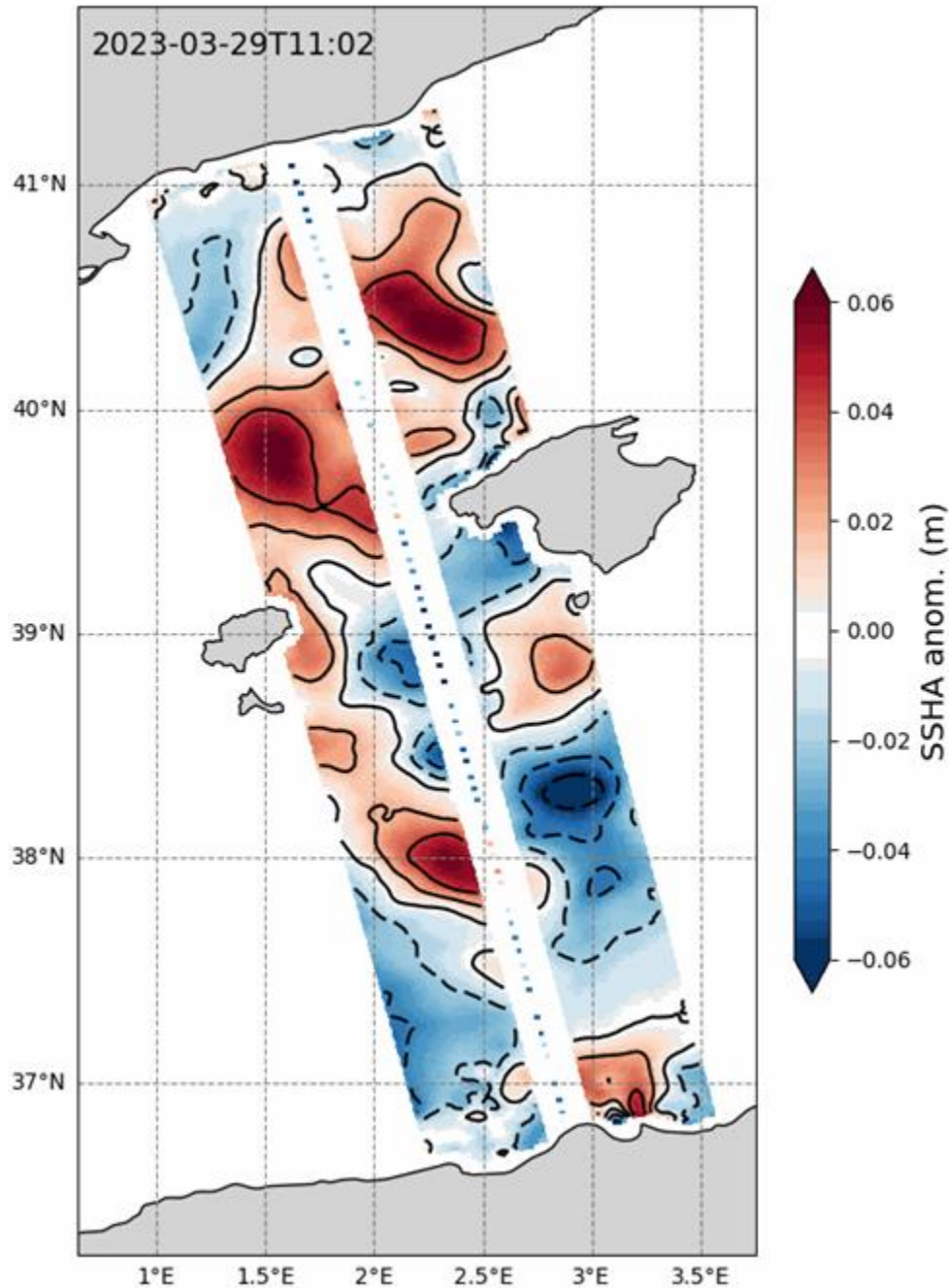


High-Resolution Observations from the FaSt-SWOT Campaigns: Validation and Fine- Scale Signal Analysis

L. Gómez-Navarro, D. R. Tarry, E. Verger-Miralles,
D. Cortes-Morales, B. Barcelo-Llull,
D. Vega-Gimenez, J.P. Peng, N. Zarokanellos,
G. López, L. Diaz-Barroso, E. Reyes, I. Lizaran,
B. Mourre and A. Pascual

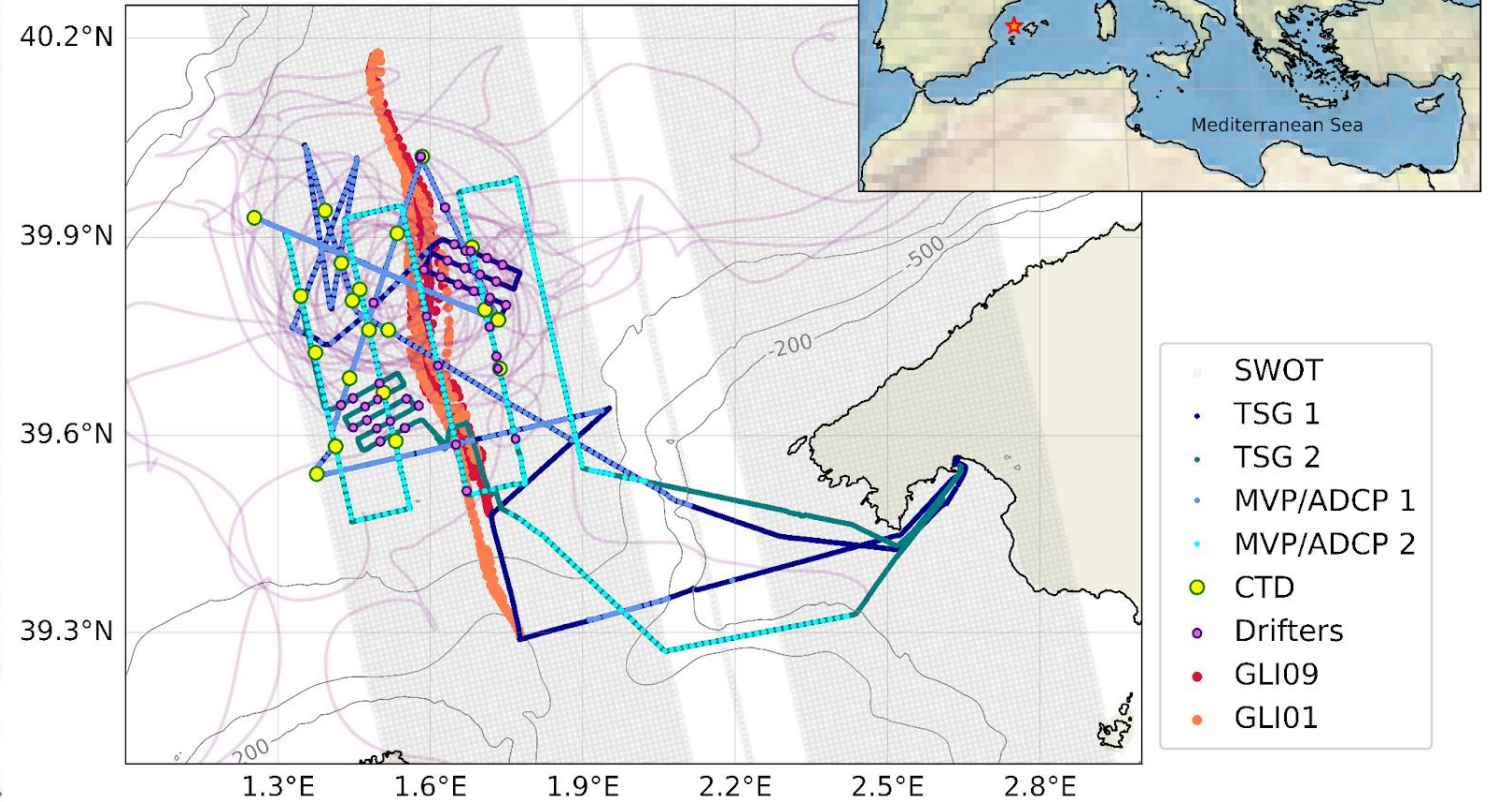
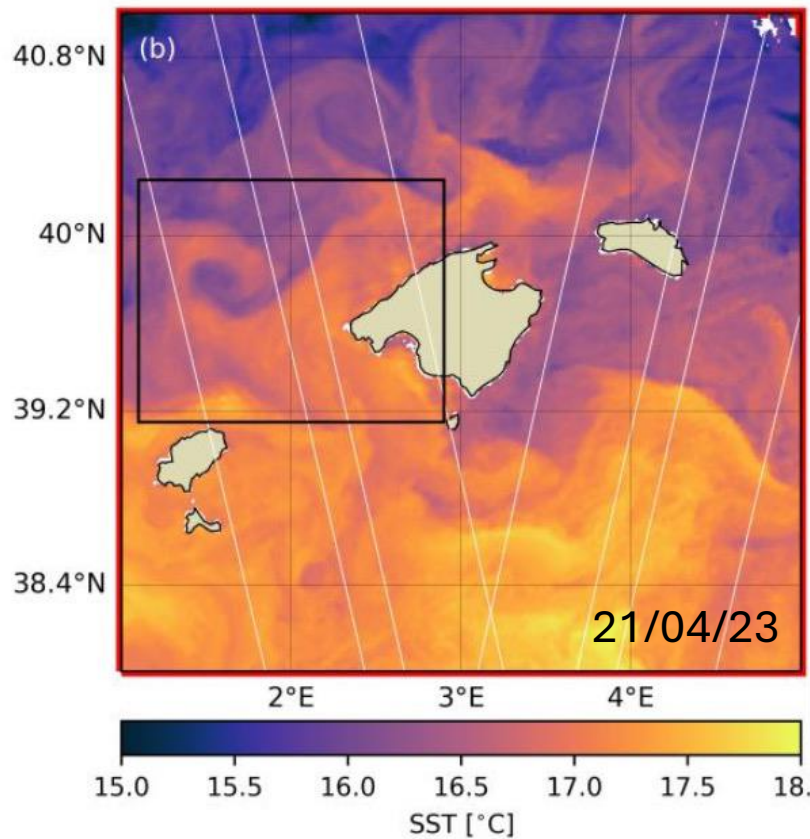


Fast-sampling phase: FaSt-SWOT experiments

Sampling strategy

Leg 1: 25-29/04/23

Leg 2: 07-10/05/23



(adapted from Verger-Miralles *et al.*, 2025)

Fast-sampling phase: FaSt-SWOT experiments

Data processing

Datasets used

2

Drifters

- Spikes removal and gap filtering
- Resampling
- Calculation of velocities
- Filtering of inertial oscillations: low-pass filter in time

