Ocean_BIT: BALEARIC ISLANDS COASTAL OBSERVING AND FORECASTING SYSTEM

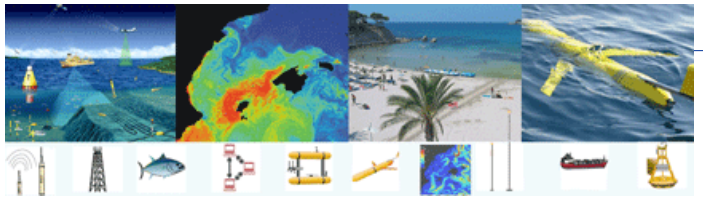
A scientific and technological coastal ocean facility, open to international, peer reviewed access

"New approaches to address science and technology based operational oceanography and global change challenges in the coastal ocean"

Joaquín Tintoré (jtintore@uib.es)

IMEDEA (CSIC-UIB)

and Ocean_BIT



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

Ocean_BIT : Balearic Islands Coastal Observing and Forecasting System

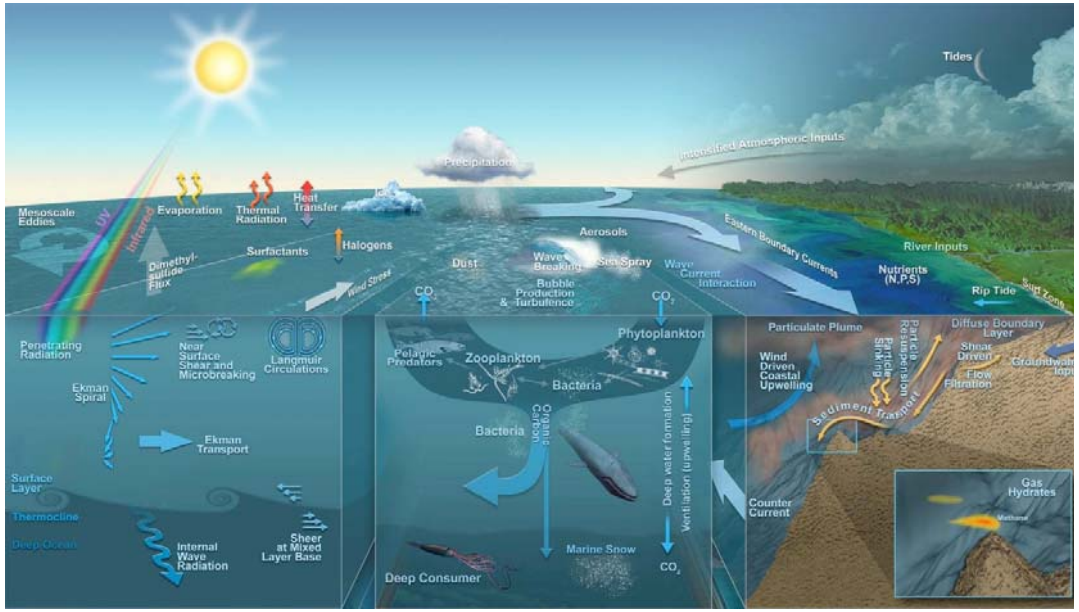
A New Approach to Marine and Coastal Research

New technologies, Three-dimensional observations in quasi real time, Forecasting numerical models and Data assimilation for …

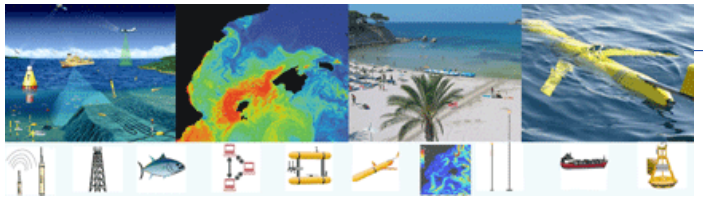
A quantitative major jump, advancement of scientific knowledge and …

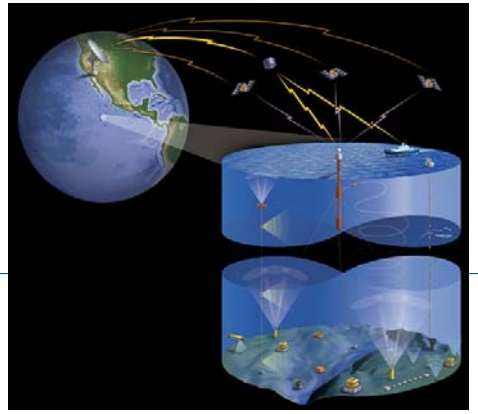
The development of a new form of Integrated Coastal Zone Management, based on recent scientific and technological achievements,

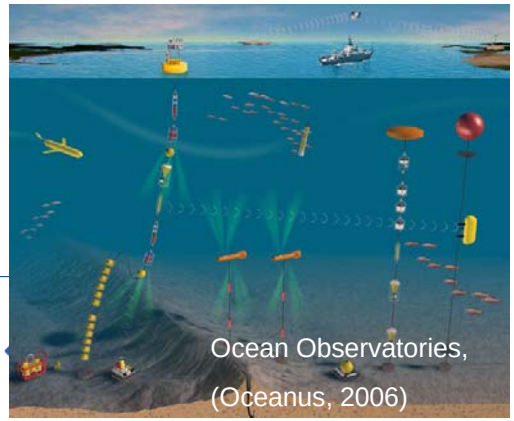
on a global change context (where climate change is one of the most important, but not the only one…), and following sustainability principles



OOI, Regional Scale Nodes (Delaney, 2008)





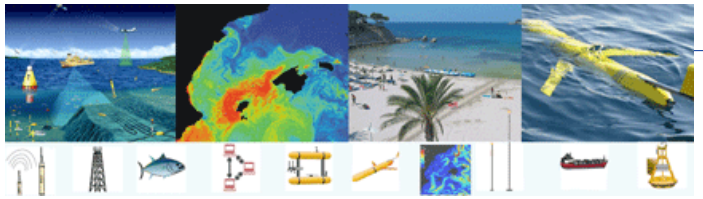


Ocean Observatories, (Oceanus, 2006)

Vision: what is Ocean_BIT?

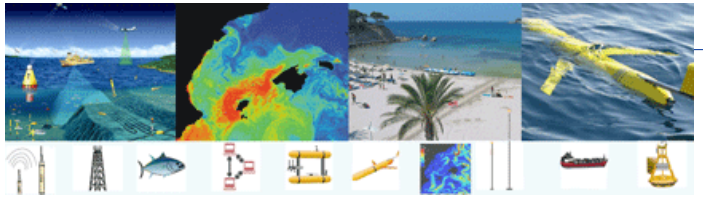
- Ocean_BIT is a **multi-platform distributed and integrated technological** facility (a facility of facilities…, in ICTS Spanish Ministry frame)
  - providing streams of oceanographic data and modelling services in support to operational oceanography R&D activities in the Balearic Islands in a European and international frame,
  - 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 to cover the needs of a wide range of scientific research priorities.



