Analysis of fine-scale dynamics in the Balearic Sea through high-resolution observations and SWOT satellite data

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[3] *IMT Atlantique, France*

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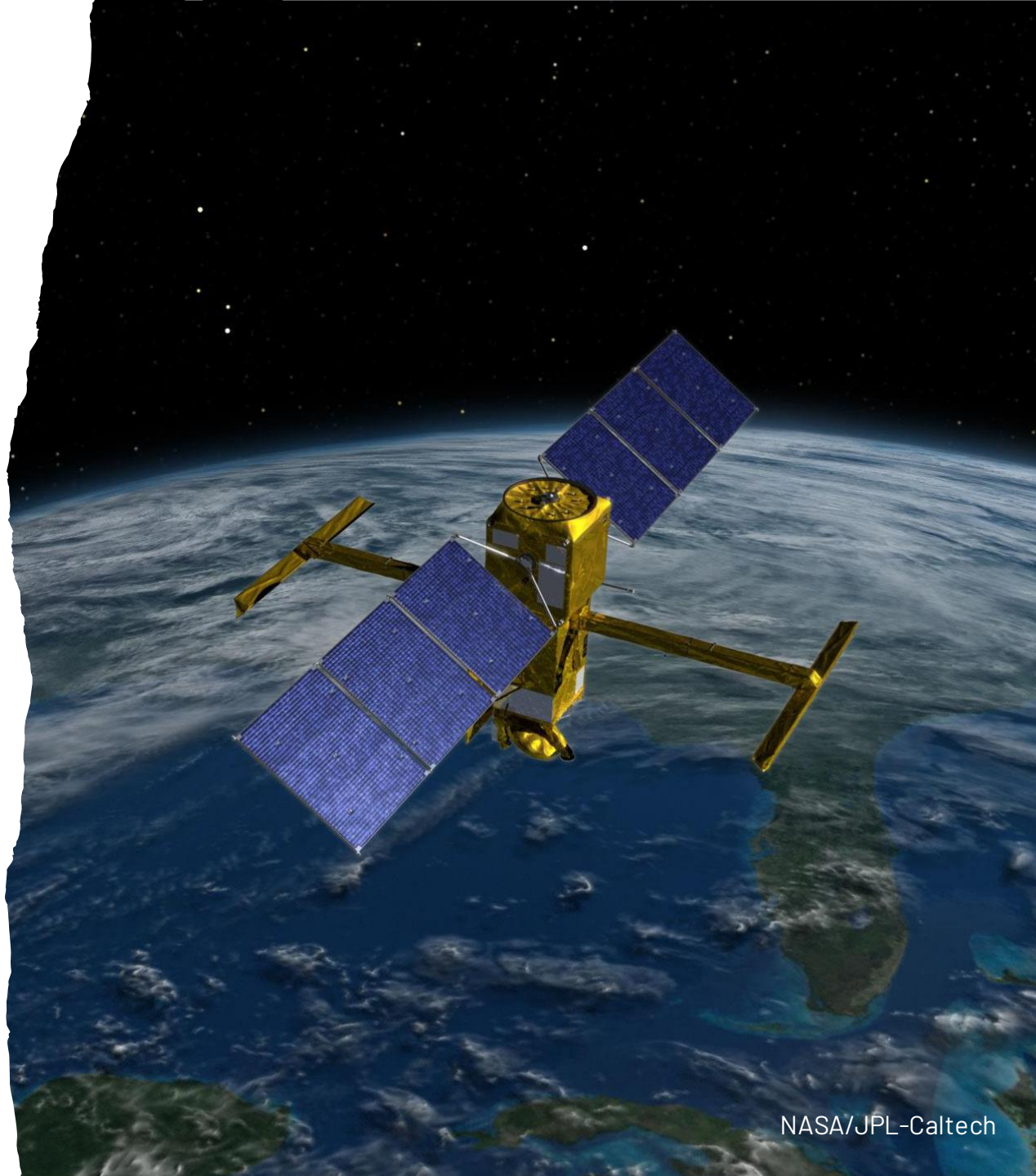
BACKGROUND & MOTIVATION

FaSt-SWOT project

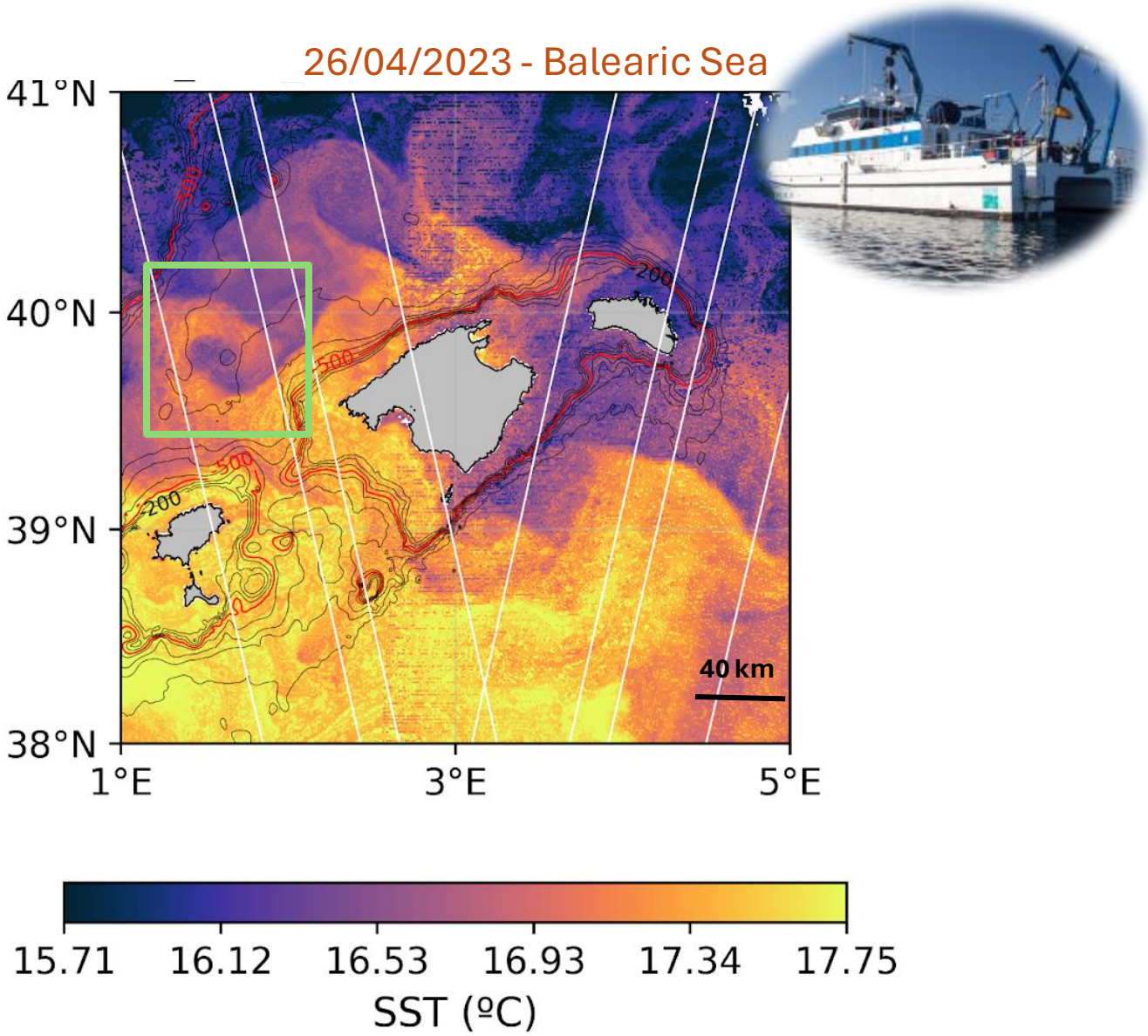
- Understanding the **3D dynamics** linked to **fine-scale ocean features** (10-100 km)
- **Validation of SWOT** satellite
- **Integrate SWOT** observations into **data-assimilative high-resolution models**
- **Evaluate the impact of SWOT resolution** on the estimation of SSH and vertical velocities



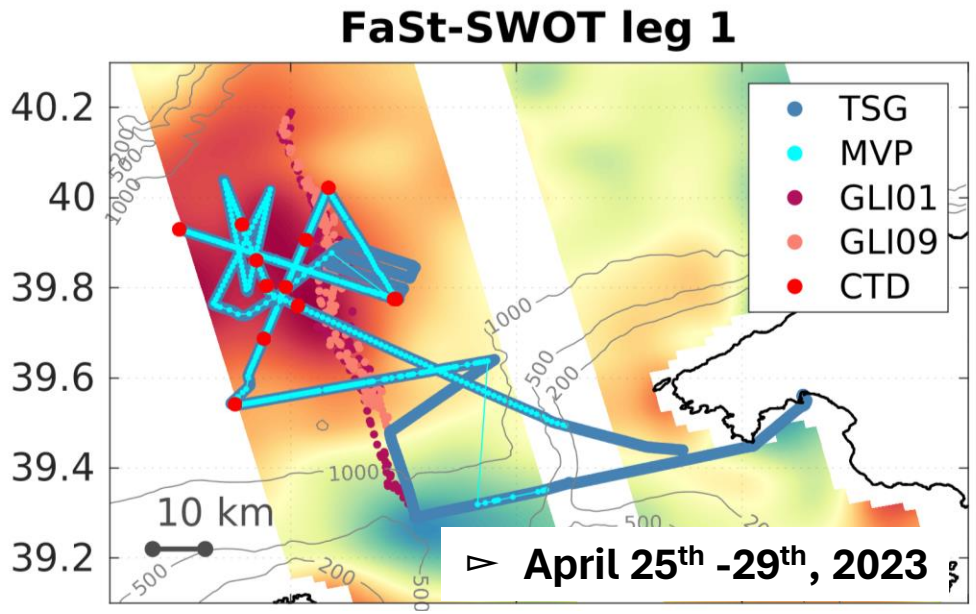
BACKGROUND & MOTIVATION

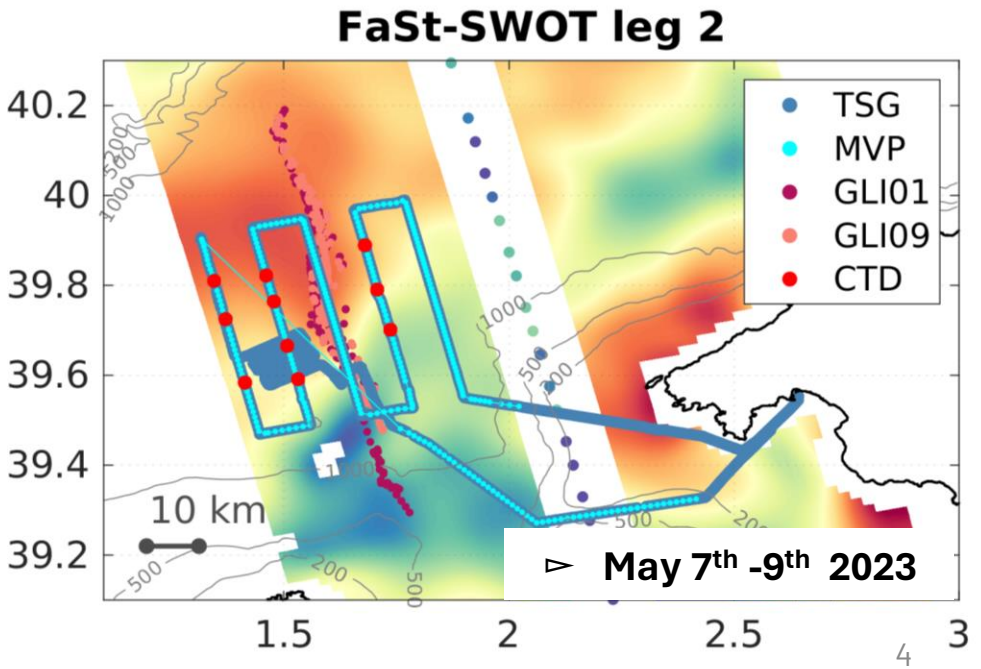
FaSt-SWOT project

- **In-situ sampling** of a **small-scale eddy** during the SWOT **fast sampling phase** in the South-Western Mediterranean
- **Repeat sampling after 10 days** to track the evolution



FaSt-SWOT experiments





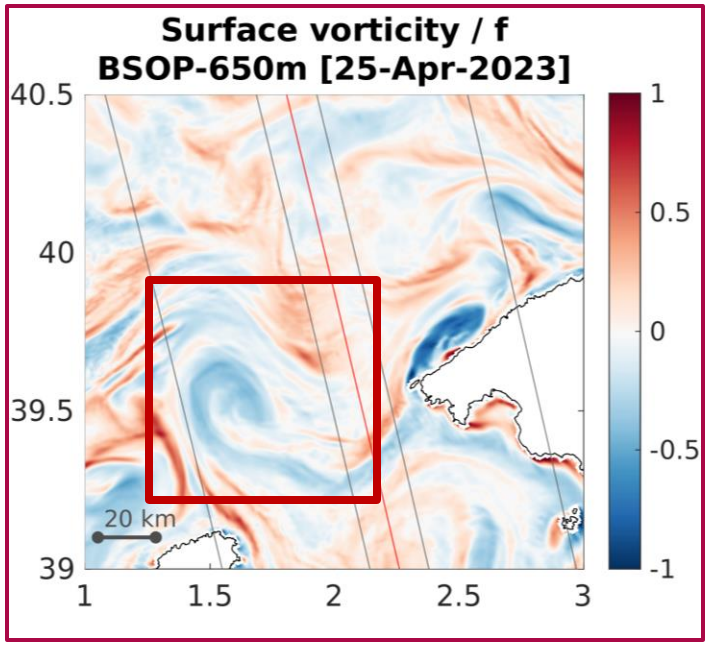
FaSt-SWOT experiments

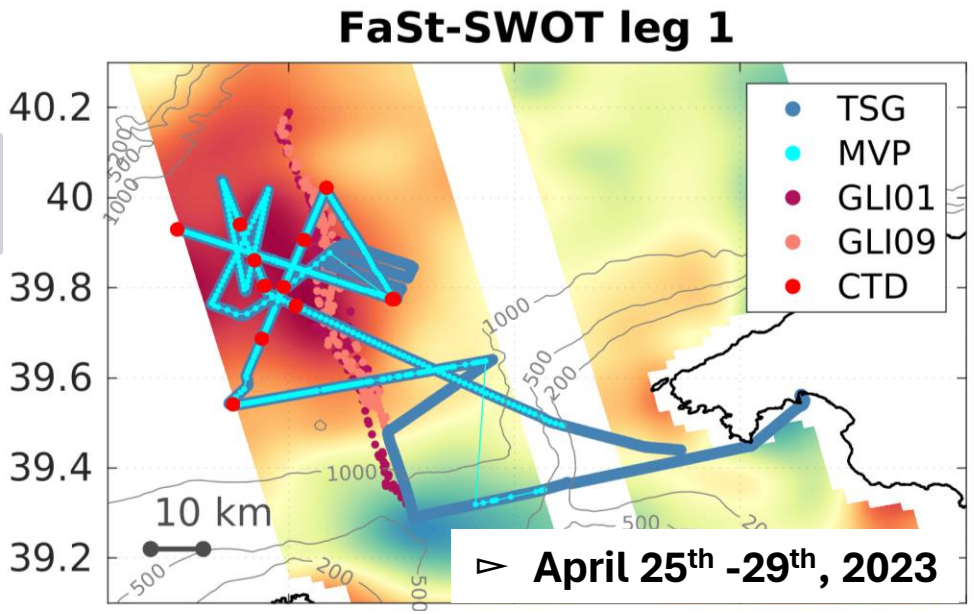
Pascual et al., 2023 – **CRUISE PLAN** https://doi.org/10.20350/digitalCSIC/15276
Mourre et al., 2024 - **CRUISE REPORT** https://doi.org/10.20350/digitalCSIC/16077