1

Gliders - SOCIB

- Spikes removal
- Optimal interpolation

ADCP

- Transect separation and spikes removal
- Low-pass filter in space

CTD

- Seabird procesing
- Validation with salinity samples

MVP

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

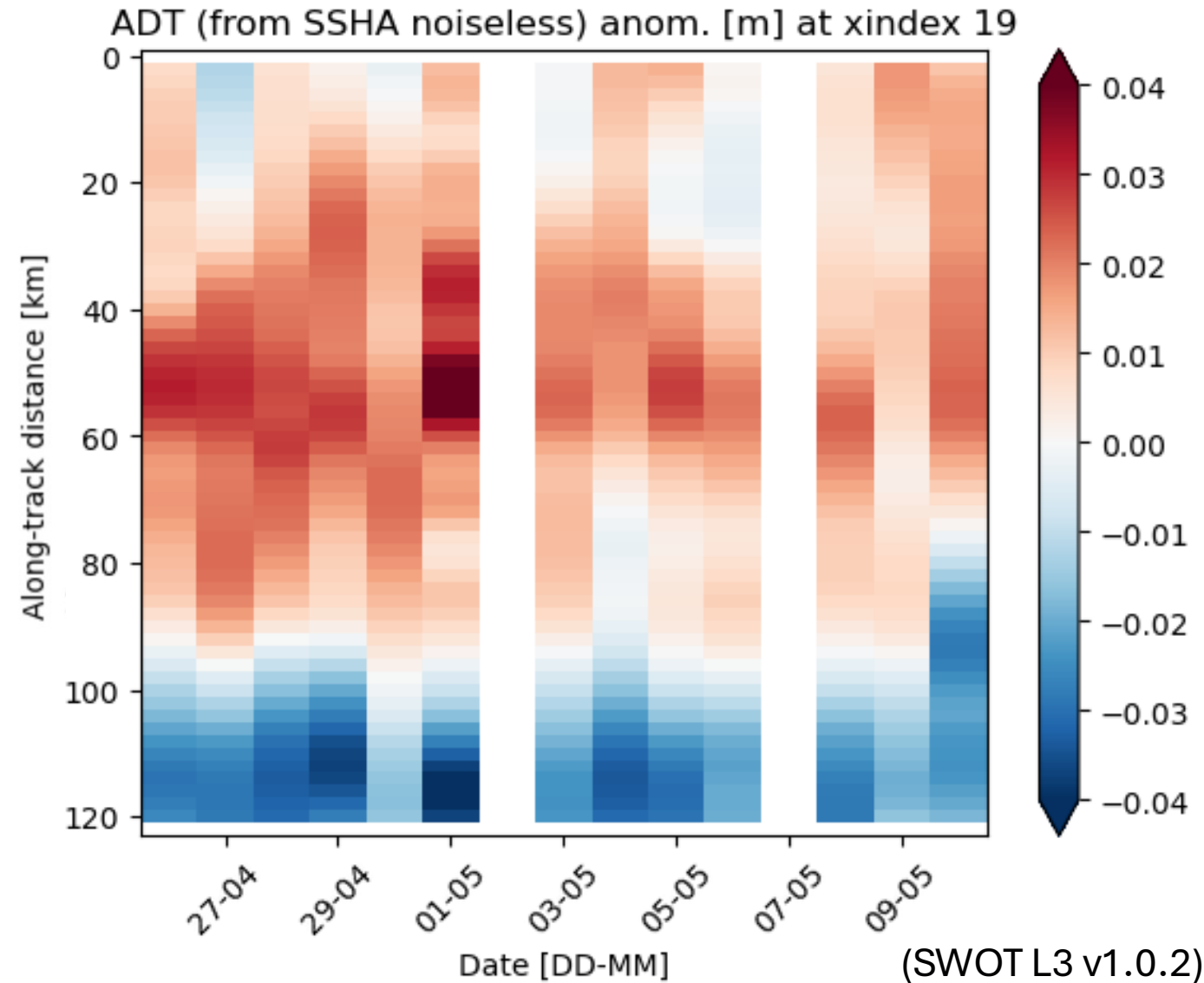
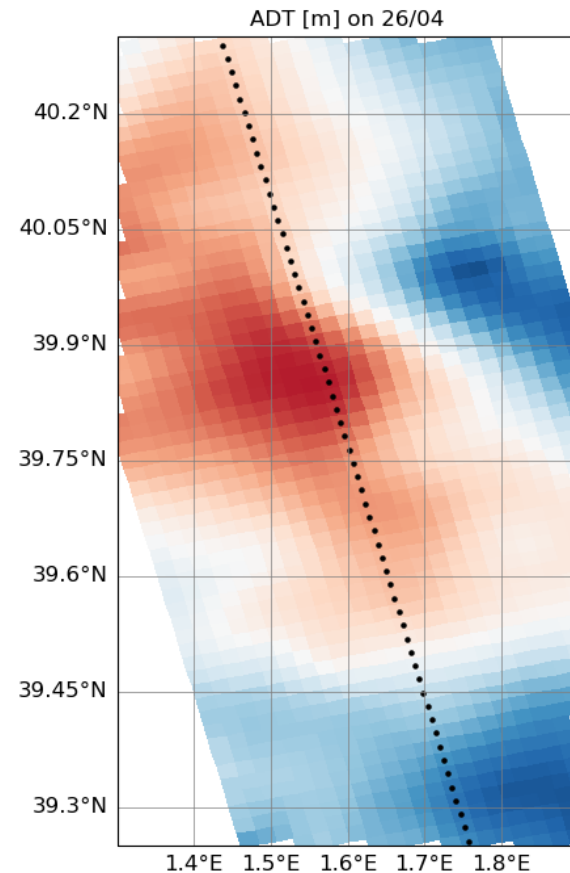
Paper in prep. E. Verger-Miralles *et al.*
Codes will be shared through GitHub:
github.com/everger-miralles/

Fast-sampling phase: Temporal variability

Fast-sampling phase: Temporal variability

Motivation

High temporal variability
observed in the SWOT data

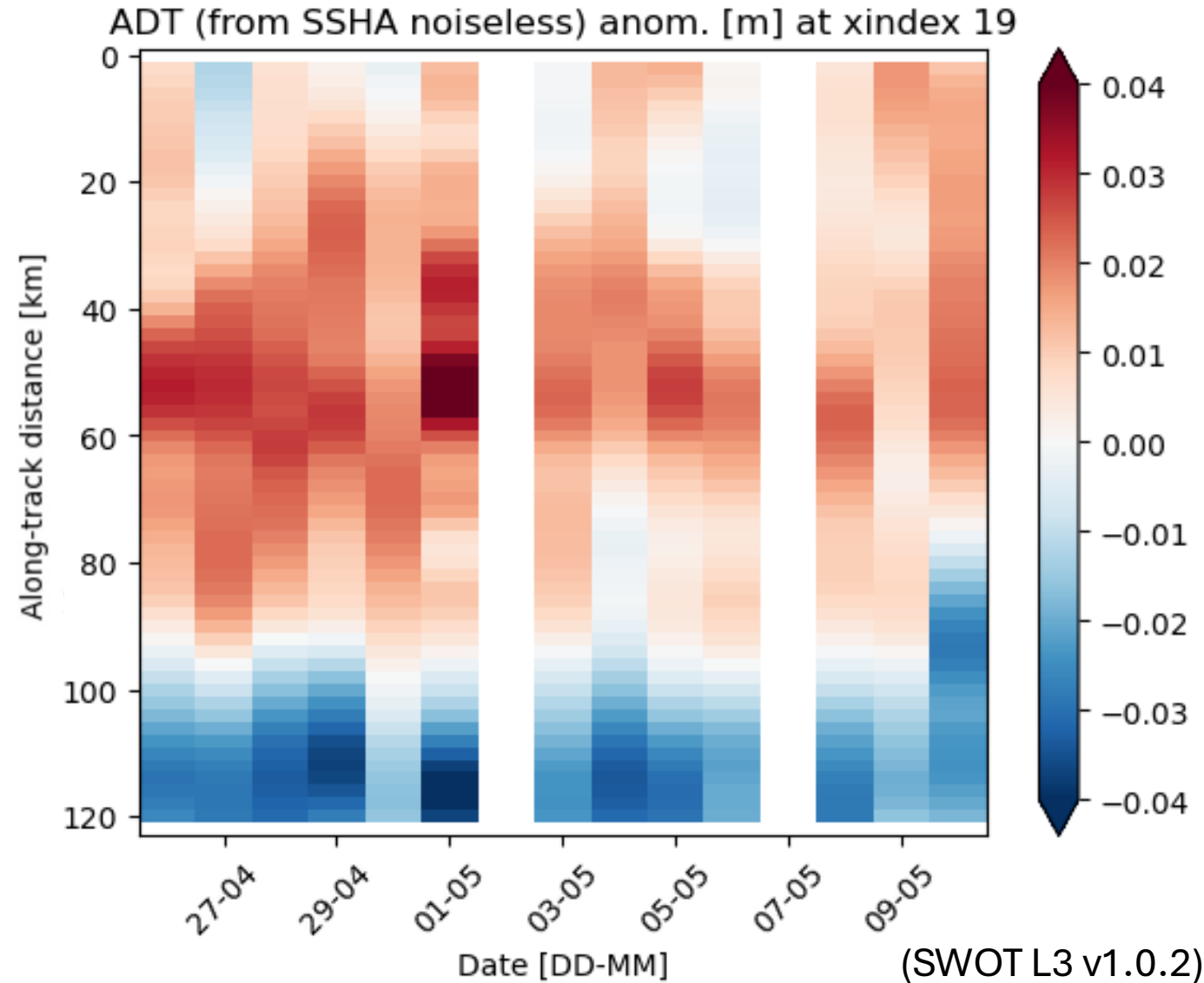
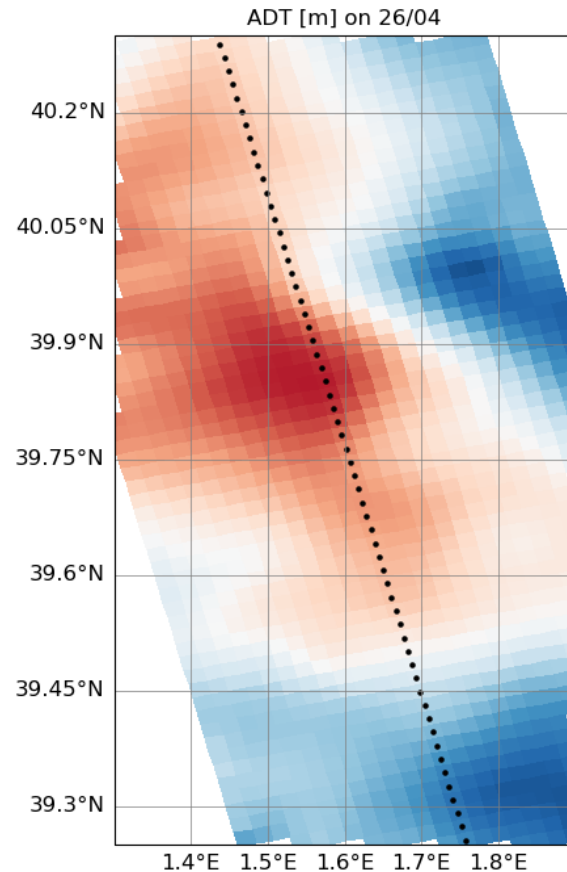


Fast-sampling phase: Temporal variability

Motivation

High temporal variability
observed in the SWOT data

**Are this high-
frequency
signals
physical?**



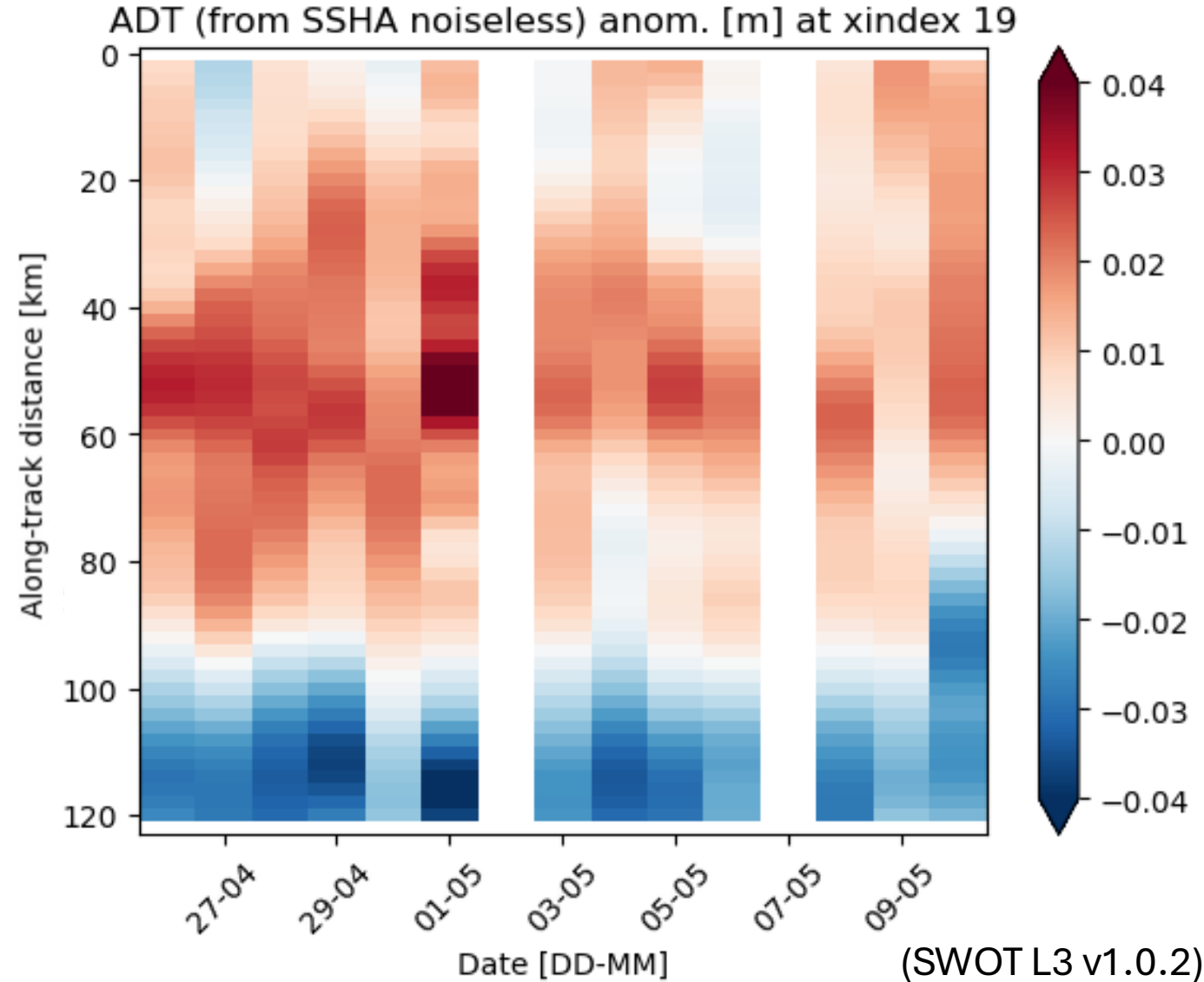
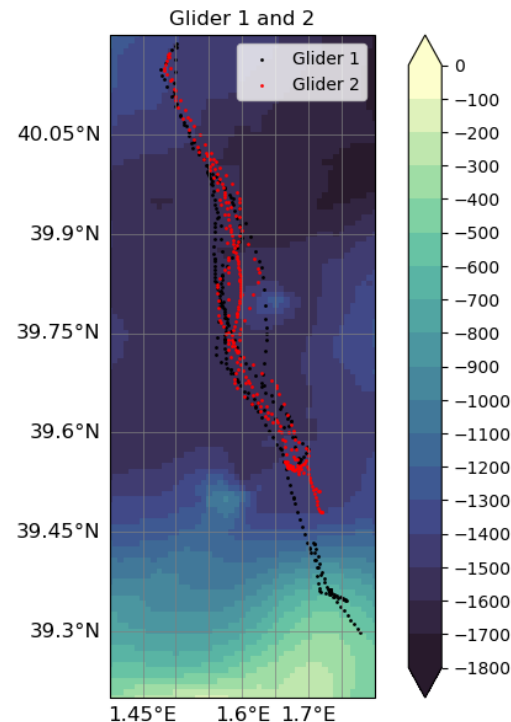
Fast-sampling phase: Temporal variability

Motivation

High temporal variability observed in the SWOT data

Are these high-frequency signals physical?

