

Euro-Argo and Multi-Platform Observing Systems: Strategy for Future Marine Operational Systems in the SES

(some examples from SOCIB: the Balearic Islands-Spain-Ocean Observing System)

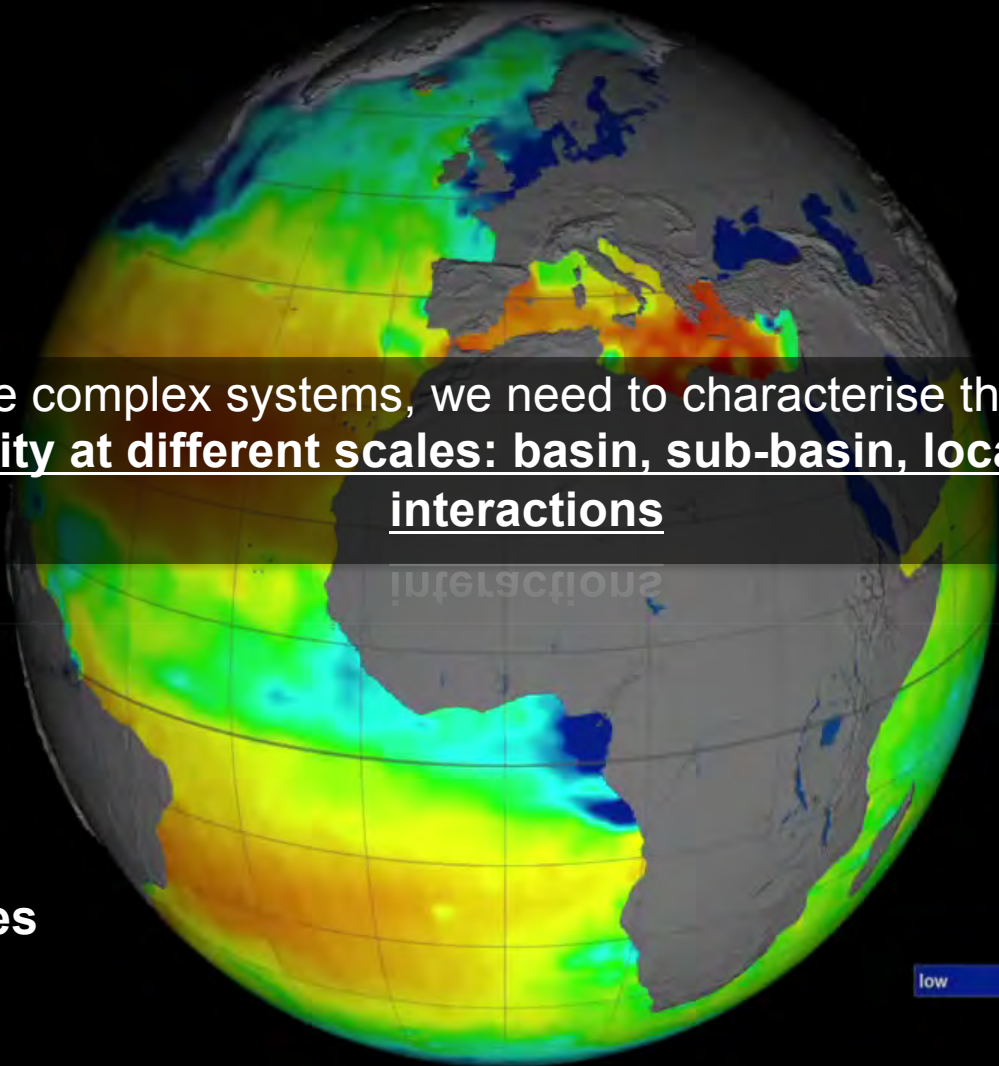
Joaquín Tintoré, SOCIB and IMEDEA (CSIC-UIB)

Pierre Poulain, OGS

OUTLINE

1. New Technologies: Paradigm Change Ocean and Coastal Observation. EU international leadership
2. Marine Research Infrastructures, Ocean Observatories: SOCIB, Integrated Science priorities, Technology Development and Society Needs
3. Innovation and Blue Growth: innovation in oceanography - gliders- (multi-disciplinary teams), data availability) and ...
“Turning Data into Jobs...”

Discussion: Are we ready for these changes ? Do we have the framework and right structures to get all the benefits from these changes ? (“to enforce what we think has to be done...”)



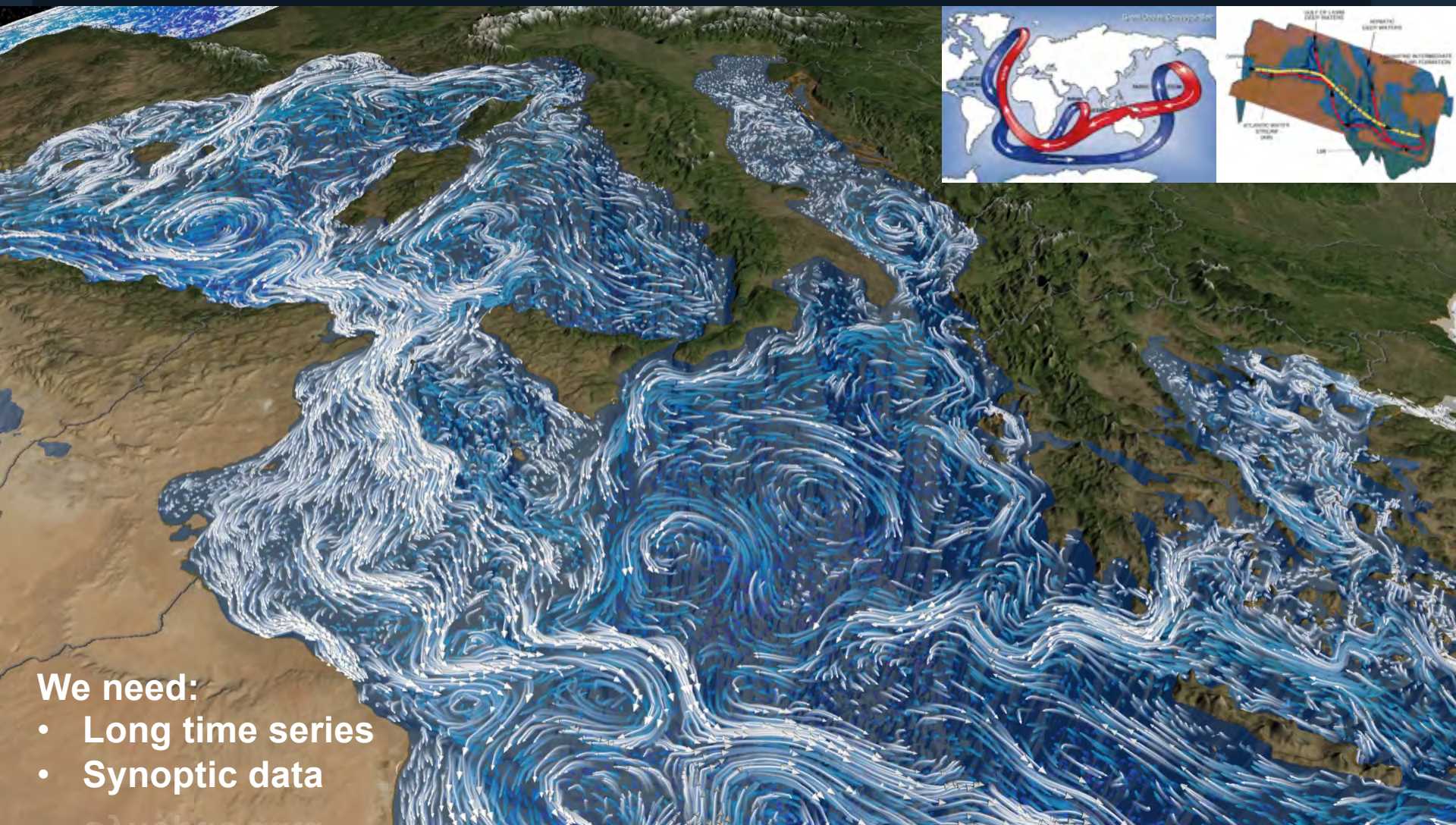
Oceans are complex systems, we need to characterise their State and Variability at different scales: basin, sub-basin, local, coastal interactions

We need:

- Long time series
- Synoptic data
- Synoptic data



NASA's Aquarius salinity, from December 2011 through December 2012



We need:

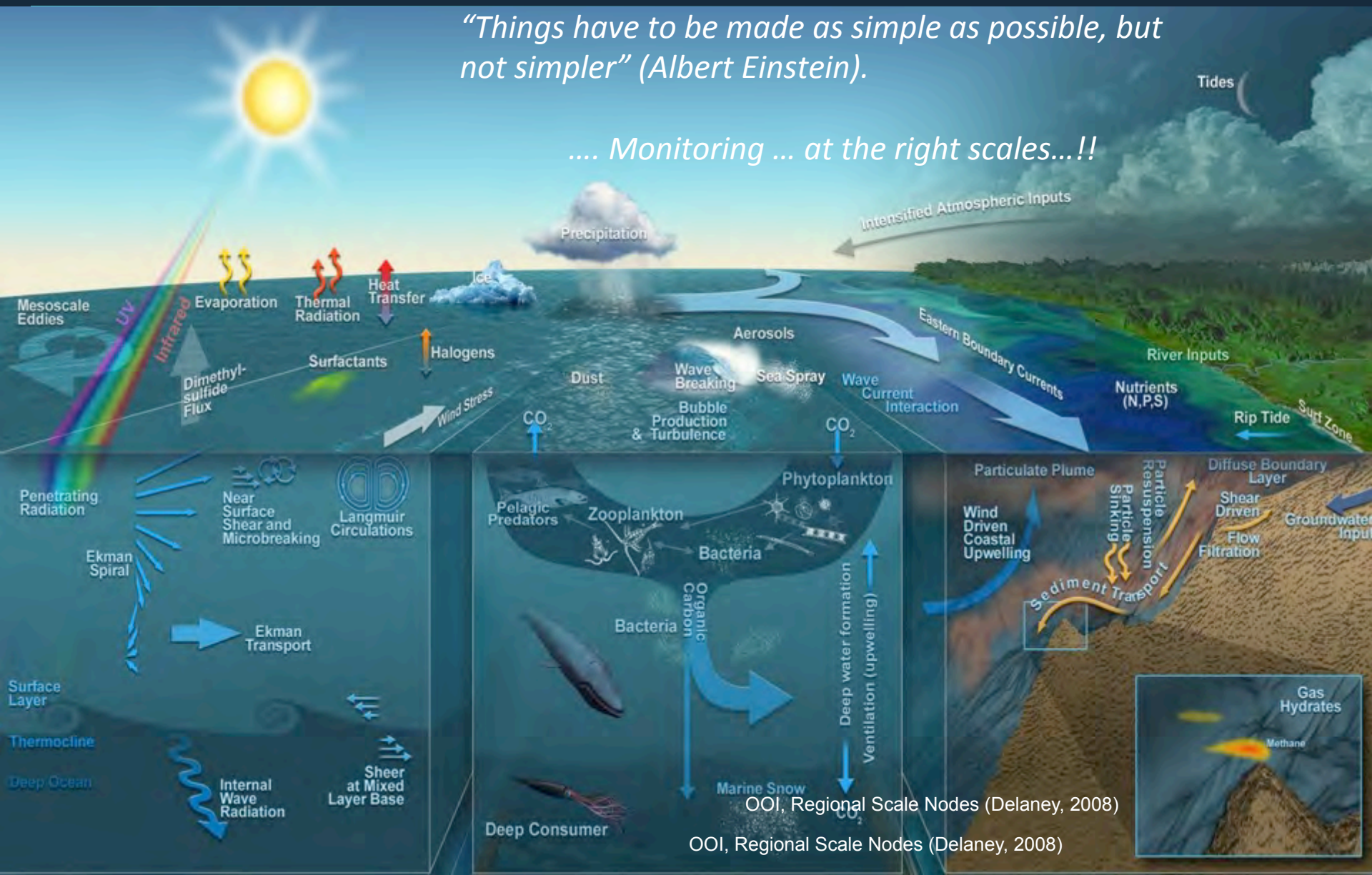
- Long time series
- Synoptic data

Mediterranean Sea: Small Scale Ocean, high relevance European Citizens (Science and Society)

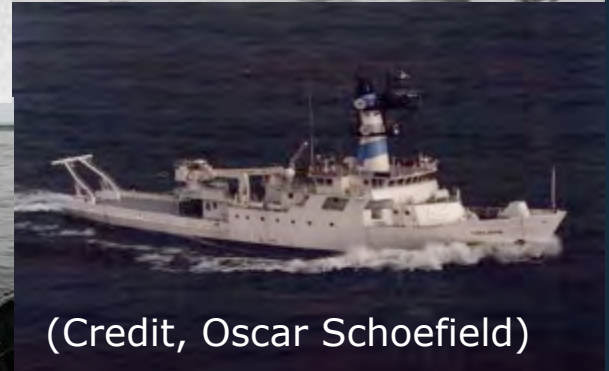
Oceans and coastal interactions are complex, central Earth system, Management is needed. No oversimplification

"Things have to be made as simple as possible, but not simpler" (Albert Einstein).

.... Monitoring ... at the right scales...!!



The oceans and the coasts are chronically under-sampled.
We need: long time series and synoptic data.



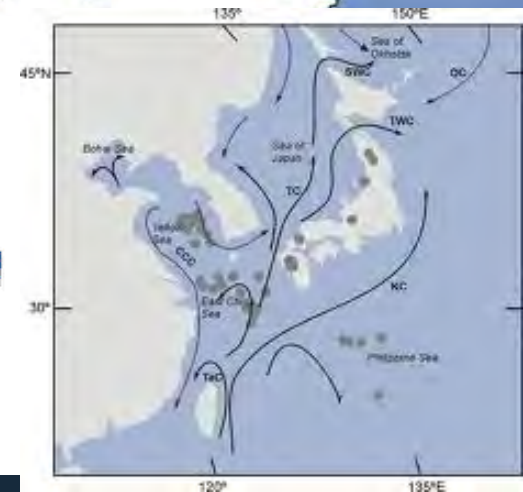
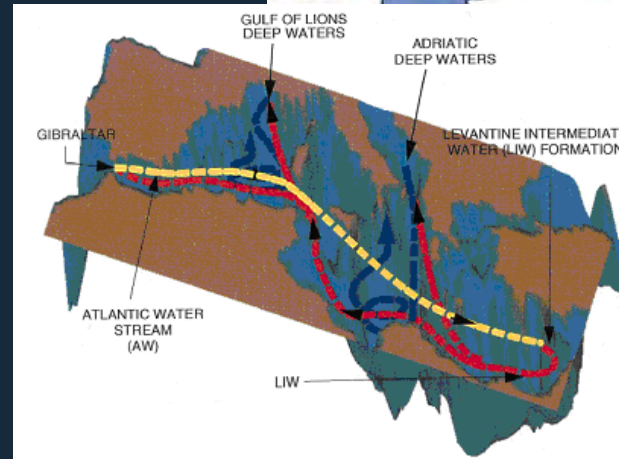
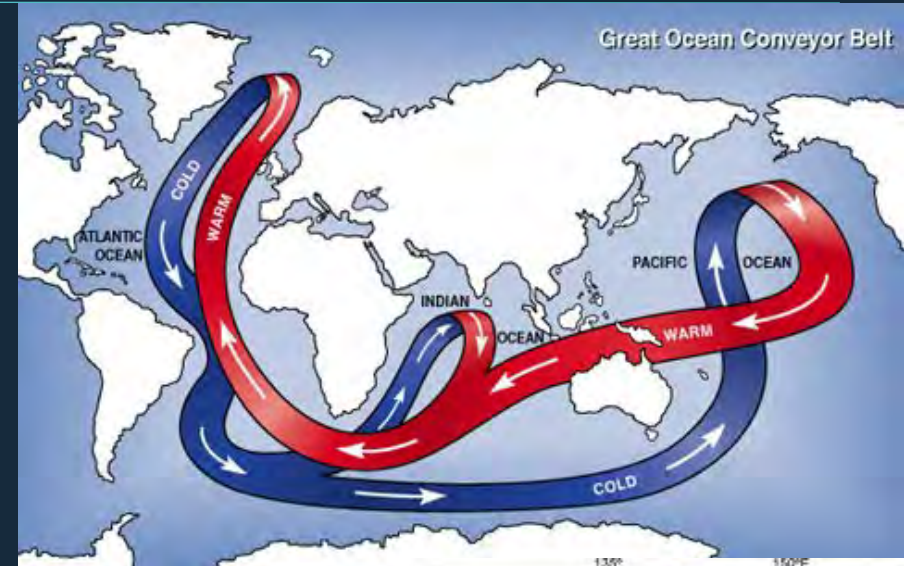
(Credit, Oscar Schoefield)

Scientific challenges: key hot topics, long term monitoring

HOT TOPICS:

- Eastern and Western boundary Currents,
- Straits exchanges, Coastal ocean variability, Shelf/slope exchanges,
- Meso and submesoscale eddies, mean flow – eddies interactions,
- Upper ocean exchanges extreme events,
- Ecosystem response,...

→ Importance of control points or sections... and also of... NOW...
Monitoring at the right scales!!!



“Long-term monitoring of ocean properties and circulation is the key to understanding climate change and to developing our ability to predict future changes”. (Bryden et al., 2012; Phil. Trans. R. Soc.)

Society driven challenges: key hot topics, long term monitoring

SCIENCE AND SOCIETY; Strong science for wise decisions.

- "Bridging the science-policy gap is arguably the biggest current challenge to achieving sustainability" (Lubchenco and Sutley, 2010, Science).
- "What we measure affects what we do. If we have the wrong measures, we will strive for the wrong things" (Joseph Stiglitz, 2010)



Changing Ocean Circulation

Changing currents: a strategy for understanding and predicting the changing ocean circulation

BY HARRY L. BRYDEN^{1,*}, CAROL ROBINSON² AND GWYN GRIFFITHS³

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Within the context of UK marine science, we project a strategy for ocean circulation research over the next 20 years. We recommend a focus on three types of research: (i) sustained observations of the varying and evolving ocean circulation, (ii) careful analysis and interpretation of the observed climate changes for comparison with climate model projections, and (iii) the design and execution of focused field experiments to understand ocean processes that are not resolved in coupled climate models so as to be able to embed these processes realistically in the models. Within UK-sustained observations,

Marine research in the past 20 years has focused on defining the **present day** ocean circulation. From these measurements of ocean circulation, we begin to understand how biogeochemical distributions are set and how the ocean and atmosphere interact to determine the present climate [4].

