

Jason-3 GDR-F mission performances over ocean

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Ocean Surface Topography Science Team (OSTST) Meeting



Nov. 7 to Nov. 11, 2023

📍 SAN JUAN, PUERTO RICO

1. GDR-F mission performances over ocean
2. GDR-F adaptive retracker outputs vs MLE4
3. Ongoing work on improvements and conclusions



1. GDR-F mission performances over ocean

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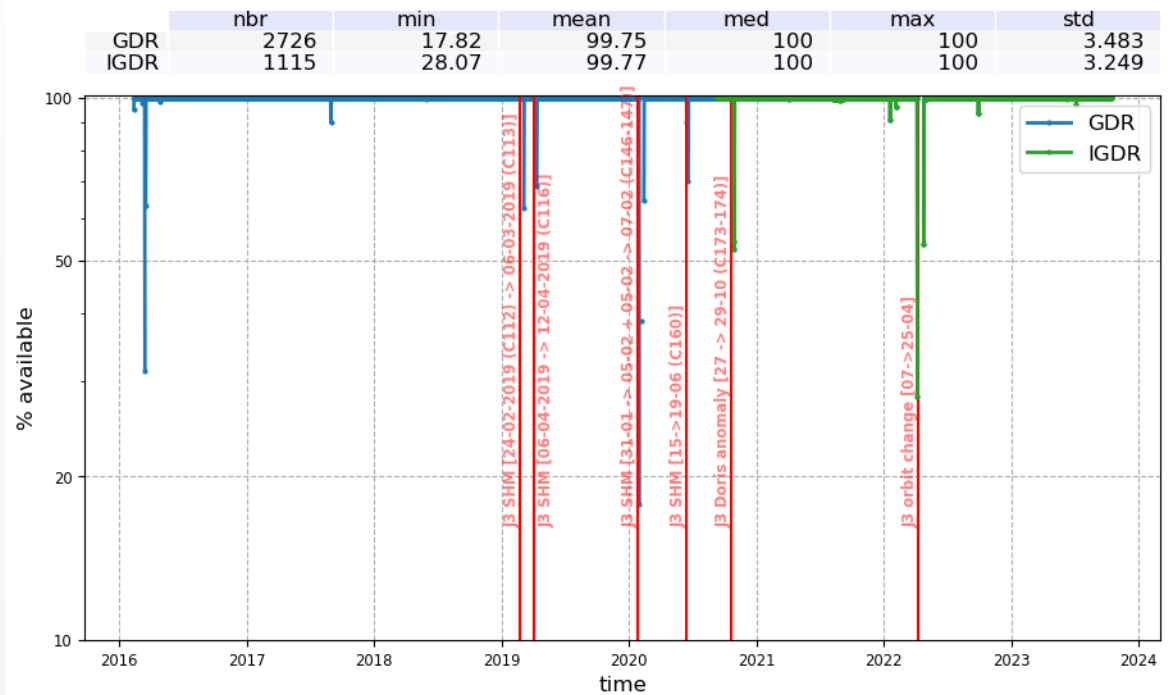


Data availability at 1Hz

Very good data availability over ocean

99.75 % calibrations included, without SHM and DEM patch uploads

Available data over ocean - Percentage per day



Sea Level Performances at 1Hz

SSH error is deduced from crossovers analyses using radiometer data : 3,4cm

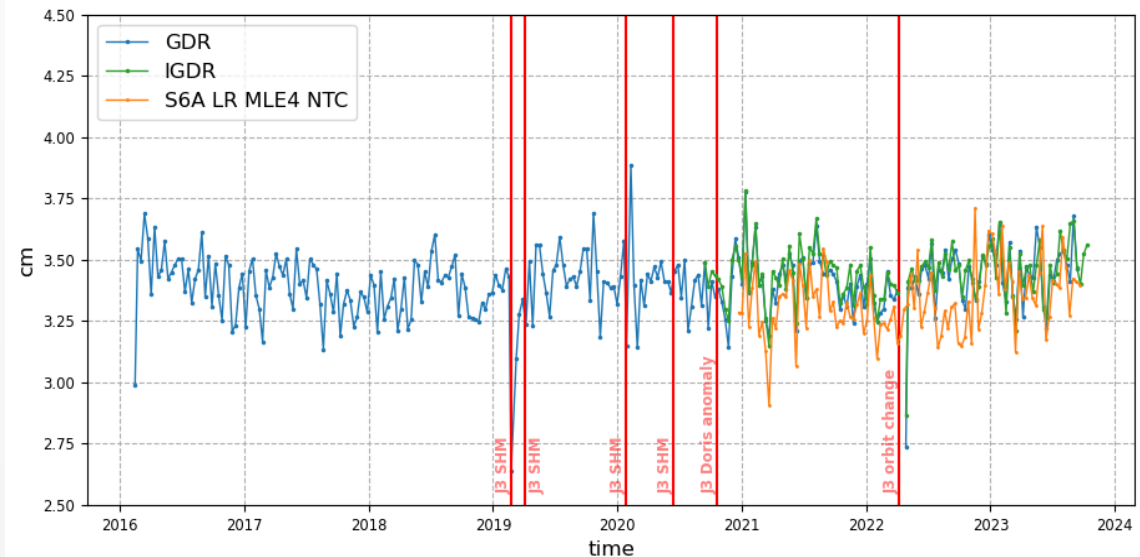
Sentinel-6 shows a higher stability in the BOL but this improvement is reduced from 2023.

selecting :

- $|\text{latitudes}| < 50^\circ$
- bathy < -1000m
- oceanic variability < 20 cm

SSH difference at crossover (cm) - Error per cycle
(sel. $|\text{lat}| < 60^\circ$, bathy. < -1000m, ocean var < 0.2m)

	nbr	min	mean	med	max	std
GDR	279	2.636	3.401	3.416	3.883	0.1322
IGDR	113	2.866	3.443	3.453	3.779	0.1175
S6A LR MLE4 NTC	102	2.905	3.33	3.315	3.709	0.1367



