

Paradigm change in ocean studies: multi-platform
observing and forecasting integrated approach in
response to science and society needs

SOCIB approach...

Joaquín Tintoré and all SOCIB team

Combining Scientific Excellence & Technology Development

with... Impact and Relevance to and for Society

The SOCIB approach.... : A STORY ON

- **Changes in how we do Science & on how we interact with Society**
- **New multi-platform & integrated ocean observing systems are transforming the interplay between humans and the oceans**
- **New era of society engagement and Responsible Research & Innovation.**

The SOCIB approach...

**“THE FUTURE IS
NOW”**

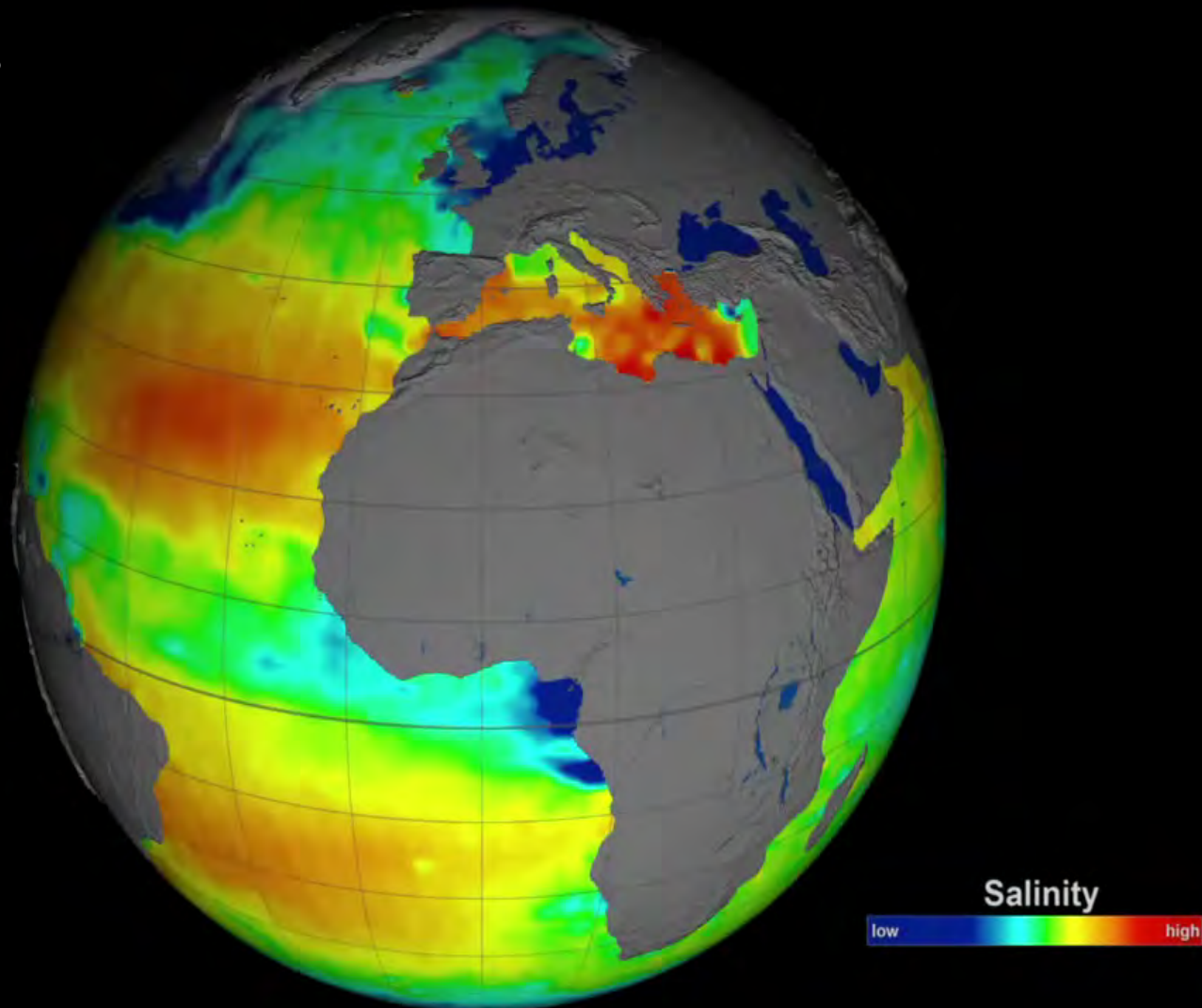
**ARE WE READY FOR
THESE CHANGES ?**

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7, T. Adams⁸, P. Adesso⁵, R. X. Adhikari¹, C. Affeldt⁹, M. Agathos¹⁰,
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S. B. Anderson¹, W. G. Anderson¹⁶, K. Arai¹, M. C. Araya¹, C. Arcene
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ey¹, J. Birch⁷, S. Biscans¹¹, M. Bitossi¹⁸, M. A. Bizouard³⁹, E. Black¹, J
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Our goal... characterise Ocean State AND VARIABILITY at Different Scales (basin, sub-basin, local & coastal interactions)

We need:

