



Towards integrated European marine research strategy and programmes

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Mechanisms to address marine research priorities in the Mediterranean Sea using common programming

WP7-D721

Septembre 2013

ANR/Ifremer



Mechanisms to address marine research priorities in the Mediterranean Sea using common programming

Grant Agreement n° 249552

Acronym: SEAS-ERA

Title: Towards Integrated Marine Research Strategy and Programs

WP7: Mediterranean Region

Task 7.2: Common Programs in the Mediterranean Region

Task Leader: ANR/Maurice Heral

Author: ANR/Maurice Heral, Ifremer/Sophie Sergent

Deliverable N°: SEAS-ERA_WP7_D 7.2.1

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Document Information	
Document Name	Mechanisms to address marine research priorities in the Mediterranean Sea using common programming
Document ID	Seas-era_WP7_D 7.2.1
Version Date	01/06/2013
Task Leader	ANR/Maurice Heral
Author/Organisation	ANR/Maurice Heral – Ifremer/Sophie Sergent
Security	PU

History				
Version	Date	Modification		
1	01/06/2013			
2	01/09/2013			
3				

Diffusion List				

Summary

The EU FP7 Seas-Era Mediterranean partnership, under the work package “Common Program”, initiates a common program in the Mediterranean region on “**Climate change impact on physical circulation and biogeochemical consequences**”. This topic has been previously identified by the Mediterranean partners (Ministries and funding agencies – *See the Seas-Era WP2 Deliverable 2.1.1*) as their first priorities.

Objectives – The impact of climate change on the whole circulation in the Med is of major interest and the studies on consequences for the biochemistry cycle are important. It is definitely a resource for a number of workshops.

Within a workshop with experts in charge of their national programs, it was proposed focusing on the coordination of national efforts in the EU countries of the area. Following the CIESM work on “Designing Med-Ship: a program for repeated oceanographic surveys”, the expert group has produced recommendations for maintaining, or increasing long time observations in the area which have been addressed to the relevant Ministries and National Funding Agencies.

How to share common facilities and data to build a long term network of scientists for best use of resources?

To achieve the construction of a comprehensive approach at the pan Mediterranean Sea, the approach by alignment of the different national projects/programs, the identification and analysis of convergences, gaps have been carried out.

WP2 and experts should precise later the content of a long term monitoring program coupling physical, geochemical and biological observations to follow and to model the impact of climate change.

Mechanisms to address marine research priorities in the Mediterranean Sea using common programming

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Introduction

Process ref. Seasera Deliverable N°: D.2.1.1.(ANR/Ifremer France)

As a consequence of the foresight exercises (WP1), the implementation of Common Programs allowed to identify the areas or themes which could be considered necessary to developed more cooperation.

For the Mediterranean region, the first step of the Common programs process has been successfully achieved. A list of research themes has been discussed and negotiated to obtain a consensus for the region.

The Identification and prioritisation for the Mediterranean Sea Basin were the followings:

THEMES & PRIORITIES	Spain		France		Italy		Malta		Greece		Turkey		Total	
	CP	JC	CP	JC	CP	JC	CP	JC	CP	JC	CP	JC	CP	JC
1Climate change and impacts	X	J	X		X		X		X		X	J	6	2
2Deep Sea Ecosystems		J			X								1	1
3Biological Invasions			X	J			X		X				4	2
4Marine Pollution - MSFD	X		X	J							X	J	4	3
5Living Marine resources		J			X						X			1
6Ocean Renewable Energy					X									
7Marine Biotechnology											X	J	1	2
8Maritime transport & Marine Environment												J		1
9Socioeconomics & policies														
10Ocean and Health														1
11Marine Spatial Planning (MSP) – Integrated Coastal Zone Management (ICZM)		J											4	1
12Natural Hazards		J			X					J			1	2
13Operational Oceanography / Observing Systems	X	J	X		X		X		X	J	X	J	6	3
14Training and Infrastructures			X								X	J	2	1

The two top priorities for collaborative programmes were:

- Climate change and impacts
- Opérational Oceanography / Observating systems

For Common Programmes, the decision was to consider the two priorities into one spécific Mediterranean programme and The Seas-era regional partners agreed to go further in the proposed theme with regional views and needs: **“How climate change impacts physical circulation? And consequences for the biochemistry cycle”**

During a **workshop hold on 27-28 September 2012**, the Med groups [experts in charge of their national programs, Seasera Med partners ⁽¹⁾] has refined the selected topic for the key scientific challenge.

It appears there is an urgent need to share vessels between the countries who are interested in participating to the cross Mediterranean surveys.

The scientific communities of the EU countries have large difficulties in maintaining long term monitoring activities to follow the physical impacts and biogeochemical changes in relation with climate change.

The main rationale of the report is to-present the conclusions of the working group. As part of the approach towards Common Program, the conclusions were drawn from :

- **An inventory and identification of existing national programs/projects and related planned programs/projects for the next years, and**
- **An analysis of the convergence, the gaps and the alignment of the different projects, leading to identify the contents of the Common Program.**

1. The Med-SHIP program ⁽²⁾

CIESM Workshop Monographs, n°43:

Designing Med-SHIP: a Program for repeated oceanographic surveys 11 – 14 May 2011, 162 p.

<http://www.ciesm.org/online/monographs/Supetar.html>

1.1 Introduction and presentation of the Med SHIP program

At the international level, IOCCP and CLIVAR had organized the GO-SHIP Program in 2007. Strategy for a sustained global repeat hydrography program was designed to:

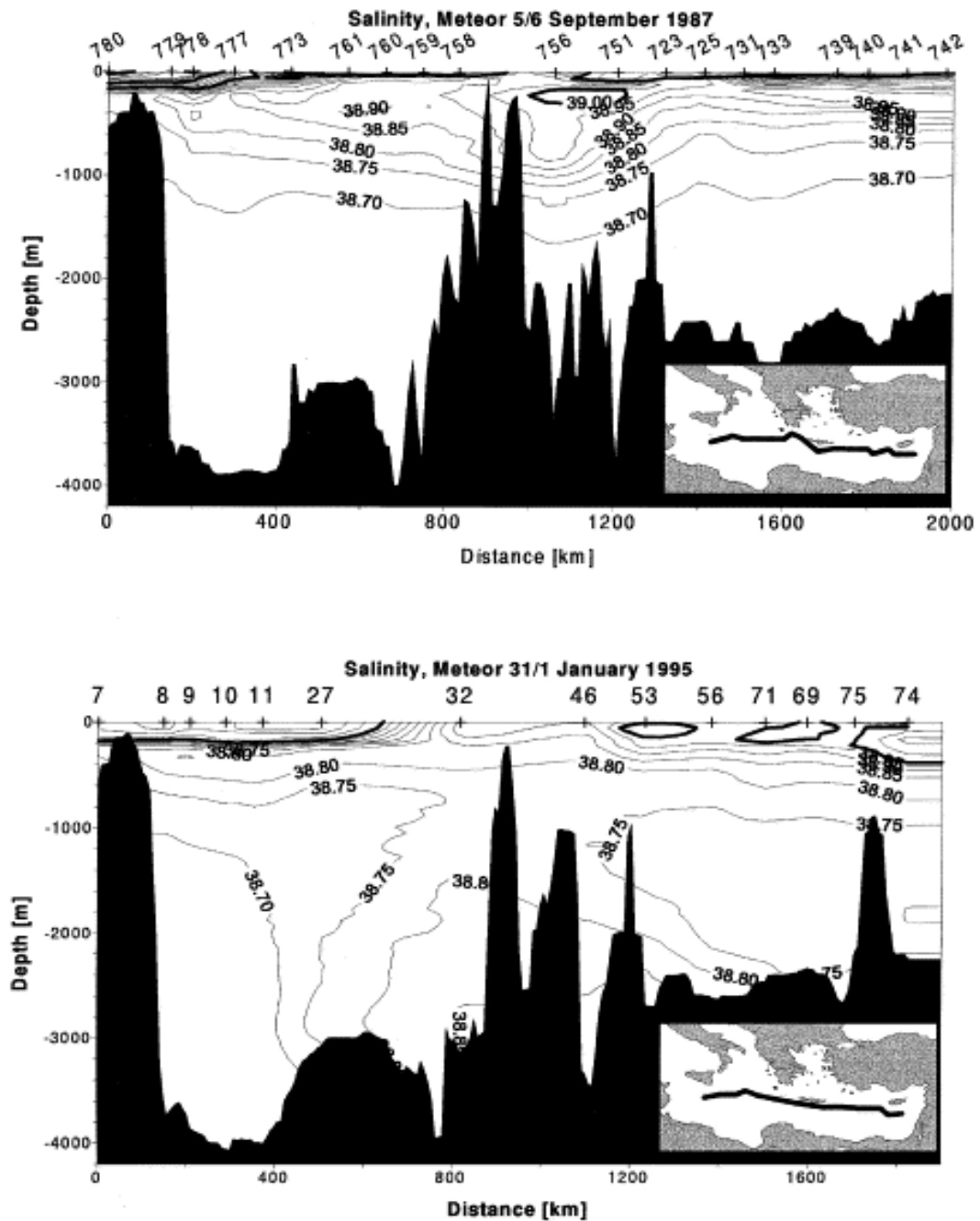
- ⇒ Develop formal international agreements for a sustained international repeat ship-based hydrography program,
- ⇒ Develop internationally-agreed strategy and implementation plan building on the guidelines in the Community White Paper,
- ⇒ Advocate for national contributions to this strategy and participation in the global program,
- ⇒ Provide a central forum for communication and coordination,
- ⇒ Develop syntheses of hydrographic data, in partnership with national, regional, and global research programs.

(1) list in annex 1

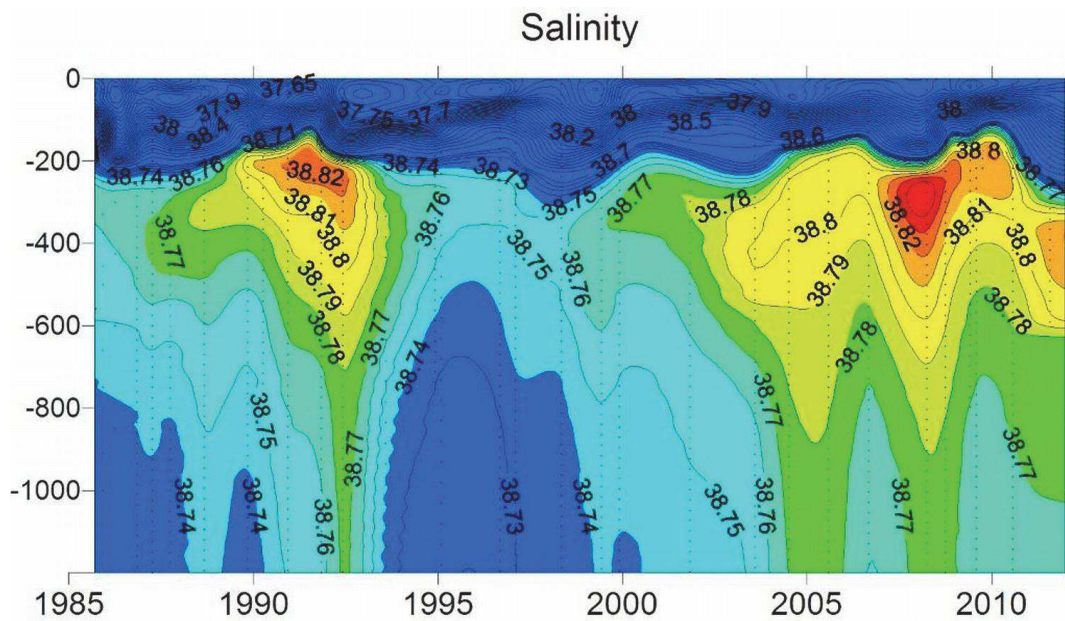
(2) By Miroslav Gacic (CIESM Coordinator, OGS, Italy)

CIESM developed the same approach to the implementation at the regional level of the Mediterranean Sea for inventories and planning repeated basin-wide surveys for climatic studies.