SSH differences at crossovers at 1Hz

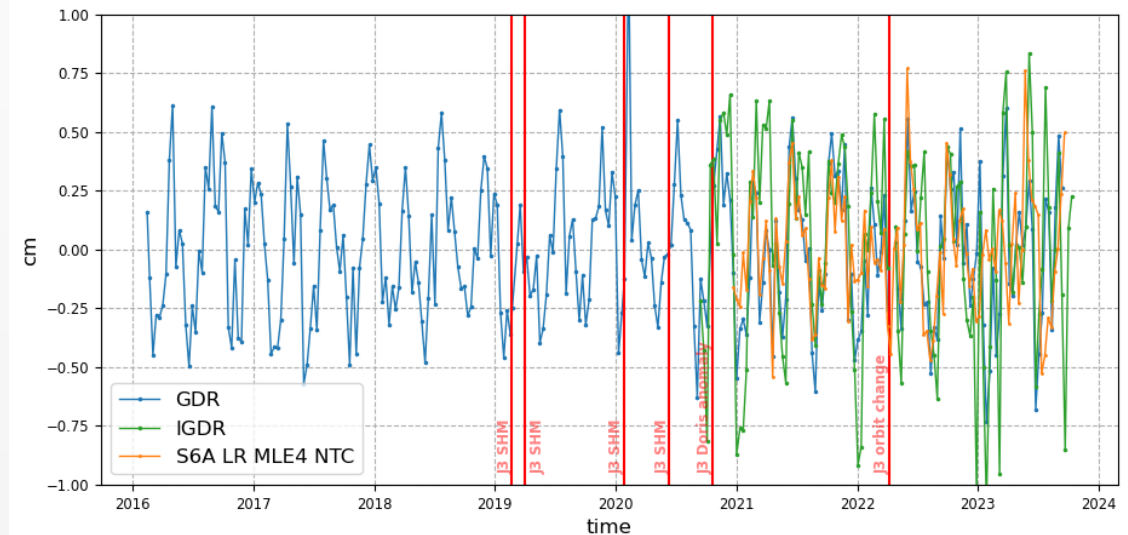
Very close to zero in average.

Sentinel-6 shows a slightly higher stability.

Small 120 days signal at crossovers, present for both missions.

SSH difference at crossover (cm) - Mean per cycle
(sel. $|\text{lat}| < 60^\circ$, bathy. $< -1000\text{m}$, ocean var $< 0.2\text{m}$)

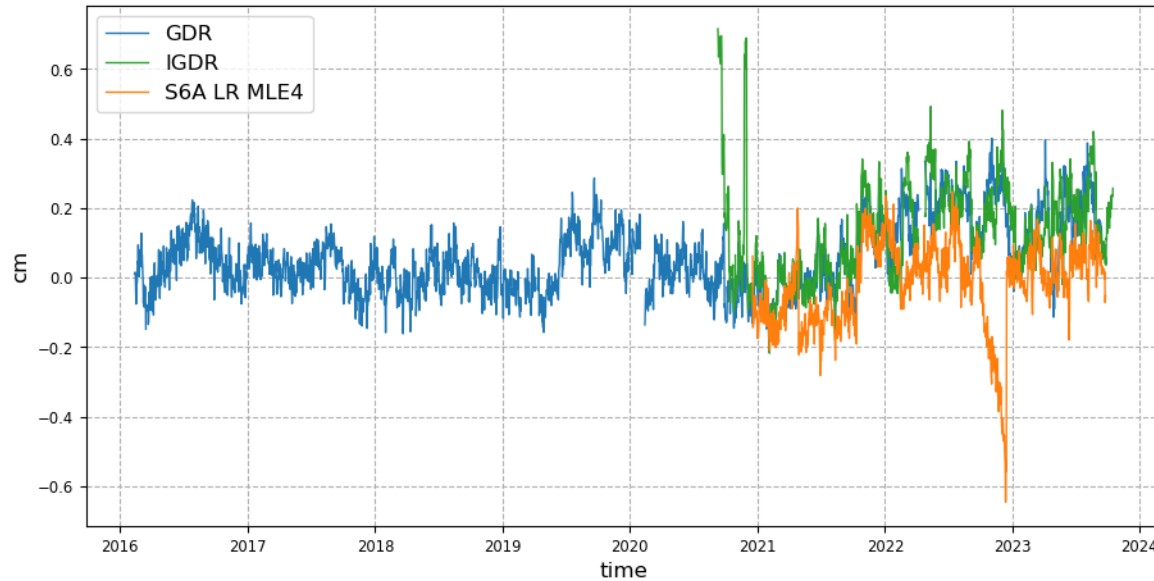
	nbr	min	mean	med	max	std
GDR	279	-0.7342	-0.01038	-0.02773	1.272	0.3004
IGDR	113	-1.079	0.00803	0.04506	0.8341	0.4367
S6A LR MLE4 NTC	102	-0.5446	-0.006354	-0.01383	0.7688	0.2558



AMR monitoring

Radiometer minus model wet troposphere - Mean per day (cm)

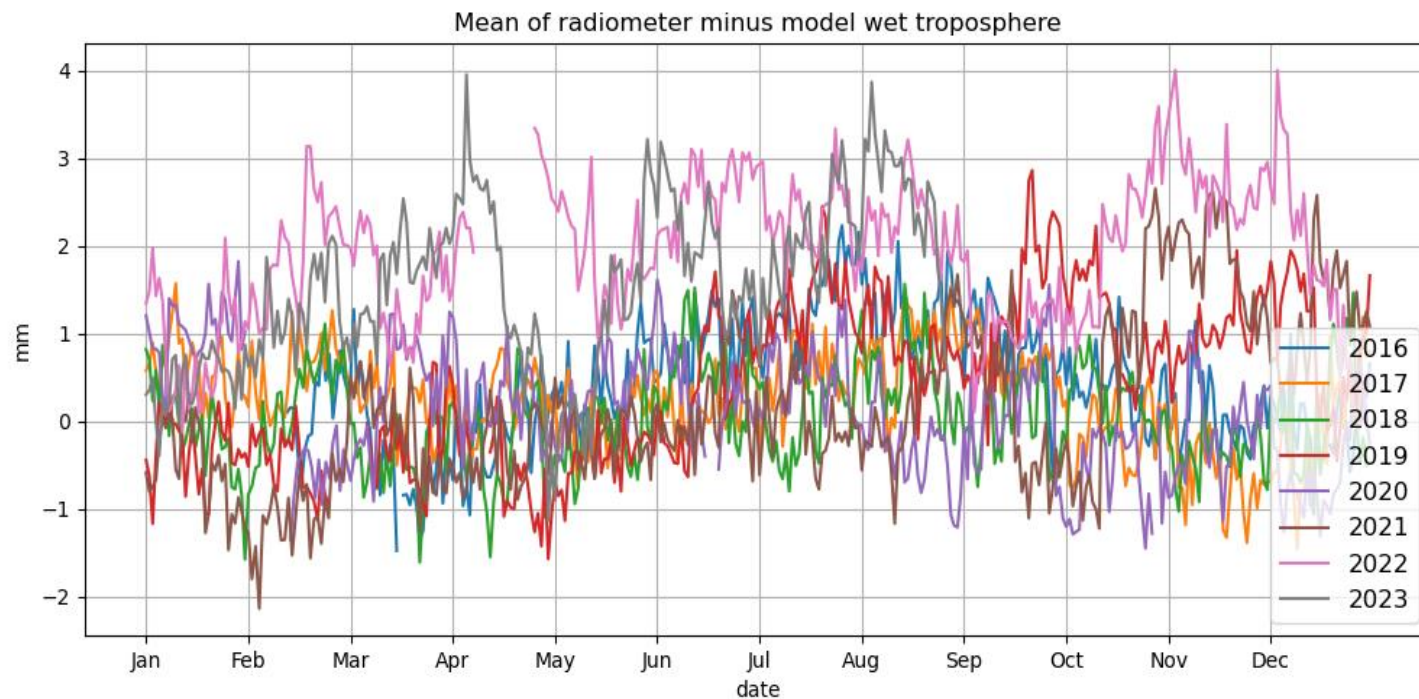
	nbr	min	mean	med	max	std
GDR	2726	-0.214	0.05734	0.0425	0.4009	0.1011
IGDR	1115	-0.2171	0.133	0.1228	0.7158	0.1419
S6A LR MLE4	1012	-0.6452	-0.01897	0.001742	0.2469	0.123



Good stability of radiometer minus ECMWF model WTC.

