Conselleria d'Educació, Cultura i Universitats
Acció Bit

III FÒRUM TECNOLÒGIC DE LES ILLES BALEARS, 24 i 25 DE NOVEMBRE

FOROTEC_2011

25 de Novembre de 2011

Les grans infraestructures d'investigació, motor de coneixement, de transferència de productes tecnològics i de tecnologies de gestió per al sector públic i privat

Joaquín Tintoré Subirana I Equip SOCIB…

ICTS SOCIB e IMEDEA (UIB-CSIC)

http://www.socib.es

SOCIB Balearic Islands Coastal Observing and Forecasting System

GOBIERNO DE ESPAÑA | MINISTERIO DE CIENCIA E INNOVACIÓN

Govern de les Illes Balears

Moltes gràcies!!!

« tornar

Presentació

03 Les grans infraestructures d'investigació, motor de coneixement, de transferència de productes tecnològics i de tecnologies de gestió per al sector públic i privat

25N
10:45-11:00
Auditori

Les Instal·lacions Científic Tecnològiques Singulars (*ICTS) o grans infraestructures d'investigació, representen un motor de coneixement i una oportunitat per a la transferència bidireccional i la innovació en tecnologies i serveis. Partint de la presentació de la *ICTS *SOCIB, es mostrarà la rellevància de la innovació tecnològica *disruptiva i/o incremental en oceanografia i la seva contribució decisiva a l'avanç del coneixement a través de la comprensió dels processos que regeixen l'evolució dels mars i oceans i les seves interaccions amb l'atmosfera i la costa. Aquest coneixement és la base per respondre a les preguntes actuals de la societat sobre, per exemple, el clima o l'elevació del nivell del mar i és també la base d'una gestió realment sostenible dels oceans i les costes. Es presentaran exemples concrets d'innovació tecnològica lligats a la introducció de nous sistemes de mesura (bucs oceanogràfics, *CTD, satèl·lits, boies *ARGO, o més recentment *gliders) i el seu impacte científic, social i econòmic, presentant-se a continuació les capacitats dels nous sistemes d'observació que, com la ICTS SOCIB, són multi-plataforma, integrats i multi-disciplinaris, amb sistemes automatitzats de control de qualitat de les dades (tant observacions com a models de predicció) i accés lliure als mateixos. Aquest nou tipus de ICTS marines permeten generar coneixement, desenvolupar i transferir tecnologies en sentit ampli, és a dir tant productes tecnològics com a tecnologies de gestió (eines de suport a la presa de decisions), i respondre a les necessitats de la societat, representant així, a més, un pont a la col·laboració sector públic-sector privat.

Ponents

Joaquín Tintoré Subirana
Sistema de Observación y Predicción Centro Costero de les Illes Balears
Director de la ICTS SOCIB i Investigador de l'IMEDEA (CSIC-UIB)

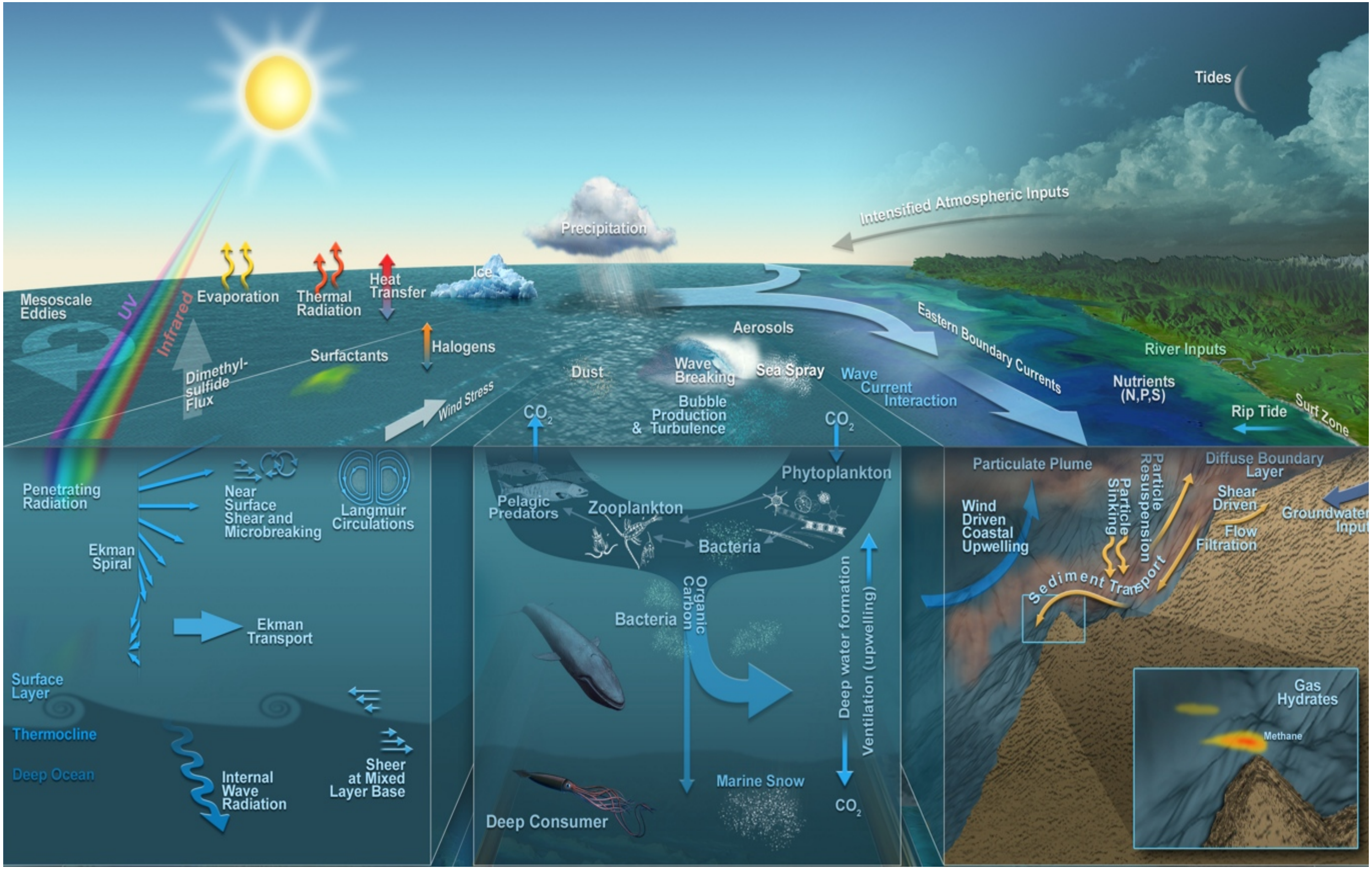
Outline

1. SOCIB: oceans complexity, monitoring, what, why, why now, scales, structure, facilities, examples

2. Innovation in oceanographic instrumentation: the case of ocean gliders.

3. The new role of ICTS SOCIB and Marine Research Infrastructures for PPP

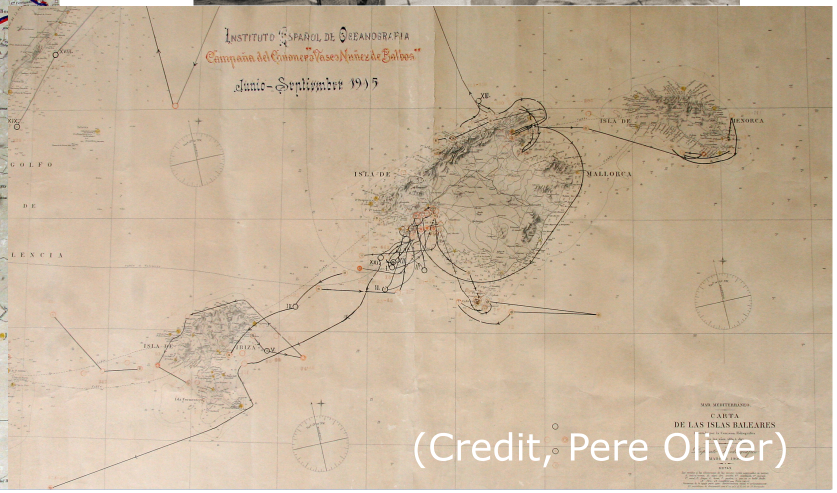
Oceans are complex and central to the Earth system



The oceans are chronically under-sampled

(Credit, Oscar Schoefield)

The oceans are chronically under-sampled



(Credit, Pere Oliver)

What is SOCIB?

SOCIB is a Coastal Observing and Forecasting System, **a <u>multi-platform</u> <u>distributed</u> and <u>integrated</u> Scientific and Technological** Facility (a facility of facilities…)

- providing streams of oceanographic data and modelling services in support to operational oceanography
- contributing to the needs of marine and coastal research in a global change context.

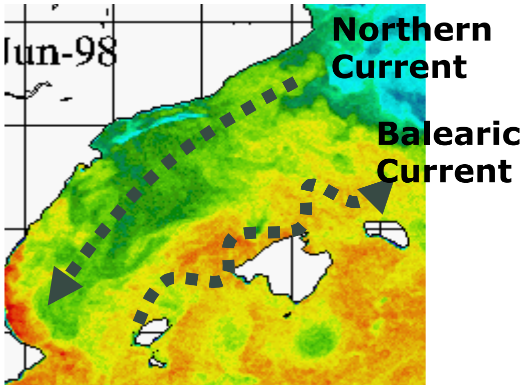
The concept of Operational Oceanography is here understood as general, including traditional operational services to society but also including the sustained supply of multidisciplinary data and technologies development to cover the needs of a wide range of scientific research priorities and society needs.

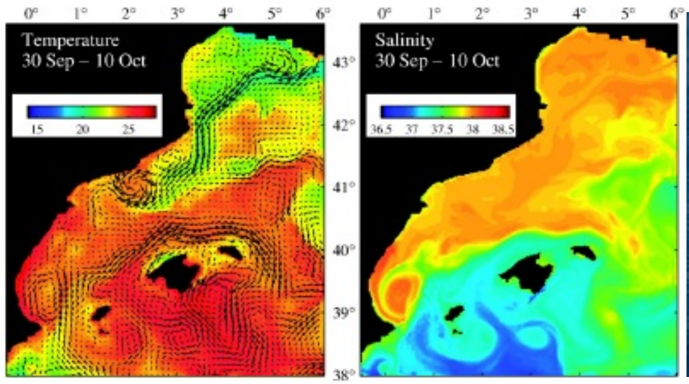
In other words, SOCIB will allow a quantitative increase in our understanding of key questions on oceans and climate change, coastal ocean processes and ecosystem variability.

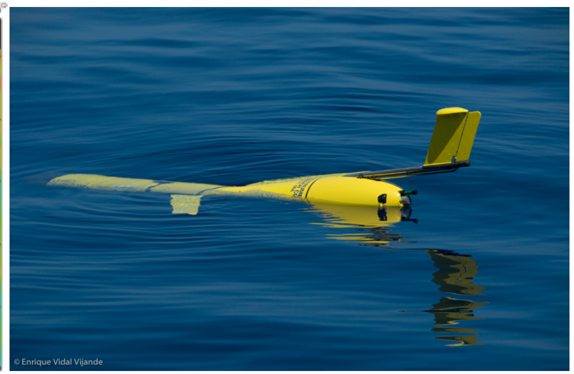
Why SOCIB, why Ocean Observatories, and **why now?**

New monitoring technologies are being progressively available for near real time coastal ocean 4D studies:

For example, **gliders** allow high-resolution sampling showing the existence of new features, such as submesoscale eddies with intense vertical motions that significantly affect upper ocean biogeochemical exchanges, an issue of worldwide relevance in the context of climate change (***Klein-Lapeyre, Ann Rev, 2008***).







