SOCIB: the impact of new multi-platform observing and forecasting systems in science, technology development and response to society needs

Joaquín Tintoré and the SOCIB & IMEDEA team

http://www.socib.es

OUTLINE, NARRATIVE; --- “the history to tell”….

Goal: Marine Research Infrastructures: key elements of Blue Growth & IMP, increase Horizon 2020 competitiveness & implementation RIS3 SS Strategies .

Outline:

1. Why Ocean Observatories/Marine Research Infrastructures (MRI), why now?
2. SOCIB; an example in the Western Mediterranean. What, where, how,…
3. Innovation in Oceanographic Instrumentation; gliders and incubation times
4. The new role of MRI; Science, Technology and response to Society needs

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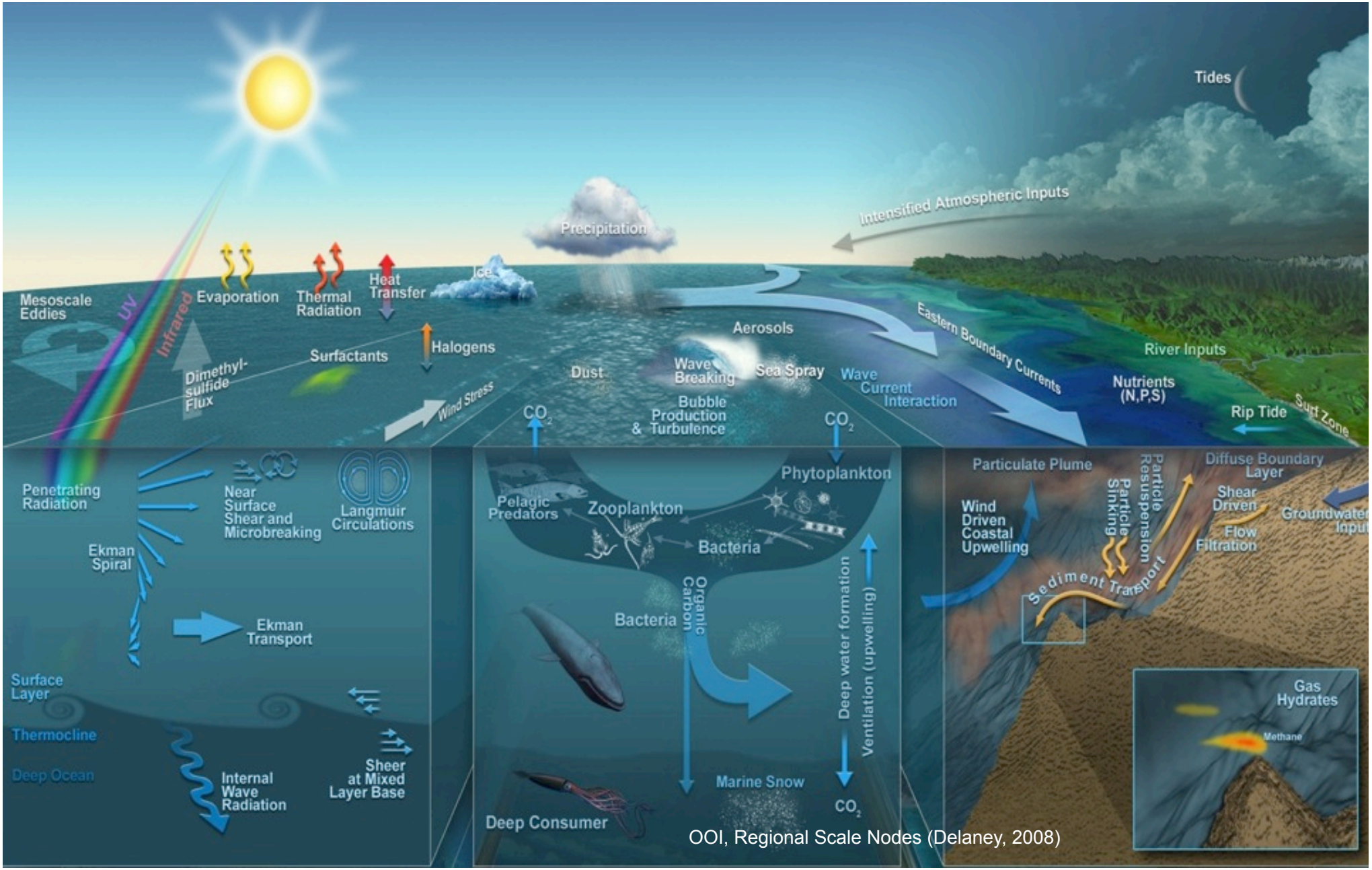
Oceans are complex, central to the Earth system
Management is needed. Oversimplification dangerous…



OOI, Regional Scale Nodes (Delaney, 2008)

The oceans are chronically under-sampled

(Credit, Oscar Schoefield)

de les Illes Balears

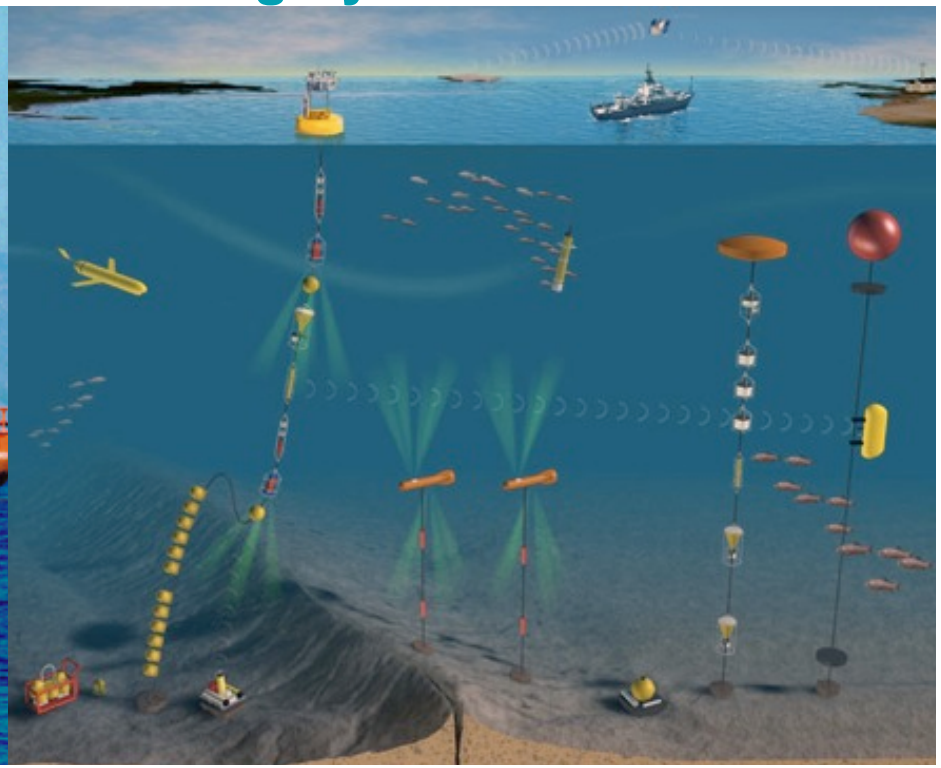
Paradigm Shift (1) in Ocean Observation

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

(Adapted from Steve Chien, JPL-NASA)

Platform-centric Sensing Systems

Net-centric, Distributed Sensing Systems



Paradigm Shift (2) in Data Availability

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

Inter-comparison

Models  **Data**

…. For ….At sea mission re-definition, new models setup…

With… huge increase in human potential for analysis

NEW CHALLENGES, TOOLS DEVELOPMENT, etc…

A 2020 Vision for Ocean Science

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

SOCIB Balearic Islands Coastal Observing and Forecasting System

CSIC

Govern de les Illes Balears

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

Why SOCIB, why Ocean Observatories, and **why now?**

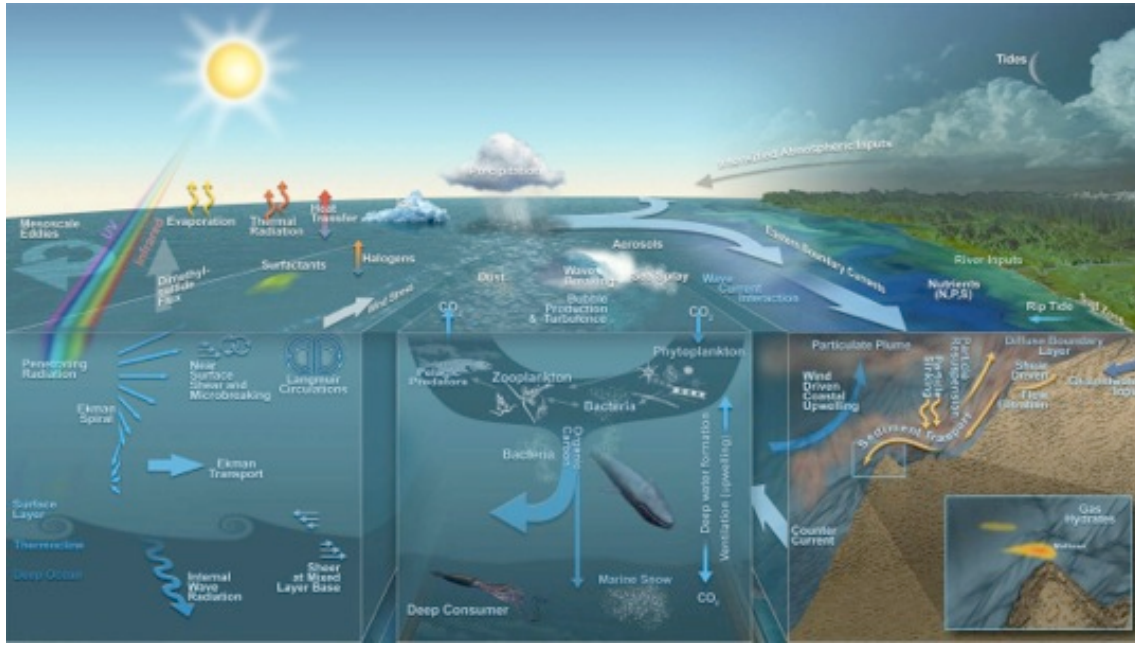
A New Approach to Marine and Coastal Research

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

A quantitative major jump, in scientific knowledge and technology development

The development of a new form of Integrated Coastal Zone Management, based on recent scientific and technological achievements,

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



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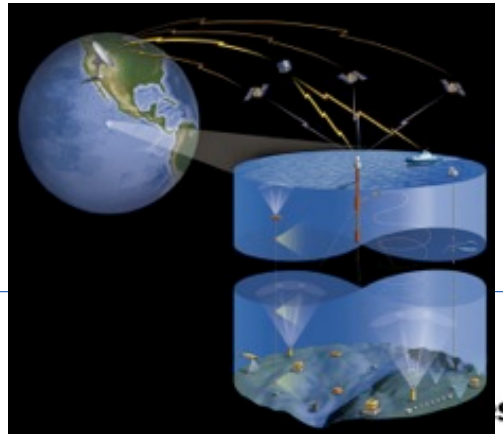

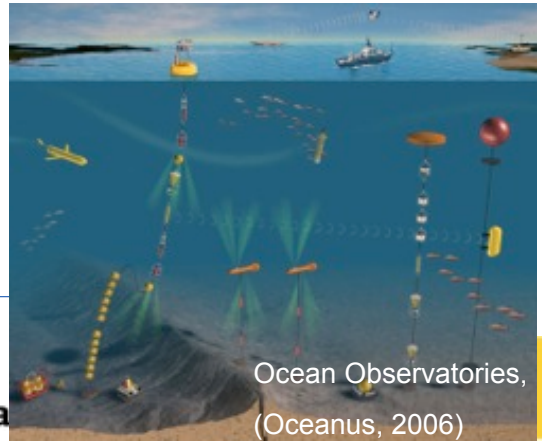

Ocean Observatories, (Oceanus, 2006)

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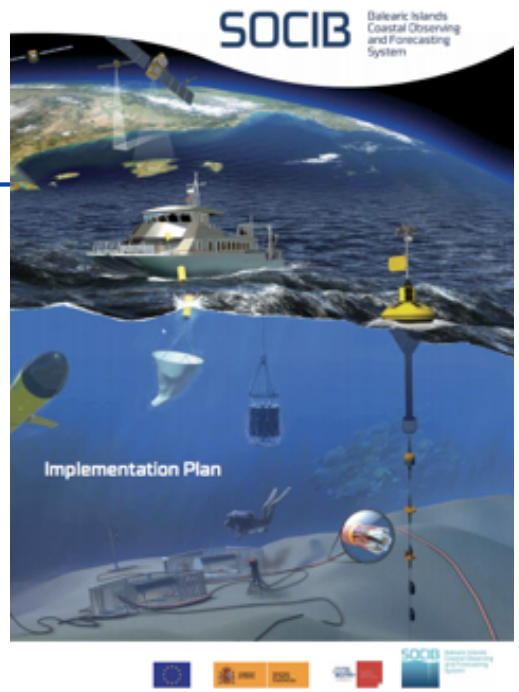
CSIC

SOCIB and Marine Research Infrastructures



Economic benefits
derived from achieving objectives

Societal objectives
- advance basic knowledge
- manage natural hazards
- preserve environment
- etc...

Information/knowledge
- understanding of the ocean
- climate projections
- weather and storm forecasts
- ecosystem response to forcing
- etc...