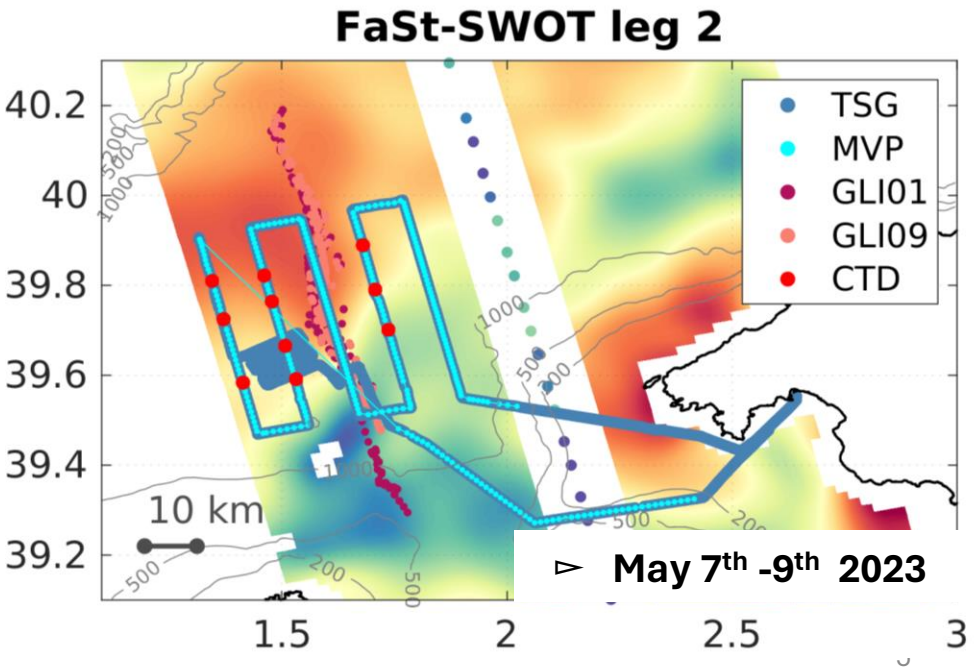
Measurements

- 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]

+ high-resolution data-assimilative modelling

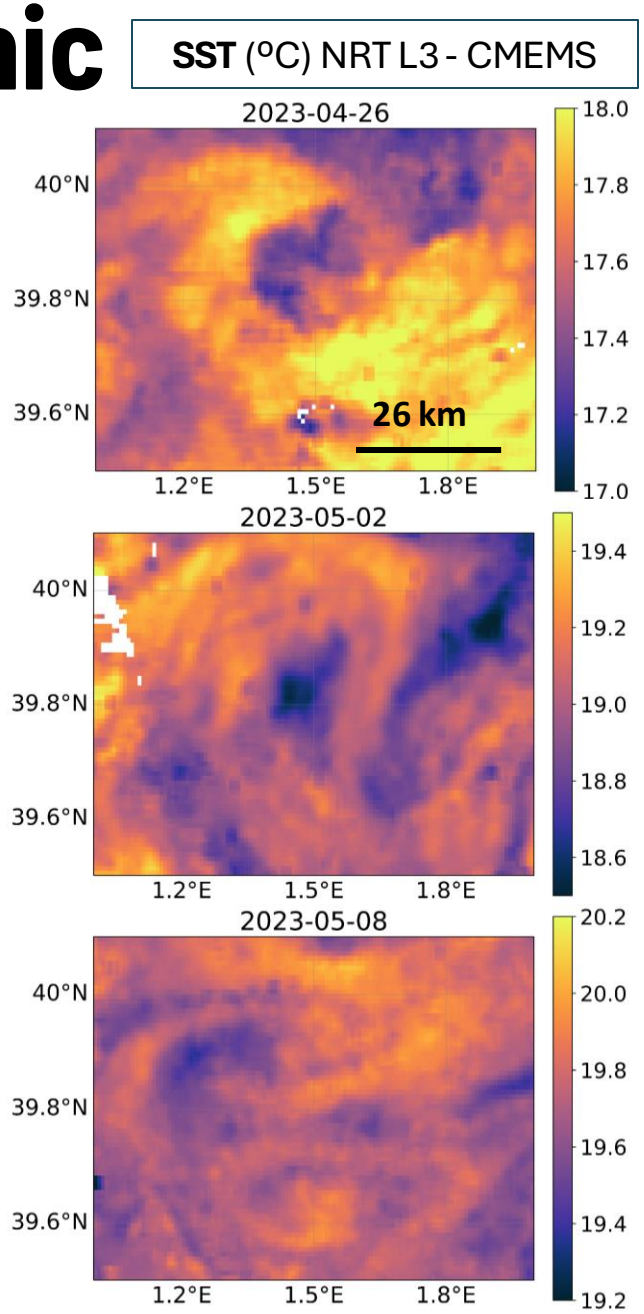






Oceanographic context

From satellites



Oceanographic context

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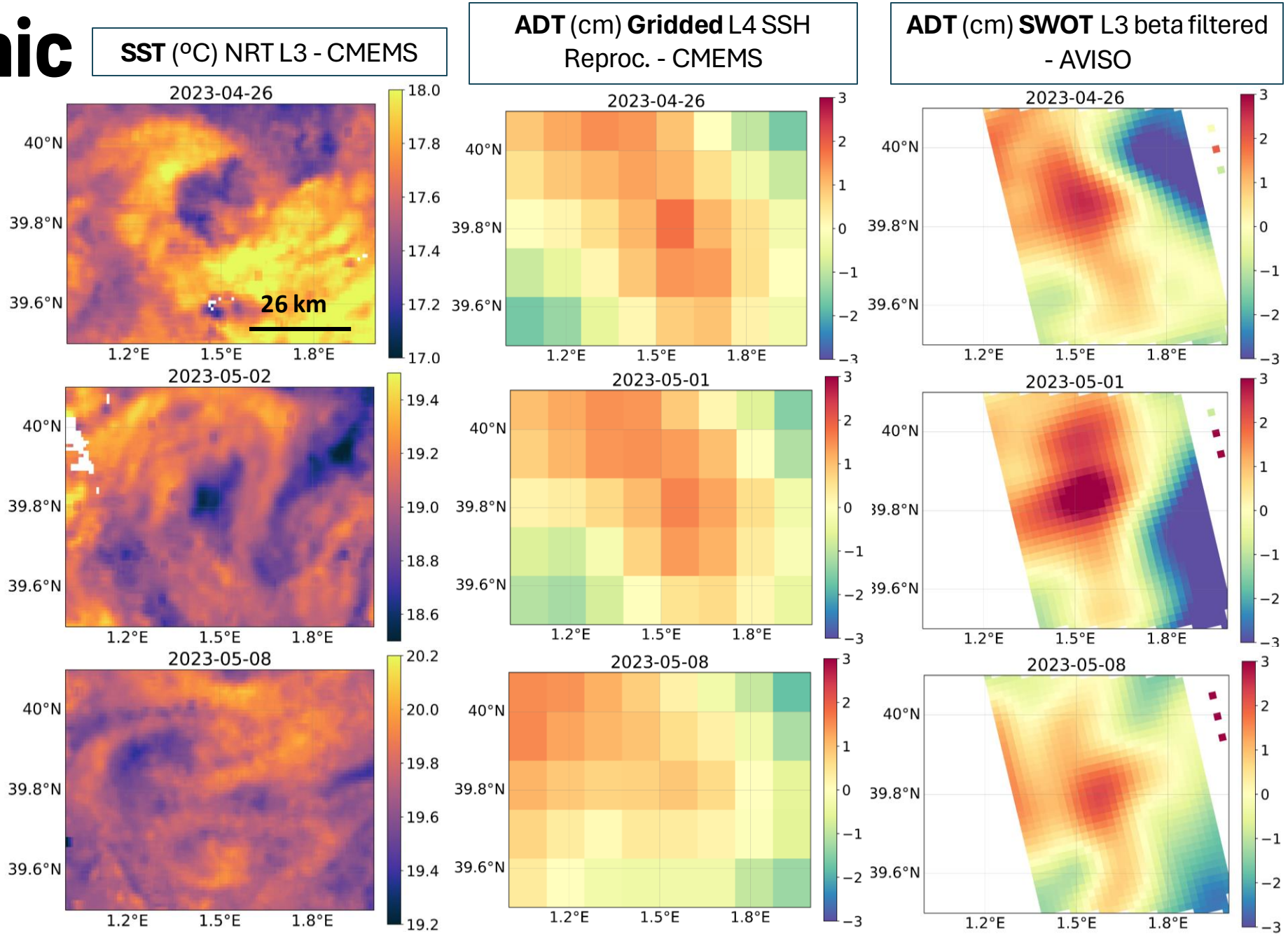
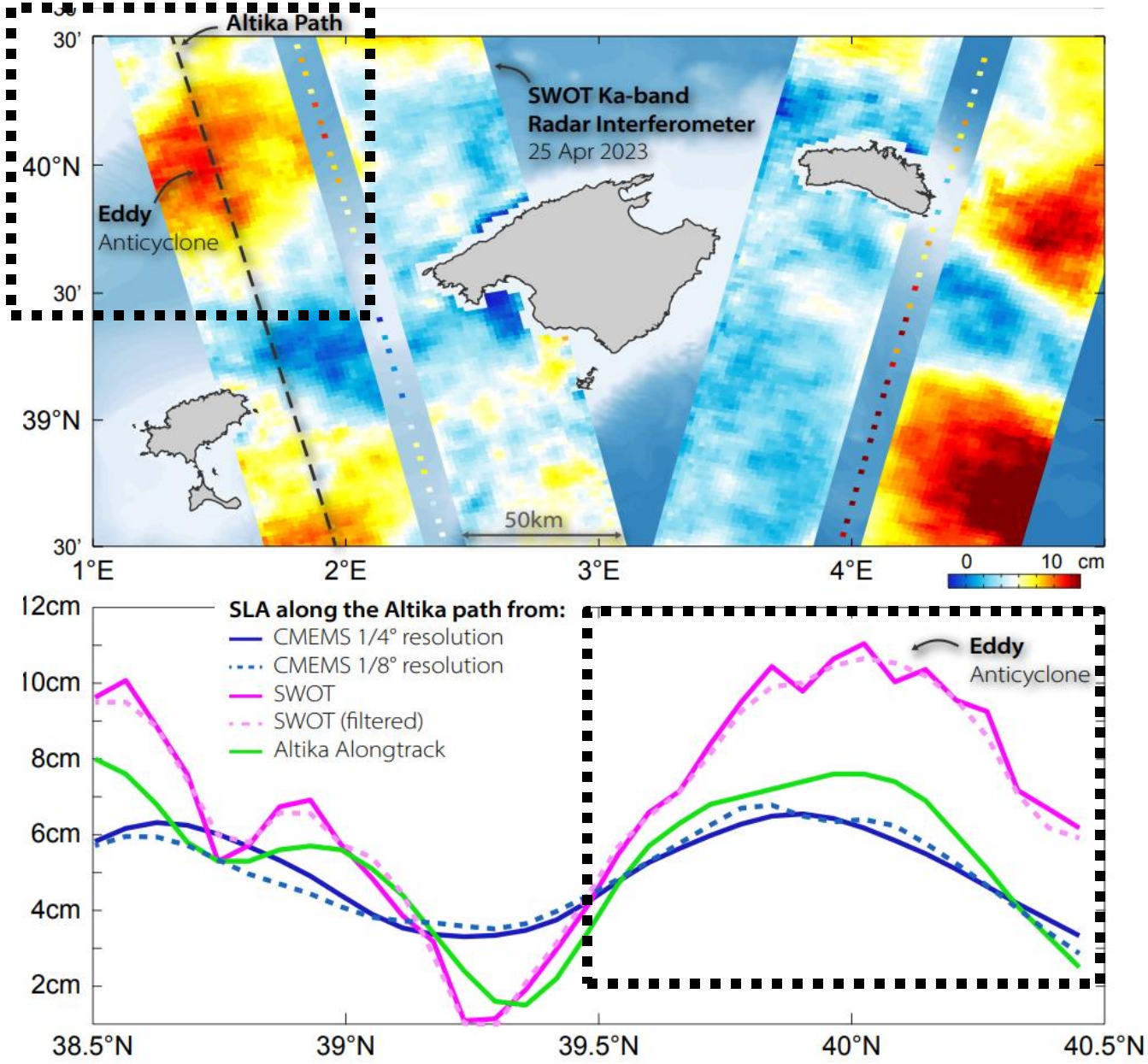


