

# A paradigm change in ocean studies: multi-platform observing and forecasting integrated approach in response to science and society

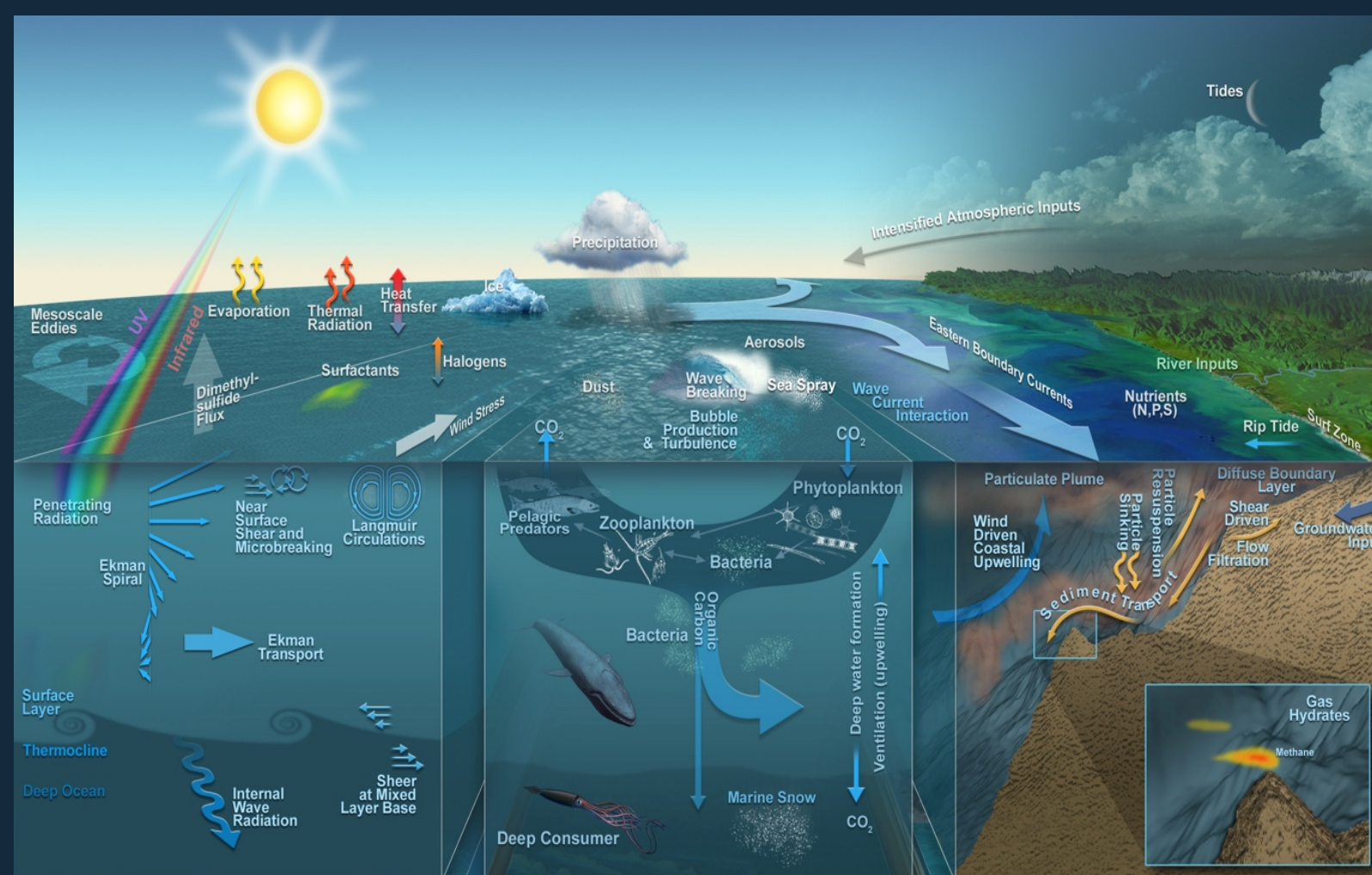
## 01 Observing ocean state, variability & ecosystem response



