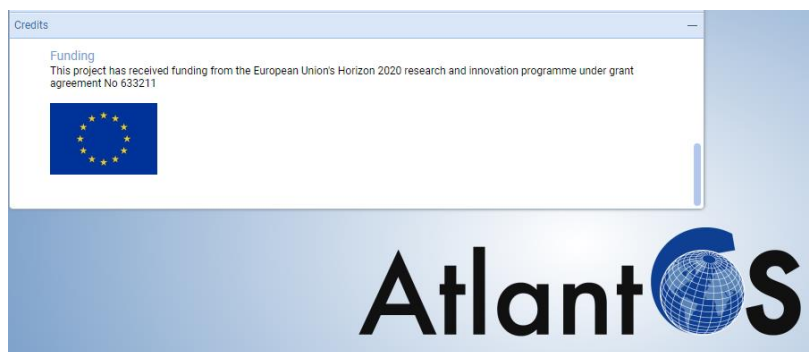

Proper references and credits for the AtlantOS project are available on the dashboard

3

JCOMMOPS Performance Indicators

Key Performance Indicators (KPIs) are critical to monitor the health of each observing system, detect gaps and weaknesses, and highlight successes, all along their evolution from a pilot project to a sustained observing network.

JCOMMOPS experts act within observing system Panels and Steering Teams, to develop targets and performance indicators that help platform operators, program managers, data managers, platforms and sensors manufacturers, satellite telecommunication providers to optimize the network implementation and data flow efficiency.

For the global observing programmes, targets and design are critical to produce indicators. Here is an example of the design grid for the Argo array. Each 3°x3° grid element can have a different target density. The calculation of indicators can be made on the global grid or on sub elements of this grid.
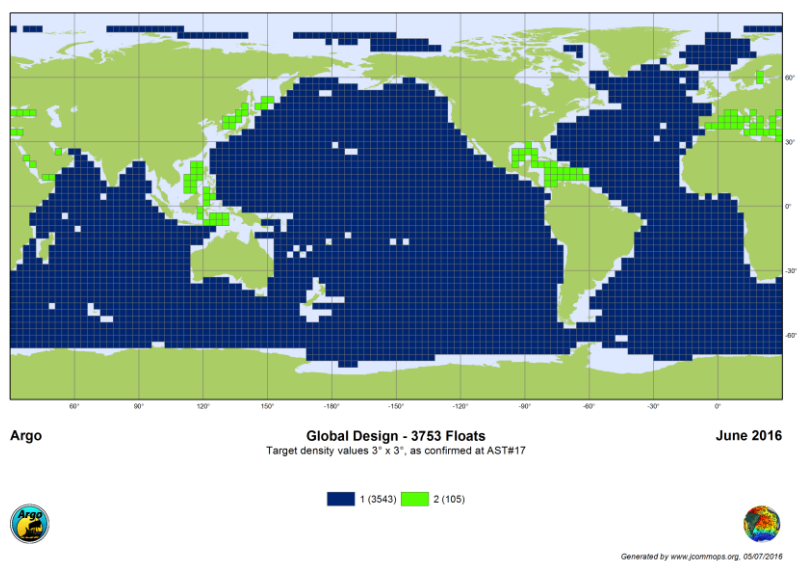
Example of design for the Argo array, including a double target density in Marginal Seas.

We have defined a specific polygon for the AtlantOS region based on discussions with different partners.

Is this polygon appropriate for AtlantOS? Alternatively, it could reflect the Atlantic Ocean definition. To overcome this issue the Atlantic and AtlantOS indicators have been merged within the same dashboard.

Nevertheless, all targets for observing networks can be calculated for AtlantOS (which will be useful for WP1) and every performance indicator can be filtered through a mask such as this one for AtlantOS.

4

KPIs are available for each observing network coordinated through the JCOMM Observation Coordination Group, with common vocabulary and algorithms as far as possible and when applicable. As the observing system continues to evolve, additional indicators will be calculated, and, in particular, more integrated metrics (e.g., EOV oriented) will be made available. Note that for observing programmes that have not yet defined targets, ratios (i.e., comparing performance to targets) are not possible; only metrics are displayed.

A number of filters are available for these indicators, for different networks, sub networks, ocean basins or sub-basins. The indicators are customizable, exportable (image and data), embeddable on any website and calculated routinely (monthly or yearly). Time series have been calculated for most indicators since 2000.

