The Western Mediterranean Operational Forecasting System

SOCIB Modelling and Forecasting Facility

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SOCIB Balearic Islands Coastal Observing and Forecasting System

www.socib.es

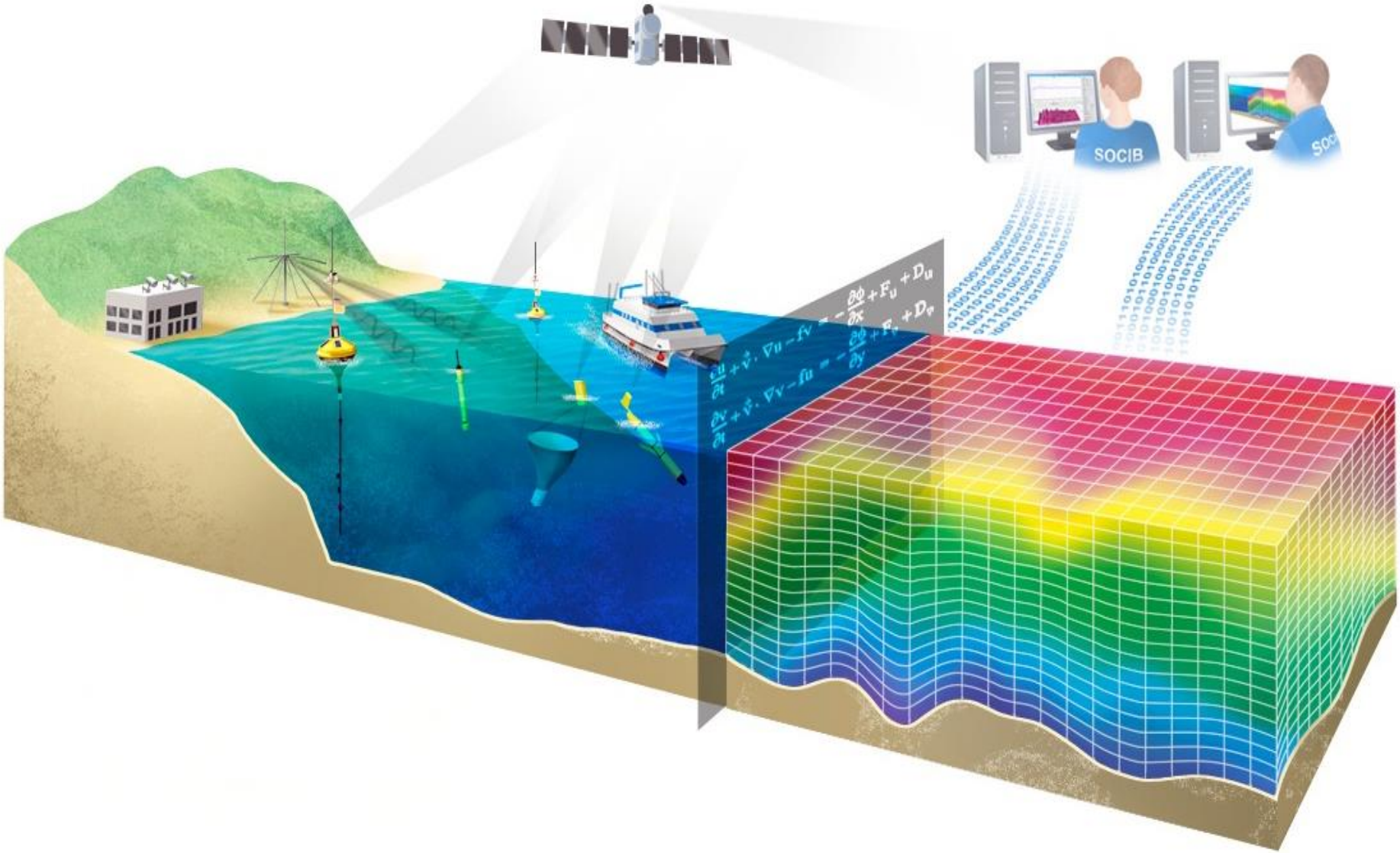
IMEDEA CSIC

Copernicus Marine Service

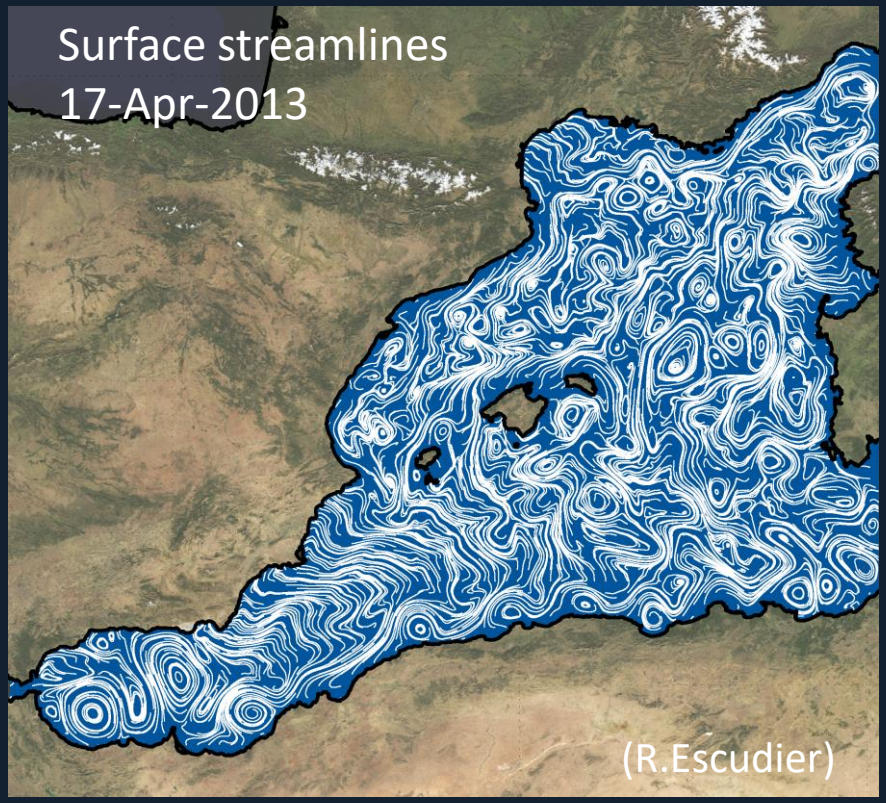
Copernicus Marine for Spain
28 March 2019

Balearic Islands Coastal Observing and Forecasting System

SOCIB approach



WMOP Western Mediterranean OPerational model



(Juza et al. 2016; Mourre et al. 2018)

✓ Regional configuration of the **ROMS** model (www.myroms.org)

✓ Horizontal resolution: ~ **2km**

✓ Initial & boundary conditions from : **CMEMS MED-MFC** model (1/24º)

✓ High-resolution atmospheric forcing: **AEMET Harmonie** (1h, 2.5km)

✓ **Data assimilation**: Ensemble Optimal Interpolation with 3-day cycles, assimilating satellite SLA, SST, Argo TS & Ibiza Channel HF radar velocities

