



Feed-back and contribution after several years of HaiYang-2B data availability

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Alexandre Philip¹, Sabine Philipps¹, Yannice Faugère¹, Matthias Raynal², Jean-Michel Lachiver² and Nadège Quérue²

1: CLS Toulouse, France

2: CNES Toulouse, France



Summary

- 1.Context
- 2.HY2-B assessment and contribution
- 3.Conclusion et perspectives

1 Context

HaiYang-2B is an NSOAS satellite, it was launched on 25/10/2018 and belongs to the long series of HY satellites.

Sensors:

- Radiometer,
- dual frequency c and ku bands,
- Scaterometer
- GPS (no DORIS)

Parameter of interest:

- Sea Level Anomaly
- Significant Wave Height
- Wind speed

Orbit:

The orbit is sun-synchronous with a 14-day cycle. Reach 80° latitudes

L2 Data:

- **Data type:**
 - IGDR : 2-3 days timeliness
 - SGDR: same as IGDR but includes waveforms
 - GDR: 1 month timeliness
- **Availability:**
 - IGDR: from 15-11-2019
 - SGDR: from 05-07-2020
 - GDR: from 20-12-2019

1 Context: NSOAS / CNES usage of data



- L2 GDR/IGDR/SGDR products



- Orbite mission
- Data feedback

- Integration of HY2B into Copernicus Marine service



L2 NSOAS

L2P

L3

L4

SLA

Along track

Along track align with S6A data
Homogenous geophysical corrections

Along track multi-mission

Gridded multi-mission product

Wind & Waves

Along track

Along track align with J3 data and in-situ measurements

Along track denoised data

Gridded multi-mission product

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2 HY2B Assessment : Data used

Period : GDR data from 2019-12 to 2022-04

Field used for Sea Level Anomaly (SLA) are based on along track reprocessing of historical dataset (L2PDT21) standards available on [Aviso+](https://www.aviso.oceanobs.com/)

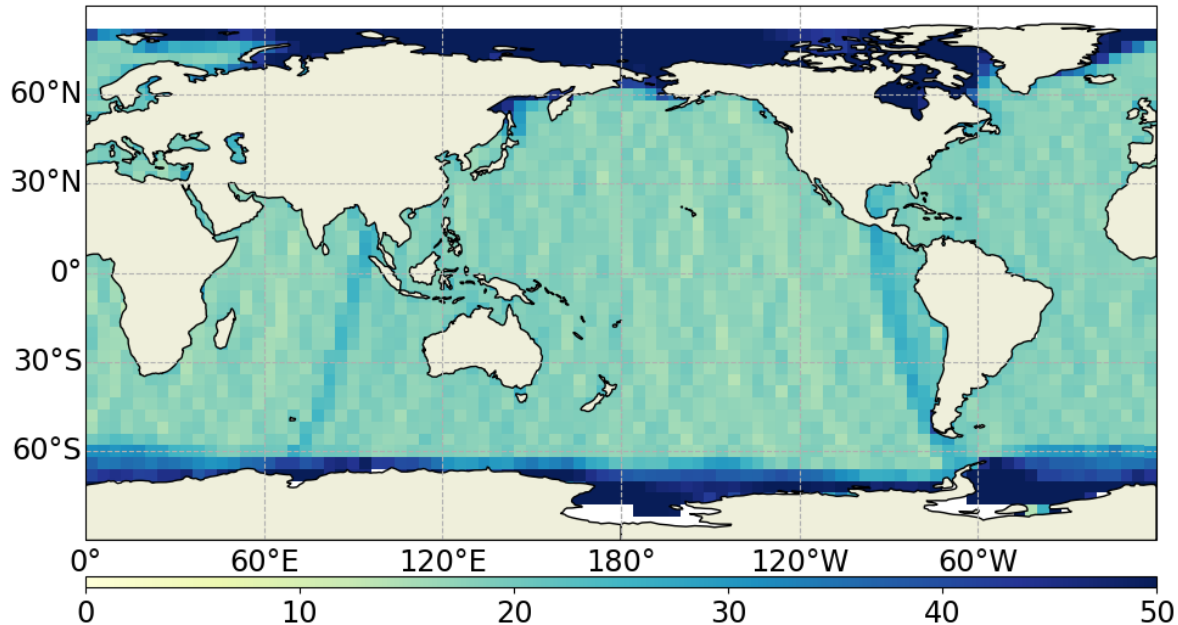


Orbite	Range	Iono	Dry tropo	Wet tropo	Ocean tide height
CNES	L2 product	GIM	ECMWF	ECMWF	FES14b

