

IONIO

Ionian Integrated
Marine Observatory

Innovative marine science

In a transformative approach to ocean science, the **IONIO** project is designing and implementing an integrated marine observatory in the Southern Adriatic and Northern Ionian Sea. The consortium's efforts are set to improve safety and resource management in the region

MARINE OBSERVATORIES ARE designed for monitoring the sea, its conditions, and evolution at different temporal and spatial scales. Collecting and interpreting marine environmental information improves understanding of the sea and results in better management of marine resources, safety, and pollution events. Nowadays, a number of marine observatories operate at several scales and in different parts of the ocean worldwide, and in Europe several important initiatives aim at providing marine environmental information about the region's Seas.

INTEGRATED MARINE OBSERVATORY

One such initiative is the IONian Integrated marine Observatory (IONIO) project, which has been transforming ocean science since 2012. The researchers are creating an integrated marine observatory for the Southern Adriatic and Northern Ionian (SANI) sea areas, which separate the Italian and Balkan peninsulas. One of the first projects in the Mediterranean to take this approach, the team aims to design and implement an observatory that will produce environmental information about the SANI region, and will support safer maritime traffic and reduce pollution hazards,

increasing the area's accessibility and attractiveness.

Funded by the European Territorial Cooperation Operational Programme, IONIO involves research partners from three institutes: the Euro-Mediterranean Centre on Climate Change, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development and the Hellenic Centre for Marine Research. The project's core activities and objectives are to collect real-time data, analyse it, and model and forecast the SANI area. Dr Paolo Oddo, IONIO's Principal Investigator explains the thinking behind their methodology: "By using a downscaling approach already established in the scientific community, we are able to gather information at a higher temporal and spatial resolution, and it is therefore better suited to serve the maritime stakeholders in near coastal areas of the SANI region".

BUOY FOR THE COLLECTION OF OBSERVATIONAL DATA, PART OF THE HCMR NETWORK SUPPORTING THE IONIO PROJECT



INNOVATIVE PRODUCTS AND SERVICES

In order to achieve their scientific objectives, IONIO is developing a range of innovative, interactive products, as well as setting up a service that will allow easy access to marine environmental information and different applications related to maritime transport efficiency and safety. The work is based on an existing set of tools that facilitate end-to-end data preservation, and access and direct interaction of models with the data acquisition process. In the future, if further developed, this might allow virtual collaborations that may be created on demand to drive data model coupling and share ocean observatory resources such as instruments, networks, computing, storage and workflows.

Specifically, IONIO aims to deploy a monitoring and forecasting system for the SANI region that will allow the dissemination of high resolution environmental information to mariners in the area. This information will form the basis of navigator decisions about safer routes, and better management of emergency situations and pollution events. The wind, wave and current observations and forecasts complement the national observing networks, adding to IONIO's cross-area monitoring capabilities.

Furthermore, the team will produce a database containing observational and modelling data. This will provide environmental information necessary to allow the sustainable development of transport systems in the SANI area, in accordance with the recently approved EU Marine Strategy Framework Directive. A web-GIS geo-portal for the cataloguing, discovery and user-friendly visualisation of the database, both in real-time and delayed mode will also be developed. This will form the basis of the IONIO service for the rapid dissemination of relevant information to regional stakeholders and end-users.

DATA COLLECTION AND ANALYSIS

The IONIO service complies with the INSPIRE principles of leaving data as close as possible to their collection source, and the collaborators are basing their system on distributed data nodes. Datasets are processed into interoperable formats, in accordance with agreed standards and protocols. Furthermore, the IONIO service will be complemented with several decision support systems (DSSs) based upon the environmental information produced by IONIO's observational and modelling components. There is a DSS for search and rescue, which computes the trajectory of bodies at the surface and subsurface to help reduce the loss of life due to ship accidents; one for ship routing and safety, which will include real-time wind, wave and current data provided by the IONIO modelling system to promote safe navigation; and a DSS for pollution hazard mapping, which contains information about ship tracks crossing the area and the potential

dispersal of pollutants along operational routes, evaluated using the analyses from the open ocean models of the SANI area and the Gulf of Taranto.

REACHING STAKEHOLDERS AND POLICY MAKERS

The IONIO products and service will be tested with marine and maritime stakeholder groups from the SANI region and the group has already engaged in a dialogue with many representatives of the end-users of the project services. A first step to gathering feedback on the development of the products was a stakeholder consultation meeting, which took place in Corfu in January. Specific questionnaires were delivered to stakeholders to assess their needs and requirements, and the group intends to maintain and enhance the dialogue with end-users throughout the project duration.

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IONIO has also been dedicated to informing and working with policy makers, who have helped finance the project. National and European funding agencies are strongly connected with national and European governments, and this ensures that there is an interest and a continuous monitoring of the progress of the project. The outcomes from these activities will also contribute to future cross-border marine strategy plans that will address the sustainable development of maritime activities in line with the Integrated Maritime Policy in the Mediterranean.

Oddo is clear that their products will help communicate scientific findings to non-scientific audiences, such as local policy makers, or wider society, which can be a major challenge. "One of the major efforts in our discipline is focused on finding the best way to 'translate' scientific findings into non-scientific information without losing the robustness achieved by our approach," he explains. "This is why, in the process of designing the user interface, a continuous and efficient communication process with policy makers and other stakeholders is absolutely mandatory." Oddo is also keen to highlight just how useful these interfaces can ultimately be: "Through these information systems, policy makers can easily be updated on the current framework of their field of interest and track changes live – adapting and tailoring their choices to the development of the situation on the basis of scientific forecasts," he concludes.

