



The role of ocean observing systems in the Mediterranean and Black Seas

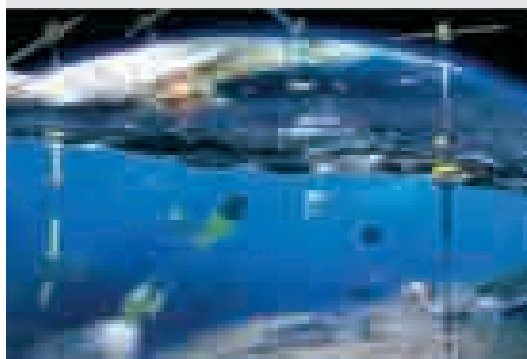
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PERSEUS contribution to observing systems

Ocean observing: past, present and future

Ocean research over the past 20 years has given us great insight into global ocean circulation patterns and has provided valuable knowledge. However as we have tried to downscale towards regional and/or local needs, it has become increasingly clear that the ocean varies across a wide range of spatial and temporal scales - there is no such thing as 'ocean state'.

Technological advances in ocean observation systems now enable us to monitor temporal and spatial variability at both global and regional level, and to monitor variability in coastal to open ocean exchanges. The challenge for the future is to utilize this technology to gain a better understanding of how the deep and coastal ocean varies over a broad range of scales.

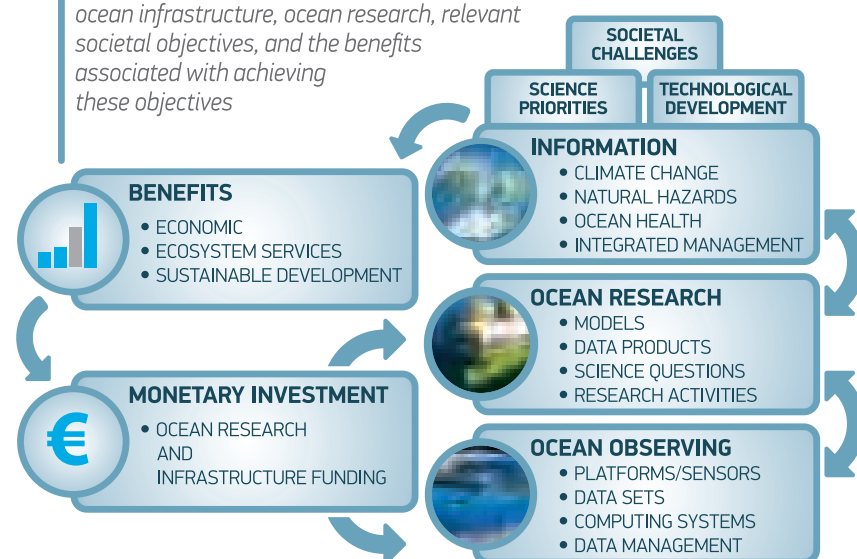


New ocean observing systems

New multi-platform integrated observation systems are now being implemented in coastal oceans across the world. These new observing systems respond to a three-fold change of paradigm in ocean observation:

- Multi-platform observing systems, from single-platform/ship-based observation to multi-platform integrated observing systems
- Real-time data is available for scientists, decision-makers and society directly
- Advances in technology facilitating the development of long-term monitoring systems that move monitoring from global to a regional, and even local scale.

Figure: Diagram showing the links between ocean infrastructure, ocean research, relevant societal objectives, and the benefits associated with achieving these objectives



Multi-platform observing systems - the links between platforms, parameters and society needs