These new technologies, <u>integrated and used together</u>, are delivering new insight into **coastal ocean variability,** which in turn will trigger **new theoretical developments**, increasing our u**nderstanding** of coastal and nearshore processes and contributing to a more science based and sustainable **management** of the coastal area.

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

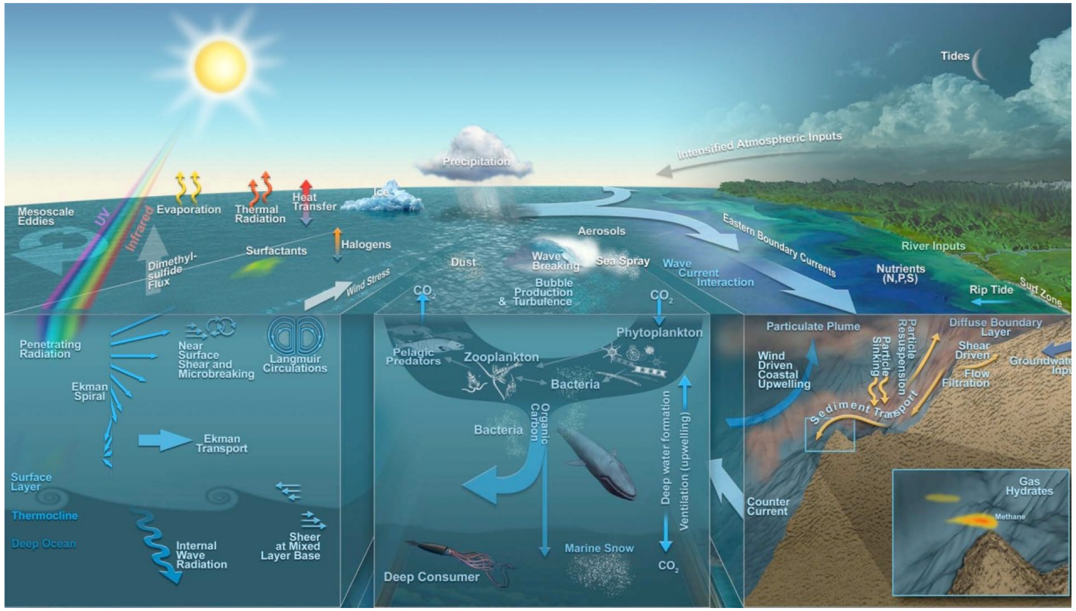
A New Approach to Marine and Coastal Research

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

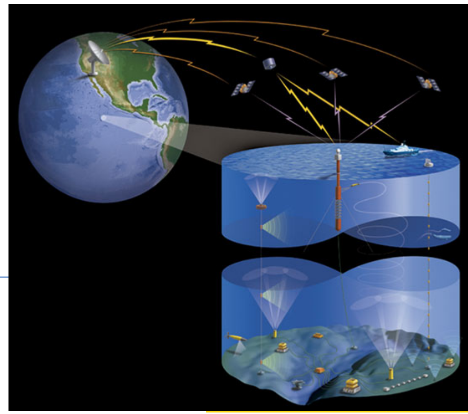
A quantitative major jump, in scientific knowledge and technology development

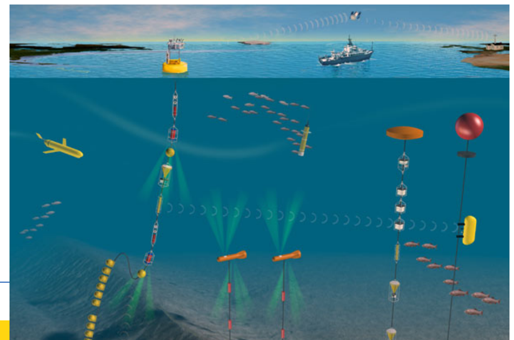
The development of a new form of Integrated Coastal Zone Management, based on recent scientific and technological achievements,

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



OOI, Regional Scale Nodes (Delaney, 2008)





Ocean Observatories, (Oceanus, 2006)

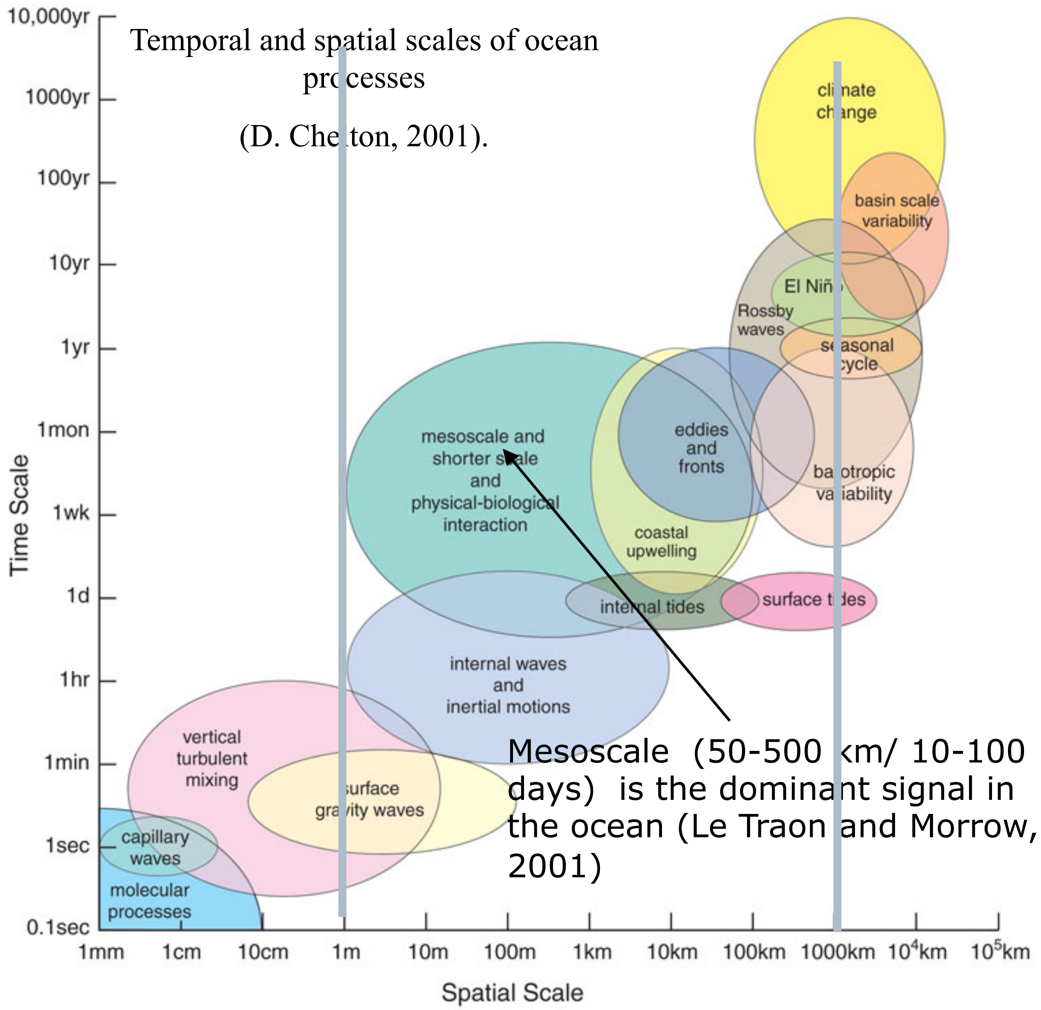
SOCIB Balearic Islands Coastal Observing and Forecasting System

SOCIB Scales Focus: coastal 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),

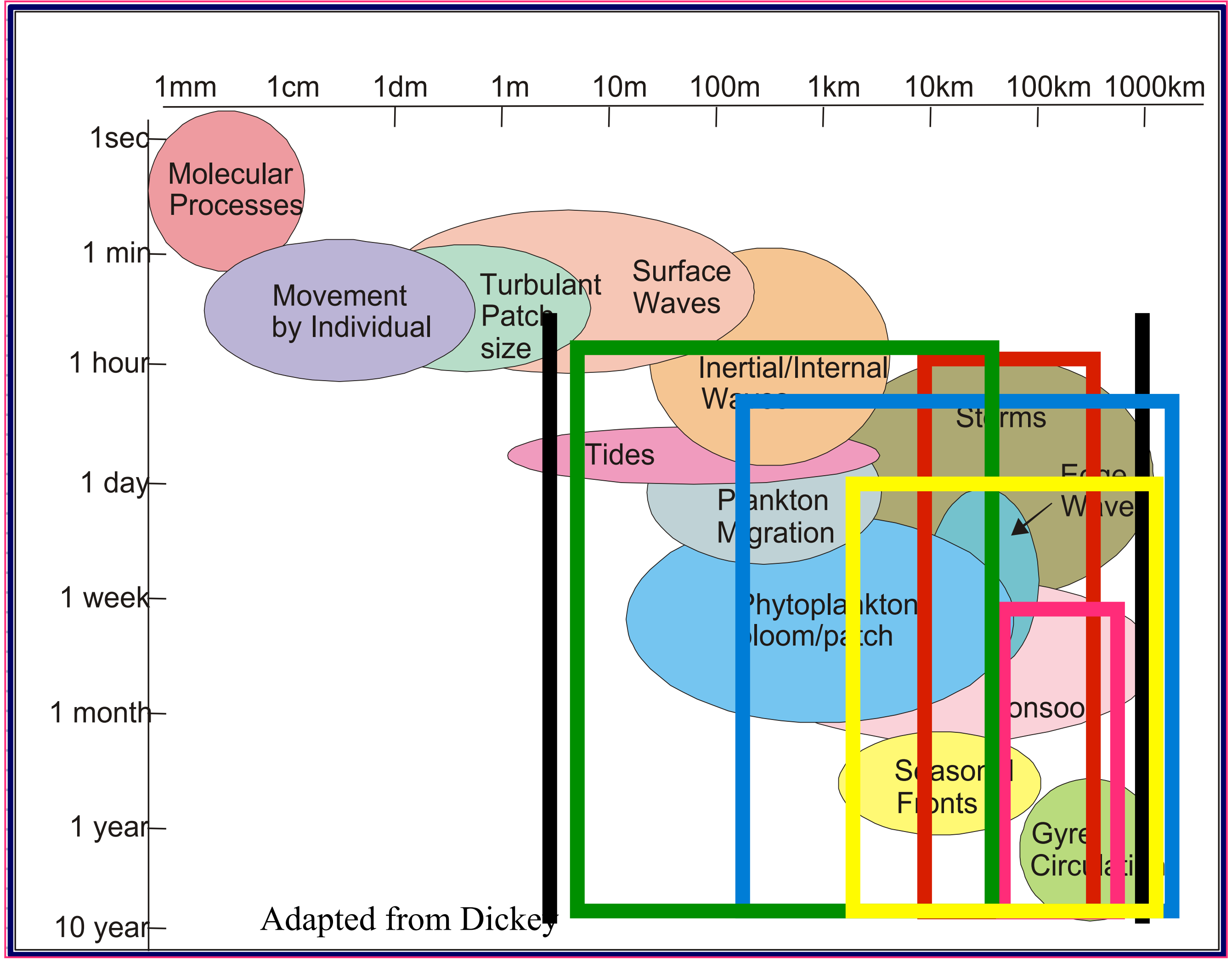
SOCIB focus: mesoscale & submesoscale and their effects on vertical motions, impact on ecosystem variability.