The key issue for the next 20 years is to understand **how the ocean circulation varies on inter-annual to decadal time scales**

And we need... “Careful analysis and interpretation of climate changes”

In April 2009, the array recorded a 30% drop in average current strength that persisted for a year, reducing the amount of heat transported to the North Atlantic

Oceans under surveillance

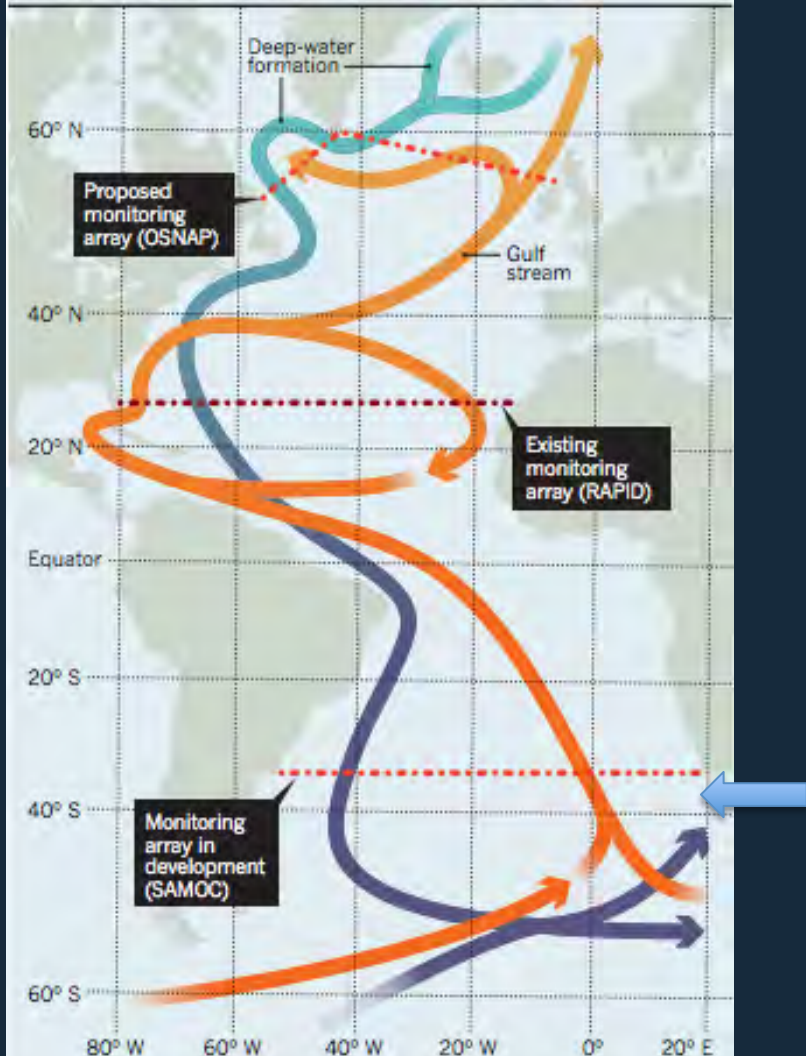
Three projects seek to track changes in Atlantic overturning circulation currents.

BY QUIRIN SCHIERMEIER

In April 2009, the array recorded a 30% drop in average current strength that persisted for a year, reducing the amount of heat transported to the North Atlantic

EBB AND FLOW

The ‘global conveyor belt’ transports warm Atlantic Ocean surface water (orange) to the poles and cool deep water (blue) to the tropics.



Our Goal: ... To characterize ocean&coastal state, variability & ecosystem response

- Walter Munk-2001- "*The last century of oceanography is marked by the degree of under-sampling*",
- Carl Wunsch 2010: "*We need data, ... models are becoming untestable*"

An Example: AMOC, Atlantic Meridional Overt. Circ. seasonal biases: "Aliasing of seasonal AMOC anomalies might have accounted for a large part of the inferred slowdown".

1 NOVEMBER 2010

KANZOW ET AL.

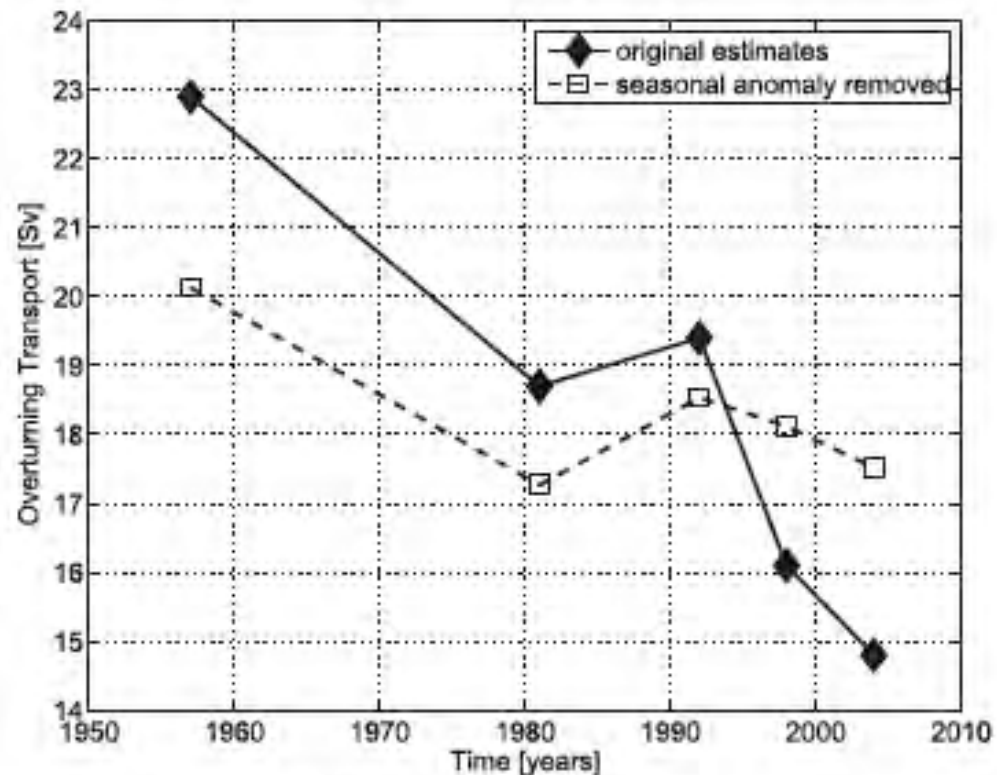


FIG. 16. The Ψ^{MAX} inferred from five hydrographic snapshot estimates between 1957 and 2004 (solid diamonds), as reproduced from Bryden et al. (2005b). The hydrography cruises were carried out in different seasons, namely, in October 1957, August–September 1982, July–August 1991, February 1998, and April 2004. The open squares represent the historical estimates of Ψ^{MAX} with seasonal anomalies of T_{UMO} (Fig. 10c; Table 2) subtracted.

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New Technologies: Paradigm Shift

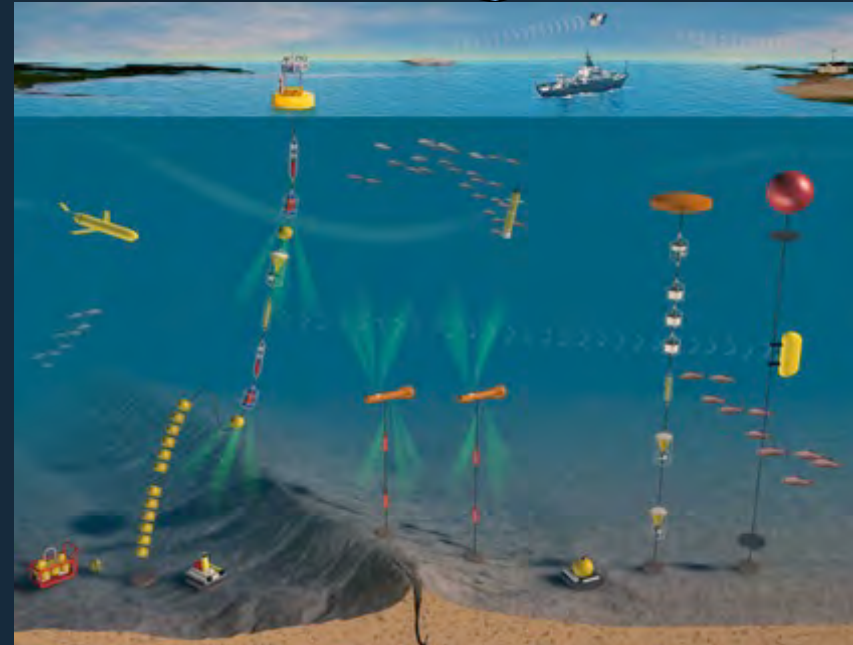
→ Ocean Observation

From: Single Platform - Ship based observation

To: Multi-platform observing systems

Network - distributed
Systems

Platform-centric
Systems



(Adapted from Steve Chien, JPL-NASA)

“A single ship can only be in one place at one time. We need to be present in multiple places in multiple times.” ([John Delaney, Nature, Sept. 25, 2013](#))

New Technologies: Paradigm Shift

→ Data Availability

From: Data only available 12-24 months/years after cruises....

To: Quasi-real time quality controlled data available

*A 2020 Vision for
Ocean Science*

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

Data available for science and society

- Huge increase in human potential for analysis, models/data inter-comparison
- Allowing new science and knowledge based management oceans and coast
- More reliable knowledge based response under emergencies

“Le véritable voyage de découverte ne consiste pas à chercher de nouveaux paysages, mais à avoir de nouveaux yeux” – “The real voyage of discovery consists not in seeking new landscapes, but in having new eyes”. (Marcel Proust)

NEW CHALLENGES: implies adaptation ... Scientists, Society...

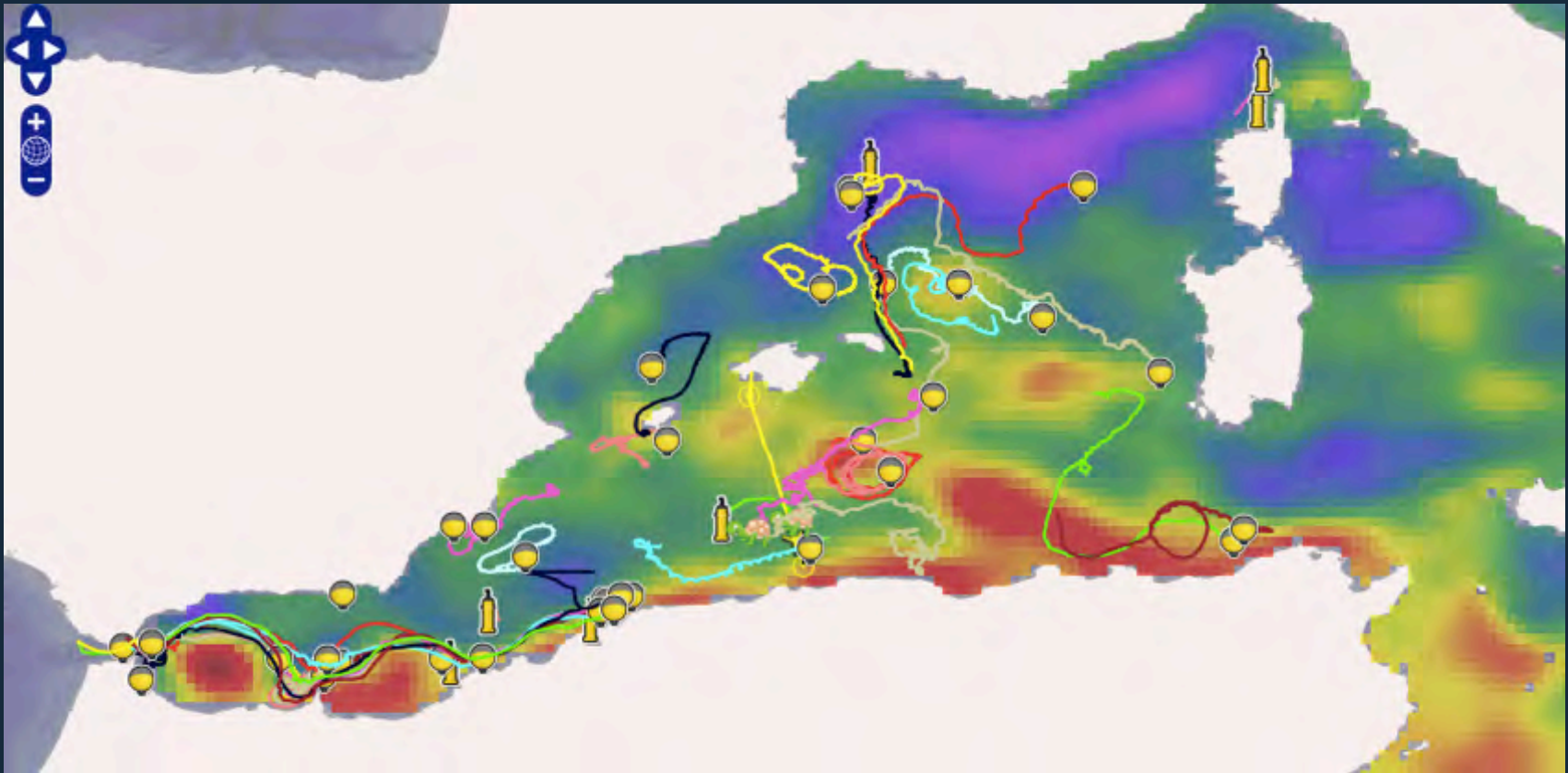
Key words:

- **Multi-disciplinary. Multi-platform. Free and Open Data. Integration.**
- Scientific career. Students. Science evaluation. Society response.

New Technologies: Paradigm Shift

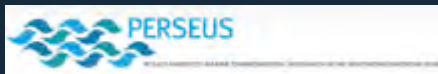
➡ Data Availability

Dapp SOCIB: Sept 24, 2014, 0800h, multi-platform real time data available: 40 surface drifters, 4 Argo profilers, 2 sea-turtles, 2 moorings, 7 tide gages, 1 glider, 3 real time beach monitoring systems)



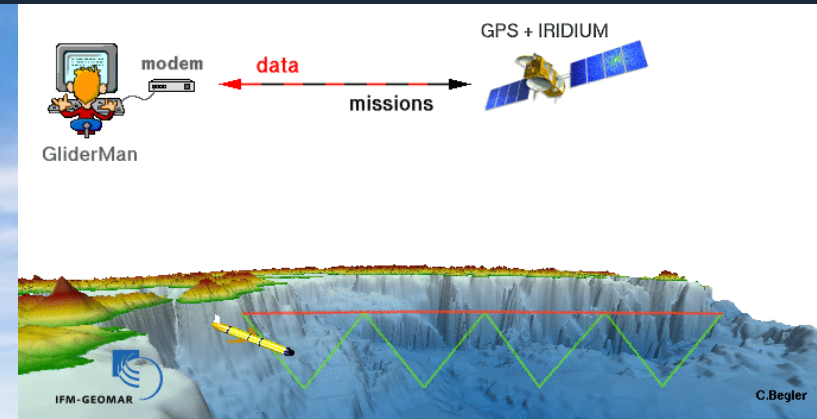
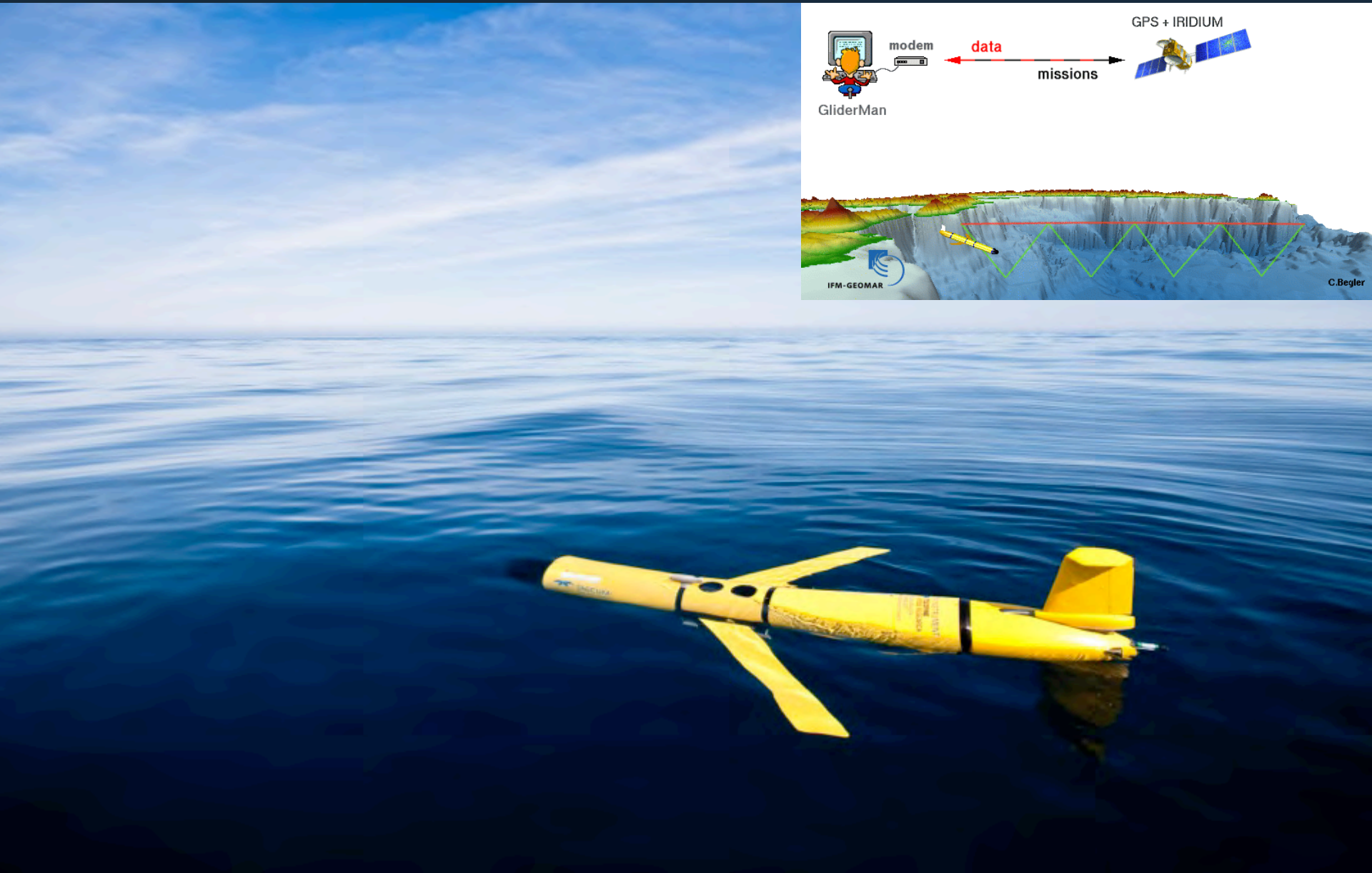
Alborán Gyres position and fisheries: Ruiz et al., 2013: Anchovy landings **SOCIB**

x 10



<http://apps.socib.es/dapp>

An Example of New Technologies: Autonomous Underwater Gliders



Why Ocean Observatories, why SOClB, why now?

New Technologies triggered a paradigm change New Approach to Marine and Coastal Research

Allow three-dimensional real time observations, that combined with forecasting numerical models, and data assimilation, ...