- Long time series
- Synoptic data

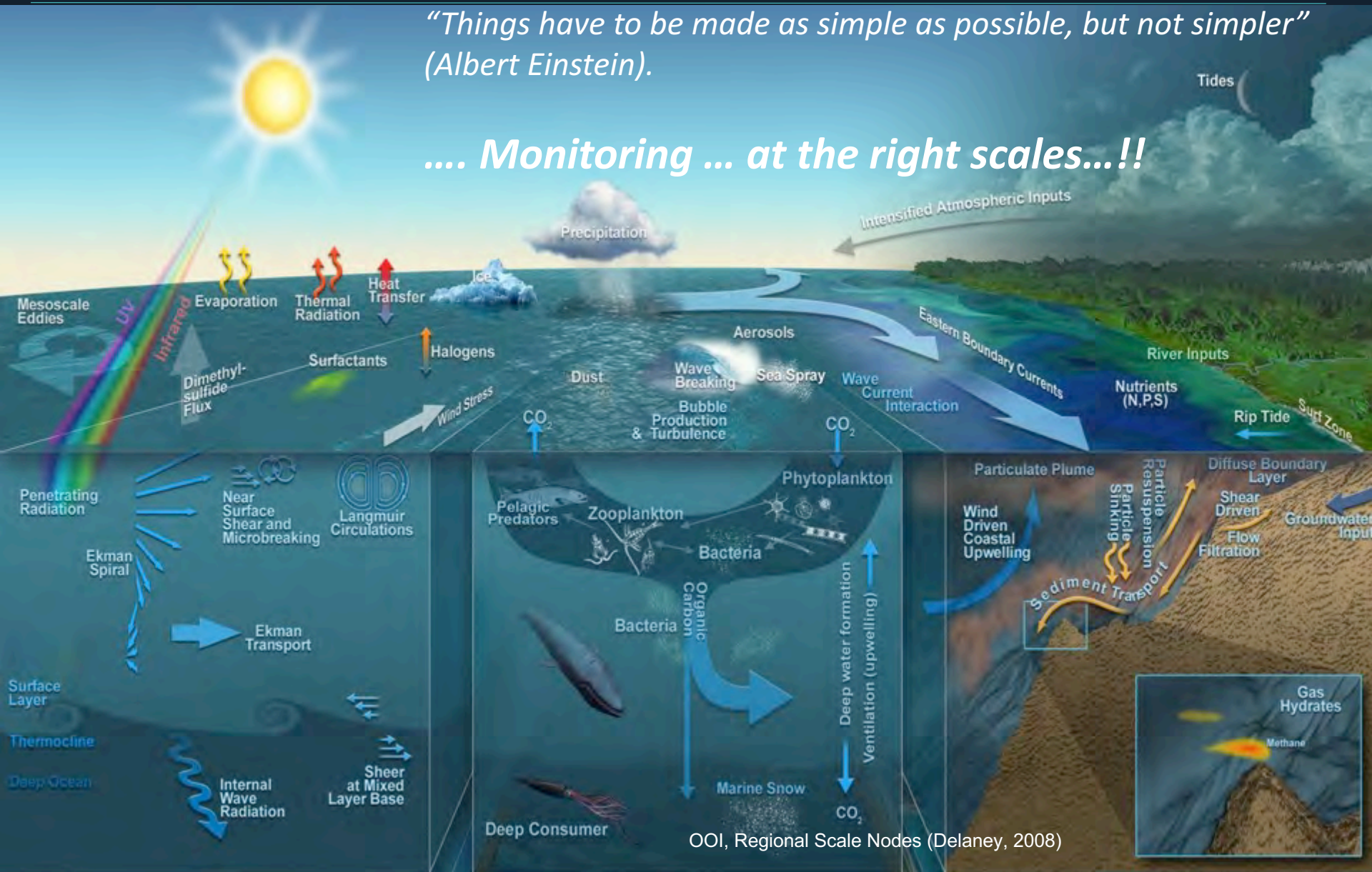


NASA's Aquarius salinity, from December 2011 through December 2012

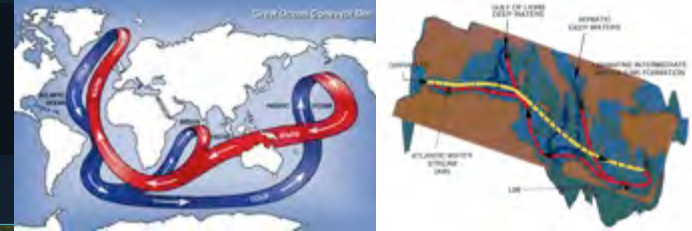
Oceans and coastal interactions. Scales interactions. Management is needed. No oversimplification.

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

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



The Mediterranean Sea

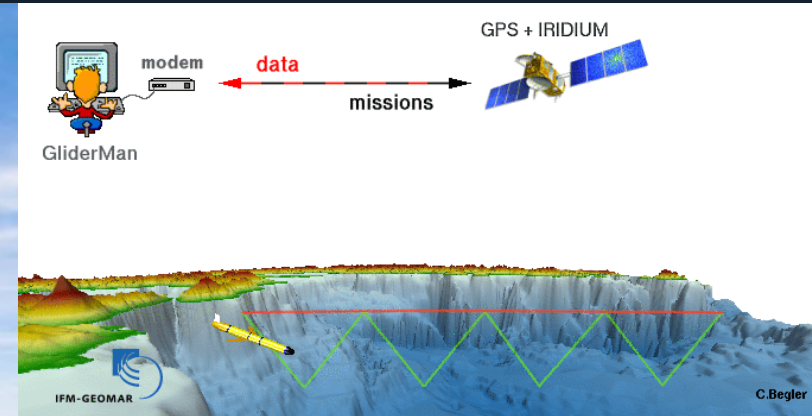


We need: monitoring at the right scale...

- Long time series
- Synoptic data

Small Scale Ocean, key Relevance EU Citizens: Scientific, Societal & Political dimensions
Mediterranean leadership in Europe, for 25 years: EC triggered with MTP.

New Technologies: drivers of change.... (gliders just an example)



New Technologies: Paradigm Shift

→ Ocean Observation

From: Single Platform - Ship based observation

To: Multi-platform observing systems

Platform-centric
Systems

Network - distributed
Systems



(Adapted from Steve Chien, JPL-NASA)

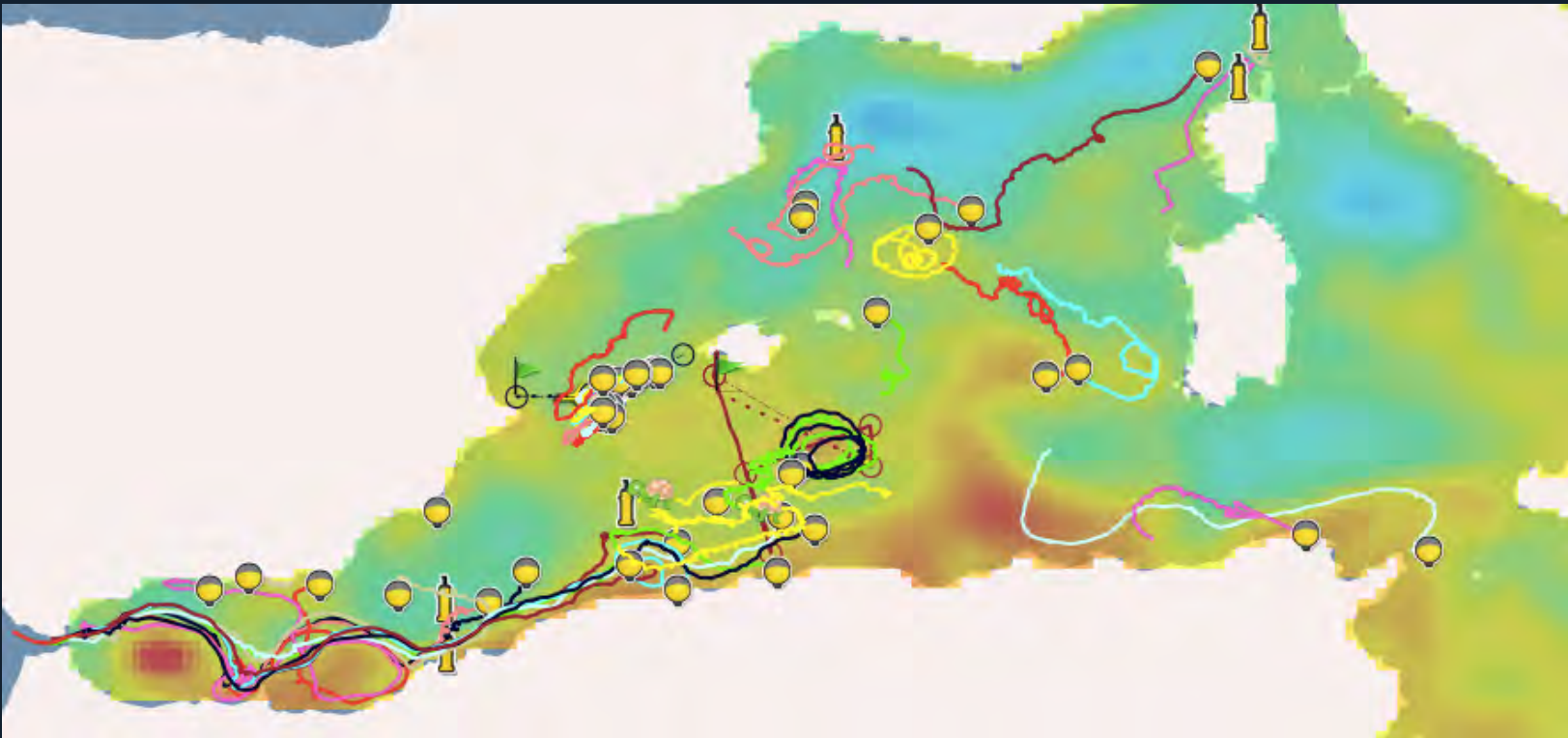
“A single ship can only be in one place at one time. We need to be present in multiple places in multiple times.” ([John Delaney, Nature, Sept. 25, 2013](#))

