Avances recientes en el modelado de corrientes en SOCIB y las aplicaciones en términos de cálculo de derivas

SOCIB Modelling and Forecasting Facility

Baptiste Mourre

Jaime Hernandez-Lasheras, Emma Reyes, Alejandro Orfila, Eva Aguiar, Mélanie Juza, Joaquín Tintoré

SOCIB Balearic Islands Coastal Observing and Forecasting System

www.socib.es

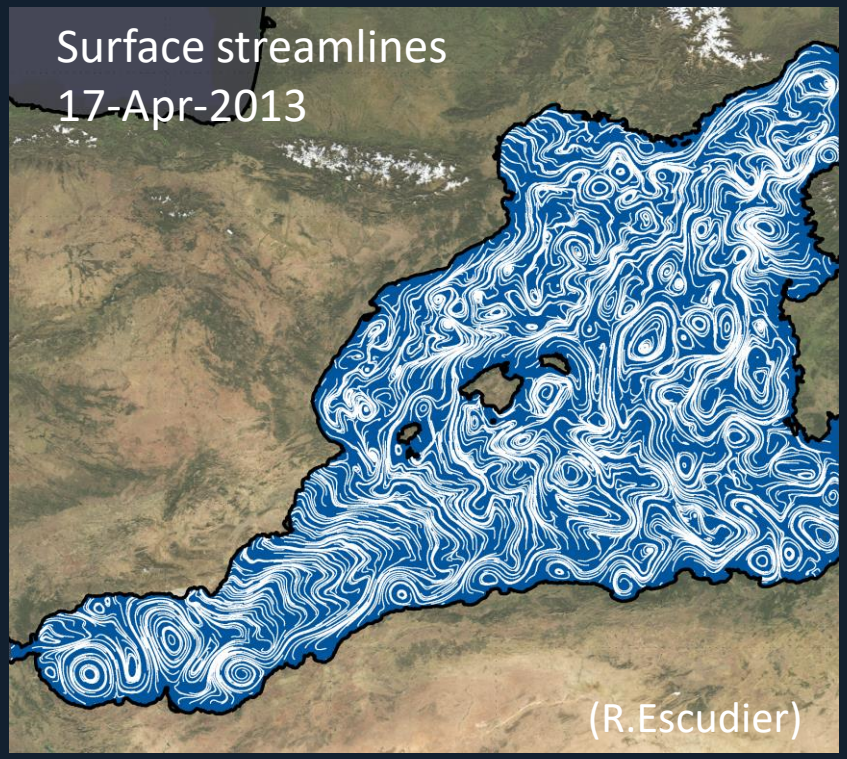
IMEDEA CSIC

Salvamento Marítimo

SASEMAR, 13 de junio de 2018

WMOP: Western Mediterranean OPerational model

(Juza et al., 2016)



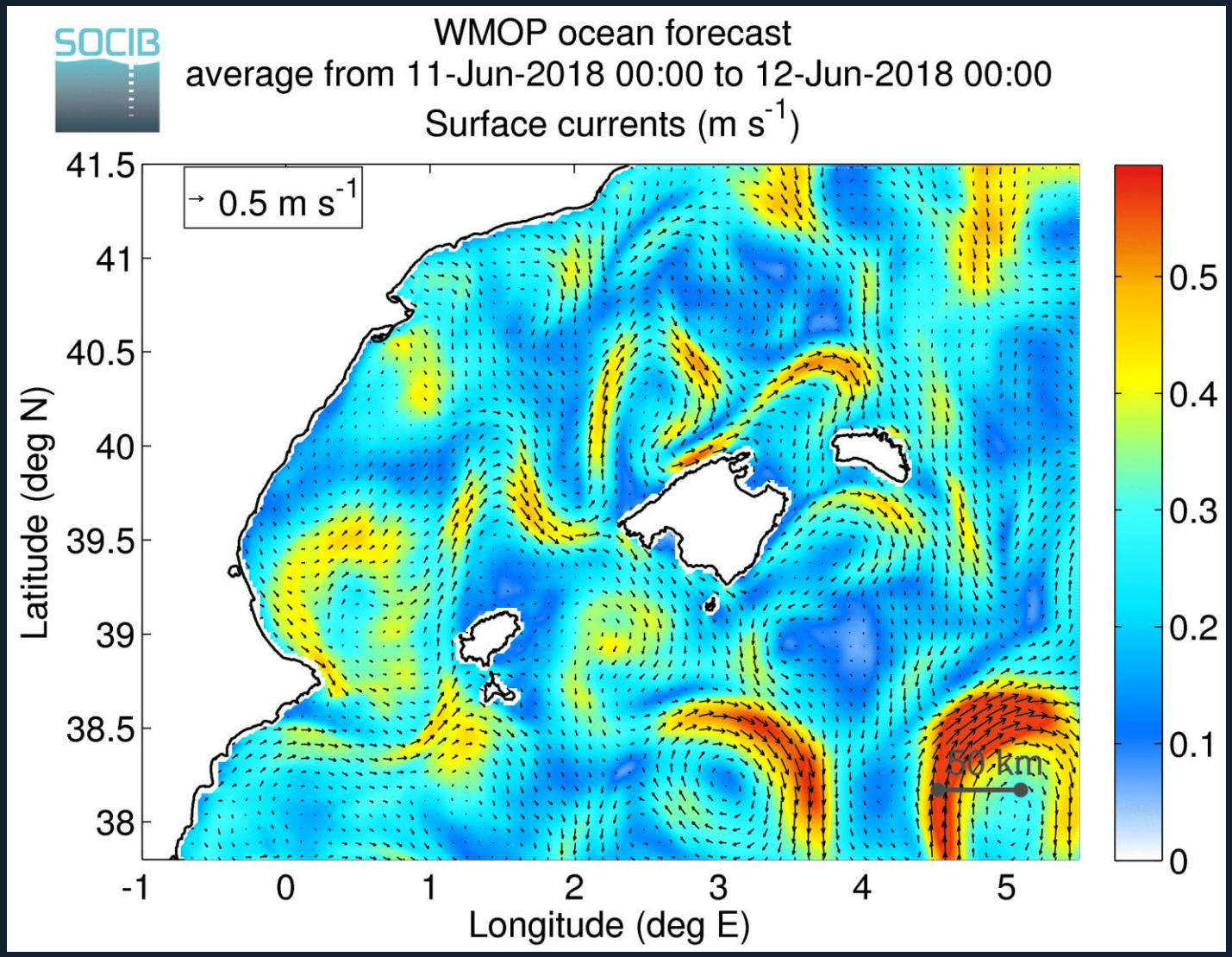
- ✓ Regional configuration of the ROMS model
- ✓ Horizontal resolution: ~ 2km (1/50º)
- ✓ Initial & boundary conditions: CMEMS MED-MFC model (1/24º)
- ✓ Atmospheric forcing: AEMET Hirlam (1h, 5km), pending to switch to HARMONIE (1h, 2.5km)
- ✓ Rivers (Var, Rhône, Aude, Hérault, Ebro, Júcar)

✓ No operational data assimilation in the standard WMOP, instead: weekly restart from CMEMS-MED conditions (with a 21-day spinup)

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

"Operational" daily production of a 72-hour forecast www.socib.es

WMOP: Western **M**editerranean **OP**erational model



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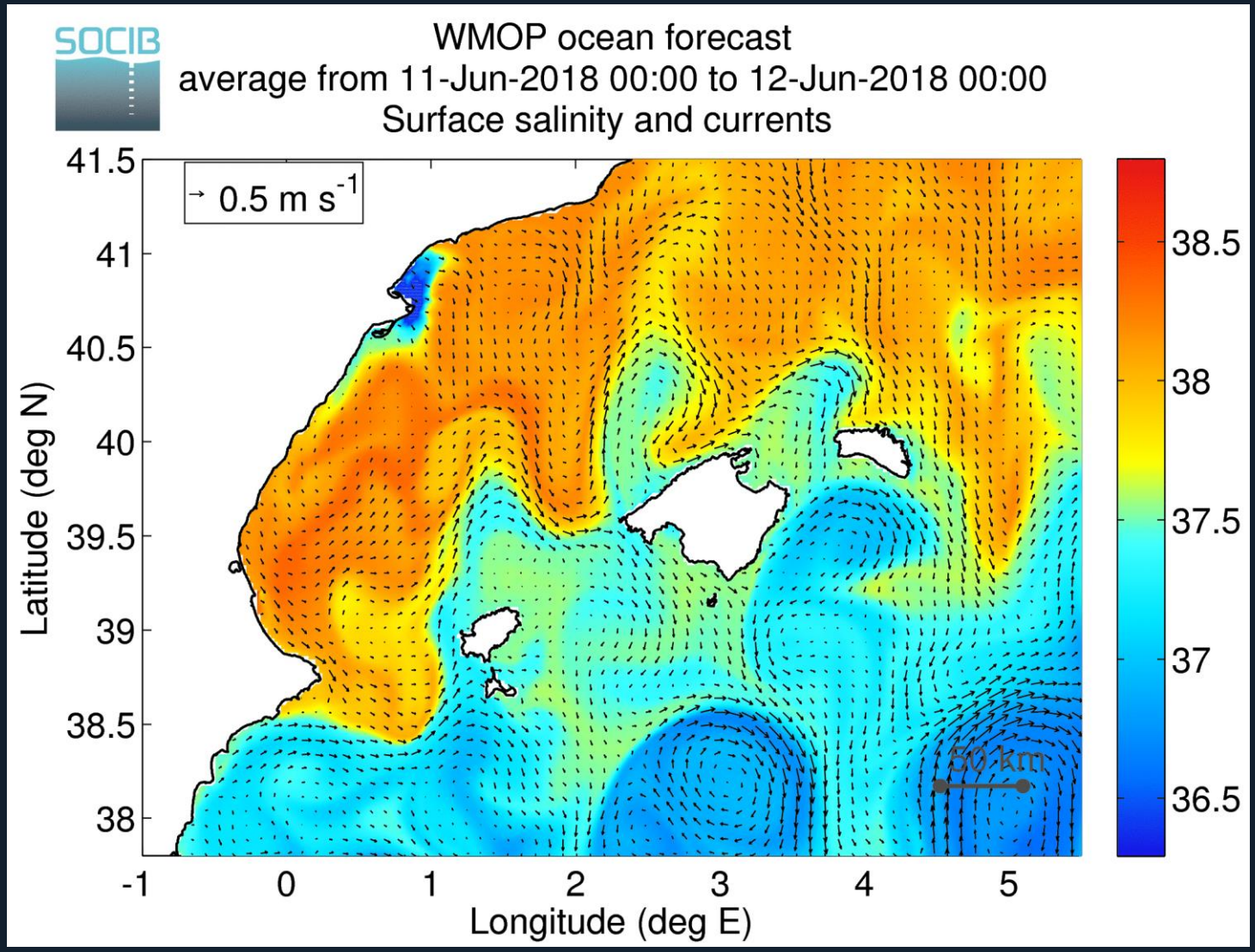

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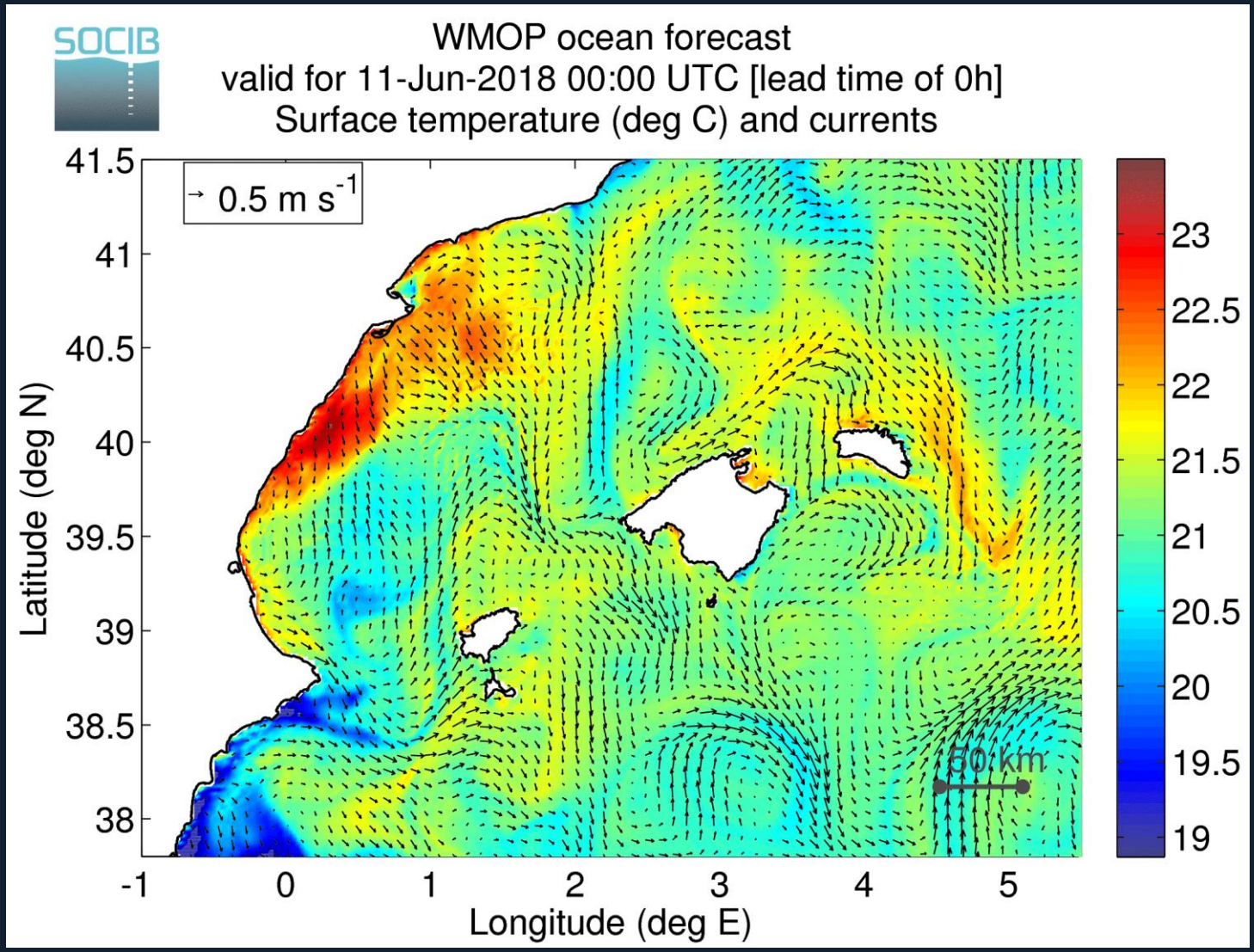

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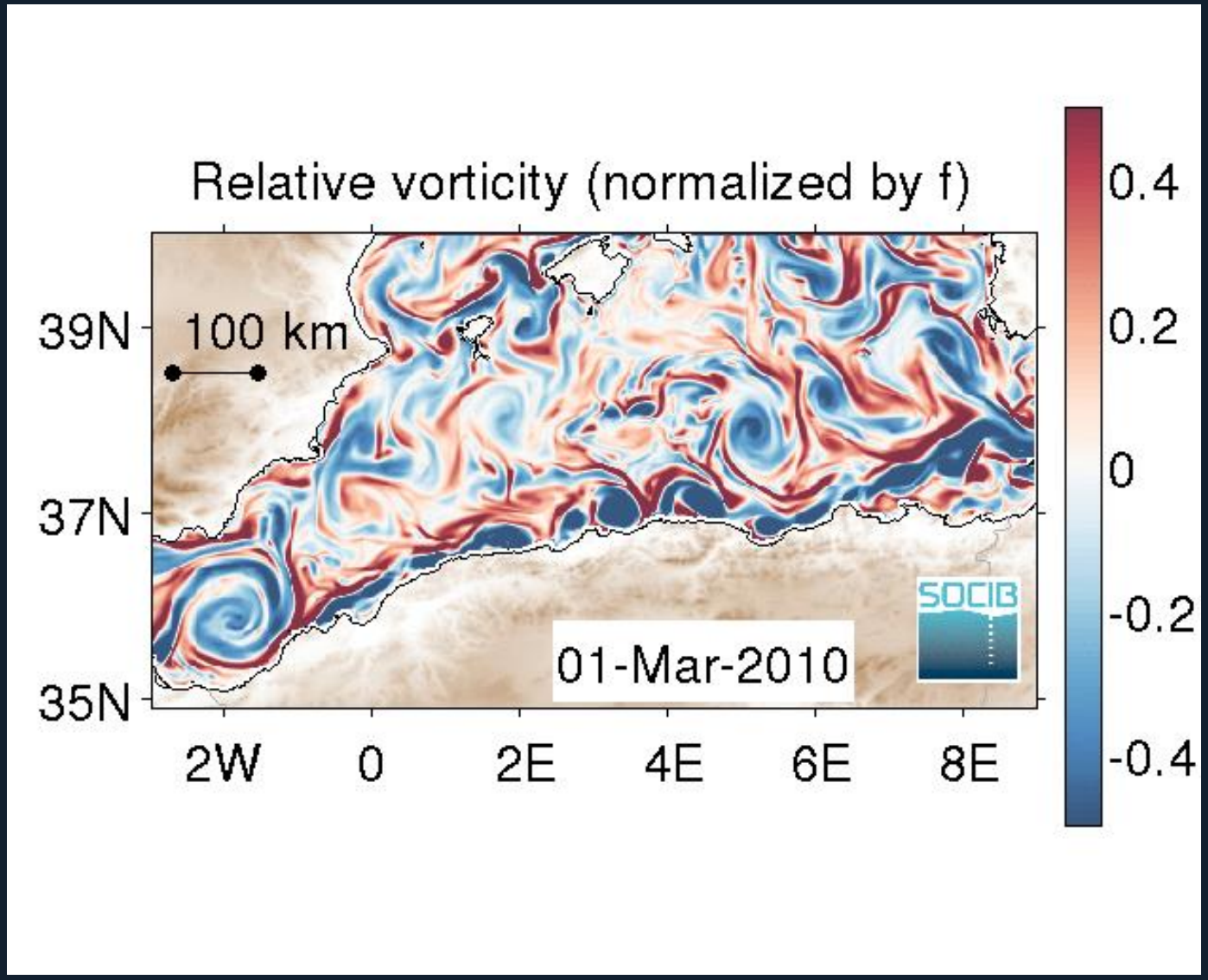
WMOP SIMULATIONS



