

High-resolution Sea Surface Height mapping with assimilative simple models: status and plans

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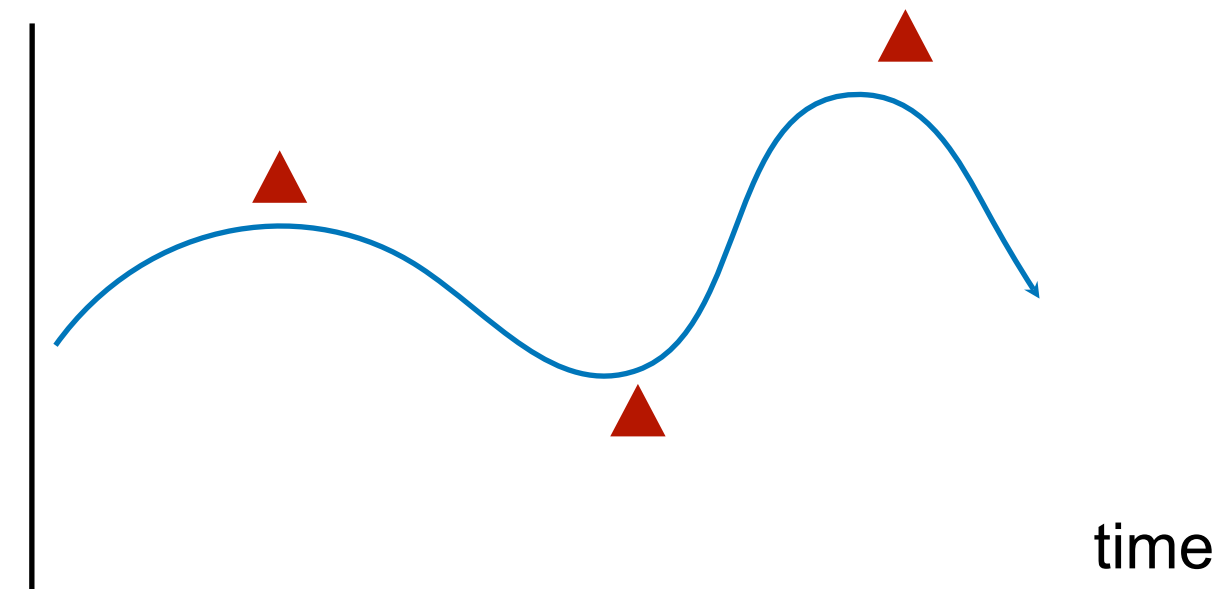
SWOT Science Team meeting 2023, Toulouse





Our approach: use simple and low-cost dynamical models

- Physically-based, consistent time interpolation of SWOT data
- Implement adapted, possibly high-level inversion algorithms
- Limit tuning efforts, ensure geographical flexibility
- Limit CPU and carbon costs
- Regional focuses (so far. And no tropics)



Check the posters!

Back-and-Forth Nudging the QG model in the Mediterranean Sea

- Tested in Near-Real-Time to cover the C-SWOT/WEMSWOT companion campaigns, 21 march – 17 april 2023
- processes 7 nadir altimeters from CMEMS + SWOT nadir when available