Drift identified for Jason-3 (~-0.5mm/yr) and some investigations are still ongoing to fix this.

AMR monitoring



Great stability of radiometer minus ECMWF model WTC over 2016 to 2021 :

- Strong increase in 2022 due to new version of ECMWF model and radiometer drift
- Back to performances previously observed in 2023

1. GDR-F mission performances over ocean

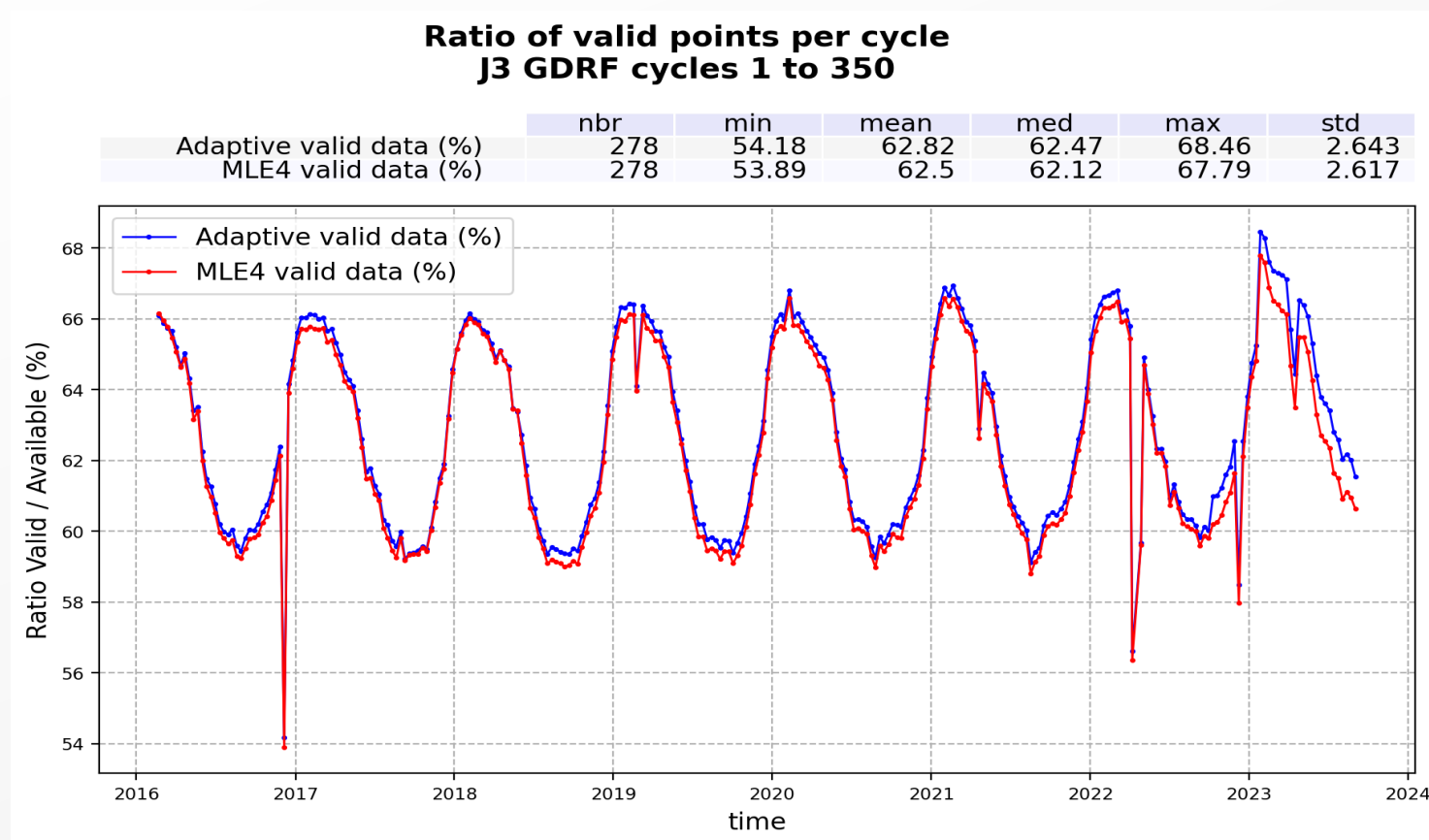
2. GDR-F adaptive retracker outputs vs MLE4

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1Hz data selection

Global valid data rate from GDR-F dataset against retracking solution (same thresholds applied to both solutions).
The level of valid data with **adaptive** retracking outputs (**62,82%**) is slightly higher than **mle4** rate (**62,5%**) .