WMOP forecasts systematic evaluation

Near real-time & Delayed modes

www.socib.es

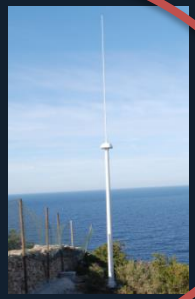
Gliders

Ship-based CTDs

Satellite

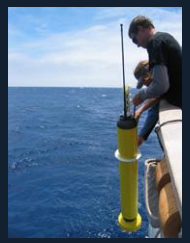
WMOP ocean forecasts

HF radar



Moorings

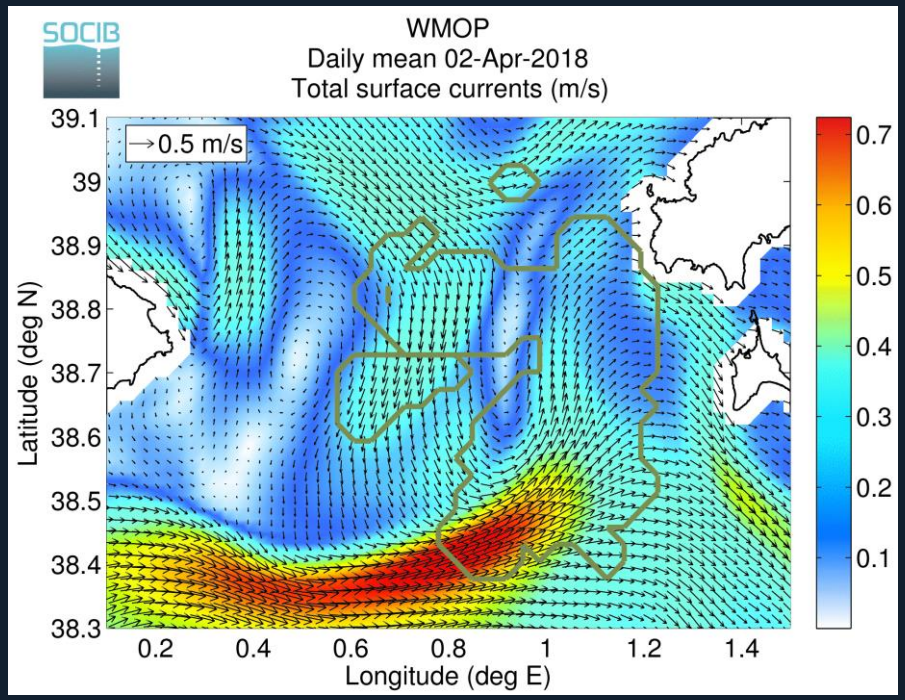
Argo floats

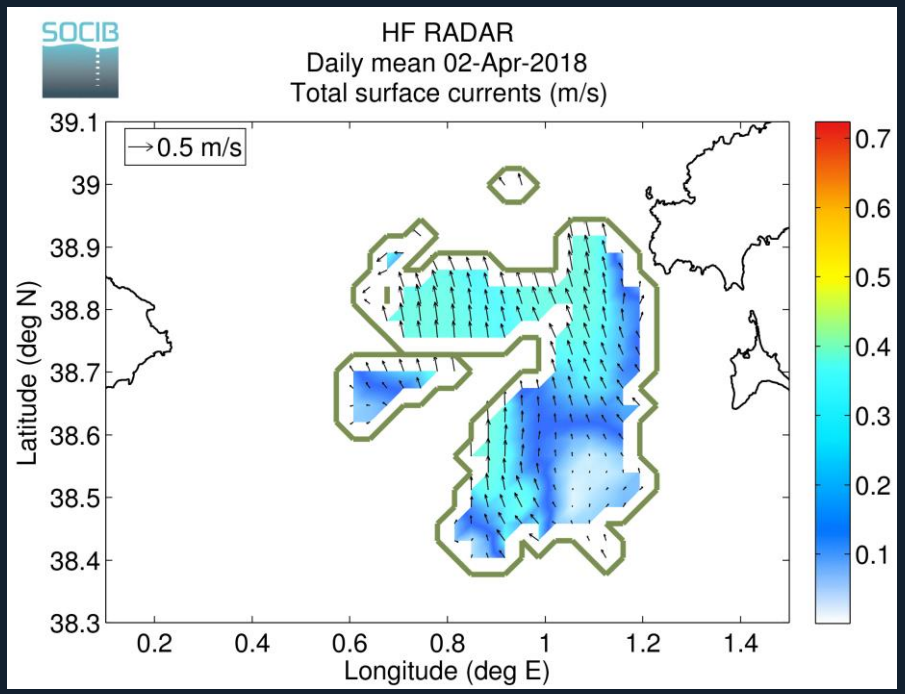


Surface drifters

WMOP forecasts evaluation: HF radar surface currents

http://www.socib.es/?seccion=modelling&facility=wmedvalidation





Ibiza Channel

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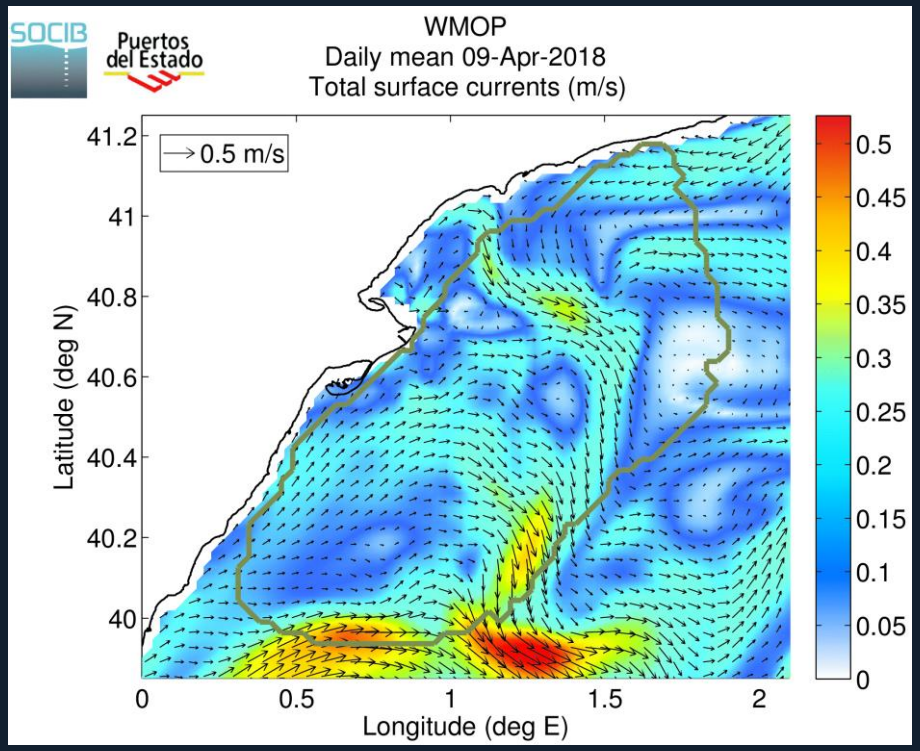

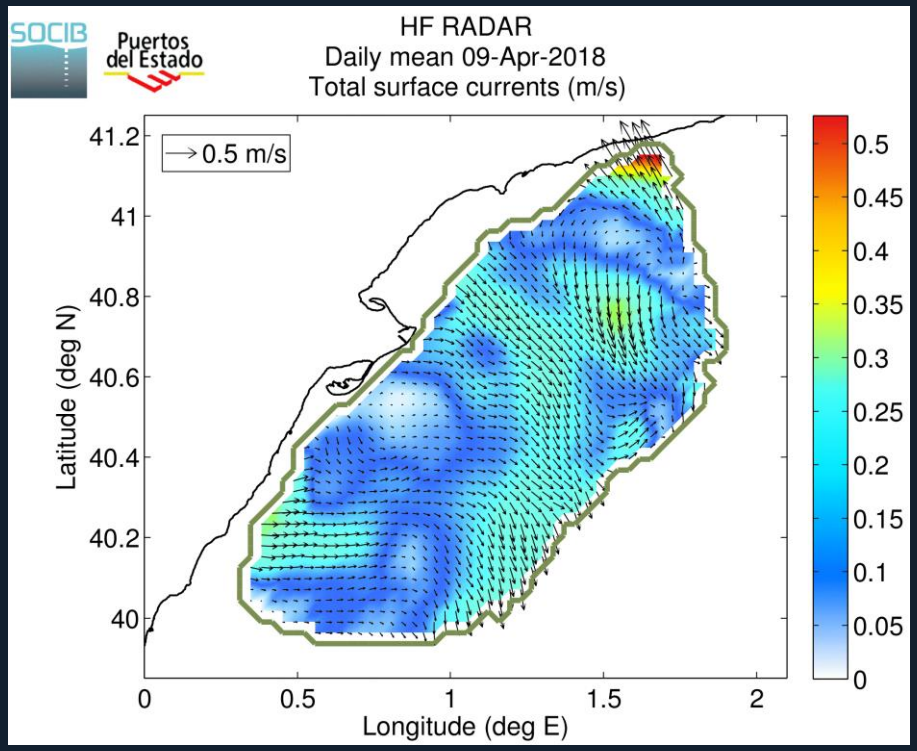

Ebro Delta region (Puertos del Estado)

WMOP forecasts evaluation: HF radar surface currents

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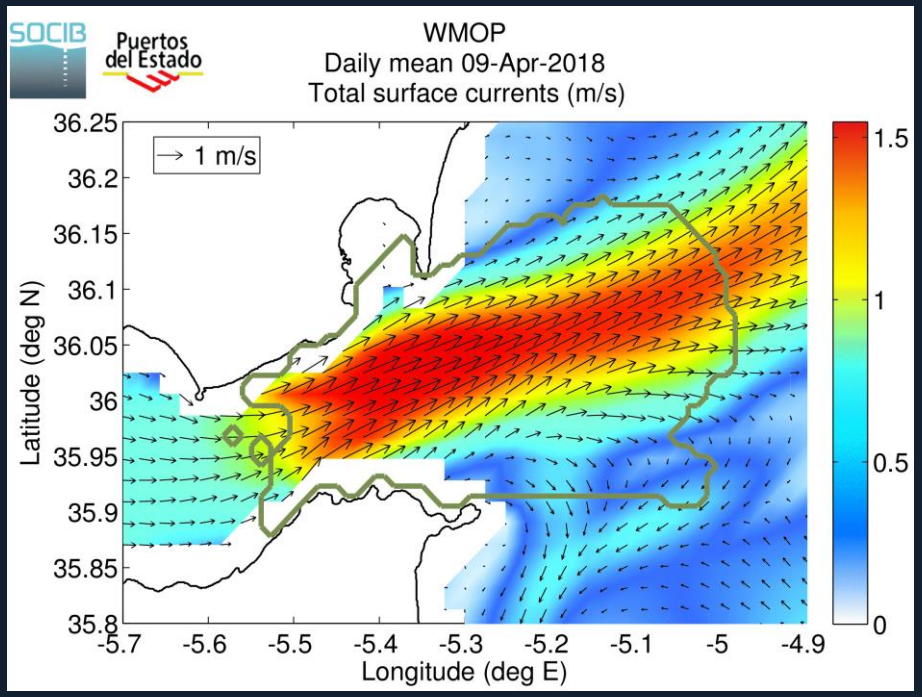

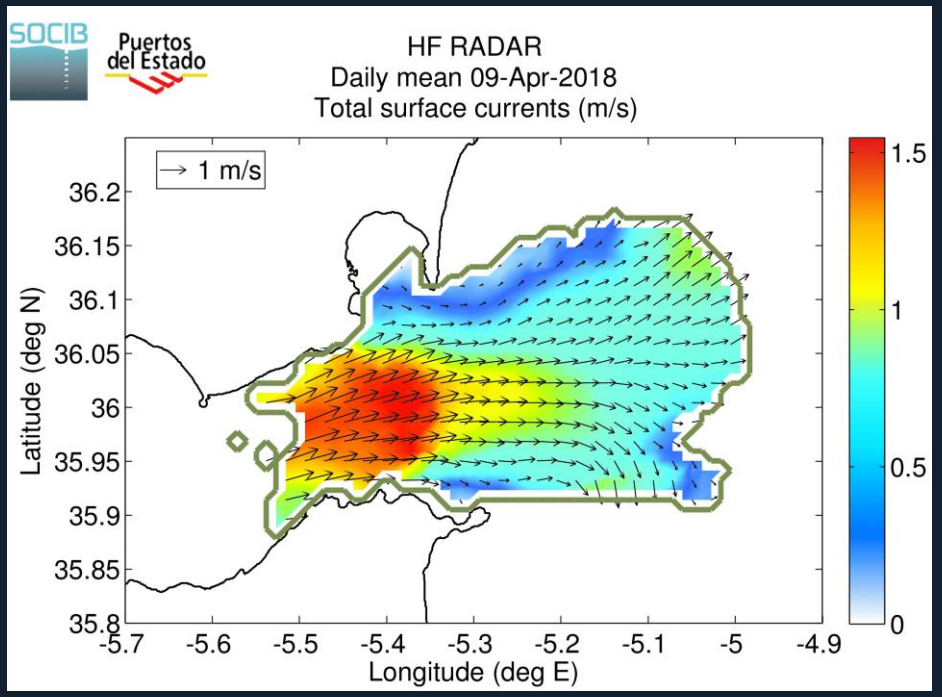

Gibraltar Strait (Puertos del Estado)

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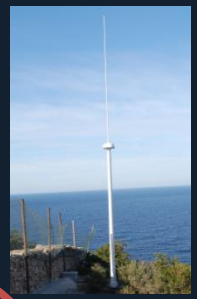

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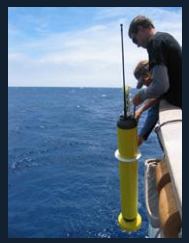
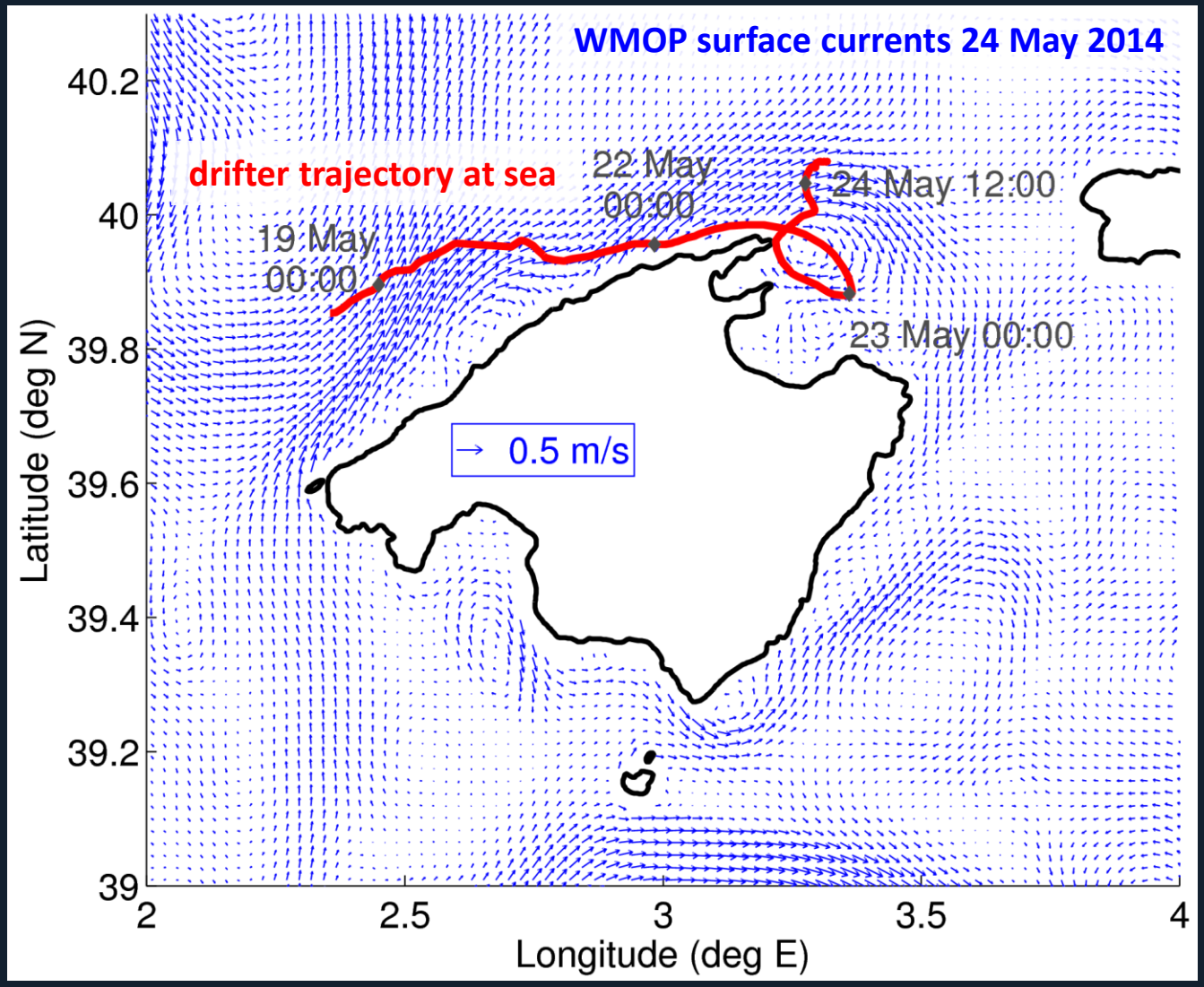