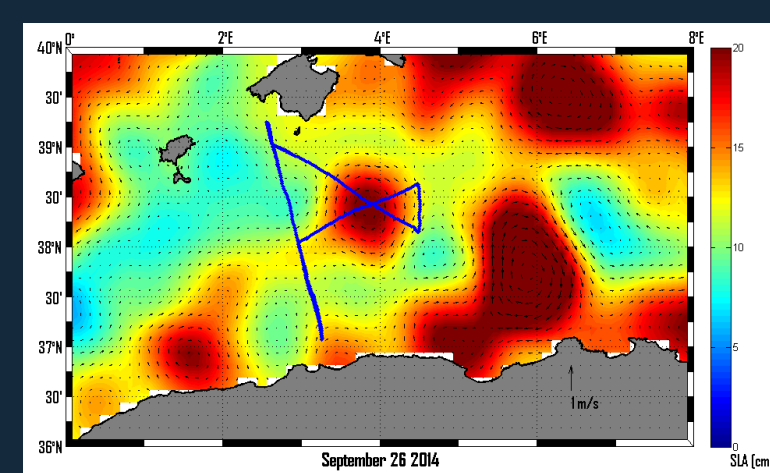
In the last 20 years marine research has focused on a description of the state of the large scale ocean circulation. From this we have begun to understand how biogeochemical distributions are set and how the ocean and atmosphere interact to determine climate. However the ocean varies on a wide range of spatial and temporal scales, and understanding ocean state, variability & ecosystem response is the new challenge.

### New Multi-Platform Observing Systems:

- From nearshore to open ocean,
- Streams of data available
- Monitoring at the right scales: meso & submeso
- Adaptive sampling
- Science, society & technology driven



OOI, Regional Scale Nodes (Delaney, 2008)



"We need data, ... models are becoming untestable" (Carl Wunsch 2010)

Real time adaptive monitoring by gliders SOCIB

## 02 New Capabilities:

### Multi-platform ocean observation:

**From:** ship based observation  
**To:** multi-platform observing systems

### Data availability:

**From:** data only available 12-24 months after cruises  
**To:** quasi real time quality controlled data available

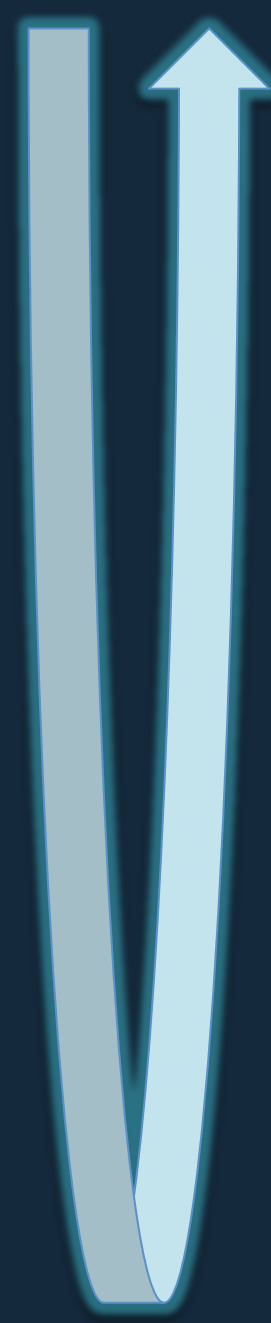
### High-resolution model simulations

**Daily forecasts:** ocean circulation, waves, meteotsunamis nested to CMEMS MED MFC  
**Multi-year hindcasts**

New monitoring and modelling technologies have emerged allowing near real-time observation and forecasting of the ocean at regional and local scales.