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



SOCIB scales

SOCIB scales and monitoring tools



Gliders

AUV's

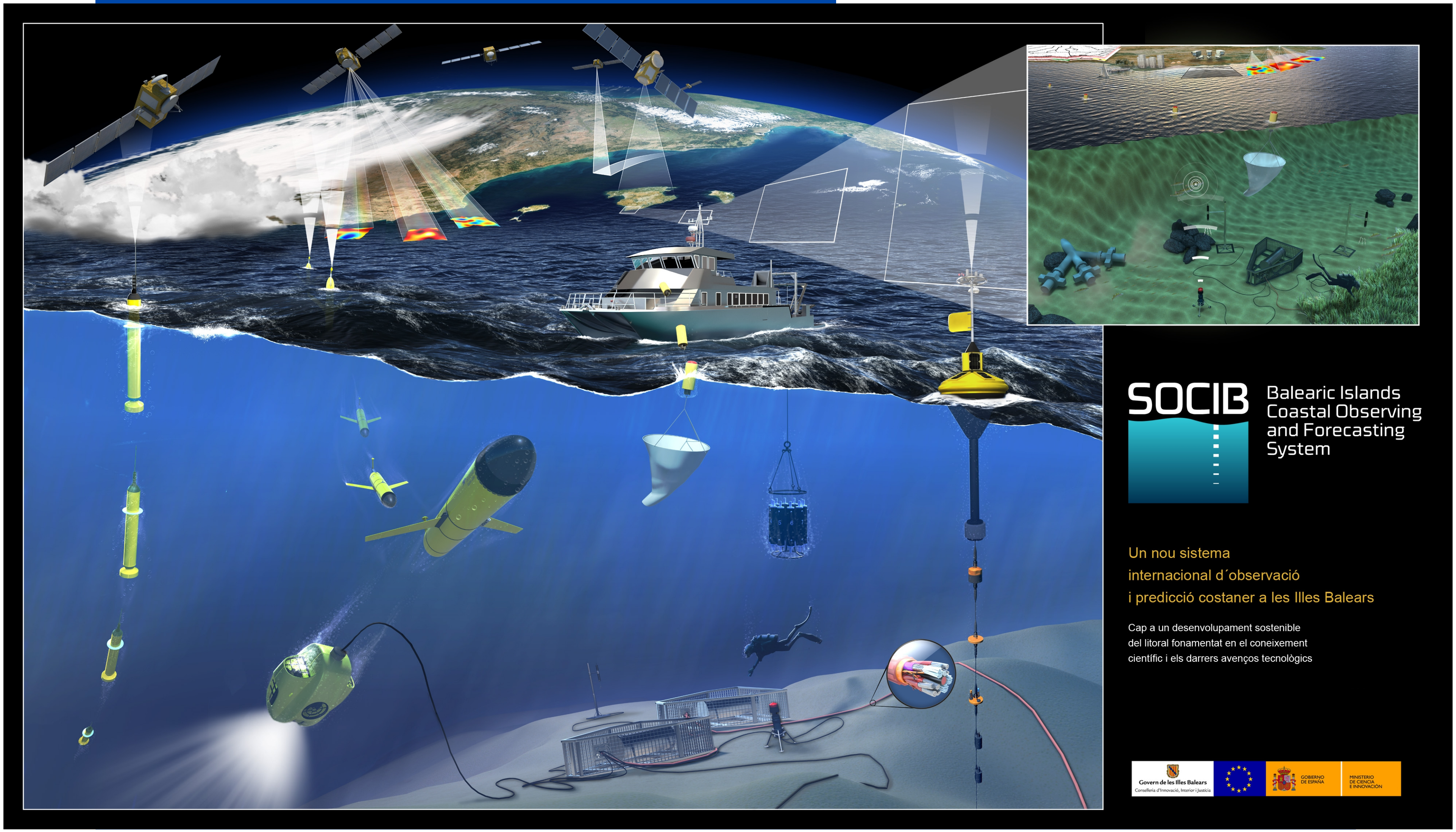
Time series

HF radar

Spatial survey

Satellite

SOCIB: the view….



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European and international framework

Spain: ICTS - MICINN

http://web.micinn.es/files/2008-folletook.pdf

Balearic Islands: R&D Plan

Govern de les Illes Balears
Conselleria d'Innovació, Interior i Justícia
Direcció General de Recerca, Desenvolupament Tecnològic i Innovació

http://dgtic.caib.es/www/plaCiencia/plaCiencia.ca.htm

Europe: (among other initiatives):

Marine and Maritime Strategy, **FP 7** projects (MyOcean, SESAME, ECOOP, etc…), **ESFRI** (European Strategy Forum on Research Infrastructures), **http://cordis.europa.eu/esfri/roadmap.htm**

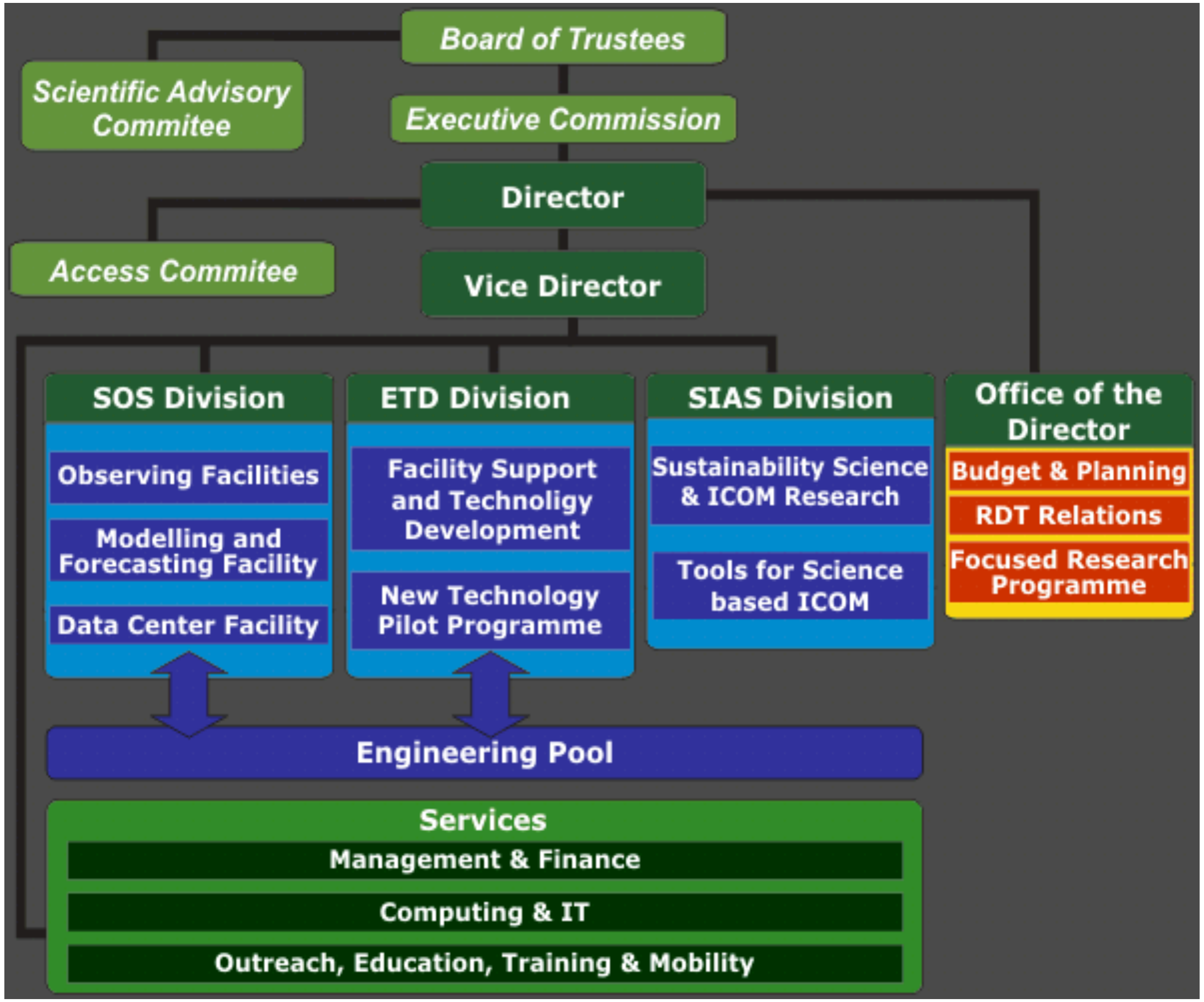
SOCIB particularities: drivers

SOCIB was designed (2006 proposal submitted to Spanish Large Scale Infrastructures Program) – Presidents' Conference 2007, …in response to:

3 KEY DRIVERS

- Science Priorities (scientific excellence)
- Technology Developments
- Strategic Society Needs

SOCIB particularities: structure

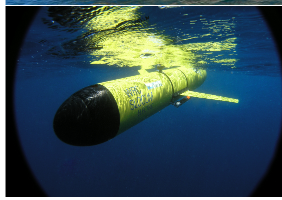
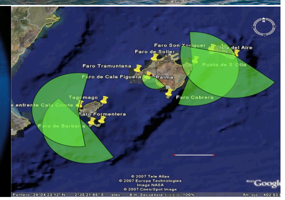


SOCIB - Systems Operations and Support

1. Observational Facilities (major elements)

- New Coastal Research Vessel (25 m LOA – 1.200 km coastline in the Islands)
- HR Radar
- Gliders and AUV's
- Moorings, tide gages and satellite products
- ARGO and surface drifters
- Nearshore beach monitoring



2. Forecasting sub-system

- Ocean currents (ROMS) and waves (SWAN) at different spatial scales, forced by Atmospheric model (WRF) and ecosystem coupling (NPZ)

3. Data Centre

- Quality control and Web access in open source
- Effective data archiving, internationally accepted protocols, delivery and communication

SOCIB particularities: principles

- Scientific and technological excellence through peer review
- Science, technology and society driven objectives
- Support to R&D activities in the Balearic Islands (existing and new ones);
- Systems integration, multiplatform and multidisciplinary coordination
- Sustained, systematic, long term, monitoring, addressing different scales
- Free, open and quality controlled data streams
- Baseline data in adherence to community standards
- Partnership between institutions

Products and Services: benefits for society, examples

- **Marine and Coastal Environment**
  - Harbors oscillations
  - Water quality in the coastal areas
  - Beach erosion, sediment transport
  - Sustainability science, indicators, baseline data, science based limits
  - ICZM, new science based integrated, multidisciplinary management of the coastal zone
  - Pollution management, marine debris, coastal impacts
- **Marine Safety: development of science based decision support tools**
  - Search & rescue operations at sea
  - Response to spills and mitigation procedures at sea and at the coast
- **Climate and Seasonal Forecasting**
  - Ocean climate variability and indicators
  - Sea level changes and impacts on coastal zone
  - Ecosystem response and variability in the Mediterranean
- **Marine Resources**
  - Ecosystem modeling, Marine Protected areas optimization and design
  - Responsible fisheries, variability, natural and anthropogenic
- **Technology development**
- **Education, public outreach and science**

SOCIB Value Chain

Observed variables

- U, V (currents, surface and profile)
- T (fixed point, profile, SST)
- Hs, Hm, Tp, Dp (Waves)
- S (fixed point, profile)
- Beach morphology
- Coastal bathymetry
- Sediment samples
- Sediment transport (OBS)
- Fluorescence (profile)
- Oxygen (profile)
- Biogeochemical indicators (N, P, Si, larvae)

Observing Systems

Fixed

- HF Radar installations
- Coastal buoys
- Beach video monitoring installations
- Nearshore cable installation

Mobile

- OceanBit R/V operations
- Gliders and AUV's
- ROV's
- Argo and Drifter's
- Fishing Fleet monitors

Model Systems

- 3D coastal ocean forecasting system (HOPS)
- Operational currents forecasting system (ROMS)
- Coastal ocean wave propagation model (WAVE)
- Coupled (ROMS - atmospheric) high resolution operational forecasting system
- Coupled (ROMS - NPZD) physical - biological ecosystem model