→ **High-resolution mesoscale-resolving simulations**

Daily predictions (72h horizon) @www.socib.es

WMOP forecasts systematic evaluation

Near real-time & Delayed modes

www.socib.es

Gliders

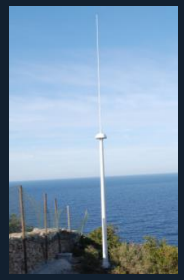
Ship-based CTDs

Satellite

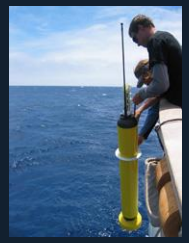
WMOP ocean forecasts

Moorings

HF radar



Argo floats



Surface drifters

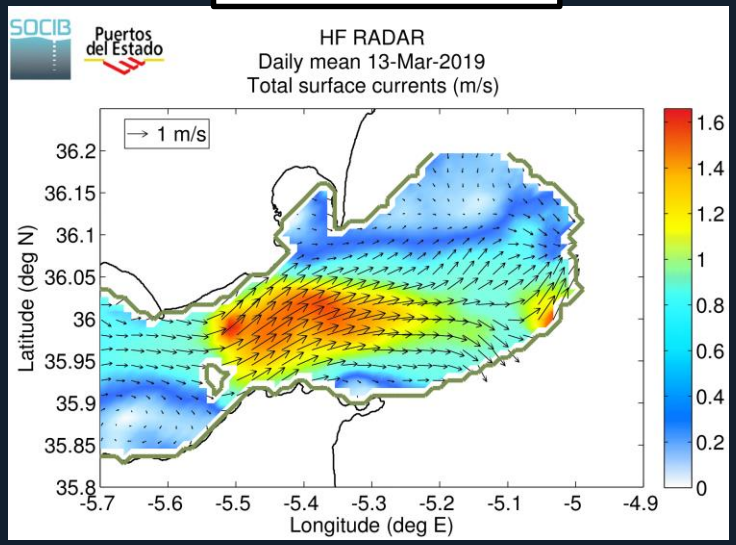
WMOP forecasts systematic evaluation

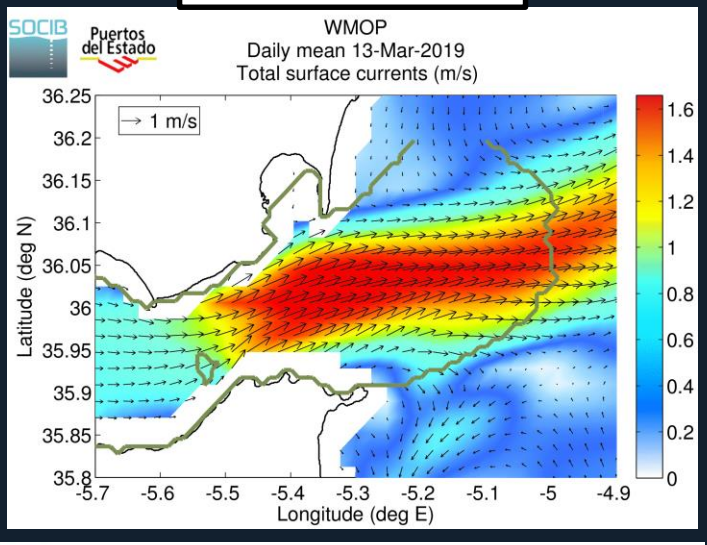
Example: HF radar in Gibraltar strait

HF radar

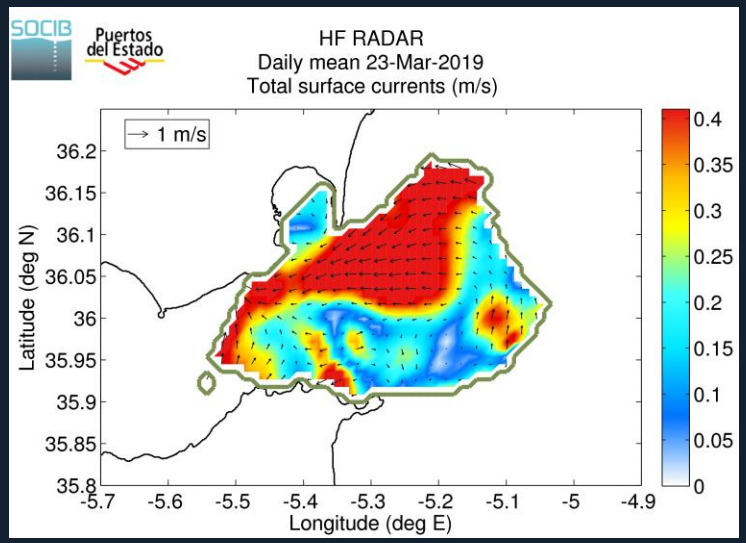
WMOP

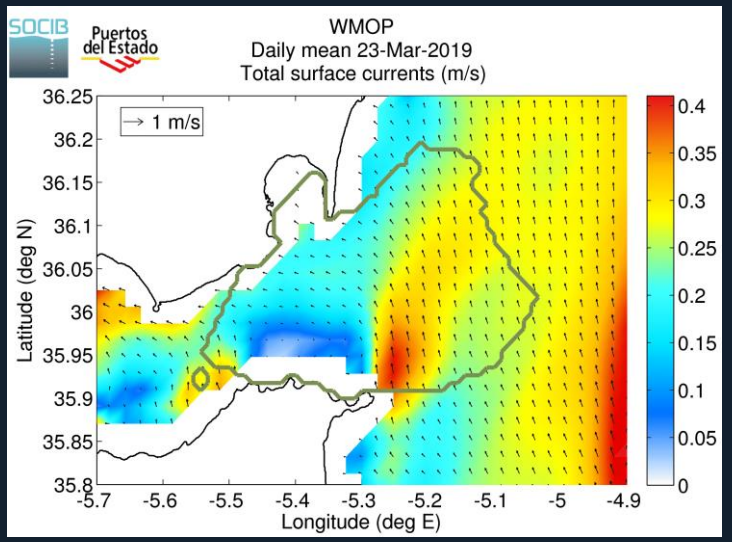
13-March-2019





23-March-2019



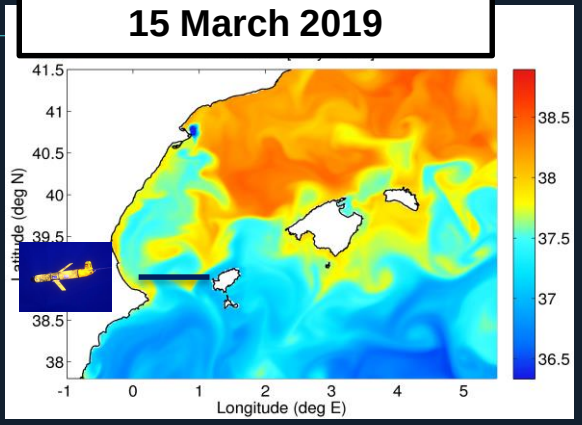


Model assessment using gliders

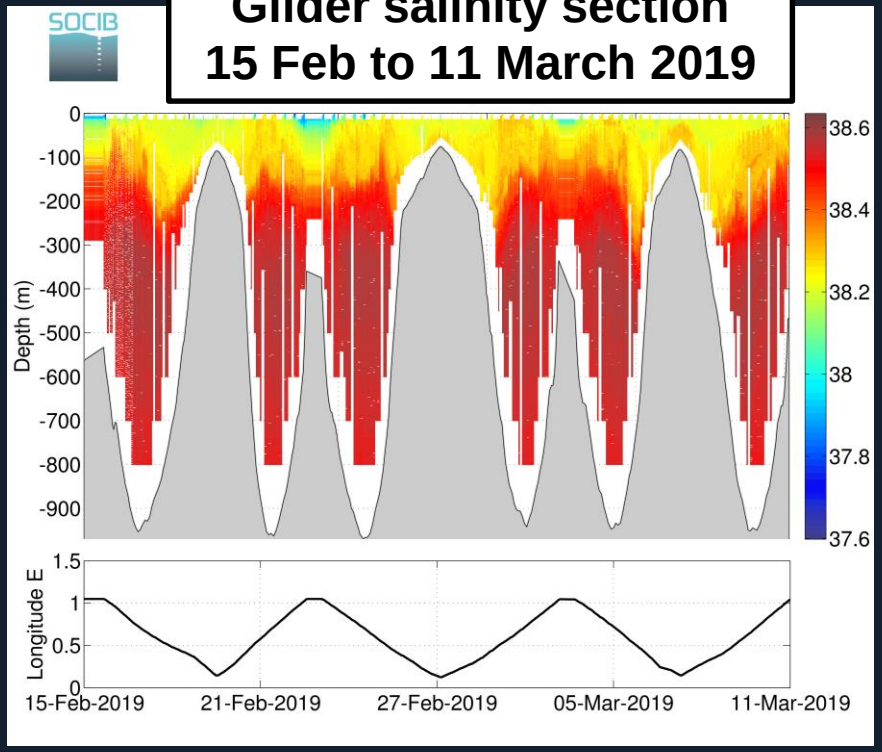
Developed in the framework of a subcontract within the CMEMS MED-MFC 2015-2018 project.

→ Assessment applied to CMEMS MED-MFC, IBI-MFC and WMOP.

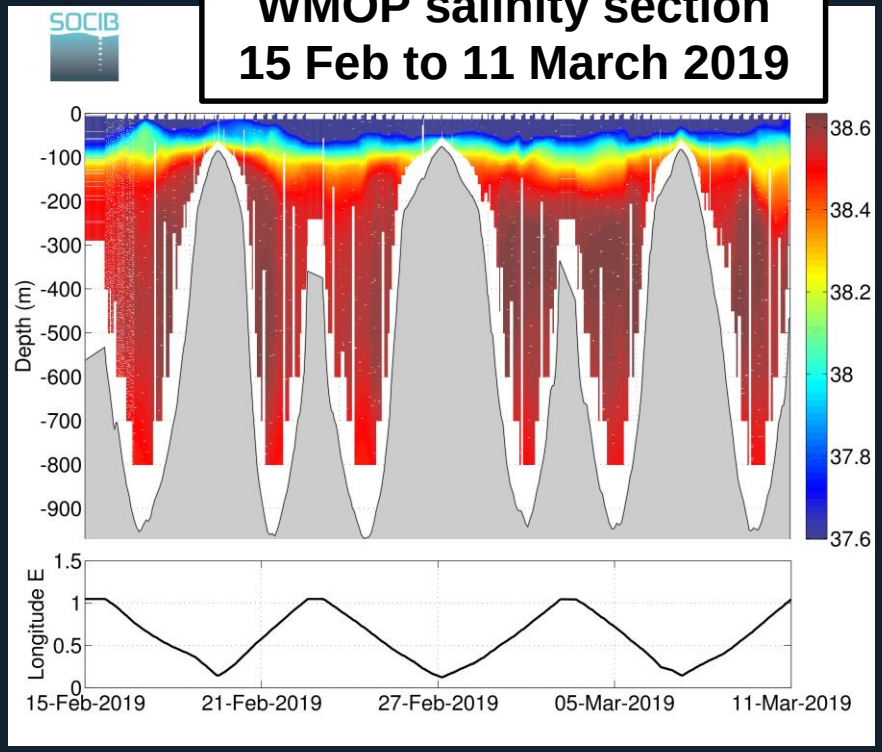
WMOP surface salinity 15 March 2019



Glider salinity section 15 Feb to 11 March 2019



WMOP salinity section 15 Feb to 11 March 2019



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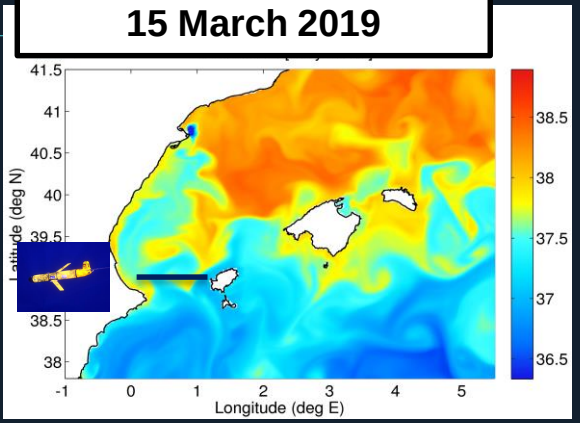

