

On the assimilation of upgraded L2 SWOT-swath SWH in the wave model MFWAM

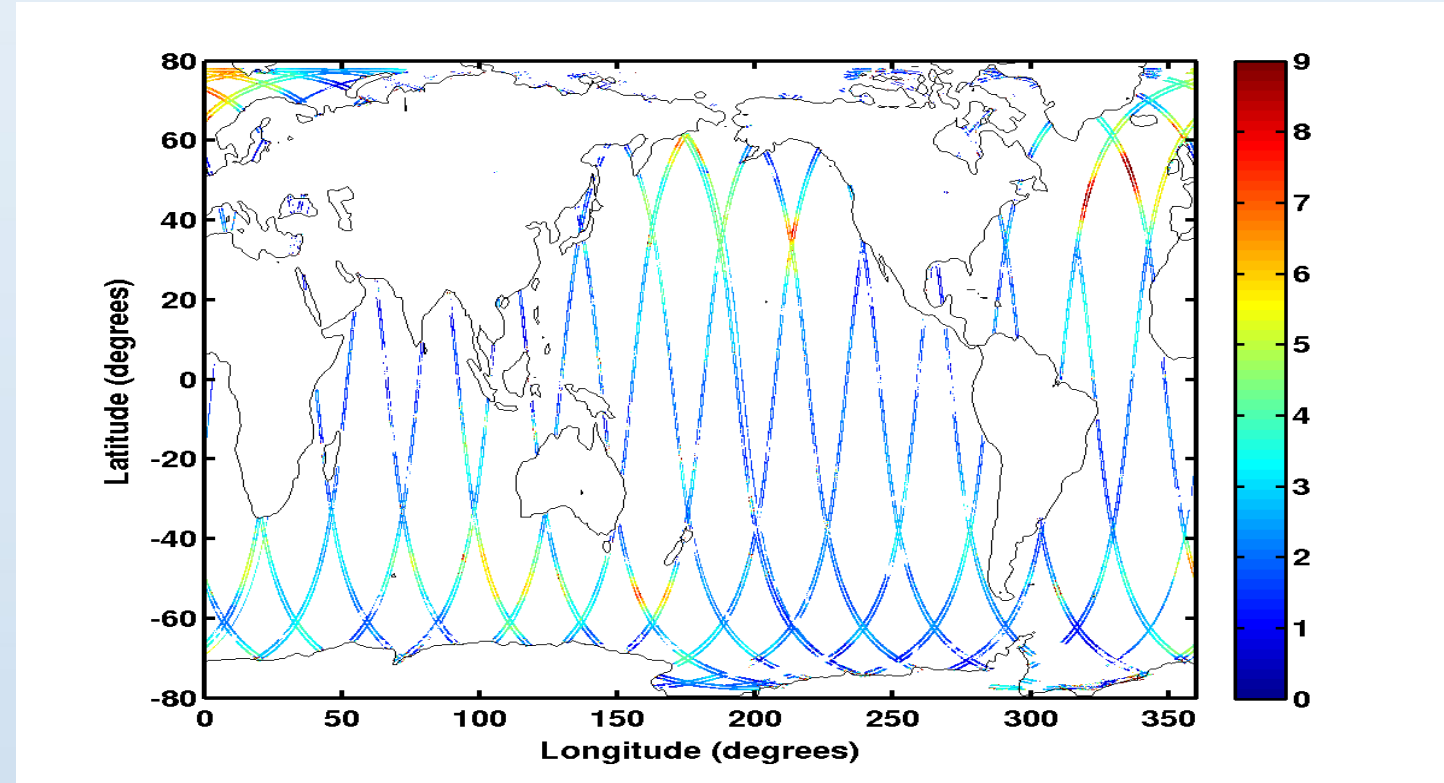
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 (1) Météo France, DIROP-CNRM, Toulouse, France



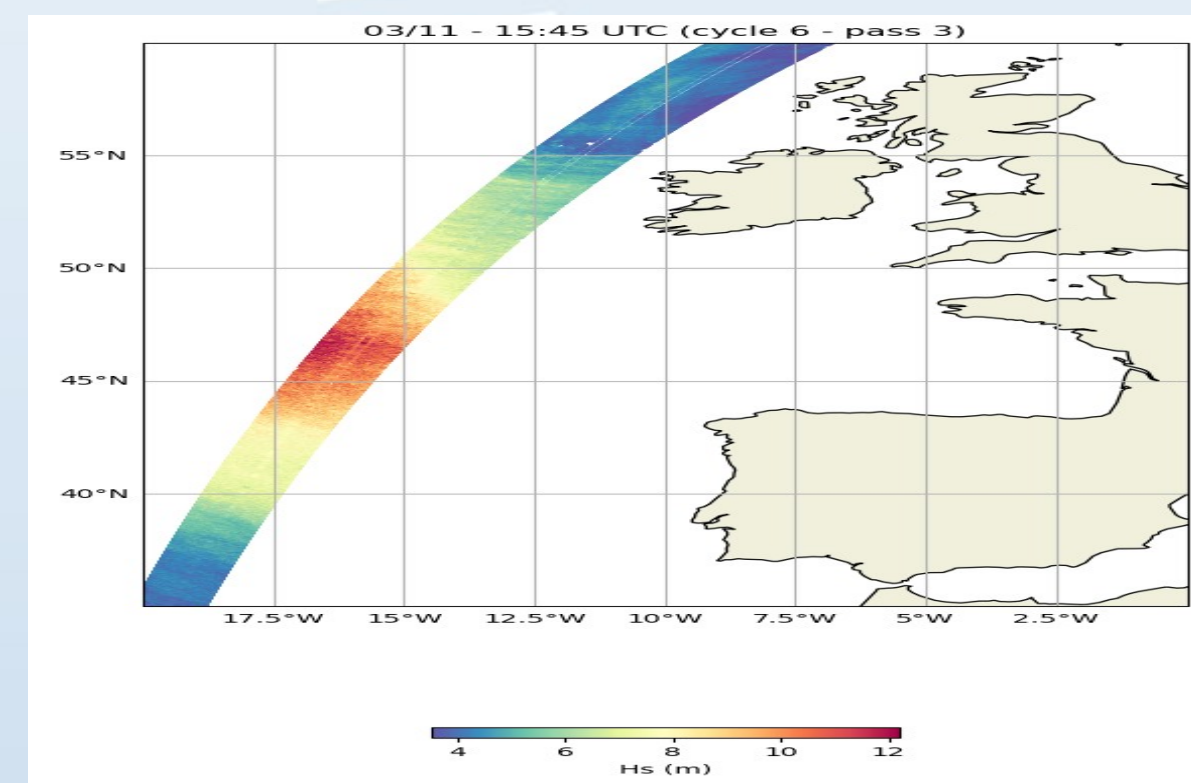
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- The 2D mapping of wave height with resolution of 2 km opens a very interesting perspectives for operational wave forecasting at global and regional scales. It has been shown that using such data can improve swell tracking since the generation at storms to coastal areas.
- This work aims to evaluate the assimilation of updated L2 processing (Bohe et al. 2025) of SWOT-swath wave height. Several model experiments with and without assimilation have been performed during January to March 2025.
- The assimilation experiments have been validated with independent wave data from nadir altimeters and available drifting buoys.