→ Comparison with glider data

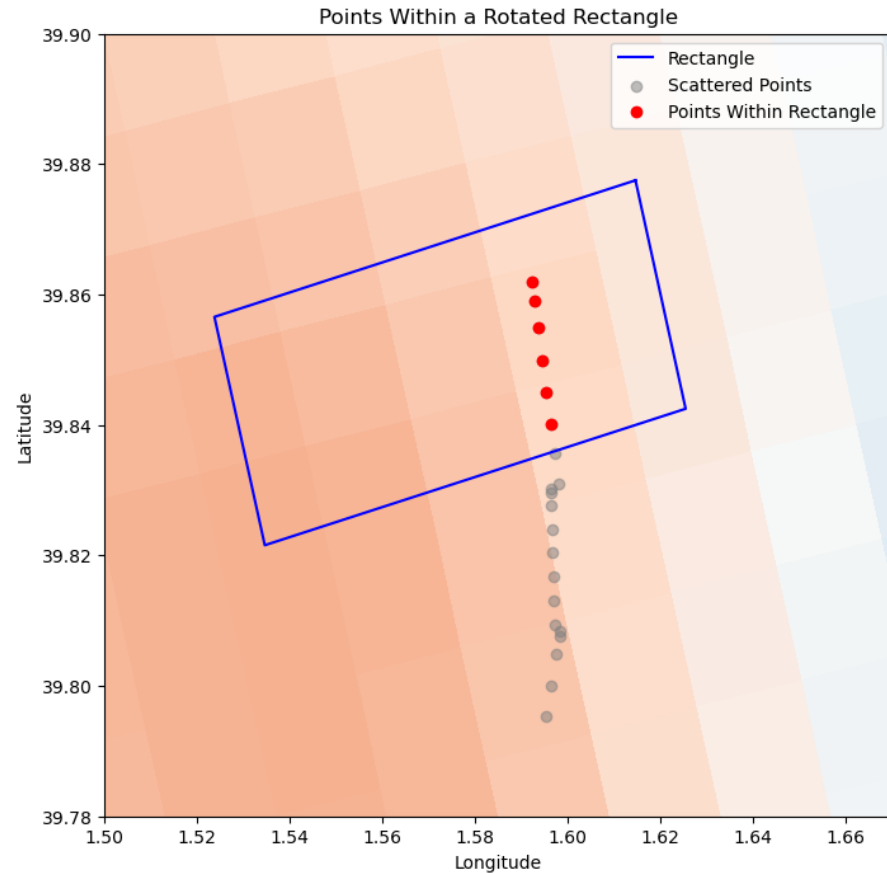


(SWOT L3 v1.0.2)

Fast-sampling phase: Temporal variability

Data processing

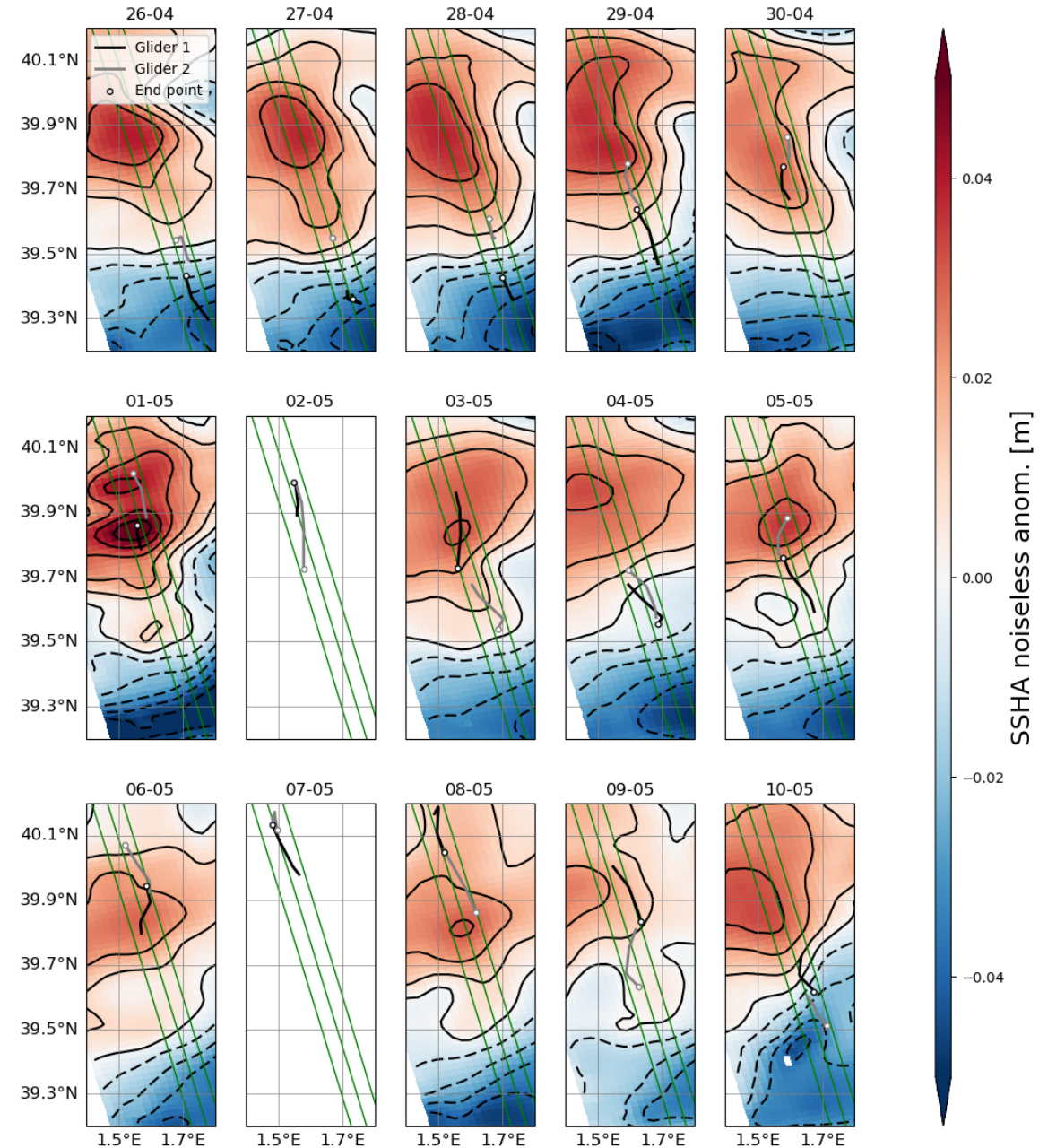
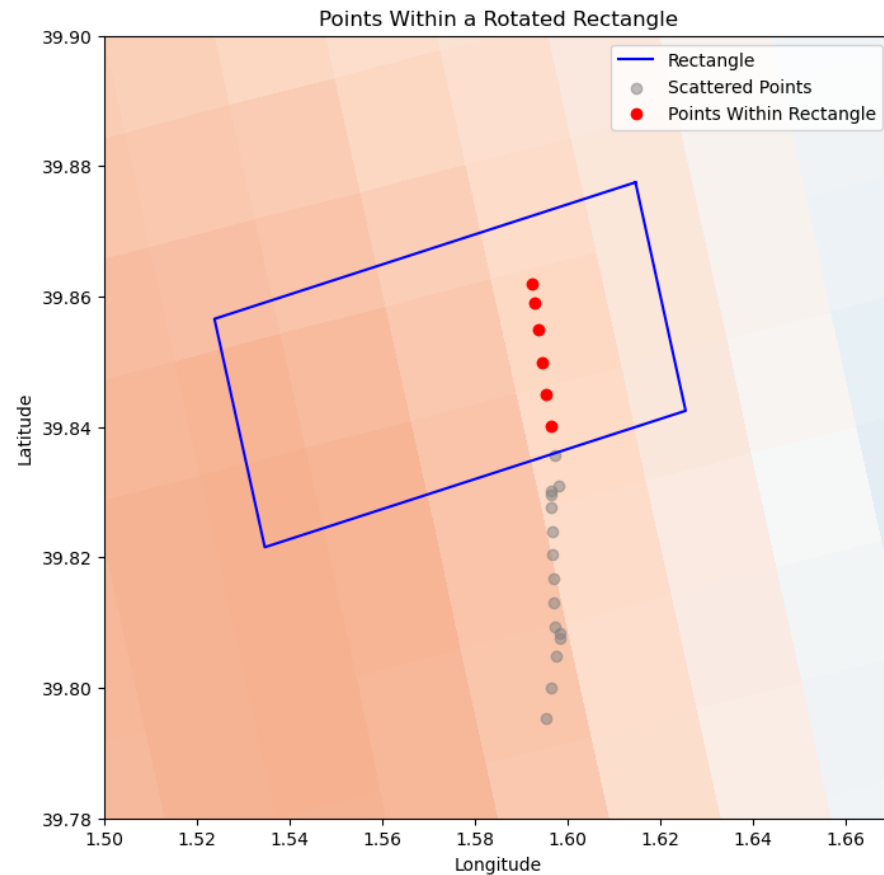
- Moving average
- Example 30/04/23:



Fast-sampling phase: Temporal variability

Data processing

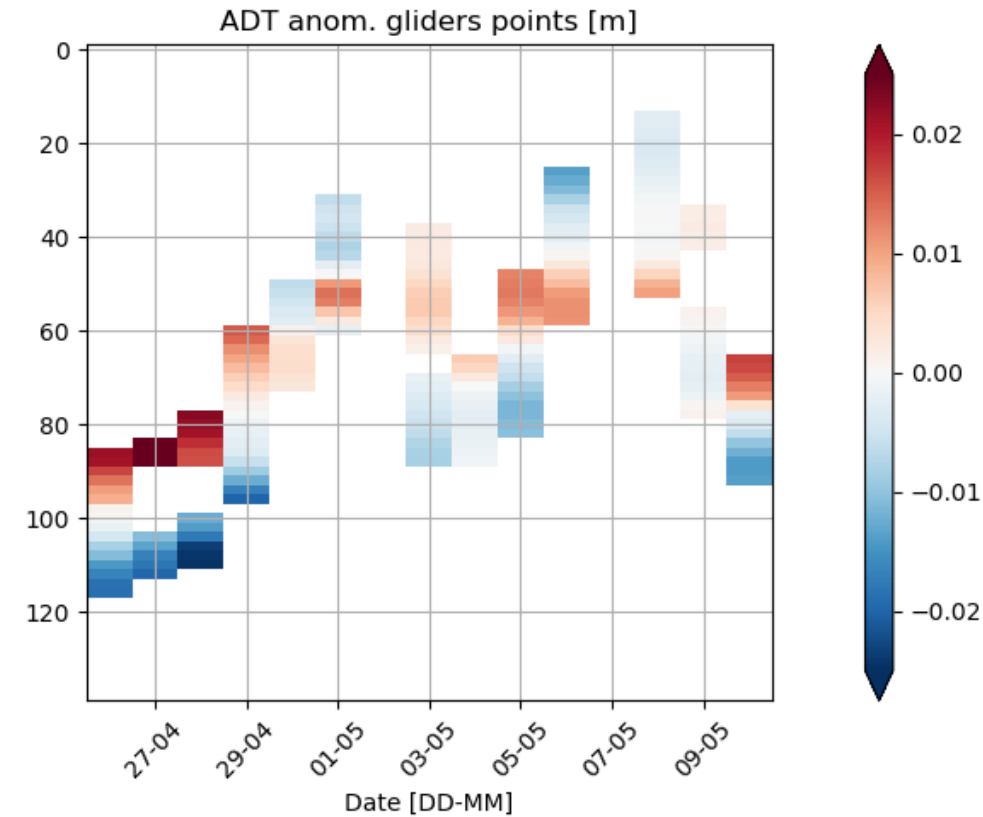
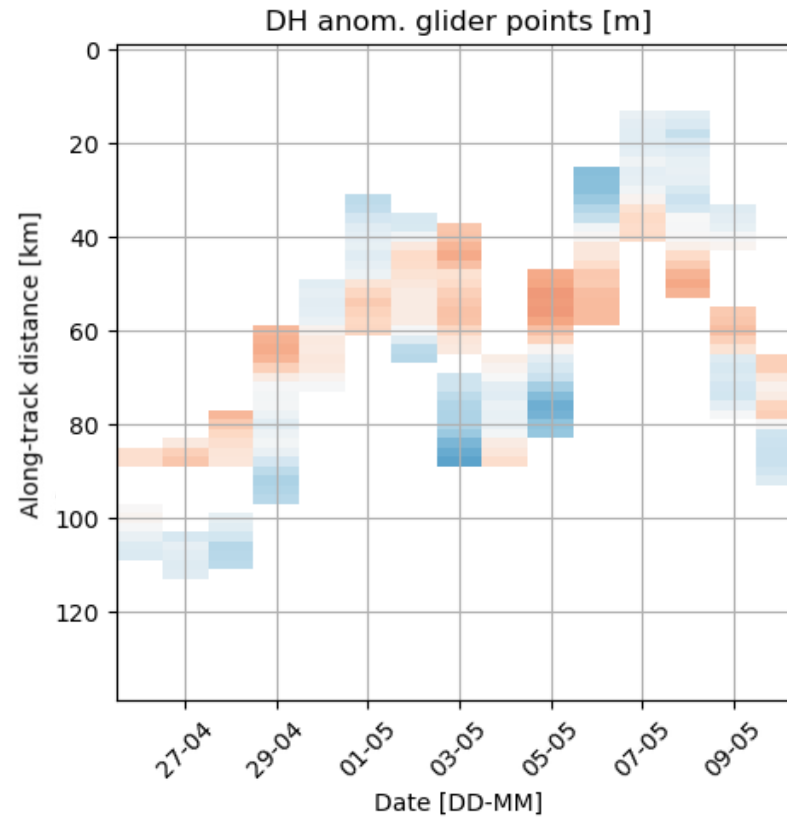
- Moving average
- Example 30/04/23:



Fast-sampling phase: Temporal variability

Hovmoller plot

- Strong temporal shifts also observed in glider data!