Note that some indicators can be produced and maintained by third parties and routinely added to the JCOMMOPS database and display. These indicators are primarily used within the observing programmes and only a subset is appropriate for large public and communication.

We have defined a common set of categories for indicators, as follows:

- **Implementation**
  - Activity (operational platforms)
  - Density (operational platform density)
  - Coverage (data spatial/temporal coverage)
  - Intensity (maintenance effort)
  - Reference lines

- **Data Flow**
  - Delivery (platform delivering data vs registered platforms)
  - Quantity (quantity of observation, by platform type, EOV)
  - Quality (quality of observations, per EOV)
  - Timeliness (difference between observation time and availability to users – GDACs, WMO/GTS)
  - Whitelist (non-blacklisted platforms)

- **Instrumentation**
  - Age of failure (average age of failures)
  - Deployment success (platforms surviving deployment)
  - Mortality rate
  - Life expectancy (similar calculation to demographic studies)
  - Reliability (% of deployments surviving N observations)
  - Level of automation (e.g. for ship weather stations)

- **Operations**
  - Critical Ships
  - Ship Time (charters)
  - Ship Time (cruises)
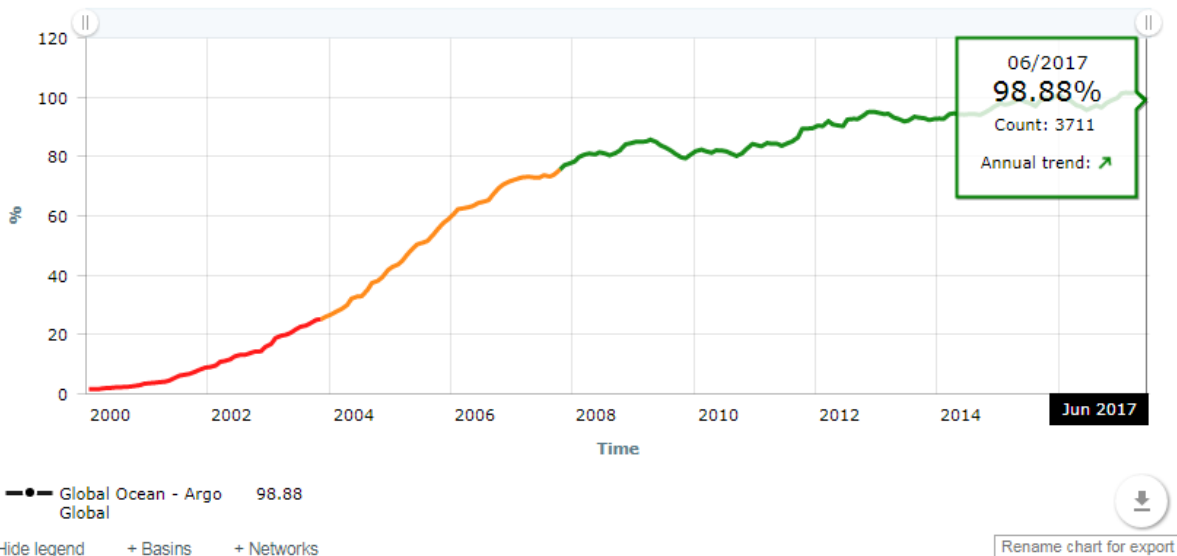
- **Data Uptake**
  - Data use (Research)

- **International**
  - Diversity (National)

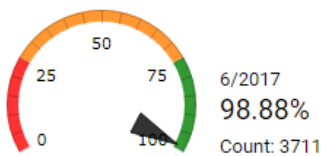As an example, consider metrics for the Argo programme:

Implementation					^
Activity Argo Global	98.88% 6/2017 ↗	3711 Raw count	3753 Target	# of operational units in the design vs target (Global Argo)	

Indicator sample (Argo Activity), including
category, generic name, value (%), trend (over last year), raw calculation, target and description
Color code (red-orange-green) is given through 2 threshold values

# of operational units in the design vs target (Global Argo)
Target: 3753

Indicator sample details, Zoom on the time series, including
Time series and complete description/algorithm.