Exemple de restitution de SWH de SWOT-swath : 30 jan 2025



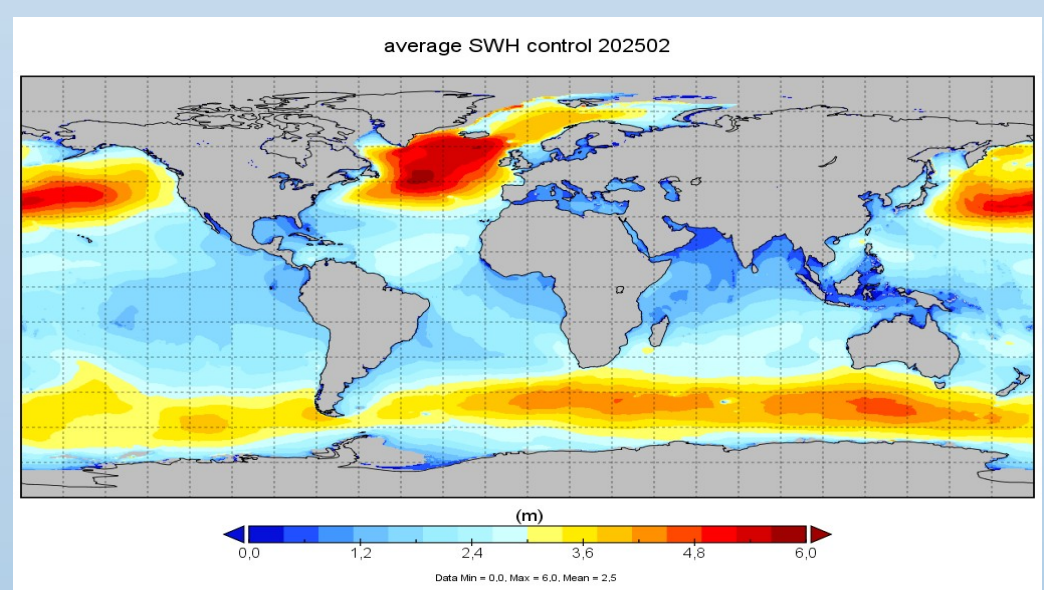
Exemple of retrieval of SWH from SWOT (nadir et Karin)



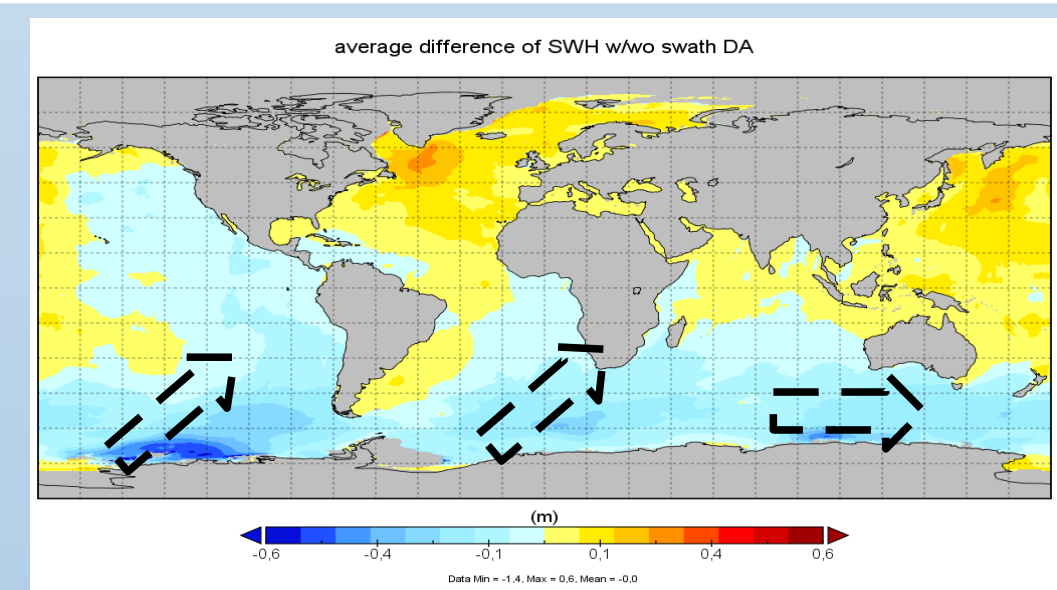
Impact of upgraded PIC2 processing for swath SWH of SWOT

February 2025

Average SWH (control run)