Oceanographic context

From satellites

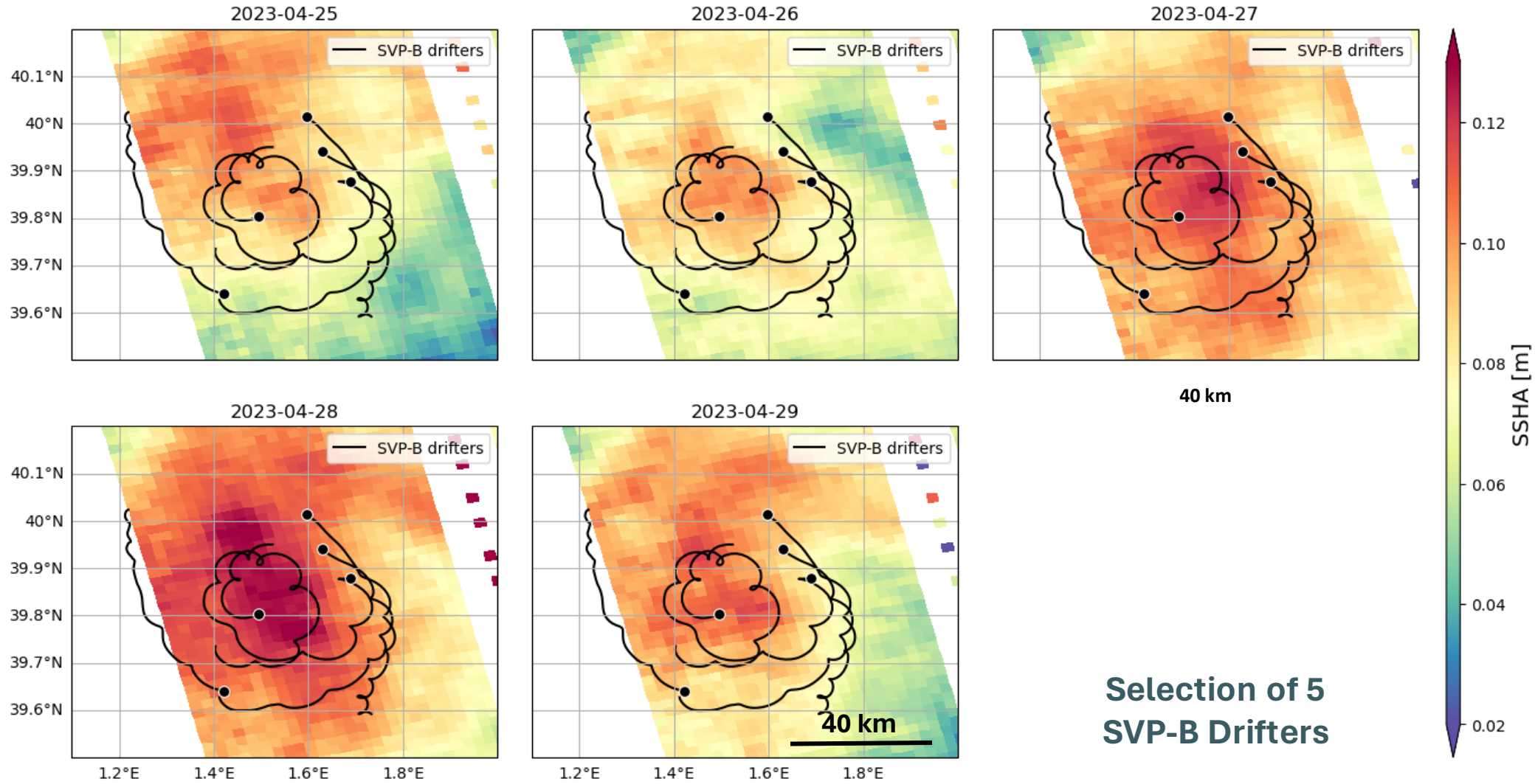
Anticylonic eddy clearly detected in SWOT