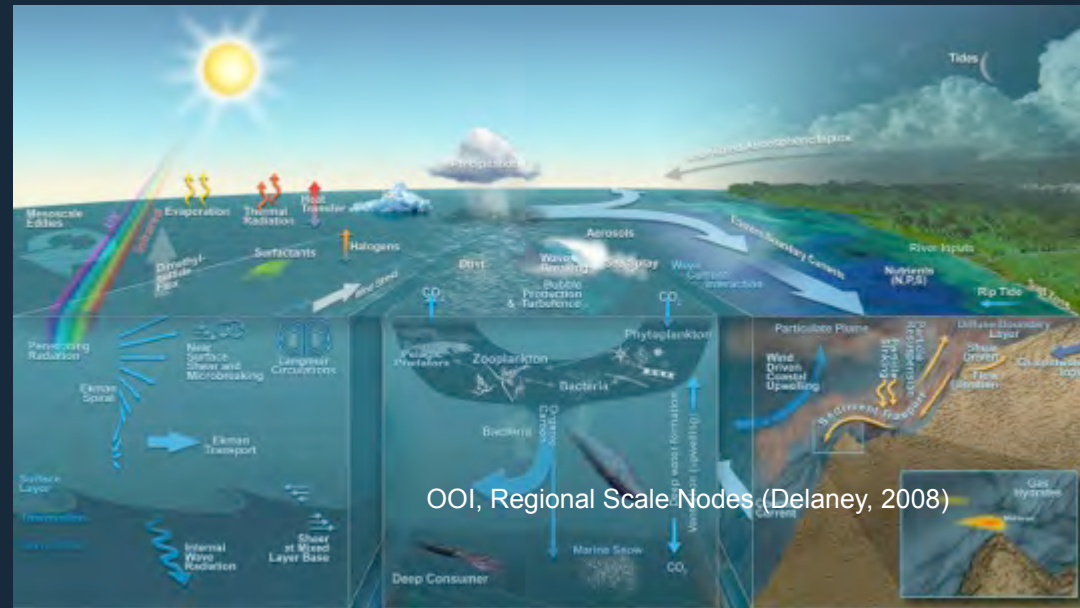


A quantitative major jump, in scientific knowledge and technology development



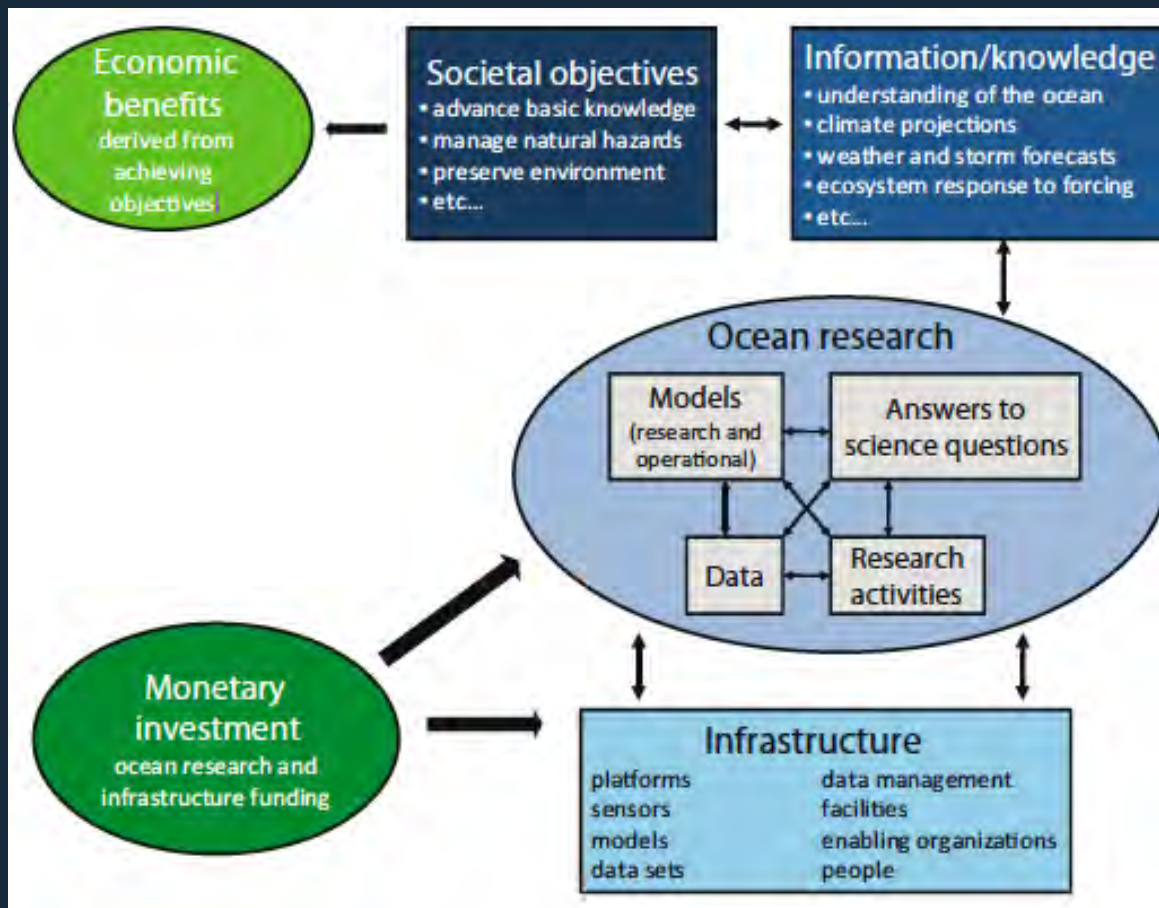
The development of a new form of Integrated Coastal and Ocean Management

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



Are we ready for these changes?
We need to open our minds, adapt
scientific and educational structures,
management procedures

Ocean Observatories, Marine Research Infrastructures: International Frame



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

MRI International Framework

Europe

- POSEIDON, Cosyna, MONGOOS, SOCIB, among others ...
- ESFRI –

EEUU

- OOI (NSF research)
- IOOS (inter-agency operational)

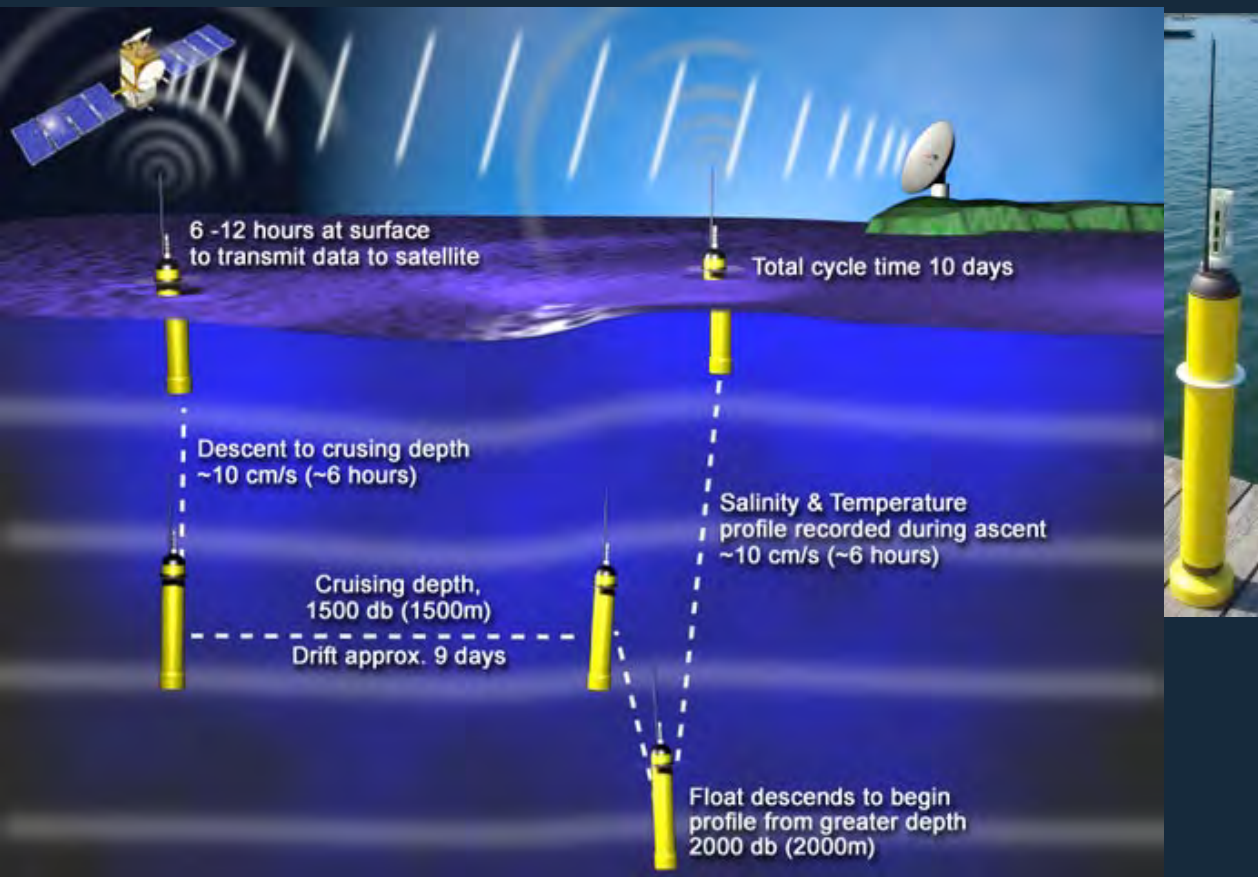
Canada

- NEPTUNE, VENUS,

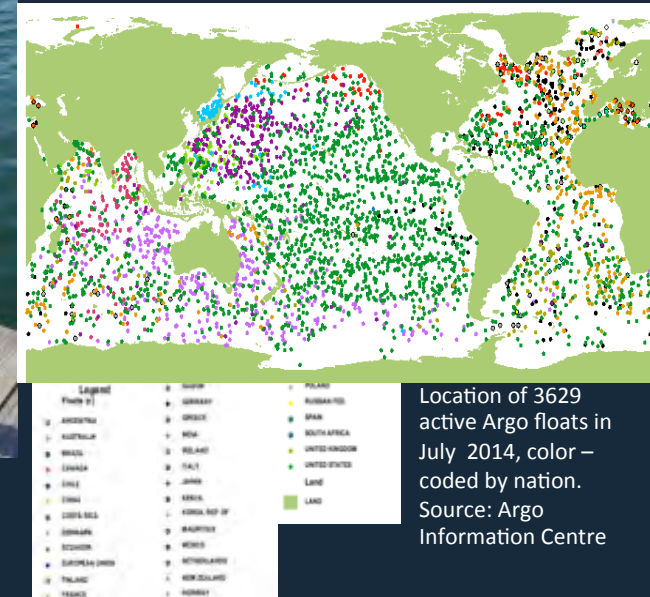
Australia

- IMOS: Integrated Marine Observing System

Why now?: Last decade, successful Argo international programme, Euro-Argo



Schematic diagram of a single Argo float cycle



<http://www.euro-argo.eu>

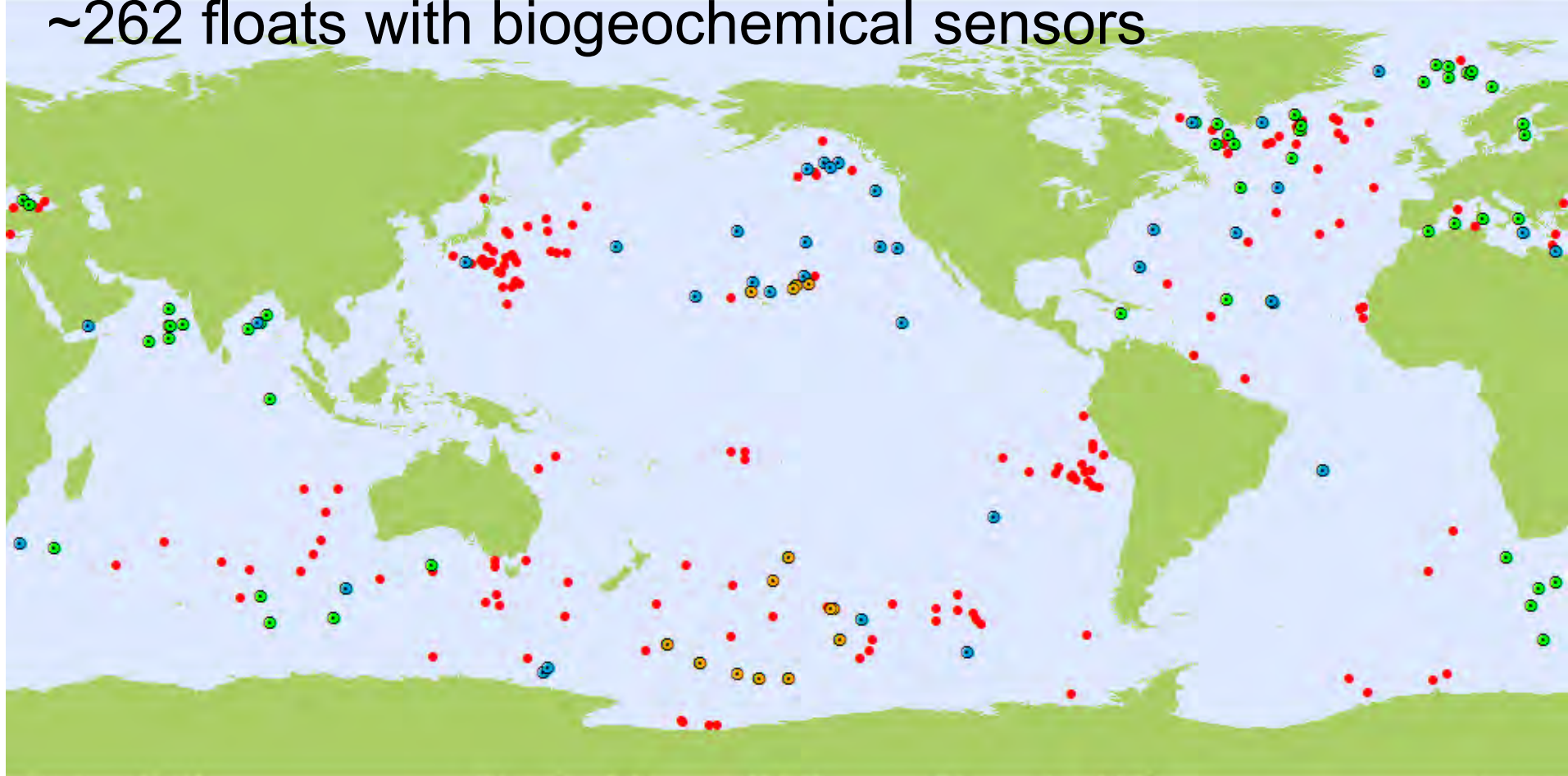
262 floats with biogeochemical sensors
638 European floats (18%)

Argo Programme -combined with satellite altimetry- allowed characterisation

STATE OF LARGE SCALE OCEAN CIRCULATION



The Argo global ocean observatory (> 3000 floats) ~262 floats with biogeochemical sensors



Bio-Argo (262)

- Dissolved Oxygen (248)
- Bio-optics (65)
- Nitrate (46)
- pH (14)

July 2014

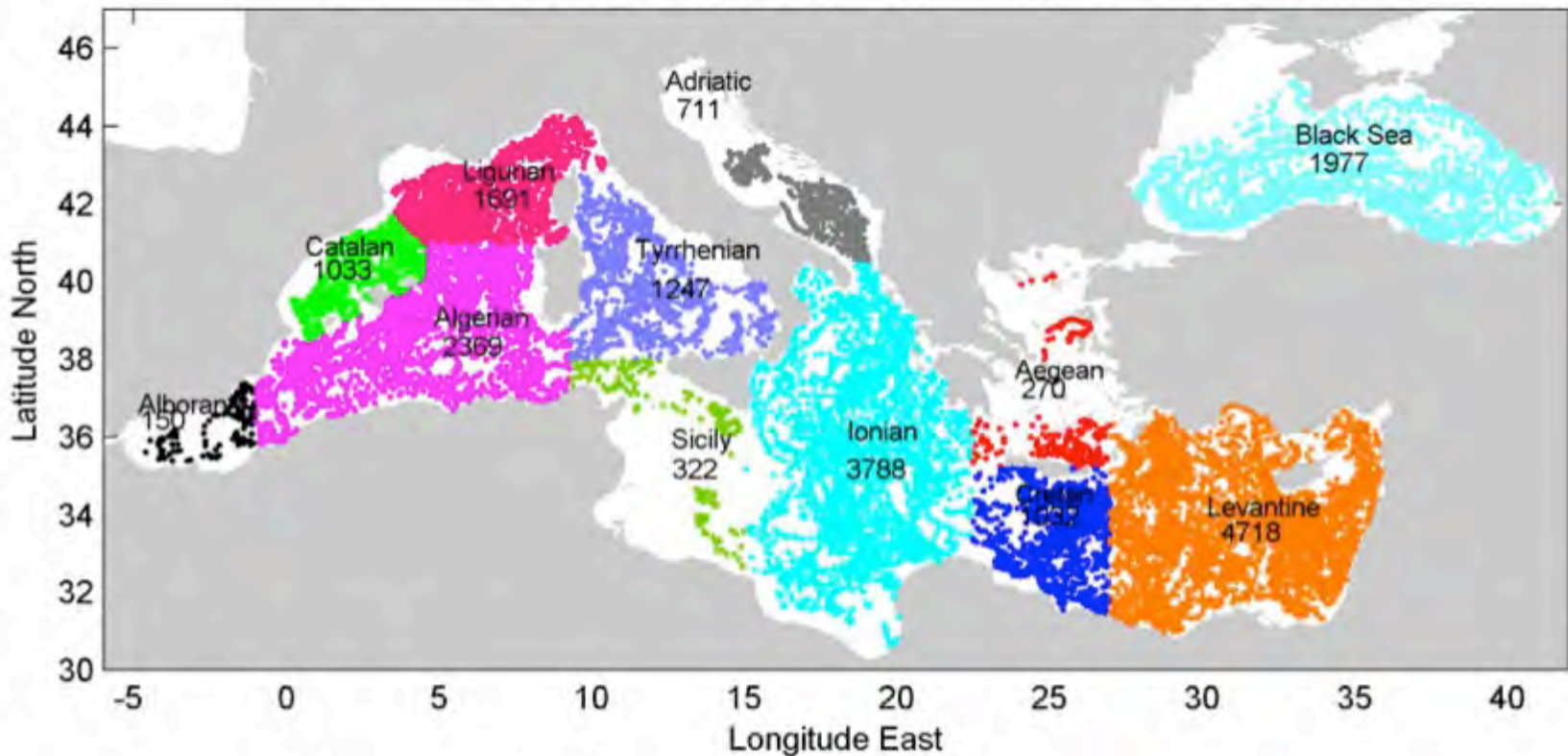
EuroArgo: European contribution to the Argo global ocean observatory