Products, Services & Outcomes

- Data Centre archive and open access portal
- Balearic Sea high resolution ocean currents forecast system
- Balearic Sea high resolution wave forecast system
- Early warning system for surge events
- Oil spill / jelly fish invasion trajectory estimations
- Balearic/Mediterranean beach system response to climate change
- Beach erosion and variability monitoring
- Beach safety and RIP currents
- Beach carrying capacity (physical and social)
- Tools for coastal zone decision makers
- Science based coastal zone policy recommendation
- Forecasting of Blue Fin Tuna spawning location and larval survival rates
- Education, Outreach and Training
- Step improvement in operational oceanography in the Balearic Islands

Goals Science, Society & Technology

General:

- Improve prediction, mitigation and management of impact of climate change and its affect on coastal zone
- Improve management of natural disasters
- Improve management of coastal ecosystems and resources
- Develop new technologies tailored to the needs of coastal ocean observing

Specific:

- Balearic Sea coastal ocean current variability
- interannual variation in the north/south exchanges in the western Mediterranean
- interannual variation in water mass properties
- mesoscale/submesoscale eddies and fronts, dynamics and multidisciplinary interactions
- sustained observations in the Balearic Seas to verify model output
- hydrodynamics and sediment transport
- physical/biological interactions focused on connectivity and MPA design
- monitoring of water quality
- identification of Blue Fin Tuna spawning sites/favorable habitats

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Implementation

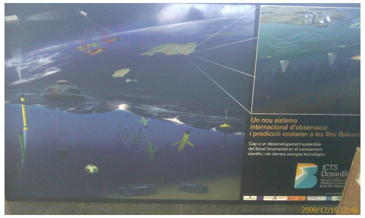
	2009		2010				2011				2012		2013	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1/Q2	Q3/Q4	Q1/Q2	Q3/Q4
Systems, Operations and Support Division														
Observing Facilities:														
Coastal Research Vessel	CD	CD	PDP	LP	LP	C	C	C	C	C	IOC	OM	FOC	FOC
Coastal HF Radar	CD	CD	PDP	LP	LP	C	C	IOC	FOC	FOC	FOC	FOC	FOC	FOC
Gliders	CD	CD	PDP	LP	IOC	IOC	OM	OM	OM	OM	FOC	FOC	FOC	FOC
Drifters	CD	CD	PDP	PDP	PDP	PDP	LP	IOC	IOC	OM	FOC	FOC	FOC	FOC
Moorings	CD	CD	PDP	LP	C	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC
Marine and Terrestrial Beach Monitoring	CD	CD	PDP	LP	C	C	C	C	C	C	IOC	FOC	FOC	FOC
Data Centre Facility	CD	CD	CD	PDP	PDP	IOC	IOC	OM	FOC	FOC	FOC	FOC	FOC	FOC
Modelling and Forecasting Facility	CD	CD	PDP	PDP	LP	C	C	IOC	IOC	OM	FOC	FOC	FOC	FOC
Engineering and Technology Development Division														
Facility Support and Technology Development	CD	CD	PDP	LP	IOC	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC
Near Shore Station	CD	CD	CD	CD	PDP	LP	PDP	C	C	IOC	OM	FOC	FOC	FOC
Ships of Opportunity/Fishing Fleet Monitoring	CD	CD	LP	PDP	IOC	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC
Strategic Issues and Application to Society Division	CD	PDP	IOC	IOC	OM	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC
Services														
Management & Finance	PDP	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC
Computing & IT	CD	C	OM	PDP	LP	C	IOC	OM	FOC	FOC	FOC	FOC	FOC	FOC
Outreach, Education, Training & Mobility	CD	CD	PDP	PDP	PDP	PDP	IOC	IOC	OM	FOC	FOC	FOC	FOC	FOC

Project Stages:

CD	Concept Development
PDP	Planning, Design and Pilots
LP	Legal Procedure/Purchase
C	Construction
IOC	Achieve Initial Operational Capability
OM	Operation and Maintenance
FOC	Final Operational Capability

Table 2: Implementation Schedule Summary for the major SOCIB elements, detailed schedules are available in Annex 3. All available at www.socib.es

SOCIB Facilities and Services – 2011
www.socib.es



Already from SOCIB and/or in kind from CSIC and IEO and UIB:

SYSTEMS OPERATIONS AND SUPPORT DIVISION

OBSERVING:
- Glider Facility (7 Slocum + 2 iRobot gliders)
- Satellite remote sensing products
- ARGO profiles and Surface drifters Facility (pilot)
- Coastal Buoys real time Facility (pilot)
- Nearshore beach monitoring Facility (pilot)

MODELLING
- Numerical Forecasting Facility

DATA CENTER
- Data Center

•Proven capability

•Pilot projects

•Non sustained

APPLICATIONS AND STRATEGIC ISSUES SOCIETY DIVISION
- ICZM and Science based sustainable coastal and ocean management

Bluefin Tuna target project

ENGINEERING AND TECHNOLOGY DEVELOPMENT DIVISION
- New technologies

Parc Bit – office – Since August 2009

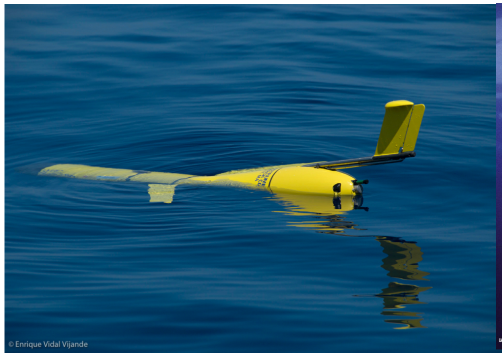
SERVICES
- Management and Finances
- Computing and IT's
- Outreach and Education

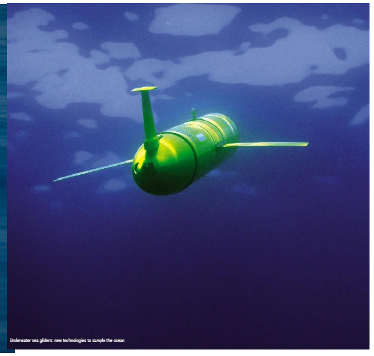
IMPLEMENTATION PLAN; approved July 2010

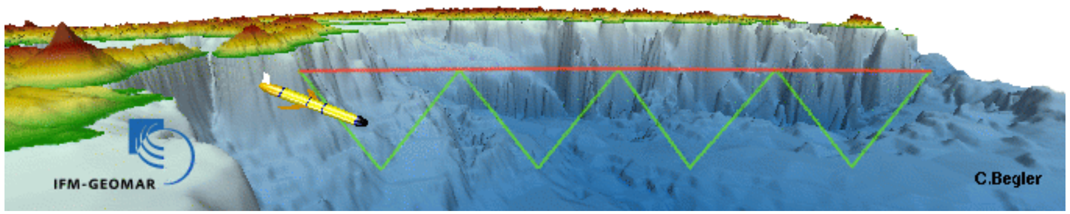
Glider Facility Activities

Glider data

- Variables: P, T, S
- Vertical extension: 10-180 m
- Horizontal resolution: 1km







Envisat data

- Along track SLA (AVISO/CLS) + MDT (Rio et al.)
- Delayed time product
- Mediterranean product
-Horizontal resolution: 7 km

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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]

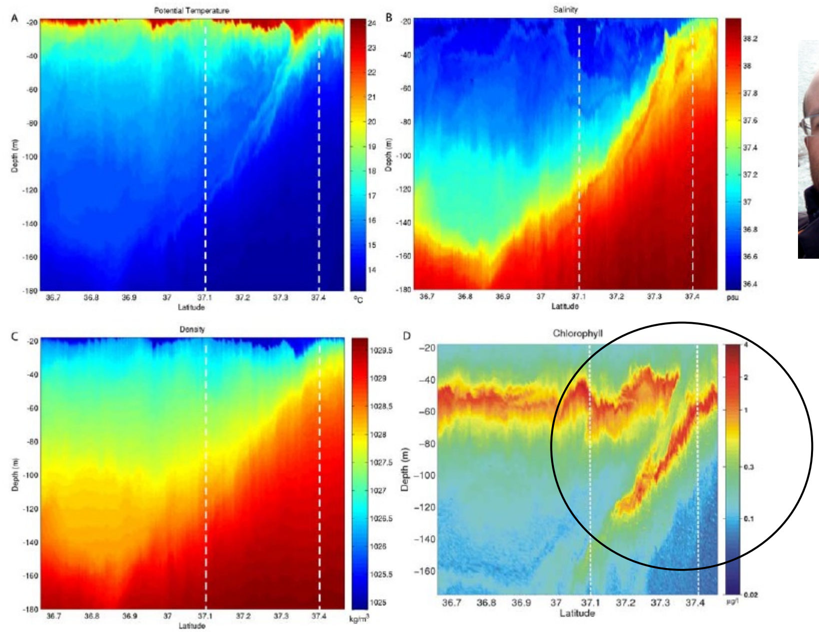


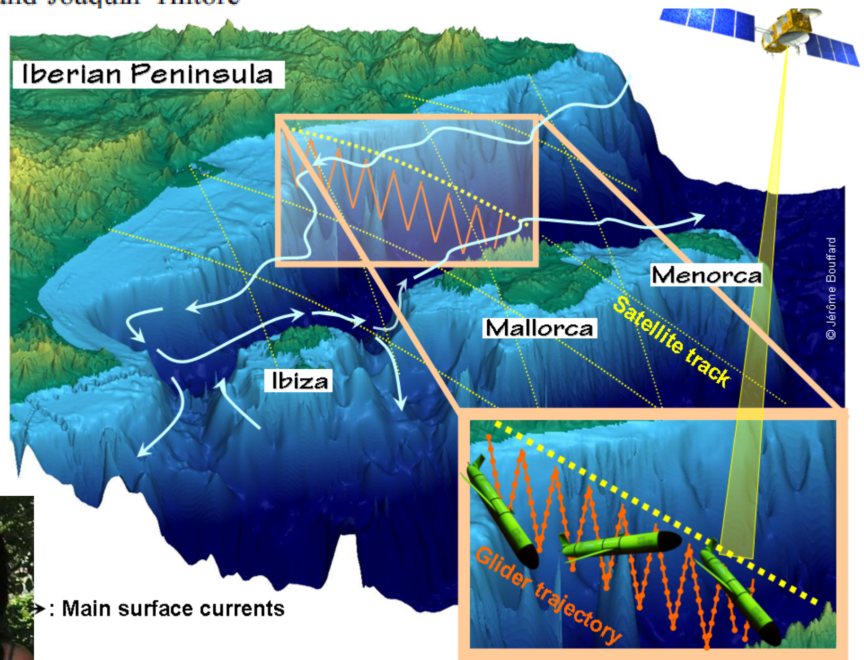
Figure 2. Vertical section of temperature (°C), salinity (PSU), density (kg/m^3) and chlorophyll (μg/l) from glider section 2 (dashed magenta in Figure 1). White dashed lines define sub-section in the northern part of the domain.