Ocean research

Models (research and operational)

Answers to science questions

Data

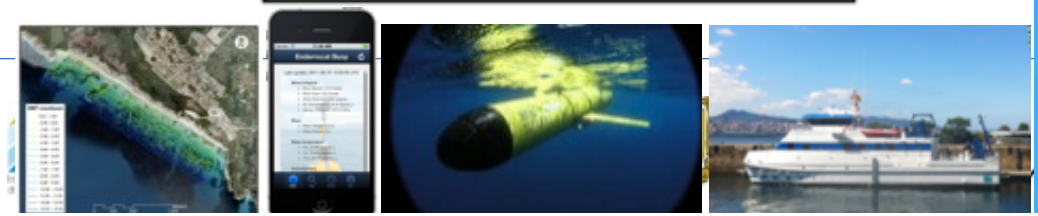
Research activities

Monetary investment
ocean research and infrastructure funding

Infrastructure
platforms
sensors
models
data sets
data management facilities
enabling organizations
people

Committee on an Ocean Infrastructure: Strategy for U.S. Ocean Research in 2030. NRC (2011)

SOCIB Balearic Islands Coastal Observing and Forecasting System



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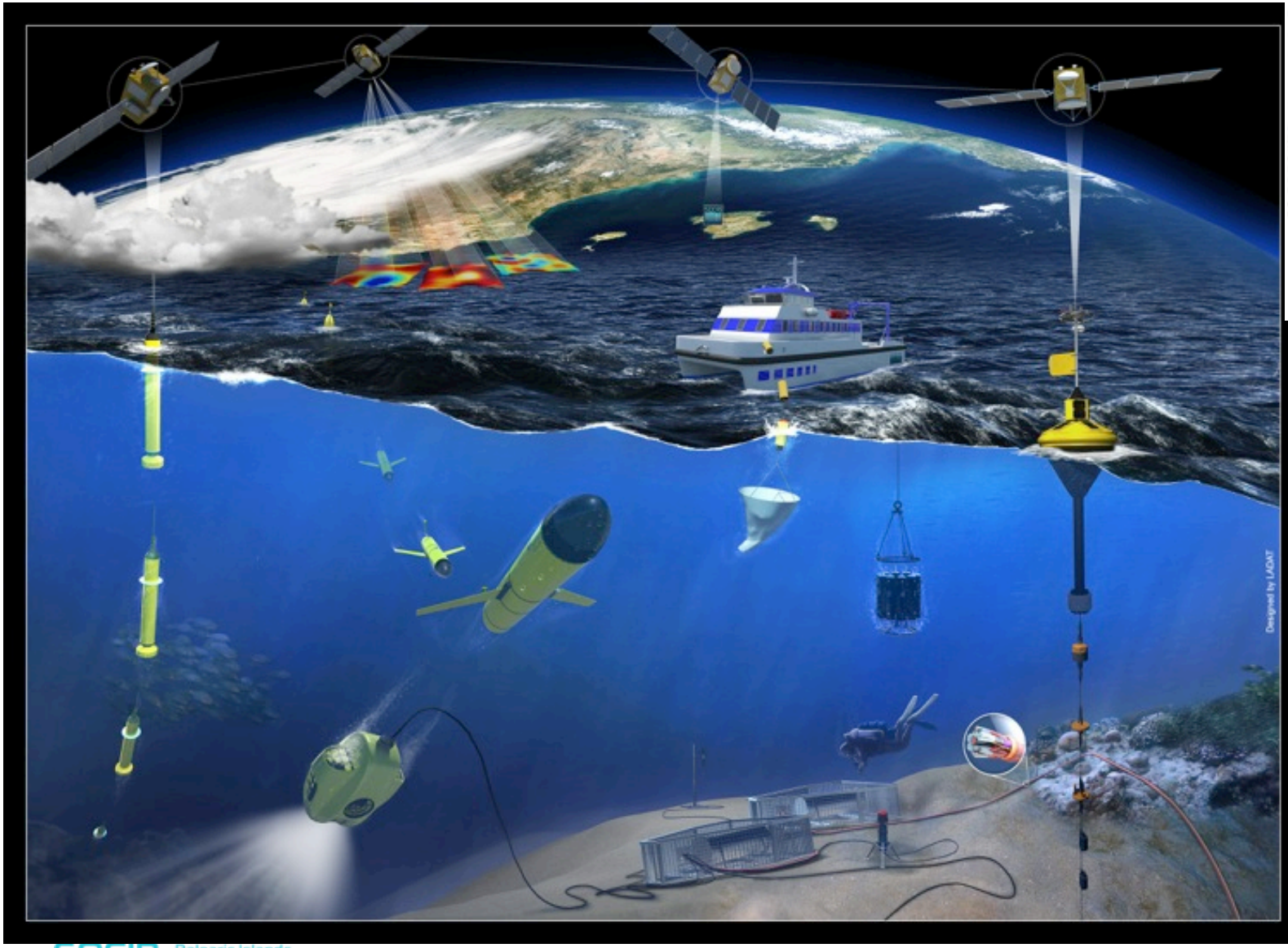
What is SOCIB? – A New Multi-Platform Observing & Forecasting System



PAPER

SOCIB: The Balearic Islands Coastal Ocean Observing and Forecasting System Responding to Science, Technology and Society Needs

AUTHORS

Tintoré et al., 2013: *Marine Tech. Soc. J.*, Vol. 47, N. 1, pp. 101-117

SOCIB Balearic Islands Coastal Observing and Forecasting System

A new international Coastal Observing and Forecasting System in the Balearic Islands

Towards a sustainable development of coastal areas based on scientific knowledge and technology development

SOCIB Balearic Islands Coastal Observing and Forecasting System

CSIC

Govern de les Illes Balears

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

The SOCIB approach to sustained ocean observation…

To assure the real sustainability of the seas and oceans and of the observing systems, SOCIB was designed:

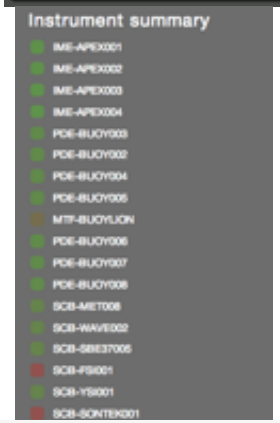
→ **RESPONDING TO 3 KEY DRIVERS**

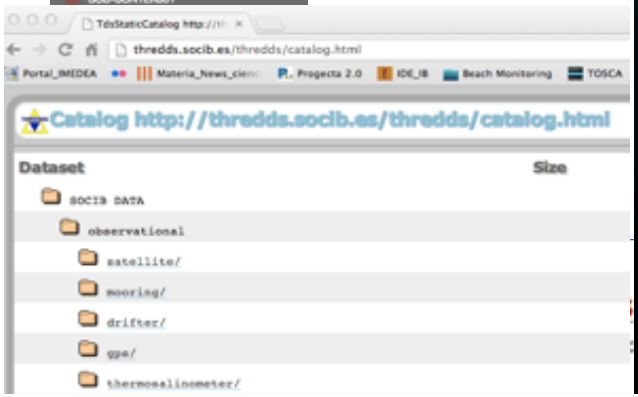
- Science Priorities
- Strategic Society Needs
- Technology Developments

→ **BALEARIC ISLANDS, EXTENDING FROM THE NEARSHORE TO OPEN OCEAN**

www.socib.es

Real Time, Free Access & Download, Quality Controlled Data

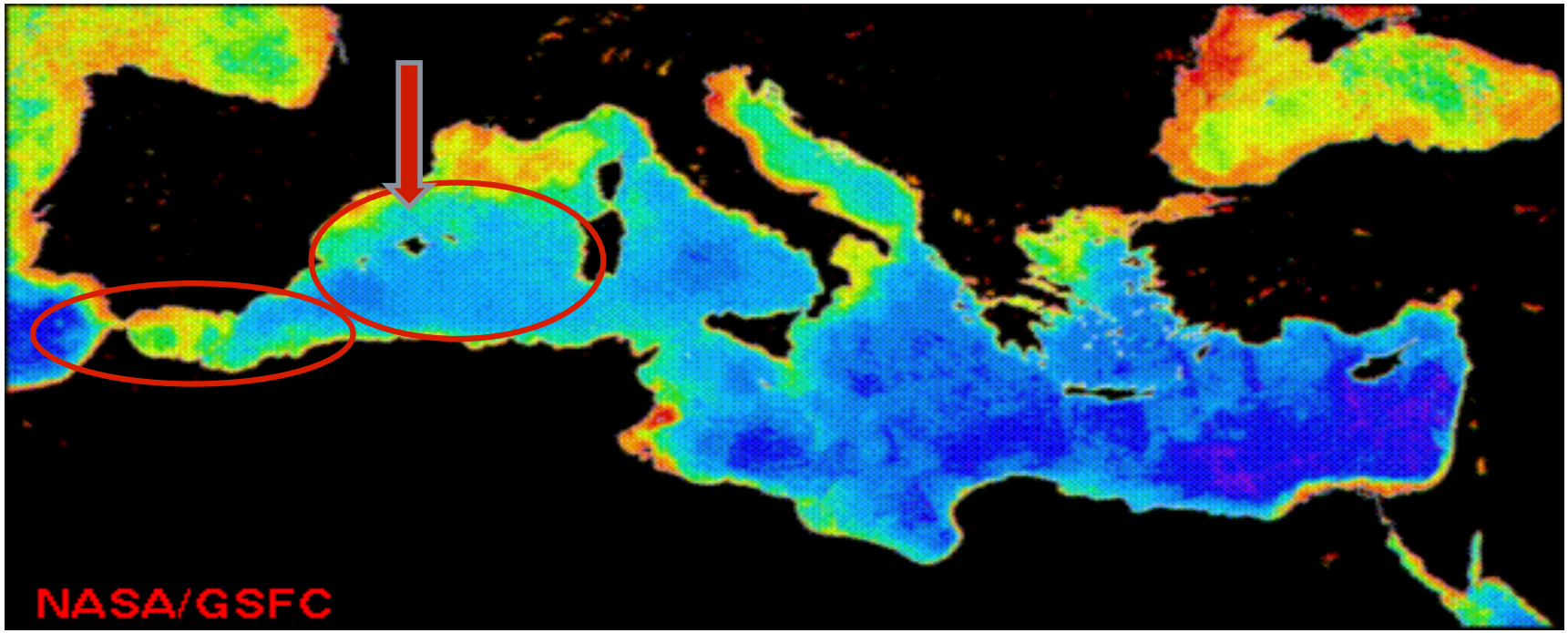




SOCIB activities; where ?

Mostly (but not only) centred in the western Mediterranean, with focus in the Balearic Islands and adjacent sub-basins (specifically Algerian and Alborán/Gibraltar) and …

covering from the **nearshore** to the **open ocean**.

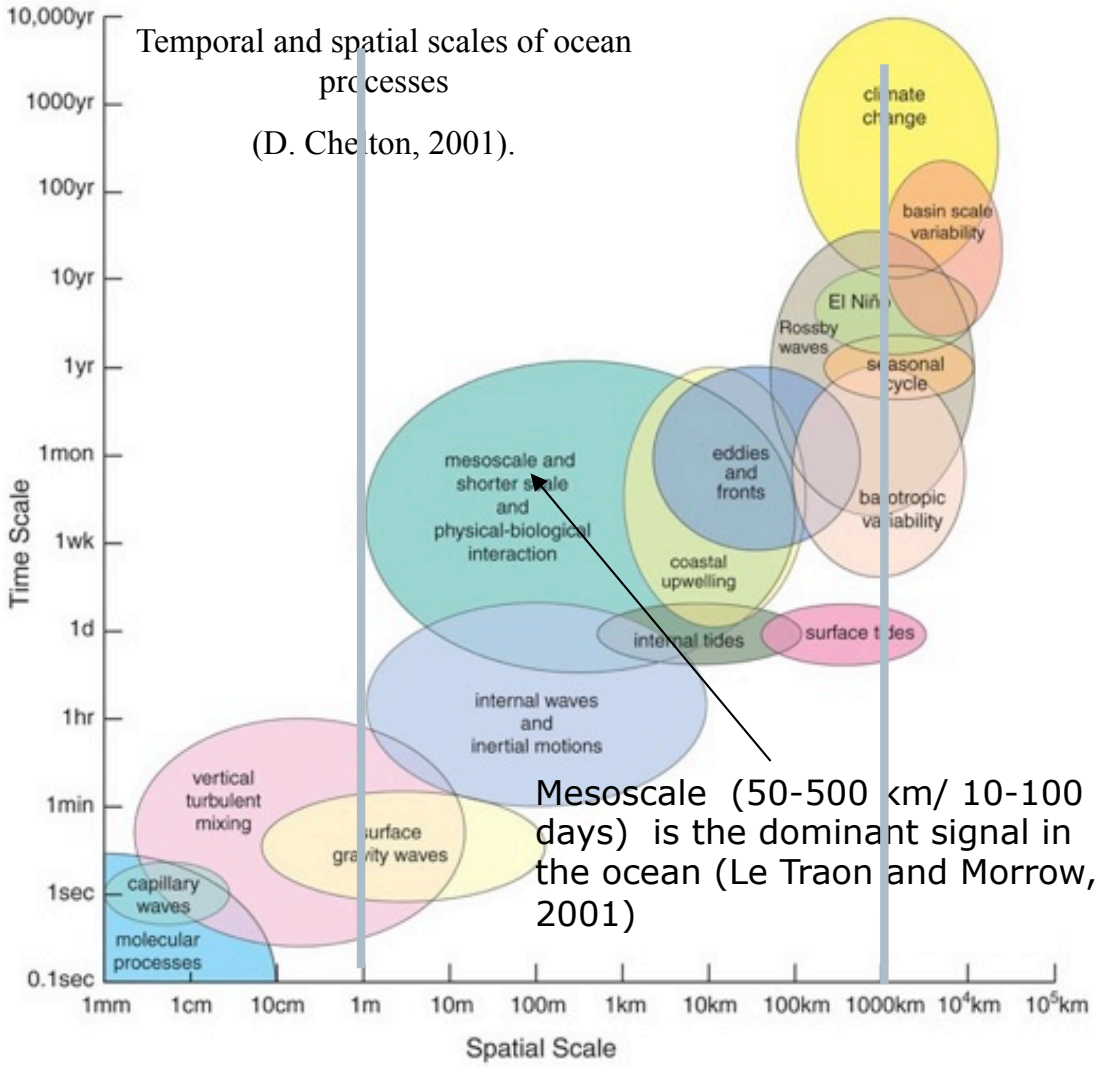


SOCIB Scales Focus: ocean variability at mesoscale/sub-mesoscale, interactions and ecosystem response

Theory and observations have shown that there is a maximum energy at the mesoscale (include fronts and eddies ~10-100km),

SOCIB focus: mesoscale & submesoscale and their interactions with general circulation and their effects on vertical motions, impact on ecosystem variability.