Ocean_BIT, a new way to fund research

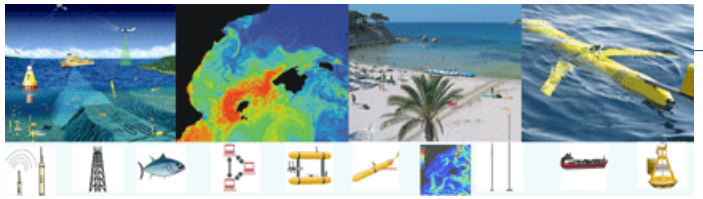
- Ocean_BIT is a new way to approach marine and coastal research through new distributed networks of monitoring platforms, providing baseline data, open to international access… and also, specifically through peer reviewed applications ….
- Ocean_BIT therefore represents a very significant change in marine and coastal observing in the Balearic Islands (and also at European level), moving to an oriented, strategic regional approach with a view to establishing a sustained marine and coastal system.
- It is a pilot initiative at regional level that can later be extended at national and/or European level. This is specially interesting in view of new Spanish ICTS being approved (PLATCAN, Murcia, Asturias and likely Galicia) and also in line with MarineERA actions (such as Workshop France, February 2009), or specific French projects and actions (HYMEX, MOOSE), Greec.



Ocean_BIT Principles

New approaches to address science and technology based operational oceanography and global change challenges in the coastal ocean

- Science, technology and service to society driven: scientific and technological excellence through peer review processes
- Support for R&D marine and coastal research activities in Balearic Islands (both existing and new ones)
- Data streams: free, open, timely and quality controlled
- Adherence to community standards and certification for operational status
- Sustained: systematic, long term, different scales
- Integration: coordinated, multi-platform, multidisciplinary, comprehensive description of the coastal ocean including observations and modeling
- State-of-the-art technologies and models
- Partnership between institutions *("no vestir un santo desvistiendo otro/s…")*

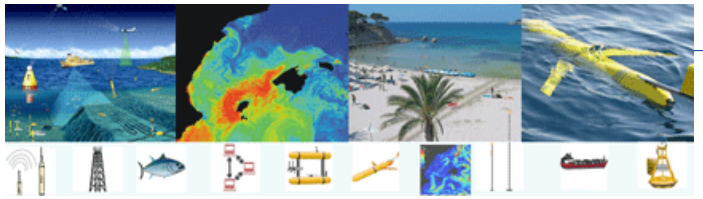


Historical Ocean_BIT background:

- More than 15 years of international research in: Process studies for Operational Oceanography and later in Coastal Observing and Forecasting Systems, in the frame of EU, CICYT and Balearic Islands Government funded projects.

- Specific actions undertaken as a result of Prestige Oil Spill (11/2002-2003), Prestige Operational Oceanography Advisory Council in December 2002, and Don Pedro oil spill in June 2007.

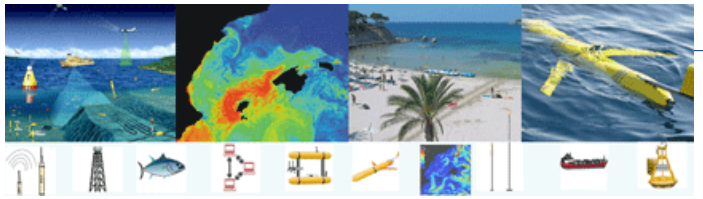
- Operational Oceanography and Marine Technologies Services and Facilities existing at TMOOS-IMEDEA (CSIC-UIB): http://imedea.uib-csic.es/tmoos/.



Historical Ocean_BIT background: 2005-2009

Specific SOCIB/Ocean_BIT actions:

- August 2005: first proposal formally submitted for a Technological Monitoring Platform in the Balearic Islands, to the Spanish Ministry of Education and Science.
- November 2005: UGIZC (CSIC-Govern Balear) first year report, specific consideration of the need of a Technological Monitoring Platform in the Balearic Islands and first description of needs and components
- January-May 2006: initial discussions with MEC (DG and SG level) and Balearic Islands Government (DG, Councillor).
- June 2006: presentation at Balearic Islands Science Advisory Council
- January 2007: formal acceptance of a Technological Platform in the Balearic Islands by the III Presidents of Autonomous Regions of Spain Conference.
- September 2007, adopted by the Spanish Council of Ministers
- December 2007: First Ocean_BIT Board, 18th December 2007. (JT invited to present scientific rationale for Ocean_BIT)
- January 2008: International call for Director, Nature
- April 2008: publication at BOE 5 April, SGPT, MEC
- December 2008: Joaquín Tintoré appointed Director



Ocean_BIT: International Framework (1)

Europe

- MFS, MOON, MOOSE, Liverpool Bay Marine Lab, POSEIDON, CYCOFOS, among other facilities…
- Projects such as: ESEOO, MERSEA, ECOOP, SESAME, MyOCEAN, etc. (EU funded)
- ESFRI – Marine Infrastructures - http://cordis.europa.eu/esfri/publications-reports.htm
- EU Maritime Policy, GMES ESA-EU initiative, MarinERA, ICZM EU Recommendation, EU Water Directive, EU Floods Directive, etc…

EEUU

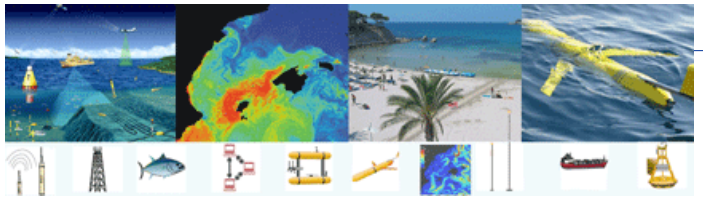
- OOI (NSF research) - http://www.joiscience.org/ocean_observing

  Collaborating to acquire research observing systems 10x what we have had. Requires making choices, consensus, priorities. Funding will go where the science interest is.
- IOOS (inter-agency operational). Coordination: http://www.ocean.us/

  Creating an operational observing system. Research supporting operations. Will support OOI and all basic ocean research. IOOS provides larger scale, long-term setting for OOI observatories. OOI provides process based research in a region leading to better IOOS observing schemes. OOI provides new technology and test bed for IOOS. Rutgers leadership in collaboration IMEDEA

Australia

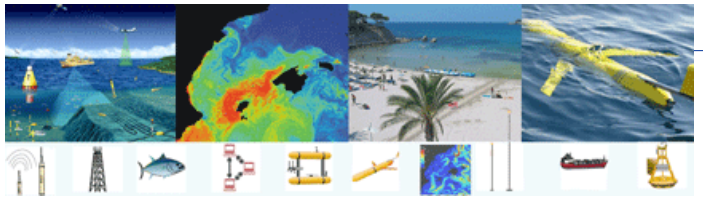
- IMOS: Integrated Marine Observing System - Marine Facilities Network , http://imos.org.au/ . Already ongoing implementation. Similar approach and strong similarities with Ocean_BIT.