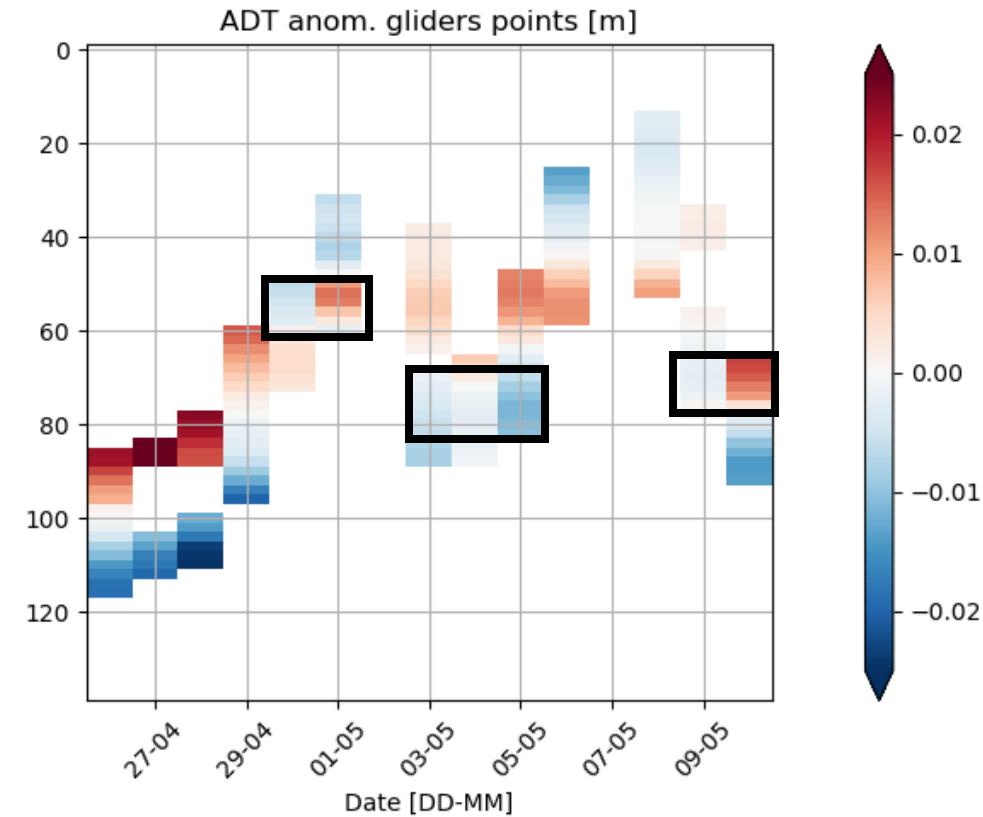
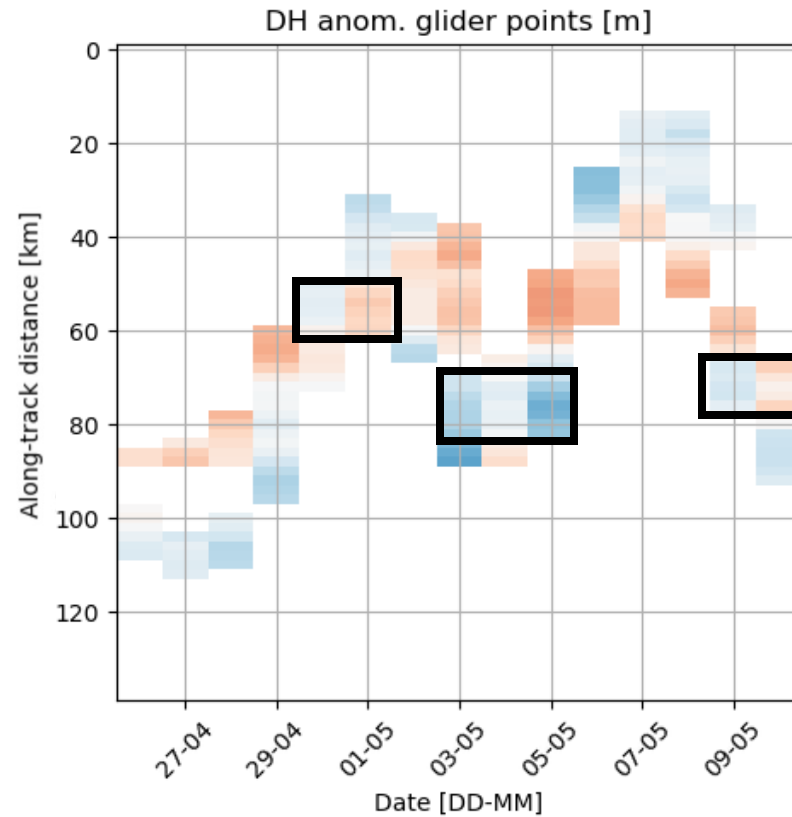
Fast-sampling phase: Temporal variability

Hovmoller plot

- Strong temporal shifts also observed in glider data!



- 1) Eddy intensification
- 2) Eddy movement (west)
- 3) Front formation



Fast-sampling phase: Temporal variability

Hovmoller plot

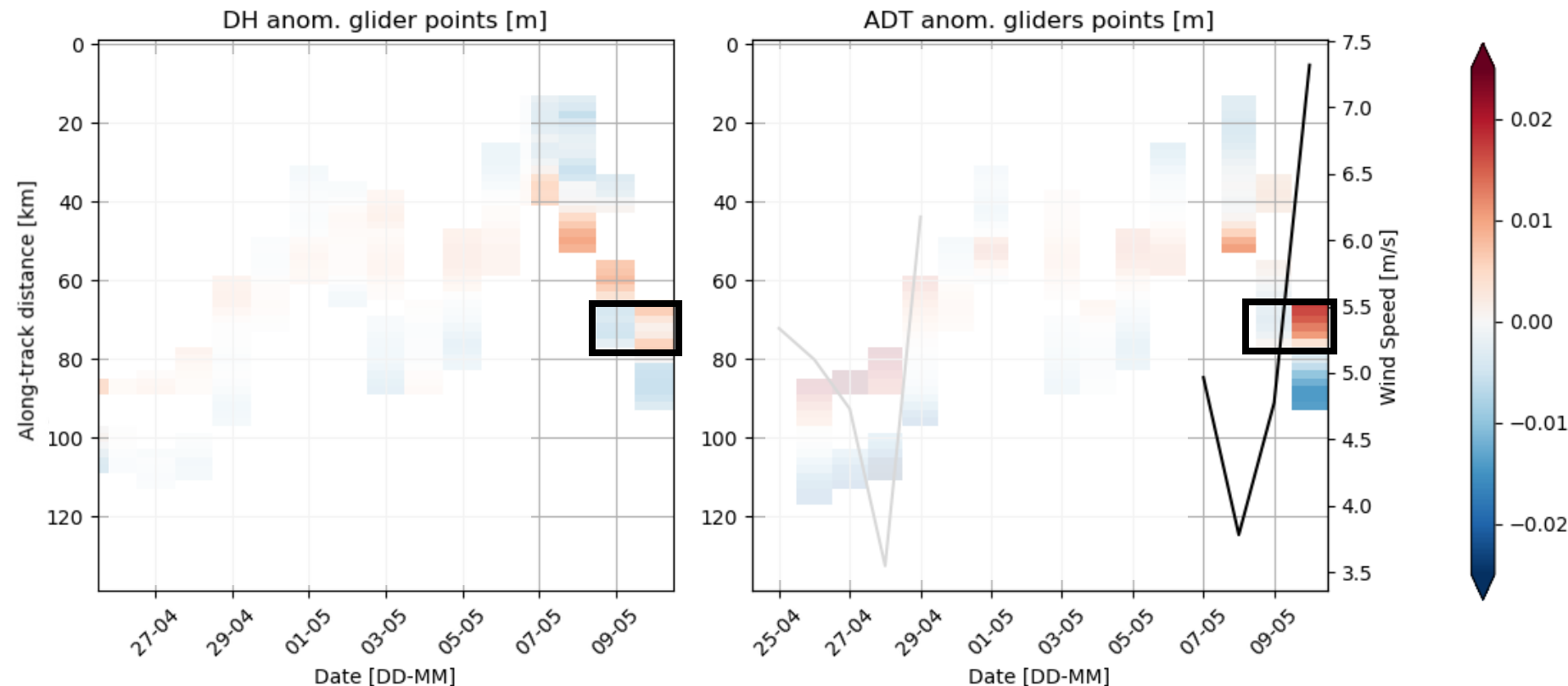
- Strong temporal shifts also observed in glider data!



3) Front formation:

→ Strong temporal variability could be related to wind changes!

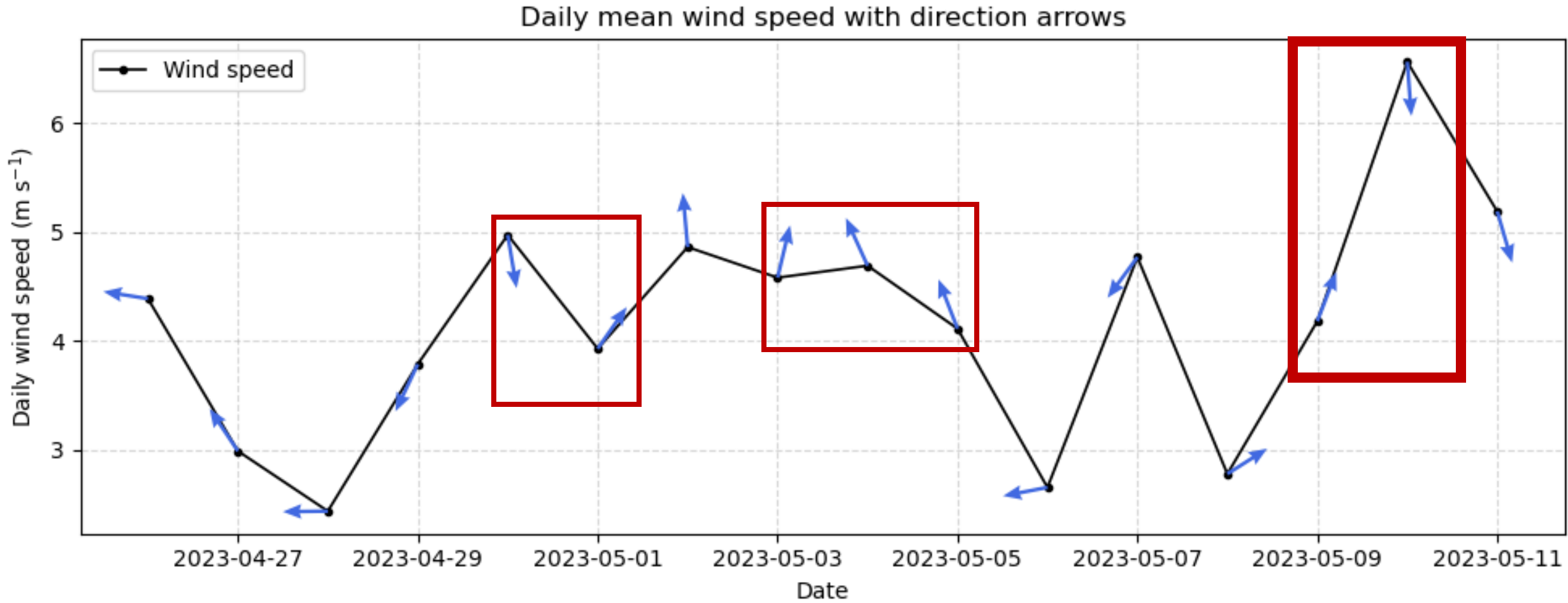
→ G. López poster!
(SWOT vs HFR)



Wind speed + direction impact?

