Report after
JERICO Strategy Workshop
30th April 2015

Grant Agreement n° 262584
Project Acronym: JERICO

Project Title: Towards a Joint European Research Infrastructure network for Coastal Observatories

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JERICO

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Executive summary

The workshop "**Strategy towards JERICO-NEXT"** took place on April 30, 2015, in Brest, as a closure for the JERICO(FP7) project and a bridge towards JERICO-NEXT (H2020). The workshop focused on four topical round tables addressing key issues for the JERICO RI long-term sustainability in the context of European Strategies. It aimed at initiating an appropriate coordination between JERICO-NEXT and relevant European organizations, to be followed up during the JERICO-NEXT project. The following conclusions and recommendations can be highlighted:

Infrastructure extension:

- Need to provide more multipurpose systems, hence increasing cost efficiency.
- Better integration of different systems: monitoring vessels, seafloor platforms.
- OSE/OSSE experiments acknowledged as an appropriate tool to analyse, in an objective way, the efficiency of a regional/local network.

Innovation and the link with industries:

- Importance to include cost-effectiveness in the design of systems, in cooperation with system developers and manufacturers, in order to ensure a good market penetration towards stakeholders and users with the objective of answering the need for environment monitoring and assessment of the "significant" environmental impacts.
- Importance to involve industry at the beginning of the process (NEXOS experience) by organising dedicated meeting focused upon industry types/needs.
- Different industries to be considered: developers & providers versus users & stakeholders… be sure developed products/services are of interest for the latter.
- Need to involve industry in the governance in order to optimize the dialogue and the use of test facilities offered through JERICO_NEXT (TNA).
- EuroGOOS seems to be the suitable framework to build upon JERICO FCT and involve the private sector.

European policy regarding coastal data:

- *How to organize EMODnet biology with the observatories for multidisciplinary data?*
- No clear answer, the different systems are not willing to deliver their data because they want to **keep their identity, there is a** problem of **data traceability.** Would a dedicated observing system identifier like a **Digital Object Identifier** DOI answer?
- To develop the intelligent sensor technology (such as plug and play). Closer links with industry are expected.
- Integrated science based on multidisciplinary datasets encompassing physical, chemical and biological data.

European strategy for sustainability of Infrastructures:

- When one plans a new RI, one anticipates the choice of sensors, payloads, etc. In decision making, one anticipates the **type of governance** and how to find the best way to adapt the systems to specific needs (i.e. for industry, science or other purposes).
- Link with JPI- Ocean to be enhanced toward coordination between activities that are common between JPI and JERICO-Next. It is important to have JERICO representatives in the relevant JPI-oceans working group to ensure coordinated actions.
- **During the preparatory Phase of RI, the stakeholder engagement is really important: it is essential to have a clear milestone regarding the consultation of the relevant stakeholders.**
- Towards sustainable ocean and coastal research infrastructure: a scientific excellence is required but also short and long term impacts on jobs, growth and societal challenges. To do so, it is important to consider cost-effectiveness and flexibility.
- Address and engage as many stakeholders as possible: an appropriate communication strategy and an early engagement are the key to succeed.

I] Introduction

Round table 3: European policy for coastal data. **The workshop** "**Strategy towards JERICO-NEXT"** took place on 30th April 2015, in Brest, as a closure for the JERICO(FP7) project and to step ahead towards JERICO-NEXT (H2020). The workshop focused on four topical round tables addressing key issues for the JERICO RI long term sustainability in the context of European Strategies. It aimed at initiating a strong coordination between JERICO-NEXT and relevant European organizations, to be followed up during the JERICO-NEXT project.

Workshop organizing Committee: Chairpersons and JERICO coordination Team.

Round table 1: JERICO RI expansion: approach following the observing system simulation experience (OSSE) and link to non JERICO national coastal infrastructures.

- *Chairpersons*: E. Buch (EuroGOOS), P. Morin (CNRS, JERICO/WP1)
- *Key participants:* H. Wehde (IMR), T. Vukicevic (CMCC)

Objective: to assess the JERICO possible expansion and strategy (ref: D1.11, D9.5, D9.6) in the context of EuroGOOS and Copernicus, to conclude on common priorities.

Round table 2: Scientific needs, innovation potential and the role of the industry

- *Chairpersons:* E. Delory (PLOCAN, NEXOS project coordinator), G. Nolan (MI, JERICO/WP10)
- *Key participants:* G. Petihakis (HCMR), L. Delauney (Ifremer)

Objective: to agree upon technological developments needed to answer scientific priorities and societal requirements/challenges.

- *Chairpersons:* J*B. Calewaert* (EMODnet), P. Gorringe (EuroGOOS, JERICO-NEXT/WP1&WP5)
- *Key participants:* F.Colijn (HZG), L. Perivoliotis (HCMR), L. Petit de la Villéon (Ifremer)

Objective: to be informed on the status of the European strategy in marine data management with a focus on the integration of multidisciplinary data. Considering JERICO-NEXT will support harmonization of new data types, a specific attention will be paid to agree on cross cuttings between the H2020 project and European initiatives.

Round table 4: European Strategy for sustainability of Infrastructures.

- *Chairpersons*: A. Robin (DG Research, Infrastructures PO), D. Durand (IRIS, JERICO-Next/WP1).
- *Key participants*: F. Coroner (JPI)

Objective: to discuss the possible European governance and economical model to sustain a European infrastructure such as JERICO-RI, considering national and European long-term priorities.

Agenda

Time slot	Round table	Speaker

	Thursday, 30th of April	
07:30-08:15	**Bus to Ifremer (Stop at Ibis Styles & Railway station)**	
08:30-08:45	**Introduction**	I. Puillat (Ifremer) J. Newton (Univ. Washington)
08:45-09:15	**Round table 1: JERICO RI Expansion - *Feedback after the observing system simulation experiment and expansion with national coastal infrastructures.***	
10’	*Introduction and presentation of D1.11*	P. Morin (CNRS)
15’	*EuroGOOS, JERICO and EOOS*	E. Buch (EuroGOOS)
5’	*Standardization of OSE/OSSE technology*	T. Vukicevic (CMCC)
09:15-09:45	**Round table 1: Discussions**	
09:45-10:15	*Coffee break*	
10:15-10:45	**Round table 2: Scientific and technological needs - *The innovation potential and role of the industry***	
5’	*Introduction (Eurogoos + WP10 Jerico)*	G. Nolan (MI)
15’	*Innovations for the monitoring of environmental status of the ocean and the link with future blue-growth activities*	E. Delory (PLOCAN)
10’	*Innovations in Technology and Methodology in JERICO NEXT (WP3 J-NEXT)*	G. Petihakis (HCMR)
10:45-11:15	**Round table 2: Discussions**	
11:15-11:45	**Round table 3: European policy for coastal data**	
5’	*Introduction (WP5 JERICO-NEXT)*	L. Perivoliotis (HCMR)
15’	*Marine Knowledge and EMODnet - Consolidating the Foundations, Building the future*	JB. Calewaert (EMODnet)
10’	*Ferryboxes and coastal data*	F. Colijn (HZG)
11:45-12:15	**Round table 3: Discussions**	

12:30-13:45	*Lunch*	
13:45-14:20	**<u>Round table 4</u>: European Strategy for sustainability of infrastructures**	
5’	*Introduction (WP1 JERICO-NEXT)*	D. Durand (IRIS)
15’	*EU strategy to address RI sustainability - towards sustainable ocean and coastal Research Infrastructure – the expectation from JERICO-NEXT*	A. Robin (DG Research)
15’	*The coastal component of the JPI-Oceans – ambitions and interaction with JERICO-NEXT*	F. Coroner (JPI)
14:20-14:50	**<u>Round table 4</u>: Discussions**	
14:50-15:15	**Workshop synthesis and conclusions**	
End of Strategy Workshop [15:30: Bus to the airport]		

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Introduction Speech (I. Puillat, IFREMER)

Strategy towards JERICO-NEXT

I. Puillat (deputy coordinator)
P. Farcy (Coordinator)
D. Durand (WP1 leader)

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OBJECTIVES OF THE WORKSHOP

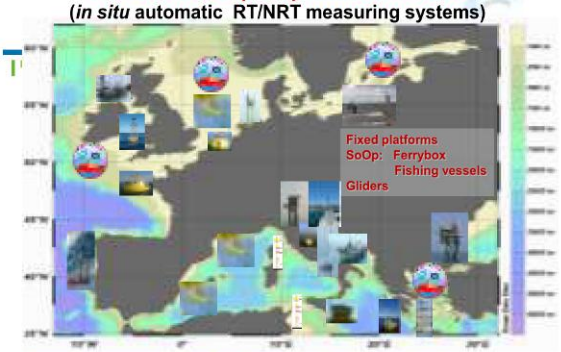
A closure for the JERICO(FP7) project and to step ahead towards JERICO-NEXT

- **Initiating** a strong coordination between JERICO-NEXT and relevant European organizations, to be followed up during the JERICO-NEXT project.
- **Focus on four topical round tables** addressing key issues for the JERICO RI long term sustainability in the context of European Strategies
- To agree on priorities to ensure coordination between JERICO-NEXT and relevant European initiatives: in a practical way

The JERICO (FP7) infrastructure

www.jerico-fp7.eu

(*in situ* automatic RT/NRT measuring systems)



JERICO priority parameters: Temp. & Sal., dissolved O_2, pCO_2, pH, Turbidity, Chl-a
complimentary parameters: nutrients, plankton species identification and sea level

JERICO (FP7): WHAT HAVE WE DONE?

Synthesis of the most important achievements

- Assessment of gaps and roadmap for the future (D.1.11 in WP1)
- State of the art in coastal observing systems: survey and description of existing infrastructures (WP2 & 3)
- Definition of best practices for deployment, maintenance etc.. of FB, gliders, FP, sensor calibration, biofouling prevention, … (WP3&4)
- Link with manufacturers (WP1: FCT)
- Definition of the JERICO label (WP1)
- Infrastructure operation and promotion / TNA & SA (WP7&8)
- Harmonisation of data flows with SeaDataNet & MyOcean (WP5&7)
- Numerical experiment assessing the impact of existing observational systems (OSE) and planned ones (OSSE) (WP9)
- Supported development of new technologies (WP10)

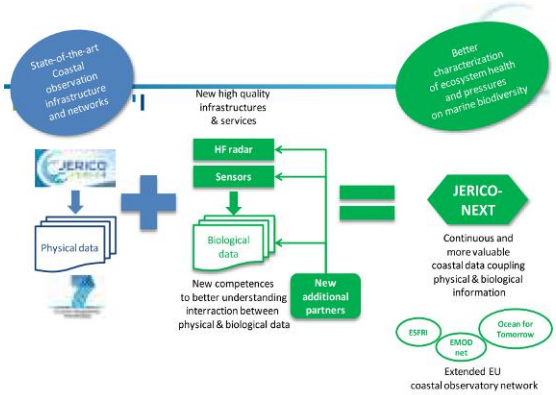
JERICO-NEXT: CHARACTERISTICS

- Requested grant: ~10M€
- 33 partners + Associated partners in Mexico, USA, Canada, South Africa
- 8 WPs + 1 WP /coordination
- Objectives:

  - organisation of a European harmonised infrastructure integrating observations of Physics, Chemistry and Biology in European coastal areas

  - lead of needed developements

  - show it works with applied projects via a good information flow



JERICO-NEXT : 6 SCIENTIFIC AREAS

- Topic#1: Pelagic Biodiversity and Eutrophication
- Topic#2: Benthic biodiversity
- Topic#3: Contaminants
- Topic#4: Trans-boundary transport & hydrodynamics
- Topic#5: Climate changes and biogeochemistry cycles
- Topic#6: Operational Oceanography and coastal forecasting

Round table 1: JERICO RI expansion: approach following the observing system simulation experience (OSSE) and link to non JERICO national coastal infrastructures.

Chairpersons: E. Buch (EuroGOOS), P. Morin (CNRS, JERICO/WP1)

Key participants: H. Wehde (IMR), T. Vukicevic (CMCC)

Objective: to assess the JERICO possible expansion and strategy (ref: D1.11, D9.5, D9.6) in the context of EuroGOOS and Copernicus, to conclude on common priorities.

Link: WP1&9 in FP7 project and WP3 in H2020 project

Round table 2: Scientific needs, innovation potential and the role of the industry

Chairpersons: E. Delory (PLOCAN, NEXOS project coordinator), G. Nolan (MI, JERICO/WP10)

Key participants: G. Petihakis (HCMR), L. Delauney (Ifremer)

Objective: to agree upon technological developments needed to answer scientific priorities and societal requirements.

Link: WP1&10 in FP7 project and WP3&6 in H2020 project

Round table 3: European policy for coastal data.

Chairpersons: JB. Calewaert (EMODnet), P. Gorringe (EuroGOOS, JERICO-NEXT/WP1&WP5)

Key participants: F. Colijn (HZG), L. Perivoliotis (HCMR), L. Petit de la Villéon (Ifremer)

Objective: to be informed on the status of the European strategy in marine data management with a focus on the integration of multidisciplinary data. Considering JERICO-NEXT will support harmonization of new data types, a specific attention will be paid to agree on cross cuttings between the H2020 project and European initiatives.

Link: WP5 in FP7 project and WP5 in H2020 project.

Round table 4: European Strategy for sustainability of Infrastructures

Chairpersons: A. Robin (DG Research, Infrastructures PO), D. Durand (IRIS, JERICO-Next/WP1).

Key participants: F. Coroner (JPI)

Objective: to discuss the possible European governance and economical model to sustain a European Research Infrastructure such as JERICO-RI, considering national and European long-term priorities.

New: WP1 in H2020 project

.

So …

GO!

II] Round Table 1: JERICO RI Expansion – Feedback after the observing system simulation experiment and expansion with national coastal infrastructures

Introduction speech and presentation of D1.11 (P. Morin, CNRS)

Pascal Morin gave an overview of Round table 1 objectives: to assess the JERICO possible expansion and strategy in the context of EuroGOOS and Copernicus, to conclude on common priorities. 3 JERICO deliverables (D9.5, D9.6, D1.11) were presented as base document relevant to the JERICO RI expansion. Indeed D9.5 and D9.6 are reporting results from simulation experiments based on data assimilation (OSE & OSSE). They shows this kind of experiment can give objective analysis results to state the basic impact of different observing systems on the quality of analysis and forecasts, and to investigate the impact of diverse additional observing systems on the analysis and forecasting quality. Such analysis in JERICO(FP7) is presented hereafter by T. Vukicevic (CMCC) in the following pages (see slides). Deliverable D1.11 is dedicated to give a possible strategy to sustain the coastal observing network and RI in Europe. It addresses regional gaps, by EuroGOOS Region, the ROOS, (stepped ahead after deliverable D2.2) with regards to the research platforms, as well as gaps towards harmonisation, summarise recommendations and a strategy for the future. Hereafter are summarized possible expansion and strategy for each region (see slides). P. Morin underlined the importance of the link with EuroGOOS which are working toward the EOOS as presented by E. Buch (Eurogoos) (see slides).