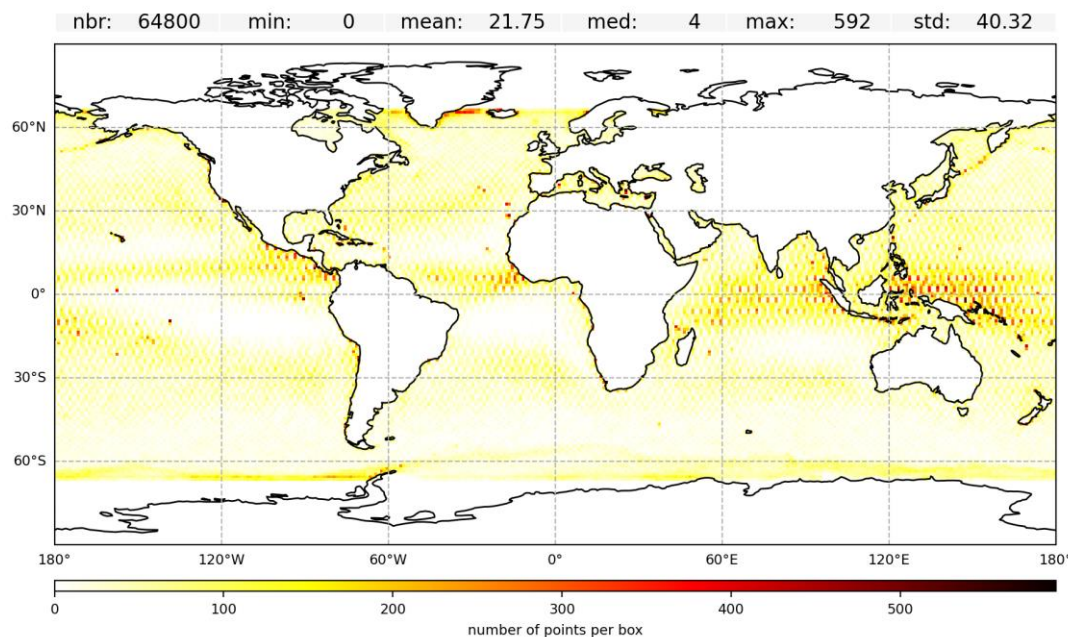


1Hz data selection

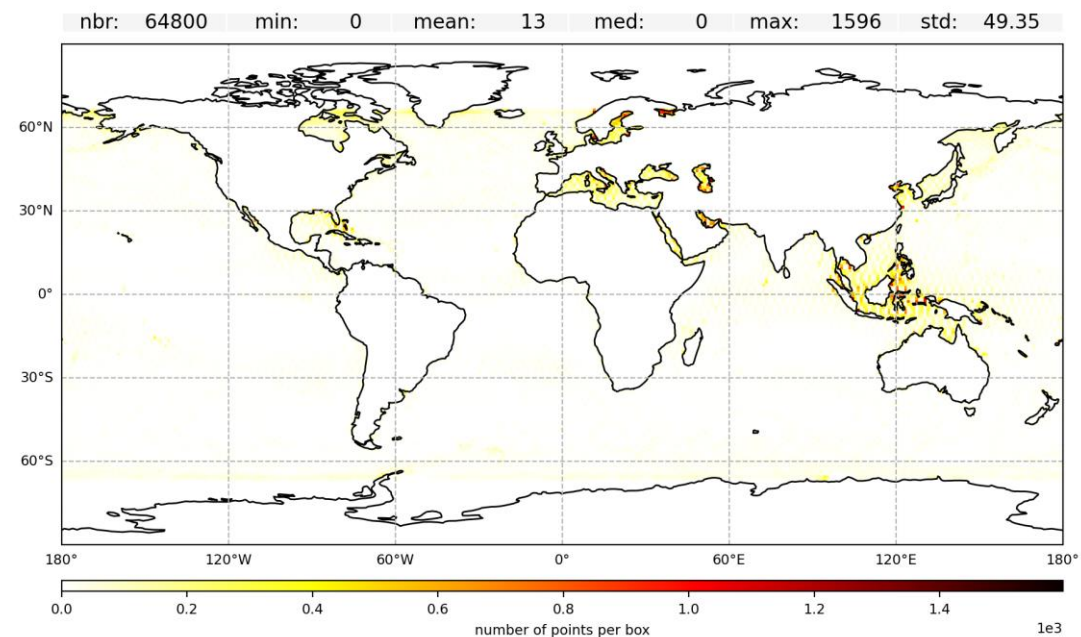
Difference in rejected points from GDR-F adaptive SLA vs MLE4 SLA over 7 years on historical ground track:

MLE4 data are globally more rejected than adaptive data over low swh and rain areas (mainly thanks to σ_0 rms decrease with adaptive wrt mle4)

Number of measurements valid for GDR-F adaptive and invalid for GDR-F MLE4
J3 GDRF cycles 1 to 329



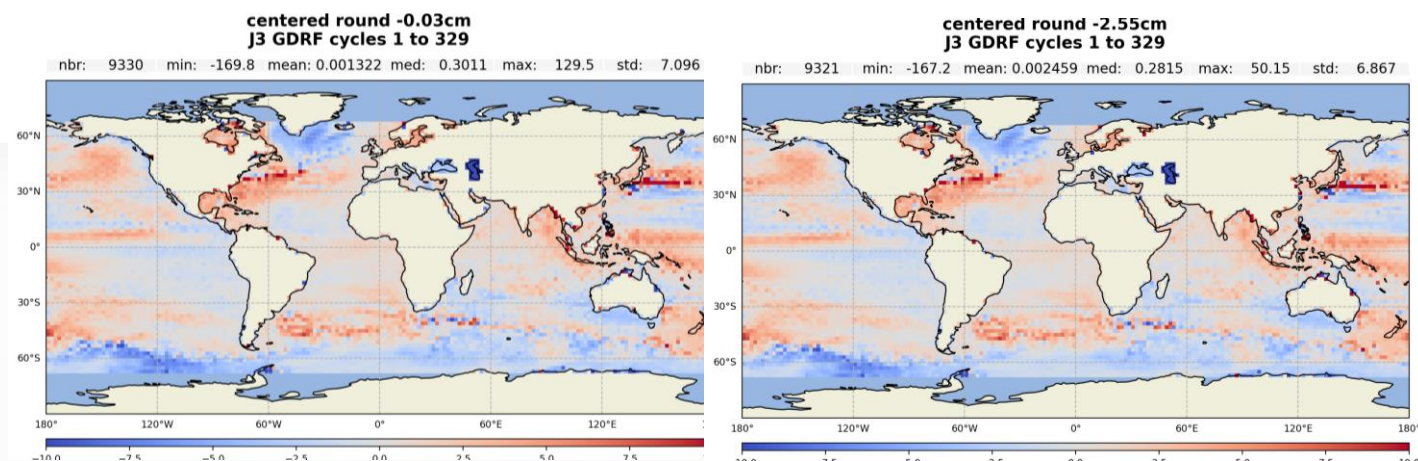
Number of measurements valid for GDR-F MLE4 and invalid for GDR-F adaptive
J3 GDRF cycles 1 to 329



Adaptive / MLE4 SLA biases

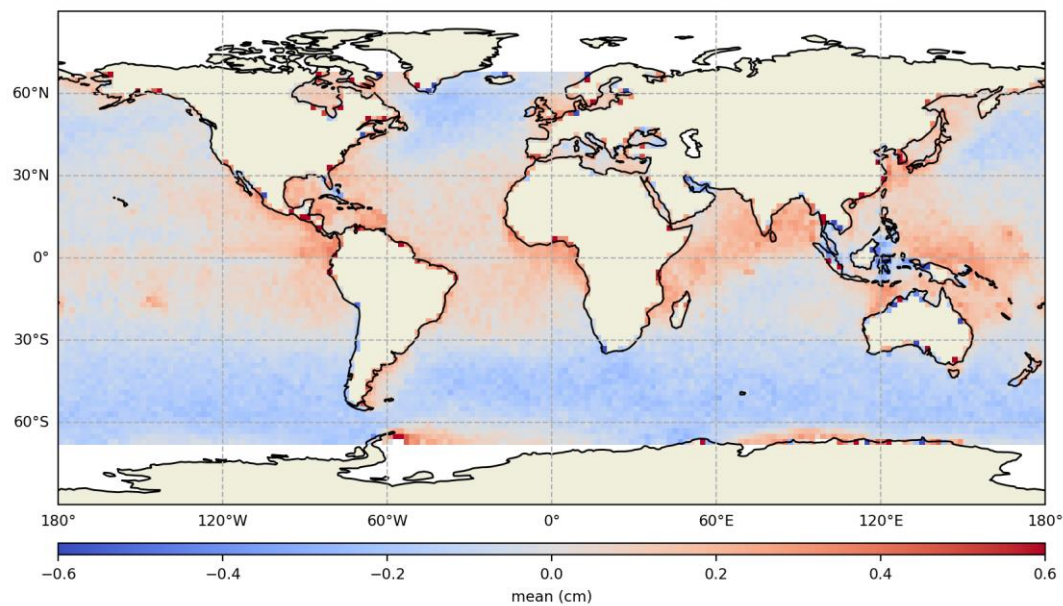
Global bias from MLE4 to adaptive SLA
round -2.5 cm

