SOCIB Balearic Islands Coastal Observing and Forecasting System

MINISTERIO DE CIENCIA E INNOVACIÓN

CSIC Consejo Superior de Investigaciones Científicas

GOVERN ILLES BALEARS

Surface drifters in the Western Mediterranean Sea

SOCIB deployments [2011-2023]

Lara Díaz-Barroso, Irene Lizarán, Emma Reyes, Mélanie Juza, Juan Gabriel Fernández, Sonia Gómara, Verónica Ortiz, Llúcia Ribot, Rosa Rodríguez, Shaun Dolk, Rick Lumpkin, Long Jiang, Mathieu Belbeoch, Lucia Bertero, Joaquín Tintoré.

First DBCP Mediterranean Training Workshop on Ocean Observations and Data Applications-Part 2

2 - 4 May 2023, Tunisia

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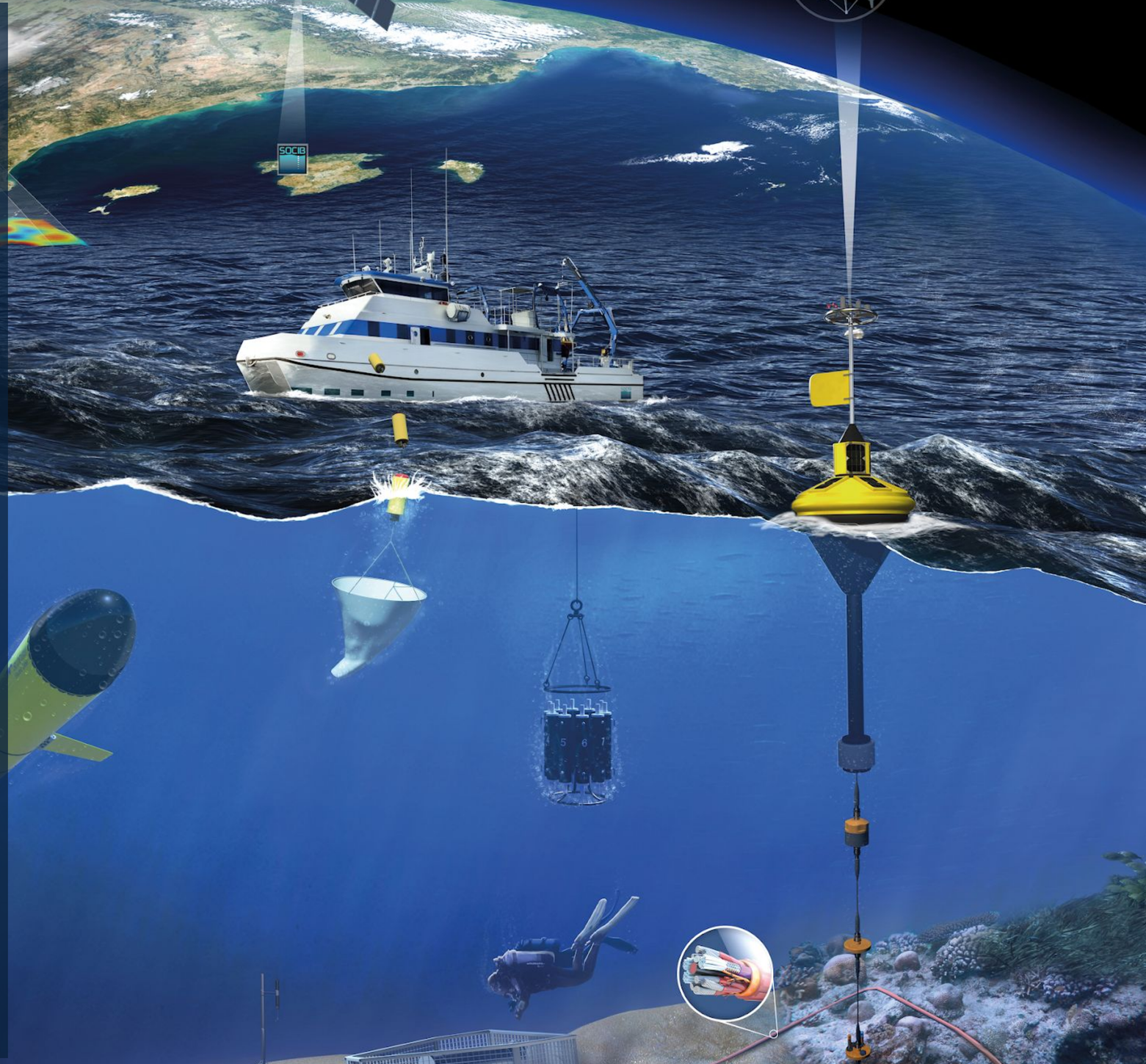
SOCIB: multiplatform observing and forecasting system

01

SOCIB - Multiplatform observing and forecasting system

The Balearic Islands Coastal Observing and Forecasting System (**SOCIB**) is a national research infrastructure, that operates an observing system that continuously monitors the western Mediterranean, collecting data through multiple platforms including high-frequency coastal radars, comprehensive beach monitoring systems, gliders, Lagrangian observation platforms (ARGO profilers and **surface drifting buoys**), oceanographic buoys, meteorological and sea-level stations, and the Research Vessel (R/V SOCIB). The data collected can be accessed in real-time and in open access through the SOCIB website (https://socib.es/).

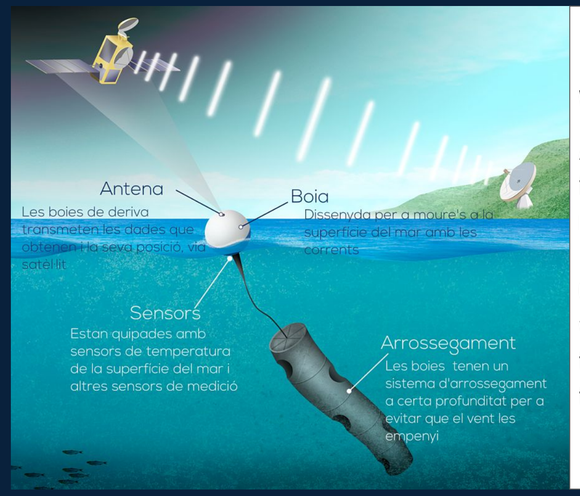


Surface drifters

Responding to **science** and **society** needs

02

Surface drifters



What is a drifter?

A drifter is an oceanographic device floating on the ocean surface and move with the ocean currents.

Consist of a buoyant sphere or disk, which is connected to a drogue, a tail-like instrument that extends below the surface of the water

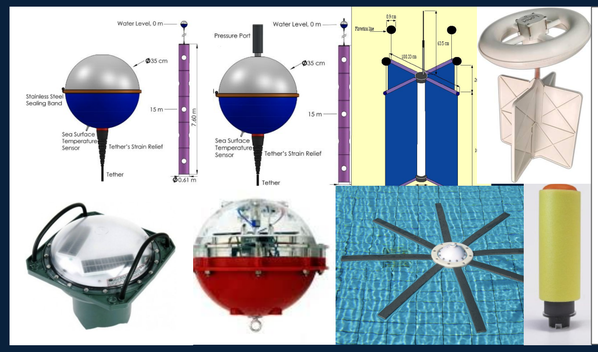
Why do we need surface drifters?