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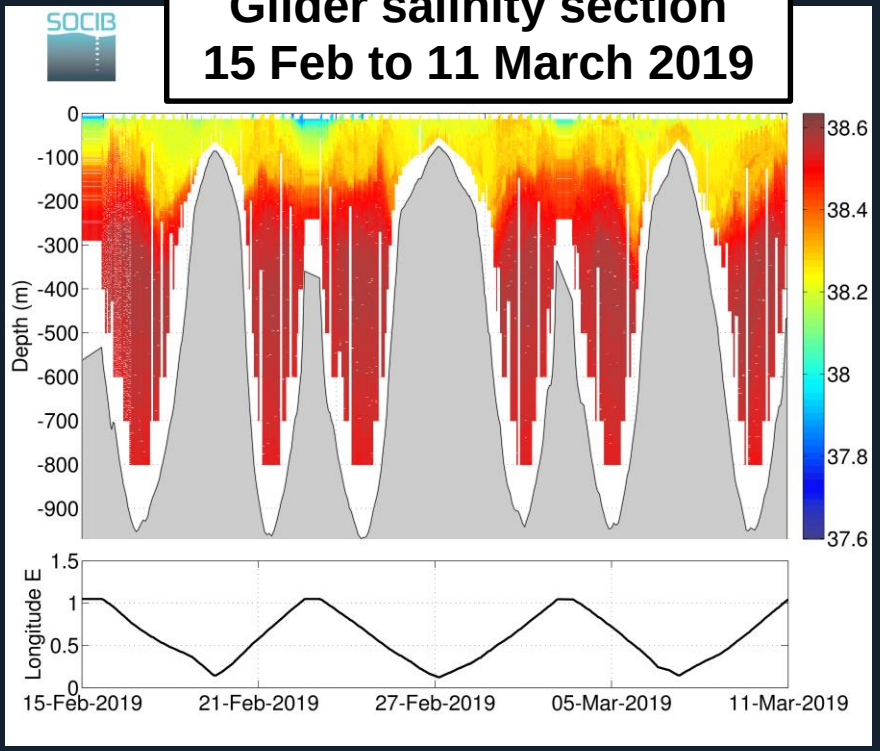
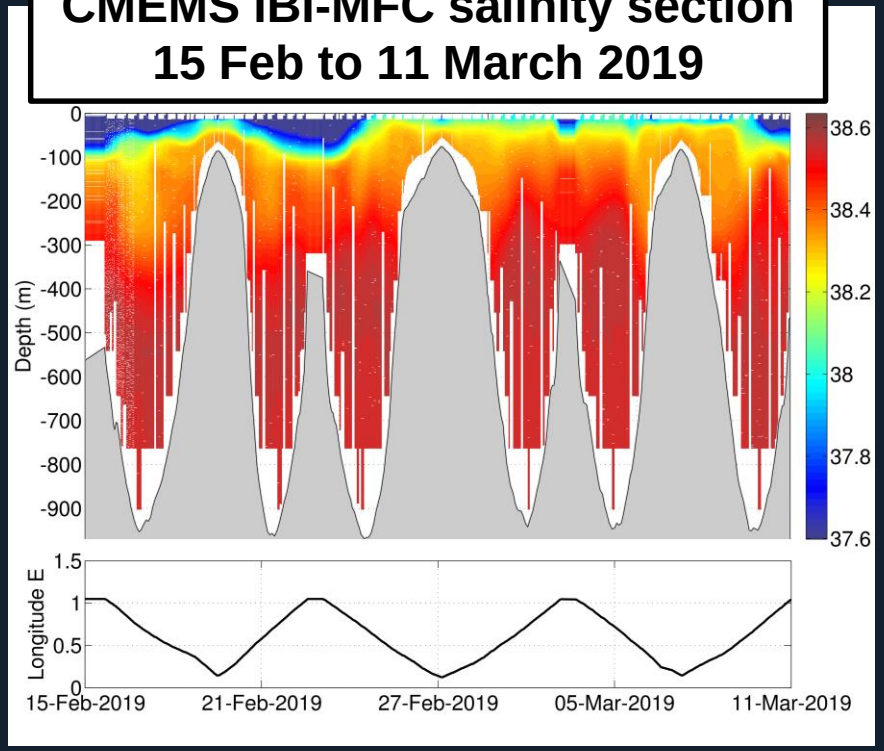


CMEMS IBI-MFC salinity section 15 Feb to 11 March 2019



WMOP simulations

FORECAST

FORECAST oct 2013 – present
(with the current version of WMOP)
data assimilation (since Oct 2018)
climatological river inputs
→ operational daily production of a 72-hour prediction

HINDCAST

HINDCAST 2009-2016
free run
daily river discharges
→ used for ocean process studies and variability analysis

REANALYSIS

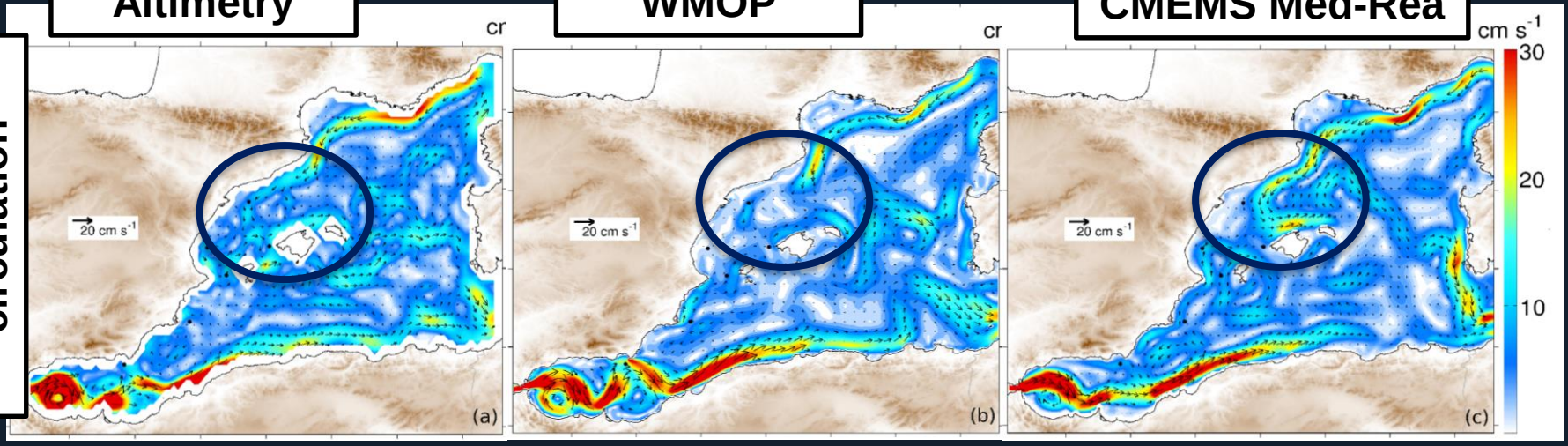
REANALYSIS of specific past periods
data assimilation
possible model grid refinements
→ analysis of sea trial experiments & impact of observations

Impact of downscaling – WMOP hindcast simulation

(Aguiar et al. 2019, submitted)

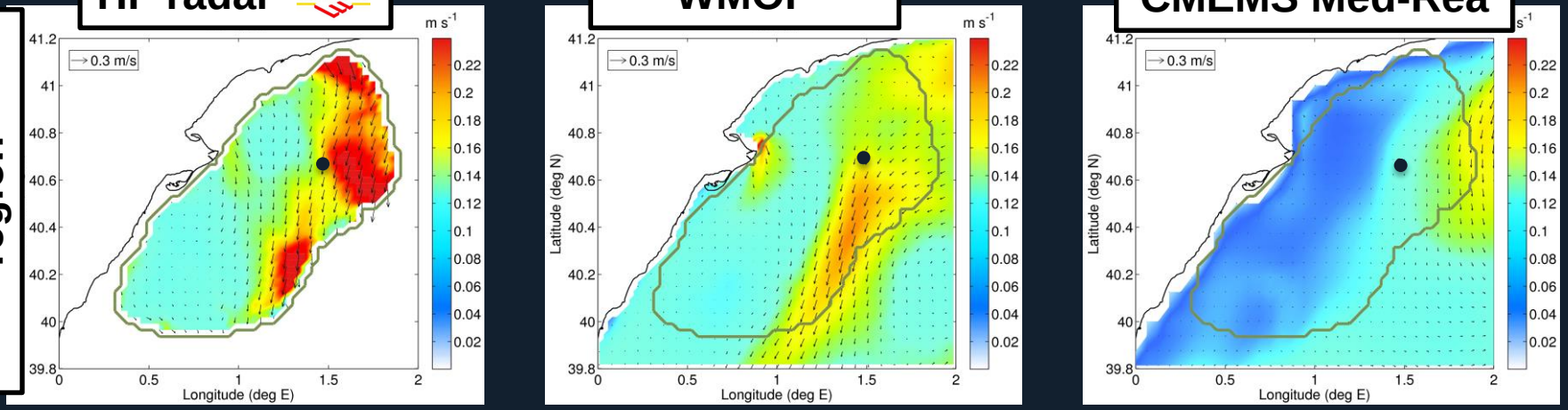
Mean surface circulation

Altimetry | **WMOP** | **CMEMS Med-Rea**



Ebro delta region

HF radar Puertos del Estado | **WMOP** | **CMEMS Med-Rea**

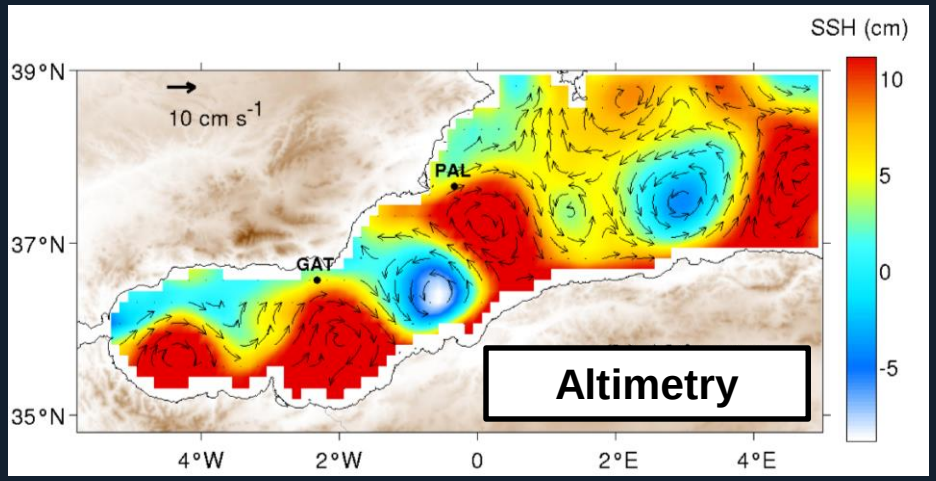


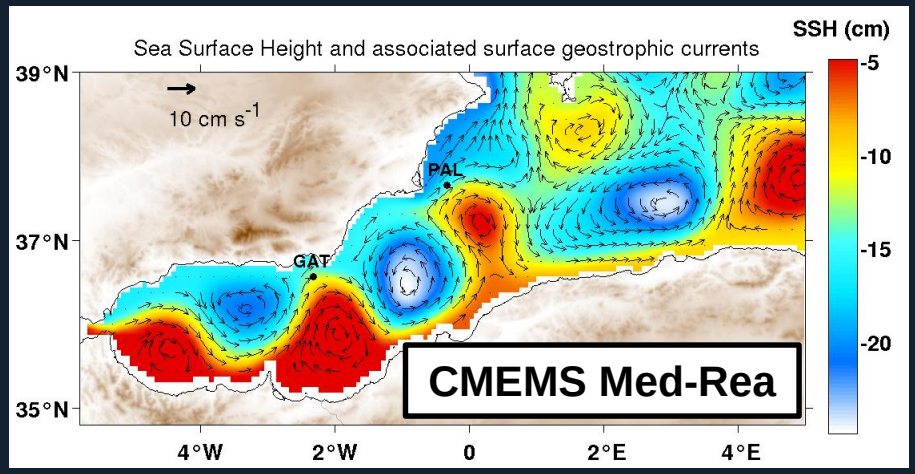
Some improvements in the mean surface circulation…