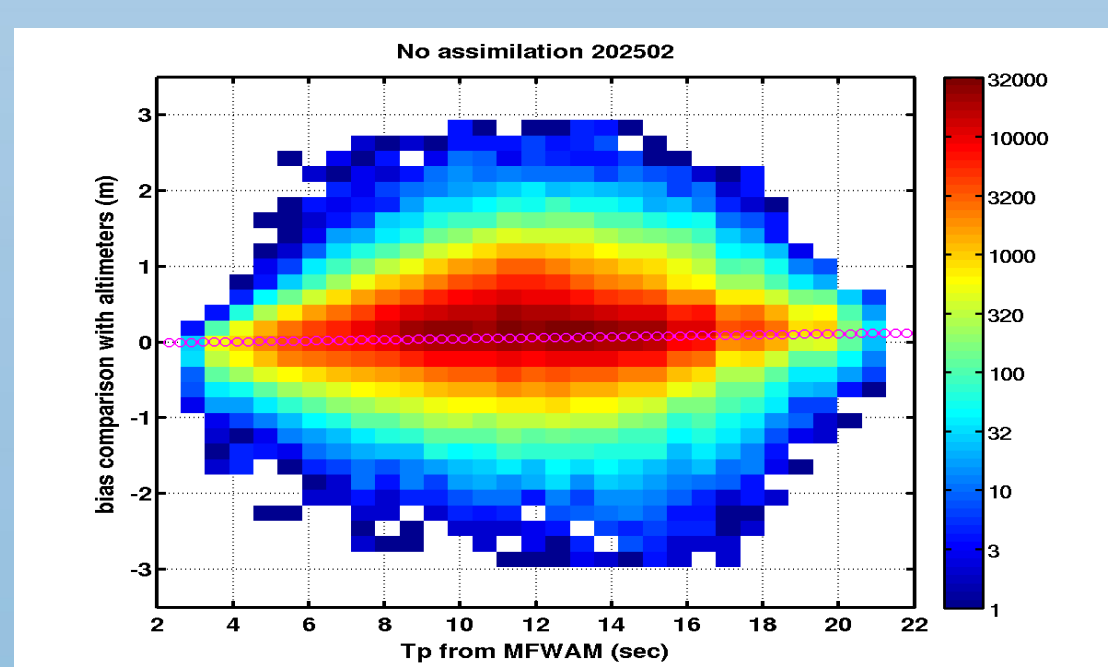


Average difference of SWH w/wo DA swath SWOT

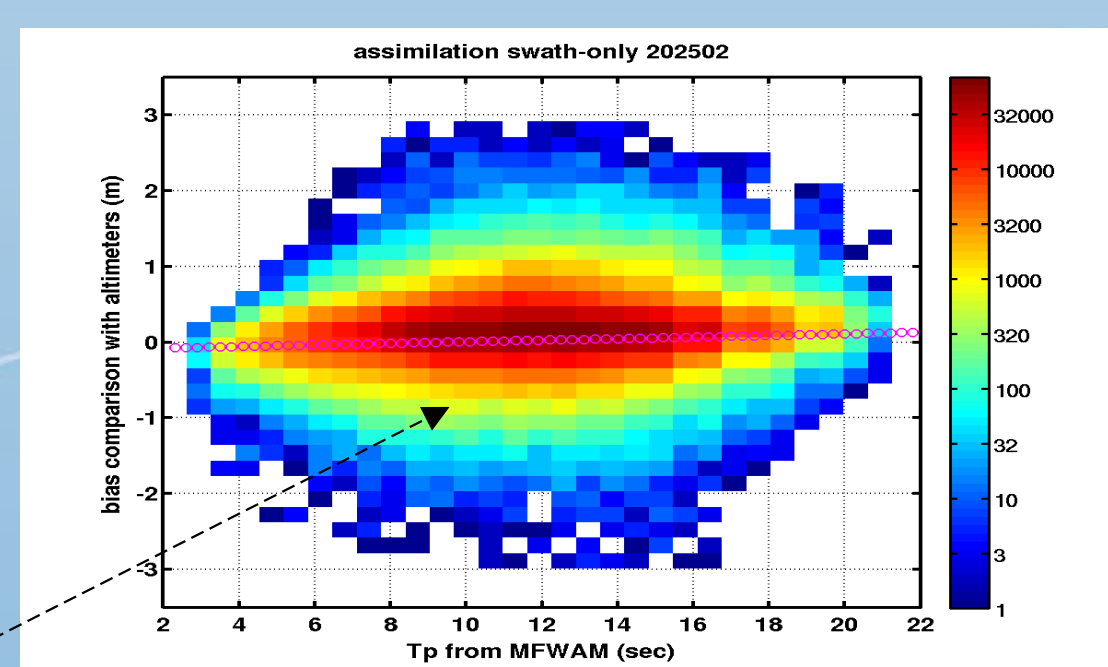


SWH bias variability with peak period

NOASSI



With DA of swath SWH



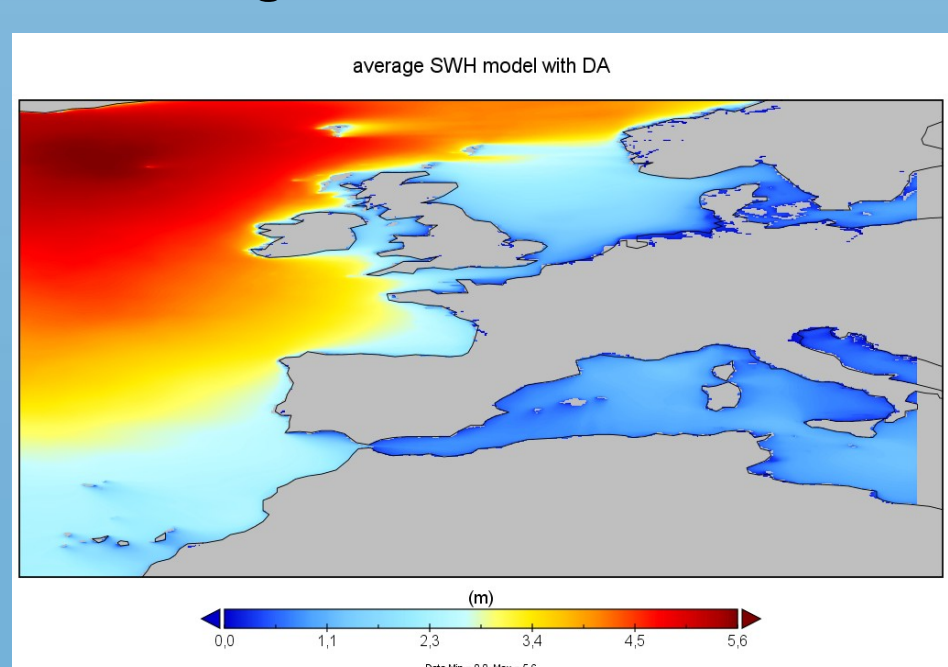
Reduced SWH bias for swell particularly for Tp greater than 10 sec

Slope=0.012
Intercept=-0.082

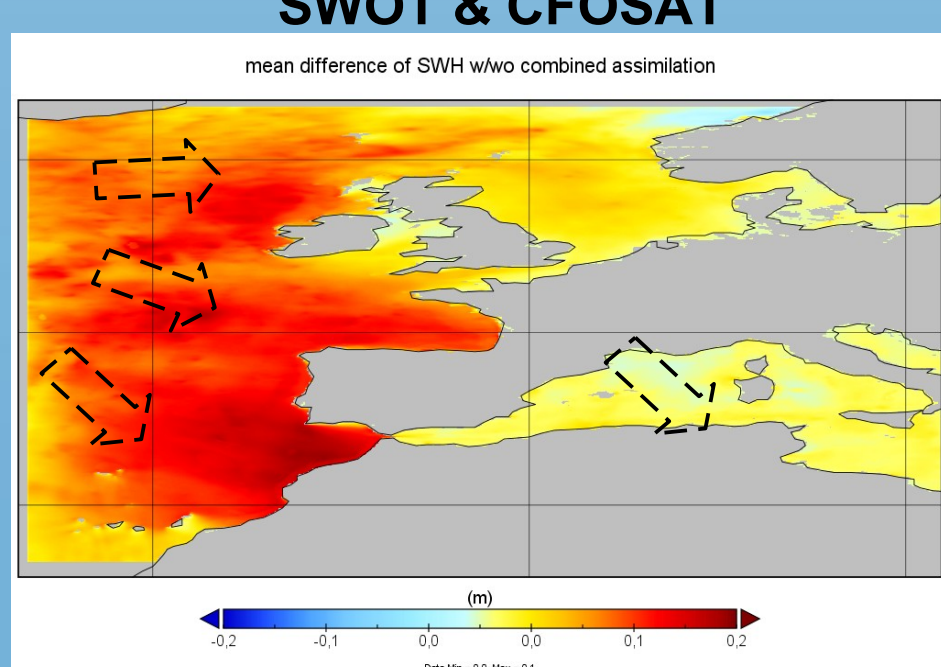
Assimilation of SWOT & CFOSAT in High resolution model : Feb. 202502