Regional biases up to few mm



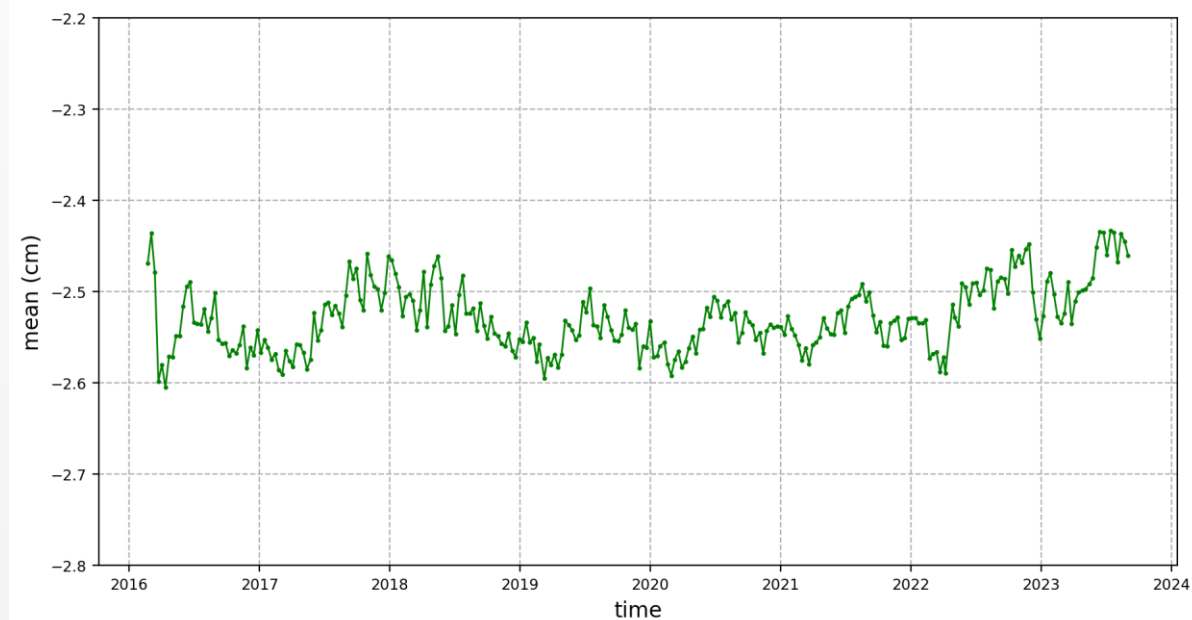
MEAN(SLA with GDR-F ADAPTIVE) - MEAN(SLA with GDR-F MLE4)
(common valid points)
centered round -2.5cm
J3 GDRF cycles 1 to 329

nbr: 9297 min: -15.64 mean: -0.01116 med: -0.0178 max: 16.04 std: 0.2973



MEAN(SLA with GDR-F ADAPTIVE) - MEAN(SLA with GDR-F MLE4) per cycle
(common valid points)
J3 GDRF cycles 1 to 350

nbr: 278 min: -2.605 mean: -2.529 med: -2.534 max: -2.433 std: 0.0362

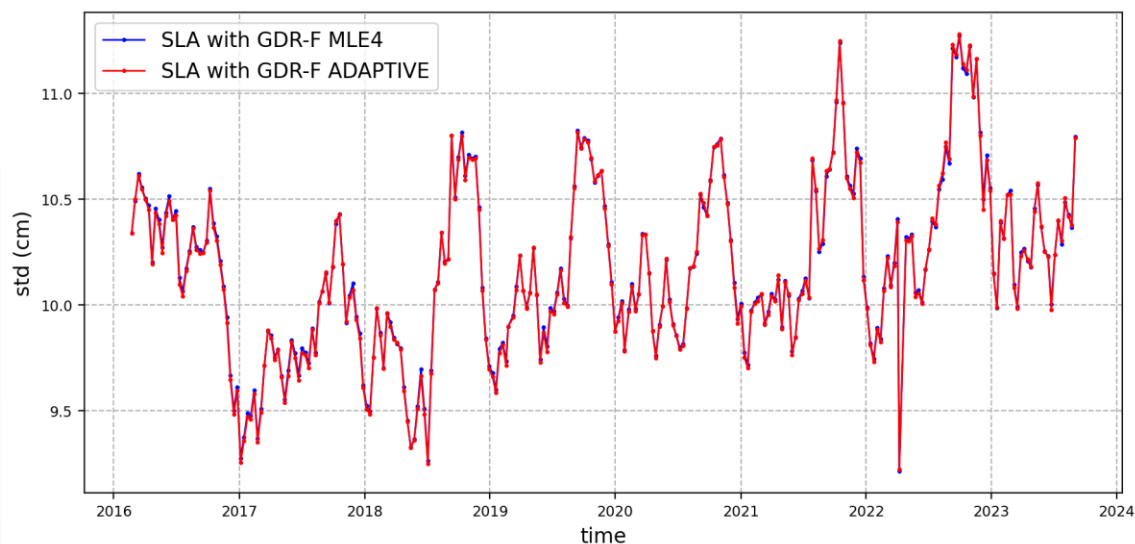


Along-track SLA performance

Variance of along track SLA shows a slight noise reduction for the **adaptive**

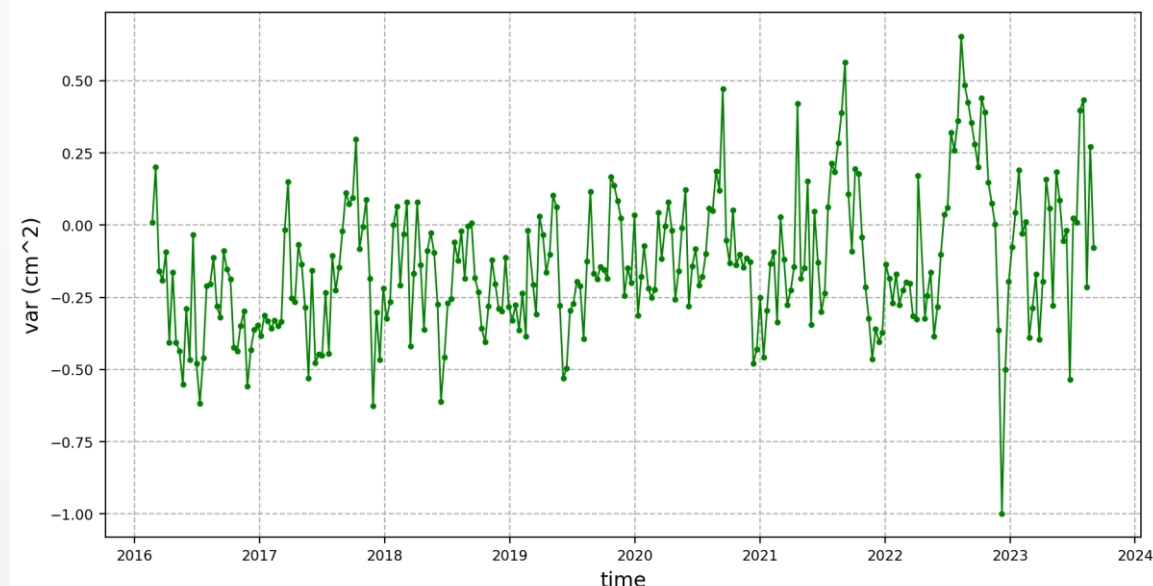
**Compare standard-deviation
(common valid points)
J3 GDRF cycles 1 to 350**

	nbr	min	mean	med	max	std
SLA with GDR-F MLE4	278	9.213	10.17	10.12	11.27	0.4014
SLA with GDR-F ADAPTIVE	278	9.223	10.16	10.11	11.28	0.406