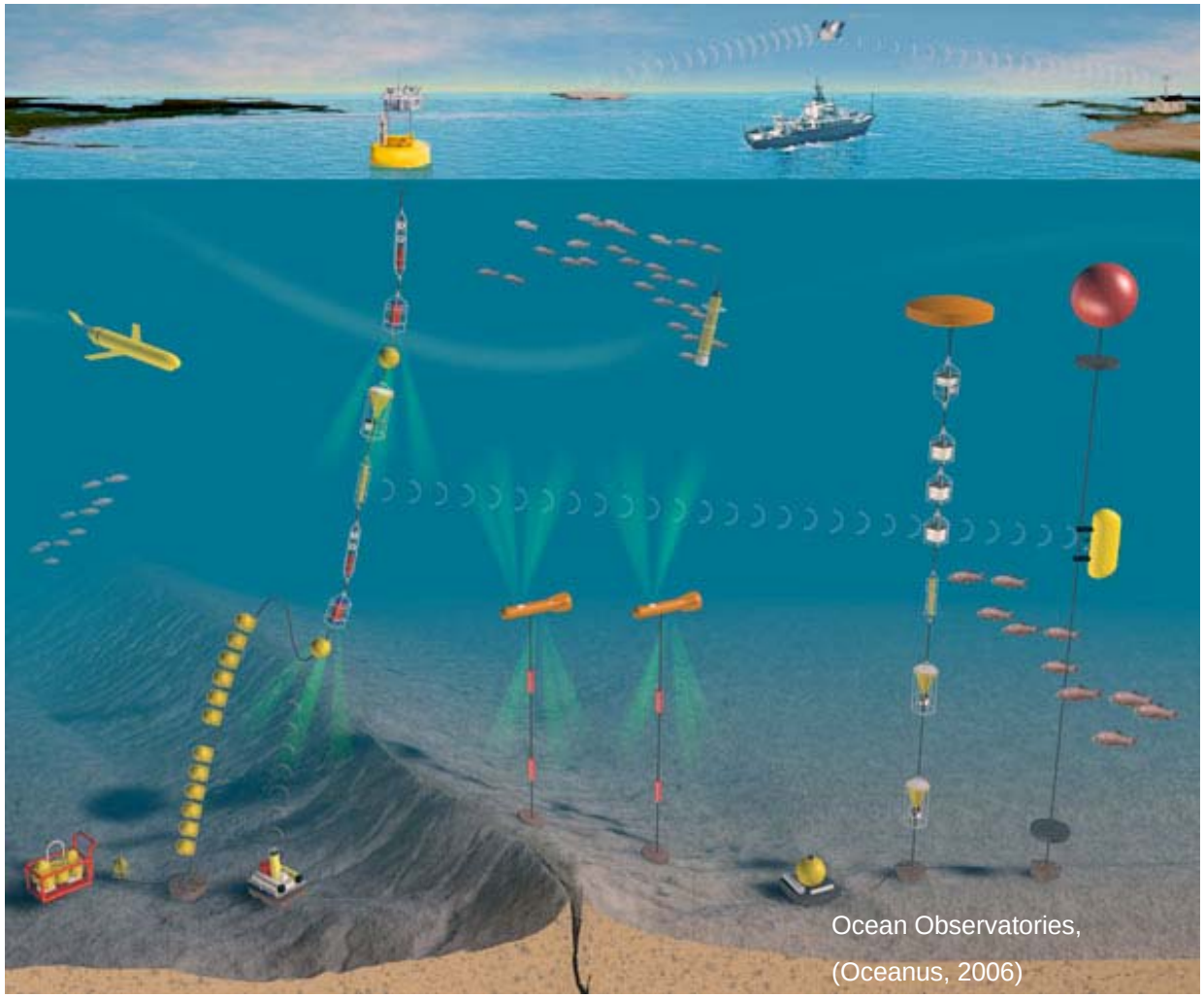
Ocean_BIT: International Framework (2)

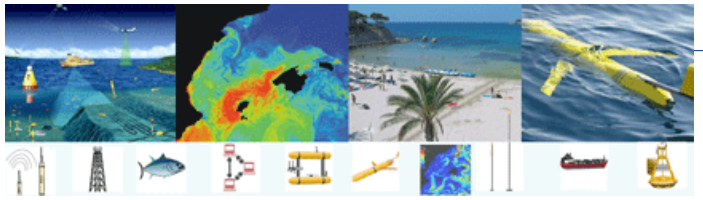
What is an Observatory: The USA perspective.

- Ocean observatories are platforms for studying the ocean and its fundamental processes in real time, while returning continuous streams of data and imagery back to shore-based researchers. They include suites of instruments and sensors, power supplies, computer command and storage capability, and Internet connections or other advanced communications systems.
- A few ocean observatories and observing systems are already in operation or under construction, while several larger ones are now being planned by universities and research institutions in conjunction with NSF's Ocean Observatories Initiative (OOI), the NOAA-led Integrated and sustained Ocean Observation System (IOOS), and other international programs.
- To truly comprehend the ocean's dynamic behavior and to monitor how it affects us back on shore, scientists WHOI, Scripps, and Oregon State University and their partners will be charged with building and maintaining the infrastructure for coastal and global systems for their American scientific colleagues.



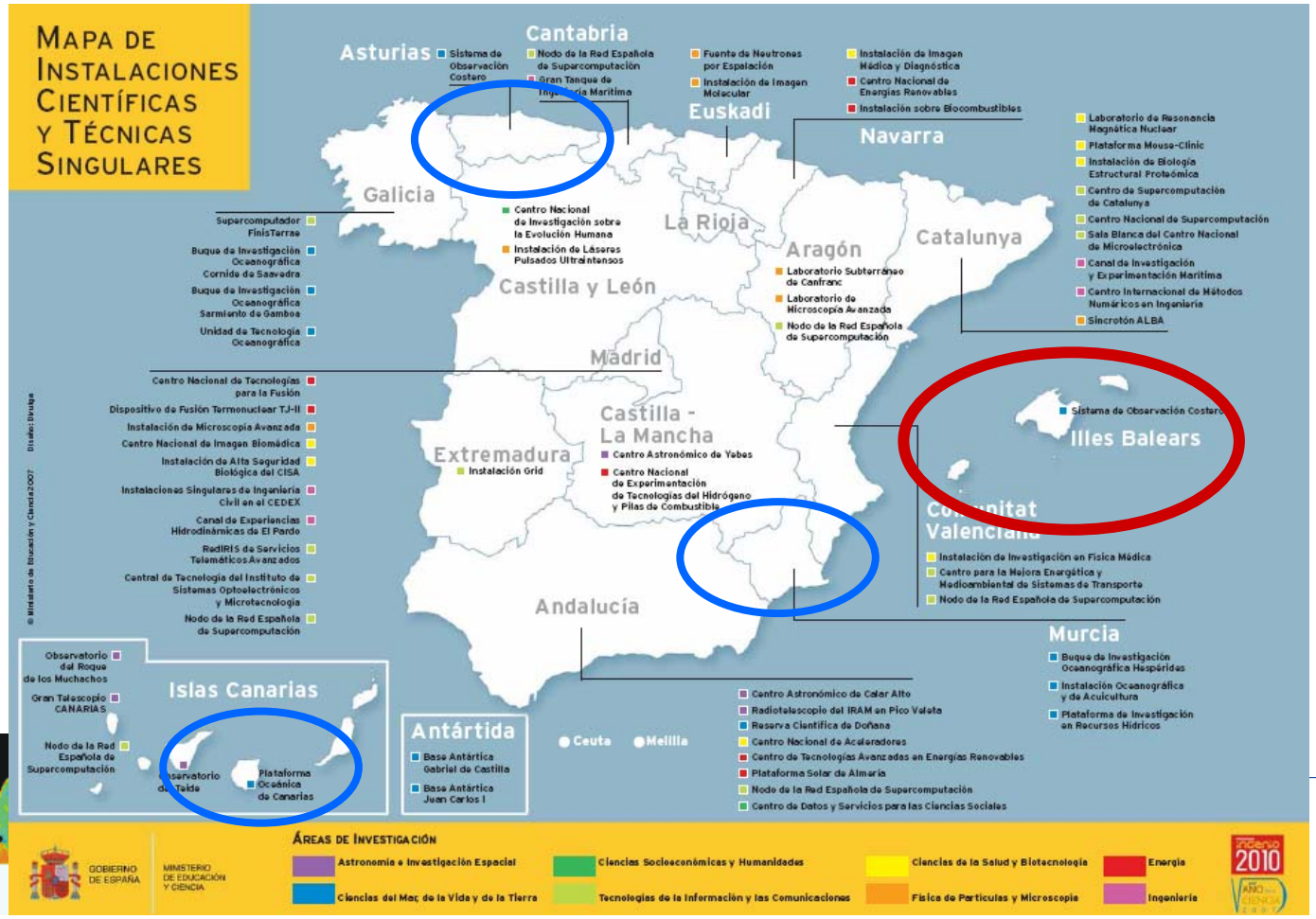
Ocean_BIT: International Framework (2)