Simulation with MFWAM-IBI : 5 km grid size
ARPEGE atmospheric forcing

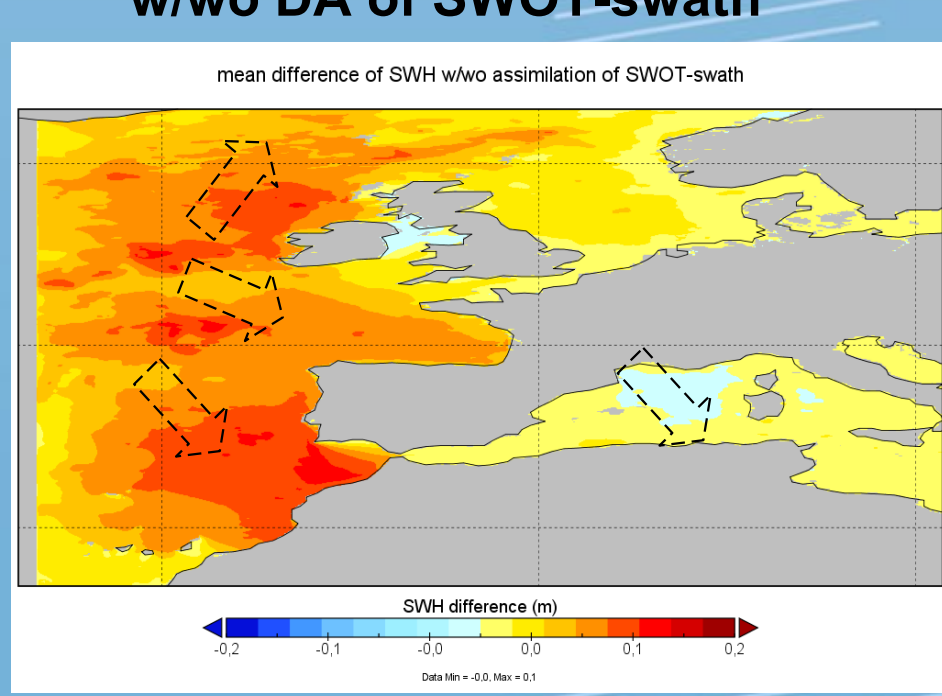
Average of SWH



Average difference of SWH w/wo DA of SWOT & CFOSAT



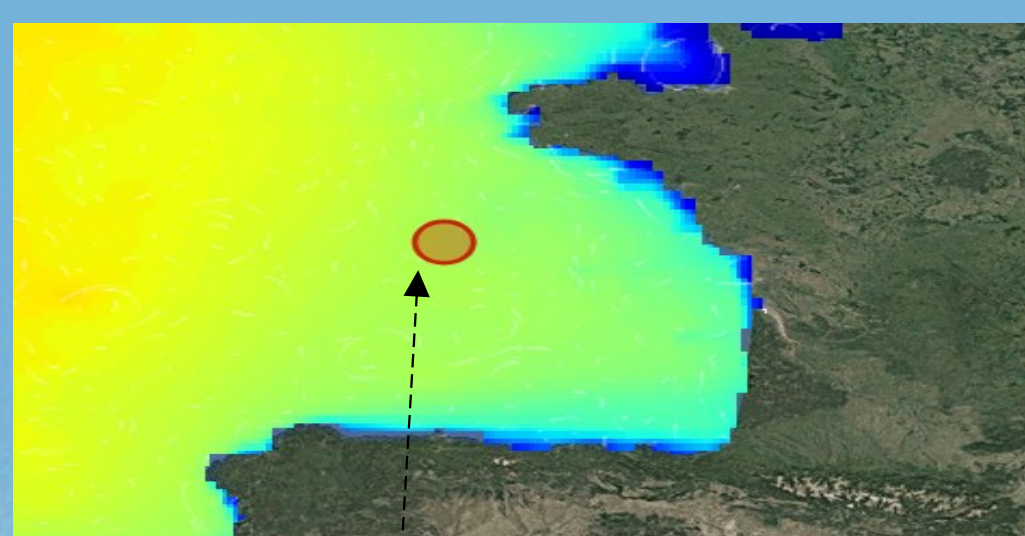
Average difference of SWH w/wo DA of SWOT-swath



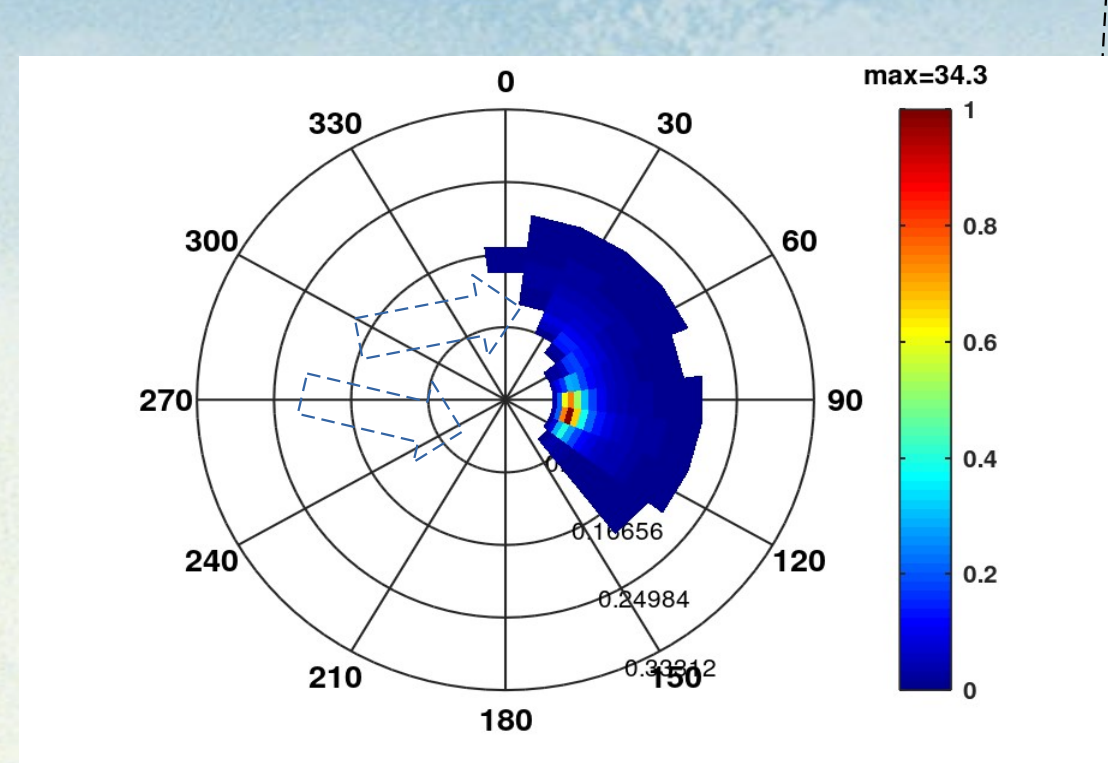
Enhanced impact on swell propagation tracks

Benefit of using SWOT & CFOSAT
Impact of spectral assimilation on 28 february 2025 at 18:00UTC