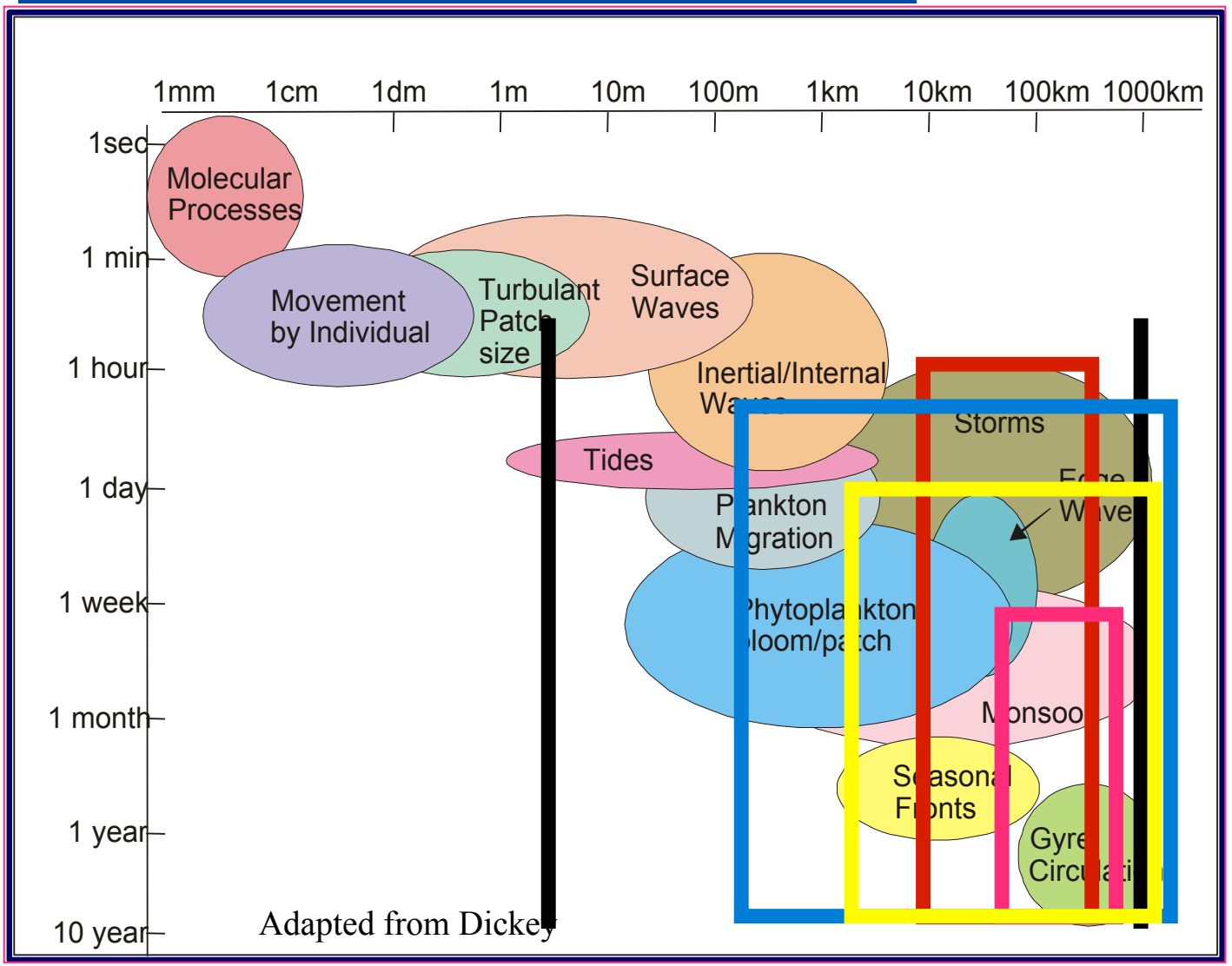
With inputs from 'both sides'....
(nearshore and coastal ocean and also seasonal/inter-annual and decadal variability)



Mesoscale (50-500 km/ 10-100 days) is the dominant signal in the ocean (Le Traon and Morrow, 2001)

SOCIB scales

SOCIB scales and monitoring tools



Gliders

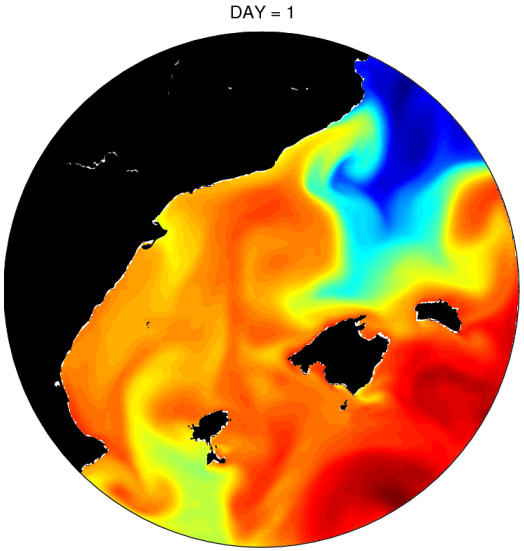
Fixed Platforms

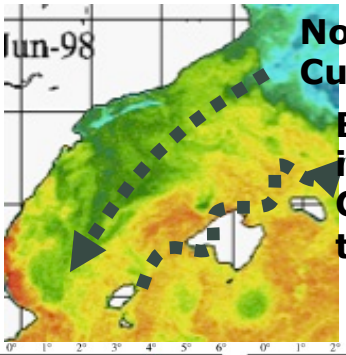
HF radar

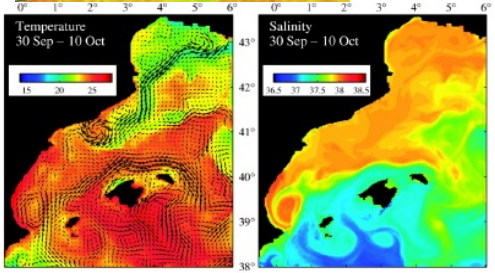
24 m R/V Catamaran

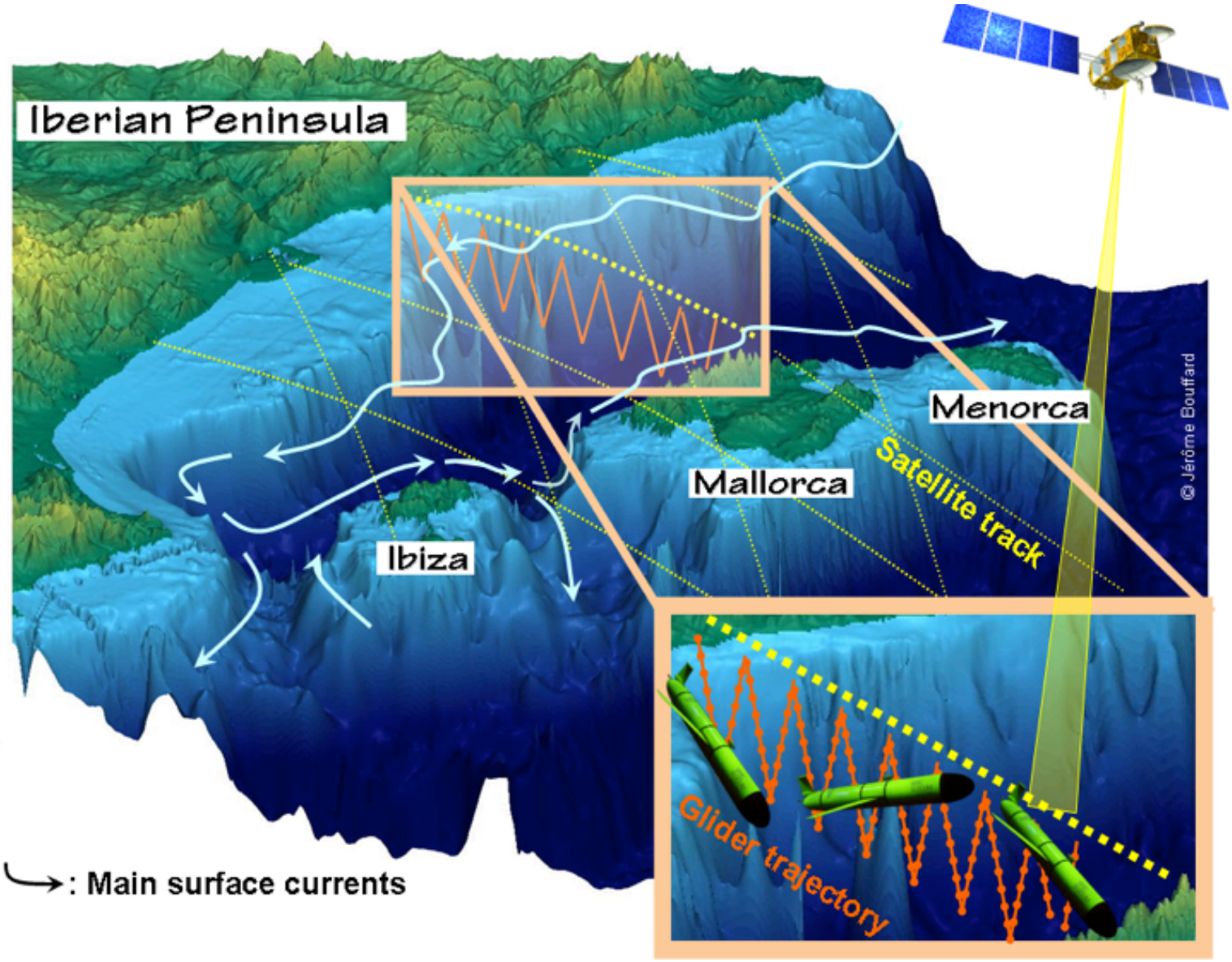
Satellite

Balearic Sea (fronts, meso scale eddies, ecosystem response)





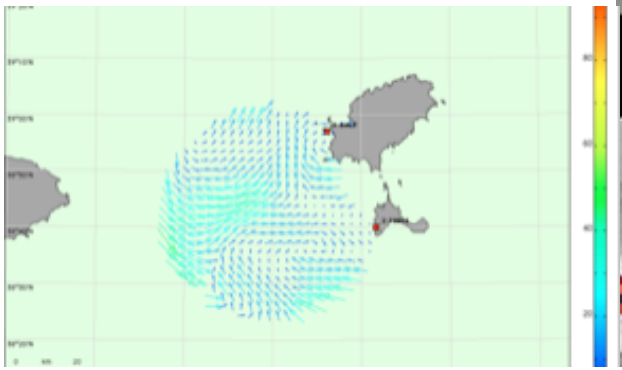




SOCIB: Systems Operations & Support Division

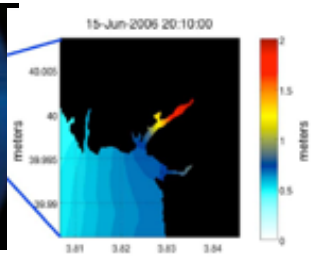
1. Observing Systems (major Facilities)

- Coastal Research Vessel: cat, 24 m LOA, 1.200 km coast Islands.
- HR Radar: long range, 12 MHz, Ibiza
- Fleet of Gliders: endurance lines & open
- Coastal Stations and Satellite products
- Lagrangian Platforms (drifters & ARGO)
- Nearshore Beach Monitoring



2. Forecasting System

- Ocean currents (ROMS) and waves (SWAN) at different scales, forced by Atmospheric model (WRF)
- Meteo-tsunamis pre-operational system, "*Rissagues*"

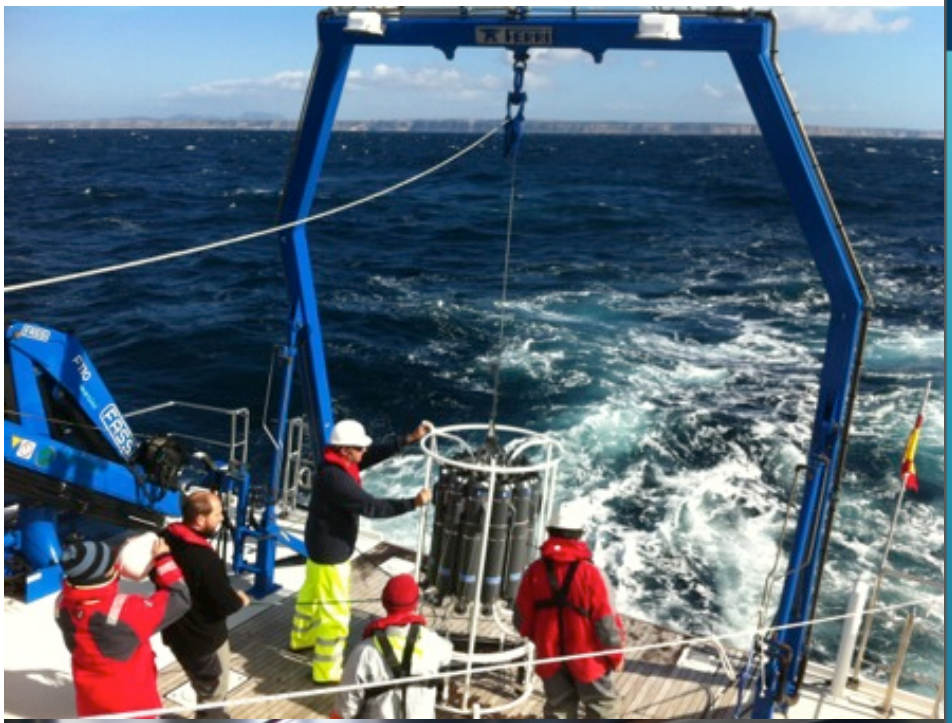


3. Data Centre

- Quality control, web access, open source
- Effective data archiving, international accepted protocols, delivery and communication

R/V SOCIB (with CSIC-IEO agreement)

R/V SOCIB



SOCIB Balearic Islands Coastal Observing and Forecasting System

Buque Oceanográfico SOCIB

ESLORA	23,76m
MANGA	9.00 m
PUNTAL	3.40 m
CALADO MÁX.	1.75 m
MOTORES	2 x MTU 1.622 CV
PROPULSIÓN	Hélices
VEL. MÁX.	27 nudos
VEL. CRUCERO PLENA CARGA	15 nudos
ACOMODACIÓN	16 personas
CONSTRUCTOR	Rodman Polyships S.A.U.
AUTONOMÍA	500 millas
DESPLAZAMIENTO	53 toneladas

El B/O SOCIB ha sido construido en el astillero RODMAN POLYSHIPS y entregado en Septiembre de 2012 al SOCIB (Sistema d'Observació i predicció Costaner de les Illes Balears). Este catamarán realiza trabajos de investigación oceanográfica en la zona marítima y costera de las Islas Baleares y el Mediterráneo.