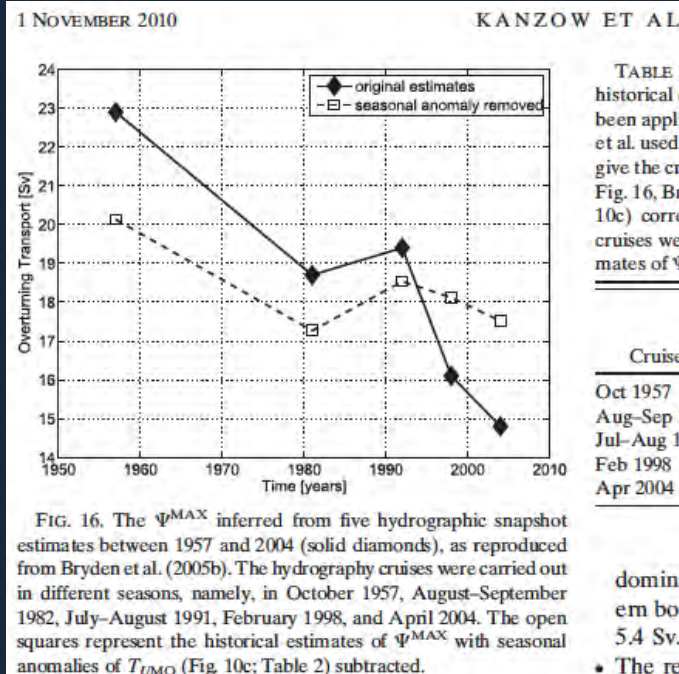
- Included in ESFRI roadmap in 2006, along with EMSO (integration and complementary)
- Goal : Europe establishes an infrastructure to contribute a significant and sustained component to Argo ($\frac{1}{4}$ of Argo fleet, i.e. 800 active floats)
- Requirement : 250 floats per year including regional enhancements (about 50 floats in Nordic Seas, Mediterranean Sea and Black Sea)

MedArgo: Argo Regional Center & distributed RI of EuroArgo

Number of float CTD profiles (19000) in the Med and BS: Nov 2000 – Mar 2014



Why now?: The real challenge today is Ocean Variability: monitoring at the right scales



An Example: AMOC, Atlantic Ocean Meridional Circulation

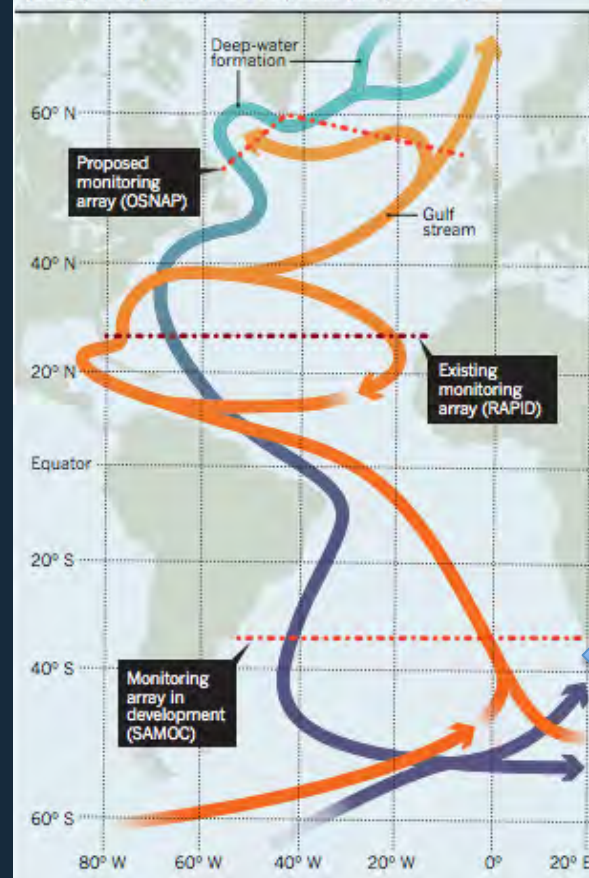
2005: decline.

2010: seasonal biases correction



EBB AND FLOW

The 'global conveyor belt' transports warm Atlantic Ocean surface water (orange) to the poles and cool deep water (blue) to the tropics.



AMOC recent key milestones:

- 2005
- 2010
- 2012
- 2013

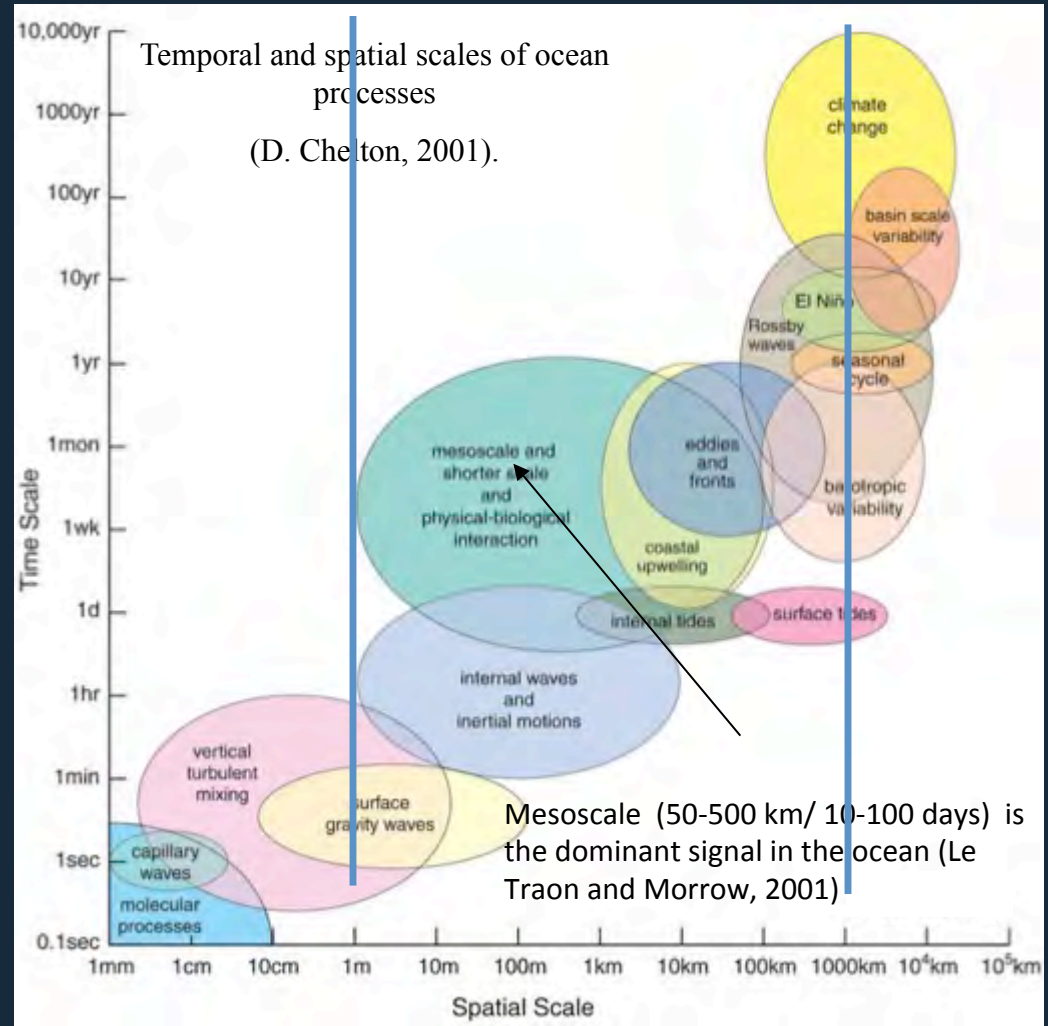
In April 2009, the array recorded a 30% drop in average current strength that persisted for a year, reducing the amount of heat transported to the North Atlantic

NOW we can....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),

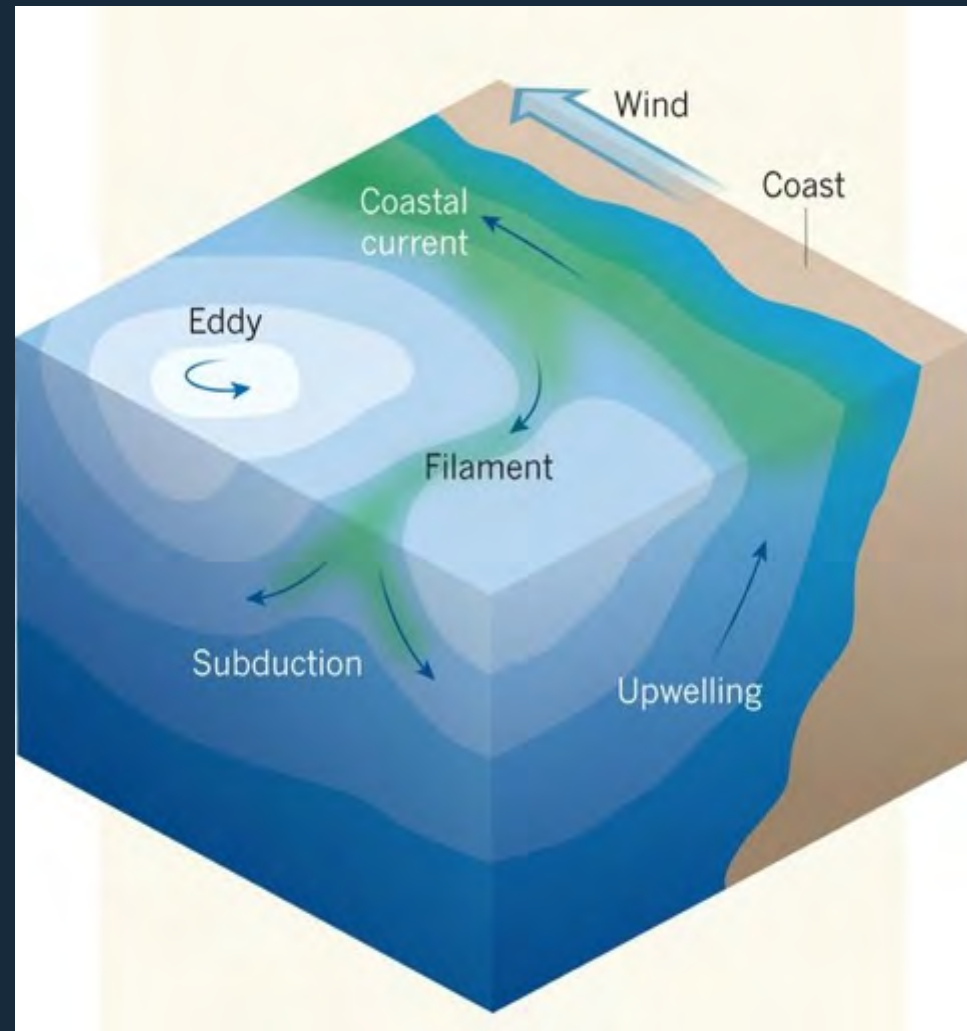
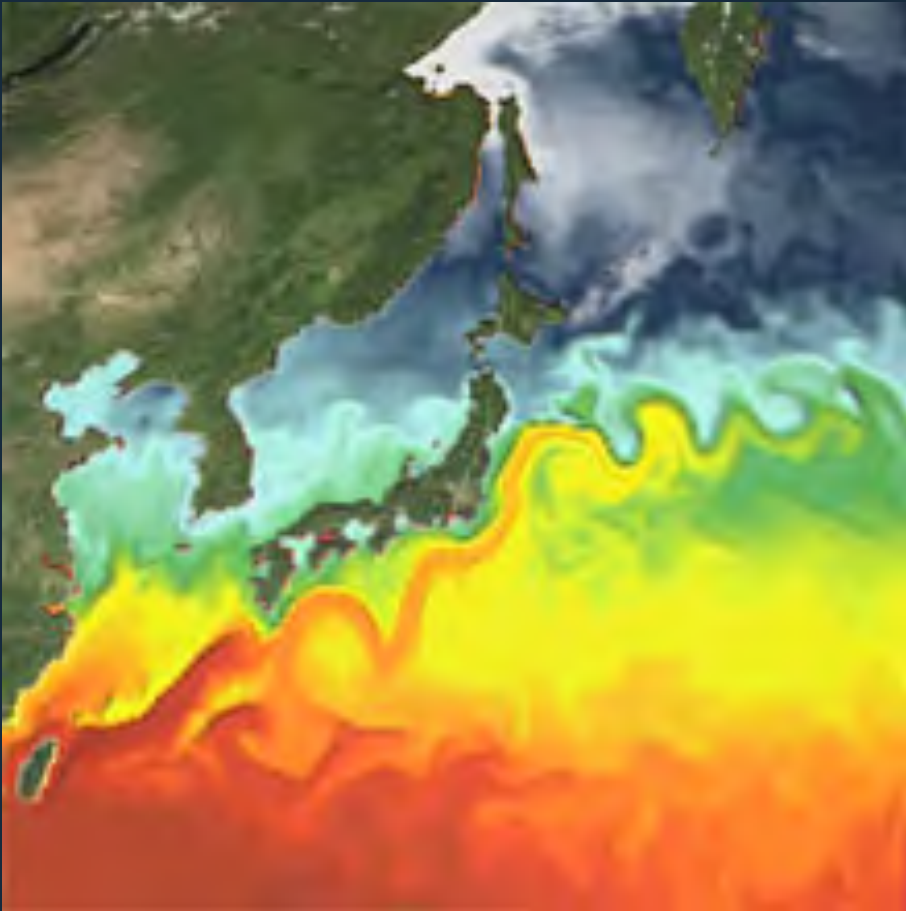
SOCIB focus: mesoscale & submesoscale and their interactions with general circulation and their effects on vertical motions, impact on ecosystem variability.

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



SOCIB scales

Ocean currents, eddies and instabilities: the mesoscale, the oceanic weather



Mahadevan (Nature, 2014)

Multi-Platform integrated approach

....from local to basin scale

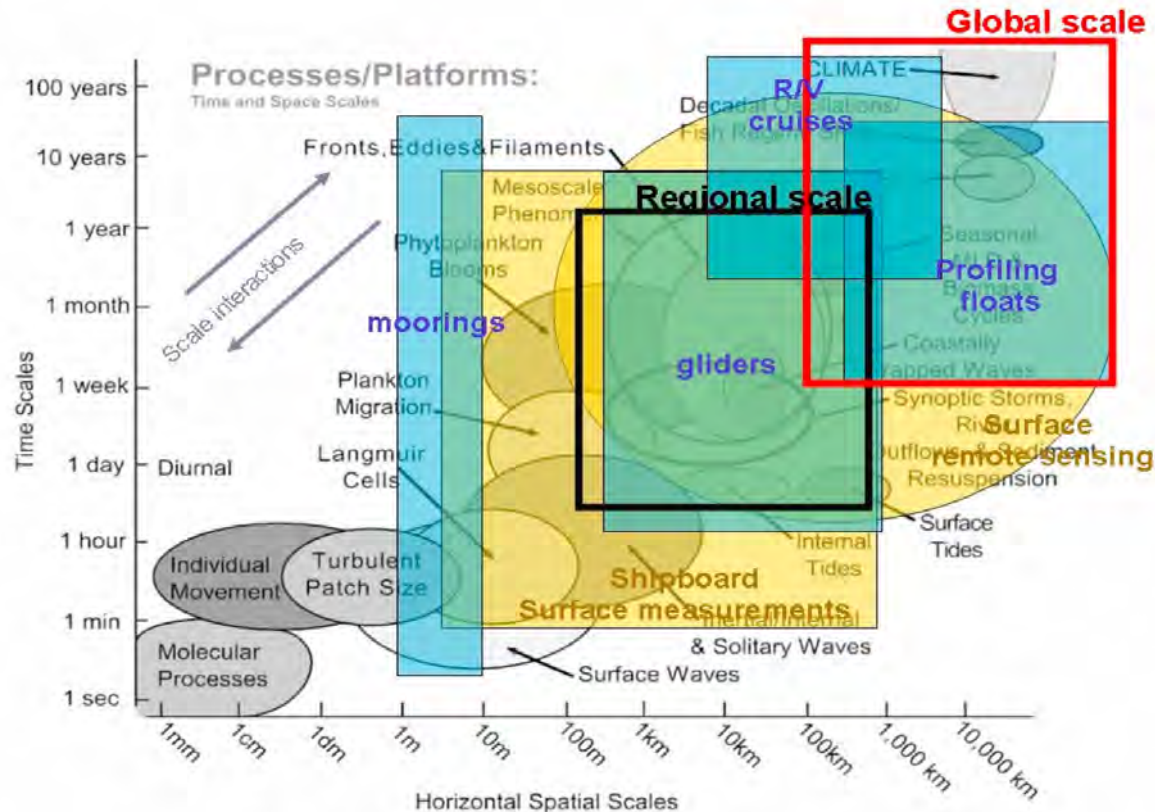
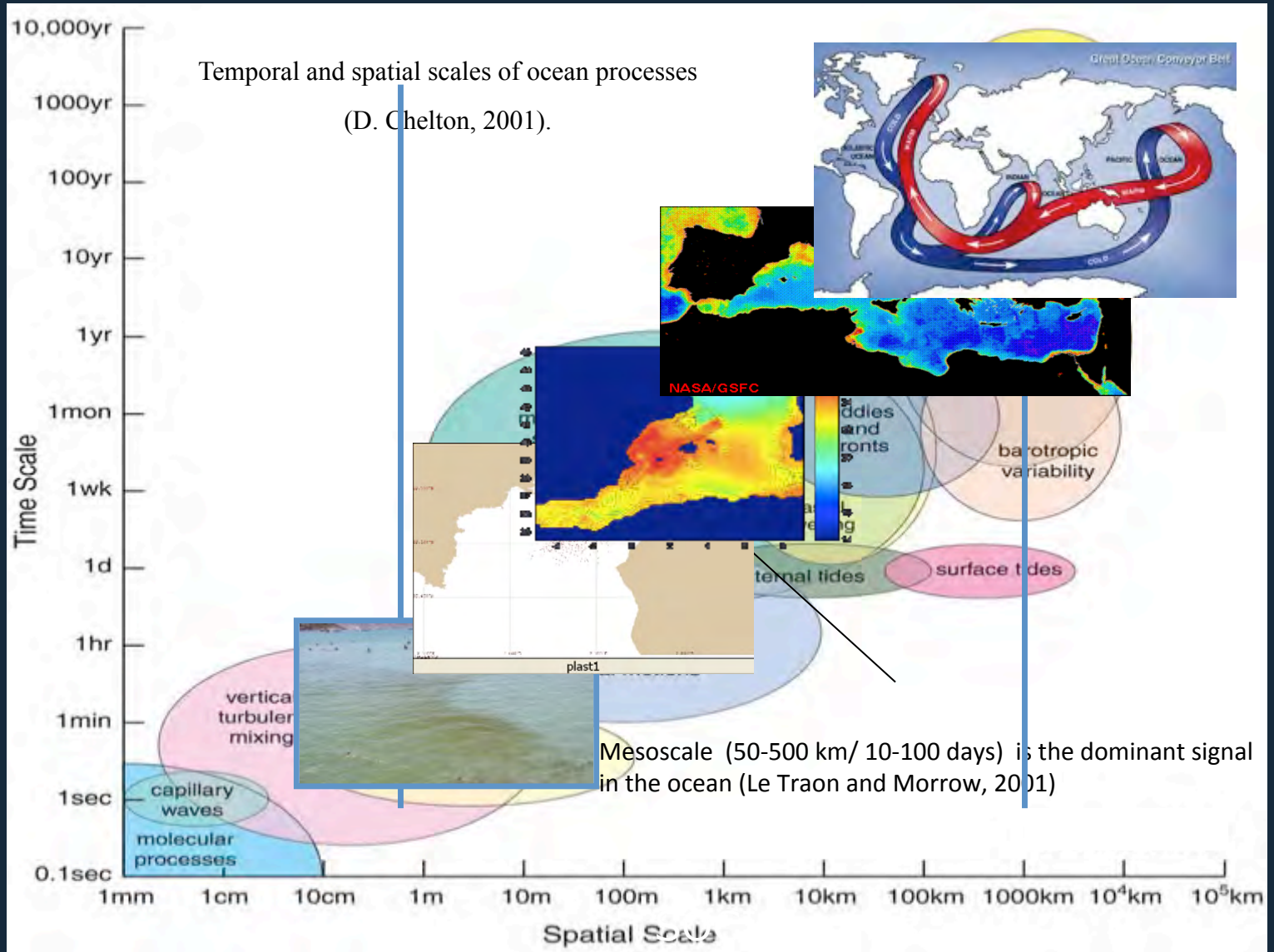