Pole tide	Solid tide	SSB	DAC	Internal tide	MSS
Desai MPL2017	Cartwright	L2 product	MOG2D	Zaron2019	Scripps combine CNES15 DTU13 sur WGS84

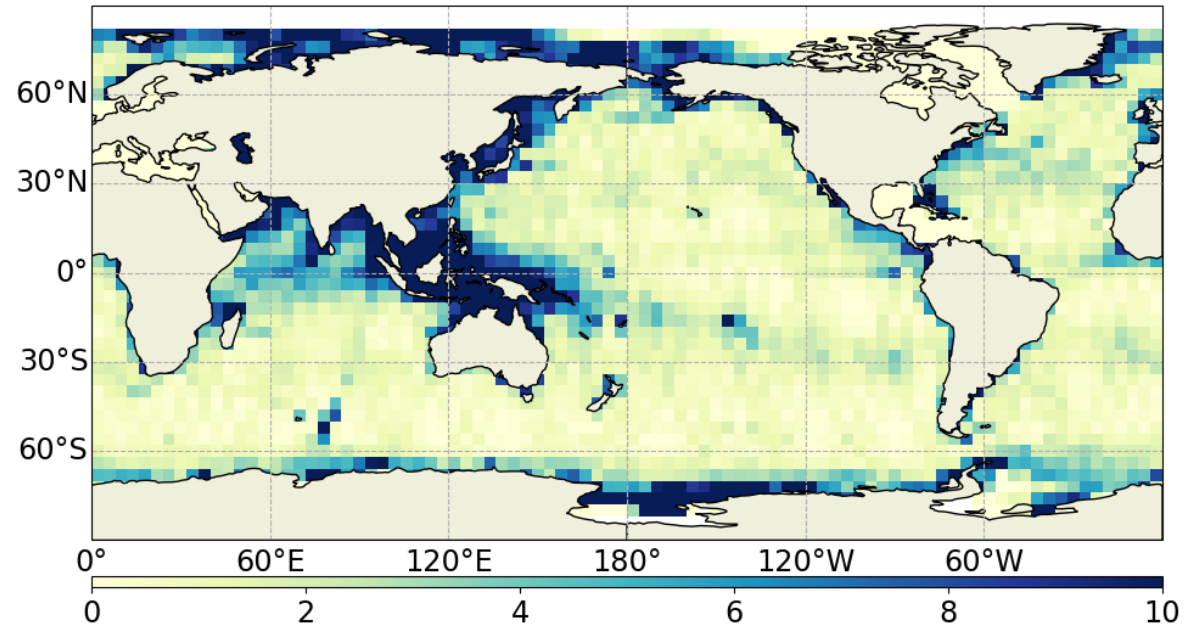
2 HY2B Assessment : Data coverage

H2B missing percentage (ocean + ice)