To understand ocean currents

To monitor the environment

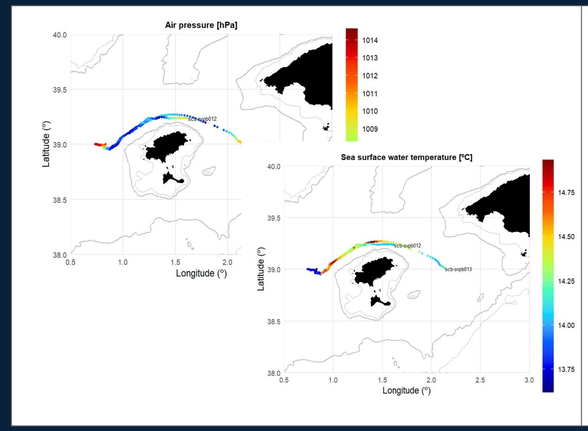
To study marine life

To aid in search and rescue



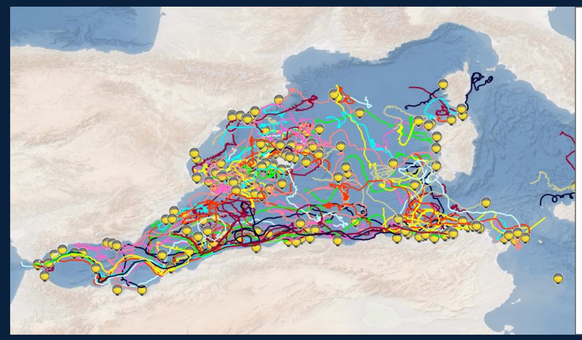
Types of drifters deployed by SOCIB

Surface drifters: CODE, TOSCA, MDO3i, CARTHE, ODi
Near-surface drifters: SVP, SVP-B, MLi



Measured variables

All drifters: GPS positions [trajectories and currents]
SVP: + Temperature [°C]
SVP-B: + Temperature [°C] + Air pressure [hPa]



Measurement frequency

5–60 mins

Spatial coverage [SOCIB]

Western Mediterranean Sea

Operational activities

03

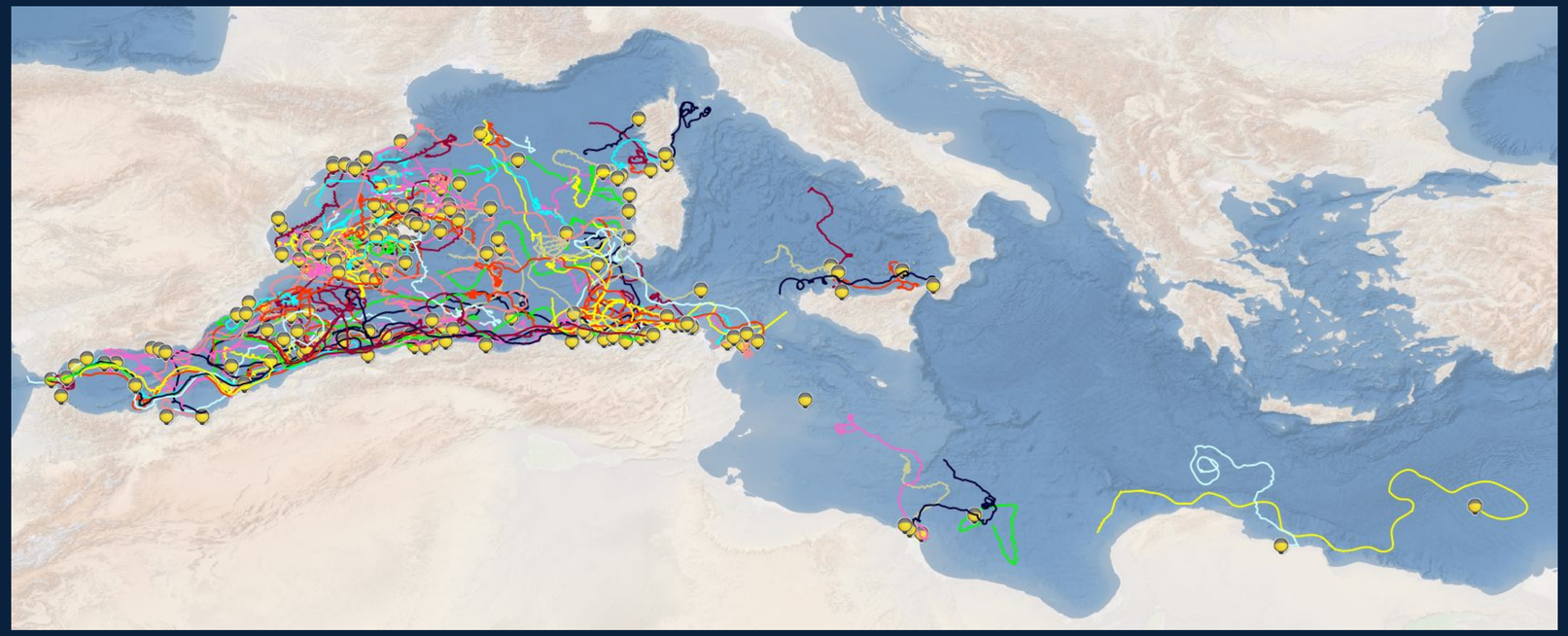
Operational activities

SOCIB operational array

Aim: Maintain an active Lagrangian platforms fleet composed of 8 surface drifters (SVP/SVP-B) to ensure the continuous observation capability.

Annual Plan: ~ 8 SVP/SVP-B per year

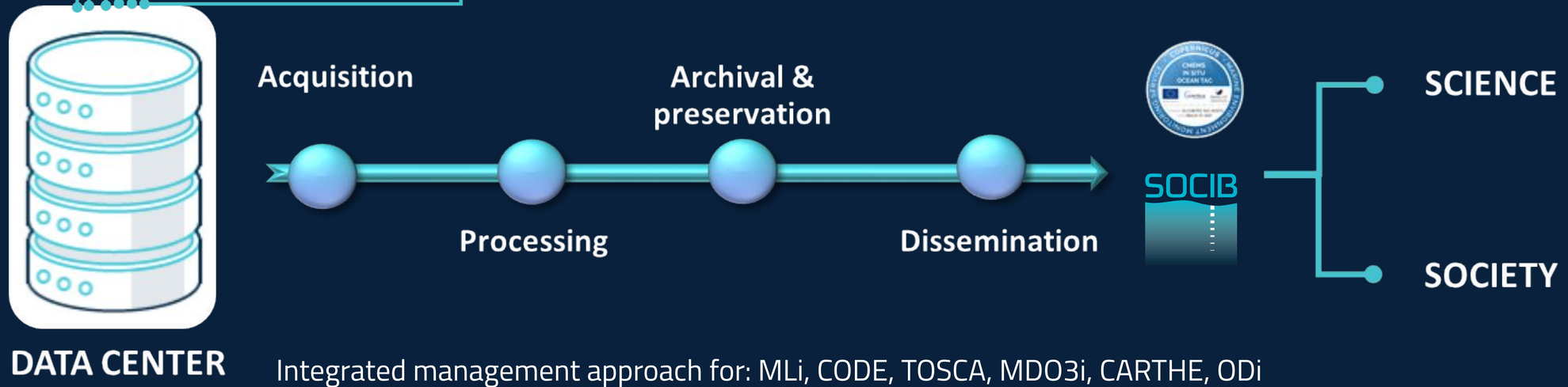
Total deployed drifters: ~ **220** [2011-2023]



Operational activities

Data access [open data]

*Note: different data management plan for GDP



Integrated management approach for: MLi, CODE, TOSCA, MDO3i, CARTHE, ODi

Operational activities

Data access [open data]

SOCIB Data Repository → CoreTrustSeal Certification

- SOCIB is recognized for its work in ocean **best practices and open data** for a sustainable ocean.
- The **CoreTrustSeal** for Data Repositories demonstrates that the SOCIB Data Repository is taking appropriate measures to ensure sustainable and reliable data infrastructures, as part of the SOCIB institutional Open Science Policy.
- SOCIB has obtained this seal, guaranteeing the management of research data in line with **FAIR Data Principles** (Findable, Accessible, Interoperable, and Reusable) and Horizon Europe Open Science requirements.