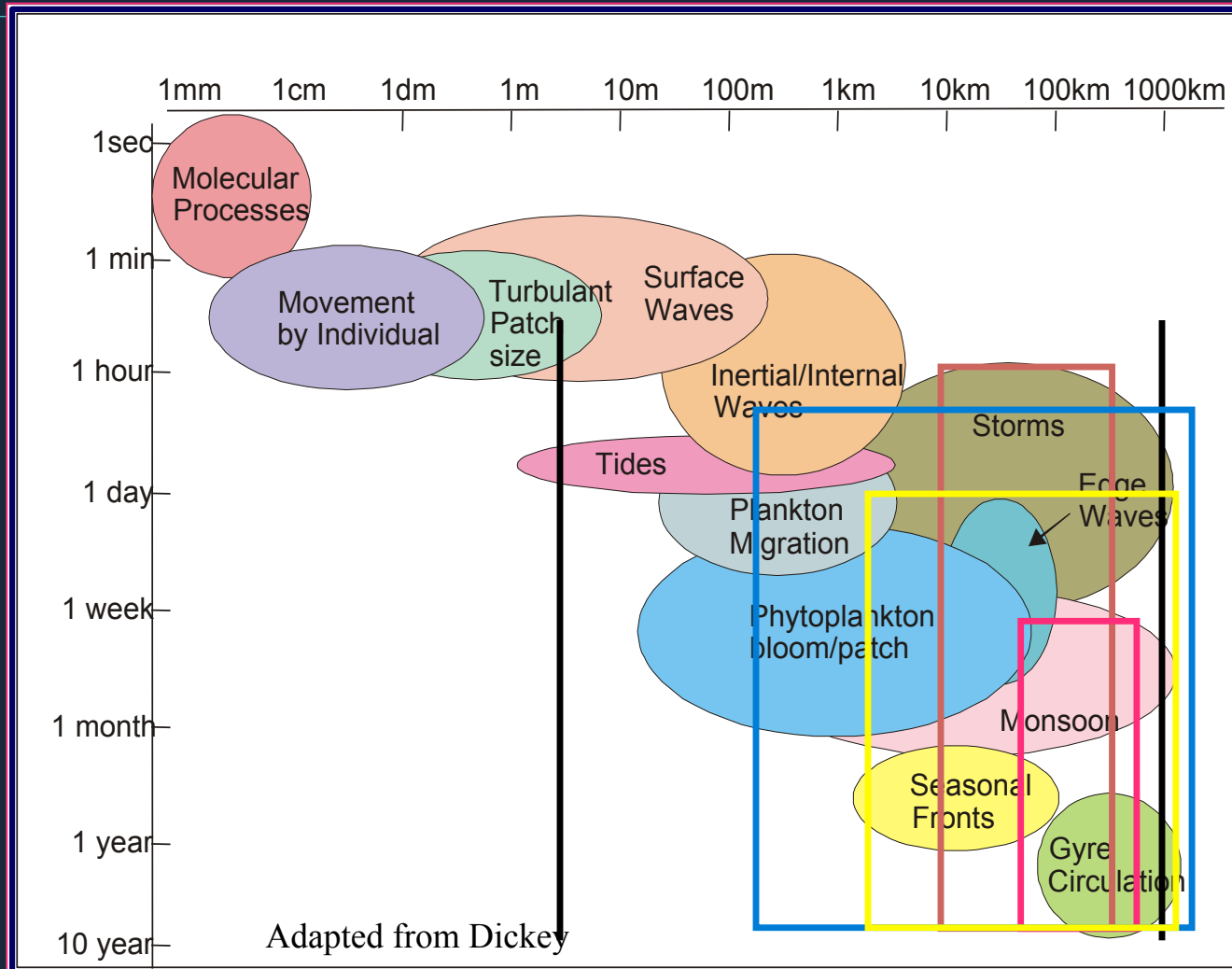
Figure 2. Space vs. time oceanic scales (processes) and the PERSEUS observing platforms; moorings, gliders, R/V, profiling and surface floats showing that today, the scales covered by platforms collecting in situ data (blue areas) can be considered equivalent to the ones collecting surface measurements (yellow areas).

“A single ship can only be in one place at one time. We need to be present in multiple places in multiple times.” (John Delaney, Nature, Sept. 25, 2013)

Multi-Platform integrated approachfrom local to basin scale



SOCIB scales and monitoring tools



Gliders

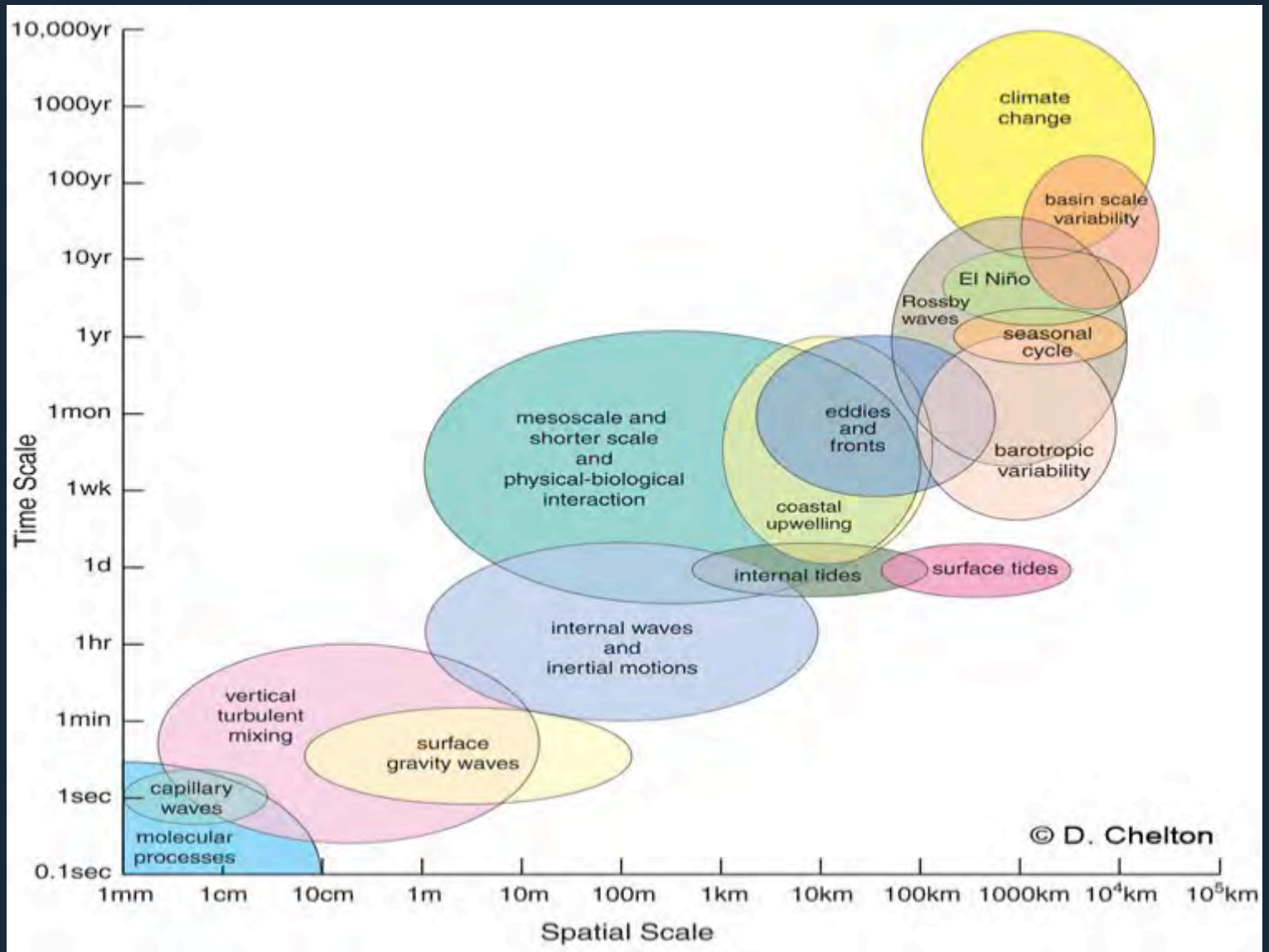
**Fixed
Platforms**

HF radar

**24 m R/V
Catamaran**

Satellite

Why and how to focus on Variability at Mesoscale and Coastal interactions?



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 ...

OUTLINE

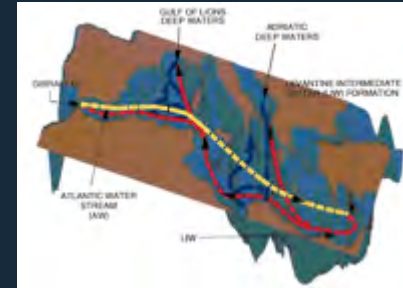
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“Turning Data into Jobs...”

Discussion: Are we ready for these changes ? Do we have the framework and right structures to get all the benefits from these changes ? (“to enforce what we think has to be done...”)

Why Mediterranean and why SOCIB, ?

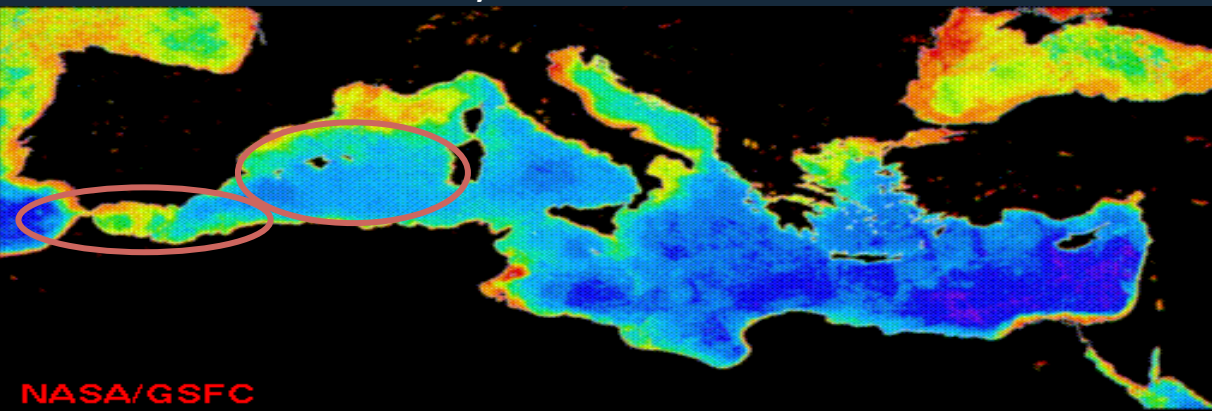
Mediterranean

- Scientific relevance as small scale ocean, THC; (e.g., Malanote-Rizzoli et al., 2014).
- Society relevance: European citizens
- Leading ocean science, new technologies, data management, society response



Balearic Islands ... after 25 years...

- Scientific know-how and technological infrastructures: leading international science
- Governmental unified joint support (MINECO and Balearic Gov); RIS3 Smart and Sustainable Tourism
- Civil Society endorsement



Why in the Mediterranean?

SOCIB takes profit of:

- Strategic position of the Balearic Islands at the Atlantic/ Mediterranean Transition Area, one of the '**hot spots**' in world's oceans research and biodiversity
- Nature of this semi-enclosed sea, an ideal reduced scale ocean laboratory, where key ocean processes (**thermohaline circulation**, **deep convection**, shelf/slope exchanges, **mesoscale and submesoscale** dynamics, coastal interactions, etc.) can be studied at smaller scales than in other oceanic regions (Internal Rossby Radius of order 10 km).

Physical mechanisms are thus better monitored and understood in this 'ocean basin', contributing to the advancement of knowledge of physical interactions and biogeochemical coupling at nearshore, local, sub-basin and global scales.

Regional monitoring: word of caution... with extrapolations to global scale ... “Real-time’ detection of secular changes in the oceanic overturning circulation by regional measurements is probably a mirage” (Wunsh, Nature geoscience, 2008)

Why SOCIB, why Ocean Observatories, and why now?

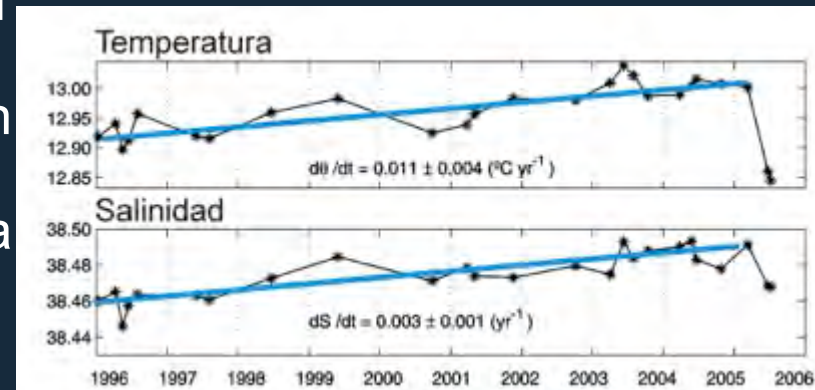
Motivation:

- Mediterranean unique ecosystems, ecosystem services, fluxes, regional and global impacts, changes, etc
- Causes and consequences still unknown in many cases....
- Conflicts of use in the marine and coastal zone

Detecting Changes Imply monitoring.
Need of reliable baseline data

Key question: example; How the interactions between the physical, biogeochemical and ecological variability in the Mediterranean can be best described and how it will evolve in the future (at what scale ?)

Changes in Mediterranean...

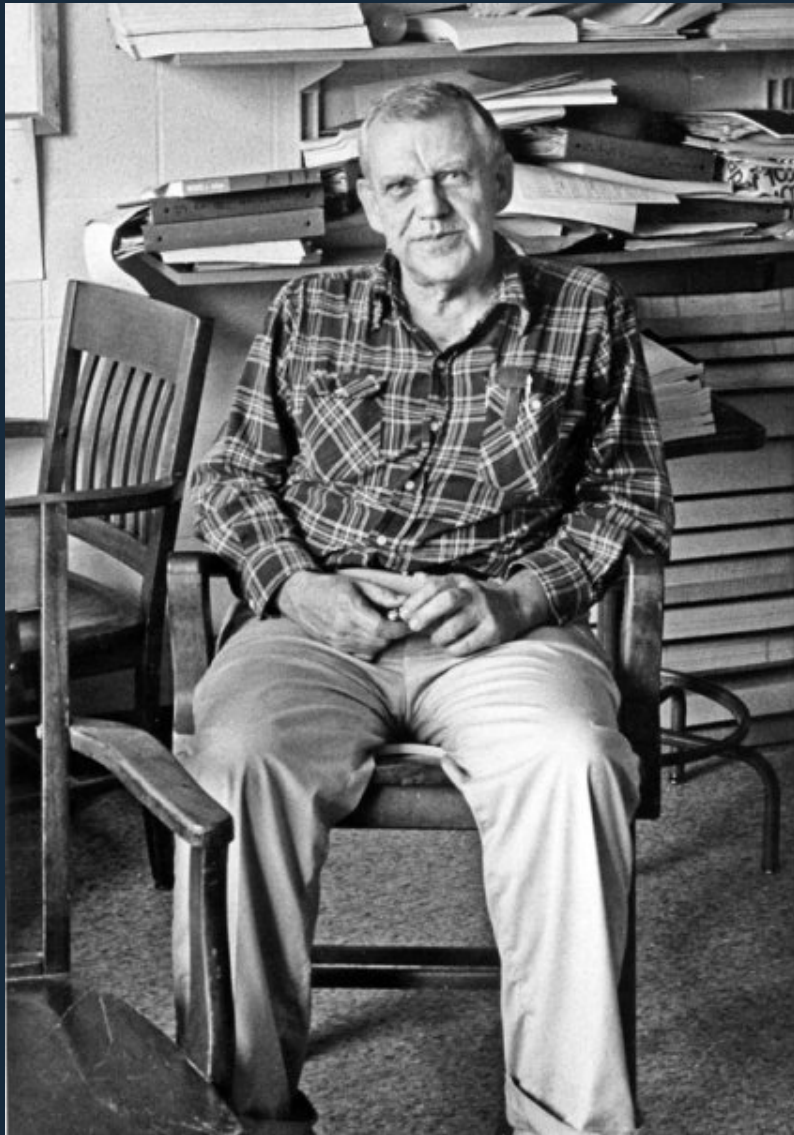


López-Jurado, J.-L. et al. (2005), *Geophys. Res. Lett.*,



Careful monitoring is needed
with traditional and with new
infrastructures, new tools,
new technologies...

Wisdom



“The chief source of ideas in oceanography comes, I think, from new observations.”

Henry Stommel



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. ■

Responding Science... and Society issues

Project based
- 3 years -
Can be done!!

But is inefficient
Next Step



Coastal
Ocean
Observ.
SOCIB

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.