Round Table 1: JERICO RI expansion:

Approach following the observing system simulation experience (OSSE) and link to non JERICO national coastal infrastructures

Introduction and presentation of D1.11

Pascal Morin I Station Biologique Roscoff (France)I pmorin@sb-roscoff.fr

Introduction and Presentation of D1.11 Future Strategy for Coastal Observatory

*1 - **Observing platforms: regional to pan-European integration***
- ❑ *Identification of gaps and recommendations for developping observing systems by ROOS regions (IBIROOS, NOOS, BOOS, MONGOOS, Black Sea, Arctic ROOS)*
- ❑ *Identification of bottlenecks and priorities for the future*

*2 - **Sensors integration, new developments and innovation** (common and specific WP10 gaps, parameter measurements gaps, Innovation process)*

*3 - **Remaining gaps toward harmonisation***
- ❑ *Calibration procedures*
- ❑ *Operation and maintenance methods*
- ❑ *Coastal data management at European level*

*4 - **Strategy towards a better harmonised JERICO RI for the future***
- ❑ *Harmonisation in conducting operations and maintenance*
- ❑ *Harmonisation of calibration procedures*
- ❑ *Future data management at European and International levels*
- ❑ *Upgrade of the JERICO label in the future*

Round Table 1: JERICO RI expansion

Objective :

To assess the JERICO possible expansion and strategy (ref D1.11, D9.5, D9.6)

in the context of EuroGOOS and Copernicus

to conclude on common priorities

Round Table 1: JERICO RI expansion

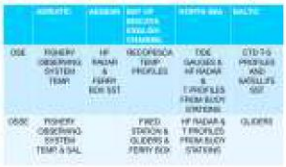
Observing System Simulation Experiment (OSSE) and Observing System Experiment (OSE) are scientific tools :

-To **study the basic impacts of different observing systems** on the quality of analyses and forecasts

- Used to investigate the **impact of different observing systems on the analysis and forecasting quality and accuracy**

Round Table 1: JERICO RI expansion

Observing systems Experiments and Simulation Experiments:
Tide gauges, Fishing vessels of opportunity, Ferrybox, Fixed platforms, gliders, HF radars



Round Table 1: JERICO RI expansion

State of the art in JERICO-FP7

ROOS regions

Possible Expansion and Strategy

State of the art in JERICO-FP7

Arctic ROOS

Arctic ROOS: FerryBox and Fixed Platforms maps

FerryBox routes in Arctic ROOS region (active lines in 2014)

Arctic ROOS: List of vessels and measured parameters

Name of platform	Institution	Destination harbours	Start and End of operation	Route
MS Norrøna	NIVA/MARLAB	Hirtshals, Tórshavn, Seydisfjord	2008-Today	Yellow
MS Norbjorn	NIVA	Tromsø, Sjømøya, Longyearbyen, Ny Ålesund	2008-Today	Red
MS Vesterålen	IMR	Bergen-Kirkenes	2006-Today	Green
MS Trollfjord	NIVA	Bergen-Kirkenes	2006-Today	Green

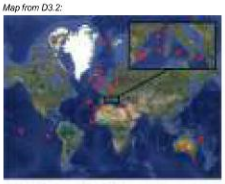
Name of platform	T	S	pCO2	Trb	Chl-a	pH	CDOM	DO	Nutrients	irradiance	radiance
MS Norrøna	X	X									
MS Nordbjorn	X	X		X	X				X	X	X
MS Vesterålen	X	X			X						
MS Trollfjord	X	X	X	X	X	X				X	X

State of the art in the networks and the sensors for the different types of platforms in the Arctic ROOS region:

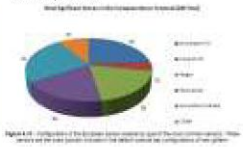
	Well observed	Not sufficiently observed	Missing	Upcoming in the next 5 years (name of projects, persons involved)
Areas or networks	FerryBox lines (Norwegian coastal waters) Fixed Platforms (Norwegian coastal waters)	FerryBox lines (Norwegian Sea) Gliders (Iceland Sea)	Gliders (Norwegian Sea)	Gliders (University of Bergen, Norway)
Sensors	FerryBox (T,S) Gliders (T, S, O2, Chl Flu, Turb)	FerryBox (Flu Chl, Turb, Nutrients) Fixed Platforms (Sea Level)	FerryBox (O2, pCO2, Biological parameters) Gliders (pCO2, Nutrients, Biological parameters) Fixed Platforms (O2, Chl Flu, Turb, pCO2, Nutrients, Biological Parameters)	
Parameters				

Arctic ROOS: Gliders

Map from D3.2:



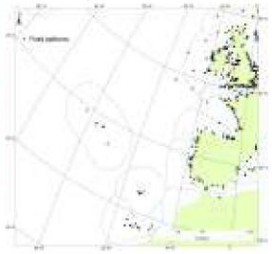
Measured parameters:



Round Table 1: JERICO RI expansion

IBI-ROOS: FerryBox and Fixed Platforms maps

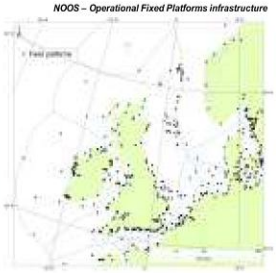
FerryBox routes in IBI-ROOS region
(active lines in 2014)



Round Table 1: JERICO RI expansion

NOOS: FerryBox and Fixed Platforms maps

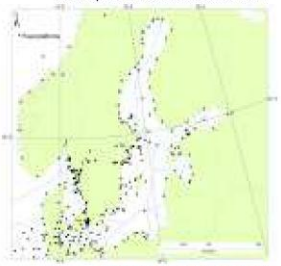
FerryBox routes in NOOS region
(active lines in 2014)



Round Table 1: JERICO RI expansion

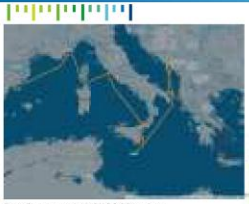
BOOS: FerryBox and Fixed Platforms maps

FerryBox routes in BOOS region
(active lines in 2014)



Round Table 1: JERICO RI expansion

MONGOOS: FerryBox and Fixed Platforms maps

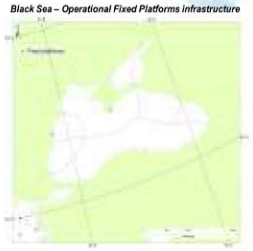


FerryBox routes in MONGOOS region
(active lines in 2014)

Round Table 1: JERICO RI expansion

Black Sea: FerryBox and Fixed Platforms maps

There are no FerryBox lines in the Black Sea

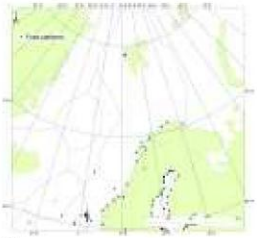


The fixed platforms in Black Sea measure only sea level.

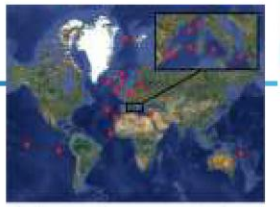
Round Table 1: JERICO RI expansion

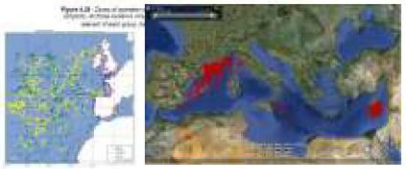
Arctic ROOS: FerryBox and Fixed Platforms maps

FerryBox routes in Arctic ROOS region (active lines in 2014)



ROOS: Gliders





JERICO Strategy Workshop I Brest I France

Round Table 1: JERICO RI expansion

State of the art in the networks and the sensors for the different types of platforms in the IBI-ROOS region:

	Well observed	Not sufficiently observed	Missing	Upcoming in the next 5 years (name of projects, persons involved)
Areas or networks	Fixed platforms	FerryBox lines Gliders (only oceanographic campaigns)	FerryBox lines in Irish Sea Ferrybox lines off Western Iberian Peninsula Gliders: better temporal resolution	FerryBox line between Portugal and Azores (H Lisbon, S. Almeida) FerryBox on hydrographic vessels (H, S. Almeida) Waiting for potential funding FerryBox between Bilbao and Pasaia (South bay of Biscay) AZTI (J. Mader) Glider operations in Portuguese waters (H Lisbon, S. Almeida)
Sensors	Fixed Platforms (Sea Level, T, S) FerryBox (T, S, O2, Chl Flu, Turb) Gliders (T, S, O2, Chl Flu, Turb)	Fixed Platforms (O2, Chl Flu)	Fixed Platforms (pCO2, Nutrients, Biological parameters) FerryBox (pCO2, Nutrients, Biological parameters) Gliders (pCO2, Nutrients, Biological parameters)	
Parameters				

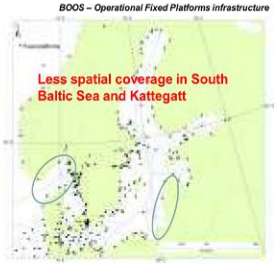
JERICO Strategy Workshop I Brest I France

Round Table 1: JERICO RI expansion

BOOS: FerryBox and Fixed Platforms maps

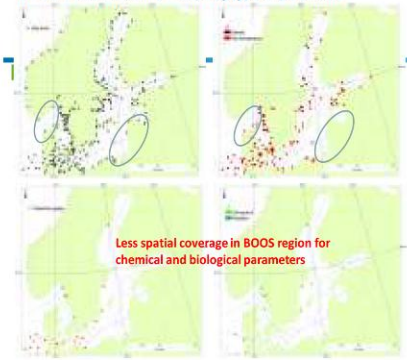
FerryBox routes in BOOS region (active lines in 2014)

BOOS – Operational Fixed Platforms infrastructure



JERICO Strategy Workshop I Brest I France

BOOS: Fixed Platforms – Maps by type of parameter



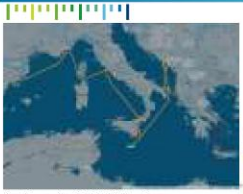
JERICO Strategy Workshop I Brest I France

Round Table 1: JERICO RI expansion

- *Questions for BOOS region:*
- *Is less spatial coverage in some areas of BOOS region for fixed platforms has a significant impact on the quality of analyses and forecasts?*
- *If yes, how can we design the distribution of stations to be added in these areas?*
- *How to design an efficient distribution of stations for chemical and biological data?*

Round Table 1: JERICO RI expansion

MONGOOS: FerryBox and Fixed Platforms maps



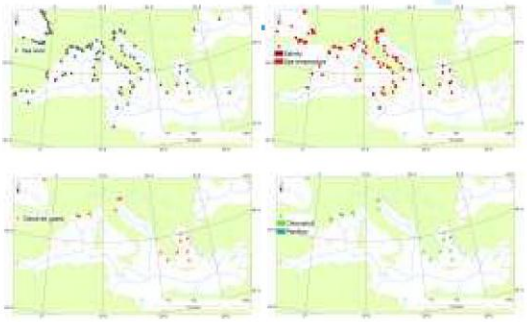
FerryBox routes in MONGOOS region (active lines in 2014)

Insufficient spatial coverage in Eastern Mediterranean and North African coasts in the MONGOOS region

MONGOOS – Operational Fixed Platforms infrastructure

JERICO Strategy Workshop I Brest I France

MONGOOS: Fixed Platforms – Maps by type of parameter



Round Table 1: JERICO RI expansion

- *Questions for MONGOOS region:*
- *How can we design the distribution of stations to be added in the Eastern Mediterranean Sea?*
- *How to design an efficient distribution of stations for chemical and biological data in the Mediterranean Sea?*

State of the art in JERICO-FP7

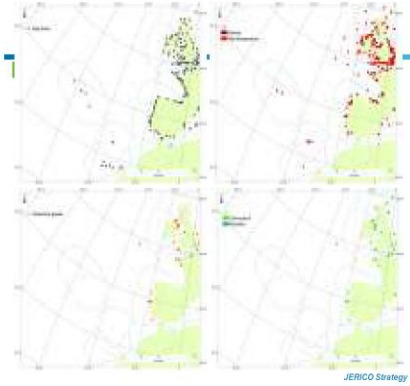
IBI-ROOS

IBI-ROOS: FerryBox and Fixed Platforms maps

FerryBox routes in IBI-ROOS region (active lines in 2014)

IBI-ROOS – Operational Fixed Platforms infrastructure

IBI-ROOS: Fixed Platforms – Maps by type of parameter



IBIROOS: List of vessels and measured parameters

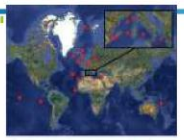
Name of platform	Institution	Destination harbours	Start and end of operation	Route
Lagan Viking	NOCL	Birkenhead- Dublin	2008-2010	
Pont-Aven	Ifremer	Portsmouth-Santander-Plymouth-Roscoff-Cork	2011-Today	Yellow
MV Armorique	CNRS-INSU/Ifremer	Plymouth-Roscoff	2010-Today	Orange
Pride of Bilbao	NOCS	Portsmouth-Bilbao	2002-2010	

Name of platform	T	S	pCO2	Trb	Chl-a	pH	CDOM	DO	Nutrients	irradiance	radiance	Wind
Lagan Viking	X	X		X	X							
Pont-Aven	X	X		X	X		X	X				
MV Armorique	X	X		X	X		X	X				
Pride of Bilbao	X	X	X	X	X			X				

State of the art in the networks and the sensors for the different types of platforms in the IBI-ROOS region:

	Well observed	Not sufficiently observed	Missing	Upcoming in the next 5 years (name of projects, persons involved)
Areas or networks	Fixed platforms	FerryBox lines Gliders (only oceanographic campaigns)	FerryBox lines in Irish Sea Ferrybox lines off Western Iberian Peninsula Gliders: better temporal resolution	FerryBox line between Portugal and Azores (IH Lisbon, S. Almeida) FerryBox on hydrographic vessels (IH, S. Almeida) Waiting for potential funding FerryBox between Bilbao and Pasaia (South bay of Biscay) AZTI (J. Mader) Glider operations in Portuguese waters (IH Lisbon, S. Almeida)
Sensors	Fixed Platforms (Sea Level, T, S) FerryBox (T, S, O2, Chl Flu, Turb) Gliders (T, S, O2, Chl Flu, Turb)	Fixed Platforms (O2, Chl Flu)	Fixed Platforms (pCO2, Nutrients, Biological parameters) FerryBox (pCO2, Nutrients, Biological parameters) Gliders (pCO2, Nutrients, Biological parameters)	
Parameters				

IBIROOS: Gliders



Measured parameters:

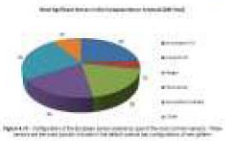
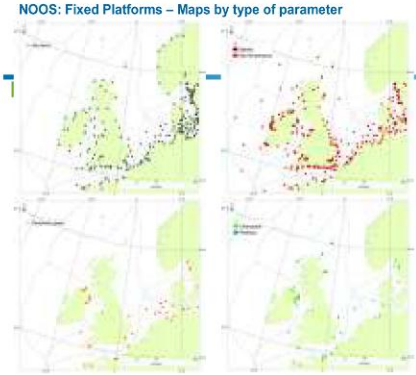


Figure * 1: Real-time Data provided for the IBIROOS region.