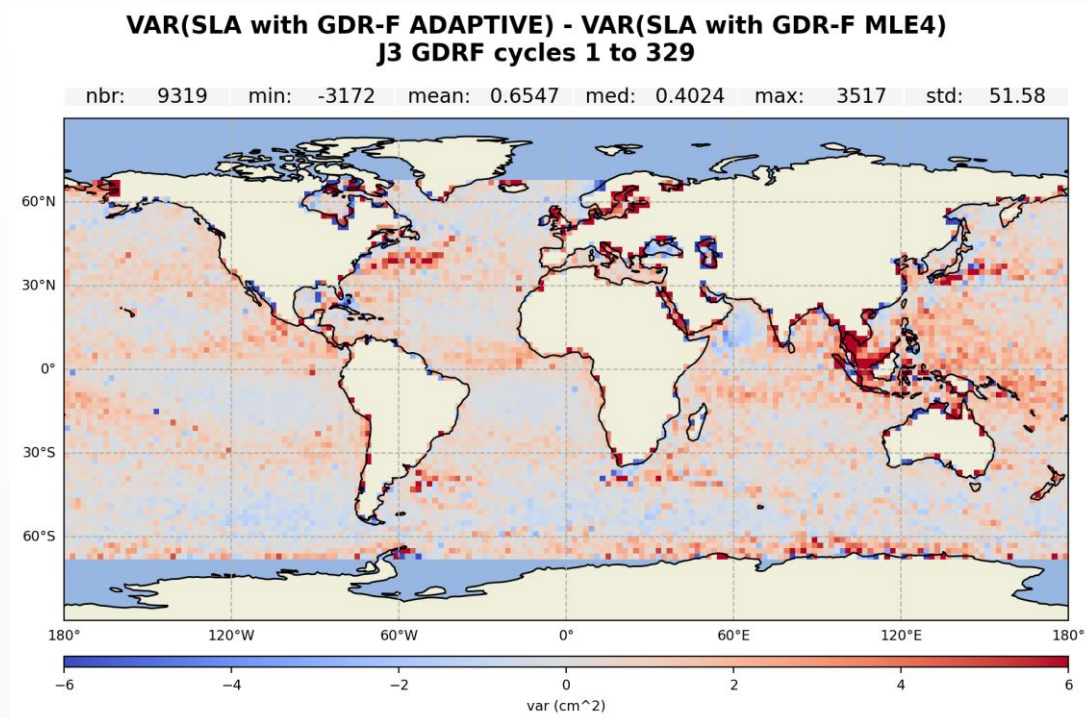
**VAR(SLA with GDR-F ADAPTIVE) - VAR(SLA with GDR-F MLE4)
(common valid points)
J3 GDRF cycles 1 to 350**

nbr: 278 min: -0.9985 mean: -0.1381 med: -0.1632 max: 0.6524 std: 0.2383

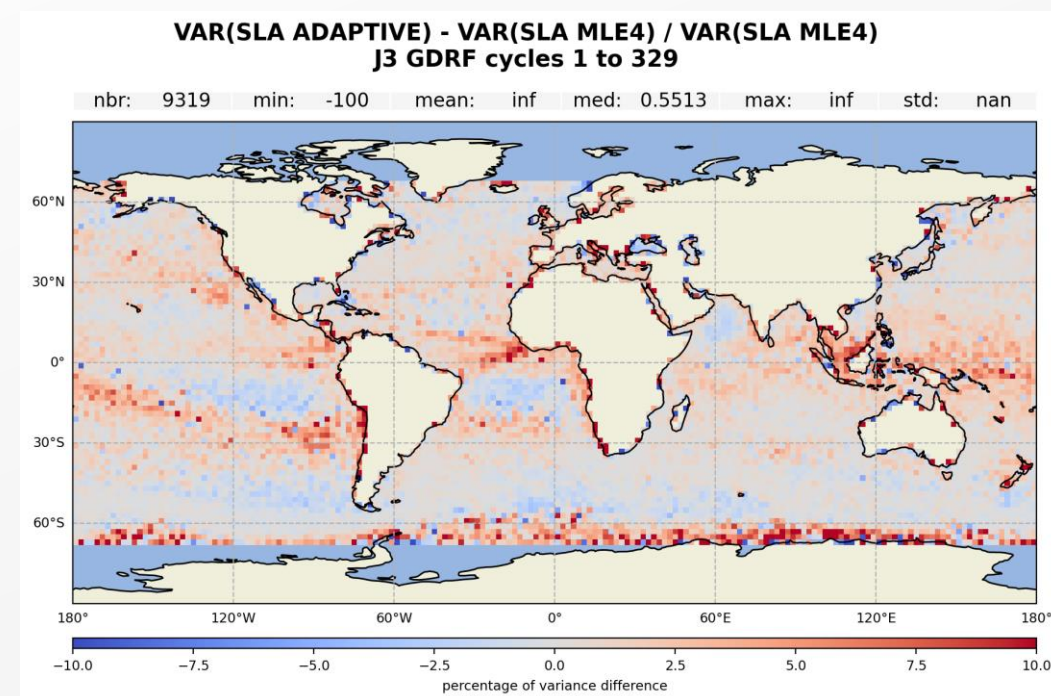


Along-track SLA performance

SLA variance difference visible over oceanic currents



Regional SLA variance reduction rate (blue) from MLE4 to adaptive
(wrt variance of SLA with GDR-F MLE4)