Surface drifters

WMOP forecasts evaluation: surface drifters



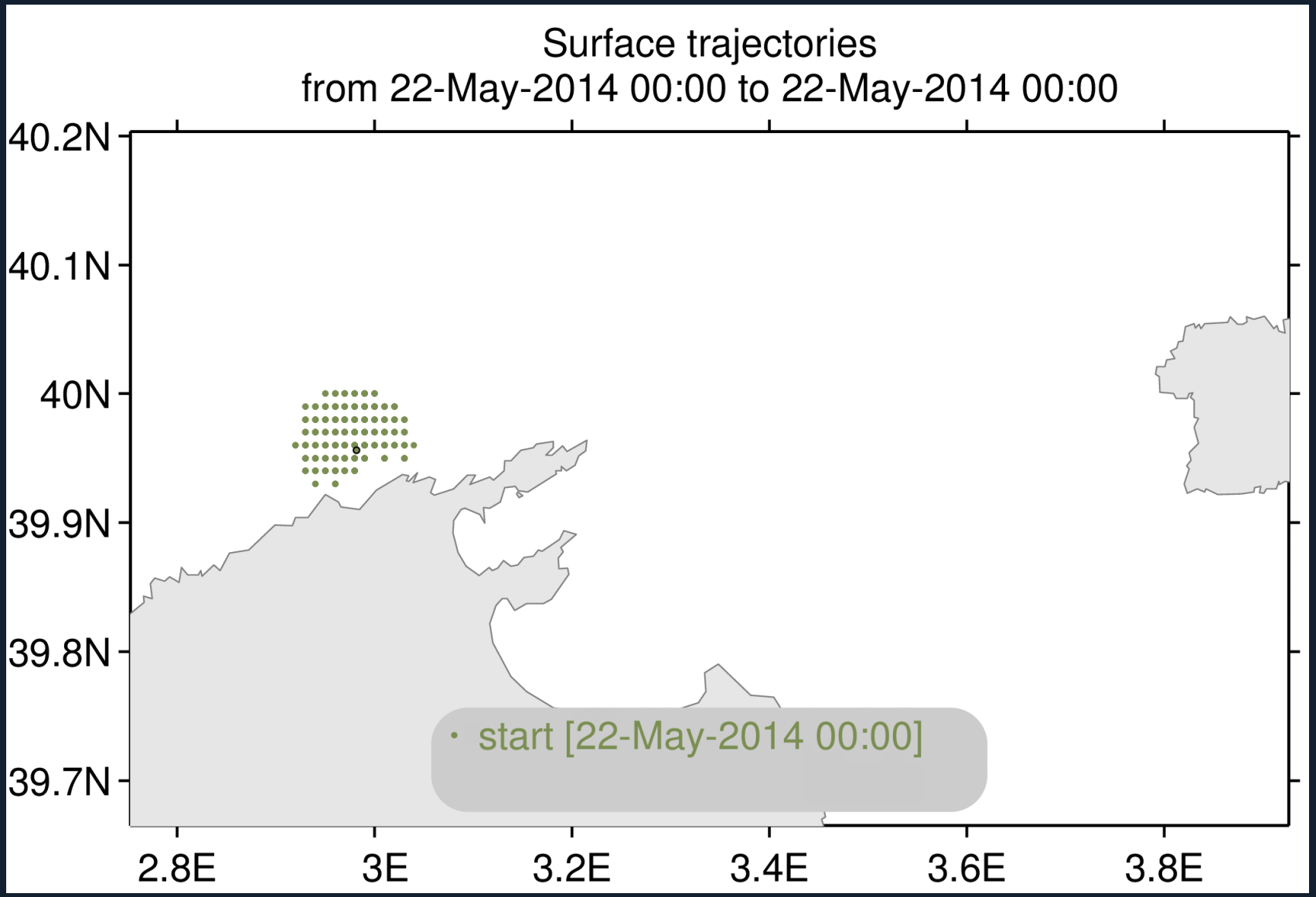
Mean velocity along the drifter trajectory:

drifter → 0.30 m/s

WMOP → 0.28 m/s

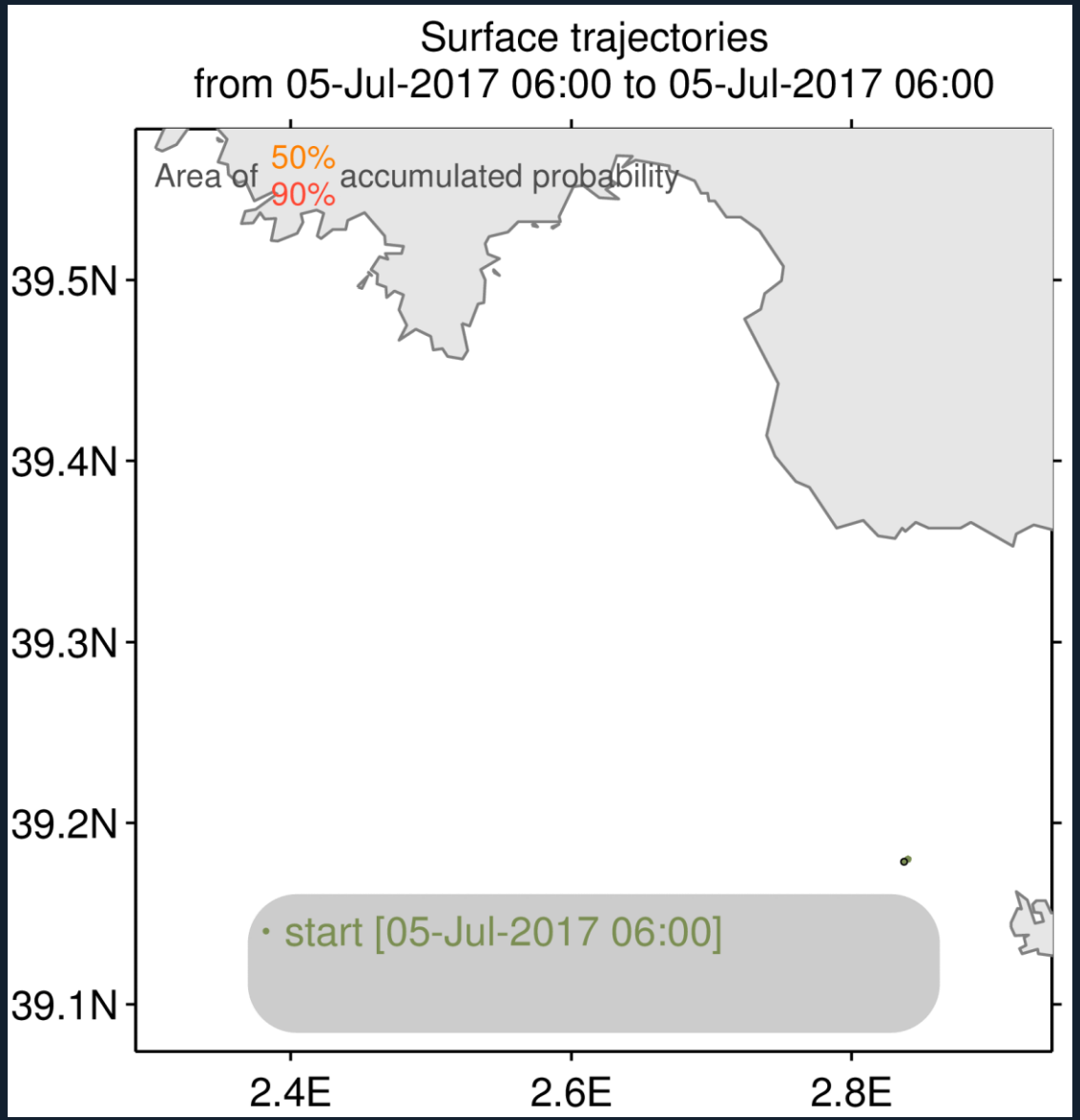
MFS → 0.16 m/s

WMOP forecasts evaluation: surface drifters



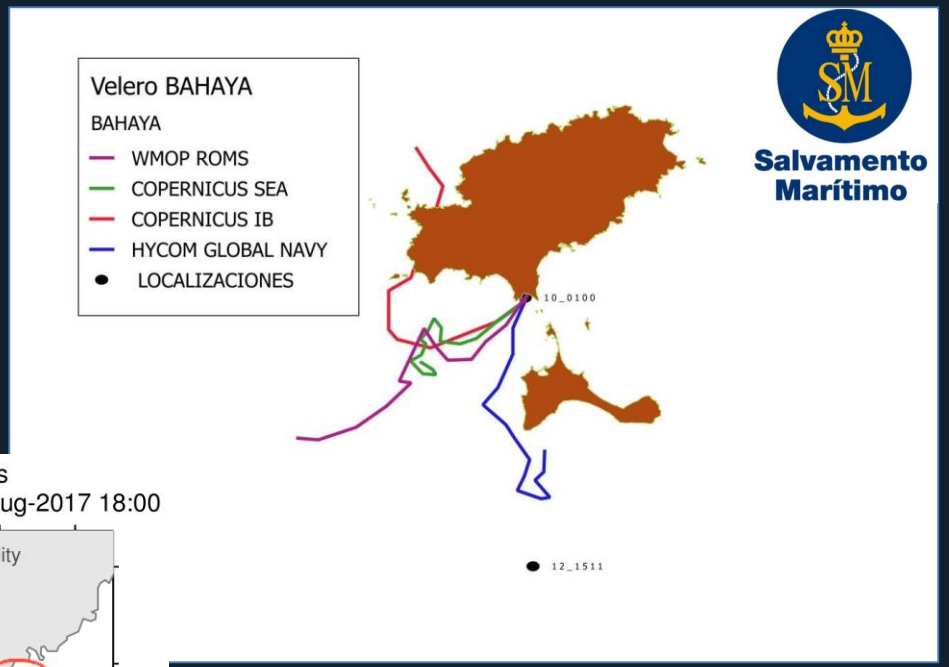
WMOP forecasts evaluation: surface drifters

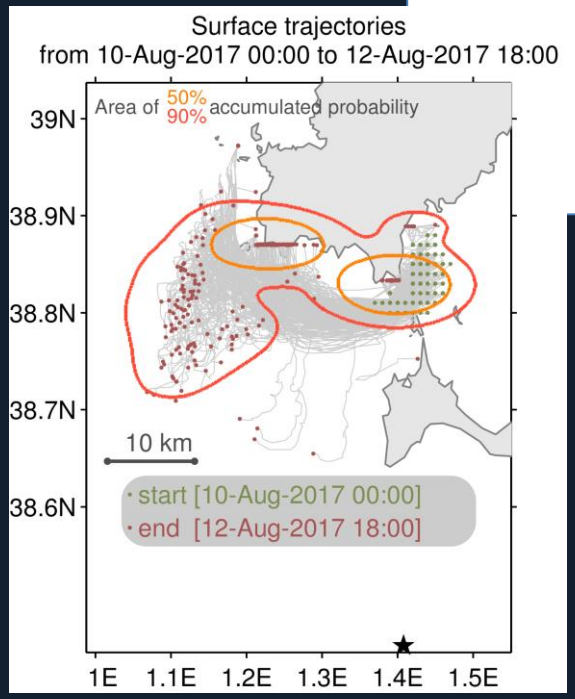
tracPy: Thyng and Hetland, 2014
TRACMASS: Döös et al., 2014
Probability kernel: Sayol et al., 2013