Operational activities

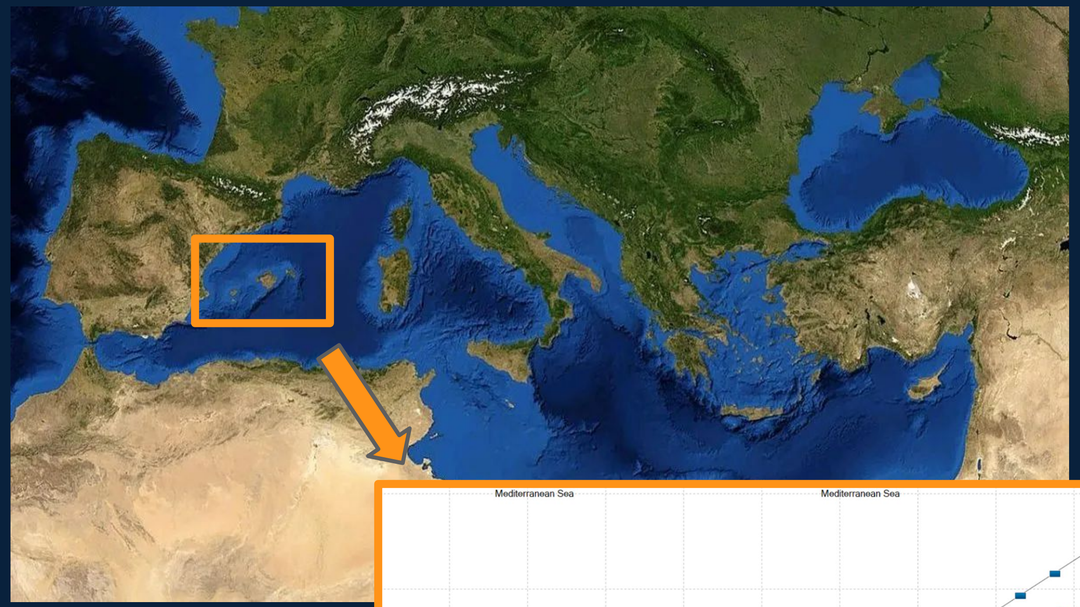
Deploying a drifter

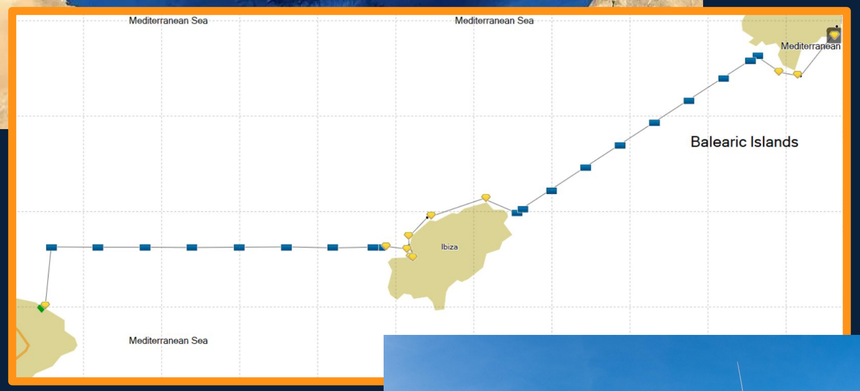
Ship-of-opportunity

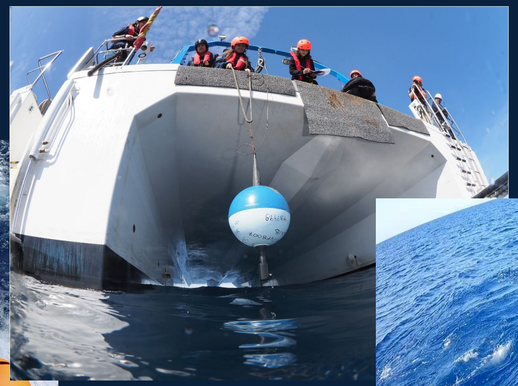
Ship: RV SOCIB

Cruises: Quarterly Canales Endurance campaigns

Deployment method: MANUAL







Operational activities

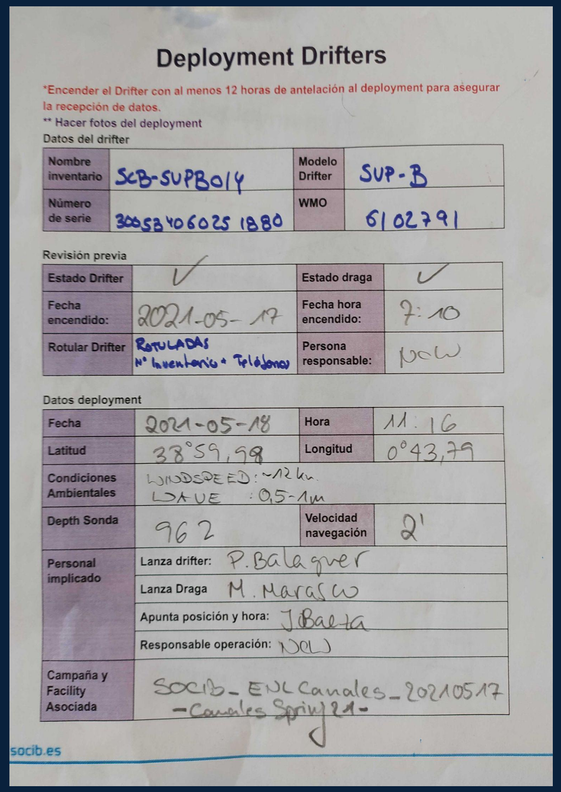
Best practices

Internal protocols

All mission checklist [summary]

- ❑ Procurement of merchandise
- ❑ Receipt of merchandise
- ❑ Deployment planning
- ❑ Goods issue
- ❑ Deployment
- ❑ Mission monitoring
- ❑ Stop the mission

Deployment checklist



Deployment Drifters

*Encender el Drifter con al menos 12 horas de antelación al deployment para asegurar la recepción de datos.
** Hacer fotos del deployment

Datos del drifter

Nombre inventario	SCB-SUPB014	Modelo Drifter	SUP-B
Número de serie	300534060251880	WMO	6102791