Ongoing

CCMP v3.1 vector wind analyses



Fast-sampling phase: Drifters

Fast-sampling phase: Drifters

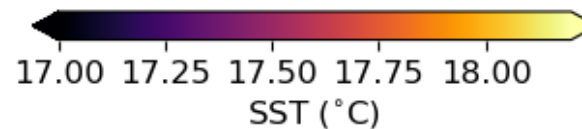
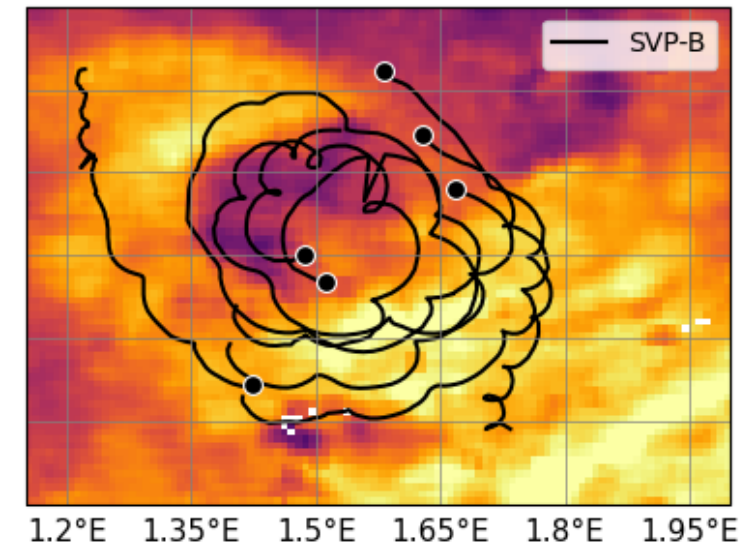
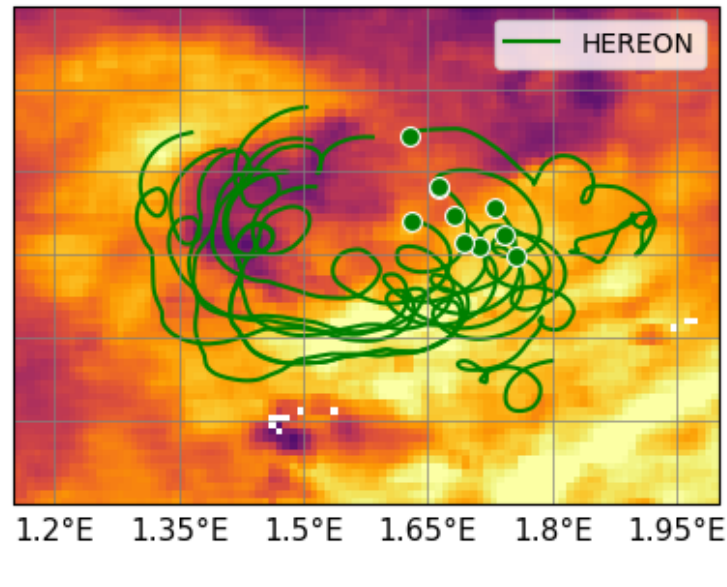
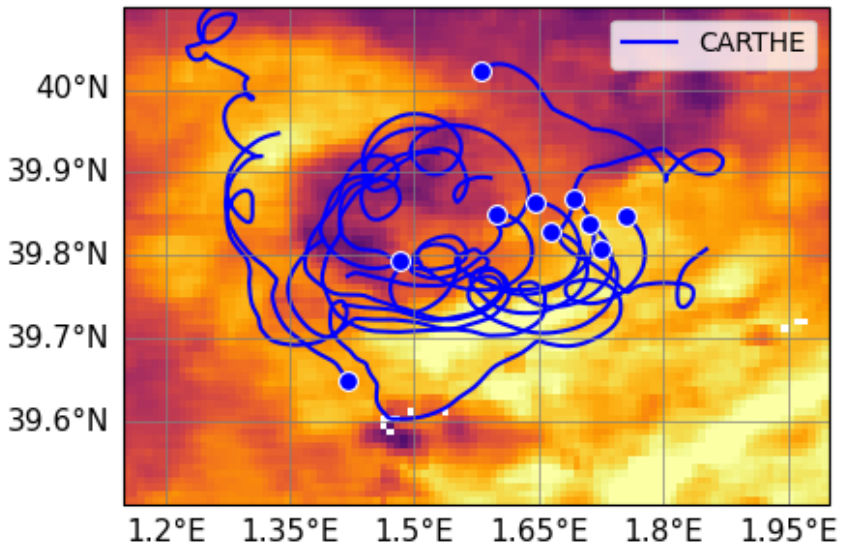
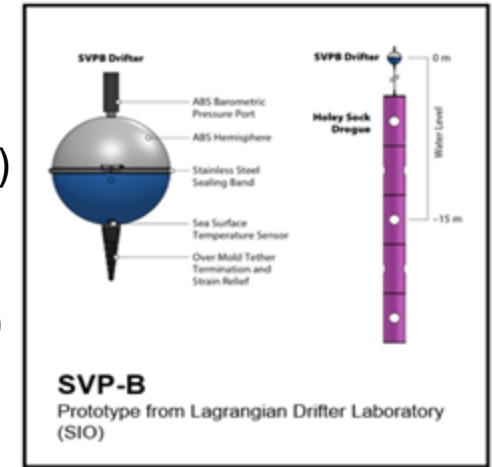
20 CARTHE
(0.4 m depth)



20 HEREON
(0.4 m depth)



5 SVP-B
(15 m depth)
(Ship of opportunity)



Fast-sampling phase: Drifters

SVP-B: 26/04 – 11/05/23

→ Inertial osc. filtered

- SWOT denoised (L3, v2.0.1)
- DUACS (L4, optimal interpolation)

- Daily spatial interpolation (cubic) to drifters points (+/-12h)

Fast-sampling phase: Drifters

SVP-B: 26/04 – 11/05/23

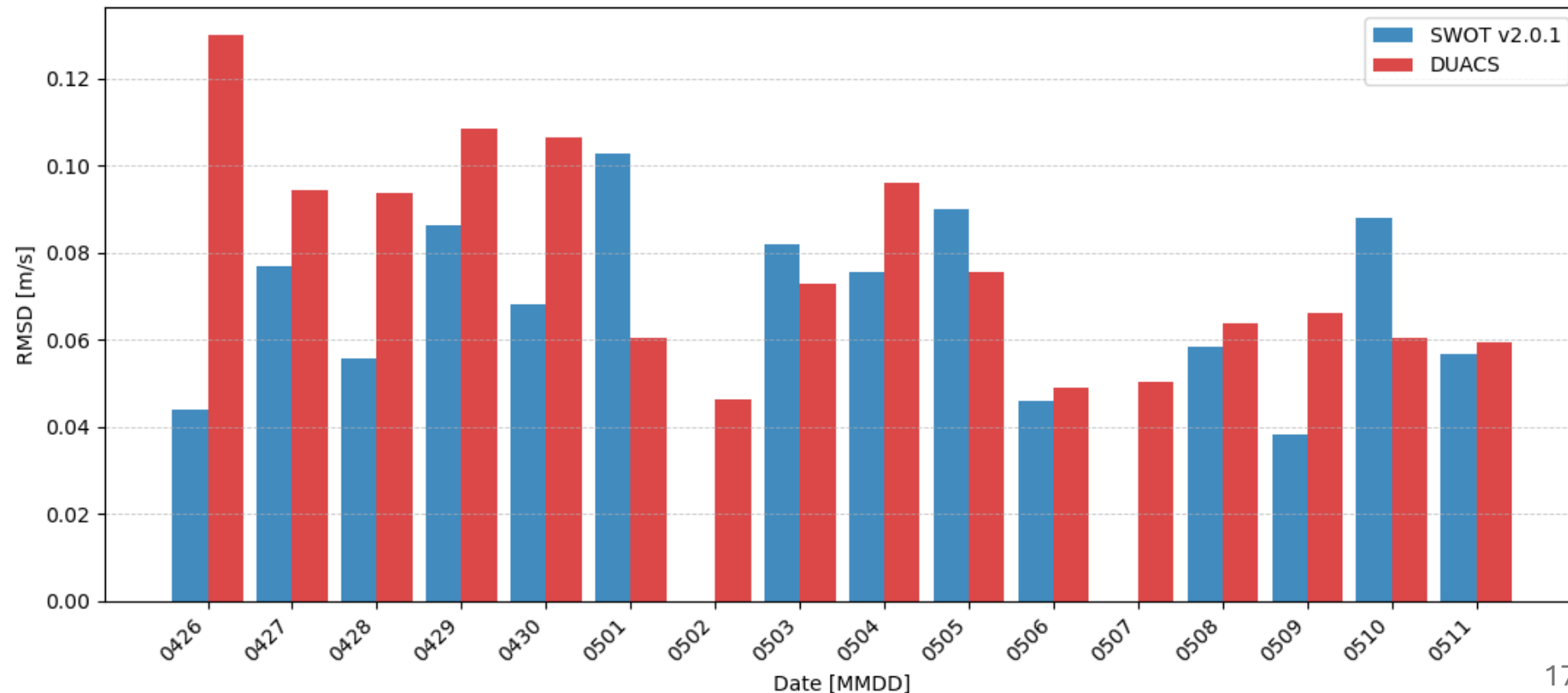
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Magnitude of vels. improved compared to DUACS for most days

RMSD of velocity magnitude



Fast-sampling phase: Drifters

SVP-B: 26/04 – 11/05/23

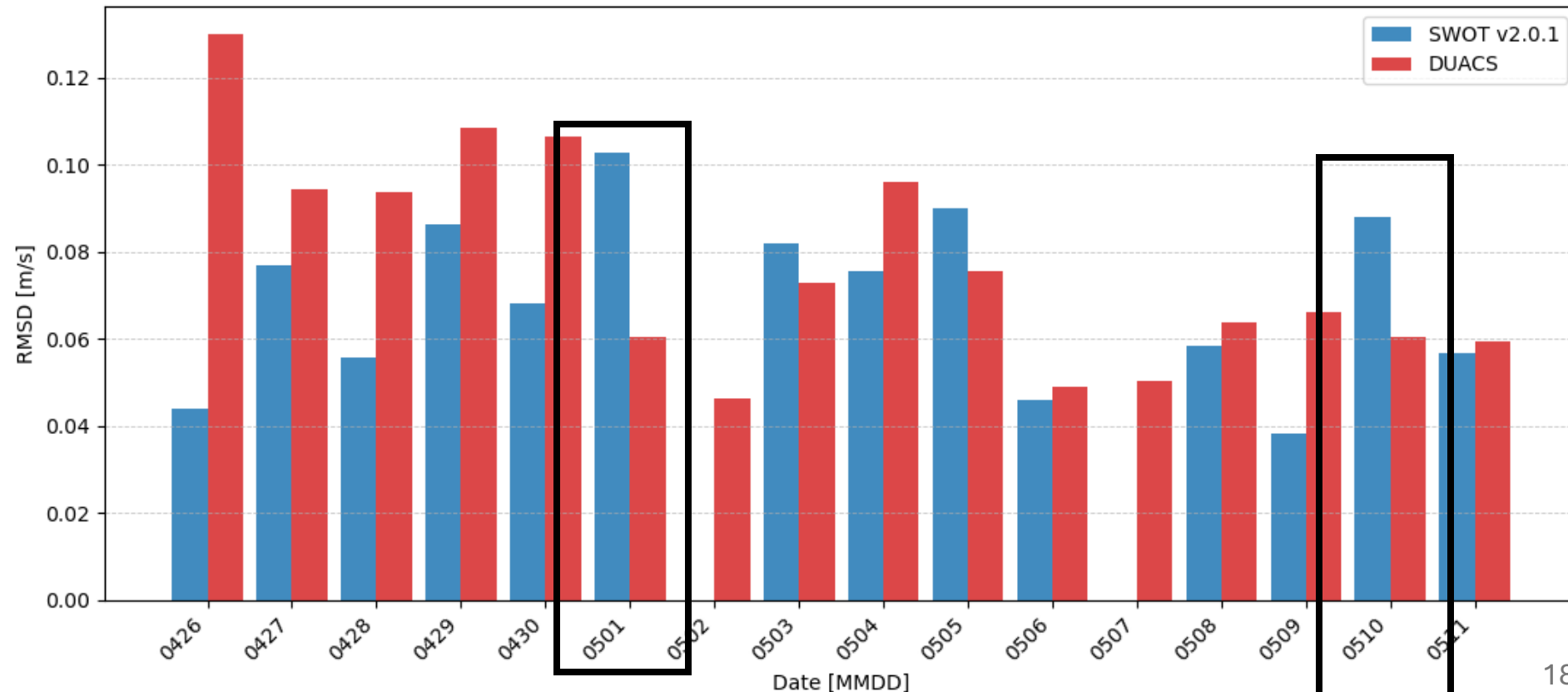
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Fast-sampling phase: Drifters

CARTHE: 26/04 – 11/05/23

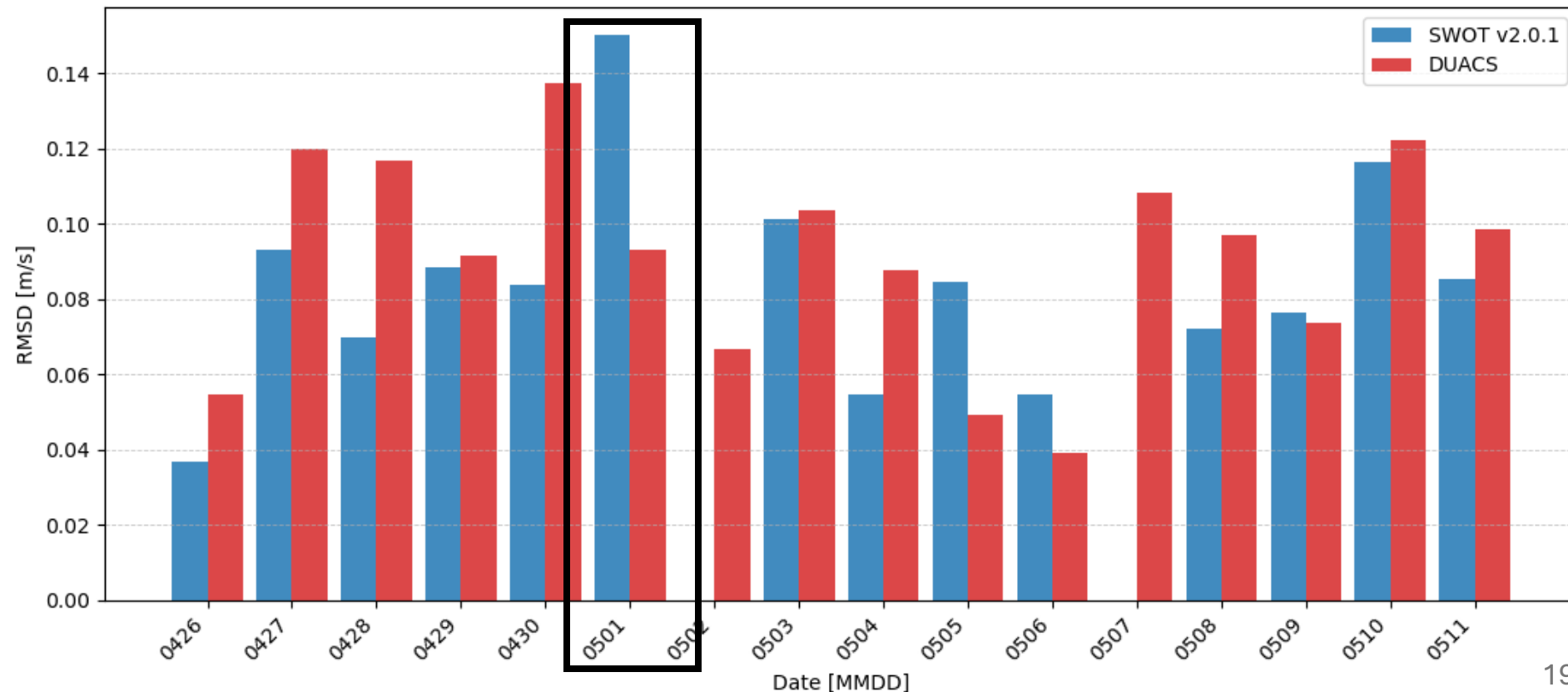
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On 01/05/23 intensification but anomalous signal found in vorticity too