Eddy/mean flow interactions – Blocking effects General Circulation

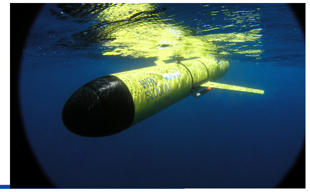
JGR, 2010

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]



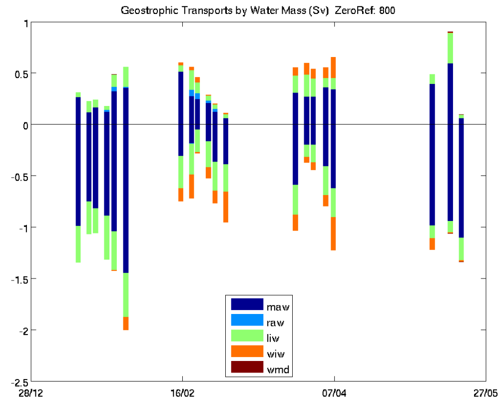
Gliders Facility: Operational

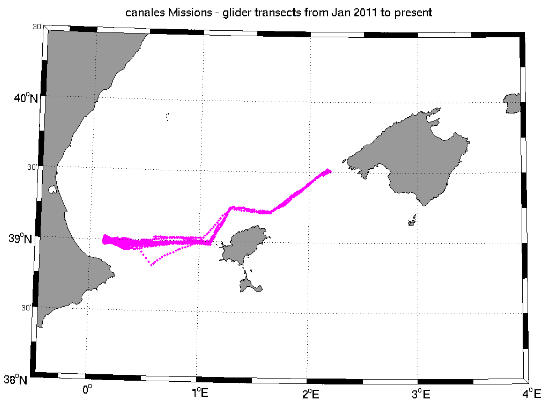


- **After 28 glider missions (started in 2006), + 10.000 profiles**
- **Since January 2011; routine operations in Ibiza and Mallorca Channels (150 miles section)**

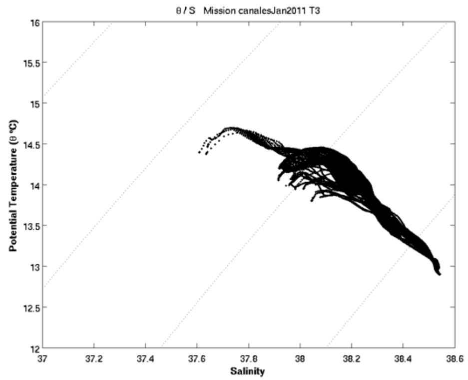
<u>NEED DEFINE KEY CONTROL SECTIONS EU</u>

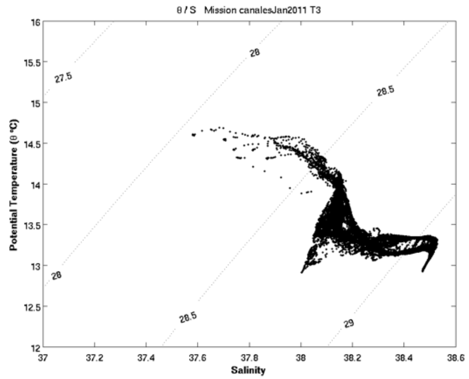
Major transport changes





TS diagrams ROMS / Glider





SOCIB Glider Facility (Summary)

Gliders (a fleet of …) ?:

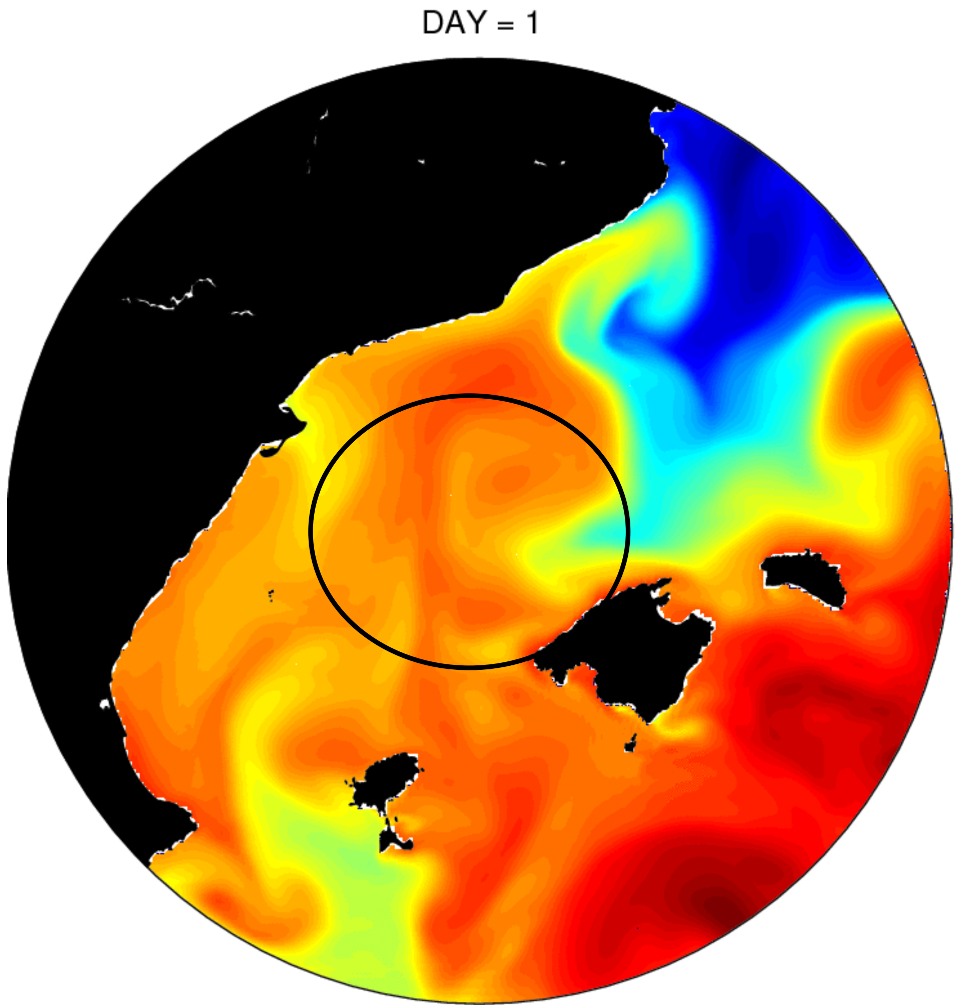
- They allow long term, sustained, multidisciplinary monitoring of the coastal ocean for example at key control sections.

- They are providing new evidences of the complexity of the coastal ocean, by resolving tridimensional mesoscale and submesoscale instabilities **never fully observed before**, showing the intrinsic dynamical relevance of theses instabilities, their interactions and effects on the mean circulation, and their role on the response of the ecosystem.
  - **A major observational breakthrough is appearing upfront**. It will trigger theoretical and numerical developments…
  - Examples from Balearic and Alborán Seas have been shown, suggesting the capabilities that will soon arise from monitoring with fleets of gliders, physical variability and ecosystem response at meso and submesoscale…

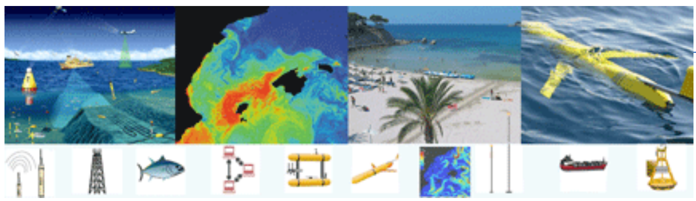
Modelling Facility: Science

Operational Modeling: ROMS, 2km To reproduce and maintain mesoscale features, interactions. In collaboration with GKSS and Univ. Rutgers, in the frame MFS/MOON.
WRF Atmospheric Model
Also **SWAN** for coastal ocean wave Dynamics and Habors (with PE)

The aim :
- Validate the model with the measurement (gliders, ...)
- From the available data and the model simulation (5 years), study the formation of mesoscale structures.
- Understand impact on the ecosystem



SST from 11/2008



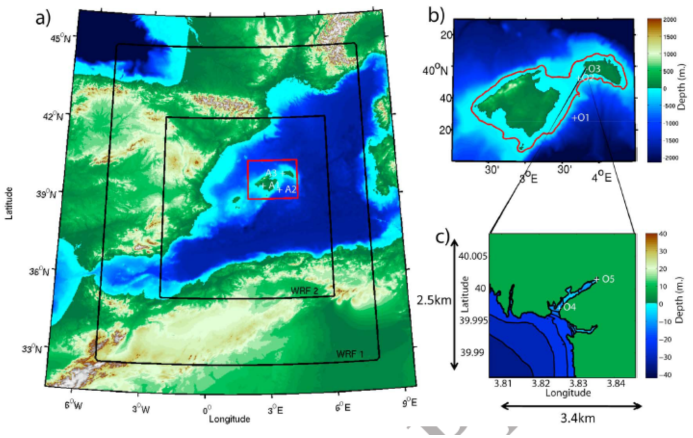
Modelling Facility: Technology tools: pre-operational, meteotsunamis forecasting

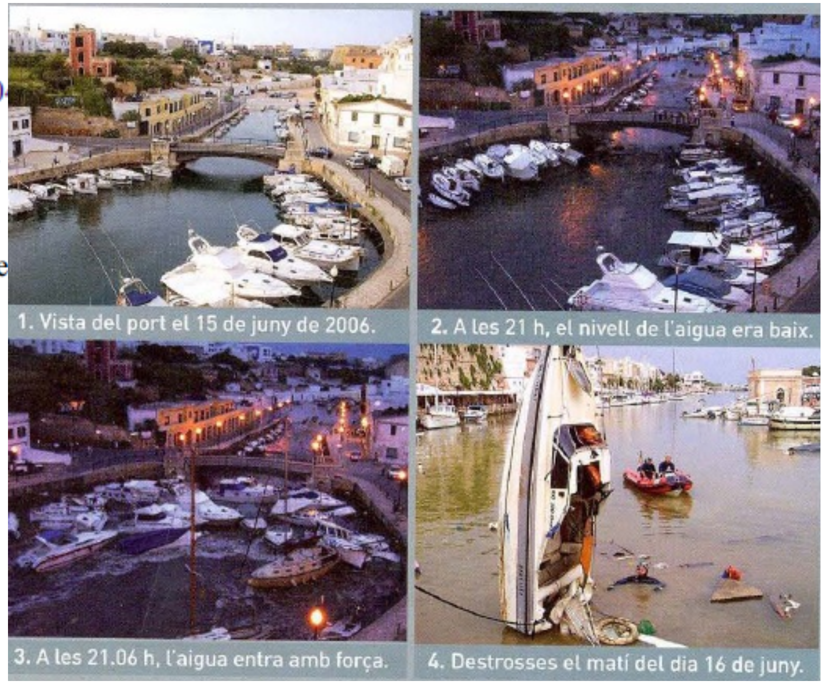
GEOPHYSICAL RESEARCH LETTERS, VOL. 38, LXXXXX, doi:10.1029/2011GL0

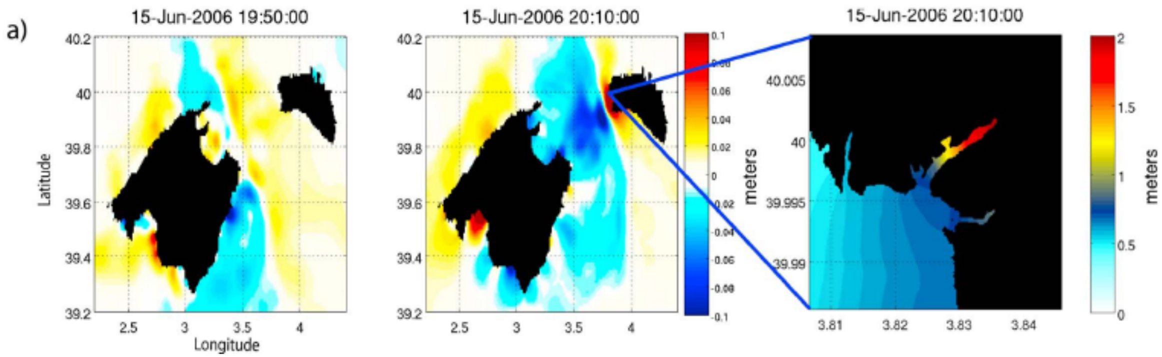
1 **Toward the predictability of meteotsunamis in the Balearic Sea**
2 **using regional nested atmosphere and ocean models**