State of the art in JERICO-FP7

NOOS

NOOS: Fixed Platforms – Maps by type of parameter



NOOS: List of vessels and measured parameters

List of vessels:

Name of platform	Institution	Destination harbours	End of operation	Route
M/S Trans Carrier	BCCR, UIB	Amsterdam - Bergen	2005-2009	
Duchess of Scandinavia	HZG	Cuxhaven - Harwich	2002-2005	
TorDania	HZG	Cuxhaven - Immingham	2008-2012	
LysBris	HZG	Moss-Halden-Zeebrugge-Immingham	2007-Today	Green
MS Funny Girl	HZG	Büsum - Helgoland	2008-Today	Red
MS FunnyGirl	HZG	Cuxhaven - Helgoland		
Hafnia Seaways	HZG	Cuxhaven – Immingham	2015-Today	light blue
MS Trollfjord	NIVA	36 locations from Bergen to Kirkenes	2006-Today	
MS Oslofjord	NIVA	Sandefjord - Strømsstad	2015-Today	
KV TOR	IMR	Norwegian West Coast (Bergen)	2011-Today	
MV Hascosay	Marlab	Lerwick - Aberdeen	??	Orange
MS Bergensfjord	NIVA	Hirtshals – Stavanger - Bergen	2008-2013	Pink
MS Norrena	NIVA/MARLAB/ Univ. Rhode Island	Hirtshals - Torshavn - Seydisfjord	2008-Today	Light brown

NOOS: List of vessels and measured parameters

Measured parameters:

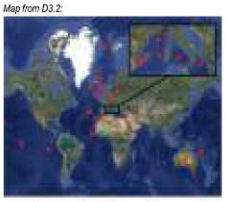
Name of platform	Route	T	S	pCO2	Trb	Chl-a	pH	CDOM	DO	Nutrients	irradiance	radiance	Wind
M/S Trans Carrier		X	X	X	X	X	?						
Duchess of Scandinavia		X	X		X	X	X		X	X			
TorDania		X	X		X	X	X		X	X			
LysBris	Green	X	X	X	X	X	X		X	X			
MS Funny Girl	Red	X	X		X	X	X		X				
Hafnia Seaways	Light blue	X	X	X	X	X	X		X				
MS Trollfjord		X	X	X	X	X	X				X	X	X
MS Oslofjord		X	X		X	X				X			
KV TOR		X	X						X				
MV Hascosay	Orange	X	X		X	X							
MS Bergensfjord	Pink	X	X		X	X				X			
MS Norrena	Light brown	X	X										

State of the art in the networks and the sensors for the different types of platforms in the NOOS region:

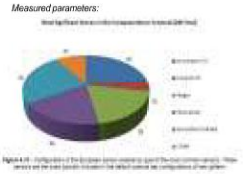
	Well observed	Not sufficiently observed	Missing	Upcoming in the next 5 years (name of projects, persons involved)
Areas or networks	FerryBox lines Fixed Platforms	Gliders (only oceanographic campaigns)		
Sensors	FerryBox (T,S, Turb, Flu Chl) Gliders (T, S, O2, Chl Flu, Turb) Fixed Platforms (Sea Level, T, S)	FerryBox (O2, pCO2, Nutrients) Fixed Platforms (O2, Chl Flu, Turb)	FerryBox (Biological parameters) Gliders (pCO2, Nutrients, Biological parameters) Fixed Platforms (pCO2, Nutrients, Biological Parameters)	
Parameters				

NOOS: Gliders

Map from D3.2:



Measured parameters:



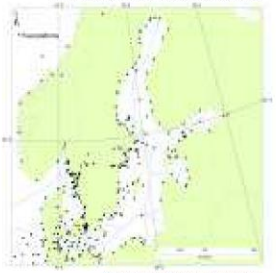
State of the art in JERICO-FP7

BOOS

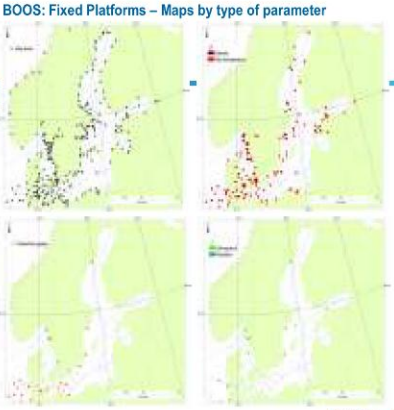
BOOS: FerryBox and Fixed Platforms maps

FerryBox routes in BOOS region (active lines in 2014)

BOOS – Operational Fixed Platforms infrastructure



BOOS: Fixed Platforms – Maps by type of parameter



BOOS: List of vessels and measured parameters

Name of platform	Institution	Destination harbours	Start and End of operation	Route
Victoria I	EMI	Tallinn - Mariehamn - Stockholm	2006-Today	Brown
Stena Baltica	IMGW	Gdynia - Karlskrona	2008-2009	
MS Silja Europa	MSI/TUT	Tallinn - Helsinki	1997-Today	Green
MS Color Fantasy	NIVA	Oslo - Kiel	2008-Today	Red
TransPaper	SMHI & SYKE	Kemi-Oulu-(Husum)-Lübeck	2009-Today	Purple
Silja Serenade	SYKE	Helsinki - Stockholm	1998-Today	Light blue
Finnmaid	SYKE	Helsinki-Travemunde, Helsinki-Gdynia	1998*-Today	Blue-grey
MS Romantika	LIAE - MSI/TUT	Riga - Stockholm	2013-2013	

*1998-200: vessel was named Finnpartner

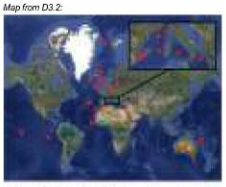
Name of platform	T	S	pCO2	Trb	Chl-a	pH	CDOM	DO	Nutrients	Irrad.	Rad.	Cyanobact	Phycocyan	Phytoplankton
Victoria I	X	X		X	X		X							
Stena Baltica	X	X		X	X			X						
MS Silja Europa	X	X	X	X	X				X					
MS Color Fantasy	X	X		X	X		X			X	X	X		
TransPaper	X	X	X	X	X	X	X	X					X	
Silja Serenade	X	X		X	X				X				X	X
Finnmaid	X	X		X	X		X		X				X	X
MS Romantika	X	X		X	X			X					X	

State of the art in the networks and the sensors for the different types of platforms in the BOOS region:

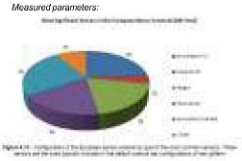
	Well observed	Not sufficiently observed	Missing	Upcoming in the next 5 years (name of projects, persons involved)
Areas or networks	FerryBox lines Fixed Platforms	Gliders (only oceanographic campaigns)		
Sensors	FerryBox (T,S, Turb, Flu Chl) Gliders (T, S, O2, Chl Flu, Turb) Fixed Platforms (Sea Level)	FerryBox (O2, pCO2, Nutrients, Biological parameters) Fixed Platforms (T, S: Kattegatt coastal waters)	Gliders (pCO2, Nutrients, Biological parameters) Fixed Platforms (O2, Chl Flu, Turb, pCO2, Nutrients, Biological Parameters)	
Parameters				

BOOS: Gliders

Map from D3.2:



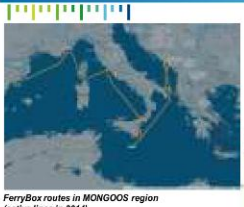
Measured parameters:



State of the art in JERICO-FP7

MONGOOS

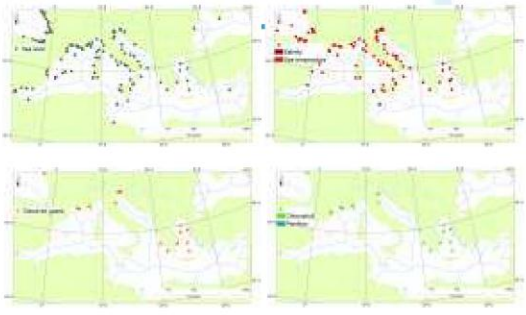
MONGOOS: FerryBox and Fixed Platforms maps



FerryBox routes in MONGOOS region (active lines in 2014)

MONGOOS – Operational Fixed Platforms infrastructure

MONGOOS: Fixed Platforms – Maps by type of parameter



MONGOOS: List of vessels and measured parameters

Name of platform	Institution	Destination harbours	Start and End of operation	Route
Olympic Champion	HCMR	Piraeus-Heraklion	2002-Today	Red
Niolon	MIO (HYMEX/CNRS/INSU)	Marseille-Algiers	2012-Today	
Jolly Indaco	MIO (CNRS/INSU)	Genoa -Libyan harbours	2010-2011	
MeinSchiff3	HZG	Several ports in Mediterranean Sea / Canary Islands	2014-Today	Orange

Name of platform	T	S	pCO2	Trb	Chl-a	pH	CDOM	DO
Olympic Champion	X	X		X	X	X		X
Niolon	X	X						
Jolly Indaco	X	X						
MeinSchiff3	X	X			X	X		X

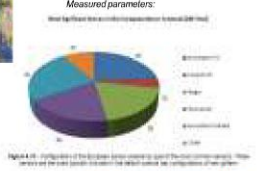
State of the art in the networks and the sensors for the different types of platforms in the MONGOOS region:

	Well observed	Not sufficiently observed	Missing	Upcoming in the next 5 years (name of projects, persons involved)
Areas or networks	Fixed Platforms (NW Med Sea, Adriatic Sea, Greece) Gliders (NW Med Sea, Cyprus area, South Italy)	FerryBox lines (2 lines) Gliders (only oceanographic campaigns)	Gliders (outside well described areas) Fixed Platforms (Eastern Med Sea outside Greece)	FerryBox line Marseille-Tunis (MIO, Marseille, G. Grégori, M. Thyssen, Tunisie)
Sensors	FerryBox (T,S) Gliders (T, S, O2, Chl Flu, Turb) Fixed Platforms (Sea Level, T, S)	FerryBox (O2, Chl Flu, Turb) Fixed Platforms (O2, Chl Flu, Turb)	FerryBox (pCO2, Nutrients, Biological parameters) Gliders (pCO2, Nutrients, Biological parameters) Fixed Platforms (pCO2, Nutrients, Biological Parameters)	
Parameters				

MONGOOS: Gliders

Map of all glider deployments from Sept. 2004 to Dec. 2012:

Measured parameters:



State of the art in JERICO-FP7

Black Sea

Black Sea: FerryBox and Fixed Platforms maps

There are no FerryBox lines in the Black Sea

Black Sea – Operational Fixed Platforms infrastructure

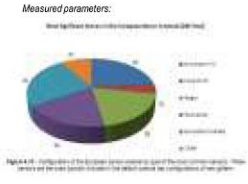
The fixed platforms in Black Sea measure only sea level.

State of the art in the networks and the sensors for the different types of platforms in the Black Sea:

	Well observed	Not sufficiently observed	Missing	Upcoming in the next 5 years (name of projects, persons involved)
Areas or networks		Fixed Platforms Gliders	FerryBox lines Gliders	
Sensors	Fixed Platforms (Sea Level)		FerryBox (All parameters) Gliders (All parameters) Fixed Platforms (All parameters, excepted Sea Level)	
Parameters				

Black Sea: Gliders

Measured parameters:



Map from D2.1:

Figure 9.2: Database Data provided for the Black Sea GOOS region via the EC supported MyOcean project

EUROGOOS, JERICO & EOOS (E. Buch, EuroGOOS)

EuroGOOS

EuroGOOS, JERICO and EOOS

Erik Buch
EuroGOOS Chair

EuroGOOS

Ocean Economy

- Ocean Economy worth 24 Trillion USD – seventh largest economy in the world
  - Food
  - Energy
  - Raw materials
  - Transport
  - Commerce
  - Tourism

http://www.thecampaign.s3.amazonaws.com/oceans/media/RevivingOceanEconomy-REPORT-lowres.pdf

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EuroGOOS

Call to Action

Ocean health is declining due to local stresses such as habitat destruction, overfishing and pollution as well as rapid and unprecedented changes in ocean temperature and acidity

The message is clear:

The ocean is a major contributor to the global economy, but we are running down our ocean assets and will push the ocean economy into the red if we do not respond to this crisis with bold and decisive actions as an international community. We must do more, much more, to protect our ocean asset base. A prudent treasurer or CEO would not wait until the next financial report to correct course. They would act now

It calls for global leadership

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We cannot manage what we do not measure

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EuroGOOS

European dimension

The need for such an integrated ocean observing system is particularly important in Europe because of the complexity and density of human activity in European seas and oceans.

This results in a high demand for marine knowledge in the form of data, products and services to support marine and maritime activities.

There is also a critical need for basic and applied marine science to inform society, ocean governance and decision-making, supporting a knowledge-based maritime economy that is sustainable into the future

EuroGOOS

European Ocean Observing system (EOOS)

- Major challenge and priority for the coming years:
  - Ostend declaration (2010) and Rome Declaration (2014)
  - "Navigating the future IV" – European Marine Board
  - European Marine Board and EuroGOOS brainstorming workshop

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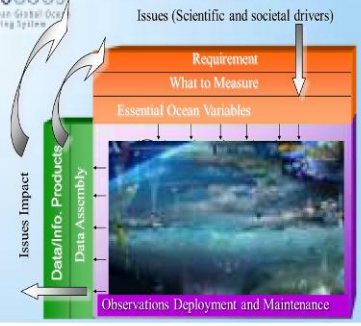
EuroGOOS

Framework Concepts

- Take lessons learned from successes of existing observing efforts – best practices
- Guide observing community as a whole to sustain and expand the capabilities of the ocean observing system
- Deliver an observing system that is fit-for-purpose
- Promote collaborative alignment of independent groups, communities and networks, building on existing structures as much as possible
- Think and plan on European scale, invest and implement locally/regionally.

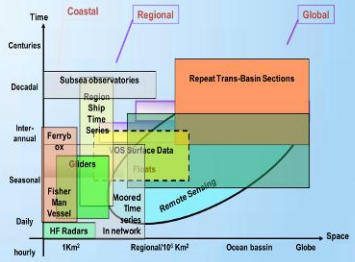
EuroGOOS

Structure of the Framework

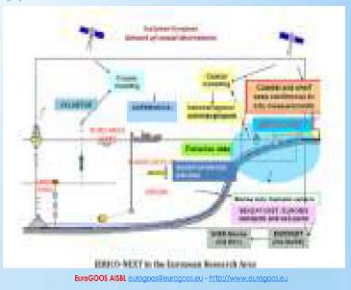


EuroGOOS

Global to Regional to Coastal



EuroGOOS



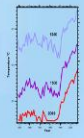
EuroGOOS

One System Several purposes

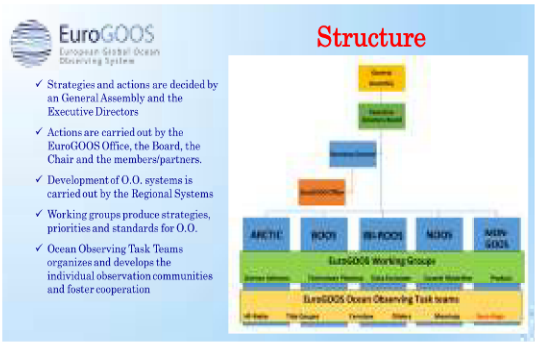
- Improve the safety & efficiency of marine operations
- Improve security in Europe
- Mitigate effects of natural hazards more effectively
- Improve predictions of climate change & their effects
- Minimize public health risks
- Protect & restore healthy coastal marine ecosystems more effectively
- Sustain living marine resources

EuroGOOS

What is missing ? (gaps)



- **Spatial gaps**
  - horizontal – SE European seas;
  - vertical – deep sea is under-sampled;
- **Temporal gaps**
  - few complete time series;
- **Parameter gaps**
  - biochemical; sensors are now available;
- **Long term commitments**
  - more than 70% based on research funding;
- **Integrated monitoring strategy at European level**
  - Reduce overlaps; maximize synergies and benefits


EuroGOOS
European Global Ocean Observing System
Structure
✓ Strategies and actions are decided by an General Assembly and the Executive Directors
✓ Actions are carried out by the EuroGOOS Office, the Board, the Chair and the members/partners.
✓ Development of O.O. systems is carried out by the Regional Systems
✓ Working groups produce strategies, priorities and standards for O.O.
✓ Ocean Observing Task Teams organizes and develops the individual observation communities and foster cooperation
ARCTIC
BOOS
EuroGOOS Working Groups
EuroGOOS Ocean Observing Task teams


EuroGOOS
European Global Ocean Observing System
Design and challenges
• Fit for purpose
○ Societal needs –not national or personal priorities
• Full system – instruments to data services
• Ocean System Simulations experiment (OSSE)
• Economy
○ New investments
○ Re-design of existing network
• Governance
• Avoid duplications
04-05-2015
EuroGOOS AISBL eurogoos@eurogoos.eu - http://www.eurogoos.eu
14

Standardization of OSE/OSSE technology (T. Vukicevic, CMCC)

Jerico-Next

Standardization of OSE/OSSE technology

Tomislava Vukicevic

CMCC

JERICO RECOMMENDATIONS FROM OSE/OSSE EXPERIENCE

- 1) **Tide Gauges** have large impact on accuracy of 12 an 24 hours sea level forecasts, need networking of data among data providers
- 2) **Fishing Vessels measurements** are impacting positively better with vertical profiles than single depth point measurements. Horizontal sampling scheme could be streamlined
- 3) **FerryBox** is a crucial component of the observing system for SST introducing high frequency data to resolve the daily cycle
- **Fixed platform** profiles have positive impacts provided that they are not overlapping and sufficiently homogeneous in positions
- 5) **Gliders** offer a positively impacting platform in the shelf areas of freshwater intefluence
- 6) **HF radars** are a formidable monitoring system for the coastal area provided more progress is done in terms of quality control of the measurements