RMSD of velocity magnitude



Fa

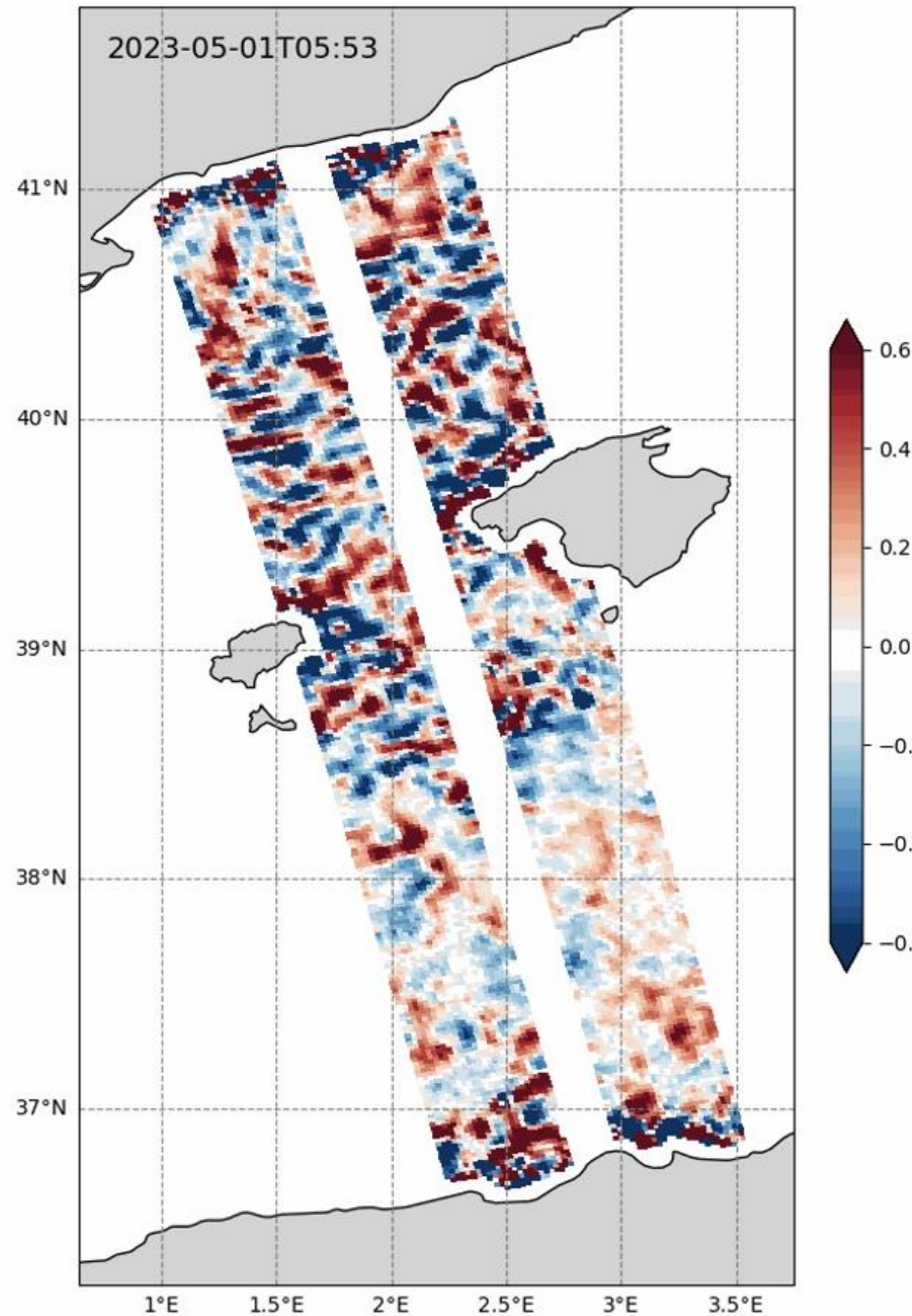
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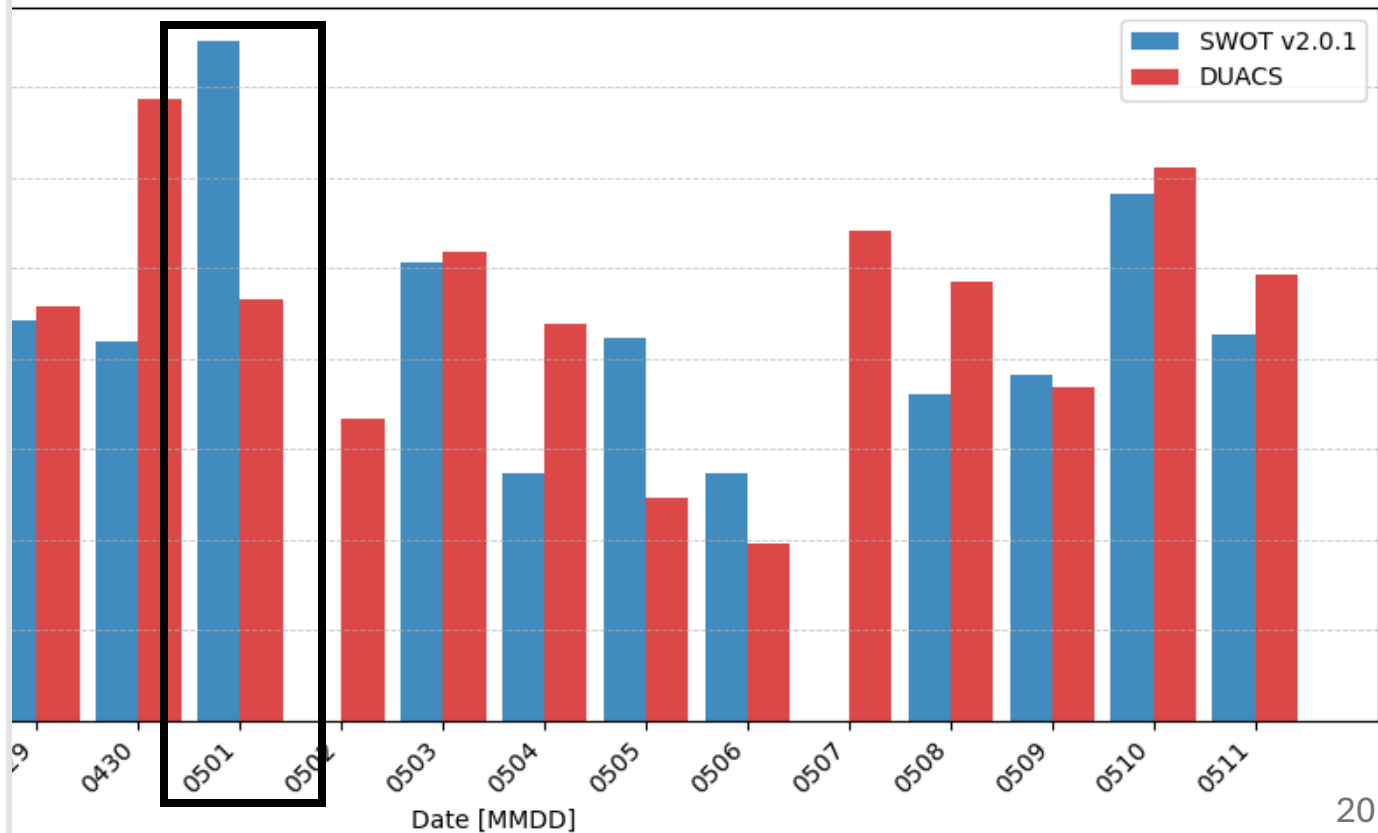
R



ers

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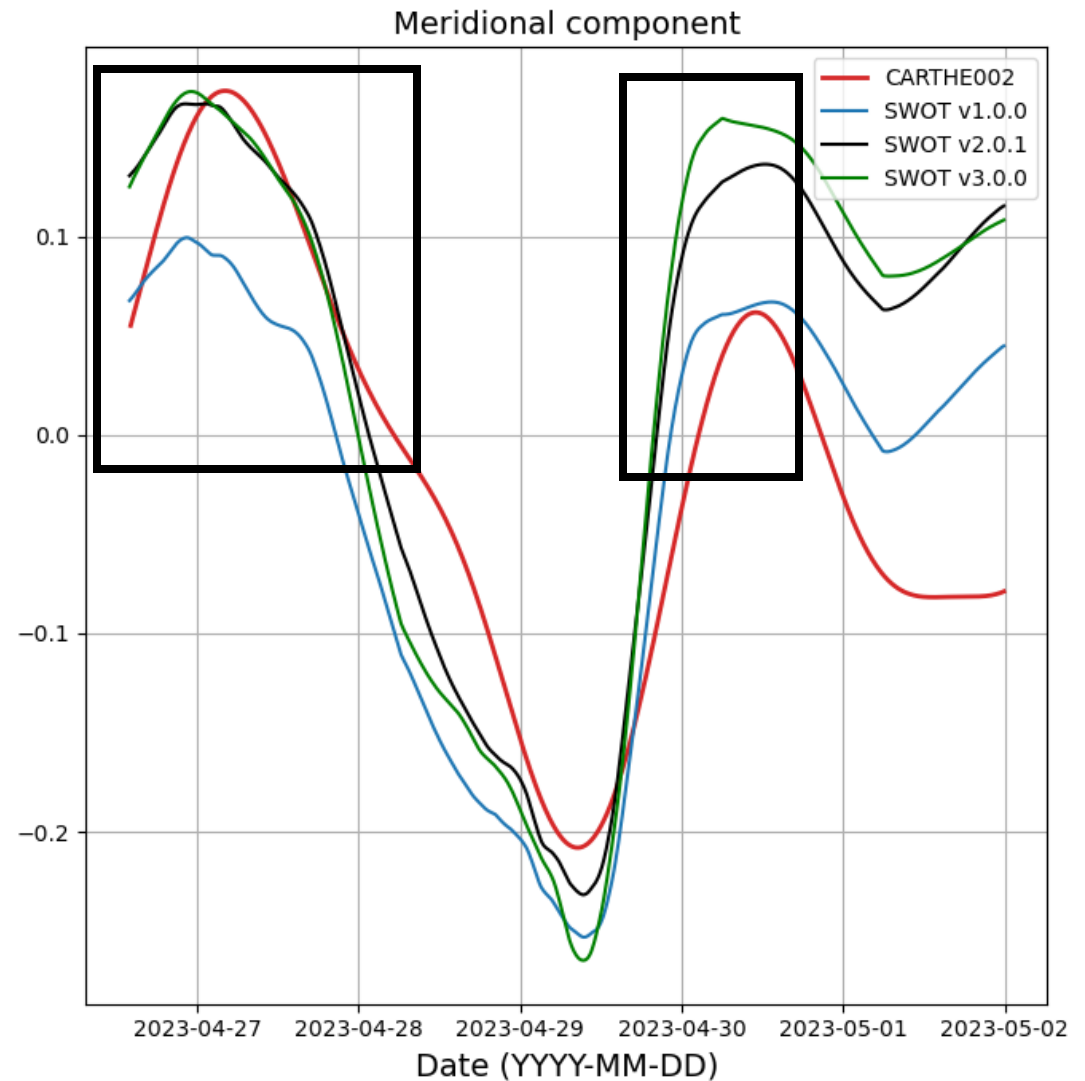
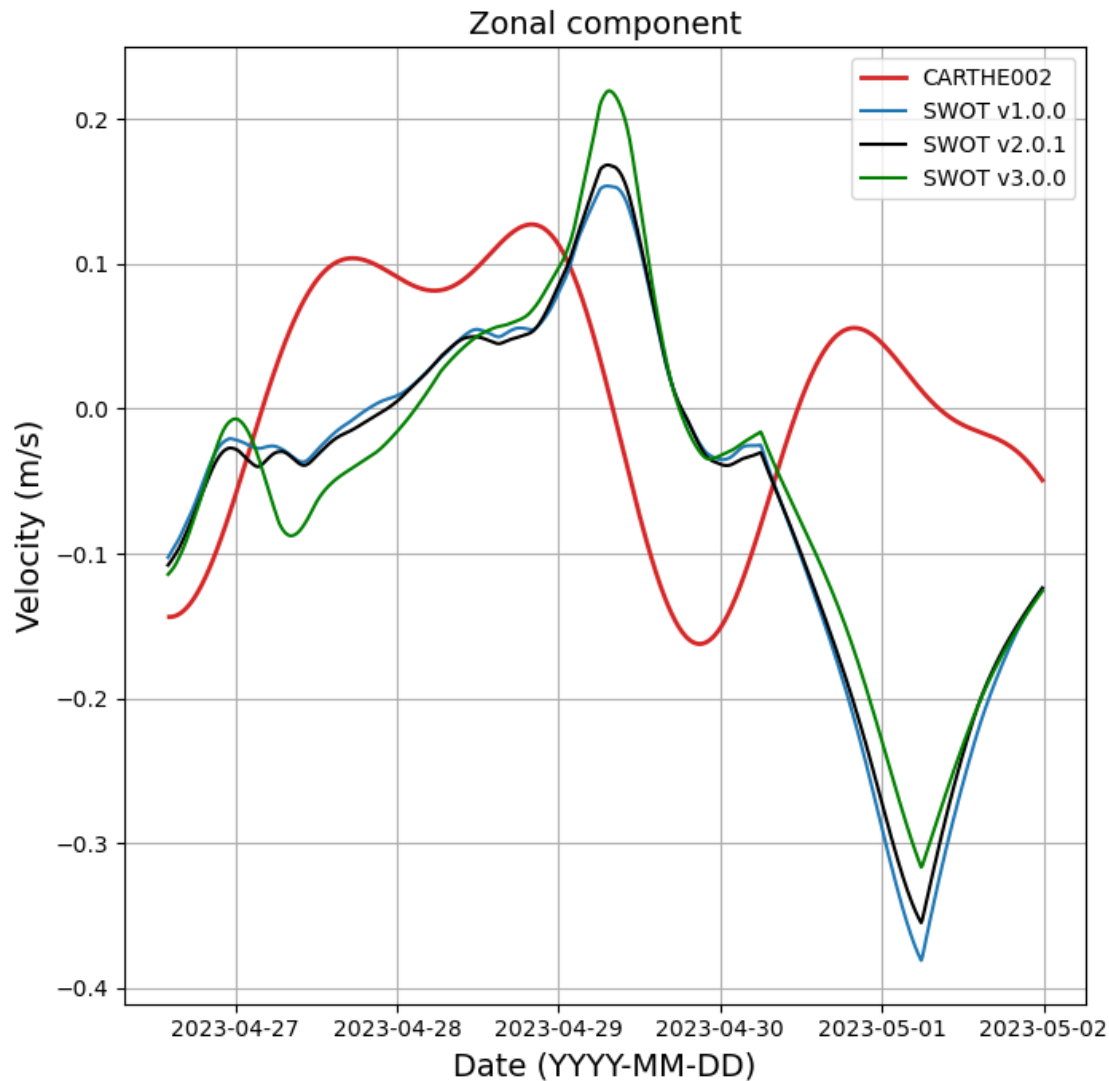