El buque puede acomodar a 9 tripulantes y 7 técnicos/ investigadores y está preparado para desarrollar campañas científicas continuadas de hasta 7 días. El diseño de la carena del B/O SOCIB conjuga altas prestaciones con un elevado confort de marcha y el mejor comportamiento en la mar, característica esencial de este tipo de embarcaciones.

Habitabilidad

El B/O SOCIB cuenta con un laboratorio multiporpósito (seco/húmedo) de 27m². En su cubierta de trabajo, de 60m², se pueden desarrollar cómodamente diversas actividades. Su puente de gobierno cuenta con visibilidad 360º. En campañas de más de 24h de duración pueden alojarse hasta 9 tripulantes y 7 técnicos/investigadores, en tres camarotes dobles, dos camarotes individuales y dos camarotes para cuatro personas. Cuenta con cocina, lavandería y un amplio comedor.

Equipo científico básico

- SBE 911 plus CTD con sensores auxiliares (Oxígeno disuelto, Fluorímetro, PAR, Altímetro, Transmisómetro, Contacto de Fondo, LADCP)
- SBE32 Water Sample Carrousel (12 botellas).
- Termosalinómetro SBE21 y Fluorómetro Turner 10AU (Análisis Continuo)
- Purificador de Agua Millipore Helix 10
- Perfilador ADCP de 150kHz (Ocean Surveyor)
- Sonda Simrad 12-16/60 (12 kHz)
- Corredera Doppler FURUNO CI-6800
- Estación Meteorológica Digital GEONICA (dirección y velocidad viento, Temperatura, Humedad, Presión Atmosférica)

Equipos de cubierta

- Dos pórticos, uno en el costado de ER y otro en popa.
- Un chigre, con cable INOX de 4mm de 3000 m longitud
- Un chigre con cable coaxial de 8mm de 3000 m de longitud
- Grúa estibor, alcance máximo 4,90 metros @ 825 kg en popa.
- Grúa babor, extensible a alcance máximo 9,95 metros @ 945 kg.

Equipos electrónicos de navegación

- Receptor de Navegación GPS, tipo DGPS
- Posicionamiento Dinámico SIMRAD - Kongsberg
- Giroscópica SIMRAD RGC-80
- Piloto Automático SIMRAD AP
- Sistema de posicionamiento GPS 3D ASHTECADU 800

Govern de les Illes Balears

www.socib.eu

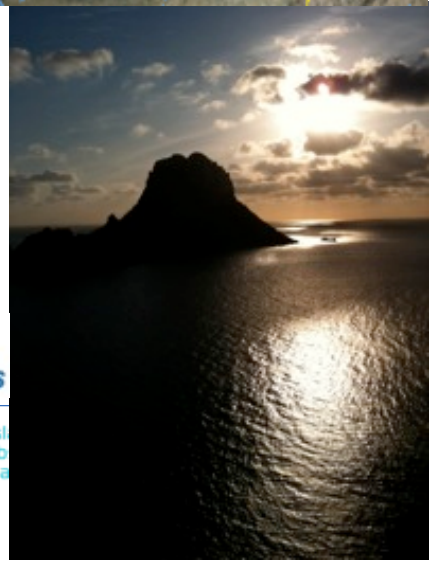
R/V SOCIB (how to apply?)

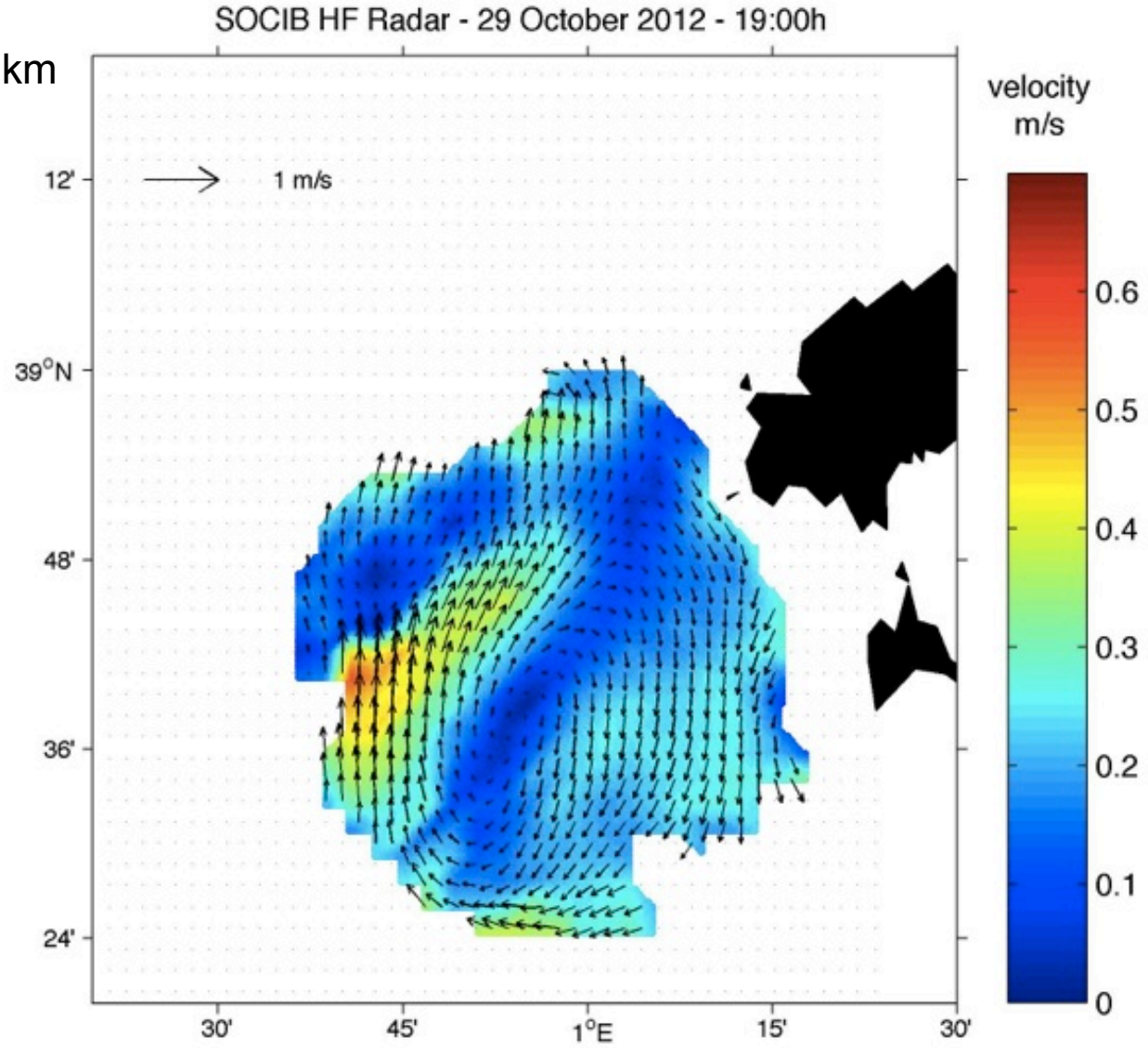
Spain:
- ICTS
- MAPA ICTS
- COCSABO

Europe:
- TNA
- Ex. JERICO project (gliders)

HF RADAR (Long Range, Ibiza Channel)

13,5 MHz.
Hourly Surface Currents
Resolution: 3 km. Mean Range: 80 km





CODAR OCEAN SENSORS

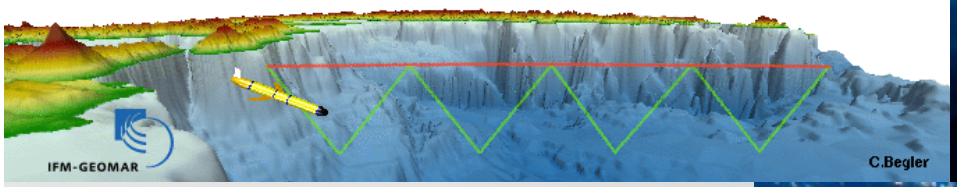
qualitas remos

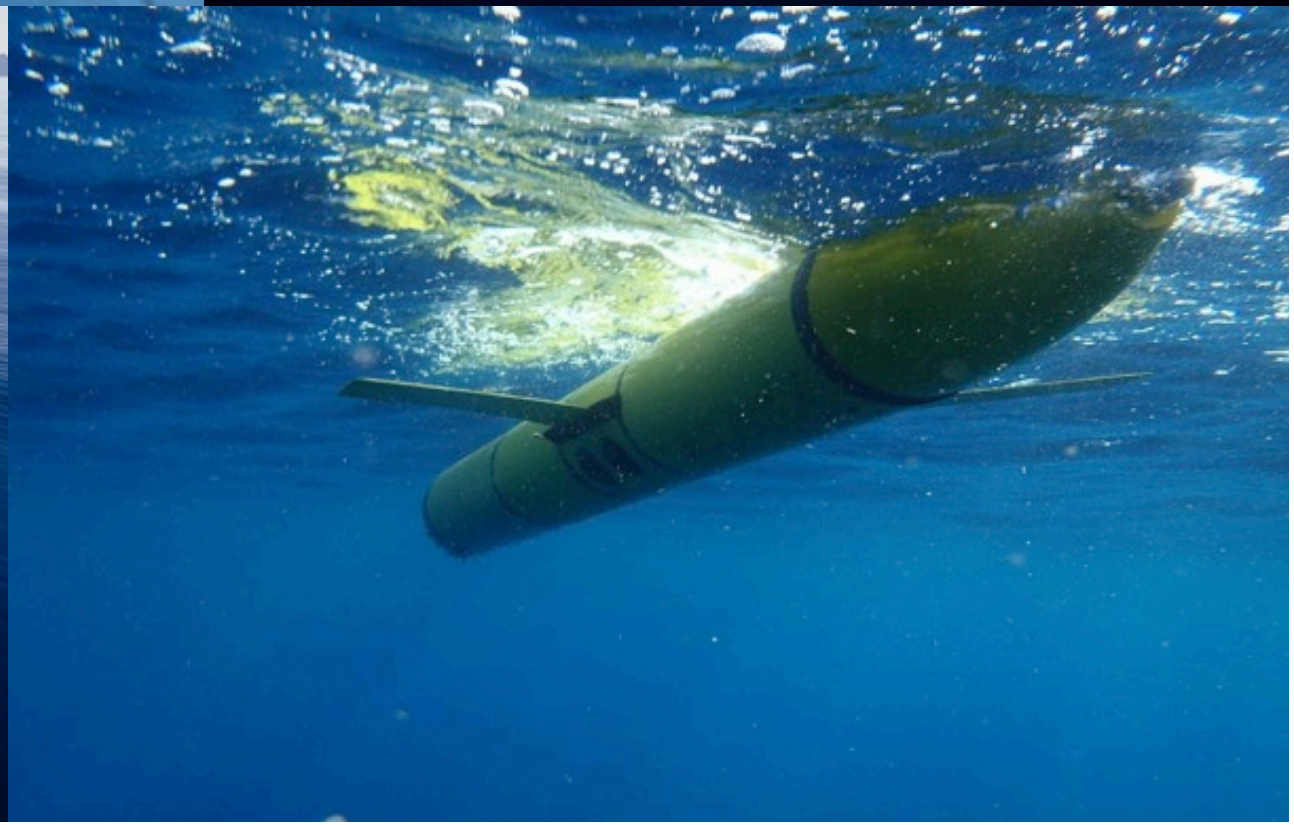
SOCIB Balearic Isl Coastal Ob and Foreca System

Buoys -Met-Ocean data

Gliders


GPS + IRIDIUM
modem
data
missions
GliderMan

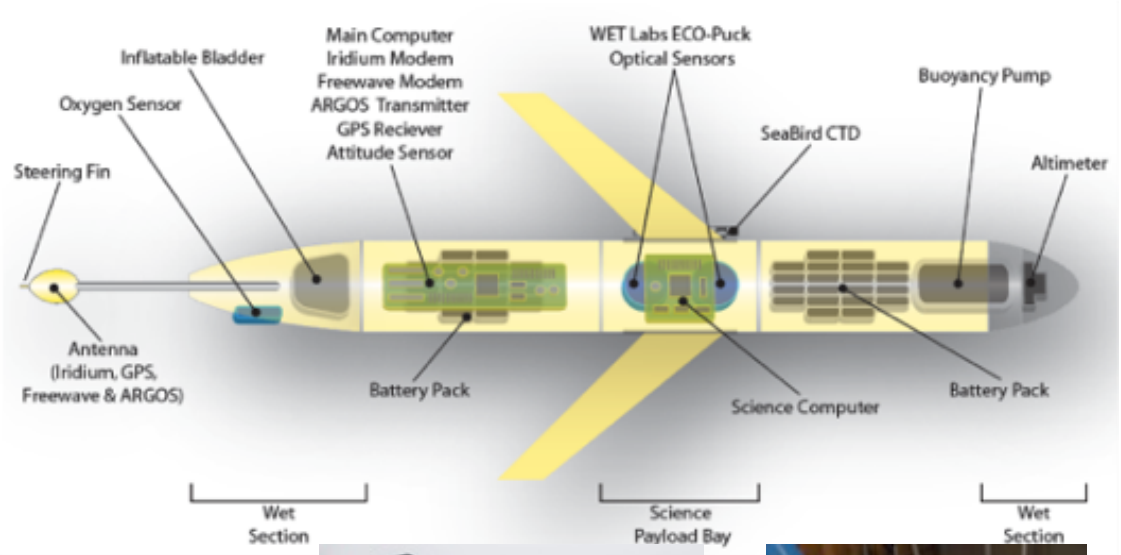

IFM-GEOMAR
C.Begler

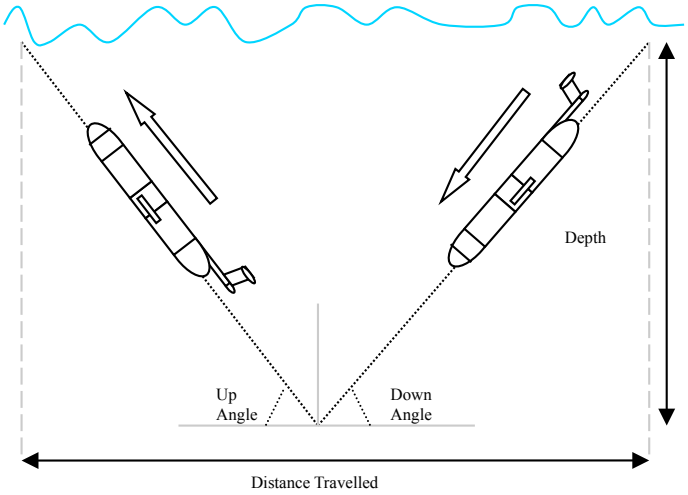


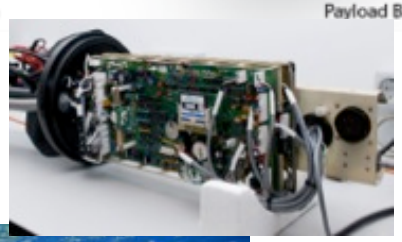
New Labs and Facilities at IMEDEA

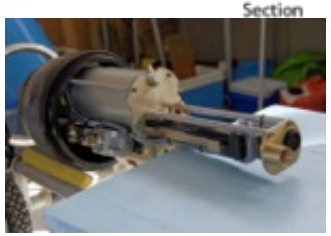
Since 2011:
New glider labs, storage room, warehouse, at IMEDEA (CSIC-UIB)