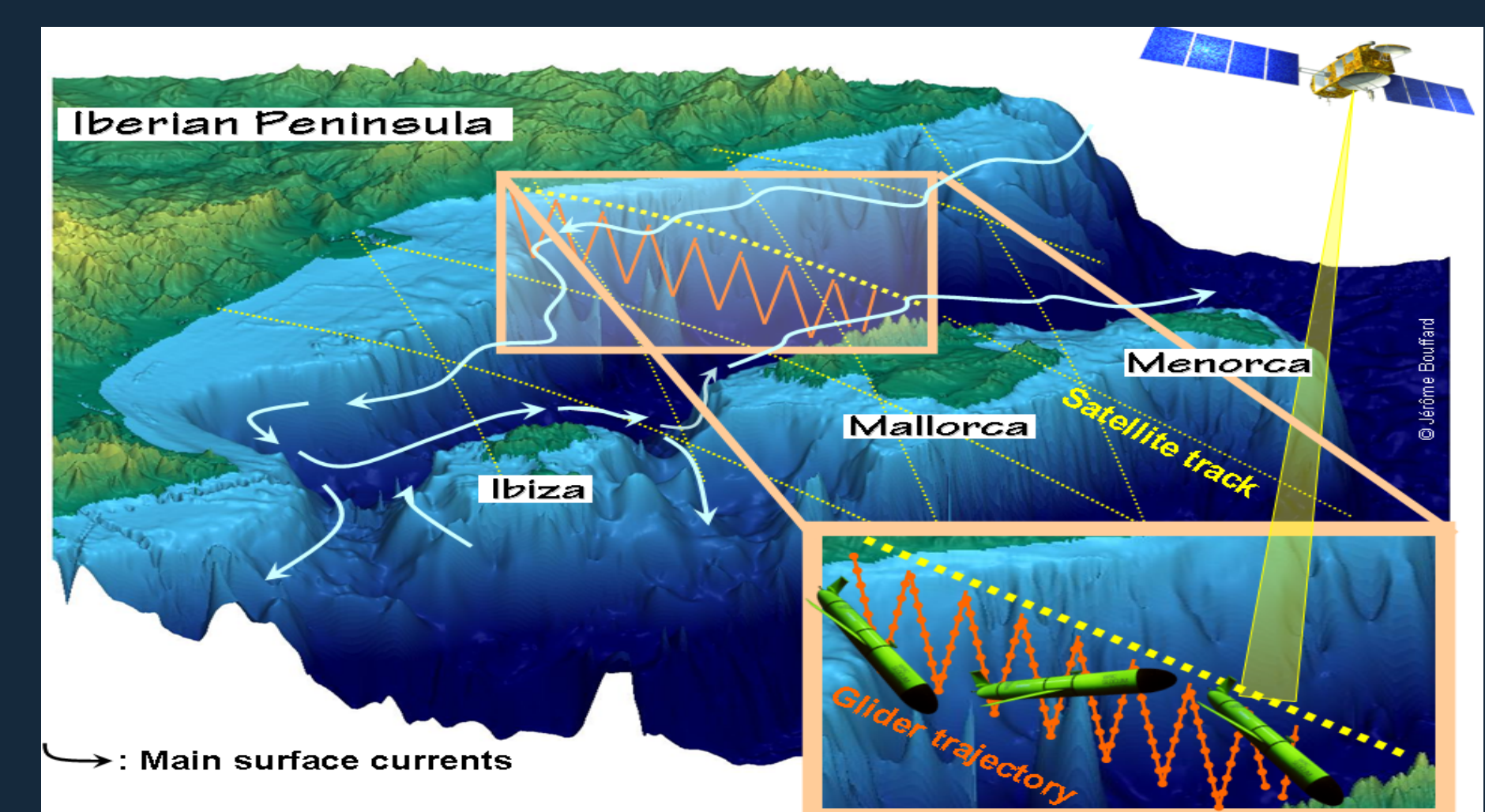
Delivering new capabilities to characterise the ocean state and more importantly, its variability at smaller spatial and temporal scales, in quasi-real time.

## 03 The new challenge: integration & smaller scales



1. Monitoring at smaller scales, to resolve sub-basin/sub-seasonal dynamics, establish interannual to decadal variability and bias
2. Advance best practice across platforms to deliver high quality RT & DM data streams
3. Connect coast to open ocean & enhance model forecast through validation & multi-platform assimilation
4. Integrate across the observing system to deliver data, services, & knowledge to support decision making