Revisión previa

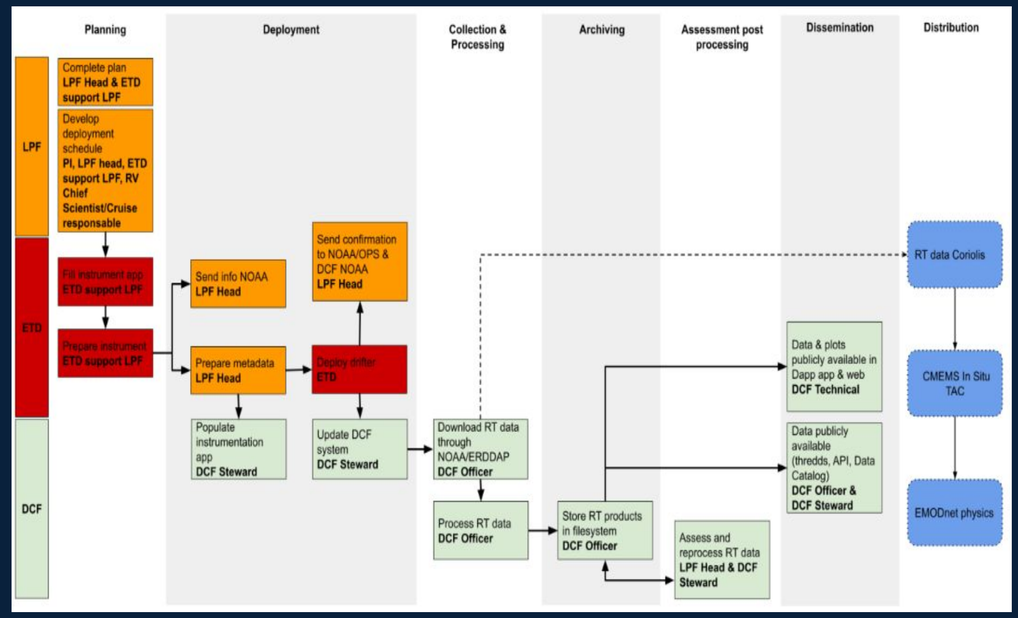
Estado Drifter	✓	Estado draga	✓
Fecha encendido:	2021-05-17	Fecha hora encendido:	7:10
Rotular Drifter	ROTULADAS Nº Inventario + Teléfonos	Persona responsable:	POW

Datos deployment

Fecha	2021-05-18	Hora	11:16
Latitud	38°59,98	Longitud	0°43,79
Condiciones Ambientales	WINDSPEED: ~12 kn LDAUE: 0.5-1m		
Depth Sonda	962	Velocidad navegación	2'
Personal implicado	Lanza drifter: P. Balaguer		
	Lanza Draga M. Marasco		
	Apunta posición y hora: J Balta		
	Responsable operación: POL		
Campaña y Facility Asociada	SOCIB_ENL Canales_20210517 -Canales Spring'21-		

socib.es

SOCIB - Global Drifter Program Data Management Plan



Marasco et al., 2022 doi: 10.25704/AHJV-DA22

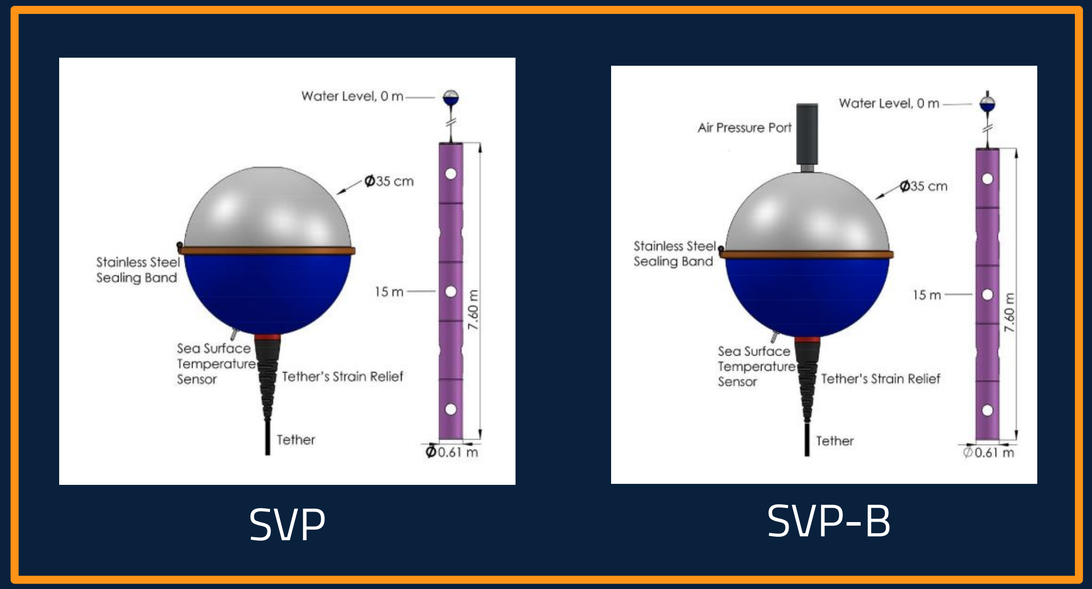
Metadata is shared with NOAA and OceanOPS before and after each deployment to ensure the accomplishment of the FAIR principles.

Operational activities

SOCIB contribution to GDP array

Global Drifter Program [GDP]

Total SVP and SVP-B: **126 [50% of SOCIB deployments]**



SVP SVP-B

Aims:

MAINTAIN a global 5 x 5 degree array of ~1,300 satellite-tracked surface drifting buoys to meet the scientific need for an accurate, globally dense set of in situ observations of Lagrangian near-surface currents, sea surface temperature, sea level atmospheric pressure (SLP), winds, salinity, and waves.

PROVIDE a data management system for scientific use of these data.

Upgrade Barometer program since 2019

- The NOAA funded Global Drifter Program supports the base SVP drifter and telecommunications
- Upgrading parter pays the cost of the barometer upgrade

https://gdp.ucsd.edu/ldl/global-drifter-program/

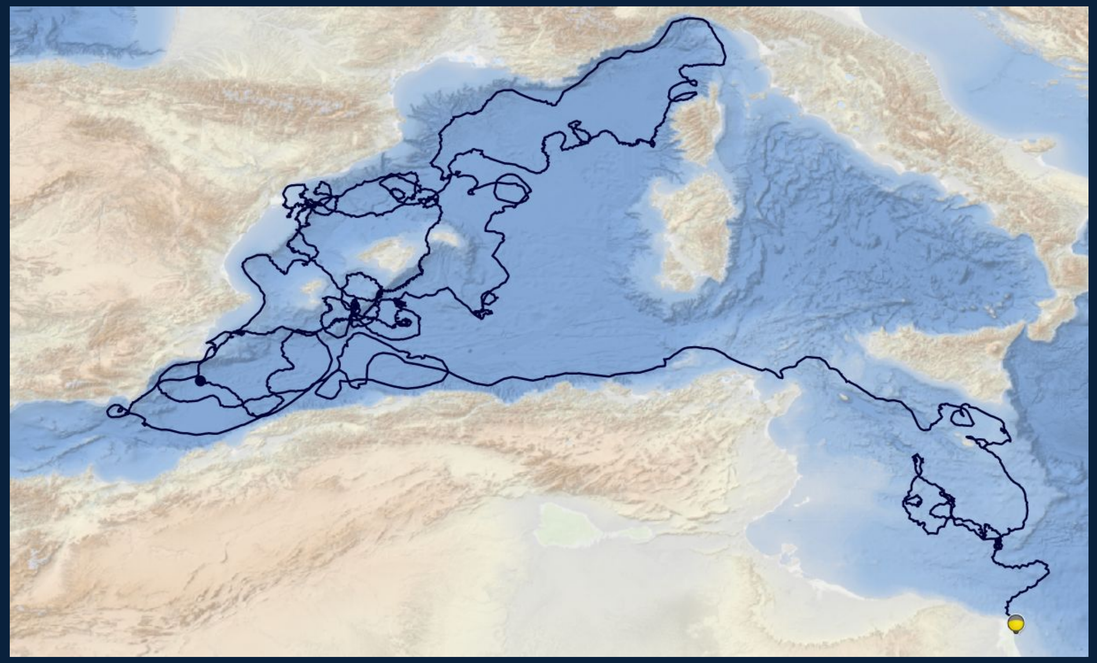
https://www.aoml.noaa.gov/phod/gdp/images/Baro_Upgrade_Brochure.pdf

