PERSEUS

POLICY-ORIENTED MARINE ENVIRONMENTAL RESEARCH IN THE SOUTHERN EUROPEAN SEAS

New Observing and Forecasting Systems for Science, Technology and Society (Wp's 3,4,7)

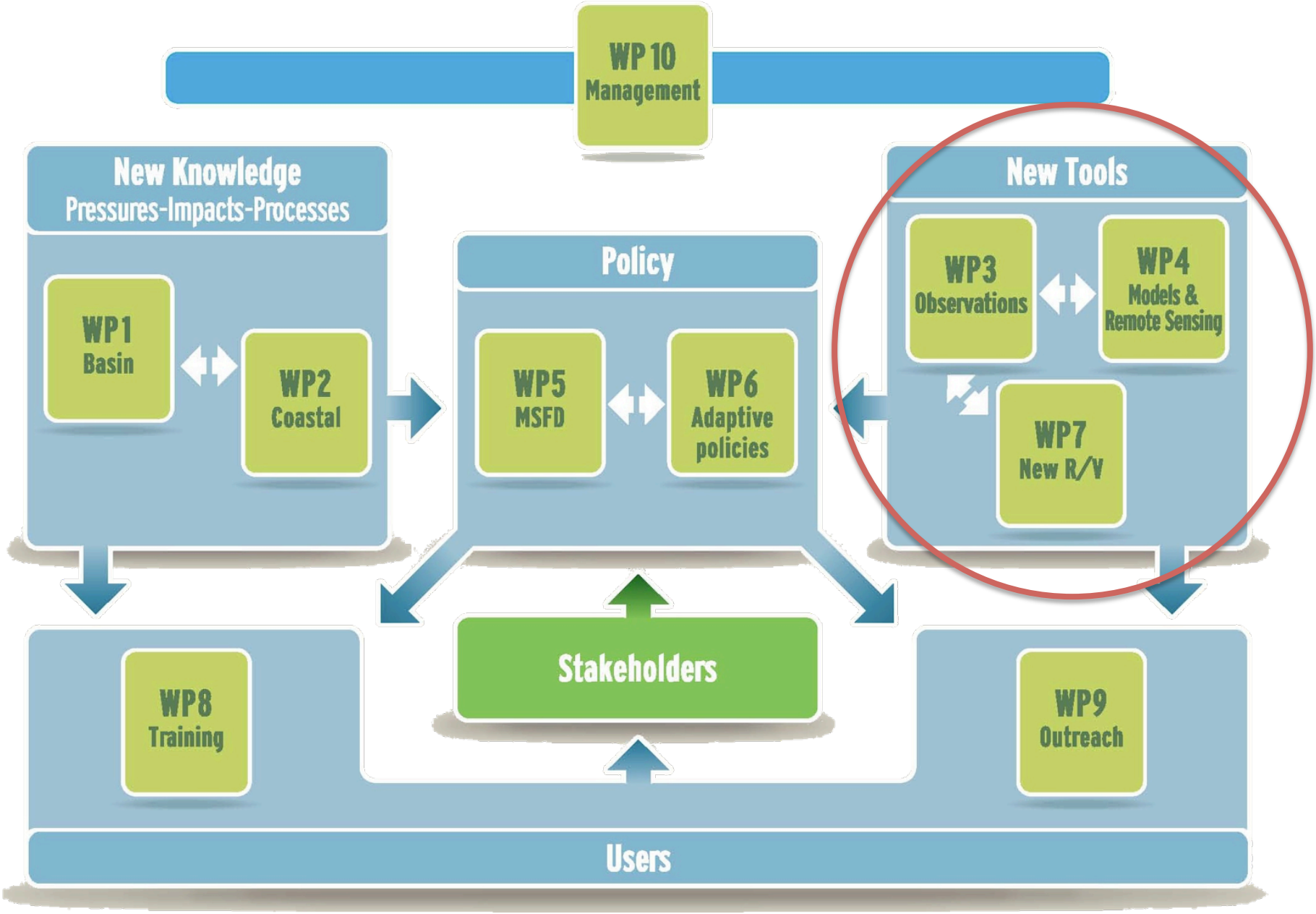
CIESM

Marseille, November 1st, 2013

HCMR, Hellenic Centre for Marine Research

SEVENTH FRAMEWORK PROGRAMME

Work Flow


WP 10
Management
New Knowledge
Pressures-Impacts-Processes
WP1
Basin
WP2
Coastal
Policy
WP5
MSFD
WP6
Adaptive policies
New Tools
WP3
Observations
WP4
Models & Remote Sensing
WP7
New R/V
Stakeholders
WP8
Training
WP9
Outreach
Users

Our Goal: … To characterize Ocean state, variability & ecosystem response

The Oceans; a complex system, changing, under-sampled

- Walter Munk-2001- "*The last century of oceanography is marked by the degree of under-sampling*",

- Carl Wunsh 2010: "*We need data, … models are becoming untestable*"

An Example: AMOC, Atlantic Meridional Overt. Circ. seasonal biases: "Aliasing of seasonal AMOC anomalies might have accounted for a large part of the inferred slowdown".

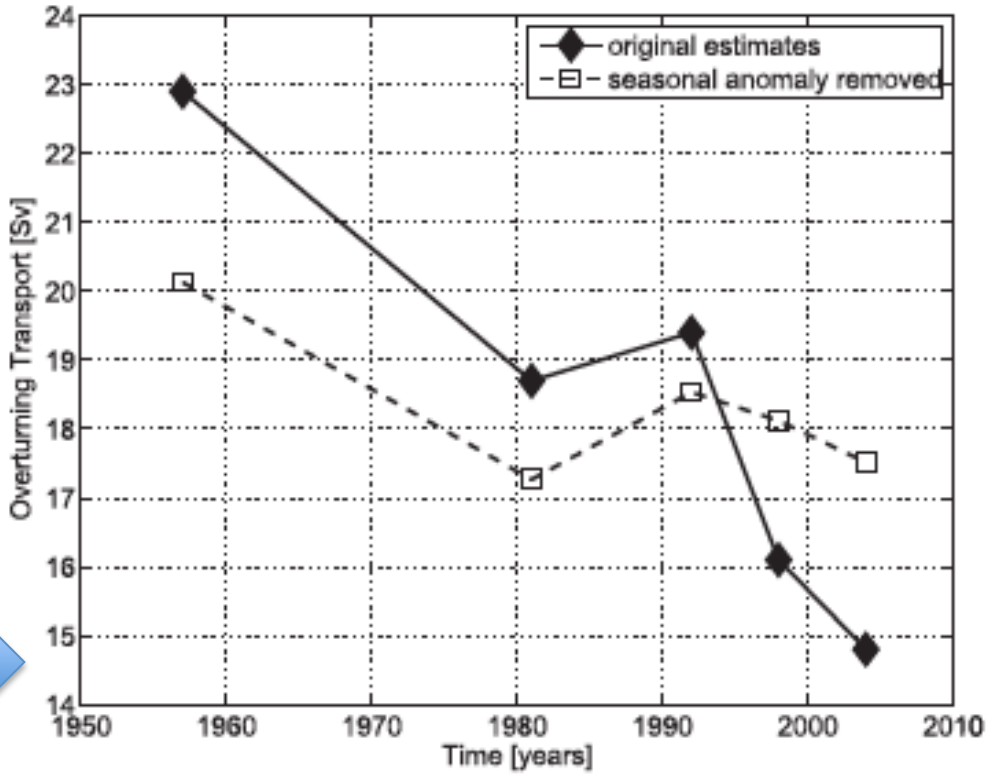


FIG. 16. The Ψ^{MAX} inferred from five hydrographic snapshot estimates between 1957 and 2004 (solid diamonds), as reproduced from Bryden et al. (2005b). The hydrography cruises were carried out in different seasons, namely, in October 1957, August–September 1982, July–August 1991, February 1998, and April 2004. The open squares represent the historical estimates of Ψ^{MAX} with seasonal anomalies of T_{UMO} (Fig. 10c; Table 2) subtracted.

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Changing Ocean Circulation

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A

CrossMark click for updates

Phil. Trans. R. Soc. A (2012) **370**, 5461–5479
doi:10.1098/rsta.2012.0397

Changing currents: a strategy for understanding and predicting the changing ocean circulation

BY HARRY L. BRYDEN[1,*], CAROL ROBINSON[2] AND GWYN GRIFFITHS[3]

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[2] *School of Environmental Sciences, University of East Anglia, Norwich Research Park, Norwich NR4 7TJ, UK*
[3] *National Oceanography Centre, University of Southampton Waterfront Campus, European Way, Southampton SO14 3ZH, UK*

Within the context of UK marine science, we project a strategy for ocean circulation research over the next 20 years. We recommend a focus on three types of research: (i) sustained observations of the varying and evolving ocean circulation, (ii) careful analysis and interpretation of the observed climate changes for comparison with climate model projections, and (iii) the design and execution of focused field experiments to understand ocean processes that are not resolved in coupled climate models so as to be able to embed these processes realistically in the models. Within UK-sustained observations,

Marine research in the past 20 years has focused on defining the present day ocean circulation. From these measurements of ocean circulation, we begin to understand how biogeochemical distributions are set and how the ocean and atmosphere interact to determine the present climate [4].

The key issue for the next 20 years is to understand how the ocean circulation varies on inter-annual to decadal time scales

In April 2009, the array recorded a 30% drop in average current strength that persisted for a year, reducing the amount of heat transported to the North Atlantic

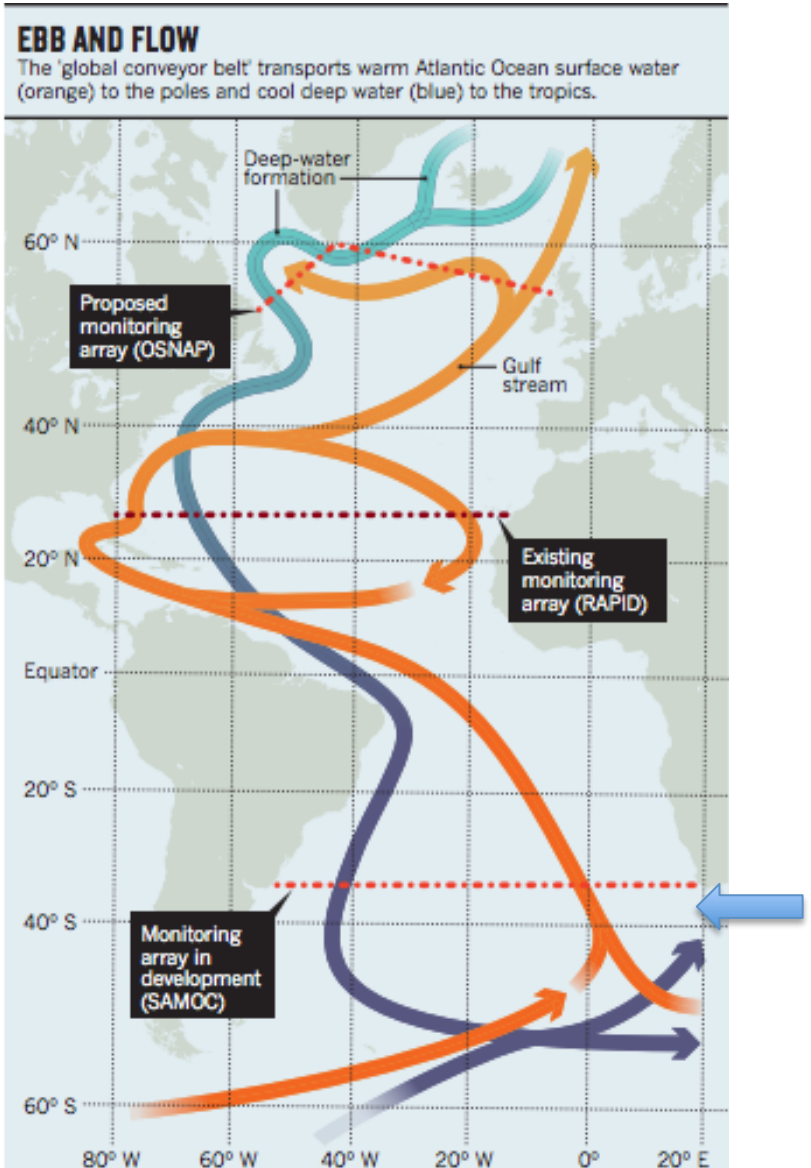
OCEANOGRAPHY

Oceans under surveillance

Three projects seek to track changes in Atlantic overturning circulation currents.