*For climate, operational ocean services, and ocean health*

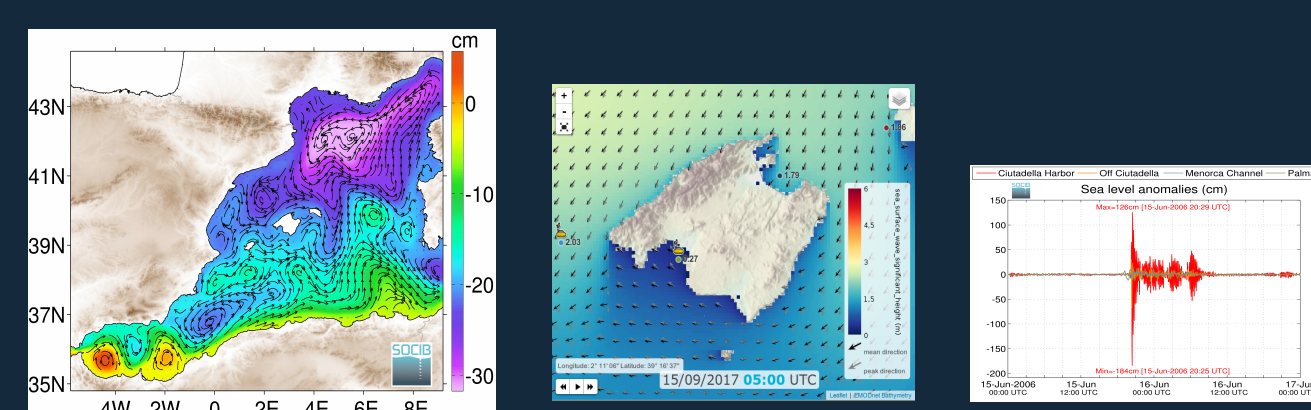


## 04 Multi-platform observing



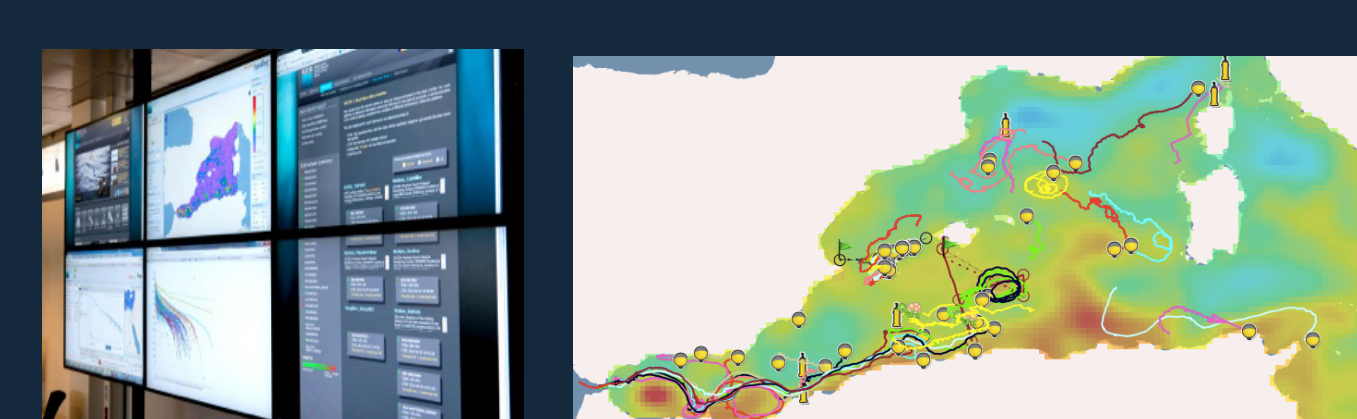
MULTI-PLATFORM OBSERVING AT MULTI-SCALES, FROM COAST TO OPEN OCEAN; SHIP, GLIDER, ARGO, DRIFTERS, MOORINGS, TIDE-GUAGES, BEACH MONITORING, HF RADAR.

## Ocean Forecasting



OCEAN FORECAST & VALIDATION, HINDCAST, DATA ASSIMILATION, ECOSYSTEM INTEGRATION, WAVES & METEOTSUNAMIS.