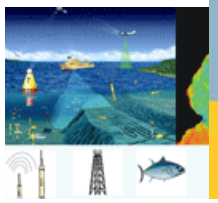




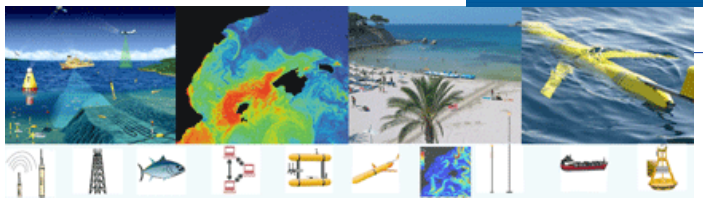
Spanish framework: ICTS MICINN

En la III Conferencia de Presidentes celebrada el pasado 11 de enero de 2007 se respaldó un Mapa nacional de Instalaciones Científicas y Técnicas Singulares (ICTS) que recoge junto con las ICTS existentes la creación de 24 nuevas ICTS cofinanciadas entre la Administración General del Estado y las Administraciones Autonómicas.





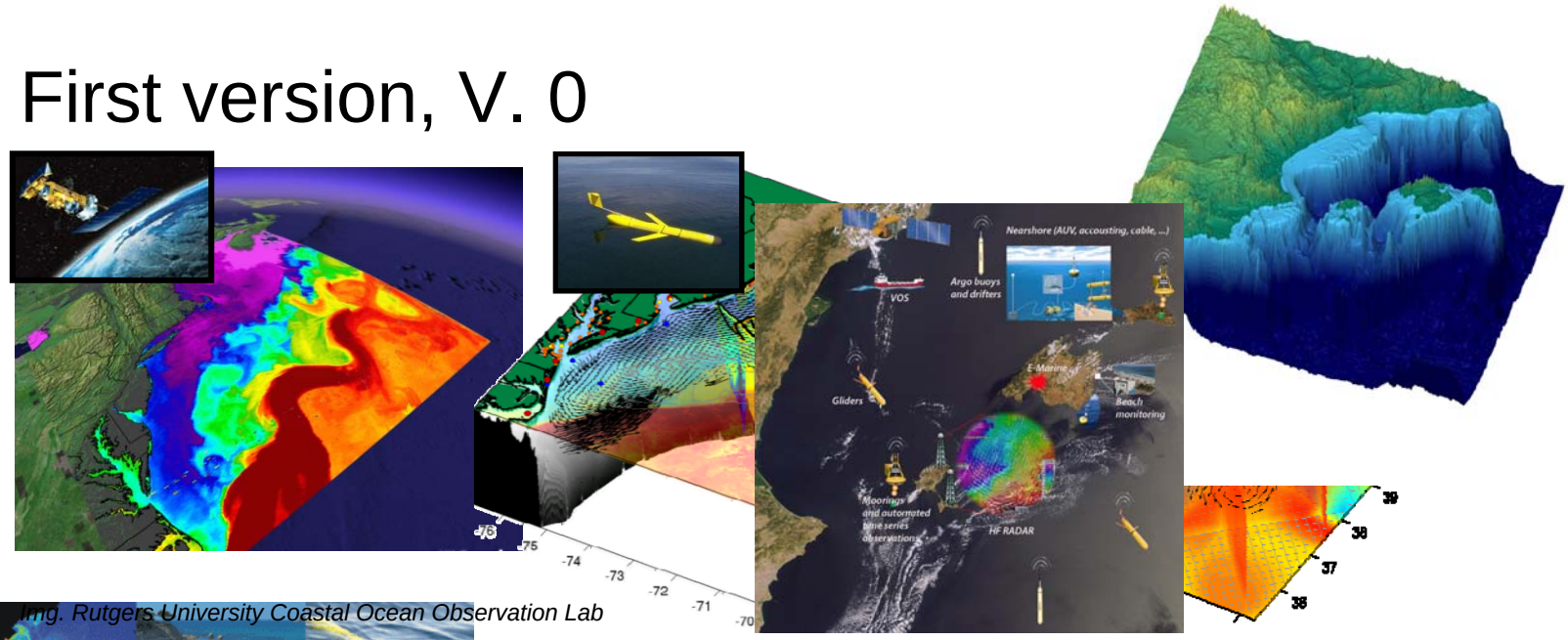
Balearic Islands framework: R&D Priorities



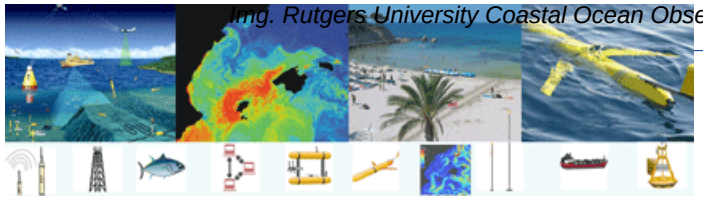
Govern de les Illes Balears
Conselleria d'Economia, Hisenda i Innovació
Direcció General de Recerca, Desenvolupament Tecnològic i Innovació

Ocean_BIT: oceanic scales, strategic Balearic Islands, Structure, Facilities, Nodes, Activities, Advisory Committee, Implementation Plan…