6

Here, the "Key" performance indicators are selected, for a consolidated view across all networks:

	Argo			DBCP				SOT		GLOSS
	Argo Core	Argo Global	Argo BioGeoChemical	Global Drifter Program	Tropical Moored Buoy	Coastal/National MB	Tsunami Buoy	VOS	SOOP XBT	
Implementation										
Activity Global Ocean	85.9% 6/2017	98.88% 6/2017	30.15% 6/2017	113.71% 6/2017	73.95% 6/2017	108.67% 6/2017	60.94% 6/2017	92.95% 6/2017		84% 3/2017
Coverage (Monthly) Global Ocean		49.27% 6/2017		41.25% 6/2017				1.18% 6/2017		
Coverage (Yearly) Global Ocean	58.61% 2016	66.04% 2016								
Density (Monthly) Global Ocean	85.31% 6/2017	88.11% 6/2017	41.35% 6/2017	85% 7/2017						
Intensity Global Ocean	78.53% 6/2017	95.4% 6/2017	45.05% 6/2017	92.31% 6/2017						
Data Flow										
Delivery Global Ocean	98.16% 6/2017	97.69% 6/2017	94.18% 6/2017					63.79% 6/2017		
Timeliness (GTS FR) Global Ocean	95.46% 6/2017	94.63% 6/2017	86.42% 6/2017	78.66% 6/2017						
International										
Diversity (National) Global Ocean	19 2016	20 2016	11 2016	10 6/2017		13 6/2017		27 2016	9 2016	

KPIs on www.jcommops.org

Most of the spatial indicators (category Implementation) use GIS processing in their calculation. Here are a few algorithms for further illustration.

> *Activity*: Most of networks have a number of operational units to sustain. The JCOMMOPS Information system updates, in real-time, the status of each observing platform. We check every month how many units are operational within the design grid and gradually build the time series for this indicator. When possible, we calculated the past values for a complete plot.

> *Density*: We calculate an indicator of the spatial distribution of an array. On a monthly basis, we count the number of design grid elements that have an operational float within a 3° radius. Different calculations of this indicator are also available through GIS layers, updated in real-time with platforms locations. Such layers are very useful to plan deployments and address future gaps.

> *Coverage*: This is a similar calculation, but realized on a 3°x3° grid and considering the observations made available to users with the targeted timeframe. Different versions of this indicator are available (e.g., monthly and yearly) and considering well-sampled elements only or adding the fractions of partially sampled elements.

> *Intensity*: This monitors the number of units that are deployed versus the requirements, on a 12 months moving window.

There are hundreds of indicators available; individual and integrated dashboards can be consulted for further information.

AtlantOS Web based monitoring tools

This section introduces some of the web-based monitoring tools, in a version focusing only on the international contributions involved in AtlantOS, available at: http://www.jcommops.org/board/?t=atlantos

This version of the JCOMMOPS' website aggregates all the metadata available at JCOMMOPS, filtering them on the AtlantOS and Atlantic Ocean criteria. It provides the user with the global experience of the main website, including cartographic tools and Key Performance Indicators (KPI).

The user, upon navigating to the website, will land on the following page:

The dashboard contains three main sections: Search (to define samples), Maps (static and interactive maps) and Metrics (KPIs), as well as other features (e.g., news, quick search).

The user can display various statistics, such as the age distribution or the deployments timeline. To do this, first defined a sample by clicking on the "Search" icon to enter the Search menu. Then choose the desired criteria: the following guide will work on a "Platforms" sample. Once this selection is made, two new windows will appear: a table and a form. The table contains the result of the query specified in the form.

Those two windows enable the user to filter the sample to reflect his needs, export the data, and monitor the sample.

The query tool is extremely rich and allows one to define platform samples on key metadata, data availability (time, space, quality), platform status, etc. It uses some GIS functions to facilitate the intersection between platforms and polygons such as maritime zones or ocean basins.

If an account is created, and the user is logged in, the defined sample can be saved for future use. The dashboard itself can then be customized to automatically display a set of widgets, without rebuilding the case from scratch.