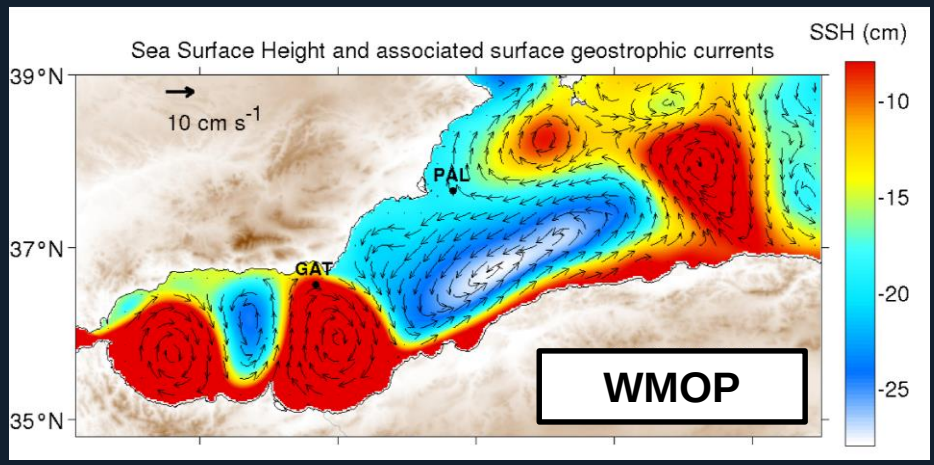
Impact of downscaling – WMOP hindcast simulation

(Aguiar et al. 2019, submitted)

Sea surface height
Average July-Sept 2012







… but the mesoscale patterns need to be constrained by data assimilation.

Uses of WMOP

Science

- Ocean process studies
- Support to sea trial experiments
- Study of the impact of observations
- Optimization of observational sampling
- Impact of oceanography on ecosystems
- …

&

Society

- Search and rescue
- Response to emergencies
- Lifeguards App
- Swimming across the Ibiza Channel
- Forensic science
- …

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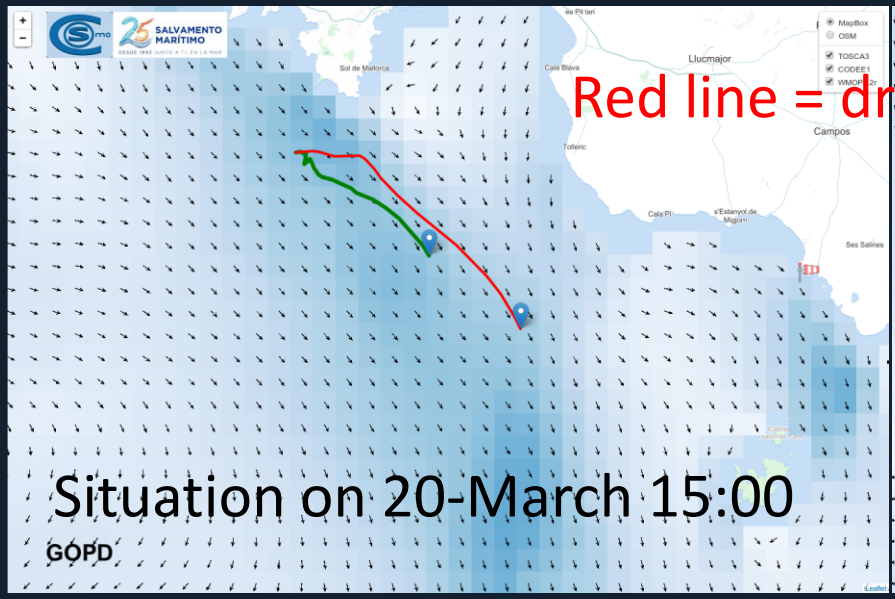
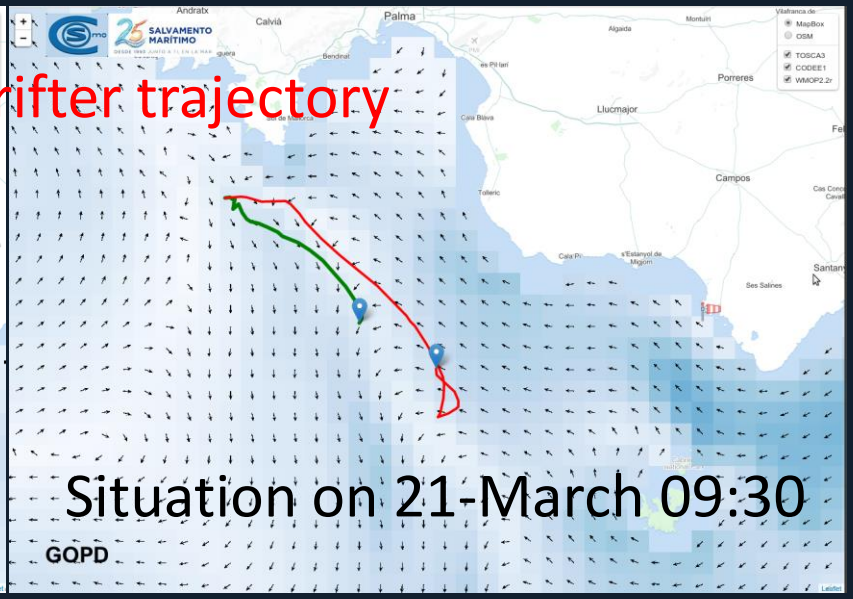
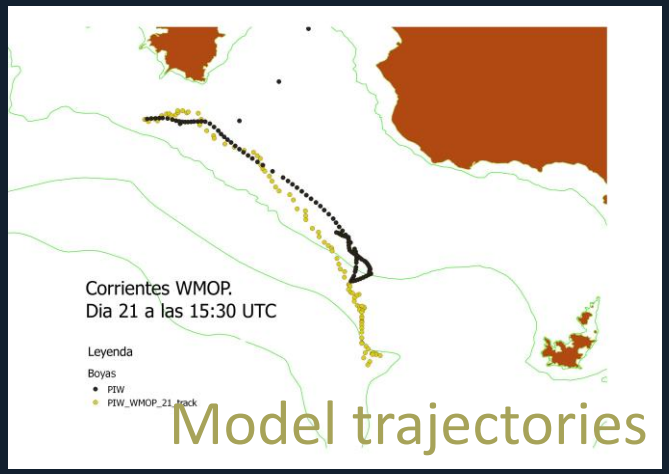
Search and Rescue: SASEMAR exercise

Drifters launched on 19-March-2018 15:00 UTC



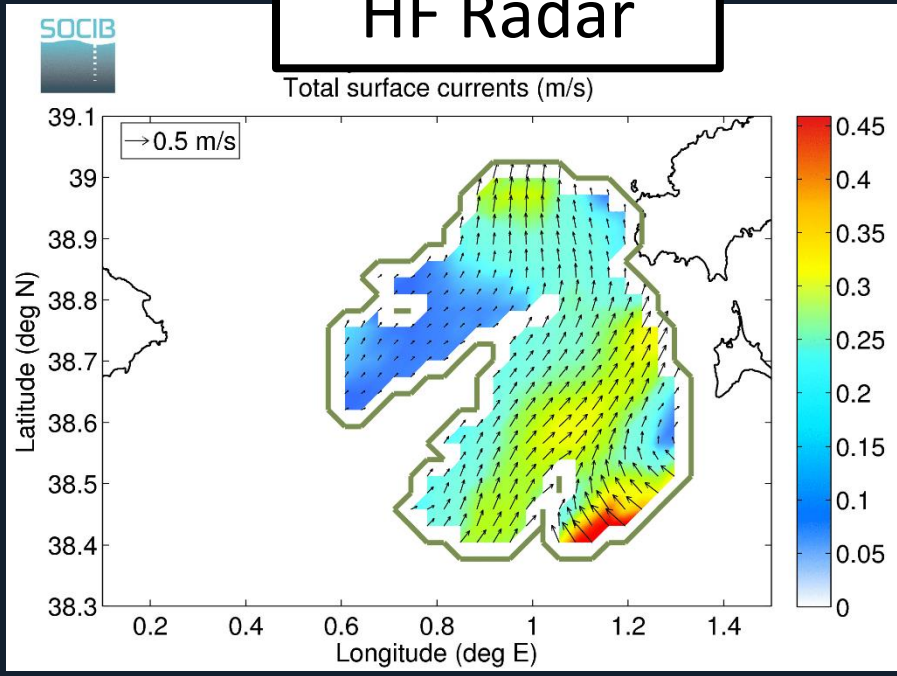




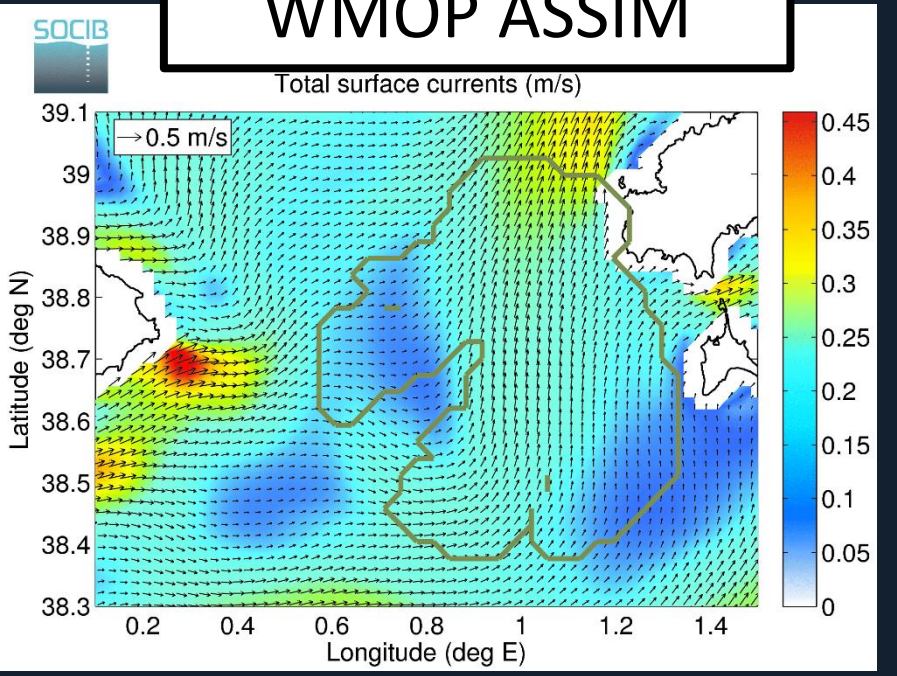
Swimming across the Ibiza Channel – Tita Llorens