BFN-QG geostrophic vel.
White arrows

C-SWOT Transect
ADCP Bk: surf, Rd: 200 m

Satellite SST

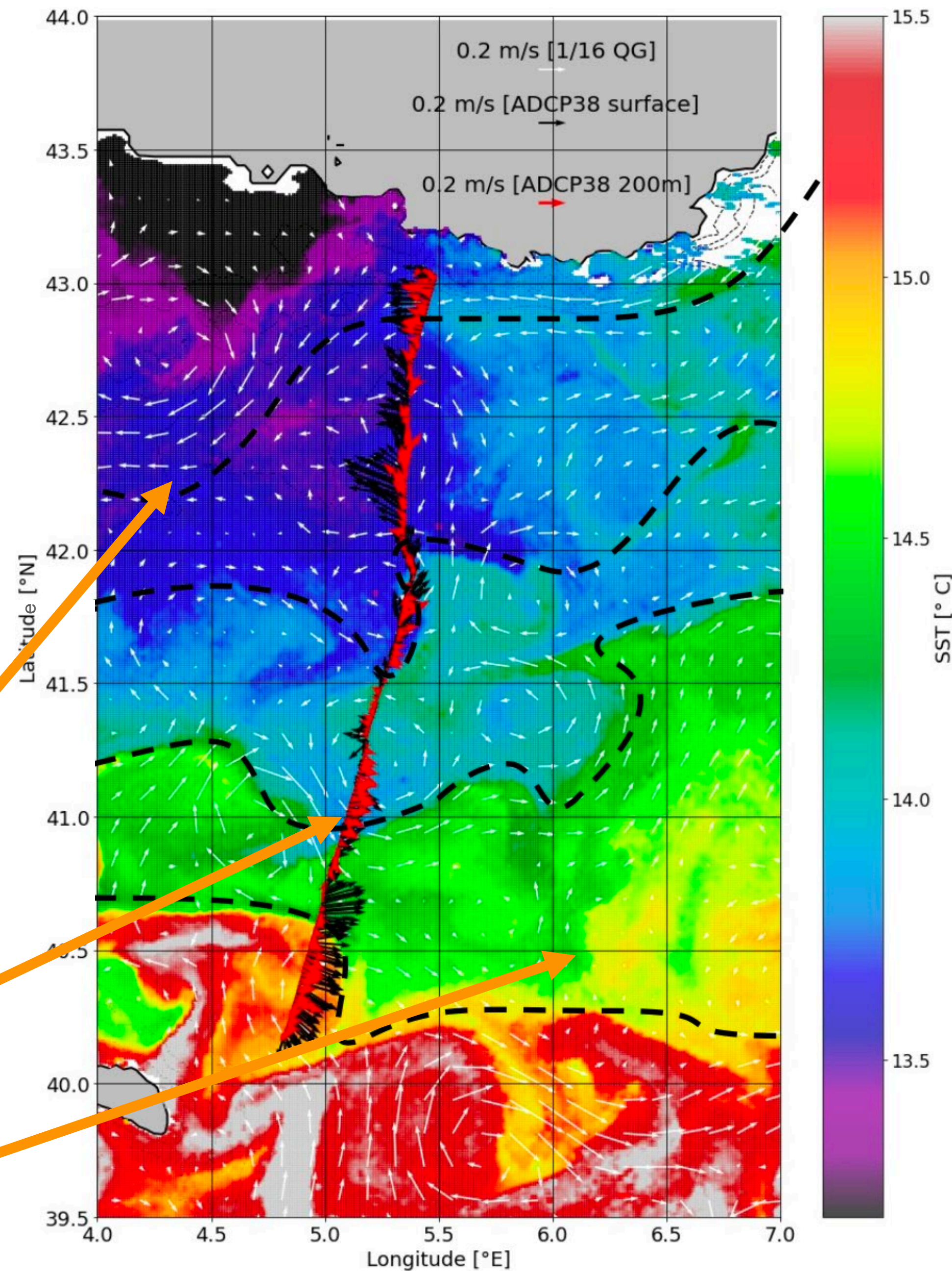
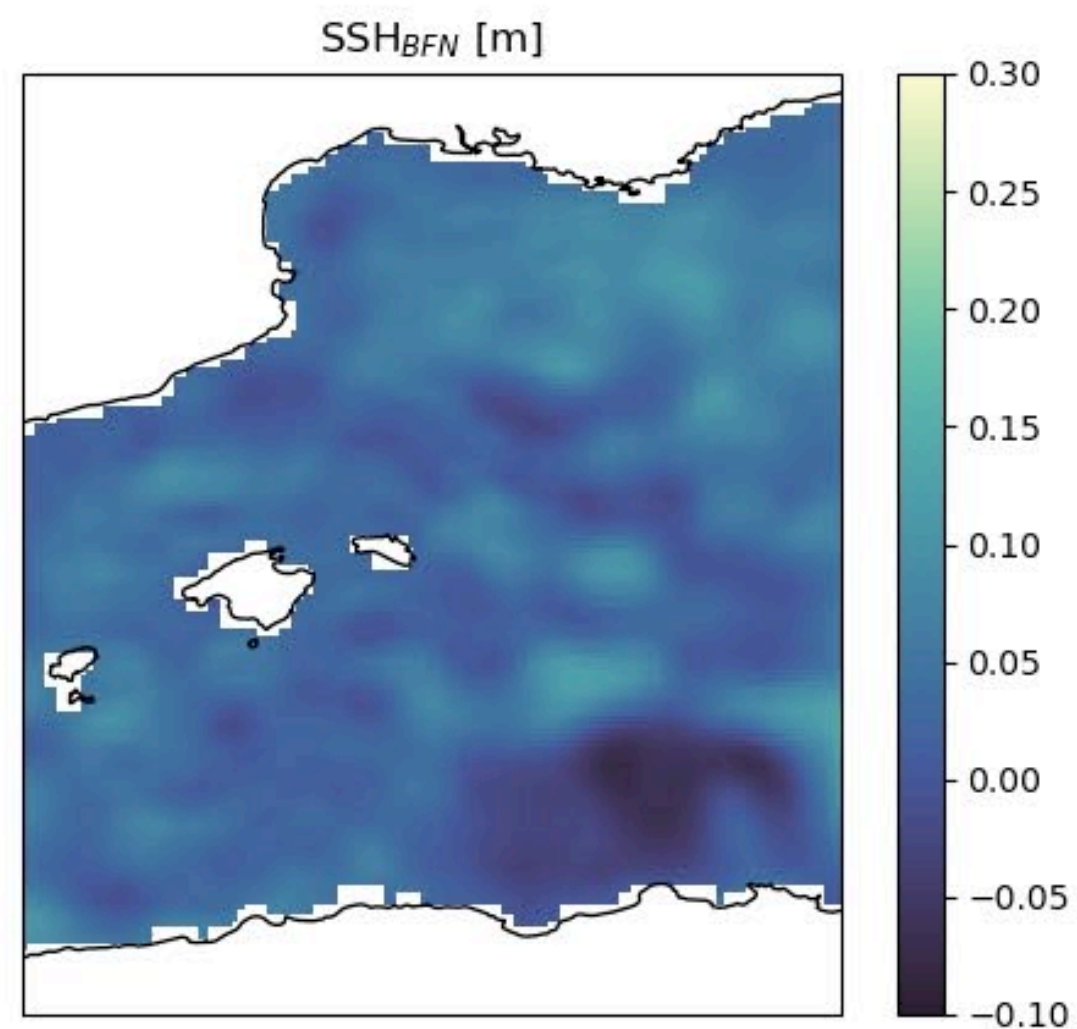
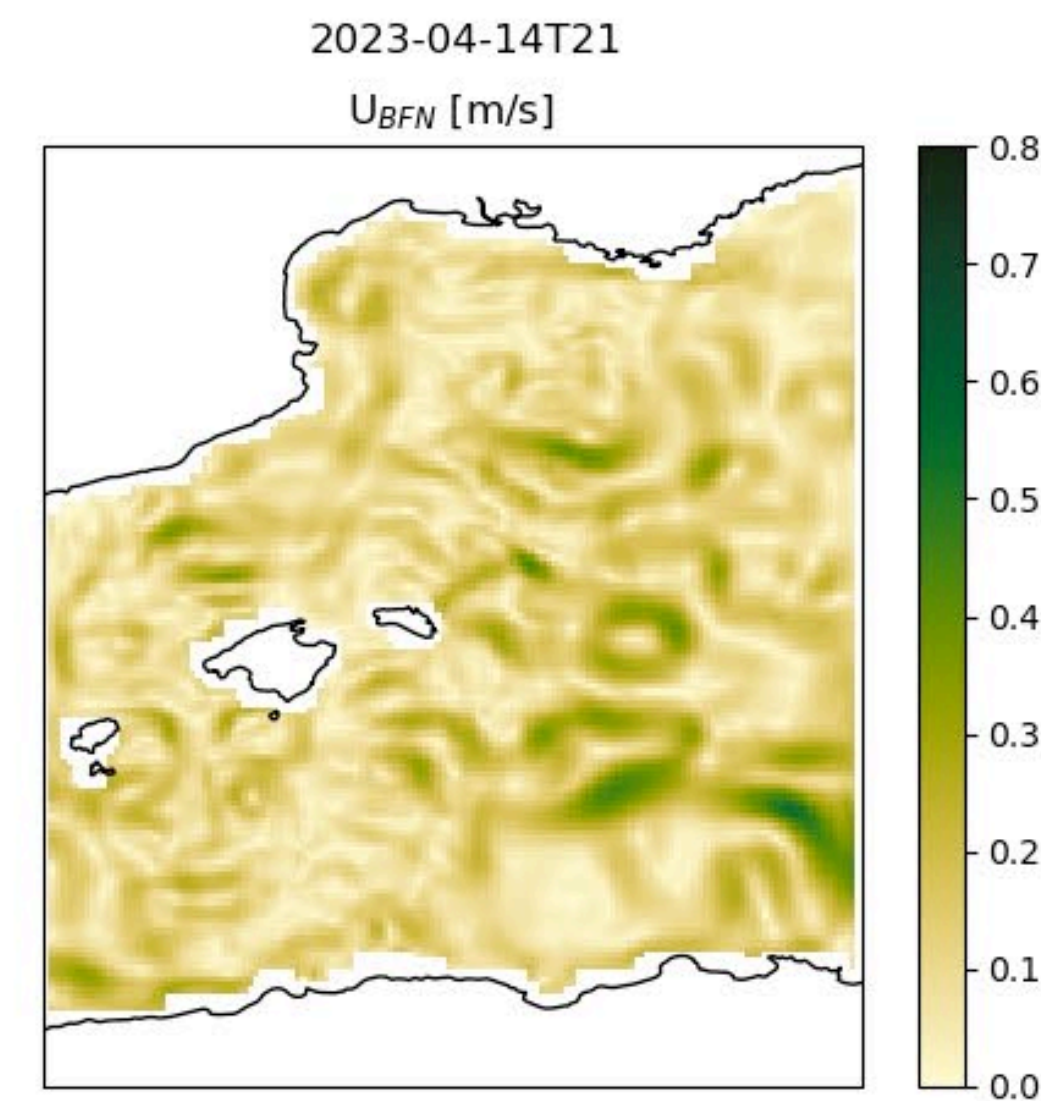