Operational activities

SOCIB contribution to GDP array

Mission

- Lifespan: **730 days** [manufacturers]
- Western Med. [Statistics → 121 SVP/SVP-B]
  - Average lifespan: **135.8 days**
  - Maximum span: **803 days**

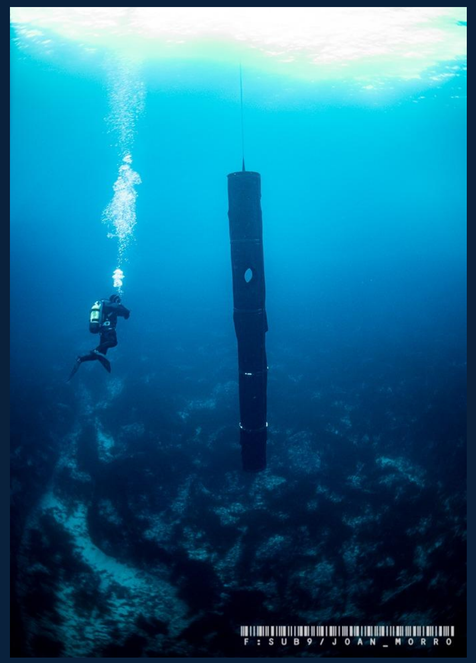


Deployment ending

- Primary cause: Beached platform

Recovery/Re-deployment

- Collaborative actions with involved actors after being agreed with NOAA and LDL (Scripps Institution of Oceanography)



Scientific contributions

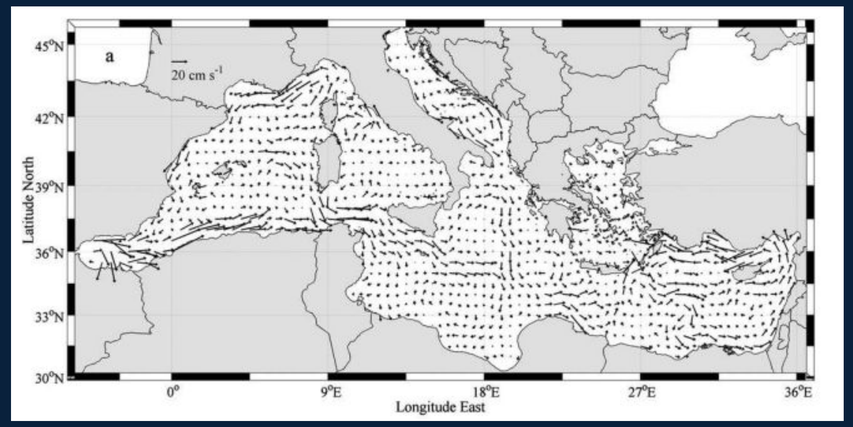
04

Scientific contributions

In the Mediterranean Sea with surface drifters

Mapping geostrophic circulation [Poulain et al. 2012]

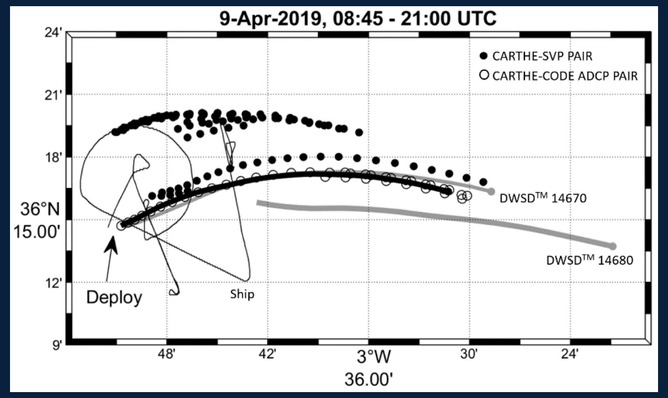
doi: 10.1175/JPO-D-11-0159.1



Pseudo-Eulerian mean surface geostrophic circulation in the Mediterranean Sea in spatial bins of 1°x1° and for the period 14 Oct 1992–31 Dec 2010; bins with less than 20 weekly observations are not considered. **Biased estimates directly derived from the drifter data**

Comparison of currents measured by different drifter types [Poulain et al. 2022]

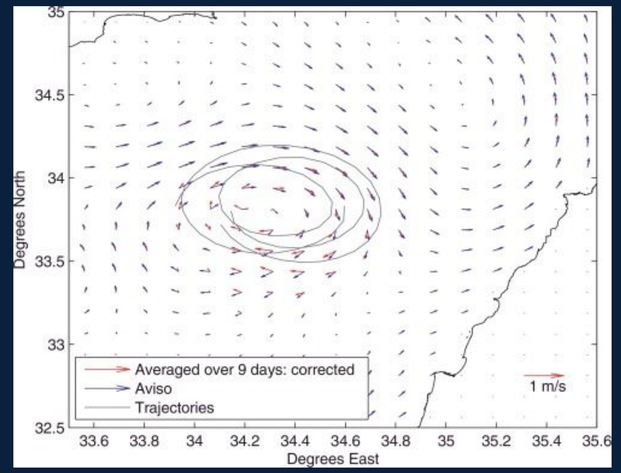
doi: 10.3390/s22010353



Trajectories of the CODE ADCP drifter (thick black) and positions of the CARTHE-SVP (black dots) and CARTHE-CODE ADCP (circles) pairs on 9 April 2019 between 8:45 and 20:47 UTC. Trajectories of the DWSDTM drifters (14670—thin gray, and 14680—thick gray) drifters and RV Pourquoi Pas? track (thin black) for the same period. All drifters are moving eastward.

Modelling surface currents using surface drifters and satellite altimetry [Issa et al. 2016]

doi: 10.1016/j.ocemod.2016.05.006



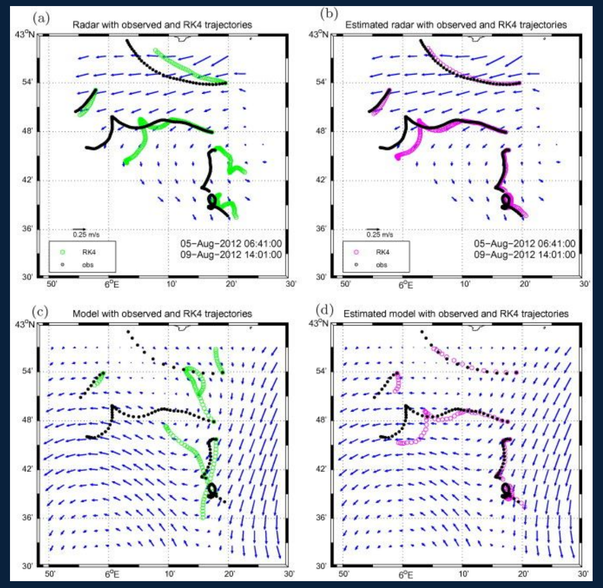
Corrected surface velocity field (in red) compared to AVISO background field (in blue). The assimilated drifter trajectories are represented in gray. The North-West coast in the figure is Cyprus.