New Technologies: Paradigm Shift

SOCIB

➔ Data Availability (Real time and QC 'at one click')

Dapp SOCIB: multi-platform real time data available: 40 surface drifters, 4 Argo profilers, 2 sea-turtles, 2 gliders, 2 fixed moorings, 7 tide gages, 3 real time beach monitoring systems). **REALLY ALL AVAILABLE** (not just on paper...)



- ➔ SOCIETAL IMPLICATIONS: Alborán Gyres position and fisheries: (Ruiz et al., 2013: Anchovy landings x 10)
- ➔ SCIENCE IMPLICATIONS: adaptive sampling with gliders...



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

The scientific challenge: oceanic scales, non-linear interactions and implications on variability & forecasting

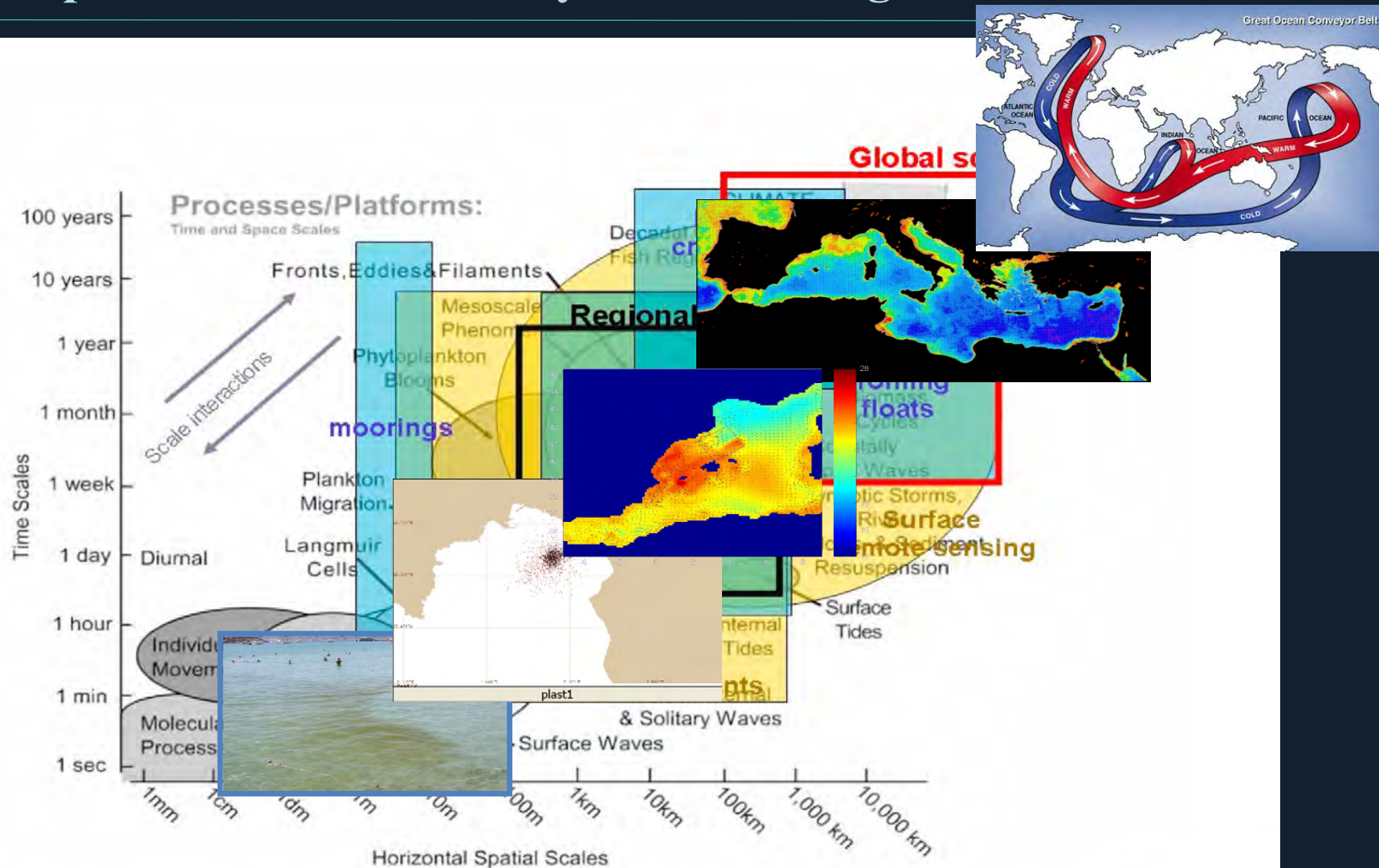
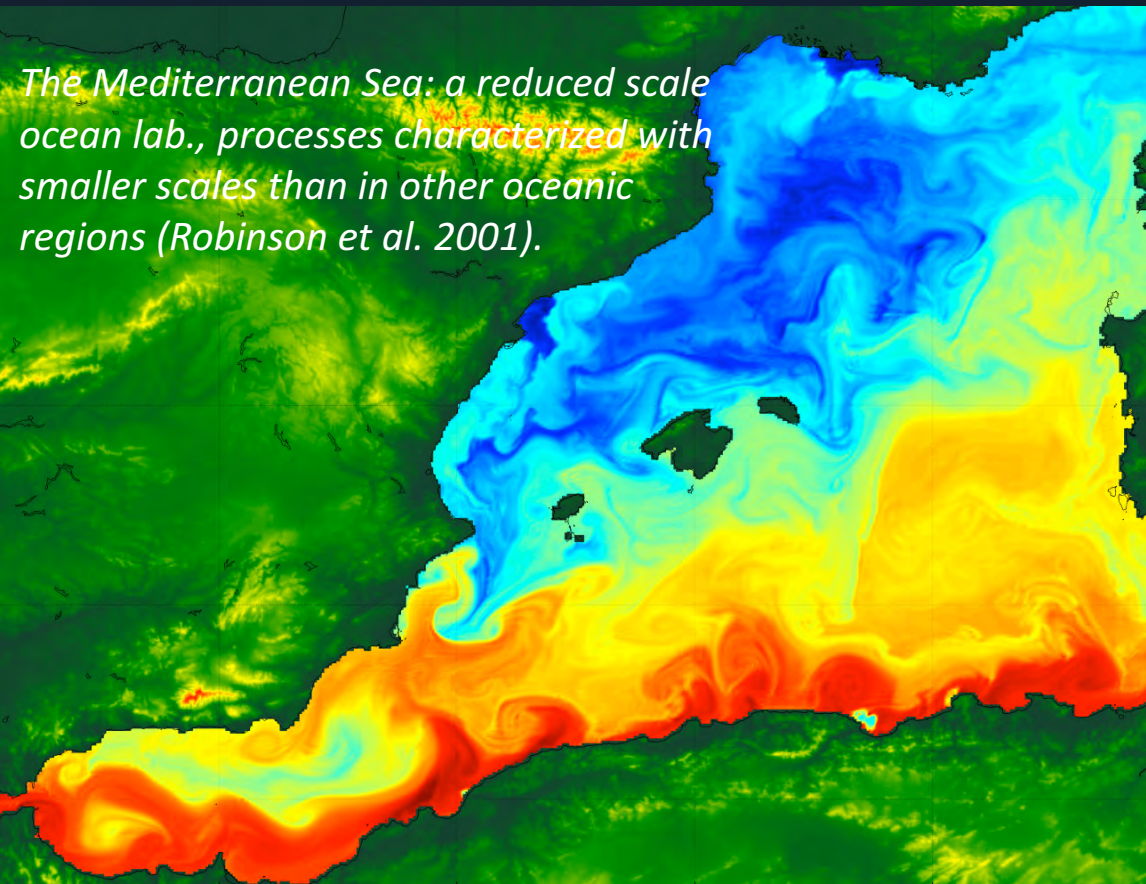
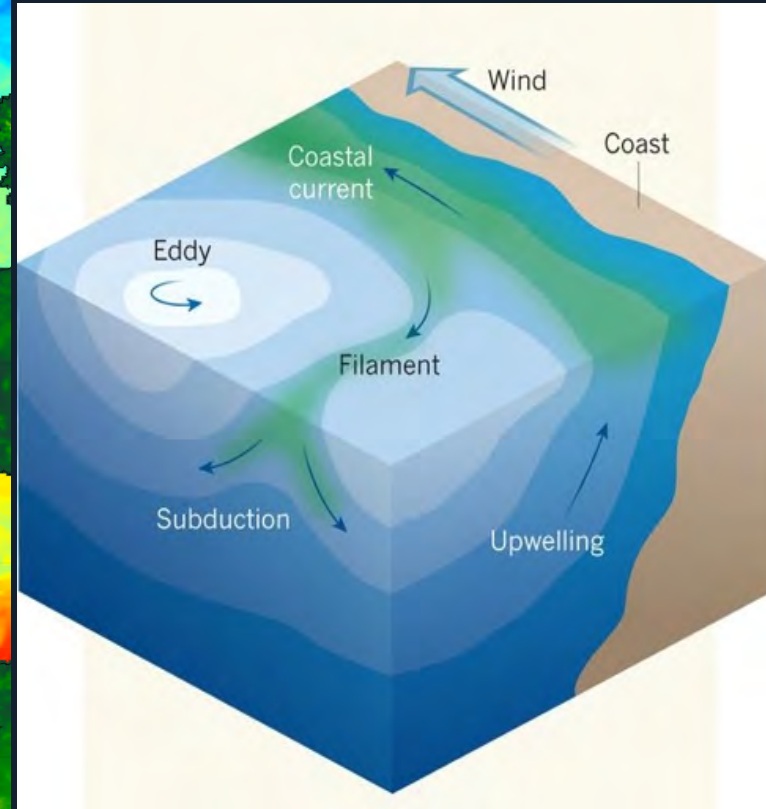