Impact of SWOT version (v1.0.0 vs 2.0.1 vs 3.0.0)

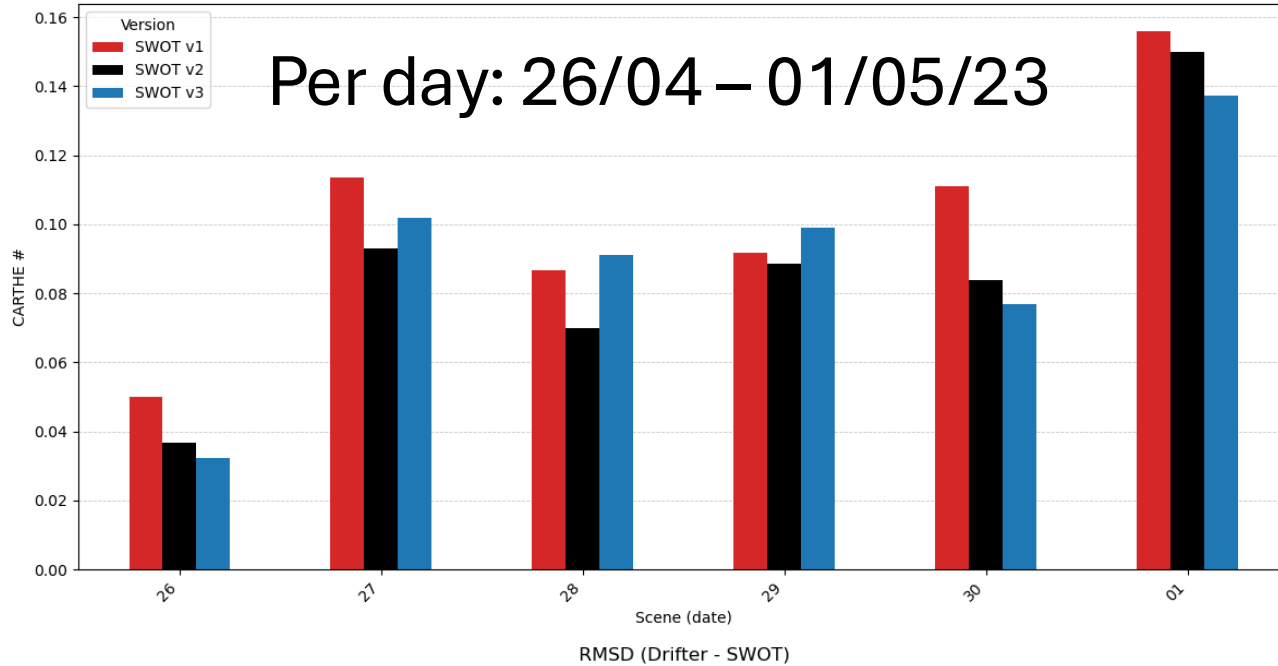
Impact of SWOT version (v1.0.0 vs 2.0.1 vs 3.0.0)

7 days of CARTHE 002:

Zonal not great... but for **meridional** which one is best?



Impact of SWOT version (v1.0.0 vs 2.0.1 vs 3.0.0)

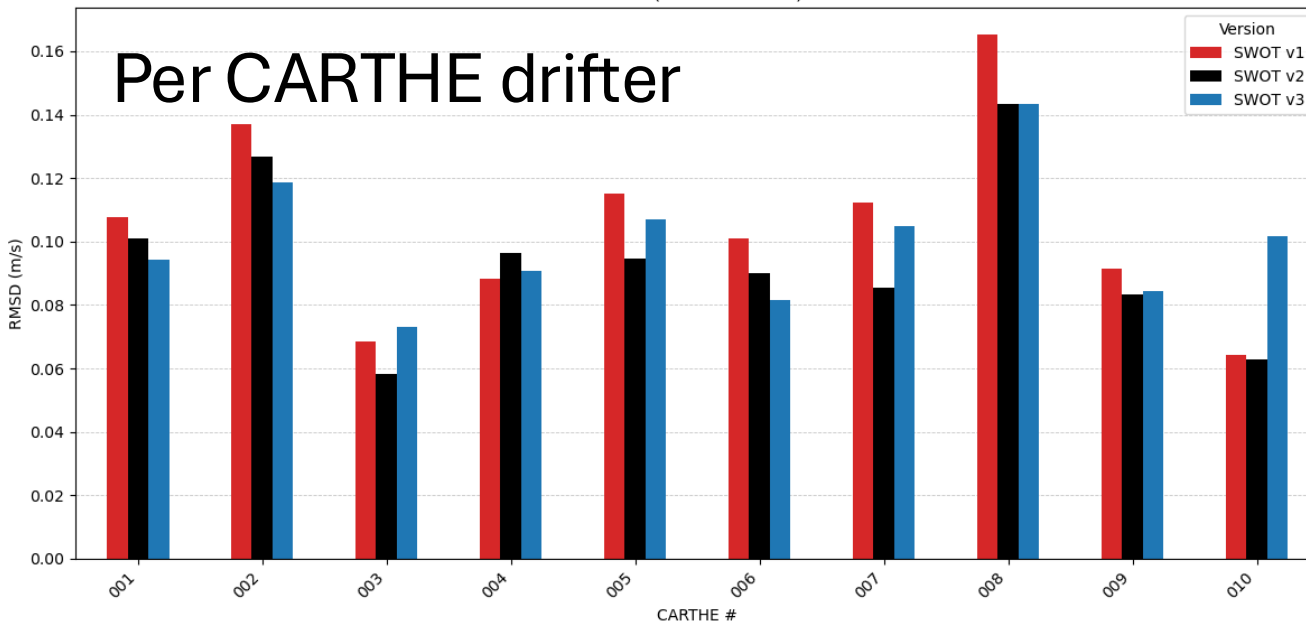


1/2 v2 1/2 v3!

Sensitivity to comparison method

Complexity of Med. region:

- Lower signal
- Smaller structures



1/10 v1

5/10 v2

3/10 v3

1/10 v2 <-> v3

Fast-sampling phase: Drifters

Differential Kinematic Properties (DKP)

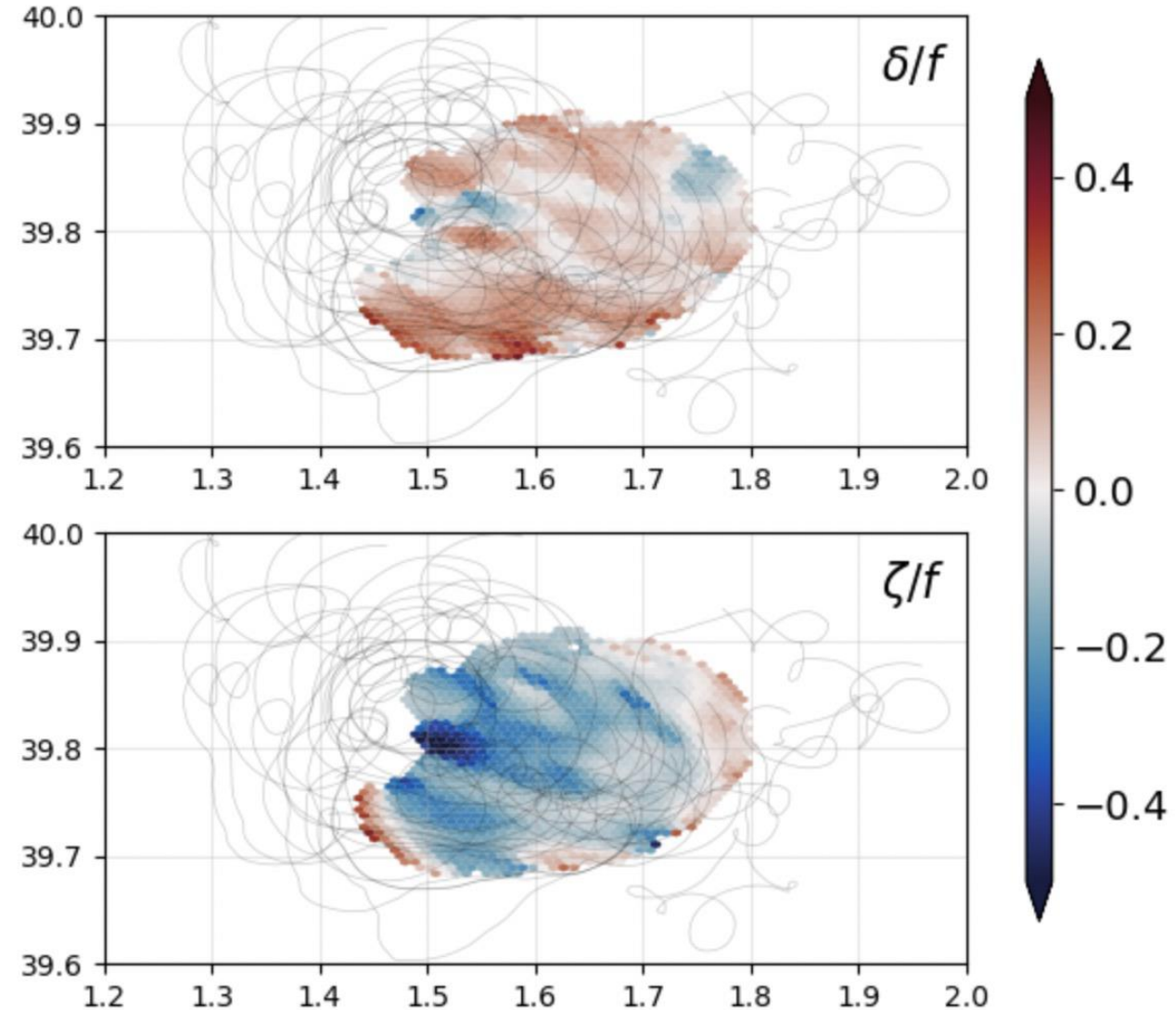
- Results inferred for FaSt-SWOT campaign leg 1 (25-30/04/23)

Divergence (top) and relative vorticity (bottom)

(Tarry *et al.*, 2022)

- **$Ro. < 1$, can assume that even if eddy observed is small (~25 km radius) the geostrophic assumption still holds**