CHALLENGES IDENTIFIED FROM OSE/OSSE JERICO EXPERIENCE

- Diversity of metrics used for representing the impact of observations made it difficult to intercompare results between different regions and observing platforms
  - **To be compatible**, standard simple metrics should be used such as bias and rms between the analysis (result of OSE/OSSE) and observations, irrespective of DA technique used
- OSSE were not calibrated to represent realistically properties of the current data assimilation capabilities
  - **To be reliable** OSSE should show same error characteristics as OSE for the existing observations ; Requires simulated existing observations in OSSEs
- Baseline was not well established neither in OSEs nor OSSEs
  - **To be objective**, value added of the coastal observations have to be established with respect to satellite-based observations, thus all OSE/OSSEs must include satellite-based observations

Borrowing from the experience in atmospheric applications

Need for harmonization and coalibration of OSSEs is motivated by

- Decisions about observing systems have important scientific, technical, financial and political ramifications
- OSSE-based assessments are equally relevant to the national and international stakeholders
- Community ownership and oversight of OSSE capability is important for maintaining credibility
- Sharing one Nature Run and simulated observation lowers the cost
- Using independent data assimilation systems with the same simulated observations increases reliability

5/6/2013

WP4 Tasks involving OSE/OSSE technolofgy

- JRAP #4
  Task 4.4 (hydrography): 4D characterization of trans-boundary hydrography and transport (M1-M36)
  AZTI, Ifremer, CNR-ISMAR, CNRS, CMCC, HZG
  - ➢ OSSEs for HF Radar observing with respect to optimal impact on assessment of biochemical transport
- JRAP #6
  Task 4.6: JRAP #6: Operational oceanography and coastal forecasting (M1-M36)
  SOCIB, IH, AZTI, CMCC, CNR, FMI, HCMR, IMR, SMHI
  - ➢ OSEs with the existing coastal observations
  - ➢ OSSEs to assess impact of additional coastal observations including HF Radar, buoys, gliders, …

5/6/2013

WP3 Tasks involving OSE/OSSE technolofgy

Task 3.7 OSE/OSSE (Observing System Experiment/Observing System Simulation Experiment) technology (M0-M24)
CMCC, HZG, Ifremer, CNRS, CNR-ISMAR

SubTask: 3.7.1 Biochemical transport in high-resolution DA systems (M0-M9)
SubTask: 3.7.2 OSE/OSSE infrastructure (M0-M12)
SubTask: 3.7.3 Optimization of HF-radar DA for the tracer transport (M0-M24)

5/6/2013

WP4 Tasks involving OSE/OSSE technolofgy

- JRAP #4
  - OSSEs for HF Radar observing with respect to optimal impact on assessment of biochemical transport
- JRAP #6
  - OSEs with the existing coastal observations
  - OSSEs to assess impact of additional coastal observations including HF Radar, buoys, gliders, ...
- **Cannot be achieved with required reliability and robustness before OSE/OSSE standardization and calibration is completed**

Discussion & Conclusion

During this round table, several comments were made about improvements and what should be a priority for JERICO-Next.

1) The work carried out for gaps analysis, validation and calibration of automatic sensors measurements with on board sample measurements (biology) in JERICO was focusing on gliders, ferry boxes and fixed platforms. **Monitoring vessels, such as oceanographic ships**, should be better taken into account in JERICO-Next, because some of them are filling the gaps. There are also national repeated stations.

2) The ferry boxes and gliders are wonderful tools to monitor the oceans but the connection and implementation into the national monitoring have to be improved.
Links with national monitoring agencies and wider organizations are to be enhanced. In order to reach this target systems have to be **multi-purpose systems,** to demonstrate the added value of observing systems to users and stakeholders. In addition to the diversity in the use of system, the measurements should be **multi-used**, making the system more cost efficient as funding are getting more and more restricted.

4) Observation from small cable observatories, which are seafloor based, is relevant and will be taken into account in JERICO-Next and might be important for EUROGOOS too.
→ *How to take that into account in our systems?*

5) There is a need to embrace an **ecosystem approach**, to catch the hydrology specificities of the regions, and to include observation of the seafloor, in order to earn the right to be sustained. Indeed, we can't simply assume that we will achieve either expansion or even sustaining of what we built after four years.
We need to think the monitoring strategy and observations at different scales which will address users' problems, for instance: from an individual aquaculture facility to delivering integrated information at the scale of policy needs, which is going to maritime areas and earlier pieces of legislation to the scale of the North Sea.
→ *We need both general and detailed information from observing system to do so.*

6) OSE-OSSE work is clearly a step towards sustainability because we would make the point that we are delivering the **best possible implementation** of our observing systems in order to meet our end-user needs. The idea is to reduce the uncertainties in the result by choosing the most suitable systems and network organization: **to get** a better accuracy. To answer this, we need to use different models, as they have different special resolution. When we tackle the specific need for an estuary, you don't use the same model and spatial resolution as if you work in the scale of the entire basin.

The strategy of using different models according to the different regions has been adopted during JERICO and will be in JERICO-Next because the coastal areas are so diverse that it is absolutely necessary to use the suitable modeling tools, in order to address in the best way the question of the impact of observation and optimization.

We wish to make a standardization of the approach to ensure the quality and the reliability of the results coming from these approaches.

III] Round Table 2: Scientific and technological needs – The innovation potential and role of the industry

Introduction speech and WP10 work (G. Nolan, MI)

Glenn Nolan introduced the round table 2 objectives: to agree upon technological developments needed to answer scientific priorities and societal requirements. To step ahead on the JERICO-FP7 achievements he presented 2 JERICO-related activities: the JERICO Forum for Coastal Technologies, a forum dedicated to gather the private sector with JERICO scientists on common issues (sensors developments and calibration), and WP10 development results. He introduced the role of other European initiatives such as EuroGOOS, AtlantOS, etc. and the NEXOS project presented in the following pages by E. Delory. NEXOS is set up the European Program Ocean of tomorrow, to deal with innovation on ocean sensors. He concluded by introducing the upcoming role of JERICO-NEXT project with its WP3 into innovation (G. Petihakis presentation).

Some key questions were raised:

- With regards to the biological compartment, a crucial question is **how far can we go** and what functional levels can be realistically observed?
- It seems that the first attempts (**novel sensors**) are initiated by the researchers as shown in JERICO NEXT. But if we want **to go operational, these efforts must be taken up by the industry.**

=> Are there enough links?
=> Is the niche market it addresses a big constraint for new small SMEs (start-up)?
=>Is the oceanographic technological constraint not a big bottleneck for the SMEs?

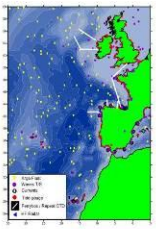
- Is it realistic to look for something similar to **ACT in Europe?**
- Are there any **examples outside EU** (IOOS - IMOS) where links with industry are established?

Round table 2:

- ***Objective:*** *to agree upon technological developments needed to answer scientific priorities and societal requirements/challenges*

In 1 hour!!
No pressure!!

FORUM FOR COASTAL TECHNOLOGIES



Glenn Nolan, Yannick Aoustin, Phil Monbet.

Date I City I Land

FCT CHRONOLOGY WITHIN JERICO

- **1st FCT: held in conjunction with Seatech week, Brest, 2012**
- Focus on field measurements
- Dissolved Oxygen and Nutrients were highlighted in Survey
- Attendees agreed that a calibration workshop to exchange
- know-how would be worthwhile
- **After 1st FCT:**
- White paper on DO produced (L.Coppola and co-authors)

FCT CHRONOLOGY WITHIN JERICO

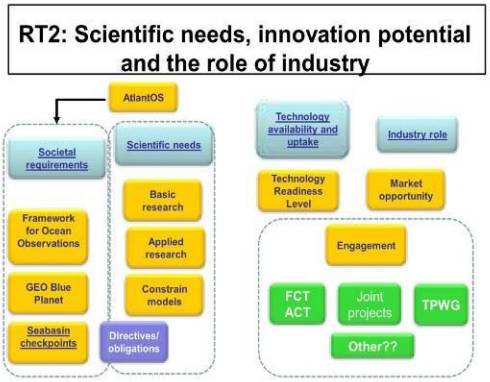
- **2nd FCT: held in conjunction with Oceanology, London, 2014**
- Session 1: Calibration protocols and Environmental Technology Verification Schemes
- Included both companies and end users of the sensors
- Session 2: Moderated discussion involving 30 attendees
- 40% of participants from Industry

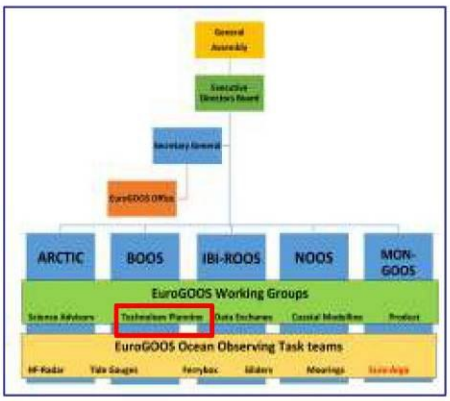
Discussion during 2nd FCT

- Sharing methods and best practice could be continued through WG/ COST action (produce guide)
- Emphasis on role that companies can play pre and post deployment and that scientists play in field (multipoint calibrations etc)
- Company participation in defining and agreeing standards (industry wish)
- Training and auditing of processes needed
- Low cost sensors considered for WQ/Aqua culture

Some key questions

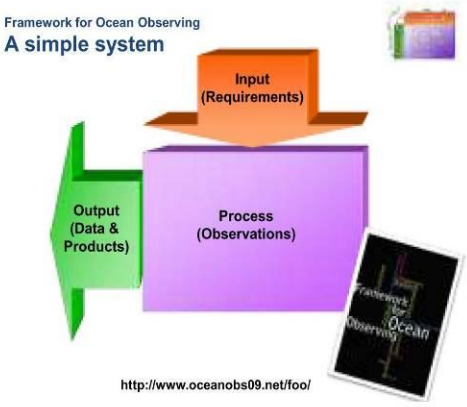
- Moving towards **biological measurements** in our observatories has been widely acknowledged. A crucial question is **how far can we go** and what functional levels can be realistically observed ?
-
- - It seems that the first attempts (**novel sensors**) are initiated by the researchers as shown in JERICO NEXT. But if we want **to go operational, these efforts must be taken up by the industry.**
  => Are there enough links?
  => Is the niche market it addresses a big constraint for new small SMEs (start-up) ?
  =>Is the oceanographic constraint not a big bottleneck for the SMEs ?
-
- - Is it realistic to look for something similar to **ACT in Europe?**
-
- - Are there any **examples outside EU** (IOOS - IMOS) where links with industry are established ?

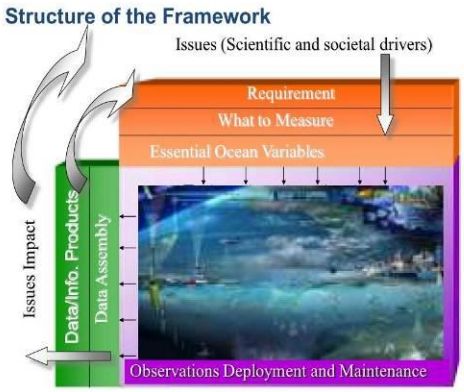


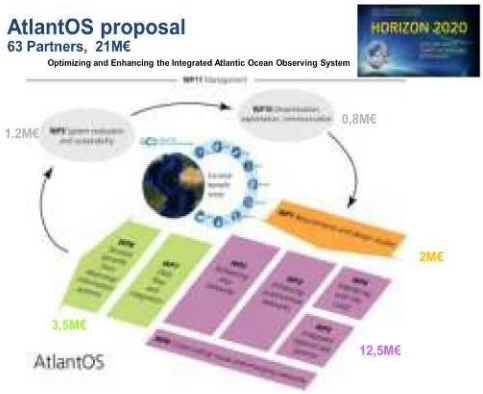


Future of Sustained Observations

- OceanObs'09 identified tremendous opportunities, significant challenges
- Called for **a framework for planning and moving forward with an enhanced global sustained ocean observing system over the next decade**, integrating new physical, biogeochemical, biological observations while sustaining present observations



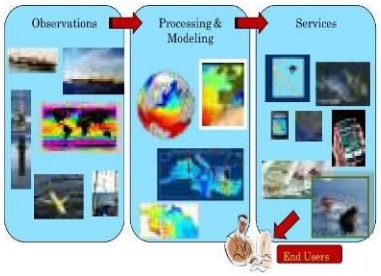




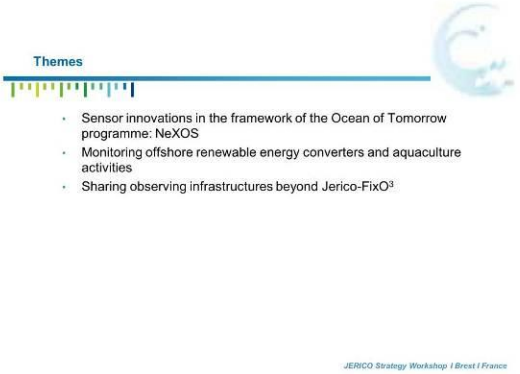
SMEs

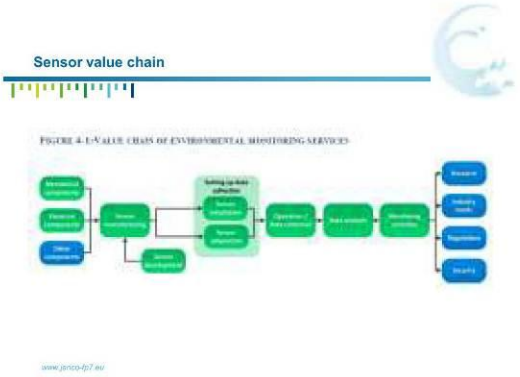
TelLab
MARLIN-YUG
develogic
EMODnet
RiboCon
CONTROS
MARIS
ACRI ST
nke
Blue Lobster

Operational Oceanography



Innovations for the monitoring of environmental status of the ocean and the link with future blue-growth activities (E. Delory, PLOCAN)





NeXOS technological breakthroughs

- *Plug and play sensor interface for seamless integration on existing and future observing systems*
- *Small form factors for installation on cost-effective mobile platforms*
- *Smart antifouling for better reliability and resilience*
- *RAMS strategy applied to ocean sensing*
- *Web enabled sensors for direct public access*
- *Multifunctional sensors for greater value for money*

Tracing of developments through systematic Technology Readiness assessment (WP3)
Developments following a system engineering plan (WP1)

Transversal Innovations

- ***Sensor antifouling:*** *Propose an innovative scheme using active protection*
- *Detect the earliest stages of biological growth on sensor surfaces (biofouling prevention)*

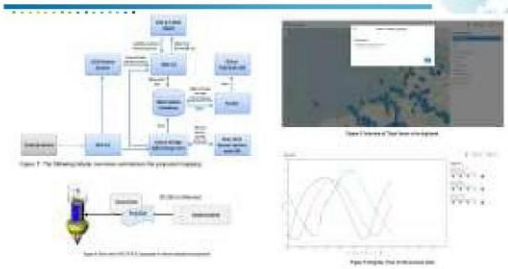
Transversal Innovations

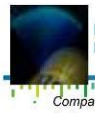
- ***Sensor Interface Interoperability:*** *Develop a Smart Electronic Interface for Sensor Interoperability*
- *Proposed as a core electronics platform for the new multifunctional sensors*
- *Implementation of latest standard advancements*
- *Implement new generation technologies in mobile communications devices (miniaturization & low power consumption)*
- *Usable for current and future platforms*

Transversal Innovations

- ***Sensor Data Interoperability:*** *observing systems still retain the data they collect*
  - *NeXOS → Enabling standard Web access to measured sensor data*
- *Contribute practical experience and evaluation mechanisms to the next evolution of standard specifications*
- *Seamless integration with existing international initiatives (GEOSS and Copernicus)*

Web of Things





Example 2: Multifunctional optical sensors Fluorescence & Absorption

- *Compact and multifunctional*
- *Polycyclic Aromatic Hydrocarbons*
- *Dissolved Organic and Suspended Matter*
- *Phytoplankton groups, Chlorophyll*
- *Carbon and related*