Also detected with lower magnitude in conventional altimetry



Oceanographic context

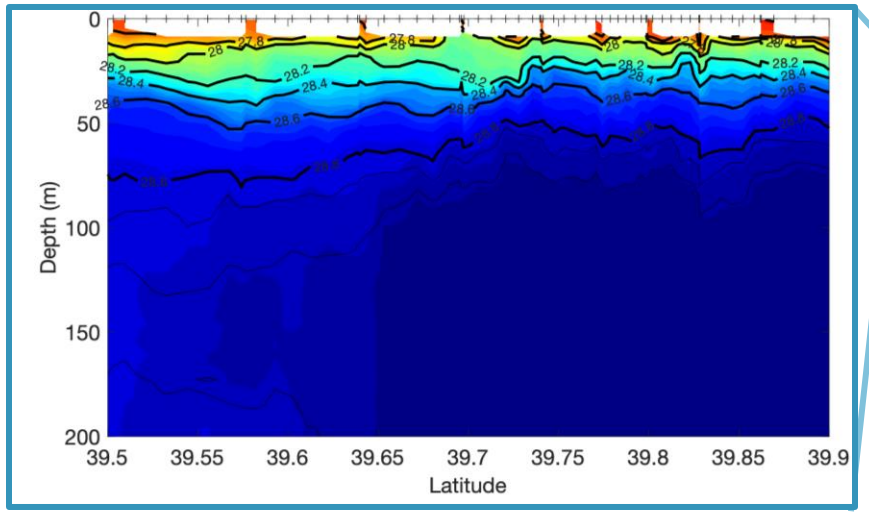
From drifters

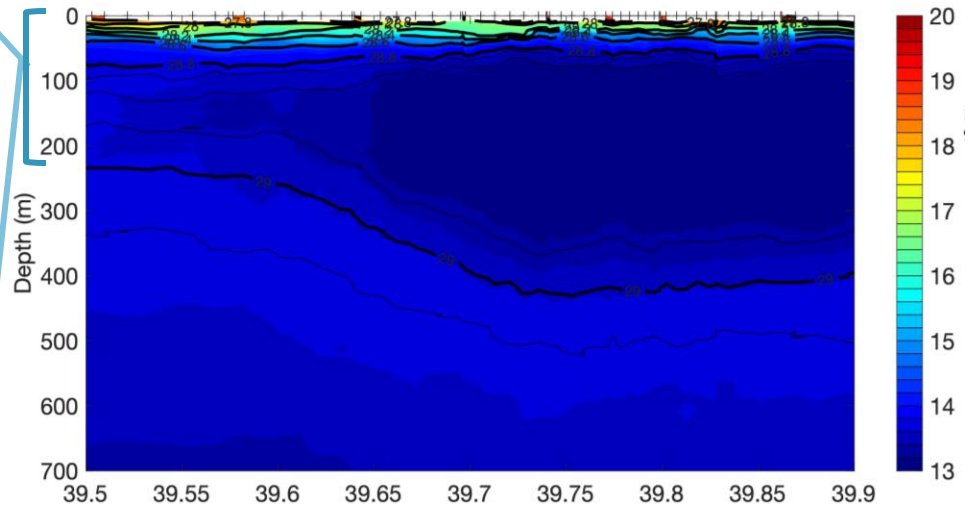


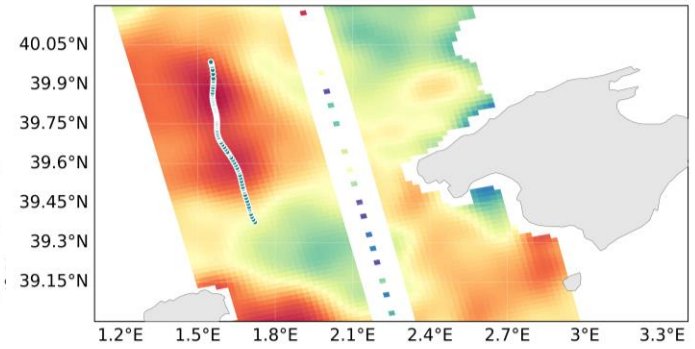
Selection of 5 SVP-B Drifters

Eddy structure

Potential temperature

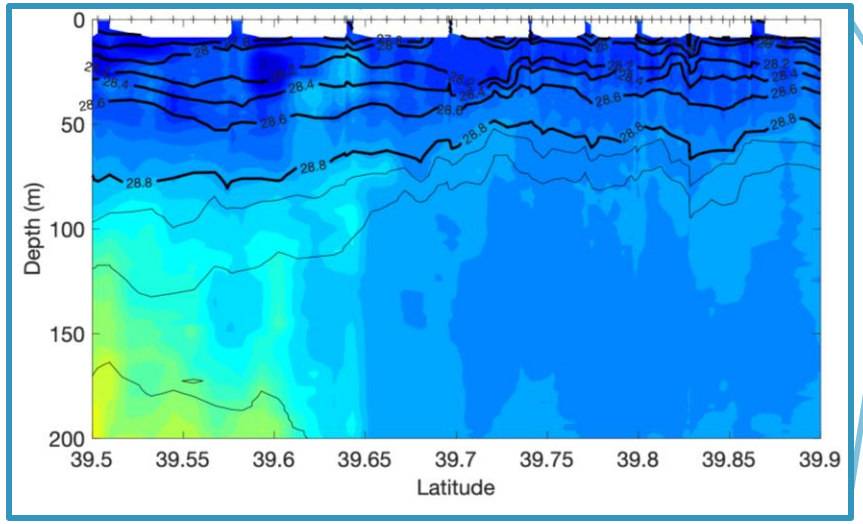


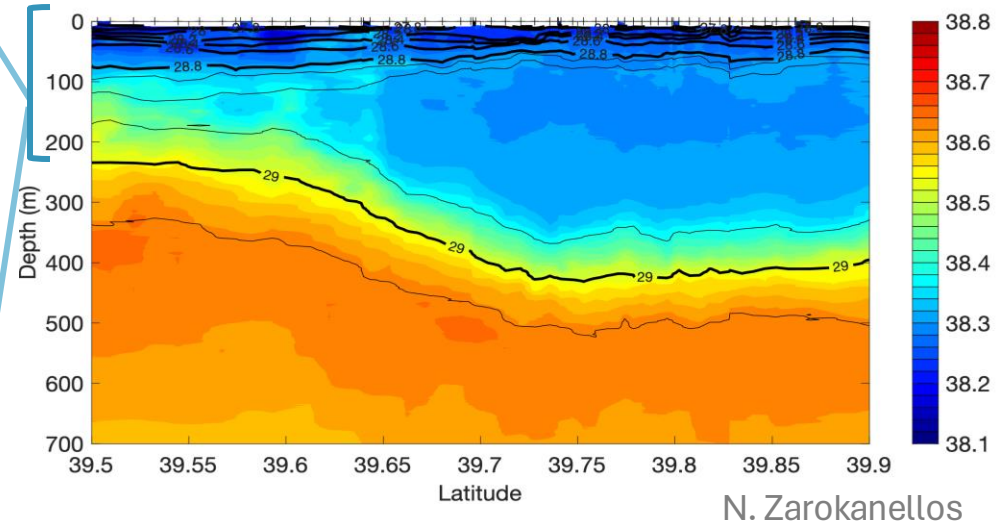




Glider SG01 Section 2
28-Apr-2023 08:59 – 02-May-2023 15:04

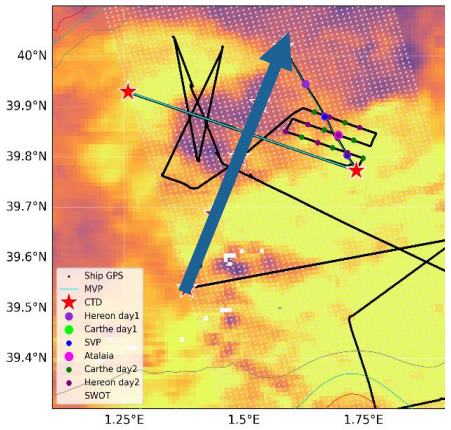
Salinity



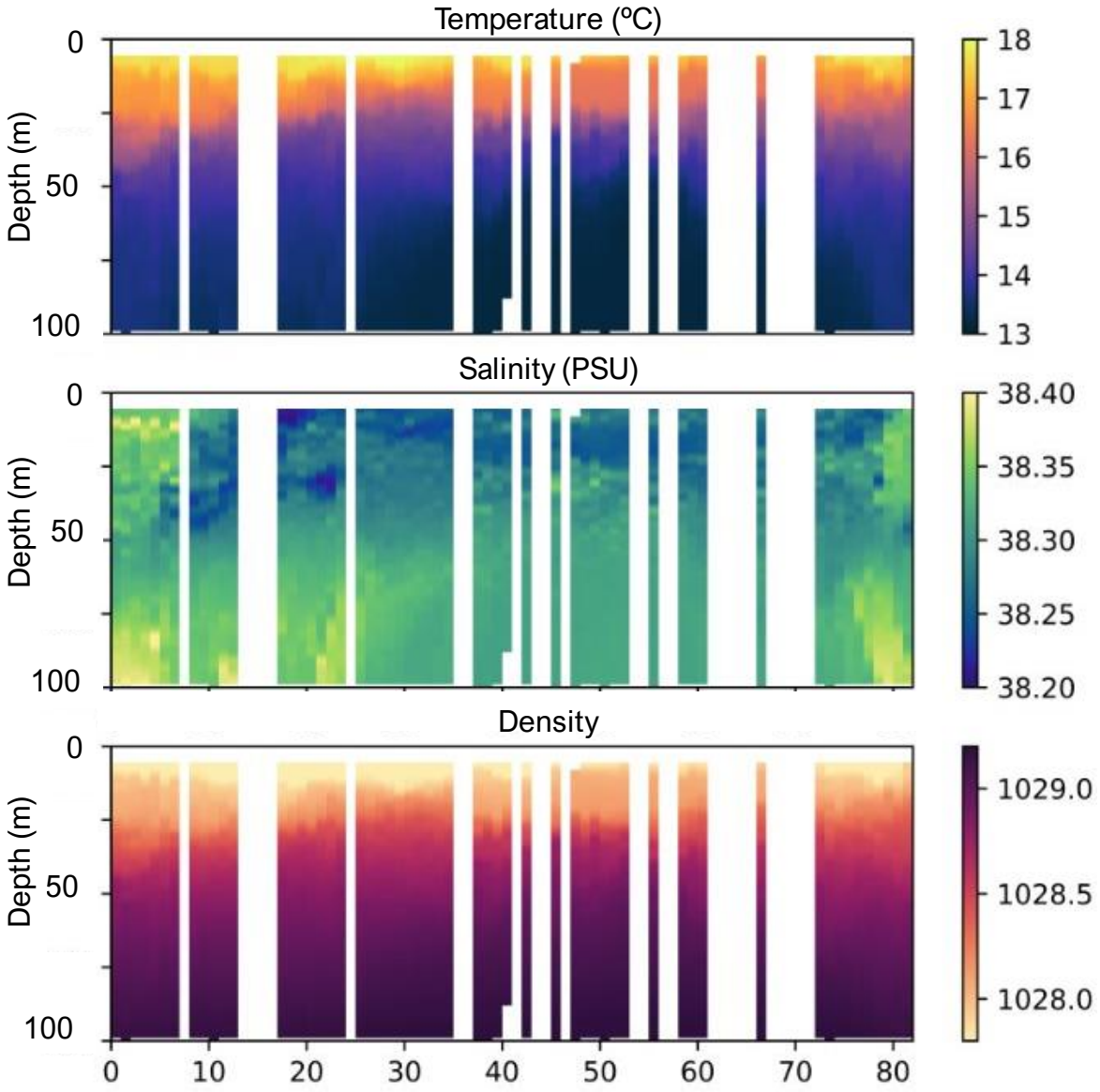


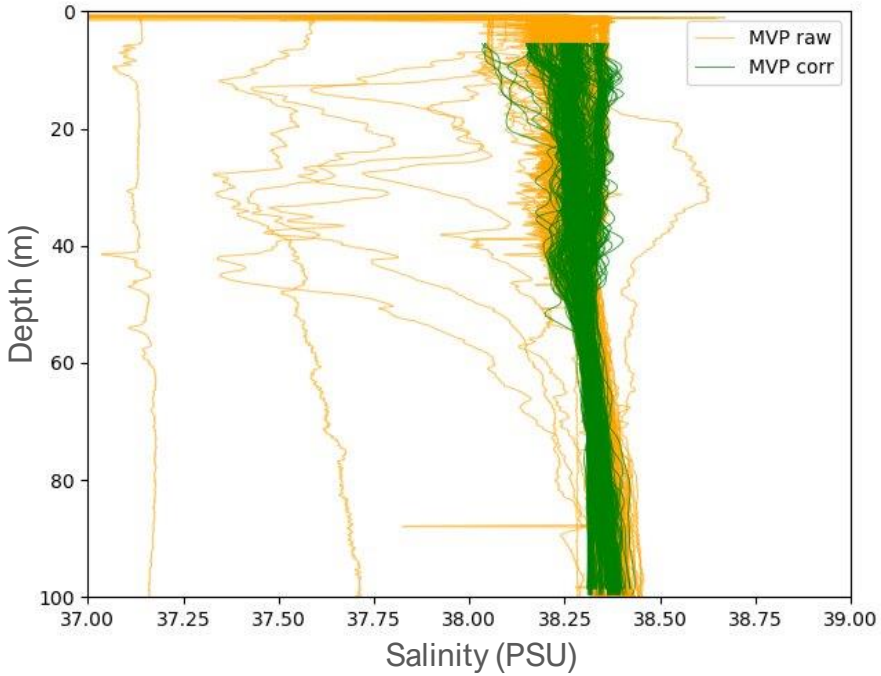
N. Zarokanellos

Eddy structure



Transect 6 MVP
26/04/24



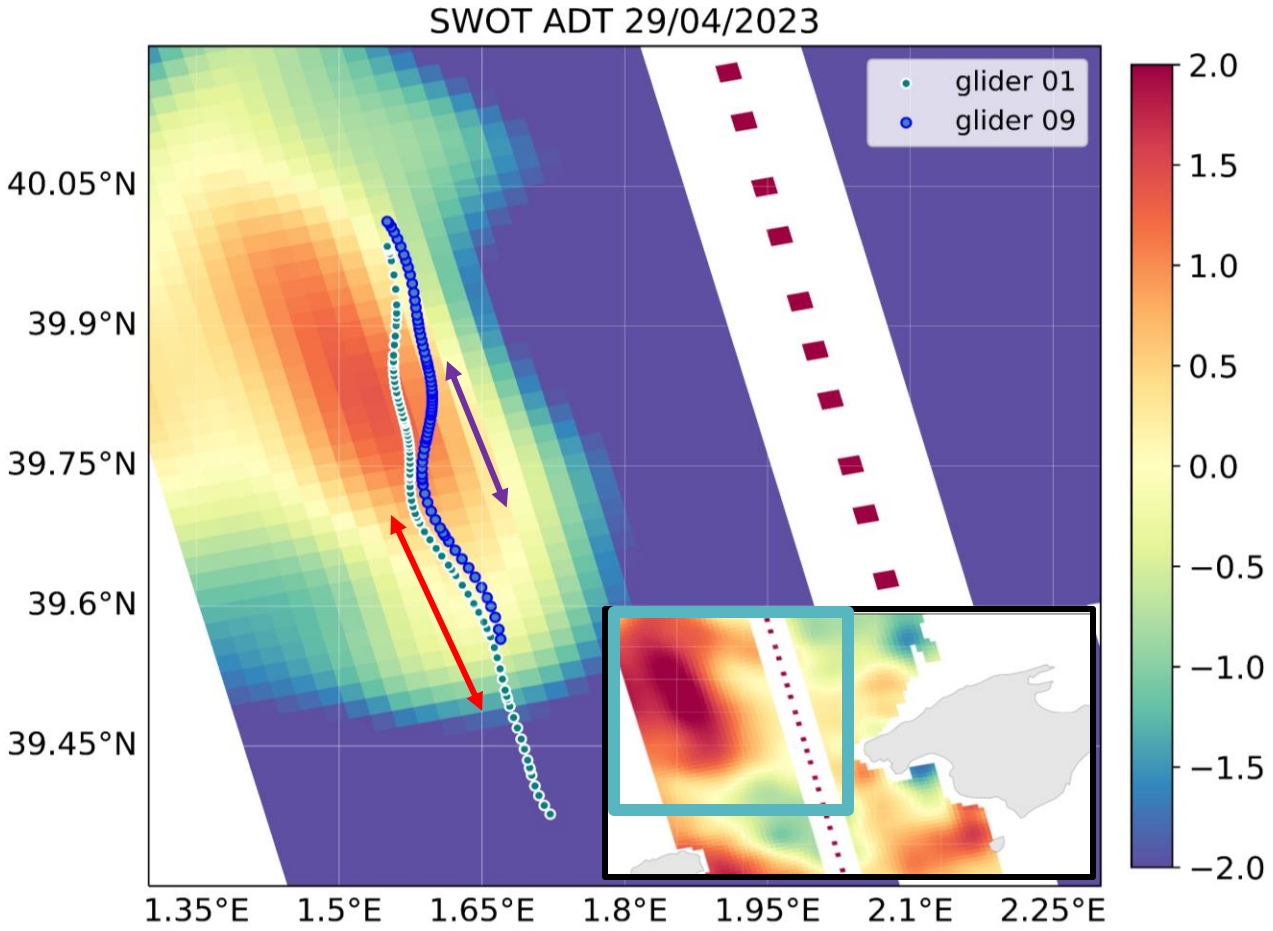


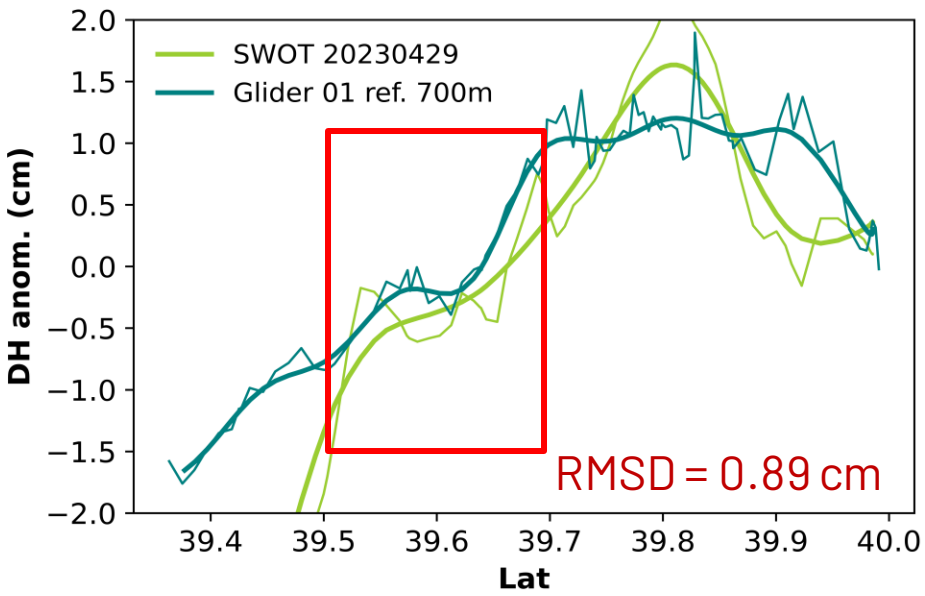
- Remove density inversions and outliers
- Temperature and conductivity alignment
- LOESS filtering

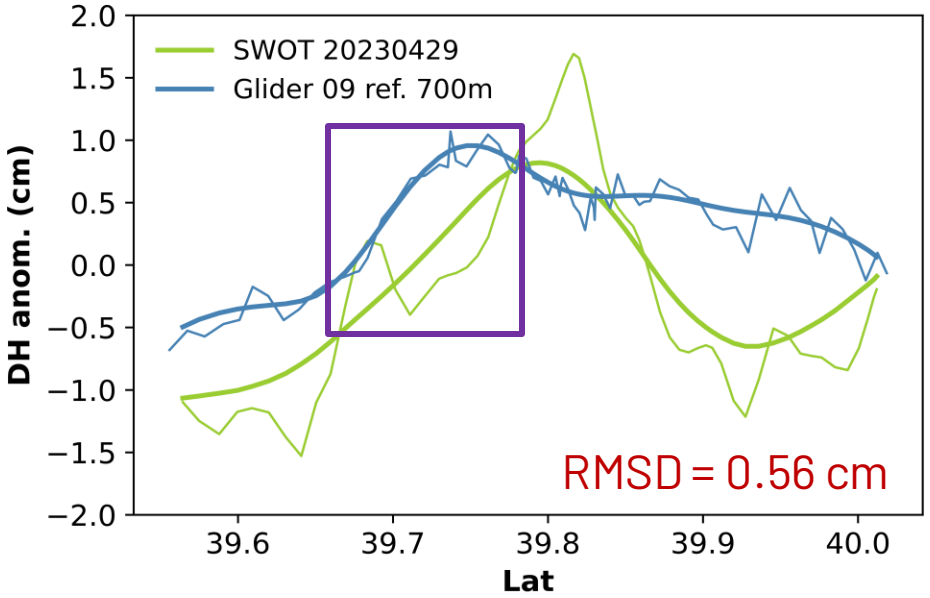
MVP processing
Paper in prep. E. Verger-Miralles et al.
Codes will be shared through GitHub:
github.com/everger-miralles/MVP_processing

SWOT comparisons

DH anomalies – Gliders







Gliders are slow!

Both start 28-Apr – 1h separation

4 days to complete the transect

SWOT daily!

SWOT comparisons

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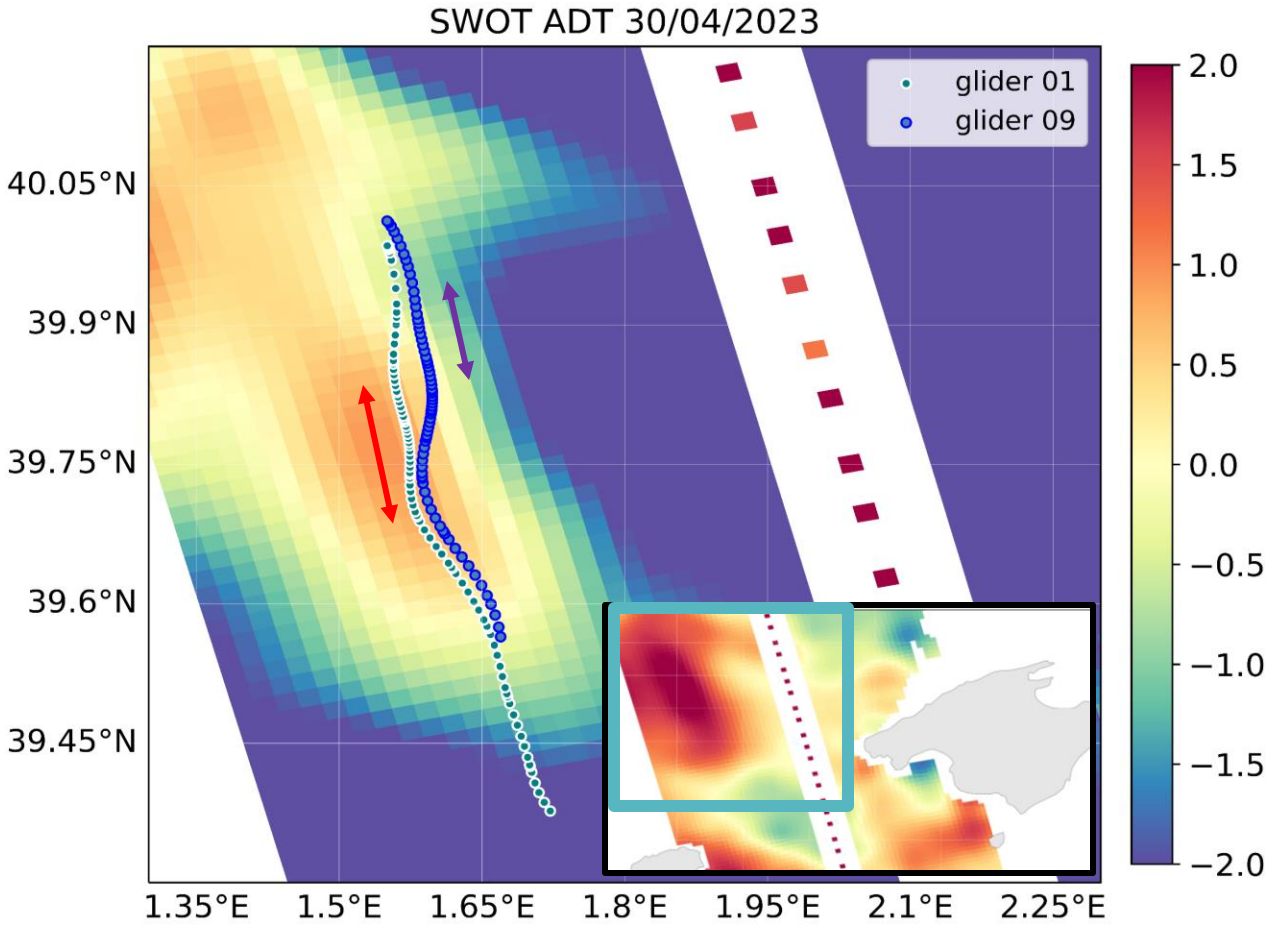