Ongoing



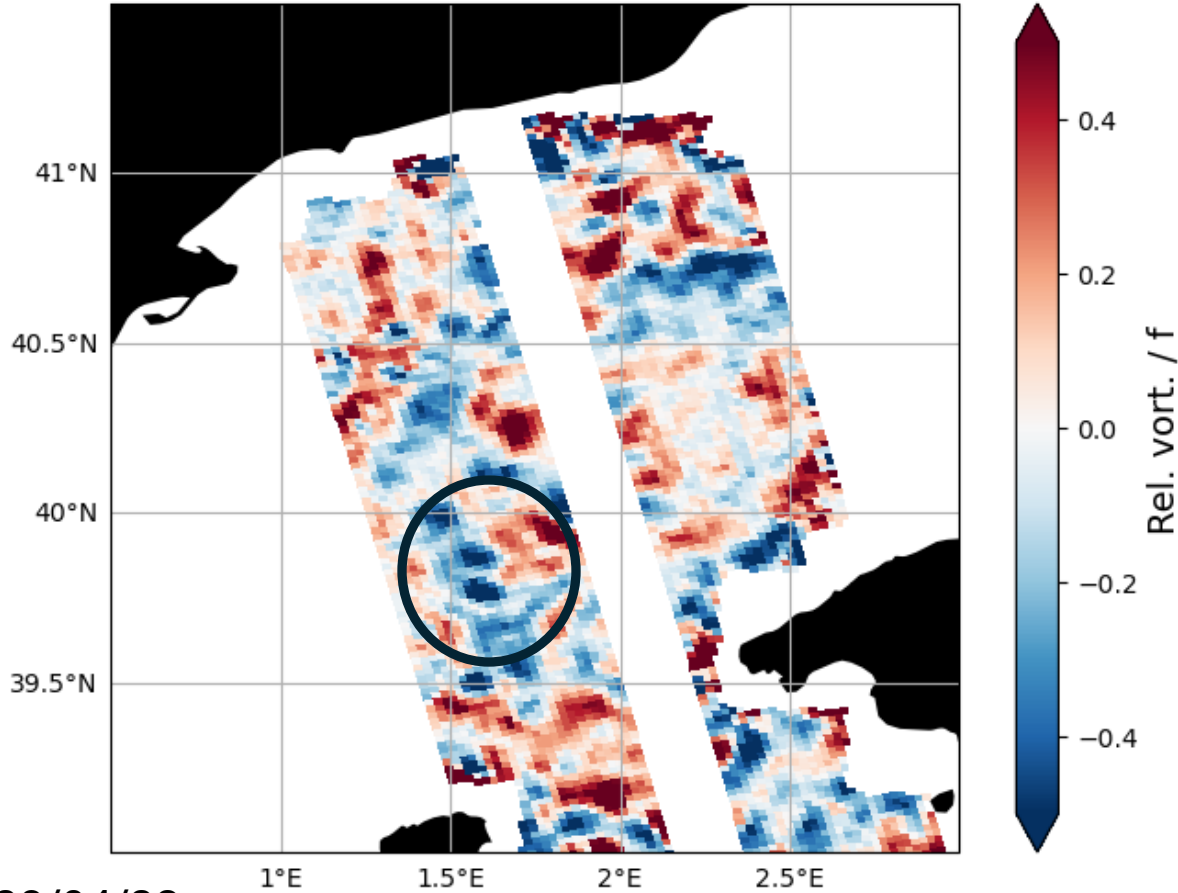
1 snapshot vs (25-30/04/23 composite)

(results from D. R. Tarry)

Fast-sampling phase: Drifters

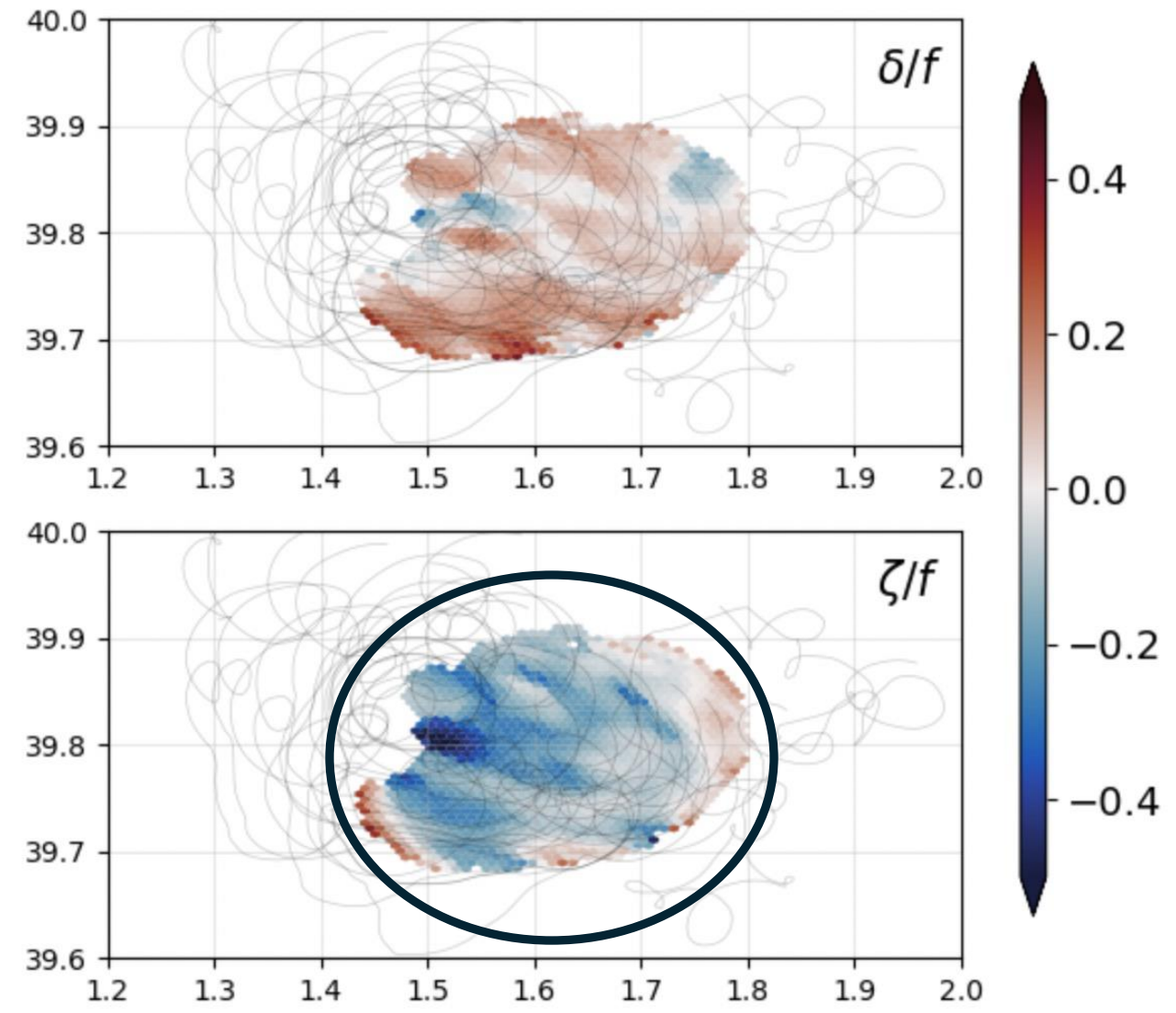
Ongoing

SWOT L3 (v1.0) vs DKP



28/04/23

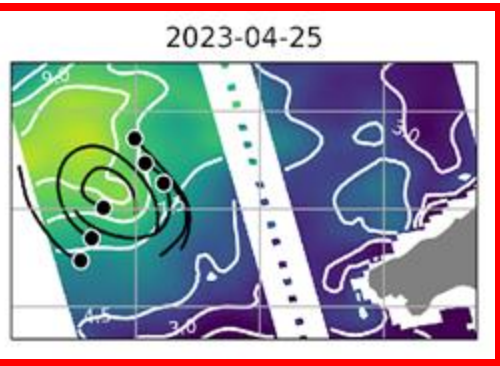
→ can assess till which point the geostrophic assumption holds (importance for the inference of velocities from SWOT data)



1 snapshot vs (25-30/04/23 composite)
(results from D. R. Tarry)

Fast-sampling phase: Drifters

Challenges

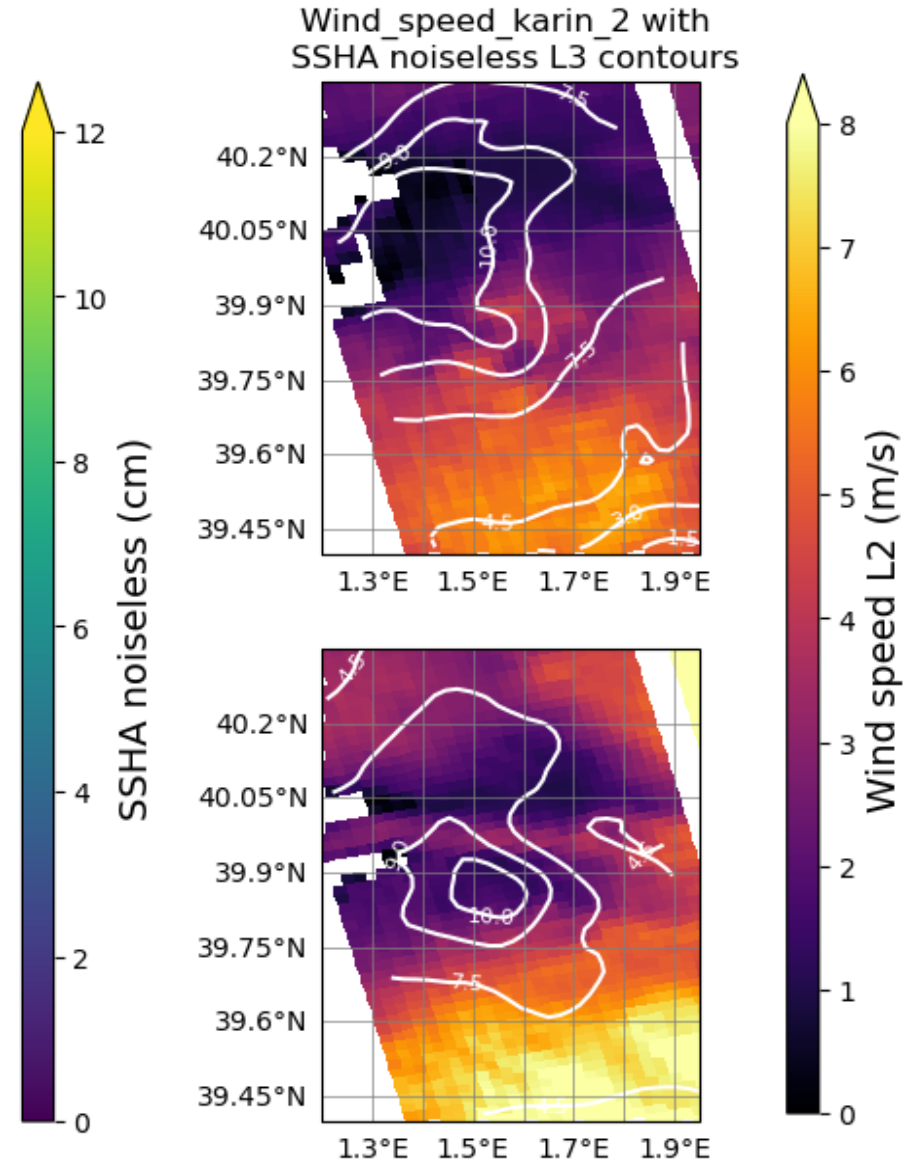
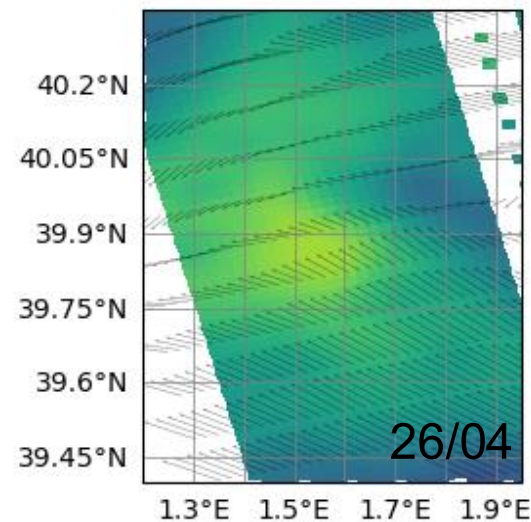
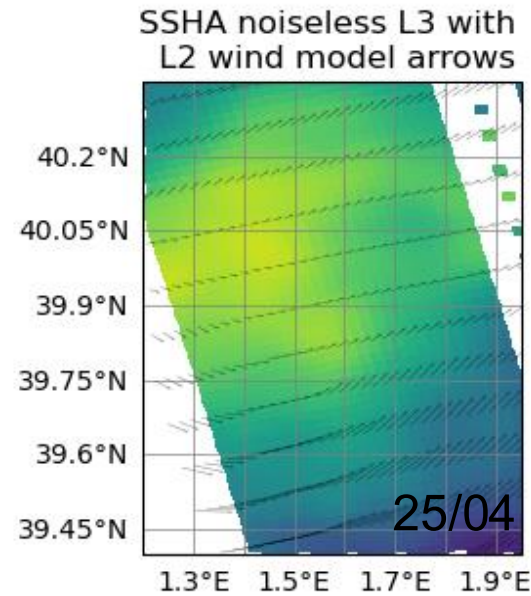


→ Eddy displacement?

Coincides with low velocity wind vel.
Possible effect of DAC correction?

First comparisons with new HR DAC does not seem to improve this

SWOT too high resolution for geophysical corrections' resolution?



Conclusions and future work

Gilders: Daily variability

- High daily variability both in glider and SWOT data!
- Impact of wind / atmospheric phenomena?

Drifters: validation and vels. assessment

- Challenge of SWOT seeing below geostrophy
- Advantage of the Mediterranean Sea: **small Rossby radius!**
(~15km in WMED)
- Impact of wind conditions: Surface and near-surface drifters
- Still problem of atmospheric impact, or other?

Challenges

SWOT high resolution → finding the **limit** of some of the **geophysical corrections applied?**



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SWOT high resolution → finding the **limit** of some of the **geophysical corrections applied?**



Thank you!

Email:

laura.gomez@icm.csic.es