In the analysis section of the table, there are two different icons leading to monitoring tools of the current sample. Note that these tools are designed to be updated automatically as the sample changes.
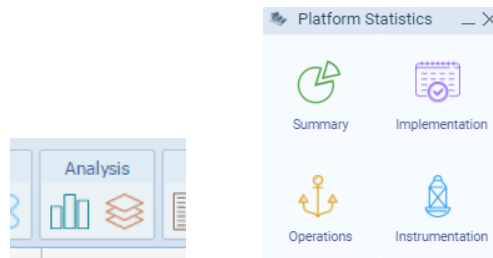

Path to statistics from the sample grid

From the Analysis menu, the user can select links to different statistic tools. The first link, "Summary", will lead the user to a tool representing the current sample with pie/bar charts. It is possible to change the definition of the charts by changing the grouping option using different metadata (e.g. countries, sensors, models, etc) in the "Group By" section of the tool bar:
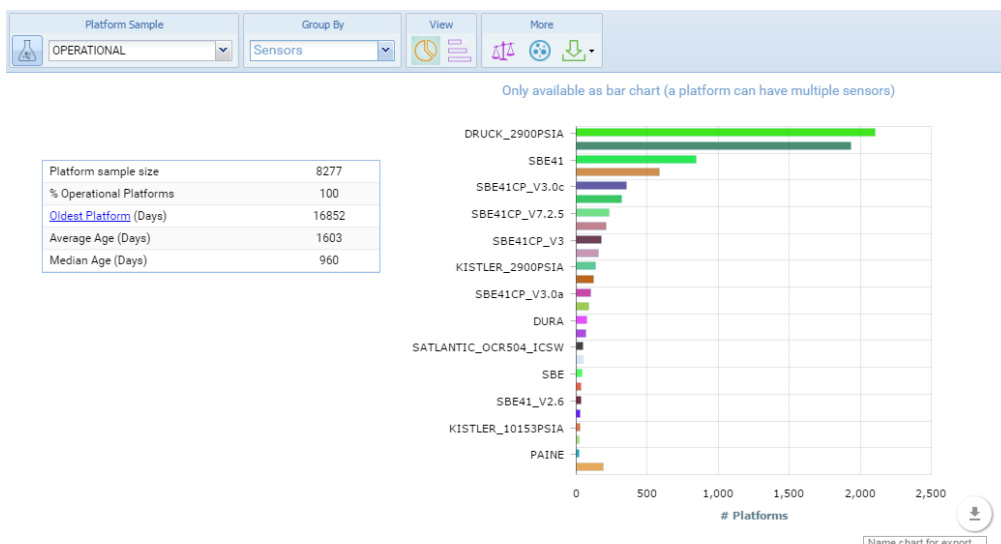

Bar chart of sensors available for the platform sample

The next link, "Implementation", contains information about the history of deployments of the different networks. The "Operation" link opens a window depicting figures about how the ships are involved in the different networks. A user can then see how Argo floats have been deployed by a vessel, but also if the latter has been participating in a survey like GO-SHIP. It is also possible to change the grouping option for this chart, using the "Group By" clause.
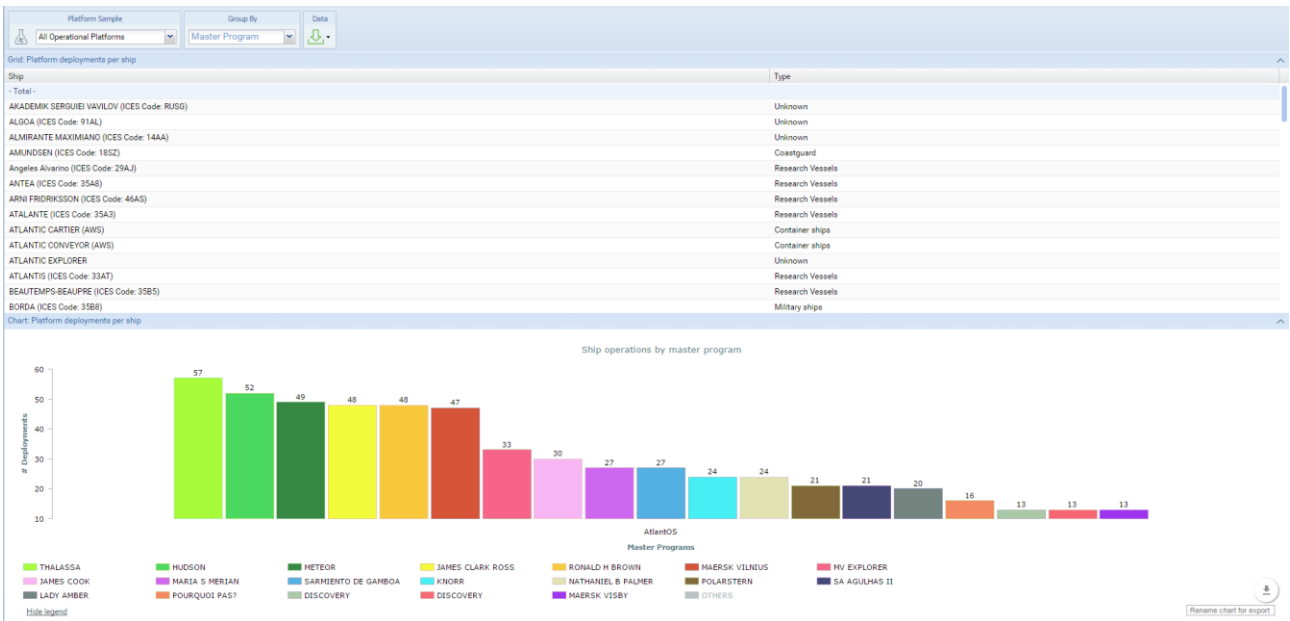
*Bar chart ships that have deployed the platforms in the defined sample*