Figure 2. Space vs. time oceanic scales (processes) and the PERSEUS observing platforms; moorings, gliders, R/V, profiling and surface floats showing that today, the scales covered by platforms collecting in situ data (blue areas) can be considered equivalent to the ones collecting surface measurements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

Next decade... Ocean Variability and ... at the right scale...meso & sub-mesoscale. The Ocean Weather



Theory and observations have shown a maximum energy at the mesoscale/fronts & eddies ~10-100km



Mahadevan (Nature, 2014)

What is SOCIB?: A Marine Research Infrastructure: a multi-platform observing system, from nearshore to open-ocean



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

3 DRIVERS

- Science priorities
- Technology Development
- Society Needs

OPEN DATA PRINCIPLES

ACCESS MODES

- Free/open data
- Endurance lines
- External Open Access.



Proposal 2006. Approved in 2009.
Operational since 2014.

Scientific production:
94 papers, 2011 – 2017
10 projects 2014-2017

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



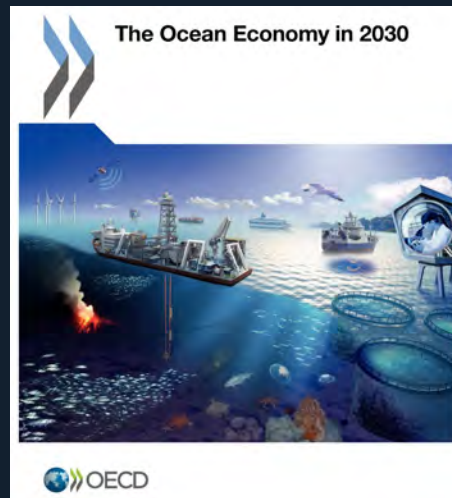
SOCIB & IMEDEA (CSIC-UIB) Team



TEAM WORK: “Connecting the pieces of an N dimensionl Planet Ocean puzzle”

Science with and for Society: international frame

Sustainability & Ocean Innovation



“The Blue Economy is a knowledge based economy looking to the sea, not really for extraction of natural goods but for data to address societal challenges and inspire solutions” (R. Spinrad).

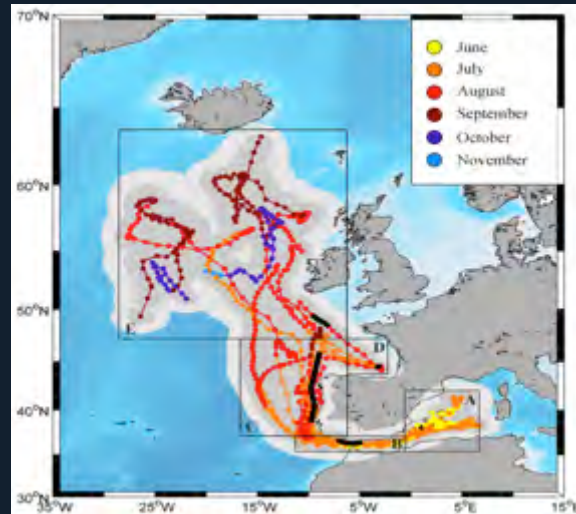
Multi-Platform Observation & integration Bluefin Tuna: ocean variability & species ecology to improve population stock assessment