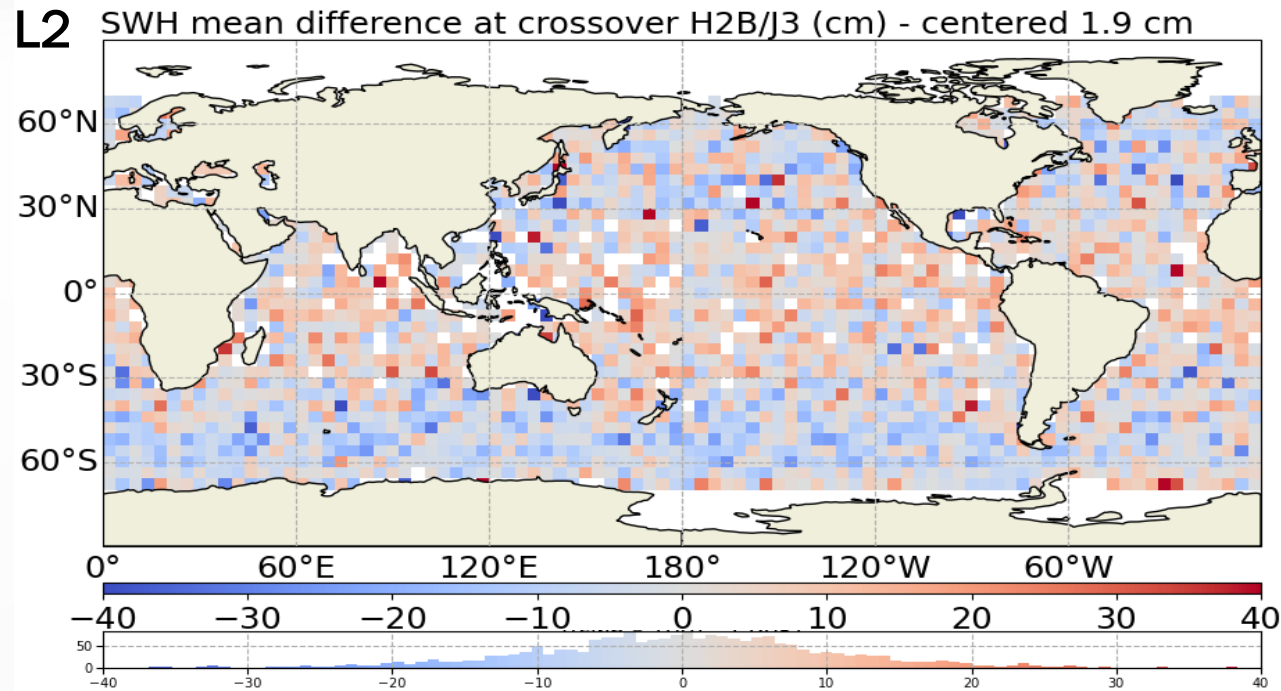
- Around 10% of missing data over ocean on standard behavior
- Lack of data availability over ice areas
- Frequently missing orbit over ocean
- Long missing period : from July 2020 to the end of 2020. (Launch of HY2C on september)

H2B rejected percentage (no ice)

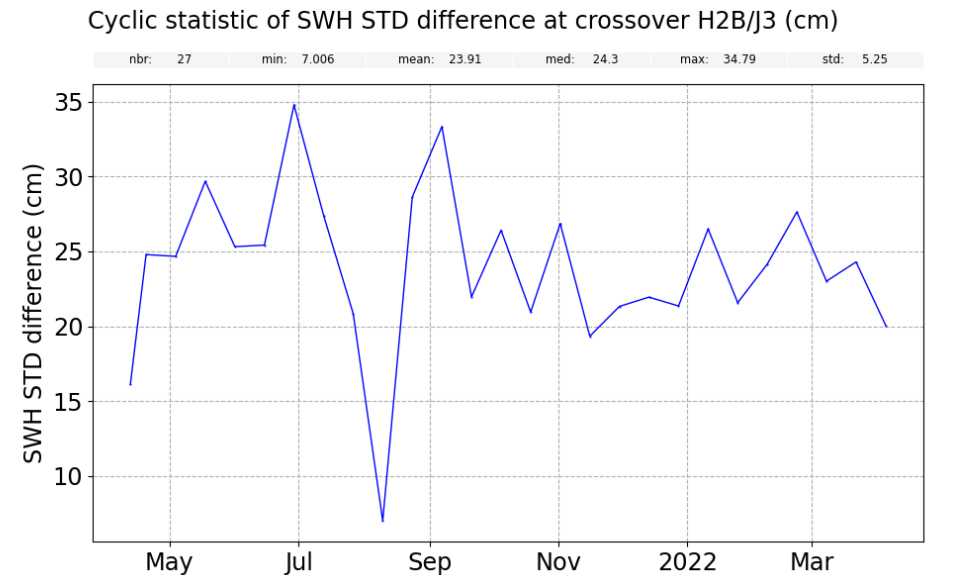
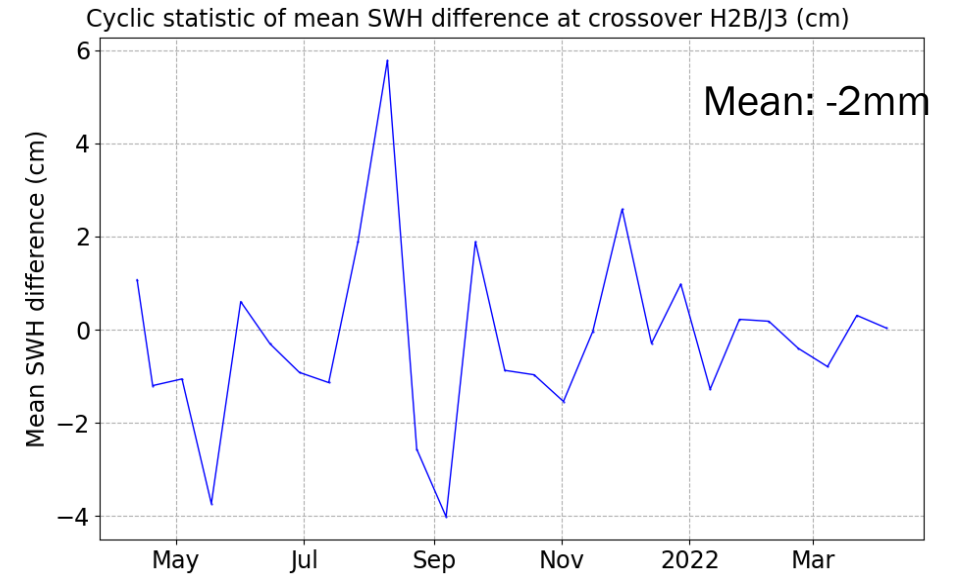