Coastal current and sea breeze effect

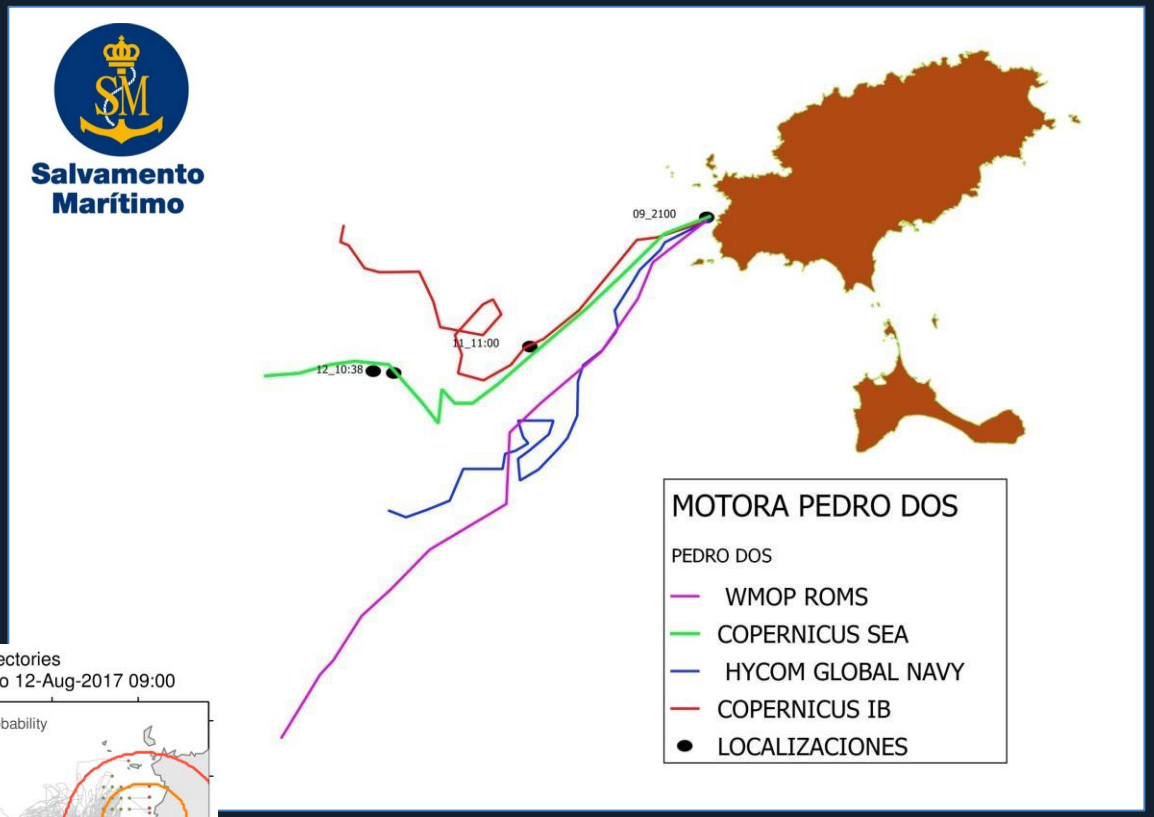
SASEMAR - Velero Bahaya – Aug 2017

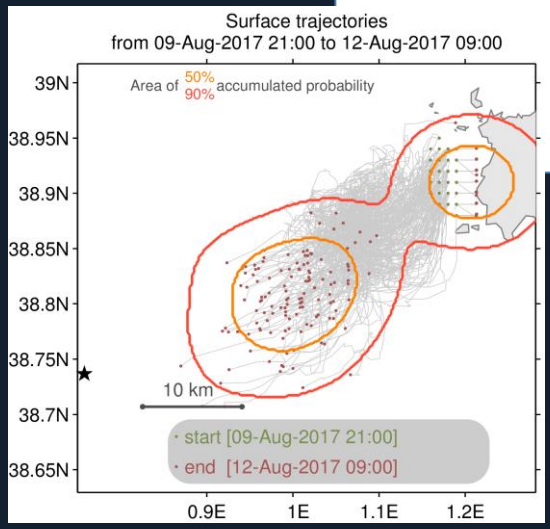




WMOP in RPS database since July 2017

SASEMAR – Pedro Dos – Ibiza Aug 2017

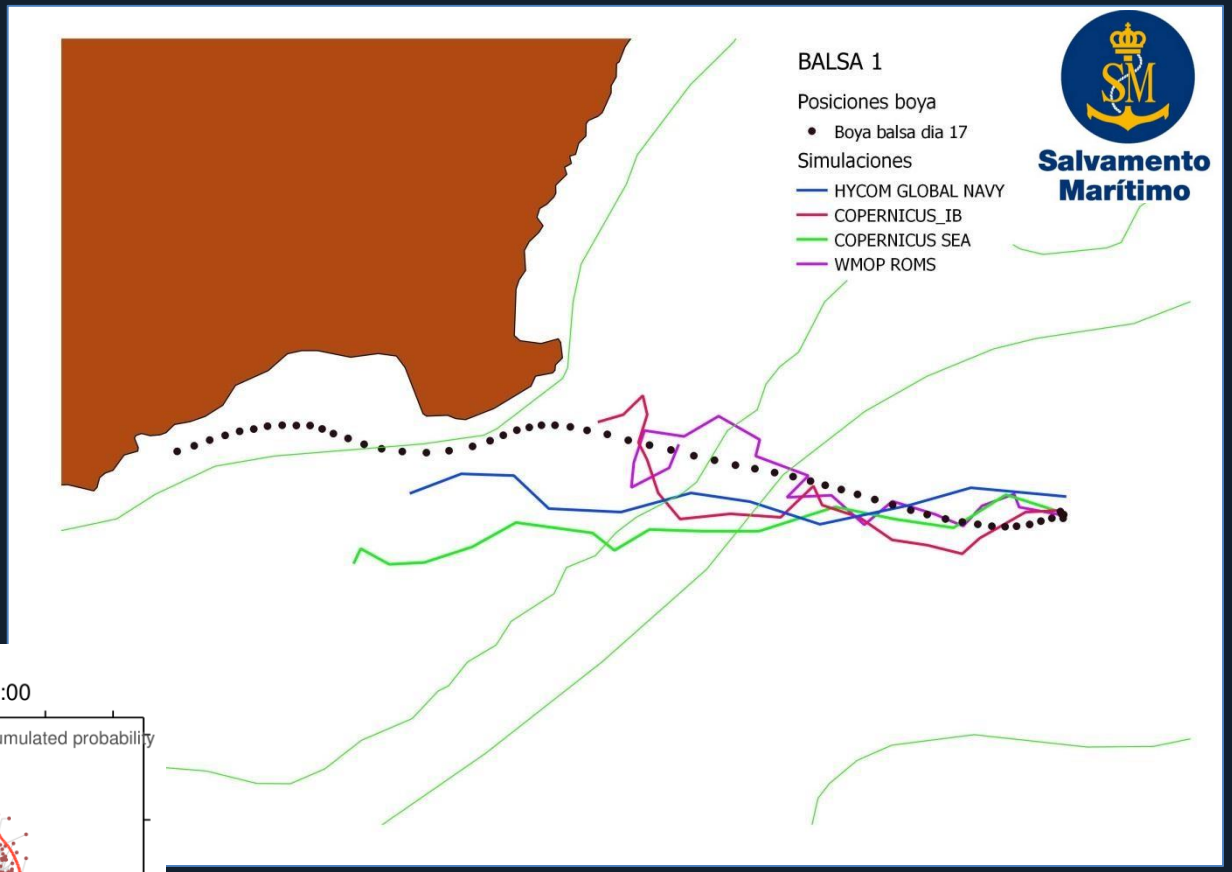


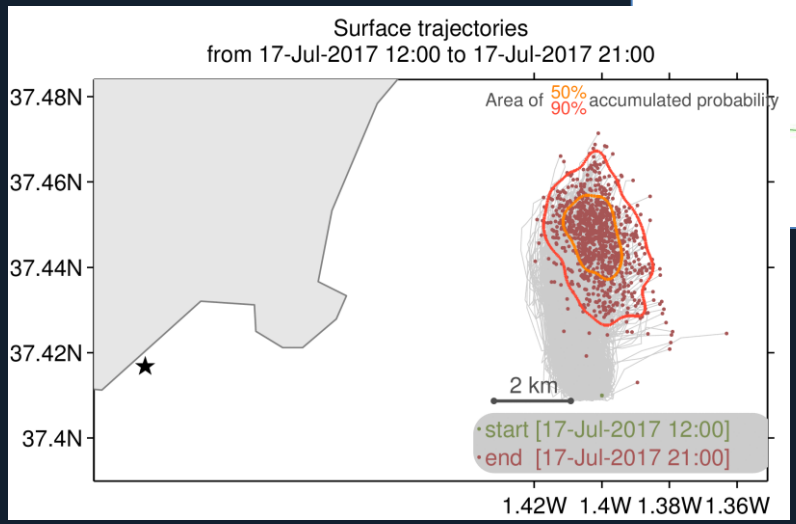


WMOP in RPS database since July 2017

SASEMAR – Balsa 1 – Cartagena Jul 2017

NEUMATICO 8 /

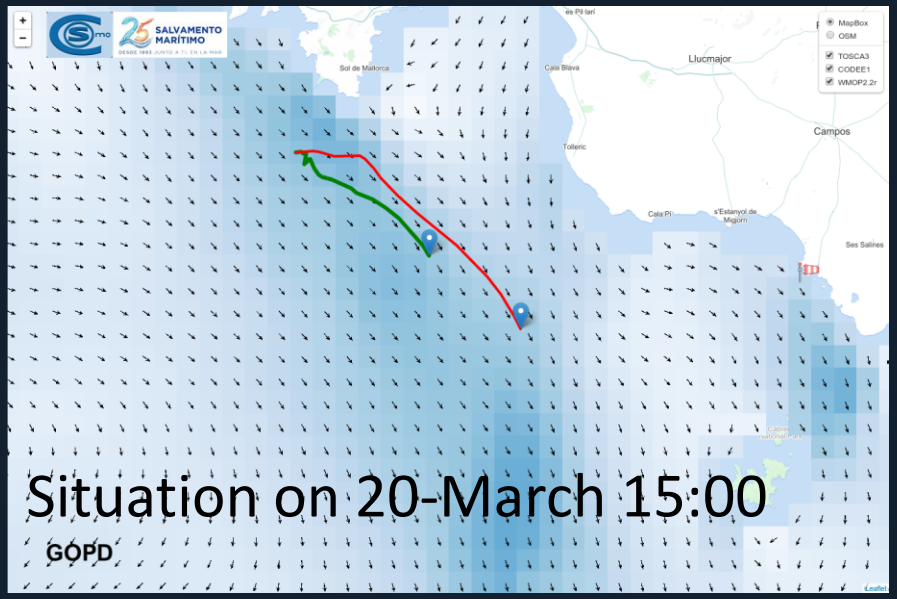


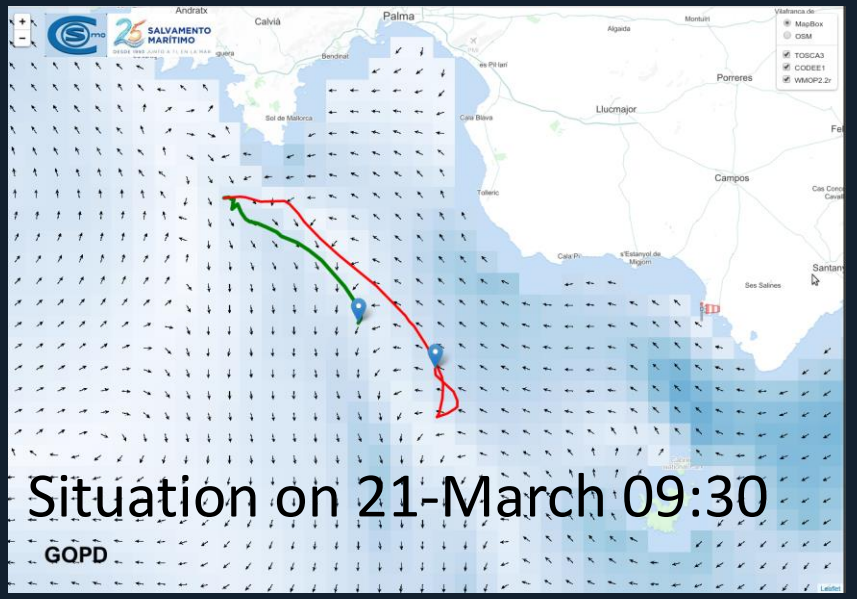


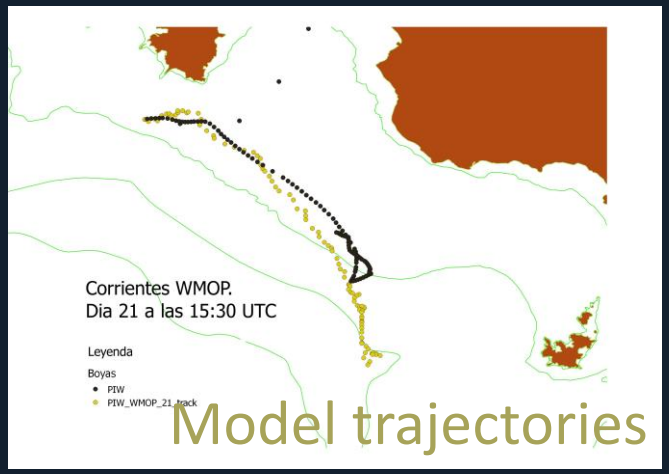
WMOP in RPS database since July 2017

Ejercicio SASEMAR– 19 de marzo de 2018

SASEMAR exercise: drifters launched on 19-March-2018 15:00 UTC





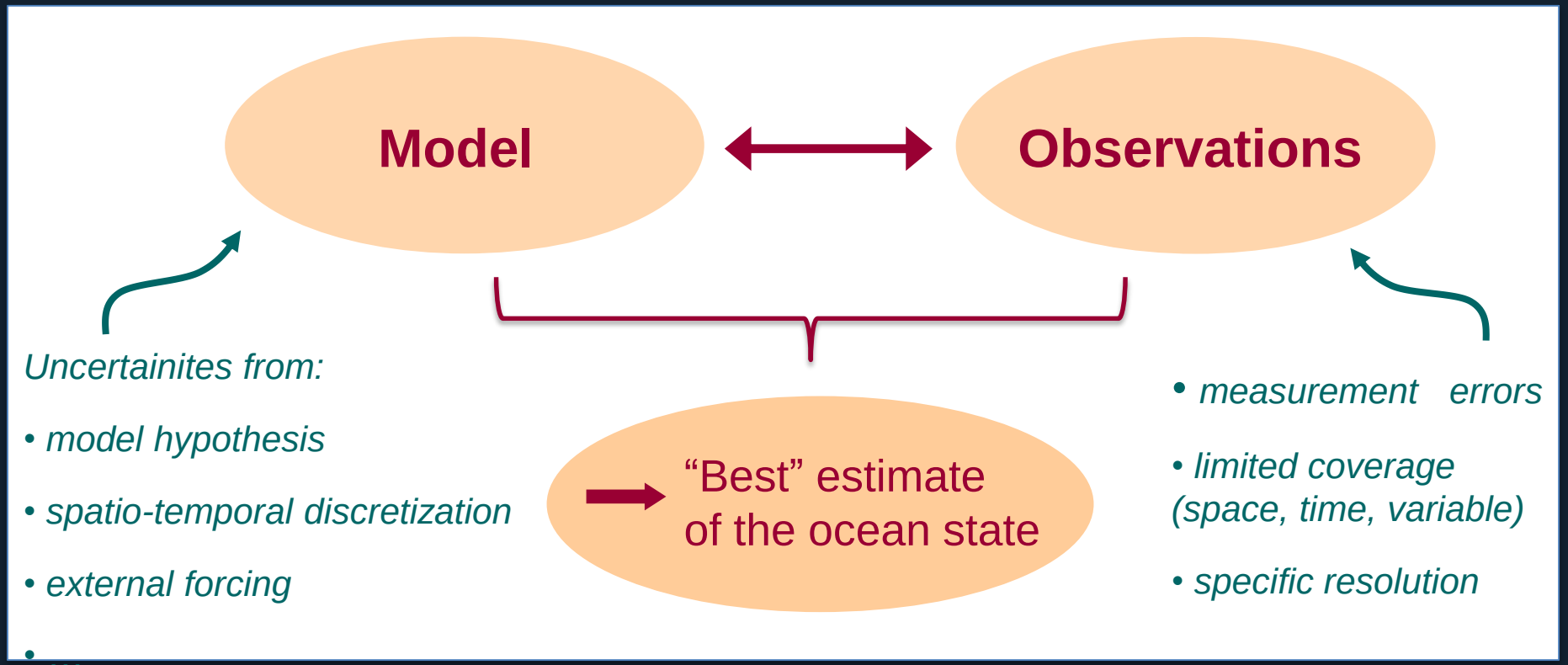


Salvamento Marítimo

Improving forecasts: data assimilation

= combine observations and model to generate an optimal initial state for the prediction

→ improve representation of mesoscale structures (when observed…)



Improving forecasts: importance of data assimilation

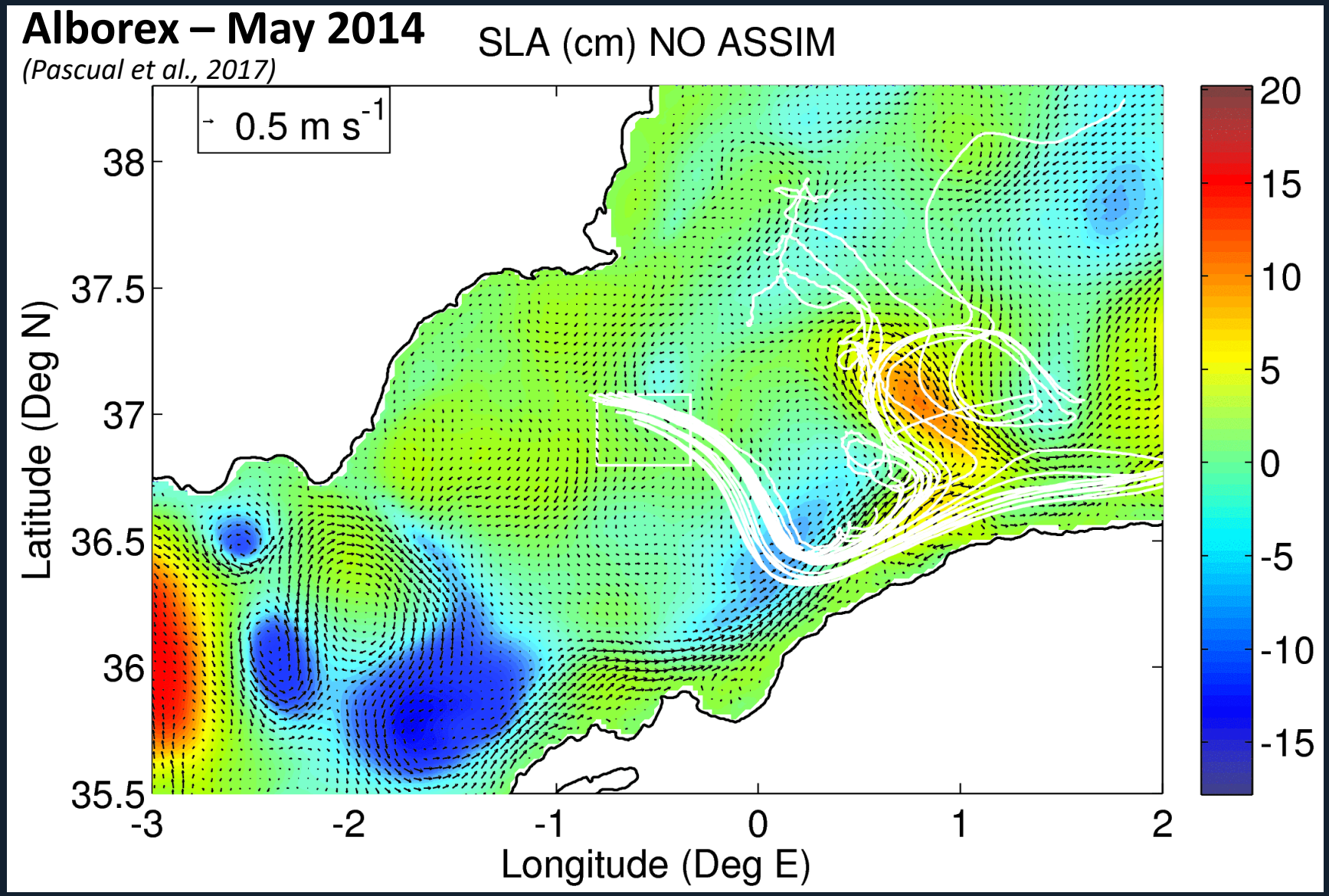
= combine observations and model to generate an optimal initial state for the prediction