Balearic Islands
Coastal Observing
and Forecasting
System



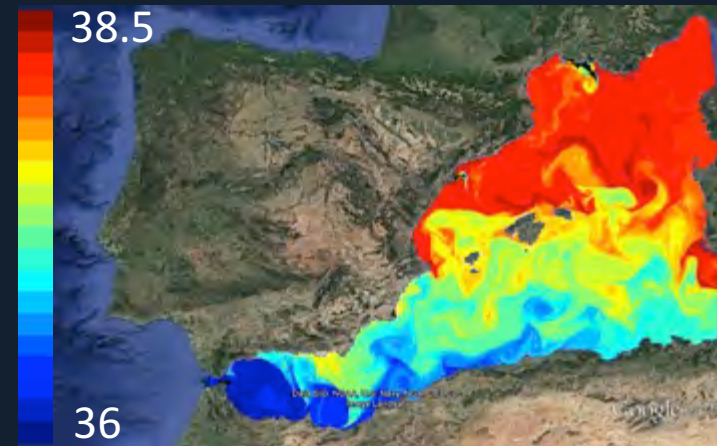
Migration patterns along the year
(Eastern Stock)



Aranda et al, Pone 2013



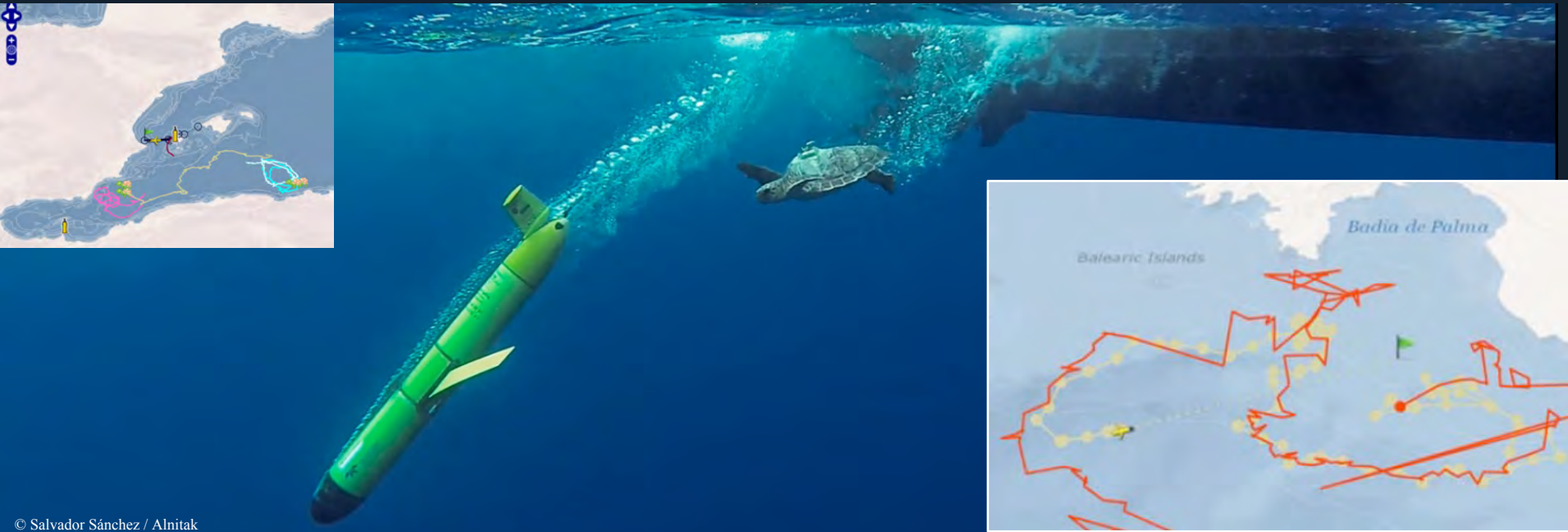
Sea Surface salinity (06/2016)



Alvarez-Berastegui et al. (ICES
JMSc. 2016)



Multi-Platform Observation & integration of seaturtles



SEA
TURTLE



GLIDER



DRIFTING BUOYS



SATELIITE

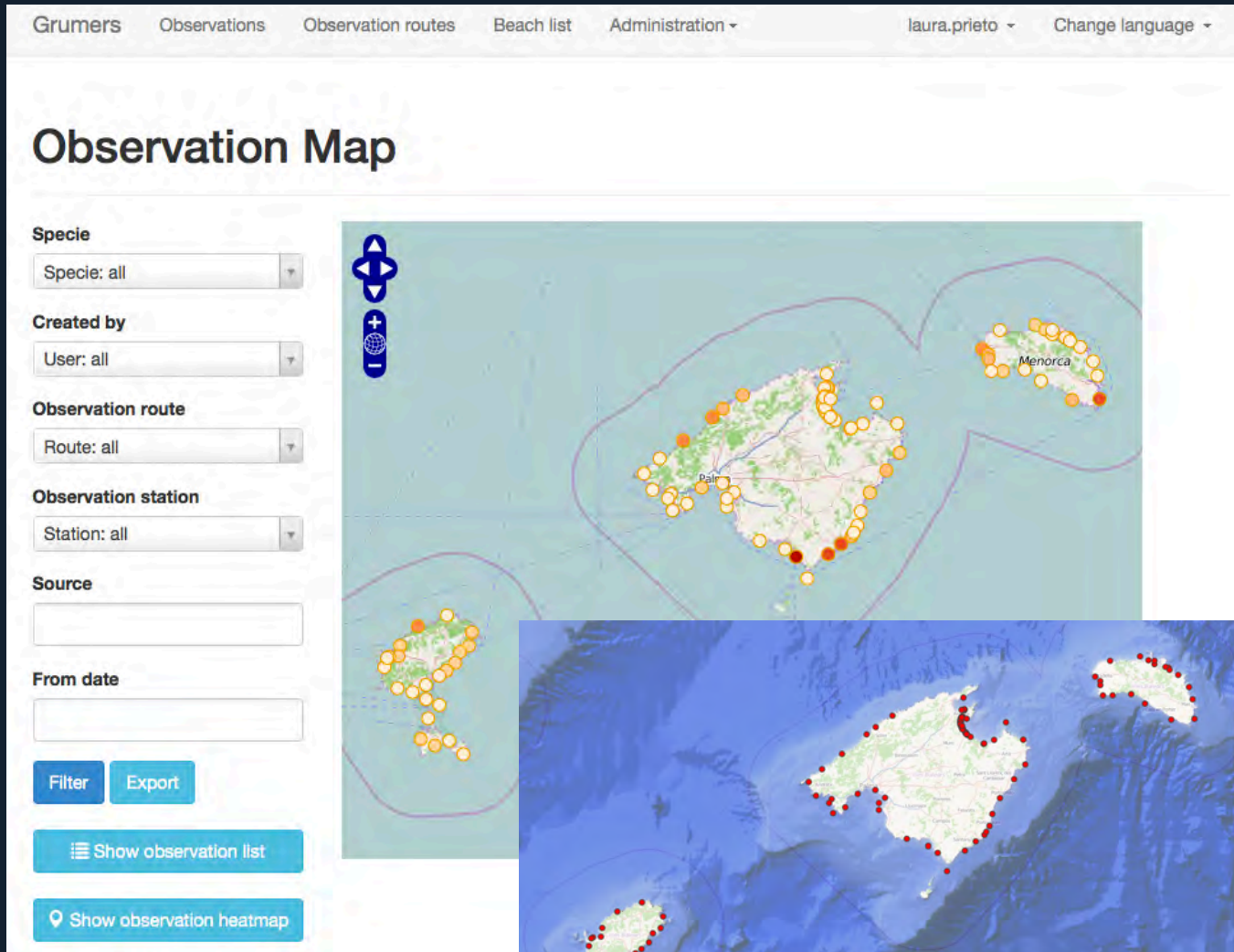


NUMERICAL MODELS



AIS ANTENNAS

Multi-Platform Observation & Jellyfish: Partnership for routine, systematic observations