- Mostly rejected at :
 - high latitude
 - Indonesia area
- Around 3% of rejected data in standard behavior.

2 HY2B Assessment: HY2B/J3 L2 SWH Crossovers



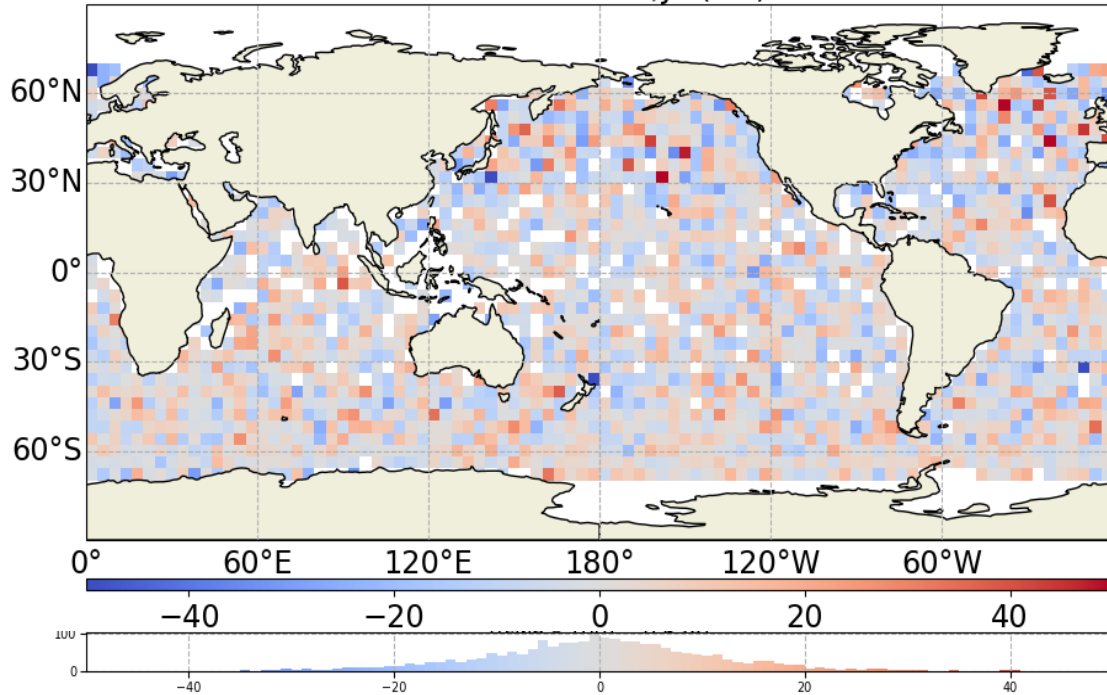
- Global bias around 1.9cm
- Amplitude difference around +/-20cm
- Bias on strong wave areas,
- Cyclic statistics stable over time around 2mm bias