BY QUIRIN SCHIERMEIER

In April 2009, the array recorded[2] a 30% drop in average current strength that persisted for a a crucial component of the conveyor belt: the region of the North Atlantic in which surface



Why Perseus- why new Ocean Observing & Forecasting Systems, why Mediterranean, why now?

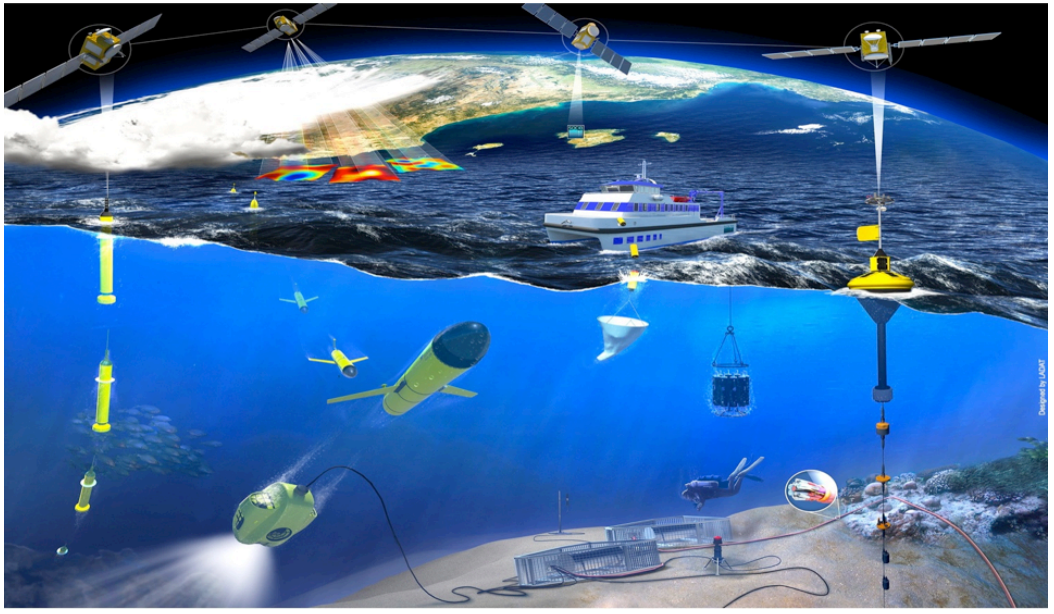
New Approach to Marine and Coastal Research

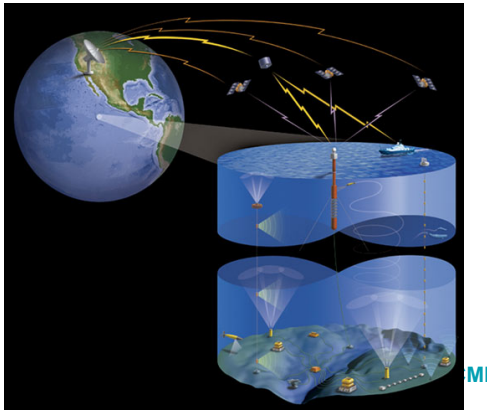
New technologies now allow three-dimensional real time observations, that combined with numerical models, and data assimilation, …

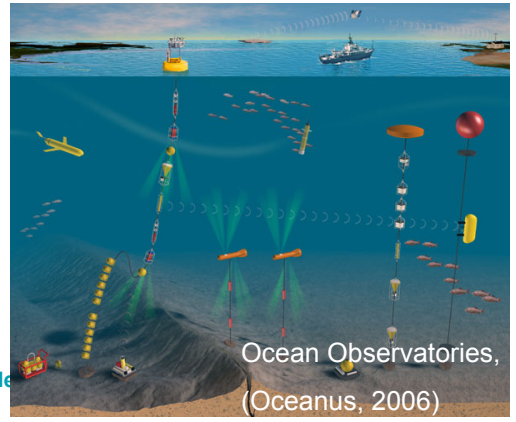
A quantitative major jump, in scientific knowledge and technology development

The development of a new form of Integrated Coastal and Ocean Management in response to society needs

on a global change context (where climate change is one of the most important, but not the only one…), and following sustainability principles







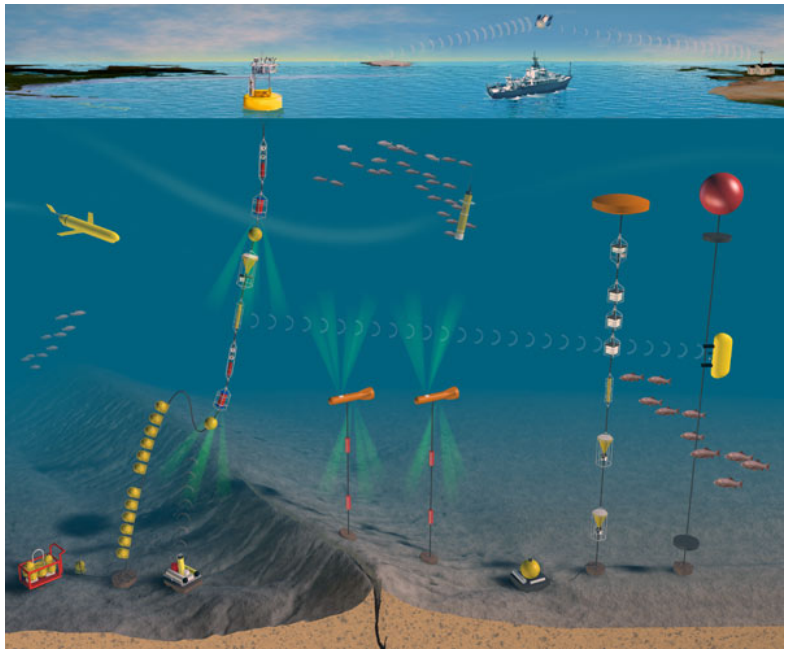
Ocean Observatories, (Oceanus, 2006)

Paradigm Shift (1) in Ocean Observation

From: Single Platform - Ship based observation
To: Multi-platform observing systems

Platform-centric Sensing Systems

Net-centric, Distributed Sensing Systems

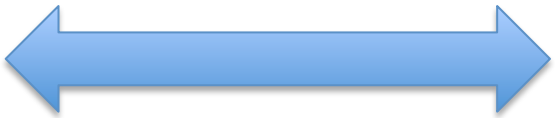


(Adapted from Steve Chien, JPL-NASA)

Paradigm Shift (2) in Data Availability

From: Data only available 12-24 months/years after cruises….
To: Quasi-real time quality controlled data available

Inter-comparison

Models  **Data**

…. For ….At sea mission re-definition, new models setup…
…. For …. Sound and knowledge based implementation of society needs… e.g., MSFD…

With… huge increase in human potential for analysis

NEW CHALLENGES, TOOLS DEVELOPMENT, etc…

From…

A 2020 Vision for Ocean Science

JOHN R. DELANEY
University of Washington
ROGER S. BARGA
Microsoft Research

Rationale

(b) **Development of TOOLS to evaluate environmental status using existing and upgraded monitoring and modelling capabilities**

PERSEUS will upgrade, expand and develop the appropriate tools to assist in the evaluation of the environmental status. These include observation systems, models and the concept of an innovative survey vessel.

b1. Upgrade/expand the existing observational systems

As oceanographic processes operate on a variety of spatio-temporal scales, ocean monitoring operations need to be consistently maintained over the long-term and to also integrate a variety of data. This is absolutely essential if key questions regarding climate change, coastal ocean processes, ecosystem variability are to be answered, and also in order to improve the estimates of current ocean states and constrain model predictions, contributing therefore to the proper implementation of Good Environmental Status as required by the MSFD. Addressing these issues and obtaining valid responses to each one of them is precisely one of the key strategic objectives of WP3, which aims to establish a new framework of interaction between researchers, technologists and final users.

To accomplish the science and society-related objectives set in PERSEUS, different scales will be addressed, from global basin processes to sub-basin and local ones. WP3 is designed in a way that combines traditional and new platforms, to ensure good integration of the tasks and processes essential for the achievement of a well-targeted science-based ecosystem management. The following Figure illustrates one of the key elements of WP3, i.e., the relation between space/time scales and the observational tools. Although remote sensing (satellites) and shipboard surface measurements cover the largest number of marine processes, they cannot capture the vertical structure of the ocean. The use of various *in situ* platforms is therefore obligatory. More importantly, the integration of the different platforms must complement the coverage of the existing global observing system (red box – Fig. 2) at the regional/coastal scale (black box – Fig. 2) and is particularly necessary for regional/coastal models, implying more societal applications for the ocean monitoring.