Scientific contributions

In the Mediterranean Sea with surface drifters

Estimation of Lagrangian platforms blending drifters, HF radar and models [Berta et al. 2014]

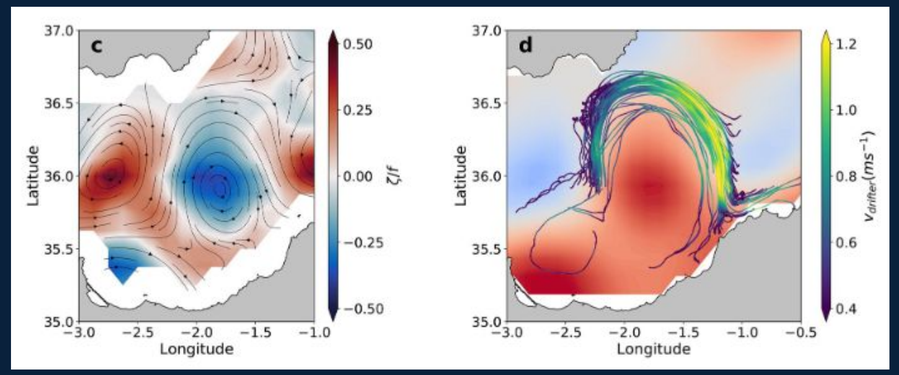
doi: 10.1016/j.pocean.2014.08.004



Comparison between observed drifter trajectories (black) and simulated trajectories computed from different velocity fields: (a) original radar velocity; (b) LAVA blended radar velocity; (c) original model velocity; (d) LAVA blended model velocity.

Frontal Convergence and Vertical Velocity Measured by Drifters [Tarry et al. 2021]

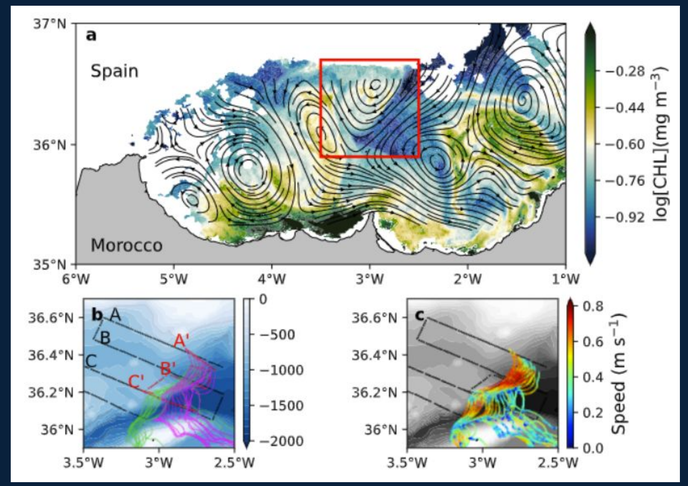
doi: 10.1029/2020JC016614



(c) Vorticity field derived from the ADT. Arrows indicate the mean flow. (d) Trajectories of drifters deployed from May 31, 2018 to June 4, 2018 with drifter velocity in color.

Drifter Observations Reveal Intense Vertical Velocity in a Surface Ocean Front [Tarry et al. 2022]

doi: 10.1029/2022GL098969



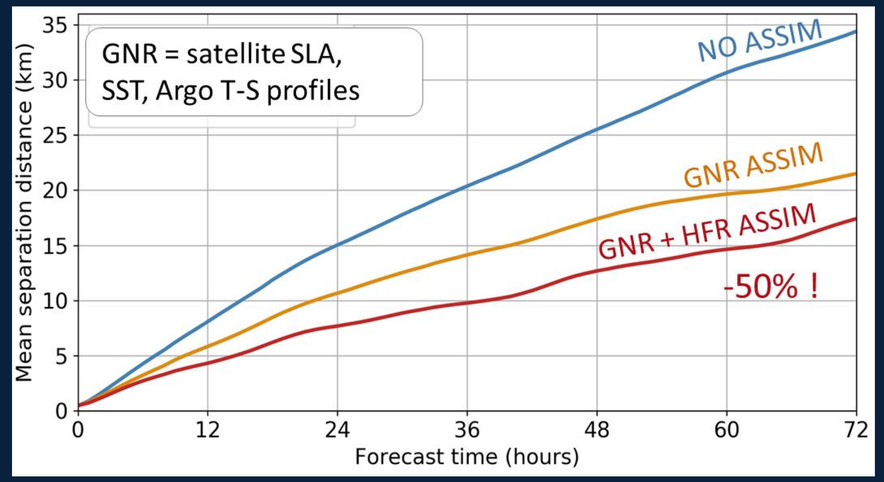
(a) Chl a concentration in the Alboran Sea for 1 April 2019. The red box indicates the region shown in panels. (b) Three-day trajectories for the drifters deployed [Pink: surface drifters, Green: near-surface drifters. Panel (c) same as (b) but with drifter velocities.

Scientific contributions

At SOCIB with surface drifters

WMOP model improvement through data assimilation [Hernández-Lasheras et al. 2021]

doi: 10.5194/os-17-1157-2021

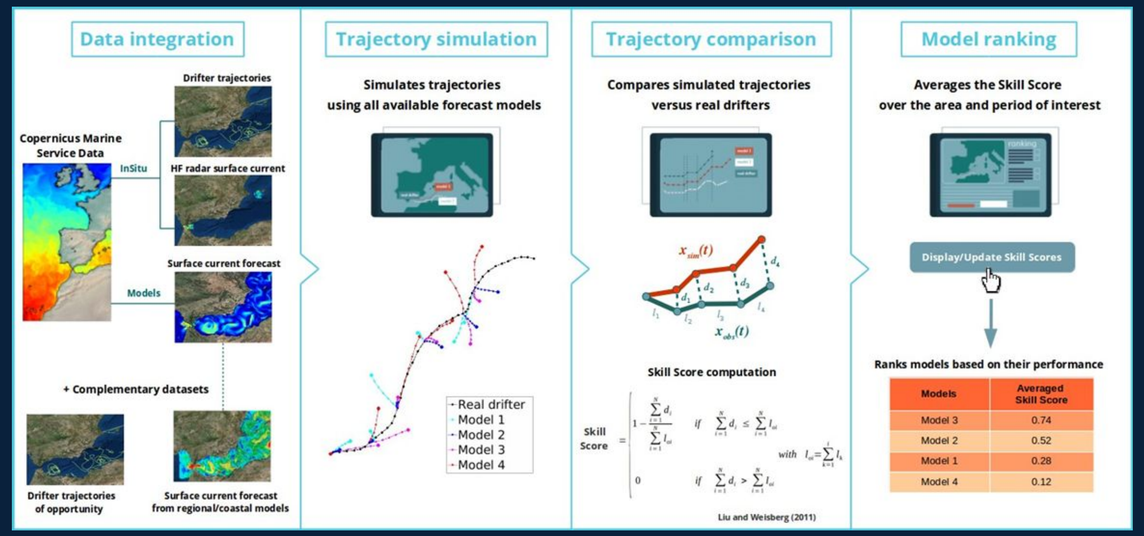


Comparison of trajectories between simulated and surface drifters.
Radar derived surface current, combined with other multi-platform observations (e.g. Argo floats, satellite altimetry, oceancolor satellites, etc) are helping to improve the operational high-resolution WMOP forecast model through data assimilation, reducing the error in simulating trajectories up to 50% in specific cases.