Figure from A. Barboni, F. Dumas, P. Garreau

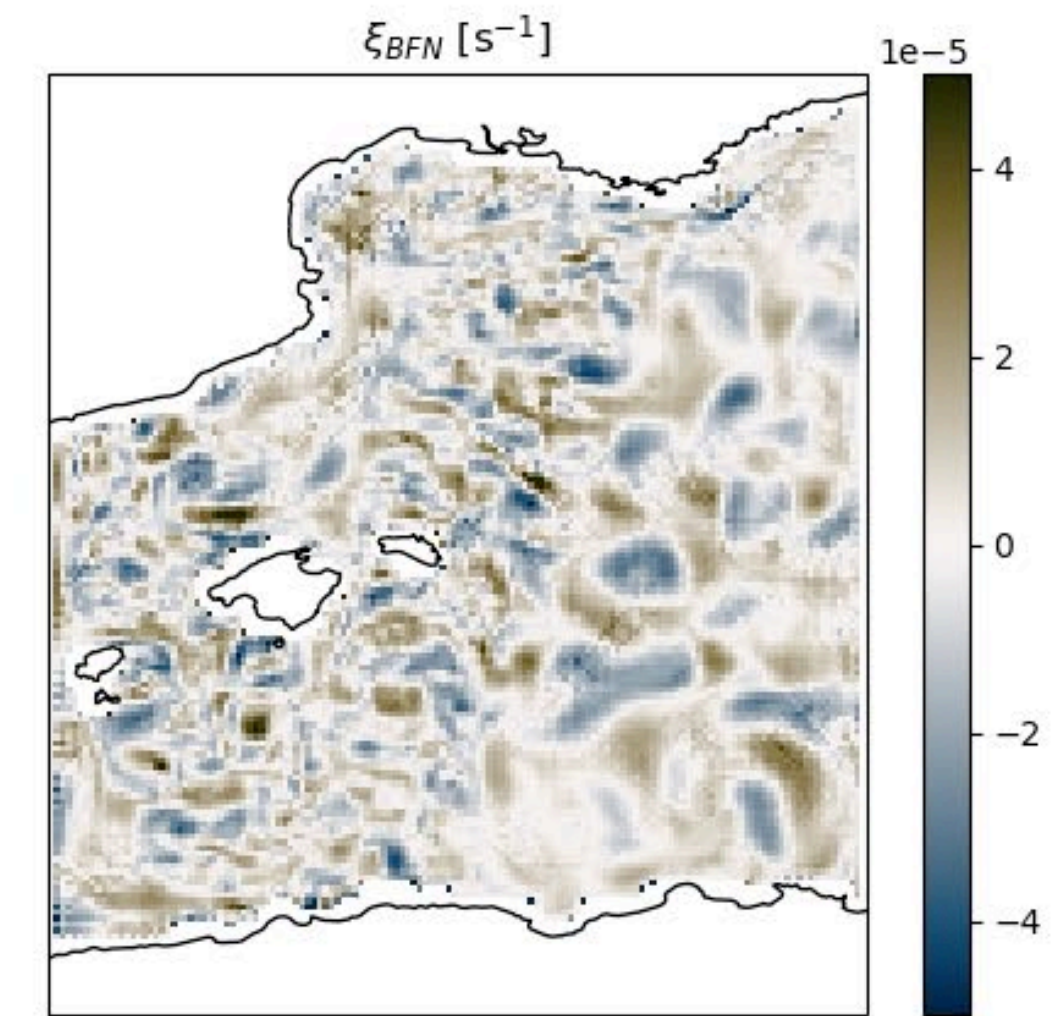
Back-and-Forth Nudging the QG model in the Mediterranean Sea **WITH SWOT**