First version, V. 0



Img. Rutgers University Coastal Ocean Observation Lab



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

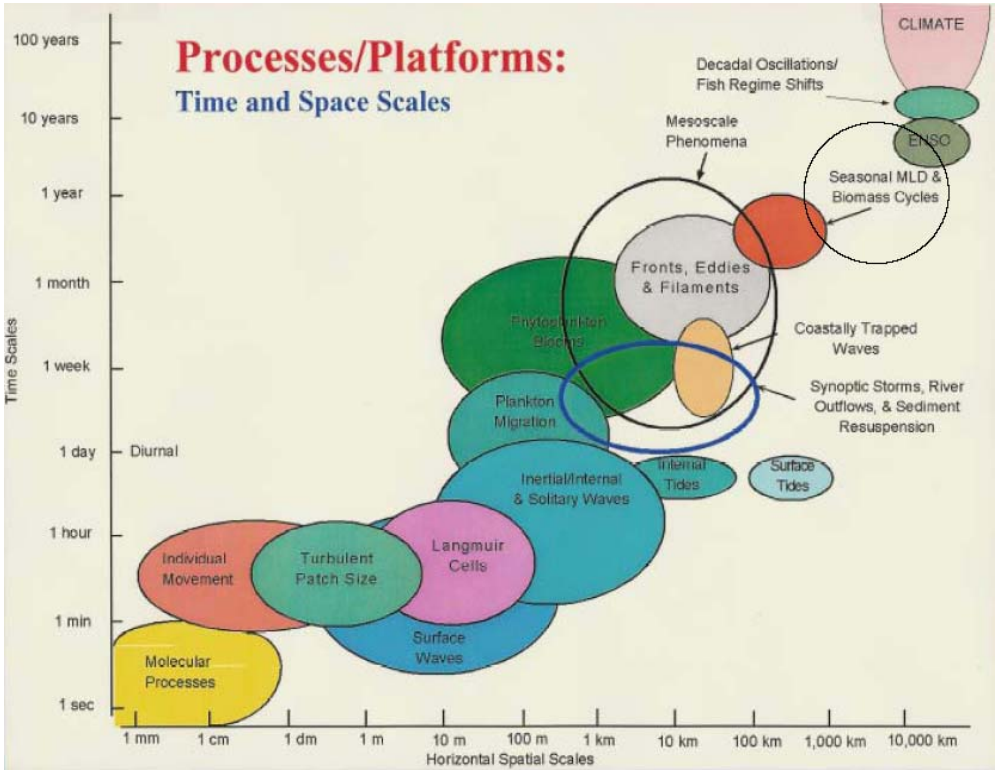
Ocean_BIT Science Focus

Ocean Variability process studies:

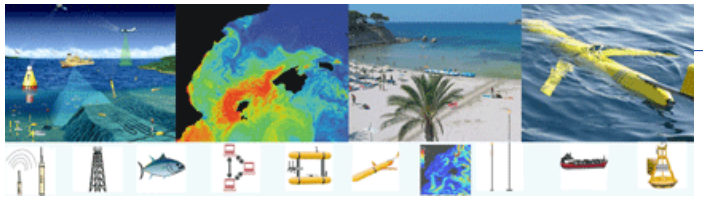
from nearshore scales to

mesoscale, sub-mesoscale, interactions and ecosystem response

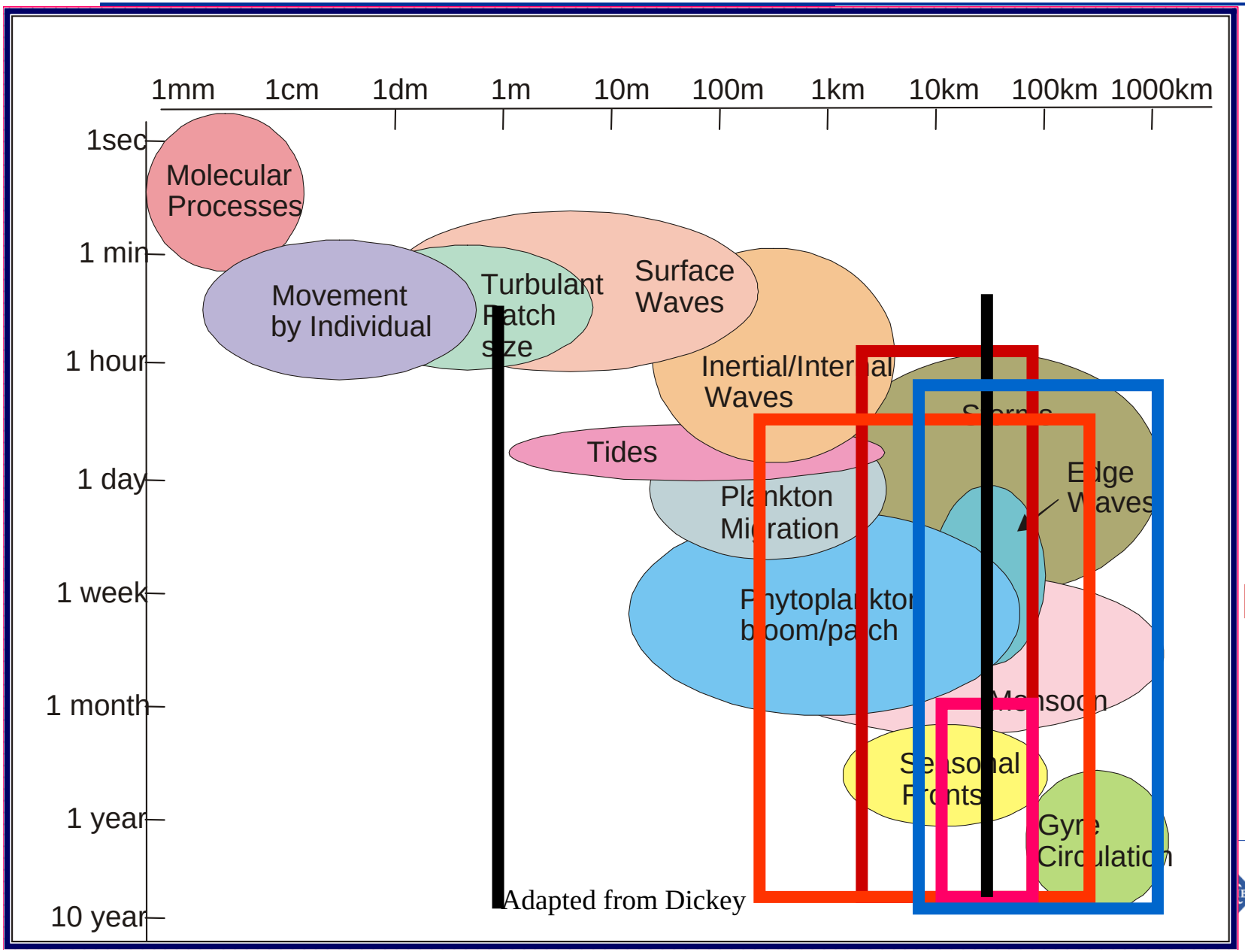
also addressing climate variability in Mediterranean



Theory and observations have shown that the energy of the ocean variability decrease as the scales as the scales of motion decrease with maximum energy at the mesoscale (include fronts and eddies, from ~10 - ~100km), Pedlosky, 1987.



Ocean_BIT Science Focus : monitoring at the right scale



Gliders

Time series

HF radar

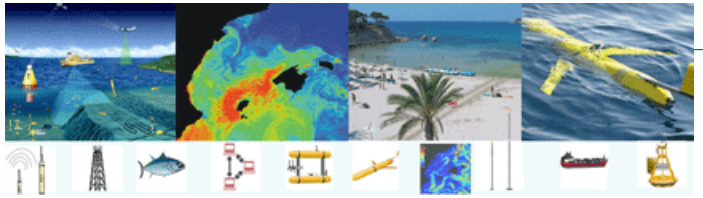
Ferry

Spatial survey

Ocean_BIT general objective:

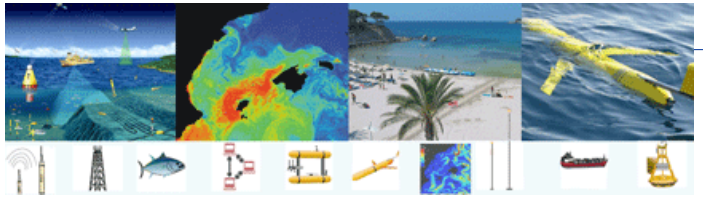
to develop an Observing and Forecasting System, a scientific and technological infrastructure which will be open to international access and collaboration (subject to peer review) to:

- Respond to the major scientific and technological challenges of the next decade as well as to the strategic needs of society related to new observing and forecasting operational oceanography capabilities in the coastal ocean in the context of global change.
- Consolidate, support and enhance excellence in research and technological development in operational oceanography in the Balearic Islands.
- Consolidate the position of the Balearic Islands as an internationally recognised centre of excellence for marine and coastal research for addressing sustainability challenges and progressing towards science based Integrated Coastal Zone Management.