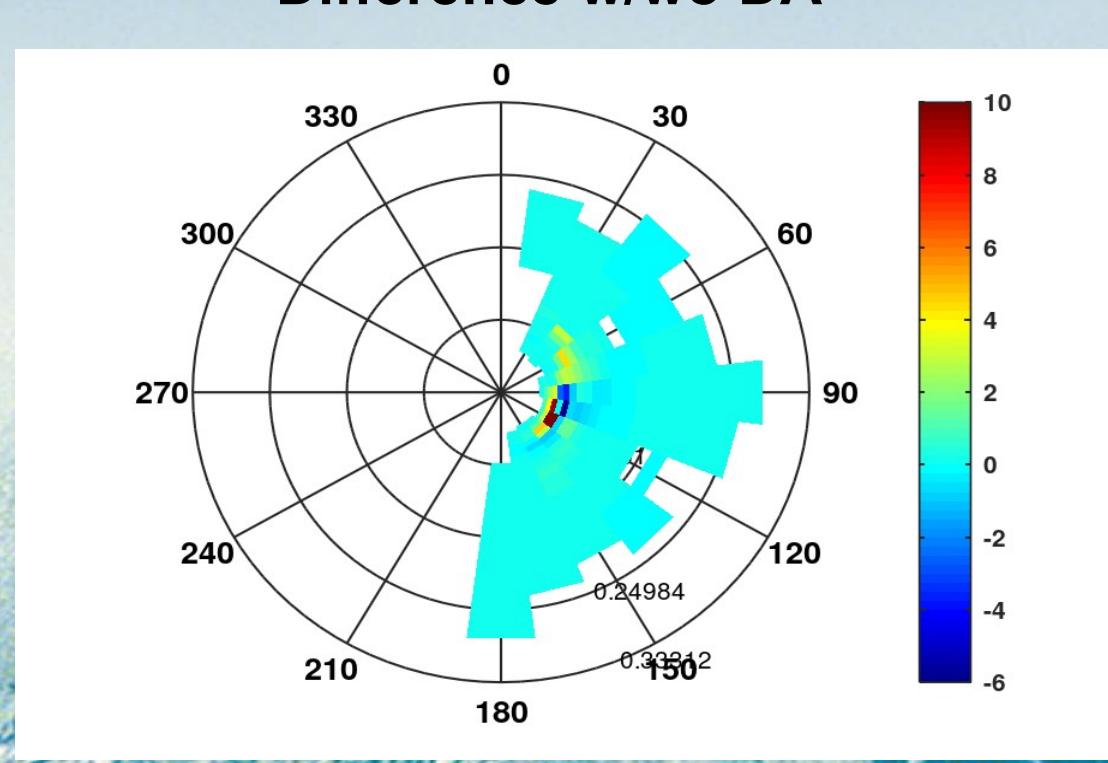
Location of wave spectrum : biscay



Wave spectrum with DA of SWOT & SWIM



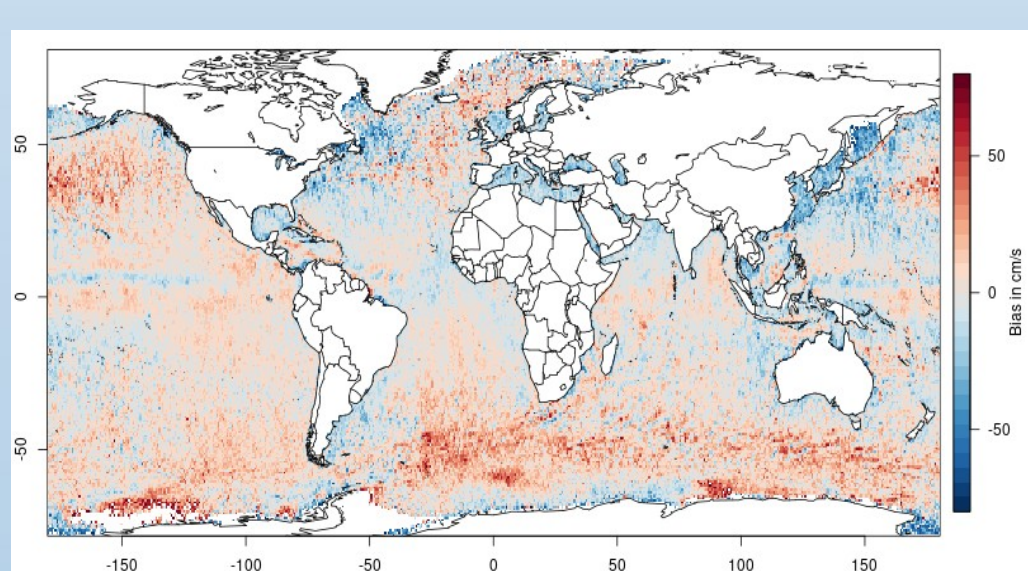
Difference w/wo DA



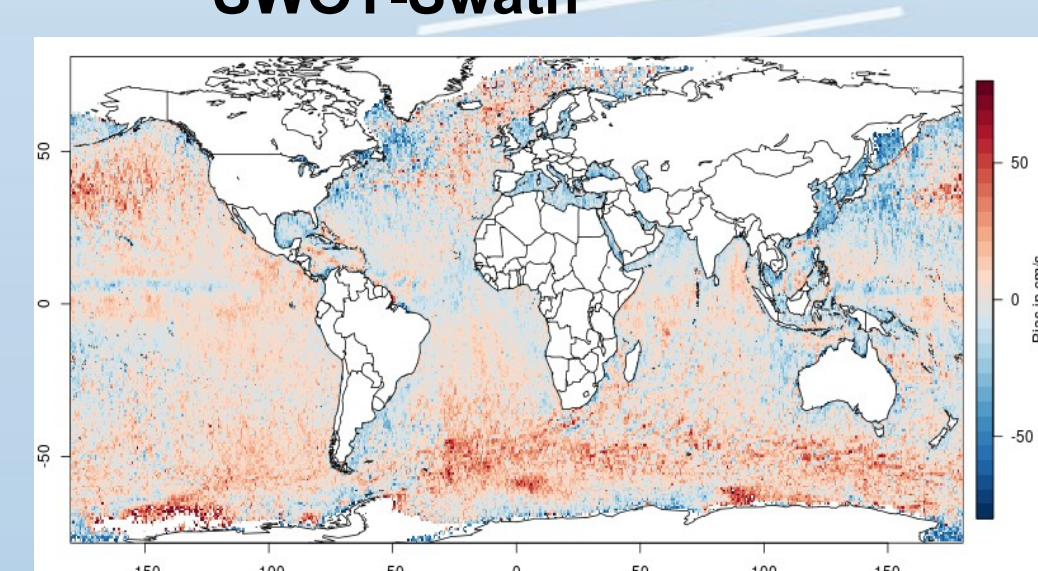
complex increment induced By Combined DA for gulf of biscay