→ improve representation of mesoscale structures (when observed…)

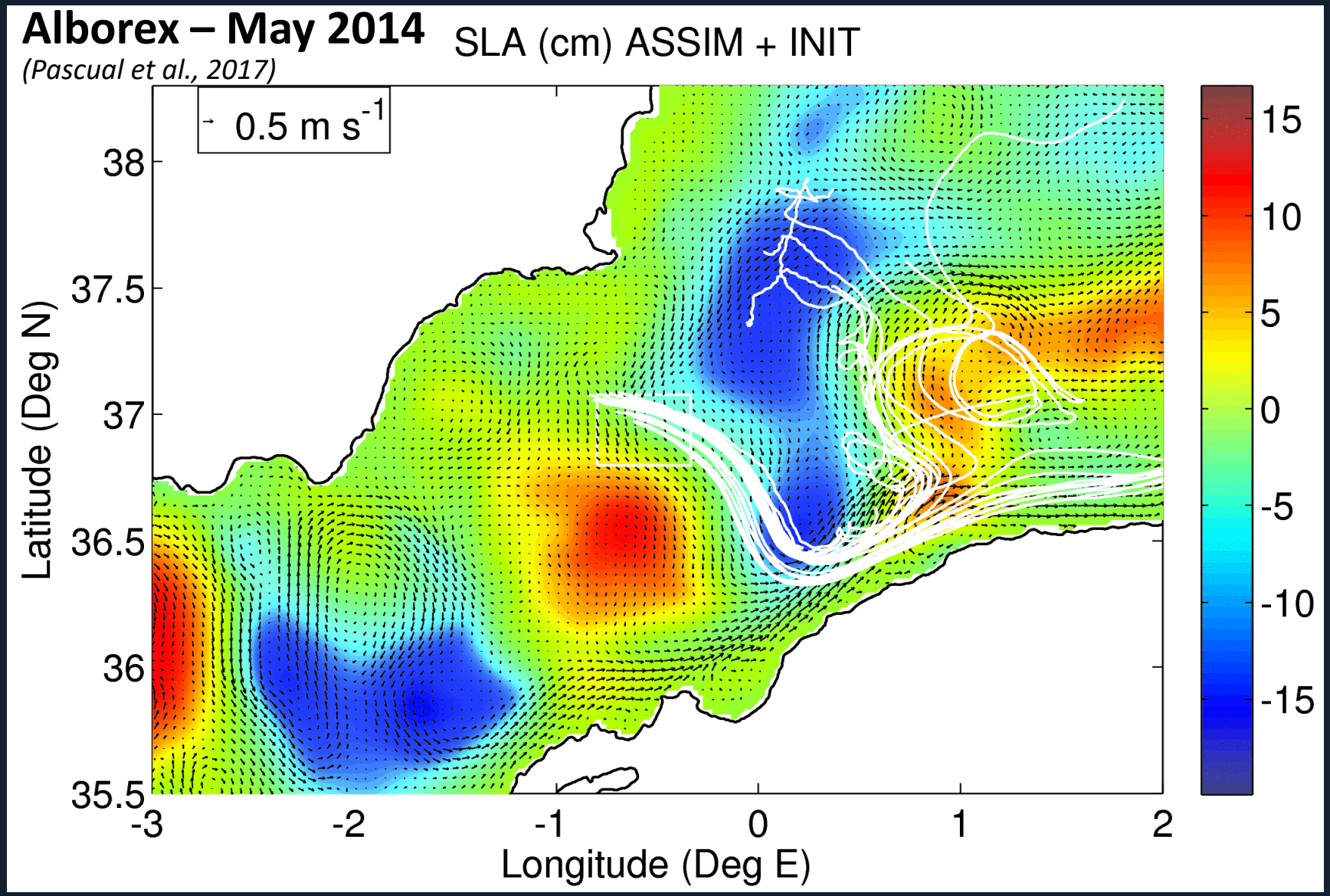
Here: Ensemble Optimal Interpolation approach, with assimilation of:

- satellite altimeter sea level
- satellite sea surface temperature
- Argo temperature-salinity profiles
- HF radar data

WMOP forecasts: importance of data assimilation



WMOP forecasts: importance of data assimilation

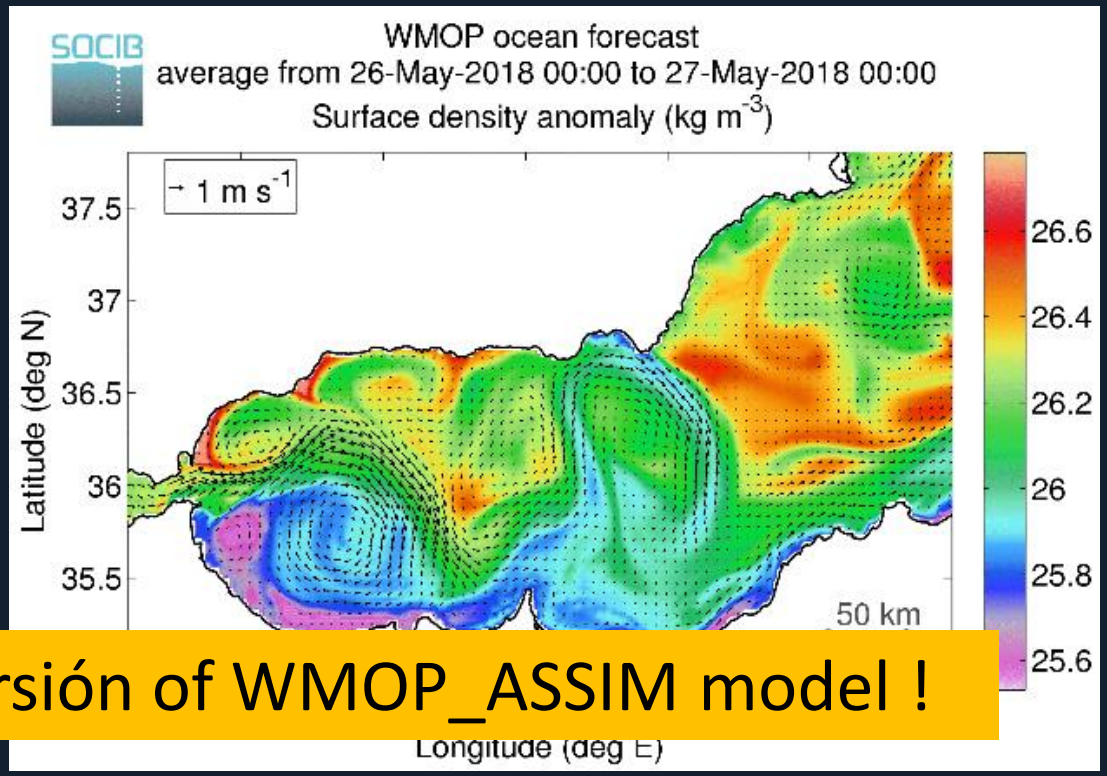


WMOP ASSIM forecasts: CALYPSO experiment

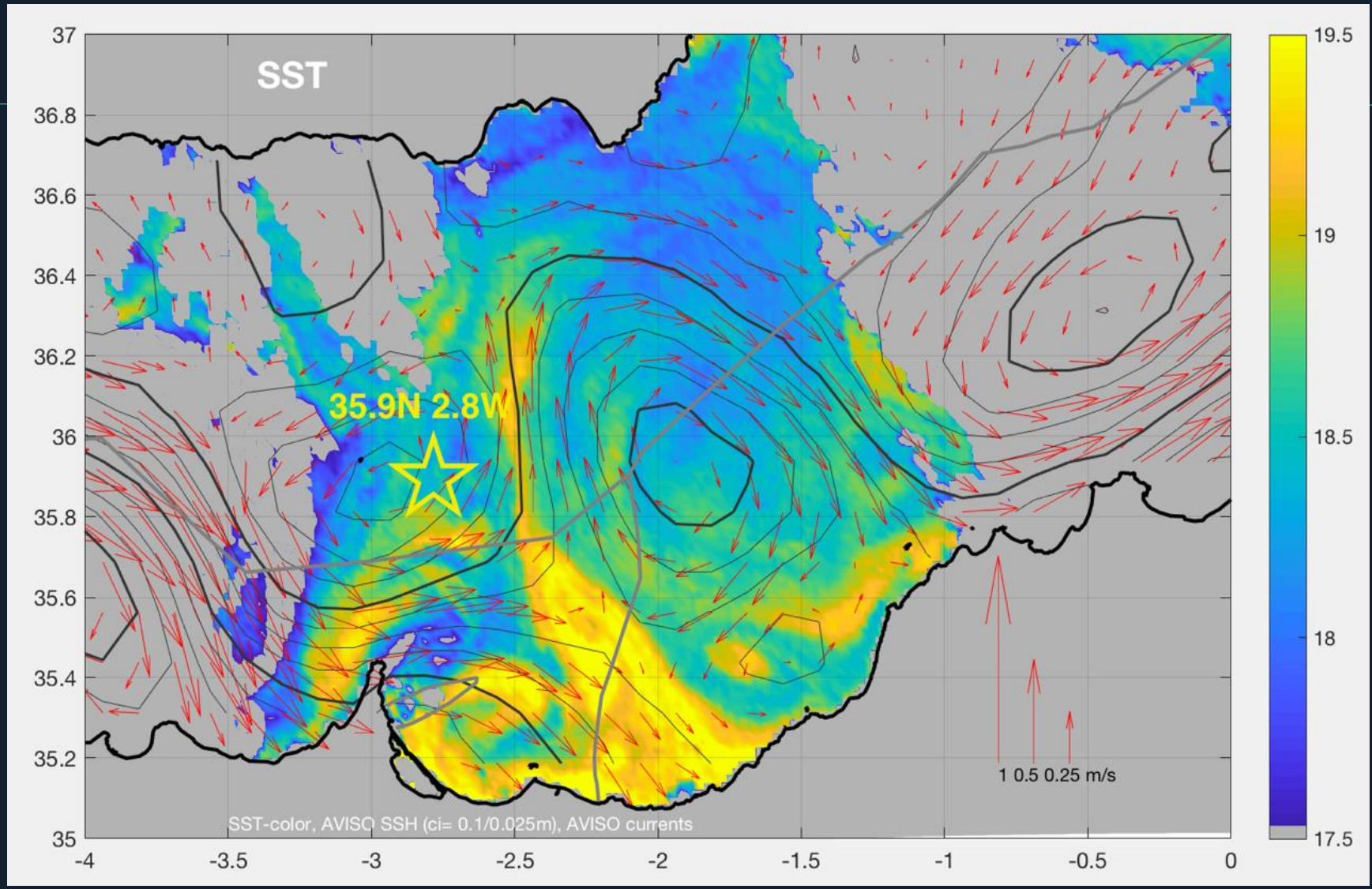
CALYPSO experiment – Alboran Sea
26 May – 2 June 2018

Monitoring fine-scale ocean structures associated with density fronts in the Alboran Sea to study 3D pathways

US ONR Research Initiative

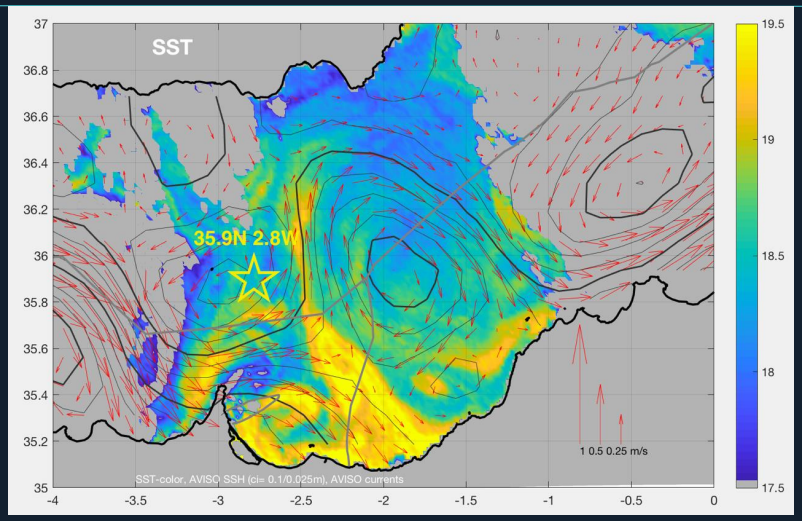


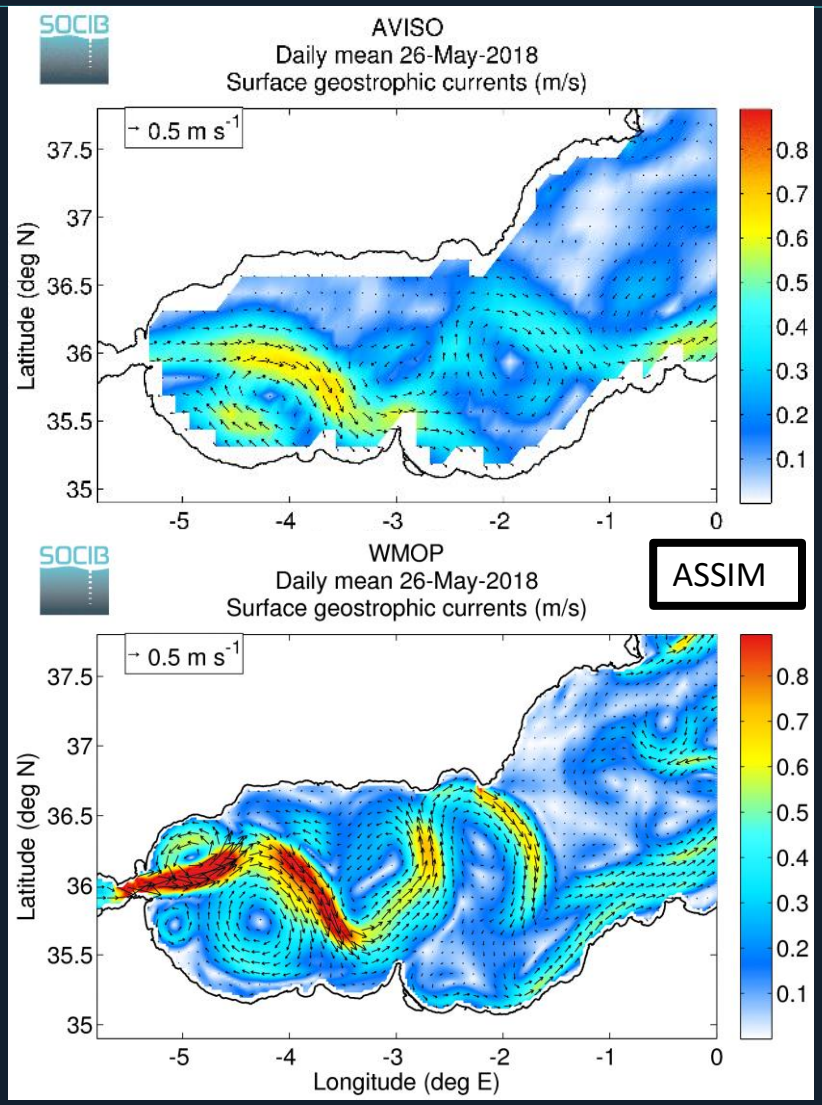
→ Pre-operational versión of WMOP_ASSIM model !