Ocean_BIT specific objectives

1. Scientific objectives
2. Technological objectives
3. Strategic objectives (in response to society needs)
4. Outreach and Education
5. Training of scientist, students, engineers and technicians

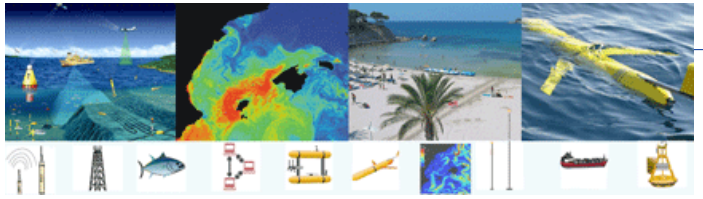


Ocean_BIT general scientific objective

in the international frame of Operational Oceanography in the Coastal Zone in a global change context,

- to advance in the understanding of the physical processes, multidisciplinary coupling and non linear interactions,
- to detect and quantify changes in the coastal systems and ecosystems, understand the underlying mechanisms and forcing responsible for theses changes and to forecast their evolution under different scenarios.

This infrastructure will also specifically address **society needs** and will therefore provide services at different levels and for different types of final en users. It will therefore provide a continuous multidisciplinary and integrated **monitoring** of the coastal variability in particular focussed in changes related to climate change as well as promote the development of **new tools and technologies for decision support and risk assessment**.



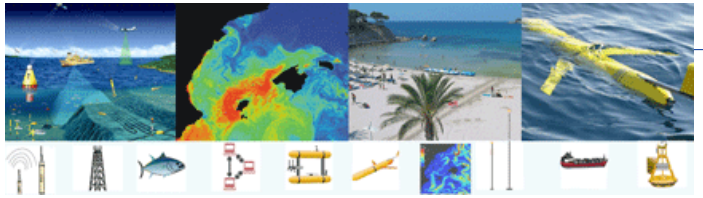
Ocean_BIT Scientific Objectives

3 major areas have been identified in line with international priorities for the next decade and taking into account environmental needs and technical capacity of the Balearic Islands:

1) Near-shore hydrodynamics and morpho-dynamics. Wave-current interactions and sediment transport.

2) Oceanography in the coastal, shelf and open seas. Marine resources variability and sustainability.

3) Climate impact and climate variability effects in the Mediterranean Sea. Regional variability and ecosystems variability in a global change context



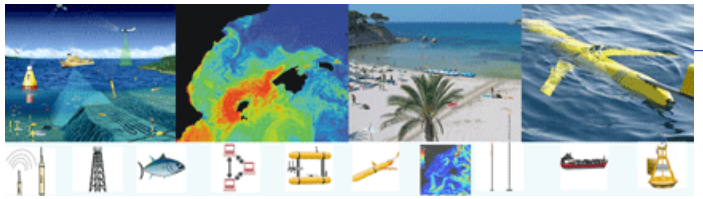
Ocean_BIT Components

Ocean_BIT is constituted by a sustained, spatially distributed, heterogeneous, potentially relocatable and dynamically **adaptive observing network**

- that will be integrated through data management and numerical methodologies
- to exploit the synergies between both the observational network *per se* and between the observational network and the numerical models and assimilation tools,
- with the aim to provide a complete and integrated description of the physical and biogeochemical properties of the marine environment.

In other words, there will be **static facilities** that will be mostly **sustained** in permanent locations (in response to operational and scientific needs) but also, …

dynamic facilities that will be **relocatable** in space and time, with adaptative capability to respond to specific scientific requests that will have to be of high scientific excellence, state of the art and through a peer review process.



Ocean_BIT Components

1. **Observational sub-system**
   - in situ moored and drifting sensing systems
   - Coastal and offshore instrumented installations
   - Remote sensing from satellites
   - Shore-based remote sensing with radar
2. **Forecasting sub-system**
   - Ocean currents and wave at different scales
   - Ecosystem variability
   - Data assimilation and analysis at overlapping spatial and temporal scales
3. **Data management**
   - The latest in data server technology and internationally accepted protocols
   - Quality control and Web access in open source
   - Effective data archiving, delivery and communication
4. **Outreach and education**
   - Identify and assess needs and data preferences, obtain user feedback
   - Targeting undergraduate and graduate student/teacher audience as end-users
5. **Training and mobility**
   - Research fellowships Ocean_BIT Program
   - Support for Ocean_BIT related activities
   - Mobility Program

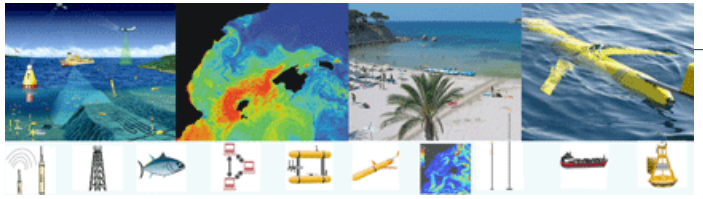
OCEAN_BIT STRUCTURE (Preliminary)

- **Facilities** (observing systems and data management): The facilities make the observations specified by the nodes.

- **Nodes** (to address scientific and technologically driven objectives)

- **Horizontal Units** (to address strategic society driven objectives - in response to society needs-)

- **General Services** (Administration, Computing, Oceanographic equipment, etc.)