The last link, "Instrumentation", takes the user to another set of statistics representing the sample efficiency. The user can select the measure to display in the "Measure" field of the top toolbar (though only one measure was available when this document was written, additional ones are expected to come). In this toolbar, an option offers the possibility to change the time division of the data present in the charts. The "Group By" option is also present for this chart, enabling the user to split the figures into several representing the grouping option.
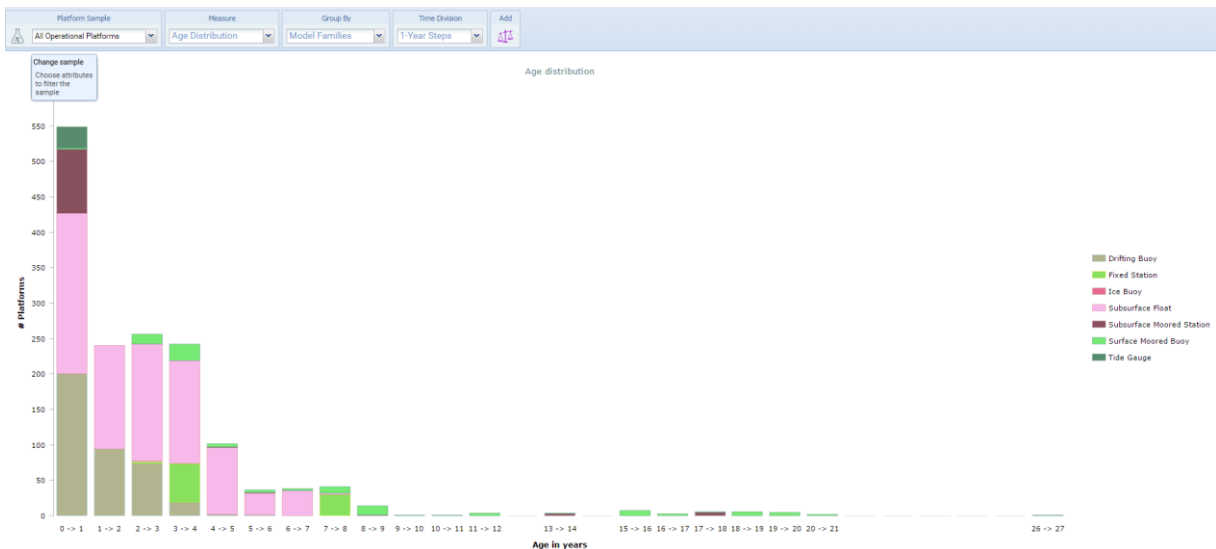
Distribution of platform's age grouped by platform model.

The second icon in the analysis section of the grid toolbar opens up the interactive map (which is also available through the "Maps" icon on the dashboard background). The maps content reflects the current sample: if the sample changes, the map will redraw itself automatically.