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

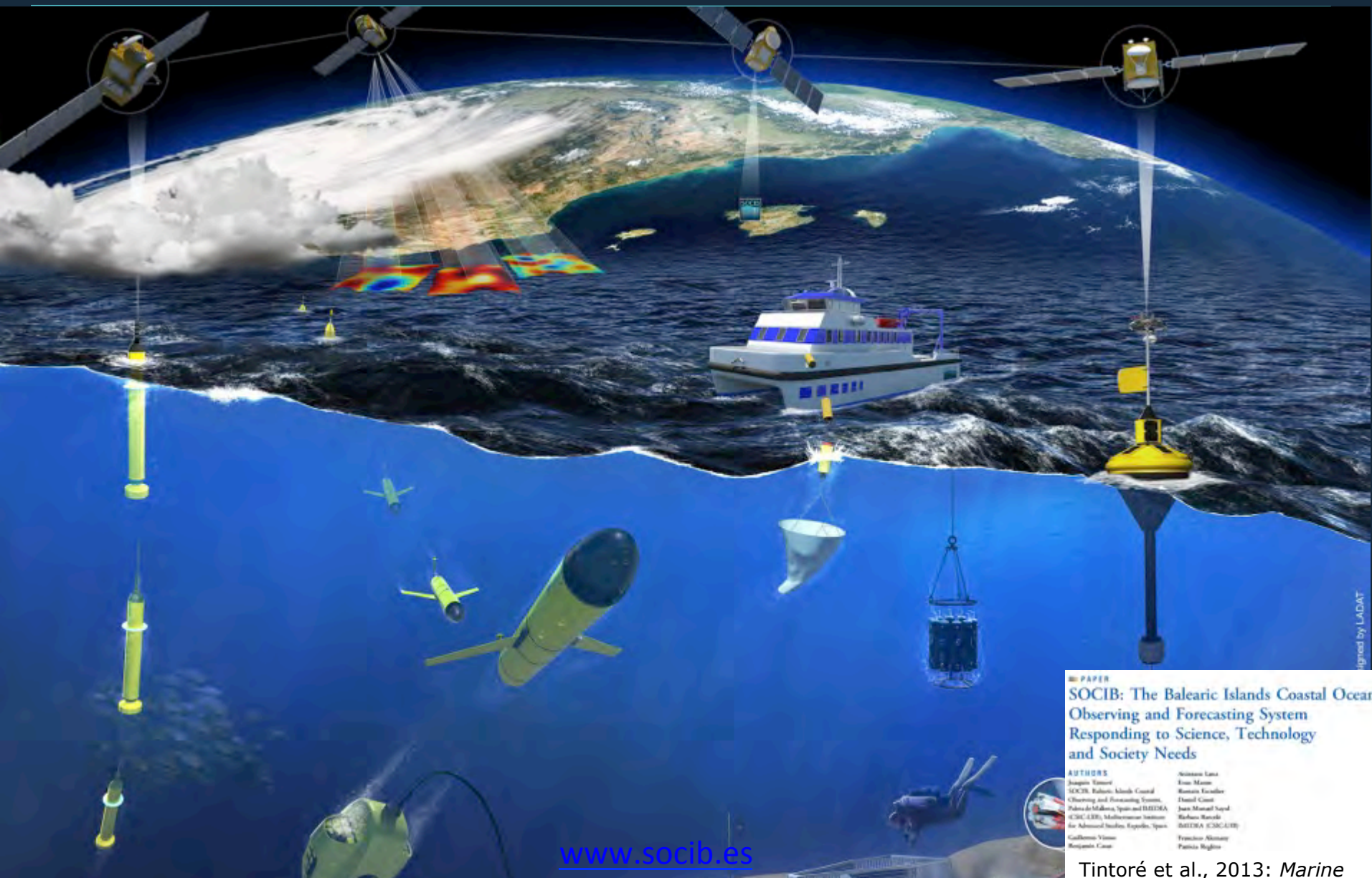
increasing fundamental scientific understanding (10 questions). Many of the questions in the report (e.g., sea level rise, sustainable fisheries, the global water cycle) reflect challenging, multidisciplinary science issues that are clearly relevant today and are likely to take decades of effort to solve. 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 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

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.

What is SOCIB? A multi-platform observing system,



PAPER

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

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Joaquín Verrini
Richard Rueda
IMEDEA CSIC-UIB
Francisco Alvarado
Patrik Riegler



www.socib.es

Tintoré et al., 2013: *Marine*

What is SOCIB? A multi-platform observing system, from nearshore to open-ocean in Mediterranean

OBSERVING FACILITIES



Research vessel



HF Radar



Gliders



Lagrangian platforms



Fixed stations

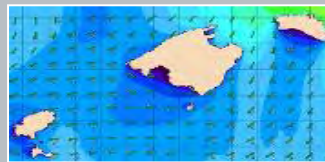


Beach Monitoring

MODELLING FACILITY



Currents (ROMS)



Waves (SWAN)

STRATEGIC ISSUES & APPLICATIONS FOR SOCIETY



Integrated Coastal Management



Marine Spatial Planning

DATA CENTER



Data access – Data Repository – Applications
Spatial data infrastructure – Real time monitor

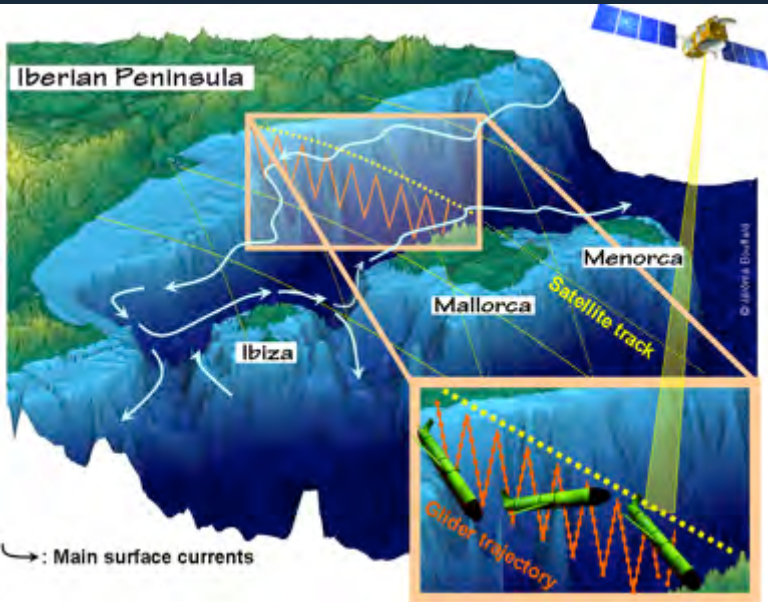
What is SOCIB? A multi-platform observing system, from nearshore to open-ocean in Mediterranean



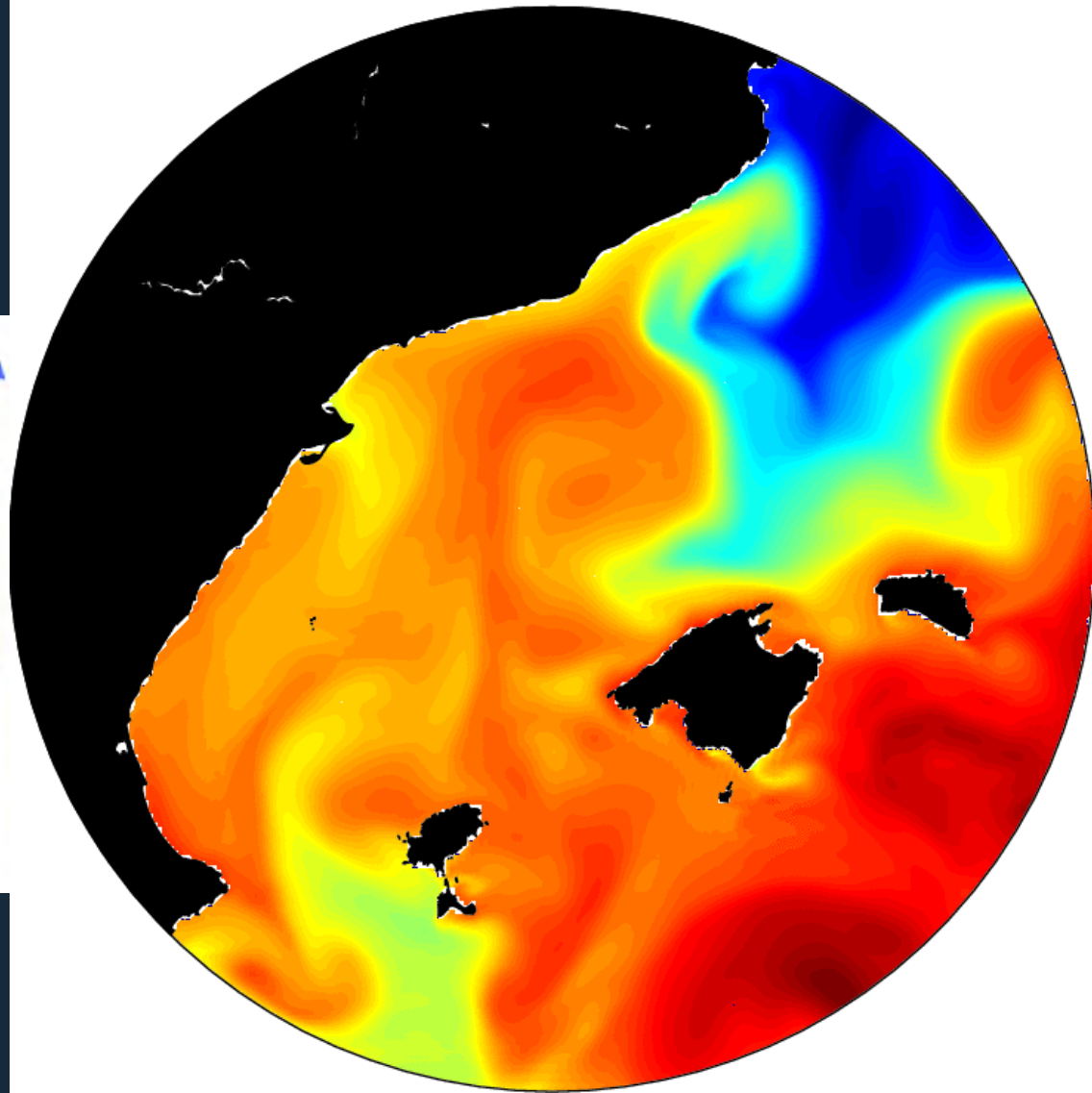
3 Drivers

- Science priorities
- Technology Dev.
- Society Needs

Ocean Circulation Variability, an example in the Balearic Sea (biodiversity hotspot)



DAY = 1



What is SOCIB? A multi-platform observing system, from nearshore to open-ocean in Mediterranean

3 Drivers

- Science priorities
- Enhance Technology Development
- Respond Society Needs

Mission

Ocean Variability, focus on meso & sub-mesoscale

- “Oceanic weather”-
- From nearshore to open ocean
- 2013 Start operational phase, data, products and services

Results

Yes, already from the 3 drivers...

SOCIB 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

SOCIB Data Centre: Real Time, Free Access & Download, Quality Controlled, Interoperable Data



MedSea Portal

SOCIB Data Centre

DATA CENTER FACILITY

- Manage all multi-platform SOCIB Data
- Allow users to discover, gather, visualize and download
- Immerse in the international framework and EU funded projects

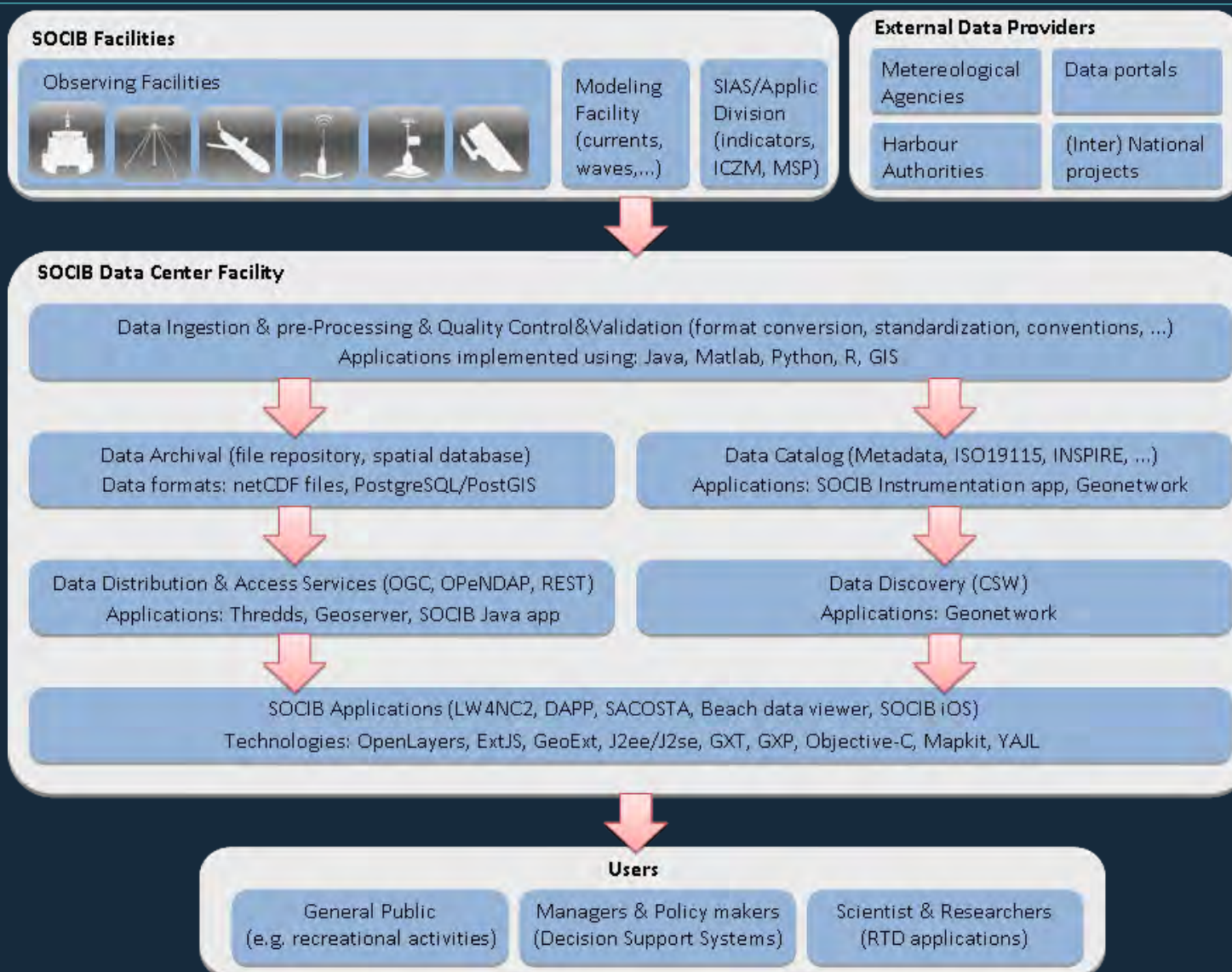
OPEN DATA PRINCIPLES

- Discoverable and accessible
- Freely available
- Interoperable, standardized and quality controlled

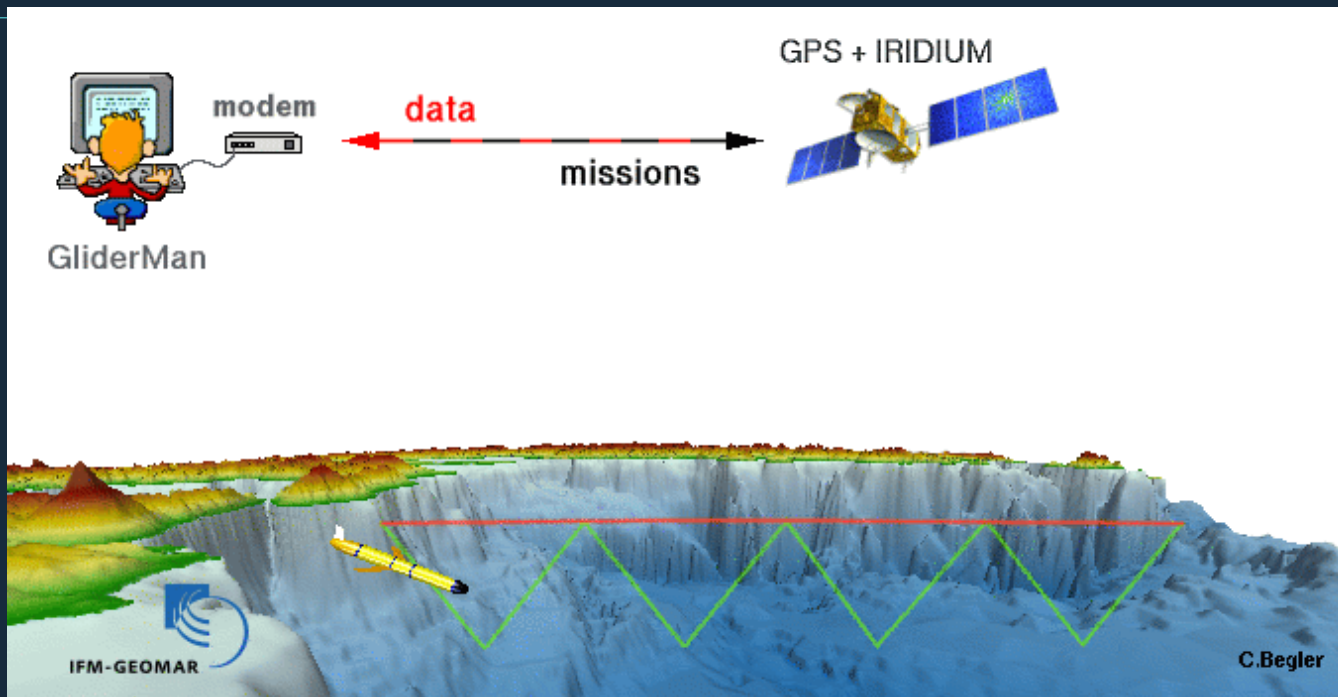


**Turning DATA INTO JOBS (US - NOAA)....
Blue Growth**

SOCIB Data Centre: Lifecycle of data



Gliders



Gliders Facility: Science



**Mesoscale – Submesoscale /
Vertical motions - biogeo effects**

**Eddy/mean flow interactions –
Blocking effects General Circulation**

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 Tintoré¹

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}

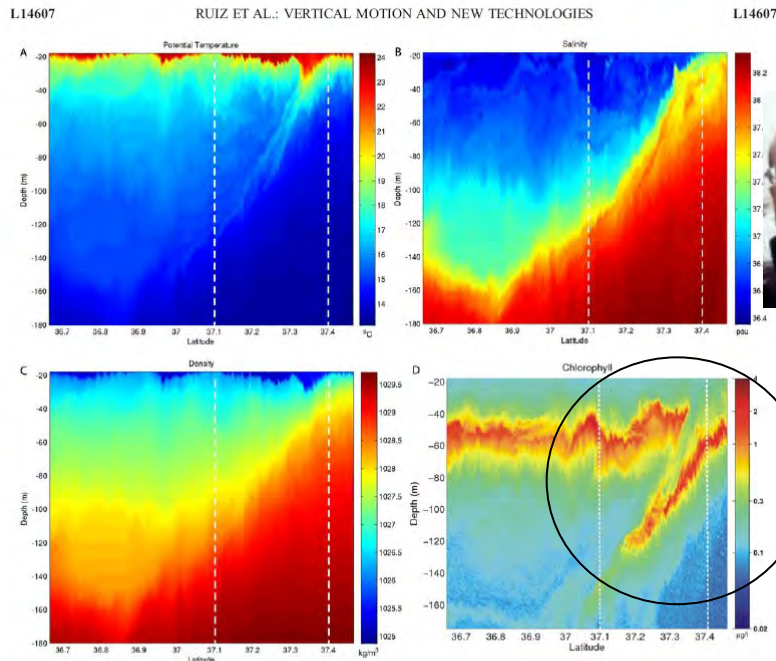
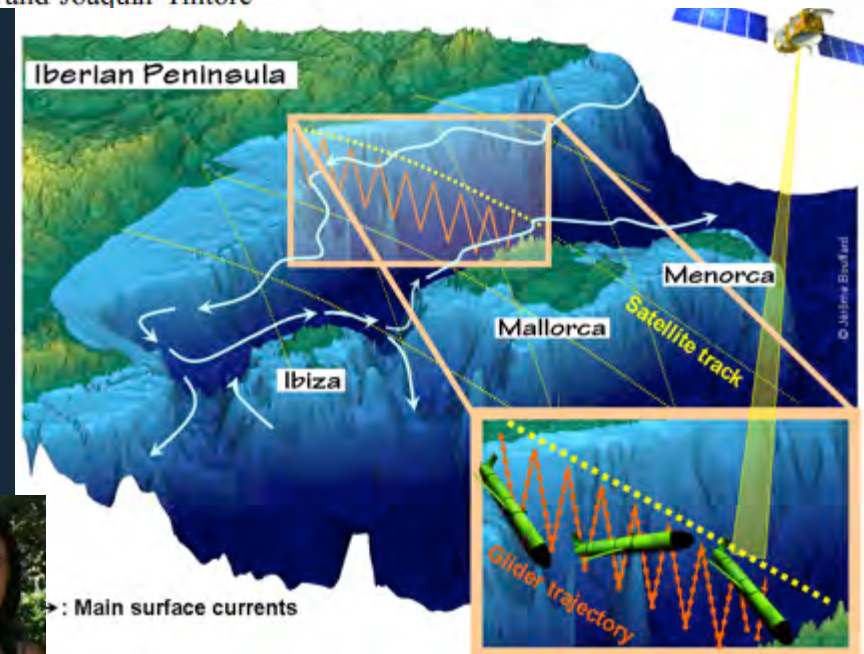
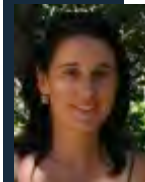