Sea Surface Height



Geostrophic Velocities



Vorticity

4DVar and QG model in the North Atlantic

2023-04-14T21

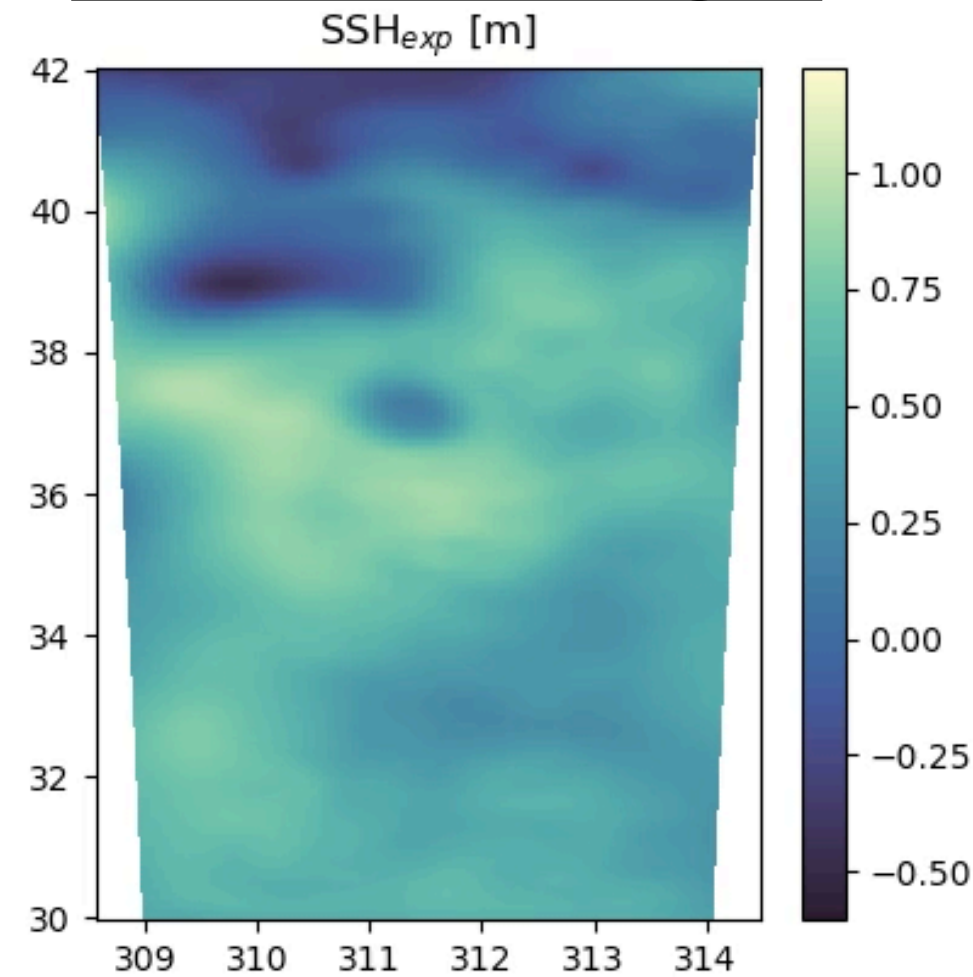
4DVar-QG (nadirs + SWOT) →



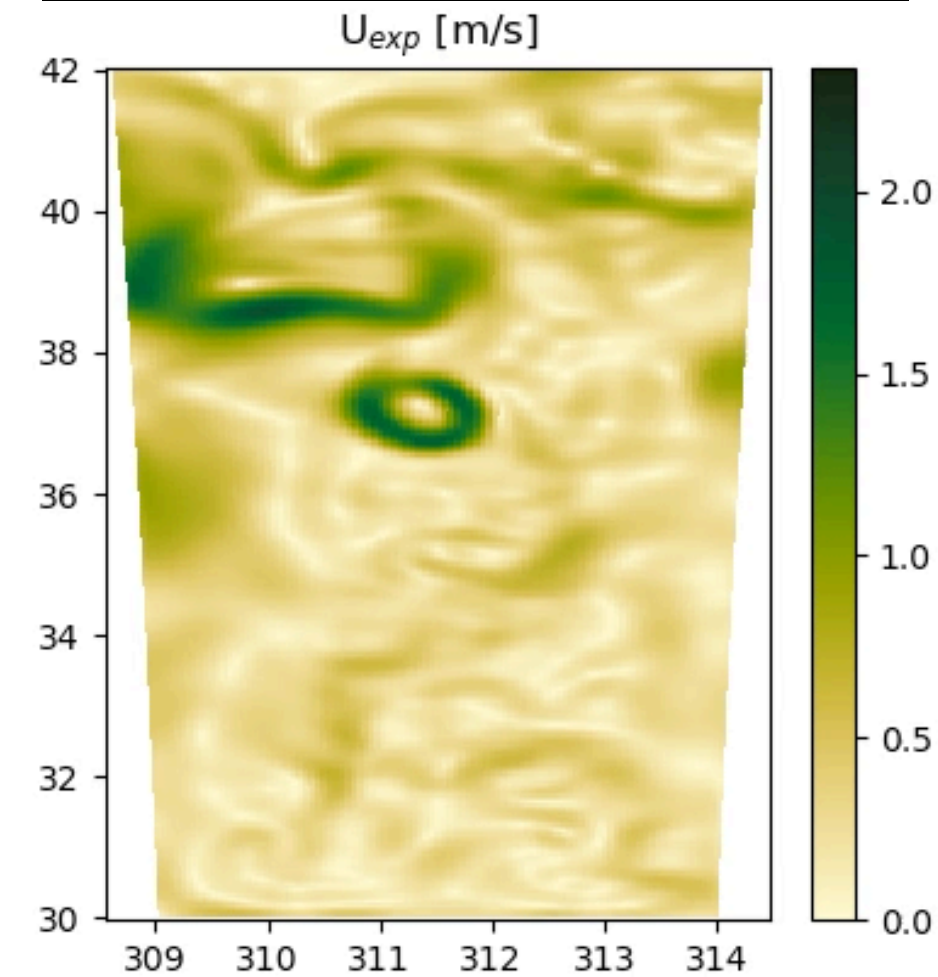
(SWOT-adac)