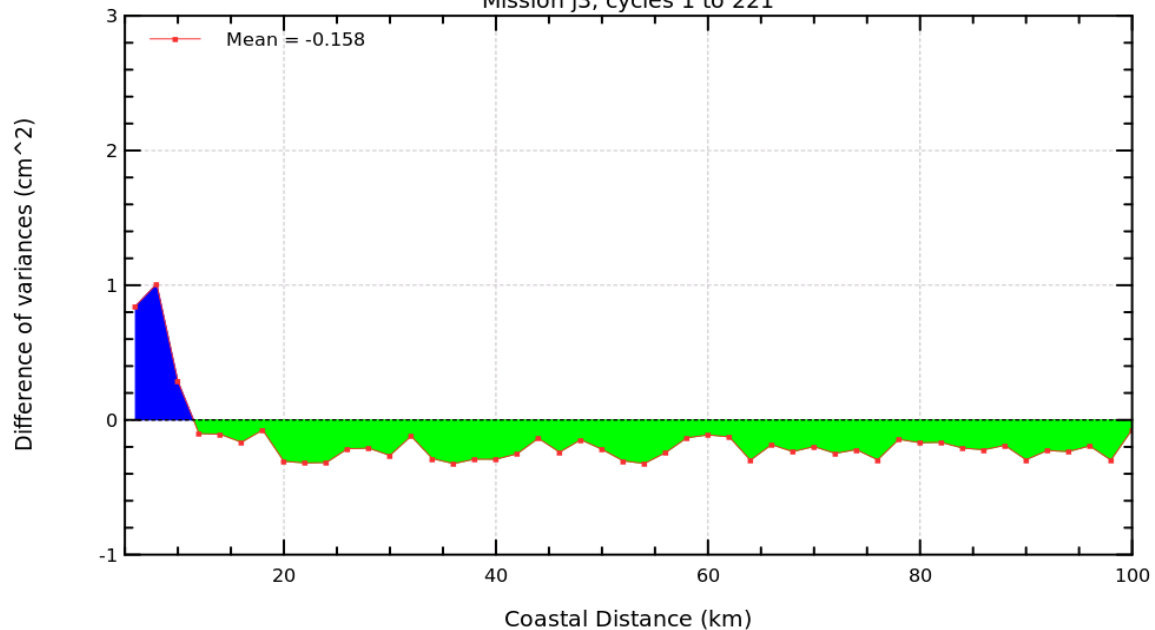
Along-track SLA performance

In the previous version ADAPTIVE version, the behaviour was degraded near coast (0-10km).

This was corrected and the variance of along track SLA is reduced near everywhere with adaptive compared to MLE4,

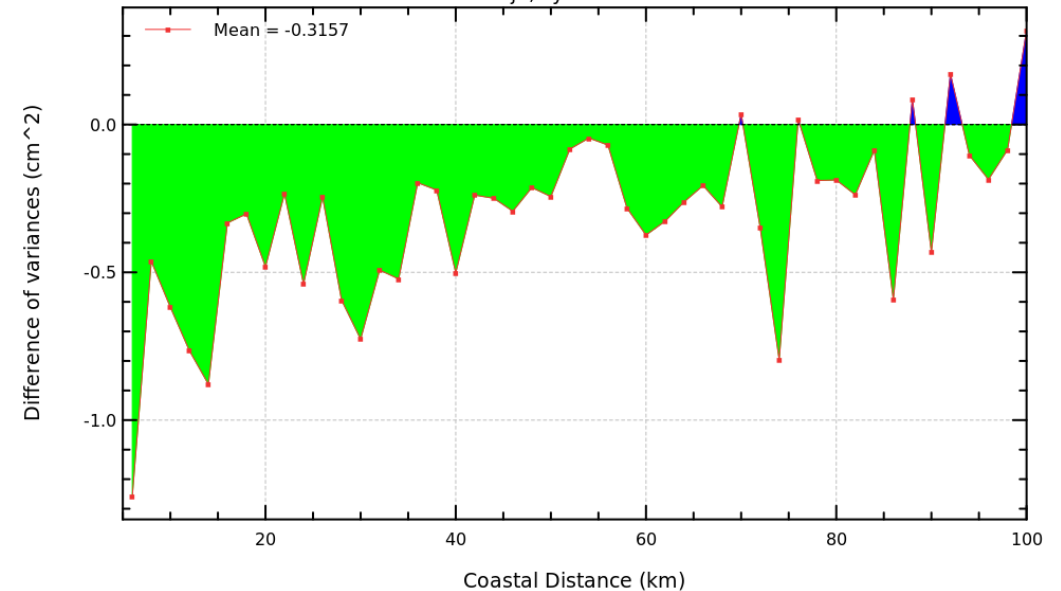
VAR(SLA with GDR-F_ADAP) - VAR(SLA with GDR-F_MLE4)

Mission j3, cycles 1 to 221



VAR(SLA with GDR-F_ADAP) - VAR(SLA with GDR-F_MLE4)

Mission j3, cycles 310 to 350



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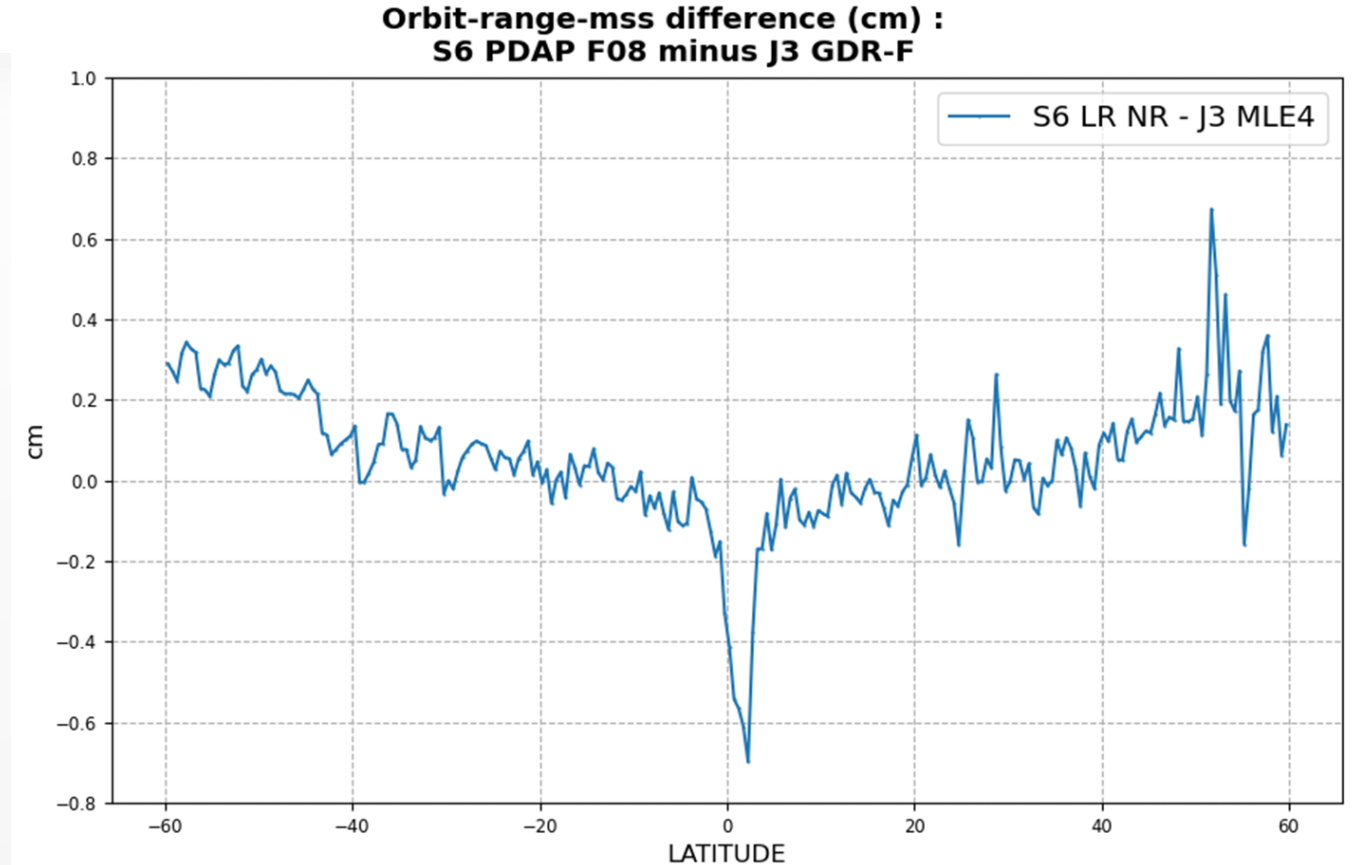
Ongoing work