→ Support to optimize the swimming route and date

HF Radar

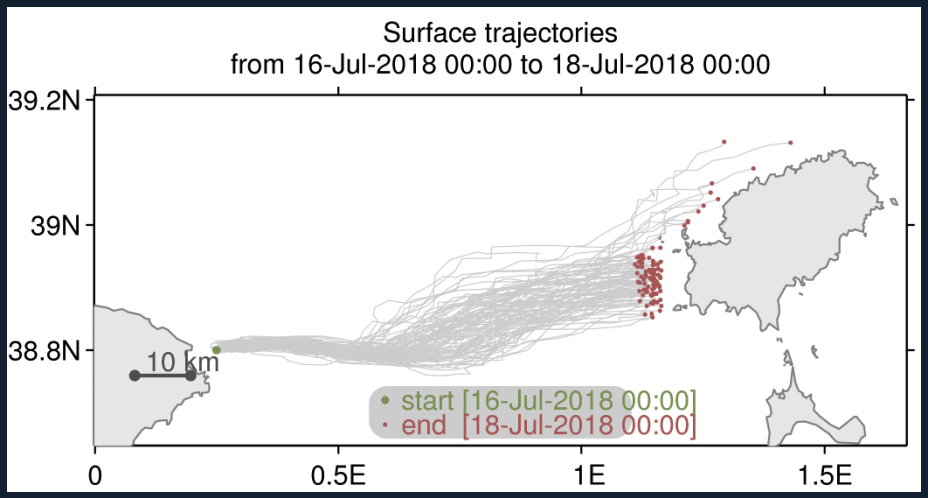


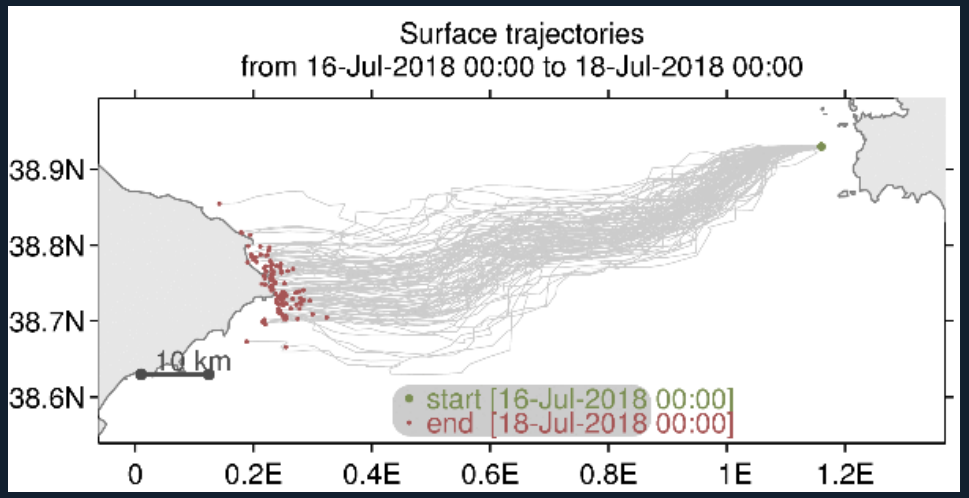
WMOP ASSIM



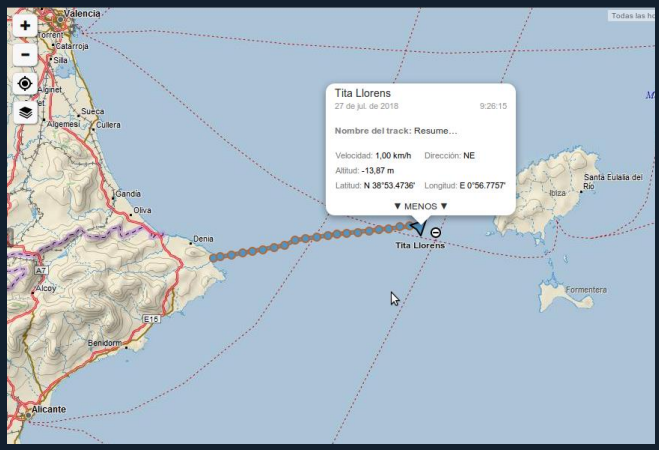
Swimming across the Ibiza Channel – Tita Llorens

→ Computation of trajectories and times incorporating currents and swimming components (favorable direction: West to East)

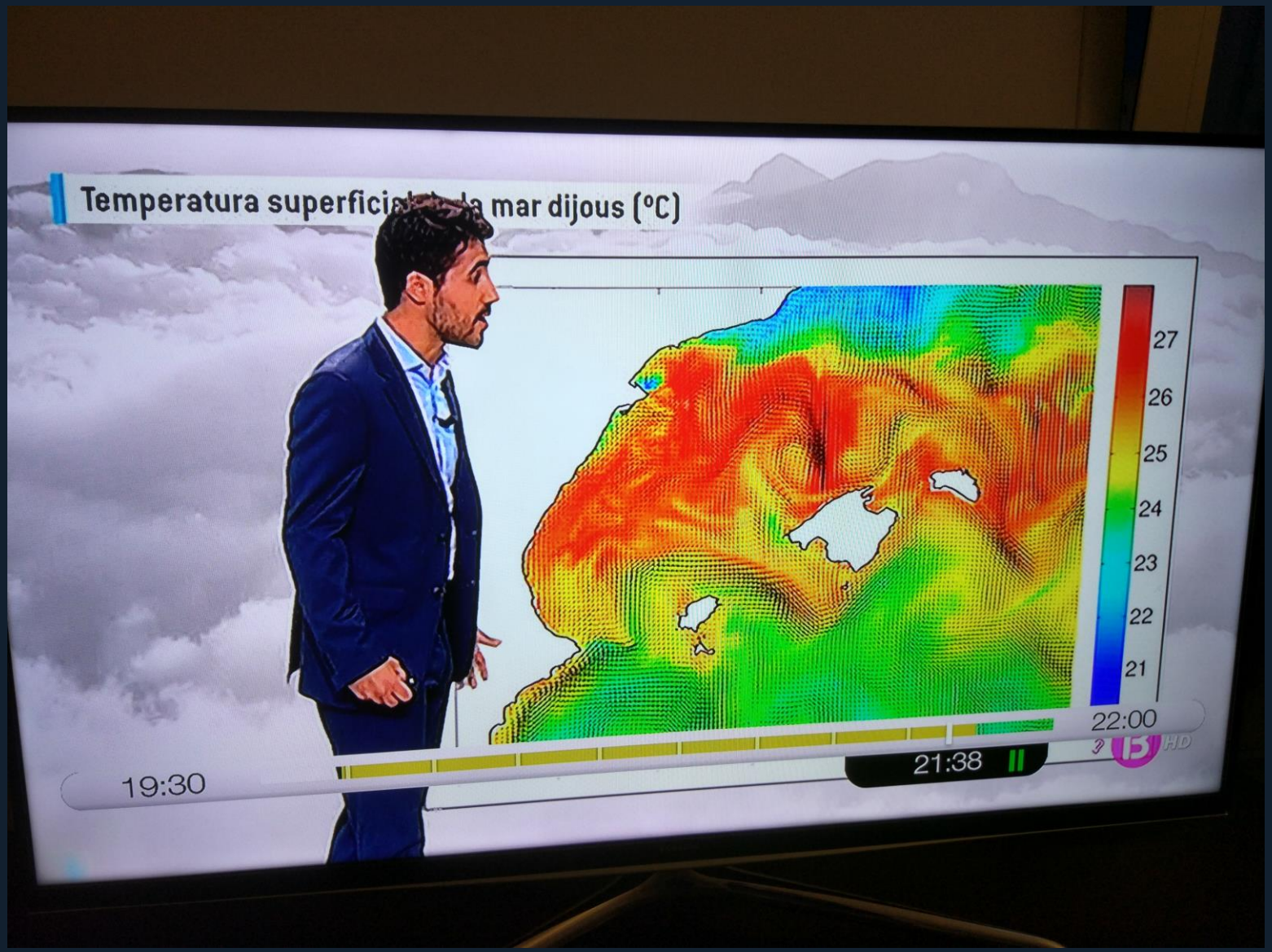




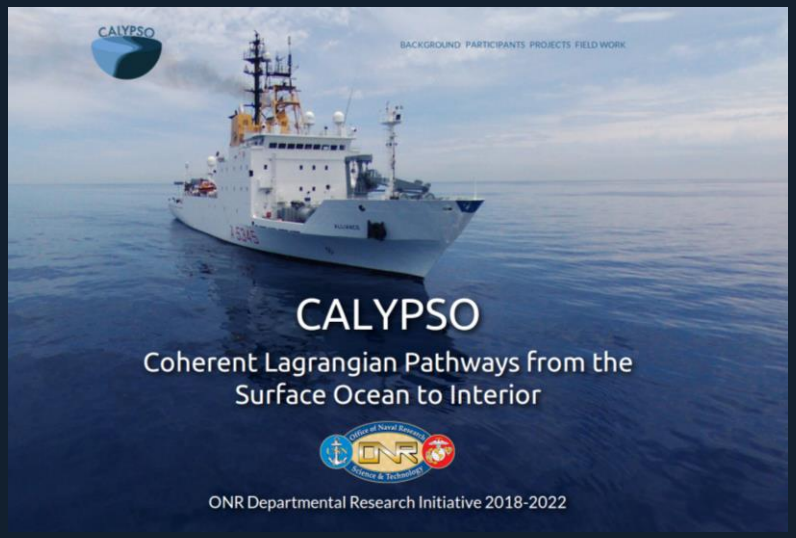
→ After 2 failed attempts in recent years due to adverse currents, the third try was the good one: Tita Llorens successfully completed the transect in 37h !!