MIOST (nadirs + SWOT) →

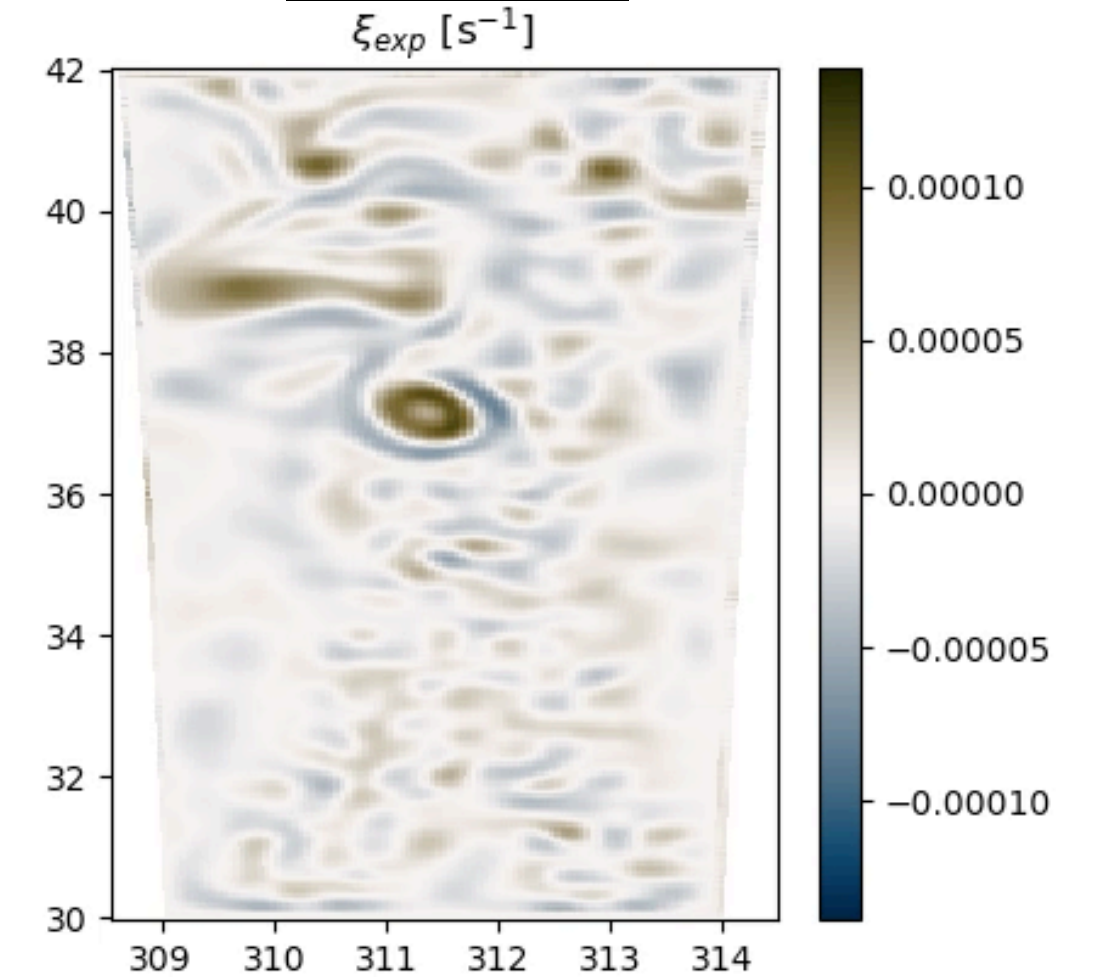
Sea Surface Height



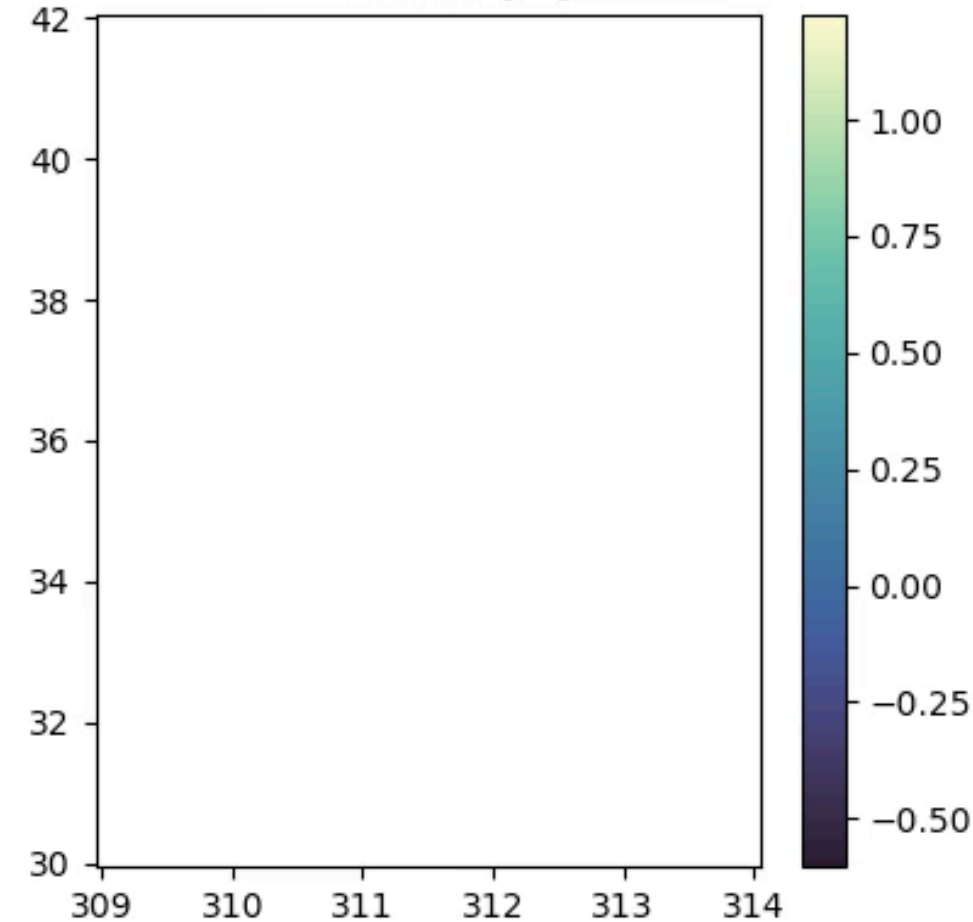
Geostrophic Velocities