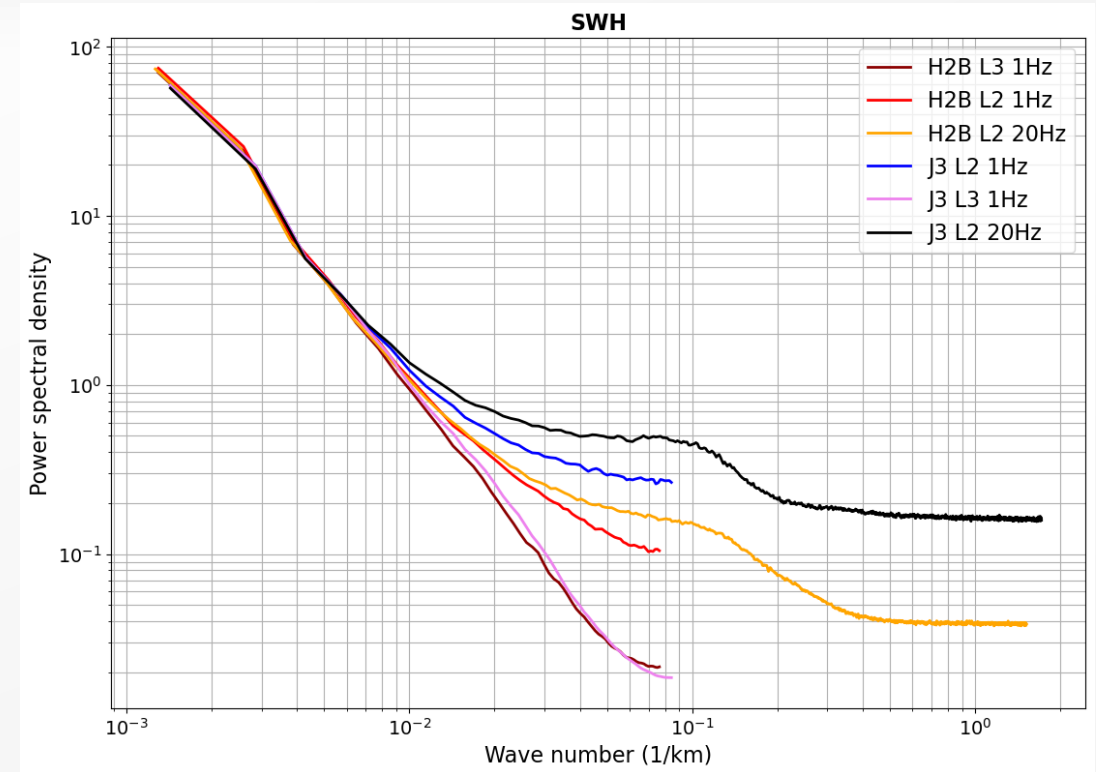
2 HY2B Assessment: Wind and Waves contribution L2P/L3