WMOP on TV


Temperatura superficial de la mar dijous (ºC)
27
26
25
24
23
22
21
22:00
19:30
21:38

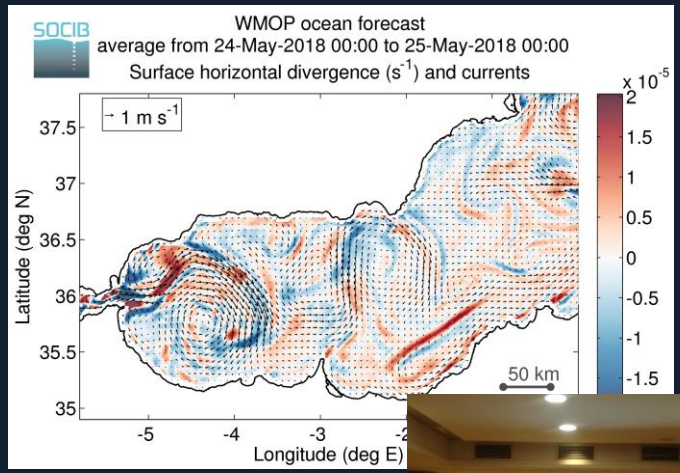
Support to sea trial experiment: CALYPSO

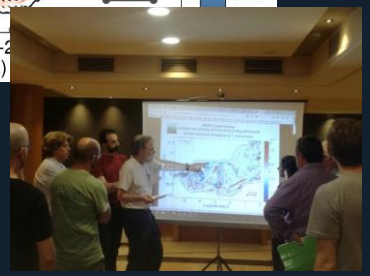


✓ Objective: improve understanding of the three-dimensional pathways of water parcels in the upper ocean

✓ Target area: Alboran Sea (ideal testbed due to its dynamic jets, fronts and gyres)

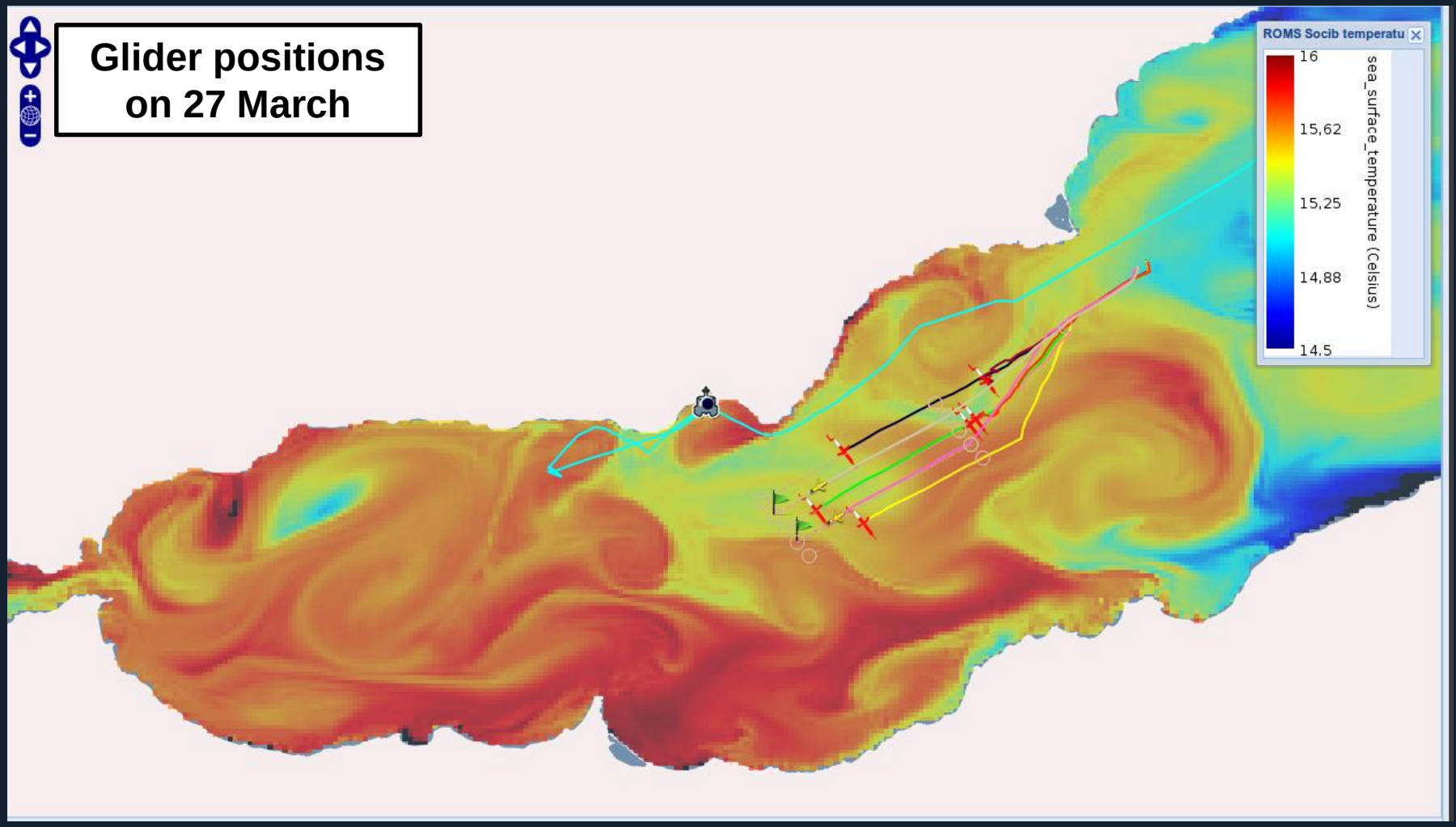
✓ WMOP simulations used in complement to satellite data to identify areas of interest (density fronts, areas of convergence and subduction) and provide insights into the expected small-scale variability, so as to optimize the deployment of instruments (moorings, floats, drifters, gliders).





Support to sea trial experiment: CALYPSO

2019 sea trial: 27 March - 11 April 2019



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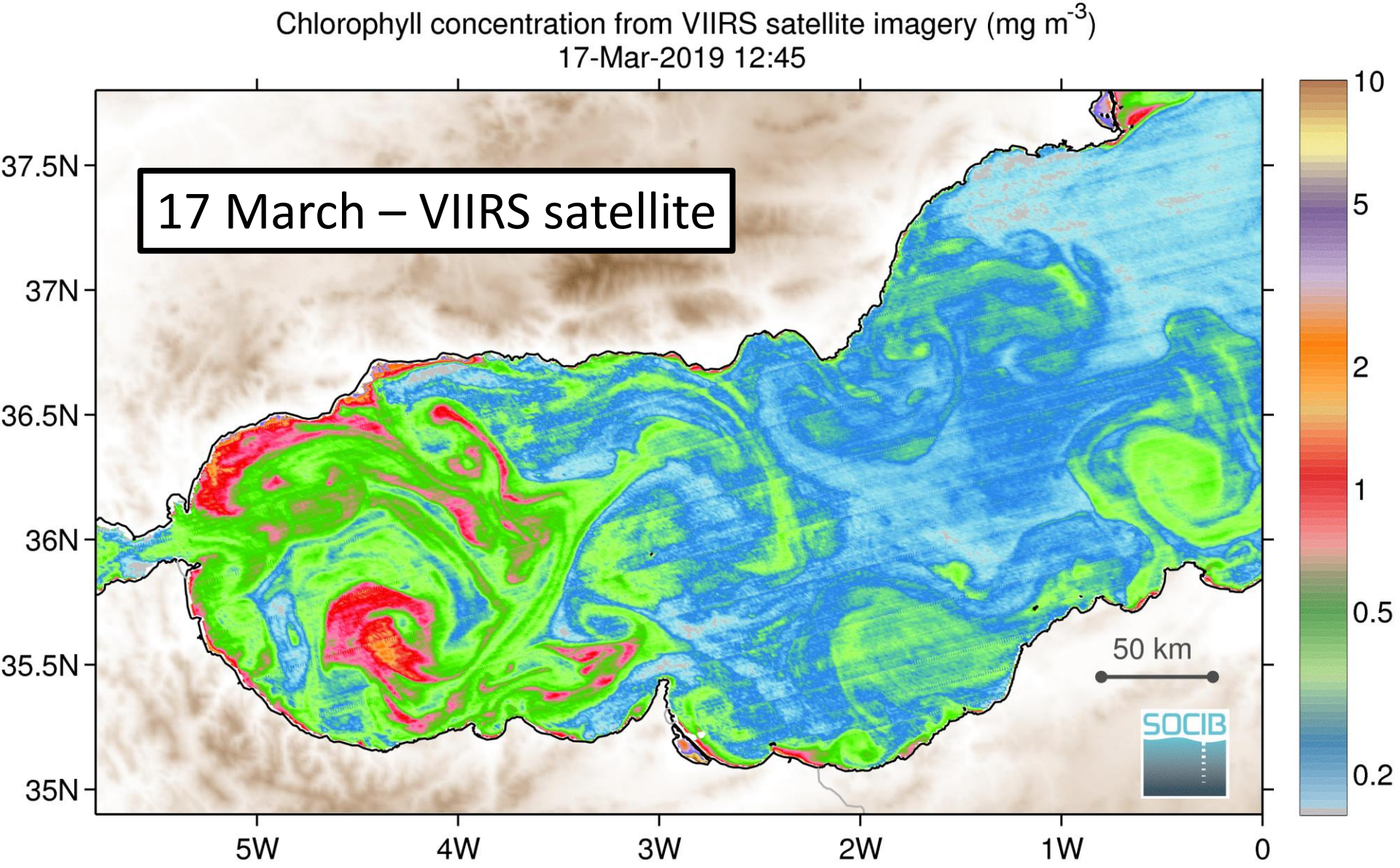