Recopesca+EAF

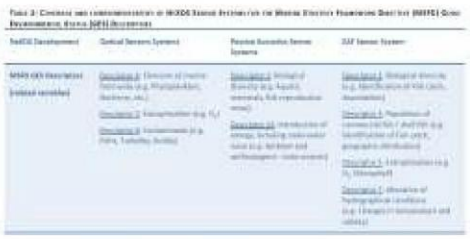
A participative approach to collect data on fishing activities and environmental parameters

- Integrated multidisciplinary system
- A sample of voluntary fishing vessels fit out with sensors (data logger)
  - Recording data on fishing effort, catches and physical parameters (temperature and salinity, turbidity coming soon) → Concrete achievement of participative approach
  - A sample of vessels representative of the whole fishing fleets (métier, fishing areas, length), at a national scale
- A modular and affordable system adapted to:
  - active or passive gears
  - the different types/lengths of vessels
- Recopesca relies on and feeds existing operational data centers:
  - Coriolis, for operational oceanography
  - The Fisheries Information System (SIH) of Ifremer and its database Harmonie

Underwater sound sensors Noise and biodiversty

- Compact and multifunctional sensors
- Noise SPL measurements and statistics
- Classification of sounds
- Sound source localisation

Contributions to GES



Impacts of NeXOS

- *Enhancing the European contribution to* ***Global Monitoring of the Oceans***
- *Reducing Ocean Modelling* ***Uncertainty***
- *Reduce* ***cost of data*** *collection system*
- *Advancing* ***competitiveness*** *for European Industries*
- *Supporting implementation of European Maritime and other relevant* ***Policies (MSFD, CFP, INSPIRE)***
- *Promoting* ***new discoveries*** *leading to better understanding of the seas*

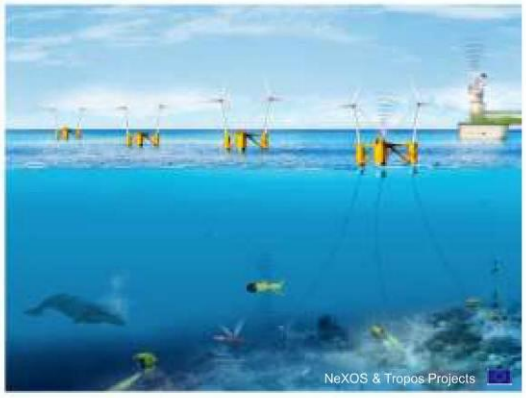
Synergies between ocean observation and impact monitoring programmes

- *Shared infrastructure for communication, transmission and power supply*
- *Reduction of procurement costs (observing systems, end-to-end)*
- *Reduction of operational costs (data management, installation, maintenance)*

www.nexosproject.eu

How NeXOS ocean sensors contribute to the monitoring of multi-use offshore platforms

- Automated water quality (water chemistry) assessment.
  - Hydrocarbons
  - Turbidity
  - Dissolved oxygen
  - Acidity, CO_2
- Automated analysis of underwater noise (MSFD Desc.11)
  - Noise pollution indicators
  - Assessment of ocean noise status
- Automated tracing of marine mammals (MSFD Desc. 1).



Sharing infrastructures with AtlantOS

Fixed and mobile platforms

Geographical scope: EU, US, Canada, Brazil, South Africa (not exhaustive)

Activity scope: deployment of multiple platforms from ships, collecting additional samples, adding sensing devices to existing activities, and coordinating multiple platforms for specific science

Two workshops towards a common methodology:

1st workshop at AGU Ocean, February 2016, New Orleans - Organisers: PLOCAN, IEEE, Ifremer

2nd workshop: TBD

Demonstration in the Central-Eastern Atlantic

ENVRIPLUS

What standards are available and applicable for the creation of an ocean and terrestrial sensor web

Demonstrating the benefits of a web of sensors, e.g. with preprocessing

Demonstrating how standards can ease the management of denser sensor networks

Conclusions/connections with Jerico

In view of the variety of programmes some degree of coordination is needed on specific aspects:

1- Dedicated Community of Practice towards standard interfacing

- sensor-platform layer

- web services and

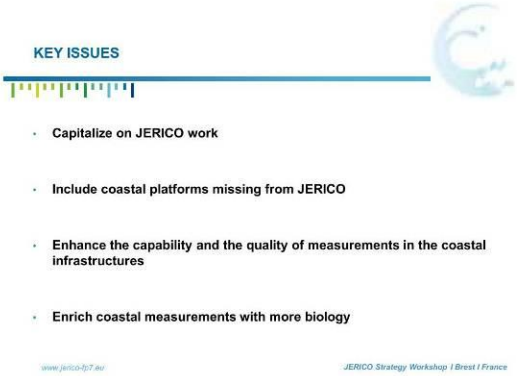
2- Access to infrastructures should allow for next generation sensor testing, validation, demonstration activities. Agenda conflicts imply flexibility and adjustments. (Test-Integration-Validation-Demonstration in NeXOS spans 2016-2017)

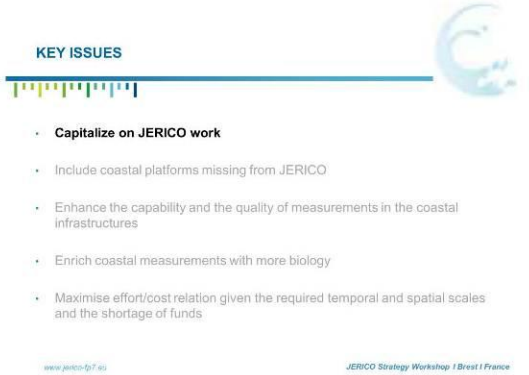
3- Optimise sensor networks in the ocean can increase cost-efficiency of EIA monitoring programmes offshore, and facilitate their development

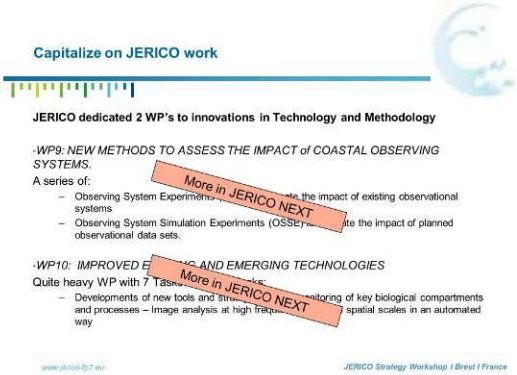
Priorities/ideas to be agreed upon

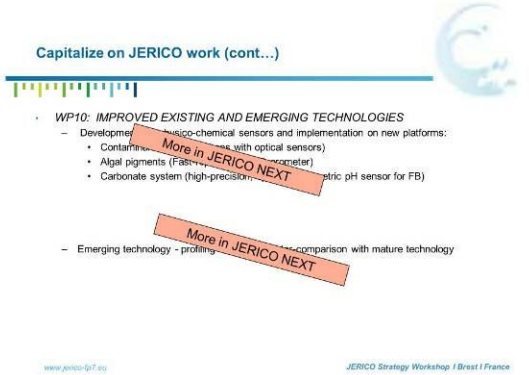
- Sensor interoperability: community request to industry for a standard protocol (e.g. OGC PUCK)
- Defining viable sensor package(s) for GES
- Exporting the TNA model to AtlantOS and beyond
- Strategy to have a stronger involvement of industry (include utility operators)

Innovations in Technology and Methodology in JERICO-Next WP3 (G. Petihakis, HCMR)









Include coastal platforms missing from JERICO

Task 3.2 HF Radars – A very promising coastal platform not touched during JERICO

- New HF radar procedures for current retrievals and data quality control – validation exercises, common protocols
- Improvements on HF radar network design at regional scales
- New products for 4D characterization of shelf/slope hydrodynamics and transport

KEY ISSUES

- Capitalize on JERICO work
- Include coastal platforms missing from JERICO
- **Enhance the capability and the quality of measurements in the coastal infrastructures**
- Enrich coastal measurements with more biology
- Maximise effort/cost relation given the required temporal and spatial scales and the shortage of funds

Enhance the capability and the quality of measurements in the coastal infrastructures

Task 3.1 Automated platform for the observation of phytoplankton diversity in relation to ecosystem services: **Combine** and **improve innovative** (semi)-automated **observation techniques** for addressing **phytoplankton** dynamics → several European coastal and shelf seas, →high resolution, → (near) real-time, →key monitoring platforms.

Three (3) main approaches will be explored and used in combination in order to build automated platforms:

1. **Imagery Instrumentation:** where 4 techniques will be explored and analysed

Enhance the capability and the quality of measurements in the coastal infrastructures (cont….)

2. **Single-cell optical characterization:** A major challenge in studies of optical properties of phytoplankton cells in the field is:
   - To develop means of discrimination between populations and (when possible) taxa,
   - To derive insights into phytoplankton functional group,
   - To define biological traits (based on pigments composition, size, shapes, free-living or colonial status)
   - To define physiological state.

Inter calibration workshops

- update the implementation of this technique into automated platforms
- better automation of data classification and analysis
- collaboration with SMEs.

Enhance the capability and the quality of measurements in the coastal infrastructures (cont….)

3. **Optical Instrumentation combination:** New optical techniques will be developed and tested to study phytoplankton biomass, taxonomy and productivity, and other optically active in-water constituents.

Algorithms will be further developed

Enhance the capability and the quality of measurements in the coastal infrastructures (cont….)

Task 3.5 Profiling coastal waters: Innovative improvement of existing profiling approaches.

Bottom mounted profiling systems

JELAB: Jerico Extended Lagrangian Bio-Geo-profiler

MASTODON2D

Rapid (down to minutes) processes at given depths.

YOYO trawl-secured profiling system

Daily full profiles measuring T, S, fluorescence and oxygen, including quasi real time automatic data

Enhance the capability and the quality of measurements in the coastal infrastructures (cont….)

Task 3.5 Combined sensors for carbonate systems: Further develop high precision and high frequency sensor systems for measuring the carbonate system.

Enhance the capability and the quality of measurements in the coastal infrastructures (cont….)

Task 3.6 Benthic compartment and process: During the FP7 JERICO, a strong focus has been put on the development of new semi-automatic techniques allowing for the assessment of the structuration of benthic communities (development of software).

Within JERICO-NEXT, we will go deeper in this approach by:

Modify the integrated multi-sensors video array towed fish

Organic Matter mineralisation

Adapt and test an existing sediment oxygen microprofiler during long observation periods, and an eddy covariance system to allow for repeated acquisition sequences

KEY ISSUES

- Capitalize on JERICO work
- Include coastal platforms missing from JERICO
- Enhance the capability and the quality of measurements in the coastal infrastructures
- **Enrich coastal measurements with more biology**
- Maximise effort/cost relation given the required temporal and spatial scales and the shortage of funds

Enrich coastal measurements with more biology

Task 3.4 Microbial and molecular sensors: Development of sensors for the molecular detection of phytoplankton, harmful algae blooms, and pollutants

Microbial molecular markers for pollution detection

Automated sampling of rDNA adapted to the Ferrybox

Biosensors for the detection of toxic algae

JERICO NEXT

Technology

Discussion & Conclusion

During this round table, several comments and questions were made about the scientific and technological needs.

1) *What is the support to the Blue Growth, for the industry? What is appealing to them?*
→ In some European countries, there are barriers to environmental impact assessments and legislation application. Indeed, a monitoring program has to be implemented for what we call the "**significant impact**" but, the monitoring program is not generally the scope of technology and systems developer. Consequently there is a need to set up a link with developers, to find a common solution. A sufficient solution would be to have a cost efficient system for monitoring.
2) *Are there other benefits to the Industry that are more of their choice?*
→ Yes, **resource measurements**. For instance, wind, waves or marine renewable energy converters.

3) In the frame of the Blue Growth the observing & monitoring networks help to make better decisions about decisions in the Marine sector.

4) E. Delory presented the sensors which will be developed in NeXOS: Regarding the decision of selecting these sensors, *was a decision taken by the scientific community or was there an interaction with the environmental agencies or the Industry? How much interaction took place?*
→ This was the first part of the project: the **requirements**. We had 4 stakeholder workshops organized in the first six months, with several types of industries (fisheries, oil and gas, etc). The conclusions were that we had some reasonable perspectives towards the needs when we wrote the proposal. We had the confirmation from the industry that there was an interest in what we will be doing.

5) Industry in the ocean observation can have **different meaning**: one conducting the sensor technology innovation and development, the other on the stakeholder end of things.
One example: *Ocean technology transfer competition* (US) → A team of ocean observing system working with a sensor industry developer, working with a user group who would use it. It's usually a three year project where the developments are made and new sensors established in the partner firms.
→ We should make sure that our developments will be useful and that the industry might have an interest in them.

6) If we think in terms of innovation, the Scientific Community has to be very much tight and **give a clear message and recommendation**. **Dialogue between different ongoing projects is really urgent and we need to deal with the next phase which will be the governance**.
We have an important work to do to integrate all these communities: to do that, we will also need feedback and good interaction with them.

7) We are developing platforms that can **be test facilities for prototypes and pre-commercialization** of sensors. We should **promote JERICO as other infrastructures** because it is coastal and closer and is suitable for testing new sensors.
We will promote JERICO-Next across the "Ocean Of Tomorrow" sensor development projects to comfort that idea.

8) From a general point of view, the issue to access an infrastructure is a general issue. For FP7 and H2020 projects, we should relate the **timeline of the TNA** to the lifetime of the project. We need to have several users during the project lifetime and not one set for the entire project. The budget allocated to TNA also justifies this choice.

9) *Is it realistic to look for something similar to ACT in Europe?*
→ Yes. **EuroGOOS** has the potential to take that onboard. We have some current technical groups and they could extend a little to other industrial partners, to have a better access to the European communities.
→ We tried to do it in JERICO with what we called **FCT** (Forum for Coastal Technology) and we need to consolidate this activity. However, it's not simple to build a new ACT. Maybe we can have something larger, which isn't only focusing on coastal technology (new forums in JERICO-Next).

10) We don't have a mechanism to **bring all these people together** (NeXOS, AtlantOS, FixO3, JERICO, etc). It could be good to harmonize all discussions and projects, for instance transfer what is done in the Atlantic side and bring it to the Mediterranean side and vice versa. We have to go further on the integration and collaboration.

IV] Round Table 3: European policy for coastal data

Introduction speech and JERICO-Next WP5 (L. Perivoliotis, HCMR)

Leonidas Perivoltis introduced the round table objective with regards to the JERICO-NEXT activities on coastal data management, and specific challenges JERICO will have to face:

- Increase the quantity and the quality of the data available through the major European infrastructures. Make more and better data available
- Manage a diverse and non-homogeneous data system as data from different communities will be available.
- Build a comprehensive and interconnected management system both for data and metadata
- Provide robust Quality Control and Assessment Procedures for specific data sets (FerryBox data, HF Radar, post mission gliders data, Biological data)

Round Table 3: European Policy for coastal data

The JERICO NEXT contribution

Leonidas Perivoliotis I HCMR I lperiv@hcmr.gr

JERICO data management

JERICO project proposed a European coastal marine observatory network by integrating different data flow systems that are based on the already existing distributed infrastructures for data collection in regional nodes.