Performance of the assimilation : Jan & Feb 2025

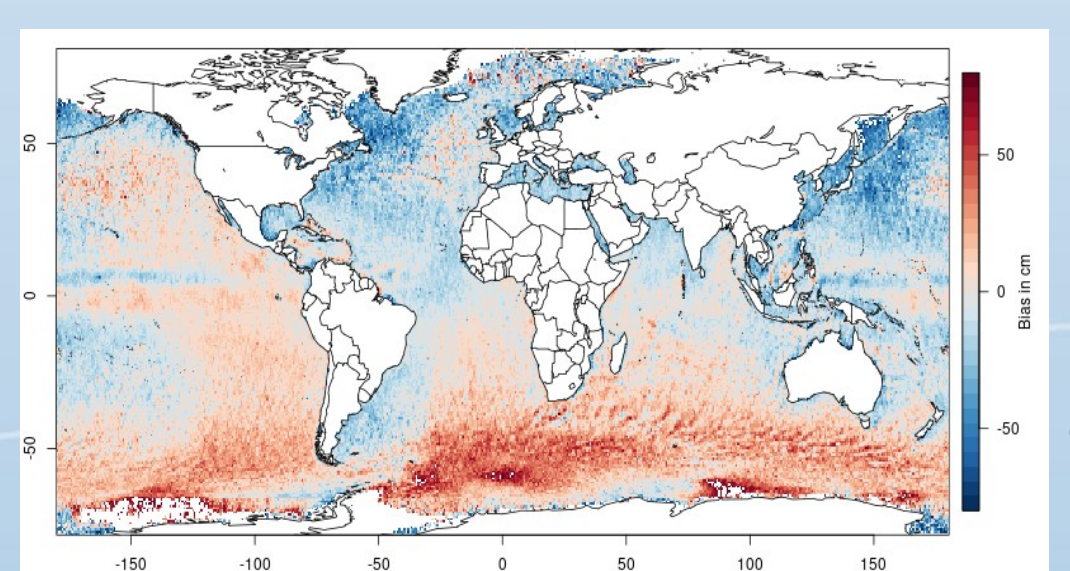
SWOT-nadir-swath



SWH bias maps (in cm) SWOT-Swath



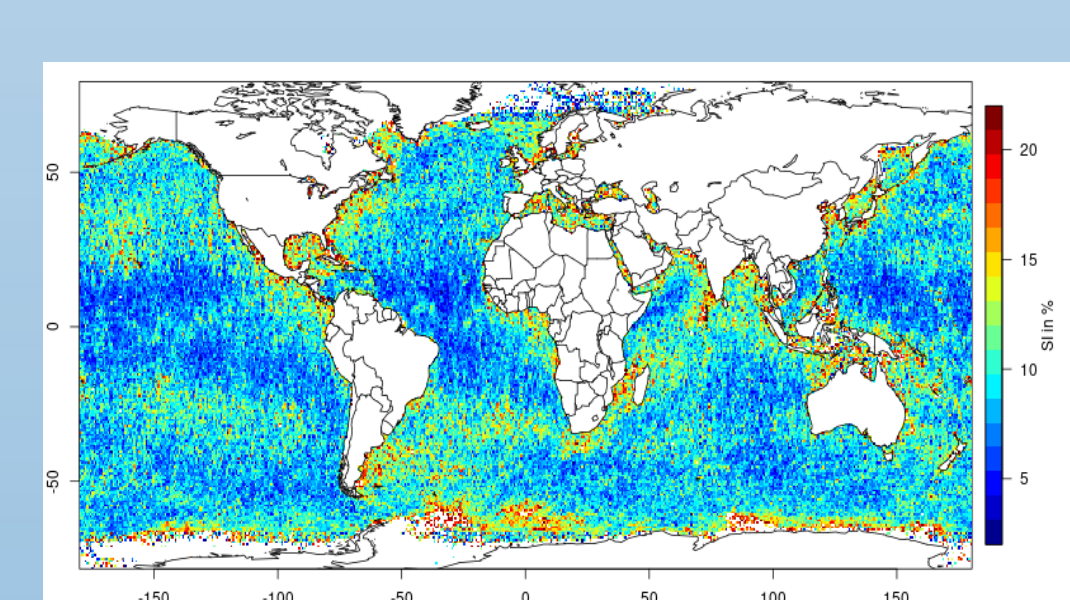
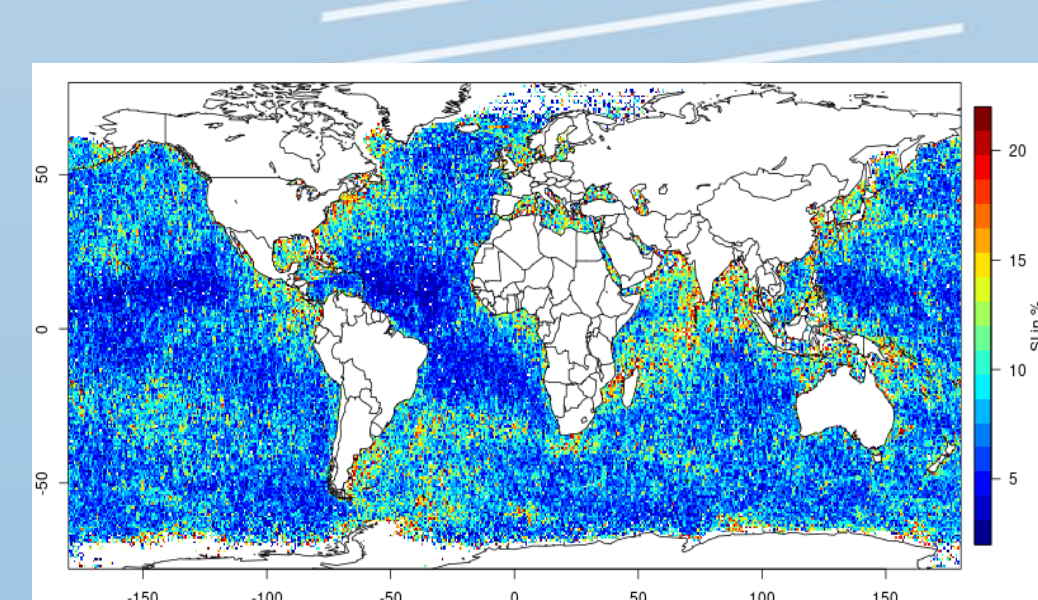
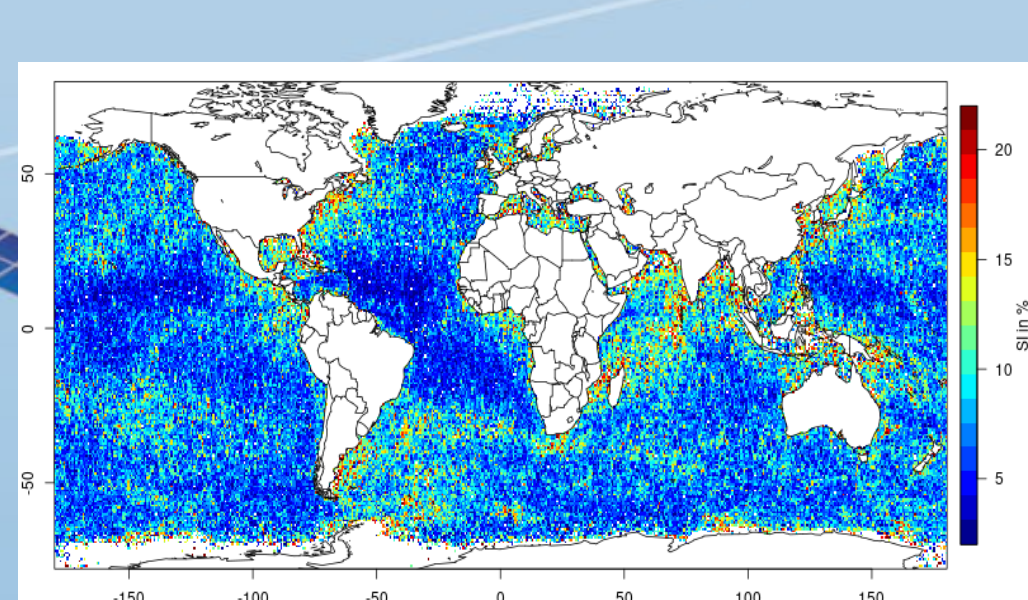
Without assimilation



Model overestimation In Southern Ocean and east pacific

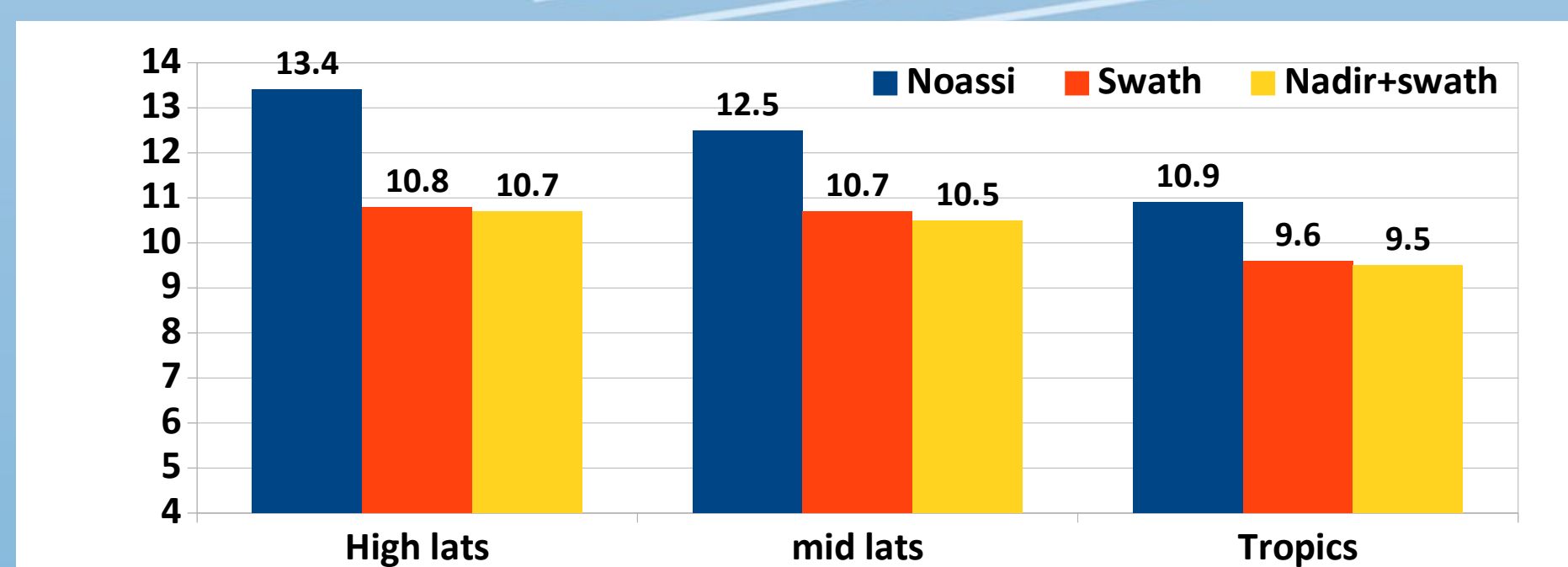
Enhanced reduction of bias when using DA nadir and swath SWH

