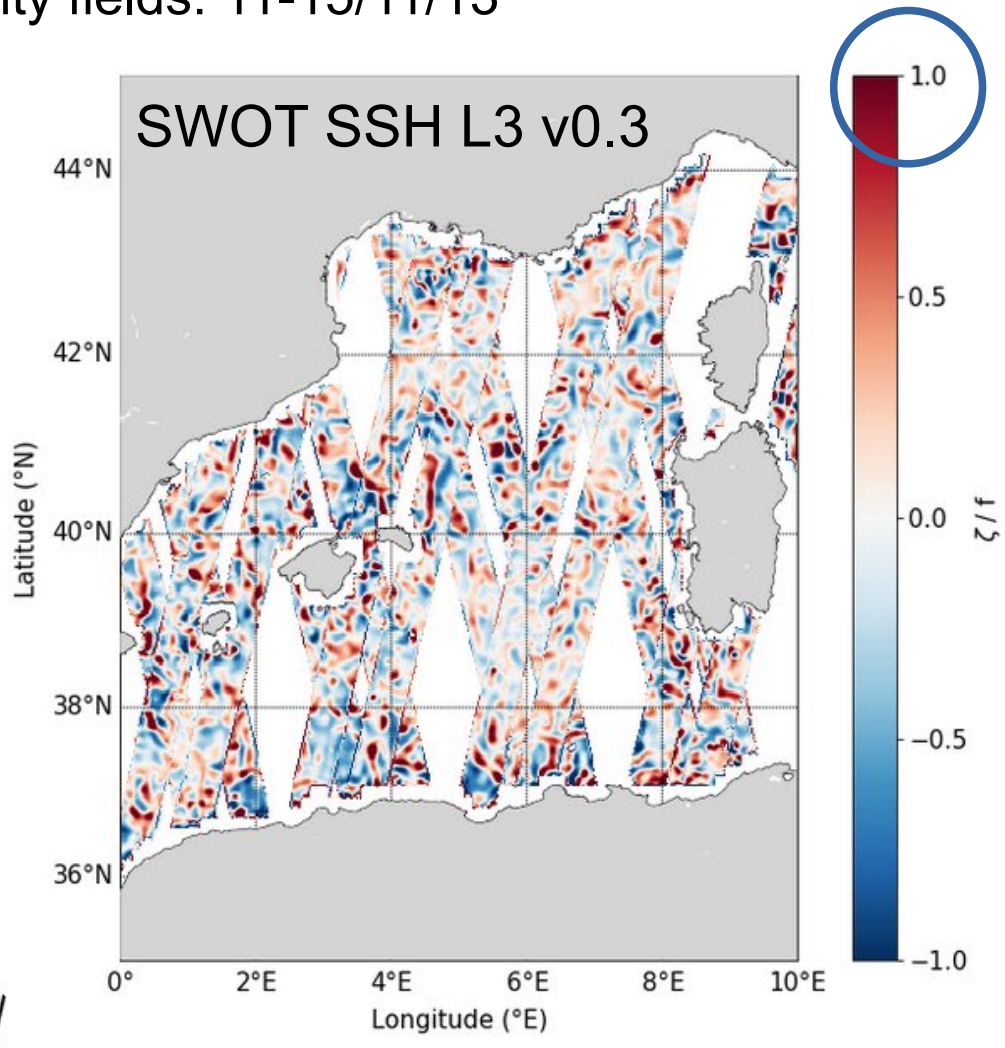
Western Mediterranean experiments

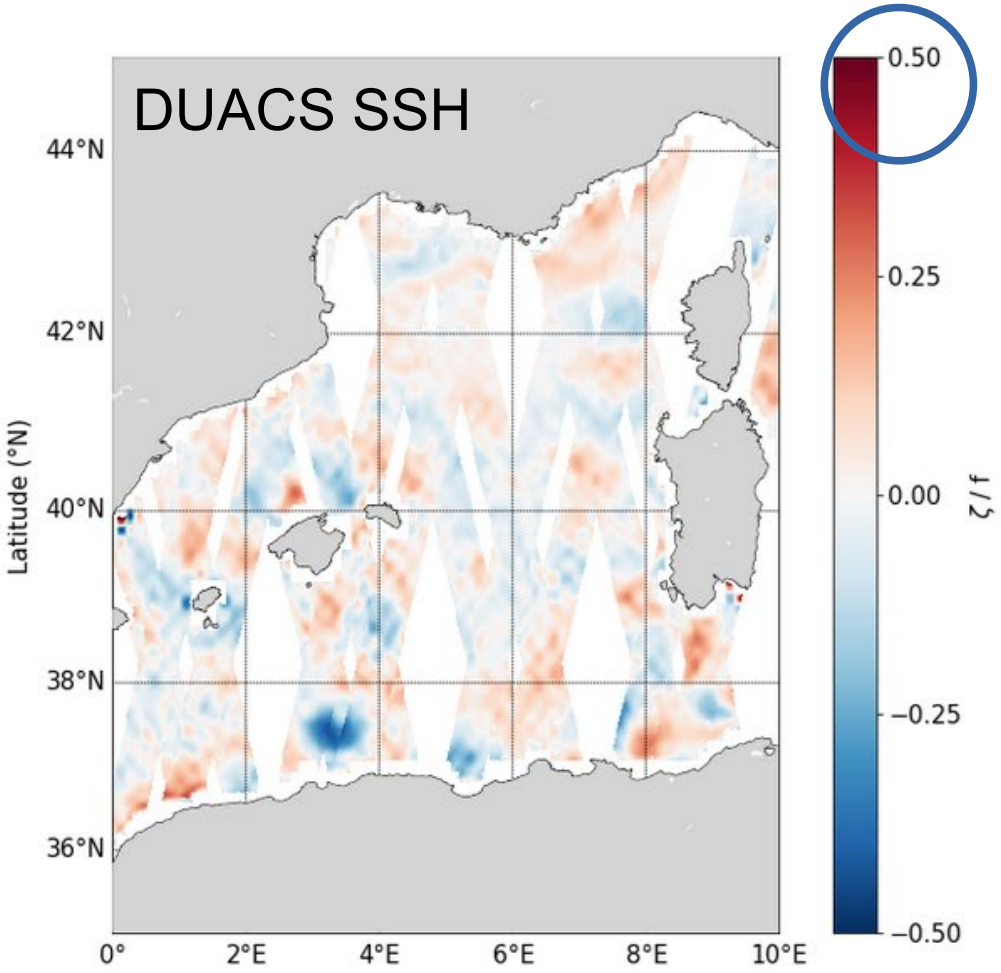
L. Gómez-Navarro, Elisabet Verger-Miralles, B. Mourre, A. Pascual, D. Vega-Gimenez, A. Sanchez-Roman, B. Barceló-Llull, B. Casas, V. Combes, E. Cutolo, L. Diaz-Barroso, I. Lizarán, E. Reyes, D. R. Tarry, N. Zarokanellos

with contributions of the Bio-SWOT and C-SWOT teams

The Mediterranean Sea is an ideal region where to expect strong signal at SWOT scales.

Vorticity fields: 11-15/11/13





(Credits: F. d'Ovidio)

The Mediterranean Sea is an ideal region where to expect strong signal at SWOT scales.

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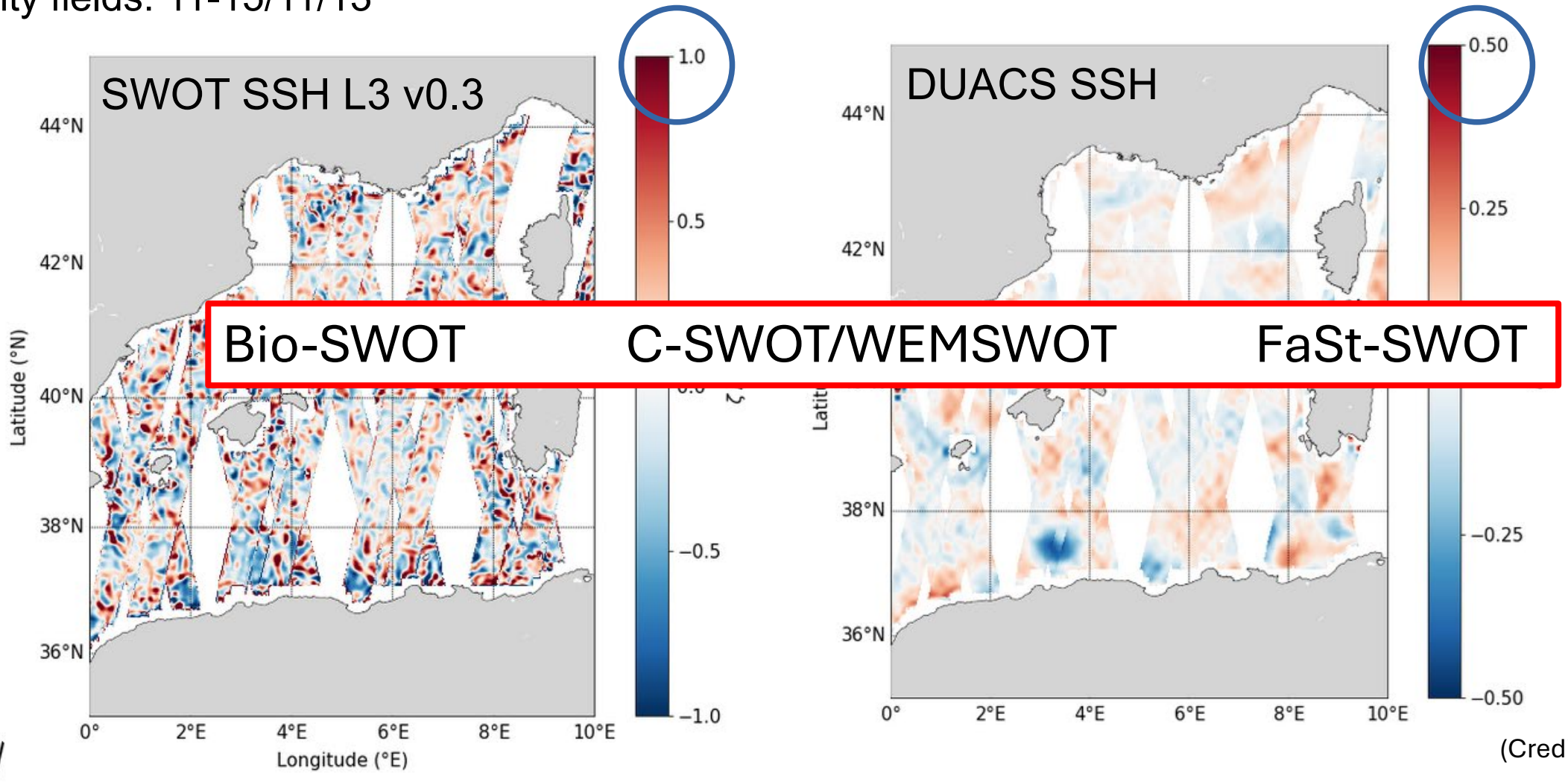
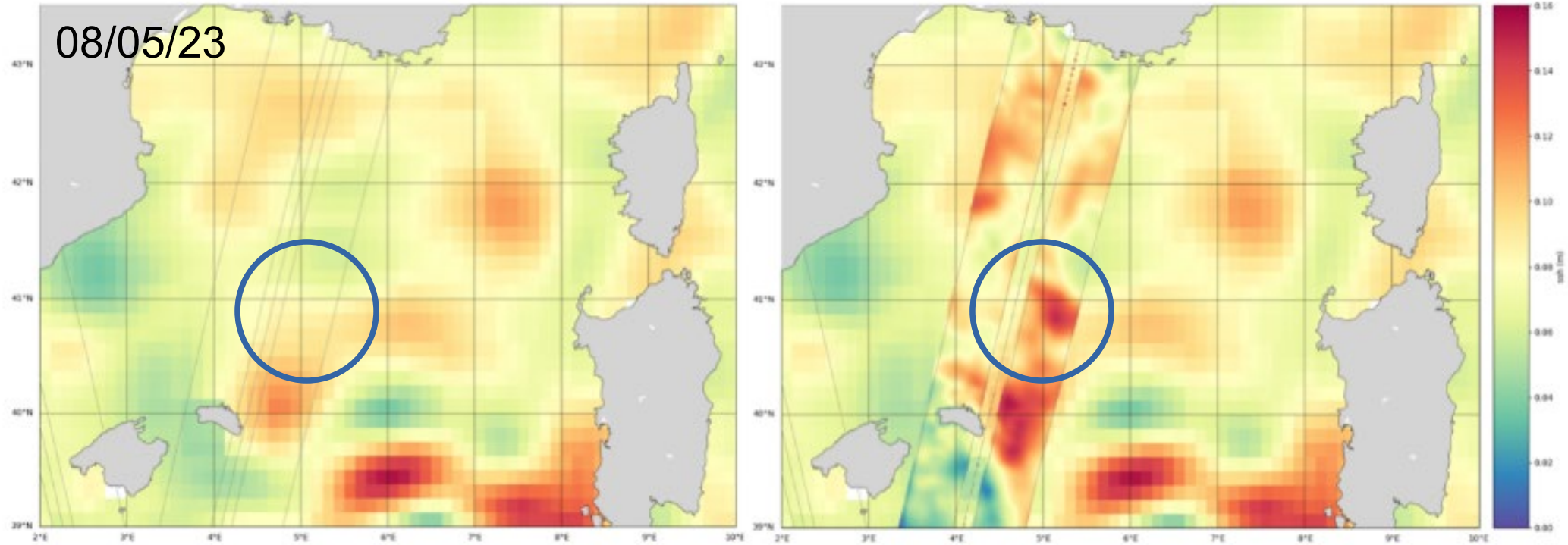