IBISAR skill assessment service for SAR operators and emergency responders

[Reyes et al. 2020] doi: 10.1080/1755876X.2020.1785097

[Révelard et al. 2021] doi: 10.3389/fmars.2021.630388



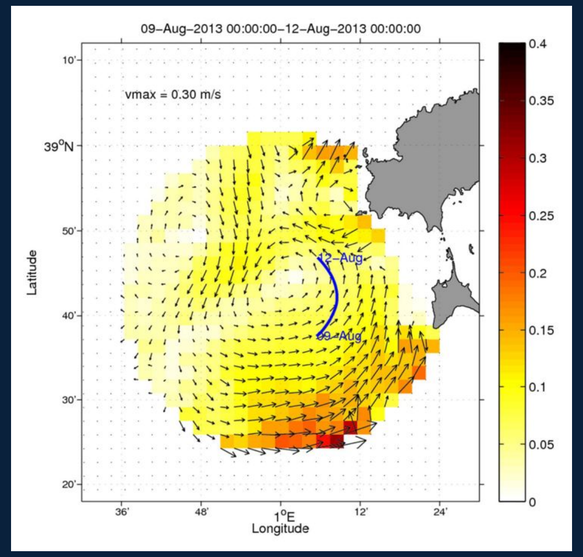
Before launching the IBISAR skill assessment service, the adequacy of the envisaged methodology proposed was applied in 4 pilot areas with different dynamical conditions **being tested against more than 140 drifters.** Additionally, the sensitivity of the skill score metric in coastal areas and for different forecast horizons was studied, introduces a novel Skill Sore and evaluates the use of HFR-derived trajectories for assessing the model performance, **complementing the scarce drifters observations in coastal areas.**

Scientific contributions

At SOCIB with surface drifters

Assessing satellite data in coastal zone [Pascual et al. 2015]

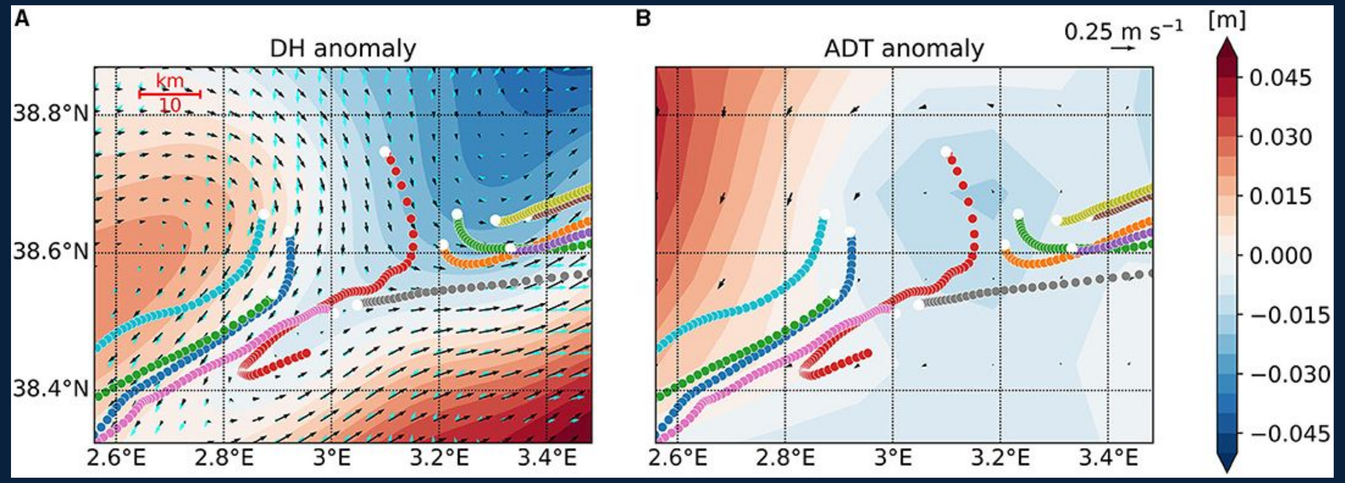
doi: 10.1080/01490419.2015.1019656



Coverage of SOCIB HF radar in the Ibiza Channel. The vectors correspond to total surface currents derived from HF radar averaged for the period 9-12 August-2013. The colors correspond to the magnitude of the currents (in m/s). The trajectory followed by of a drifter during the same days is overlaid (high frequency signals such as inertial and tidal oscillations have been filtered out with a 36h hour filter).

Observation of fine-scale ocean currents [Barceló-Llull et al. 2021]

doi: 10.3389/fmars.2021.679844



(A) Dynamic height (DH) anomaly at 5 m depth and geostrophic velocity vectors (in black) at 20 m depth (for consistency with ADCP velocity) calculated using CTD data. ADCP velocity vectors at 20 m depth are plotted in cyan. For clarity, only one out of two current vectors are plotted. (B) Absolute dynamic topography (ADT) anomaly computed from CMEMS altimetry gridded products and derived geostrophic velocity vectors. All velocity vectors are plotted with the same scale. Dots show the trajectories followed by the drifters released during the PRE-SWOT experiment; white dots are the release positions.