Reminder :

- Sentinel 6A / Jason 3 tandem phase allows to detect a 5 mm differences within a 4° large band at equator
- Investigations shows that J1/J2/J3 have the same behavior on one hand, and S6, S3, Altika, Topex on the other hand

Up to date :

- Investigations still on to identify the root cause



Behaviour at
equator crossing

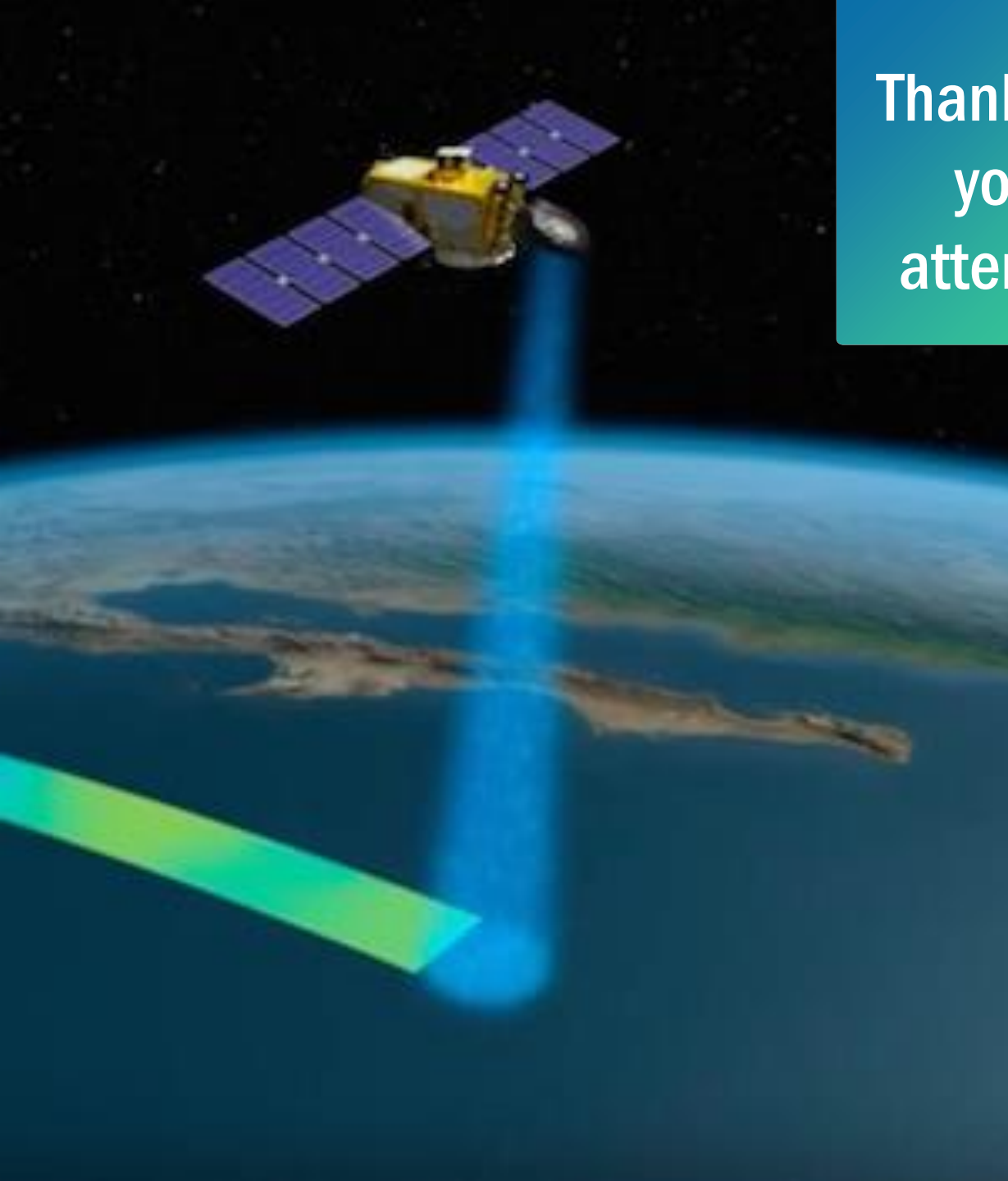
Conclusions

Very good performances of reference MLE4 Jason-3 GDR-F SLA

- No visible degradation of the products due to the instruments ageing
- Almost no impact of the new orbit on the performance

Improvements are allowed using adaptive retracker outputs

- SLA ADAPTIVE data are globally more valid than SLA MLE4 data (using recommended in handbook procedure)
- Taking into account valid in both datasets points, performances are better with adaptive solution than with MLE4, over 7 years (2016/02 to 2023/02) of data :
 - ✓ variance of along-track 1Hz SLA is reduced by 0,13cm²



Thanks for
your
attention

Questions ?



Thibaut P., Piras F., Roinard H., Guerou A., Boy F., Maraldi C., Bignalet-Cazalet F., Dibarboure G., Picot N., 2021:
Benefits Of The “Adaptive Retracking Solution” For The Jason-3 Gdr-F Reprocessing Campaign
https://www.aviso.altimetry.fr/fileadmin/documents/data/tools/NT-Thibaut_AdaptiveRetrackingForJason3GDRE.pdf

Roinard H., Bignalet-Cazalet F.
Jason-3 validation of GDR-F data over ocean, reprocessing report
https://www.aviso.altimetry.fr/fileadmin/documents/calval/validation_report/J3/SALP-RP-MA-EA-23480-CLS_Jason3_Reprocessing_Report_v1-2.pdf

Flamant B., Roinard H., Bignalet-Cazalet F.
Jason-3 validation and cross calibration activities (Annual report 2021)
https://www.aviso.altimetry.fr/fileadmin/documents/calval/validation_report/J3/SALP-RP-MA-EA-23528-CLS_Jason3_AnnualReport_2021_v1-3.pdf

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