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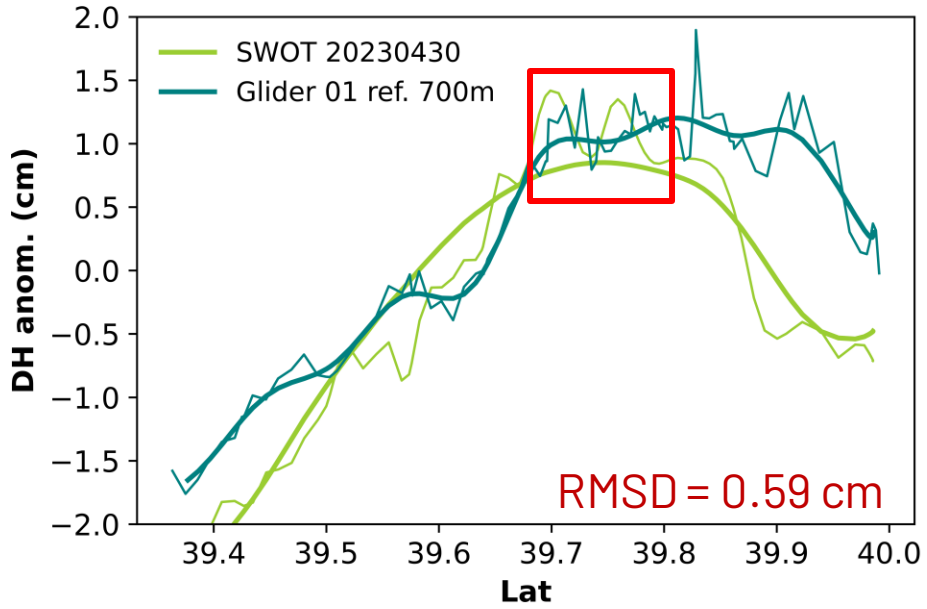
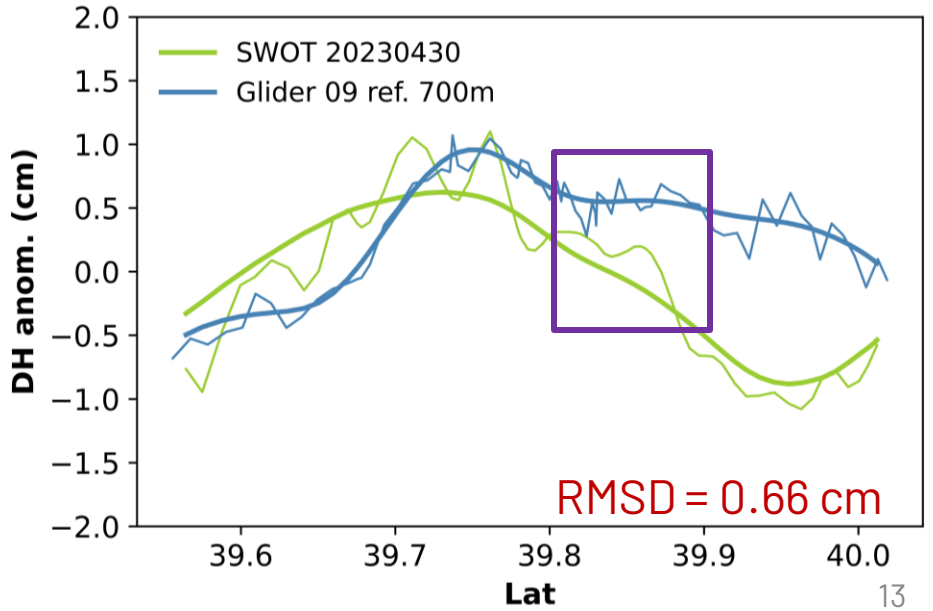
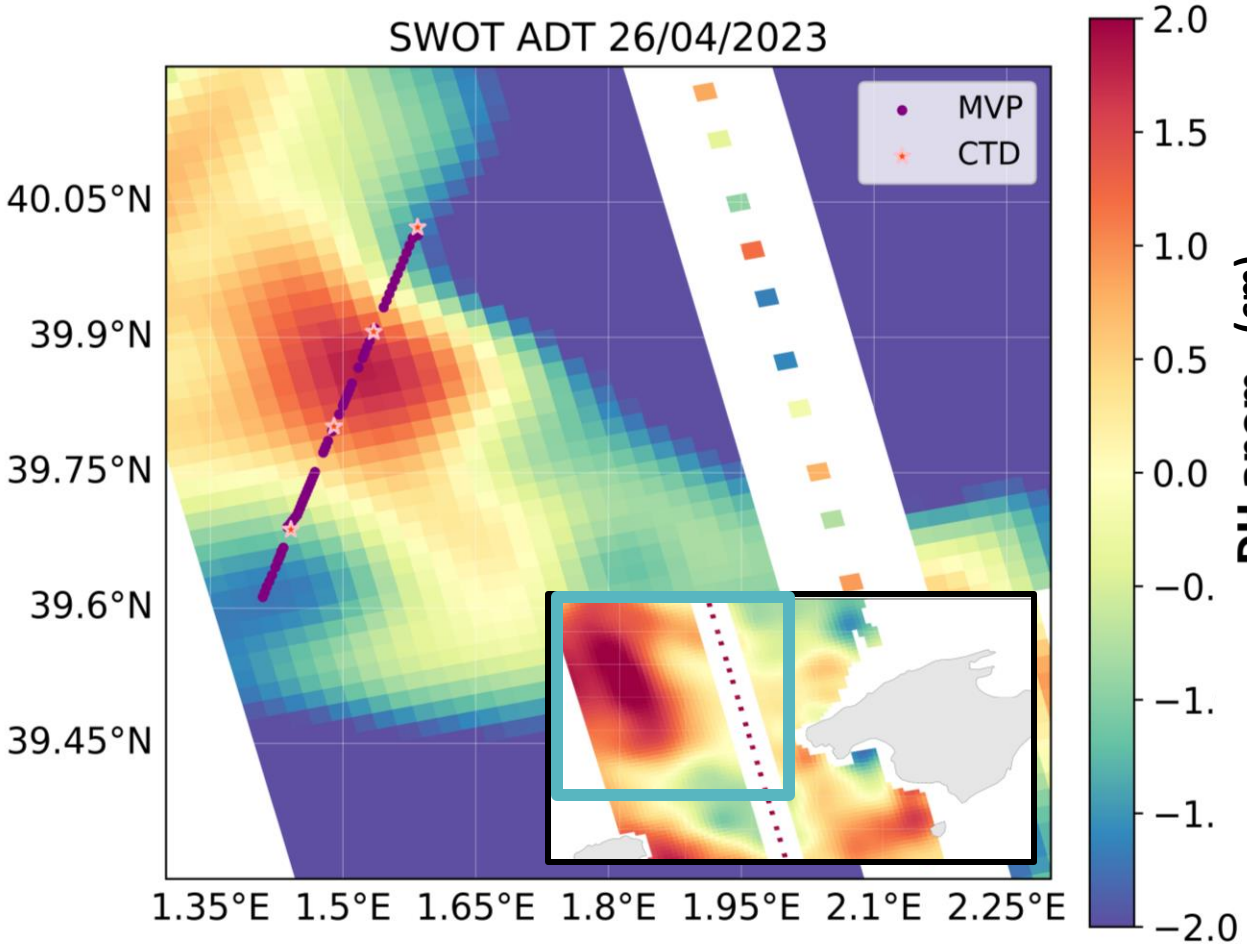
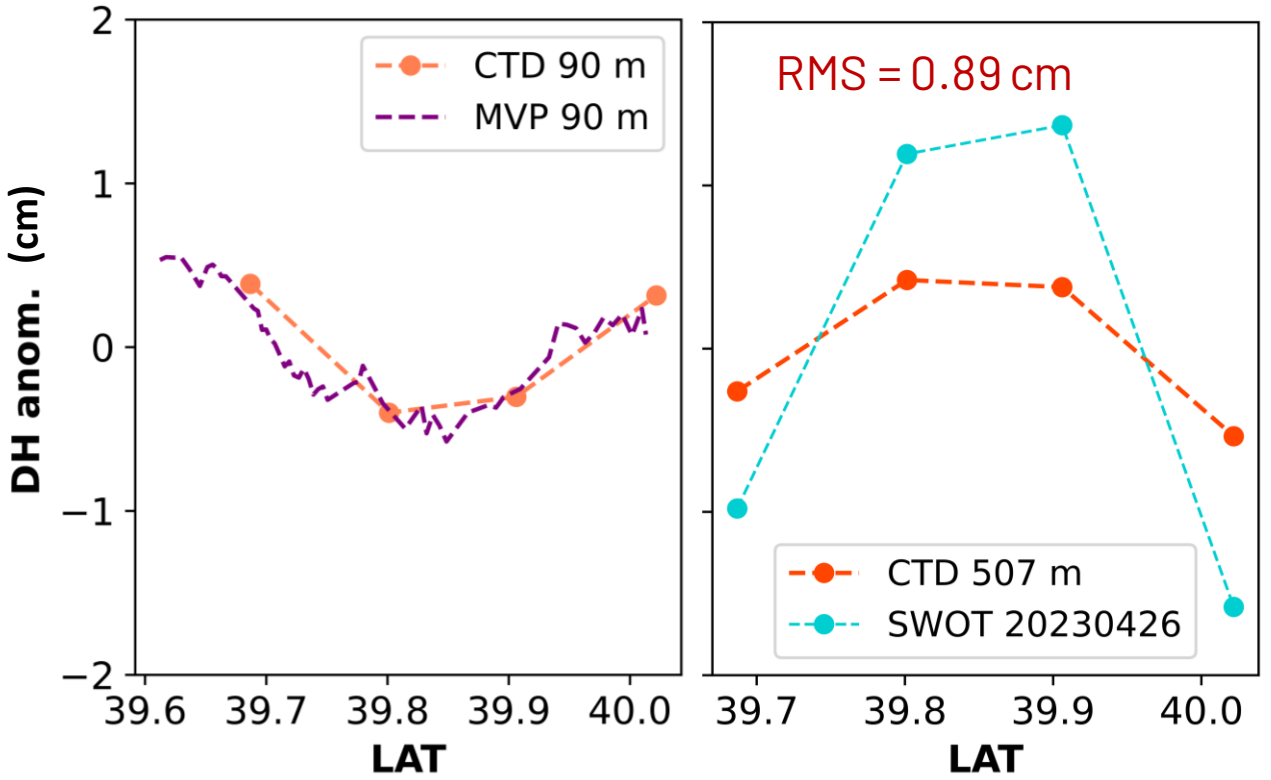