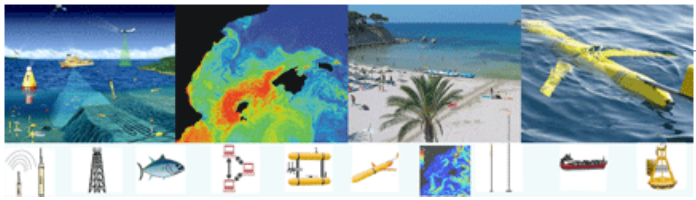
3 Lionel Renault,[1] Guillermo Vizoso,[2] Agustin Jansá,[3] John Wilkin,[4] and Joaquin Tintore

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





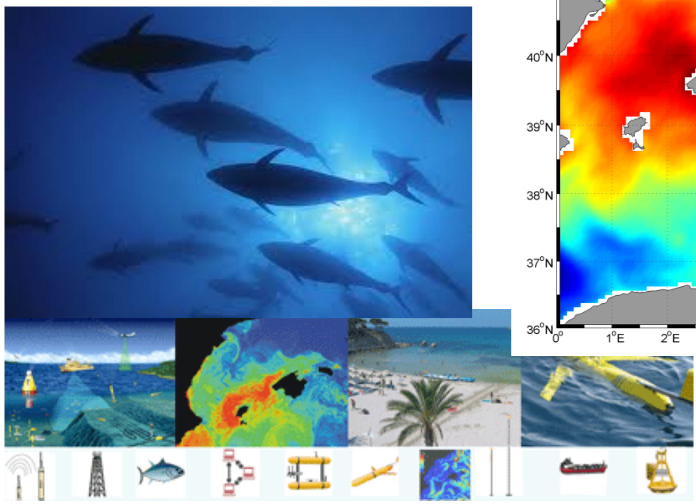


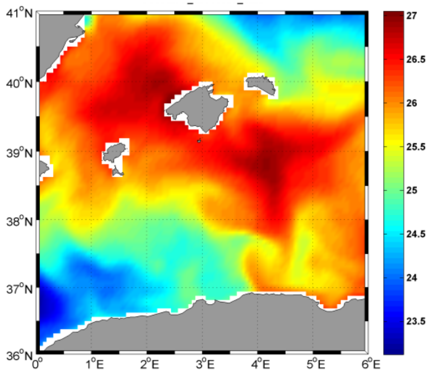


Bluefin Tuna Target Project: scientific problem solving for sustainable fisheries: at SOCIB since 2011

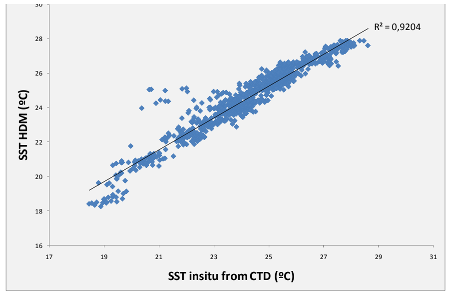
Initial Activities and First Results:

- Compilation of historical larvae data from various projects at IEO
- Link fishing data with ROMS, remote sensing and in situ hydrography
- Validate ROMS historical hydrographic data (SST and SSS) in the study area
- Development of an analysis framework and tools for modelling habitat-species relations.
- Development of field campaigns for studding specific key ecological questions
- Organize a inter-institutional working framework for data management and project flow control





ROMS derived SST vs CTD



ICTS OceanBit

Conselleria d'Economia, Hisenda i Innovació
Direcció General de Recerca, Desenvolupament Tecnològic i Innovació

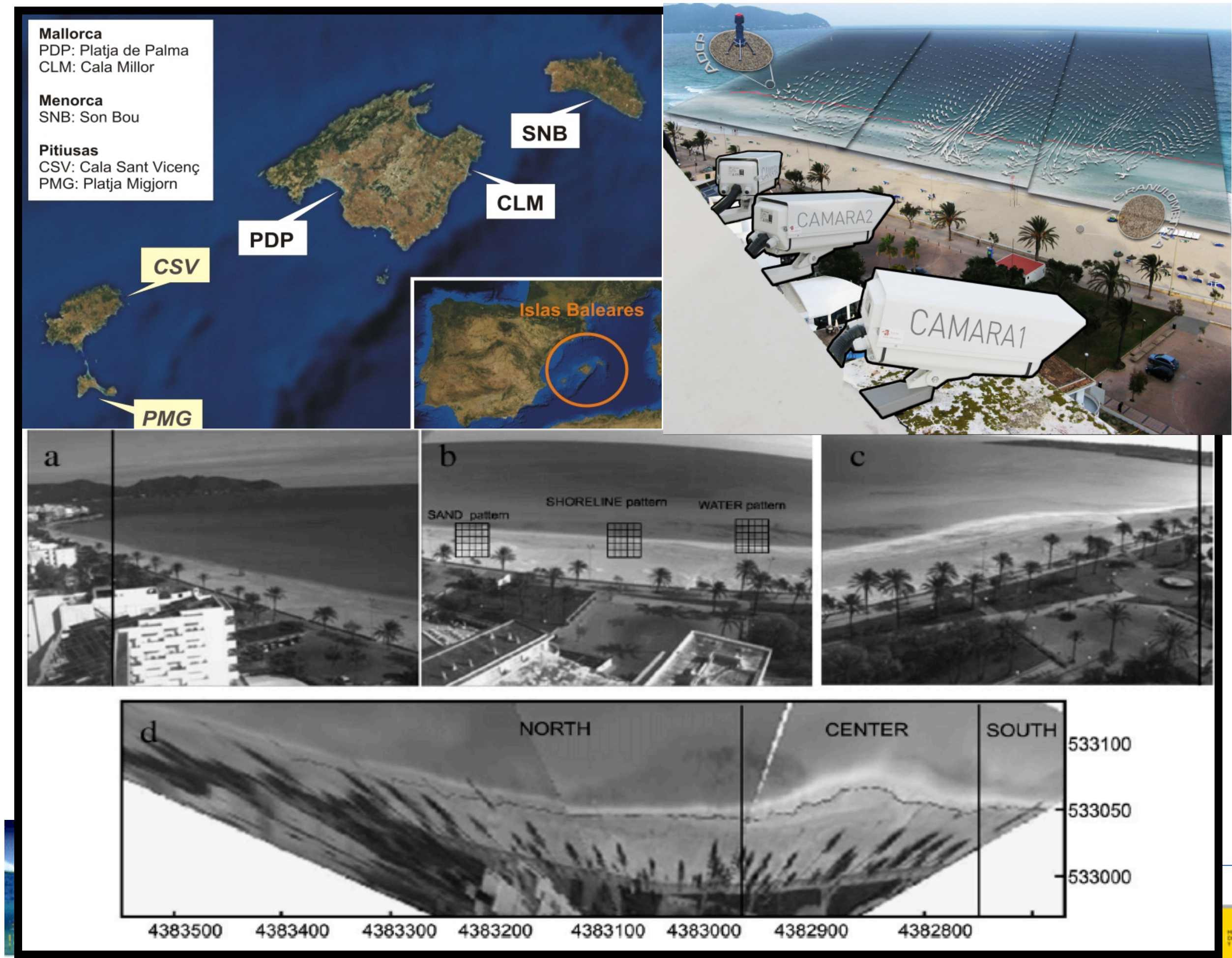
UIB

UIB I·M·E·D·E·A

CSIC

Beach Monitoring Facility: Science & Technology

TMTBMF is a MODULAR SYSTEM designed to monitor continuously and in an autonomous way short and long term physical beach hydrological and morphological parameters.



MOBIMS

- Beach videomonitoring (SIRENA)
- Waves and currents (ADCPs)
- Bathymetry and beach profiles surveys
- Sediment parameters

PRODUCTS & SERVICES FOR BEACH MORPHODYNAMICS RESEARCH, BEACH SAFETY & COASTAL MANAGEMENT

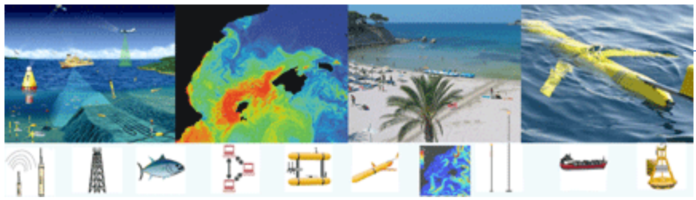
Data Centre Facility

A crucial element for real multi-platform integration, a pilot element for a Spanish Data Management strategy.

Goal: to provide researchers and users with a **system** that allow to **locate and download the data** of interest (near real time and delayed mode) to **visualize, analyze** and manage the information.

Principles of SOCIB Data Center: the data are,

- Discoverable, accessible, 'collect once, use many' (data and metadada)
- Freely available
- Interoperability, standardization and sharing guarantee



Data Centre Facility

The European framework

MERSEA

myOcean

SESAME

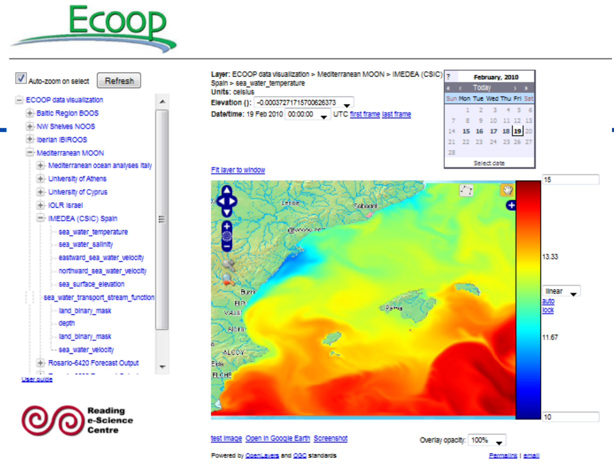
The international framework

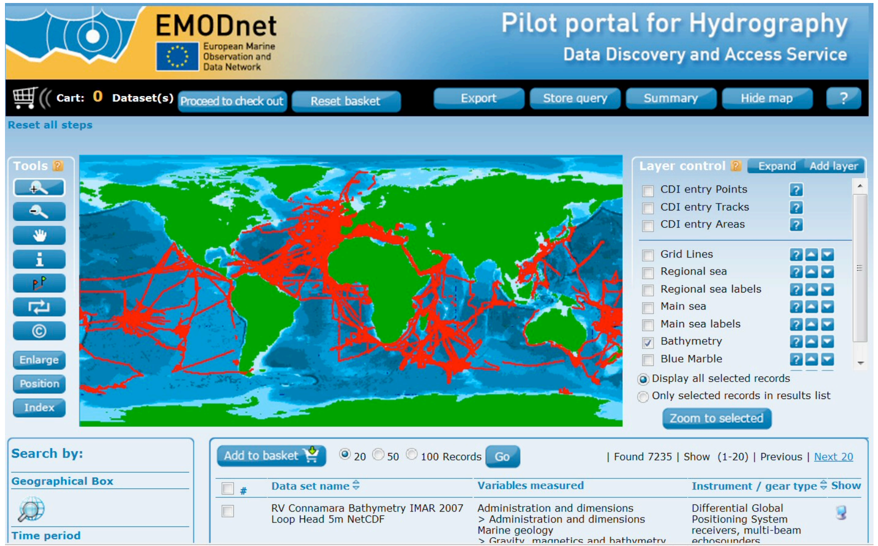
IMOS

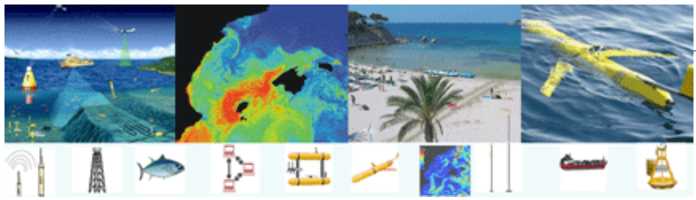
OOI
OCEAN OBSERVATORIES INITIATIVE

IOOS

NEPTUNE Canada







ICTS OceanBit

Govern de les Illes Balears
Conselleria d'Economia, Hisenda i Innovació
Direcció General de Recerca, Desenvolupament Tecnològic i Innovació

UIB

I·M·E·D·E·A

CSIC

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

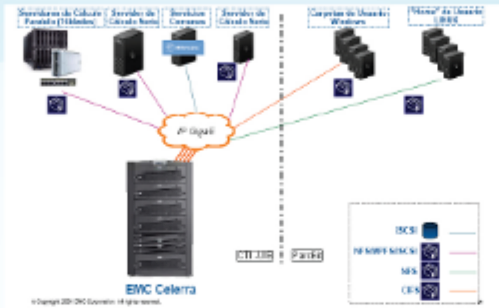
Data Centre: Technologies

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.