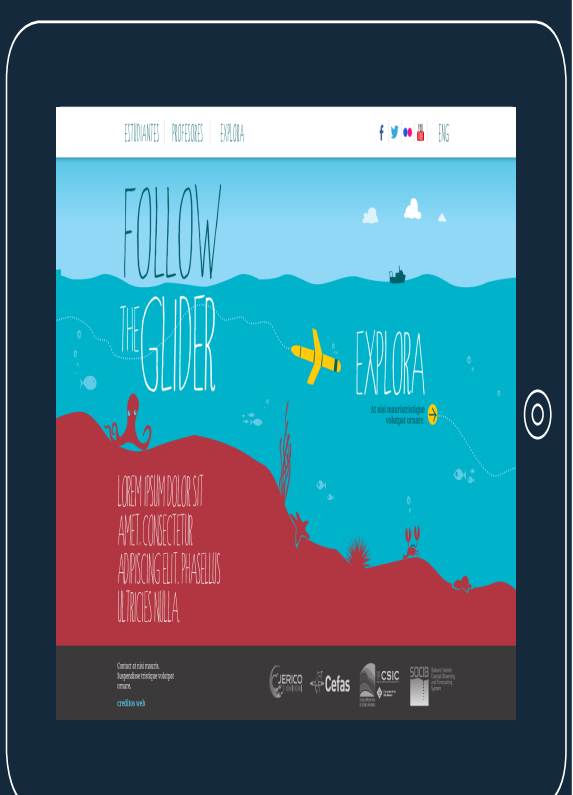
## Data Centre



REAL-TIME & DELAYED MODE DATA, OPEN ACCESS, RT QUALITY CONTROL, OBSERVATIONS & MODEL DATA.

## Outreach

SOCIB WEBSITE, EDUCATIONAL TOOLS, TRAINING FOR TRAINERS, WEB DESIGN & ACCESSIBILITY.



## 05 Delivering value from an integrated approach

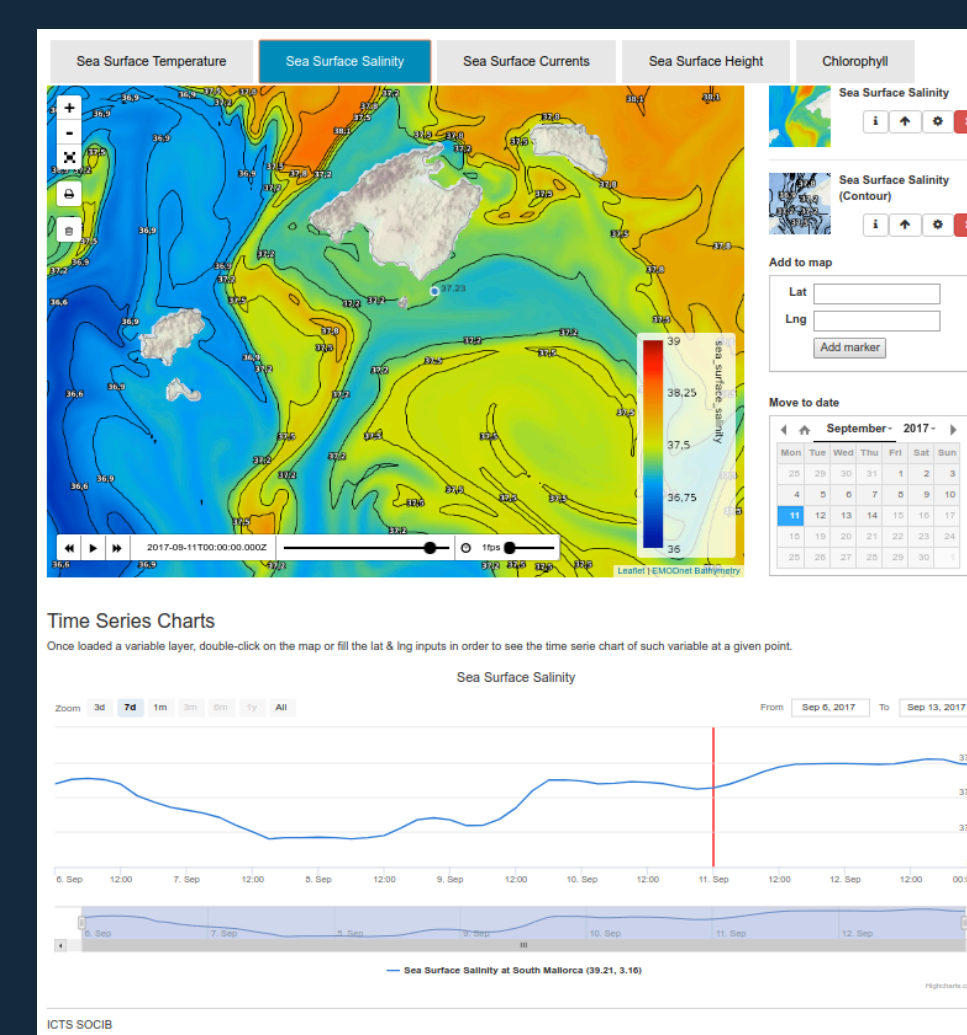
HIGHLIGHTS from integrating across the system to deliver VALUE for science and society

