NEWSLETTER

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Creating products and knowledge for the Mediterranean

Editorial

ODYSSEA: a quest for innovative, intelligent and balanced Blue Growth

Georgios Sylaios

ODYSSEA is a complex, multi-tasking and multi-level project. The EU-funded project aims to advance operational oceanography and link it to the needs of society and businesses.

A wealth of marine data is produced daily from high-tech systems and on-site sensors measuring an extended range of marine properties. Numerical models produce highly accurate forecasts on sea conditions whilst satellites efficiently scan the sea surface and report on diverse ocean properties. All these high-volume data are packed into 'big data' files, which are stored in advanced computerised systems at immense costs.

While many marine and maritime users could benefit from these data, only very few have the capacity to access these files, retrieve the measured and/or forecasted parameters and make use by transforming them into meaningful information useful for their work. Moreover, large parts of the Southern and Eastern Mediterranean seem to be out of the picture, neither collecting nor benefitting from local marine data.

ODYSSEA, a Horizon 2020 project, aims to change this reality, bridging the gap between the operational oceanographic capacities and the need for information on marine conditions from the community of end-users on both shores of the Mediterranean. The project is based on the following four pillars:

- The development of a novel, easy-to-use platform in which data from existing platforms, networks and facilities will be collected, integrated, aggregated, exposed, and delivered to end-users who can gain from this information. Although several platforms and systems are currently in operation providing marine data, they remain fragmented, inhomogeneous in types and formats, with gaps in space (especially along Northern Africa) and parameters (especially in chemistry and biology). The ODYSSEA platform is expected to attract operational users from the entire Mediterranean Sea and aid scientists and consultants providing technical support on marine issues.

- The development and integration of new sensors into already existing monitoring systems. An operational sensor for emerging pollutants such as micro-plastics, the most significant topic in marine research nowadays, will be a key deliverable for ODYSSEA. The sensor will be miniaturized and integrated on an existing mobile monitoring system (the Sea Explorer glider) and a surface and benthic static system (the Modular Seafloor Lander). The operational measurement of microplastic particles is considered as a major breakthrough, as until now these microparticles are collected using towed nets. In parallel, submarine cameras and acoustic sensors will be integrated into existing vehicles and systems to be tested at operational scale.

- ODYSSEA intends to use operational modelling. For the first time, a set of well-known numerical models will be operationally coupled and interlinked to provide services and products to a broad range of end-
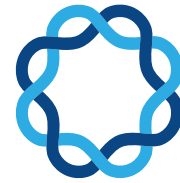
ODYSSEA

users. Existing tools and interfaces will be used for models' coupling, data management, assimilation and data exchange with the central ODYSSEA platform.

- Developing and providing well-defined services and products to end-users. A set of nine Observatories has been established for this task, mostly in Southern and Eastern parts of the Mediterranean. Users will be able to test and validate the capacity of the ODYSSEA platform to deliver these services. Modern algorithms and tools will be designed and incorporated into the platform for this purpose. For the first time, a business model for the provision of these operational services will be explored and designed.

As ODYSSEA coordinator, I find this a challenging and fascinating project making a step forward in linking science and research with the needs of society and business across both shores of the Mediterranean in the emerging sector of Blue Growth.

In this issue:

- ODYSSEA project overview, aims and objectives

- Blue economy in the Mediterranean: a factor of growth and development

- The ODYSSEA End-User Focused Approach

- ODYSSEA Platform

ODYSSEA project overview, aims and objectives

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The Scope of ODYSSEA

ODYSSEA is an H2020-funded project aiming to develop an integrated infrastructure comprised of platforms, models and on-site sensors. The ODYSSEA Project will bridge the gap between operational oceanographic capacities and the need for information on marine conditions from the community of Mediterranean end-users. The central objective of the project is to make Mediterranean marine data easily accessible and operational to multiple end-users. To achieve this central scope, ODYSSEA plans to:

- Collect, integrate and harmonise the existing diverse marine datasets originating from Earth Observing Systems, facilities and networks, as CMEMS, EMODnet, Mongoos, Lifewatch, Med-OBIS, GBIF, AquaMaps, Marine IBA e-atlas, MAPAMED and others.