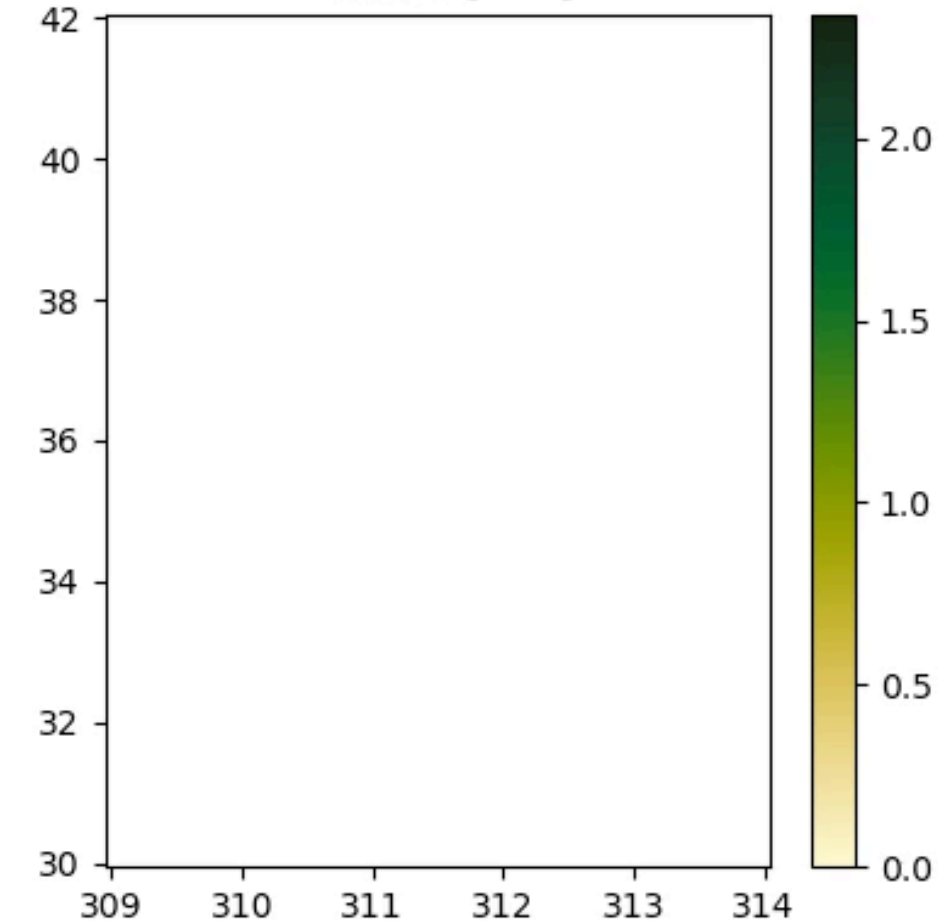
Vorticity



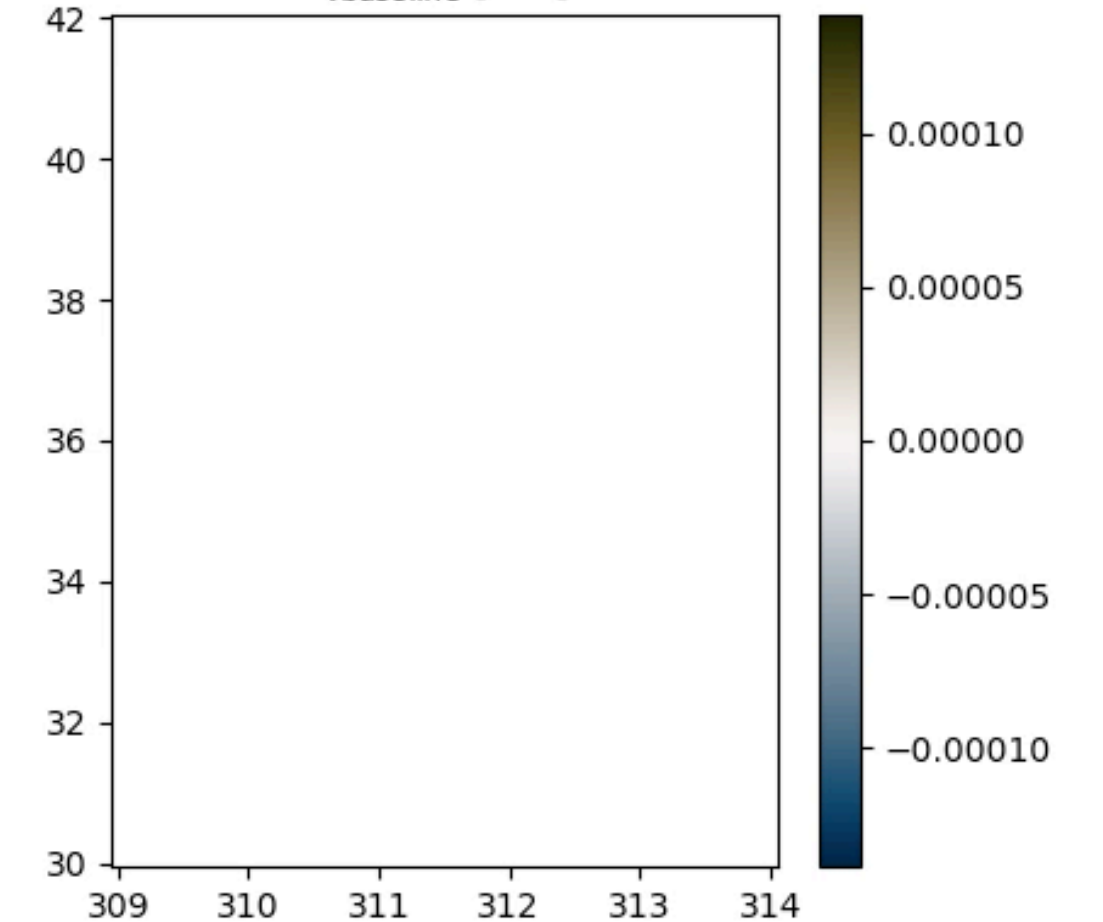
SSH_{baseline} [m]



U_{baseline} [m/s]