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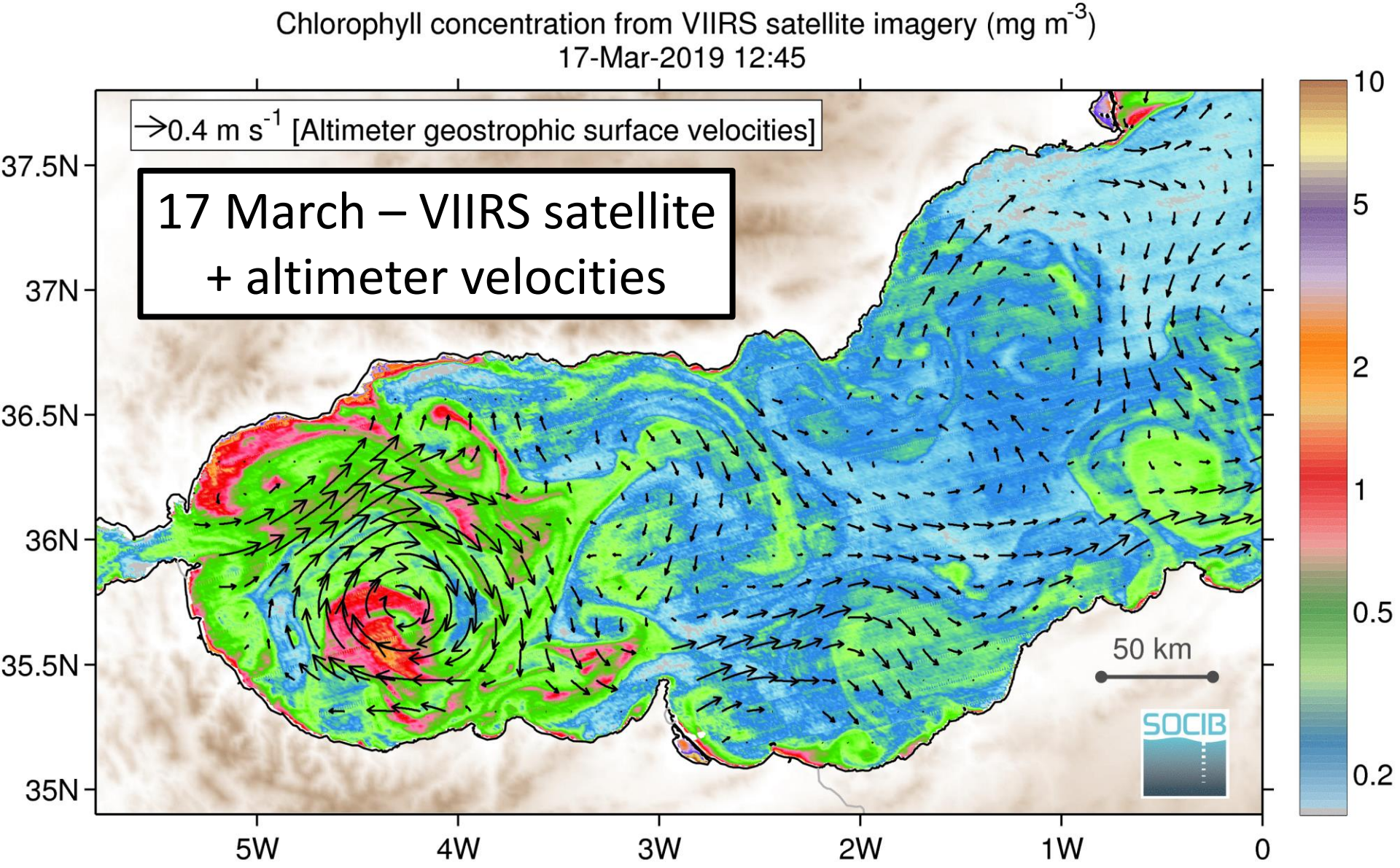

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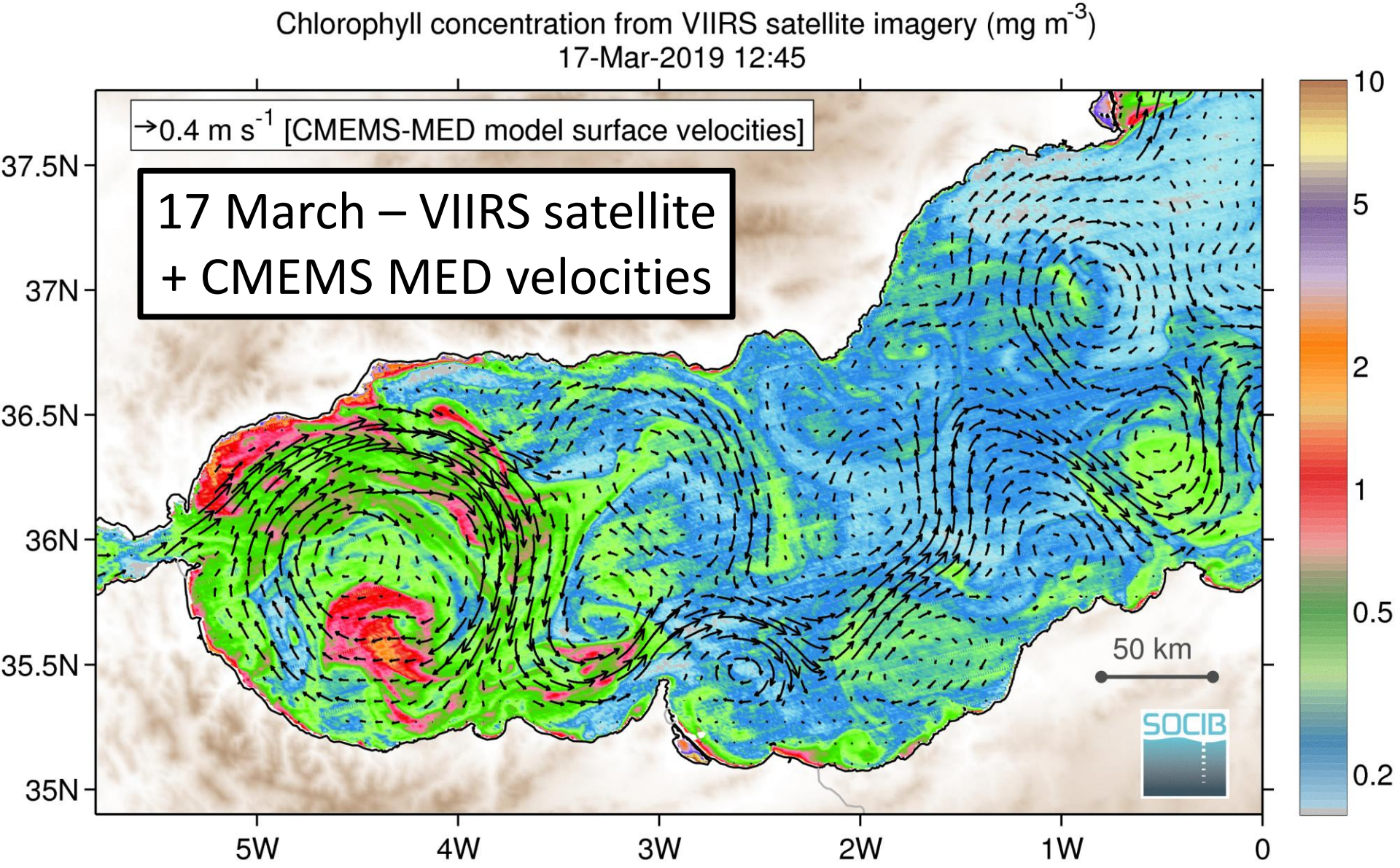