- Upgrade existing operational oceanographic capacities of CMEMS at local/regional level, focusing on areas with data gaps and limited modelling efforts, such as the Northern Africa and Middle East coastline.

- Support the implementation of EU marine policy instruments, especially the EU Integrated Maritime Policy, the Marine Strategy Framework Directive, the Maritime Spatial Planning Directive, the Habitats Directive and the Integrated Coastal Zone Management Convention.

- Improve the interoperability in monitoring, making collected and integrated data easily accessible, free of restrictions in use, following already established marine data standards.

- Foster jobs creation in blue economy supporting the Blue Growth Strategy, aiding sectors with high potential such as aquaculture, coastal tourism, ocean energy, maritime transport, etc.

- Promote a holistic view of the Mediterranean Sea by opening the participation of non-EU countries.

The Platform: A Hub of Opportunities

The ODYSSEA **interoperable and cost-effective platform** will integrate networks of observing and forecasting systems across the Mediterranean basin, addressing both the open sea and the coastal zone. The innovative platform will support user requirements as identified through consultation processes with end-users and stakeholders. The ODYSSEA platform will encompass and offer a series of novelties classified as service-level, information-based and platform-level novelties. Service-level abilities will allow users to search and retrieve marine data and deliver products and services built upon the existing datasets. Information-based features will provide the capacity to aggregate physical, chemical, geological, biological, biodiversity and fisheries datasets through an ontology approach and semantic information fusion. The system will be fully decentralized, event-driven and easily deployable on a cloud system for big data processing.

An ever-growing network of Observatories

ODYSSEA will also develop a methodology for establishing, operating and maintaining a local and regional Observatories in the Mediterranean Sea, aiming to cover and support end-users' specific needs in marine data. Nine Observatories will be fully functioning within the frame work of the project striving to improve the spatial and temporal resolution of existing operational forecasting systems. These observatories will serve as 'prototypes', easily replicable in other sea basins.

A prototype numerical model 'chain', linking existing databases, on-site sensors and remote sensing data will be built to provide short- and long-term prognostic results. These will include the integration and harmonisation of already existing model results and will integrate new high-resolution models. Existing models, such as hydrodynamic (Delft3D), wave (SWAN), water quality (DELWAQ), oil spill (MEDSLICK II), ecosystem (Ecopath) and newly-developed models for mussel farm population growth, will be linked using interfaces such as FEWS and Aquasafe. In parallel, static and mobile sensors and systems will be deployed at the Observatories. The monitoring systems will be compact, autonomous, cost-effective and multifunctional, forming integrated packages taking advantage of "new generation" technologies in the fields of miniaturisation, communication, etc.

All data will be collected by the ODYSSEA platform for integration, aggregation and end-user's services generation. The platform will allow for easy combination of diverse datasets, such as physico-chemical data, habitat types, biota, etc. It will also support the calculation of secondary indicators (e.g., eutrophication indices, pollution indices, MSFD descriptors, etc). End-users operating at Observatory level will be directly and continuously involved in the design and operation of the platform.

In effect, the key aim of ODYSSEA lies in its quest to contribute to the development of a community of Mediterranean marine data users (industry, policy makers, public authorities, knowledge-carriers and NGO's) and to enabling them to use facilitated access to marine data for optimising their performance.