SWOT comparisons

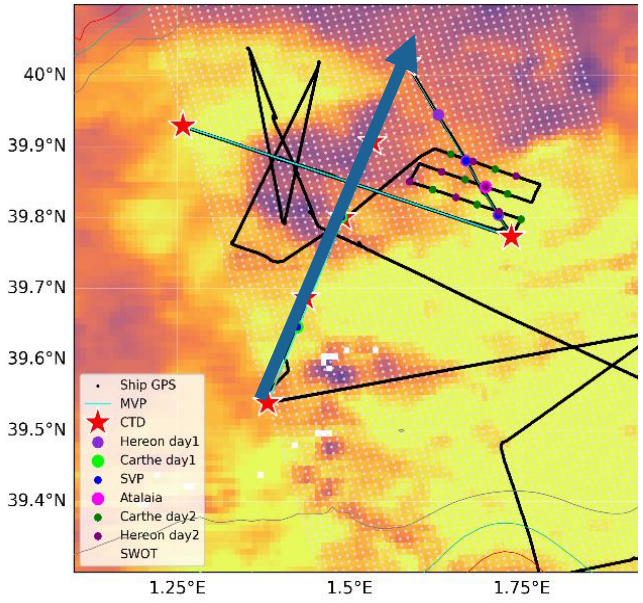
DH anomalies – MVP and CTD



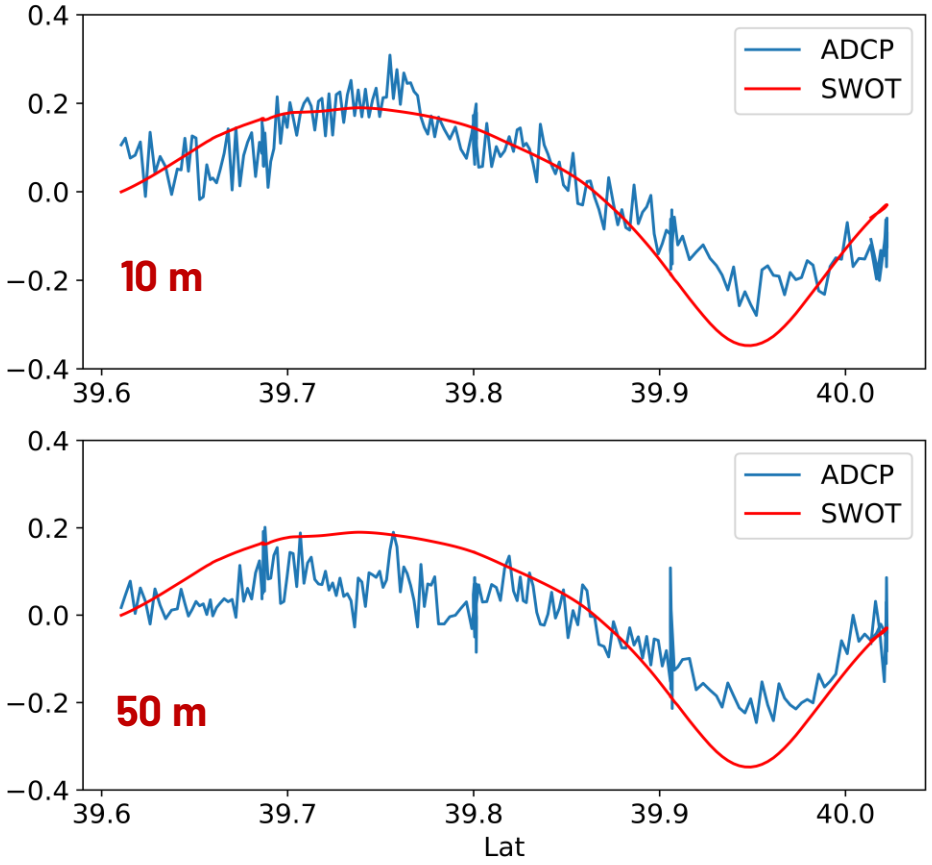


SWOT comparisons

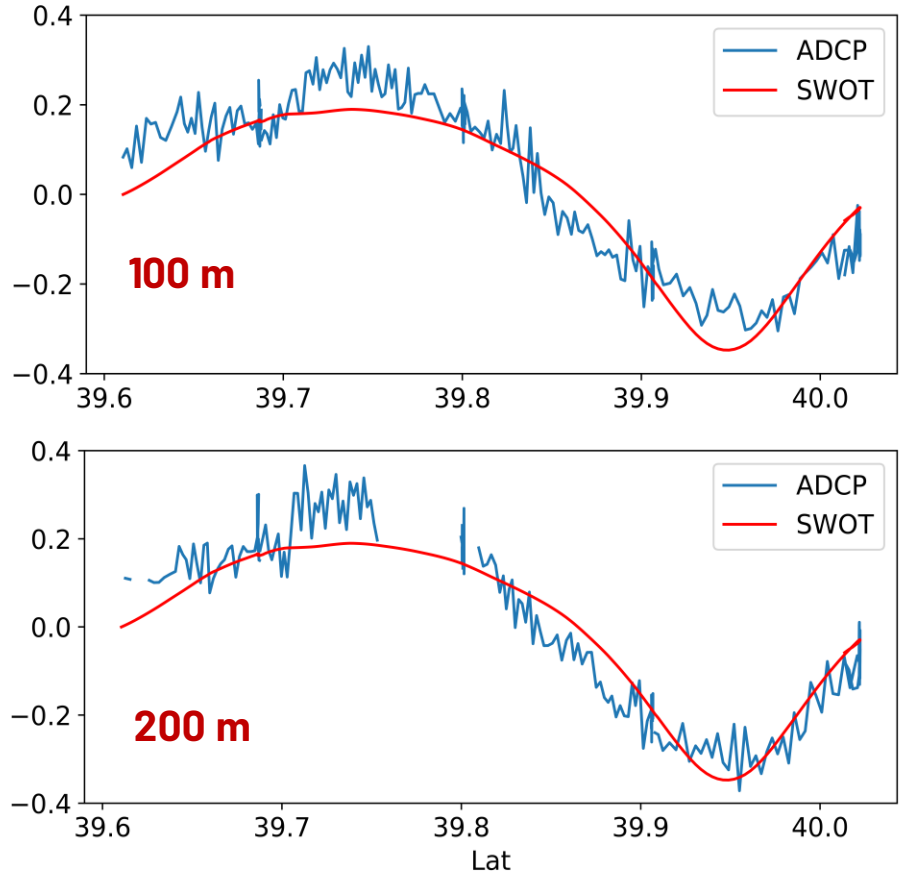
Cross section velocities - ADCP



Transect 6 MVP
26/04/24



SWOT Absolute geostrophic velocity (m/s)



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

SWOT demonstrates **capabilities to detect small gradients** and daily changes

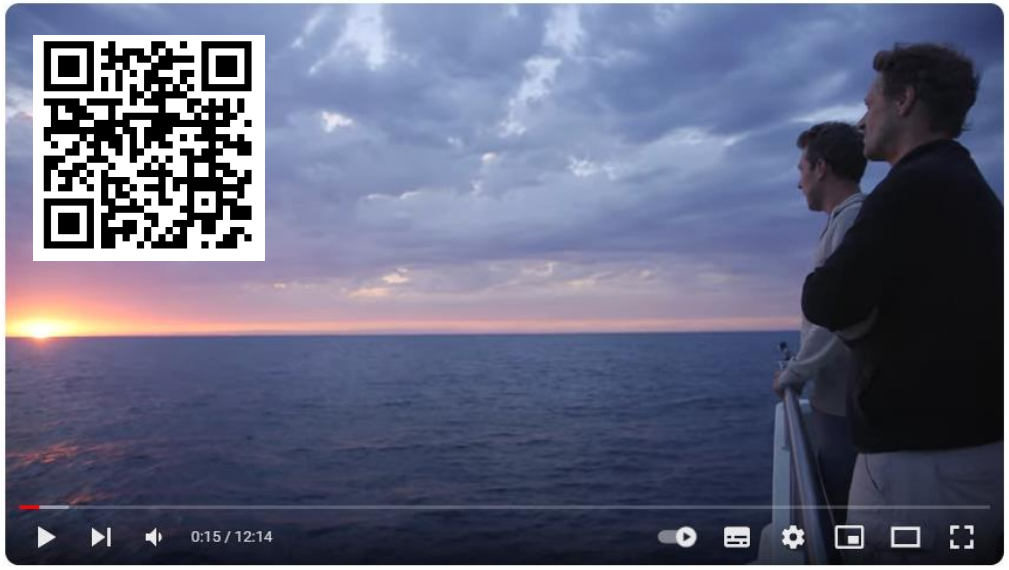
Promising agreement between **SWOT** and **in-situ data** (RMSD < 1 cm), and **impressive** for ADCP **velocities**

Contribution to SWOT Science Team

FUTURE PERSPECTIVES

- Deeper analysis of in-situ data
- Dynamic height reconstruction (Using AI techniques)
- Integrate SWOT observations into data-assimilative HR models
- Continue collaborating with Bio-SWOT team

More details… See poster B. Mourre and colleagues! X5.226



"Del espacio al Mediterráneo: Persiguiendo corrientes marinas"

Thank you!

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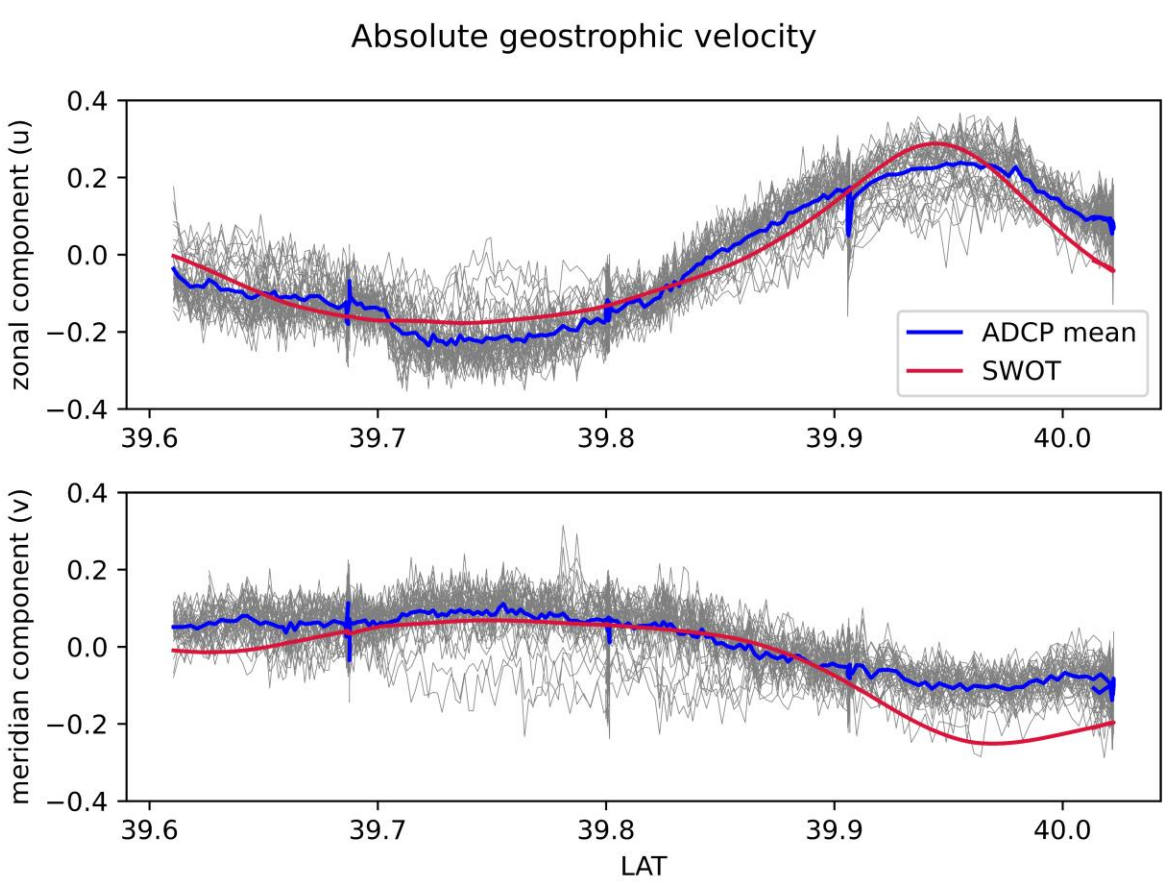
How to cite: Verger-Miralles, E., Mourre, B., Barceló-Llull, B., Casas, B., Cutolo, E., Combes, V., Díaz-Barroso, L., Gómez-Navarro, L., R. Tarry, D., Reyes, E., Zarokanellos, N., and Pascual, A.: Analysis of fine-scale dynamics in the Balearic Sea through high-resolution observations and SWOT satellite data, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-17643, **https://doi.org/10.5194/egusphere-egu24-17643**, 2024

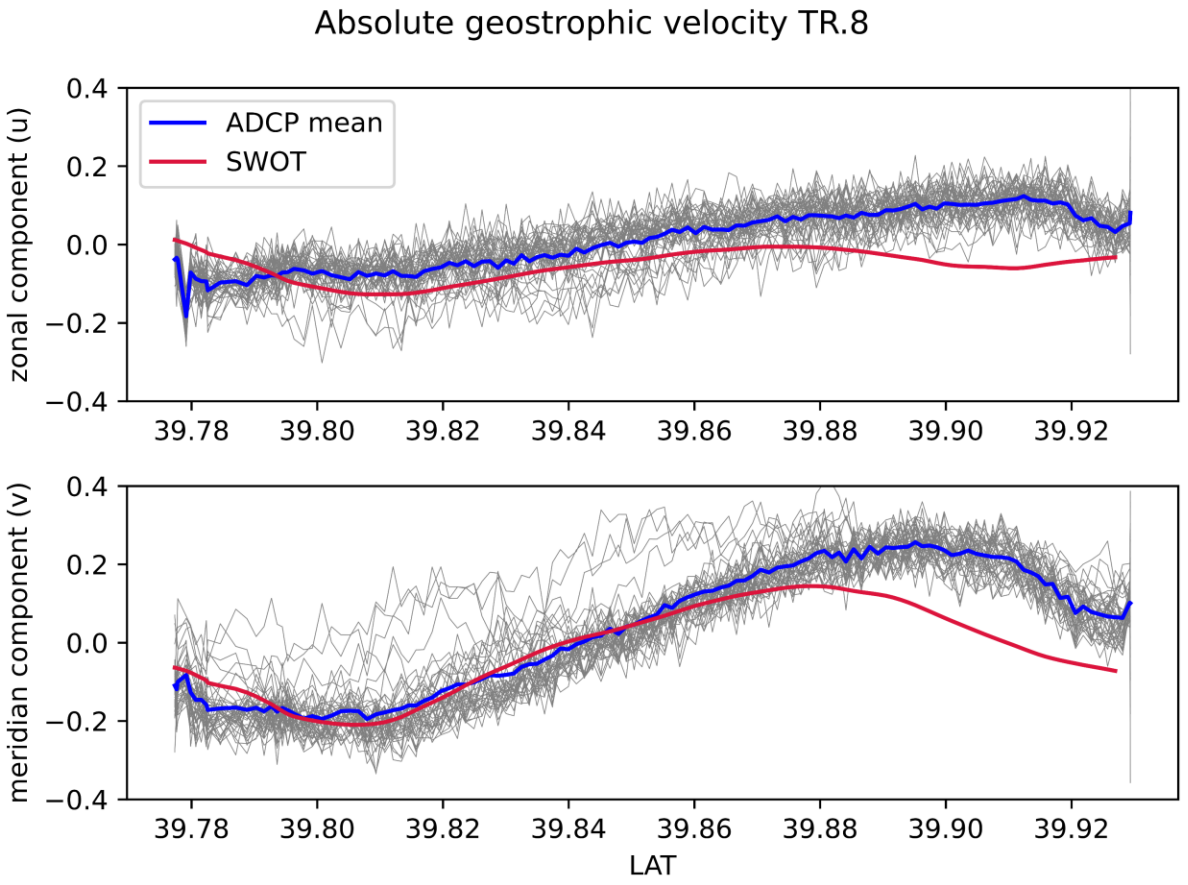
Acknowledgements: The FaSt-SWOT project is funded by the Spanish Research Agency and the European Regional Development Fund (AEI/FEDER, UE) under Grant Agreement (PID2021-122417NB-I00). The present research is conducted within the framework of the activities of the Spanish Government through the ”María de Maeztu Centre of Excellence” accreditation to IMEDEA (CSIC-UIB) (CEX2021-001198). The Spanish Ministry of Science and Innovation, the Regional Government of the Balearic Islands and the Spanish Research Council (CSIC) are also acknowledged for their support to the ICTS SOCI.