Multi-Platform integrated approach

….from local to basin scale

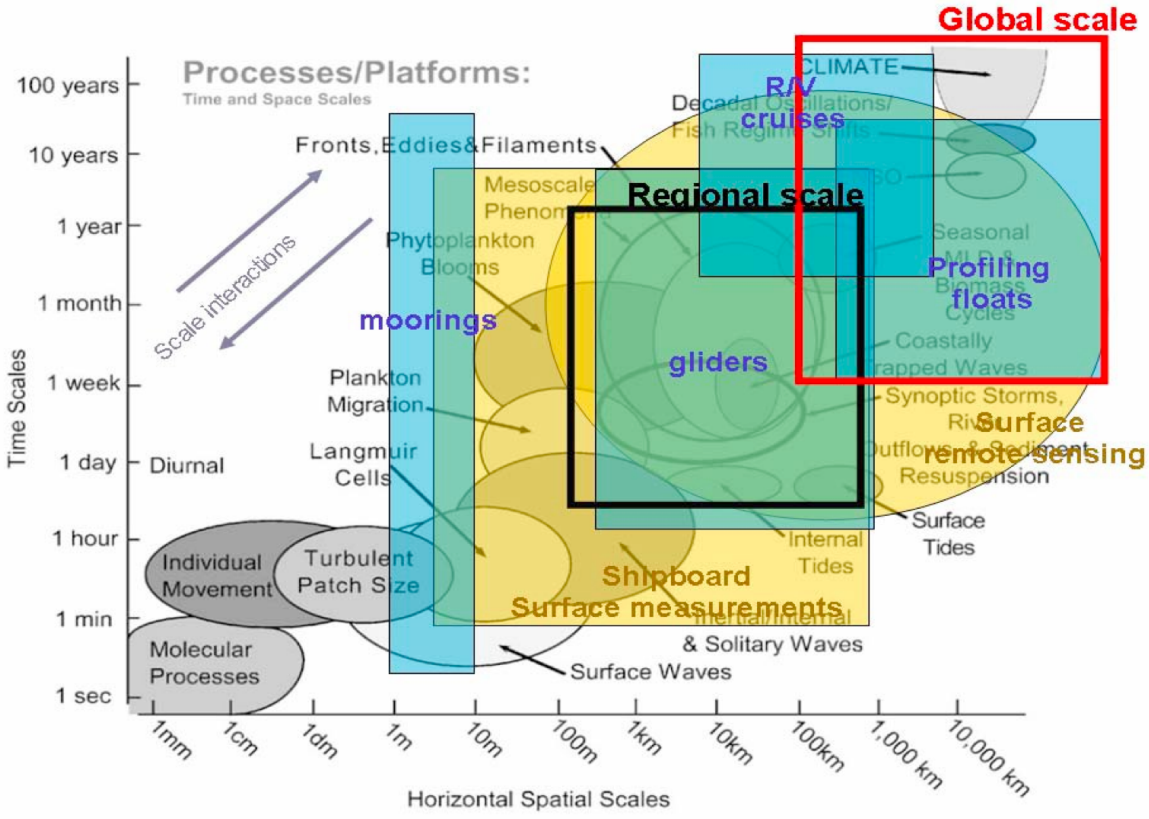
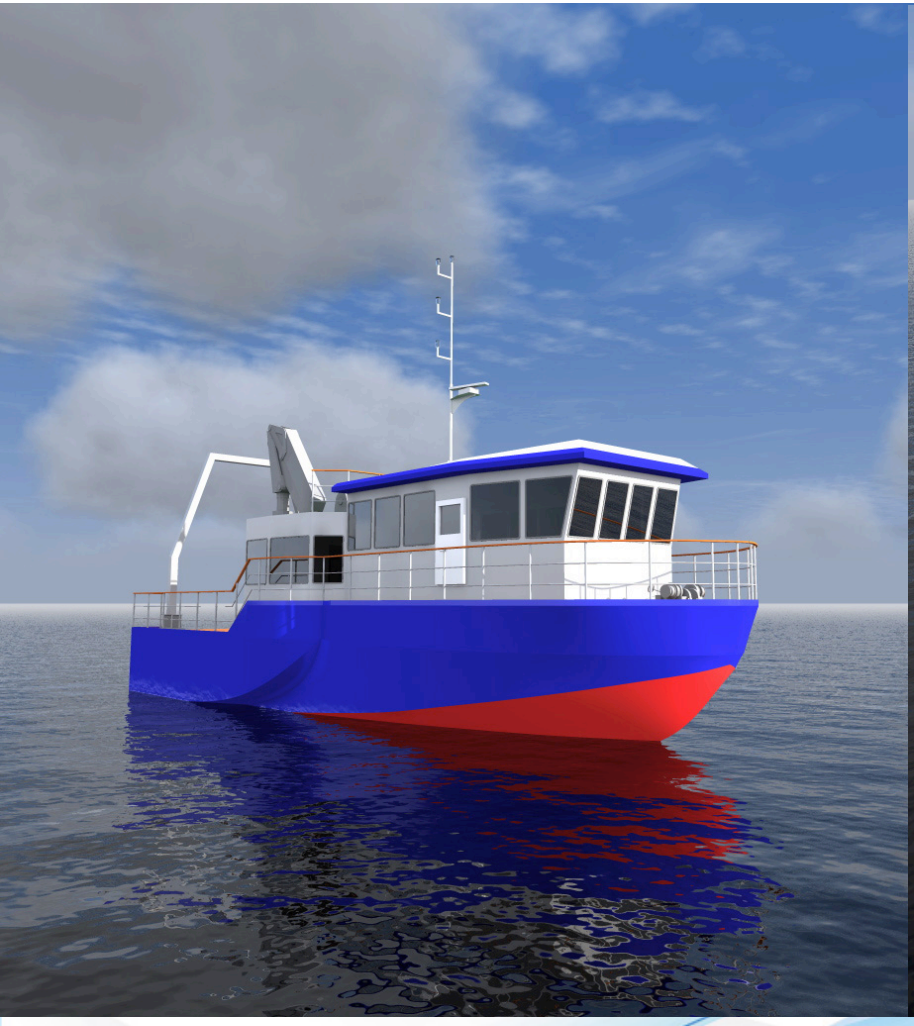
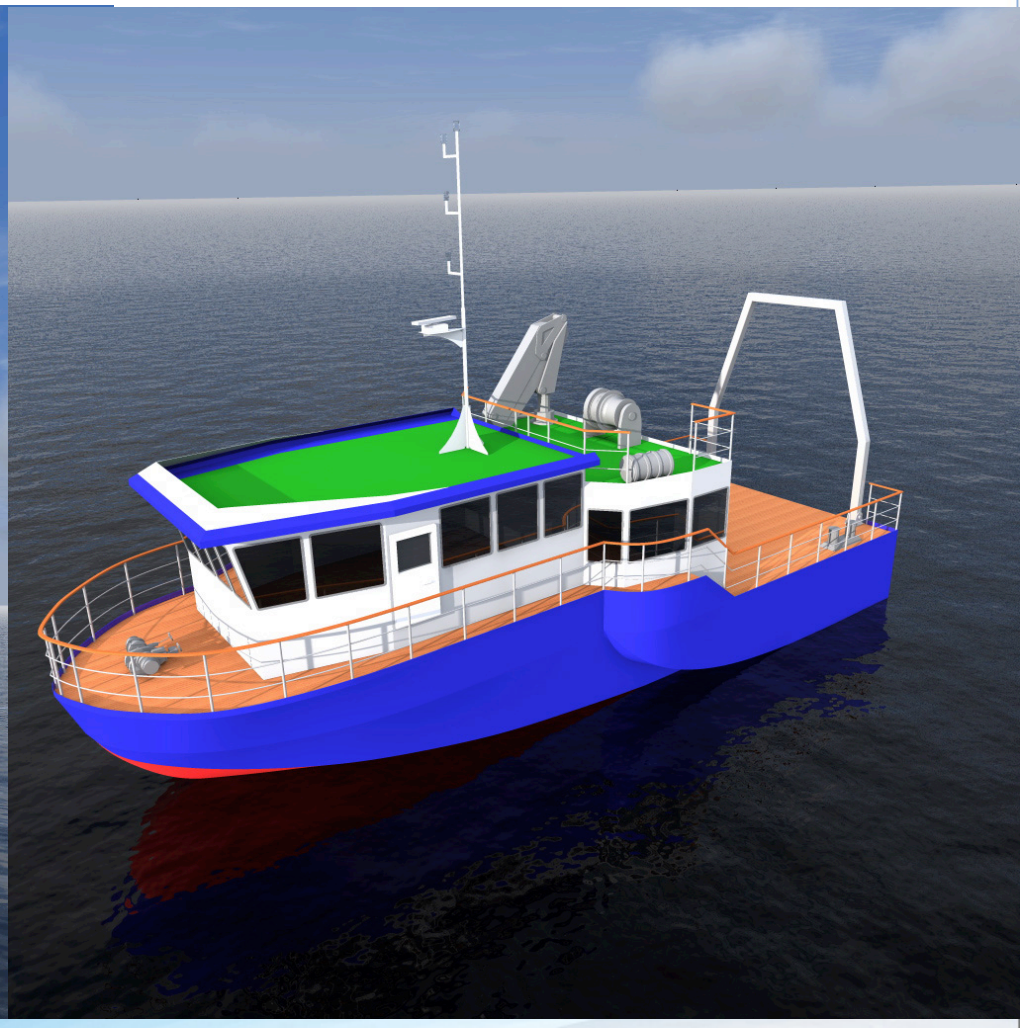


Figure 2. Space *vs.* time oceanic scales (processes) and the PERSEUS observing platforms; moorings, gliders, R/V, profiling and surface floats showing that today, the scales covered by platforms collecting in situ data (blue areas) can be considered equivalent to the ones collecting surface measurements (yellow areas).

"A single ship can only be in one place at one time. We need to be present in multiple places in multiple times." (J. Delaney, Nature, Sept. 2013)

Innovative Research Vessel, Wp 7





Developing Integrated Tools for Environmental Assessment (Wp 4)

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Objectives

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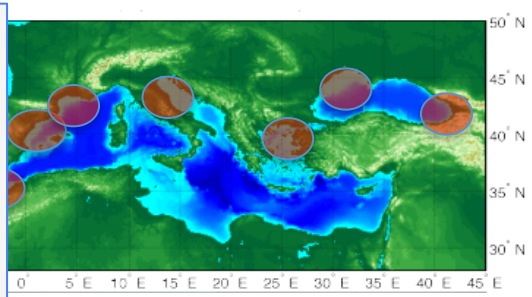
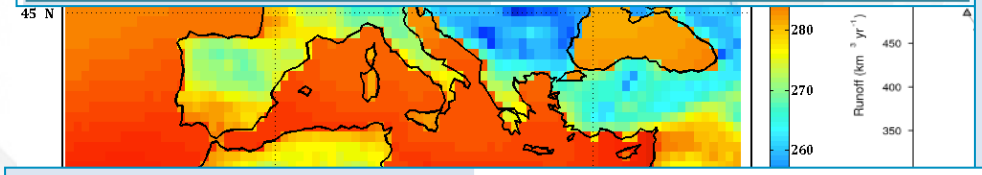


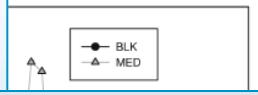
Basin and regional scale implementations

to SES by....