(Credits: F. d'Ovidio)

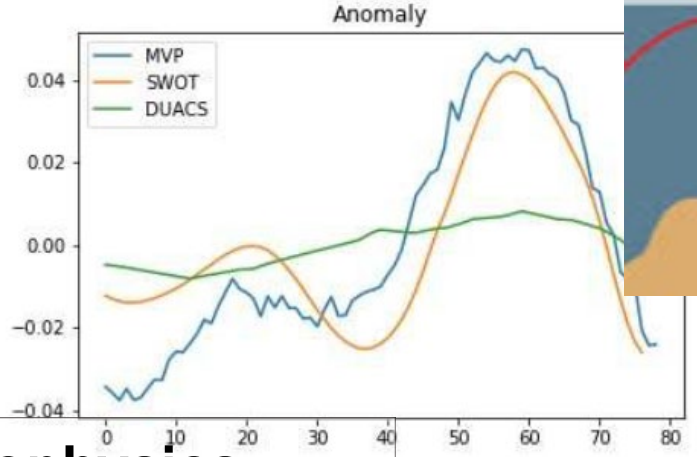
BioSWOT Med

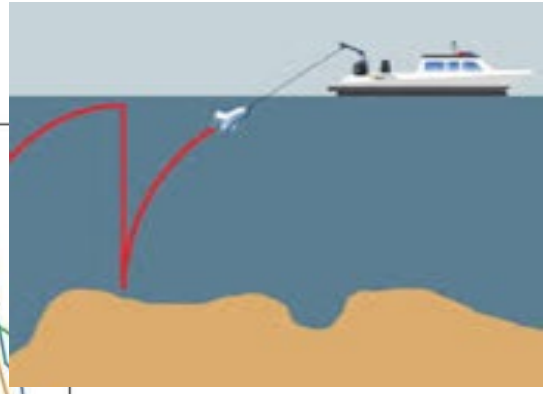
The **BIOSWOT-Med** cruise (A. Doglioli, G. Grégori) targetted for one month a typical Mediterranean anticyclone of small radius (30 km x 60 km) invisible in DUACS maps studying its physics, biogeochemistry, and ecology. https://doi.org/10.17600/18002392



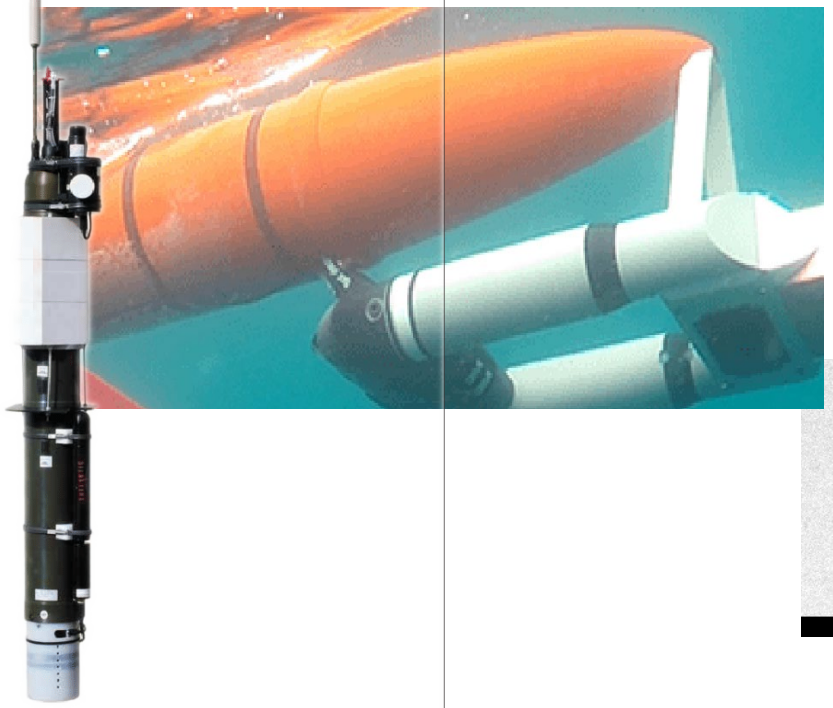
Some on-going work

SWOT CalVal

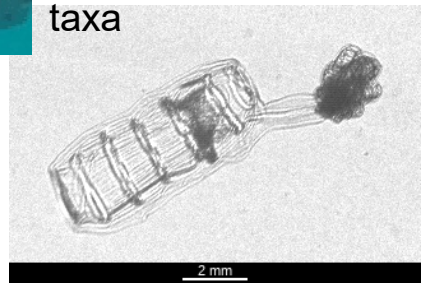




Biophysics

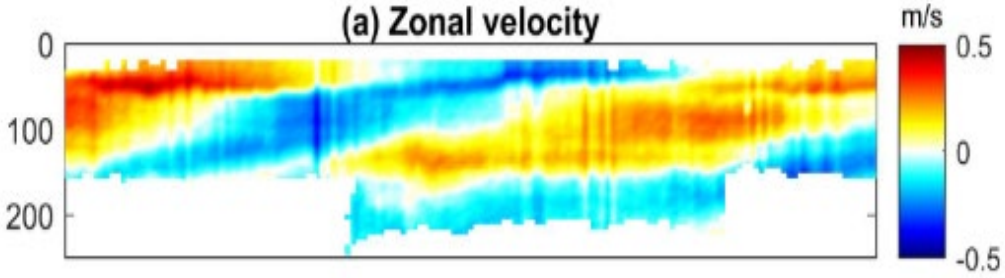


CTDs, gliders, zooglider, flow cytometry, genomics, acoustics, ARGOs, high-precision nutrients for fine-scale biogeochemistry, phyto- and zooplankton taxa