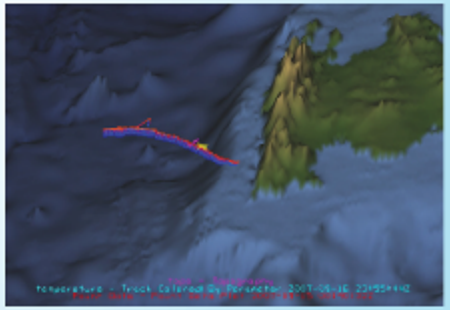
4. Catalog

THREDDS to organize data and Metadata to automatic harvesting.

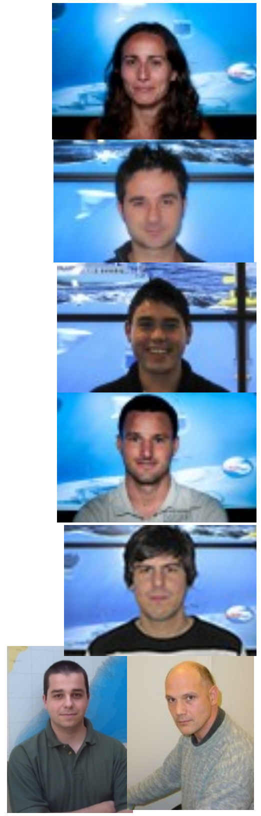
5. Discovery

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

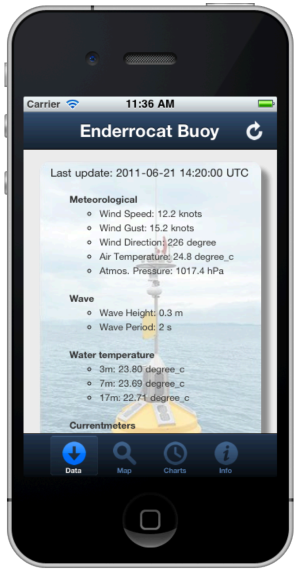
6.Analisis and Visualization



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



Data Centre (Technologies; example of Apps)



SOCIB Engineering and Technology Development; ETD Division (TMOOS based transferred AMT)

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October 2011 Issue

ENVIRONMENTAL MONITORING
REMOTE SENSING
& POLLUTION CONTROL

COVER

The Instituto Mediterráneo de Estudios Avanzados performs maintenance on its oceanographic and meteorological Enderrocat buoy in Palma Bay, Mallorca Island. The mooring produces atmospheric data variables (e.g., wind, atmospheric pressure and air temperature) and variables measured in the water column (e.g., currents and temperature) from the surface to a depth of 20 meters. It takes measurements every 10 minutes and transfers the data via VHF radio to the coastal station in Calanova, Spain. Data are then transferred via the Internet to servers for preprocessing, quality control and publication on the institute's website. (Photo credit: Eduardo Infantes Oanes)

Monitoring the Eastern Alborán Sea Using High-Resolution Glider Data

The Challenge of Sampling Rough Upper-Ocean Areas With Underwater Vehicles

www.sea-technology.com MARCH 2009 / *st* 29

32 *st* / JULY 2010

Combining New and Conventional Sensors To Study the Balearic Current

The SINOCOP Experiment Improves Understanding Of Coastal Mesoscale Processes in the Western Mediterranean Sea

By Dr. Ananda Pascual
Tenured Scientist

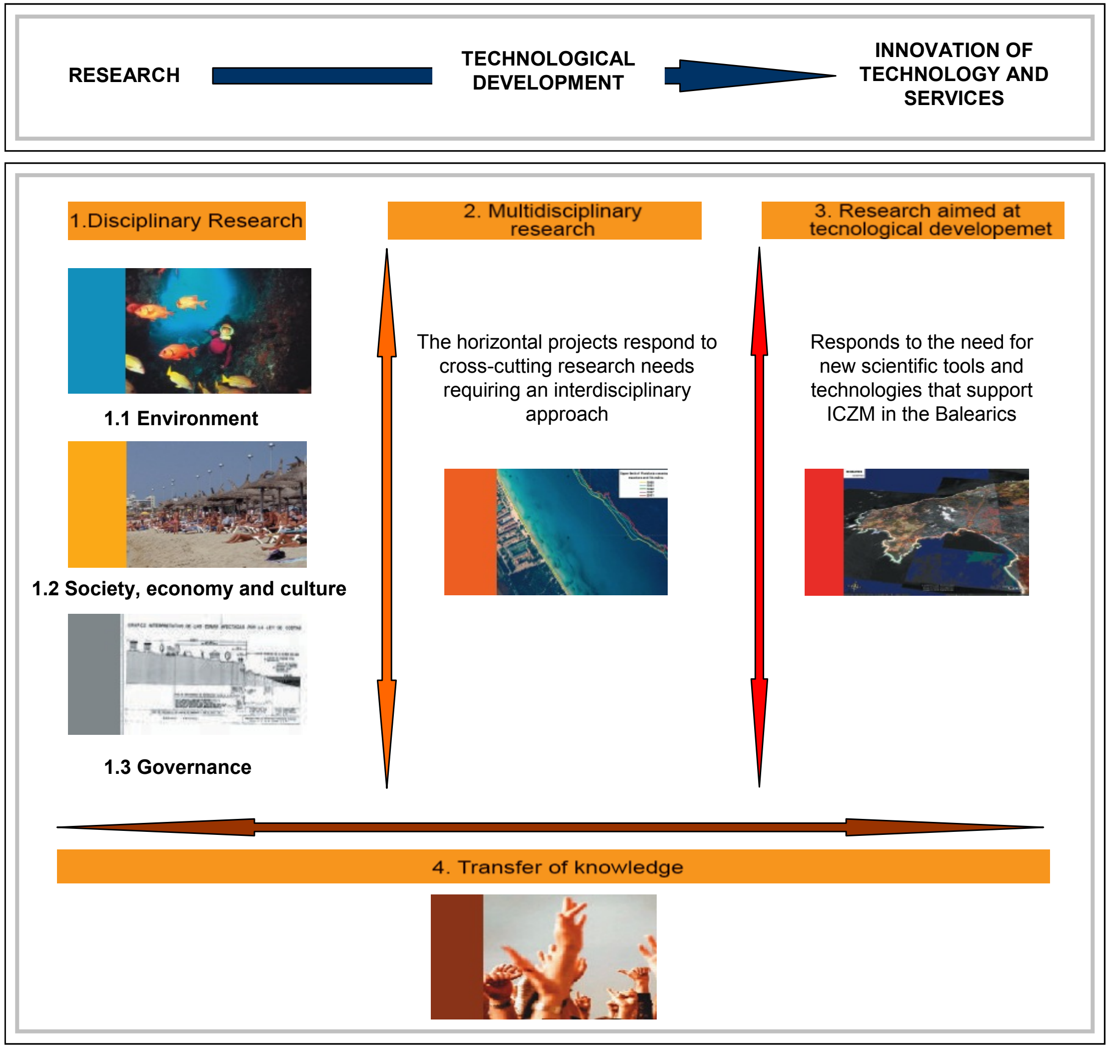
Also important are both the strategic position of the Balearic Islands in the Western Mediterranean Sea and the

SOCIB Balearic Islands Coastal Observing and Forecasting System

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

Govern de les Illes Balears

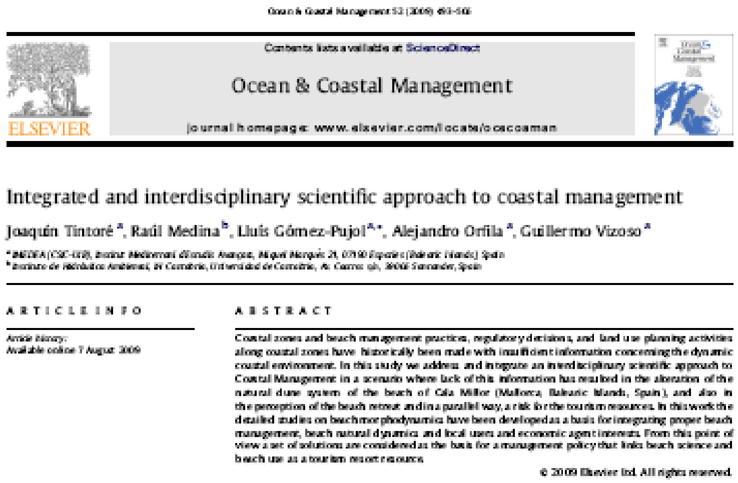
Technologies (Management technologies): SOCIB Applications and Strategic Issues Society Division



- From beach erosion 2001 to ICZM 2005, ICOM, MSP 2010,… Driven by interest from the Balearic Islands (gov&soc).

Example: Sustainability Indicators – together with CES Council. -

http://www.costabalearsostenible.es



Ocean & Coastal Management 52 (2009) 493–506

Contents lists available at ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

ELSEVIER

Integrated and interdisciplinary scientific approach to coastal management

Joaquín Tintoré [a], Raúl Medina [b], Lluís Gómez-Pujol [a,*], Alejandro Orfila [a], Guillermo Vizoso [a]

ARTICLE INFO

Article history:
Available online 7 August 2009

ABSTRACT

Coastal zones and beach management practices, regulatory decisions, and land use planning activities along coastal zones have historically been made with insufficient information concerning the dynamic coastal environment. In this study we address and integrate an interdisciplinary scientific approach to Coastal Management in a scenario where lack of this information has resulted in the alteration of the natural dune system of the beach of Cala Millor (Mallorca, Balearic Islands, Spain), and also in the perception of the beach retreat and in a parallel way, a risk for the tourism resources. In this work the detailed studies on beach morphodynamics have been developed as a basis for integrating proper beach management, beach natural dynamics and local users and economic agent interests. From this point of view a set of solutions are considered as the basis for a management policy that links beach science and beach use as a tourism resort resource.

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SOCIB Balearic Islands Coastal Observing and Forecasting System

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Technologies (Management technologies): SOCIB Applications and Strategic Issues Society Division

Sustainability Science and Integrated Coastal and Ocean Management, MSP

We are…

- Developing and evaluating science-based decision-making tools and methods to support ICMM, with particular emphasis on the integration of environmental and social dimensions

- Identifying and implementing indicators to assess, monitor, and predict limits to growth and critical thresholds,

- Integrating research with environmental governance and management systems to assure sound transfer two sides science to society and back!.