2014-2016

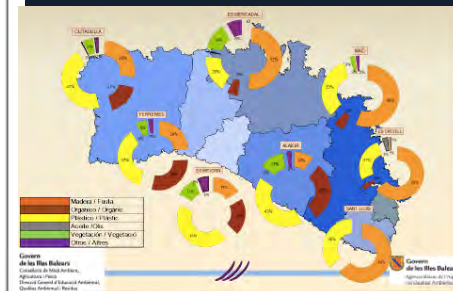
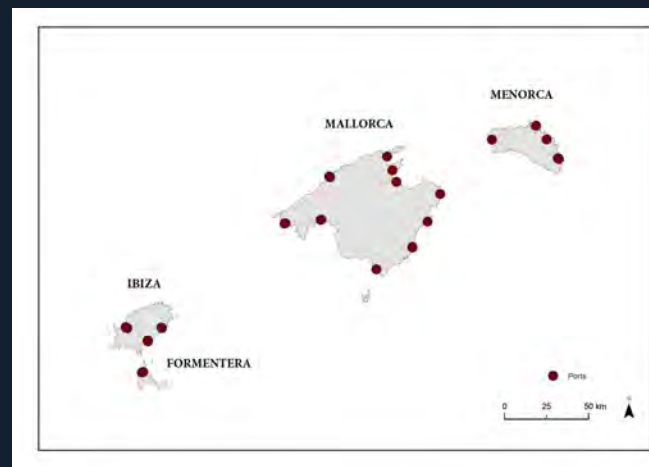
- 5 MPA's (9 pts of observation)
- 33 rutas de los servicios de limpieza con barcas (66 puntos obs.)
- 120 playas (DG Emergencia)

Multi-Platform Observation & Plastic debris accumulation areas, tools.



Balearic Islands Sustained and Systematic monitoring system covers 4 islands, 33 boats, 18 harbours.

- Abundance
- Characterization



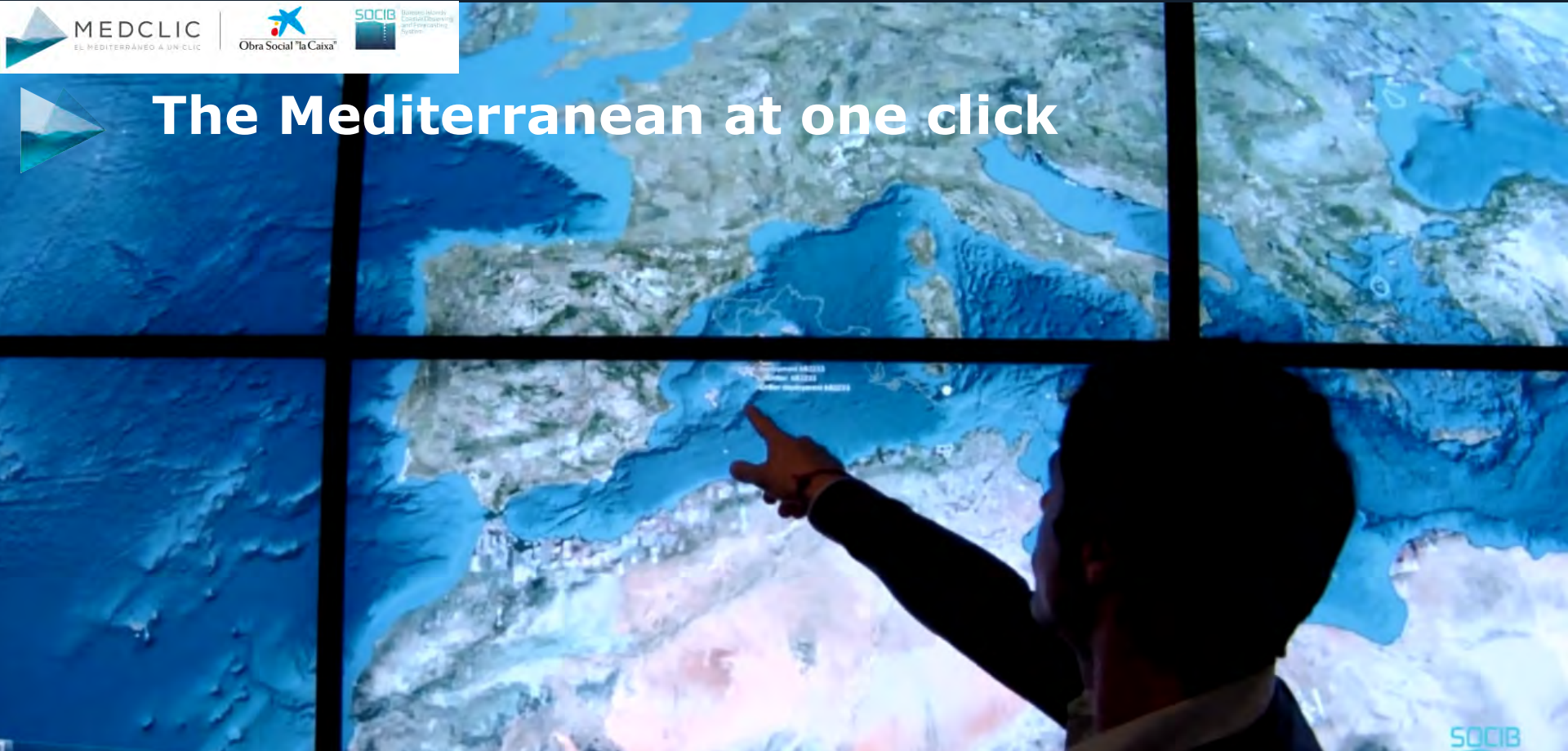
Summary of total marine debris collected during the 2015 survey (kg) in the Balearic Islands.

Month	Plastic	Wood	Organic Material	Oil	Vegetation	Other
May	5045.35	4927.77	1356.76	137.95	1907.21	756.55
June	9641.96	6049.66	1674.65	34.99	2720.92	1148.65
July	14062.8	6412.68	882.28	75.62	4411.2	1317.67
August	17035.9	6402.1	1041.06	191.5	6310.75	1247.41
September	7323.74	3230.6	820.48	33.79	2652.99	892.92
Total	53109.75	27022.81	5775.23	473.85	18003.07	5363.2

SOCIB Outreach and Education; MEDCLIC to bridge the Science-Society gap.