Eddy-wave interaction

Long stations : Inertial wave chimney effect after a storm



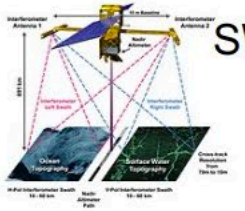
Lagrangian dynamics

SVP, CODE and CARTHE

C-SWOT2023 -- MEDITERRANEAN SEA

A two-ship strategy sailing in parallel under SWOT swathes

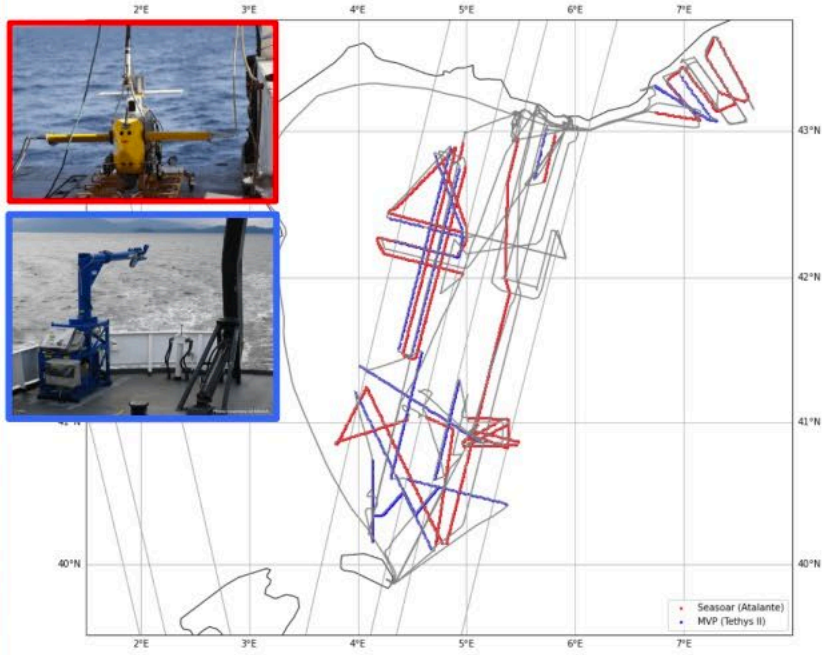
THETHYS II



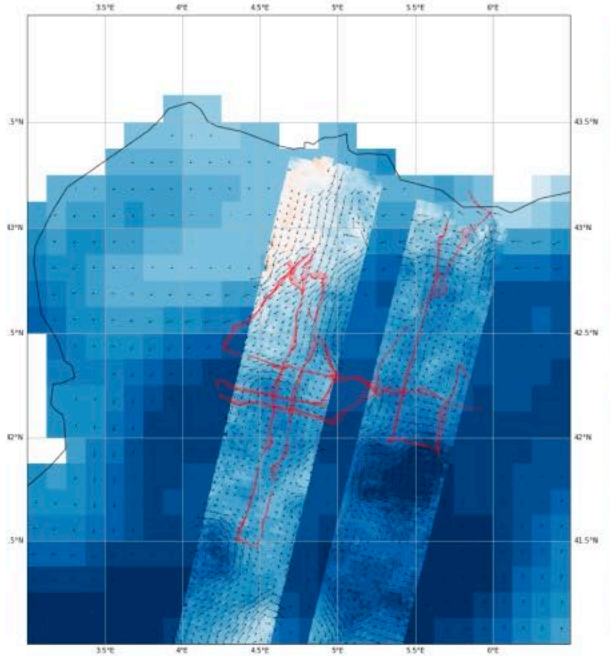
SWOT

ATALANTE

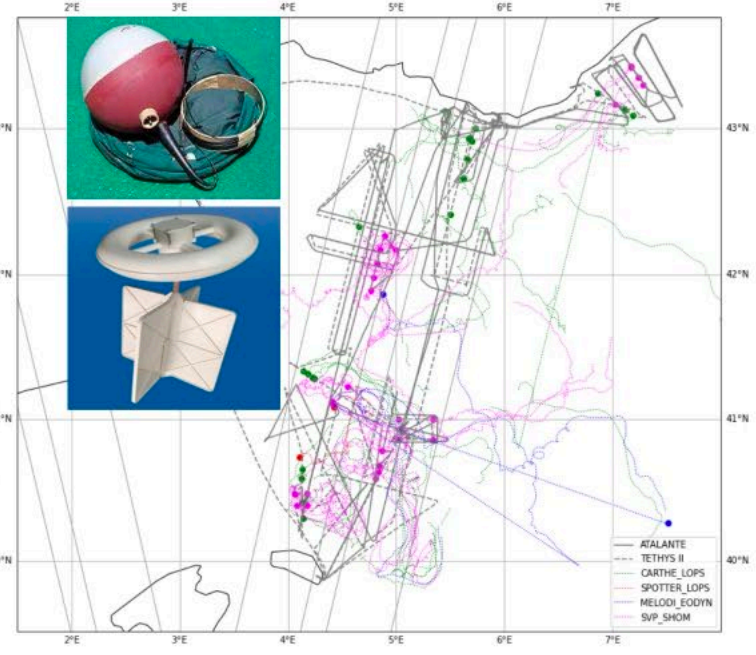
Temperature and Salinity profiles



Hull mounted ADCPs



Massive drifters release



Evaluation of the geostrophic balance

Evaluation of Vorticity Divergence Strain and Vertical Velocity

Reconstruction of the momentum equation.

MedSea Lagrangian working group

CSWOT-WEMSWOT-BIOSWOT-FaSt-SWOT trajectories

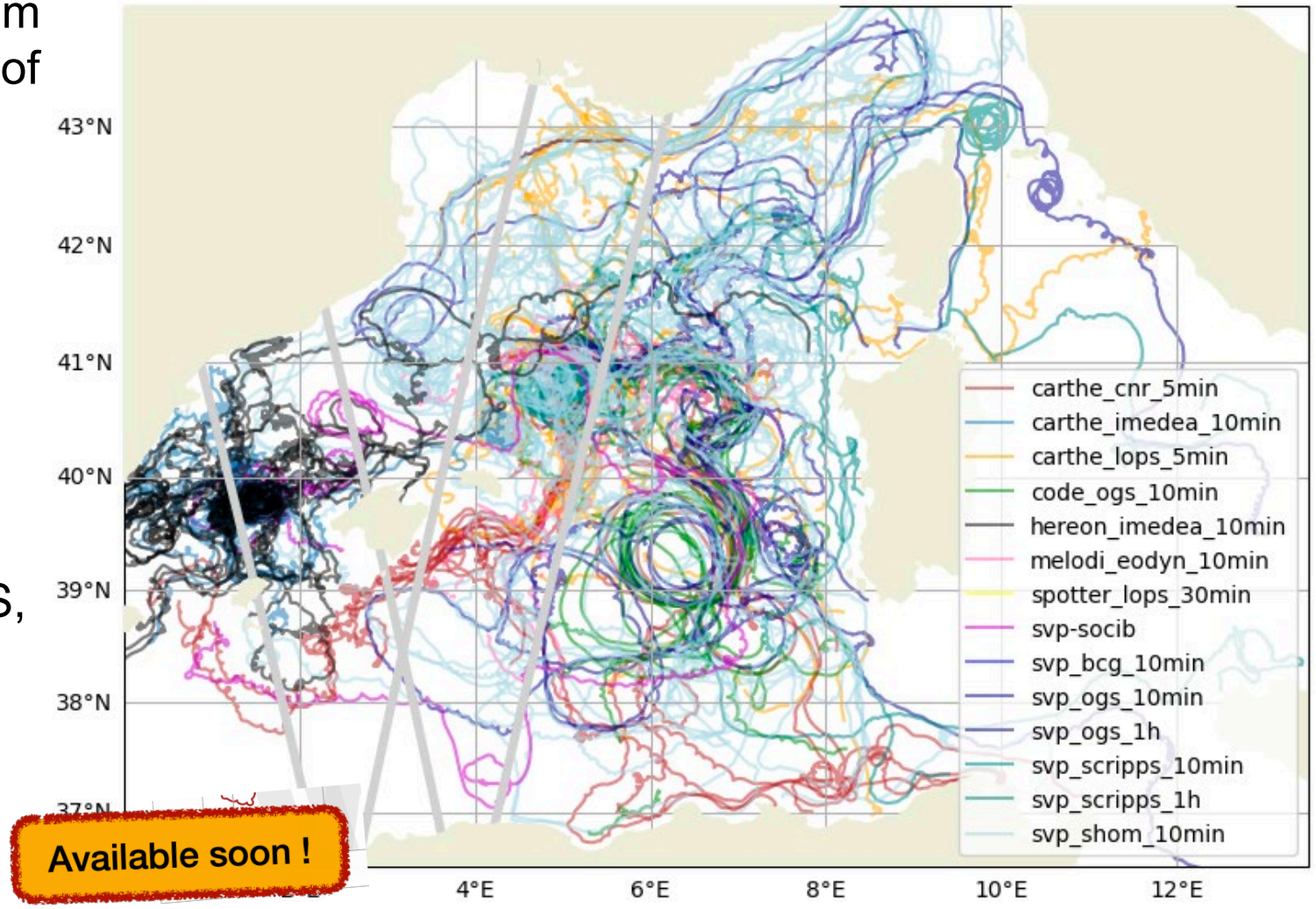
4 experimental campaigns of the consortium www.swot-adac.org led to the deployment of about **150 drifters** under SWOT tracks during the fast-sampling phase.

The group led to the generation of a combined/uniformly pre-processed drifter dataset that will be released over the summer

Ifremer, SHOM, CNR-ISMAR, OGS, CNRS, IMEDEA, SOCIB, SCRIPPS

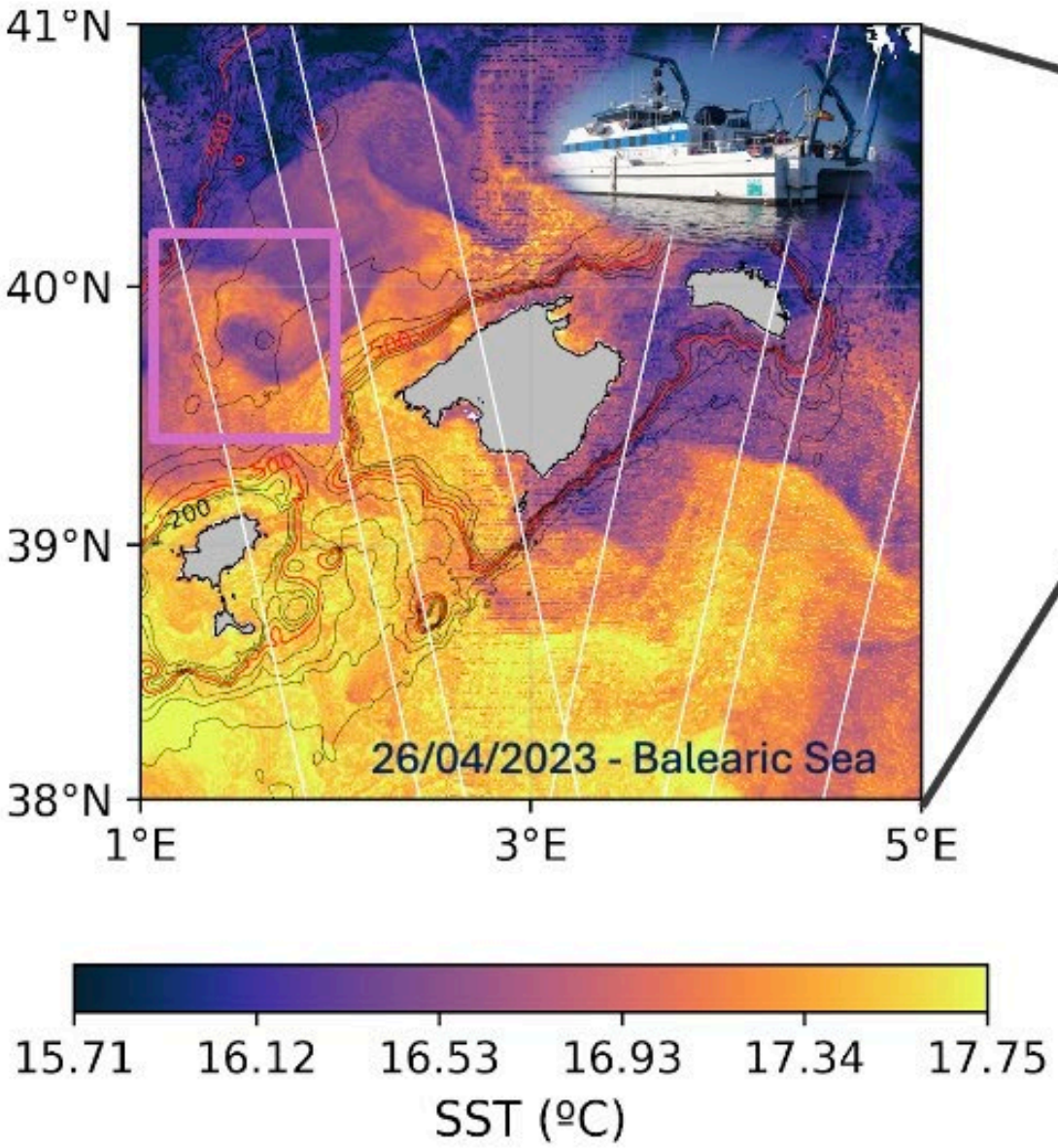
contact: swot_lagrangian@listes.ifremer.fr