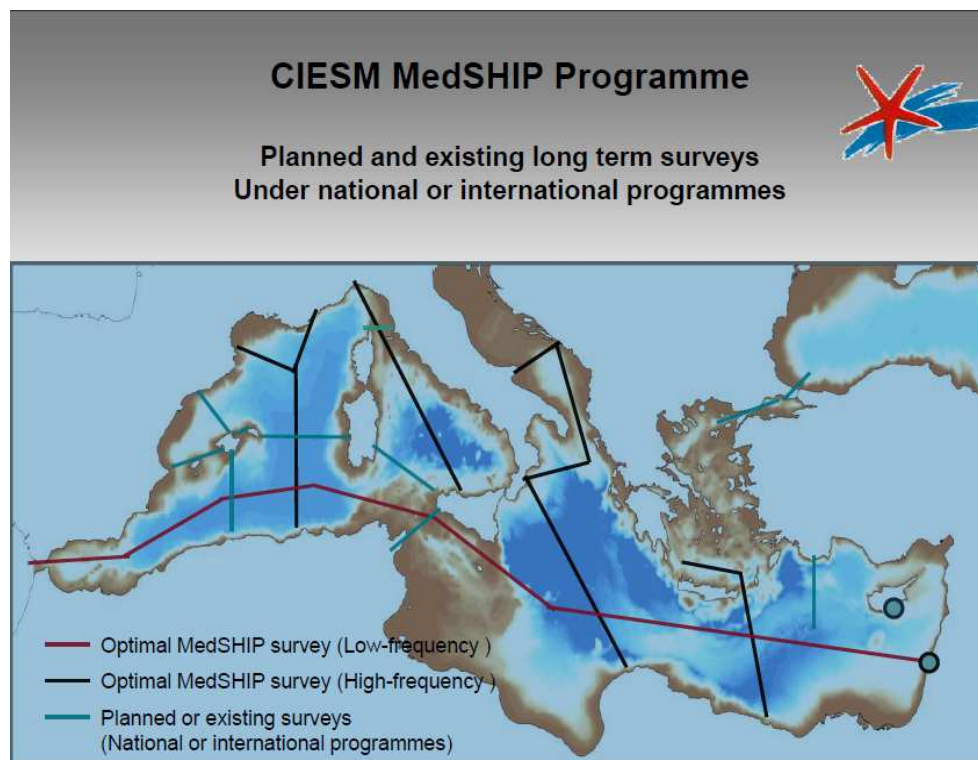
Examples of surveys which demonstrate the variability of deep waters



Long term evolution clearly demonstrates important variability of high salinity waters which has large consequences on the whole ecosystem functioning, on the biochemical budget and productivity of the area.



1.2 CIESM recommendations



The MedSHIP Program recommends support for optimal surveys:

- 1 East-West line (in red color) - low frequency - every 3 years
- 4 North-South lines - high frequency - each one every 1 or 2 years

CIESM plays an important role in the Mediterranean to reinforce cooperation between scientists from all neighboring countries, but the CIESM is not an advisory body for its members and international treaties. There is no strong commitment from Member States to devote large infrastructure and access to scientific vessels.

In Seas-era network through a dedicated work package on “infrastructure”, one of the main objectives to be attained is *a better and sustainable use of the existing marine research infrastructure*. Note that in the ERA-Net only the EU members are involved

2. Research activities in the respective countries *which can be shared at regional level*

See synthesis of the national expert presentations in annex 2

Current research / national programs/projects in progress

Main results , reasons to be shared by different countries

Planned projects (next 4 years)

3. Analysis of the existing research: convergence, gaps and alignment of the different projects

Projects reduced or stopped which have international consequences in the Med opinions on needs, gaps, what needs to be done

Comment on the indicative research priorities/enabling actions relevant to the sector

Identification of selective programs (between 2 and 3) upon which you propose joint collaboration

3.1 General background

Even if the objective is to build proposals for common programs within Seasera as well for data management, data acquisition and modeling, the group wants to promote an integrate approach combining modeling efforts and multi-level nested data acquisition via oceanographic cruises, autonomous stations and satellite observations.

The present “ocean operational observing systems” in the Mediterranean are a small number of regionally or nationally supported systems which are based on several measuring platforms, including in general research vessels (R/V), to survey a given region (ADRICOSM in the Adriatic, CYCOFOS south of Cyprus, MOOSE in the North Western Mediterranean, POSEIDON in the Greek waters, mainly the Aegean, and SOCIB around the Balearic Islands). All these systems deliver near real time and quality checked information which is distributed to the public, in particular through the Marine Core Service channels.

The coordination between these systems is weak, except from the platform point of view where several European MRIs (EuroSITES, EuroARGO, GROOM, JERICO, ...) are active to guarantee in principle common methodologies at the European level, including for the above systems which rely on these MRIs.

In addition to these systems, there are also some useful thematic systems or networks: some are based on one single platform (e.g. R/V based hydrological survey of the RADMED project from IEO) and/or limited to a very restricted set of parameters (e.g. the HYDROCHANGES network of bottom moorings from CIESM). Some of these networks may have an international coordination but, in that case, without any long term national nor European support.

Even if RVs are no more the unique platform to collect in-situ hydrological information, hydrological surveys are still needed for three important reasons: (1) Some essential ocean parameters are only accessible through this platform; (2) there is need for ground truth on the long term for modeling purposes as well as for the parameters collected by the other autonomous platforms, as their sensors can drift or because they collect only proxies; (3) Some regions cannot be easily surveyed by the other platforms; (4) geochemical approaches and the coupling with biological parameters of the food chain is possible only through direct in situ observation with R/V.

R/VS are also expensive. The existing regional vessels or coastal R/Vs in South of Europe suitable for surveys or research cruises in the Mediterranean are becoming sub critical, especially on a long term perspective. Furthermore, they are managed independently at the national level.

3.2 Data base

Scientists point out that common database must be maintained in the duration. Previous records collected in the MEDATLAS database were unfortunately stopped.

Some preliminary work must be carried out on:

- What data is required?
- How can they be calibrate and validate?
- Harmonization of key-parameters and upgrading of instrumentation between stations and other observations time series types including opportunities measurement.

Recent multidisciplinary approaches and the demands of the new EU Directives (WFD, PCP, and MSFD) are in favor of increasing the number of parameters collected simultaneously with a unique or connected regional database.

The development of the database must be built to capitalize on the amount of data regarding climate change and its long term evolution. Basic statistical tool must be associated to recognize trends in the variations in marine ecosystems that are particularly relevant in the context of global change.

The database can be used as a tool for planning future observations. For example, the spatial analysis of regional areas function could demonstrate areas where tremendous gaps are recorded.

Therefore, it is imperative to plan future international campaign in this area. It could become a useful tool to complement the knowledge of poor data areas focusing on gaps. Otherwise it will be also of help to optimize observations, avoiding duplications and addressing the good time scale. It was noted that the database must include historical data and connecting with the previous MEDATLAS.

Discussion on property rights and free access to the data must be a long term objective.

On these aspects, an agreement between Seas-era partners and associated partners can be proposed as a first step.

The group has expressed concern about the difficulty of maintaining this Mediterranean database as there is a need for funding for a long time, especially data from the open sea. In contrast to the Baltic Sea, North Sea and the other regional Atlantic areas, where ICES supports these regional databases, with a co-funding from members countries and the EU. Such efficient system is not set up to for Mediterranean areas.

3.3 Modeling

The participants recognized all that more coordination in the modeling exercises shall be organized. The purpose is not to try to support a unique model but to organize through inter-comparisons of different approaches and tools, the strength and the weakness of each of them.