The Mediterranean at one click



- **Disseminate Science:** good... but not enough to share the importance of the ocean for future generations: we need to involve society...
- **Engage Society:** educational activities & online & open materials

SOCIB Outreach and Education; MEDCLIC




NEW PHASE COMMUNITY ENGAGEMENT; *“We are entering a new phase of community engagement in which scientists and society, educators, are encouraged to use the data, provide feedback on data access ease and quality and in the process, expand our knowledge on the coastal oceans”* — Fulweiler, Gawarkiewicz, Davis, OOI, EOS, August 1st, pag. 9, 2016)

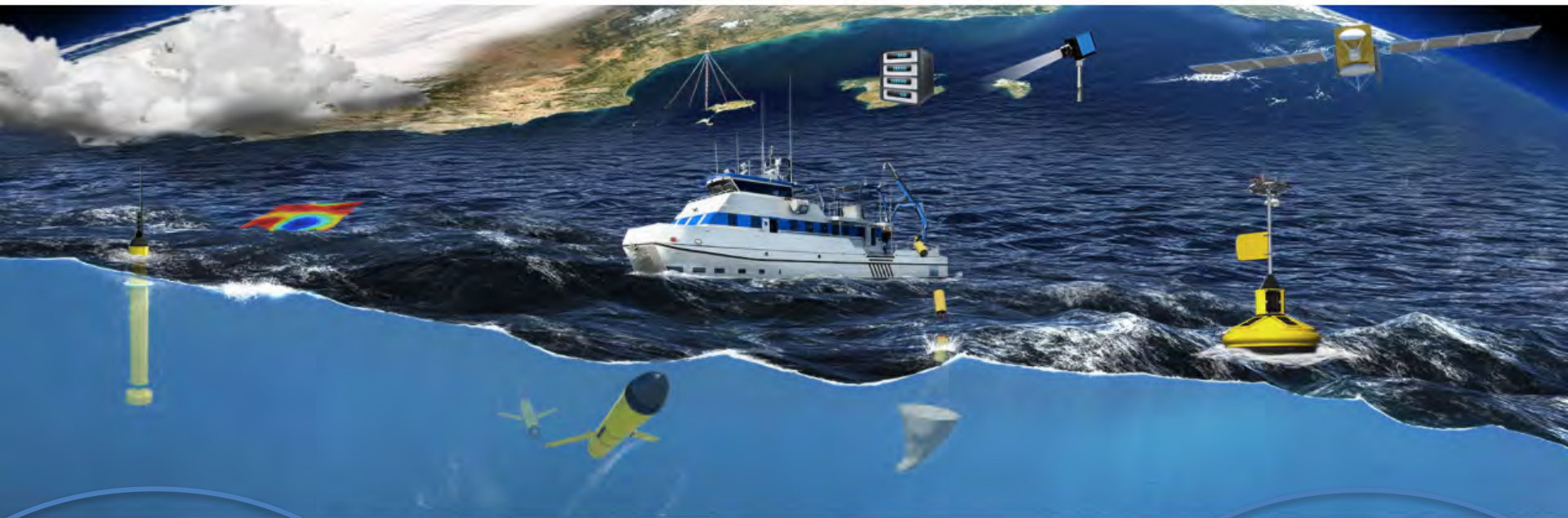
MEDCLIC: the Mediterranean at one click

www.medclic.es



EN / CA / ES

THE PROJECT EXPLORE DIVULGATION NEWS  



Educational Activities

- Workshops kids & teachers
- Training workshops for teachers
- Visits to R/V Cat SOCIB
- Scientific fairs

MEDCLIC: THE MEDITERRANEAN IN ONE CLICK

We invite you to immerse yourself in a sea of information thanks to the multiple operating systems which are currently monitoring the Western Mediterranean, collecting real-time data which is accessible to all of society.

Explore the different observation systems, **learn** about temperature and wave forecasting and **discover** the importance of oceanographic research.

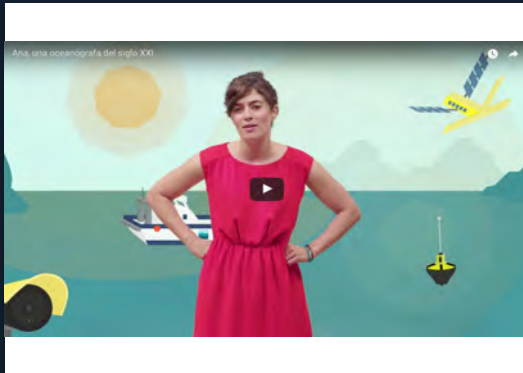
Online Educational Material / Resources

- Teaching Units
- Videos
- Videogames
- Audiovisuals

MEDCLIC: the Mediterranean at one click

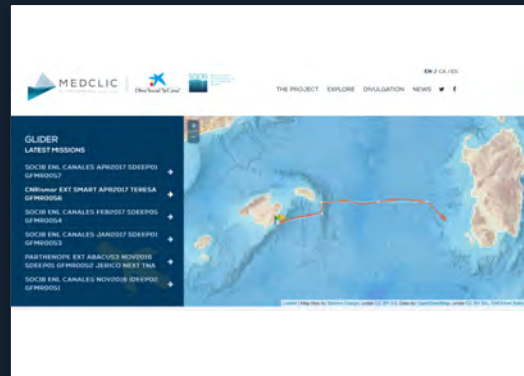
Multimedia / Interactive Outreach Platform

Ana, an oceanographer of the 21st century



Encourage vocations
32 videos available !

Check a glider's mission
minute by minute



Connected to
science

Face the challenge: Handle an
emergency at the sea!



Learn by playing

MEDCLIC: the Mediterranean at one click

For teachers

Educational materials









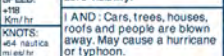


Workshops



MEDCLIC: the Mediterranean at one click

For students

Educational materials

		
STRONG STORM (SEVERE GALE)	HEAVY STORM (WHOLE GALE)	VIOLENT STORM (HURRICANE)
FORCE: 9	FORCE: 10	FORCE: 11
SEA: Very high, breaking waves. Reduced visibility.	SEA: Very high waves with overhanging crests. The sea's surface is white.	SEA: Exceptionally high waves, completely white sea, severely reduced visibility.
SPEED: 75 to 88 Km/hr	SPEED: 89 to 102 Km/hr	SPEED: 103 to 117 Km/hr
WIND: 41 to 47 mps/10 mps/hr	WIND: 48 to 55 mps/11 mps/hr	WIND: 56 to 63 mps/12 mps/hr
AND: Damage to trees, impossible to walk against the wind.	AND: Trees uprooted, structural damage to buildings.	AND: Cars, trees, houses, roofs and people are blown away. It causes damage everywhere.
		
HURRICANE FORCE (HURRICANE)		
FORCE: 12		
SEA: Huge waves, white sea, zero visibility.		
SPEED: 118 Km/hr		
WIND: 64 mps/14 mps/hr		
AND: Cars, trees, houses, roofs and people are blown away. May cause a hurricane or typhoon.		
		