Mediterranean Sea atmospheric surface function data

Deliverable Nr. 4.1





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SES land-based runoff and nutrient load data (1980 - 2000)

Deliverable Nr. 4.3

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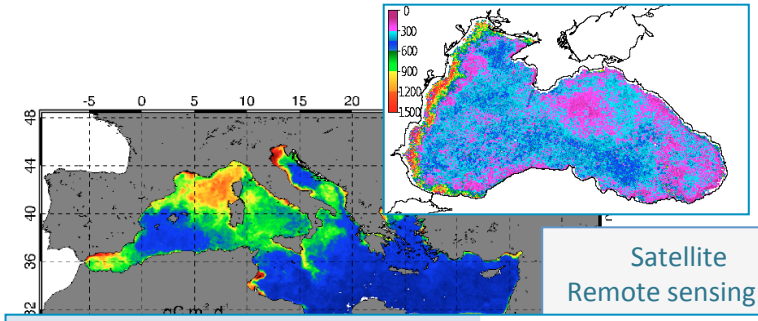
Black Sea atmospheric surface forcing function data

Deliverable Nr. 4.2

on hydrological models
ode simulations)

Remote Sensing & “E2E” Modelling



Satellite Remote sensing of

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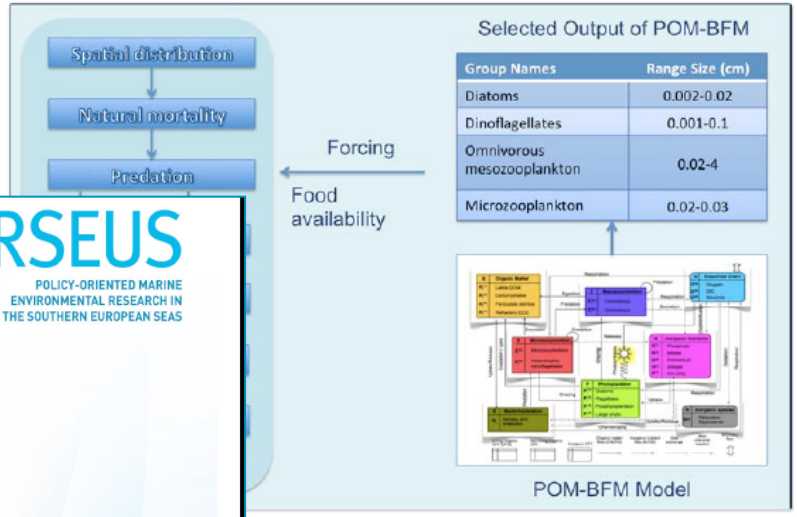

Spatial analysis of vigor and organization from remote sensing

On/off Line coupling

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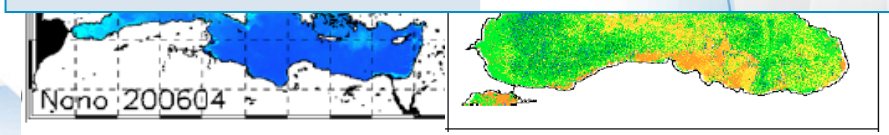
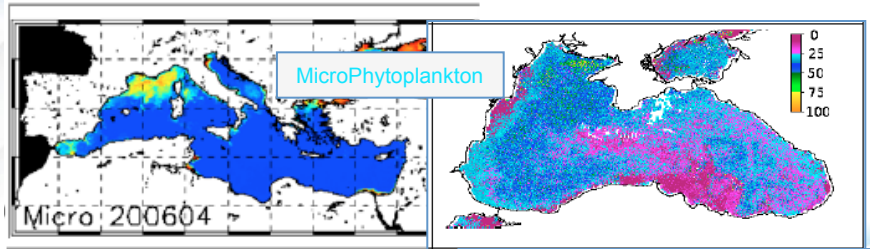




Satellite remote sensing of phytoplankton functional types.
Size based: Micro-, Nano-, Pico-

LTL-HTL regional model coupling to establish E2E modeling systems and assessment of the models skill

Deliverable Nr. 4.4

WP3 Objectives

To respond to scientific and society needs with emphasis on the characterisation of present state, and provision of solid grounds for the implementation of MSFD, upgrade and expand the observing capacities in the SES and to increase forecasting capabilities.

• Revision of existing observing capacities (from local to sub-basin and basin scale variability) and Identification of gaps and needs
• Upgrade and expand development of observing systems in response to policy and science needs identified by WP1, WP2, WP4, WP5, WP6 (short to medium term gaps)
• Establishment of a Near Real Time data delivery flow with agreed quality assurance procedures/standards and under an open access data policy.
• Development of a long-term monitoring strategy based on the identified needs as well as existing capacities and national commitments

WP3 Overview

Task 3.1 Review of Existing Observing Capacities (from local to sub-basin and basin scale variability) - Identification of needs and gaps
Responsible: OGS

Task 3.2 Upgrade of existing observing components
Responsible: HCMR

Task 3.3 Develop New Observing Components
Responsible: CNRS

Task 3.4 Data availability coordination
Responsible: IFREMER

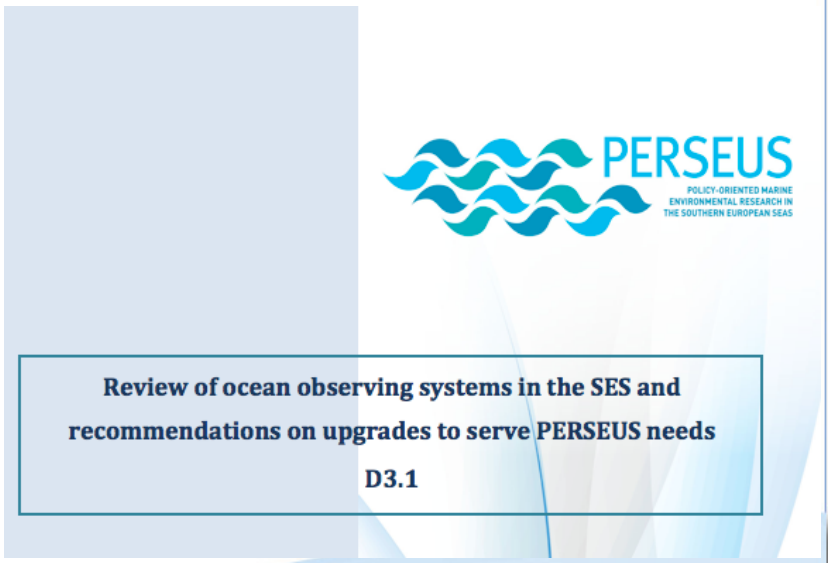
Task 3.5 Development of a long-term observing strategy
Responsible: CSIC

Tasks 3.1 Review of Existing Observing Capacities (from local to sub-basin and basin scale variability) – Identification of needs and gaps

FINAL D3.1 Review Report

Review all the observations collected across 6 major platforms; Argo profilers, surface drifters, R/V, open water moorings, gliders, local and coastal stations, and satellites, across all the SES region

Identifies GAPS and NEEDS

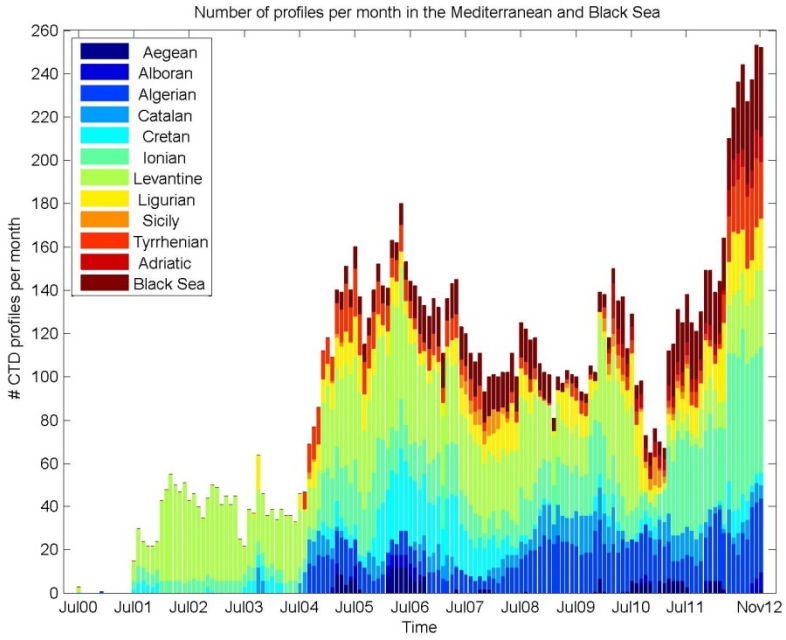


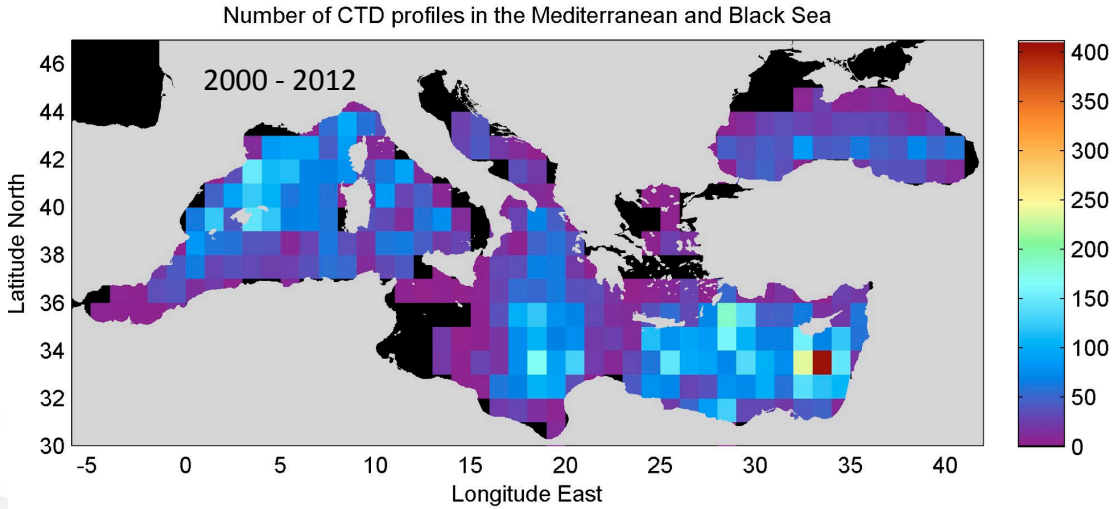
D3.1 Argo Profilers:

✓ ARGO PROFILERS

174 floats since 2000 in the SES → 14000 profiles

Sea-bird CTD + optional: dissolved oxygen sensors, optical sensors (chlorophyll fluorescence, etc.) and nitrate sensors.



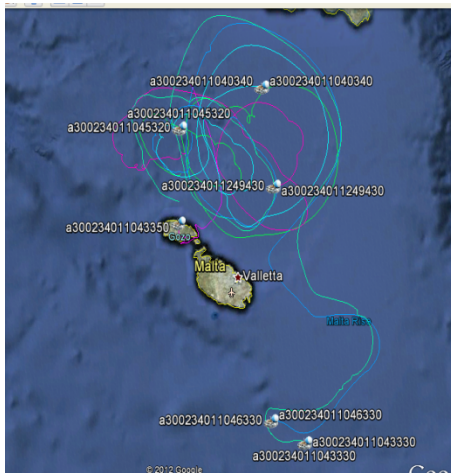


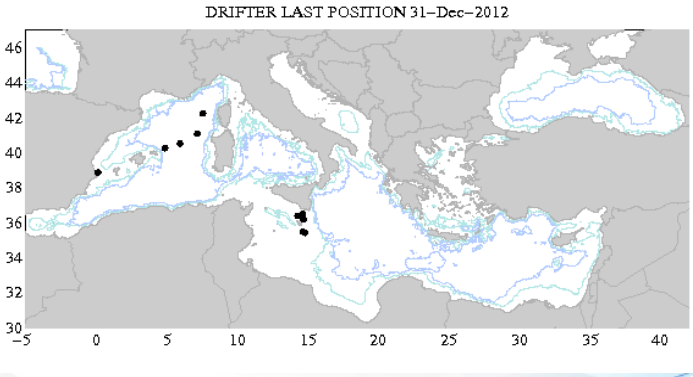
D3.1 Surface Drifters

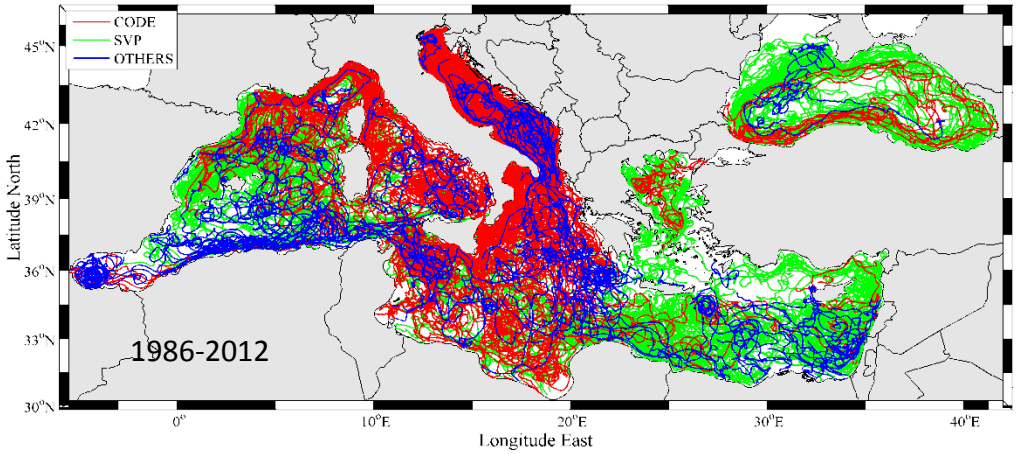
✓ SURFACE DRIFTERS

1458 tracks since 1986 in the SES

Near surface currents and SST.