Integration of the different scales must be retained:

- for the time scale, past/actual/future scenario at the decadal scale must be analyzed.
- for the space scale the whole Mediterranean Sea as well as the regional and at the local scale (bay, harbor...) must be approached by downscaling techniques
- at the regional levels, effects of freshwaters inputs (rivers...) must be incorporated to analyze the forecast scenario in relation with an increase of drought

The goal is to achieve an Integration of the different numerical models with components from hydrodynamic model to couple with geochemical components and biological food chain. If the physical parameters are quite robust, ecological modeling needs still some improvement. Modeling climate evolution is also a new area of research as there is a need to develop long term scenarios at Mediterranean scale (coupled ocean/atmosphere modeling if needed)

3.4 Long term observational network

3.4.-1 Analysis of the gaps:

The first concern is the parameters which are collected as they have to fulfill the needs related to the MSFD or the GMES. These gaps definitively prevent from having a global view of the Mediterranean Sea in both space and parameters. And as a consequence, there are big gaps in the services that these systems and networks can deliver, in particular for the important fishery sector which needs a global view of the stocks and of the environmental conditions (e.g. qualitative descriptors of the MFSD).

The second gap concern the Research Vessels (R/V)

It is also clear that the R/V component of the observing systems is not as well defined as other physical instruments such as profiling floats, fixed point observatories or gliders, because of the lack of an agreed international coordination on the scientific objectives and obvious operational considerations. This gap has important consequences because still today some data can be collected only by R/Vs such as the chemical and the biological parameters and because data collected by RVs act as reference data for the calibration of the sensors on the other platforms.

3.4-2 An Inventory of Existing R/V based hydrological surveys in the Mediterranean Sea has been proposed by INSU (<http://www.dt.insu.cnrs.fr/flottille/flottille.php>)

Surveys in the frame of research projects

This concerns traditional research cruises for dedicated process studies or mapping, carried out with some periodicity over several years. The parameters space depends on the scientific objectives, and can range from basic CTD cruises to the acquisition of complex parameters (geotraces, genomics, etc.) with subsequent different coverages in time and space. The periodic character is motivated in

general by a focus on the mesoscale or the seasonal variabilities (e.g. POEM, VECTOR) or on the interannual variability and trends (e.g. the METEOR cruises in the 80-90s), in this last case with a large scale/low resolution character in general. During the FP6-SESAME, some cruises of this last type have been carried out with the aim to cover all sub-basins.

Regular transect from the coast (radial transects)

Regularly carried on the same section, between the coasts to a point offshore, these surveys have been (successfully) designed to build long time series of some core parameters. Only a few prominent examples are available in the Mediterranean: the DYFAMED monthly section off Nice (performed by LOV/CNRS), the RADMED (performed by IEO) annual 'radiales' survey over almost the whole Mediterranean Spanish coast. Here the parameters space covers the so-called JGOFS core parameters, extended to some (chemical) environmental tracers in the case of RADMED.

Mesoscale surveys

Such long term periodic mesoscale hydrological surveys are needed because of the importance of the fluxes induced by such processes in the Mediterranean. These surveys intend to give a 'ground truth' over a large area at least on an annual basis which is useful in particular for model validation. The annual survey carried south of Cyprus (CYBO performed by UCY) since two decades is the best example in the Mediterranean.

Basin scale surveys

The MEDOCC cruises carried from 2005 to 2010 by ISMAR-CNR is good example with a sampling strategy based on a 'box' approach covering the Western Mediterranean Sea. In the frame of MOOSE, R/V cruises over almost the whole North-Western Mediterranean have already been carried annually since 2010, with a relatively high space resolution. This survey is scheduled at least up to 2020. In this area, the annual basis is also motivated by the rapid changes of deep water formation because of climate warming. The parameter space of MOOSE is based on 'JGOFS' rationale but, thanks in particular to new optical devices, is extending now to much more complex information (zooplankton indicators from video, particle counters, etc.).

Voluntary observing ships and ships of opportunity (VOS/SOOP)

It is worth mentioning, the XBT (profiles of temperature) surveys carried out from VOS during the early stages of the Mediterranean operational oceanography era (VOS-XBT program coordinated by ENEA during the two FP5 and FP6 MFS projects). But this effort was supported mainly by EU funding for demonstration purposes. The TRANSMED (now PARTNERSHIPS) program from CIESM (continuous surface measurement) has some similarities with the FERRYBOX European network, but is addressing at the moment only T and S and only one ship is presently equipped.

Data Collection Framework for the Common Fisheries Policy

It is also worth mentioning here DCF surveys, which are targeted for assessing specific fish stocks, usually on an annual basis. This data collection effort could be valuably exploited for the hydrological monitoring if CTD were performed during DCF surveys. An important source of economy is at stake here since these surveys are already supported mainly by the EC in the frame of its CFP.

4. Identification of potential projects/tasks to be shared between voluntary countries - Explore possibilities

4.1 Needs for use of R/V in the Mediterranean for long time series observation

Up to now time-series are too short to obtain reliable pictures of global change impact on biogeochemical cycles in the Med as decadal variability dominates the evolution of the deep waters.

This unique international programme has to be co-built by the scientists of the countries interested (Spain, France, Italy, Greece, Turkey, Germany...) on a decadal time scale.

After validation by the member states or their institutes, this programme would be cofounded by the different national agencies. It will optimize ship-time resources in order to plan repeated hydrographic surveys at basin and sub-basin scale.

As the main costs are the R/V it is proposed that a long term agreement would be signed by the different members with allocation of ship time.

This reduction of fragmentation between the different national programmes normally will allow reduction of national costs by sharing facilities with cooperating partners. For example each country will support 2 surveys for a programme phase of 10 years in the case of 5 partners involved.

Furthermore this project will largely contribute to an increase of the scientific cooperation in the scope of impact of climate change on the Mediterranean Sea ecosystem.- Of course this project will improve spatial cover for process studies at regional scale, going also in areas of difficult access (e.g., the Croatian coast of the Adriatic, the Lybian continental shelf). The CIESM MEDSHIP recommendations are: North South radials, annual bases: Spain, France, Italy, Greece, Turkey and East West radials each 3 years: Spain, France, Germany.

The time scale is not definitely fixed and could be modified function of the international negotiations.

4-2 Implementation of a future integrated long time observing system

Based on the above elements, there is a consensus during the Seas-Era Workshop to say that building the R/V component of a future integrated long time observing system can be achieved only with a strong international cooperation including as a first phase the European level.

Due also to the fact that most of the present systems are not mature enough and need still consolidation by the scientific communities, a massive effort for a long term R/V based monitoring in the Mediterranean will be done progressively.

4-3 Human Capacity Building

Process ref. Seasera Deliverable N°: D.5.3.1 (CNR/DTA Italy),

Preliminary proposals of Human Capacity Building actions have been addressed for the Common Programs implementation

- Master course/workshops for researchers to implement long-term climatological models
- Training course for technicians to routinely perform oceanographic data analysis
- Internship for technicians/operators to build a team to specifically manage oceanographic campaigns for the purposes of CP

Conclusion

The group of experts discussed the following specific topics:

- Data management (included property rights), and best practices of data maintenance (included instruments calibration);
- Long-term climatological modelling at regional scale;
- Trans-Mediterranean common transects to monitor long-term variations.