- *The NODCs network organized under the SeaDataNet (SDN) for the access to the delayed-mode data and*
- *The EuroGOOS ROOSes organized via the MyOcean (MyO) project and currently supported through the Copernicus Insitu TAC service for the access to in situ, near real-time data.*

Supported the open access data policy
Focused on "physical" parameters
Handled mainly data from operational oceanography platforms

JERICO NEXT : The strategy for the data

- *The collected oceanographic data should be accessible, freely available, quality-controlled and in agreement with existing standards and conventions*
- *The data capacity of the European coastal observatory should be increased and the quality of the data provided should be improved. This will allow long-term and sustainable access to high-quality data necessary to understand not only the physics, but also the biological and chemical processes in the coastal zone.*
- *The direct linking with the major European infrastructures such as the EMODNET and the Copernicus Marine Core Service should be maintained and further upgraded. This will ensure both the proper and effective data dissemination and the data interoperability.*
- *The observations acquired through different in-situ platforms (mooring, profiling floats, gliders, HF radar, etc.) should follow a standardized data management for their processing and validation.*
- *Principles and methods regarding the data flow and the quality control procedures that have been already developed through other European*

JERICO NEXT : The approach

- *JERICO NEXT is not building its own data center. The data management activities will provide the necessary support in order the JERICO NEXT data to be available through the already established main European data Centers (EMODNET portals, Copernicus Insitu TAC, ROOSs, etc.)*
- *New Biological data will be aggregated. An operational link will be created with EMODNET biology that will facilitate the exchange between JERICO NEXT and the existing marine biological data networks*
- *The quality of measurements derived from specific platforms that are widely used in coastal monitoring such as the FerryBoxes, HF Radars and Gliders will be assessed and the new enhanced methodologies will then be applied by the partners before the release of such kind of data.*
- *A platform registration and metadata management system will be implemented in order to facilitate the data ingestion from the observatory operators*

JERICO NEXT : The challenges

- *Increase the quantity and the quality of the data available through the major European infrastructures. Make more and better data available*
- *Manage a diverse and non-homogeneous data system as data from different communities will be available.*
- *Build a comprehensive and interconnected management system both for data and metadata*
- *Provide robust Quality Control and Assessment Procedures for specific data sets (FerryBox data, HF Radar, post mission gliders data, Biological data)*

Marine knowledge and EMODnet (JB. Calewaert, EMODnet)

J.B. Calewaert presented European policy and context for data and EMODNET. He pointed that access to marine data is of vital importance for marine industries, decision-making bodies and scientific research.
Up to now, most of European marine data is fragmented and not accessible, held by various local, national and regional entities and databases – or when available the data or not compatible making aggregation and wider scale use impossible.
Making high quality marine data held by EU public bodies in the EU widely available would:

- improve productivity by 1 billion euro per year (roadmap on marine knowledge 2020 accompanying the recently publish EC communication on "Innovation in the Blue Economy"

- Increase innovation estimated at 200-300 million euros per year.

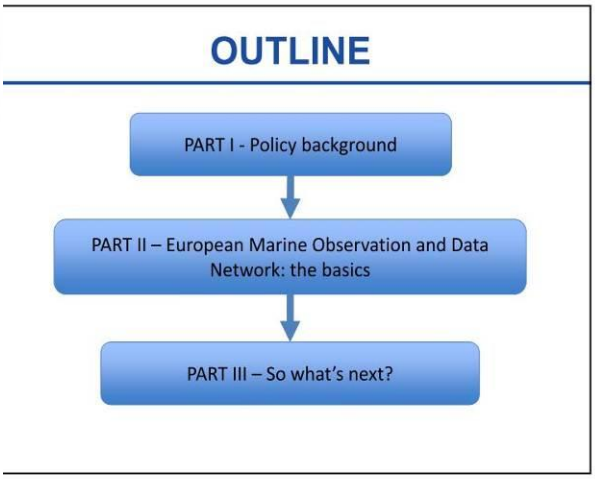
A higher quality and more accessible data would facilitate implementation of the MSFD.

EMODNET is one answer: It is a long term marine data initiative supporting blue-green economy in Europe. EMODnet portals are built on pre-existing systems to demonstrate feasibility – now it is time

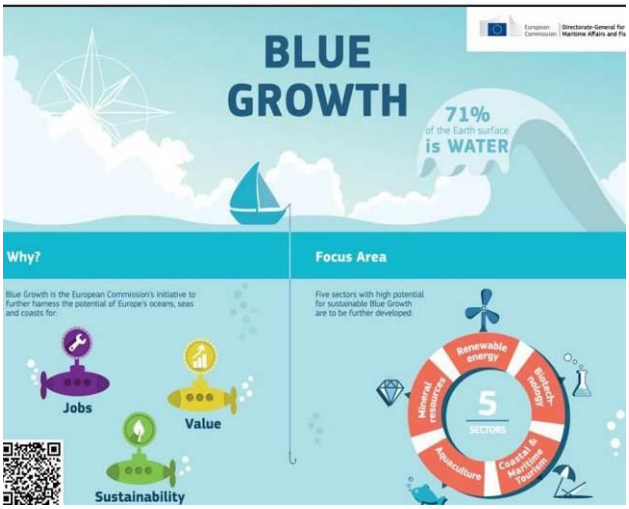
- For better integration at various levels
- Become more inclusive/open towards other data holders

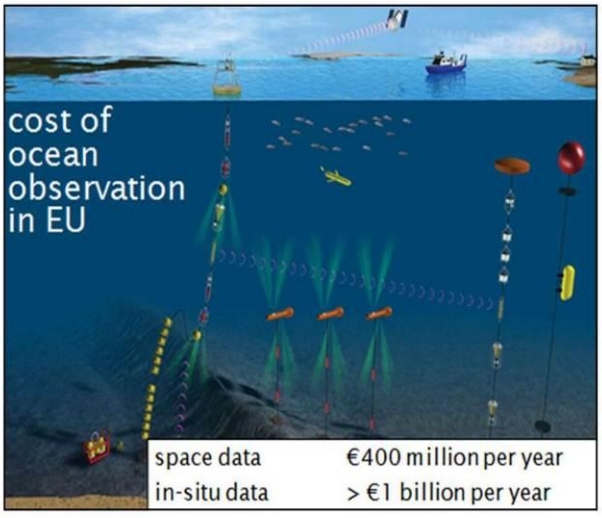
EU projects such as AtlantOS and JERICO- NEXT could and should contribute to ensure data integration of the various observation systems feeding into EMODnet

- Good practices from existing portals show the way forward
- EMODnet Central Portal may offer some tools to harvest data from various sources and disciplines simultaneously.



I. Policy Background



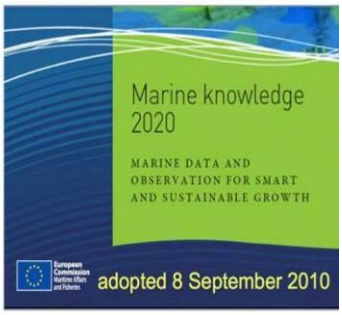


Maria Damanaki, former Commissioner for Maritime Affairs and Fisheries

(…) the data collected through observations can only generate knowledge and innovation if Europe's engineers and scientists are able to find, access, assemble and apply them efficiently and rapidly. At present this is often not the case.

Marine Knowledge 2020 – a new vision

- Change the present fragmented EU repositories of marine data with an interoperable sharing framework
- Move to a new paradigm where data are collected once and used for many purposes
- Optimize observation networks by showing how monitoring meets the needs of public and private users (CHECKPOINT)



Target for 2020

Seamless multi-resolution digital seabed map of European waters by 2020

- Highest resolution possible in areas that have been surveyed;
- Topography, geology, habitats and ecosystems;
- Accompanied by timely information on
  - Physical, chemical and biological state of the overlying water column
  - Oceanographic forecasts;
- Easily accessible, interoperable and free of restrictions on use;
- Accompanied by a process that helps Member States maximise the potential of their marine

Why is it so important?

An effective pan-European marine data infrastructure will

Improve offshore operators' efficiency and costs in gathering and processing marine data for operational and planning purposes → estimated at **1 billion € per year**

Stimulate competition and innovation in established and emerging maritime sectors → est. at **200-300 million € per yr**

Improve efficiency of **marine planning and legislation** (e.g. environment – MSFD in particular, fisheries, transport, etc.);

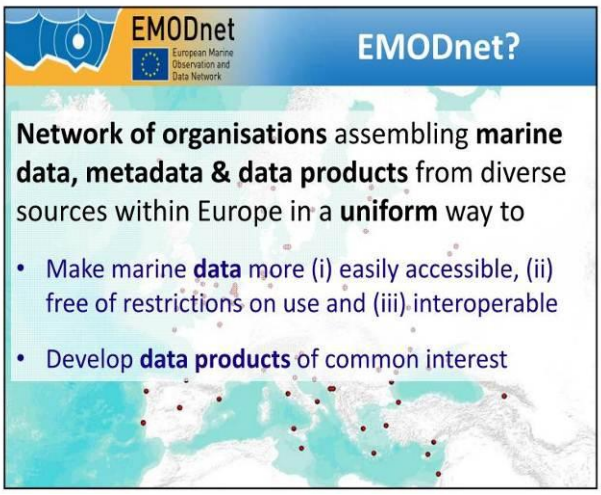
Reduce uncertainty in our knowledge and ability to forecast the behaviour of the sea.

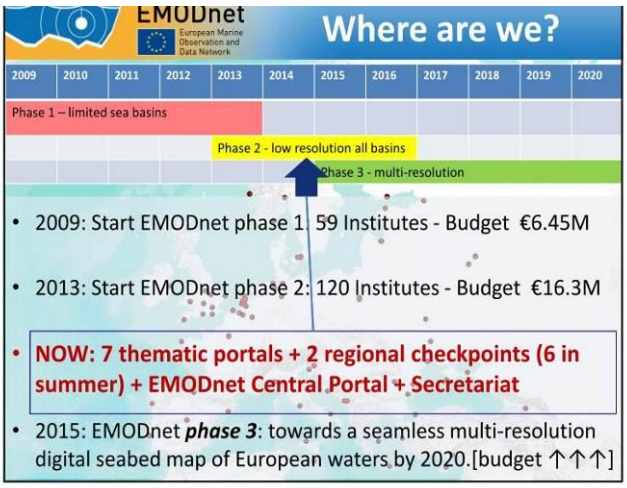
How?

→ Innovation in blue economy EC COM(2014)
→ Marine Knowledge 2020 Roadmap (2014)

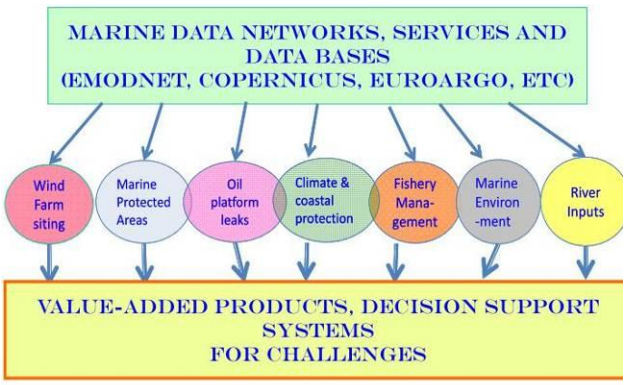
- **Improve European Marine Observation and Data Network (EMODnet) – from prototype to fully operational system**
- ***Better integration of existing data systems*** *(Copernicus Marine Service, Data Collection Framework for fisheries, WISE-Marine & EMODnet using common standards)*
- ***Involve industry*** *to promote data supply and use*
- ***Facilitating data ingestion into*** *EMODnet from industry and (EU) research projects*
- ***Sea-basin level strategic coordination*** *of observation systems, sampling programmes & surveying priorities*
- *Selective support for observations infrastructures/activities of pan-European added value (e.g. Euro-Argo floats)*

II. EMODnet





MedSea high level scheme



EMODnet Coastal Mapping

Tender DGMARE/2014/10 → start before summer

- deliver **prototype digital map of Europe's coastal zone** (the land/sea boundary) for inclusion in EMODnet
- focus on use of **high-res topographic / bathymetric data** & **development of standards** for relevant mapping datums (incl. defined coastline boundary at HAT & LAT levels).
- demonstrate use & integration of available data and how this can be interfaced with data for terrestrial and deeper water mapping.

III. What lies ahead

Addressing the need for more integration

→ Between major data initiatives
→ Within EMODnet & other major initiatives

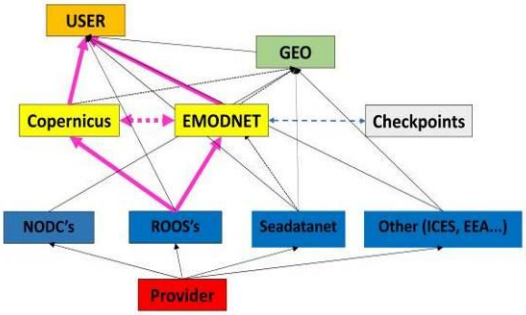
What's next?

→ Innovation in blue economy EC COM(2014)
→ Marine Knowledge 2020 Roadmap (2014)

- *Improving European Marine Observation and Data Network (EMODnet) – from prototype to operational*
- ***Involve industry*** *to promote data supply and use*
- ***Facilitating data ingestion into*** *EMODnet from industry and (EU) research projects*
- ***Strengthen sea-basin strategic coordination of observation systems*** *& sampling programmes*
- ***Selective support for observations infrastructures / activities*** *of pan-European added value e.g. Euro-Argo floats*
- **Better integration of existing data systems** (Copernicus Marine Service, Data Collection Framework for fisheries, WISE-Marine & EMODnet using common standards)

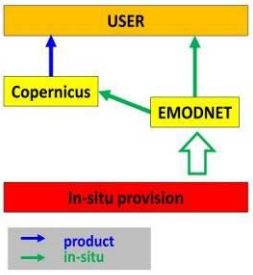
Copernicus – EMODnet?

Current landscape



Copernicus Marine Service & EMODnet are complementary - precise roles, positioning and interactions need to be discussed, defined and clarified to data provider & user communities

Copernicus as user of EMODnet?



Option

1. Copernicus marine service access *in-situ* data via EMODnet
2. If not possible:
   → Use direct access on short term
3. Work towards transfer from 2. to 1.

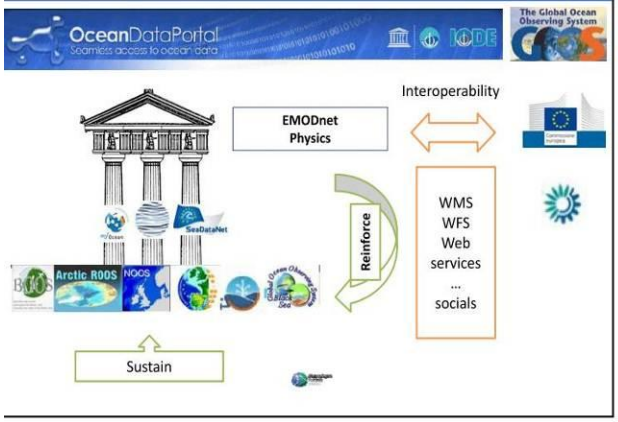
✓ Improved articulation towards provider and user
✓ No duplication within EU funded activities
✓ Potential improved resource usage at national level

EMODnet Physics

– Single point of free & open access to marine real-time & archived data on **physical conditions of all European Seas**
  • → *salinity, temperature, currents, sea level, waves, turbidity, pH, atmopheric pressure, etc.*
  • → *monitored by fixed platforms, ferry boxes, ARGOs, gliders, etc.*
– Make available **basic products**
  • → monthly average/max/min, sea level, ice

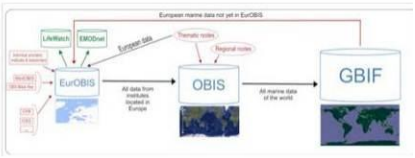


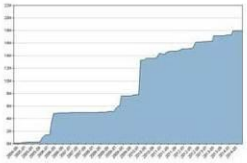
EMODnet Physics



EMODnet Biology

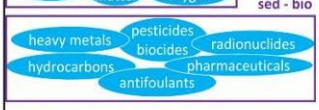
- Data on **temporal and spatial distribution of species abundance and biomass** from several species groups.
- Main components
  - WoRMS
  - EurOBIS-OBIS





EMODnet Chemistry

Heavily based on SeaDataNet consortium of NODCs



Methodology for Data Assembly

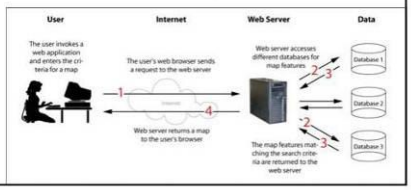
- **DIVA (Data-Interpolating Variational Analysis) concentration maps** for parameters **with homogeneous coverage**, measured at **basin scale**;

-Dynamic **plots** and coastal visualizations for not homogeneous data (**coastal points** repeated in time, datasets with **fragmented coverage**)