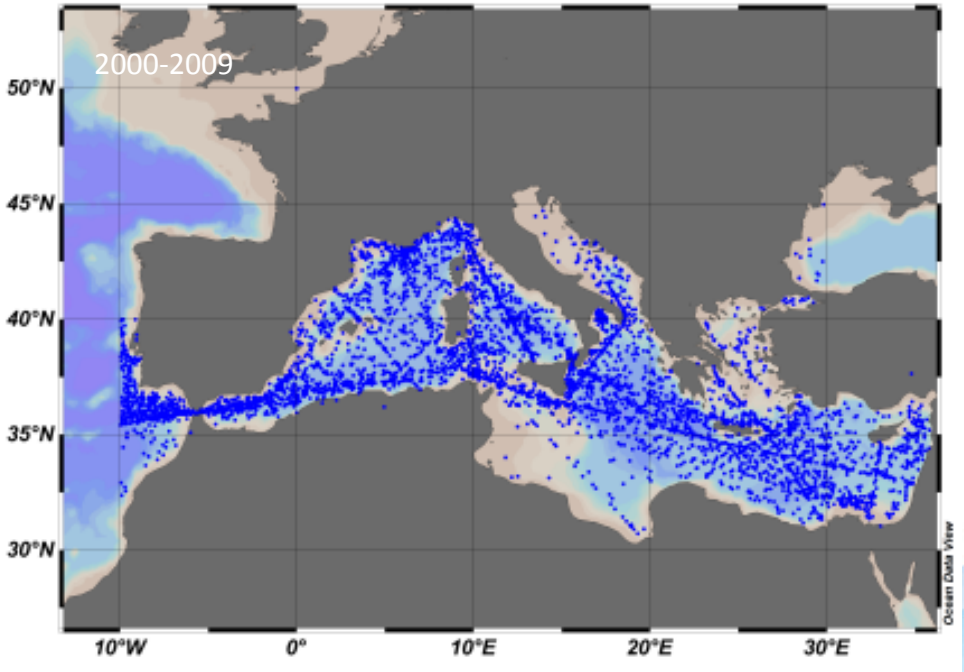


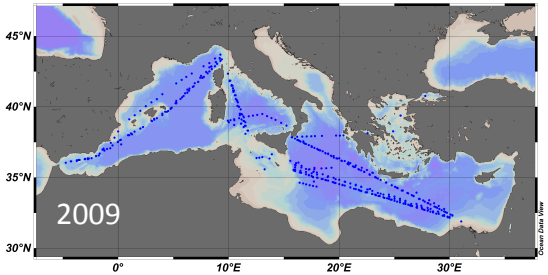
D3.1 SOOP:

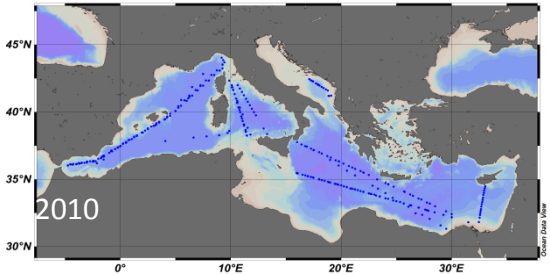
✓ SOOP in the Med

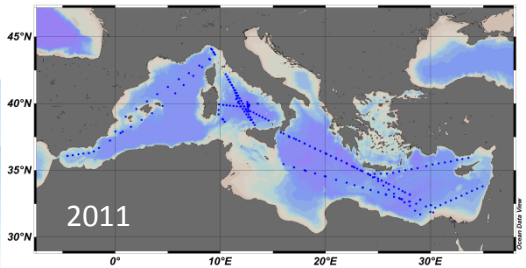
XBT lauches from ships of opportunity

Temperature profiles

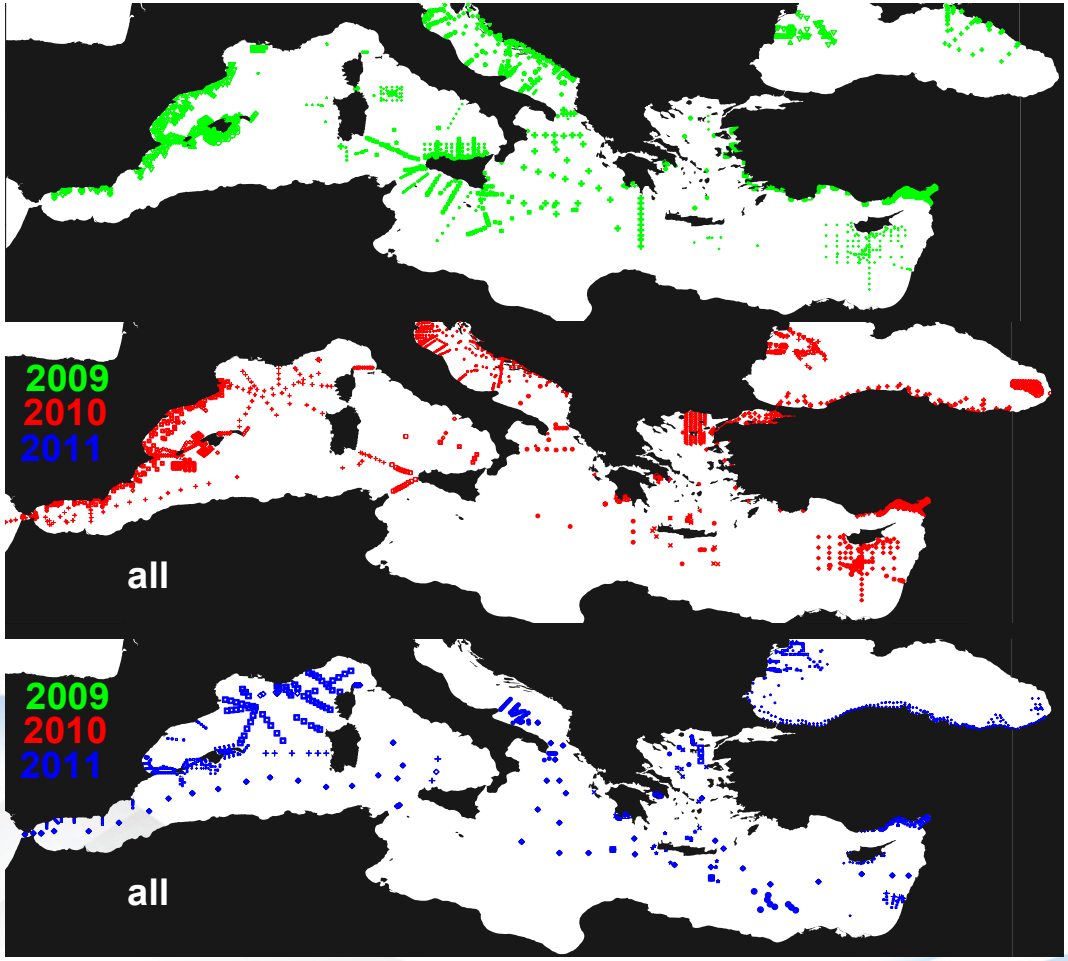








D3.1 Research Ships Monitoring:

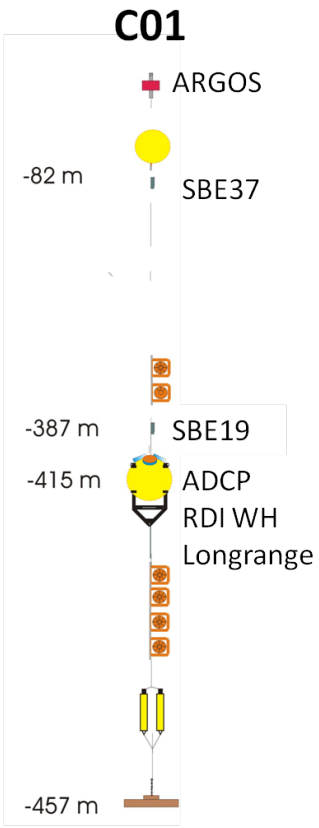


Parameters routinely measured vary from insitutte to institute and comprise:
CTD, O2, ADCP, LADCP, Thermosalinograph, Surface drifters, Optical backscatter, Fluorescence, Dissolved inorganic nutrients, DOM, POM, Chl. PP, pH, Eh, Hydrogen sulphide, Bacteria/ micro-organisms, Phyto-, Zooplankton, Phyto-, Zoobenthos, Sediment traps, Petroleum hydrocarbons, Organic biomarkers, Multibeam sounding, Heterotrophy

D3.1 Moorings (deep and coastal, water column orientated):

Overall geographical coverage is poor.
Lack of additional parameters (chlorophyll, oxygen CO2, nutrients)

The Eurosites network in the Mediterranean

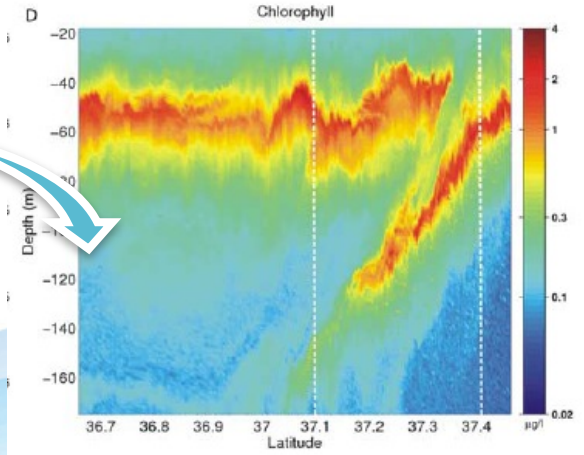


D3.1 Gliders:

130 missions since 2004 → 60000 profiles

Gliders have been intensively deployed in some parts of the Mediterranean Sea

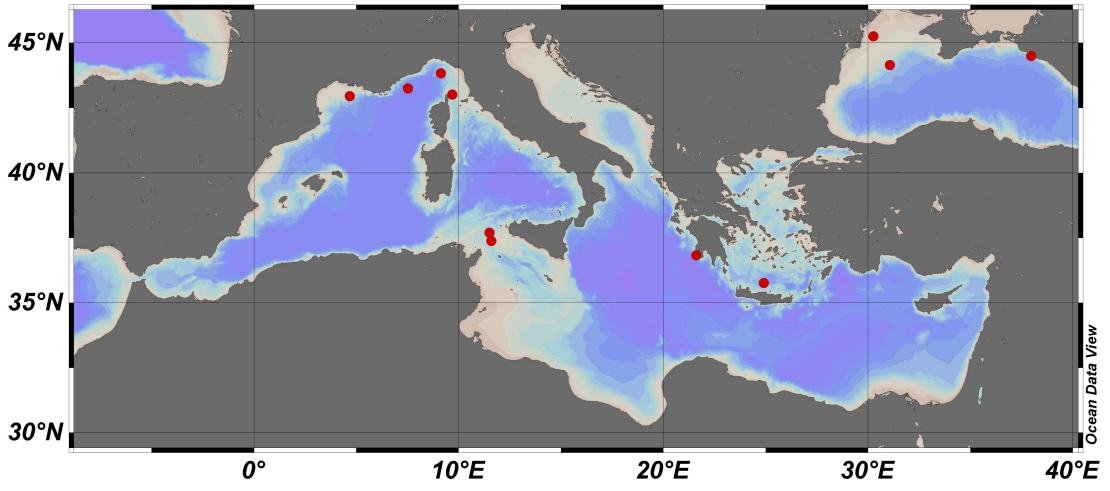
Sea-bird CTD + optional miniaturized biogeochemical sensors (fluor. Chla, O2, turbidity, NO3, NO2).



Task 3.2 Upgrade of existing observing components

Highlights 2013 planned next steps:

- Upgrades to moorings will be undertaken as previously outlined, see below.
- Argo deployments in Back Sea IO-BAS, NE SIO-RAS (maybe with DO), GeoEcoMar (bio float), OGS bio floats (DO, Chl, Nitrates) in the Central Med, OC-UCY in Eastern Med, 10 bio floats LOV (NAOS project) plus others
- Cruises will be undertaken as previously outlined
- Cruise calendar R/V SES 2013-2104 available…!!!



Task 3.3 New Observing Components

3.3.1 Repeated glider section in key channels and sub-basin (CNRS)

Aim:

Continue and extend the existing component of the SES glider network and to assess where new components could be developed

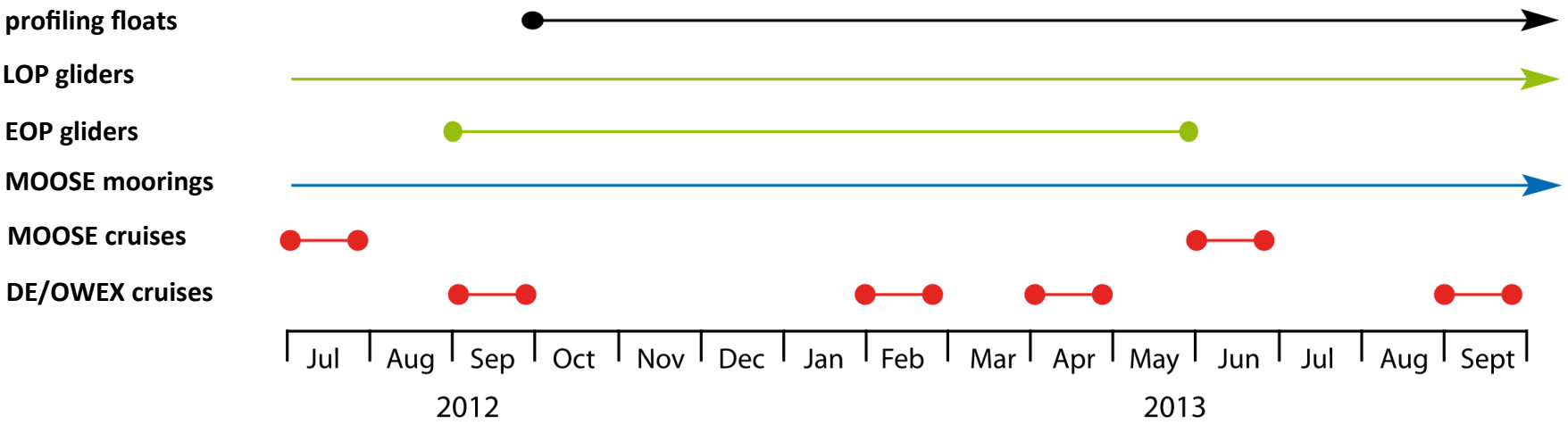
Main actions accomplished and highlights 2012:

- Extension Marseilles-Lion endurance line to Menorca
- Continuation Nice-Calvi endurance line with NITRATE sensor
- Continuation endurance line Mallorca-Ibiza-Mainland
- Continuation endurance line south of Cyprus (IPOKINOIMODA)
- 2 Seagliders acquired for OGS fleet

Issues and Delays:

None

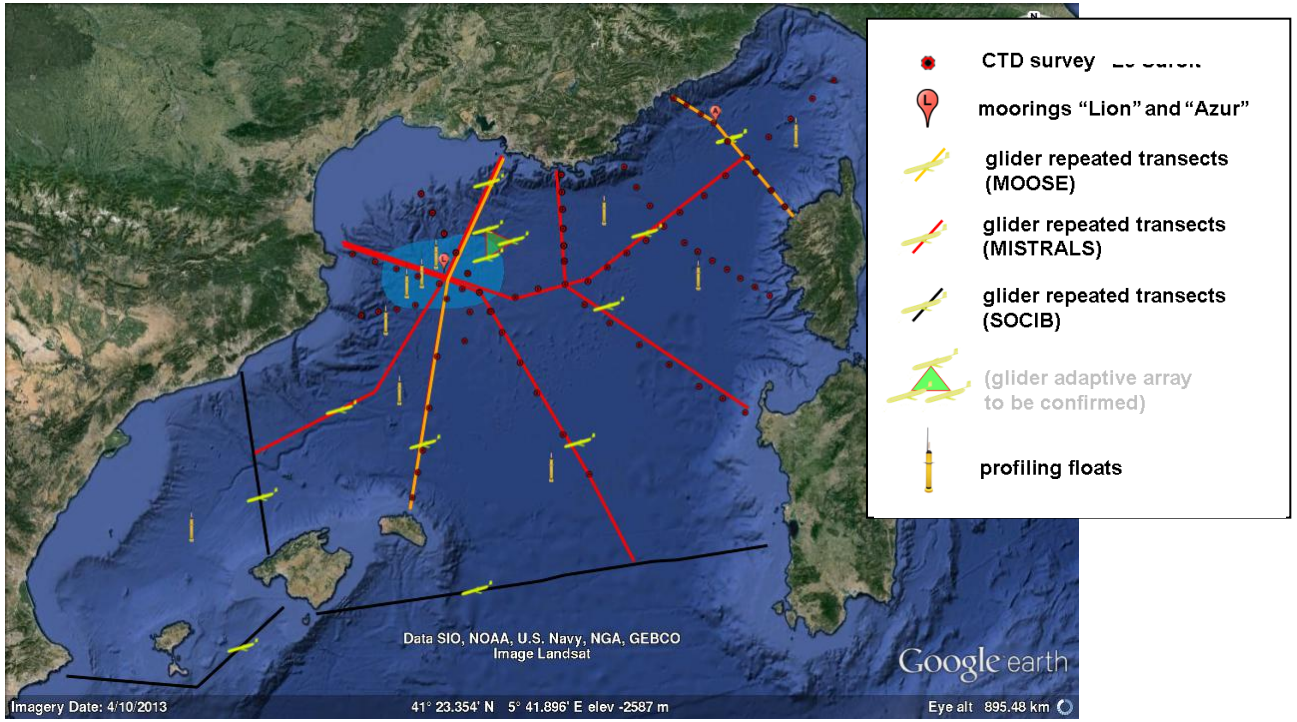
Sampling strategy



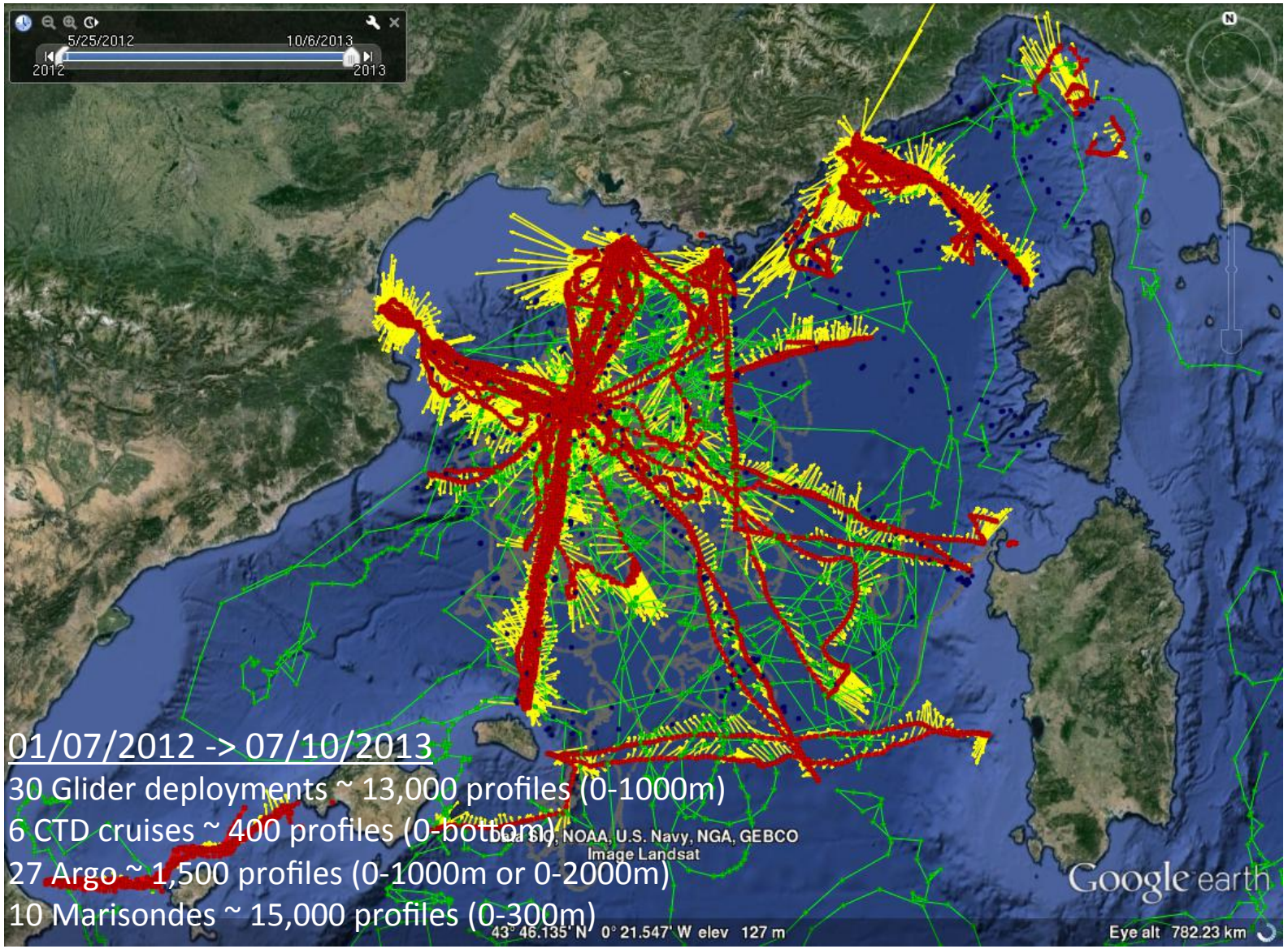
Projects:

- **FP7 GROOM**
- **FP7 PERSEUS**
- **FP7 JERICO**
- **FP7 E-Aims**
- **FP7 OSS-2015**

- **HyMeX /MerMeX**
- **SOERE MOOSE**
- **ANR ASICS-MED**
- **EQUIPEX NAOS**
- **GMMC MESOLAB**
- **…**



Gliders, Profiling floats, Marisondes, Cruises…



Gliders, Profiling floats, Marisondes, Cruises…

Task 3.3 New Observing Components
Subtask 3.3.3 Fishing Fleet Vessel Monitoring System (HCMR)

Three VMS areas: Baleares, Adriatic, Aegean

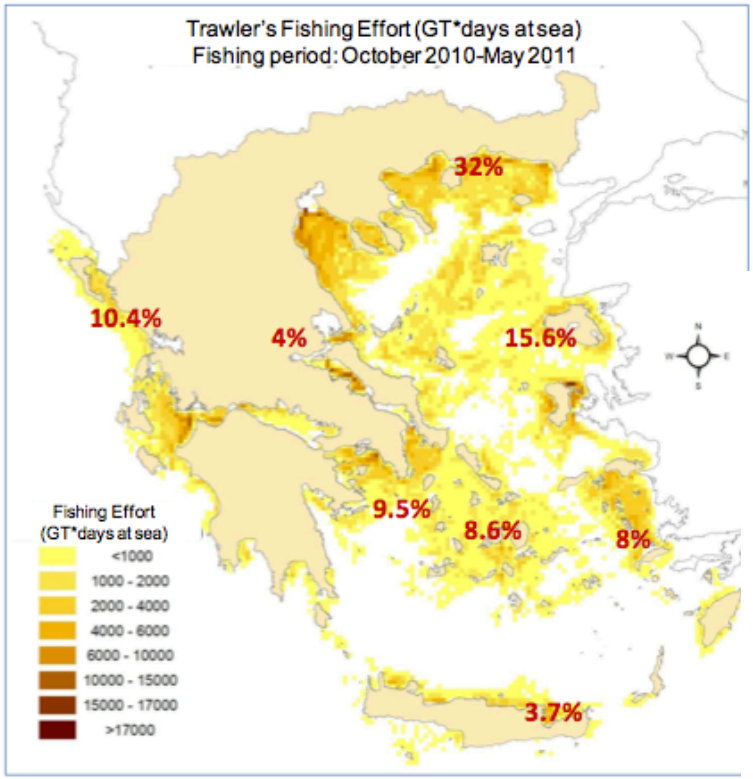


Figure 1. Total fishing effort (GT*days at sea) of trawlers in the period October 2010-May20

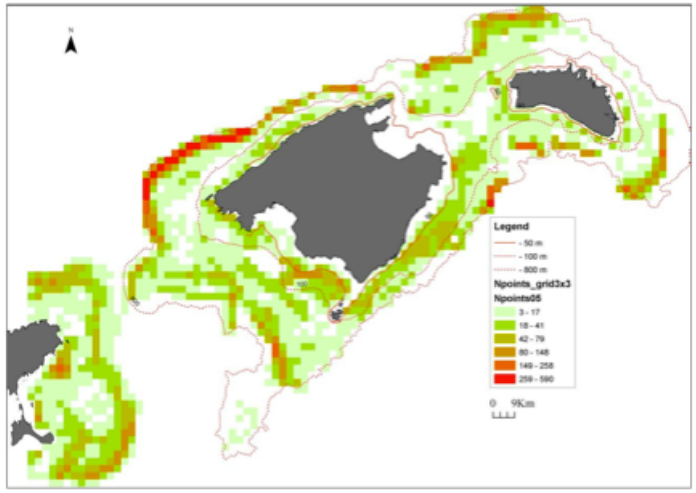


Fig. 3. Density of VMS records of trawlers around the Balearic Islands in 2005, expressed as the number of points in grids of 3x3 km.

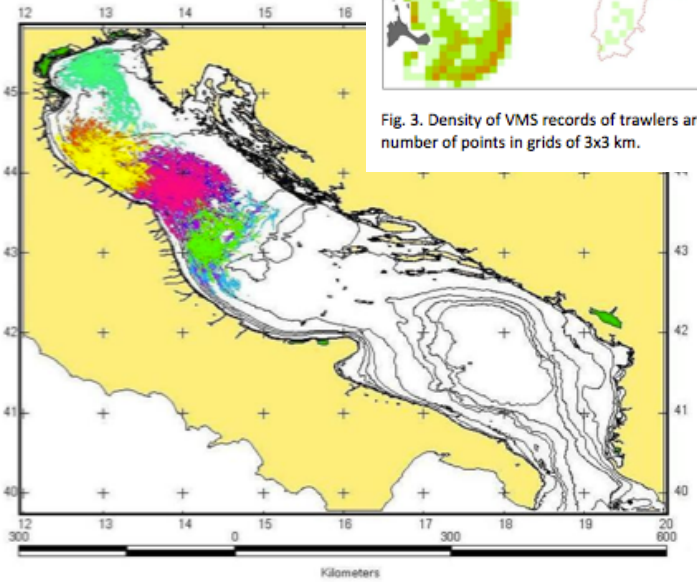
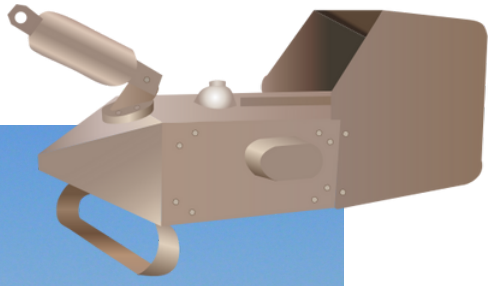
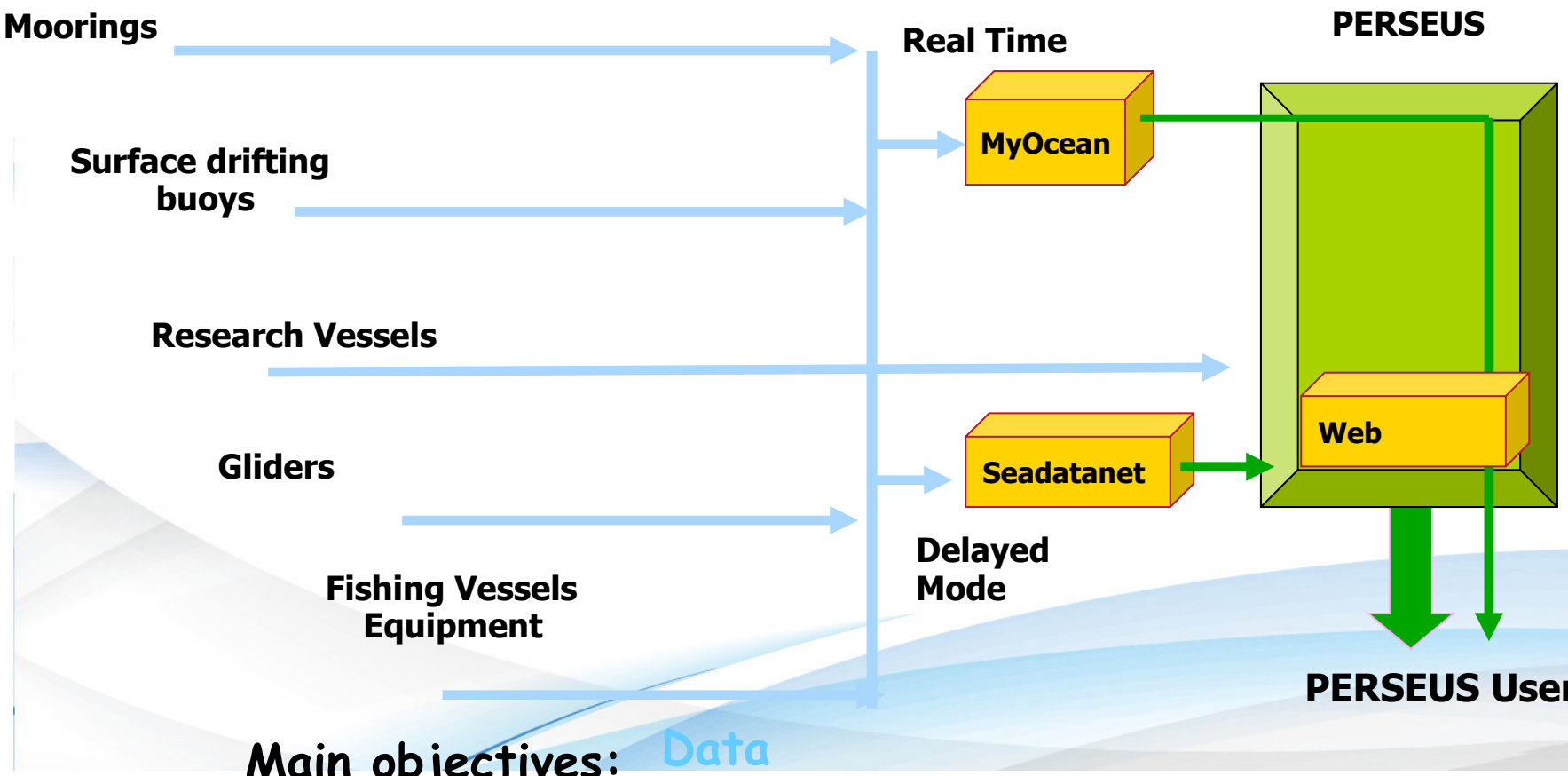


Figure 2: Record of routes of vessels monitored, collected between 2003 and 2008.