ODYSSEA is a consortium of 28 partners from 14 countries, 6 of which are non-EU Mediterranean countries. The project commenced on June 1, 2017 and is expected to be completed by November 30, 2021.
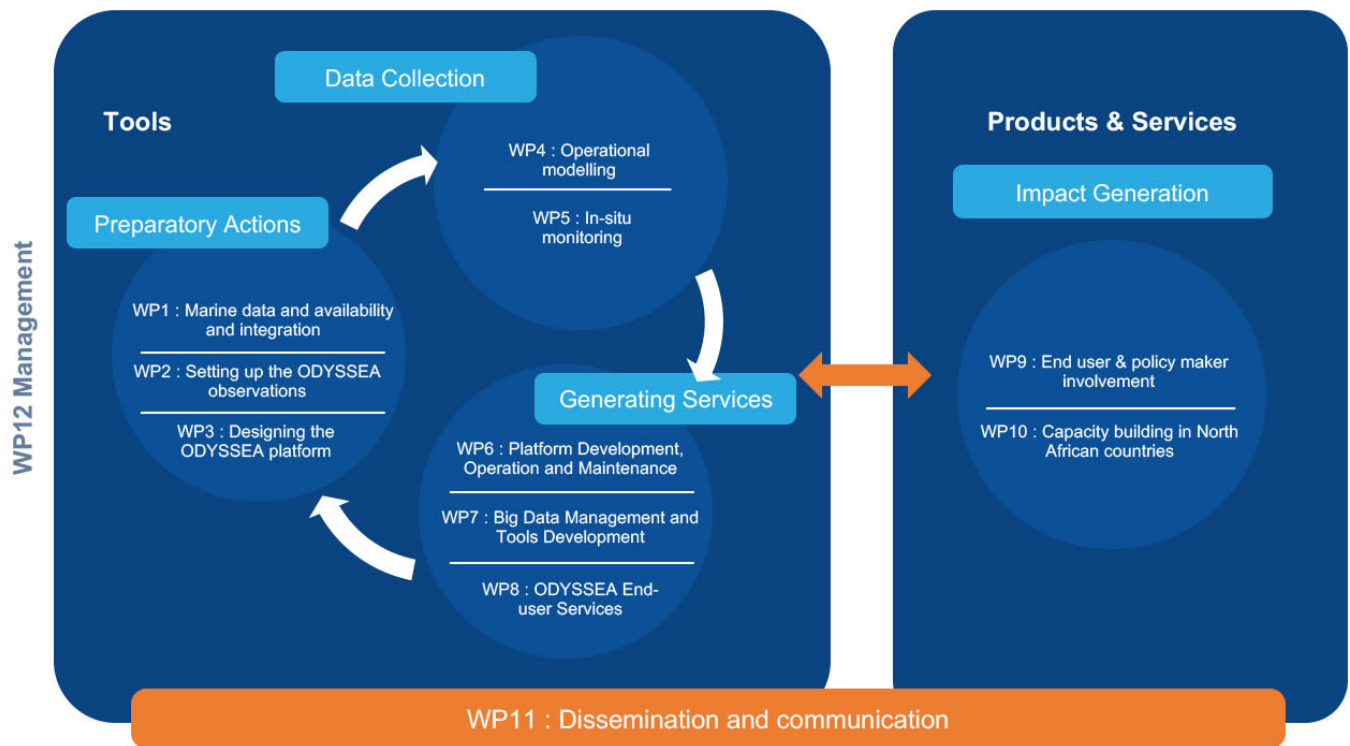
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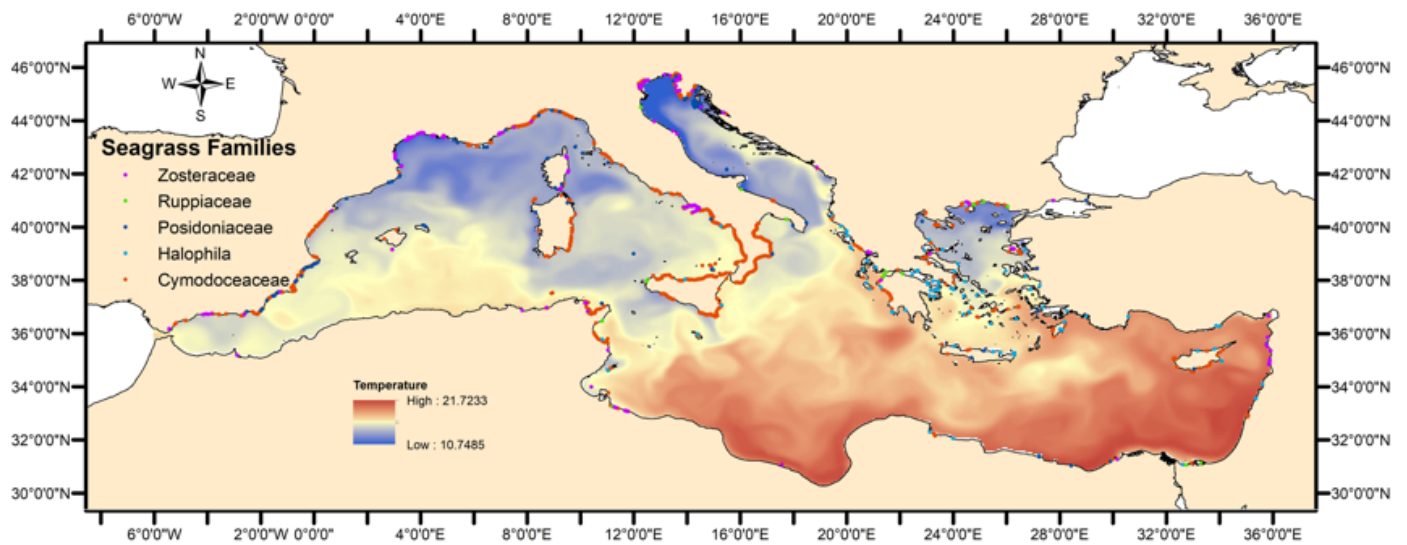
Combining physical and biological data from existing databases