Figure 2. Vertical section of temperature ($^{\circ}\text{C}$), salinity (PSU), density (kg/m^3) and chlorophyll ($\mu\text{g/l}$) from glider section 2 (dashed magenta in Figure 1). White dashed lines define sub-section in the northern part of the domain.



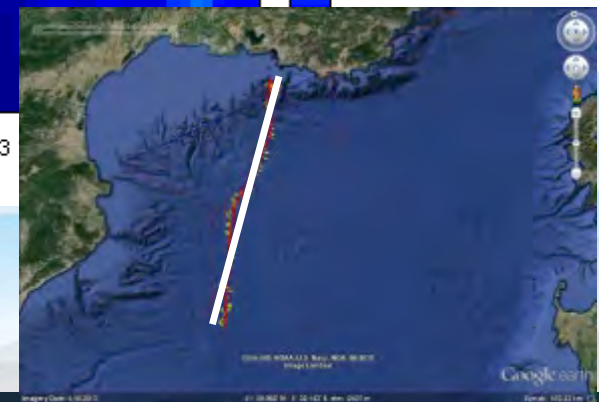
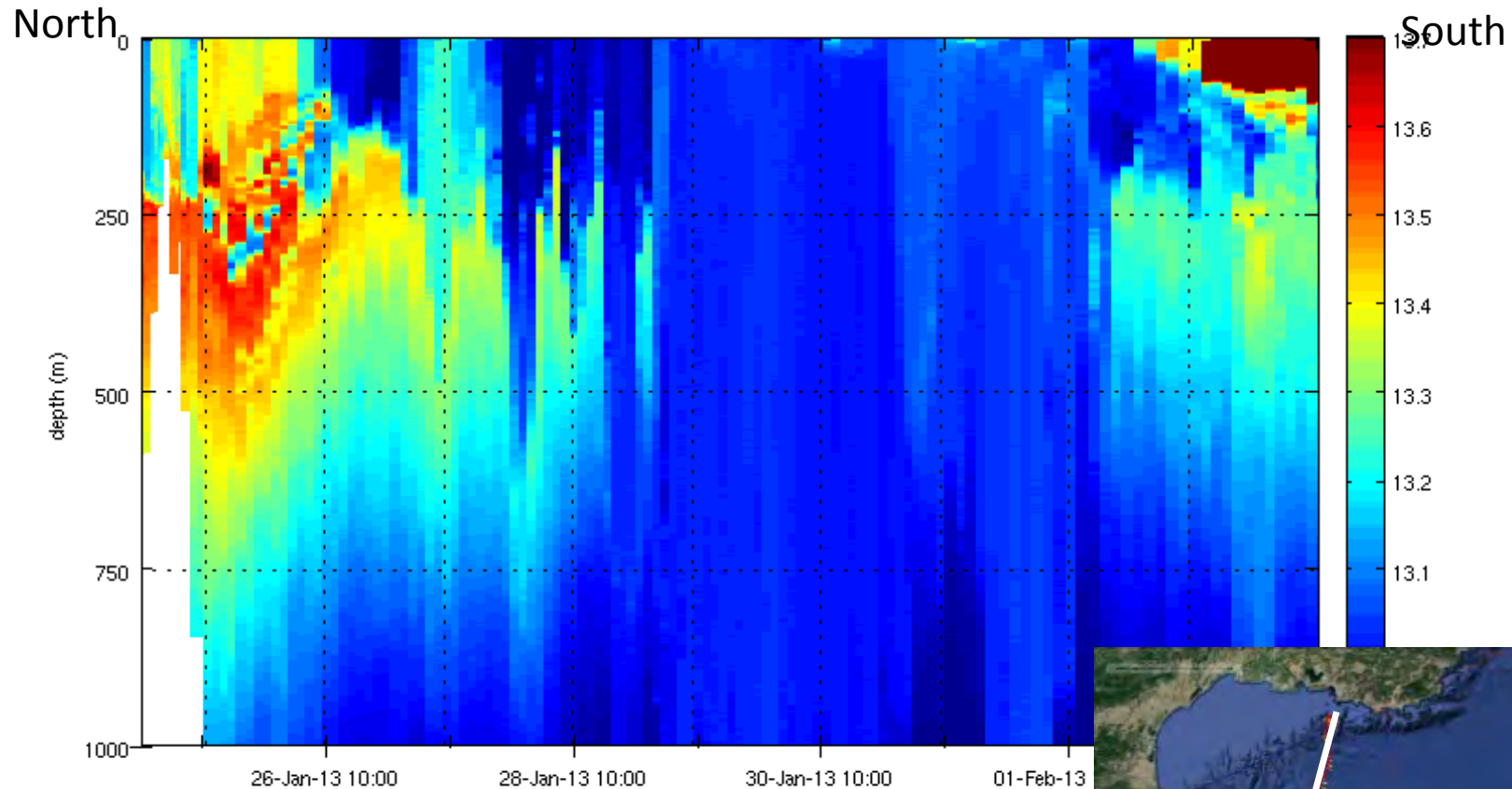
→ Main surface currents

Violent Mixing Phase of Deep Convection

Example of a Perseus Glider section

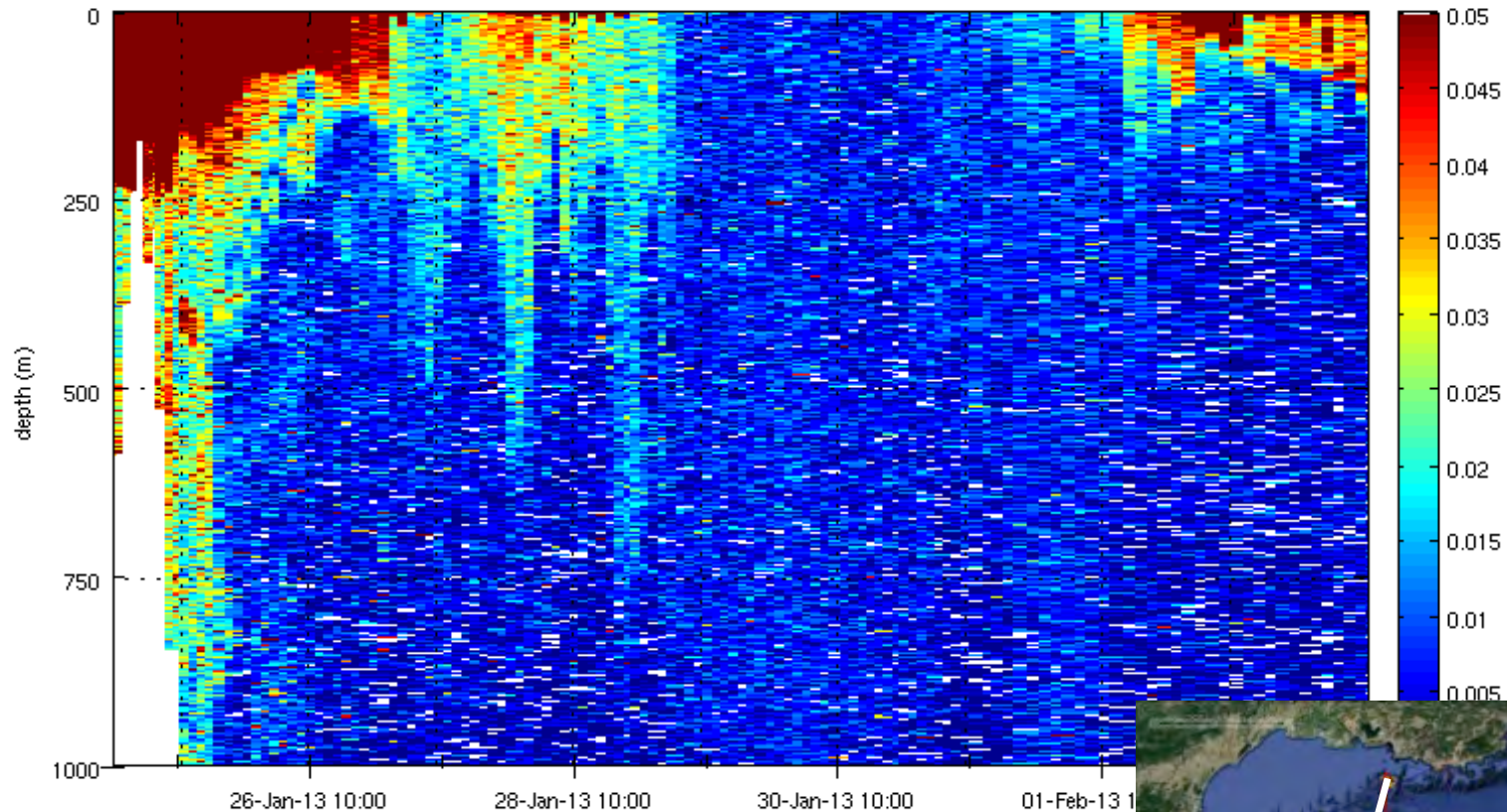


•Pot. Temp

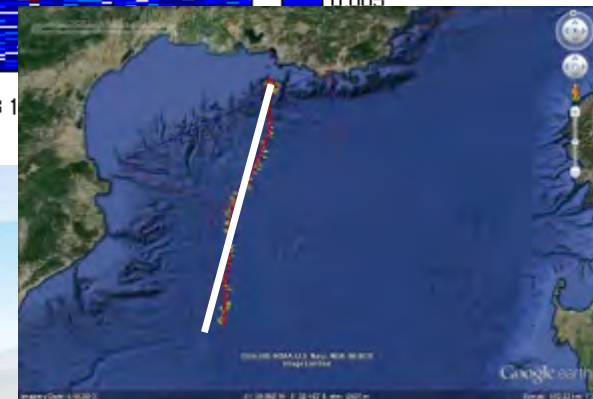


Violent Mixing Phase of Deep Convection

•Turbidity



Presence at sea even when weather conditions are bad
Multidisciplinary data to study the physical-biogeochemical
interactions



Gliders Facility: Operational

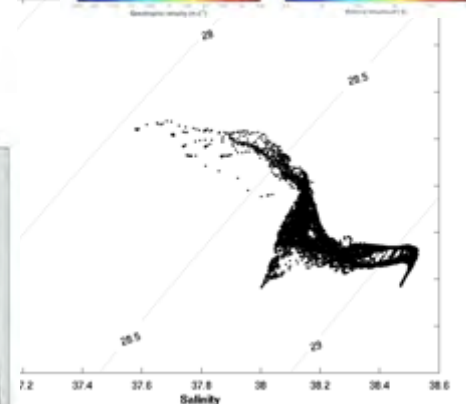
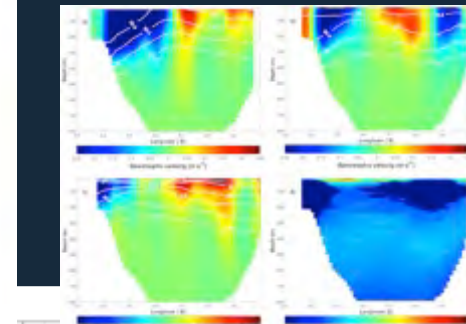
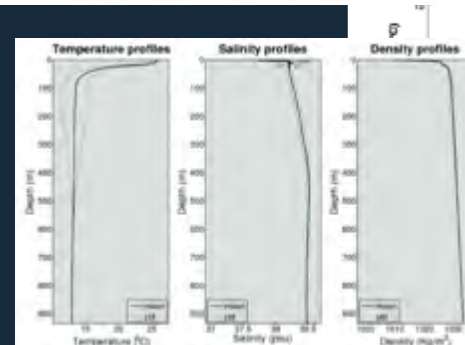
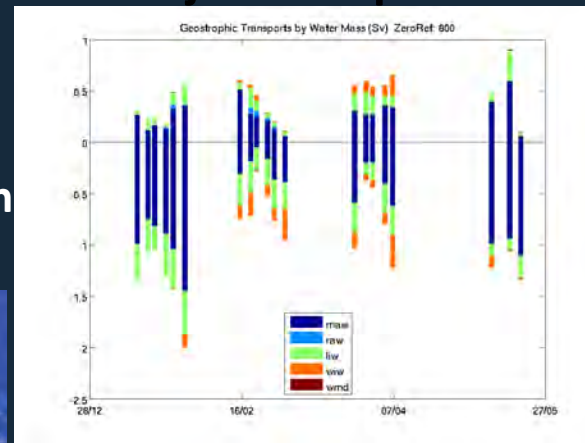
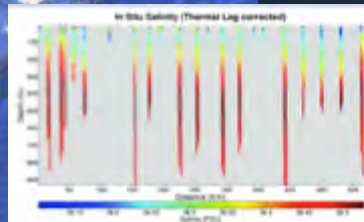
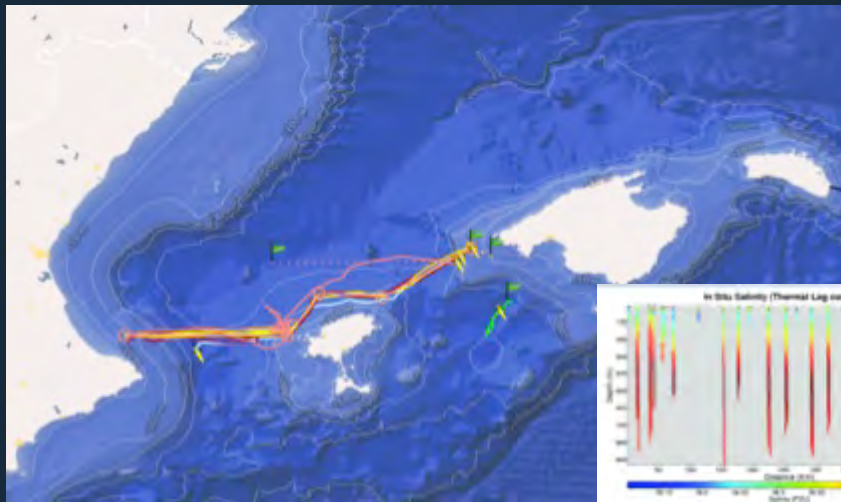
GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L20604, doi:10.1029/2012GL053717, 2012

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

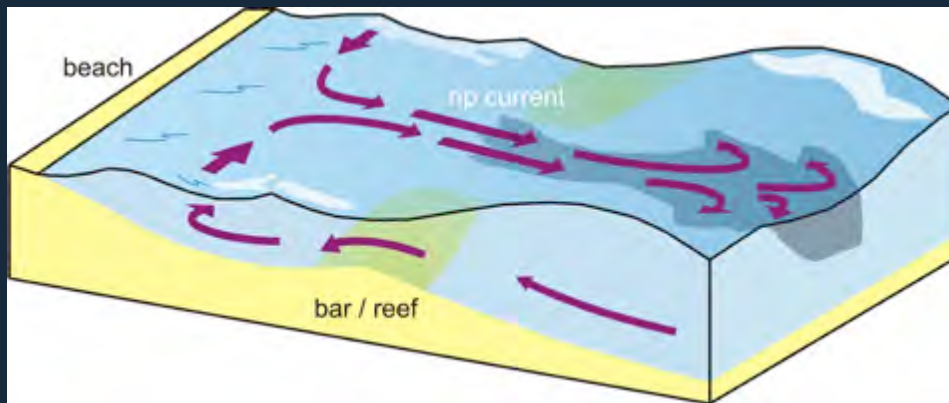
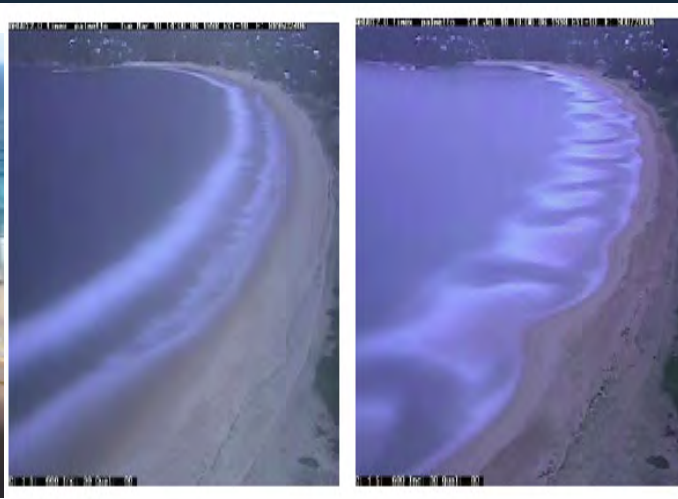
Emma E. Heslop,¹ Simón Ruiz,¹ John Allen,^{2,3} José Luís López-Jurado,⁴ Lionel Renault,⁵ and Joaquín Tintoré^{1,5}

Major transport changes

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



SOCIB Technology Development & Applications: Beach Safety -Rip Currents-



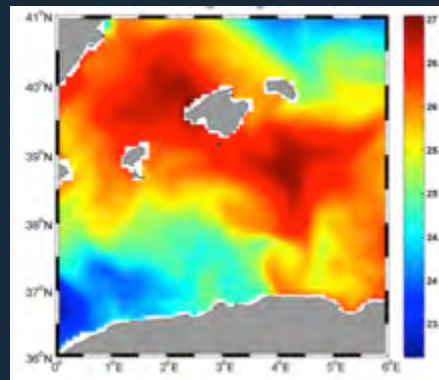
Beach monitoring using cameras, breakers, rips, bathymetry changes, etc.