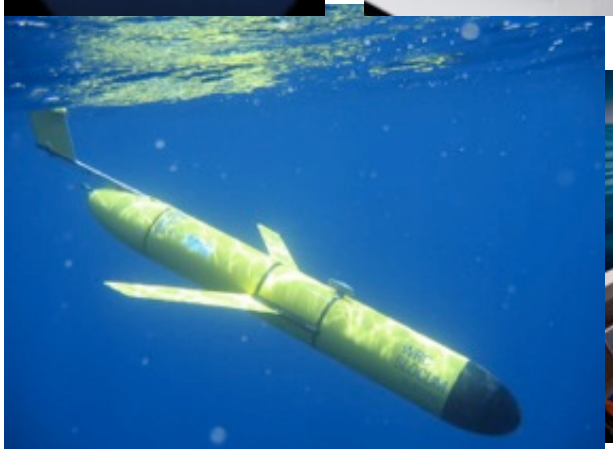
SLCOCUM GLIDERS





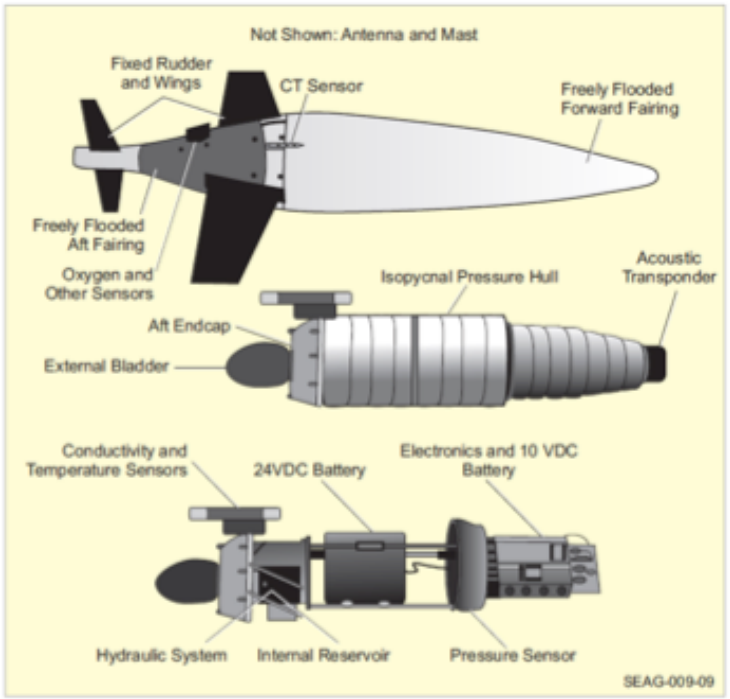


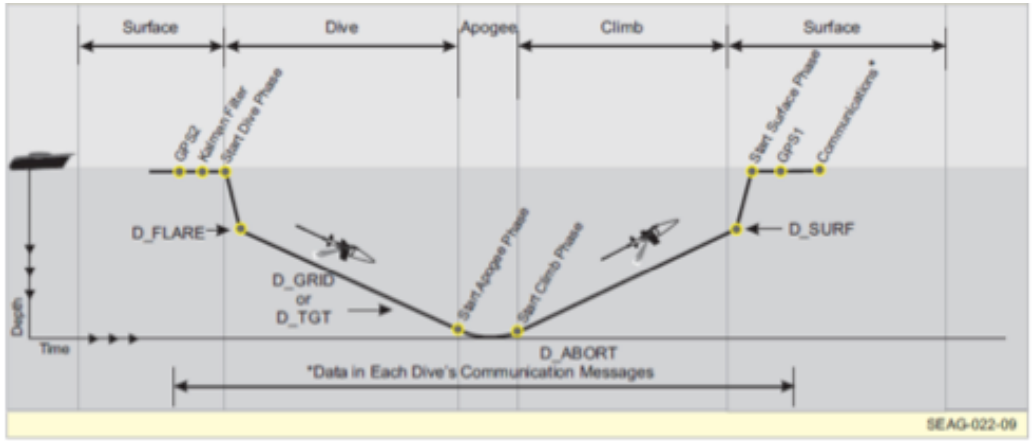


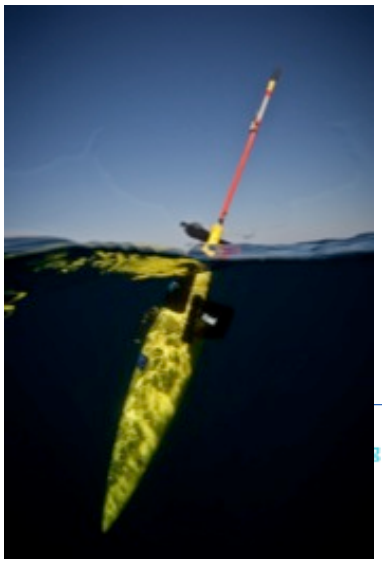


Weight in air:	52 Kg
Weight in water:	Neutrally buoyant
Hull Diameter:	21.3 cm / 8 3/8 Inch
Width including Wings	100.3 cm / 39 1/2 Inch
Vehicle Length:	1.5 meters
Depth Range:	4 - 1000 meters (Deep) / 4 – 200 meters (Coastal)
Speed, projected:	0.4 m/sec horizontal
Energy:	Alkaline Batteries
Endurance:	Dependent on measurement and communication, type. 30 days
Range:	1500 km
Navigation:	GPS, and internal dead reckoning, altimeter
Sensor Package:	Conductivity, Temperature, Depth, Fluorescence, turbidity and oxygen
Communications:	RF modem, Iridium satellite, ARGOS, Tele-sonar modem

SEAGLIDERS







Weight in air: 52 Kg
Weight in water: Neutrally buoyant
Hull Diameter: max 30 cm
Hull material: Aluminium
Width including Wings 100 cm
Vehicle Length: 1.8 meters
Depth Range: 0 - 1000 meters
Speed, projected: 0.25 m/sec horizontal
Energy: Lithium Sulfuryl Chloride primary batteries, 17 MJ.
Endurance: Dependent on navigation and sampling. Typically 4 months.
Range: 3000 km
Navigation: GPS, internal dead reckoning, altimeter
Sensor Package: Conductivity, Temperature, Depth, Clorophyll, CDOM, backscatter 650nm and oxygen
Communications: Iridium satellite, ARGOS, Serial cable, Pinger for recovery

New Pressure chamber Facility (1.000 m)

General specifications:

Manufacturer:
- •KW Designed Solutions (UK)

Main Parts
- •Pressure Chamber
- •High Pressure Hand Pump (with 150mm analog gauge)
- •Support Frame
- •Purge Line Connection

Directive Compliance
- •European Pressure Equipment Directive (PED) 97/23/EC
- •European Machinery Directive (EMD) 2006/42/EC

Media
- •All fluids but those Explosive, Flammable, Toxic and Oxidising

Operation Mode:
- •Manual only

Technical specifications:

Materials
- •Carbon Steel variety (European EN 10204:3.1b certified)
- •Standard Rubber shore 70 (O-ring)

Working Pressure:
- •100 bar (1,450 psi)

Volume:
- •250 Liters (66 Gallons)

Dimensions
- •750x2460 mm (external)
- •400 x 2000 mm (internal)

Overall Weight:
- •1300 Kg (2866 Pounds)

Security Pressure Relief Valve cracking at
- •110 bar (CE marked)

Gliders Facility: Science

Mesoscale – Submesoscale / Vertical motions - biogeo effects

GEOPHYSICAL RESEARCH LETTERS, VOL. 36, L14607, doi:10.1029/2009GL038569, 2009

Vertical motion in the upper ocean from glider and altimetry data

Simón Ruiz,[1] Ananda Pascual,[1] Bartolomé Garau,[1] Isabelle Pujol,[2] and Joaquín Tintoré[1]

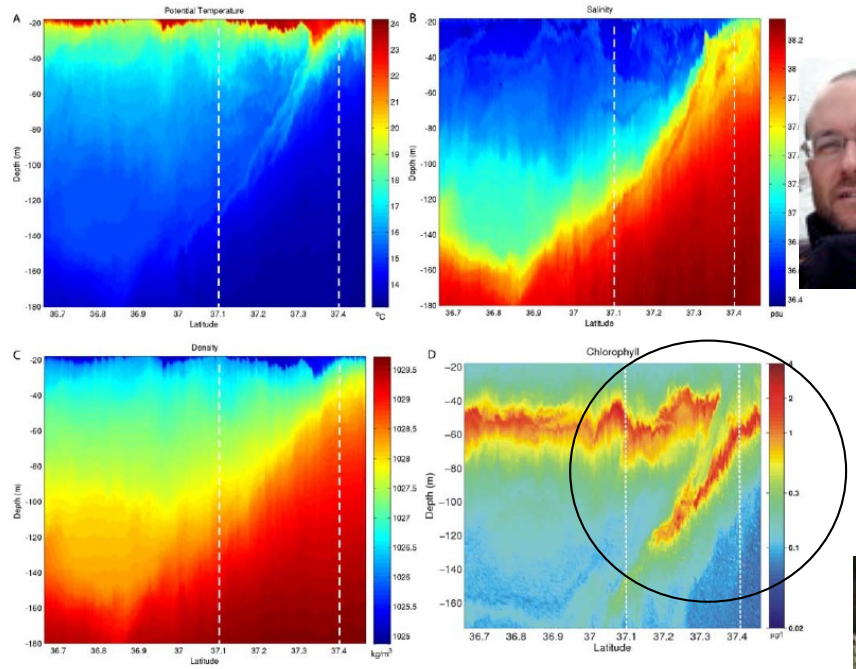


Figure 2. Vertical section of temperature (°C), salinity (PSU), density (kg/m^3) and chlorophyll (μg/l) from glider section 2 (dashed magenta in Figure 1). White dashed lines define sub-section in the northern part of the domain.

Eddy/mean flow interactions – Blocking effects General Circulation

JGR, 2010

Coastal and mesoscale dynamics characterization using altimetry and gliders: A case study in the Balearic Sea

Jérôme Bouffard,[1] Ananda Pascual,[1] Simón Ruiz,[1] Yannice Faugère,[2] and Joaquín Tintoré[1,3]

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Gliders Facility: Operational

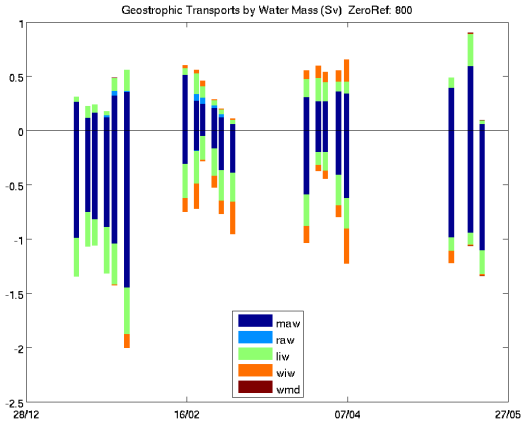
GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L20604, doi:10.1029/2012GL053717, 2012

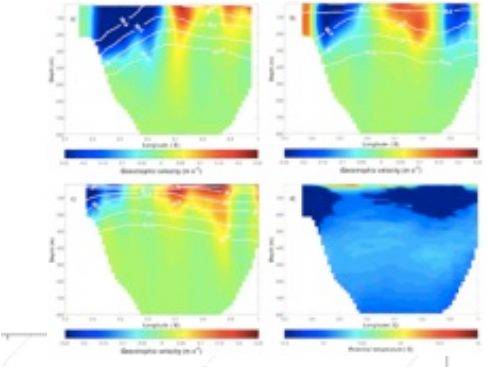
Autonomous underwater gliders monitoring variability at "choke points" in our ocean system: A case study in the Western Mediterranean Sea

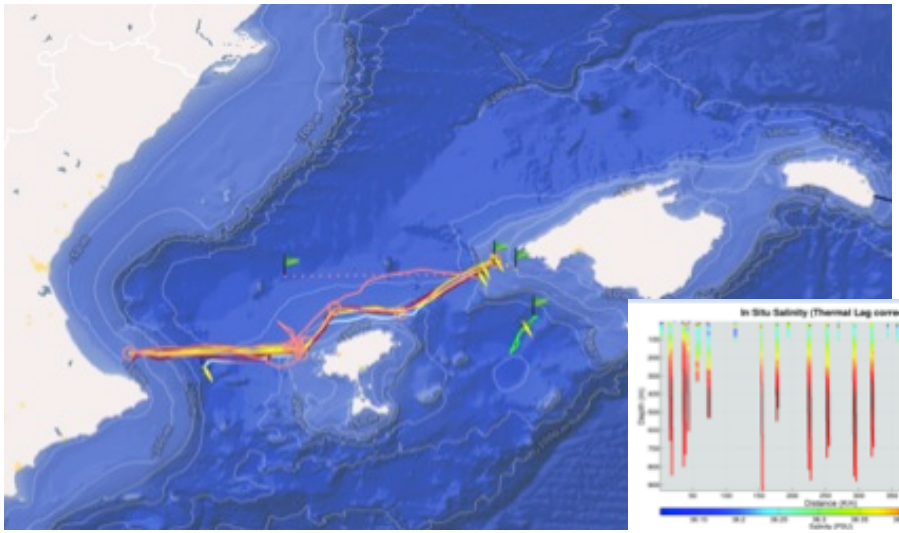
Emma E. Heslop,[1] Simón Ruiz,[1] John Allen,[2,3] José Luís López-Jurado,[4] Lionel Renault,[5] and Joaquín Tintoré[1,5]