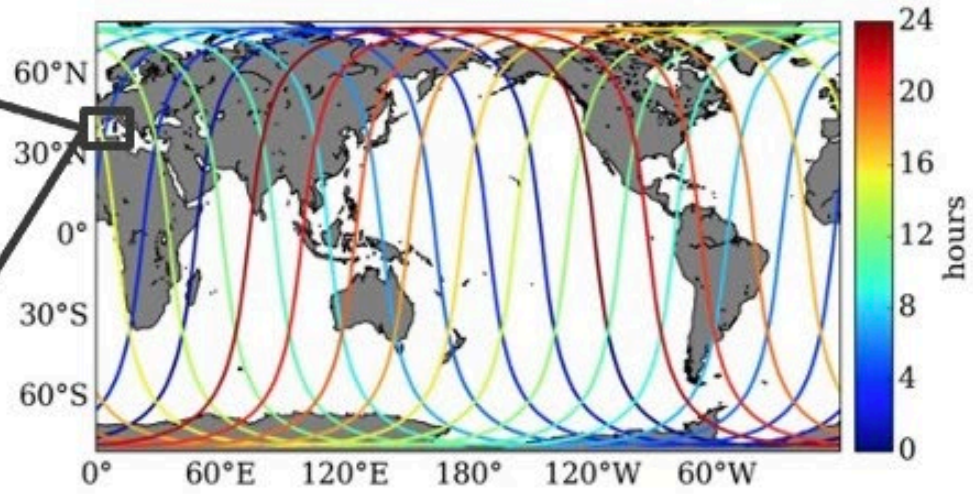
C_SWOT/WEMSWOT https://doi.org/10.17600/18002077
BioSWOT-Med https://doi.org/10.17600/18002392
FastSWOT http://doi.org/10.20350/DIGITALCSIC/16077



(adapted from M. Demol)

FaSt-SWOT experiments





(d'Ovidio *et al.*, 2019)

- Region around the Balearic Sea selected for SWOT validation (2 passes daily)
- 2 high-resolution multi-platform experiments
- *In situ* sampling of a small-scale eddy during the SWOT fast sampling phase.

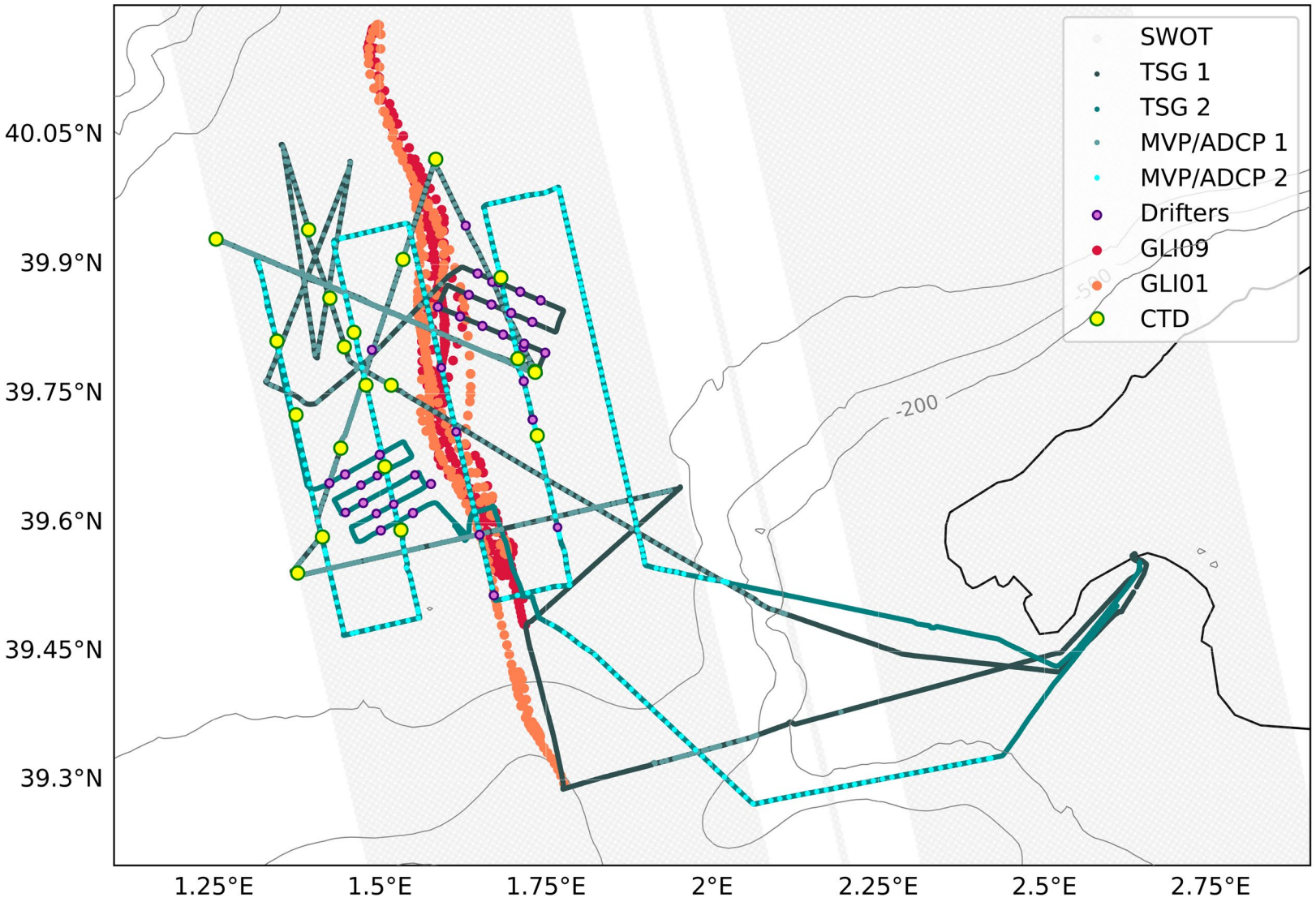
FaSt-SWOT experiments

Sampling strategy

Measurements

- 2 Slocum **gliders** [0-700 m]
- Moving Vessel Profiler (**MVP**) [0-200 m]
- Vessel-mounted **ADCP** [10-200m]
- **Thermosalinograph**
- 45 surface **drifters**
- **CTD** stations [0-700m]
- **GoPros** (sea surface images)

Leg 1: **April 25th -29th, 2023**
Leg 2: **May 7th -9th 2023**



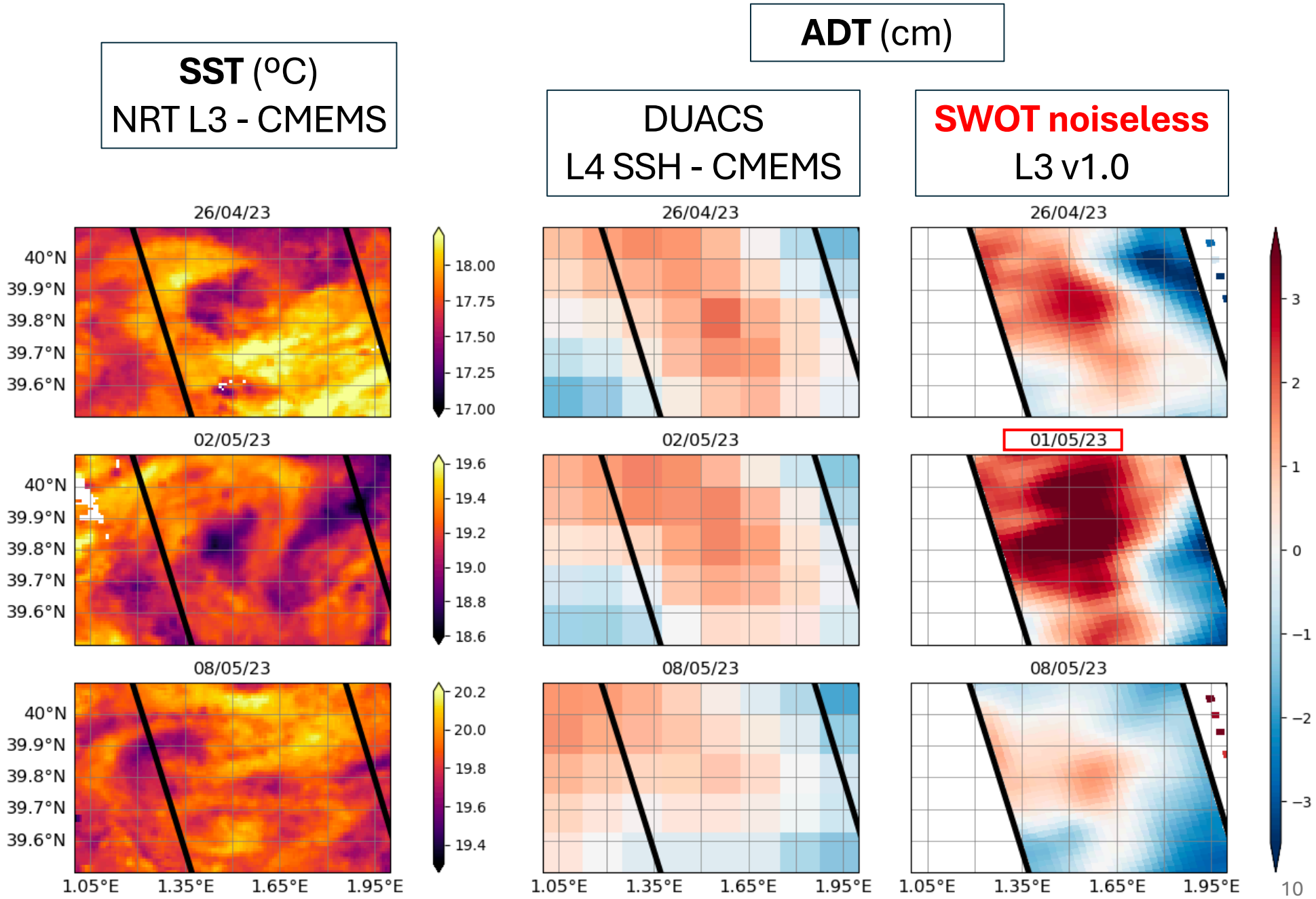
Pascual et al., 2023 – **CRUISE PLAN**
https://doi.org/10.20350/digitalCSIC/15276
Mourre et al., 2024 - **CRUISE REPORT**
https://doi.org/10.20350/digitalCSIC/16077