Task 3.3 New Observing Components
Subtask 3.3.2: CPR



Tasks 3.4 Data Availability coordination



Main objectives:

- to distribute the data using existing facilities (Coriolis, EuroGOOS/MyOcean, SeaDataNet)

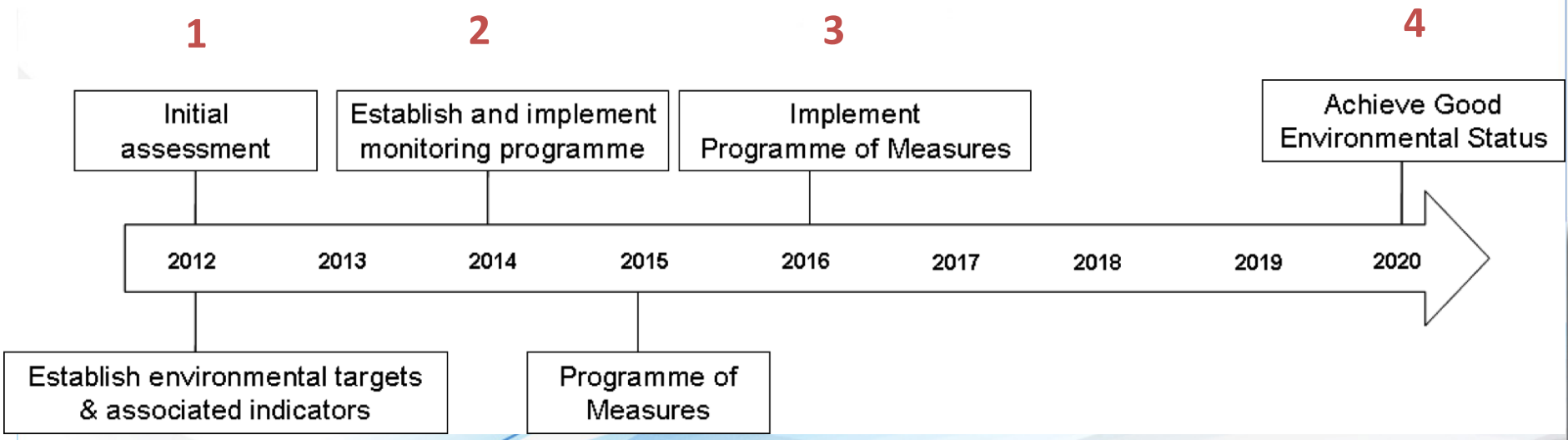
Web

- Make the Perseus data visible (WP 9)

Perseus WP 3/4 contribution to policy oriented areas:

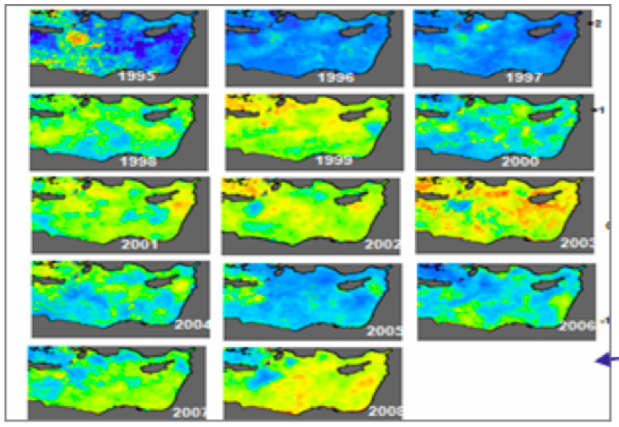
Indicators used and relevance to GES:

- **MSFD A KEY SOCIETAL DRIVER:** requires (1) An Initial Assessment present status to guarantee achievement of (2) Good Environmental Status by means of actions that include (3) Monitoring Programs and detailed (4) Programs of management measures.

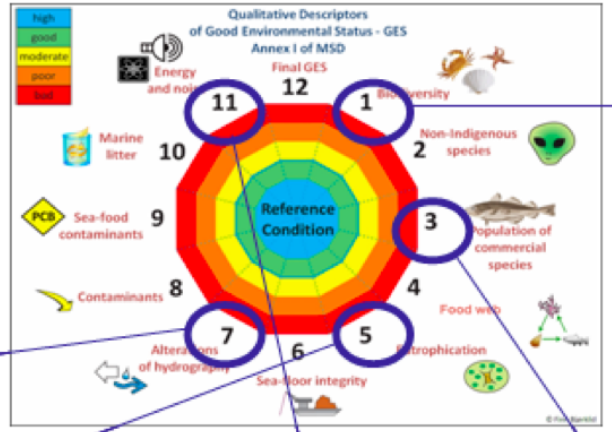


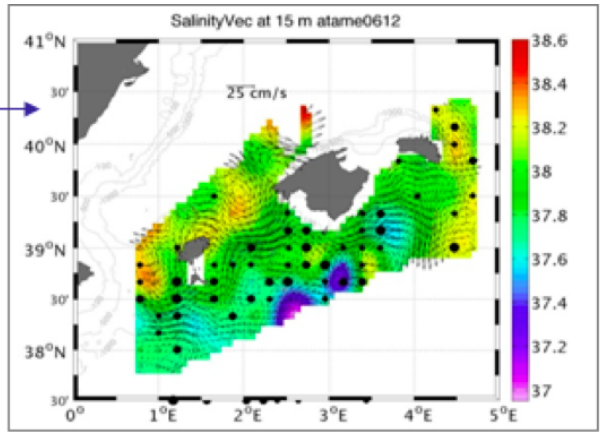
WP3/4 contribution to policy oriented areas: Indicators used and relevance to GES.

By Integrating different types of monitoring platforms at different scales, we are providing data and tools and contributing to establish MSFD pressures & states indicators

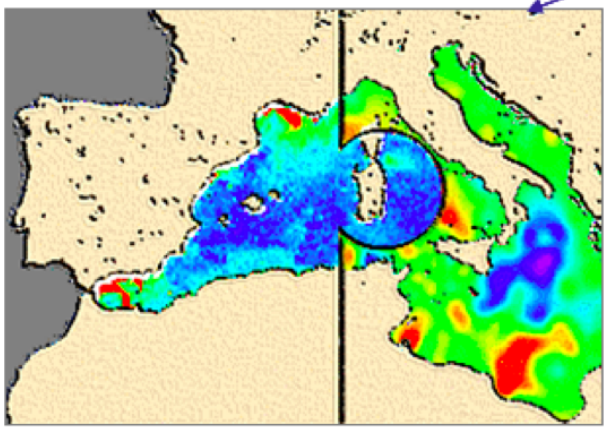


SST to assess hydrography

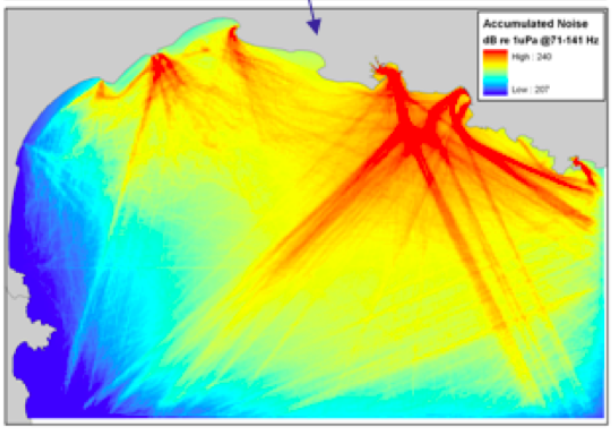




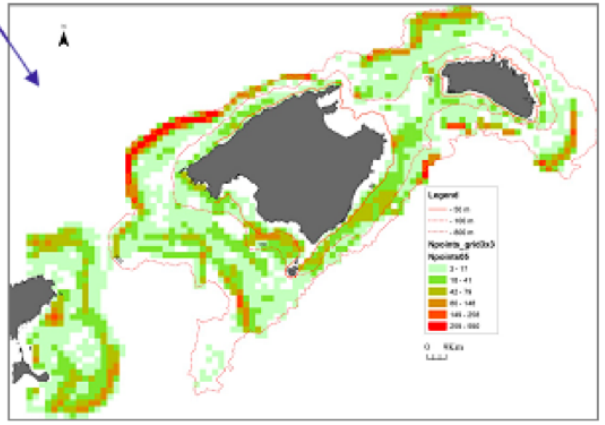
Biological models to assess biodiversity



Ocean color to assess eutrophication



AIS to assess underwater noise



VMS to monitor fishing pressure

SUMMARY: …. PERSEUS WP'S 3,4,7 DEVELOPPING & IMPLEMENTING NEW TOOLS FOR SCIENCE&SOCIETY…

- ADRESSING THE SCALES VARIABILITY, AND THE NEED TO MONITOR AT THE RIGHT SCALES, ESTABLISH BIASES AND CORRECT THEM! – KEY IN THE MEDITERRANEAN !!!....

- THROUGH MULTI-PLATFORM OBSERVING and MODELLING SYSTEMS APPROACH

- THE KEY CHALLENGE IS INTEGRATION EXISTING AND NEW COMPONENTS AND ALSO DATA AVAILABILITY (MOSTLY COAST!).

- NEW OCEANOGRAPHY MORE OPEN, TO AND FOR SOCIETY

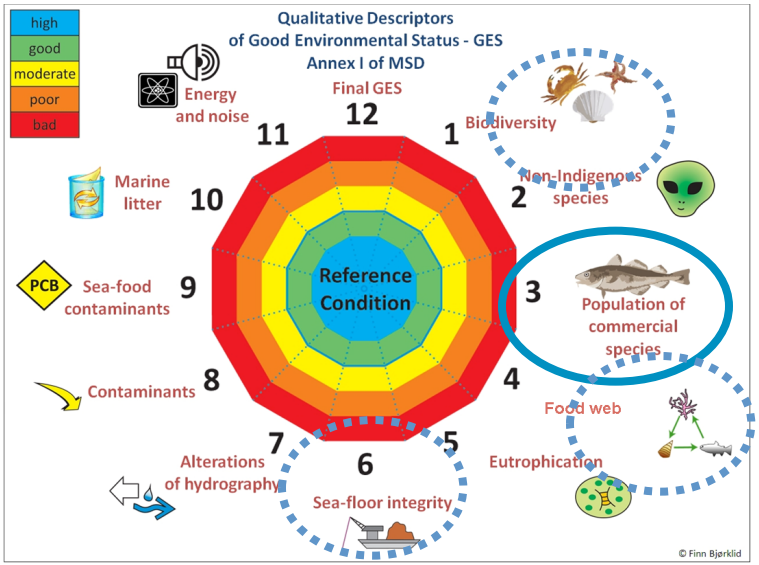
PERSEUS

POLICY-ORIENTED MARINE ENVIRONMENTAL RESEARCH IN THE SOUTHERN EUROPEAN SEAS

THANK YOU!

Main achievements in WP3
(January 2012-October 2103)

- REVIEW OF EXISTING OBSERVING SYSTEMS FOR SCIENCE AND POLICY
- IDENTIFICATION OF DATA GAPS AND NEEDS IN THE MEDITERRANEAN AND BLACK SEA FOR SCIENCE AND POLICY
- IMPLEMENTATION OF NEW MONITORING TECHNOLOGIES
- NEW RESEARCH VESSEL CALENDAR 2013 AND 2014 IN THE MEDITERRANEAN AND BLACK SEA FOR SCIENCE AND POLICY
- STRATEGIES FOR FUTURE OBSERVING SYSTEMS


high
good
moderate
poor
bad
Qualitative Descriptors
of Good Environmental Status - GES
Annex I of MSD
Final GES
12
1
Biodiversity
2
Non-Indigenous species
3
Population of commercial species
4
Food web
5
Eutrophication
6
Sea-floor integrity
7
Alterations of hydrography
8
Contaminants
9
PCB
Sea-food contaminants
10
Marine litter
11
Energy and noise
Reference Condition
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