Workshops and fairs



MEDCLIC: the Mediterranean at one click

For all the society

Talks and conferences



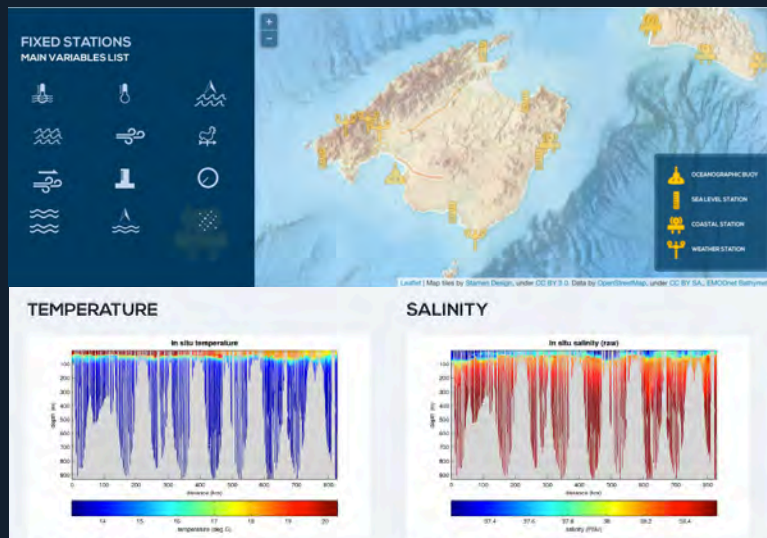
Open days visits to the Research Vessel



MEDCLIC: the Mediterranean at one click

Science for society

Data relevant to the community



Mass media outreach



MEDCLIC & JERICO-NEXT: Outreach & Education

www.followtheglider.socib.es

STUDENTS | TEACHERS | EXPLORE



ESPAÑOL

FOLLOW
THE GLIDER

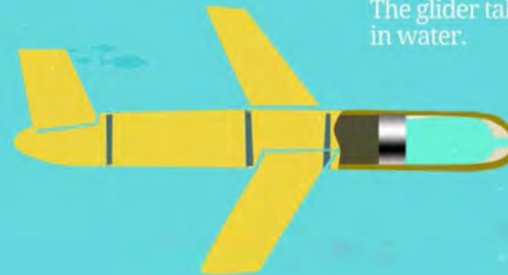


EXPLORE

Where are our gliders today



DISCOVER THE OCEAN'S
SECRETS WITH
UNDERWATER GLIDERS



The glider takes
in water.

SOCIB: ICTS SOCIB
Sistema d'observació i predicció costaner
Illes Balears +034 971 43 99 98

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MEDCLIC & JERICO-NEXT: Outreach & Education

Educational material, Guided visits for students and workshops for teachers



MEDCLIC and “La Mar de Ciencia” Contest

National Contest for young artists who are interested in science and the sea



INICIO PREMIADOS BASES INSPIRATE OTRAS EDICIONES ACTUALIDAD PREGUNTAS FRECUENTES CONTACTO

CAST / CAT



PARTICIPATION Numbers...

- 1800 kids
- 400 schools
- 250 teachers
- 300 parents
- 20,000 web visits
- 90,000 registered users
- 200 registers in media

MEDCLIC and “La Mar de Ciencia” Contest

Online resources:
www.lamardeciencia.es

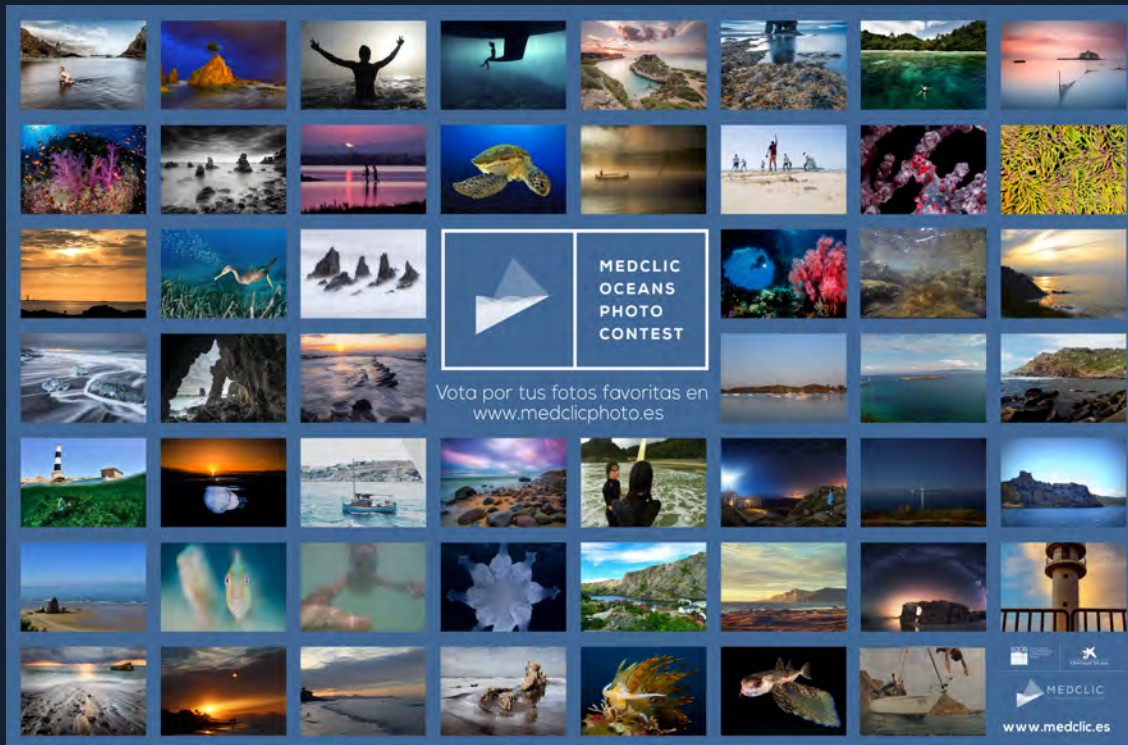


Oceanographic campaign to the Cabrera National Park



MEDCLIC-photo

National Contest to celebrate the beauty and diversity of our seas and oceans



The SOCIB approach.... : A STORY ON

- **Changes in how we do Science & on how we interact with Society**
- **New multi-platform & integrated real time ocean observing systems are transforming the interplay between humans and the oceans**
- **New era of society engagement and ... Responsible Research & Innovation**



Some examples....

Open data integrated observing systems are key elements for new real time innovation initiatives in particular in Outreach, Education, Communication... a new era of Society Engagement & RRI

SOCIB Approach; integrating science, technology and society



Merci !

“Le véritable voyage de découverte ne consiste pas à chercher de nouveaux paysages, mais à avoir de nouveaux yeux” (Marcel Proust)

“The real voyage of discovery consists not in seeking new landscapes, but in having new eyes”.

- A. Facebook @ICTSSOCIB, 1196 followers
- B. Twitter @socib_icts, 1470 followers
- C. Youtube Outreach SOCIB, 102 followers , 17 reproduction lists



SOCIB Approach; integrating science, technology and society

THANKS TO....