Society needs

05

Society needs

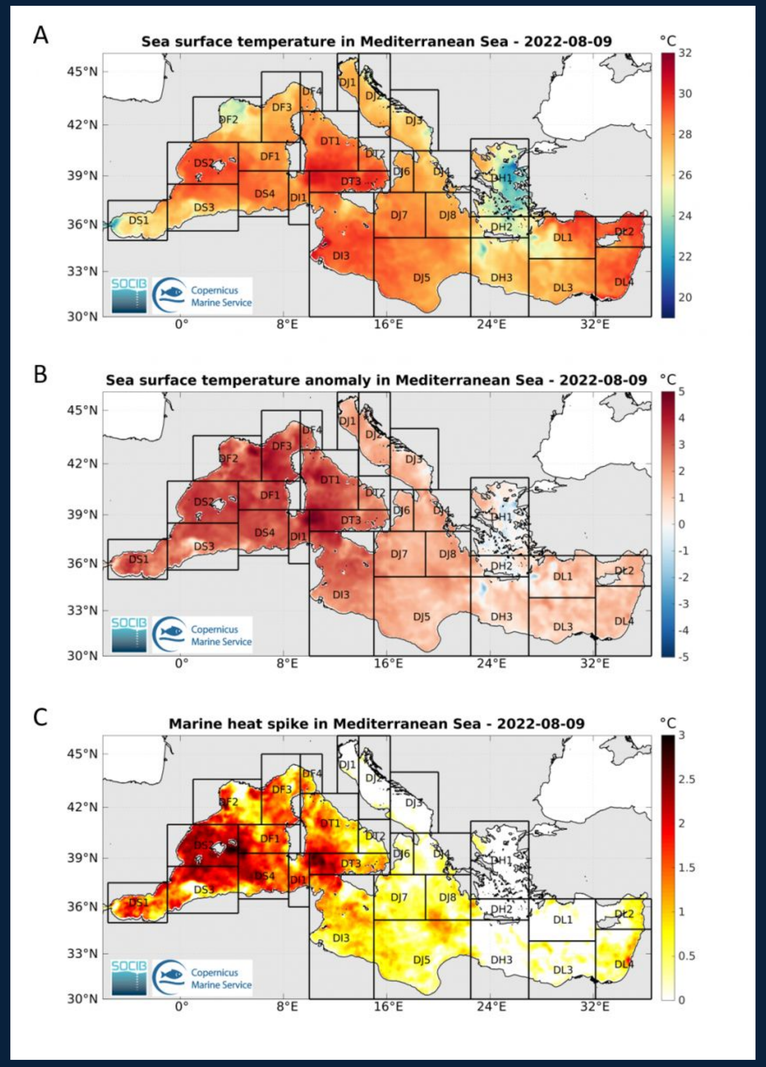
Extreme events

2022

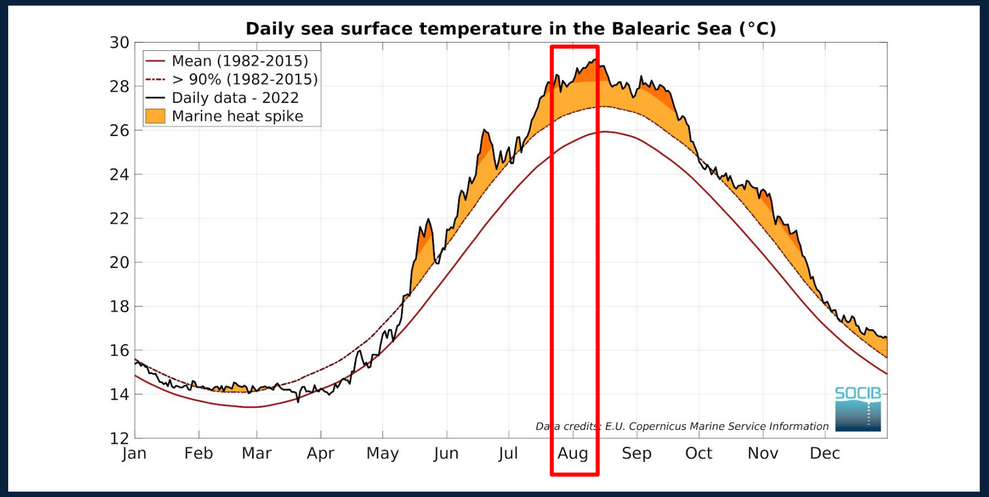
All regions of the Western Mediterranean are experiencing unprecedented extreme events.

The **Balearic Sea** has experienced **five** in a row **marine heat waves** that are exceptional for their early onset (in May and June), their intensity, and their duration.

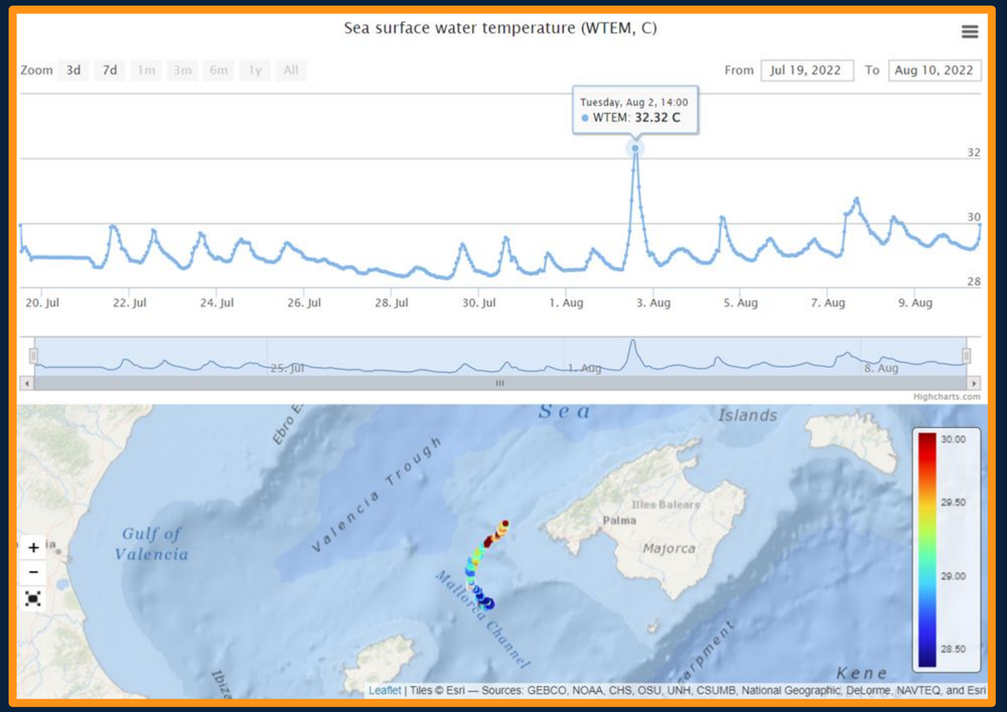
These data are regional averages in the Balearic Sea (max. 29.2 °C). Locally, **SVP-B deployed by SOCIB, detected SST values exceeding 32.3 °C in the Mallorca Channel**



Juza et al., 2022 doi: 10.3389/fmars.2022.785771



https://apps.socib.es/subregmed-marine-heatwaves/



Outreach activities

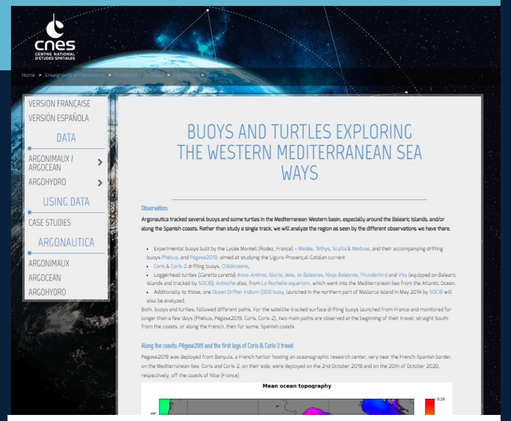
06

Outreach activities

School activities

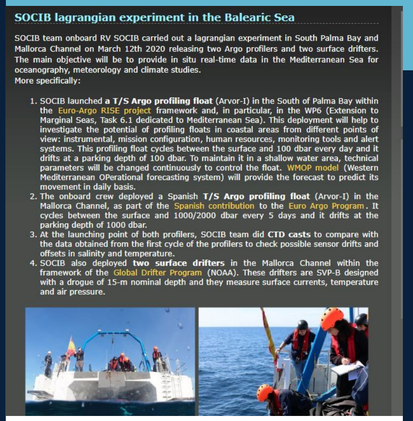
[Apadrina una boya oceanográfica](#) [Pre-SWOT project]

[Boia a l'aigua!](#) [FaSt-SWOT project]



[Argonautica](#)

Web and social media

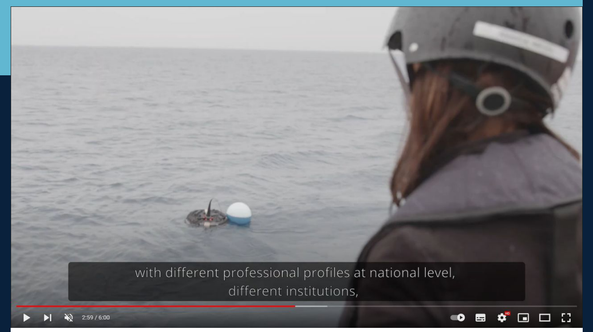


[News](#) (Website)

[@socib_icts](#) (Twitter)

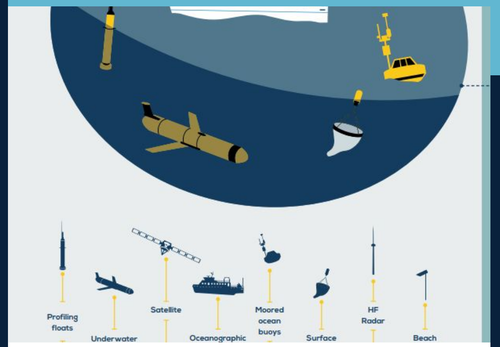
Videos

[Conecta con las científicas](#) (Women in science)



[SWOT pre-launch experiment in Mediterranean Waters](#)

Educational materials



[Ocean currents](#) (Teaching units)

MEDCLIC

[Infographic](#)

MEDCLIC

Authors and acknowledgement

07

Authors

SOCIB team










Surface Drifter Program


OceanOPS


Global Drifter Program

Acknowledgement

Global Drifter Program

Luca Centurioni

Director of the Lagrangian Drifter Laboratory and Principal Investigator of the Global Drifter Program

SOCIB Balearic Islands Coastal Observing and Forecasting System

Thank you very much!

We research the sea; we share the future

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