L2P

SWH mean difference at crossover H2B/J3 (cm) - centered -0.64 cm



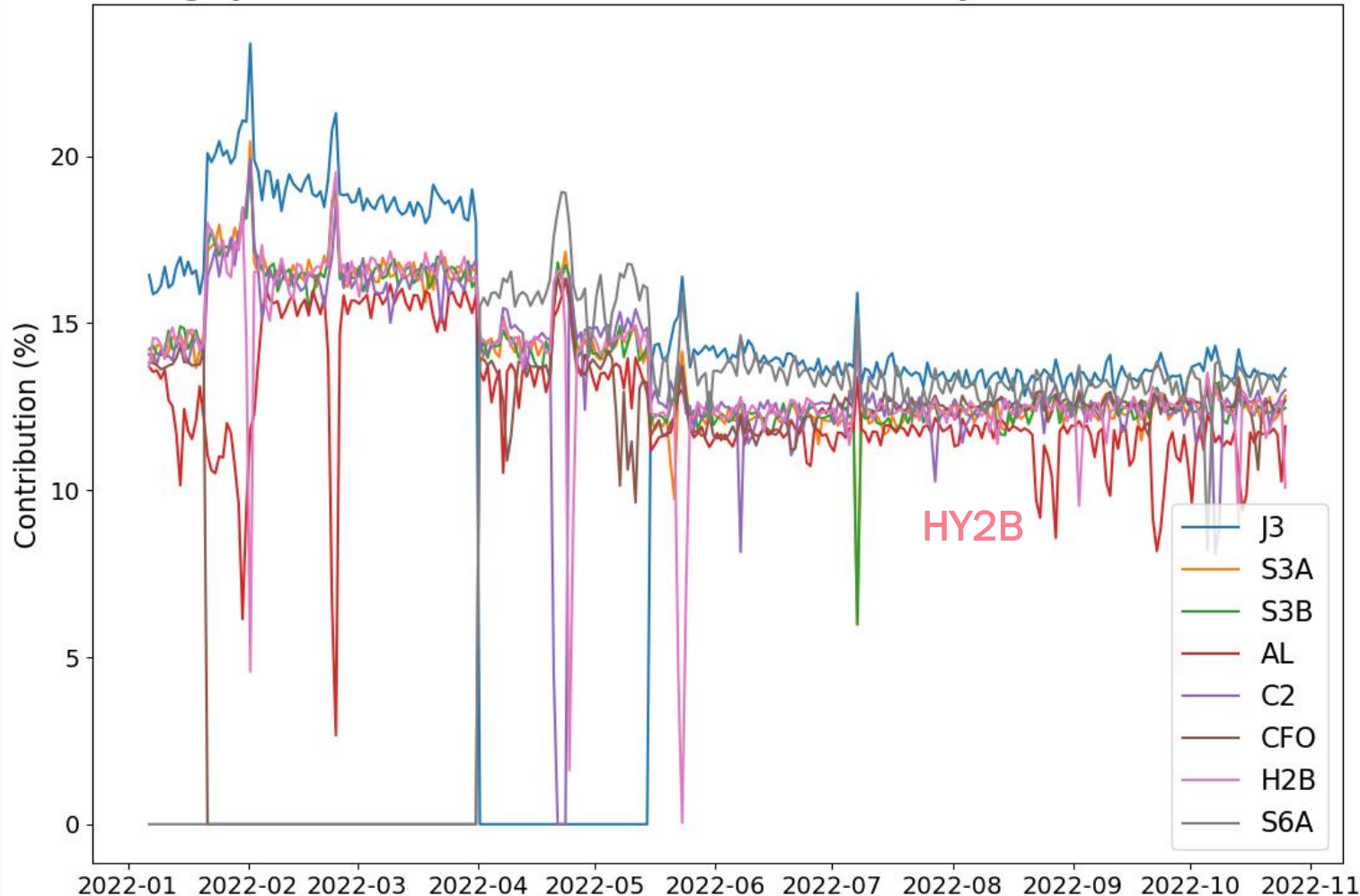
- A calibration is applied on HY2B SWH
- HY2B L2P W&W products are regionally unbiased



- Noise level on SWH is around 80% lower for HY2B than J3 in 20Hz
- Filtering applied on calibrated SWH reduce the noise for wavelengths below 100km
- L3 HY2B and J3 W&W SWH spectra are similar

2 HY2B Assessment: Wind and Waves contribution

Percentage per mission of L3 SWH measurement used daily to build 'D-5' L4 SWH map