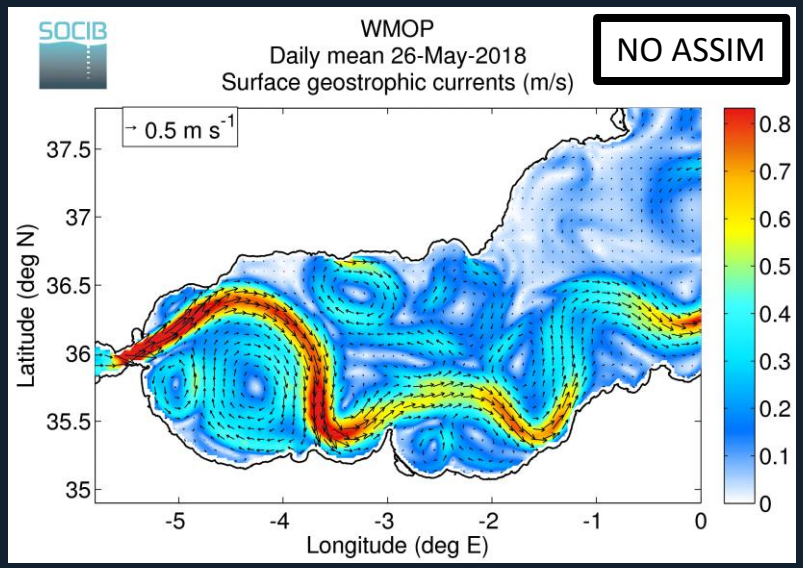


Color: SST; Contours: AVISO SSH; Arrows: AVISO currents (E. D´Asaro, 26 May 2018)