Scatter index of SWH maps (in %)



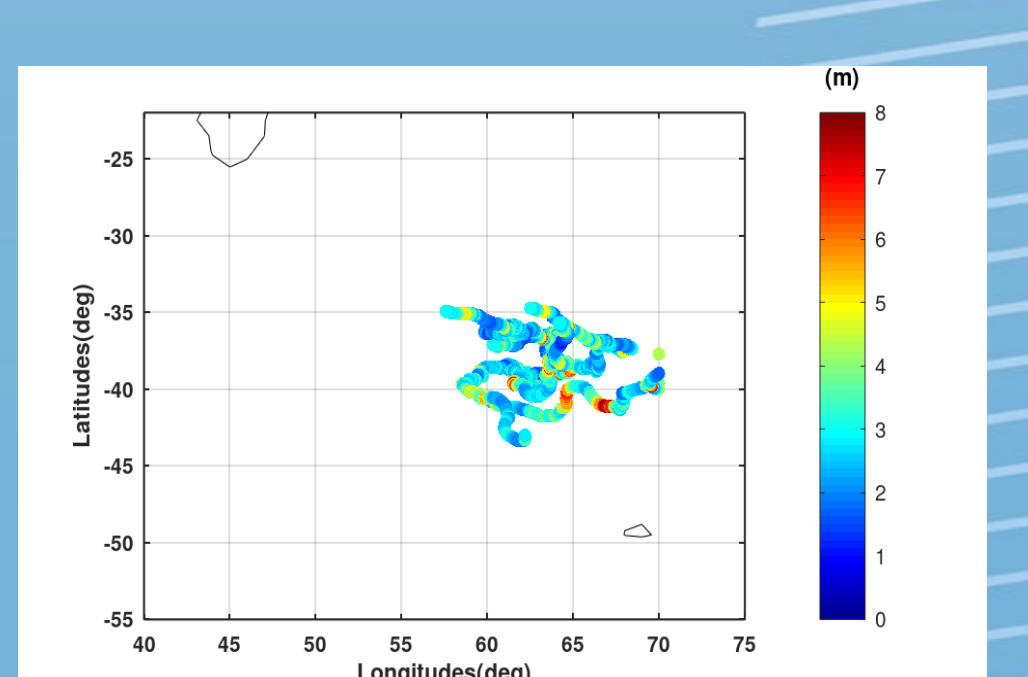
Validation with altimeters

Scatter index of SWH in different ocean basins

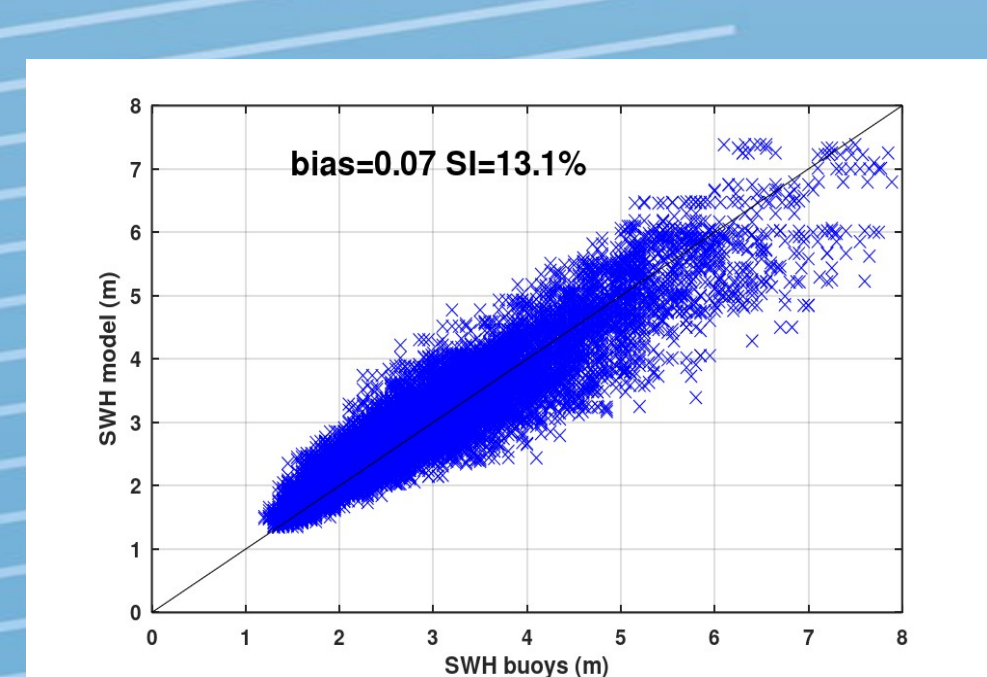


Validation with Melodi buoys in indian ocean

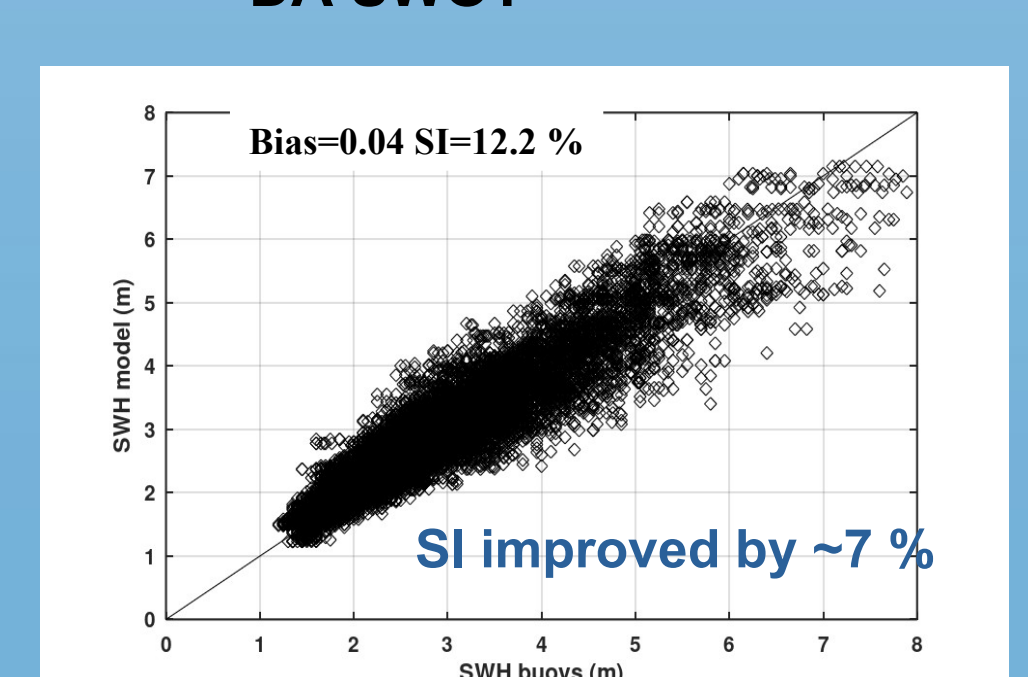
Melodi SWH and locations



Without assimilation

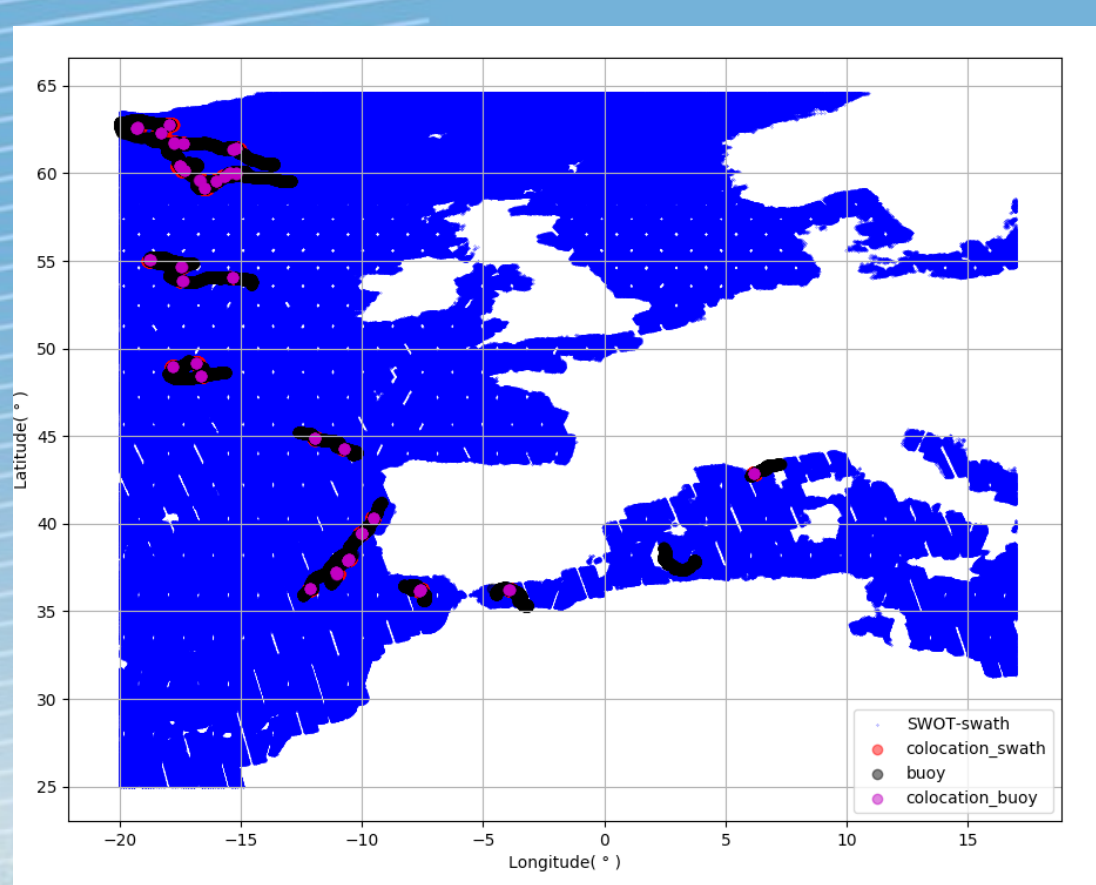


DA SWOT



Validation SWOT swath X melodi buoys time period: 09/05/2025 -09/06/2025

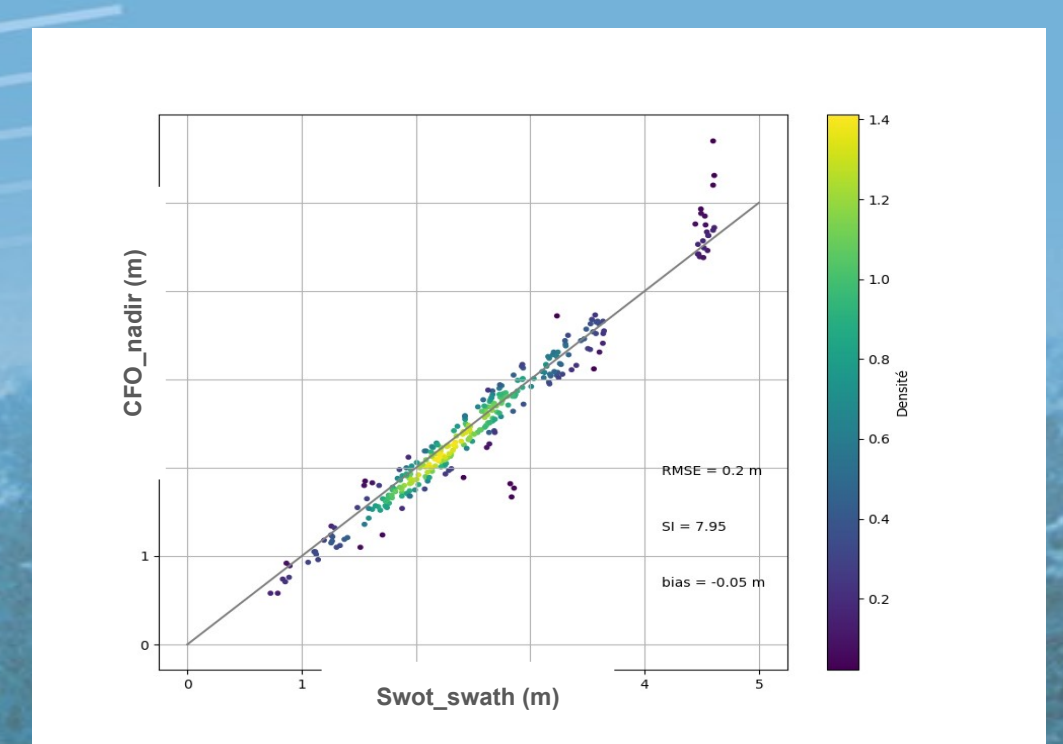
335 intersections



Statistical parameters on SWH

10 km	SI	BIAS
SWOT swath	20.71%	-0.22
SWOT nadir	25.61%	-0.1
CFO nadir	10%	-0.07

SWOT-swath x CFOSAT-nadir
Time window = +/- 30min
Distance window = 10.5 Km



Key messages

- The assimilation of updated SWOT-swath SWH improves significantly the estimate of SWH. The impact is slightly enhanced when using nadir and swath.
- Good reduction of bias and scatter index of SWH during January and february 2025. the comparison with melody buoys in indian ocean shows significant improvement of wave forecast.
- Very interesting combined assimilation of SWOT and CFOSAT data in high resolution wave model : enhanced impact on swell propagation and coastal regions.
- Recent validation of SWOT-swath with Melodi buoys shows larger bias and scatter index during May 2025. Ongoing investigations on the quality control of SWOT-swath and melodi buoys.