It appears that there is an urgent need to share vessels between the countries that are interested in participating to the cross Mediterranean surveys.

The scientific community of the Mediterranean region have large difficulties in establishing long term monitoring activities to follow the physical impacts and biogeochemical changes in relation with climate change. These actions are not supported by grants and proposals of the EU and the national budget are declining.

5 main proposed actions have been identified:

- (1) Co-organize between CIESM and Seas-era, a special session on the MedSHIP program at the next CIESM Congress (Marseille 2013) to address common issues: ship time, manpower...
- (2) The Mediterranean countries must address the urgent need to build an international database. During the joint session CIESM/Seas-era on the MedSHIP program (CIESM Congress - Marseille 2013) the building of common database, common data access and data policy rights will be highlighted
- (3) A sub-group has to write a short document outlining the main ideas and the content of an inter-modeling exercise. This document can also cover the Black Sea as the same tool kits are or can be used. This document would be useful for further activities inside Seas-era.
- (4) Seas-eEra WP2 will: (i) provide for the adoption of this vision within the Seas-Eera Steering Committee, (ii) present the program as a pilot case study to JPI Ocean, (iii) validate the concept by implementing a pilot project to demonstrate the potential sharing R/V
- (5) HCB needs have to be validated and confirmed by the partners. Seasera WP2 and WP4 recommend including HCB plan as an important part of the Seasera Med CP

Further developments - supported the idea of identifying an international long term monitoring programme coupling physical, geochemical and biological observations – Commitment of Members States and International cooperation

- WP2 has provided the synthesis and the recommendations of the meeting to the Seas-era Steering Committee (Feb.2013) which:
 - supported the idea of identifying an international long term monitoring programme coupling physical, geochemical and biological observations to follow and to model the impact of climate change [physical characteristics, geochemical consequences and biological impacts through the food chain],
 - agreed that the writing of the precise content of this programme can be continued within the WP2 of Seas-era "common program",
 - pointed out that negotiation of an agreement between the countries for sharing vessels is a long term issue and perspective. JPI could be the framework to address this issue
- WP2 has worked on this project and recently, on behalf of the Seas-Era partners, France has proposed this idea to the governing board of the JPI Ocean (Feb.2013), including also a long term monitoring approach through transect cross the Mediterranean Sea.

The proposed case study for the JPI is **“Sharing vessels facilities for the achievement of long term common programmes on impact of climate change on physical circulation, geochemical and biological consequences in the Mediterranean Sea”**.

The proposed case study for the JPI is to invent a new way of sharing large vessels infrastructure to implement a common international programme. It is different from the exchange of OFEG and different from the offer of EUROFLEET 1 and 2. Members of the JPI have to commit their fleet managers to see how they can find the way to plan self-organization for next decade:

- An annual trans-Mediterranean international campaign with scientists from the North, the South, East and West of the Mediterranean Sea. The following countries have expressed their interest: France, Spain, Italy, Germany, Greece, Turkey (and others?) which are working actually in isolation.

The ERA-Net Seas-Era cannot do this task as it is a long term issue and Seas Era will end next year. It would be a great success for the JPI if it manages to go further in common programming by sharing vessels for a unique important international programme in the Mediterranean Sea.

The scientific advisory board of the JPI has strongly supported this proposal. However it insisted that preferably in two years a clear result of the proposal should be visible and at first feasible through a case test study. Each proposal should have the commitment of at least four countries to be assessed as mature...

Annex1 – Seasera Med group - List of the national experts

Attendance list

Seasera Mediterranean Workshop on
Climate change impact on physical circulation and biogeochemical consequences.

27-28 September 2012
Ifremer - Toulon (France)

Name	E-mail	
Eva Krasakopoulou	ekras@hcmr.gr	Physicist - Oceanographer Hellenic Center for Marine Research (HCMR), Greece
Dimitris Velaoras	dvelaoras@hcmr.gr	Physicist - Oceanographer Hellenic Center for Marine Research (HCMR), Greece
Miroslav Gacic	mgacic@ogs.trieste.it	Head, Oceanography Group Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS (Trieste) Italy
Leonardo Langone	leonardo.langone@bo.ismar.cnr.it	CNR-ISMAR, Bologna – Italy
X. Antón Álvarez-Salgado	xsalgado@iim.csic.es	Instituto de Investigaciones Marinas (CSIC), Vigo, Spain
Rosa Balbín-Chamorro	rosa.balbin@ba.ieo.es	Instituto Español de Oceanografía (IEO) Palma de Mallorca, Spain
M. Montserrat Sala	msala@icm.csic.es	Institut de Ciències del Mar (CSIC), Barcelona, Spain
Emin Ozsoy	ozsoy@ims.metu.edu.tr	Institute of Marine Sciences, Middle East Technical University, Turkey
Mustafa Kocak	muskocak@yahoo.com	Institute of Marine Sciences, Middle East Technical University, Turkey
Pierre Garreau	Pierre.Garreau@ifremer.fr	Ifremer , Brest France
Isabelle Taupier-Letage	Isabelle.Taupier.Letage@ifremer.fr	Mediterranean Institute of Oceanography (MIO),UM110 Antenne de La Seyne
Margherita Cappelletto	margherita.cappelletto@cnr.it	Seasera WP4, Department of Earth and Environment National Research Council, Italy
Maurice Heral	Maurice.Heral@agencerecherche.fr	Seasera WP2, Head of department ANR, France
Sophie Sergent	sophie.sergent@ifremer.fr	Seasera WP2, European Affairs Department Ifremer, France
<i>and writing contribution from</i>		
Laurent Mortier	laurent.mortier@locean-ipsl.upmc.fr	LOCEAN, France

Annex2 – Synthesis of the national expert presentations

Leonardo LANGONE - Italian National Research Council (CNR) - Institute of Marine Sciences (ISMAR), Bologna