EXTRA

SWOT comparisons

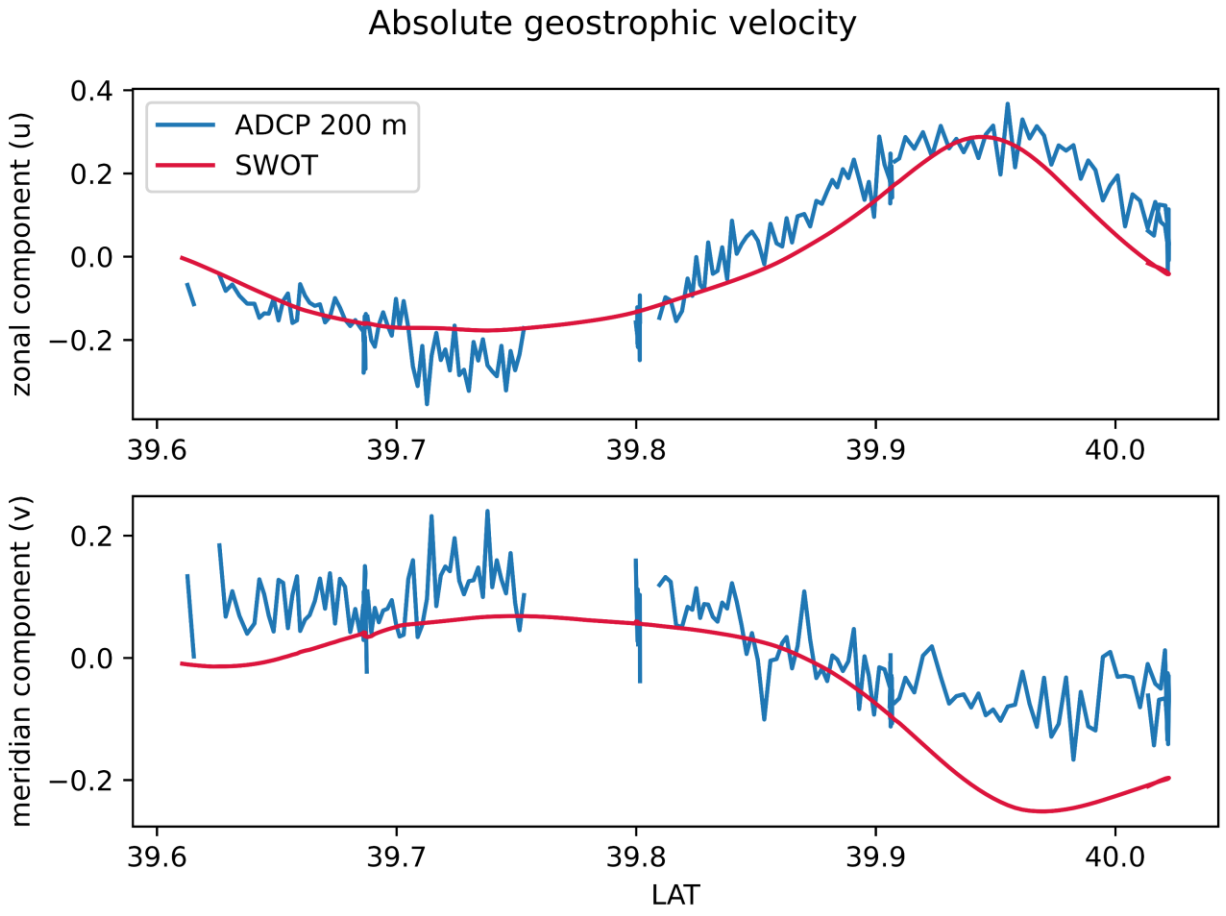
Velocities – ADCP

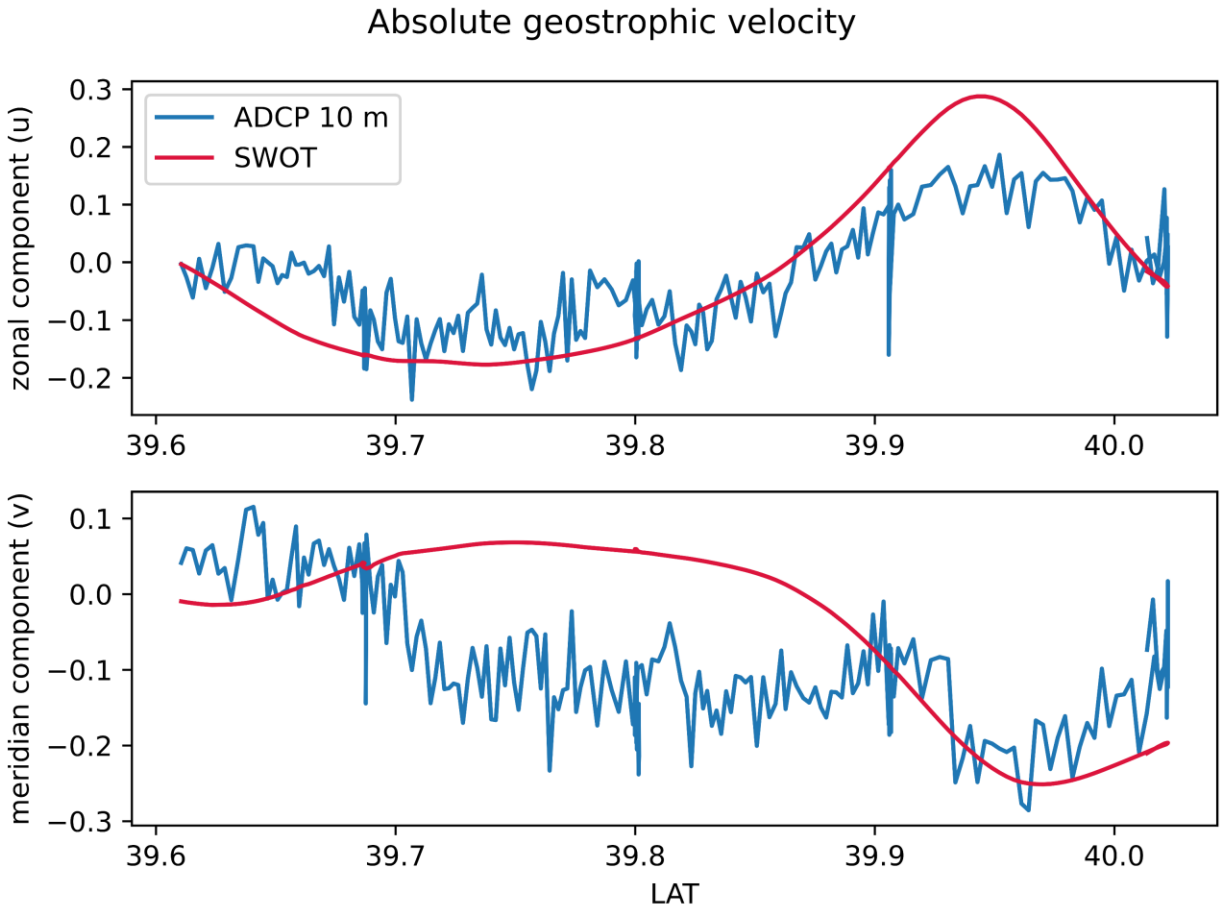




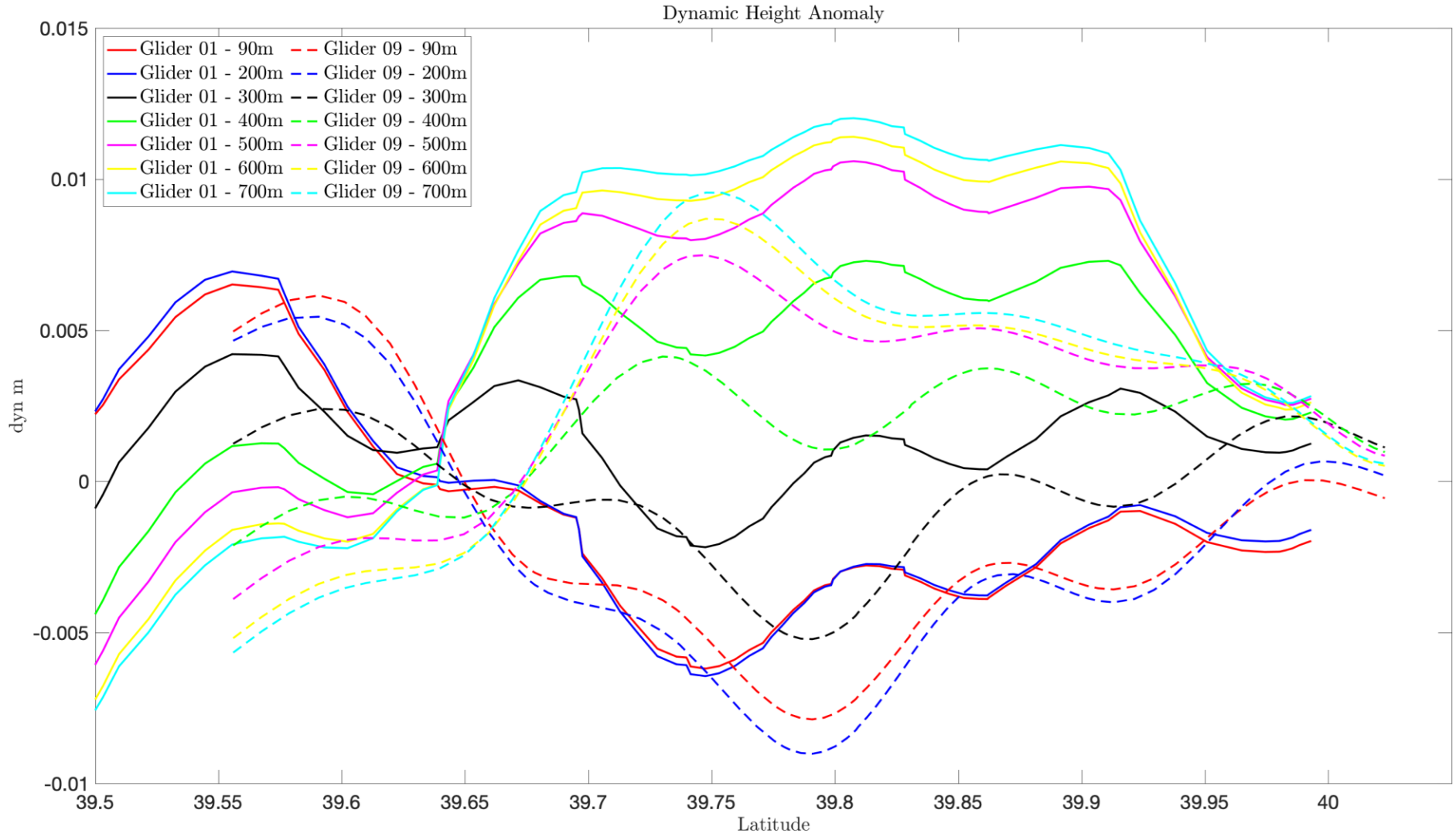
SWOT comparisons

Velocities – ADCP

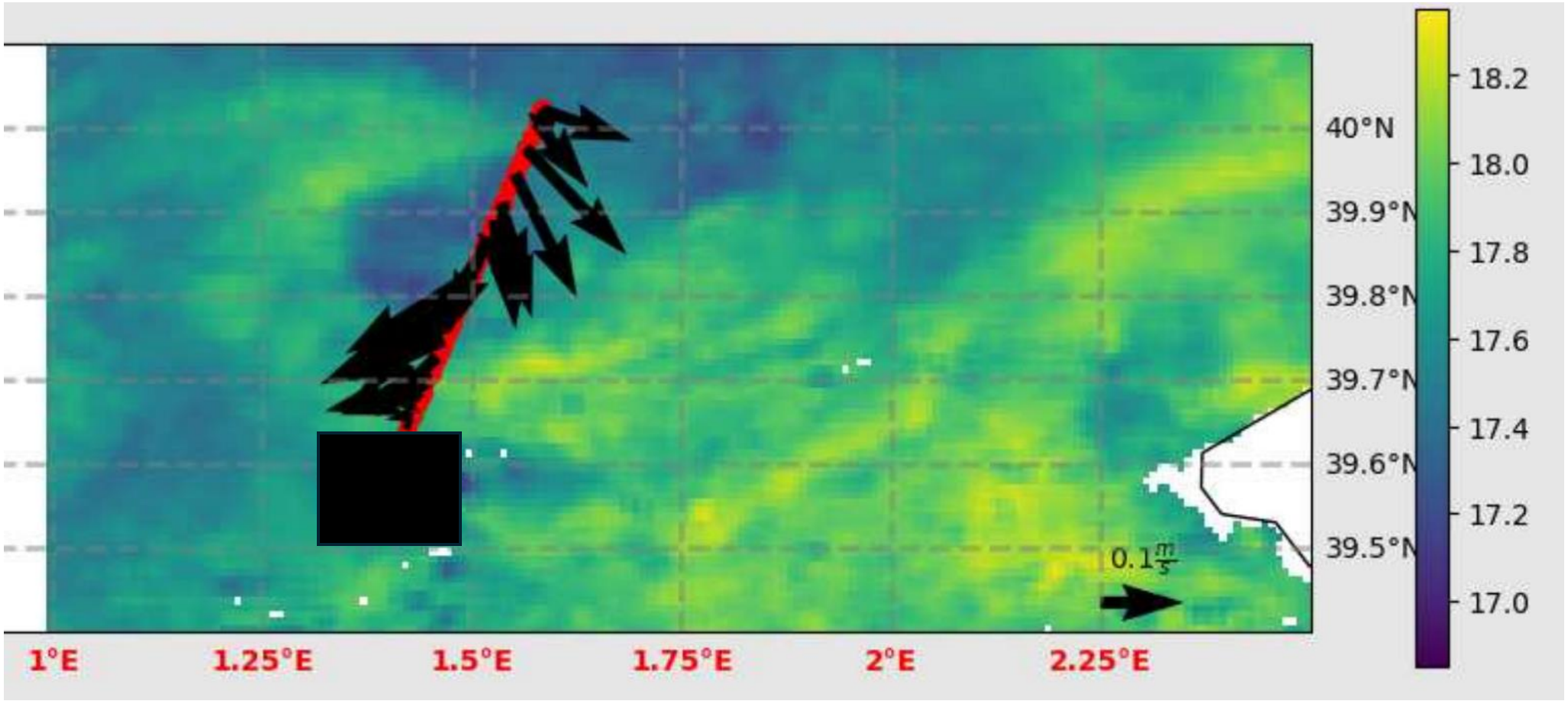




DH change with different depth ref.