Oceanographic context

From satellite data

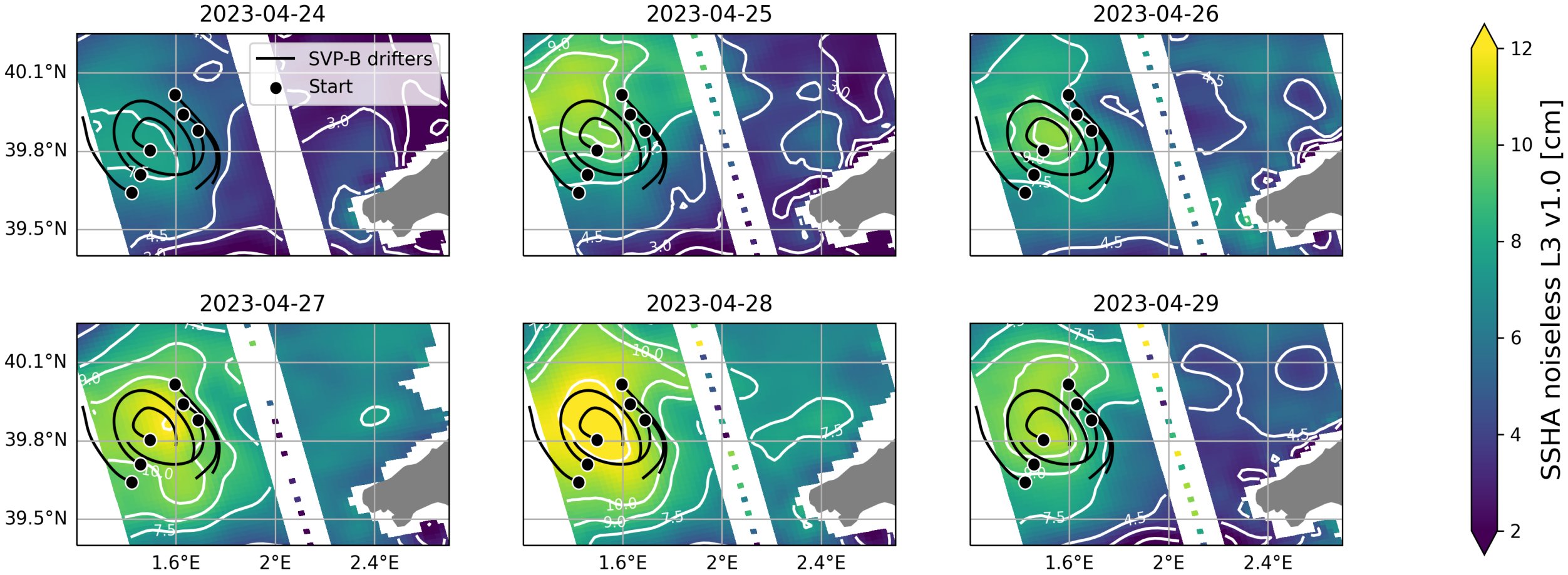
- Sea level signature of the small mesoscale eddy observed in SST represented with a much higher level of detail by SWOT compared to the gridded altimeter product.

(no SWOT data on 02/05/23)



Oceanographic context

From drifters



- Very good agreement between SWOT contours (filtered) and drifter trajectories (SVP-B with drogue at 15m, inertial oscillations filtered).

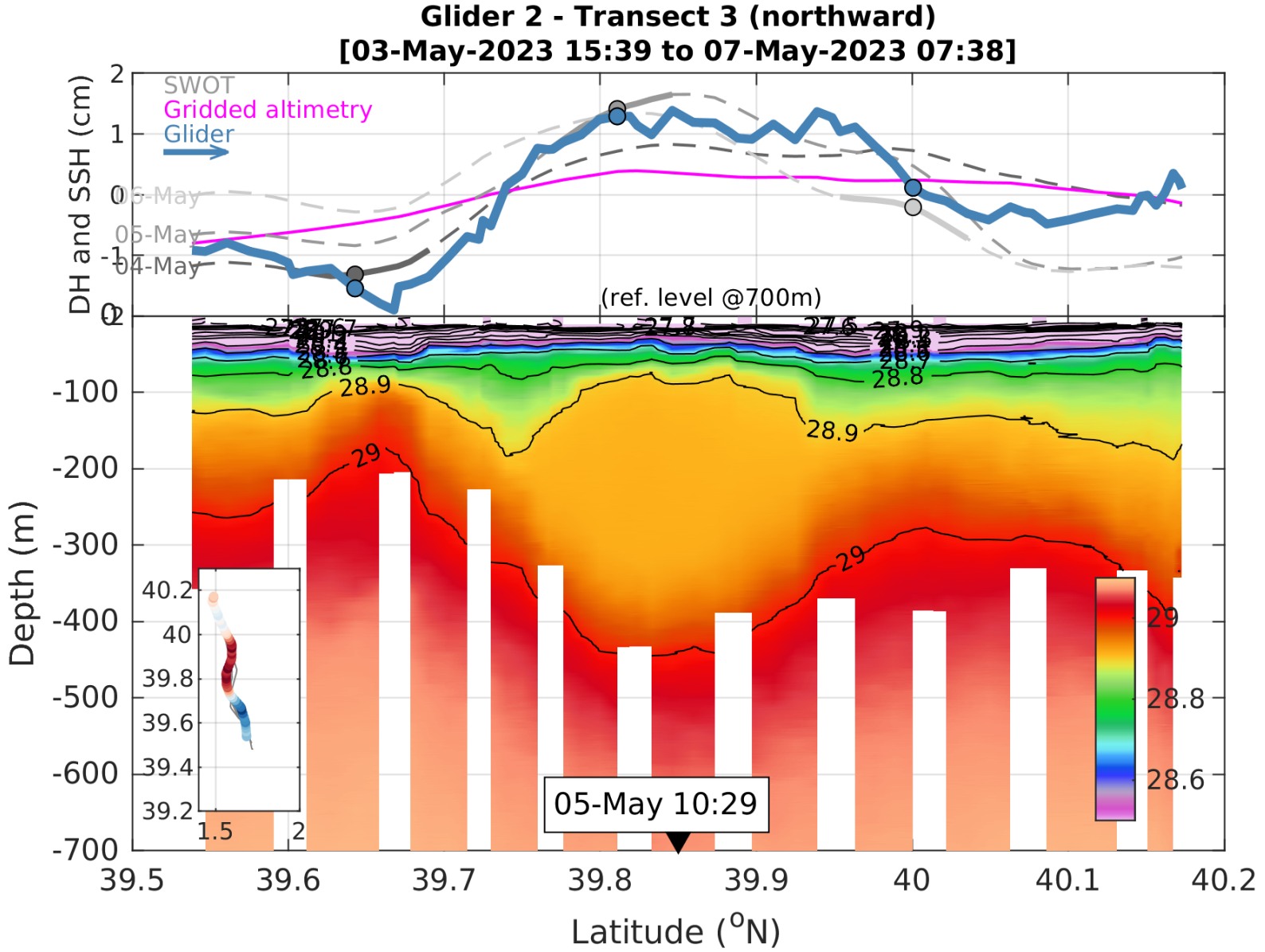
Selection of 6 SVP-B Drifters
25/04 – 29/04/24 (IOs filtered)

SWOT comparisons

DH anomalies - gliders

Potential density anomaly section from glider observations and comparison between SSH from SWOT (L3 v1.0, new version), DUACS (REP L4), and glider dynamic height.

- Intrathermocline eddy!



(Credits: B.Mourre)

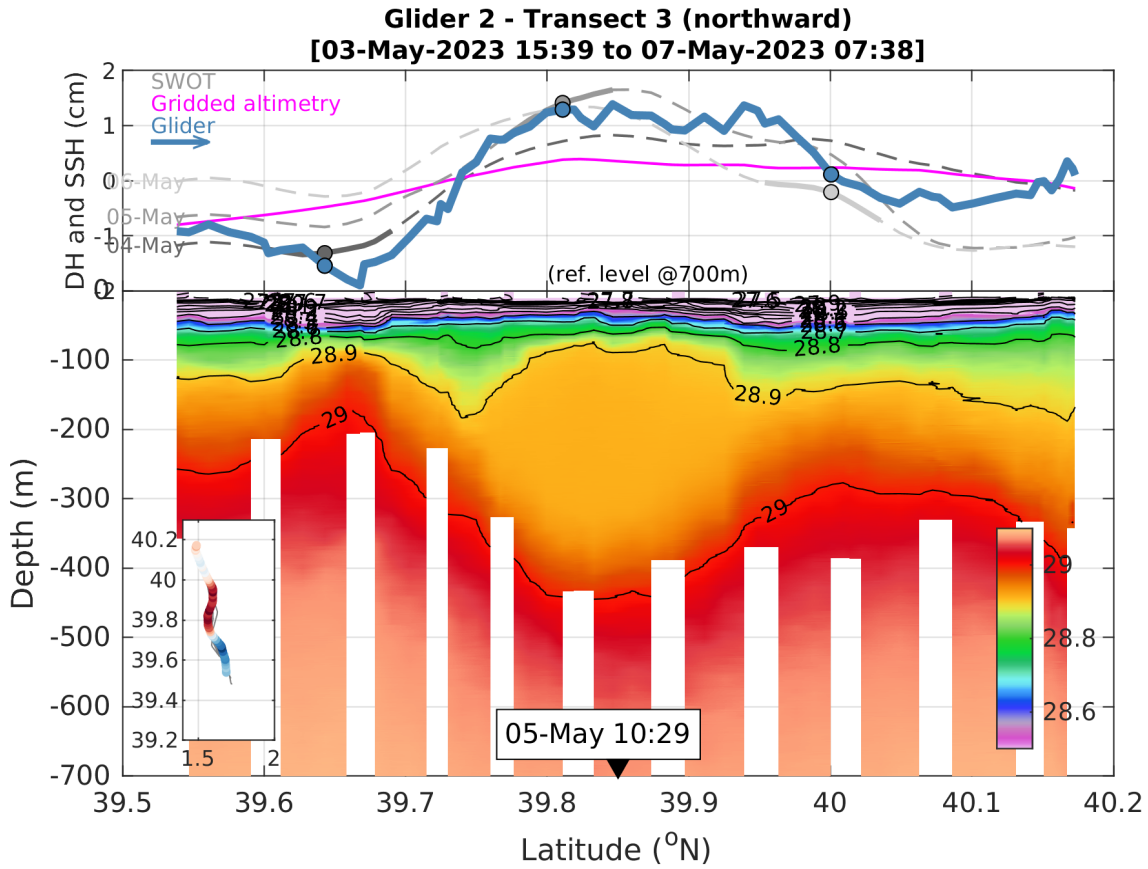
SWOT comparisons

DH anomalies - gliders

Gliders are slow…

SWOT daily!