### Science

- Scientific Production: 95 papers in peer reviewed journals from 2011-2017,.
- Research Projects: 13 external projects from 2013 – 2017, among others CMEMS IN SITU TAC, MEDSEACHECKPOINT, ODIP2,, JERICO-NEXT, MedSUB, INCREASE, etc.
- Observational Capacities: 120 days ship time for 2017 (Dec/Nov estimated). Gliders, 379 days, 3825 nm, & 16935 profiles sampled by the glider fleet in 2016
- 3 SOCIB research projects; Bluefin Tuna (SOCIB/IEO), Jellyfish (SOCIB/CSIC/CAIB) and Gliding Turtles (SOCIB/Fundacion BBVA)
- 2 multi-platform process studies; ALBOREX (SOCIB/IMEDEA/PERSEUS), IRENE (SOCIB/IMEDEA/ONR)

### Products & Services

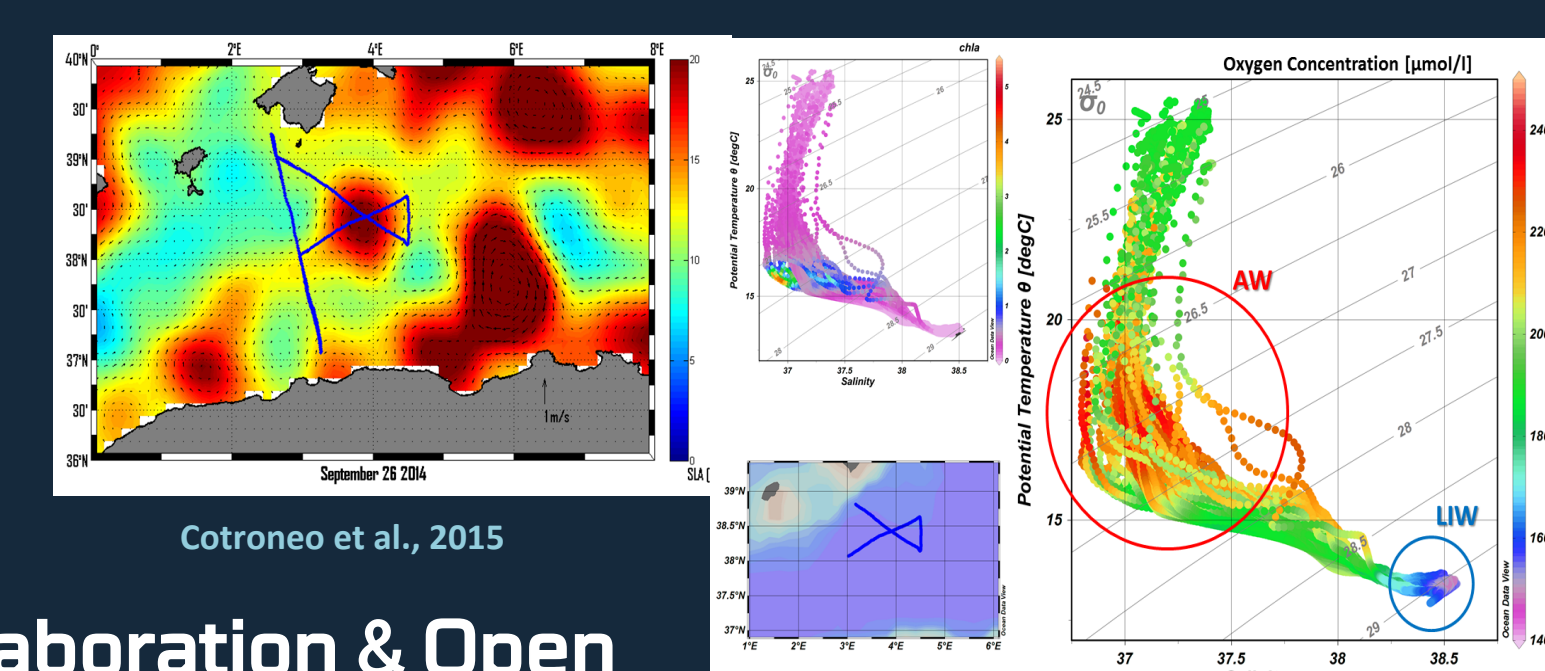
- Strategy – sector, data value & match with SOCIB capabilities
- 10 target sectors identified
- All data free and available online
- New sector focused products for user groups, developed following minimum viable product (MVP) principals