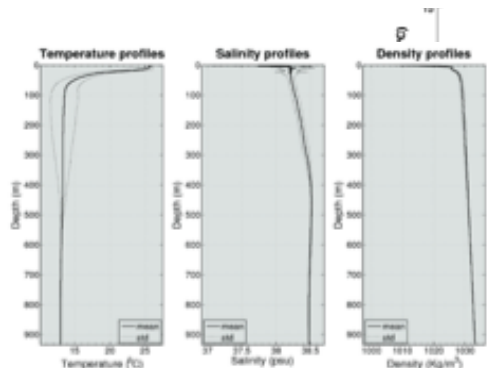
- **After 32 glider missions (started in 2006), + 17.000 profiles (30 Euros/profile)**
- **Since January 2011; routine operations**

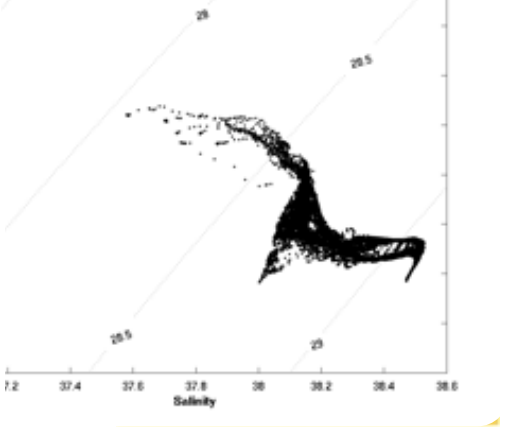
Major transport changes











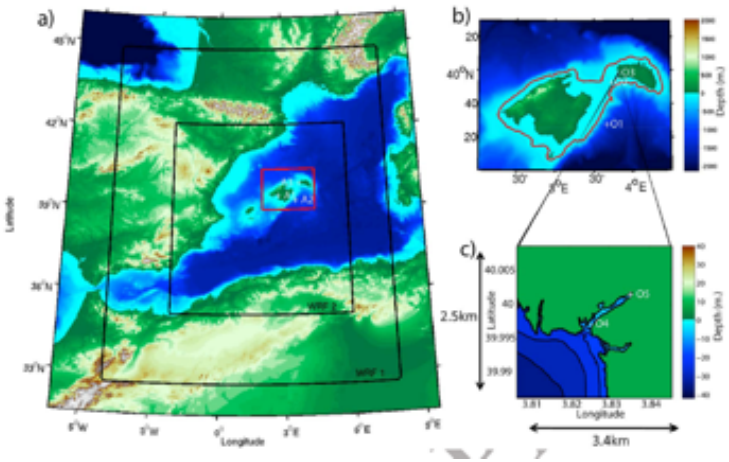
Modelling Facility; Meteotsunamis forecasting

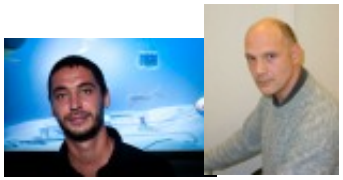
GEOPHYSICAL RESEARCH LETTERS, VOL. 38, LXXXXX, doi:10.1029/2011GL0

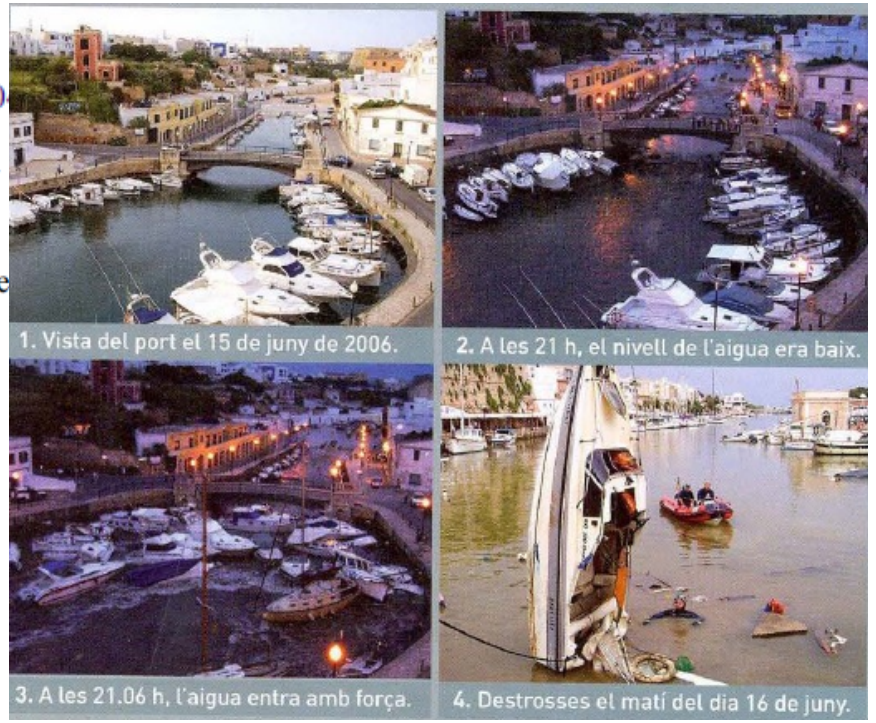
Toward the predictability of meteotsunamis in the Balearic Sea using regional nested atmosphere and ocean models

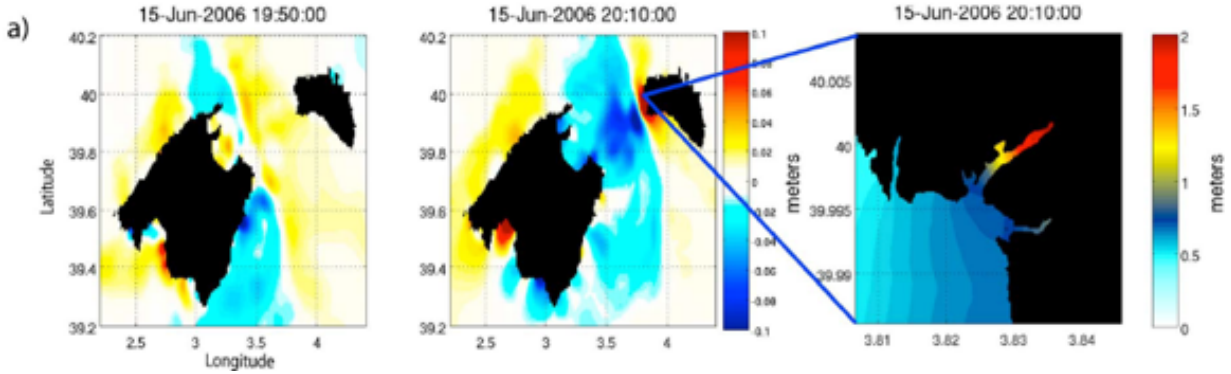
Lionel Renault,[1] Guillermo Vizoso,[2] Agustin Jansá,[3] John Wilkin,[4] and Joaquin Tintore

Received 4 March 2011; revised 29 March 2011; accepted 30 March 2011; published XX Month 2011.









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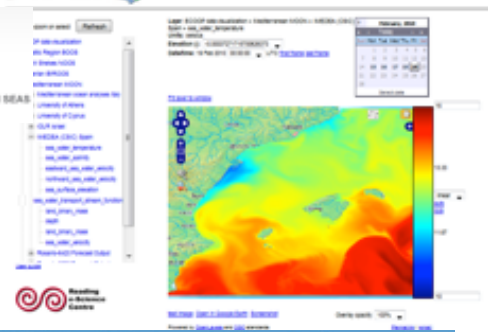
Data Centre Facility

The European framework

PERSEUS
POLICY-ORIENTED MARINE ENVIRONMENTAL RESEARCH IN THE SOUTHERN EUROPEAN SEAS

Ecoop



GROOM

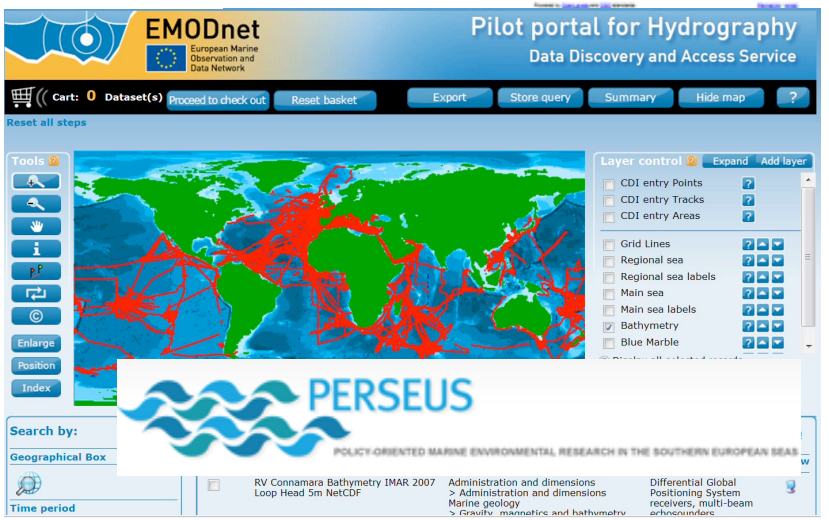
SEVENTH FRAMEWORK PROGRAMME

myOcean

SESAME

MERSEA

The international framework



PERSEUS
POLICY-ORIENTED MARINE ENVIRONMENTAL RESEARCH IN THE SOUTHERN EUROPEAN SEAS

IMOS

OOI
OCEAN OBSERVATORIES INITIATIVE

IOOS

NEPTUNE Canada

HyMeX
HYdrological cycle in Mediterranean EXperiment

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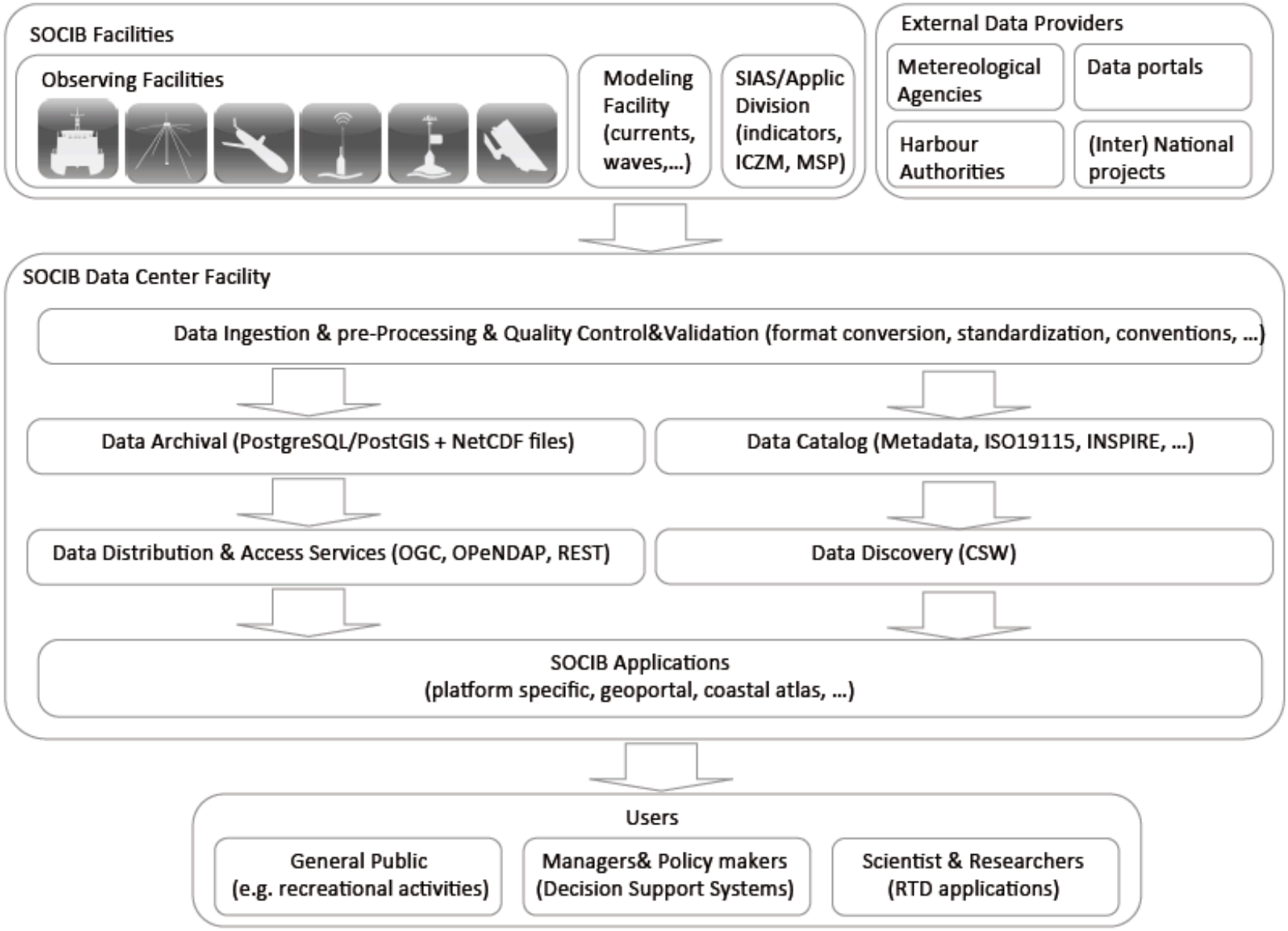
Data Center: Science and Technology

To accomplish the full lifecycle data (from the modeling and observing systems ingestion up to the user), the data center has defined seven steps for the Data Management Process:

1. Platform management and communication
2. Quality Control assurance
3. Metadata Aggregation and Standardization
4. Data Archive
5. Data Search and Discovery
6. Data Policy and distribution
7. Data Viewing


SOCIB Facilities
Observing Facilities
Modeling Facility (currents, waves,...)
SIAS/Applic Division (indicators, ICZM, MSP)
External Data Providers
Metereological Agencies
Data portals
Harbour Authorities
(Inter) National projects
SOCIB Data Center Facility
Data Ingestion & pre-Processing & Quality Control&Validation (format conversion, standardization, conventions, ...)
Data Archival (PostgreSQL/PostGIS + NetCDF files)
Data Catalog (Metadata, ISO19115, INSPIRE, ...)
Data Distribution & Access Services (OGC, OPeNDAP, REST)
Data Discovery (CSW)
SOCIB Applications
(platform specific, geoportal, coastal atlas, ...)
Users
General Public
(e.g. recreational activities)
Managers& Policy makers
(Decision Support Systems)
Scientist & Researchers
(RTD applications)

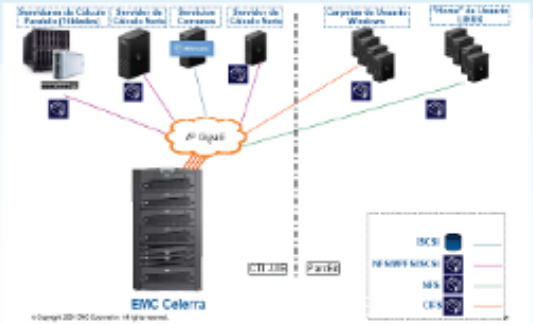
Data Centre: Technologies

The main technologies used are: OPeNDAP / THREDDS server hosting CF-compliant NetCDF; the open-source RAMADDA as a content management system and collaboration services for Earth Science data. Those technologies permit the distribution, cataloging and discovery over the oceanographic data.