Policy / Societal need	Key parameters	Multi-platform observing systems
Environmental policy <ul style="list-style-type: none"> • MSFD • WFD • CFP • Habitats Directive 	<ul style="list-style-type: none"> • Fish capture • Plankton • Chlorophyll • Nutrients • Benthic habitats • Organic pollutants, biotoxins • Metals 	<ul style="list-style-type: none"> • Ship surveys • CPR (Continuous Plankton Recorder) • Moorings • Gliders • Satellite remote sensing • VMS (Vessel Monitoring Systems) • AIS (Automatic Identification System)
Ocean/Climate interactions <ul style="list-style-type: none"> • Ocean circulation • Impact of climate change 	<ul style="list-style-type: none"> • Temperature • Salinity • CO₂, pH • Oxygen 	<ul style="list-style-type: none"> • Argo and drifters • Moorings • Gliders • Ship surveys
Socio-economic need <ul style="list-style-type: none"> • Marine Energy/Transport • Biological/mineral resources • MSP/ICZM • Marine safety • Weather forecast 	<ul style="list-style-type: none"> • Bathymetry • Noise • Wind, waves and currents • Fishing effort 	<ul style="list-style-type: none"> • Argo and drifters • Ship surveys • VMS • HF Radars • AIS

New observing systems monitor a wide spectrum of key ocean parameters that are necessary for implementing marine policies and responding to scientific priorities.

Knowledge-based decision making

How PERSEUS contributes to observing capacity in the Mediterranean and Black Seas

- ⚙ Review of existing observing systems from local to basin scale across multiple platforms
- ⚙ Establish an open access European data delivery protocol for real time and delayed mode data transfer that meets quality assurance standards
- ⚙ Upgrade and expand existing observing systems, and support for the implementation of new platforms in response to policy and science needs
- ⚙ Plan for the future by developing a long term monitoring strategy based on identified needs, existing capacity and future requirements

Main results and actions

PERSEUS reviewed information on the data currently available across multiple observing platforms to understand gaps and needs in the Southern European Seas (SES). This review identified 5 key issues for ocean observing in the SES. In less than 4 years the PERSEUS Project has contributed to filling a number of the gaps and needs identified in this initial review. However, many challenges remain.

Issue	Initial review	PERSEUS actions
Geographical coverage	SES are under-sampled. Gliders are underutilised. Significant gaps present in geographical coverage of multi-parameter moorings.	PERSEUS has supported an increase in coverage. New multi-parametric moorings installed and new glider transects supported, specifically in southern Mediterranean. New Argo floats deployed in the Black Sea and sustained ship campaigns supported in key locations. However significant gaps remain.
Biogeochemical observations	Scarce across the SES, in particular in the southern regions.	Multi-parametric moorings upgraded with new sensors, new bio-Argo floats launched. New observing platforms implemented (CPR-Continuous Plankton Recorder). However much more is required in this area.
MFSD descriptor focused observations	Marine litter and noise are two examples of descriptors that have not yet been considered in ocean observing systems and are missing a SES strategy for sustained and reliable observations.	Multi-parametric moorings upgraded with new acoustic sensors. Specific field experiments carried out to test new monitoring tools for marine litter. Appropriate methods of observation for some descriptors need to be defined and tested and a SES strategy is still required.
Data management, quality control and products for society	Not all ocean observing data are managed at SES level. Standard quality control procedures are not yet established for a number of platforms, e.g. biogeochemical and acoustic sensors. Products for evaluating ecosystem attributes relevant to MFSD are not always available or well planned.	PERSEUS data policy, data management and quality control directly address these issues at a SES level. However, a vision encompassing data to relevant products for society is still required.
Multi-platform approach to scales	Different platforms, observations and experiments are required to study multi-scale ocean processes and to characterise the ocean variability across these key scales; ranging from basin scale to sub-basin and local scales and from days to months to years.	PERSEUS undertook a variety of multi-platform experiments in order to study multi-scale ocean processes. The knowledge gained from this needs to be incorporated into a multi-platform observing systems strategy for the future.

Future Challenges

Clearly the integration of new ocean observing technology can enhance our knowledge of ocean state and ocean variability. This understanding of ocean complexity, across a wide range of parameters and scales, will support the implementation of adaptive management frameworks for the oceans and the coast, contributing to filling the science-policy gap. In order to enable the ongoing development of sustained observing systems capacity in the SES, PERSEUS will deliver a final report outlining the future developments required to create a multi-platform ocean observing system for the SES, that is sustainable and flexible for the long term needs of science and society.

This fact sheet is based on the PERSEUS deliverable: "Review of ocean observing systems in the SES and recommendations on upgrades to serve PERSEUS needs" (D3.1).

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