- Very good agreement between SWOT sea level and glider DH and significant improvement compared to gridded altimetry.



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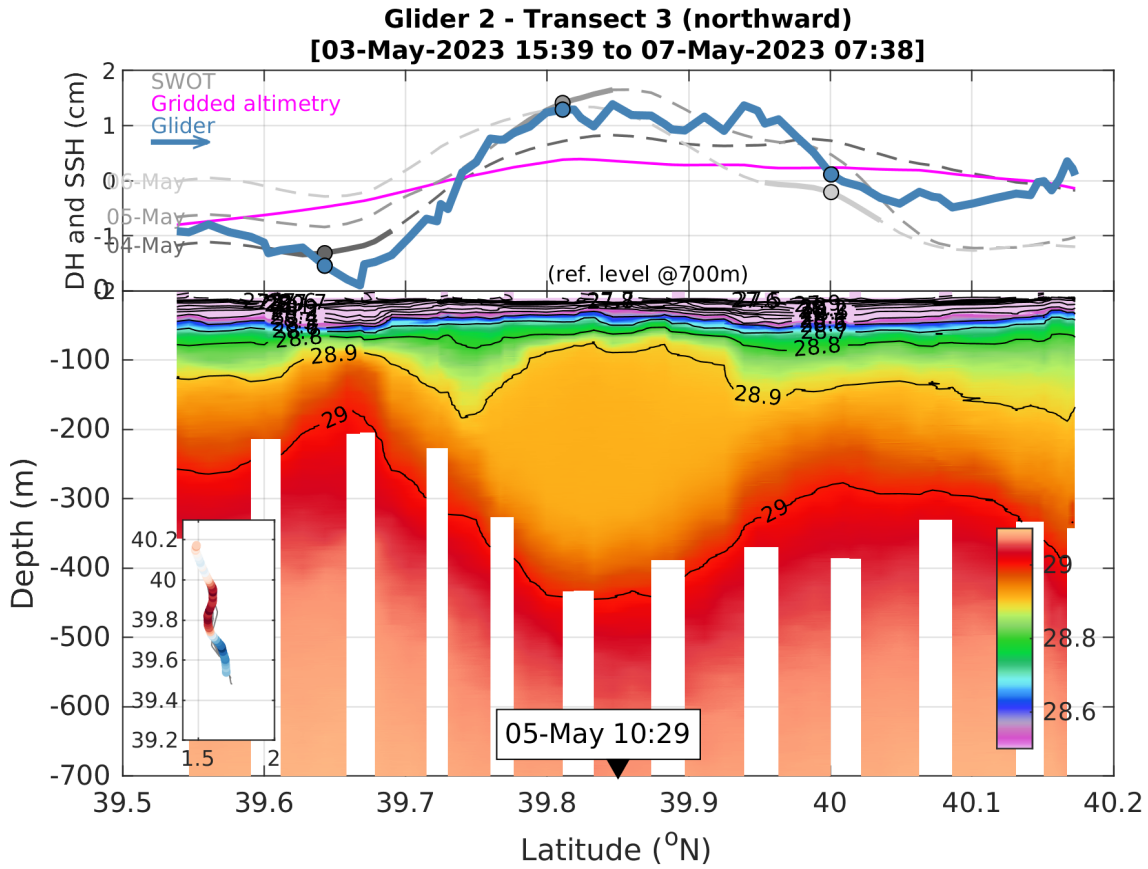


- Very good agreement between SWOT sea level and glider DH and significant improvement compared to gridded altimetry.

RMSD

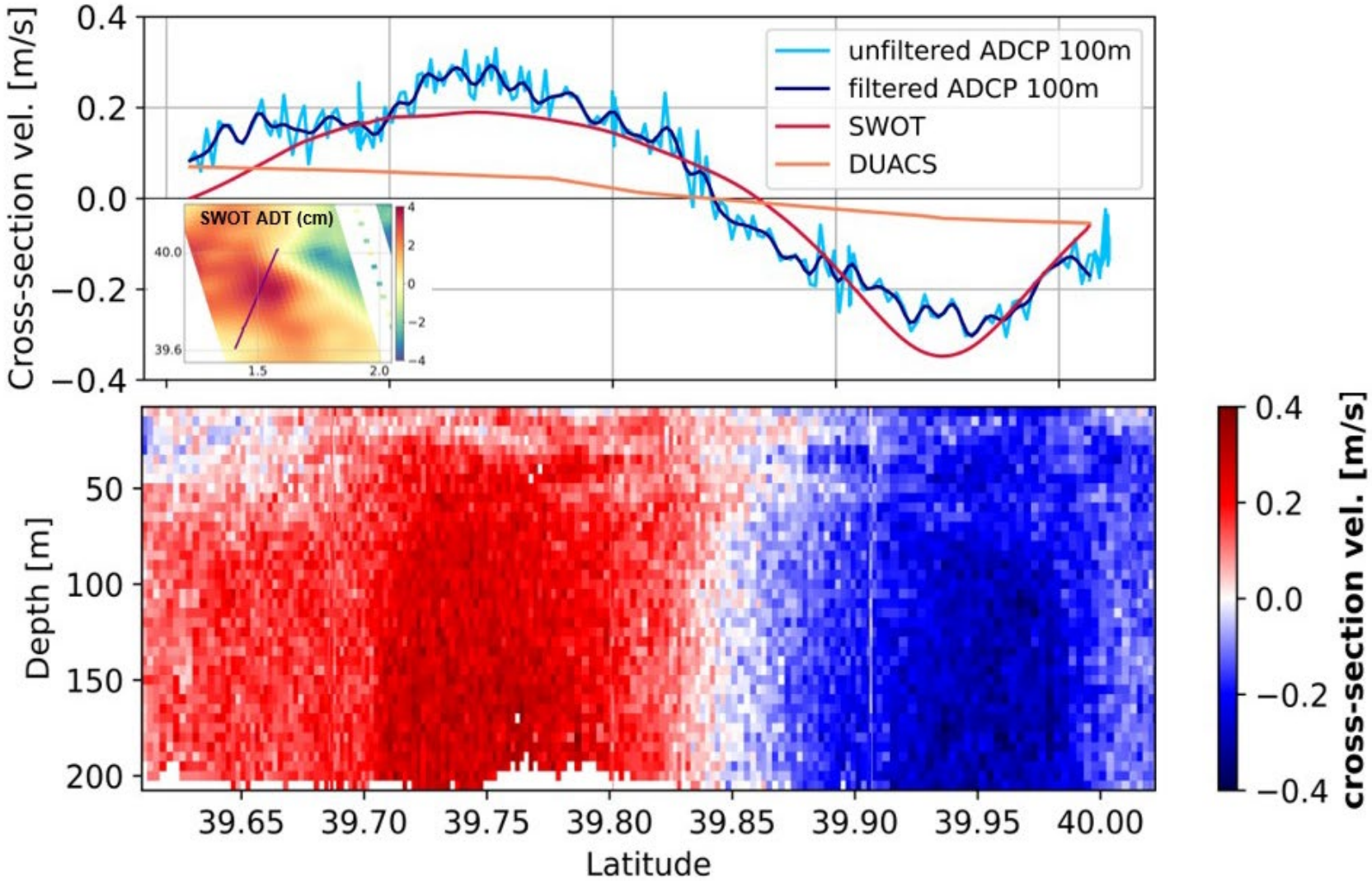
RMSD	vs SWOT v1.0	vs DUACS	% impr.	Day	Units
Glider 2 tr3	0.42	0.62	32	04/05/23	cm
Glider 2 tr3	0.60	0.66	9	05/05/23	cm
Glider 2 tr3	0.89	0.62	-45	06/05/23	cm

SWOT comparisons

ADCP: Cross section velocities

Eddy cross-section horizontal velocities:

→ Very good agreement between SWOT-derived geostrophic velocities and sADCP at 100m!



(Credits: E. Verger-Miralles)

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ADCP tr6 100 m	**6.08**	**15.07**	**60**	**26/04/23**	**cm/s**

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ADCP tr6 100 m	**6.08**	**15.07**	**60**	**26/04/23**	**cm/s**
SVPB35	**7.20**	**14.36**	**50**	**29/04/23**	**cm/s**
CARTHE02	**15.94**	**28.72**	**45**	**26/04/23**	**cm/s**

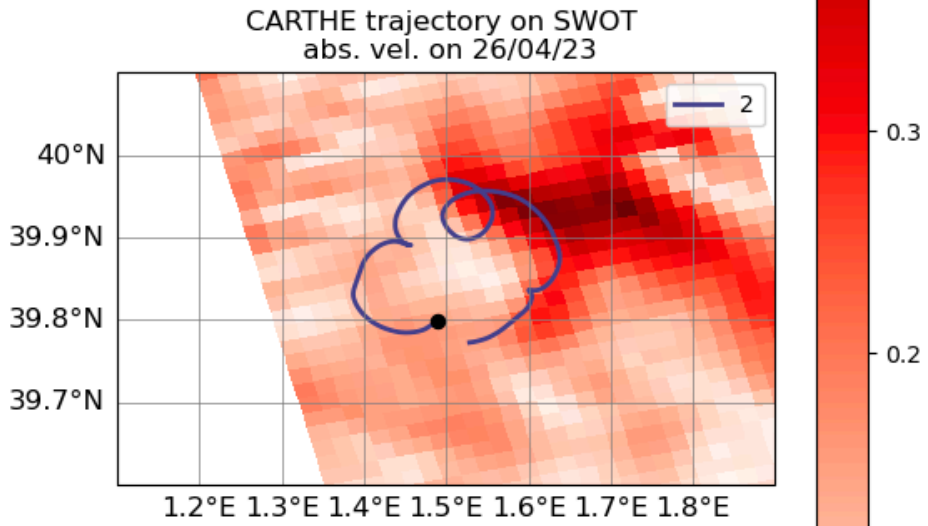
→ Preliminary analyses shows very promising results!