1. Multi Platform Management

Alredyavailable:glidersdrifters,moorings,adcp, beach monitoring cameras, ... Real time monitoring and wide descriptions of data sets (standardscompliant).

2. Data Archive



Informatic infraestructure: to securely archive data and metadata and retrieve them on demand.

3. Distribution

OPeNDAP, WCS, WMS, HTTP, FTP, ... to access the data in an interoperable manner from client applications.

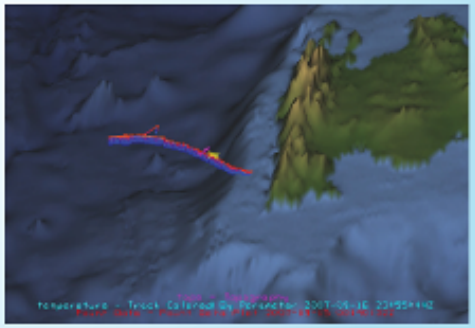
4. Catalog

THREDDS to organize data and Metadata to automatic harvesting.

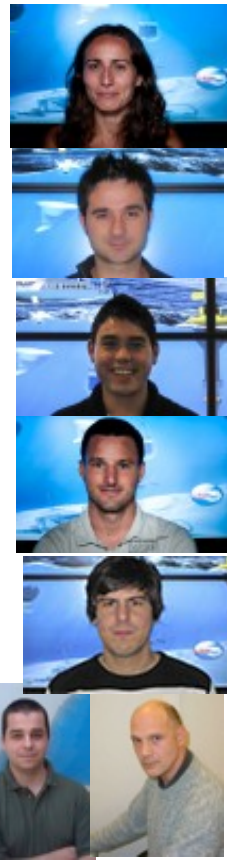
5. Discovery

RAMADDA to search for and find data sets of interest for human interaction.

6.Analisis and Visualization



IDV, own Web Aplications, GODIVA, LAS,... capability to provide an integrated viewing service.



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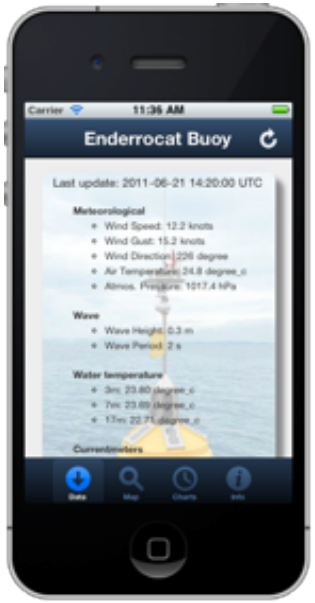
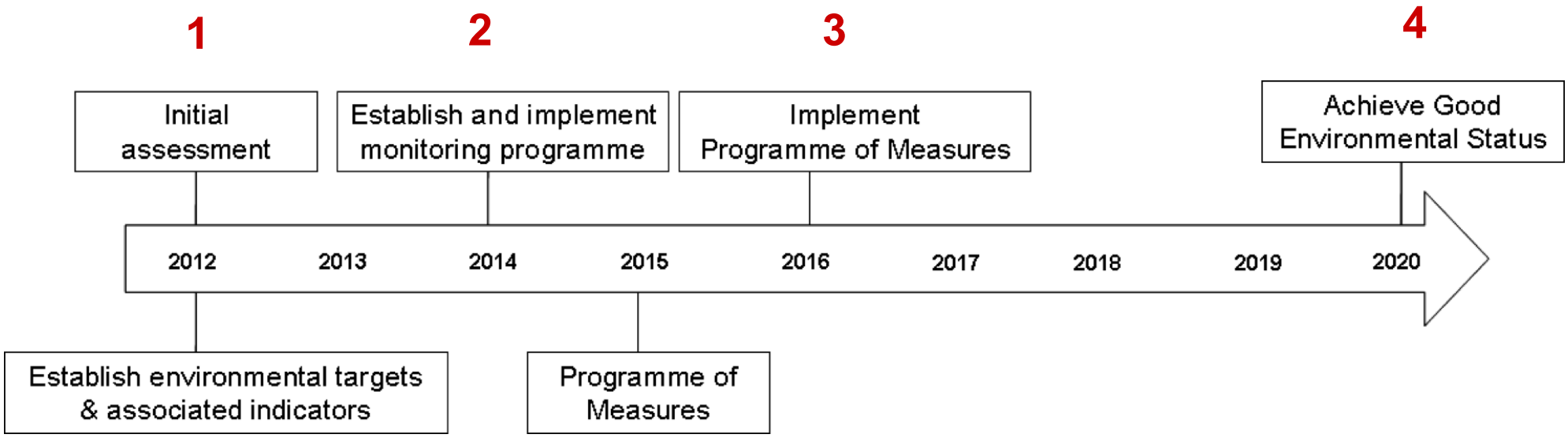
Data Centre (Technologies; example of Apps)



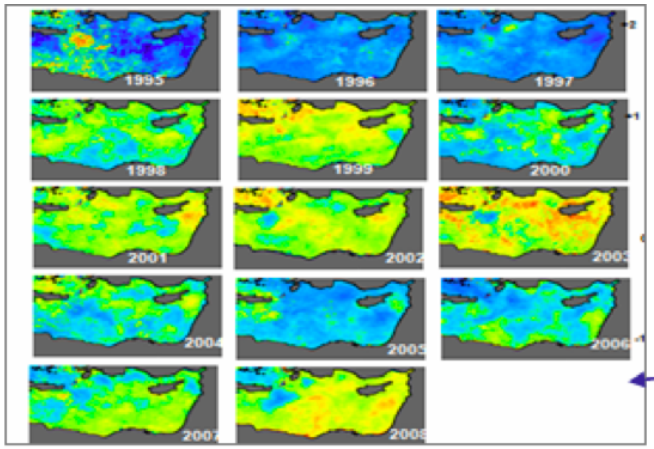
SOCIB (contribution to IMP, e.g., MSFD)

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

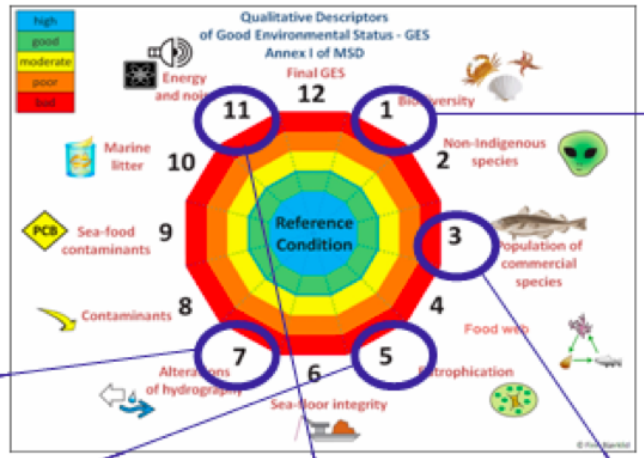


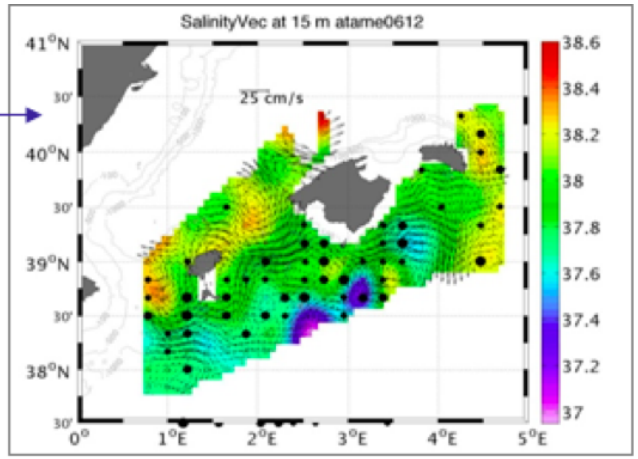
SOCIB (contribution to IMP, e.g., MSFD)

SOCIB and MRI role; by Integrating different types of monitoring platforms at different scales, and by this, providing data and tools, contribute to establish MSFD pressures & states indicators.

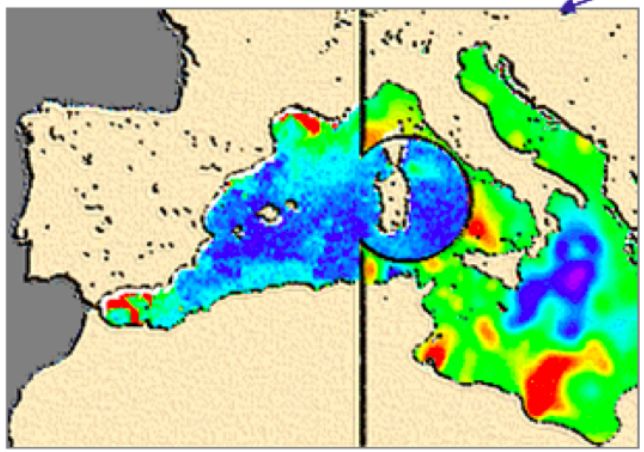


SST to assess hydrography

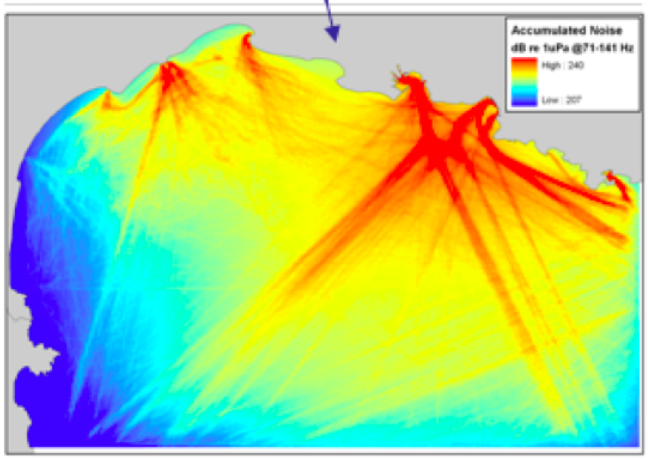




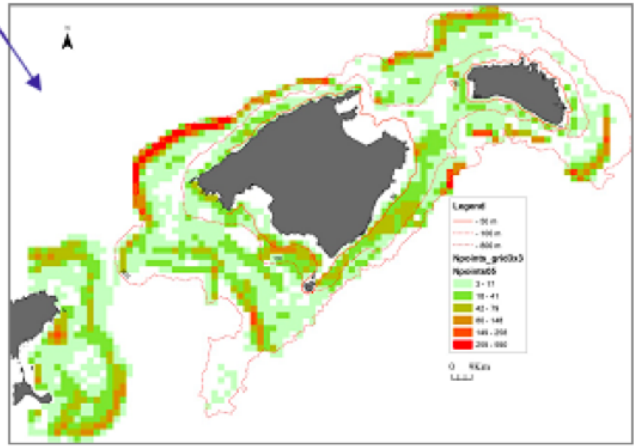
Biological models to assess biodiversity