ITALY	National Projects / Installations	Description	Key issues
<p>Observational System - a wide series of observing systems maintained by many different institutions <i>ISMAR, ISSIA, ISAC, ISSIA, IAMC, CoNISMa, INGV, OGS, SZN, ENEA, ISPRA, E.R region, regional agencies</i></p>	<p>No specific national program, many national and EU research projects supported the observational system consisting in:</p> <p>Large scale hydrological cruises / repeated transects</p> <p>Buoys, platforms, moorings or floating and other fixed sites</p> <p>Volunteer Observing Ships (VOS) / Fishery Observing System (FOS)</p> <p>LTER-IT marine stations (North Adriatic, Antartica, Venice Lagoon, Portofino MPA, Gulf of Naples, marine ecosystem of Sardinia)</p> <p>MSFD implementation</p>	<p>Prevalence of observations in the Adriatic Sea</p> <p>ISMAR sites: PALOMA, Acqua Alta, S1, E1, TeleSenigallia, Gargano, Bari canyon moorings, moorings C01, C02 and COR,</p> <p>ISSIA site: W1-M3A</p> <p>IAMC sites: ENERMAR-KOBOLD</p> <p>OGS sites: Mambo1, E2-M3A</p> <p>Transects: North Adriatic, Senigallia, Gulf of Manfredonia, Bari-Dubrovnik, Strait of Sicily, Corsica channel</p>	<p>The Adriatic sea → one of the most sensitive areas of the Mediterranean to climate changes in the incoming decades, both as regards hydrological properties and biogeochemical characteristics</p>
<p>The Italian Research for the Sea - Marine and maritime policy</p>	<p>RITMARE</p>	<p>Duration: 2012-2016 Coordinator: Consiglio Nazionale delle Ricerche (CNR) Funding from Ministry of University and Research: 250.000.000 € Public and private Partners</p>	<p>Development of research infrastrutture</p> <p>⇒ a new research vessel</p> <p>⇒ improvement of the observational network:</p> <ul style="list-style-type: none"> - real time connected sites with application of RT_QC methodology - remote sensing observations (development SAR component) - coastal radar in key areas - building of fleets of autonomous vehicles (gliders, argofloats, USV) - development of deep sea observing stations - set up of a relocatable observing system for specific applications at high-resolution spatial scale

			<ul style="list-style-type: none">- reduction of fragmentation from single observing sites to observatories and integrated networks (fixed stations, VOS, floating instruments, satellite obs, ...)- integration of observing system and marine forecasting system
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X. Antón Álvarez-Salgado – Instituto de Investigaciones Marinas (CSIC), Vigo, Spain

M. Montserrat Sala – Institut de Ciències del Mar (CSIC), Barcelona, Spain

SPAIN	National Projects / Installations	Description	Key issues
<p>MINECO projects 2012–2015</p>	<p>CSIC research on global change in the Med Sea</p>	<p>Universities, CSIC, IEO, Others Total funding of the main projects : >2000Keuros - Global change and acidification - Biogeochemistry in the coastal ocean - Aerosol deposition - Biogeochemistry of the open ocean - Mediterranean flux of waters</p>	<p>Multidisciplinary perspective to investigate the processes governing the transformations of dissolved organic matter in contrasting marine systems</p>
	<p>HOT-MIX</p>	<p>Dark-ocean water mass boundaries and mixing zones as "hot-spots" of biodiversity and biogeochemical fluxes across the Mediterranean Sea and Eastern North Atlantic Period: 2012–2014 Funds: 400.000 €</p>	<p>To understand the dynamics of the diversity and function of the meso- and bathypelagic food web in relation to the hydrographic and chemical conditions in distinct deep-water masses of the Mediterranean Sea and the Eastern North Atlantic and at interfaces between water masses, where diversity hot-spots are expected to occur as predicted by the ecotone concept</p>
	<p>DO-RE-MI</p>	<p>Dissolved organic matter remineralization in the ocean: microbial and biogeochemical constraints Period: 2013–2015 Funds: 275.000 €</p>	<p>To examine the biological and biogeochemical mechanisms that hinder DOC mineralization</p>
	<p>Mediterranean flux of waters (University of Malaga) Project: INGRES-3.</p>	<p>Mediterranean flux in Gibraltar, influence of ventilation of Mediterranean waters and coupling with central waters in the Cadiz Gulf Period: 2011---2013</p>	

CSIC CLIMATE CHANGE observatories /Times series	BLANES BAY MICROBIAL OBSERVATORY (ICM/CSIC)	Blanes Bay Microbial Observatory Location: Blanes Bay, 1 mile offshore, 20m depth Starting date: 1992 (temp and chla). 2002 biological parameters	Frequency: monthly Variables: temperature, salinity, inorganic nutrients, chlorophyll and phytoplankton, microbial activities and diversity
	BARCELONA (ICM/CSIC)	Coastal Monitoring Station of Barcelona Location: 8 stations in a transect in front of Barcelona. Urbanized area Starting date: 2002	Frequency: monthly Variables: temperature, salinity, turbidity, inorganic nutrients, chlorophyll and phytoplankton.
	ESTARTIT—ILLES MEDES (ICM/CSIC)	Location: 4km off the coast of Estartit, in a fishing protected area Starting date: 1973	Frequency: Monthly Variables: temperature, salinity, turbidity, oxygen, alcalinity, pH, Inorganic nutrients, chlorophyll, coccolitophorids, flow cytometry
	OOCS (CEAB/CSIC)	Operational Observatory of the Catalan Sea (OOCS) Location: Blanes, 192m depth. 5.6 km off the coast. Starting date: 2009.	Frequency: Real time data from sampling buoy. 15 days sampling Variables: temperature, salinity, turbidity, irradiance, inorganic nutrients, meteorological conditions, chlorophyll, cytometry
	Cap Salines (IMEDEA/CSIC)	Location: Cap de Ses Salines. Mallorca. Coastal Starting date: 2004	Variables: Chlorophyll, Nutrients, pCO ₂ , T, S, DOC, VOCs, phytoplankton, cytometry, marine angiosperms (<i>Posidonia oceanica</i>), plankton metabolism.
	GIFT (ICMAN/CSIC)	Gibraltar fixed time series -from 2005 Integrated in FP VII project CARBOCHANGE and ICOS (Integrated Carbon Obs. System) Location: 3 deep stations close to the coast Starting date: 2005	Frequency: seasonal Variables: temperature, salinity, turbidity, oxygen, alcalinity, pH, pCO ₂ , DOC, TOC, DON, ADCP
	<u>SMOS satellite mission in the Mediterranean Sea</u>		Pioneer technology for Earth observation (microwave interferometric radiometer) -ICM leading European research activities for salinity retrieval algorithm -SMOS Barcelona Expert Centre (CSIC+UPC) working to improve data quality (brightness temperature, salinity, soil moisture) plus high level products generation and distribution -Ocean data in the Mediterranean degraded by land contamination and radio frequency interferences due to illegal emissions in the protected band