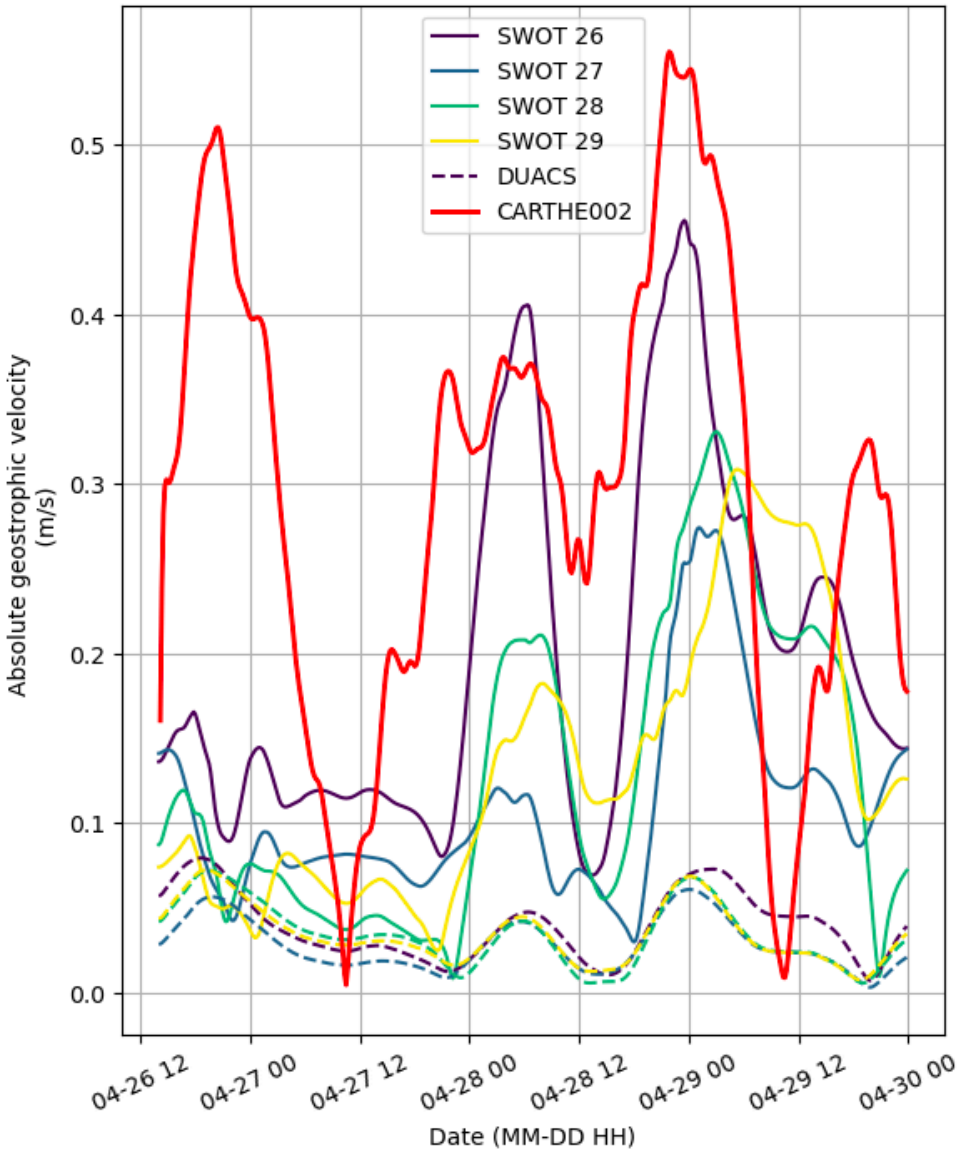
Challenges encountered

SWOT vs conv. altimetry and drifters

- Comparison of velocities

SWOT observes HF signals!





→Inertial variability

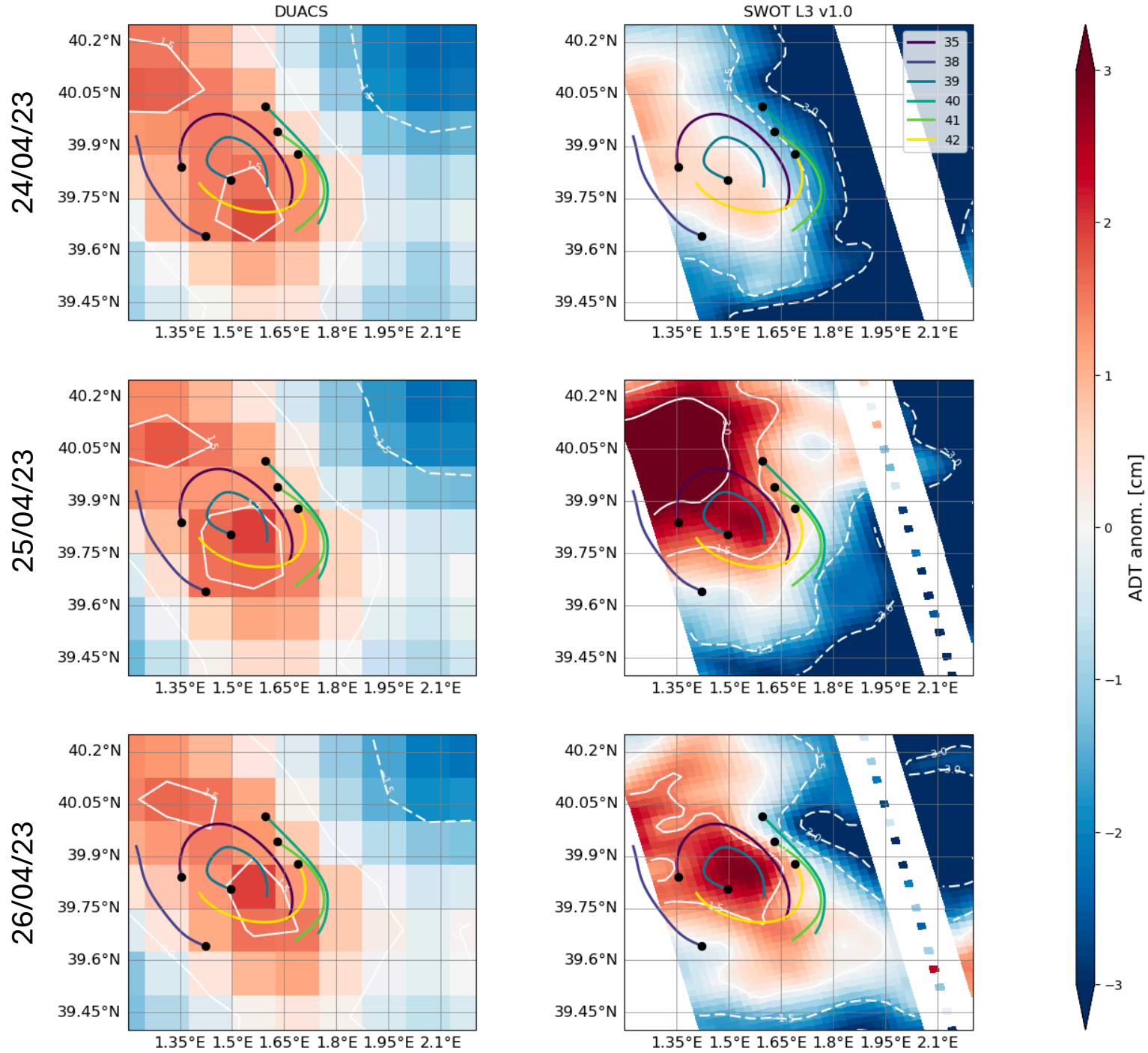
- Synopticity for comparison

Challenges encountered

SWOT vs conv. altimetry and drifters

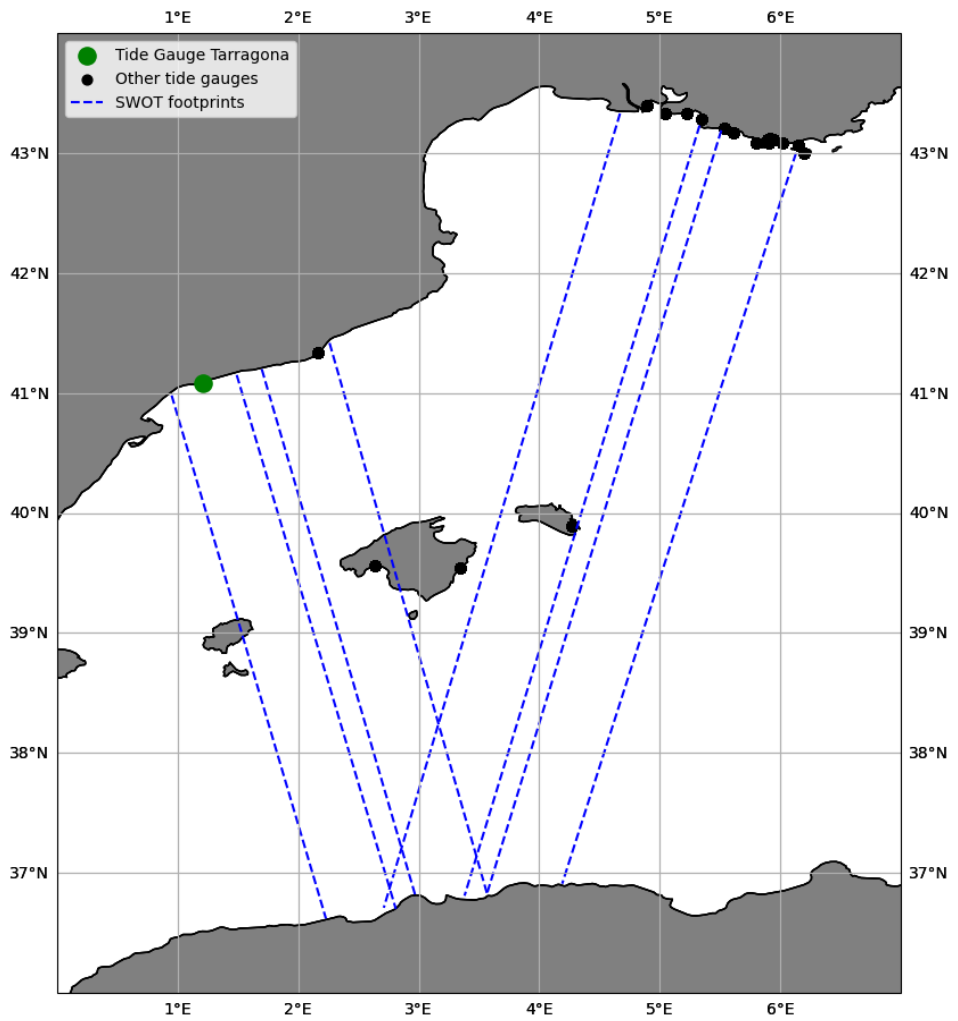
- Positive eddy SLA signal, more intense in SWOT data, with finer scale features

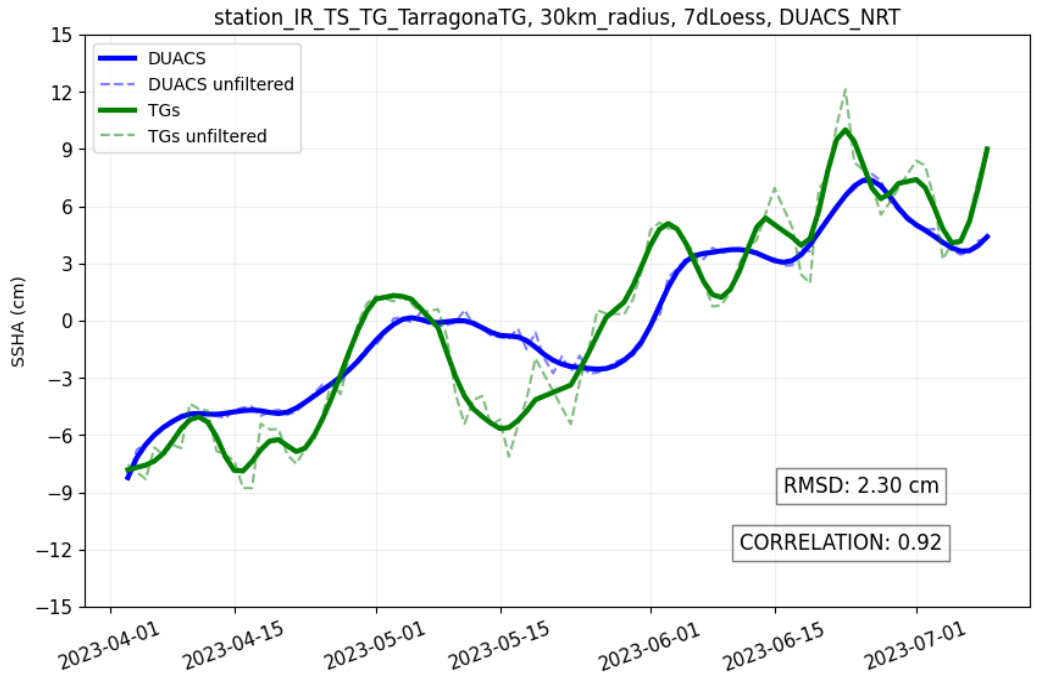
- High SWOT SSH variability between 25 and 26 April
  - **Is it realistic?**
  - Possible geophysical error?