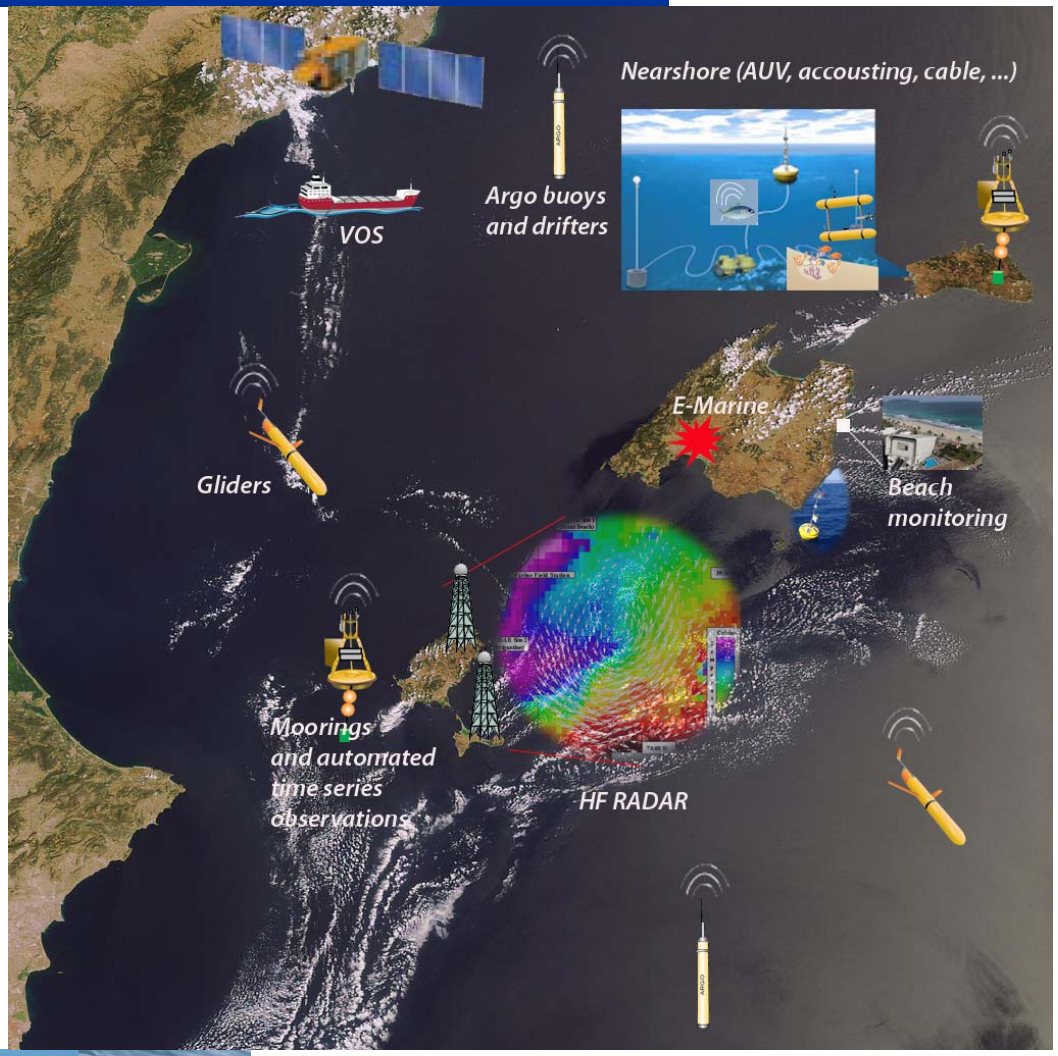


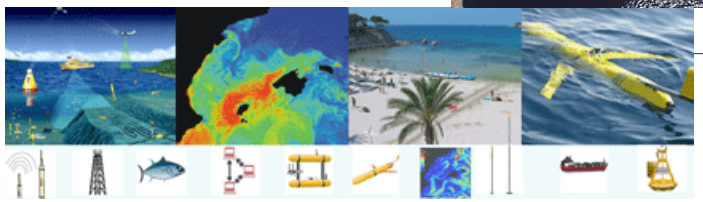
Major Ocean_BIT Facilities (observing systems and data management).

Facilities make the observations specified by the nodes, new from Ocean_BIT and also in kind from Institutions. Importance of Partnership

1. R/V Coastal Ocean Ship facility
2. Anchored Buoys facility
3. Ships of Opportunity facility / VOS
4. Gliders and profilers facility
5. AUV's facility
6. ARGO floats and Surface Drifters (SVP) facility
7. Radar
8. Satellite facility
9. Marine animals tracking facility
10. Nearshore coastal variability and ecosystem field facility (including acoustic tagging, quantification of MPA effects, Connectivity)
11. Nearshore beach monitoring system
12. E_marine: data Management facility (including visualization and communications, QC, etc)

Ocean_BIT Facilities

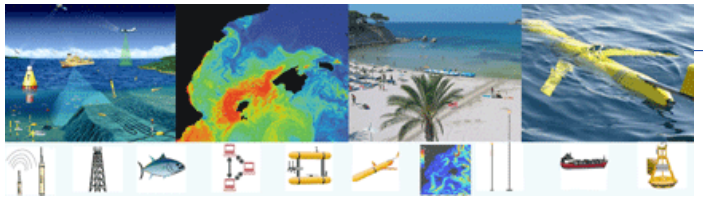




Govern
de les Illes Balears
Conselleria d'Economia,
Hisenda i Innovació
Direcció General de Recerca,
Desenvolupament Tecnològic i Innovació

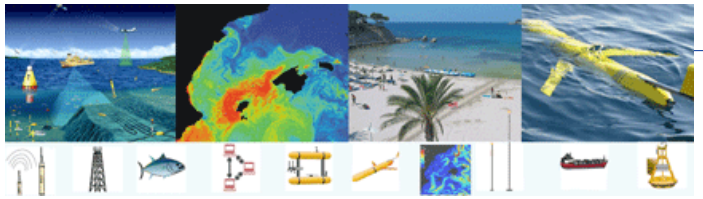
Ocean_BIT Description of Facilities

- **Argo** fleet. Profiling floats observing ocean physics to 2000 m and **Drifters**, measuring surface currents and properties such as temperature and salinity.
- Measurements on **Ships of Opportunity** – a set of underway observing systems for physical, chemical and biological oceanography on volunteer observing ships (merchant, fishing fleet, etc).
- **Gliders** fleet. A multisensor system similar to a Argo float, which can traverse as well as profile, and is operated from a land base.
- **Coastal Ocean Radar Network** for high resolution mapping of coastal currents and waves.
- **Mooring Network** – a network of reference stations, plus moorings on shelves and slopes.
- **AUV facility**: a set of AUV for autonomous monitoring of the coastal, benthic and nearshore environment.
- **Nearshore** coastal variability and ecosystem field **facility** (including acoustic tagging, quantification of MPA effects and AUV fleet). High resolution data and surveys of benthic habitats.
- Nearshore **beach monitoring system**. Automated collection, analysis and storage of high-resolution digital pictures, that are then used to observe and quantify a wide range of coastal phenomena.
- **Satellite: enhancing Access to Ocean Remote Sensing Data** – to make Satellite products to support research in coastal waters.
- **eMarine Information Infrastructure** – responsible for hosting, managing, distributing and archiving data.
- **Research Vessel**, to service moorings and to conduct spatial surveys (in-situ data).