<p>Large scale facilities</p>	<p>Installations, resources Services to the National and International scientists</p> <p>SOCIB Multiplatform that provides streams of oceanographic data and modeling services to support operational oceanography</p> <p>OCCMUR</p> <p>OBSEA</p>	<p>Total: 54</p> <p>Balearic Islands Coastal Observatory System <i><u>See more details below</u></i></p> <p>Coastal Ocean Observatory of Murcia</p> <p>Expandable submarine Observatory</p>	<p>Under construction - Base of work for research in oceanographic and biological processes linked to climate change Will provide: Facilities for oceanographic and ecosystems forecasting</p> <p>Location: 4km off the coast in Vilanova, in a fishing protected area Equipment: Videocamara and sensors: pressure, salinity, temperature and conductivity, Open to new incorporations.</p>
<p>Spanish fleet of research Vessels</p>	<p>CSIC, CSIC/Army, IEO</p>		

Rosa.balbin - IEO Instituto Español de Oceanografía, Baleares, Spain

SPAIN	National Projects / Installations	Description	Key issues
Monitoring	<p>IEO Mediterranean monitoring</p> <p>RADMED</p> <p>IBAMar 2.0 Data Base</p>	<p>RADiales del MEDiterráneo - the IEO carries out quarterly cruises covering a large set of oceanographic stations along the Spanish Mediterranean and are distributed in transects perpendicular to the coast (some since 1992)</p> <p>A new database with the oceanographic data obtained from cruises from 1974 until 2010 in Western Mediterranean waters. Compilation of data from 27 research projects within 134 oceanographic surveys developed by the COB-IEO</p>	<p>The basic strategy is to explore the different areas where differences in the large scale oceanographic conditions could be expected. The sampling includes: T, S, DO, chl_a, inorganic nutrients, phyto and zooplankton abundance and taxonomic composition. Actually, other variables of key importance: pH, Total Inorganic Carbon, nitrous oxide and methane.</p> <p>In IBAMar 2.0 database are included: P, T, S, DO, turbidity, chl-a and nutrients.</p>
Climate Change	IEO Mediterranean Group on climate change (MGCC)		<p>Improve the knowledge about the health state and functioning of the Mediterranean waters. Special attention to the possible effects of climate change and the alterations that it could induce in the Mediterranean marine environment <i>See MGCC web</i></p>
Modeling at basin scale In Spain	<p>SOCIB facilities</p> <p>Puertos del Estado - VANIMEDAT-2 project</p>	<p>Balearic Islands Coastal Observing and Forecasting System SOCIB is a multi-platform distributed and integrated system that provides streams of oceanographic data and modelling services to support operational oceanography in a European and international framework, therefore also contributing to the needs of marine and coastal research in a global change context.</p> <p>Impact of climate change in the Mediterranean Sea from a regional ocean model</p>	<p>In line with EuroGOOS, operational oceanography is here understood in a wide sense, including both the systematic long-term measurements of the seas and their interpretation and dissemination</p> <p>This allows a quantitative increase in the understanding of key questions on oceans and climate change, coastal ocean processes, ecosystem variability, sea level rise, etc. and also drives towards a more science based coastal and ocean management.</p> <p>SOCIB is not carrying out direct research activities (except in specific areas directly related to SOCIB objectives) but provides support for them. The research activities are being carried out by IMEDEA, COB/IEO and UIB, among other organisations, in close coordination to SOCIB.</p>

Mustafa Koçak - Institute of Marine Sciences - Middle East Technical University, Turkey

Emin Özsoy Institute of Marine Sciences - Middle East Technical University Erdemli, Mersin, Turkey

TURKEY	National Projects / Installations	Description	Key issues
<p>Government of the Turkish Republic</p>	<p>DEKOSIM (CMECLIM) IMS-METU MARINE ECOSYSTEMS AND CLIMATE RESEARCH CENTER</p>	<p>Center for Marine Ecosystems and Climate Research 2012-2014 Monitoring of climate variability and sensitivity to climate change in the seas surrounding Turkey – in situ and satellite observation systems, digital data transfer, model based prediction, forecasts and services</p> <p>DEKOSIM Infrastructures (1) Computing center (2) Satellite communication (3) Research vessel (4) Deep sea mooring (5) Glider (6) Moored instruments (7) APEX ARGO (8) Coastal mooring system (9) Small boat (10) Atmospheric sampling tower (11) Research center</p> <p>Coasts of Turkey to the Mediterranean Levantine Basin, Aegean Sea, Black Sea, Turkish Straits System</p>	<p>Carry out experimental research in line with the objectives and research focus of the Intergovernmental Panel on Climate Change (IPCC) and provide scientific and management-related products primarily for the national institutions of Turkey but also with a global perspective in order to help enhance the climate related research.</p> <p>To enable:</p> <ul style="list-style-type: none"> - new multidisciplinary research programs and projects, based on the DEKOSIM infrastructure - interactions and collaborative research with national and international groups (seminars, courses, workshops, colloquia, conferences) - participation in research, networking, collaboration development of marine governance and contribution to marine policy <p>Scientific advisory council Marine ecosystems and climate research working group</p>
<p>TÜBİTAK / 2011 – 2014</p> <p>TÜBİTAK / 2011 – 2013</p>	<p>MYTITURK</p>	<p>Deep Sea and Continental Shelf Dynamics, Bacterial and Primary Productivity Potential And Upper Trophic Level Interactions of Different Eastern Mediterranean Ecosystems</p> <p>The Effects of Acidification on the Pelagic Food Web of an Eastern Mediterranean Coastal Area</p> <p>Sub-regional Surveys for the Assessment of Contamination Level of Aegean and Mediterranean Coastal Waters of Turkey Using Caged Mussels Existing in Turkish Coasts UNEP – MAP / 2011 – 2012</p>	

TÜBİTAK 2012-2015		Dynamics of high Energy Environment: Processes at the Turkish Straits System (DEEP)	
TÜBİTAK 2011-2015		High Reynolds number turbulent mixing in Bosphorus Strait (TURBO)	
Future projects	Towards a Black Sea Protection and Prediction System (BSPPS)	Predicting vital characteristics of the Black Sea at both short and long lead times.	Dynamic downscaling will be employed in a regional modeling framework; on-site sensors; and satellite observations to generate skillful and usable forecasts for the Black Sea watershed with high spatial resolution.