ADCP

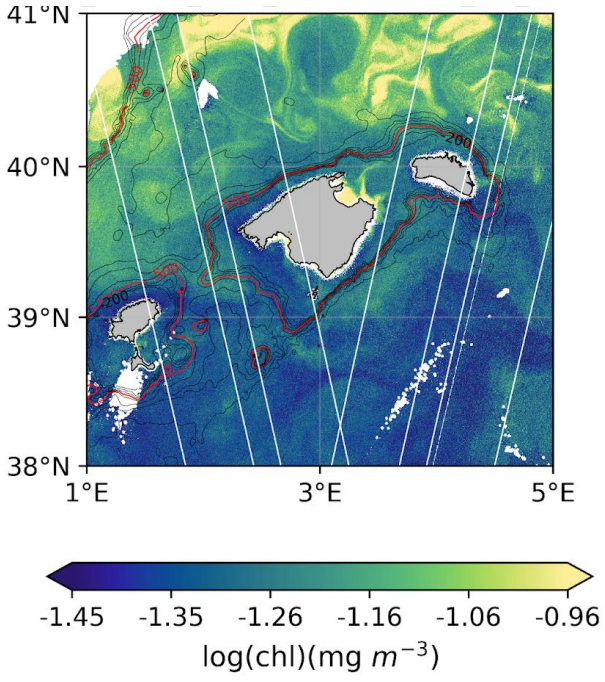


E. Cutolo

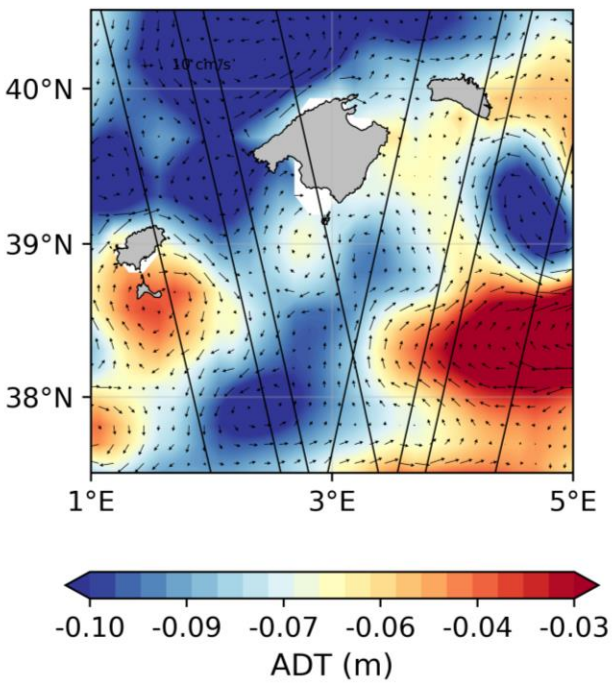
IMAGES

Oceanographic context from satellites

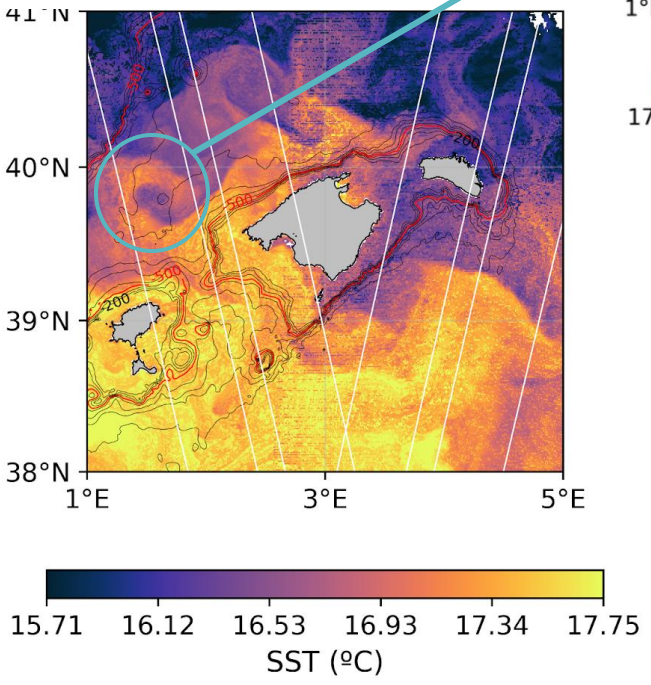
Ocean color 21/04/2023



SSH 21/04/2023



SST 21/04/2023



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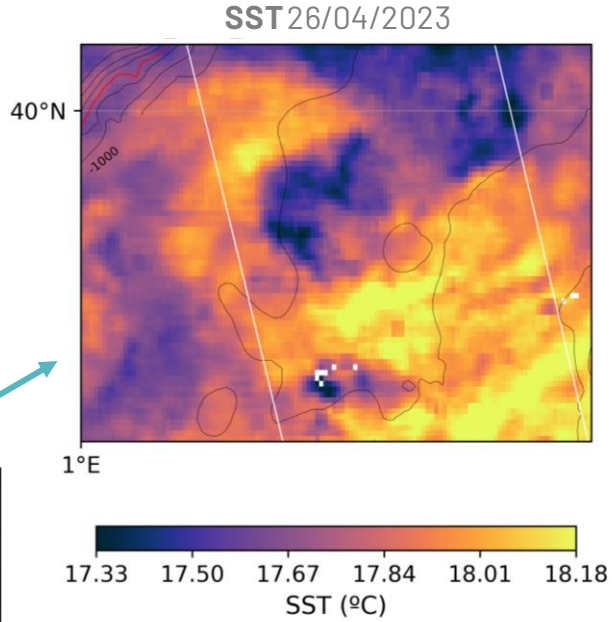

SWOT comparisons

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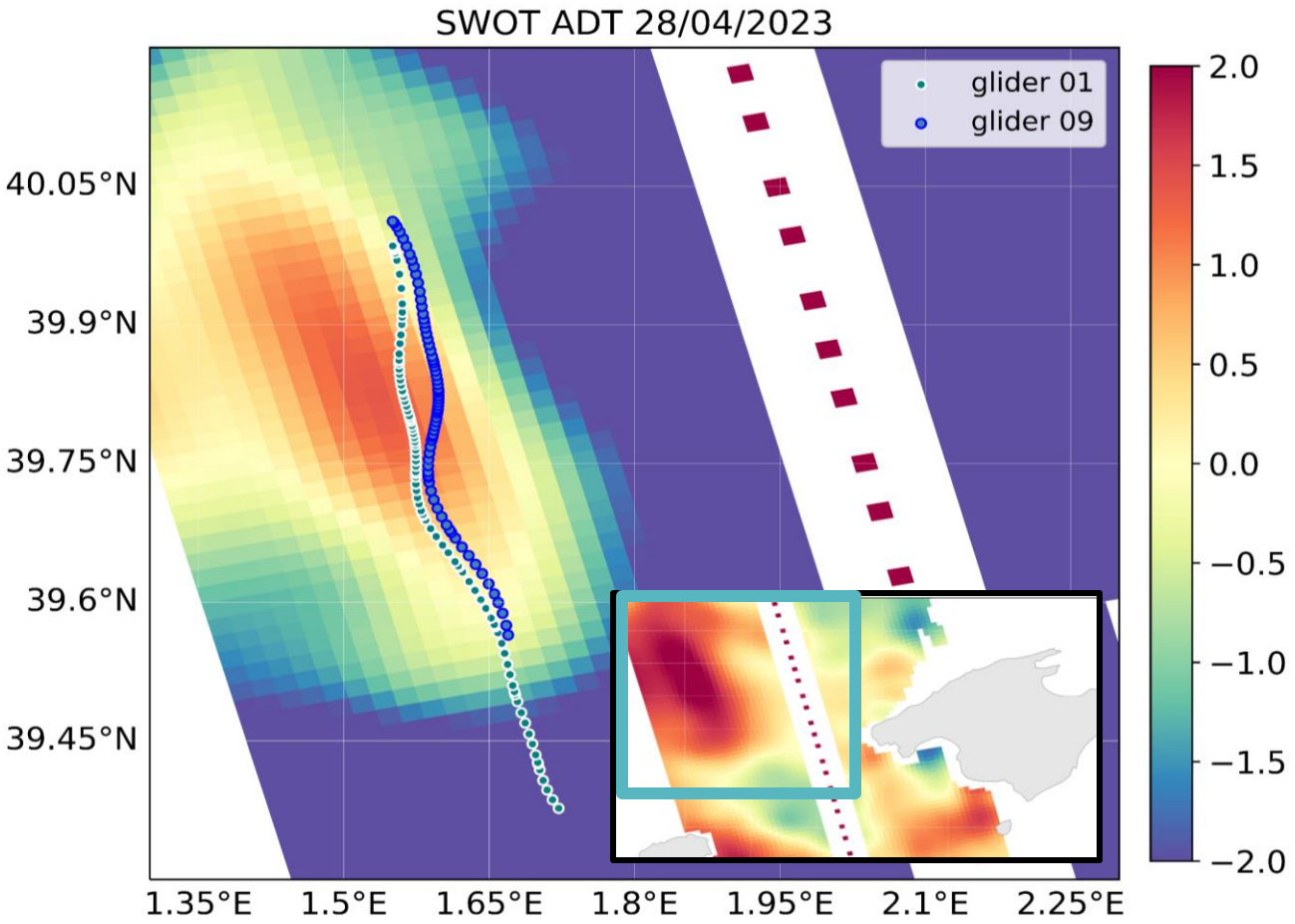

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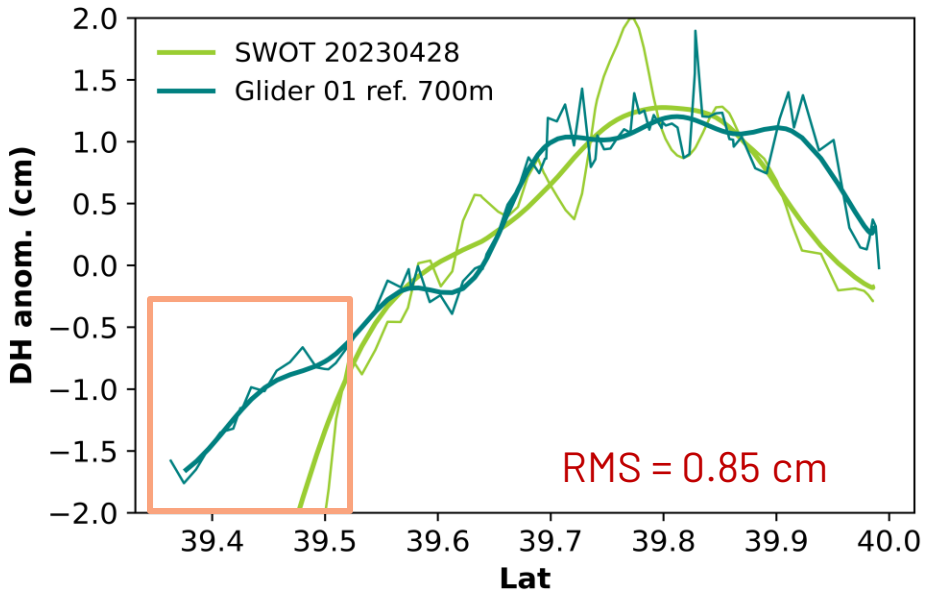

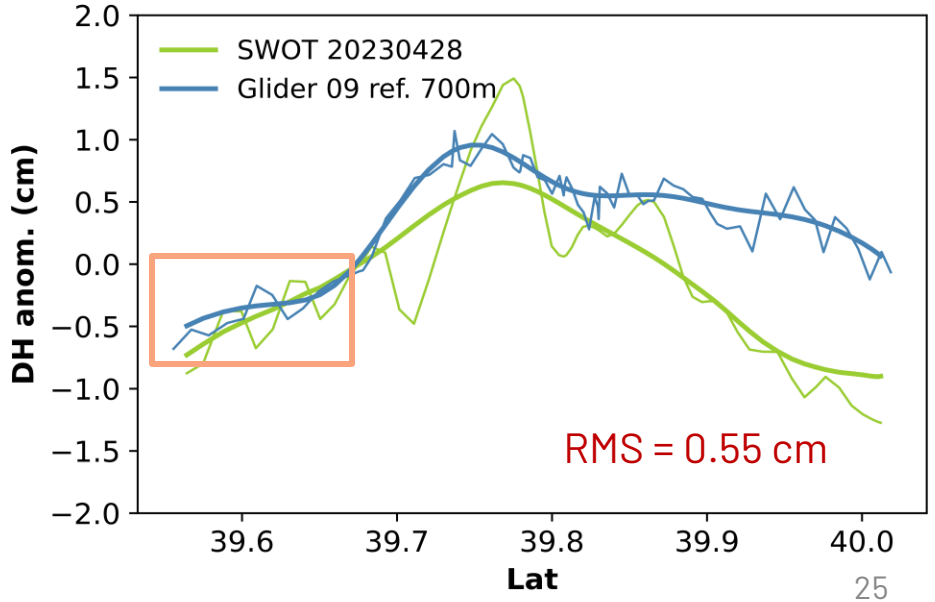

SWOT comparisons

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