WMOP ASSIM forecasts: CALYPSO experiment



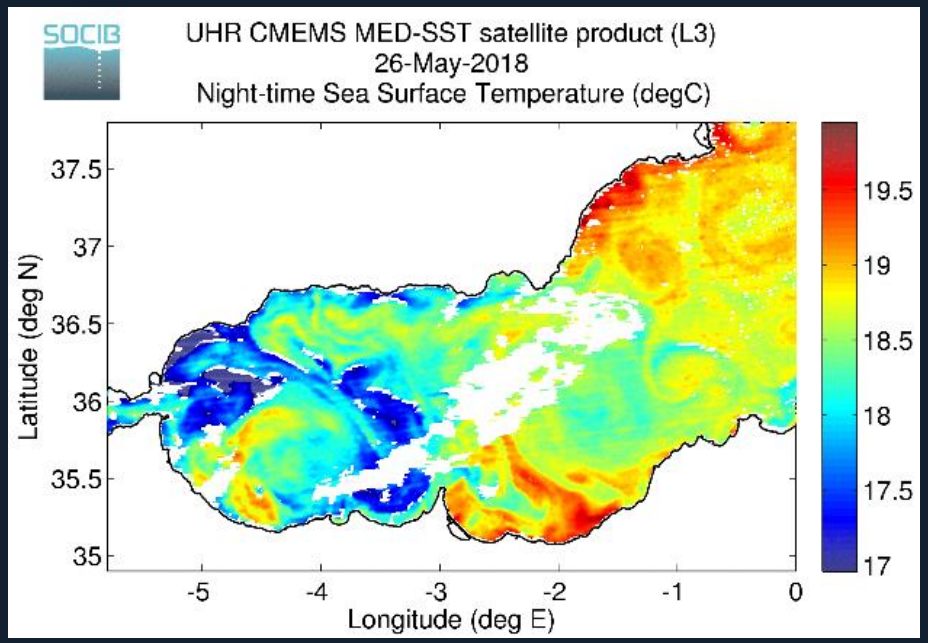


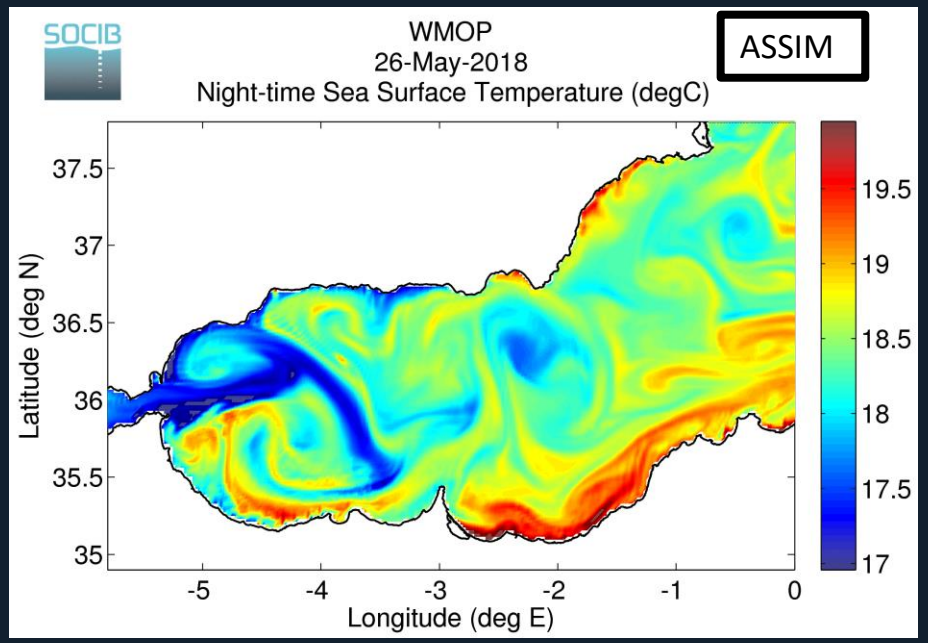


Surface currents

WMOP ASSIM forecasts: CALYPSO experiment

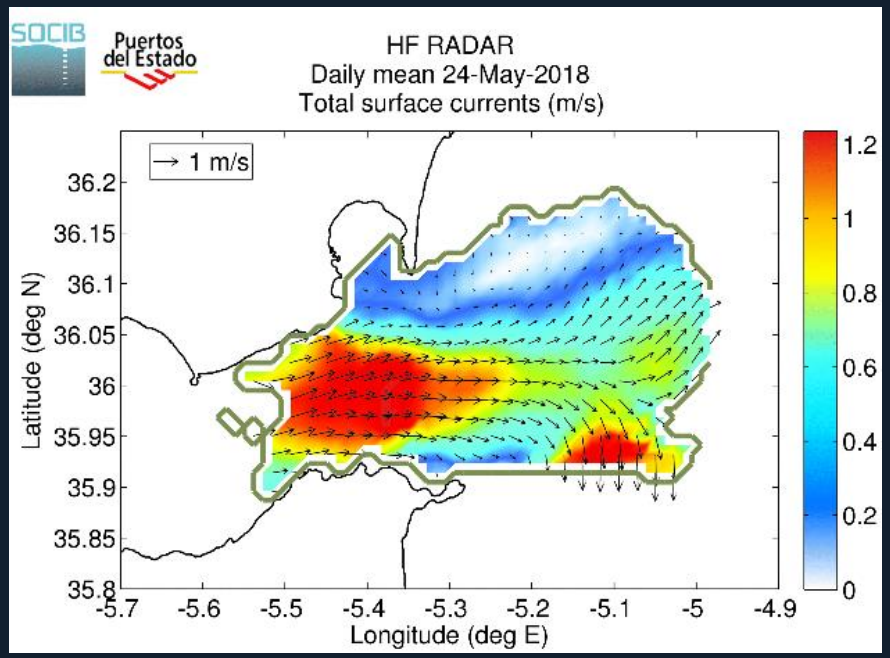
26-May-2018





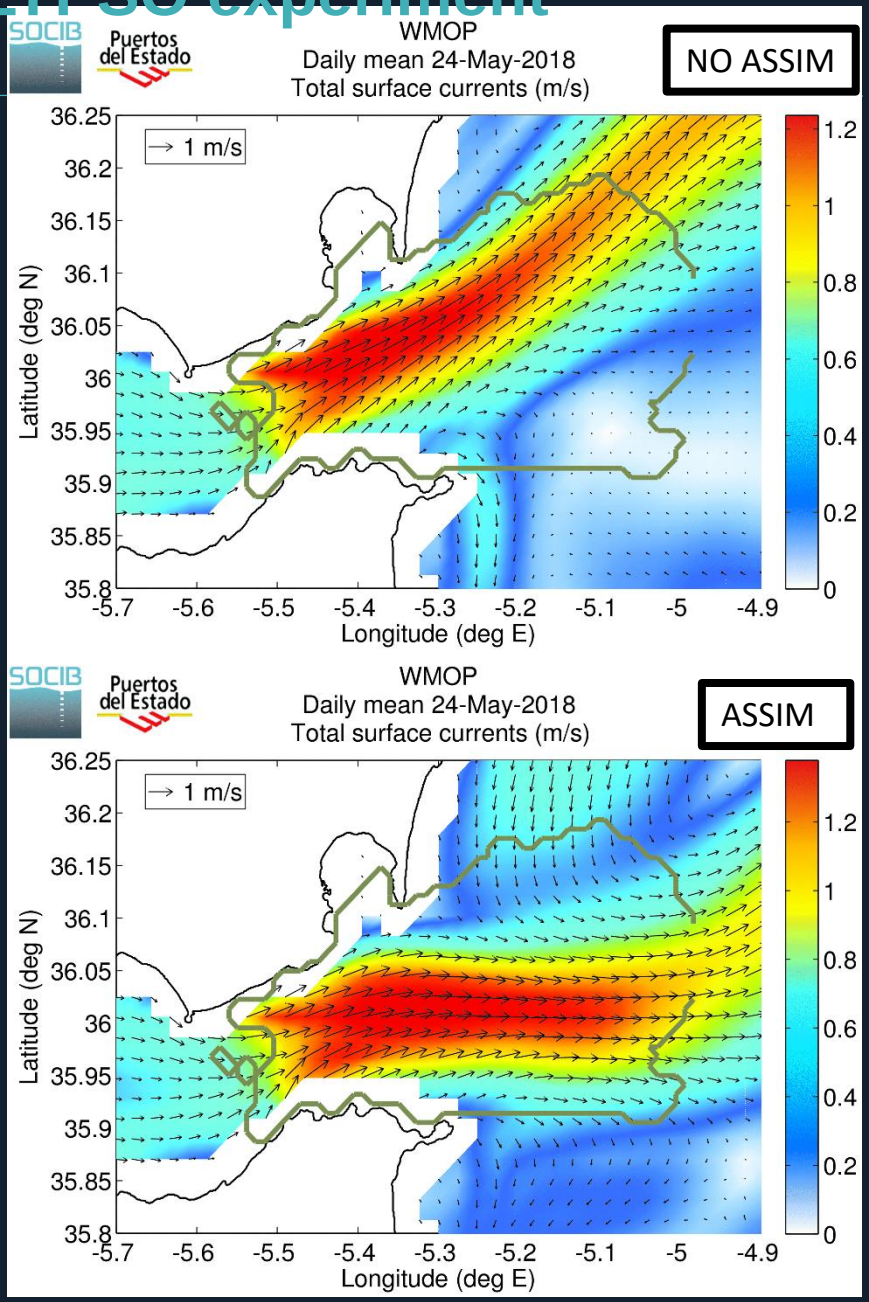
Sea Surface Temperature

WMOP ASSIM forecasts: CALYPSO experiment

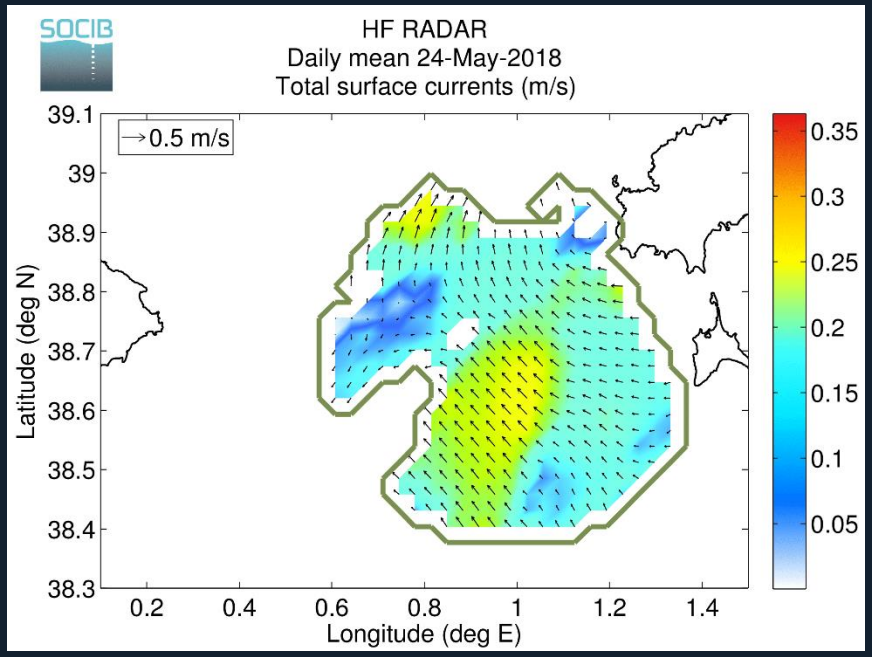


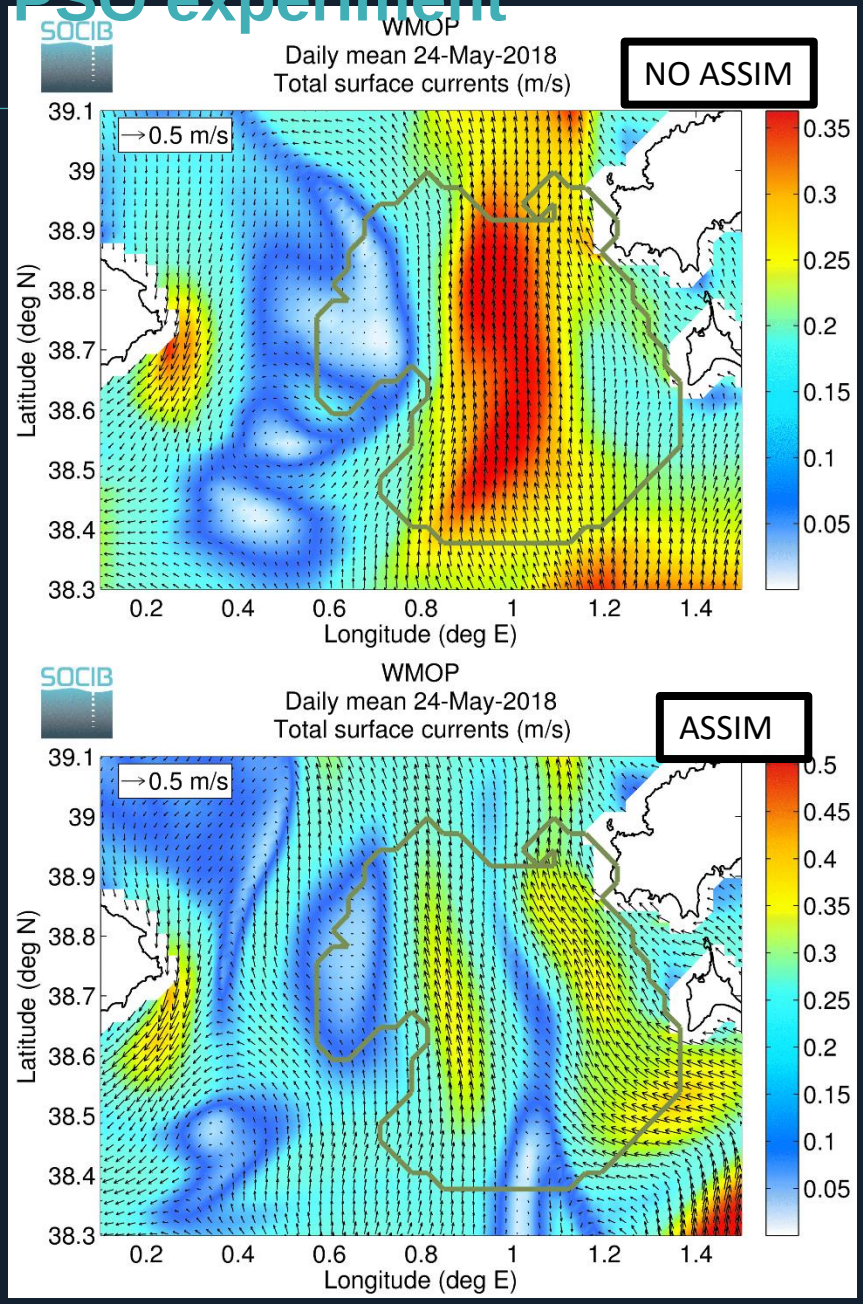
24-May-2018

HF radar Surface currents
Gibraltar Strait



WMOP ASSIM forecasts: CALYPSO experiment

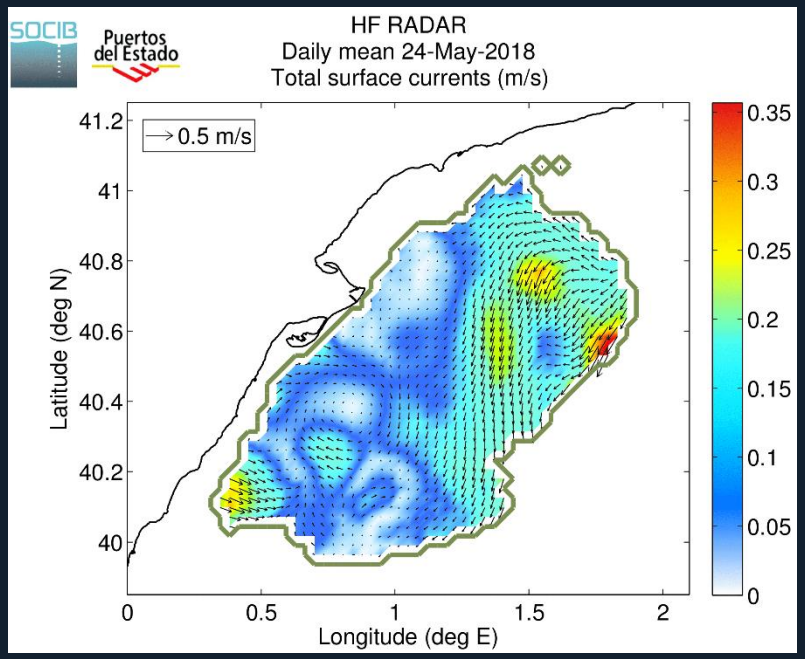




24-May-2018

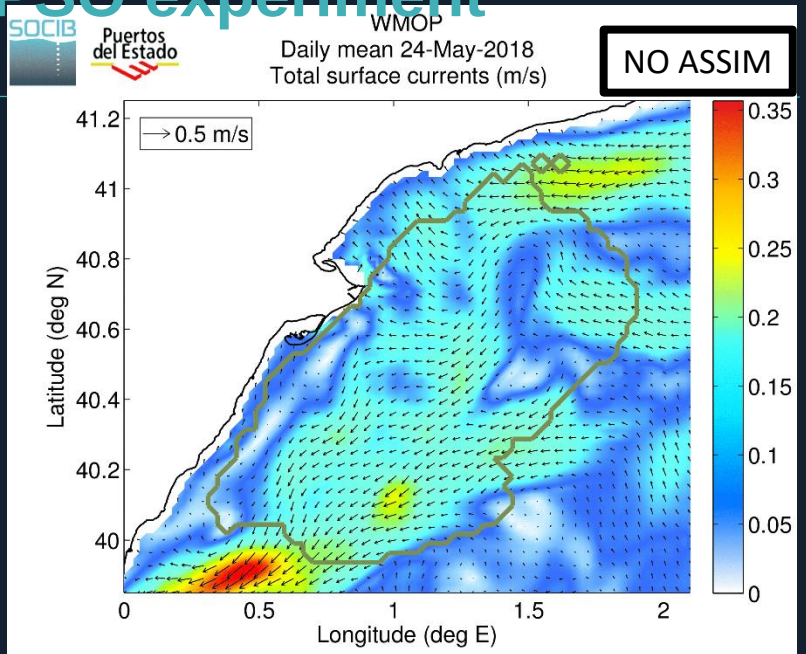
HF radar Surface currents
Ibiza Channel

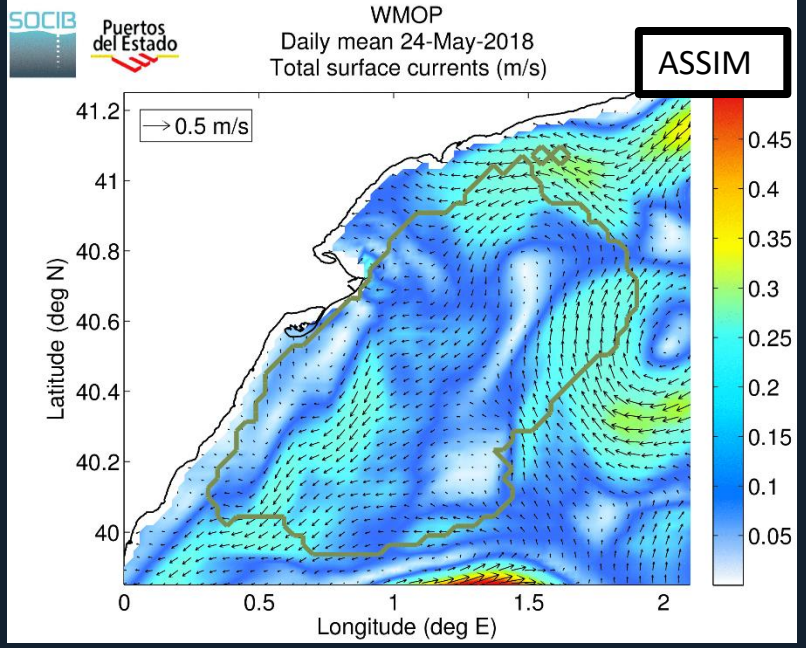
WMOP ASSIM forecasts: CALYPSO experiment



24-May-2018

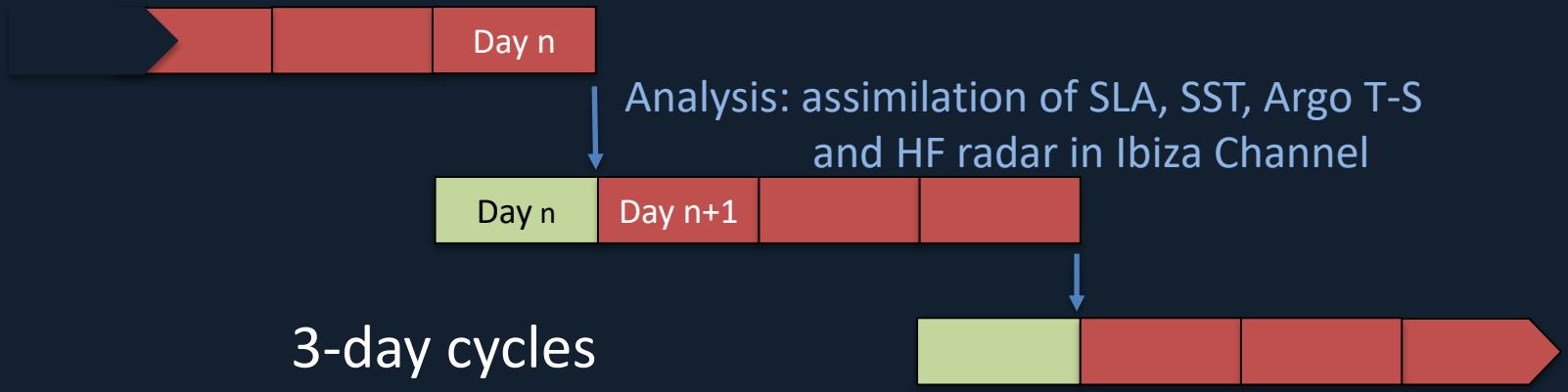
HF radar Surface currents
Delta del Ebro



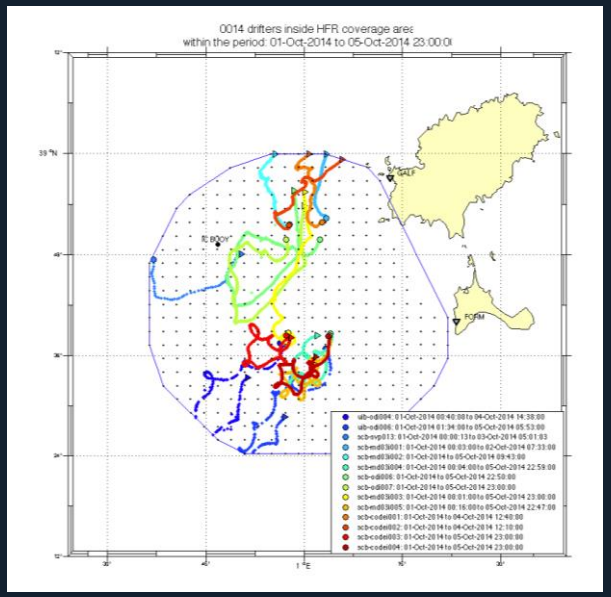


Assimilation of HF radar surface currents

Ibiza Channel HF radar data assimilation – June 2014

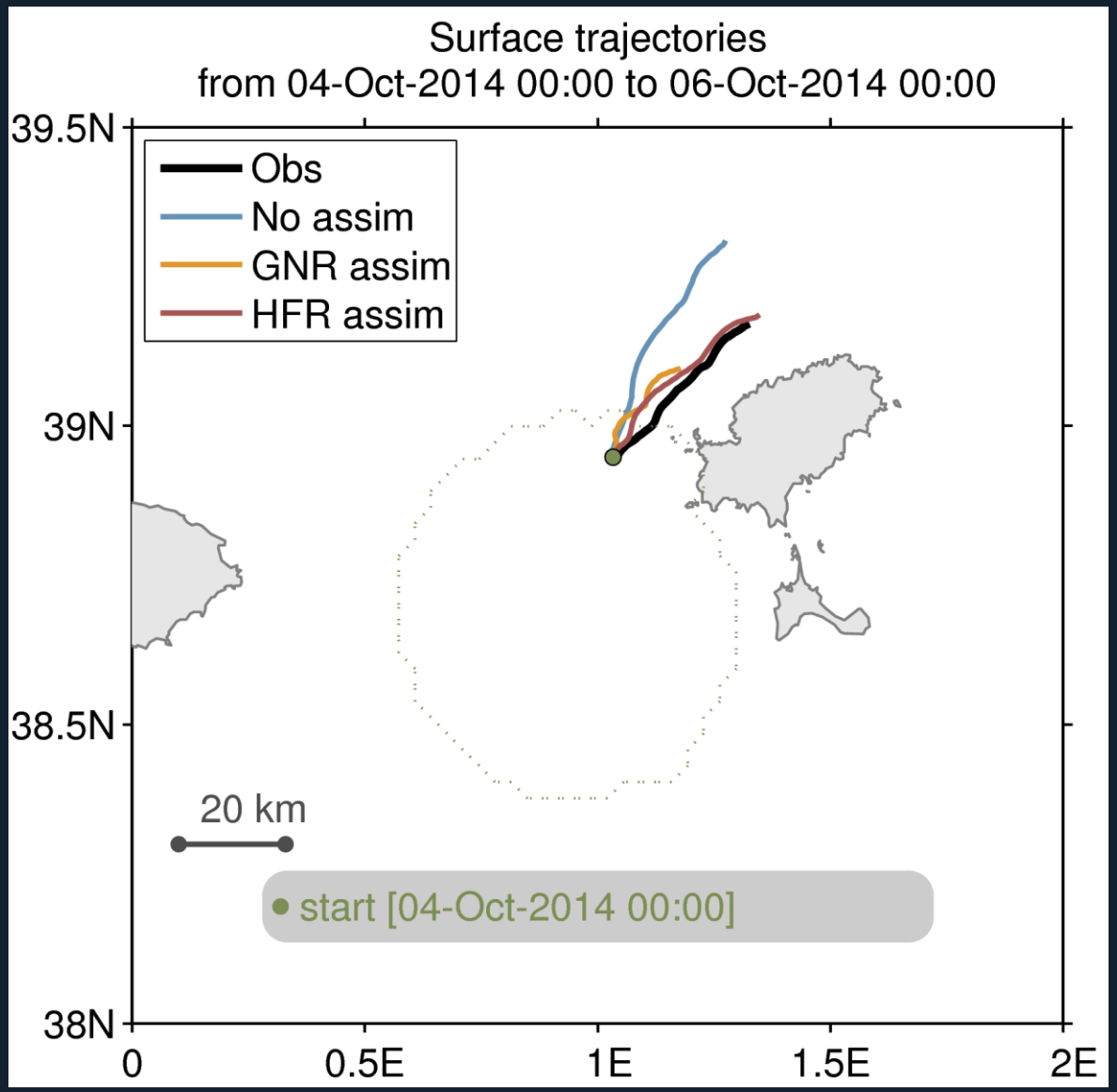


(Hernandez-Lasheras et al., EGU 2018)



Validation using the trajectories of 14 drifters during 10 days

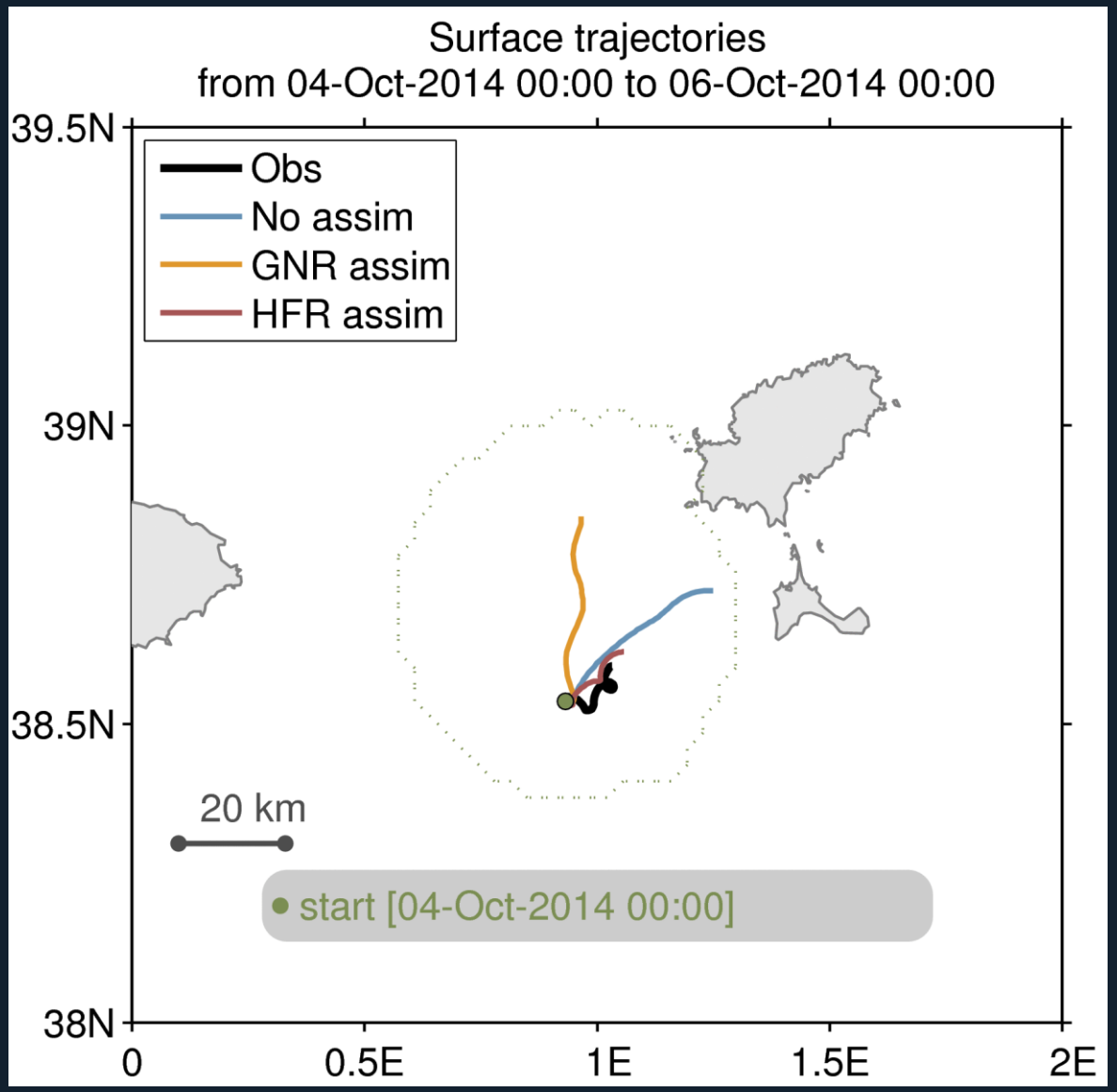
Assimilation of HF radar surface currents



GNR: assimilation of SLA, SST and Argo TS

HFR: assimilation of SLA, SST and Argo TS
+ HF radar

Assimilation of HF radar surface currents



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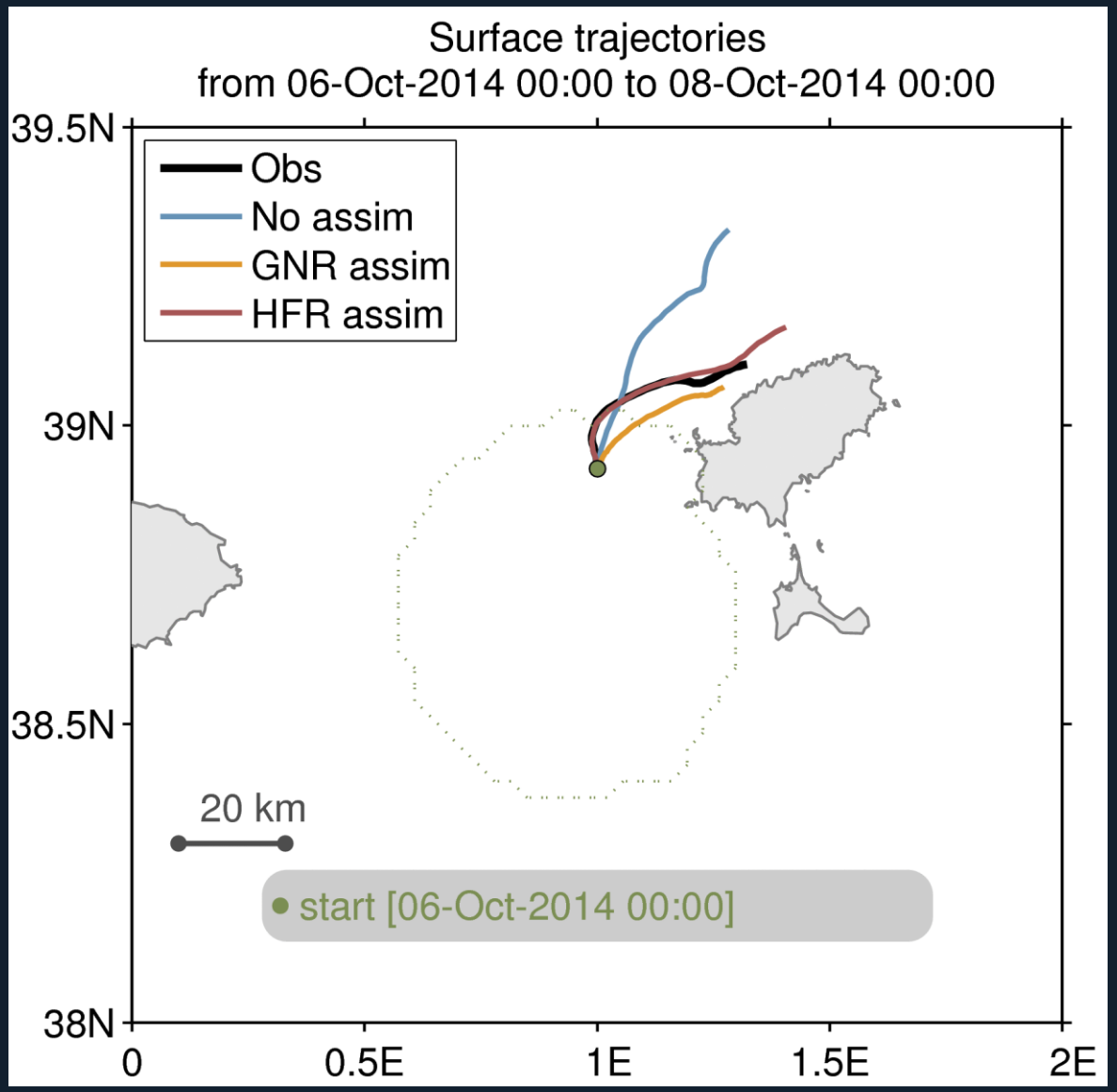
Assimilation of HF radar surface currents