The Central Portal

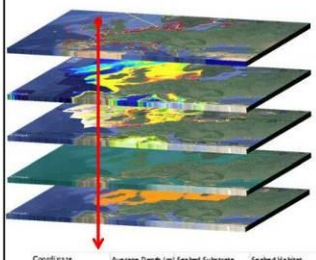
www.emodnet.eu

- Acts as a gateway to the other thematic and regional EMODnet portals
- Also develops own data products combining data from at least 2 thematic data portals



Use Case I: Query products simultanuously

Retrieve Data from specified coordinates at a given time or for a time interval



Physical Parameters (temperature, salinity)

Bathymetry

Seabed Substrate

Marine Region (ICES, Protected Area)

Species Abundance

Coordinate	Average Depth (m)	Seabed Substrate	Seabed Habitat	Cod mean abundance	Nitrates (5m -µmol/l)	ICES Statistical Area	EEZ
2,5461 51,7123	23.0	mud to sandy mud	Infralitoral mixed	0,37	16,1	IVb	French EEZ
3,7461 54,7123	27.4	mud	Circalitoral sandy	0,45	34,1	IVb	Dutch EEZ
6,5461 53,7123	87.5	coarse-grained sedi	Circalitoral muddy	1,89	27,1	IVb	Danish EEZ

Concluding remarks

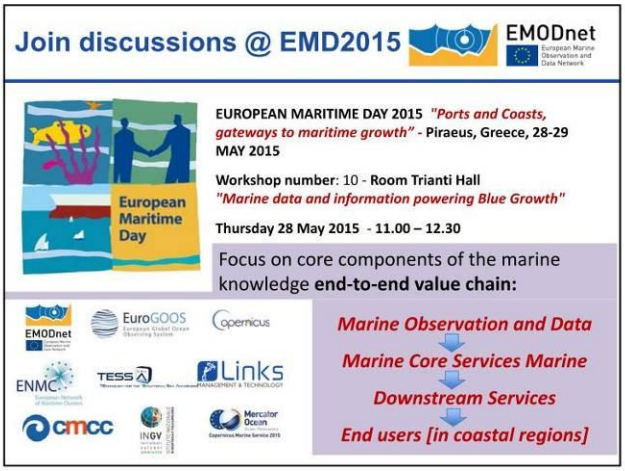
- EMODnet = long term marine data initiative supporting blue-green economy in Europe
- EMODnet portals are build on pre-existing systems to demonstrate feasibility – now it is time
  - For better integration at various levels
  - Become more inclusive/open towards other data holders
- EU projects such as AtlantOS and JERICOnxt could and should contribute to ensure data integration of the various observation systems feeding into EMODnet
- Good practices from existing portals show the way forward
- EMODnet Central Portal may offer some tools to harvest data from various sources and disciplines simultaneously

Join discussions @

EMODnet

A unique forum for the marine/coastal observation and data community, policy makers/advisors and stakeholders from various sectors and societal domains to meet, discuss and respond to the many challenges and opportunities that lie ahead – in particular towards better integration of the different data streams and initiatives..

For more information about the Conference and regular updates see http://www.emodnet.eu/openconference-info.


Join discussions @ EMD2015
EMODnet
European Marine Observation and Data Network
European Maritime Day
EUROPEAN MARITIME DAY 2015 "Ports and Coasts, gateways to maritime growth" - Piraeus, Greece, 28-29 MAY 2015
Workshop number: 10 - Room Trianti Hall
"Marine data and information powering Blue Growth"
Thursday 28 May 2015 - 11.00 – 12.30
Focus on core components of the marine knowledge end-to-end value chain:
EMODnet
EuroGOOS
Copernicus
ENMC
TESSA
Links
cmcc
INGV
Mercator Ocean
Marine Observation and Data
Marine Core Services Marine
Downstream Services
End users [in coastal regions]


Thank you
for your attention

Ferryboxes and coastal data (F. Colijn, HZG)

F. Colijn presented the ferrybox component of the coastal data system and raised strategy question to address for the future:

- How to improve integration of FB data in European marine data management?
- How can we enhance the links with European marine policies?
- Who are using the data collected? (stakeholder involvement)
- How can we establish a long term support and governance system for FB data?

Franciscus Colijn, em.

former Director Institute for Coastal Research HZG
Coordinator EU FerryBox 2002-2005
Chair FerryBox task team EuroGOOS

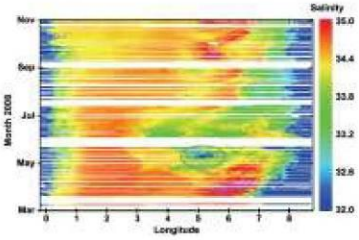
Round Table 3: European policy for coastal data

- FerryBox data are excellent examples of multidisciplinary data (chemistry, physics, biology)
- FB data are delivered to the EMODNET physics portal
- To show the relevance of the FB system a FerryBox whitebook is produced to show the achievements over the last 10 years

Contents FB whitebook

- Regional and global long term time series based on FB observations
- FB measurements as ground truth for satellite observations
- Use of FB for fishing and aquaculture community
- Use of FB data for modellers (e.g. validation)
- Development of new sensors for coastal observations
- Costs of FB systems incl. maintenance
- Integration between FB and other observational systems
- Use of FB data by EEA for the MSFD
- Role of FB data in ocean acidification

Example FB observations



Questions

- How to improve integration of FB data in European marine data management?
- How can we enhance the links with European marine policies?
- Who are using the data collected? (stakeholder involvement)
- How can we establish a long term support and governance system for FB data?

Discussion & Conclusion

During this round table, several comments and questions were made about the European policy for coastal data.

1) It is very important to **maintain this system** for many years, for long term parameter series as well as HF radars, etc. With ferryboxes, we cross the open seas and we need this important information.

2) *What are the complementarities between satellite and ferryboxes information?*
→ The complementarities are **the scale of observation**, the routes are very similar but it is difficult in terms of different times and delays. In case you have no cloud, you get a picture which fits pretty well with ferrybox observation. It is complementary with satellite observations

3) There is a strong notion of **transect repeatability** with ferrybox.
Even if the observation is limited, the repeatability of the observation is a positive point. It helps validating results.
Does it make sense to put boxes on research vessels where the repeatability is lost? It has been done on Polarstern which gives specific information in the Arctic and Antarctic areas and give good information from a European area to the South. The new research vessel will have the same system on board with no repeatability but offering important information.

4) We have to improve data management at European level, for an easy access to **good data quality**. This can be done if we set up quality and operability control data (harmonization of control procedure). It has been done in the networks but not in EMODnet. The major thing is that data should be accessible and EMODnet focused mainly on accessibility.

5) EMODnet Physics only gives physics data but it is **open for other parameters** to be available. Their data are near real time and the parameters have close links between EMODnet, ROOSes and Copernicus.

6) Biological data in JERICO-Next is an interesting task. *But how can we organize that in EMODnet biology with the observatories?*
→ We have no clear answer at the moment with the ROOSes or with Seadatanet. For a very general data management system, we want to have more and more data circulating, but the different systems don't want to deliver their data because they want to **keep their identity**.

7) We also have the problem of **data traceability**: maybe we should try to implement a dedicated observing system like DOI or have closer links with industry, for intelligent sensors. The point is that integrated science means that we have to consider together the physics and biologic data.

V] Round Table 4: European Strategy for sustainability of infrastructures

Introduction speech and JERICO-Next WP1 (D. Durand, IRIS)

D. Durand introduced the round table objective: to discuss together with key-players, European governance and economical model to sustain a European Research infrastructures such as JERICO-RI, considering national and European long-term priorities, and to consider the role of JERICO-NEXT in this context. We should also address collaboration and interaction with JPI-Ocean since a number of activities and tasks planned in JERICO-NEXT are in line with the priorities defined in JPI-Ocean.

.3 key questions were raised, introducing the next talks (A. Robin, EC, and F. Coroner, JPI-Ocean):

- *What are the **economic opportunities** to sustain the RI (MSFD, Marine renewables, Operational services) (WP1.1, WP1.2, WP3, WP4)?*
- *What are the **possible governance schemes** at European scale (WP1.5)? Coordination with the EuroGOOS/marine Board governance action (ERIC, INPO, EOOS?)…incl. the role of the Regions*
- *Model of coordination between JPI-Oceans, EuroGOOS and JERICO-NEXT (WP1.3 & 1.4)?*

Round Table 4: European strategy for sustainability of RI

Dominique Durand - IRIS - dodu@iris.no

Context

Chair: Agnes Robin (DG Research) & Dominique Durand (JNEXT-WP1)
Speaker: Florence Coroner (JPI-Oceans)

Objectives:

to discuss together with key-players, European governance and economical model to sustain a European Research infrastructures such as JERICO-RI, considering national and European long-term priorities, and to consider the role of JERICO-NEXT in this context.

Introductory talks:

A. Robin : "EU strategy to address RI sustainability - towards sustainable ocean and coastal Research Infrastructure – the expectation from JERICO-NEXT"

F. Coroner: "Joint programming initiative on healthy and productive seas and oceans: Increasing the value of national R&D investments"

Key-questions

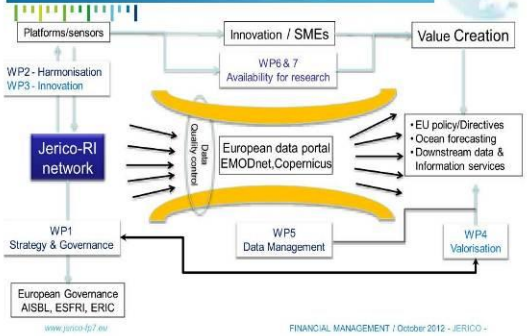
- *What are the **economic opportunities** to sustain the RI (MSFD, Marine renewables, Operational services) (WP1.1, WP1.2, WP3, WP4)?*
- *What are the **possible governance schemes** at European scale (WP1.5)? Coordination with the EuroGOOS/marine Board governance action (ERIC, INPO, EOOS?)…incl. the role of the Regions*
- *Model of coordination between JPI-Oceans, EuroGOOS and JERICO-NEXT (WP1.3 & 1.4)?*

Priorities/ideas to be agreed upon

- *To have communicated, clarified and agreed upon the role of JERICO-NEXT with key strategic stakeholders (EC, EuroGOOS, JPI-Oceans, Marine Board)*
- *To have established a coordination platform between JERICO-NEXT and these stakeholders*

WP#1 - Integrated Science Strategy and Governance from local to European scales

Dominique Durand I IRIS I dodu@iris.no



WP1: Integrated Science Strategy and Governance from local to European scales

- To provide a framework for the realisation of the project workplan and for the long term sustainability and impact of the RI on research and on the implementation of the relevant European policies.
- To produce a long term strategy for the development and integration of coastal observatories in Europe
-
  - **Task1.1: Literature review** (CEFAS) on main environmental problems and threats and how they are presently tackled through European organizations, initiatives and projects
  - **Task 1.2: Science strategy** (CNRS) To tackle key scientific questions about how best to observe physical, chemical and biological parameters in European waters and the adequacy of present observation strategies to meet key scientific and societal challenges in the coastal ocean
  - **Task 3 & 4** (HCMR, SOCIB) Specific interactions with other relevant European and international ocean observing systems and infrastructures that provide complementary observations of biological (task 1.3) and /or physical, chemical (task 1.4) parameters.
  - **Task 1.5** (MI) - Strategy towards sustainability. To look at long term financial and legal governance structures for the sustainable implementation of JERICO-NEXT infrastructures
  - **Task 1.6** (Ifremer) - Strategy for the future and the JERICO label
-

WP 1 – Outcomes

- **Scientific strategy** to be applied to answer specific scientific questions, and policy requirements. (tasks 1.1, 1.2 and 1.6)
- **Financial and governance strategy** to make sustainable the infrastructure and the work supported by it. The legal issue should address the possible sketches to sustain the infrastructure in a dedicated governance. This work should be supported by use of economical models and involvement of staff from juridical offices. (task 1.3 to 1.5)
- Integrate the scientific and governance strategies into a **comprehensive strategy for the sustainability of JERICO-NEXT** and the delivery of an harmonized infrastructure, compliant with EMODNET and Copernicus. (task 1.7)

Link to JPI-OCEANS SRIA

Valorisation through MSFD descriptors and key scientific areas

- *1- JRAP-1 on pelagic biodiversity*
- *2- JRAP-2 on benthic biodiversity*
- *3- JRAP-3 on chemical contaminant occurrence and related biological responses*
- *4- JRAP-4 on hydrography and transport*
- *5- JRAP-5 on carbon fluxes and carbonate system*
- *6- JRAP-6 on operational oceanography*

EU strategy to address RI sustainability (A. Robin, DG Research)

Agnès Robin introduced the EU strategy to address RI sustainability, towards sustainable ocean and coastal research infrastructure, and the expectation from JERICO-Next.

Infrastructure sustainability is a key issue and a challenge in the current economic context. The European Strategy Forum on Research Infrastructures (ESFRI) started working on this matter by promoting national roadmaps in addition to the successive ESFRI roadmaps. At EU level, sustainability of many RIs within the ESFRI roadmap raised concerns, leading in 2014 to a further prioritization exercise, inviting Member States to focus even more their available national resources. **ESFRI plans to engage further in monitoring the implementation of the RIs currently on the ESFRI roadmap and only few new projects will be added during the 2016 update**.

It is essential that policy and funding bodies have a sound decision basis. For example conceptual/technical design of RIs, by informing on strategic and financial needs of scientific community, contributes to the establishment of long-term plans, roadmaps.
A further step, the Preparatory Phase, aims to more detailed plans towards the implementation of the infrastructure, focusing on legal and financial issues (including governance, internal rules, etc.). As it will require strategic decisions, **the stakeholder engagement at the earliest stage is really important: it is essential to have a clear milestone stating the consultation of the relevant stakeholders including funding authorities.**

Regarding sustainability of JERICO infrastructure, the JERICO-Next project has to identify, expand and involve the user communities and in particular build links with as many stakeholders and industries as possible to optimize the use of our technology, facilities and data.
It is also essential to ensure a common understanding within the JERICO community of the shared objectives and to check this understanding at the beginning of the project to avoid issues during the lifetime of the project: which level of cooperation, which level of integration
Last but not least, engaging relevant decision funding bodies has to be taken into account: to do so**, it is crucial to provide convincing information on the added value of what you want to achieve and if they have interest in funding you or not**.
→ A good opportunity to exercise and understand which information is needed by national authorities and decision makers is to look at the content of the application forms of the call towards the "2016 ESFRI Roadmap update".