Bluefin Tuna Target Project: science for sustainable fisheries: at SOCIB since 2011

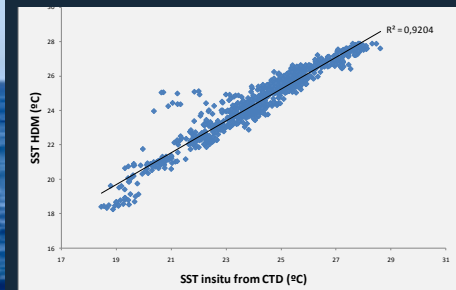


Initial Activities and First Results:

- 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



SOCIB Developments and Applications: Mobile Apps



900 downloads



300 downloads

SOCIB Developments and Applications: Touristic sector



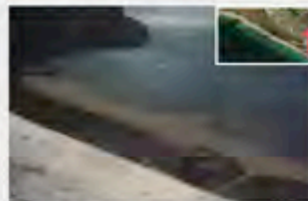
Be proud of your hotel!

We are pleased to inform you that this hotel contributes to beach conservation and science based coastal and ocean management. Your hotel collaborates with the Beach Monitoring Programme from SOCIB.



Observation and real time data

Beach evolution



Son Bou - Cam 01: 19/03/2014 12:00

Hotel weather station

Rain accumulation

0.24 mm

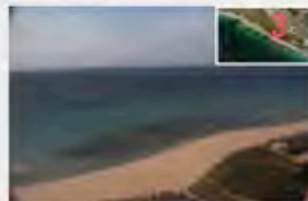
0.24 High 0.24 Low

Swimming conditions



No data received

Beach overview



Son Bou - Cam 03: 19/03/2014 13:18

Beach information

Beach type: 2.5 km linear natural beach with dunes
Sediment type: medium to fine biogenic sands
Scientific interest: beachrocks, lagoon inlet, rip

More information



Forecast

Weather forecast

Light rain on Sunday and Monday;
temperatures peaking at 19° on Saturday.

Today



Windy in the morning.

Temp	Wind	Humidity	Pressure
17.9 °C 13.7 °C	25.0 km/h (SE)	76 %	1022.0 hPa

Thursday



Mostly cloudy throughout the day

Temp	Wind	Humidity	Pressure
18.8 °C 14.1 °C	6.4 km/h (SW)	82 %	1020.7 hPa

Friday

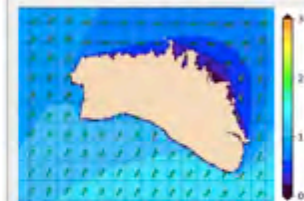


Clear throughout the day

Temp	Wind	Humidity	Pressure
18.8 °C 14.4 °C	5.8 km/h (SE)	81 %	1019.6 hPa

*Based on Direccion

Waves forecast

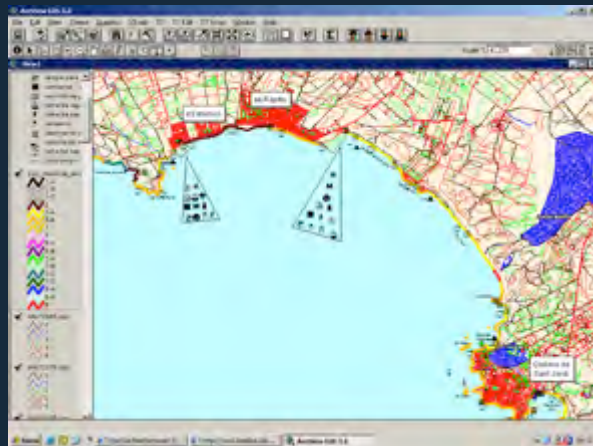


Waves at 21/03/2014 11:00

SOCIB Developments and Applications: Tools for Marine and Coastal Safety Decision Support

ESI (Environmental Sensitivity Index)

This system incorporates all the available information and identifies resources at risk, establishing protection priorities and identifying appropriate response.



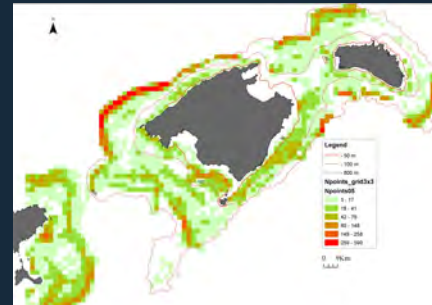
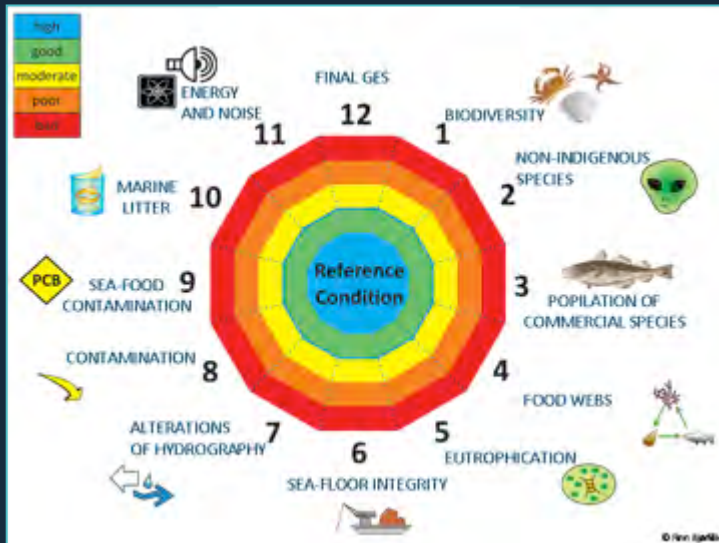
SOCIB Developments and Applications: Contribution to IMP, e.g., MSFD. Strong science for wise decisions.

MSFD A KEY SOCIETAL DRIVER:

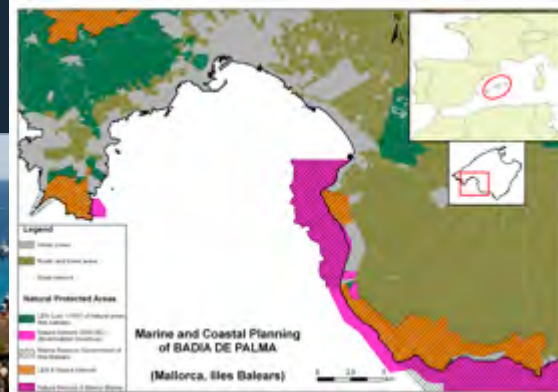


"What we measure affects what we do. If we have the wrong measures, we will strive for the wrong things"
(Joseph Stiglitz, 2010)

"Bridging the science-policy gap is arguably the biggest current challenge to achieving sustainability"
(Lubchenco and Sutley, 2010, Science).



SOCIB Developments and Applications: Sustainability indicators; Science and Society



New tools: MSP, ICOM
Social and Economic Council.



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.

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



Official Opinion 5/2007 of the Economic and Social Council of the Balearic Islands

SOCIB Developments and Applications: Socio-environmental studies carrying capacity beaches



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DOI: 10.1080/08920753.2012.677636



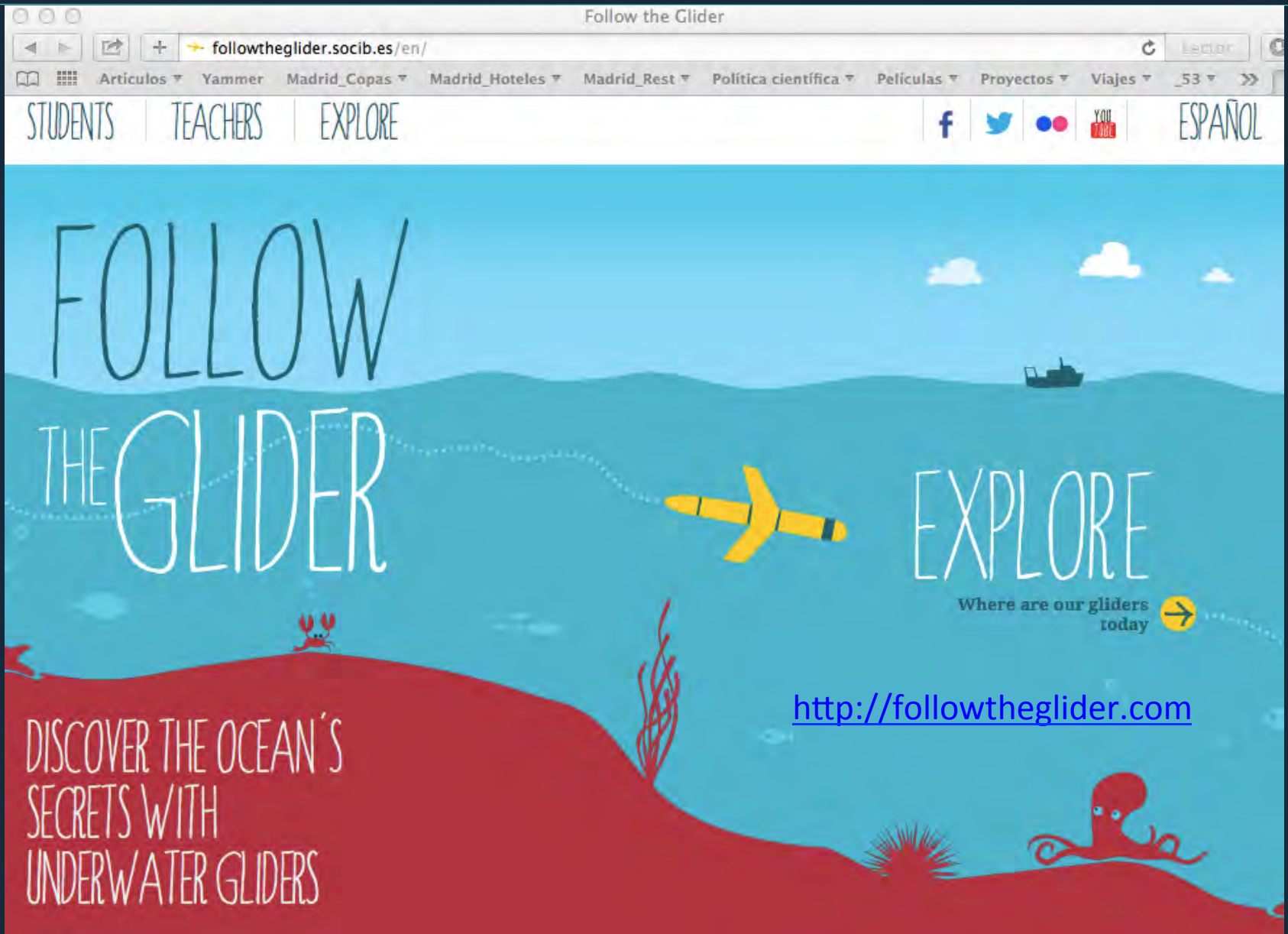
Multi-Method Approach to Exploring Social–Ecological Dimensions in a Mediterranean Suburban Beach Setting

AMY DIEDRICH¹ AND JOAQUÍN TINTORÉ^{1,2}

¹SOCIB (Balearic Islands Coastal Observing and Forecasting System)
Balearic Islands, Spain

²IMEDEA (CSIC-UIB) (Mediterranean Institute of Advanced Studies)
Balearic Islands, Spain

SOCIB Developments and Applications: Outreach



OUTLINE

1. New Technologies: Paradigm Change Ocean and Coastal Observation. EU international leadership
2. Marine Research Infrastructures, Ocean Observatories: SOCIB, Integrated Science priorities, Technology Development and Society Needs
3. **Innovation and Blue Growth: innovation in oceanography - gliders- (multi-disciplinary teams), data availability) and ...
“Turning Data into Jobs...”**

Discussion: Are we ready for theses changes ? Do we have the framework and right structures to get all the benefits from these changes ? (“to enforce what we think has to be done...”)

Innovation in oceanographic instrumentation

We need:

- Long time series
- Synoptic data
- $\gamma\lambda\upsilon\omicron\beta\tau\iota\varsigma$ $\alpha\sigma\tau\epsilon\varsigma$

3 elements:

- Oceans complexity imply and drive a need for improvement of instrumental capacities
- The innovation process, complexity and incubation time:
 - Incubation time: 15-30 years (computer mouse, 30 years). Gliders 10 years. WHY?
- The key to success

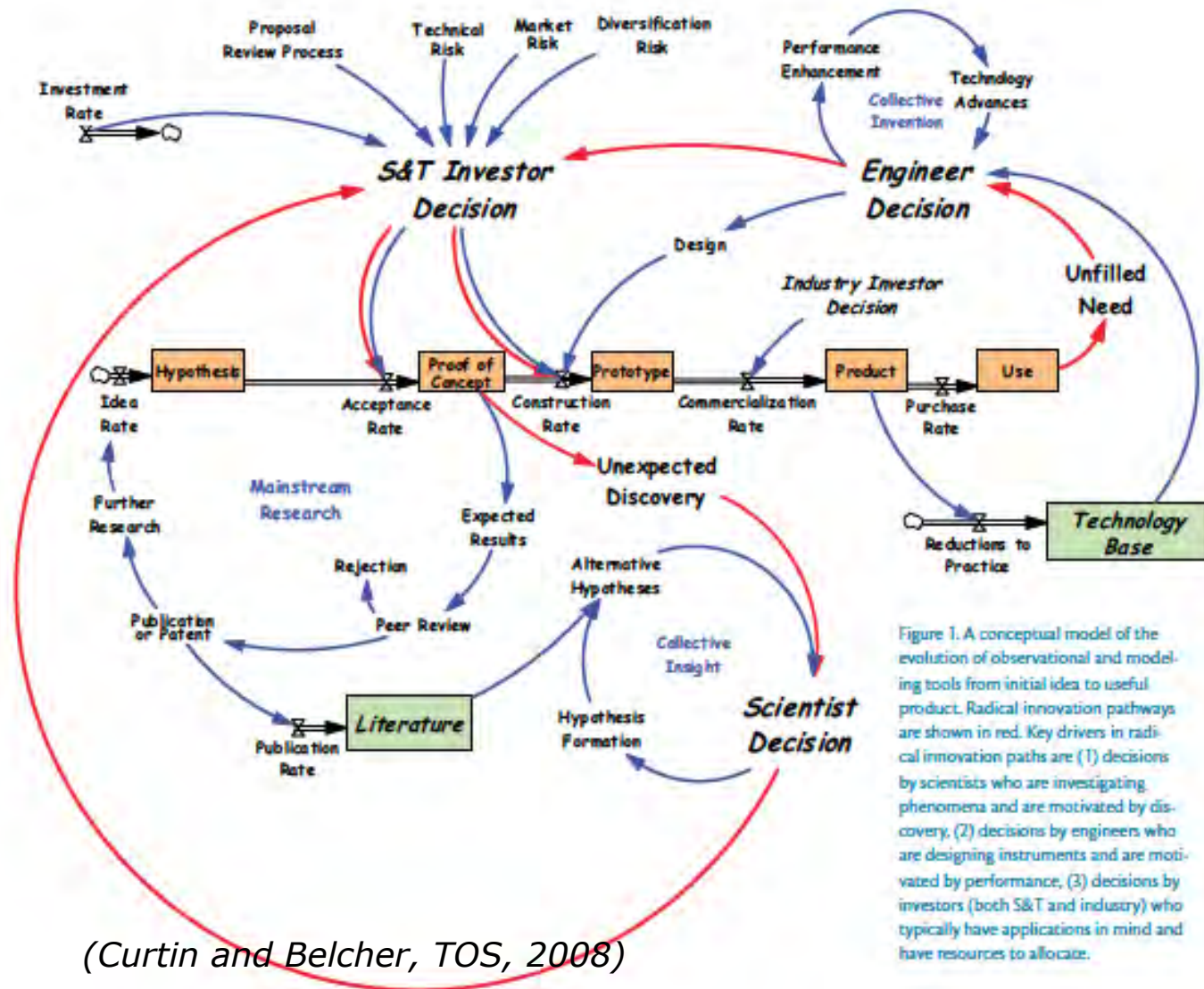
3



(Curtin and Belcher, TOS, 2008)

The innovation process (for advancing instrumentation)

3 key decision centres:



(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.

- MULTI-DISCIPLINARY APPROACH
- INTEGRATION

Data Availability....

OPEN DATA PRINCIPLES

- Discoverable and accessible
- Freely available
- Interoperable, standardized and quality controlled

EU FRAMEWORK

- MARINE KNOWLEDGE 2020;
- EU COM May 8, 2014;

[EU eyes oceans innovation as source of sustainable growth;](#)



Turning DATA INTO JOBS (US - NOAA)....

The role of Ocean Observatories/new Marine Research Infrastructures-MRI- in H2020, Blue Growth, RIS3, ...

- ➔ SOCIB, an example MRI capabilities to **respond to 3 drivers**:
- Science Priorities (ok!)
 - Strategic Society Needs (more listening!: to policy makers & managers endorsement, MSFD -GES- Energy, Tourism, etc.).
 - New Technology Developments (to reach companies, social society endorsement)


➔ **Ocean Observatories/MRI are key innovation elements, well placed to fill science-policy gap in H2020:** mission, vision, critical mass, multi-disciplinary and integrated approach.

➔ Need to define a **JOINT STRATEGY** at European level, more than coordination, **Partnership**...

In Summary

1. New technologies/paradigm change Ocean Observation: Ocean Variability, with shift from Large Scale to Mesoscale and Coasts.
2. Marine Research Infrastructures/Observing Systems in Europe; international leadership -e.g., SOCIB-, & key elements in Blue Growth initiatives (**EU Oceans Innovation COM**) because their:
 - Critical mass
 - Multi-disciplinary approach
 - Integration capabilities of Science, Technology, Society

In other words: ...



**New observing systems with real time open data are
key elements for real innovation initiatives
“Turning data into jobs”**

Efgaristö

감사합니다

kamsahamnida