Blue economy in the Mediterranean: a factor of growth and development

Arslan Chikhaoui**

Since Themistocles and the legendary naval battle of Salamis, we know how important the sea is to power. Today, Blue Growth is an inexhaustible source of wealth.

According to a report, published in 2017 by the World Wide Fund for Nature (WWF) and the Boston Consulting Group (BCG), oceans activities in the Mediterranean generate an annual economic value of $450 billion, making it the fifth largest economy in this region in terms of GDP.

The importance of the Mediterranean is illustrated by the fact that, although the sea represents less than 1% of the world's ocean, it represents 20% of the world's gross marine product. Blue economy industries will continue to support the growth of other economic sectors in the area, both in terms of added value and employment. This is part of a global megatrend that is highlighted by the OECD in its recent report "The Ocean Economy in 2030". This study notes that the ocean is the new economic frontier and continues to predict that a "business-as-usual" scenario will increase the value of production in the ocean economy in 2030 to $3 billion twice as high as in 2010.

Offshore hydrocarbons, marine and coastal tourism, maritime trade, marine equipment and ports, fishing and aquaculture are the main promising trends. Nevertheless, their long-term prospects depend on their ability to connect and use innovative marine technologies and their ability to engage in transnational cooperation.

Technological developments, social and demographic phenomena and other long-term trends are the backbone of many economic activities such as marine renewable energies, environmental protection, marine biotechnology, aquaculture, tourism, etc. All these represent tremendous areas of opportunity especially in countries in economic transition, looking for new sources of growth, such as North African countries bordering the Western Mediterranean Basin.

In recent decades, the evolution of operational oceanography has been supported by a deep-rooted scientific tradition and considerable EU investment in research and technological development. This has resulted in the creation of a vast ocean observing system that produces large amounts of data, which must be transformed into information that can be harnessed to develop decision-making in businesses, governments, and society. This challenge is accentuated by the fact that non-EU Mediterranean countries are not always as well endowed with means of observation and that many do not allocate human resources to the same level of capacities. Access to cooperation programmes by these countries is hampered by both legal and regulatory obstacles and historical geopolitical rivalries.

It is in this context that ODYSSEA presents itself as one of these flagship projects.. The data gathered by the ODYSSEA platform will be easily accessible and used, in real time, by the end-users (business community, scientific community, government organizations, NGOs, etc.).

This is a "smart power" logic which is defined by the ability and intelligence to make the partnership meet, at the right time, with the right information and the right network.

"The Mediterranean Basin is emerging as an essential part of the Chinese initiative 'Belt and Road Initiative (BIS)' which is called to reshape geopolitical and geo-economic balances," says Saida Neghza, President of the Mediterranean Confederation of Enterprises (BusinessMed). said "It is now at the heart of the global system because the Mediterranean region brings together a diversity of cultures, natural resources and economic dynamics, which consequently attracts regional and global players looking for new opportunities."

Neghza added that, the region has become a central element, not only in the strategies of the regional countries, but also for those of more distant countries. The European Commission is engaged in initiatives that enable the Mediterranean Sea to achieve its true value. One of these flagship initiatives 'ODYSSEA', is for BusinessMed and for all business communities in the Mediterranean basin a springboard to exploit the importance of the blue economy in Mediterranean to achieve growth and development.