INTELLIGENCE

IONIO

IONIAN INTEGRATED MARINE OBSERVATORY

OBJECTIVES

To design and implement an 'IONian Integrated marine Observatory' that will provide environmental information and meteorological measurements about the Southern Adriatic and Northern Ionian (SANI) Programme Area.

PARTNERS

Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Italy

Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Italy

Hellenic Centre for Marine Research (HCMR), Greece

FUNDING

European Territorial Cooperation Programme.

Co-funded by the EU's ERDF and National Funds of Greece and Italy

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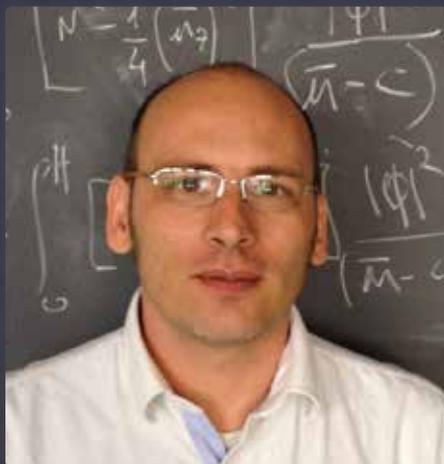
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DR PAOLO ODDO is a scientist at Istituto Nazionale di Geofisica e Vulcanologia, National Institute of Geophysics and Volcanology (INGV) and at Euro-Mediterranean Centre on Climate Change (CMCC). He has a PhD in Marine Environmental Science at Bologna University, and in 2005 he started working as a researcher specialising in the field of numerical modelling applied to physical oceanography. He is a member of the Nucleus for European Modelling of the Ocean (NEMO) Developer's Committee and co-chair of the Euro-GOOS Coastal and Shelf Sea modelling Working Group.



Integrated ocean odyssey

In the quest to improve understanding of the sea, **Dr Paolo Oddo** leads the development of IONIO, a marine observatory that will produce a set of innovative, integrated products and services for users of the Southern Adriatic and Northern Ionian Sea region



What are the key objectives of the IONian Integrated Marine Observatory (IONIO)?

The project aims at designing and implementing an observatory that will produce environmental information about the Southern Adriatic and Northern Ionian (SANI) area to support safer maritime traffic and reduce pollution hazards.

Could you elaborate on the main components of a marine observatory?

A marine observatory is a complex structure that involves several types of observing platforms working together with a modelling component that helps to fill the gaps between the observations, integrate different kinds of observations in coherent environmental fields and provide environmental forecasts in support of safety or different maritime activities.

What is the premise behind the construction of a science-based decision support system (DSS)?

The concept is built on the need to understand the relevant processes and

dynamics for a given usage of the sea where decisions are needed. By monitoring the sea, information is collected to understand the characteristics of the observation area, the typical processes occurring, and thus the scientific knowledge to build an instrument (the DSS) that combines all these inputs. The result is a synthetic answer enabling end-users to make improved plans and operational choices.

Why are DSSs required in the field of marine science?

DSSs are an outcome of ocean science. There are several ways to approach scientific studies and research in general. Our group firmly believes that science has to serve the community, research must have concrete applications to everyday life. This is the basis we use to plan our activities, we focus on disciplines of ocean science that can have short- to medium-term direct impacts on society. DSSs are required in this field as they enable navigators, marine authorities, environmental agencies, ship companies and all the people who are at sea for work or leisure purposes, to have a better knowledge of the context in which they are operating and make more conscious and safe decisions with the support of scientific tools.

IONIO is constructing a number of different DSSs for pollution hazard mapping, search and rescue, and ship routing and safety. Are these independent systems or do you intend them to link up?

The different DSSs will share the same base of observational and model data, but will be built and developed independently. It is easy to understand that an integrated instrument could better serve the maritime stakeholder. For example, in a search and rescue operation it would be very useful to have a tool that helps to define the ship track. Clearly, this is

the first step toward a final scientific product that should also integrate all the information, but unfortunately this is beyond the scope of the project.

The concepts of 'federation' and 'layers' form the foundation for the information system that you are establishing. Could you expand upon these terms within this context?

'Federation' is important because we believe that local expertise and experts are crucial and must be preserved. Thus we try to harmonise the inputs of different scientists and institutions, leaving them with the responsibility and leadership of the different areas/disciplines. 'Layers' are also integral because datasets are organised in a hierarchical approach; each level depends on the levels below and is the basis for the one above. Data management and archiving is carried out locally by the IONIO partners along predefined 'themes' or regions (eg. NRT data from ships, NRT data from buoys, archived data, Italian or Greek coasts). Locally, data managers will build metadata using the pre-existing experience of other relevant international scientific projects. The local information systems are the first layer of the IONIO information system, beyond which are the DSSs.

Could you outline the key goal of IONIO over the next year in terms of improving access to marine research and gathering more data in certain areas?

The results of the next year will be crucial to understanding the success of the IONIO project as the components designed and partially developed during the first year will be put in place. Furthermore, the web tool for the dissemination of the environmental information will be finalised and new instruments (ARGO buoys) deployed in the SANI area.