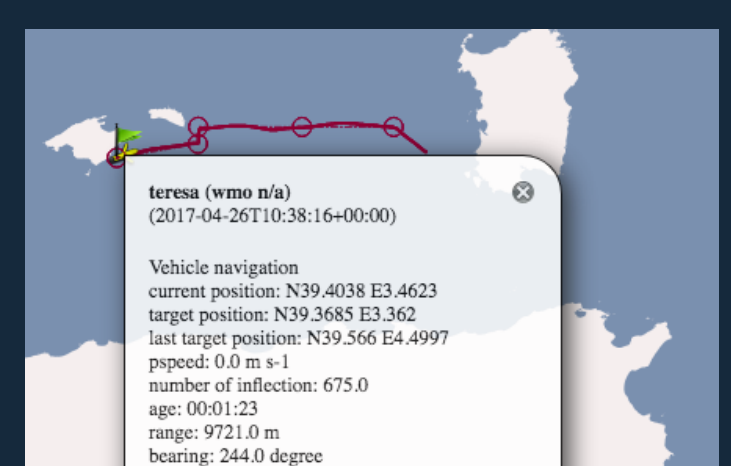
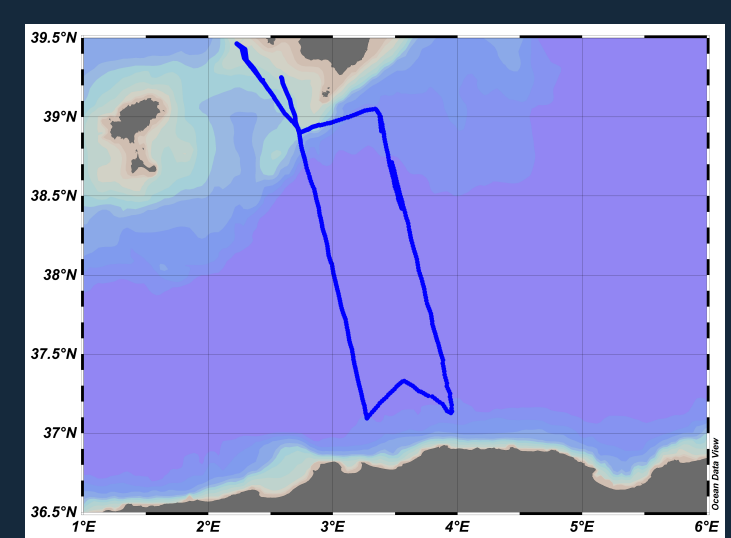
Sustainable Marine Resources Planning Tool

### Collaboration & Open Access to facilities

- SOCIB Open Access program for glider and ship time, including data availability
- JERICO and JERICO-NEXT Trans-National Access (TNA) – 4 glider missions - proto endurance lines in under sampled regions
- ISMAR/SOCIB Collaboration – Open Access & MOU – ISMAR glider, SOCIB piloting & ground support, Sardinia to Mallorca. Leveraging infrastructure for new endurance line monitoring