ODYSSEA will try to fill the capacity and skills gap between the North and South regions bordering this space of multiform exchanges and living together in peace and stability by contributing to an exponential blue growth and sustainable development in the Mediterranean Sea.

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The ODYSSEA End-User Focused Approach

Simon van Dam and Josie Wastell

The complex set of interactions of different drivers and competing environmental, economic, social, cultural and recreational objectives that affect 21 countries located along the Mediterranean Sea Basin poses a significant challenge for providing on-demand derived data services. Moreover, different types of end-users and stakeholders have very different (even opposed) requirements. The ODYSSEA Project addresses these challenges and opportunities by developing its platform through applying a user-centred approach to ensure relevance and sustainability as all end-users and stakeholders are involved from Day 1.

End-user involvement is not a simple process. Though no other group is more intimately familiar with the end-user needs than the end-users themselves, understanding those needs is not easy. It can sometimes be difficult to know in what form or shape their needs can be addressed technically. For this reason, ODYSSEA will extract user requirements through consultation processes with end-users and stakeholders.

First, we are working to identify the key end-users in all their diversity and establish partnerships with them. This includes decision-makers and European agencies and industry representatives. Once identified, we will start a dialogue. We can assume that end-users know what they want and lack but may not know how to articulate it. So, we will ask specific questions that provide useful insights for the platform's design.

The dialogue will also take personal or business problems into consideration. For example, features-based questions do not always provide the required responses, because many end-users are not thinking about specific features of the platform. Some of them are trying to improve their business, while others are interested in ensuring compliance with policy.

Accordingly, we will ask questions about end-users problems and will try to address their needs in the innovation of the ODYSSEA platform.

Based upon end users response and our own experience we are currently in the process of developing an initial mock-up of the ODYSSEA platform that matches initial users' requirements. The mock-up will demonstrate to end users the provision of on-demand derived data services, with emphasis on the core attributes and functional features. It will also demonstrate how the whole experience, the related business or policy implementation, can be supported by on-demand derived data services.

Furthermore, in order to increase the user-friendliness of the platform, a set of interactive web tools will be developed to allow the user to visualise both the location of the data points (using maps) and the data values (using plots / data visualisation layers). Through this end-user focused approach, ODYSSEA will ensure the relevance and sustainability of its platform.

Fish farm in La Spezia Italy

ODYSSEA Platform

Nicolas Granier
Abbassi Ghislaine
Simon Keeble

The first version of the ODYSSEA Platform was made available to the ODYSSEA Project partners during July of 2018 and a wide range of users have experienced the platform and provided valuable feedback on its use and proposals for further development. It was also demonstrated and used by students at the first ODYSSEA Summers School which was held in Kavala, Greece in September 2018.

The initial development phase of the platform aims to provide a visualisation tool for Metoceanic, In-situ data and also allow them to be downloaded and organised in 'dashboards'. Data comes from the project partners as well as Copernicus (CMEMS) and CLS catalogues.

When operational by 2021, the final platform will provide easy discovery and access to marine data and derived products to a variety of users to improve knowledge and decision-making capabilities in the Mediterranean.

To reach this goal the ODYSSEA system will encompass and offer to its users a series of novelties classified as service-level, platform-level and information-based novelties.

In terms of Data Access and Quality innovations, the ODYSSEA Platform will provide the capability to search and retrieve marine data, but also to deliver products and services built upon the new and existing datasets.

In terms of information-based novelties, the ODYSSEA Platform will aggregate physical, chemical, geological, biological, biodiversity and fisheries datasets through ontology approach and semantic information fusion to provide functionalities and services.

By developing in an agile manner, the development team will be able to quickly review developments with users and iteratively improve the system until achieving the desired result.

Collaboration among stakeholders, users and IT partners is the core of this project the basis for adapting functionalities to suit the end user needs.