SYSTEM OF INDICATORS
for Integrated Coastal Zone Management in the Balearic Islands

Marine Policy 34 (2010) 772–781

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Balancing science and society through establishing indicators for integrated coastal zone management in the Balearic Islands

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ABSTRACT

This paper explores the process by which indicators may be developed as tools for communicating science to decision-makers using the participatory approach demonstrated by the Balearic Indicators Project. This initiative reflects a series of compromises considered necessary to achieve the objective of generating an indicator system that is scientifically viable, comparative internationally yet locally relevant, and to facilitate its implementation. The article highlights questions regarding the utility of science for addressing current global issues related to sustainability and why science often fails to promote change at the societal level.

Ocean & Coastal Management 52 (2009) 493–506

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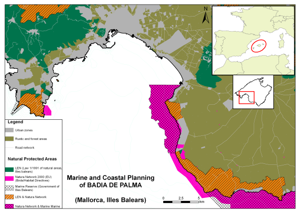

SOCIB Balearic Islands Coastal Observing and Forecasting System

GOBIERNO DE ESPAÑA | MINISTERIO DE CIENCIA E INNOVACIÓN

Govern de les Illes Balears

Outline

1. **SOCIB: oceans complexity, monitoring, what, why, why now, scales, structure, facilities, examples**

2. **Innovation in oceanographic instrumentation: the case of ocean gliders.**

3. **The new role of ICTS SOCIB and Marine Research Infrastructures for PPP**

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

Oceans complexity, needs for improvement of instrumental capacities

Rationale:

The Oceans; a complex system, changing, under-sampled: tools to study them include

- Instruments to measure properties
- Models for continuous estimates of states and evolution

Improvements in tools capabilities

↓

Increase understanding → **Major practical benefits**

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 (for advancing instrumentation)

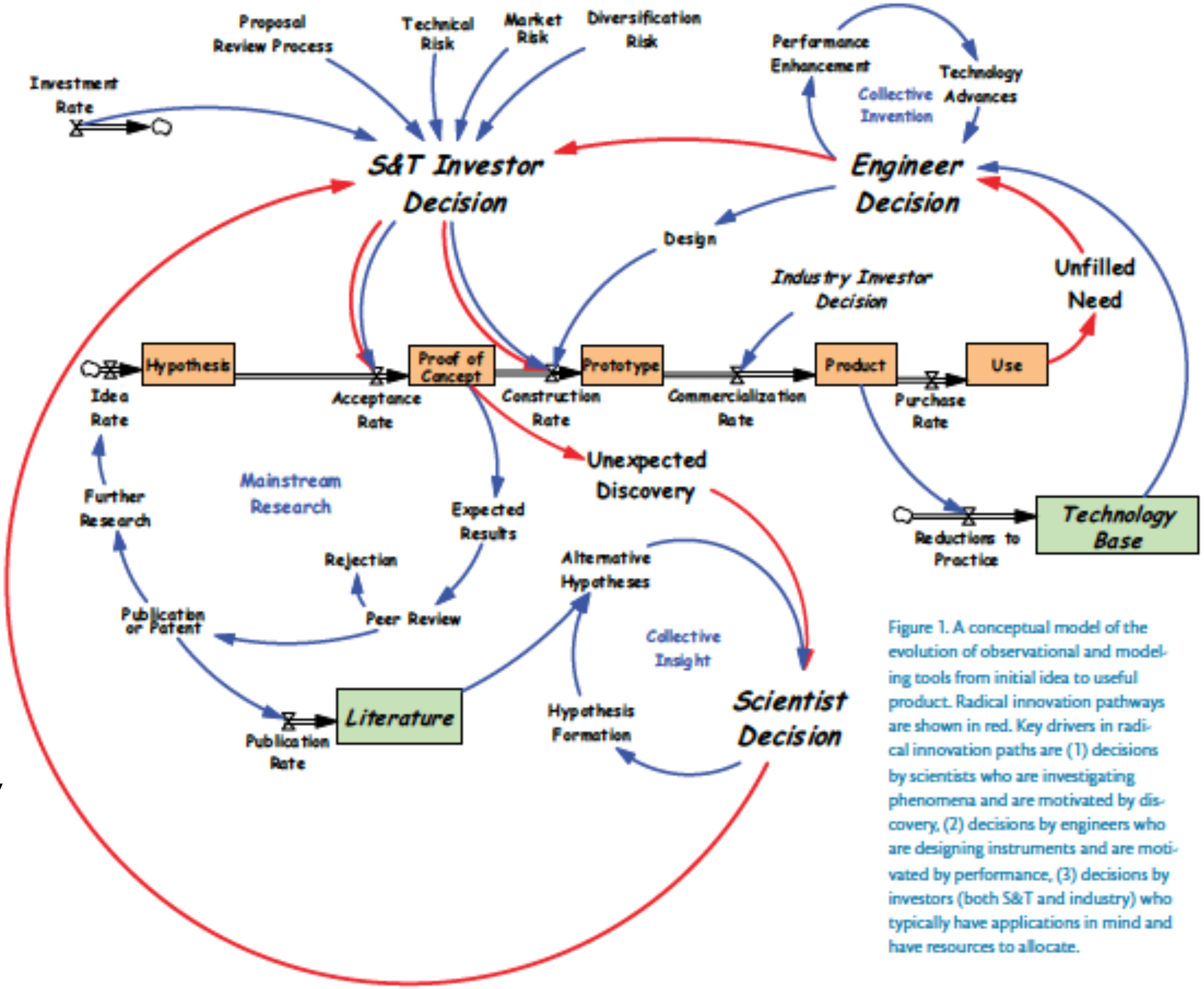

Figure 1. A conceptual model of the evolution of observational and modeling tools from initial idea to useful product. Radical innovation pathways are shown in red. Key drivers in radical innovation paths are (1) decisions by scientists who are investigating phenomena and are motivated by discovery, (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)

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 real challenge for the next decade…:

To use and integrate these new technologies to carefully and systematically

- Monitor the variability at small scales, e.g. mesoscale/weeks, to
- Resolve the sub-basin/seasonal and inter-annual variability and by this
- Establish the decadal variability, understand the associated biases and correct them …

nature

www.nature.com/nature Vol 450 | Issue no. 7171 | 6 December 2007

Patching together a world view

Data sets encapsulating the behaviour of the Earth system are one of the greatest technological achievements of our age — and one of the most deserving of future investment.

Now or never

Monitoring the Earth system requires great expertise, not just to build the instruments but to use them properly and interpret their output. Many scientists are, however, far from enthused by projects that do not involve the forming and testing of hypotheses. At worst, monitoring is traduced as stamp collecting and looked down on as drudgery.

Such attitudes must not be allowed to prevail. Testing hypotheses about how the world works requires not just information on the current state of the three-dimensional globe, but on its progress through the fourth dimension of time. Data on the colour of the seas that are not gathered today can never be gathered in the future — gaps left in the record cannot be filled (see page 782). And continuous data sets are going to be vital to the validation of the ever more informative models of the Earth system that we need.

This is why operational systems for data collection in which scientists play key roles are so important. Only they can give us multiscale and multifactor ways of seeing the world that are up to the challenges of the twenty-first century. When the expenditure needed to maintain these data flows conflicts with the funds needed to support fresh scientific research, researchers must acknowledge that there is a strong case for preferring continuous, operational monitoring. An accurate and reliable record of what is going on can trump any particular strategy for trying to understand it.

There is only one Earth, with only one history, and we get only one chance to record it. Ideas not followed through can be taken up again later. A record not made is gone for good. Long zooms in and out of our ever more detailed images of Earth will delight and inform us for years to come. But no digital trickery can replace the steady, fateful pan from past to future.

Science... and Society!

But... now

MORE EFFICIENT

HIGHER SOCIAL IMPACT

Eos, Vol. 92, No. 25, 21 June 2011

NEWS

Determining Critical Infrastructure for Ocean Research and Societal Needs in 2030

PAGES 210–211

The United States has jurisdiction over 3.4 million square miles of ocean—an expanse greater than the land area of all 50 states combined. This vast marine area offers researchers opportunities to investigate the ocean's role in an integrated Earth system but also presents challenges to society, including damaging tsunamis and hurricanes, industrial accidents, and outbreaks of waterborne diseases. The 2010 Gulf of Mexico Deepwater Horizon oil spill and 2011 Japanese earthquake and tsunami are vivid reminders that a broad range of infrastructure is needed to advance scientists' still incomplete understanding of the ocean.

The National Research Council's (NRC) Ocean Studies Board was asked by the National Science and Technology Council's Subcommittee on Ocean Science and Technology, comprising 25 U.S. government agencies, to examine infrastructure needs for ocean research in the year 2030. This request reflects concern, among a myriad of marine issues, over the present state of aging and obsolete infrastructure, insufficient capacity, growing technological gaps, and declining national leadership in marine technological development; these issues were brought to the nation's attention in 2004 by the U.S. Commission on Ocean Policy.

increasing fundamental scientific understanding (10 questions). Many of the questions in the report (e.g., sea level rise, sustainable fisheries, the global water cycle) reflect challenging, multidisciplinary science issues that are clearly relevant today and are likely to take decades of effort to solve. As such, U.S. ocean research will require a growing suite of ocean infrastructure for a range of activities, such as high-quality, sustained time series observations or autonomous monitoring at a broad range of spatial and temporal scales. Consequently, a coordinated national plan for making future strategic investments becomes an imperative for addressing societal needs. Such a plan should be based on known priorities and be reviewed every 5–10 years to optimize the federal investment, the report states.

The committee examined the past 20 years of technological advances and ocean infrastructure investments (such as the rise in the use of self-propelled, uncrewed, underwater autonomous vehicles), assessed infrastructure that would be required to address future ocean research questions, and characterized ocean infrastructure trends for 2030. One conclusion was that ships will continue to be essential, especially because they provide a platform for enabling other infrastructure, such as autonomous and remotely operated vehicles; samplers and

The committee also provided a framework for prioritizing future investments in ocean infrastructure. It recommends that development, maintenance, or replacement of ocean research infrastructure assets be prioritized in terms of societal benefit, with particular consideration given to addressing important science questions; affordability, efficiency, and longevity; and the ability to contribute to other missions or applications. These criteria are the foundation for prioritizing ocean research infrastructure investments by estimating the economic costs and benefits of each potential infrastructure investment and funding those investments that collectively produce the largest expected net benefit over time. While this

increasing fundamental scientific understanding (10 questions). Many of the questions in the report (e.g., sea level rise, sustainable fisheries, the global water cycle) reflect challenging, multidisciplinary science issues that are clearly relevant today and are likely to take decades of effort to solve. As such, U.S. ocean research will require a growing suite of ocean infrastructure for a range of activities, such as high-quality, sustained time series observations or autonomous monitoring at a broad range of spatial and temporal scales. Consequently, a coordinated national plan for making future strategic investments becomes an imperative

—DEBORAH GLICKSON, Ocean Studies Board, National Research Council, Washington, D. C.; E-mail: dglickson@nas.edu; ERIC BARRON, Florida State University, Tallahassee; and RANA FINE, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Fla.

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 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.

Outline

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3. **The new role of ICTS SOCIB and Marine Research Infrastructures for PPP**

The role of new research infrastructures, ICTS

→ Need 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 (social society endorsement)

ICTS are particularly well placed for this challenge… PPP

AND → Need to define a **JOINT STRATEGY** (European/ national level in the international framework, more than coordination, Partnership…)

The role of new research infrastructures, ICTS

ICTS SOCIB design is well suited to respond to theses 3 basic elements that lead to disruptive innovation.

- SCIENCE
- TECHNOLOGY
- SOCIETY

Ideal position for public / private cooperation

Moltes gràcies!!!