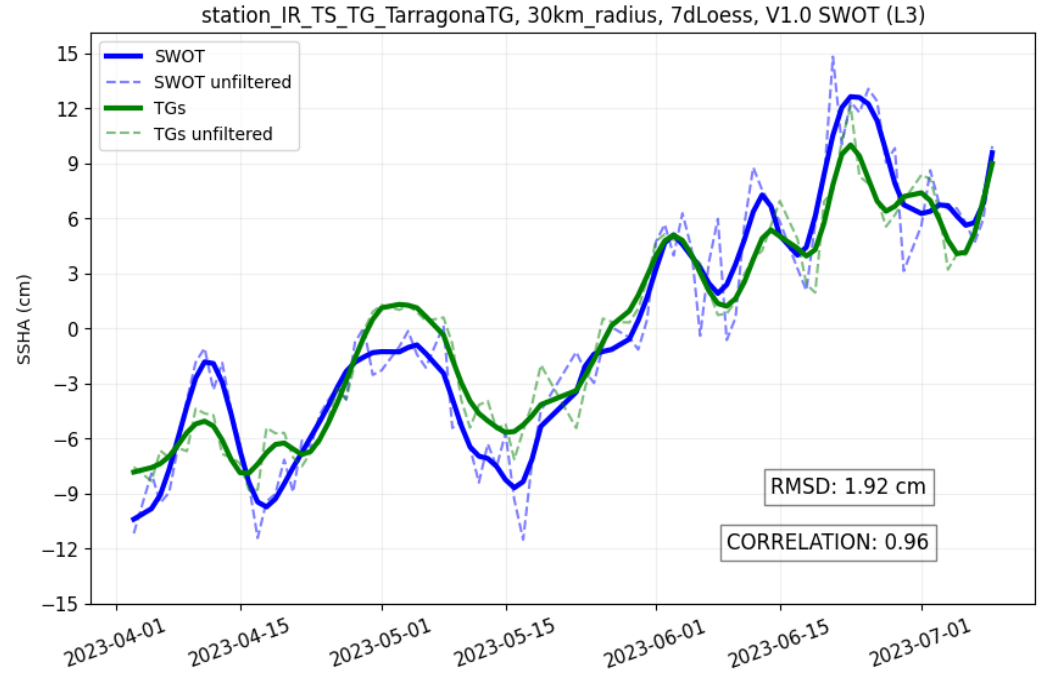


Selection of 6 SVP-B Drifters
25/04 – 29/04/24 (IOs filtered)

Comparisons with Tide Gauges







Altimetry processing: (Sanchez-Roman *et al.*, 2023)

- Average values within 30 km radius around TG's
- LOESS filter of 7 days

(Credits: D. Vega-Gimenez)

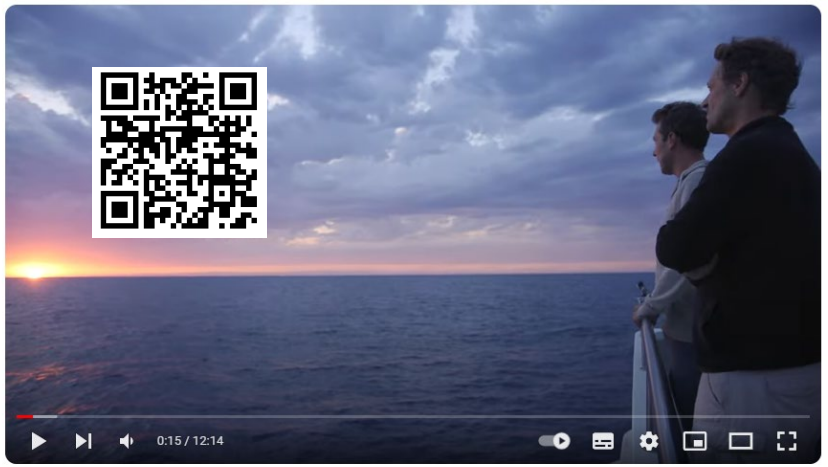
FaSt-SWOT Summary

Processing of *in situ* data. Dataset release SOON (DOI – public access)

***In situ* data analysis** of a small-scale eddy

First **comparisons to SWOT observations**, DH and velocities

Promising agreement between **SWOT** and ***in situ* data**



"Del espacio al Mediterráneo: Persiguiendo corrientes marinas"

laura.gomez@uib.es

GitHub LauraGomezNavarro

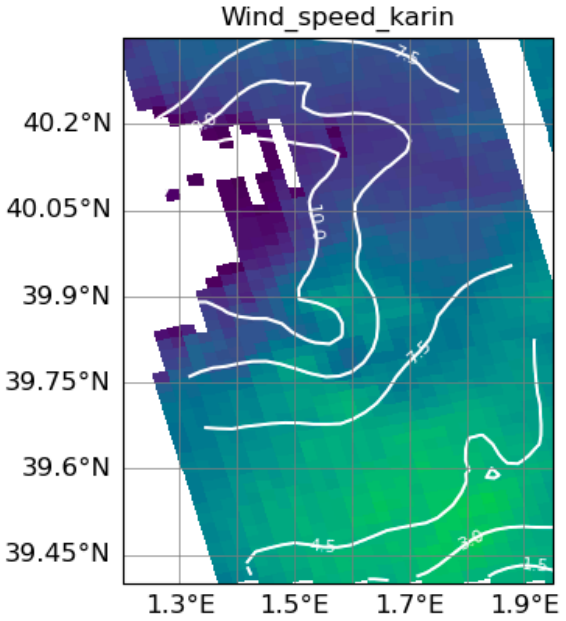
ACKNOWLEDGMENTS

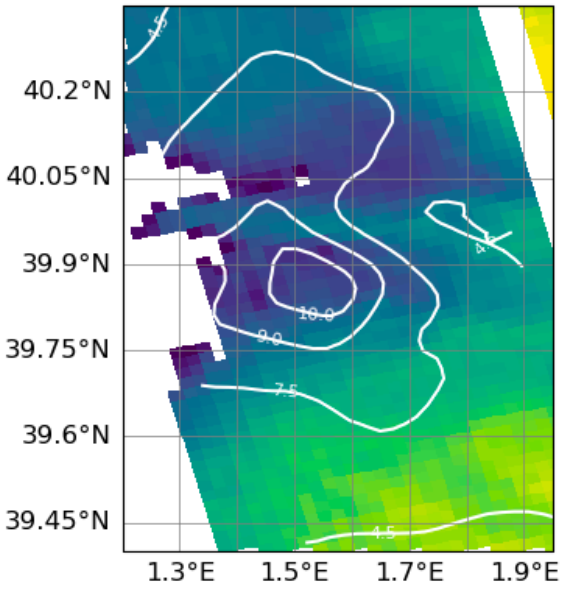
PID2021-122417NB-I00 funded by MCIN/AEI/10.13039/501100011033/ FEDER,UE

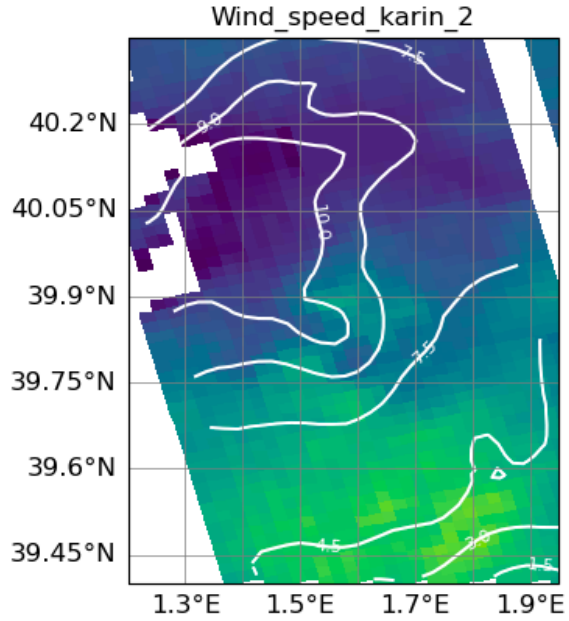
Additional slides

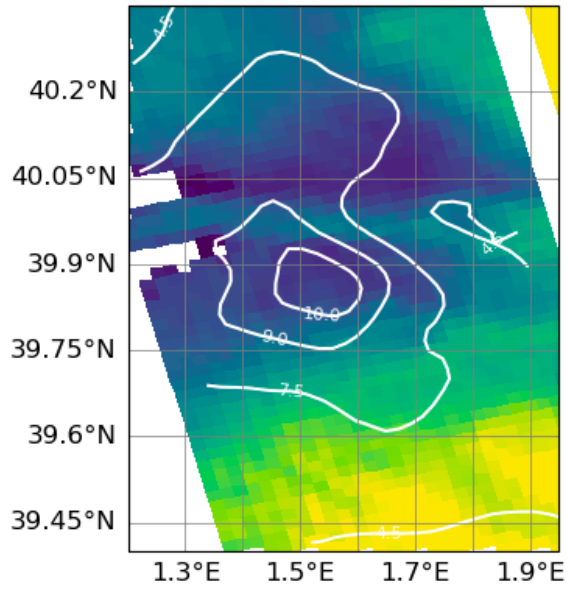
Getting closer to error source?

- Background field: L2 KaRIn wind speed
- Contours: SWOT L3 1.0 SSHA_noiseless contours









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