The first year has focused on development of the main functionalities of the platform and the development team is poised to improve ease of use and add functionality during the coming years.
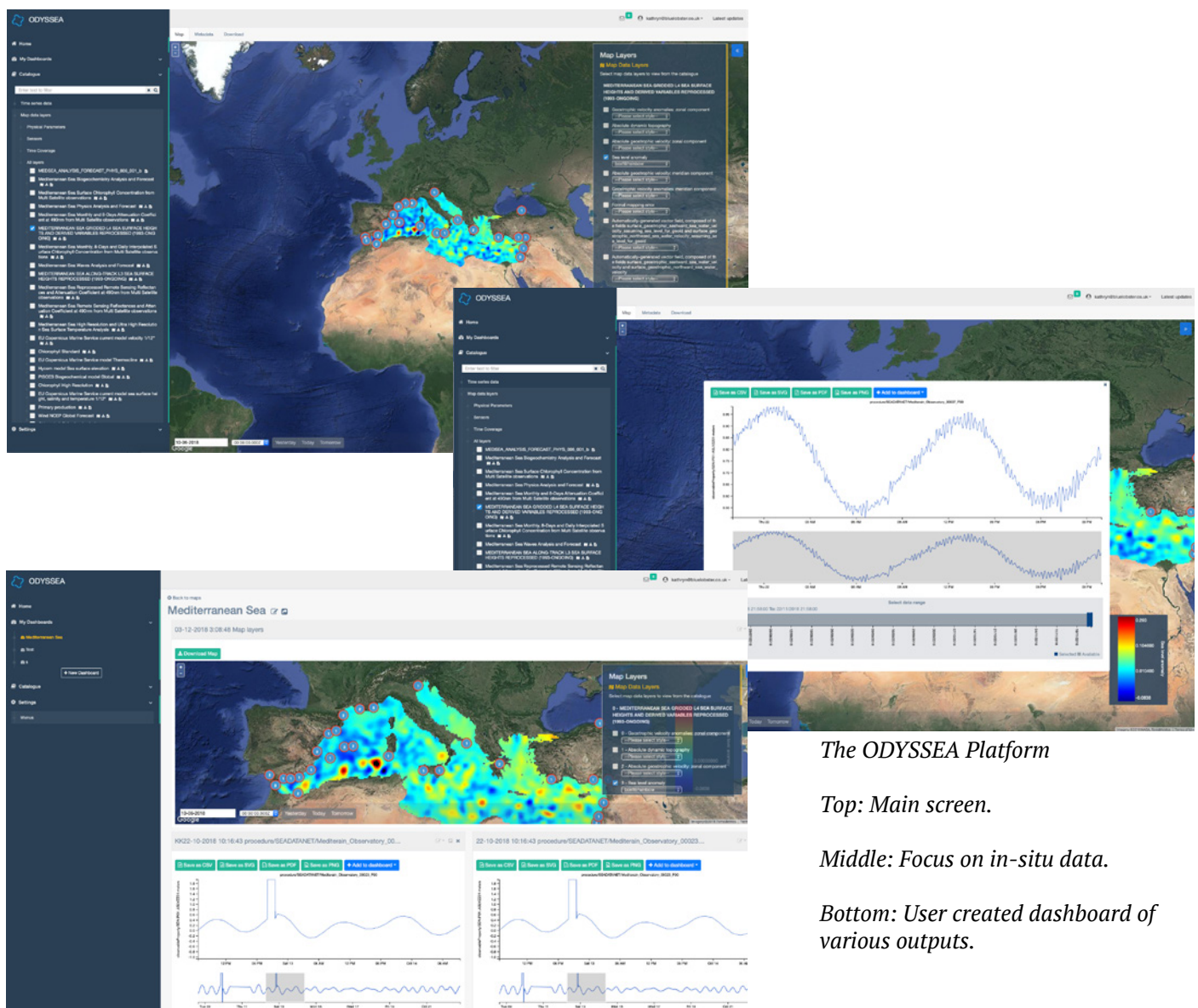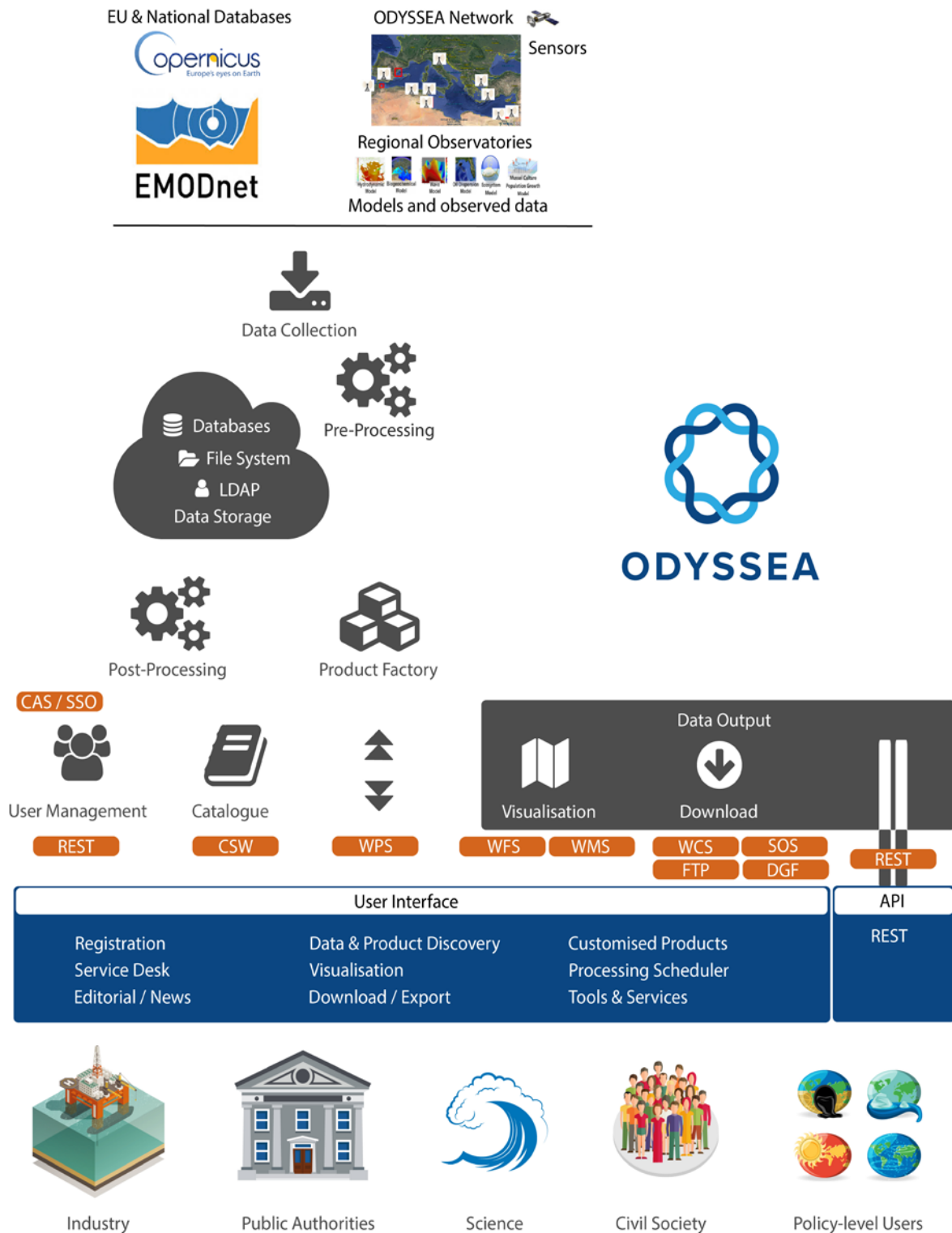

The ODYSSEA Platform

Top: Main screen.

Middle: Focus on in-situ data.

Bottom: User created dashboard of various outputs.

Architecture schema

The platform will be fully decentralised, event-driven and easily deployable on a cloud system for big data processing (e.g., DIAS) thanks to Docker and KubernateS technologies.

To build a web ecosystem and create a new data ecosystems and markets among data providers, users and consumers we designed the platform to be expandable, scalable, flexible, transferable and interoperable.

The main elements and components of ODYSSEA platform, illustrated in schema hereafter, will allow users to:

- *Store and identify sets of reliable data*
- *Provide a responsive and personalised user interface to navigate*
- *Integrate advanced visualisation options*
- *Optimise architecture for real time analytics*
- *Validate data from both technical and final user perspectives*
- *Support building know-how and innovative collaboration*