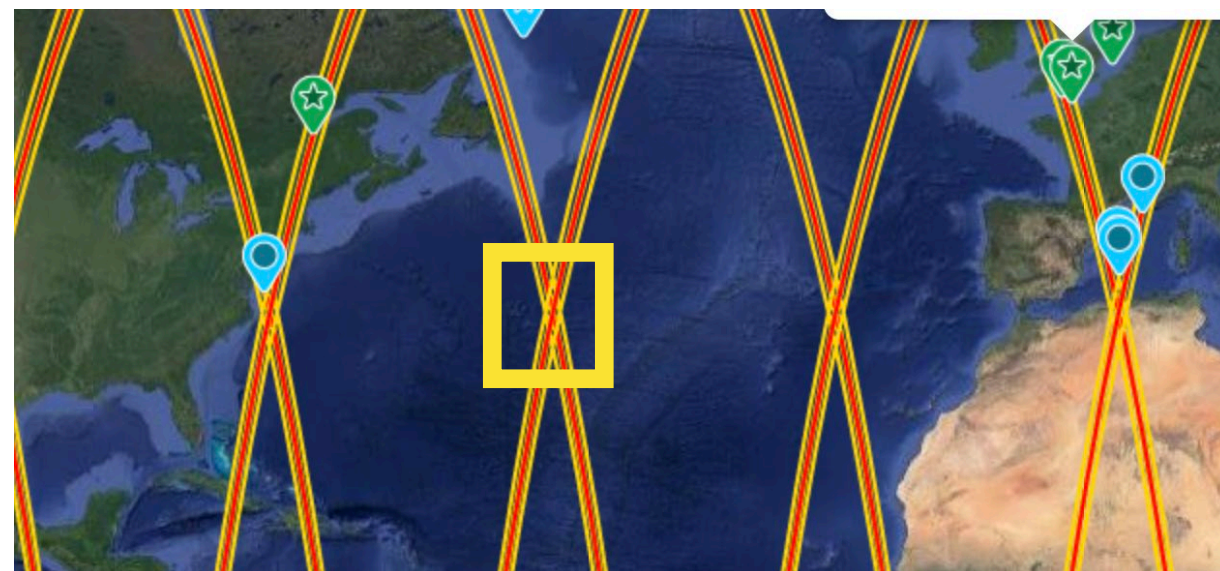


ξ_{baseline} [s⁻¹]



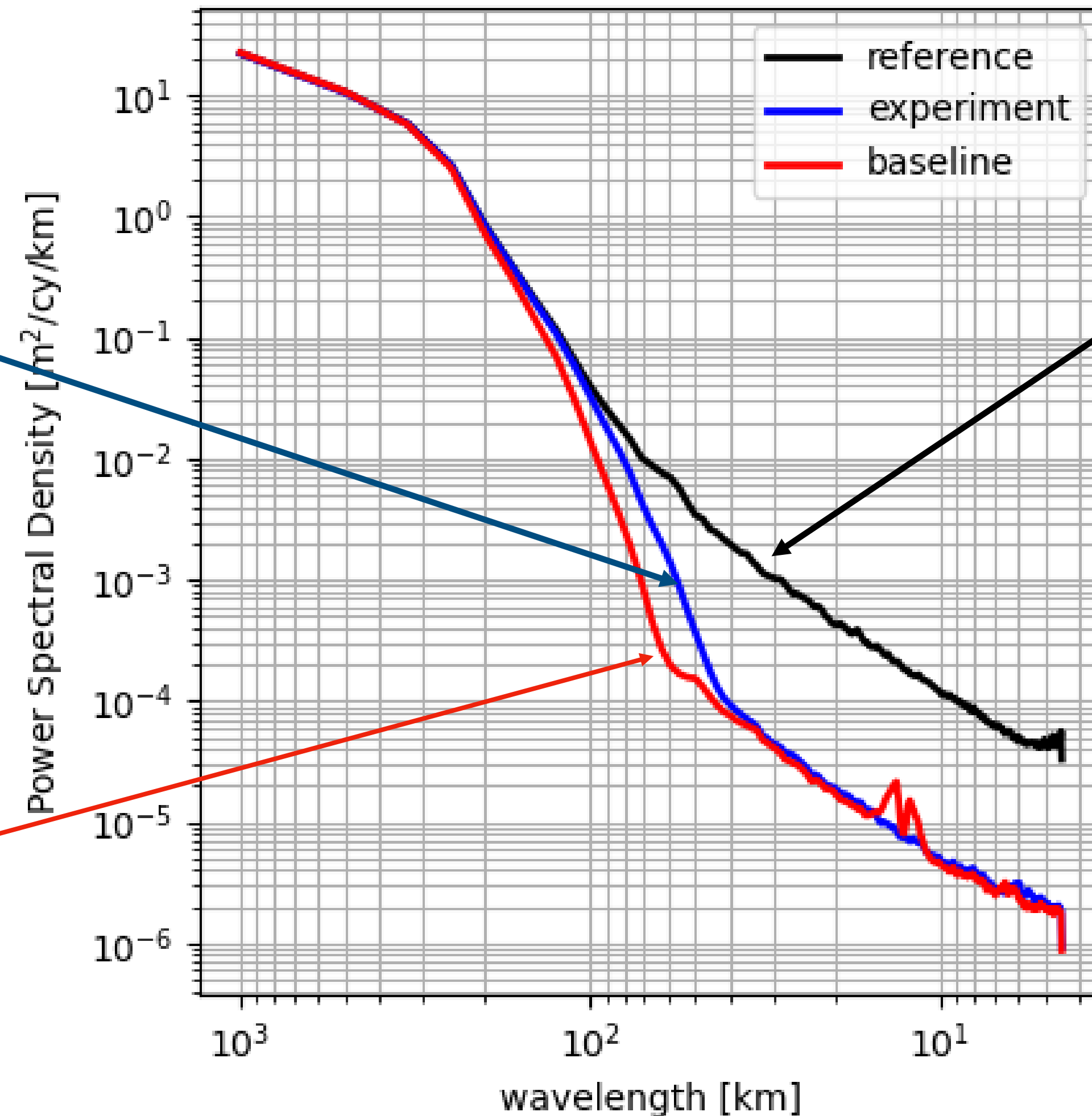
4DVar and QG model in the North Atlantic

4DVar-QG (nadirs + SWOT)
on SWOT swath



(SWOT-adac)