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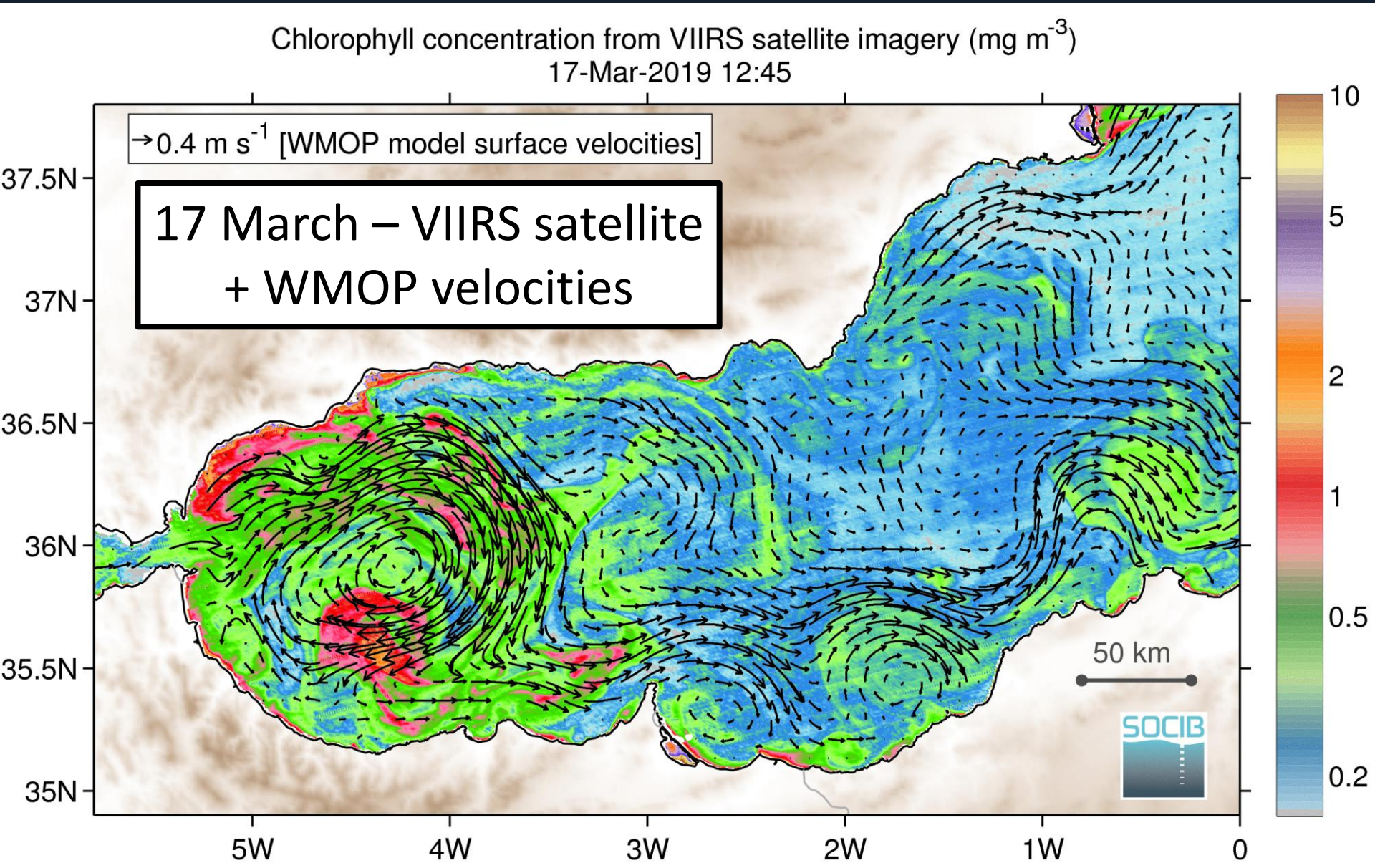
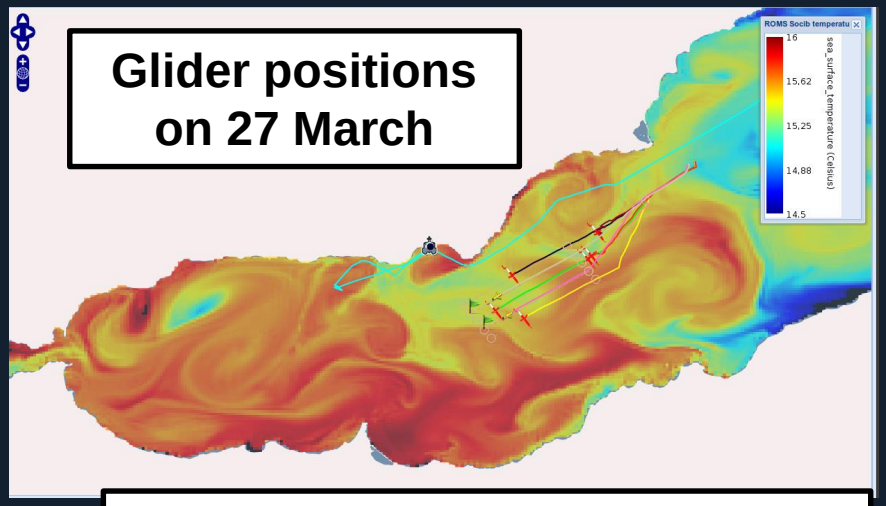


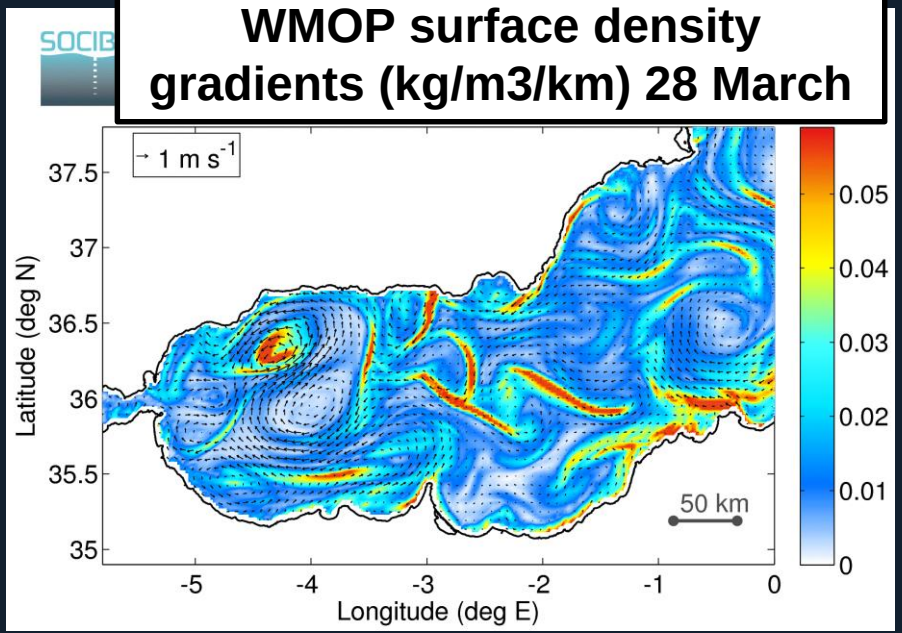
Support to sea trial experiment: CALYPSO

2019 sea trial: 27 March - 11 April 2019

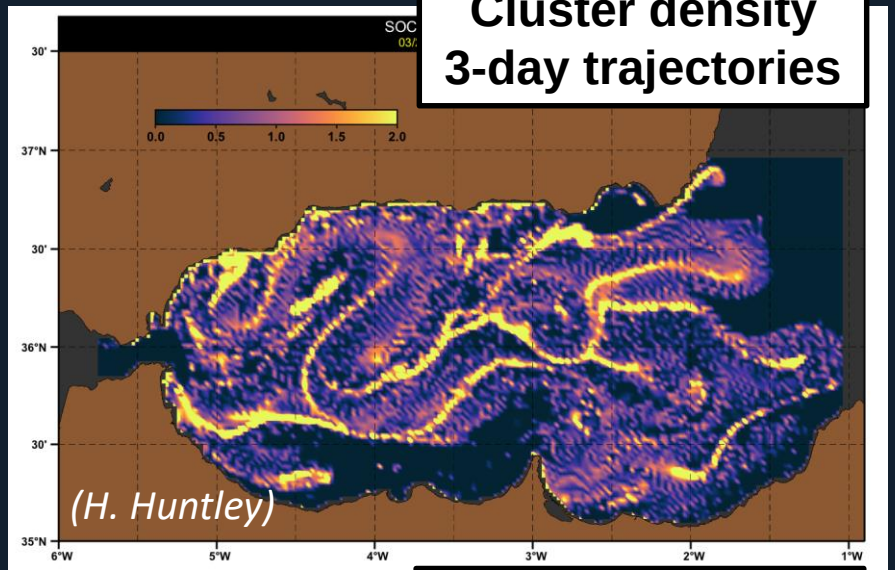
Glider positions on 27 March



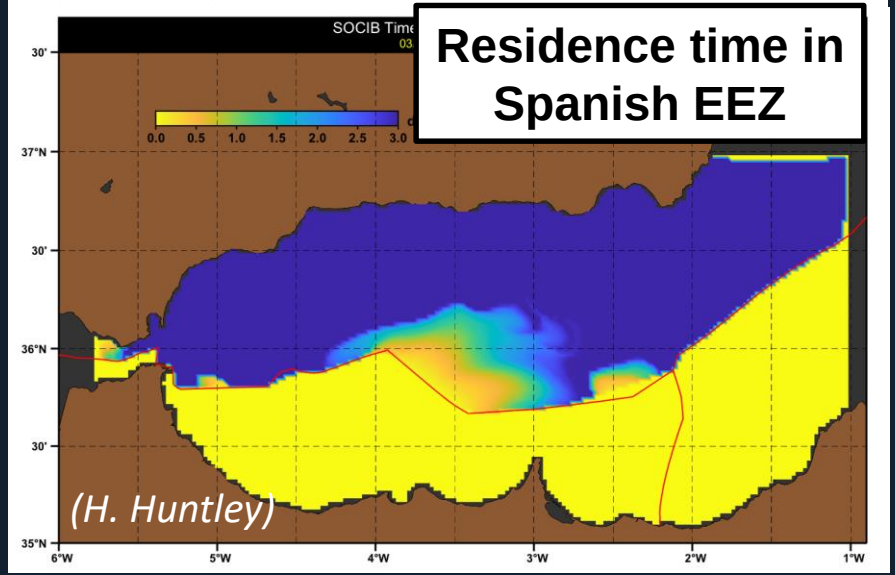
WMOP surface density gradients (kg/m3/km) 28 March



Cluster density 3-day trajectories



Residence time in Spanish EEZ



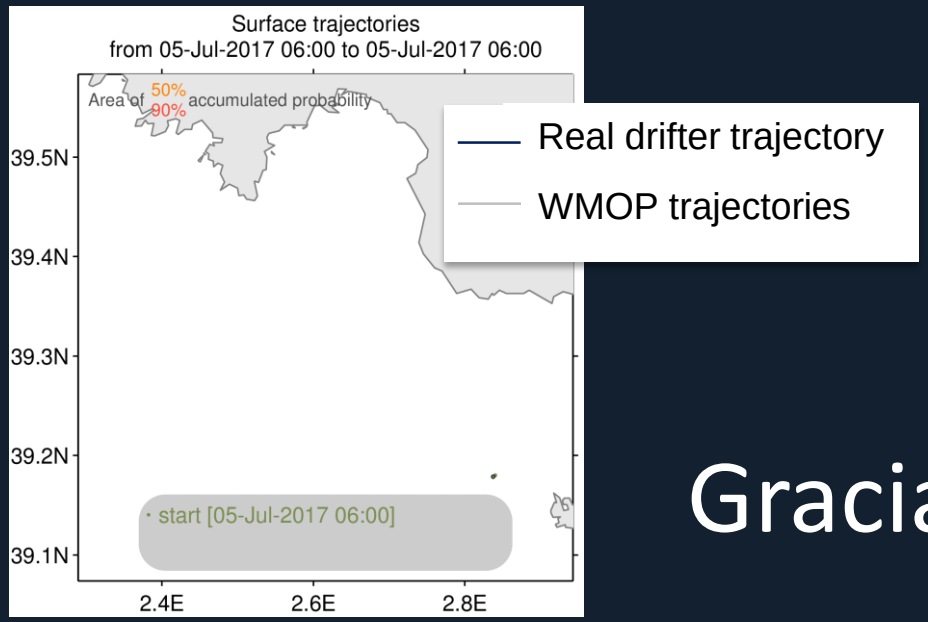
Summary

WMOP is a regional modelling system

… downscaling CMEMS MED model

… using observations from CMEMS catalogue (among others) for model assessment and data assimilation

… exploited to address scientific questions and to generate products and services for society



Gracias !