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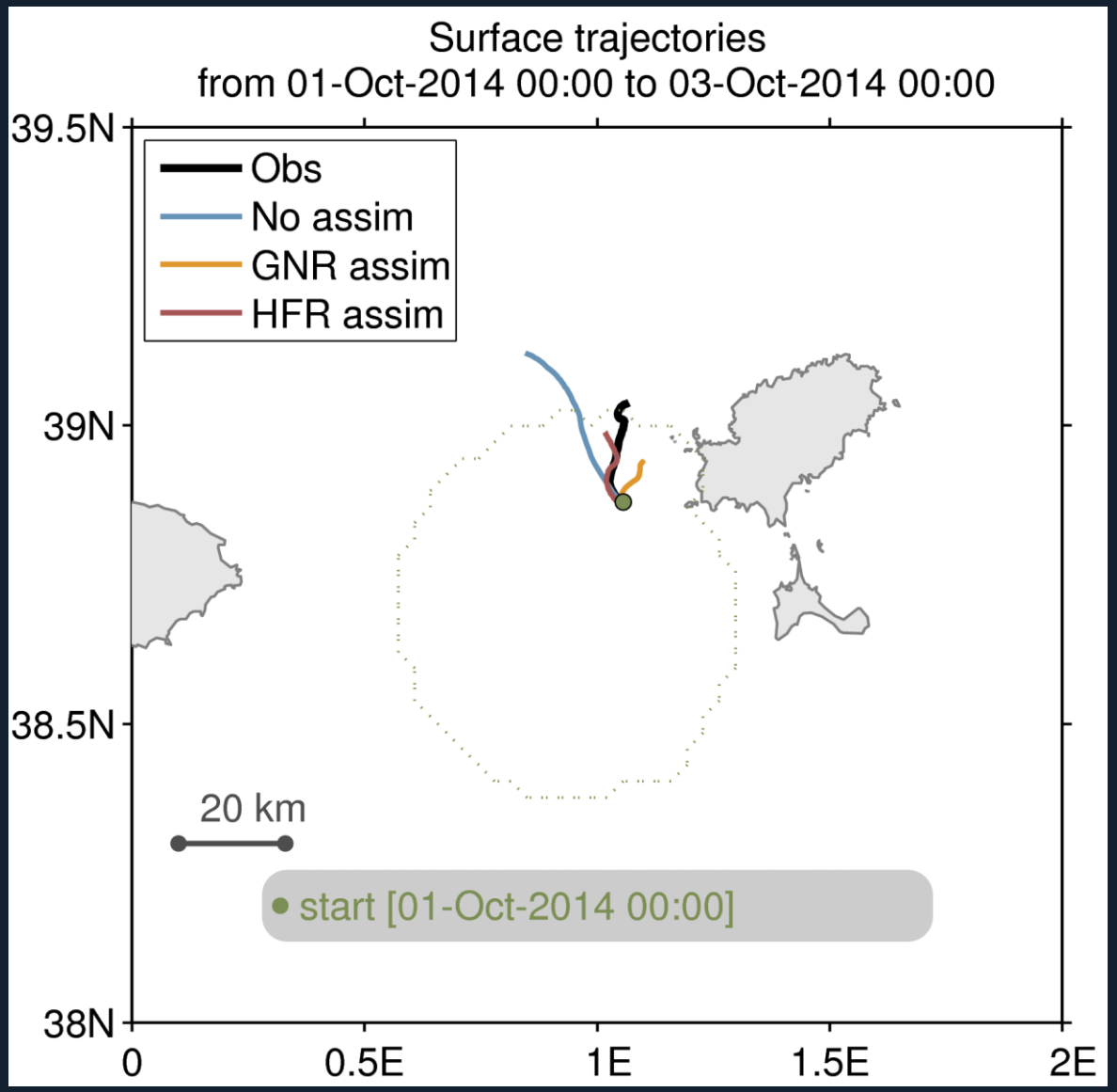

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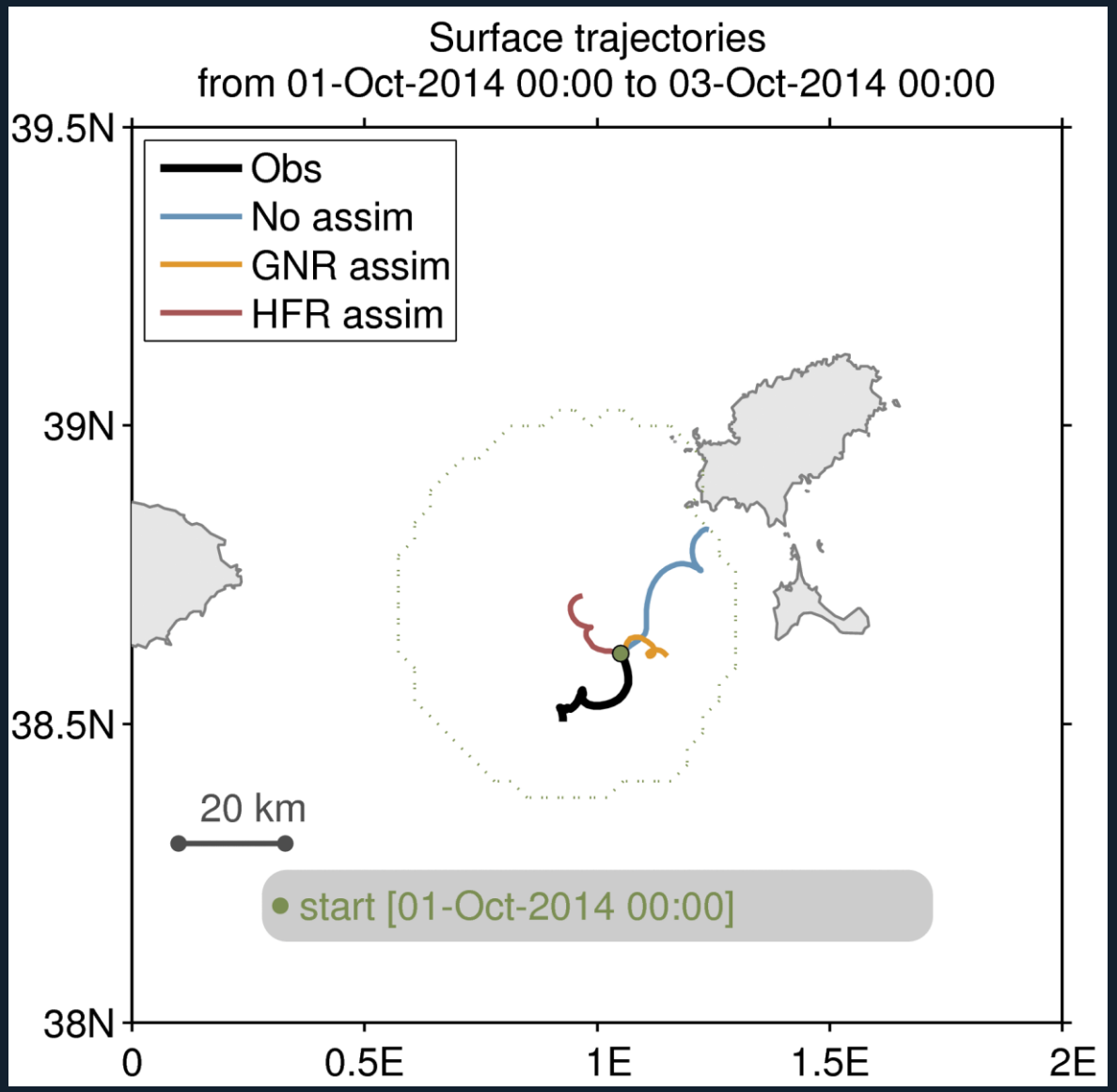
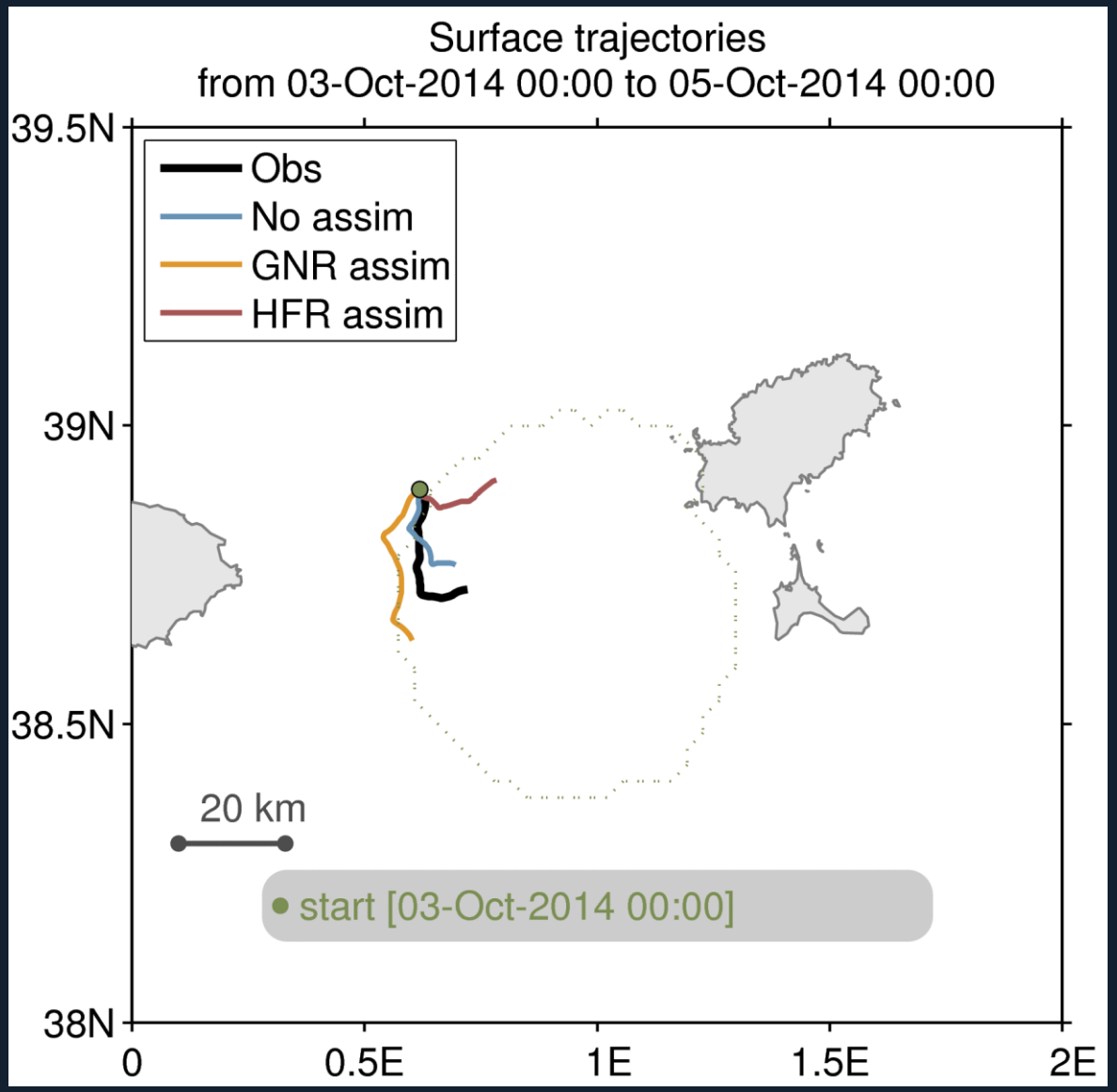
Assimilation of HF radar surface currents



GNR: assimilation of SLA, SST and Argo TS

HFR: assimilation of SLA, SST and Argo TS + HF radar

WMOP forecasts: importance of data assimilation



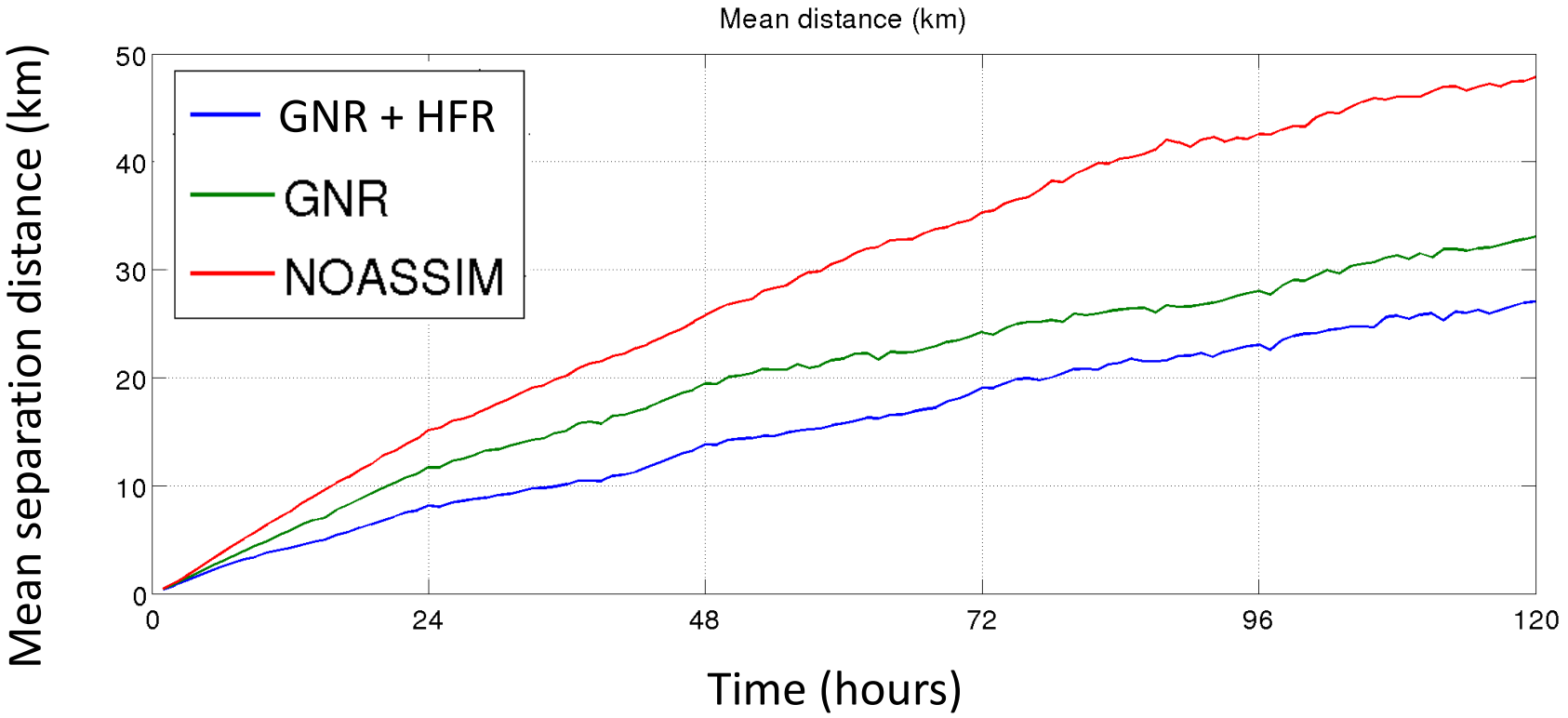
GNR: assimilation of SLA, SST and Argo TS

HFR: assimilation of SLA, SST and Argo TS
+ HF radar

Assimilation of HF radar surface currents

Separation distances between model and real drifters (14 drifters)

Average over the number of drifters and initial dates



GNR: assimilation of SLA, SST and Argo TS

Conclusions

- ✓ High-resolution (2-km) “operational” daily predictions of ocean currents, with evaluations based on multiplatform observations.
- ✓ Some very positive results in terms of ocean drift forecasts over the last years, but this is not systematic …
- ✓ Potential for improvement with the implementation of data assimilation: successful experiments with HF radar in Ibiza Channel and CALYPSO Alboran Sea sea trial.
- ✓ Pre-operational WMOP_ASSIM since May 2018. Will replace the standard WMOP after careful evaluation of the results !

Gracias !

Preguntas ?