MIOST (nadirs + SWOT)
on SWOT swath



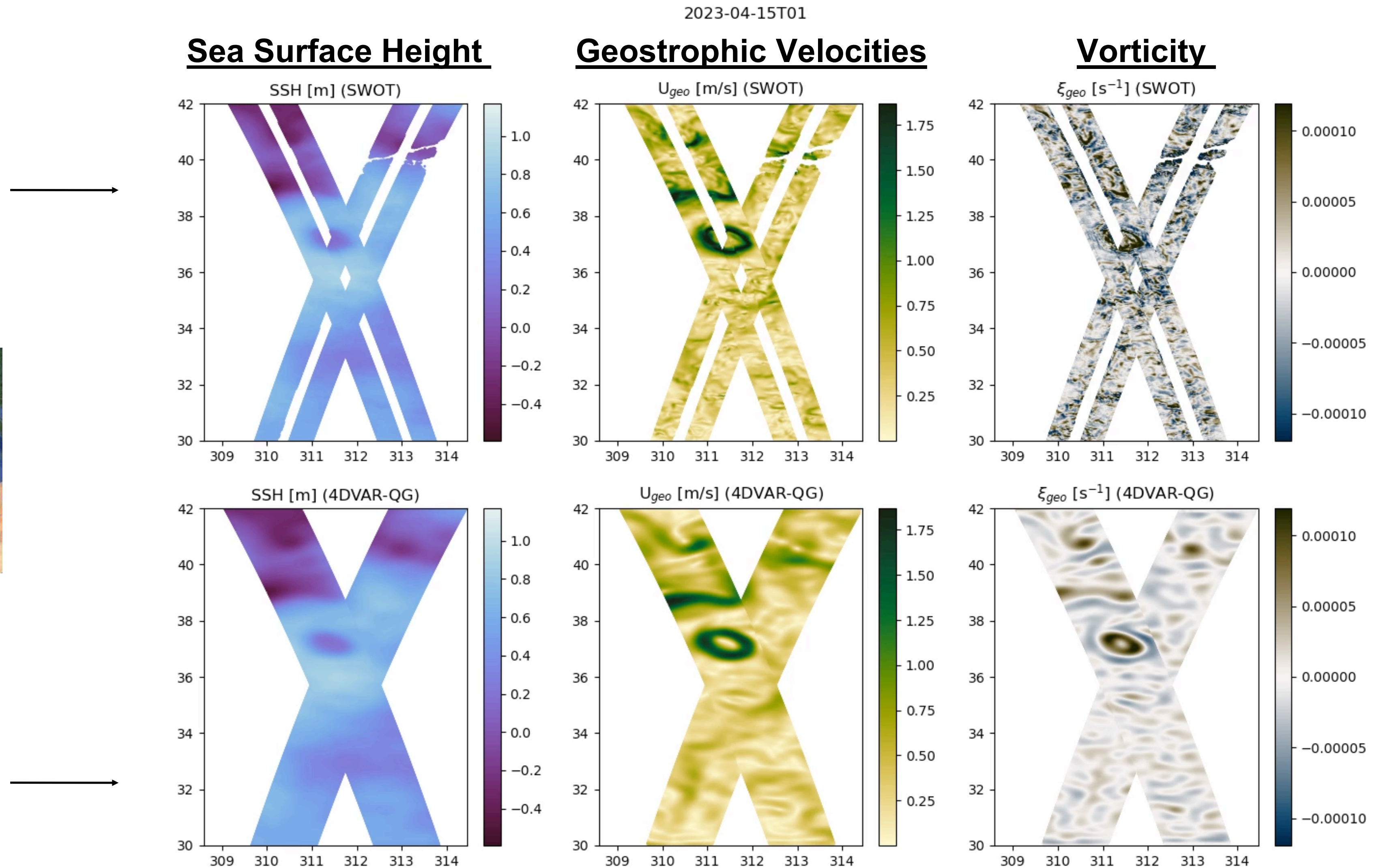
4DVar and QG model in the North Atlantic

SWOT filtered with Unet
(Treboutte et al, 2023)



(SWOT-adac)

4DVar-QG (nadirs + SWOT)





Data challenges and tools for diagnostics

ocean-data-challenges

Overview Repositories 9 Projects Packages Teams 1 People 9 Settings

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- 2022a_SWOT_karin_error_filtering** (Public)
A challenge on the SWOT Karin instrumental error filtering organised by Datlas, IMT Atlantique and CLS.
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- 2020a_SSH_mapping_NATL60** (Public)
A challenge on the mapping of satellite altimeter sea surface height data organised by MEOM@IGE, Ocean-Next and CLS.
benchmark machine-learning dataset oceanography satellite-data
Jupyter Notebook MIT 10 24 1 0 Updated 5 days ago
- 2023a_SSH_mapping_OSE** (Public)
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Jupyter Notebook 0 0 1 0 Updated 5 days ago
- 2021a_SSH_mapping_OSE** (Public)
A challenge on the mapping of real satellite altimeter sea surface height data organised by MEOM@IGE, Ocean-Next and CLS.
Jupyter Notebook MIT 4 7 2 0 Updated 5 days ago

ODC - global OSE mapping [Edit on GitHub](#)

ODC - global OSE mapping

Data Challenges
DC global OSE

SLICING Copernicus MERCATOR OCEAN datlas CLS

Context & Motivation

The Copernicus Marine Service (CMEMS) is committed to providing high-quality, state-of-the-art ocean products through the validation and verification of physical oceanic parameters on both global and regional scales. Among the variables distributed by the service, ocean surface topography and surface currents are of great interest to the oceanographic communities for practical applications and for scientific research.

Global scale
Gulf Stream region

SPECIFIC FOCUS

- Near inertial oscillation

NOTEBOOKS

- Notebooks evaluation
- Notebooks download the data

METRICS DETAILS

- SSH - Along track metrics
- Currents - Along drifter metrics
- Currents - Lagrangian metrics

SCRIPTS

- mod_compare module
- mod_filter module
- mod_interp module
- mod_plot module
- mod_powerspec module
- mod_read module
- mod_spectral module
- mod_stat module

[Read the Docs](#) v: latest





A few plans

- Consolidate results on the Med Sea
- Further develop mapping capacities, in particular for geostrophic current / internal wave separation (see poster on 4Dvar)
- Estimation of ageostrophic part of current
- Consolidate codes usability



What we can provide to colleagues



- All the codes are in open access (github.com/leguillf/MASSH)
- We are (almost) ready to run BFN-QG or 4DVar-QG in any non-tropical region upon request
- We provide free, open, documented and easy-to-use diagnostic tools.