An interactive map 2.0 is available to use latest features of ESRI GIS engine, including 3D view.
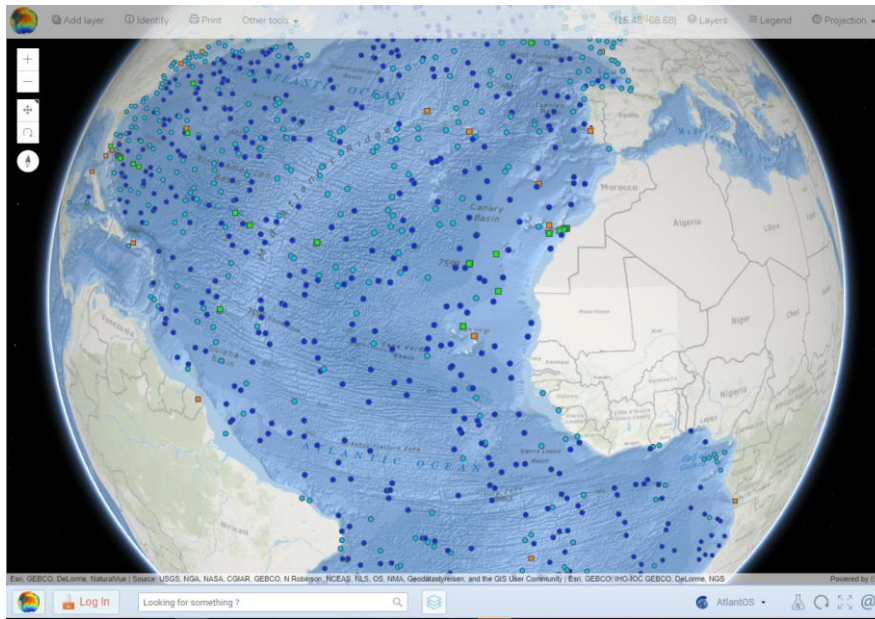
view on the AtlantOS interactive map

The interactive maps allow the user to:
- display different layers
    Work layers (saved in the cookies)
    Operational, based on the sample and enabling different geometries
    Analysis (density, coverage, design)
    Common layers and base maps
- switch to any projection
- change layer symbology
- export map assembled in dfferent formats
- and other tools (navigation, selection, distance measures, etc).
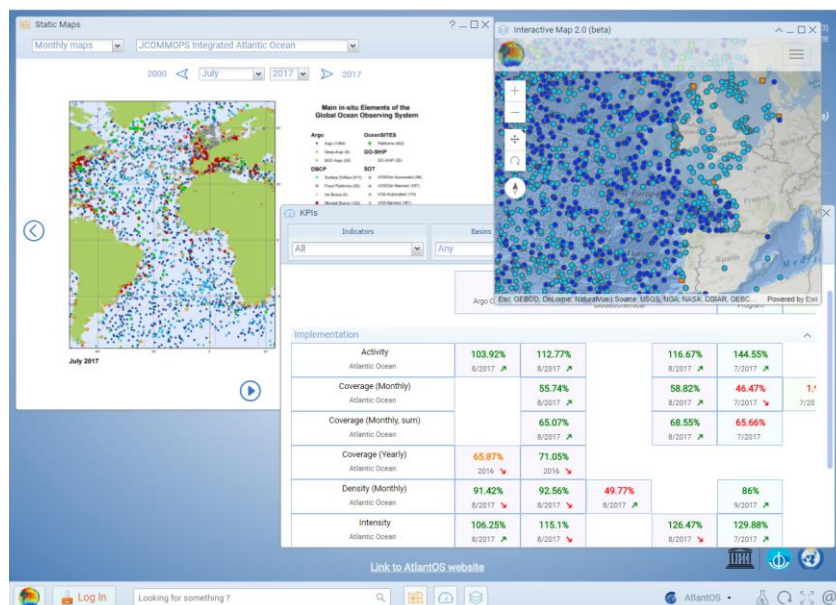
view on the AtlantOS dashboard

Conclusion and Challenges

JCOMMOPS has still a number of challenges regarding the web-based monitoring tool, related to AtlantOS and also to its wider international context:

- Embed monitoring tools on https://www.atlantos-h2020.eu/
- Develop tutorials (videos) for the web application use
- Include more observing platforms in its system (gliders, sea mammals)
- Develop additional metadata standards and indicators (e.g., for OceanSITES, GO-SHIP, SOOP)
- Enable more existing indicators with the AtlantOS filter
- Include indicators made by third parties (such as EMODNET KPIs on users community)
- Develop EOV based and cross-programmes indicators

AtlantOS will increasingly benefit from the progress realized by the JCOMMOPS Team whose objectives are aligned with the AtlantOS overarching goal to "leave a legacy of sustainability after the life of the project".