Cotroneo et al., 2015



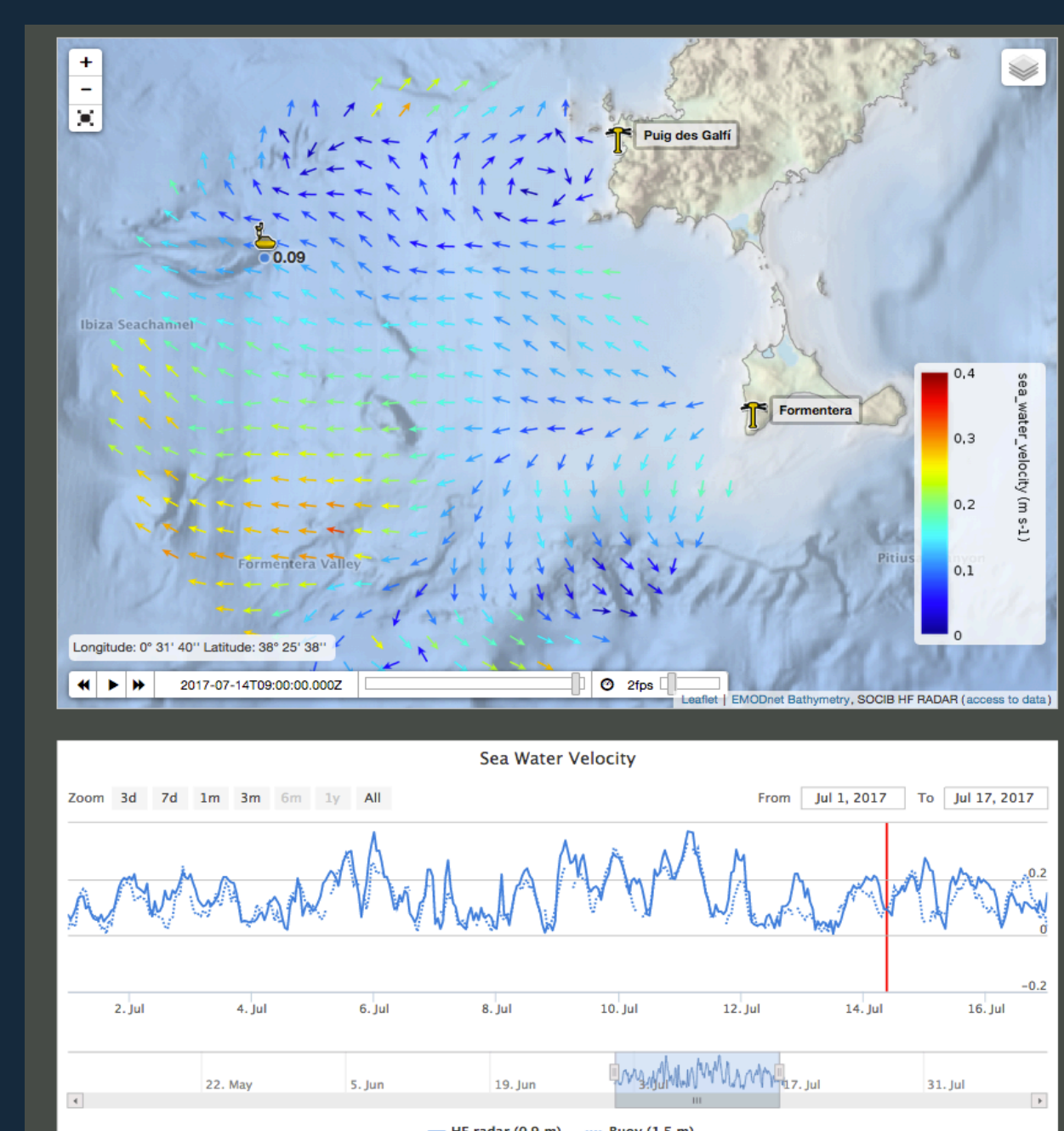
## 06 CMEMS and future challenges

### 1. CMEMS & SOCIB

- CMEMS data used: MED-MFC forecast and re-analysis products (T, S, u, v, SSH), altimetry products, NRT & re-processed SST & interpolated Chl-a
- In SOCIB services: Model boundary forcing, inter-comparisons, evaluation, data assimilation, RT deployment/mission planning & downstream products

### 2. HF Radar: new dataset for 2018

- Near real-time (NRT) coastal surface current monitoring, in the Ibiza Channel, with quality controlled data distribution and validation.
- Automatic monthly QUIDs available and NRT warnings to monitor the service.
- Keystone for validation and assimilation of MFCs.
- HFR data applications: data-gap filling, Lagrangian Coherent Structures, etc.



### 3. Future challenge - two-way communication

- From users of CMEMS back to observing systems
- New communication channels enabling response to user needs, information on data accuracy, coverage, variables, model validation and assimilation

**SOCIB** Balearic Islands Coastal Observing and Forecasting System