Ocean color to assess eutrophication



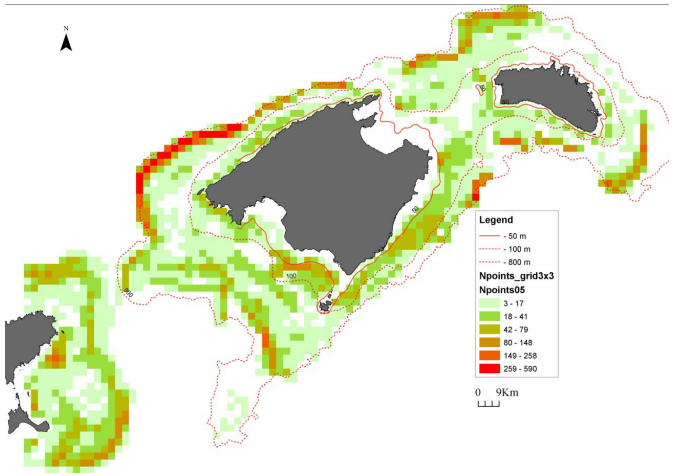
AIS to assess underwater noise

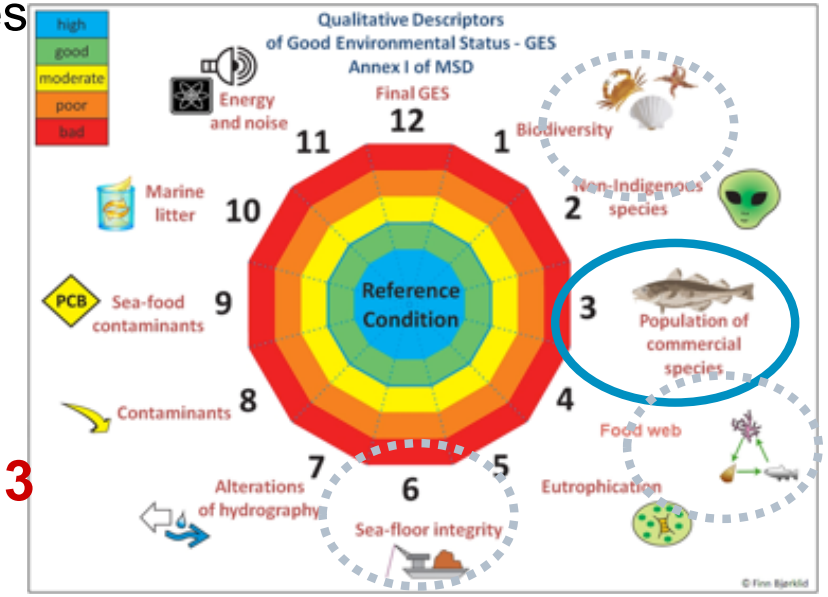


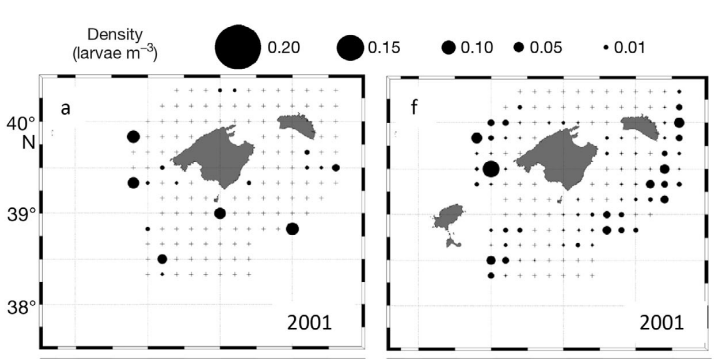
VMS to monitor fishing pressure

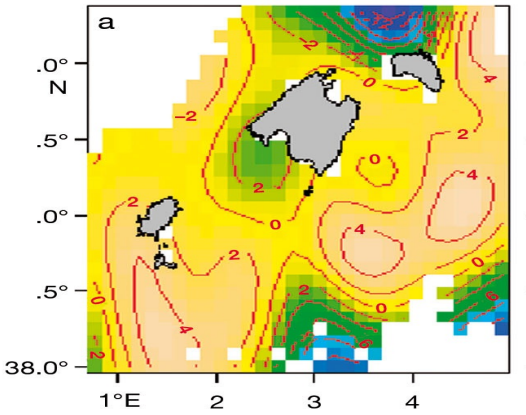
SOCIB contribution to policy oriented areas: Indicators used and relevance to GES:

Descriptor 3: Population of commercial species









WP3 contribution:
- VMS
- Intensive focused studies
- Satellite

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Ministerio de Ciencia e Innovación

OUTLINE, NARRATIVE; --- “the history to tell”….

Goal: Marine Research Infrastructures: key elements of Blue Growth & IMP, increase Horizon 2020 competitiveness & implementation RIS3 SS Strategies .

Outline:

1. Why Ocean Observatories/Marine Research Infrastructures (MRI), why now?
2. SOCIB; an example in the Western Mediterranean. What, where, how,…
3. Innovation in Oceanographic Instrumentation; gliders and incubation times
4. The new role of MRI; Science, Technology and response to Society needs

Innovation in oceanographic instrumentation

3 elements:

- Oceans complexity imply and drive a need for improvement of instrumental capacities

- The innovation process, complexity and incubation time

- The key to success

(Curtin and Belcher, TOS, 2008)

Innovation in Oceanographic Instrumentation

BY THOMAS B. CURTIN AND EDWARD O. BELCHER

INTRODUCTION

The tools of oceanography include instruments that measure properties of the ocean and models that provide continuous estimates of its state. Major improvements in tool capabilities lead to leaps in understanding, and this increased knowledge has many practical benefits. Advances in tool capabilities are sometimes viewed as an objective of basic research, a viewpoint reflected in the basic research funding category of "science and technology" (S&T).

The complexities of and incubation times for advancing instrumentation are often not fully appreciated, resulting in unrealistic expectations and discontinuous support. Greater understanding of the process of innovative instrument development can contribute to sustaining it. Innovation can be incremental or radical depending on performance gains (Utterback, 1994), stimulated or suppressed depending on institutional factors (Van de Ven, 1989; Office of Technology Assessment, 1995), and sustaining or disruptive depending on value propositions (Christensen, 1997). For example, going from a Nansen to a Niskin bottle was an incremental innovation, whereas going from bottle casts to CTD profiles was a radical innovation. Moored current meters incrementally advanced from film recording of gauges, to mechanically digitized signals on reel-to-reel tape, to solid-state analog, to digital conversion and memory. Radical innovation of current-field measurement came with the acoustic Doppler current profiler.

In large organizations, stimulated innovation often occurs in research departments, particularly when the projects have champions: "the new idea either finds a champion or dies" (Schon, 1963). In other parts of the same organization, innovation may be suppressed by the costs associated with re-integrating a system and minimal perceived competition. The incubation time of the computer mouse from inception to wide use was 30 years. In oceanographic observation, where synoptic coverage is an objective, a sustaining innovation would be a sampling platform with improved propulsion that doubles its speed. A disruptive innovation would be a new platform with much *slower* speed, but with much longer duration and a low enough cost to be deployed in great numbers. Here, we will focus on radical, stimulated, disruptive innovation that involves both science and engineering.

To motivate continued investment in basic research, the histories of many radical innovations, ranging from the transistor to radar to the Internet, have been documented (Bacher, 1959; Hetrick, 1959; Becker, 1980; Hove and Gowen, 1979; Allison, 1985; Abbate, 2000. The Defense Acquisition History Team at the US Army Center of Military History is also preparing a document on this subject.). These cases clearly demonstrate that "rapid" innovation in

The innovation process (for advancing oceanographic instrumentation)

Complexity of innovation process: needs to be known, to avoid unrealistic expectations and/or discontinuous support.

Incubation time: 15-30 years (computer mousse, 30 years). Gliders 10 years. ¿?

Innovation can be incremental or radical, stimulated or suppressed.

The innovation process (disruptive, gliders)

Incubation time for gliders; ½

Why?:

… “A coherent set of scientists, engineers, and investors that envisioned the scientific goal, understood the technology potential and sustained the funding” (Curtin and Belcher, TOS; 2008).

The innovation process (for advancing instrumentation)

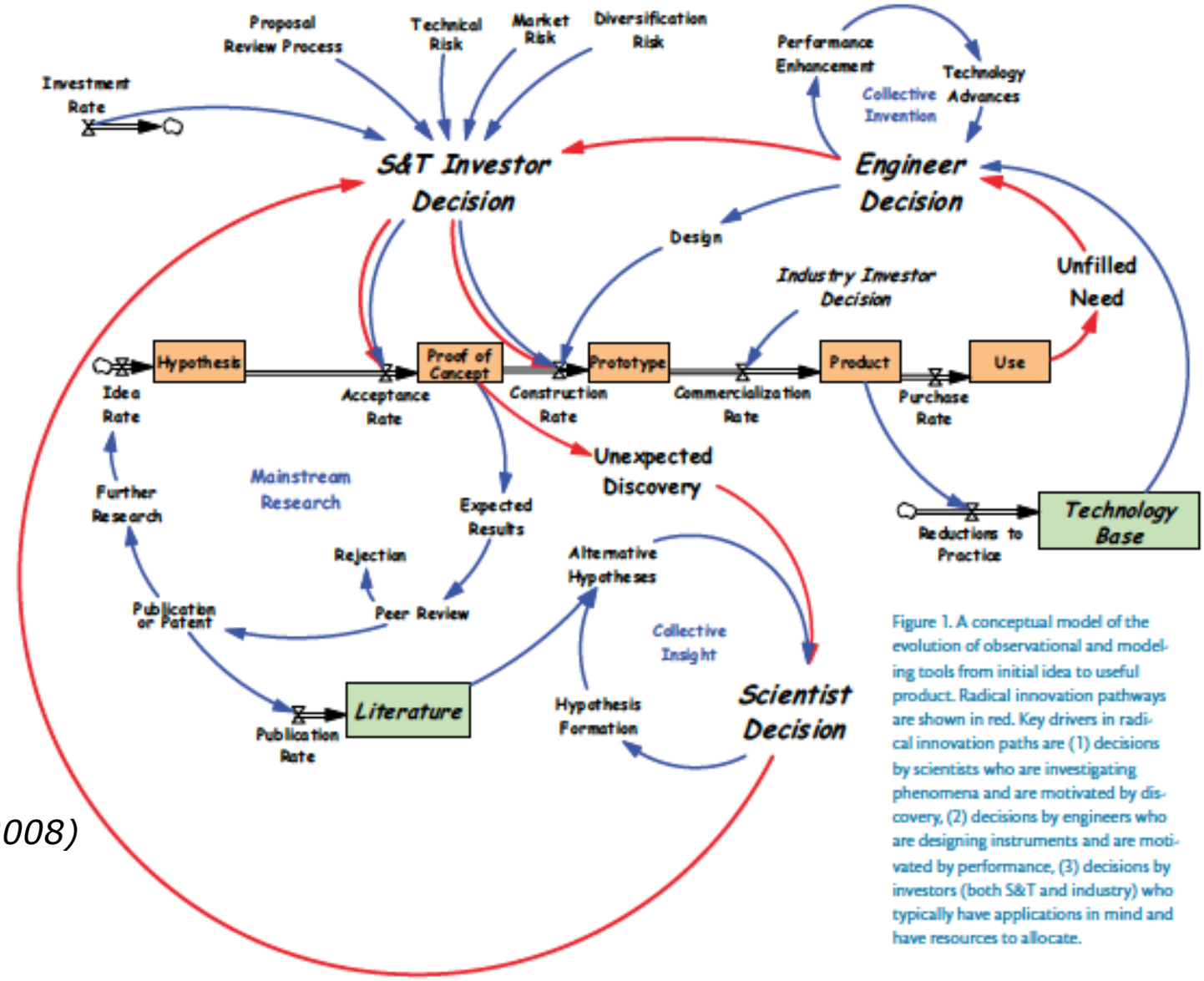

Figure 1. A conceptual model of the evolution of observational and modeling tools from initial idea to useful product. Radical innovation pathways are shown in red. Key drivers in radical innovation paths are (1) decisions by scientists who are investigating phenomena and are motivated by discovery, (2) decisions by engineers who are designing instruments and are motivated by performance, (3) decisions by investors (both S&T and industry) who typically have applications in mind and have resources to allocate.

(Curtin and Belcher, TOS, 2008)

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The innovation process (for advancing instrumentation)

Why is it important? : we need synoptic coverage

And… “Every time a new instrument has arrived, new key findings”…

Examples of innovations:

- Ships → Public – Private transfer
- Satellites → Ocean Weather…
- CTD → Micro-structure,
- Buoys- ARGO profilers →
- Currentmeters (rotor to ADCP) → Spectrum…
- Gliders → Submesoscale - …

The key to success for radical innovation in oceanographic instrumentation

1. Visionary leadership
2. Close coupling between science and engineering
3. A coherent investment strategy based on distributed, coordinated resources
4. Effective processes for communication, feedback, and contingency planning.
5. Incentive to assume responsibility for risky instrumentation development projects without undue career jeopardy.

In summary: work in collaborative, multidisciplinary teams, be tenacious and focused on long term objectives while producing short-term success, and find creative champions among funding agencies and investor organizations.

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PAPER

SOCIB: The Balearic Islands Coastal Ocean Observing and Forecasting System Responding to Science, Technology and Society Needs

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Temel Oguz
SOCIB and METU, Middle East

ABSTRACT

New monitoring technologies are being progressively implemented in open-ocean and coastal observatories. The Mediterranean Sea is a well-known, reduced-scale ocean, an ideal natural laboratory to study global ocean processes, in particular those associated with meso- and submesoscale variability, interactions with mean flows and associated ecosystem response. SOCIB, the Balearic Islands Coastal Ocean Observing and Forecasting System, is one of such observatories, a multi-platform distributed and integrated system, a facility of facilities that extends from the nearshore to the open sea. SOCIB profits from the strategic position of the Balearic Islands at the Atlantic/Mediterranean transition area, one of the "hot spots" of bio-diversity in the world's oceans, and also of societal needs in islands where preservation of the environment is essential to assure both residents' welfare and the competitiveness of the tourist sector. SOCIB is unique in that, from peer-reviewed excellence, its mission and objectives are science-, technology-, and society-driven. These types of new marine infrastructures, because of their critical mass and sustained funding, are presently establishing new ways of international cooperation, leading to major science breakthroughs, innovations in oceanographic instrumentation, and new ways of more efficient and science-based coastal and ocean management. We describe the major elements and structure of SOCIB and present some recent scientific, technological, and society-related results that are of relevance at a global ocean scale.

Keywords: ocean observatories, paradigm change on ocean observation, multi-platform integrated observing and forecasting system, science, technology and society driven mission and objectives, scientific excellence and response to society needs

Tintoré et al., 2013: *Marine Technology Society Journal.* January/February 2013., Vol. 47. N. 1. pp. 101-117. http://dx.doi.org/10.4031/MTSJ.47.1.10

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The role of new marine research infrastructures (MRI/ ICTS/Ocean Observatories….) Blue Growth, Horizon 2020, RIS3

→ Capability to…: **RESPOND TO THE 3 KEY DRIVERS**

- Science Priorities – (ok!)
- Strategic Society Needs (more listening!, policy makers&managers endorsement), MSFD (GES); Energy, Tourism, etc.
- New Technology Developments (companies, social society endorsement)

Ocean Observatories/Marine Research Infrastructures are particularly well placed (mission, vision, critical mass, etc.)

AND → Need to define a **JOINT STRATEGY at European** level, more than coordination, Partnership…, for…Horizon 2020, RIS3 Strategies, etc.

Muchas gracias!!!