Pierre GARREAU / IFREMER, France

Isabelle TAUPIER-LETAGE - CNRS/Aix-Marseille Université MIO UMR7294 /AMU/CNRS/IRD/USTV, France

FRANCE	National Projects / Installations	Description	Key issues
<p>Observations of the long-term effects of climate change and those caused by human activities in North Western Mediterranean</p>	<p>SOERE MOOSE (Banyuls/UPMC)</p>	<p>Mediterranean Ocean Observing System on Environment The SOERE MOOSE is based on: 1) a network of marine measurements from fixed platforms (surface buoys, mooring lines deep) and mobile (ships, gliders, drifters) 2) and continental sites for monitoring rivers, atmospheric inputs and the currents of surface radar remote sensing.</p>	<p>Objectives: to sustain the time series of observations, harmonize strategies between laboratories, implement measurement means for a modern and automated observation coupled ocean-atmosphere and significantly increase the data stream real time to better constrain climate-ocean models and those related to operational oceanography. Finally, with the help of models, MOOSE must provide the data needed to establish scenarios for the "future" that will explore the evolution of the Mediterranean in response to climate change and anthropogenic pressures, thus offering adaptations</p>
<p>Hydrological cycle in the Mediterranean eXperiment</p>	<p>HYMEX (CNRS/INSU)</p>	<p>Ocean atmosphere interaction (flux of water) Focus on extreme event Observation (2010-2020 + regional enhanced approach + event approach) Trans-Med monitoring with opportunity ships Modeling plate-form at global/basin/regional scale (MEDCORDEX)</p>	
<p>Marine biogeochemistry and biological ecosystems</p>	<p>MERMEX Institut National des Sciences de l'Univers (CNRS/INSU)</p>	<p>Marine Ecosystems Response in the Mediterranean Experiment - associated to other programmes related to the study of the hydrological cycle (HyMeX) and atmospheric chemistry (ChArMEx) in the Mediterranean basin. - Deepen the current understanding of the Mediterranean marine ecosystems to better anticipate their upcoming evolution. - Focus on the response of ecosystems to modifications of physico-chemical forcing at various scales, both in time and space, linked to changing environmental conditions and increasing human pressure. - Propose a comprehensive, integrated approach considering the continuum between the coastal zone and the open sea and its interfaces, including ocean-continent, ocean-atmosphere and water-sediment to precisely describe and</p>	<p>Coordinated and ambitious strategy addressing simultaneously the physics and biogeochemistry of these systems will permit to explore and analyse the present sensibility of marine ecosystems, and to validate the tools used to forecast their changes.</p>

		model the current state of the Mediterranean ecosystems and the complex interactions existing between the environmental and human factors.	
Conservation of highly diverse benthic ecosystems	ClimCARE Project Period: 2011–2013 CSIC, Ifremer, Ippo Facto	to assess the potential impacts of climate change on coastal benthic ecosystems at regional scale - the Northern Western Mediterranean basin. It is primarily focused on the development of an original strategy combining numerical simulations and thermotolerance of key species	<ul style="list-style-type: none"> - Simulating potential warming of NW Mediterranean coastal habitats. - Assessing biological responses to temperature increase. - To anticipate potential impacts of climate change

D.Velaoras & E. Krasakopoulou - Hellenic Center for Marine Research (HCMR)

GREECE	National Projects / Installations	Description	Key issues
<p>Monitoring, Forecasting and Information System for the Greek Seas</p>	<p>POSEIDON multi-parametric monitoring stations</p>	<p>Up to 10 instrumentation platforms are deployed in key marine areas equipped with sensors for the monitoring of atmospheric and oceanic parameters. Every station can potentially monitor temperature, salinity, pressure and biochemical parameters in several depths by adjusting instruments on the mooring line, as well as atmospheric parameters such as air pressure, air temperature, wind, etc.</p> <p>In the near future, the POSEIDON system will be upgraded with new sensors (CO₂, pH etc). The upgrade also includes installing sediment traps at various depths at the POSEIDON sites. Additionally, deep moorings in each of the Cretan Straits capable of monitoring temperature, salinity and current, will be installed to successfully diagnose deep water outflow from the Cretan Sea to the Emed</p>	<p>Monitoring of atmospheric and marine parameters in both coastal and open ocean areas in order to keep track of seasonal and interannual variability connected to climate change issues.</p> <p>Data produced by the POSEIDON system are used to “feed” numerical models through assimilation schemes. These models are incorporated in the POSEIDON system and provide forecasts for atmospheric, hydrodynamic, wave and ecological conditions in the Aegean and the Mediterranean Seas.</p> <p>The forthcoming installation of sediment traps at various depths at the POSEIDON sites will allow the characterization of sinking particles which could provide valuable information on the C and N sources and budgets and on the biogeochemical processes</p> <p>Deep moorings in the Cretan Straits will monitor deep water production in the Aegean Sea, which plays a key role in the Mediterranean thermohaline circulation connected to climate change.</p>
<p>Technological and oceanographic cooperation</p>	<p>AegeanMarTec</p>	<p>AegeanMarTec” project, financed by the General Secretariat for Research and Technology (GSRT) in the frame of THALIS projects.</p>	<p>Network for the Study of mechanisms fertilizing the North-East Aegean Sea. The project investigates the two major physical mechanisms of fertilization of the Aegean Sea, i.e. the inflow of mesotrophic waters from the Black Sea in the North Aegean, and the wind-generated coastal upwelling taking part in the Eastern Aegean every summer and their consequent effect on the carbon uptake by the ocean.</p>

Links with EU FP7 Projects

- ❑ **MedSeA** Mediterranean sea acidification in a changing climate
Period: 2011–2013
- ❑ **PERSEUS** Protecting European SEas and borders through the intelligent Use of surveillance
Period: 2011–2014
- ❑ **PERSEUS** Policy-orientated marine Environmental Research for the Southern European Seas
Funded by the EU under FP7 Theme “Oceans for Tomorrow”
Total project funding: 13 M de €
Duration: 2012-2015
- ❑ **COCONET** A Coast to Coast Network of protected areas: from the shore to the deep sea
2011 - 2014
- ❑ **OPEC** Operational Ecology: Ecosystem forecast products to enhance marine GMES applications
2012 - 2014
- ❑ **EUROBASIN** EU Basin-scale Analysis, Synthesis & Integration
2010 - 2014
- ❑ **ODEMM** Options for Delivering Ecosystem-based Marine Management
2010 - 2014
- ❑ **MEECE** Marine Ecosystem Evolution in a Changing Environment
2008 - 2012
- ❑ **MedEx** (MarinERA, EU-RTD): Inter-basin exchange in the changing Mediterranean Sea: Impact n ecosystems in the vicinity of the Straits connecting the Mediterranean Sea with the adjacent Basins
- ❑ **MedEcos** (MarinERA, EU-RTD): Decadal scale Variability of the Mediterranean Ecosystem

... a strong coordination with the operational networks **MOON/MedGOOS** in the Mediterranean and **BS-GOOS** in the Black Sea, as well as European initiatives such as the operational **GMES** (Marine Core Service implemented by MyOcean) and other EU projects such as **Euro-Argo, EuroSITES, JERICO** ...

and

EUROFLEETS Towards and Alliance of European Research Fleets & **EUROFLEETS 2**

MFS

MyOcean

GNOO

ENVEUROPE

JERICO

GROOM

...

ESONET-EMSO

EMODNet

SeasDataNet

...