The following conclusions were highlighted:

- ***Towards sustainable ocean and coastal research infrastructure: a scientific excellence is required but also short and long term impacts on jobs, growth and societal challenges. To do so, it is important to think about cost-effectiveness and flexibility.***
- ***Address and engage as many stakeholders as possible: an appropriate communication strategy and early engagement are the key to succeed.***
- ***The European Commission is a facilitator and encourages to work at the national level: EU & national road-mapping, joint programming; supporting coordination, preparatory work; facilitating access to financing (Eib / InnovFin), Horizon 2020 for R&I activities but core funding at national level.***
- ***JERICO-NEXT: opportunity for preparatory work on both design/concept and legal/financial/governance issues (help answering "ESFRI like" questions).***

Round Table 4: European Strategy for sustainability of infrastructures

EU strategy to address RI sustainability & expectation from JERICO-NEXT

Agnès Robin I European Commission, Research Infrastructures I agnes.robin @ ec.europa.eu

EU strategy to address RI sustainability - the expectation from JERICO-NEXT

New political agenda! European Commission priorities, including:

- *Jobs, Growth and Investment (€300 billion Investment package)*
- *Digital Single Market*
- *Energy Union and Climate*

Mission letter to the Commissioner Carlos Moedas:

"Improving research infrastructure and making better use of research results is essential to strengthen innovation further, develop new activities and boost the productivity and competitiveness of our economy"

"Mobilising innovative financial instruments available under Horizon 2020, facilitating investment in education, research and innovation infrastructure and maximising synergies with the implementation of the ESIF at national and regional level".*

* European Structural and Investment Funds

EU strategy to address RI sustainability - the expectation from JERICO-NEXT

New political agenda ⇨ impact on priorities for RIs

- *Facilitate investment in RI : towards long term sustainability*
- *Increase scientific excellence and effectiveness (planning, decision making process, governance, management, cost control…)*
- *Exploit the innovation potential of RI*
- *Maximise research results (data)*
- *Promote EU excellence abroad and "internationalise" when necessary (support international collaboration and facilitate the integration of partners from third countries)*
- *Stairway to excellence (train and attract young talents, facilitate transnational access on the basis of merit but not exclusively)*

EU strategy to address RI sustainability - the expectation from JERICO-NEXT

Horizon 2020

Excellent science

- European Research Council
- Future and Emerging Technologies
- Marie Curie actions
- **European Research infrastructures (including e-infrastructures) – 2383* M€**

Societal challenges

- Health, demographic change, wellbeing
- Food security, sustainable agriculture, marine - maritime research, bio-economy
- Secure, clean and efficient energy
- Smart, green, integrated transport
- Climate action, resource efficiency, raw materials
- Inclusive, innovative and reflective societies
- Secure societies

- *Spreading excellence & Widening Participation*
- *Science with and for Society*

Industrial leadership

- Leadership in enabling and industrial technologies (ICT, space, nanotechnologies, advanced materials and advanced manufacturing and processing, biotechnology)
- Access to risk finance
- Innovation in SMEs

* taking into account contribution to European Fund for Strategic Investments 'EFSI'

EU strategy to address RI sustainability - the expectation from JERICO-NEXT

RI sustainability: recognised as a major challenge

- *By ESFRI (promoting national roadmaps; 2014 prioritisation exercise; monitoring implementation of RI on ESFRI roadmap; new requirements to apply to 2016 roadmap: funding commitment and political support);*
- *Expected to be addressed as well by networks of national RIs (Integrating Activities FP6-FP7-Horizon 2020): plans for sustainability of integrated services;*
- *By Horizon 2020 Advisory Group on European Research Infrastructures including e-Infrastructures*
- *See as well OECD report "International Distributed Research Infrastructures"; EIROforum discussion paper "Long-term sustainability of Research Infrastructures"; etc.*

EU strategy to address RI sustainability - the expectation from JERICO-NEXT

Policy and funding bodies need sound decision basis!

- *Design studies (conceptual and technical design)*
  - ⇨ *Awareness on strategic and funding needs of the scientific community (and user community at large)*
  - ⇨ *Long-range plans and roadmaps of pan-European or global interest*
- *Preparatory Phase (stakeholders engagement, legal and financial work including governance, siting, internal rules)*
  - ⇨ *Raising (technical,) legal and financial maturity to enable funding decisions and prepare legal agreements (e.g. MoU)*
- *Implementation Phase (enlargement of membership, int'l coop., pilots for testing/improving user services, definition of service level agreements & business plan, technology transfer etc.)*

EU strategy to address RI sustainability - the expectation from JERICO-NEXT

2010 ESFRI Roadmap

Social Sc. & Hum. (5)	Life Sciences (13)		Environmental Sciences (9)		Energy (7)	Material and Analytical Facilities (6)	Physics and Astronomy (10)		e-Infra-structures (1)
SHARE	BBMRI	ELIXIR	ICOS	EURO-ARGO	ECCSEL	EUROFEL	ELI	TIARA*	PRACE
ESS Survey	ECRIN	INFRA FRONTIER	LIFEWATCH	IAGOS	Windscanner	EMFL	KM3NeT	CTA	
CESSDA	INSTRUCT	EATRIS	EMSO	EPOS	EU-SOLARIS	European XFEL	E-ELT	SKA	
CLARIN	EU-OPENSCREEN	EMBRC	SIOS	EISCAT_3D	JHR	ESRF Upgrade	SPIRAL2	FAIR	
DARIAH	Euro BioImaging	ERINHA BSL4 Lab		COPAL	IFMIF	NEUTRON ESS	SLHC-PP*	ILC-HIGRADE*	
	ISBE	MIRRI			HiPER	ILL20/20 Upgrade			
	ANAEE				MYRRHA				

ERIC established

ERIC in preparation

Distributed research infrastructures

Single sited research infrastructures

EU strategy to address RI sustainability - the expectation from JERICO-NEXT

JERICO-NEXT and sustainability: (not exclusive) it is expected to...

- *Identify, expand and involve the user communities*
  - *Research, monitoring (e.g. MSFD), operational n.r.t. services, industry*
- *Ensure within JERICO common understanding of shared objectives: what and how?*
  - *Expected benefits ? JERICO appropriate scale? How does it fit with the (evolving) landscape and on-going initiatives (local – national – regional – European - global)*
  - *Level and nature of cooperation – coordination – integration: network or pan-European (research) infrastructure?*
- *(Identify and) Engage relevant decision/funding bodies*
  - *Good exercise: self-assessment of 'RI readiness' using submission form of proposals for the 2016 ESFRI Roadmap (user involvement strategy, access policy, investment alignment, impact, e-needs, business case, planning, governance, commitments…)*

Conclusions

- *Towards sustainable ocean and coastal research infrastructure: scientific excellence AND jobs and growth AND societal challenges AND… AND… No definitive balance between (contradicting?) priorities therefore cost effectiveness and flexibility are essential*
- *Many stakeholders: appropriate communication strategies and early engagement are key!*
- *EC role: facilitator! Encouraging (ESFRI) EU & national road-mapping, joint programming; supporting coordination, preparatory work; facilitating access to financing (Eib / InnovFin), Horizon 2020 for R&I activities but core funding at national level (and ESIF if part of Smart Specialisation Strategy).*
- *JERICO-NEXT: opportunity for preparatory work on both design/concept and legal/financial/governance issues (help answering "ESFRI like" questions).*

Priorities/ideas to be agreed upon

The coastal component of the JPI Oceans (F. Coroner, JPI)

Florence Coroner introduced the work done by JPI Oceans and its coastal component, alongside with the ambitions and interaction with JERICO-Next.

Joint Programming is focusing on the 85% budget for research, which is mainly managed at member state level: only 15% of research budget is either coordinated by the Framework Program and other intergovernmental programs.

JPI Oceans is composed of 21 participating countries covering all European seas. These countries have identified priorities, which are listed in what is call the "Strategic Research and Innovation Agenda" (several points can be of interest for the JERICO community, see slides below and contact your national JPI representatives).

Florence Coroner presented the Workshop "Maritime Spatial Planning" which occurred in March 2015 and whose role is to build a forum for planners and scientific community involved in maritime spatial planning.
This forum is composed of two layers: a core forum with an interdisciplinary pan European scientific partnership and an outreach partnership gathering scientists, policy makers, etc.

The following conclusions were highlighted:

- There is a need for upscaling **experimentally-based process studies (mostly under laboratory conditions and short-term),** from species-specific impacts on organisms to their consequences for ecosystems and human society, relevant to marine management and policy decisions.

- Furthermore, there is a need for a coordinated European ocean observing system – building on existing national efforts, the work of GOOS/ EuroGOOS, OSPAR, ICES, IOC and others - to monitor climate change impacts such as ocean warming and ocean acidification.

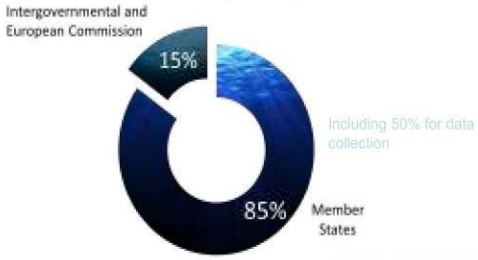
JPI OCEANS

European Strategy for sustainability of infrastructure

Florence Coroner I JPI Oceans I florence.coroner@ifremer.fr

JPI OCEANS

What is Joint programming ?



JPI OCEANS

What is JPI Oceans ?

- A high-level strategic process, to provide a **long-term integrated approach to marine and maritime research, infrastructures and technology** development in Europe
- An **Intergovernmental process**, open to all Member-states and Associated Countries with an interest in marine maritime research (variable geometry principle)
- It aims to increase and improve the cross-border **collaboration, coordination and integration** of member-states publicly funded research programmes
- The full **tool box of public research instruments** (National and regional research programmes, intergovernmental research organisations and collaborative schemes, Research infrastructures, Mobility schemes...) should be explored and used to implement JPIs

JPI OCEANS

21 Participating countries

JPI OCEANS

Overview: Strategic Research and Innovation Agenda

1. Exploring deep sea resources
2. Technology and sensor developments (including for extreme environments)
3. Science support to Management of coastal and marine ecosystems
4. Linking oceans, human health and wellbeing
5. Interdisciplinary Research for Good Environmental Status
6. Observing, modelling and predicting ocean state and processes
7. Climate change impact on physical and biological ocean processes – Oceans circulation
8. Effects of Ocean Acidification on Marine Ecosystems
9. Food security and safety in a changing world of climate change and marine degradation
10. Use of marine biological resources through development and application of biotechnology

JPI OCEANS

Relevant Strategic areas / Actions – JERICO / JPI OCEANS

Strategic Area 2:Technology and sensors development

- Action 1 : Create an oceans technology and engineering community (public-private partnership for innovation)
- Action 2: Technologies and maritime operations and platforms on the surface and in the deep sea
- Action 5: Improve the performance of fixed and mobile platforms

Strategic Area 3: Science support to Management of coastal and marine ecosystems

- Action 2 : Develop and implement an integrated monitoring strategy for coastal observation

Strategic Area 5: Interdiciplinary research for Good Environmental Status

… cross-cuttting initatives

JPI OCEANS

Cross-cutting area Infrastructure: Shared use, common procurement strategies

- Develop a common vision for better and faster use of existing knowledge from different disciplines structure use and access
- Set-up common procurement strategies, develop common business plan
- Strengthen land-based facilities and develop in situ testing sites for ocean engineering, shipbuilding, ocean energy, sub-sea technologies and instrumentation

Interdisciplinary Research for Good Environmental Status (Workshop 5 March 2015)

- Cumulative effects (of anthropogenic disturbances)
- Integrated assessment of effects of new pollutants
- Ecosystem goods and services for coastal and marine waters

Experts workshops, joint calls, MoU…

Building an efficient interdisciplinary scientific community for Policy Relevant Knowledge (Workshop MSP 20 March 2015)

A forum in which planners and scientific advisers to the Maritime Spatial Planning processes from local to international level can network and share experiences:

- **CORE FORUM** as the 1st layer: build an interdisciplinary pan-European scientific partnership with the aim to develop and implement advanced models of human-nature interface and the land-sea interactions, while addressing cross-boundary issues,
- **OUTREACH PARTNERSHIP** of scientists, policy makers and stakeholders as the 2nd layer.

- Step 1 (May – December 2015) : Creation of a long-term knowledge hub
- Step 2 Connectivity: networks of people in 2016, including interaction with existing ERA-nets or BONUS to find relevant experts;
- Step 3 (start in 2016?) Capacity building: training, mobility of human resources, workshops to define specific capacity building possibilities;
- Step 4:joint call for research (timing beyond 2017?) engaging structural funds, while ensuring support to procedures/agreements for transnational access and sharing of infrastructures, access to data during the entire process for this action.
- While ensuring support to procedures / agreements for TNA and sharing of infrastructures, access to data

Improved understanding of how climate change can affect ocean processes, ecosystems and the services they provide (Workshop 24-25 March 2015)

Need to upscale **experimentally-based process studies (mostly under laboratory conditions and short-term)** from species-specific impacts on organisms to their consequences for ecosystems and human society, over space- and time-scales relevant to marine management and policy decisions.

Next steps :

- Workshops to set priority interdisciplinary science questions in climate-sensitive regions and develop transnational cooperation (2016?)
- Develop a JPI-Ocean label on climate change impacts for initiatives developed on the basis of existing MRI and training programmes (2016)
- Develop calls for projects promoting climate-related multi-national cooperation and bridging the use of MRI at regional scale (2017-2010)

Optimization of transdisciplinary marine monitoring to support assessments of the physical, chemical, biological and societal consequences of climate change (including ocean acidification) (Workshop 24-25 March 2015)

Need for a coordinated European ocean observing system – building on existing national efforts, the work of GOOS/ EuroGOOS, OSPAR, ICES, IOC and others - to monitor climate change impacts such as ocean warming and ocean acidification.

Next steps:

- Step 1: update picture of the landscape as starting point
- Step 2: engage a dialog with EuroGOOS and other relevant initiatives/ networks

JPI OCEANS

THANK YOU

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Discussion & Conclusion

During this round table, several comments were made about the European strategy for sustainability.

1) One of the main asset of JERICO is to gather scientists in **groups according to coastal infrastructure types (for instance FB, Fixed platforms etc.), at European level**. Nevertheless, the right priorities have to be taken at national level, through better d recommendations from us as the European community. That means that JNEXT challenge is also to go from several scientific communities to one coastal scientific community giving strong and coordinated message in the respective countries, towards more coordinated decision making between European countries

2) When one plans a new RI, one anticipates the choice of sensors, payloads, etc. In decision making, one anticipates the **type of governance** and how to find the best way to adapt the systems to specific needs (i.e. for industry, science or other purposes).

3) We have to be agile and learn from the UK experience. A research council observatory in Liverpool Bay was research-funded. At the end the community involved asked for more funding to answer other questions and received it for the second time, by not for the third and everything was taken away. It is the inbuilt tension with the system.

We have to reassess and try to **adapt the monitoring strategies** to new questions

4) The link between **JERICO-Next and JPI Ocean** should be exploited to create greater scientific value while reducing costs and optimizing the use of resources. Several components of the JPI Ocean program can be linked with JERICO-Next. It is important to have JERICO representatives in the relevant JPI-oceans working group to ensure coordinated actions.

5) The European Commission acts as a **facilitator.** JERICO-Next is a good example of such action. The project is the perfect framework for networking, since we have links with stakeholders from the private and public sectors.

VI] Synthesis and main conclusion

Several round tables conclusions are highlighted in the following lines.

With regards to the infrastructure extension:

- Need to provide more multipurpose systems, hence increasing cost efficiency.
- Better integration of different systems: monitoring vessels, seafloor platforms.
- OSE/OSSE experiments acknowledged as an appropriate tool to analyse, in an objective way, the efficiency of a regional/local network.

With regards to innovation and the link with industries:

- Importance to include cost-effectiveness in the design of systems, in cooperation with system developers and manufacturers, in order to ensure a good market penetration towards stakeholders and users with the objective of answering the need for environment monitoring and assessment of the "significant" environmental impacts.
- Importance to involve industry at the beginning of the process (NEXOS experience) by organising dedicated meeting focused upon industry types/needs.
- Different industries to be considered: developers & providers versus users & stakeholders… be sure developed products/services are of interest for the latter.
- Need to involve industry in the governance in order to optimize the dialogue and the use of test facilities offered through JERICO_NEXT (TNA).
- EuroGOOS seems to be the suitable framework to build upon JERICO FCT and involve the private sector.

With regards to the European policy of coastal data:

- *How to organize EMODnet biology with the observatories for multidisciplinary data?*
- No clear answer, the different systems are not willing to deliver their data because they want to **keep their identity, there is a** problem of **data traceability.** Would a dedicated observing system identifier like a **Digital Object Identifier** DOI answer?
- To develop the intelligent sensor technology (like plug and play ones), closer links with industry, are expected.
- Integrated science based on multidisciplinary datasets encompassing physical, chemical and biological data.

With regards to the European strategy for sustainability of Infrastructures:

- When we plan a new RI, one anticipates the choice of sensors, payloads, etc. In decision making, one anticipates the **type of governance** and how to find the best way to adapt the systems to specific needs (i.e. for industry, science or other purposes).
- Link with JPI- Ocean to be enhanced toward coordination between activities that are common between JPI and JERICO-Next. It is important to have JERICO representatives in the relevant JPI-oceans working group to ensure coordinated actions.
- **During the preparatory Phase of RI, the stakeholder engagement is really important: it is essential to have a clear milestone stating the consultation of the relevant stakeholders.**
- Towards sustainable ocean and coastal research infrastructure: a scientific excellence is required but also short and long term impacts on jobs, growth and societal challenges. To do so, it is important to consider cost-effectiveness and flexibility.
- Address and engage as many stakeholders as possible: an appropriate communication strategy and an early engagement are the key to succeed**.**