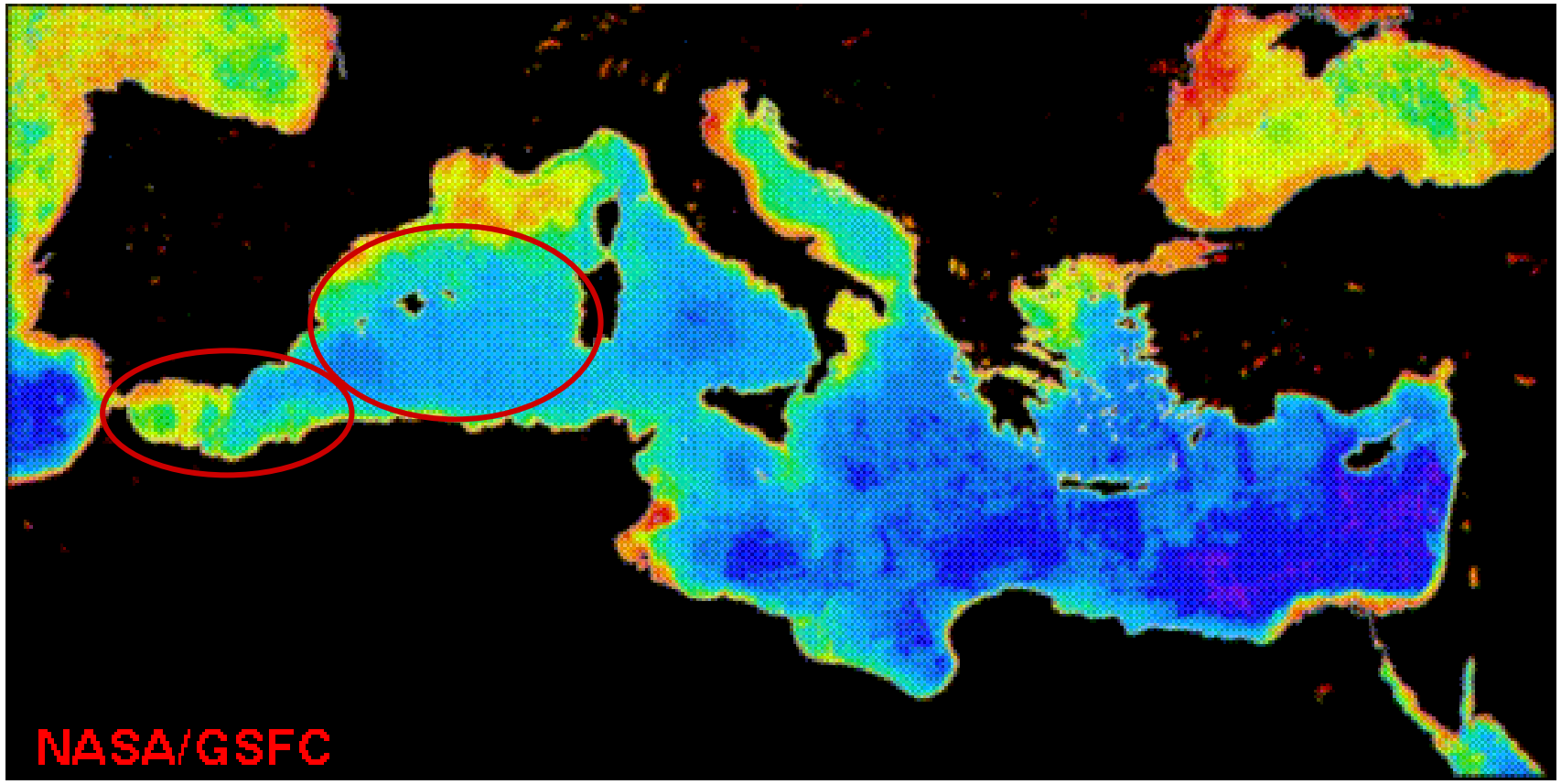


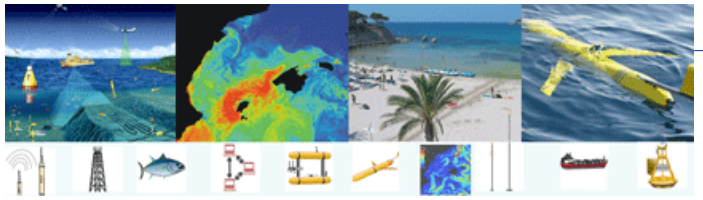
Ocean_BIT: Nodes

1. Nearshore coastal dynamics and ecosystem interactions
2. Coastal ocean and shelf variability including shelf/slope interactions, marine ecosystem and resources variability and sustainability.
3. Regional nodes: Balearic Islands Channels and interacting sub-basins (Alboran and South Balearic/Algeria)
4. Blue water variability and interactions, climatic effects in the Mediterranean Sea. Regional variability and ecosystems variability in a global change context.
5. Technology development and new tools implementation



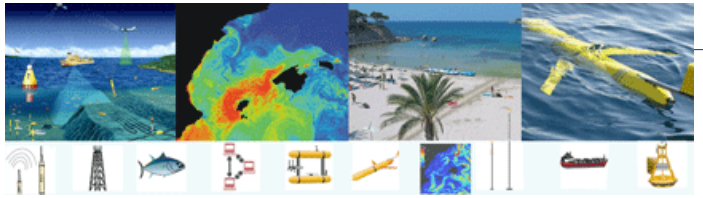
Ocean_BIT: sub-basins of direct interest





In summary….

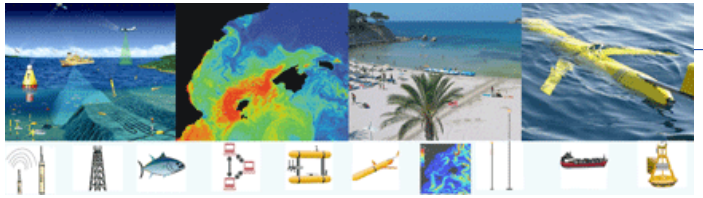
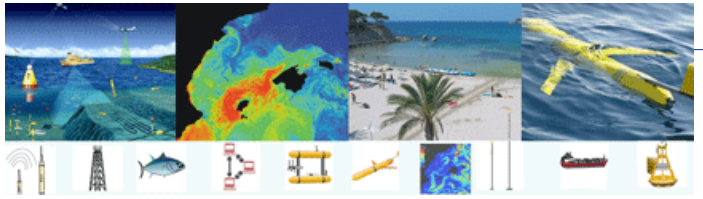
- Ocean_BIT will be the main facility supporting the R&D activity in Operational oceanography in Balearic Islands also contributing to contributing to the needs of marine and coastal research in a global change context.
- Ocean_BIT is an opportunity for a new type of research, monitoring activities, covering western Mediterranean.
- Ocean_BIT will be an open access facility for any other R&D institution with similar concepts and focus.
- Ocean_BIT has management, administration, budget and services autonomy and has own staff.
- Strong and active involvement and partnership with key Science and Technology institutions is essential.
- 2009 Activities foreseen Ocean_BIT (open process –in line with principles and mission-, discussion, collaboration and partnership, jtintore@uib.es):
  - Ocean_BIT Scientific Advisory Committee
  - Ocean_BIT Structure, functioning, partnerships, agreements, etc…
  - Implementation Plan (to start mostly from 2010, acquisitions, recruitments, etc…).



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

Ocean_BIT Outline

- Ocean_BIT Consortium: a new way to fund marine research infrastructures, along lines of international initiatives such as OOI, IOOS, IMOS, etc.
- Ocean_BIT: scientific excellence, science, technology and society needs driven.
- Partners and main actors: MICINN-ICTS & Balearic Islands Gov. and CSIC, IEO, UIB, etc. IMEDEA specific crucial role.
- Initial Proposal: 12/2007 and formal start: 12/2007, published officially BOE-5 April 2008 (SGPT-MEC)
- Ocean_BIT total investment 36 M€ (2008-2021). 13,5 M€ equipments. 2M€ running costs. Equal investments
- Ocean_BIT is/will be the main facility supporting the R&D activity in Operational oceanography in Balearic Islands.
- Ocean_BIT is the first and only existing Large Scale ICTS Facility in the Balearic Islands.
- Ocean_BIT will be an open access facility for any other R&D institution with similar concepts and focus.
- Ocean_BIT has management, administration, budget and services autonomy and has own staff.
- Strong and active involvement and partnership with key Science and Technology institutions is a must for success of this initiative.
- Director: Joaquín Tintoré, 12/2008 (Agreement CSIC-Ocean_BIT)
- Still many unknowns, but references exist at international and national level.
- To do 2009: implementation plan, including partnership with national and international key players



Thank You !