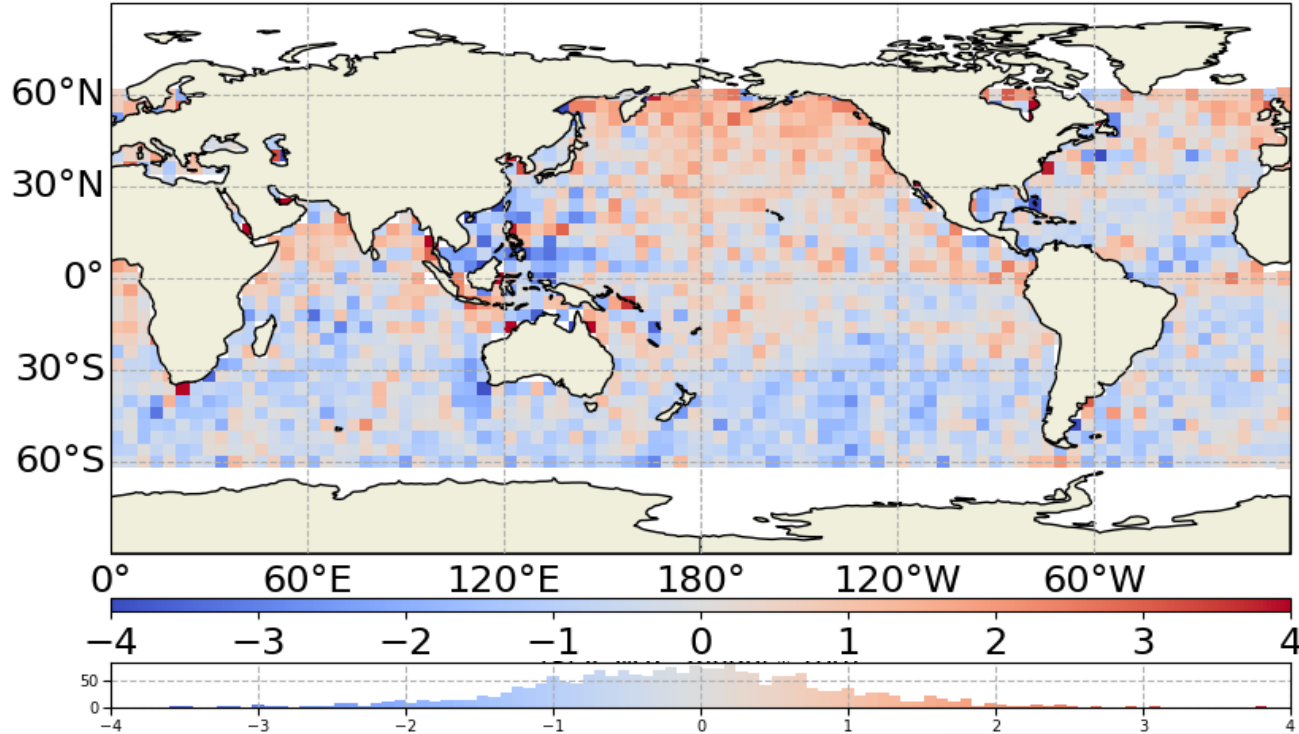


- HY2B only contributes to the final « D-5 » L4 map, as IGDR data are not available on time for the « D-1 » and « D-2 » map.
- Around 12 % of contribution
- Similar to mission such as CryoSAT-2, Sentinel-3A and -3B

2 HY2B Assessment: HY2B/HY2B SLA Crossovers

SLA Mean difference at crossover H2B/H2B (cm)

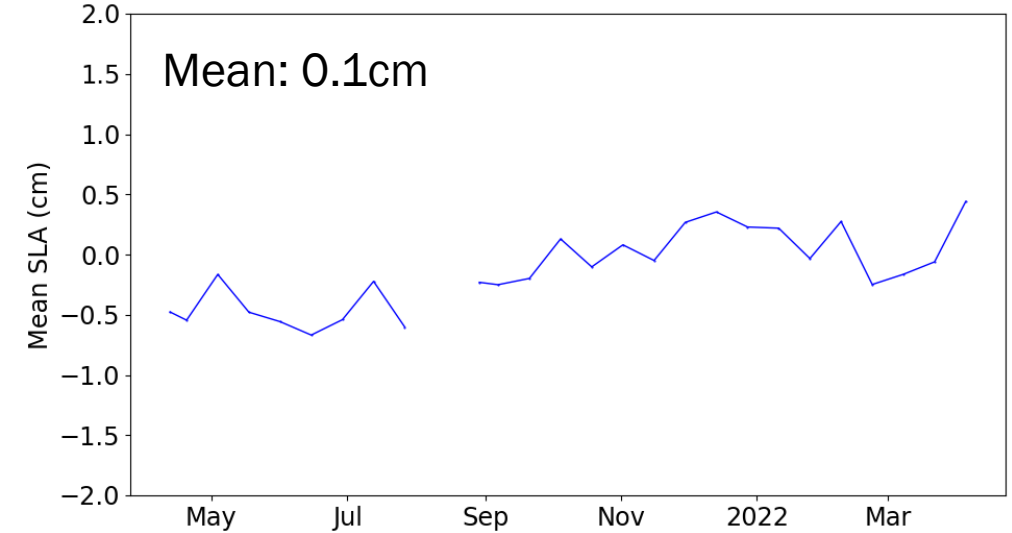
nbr: 2117 min: -22.42 mean: -0.1494 med: -0.1202 max: 9.361 std: 1.343



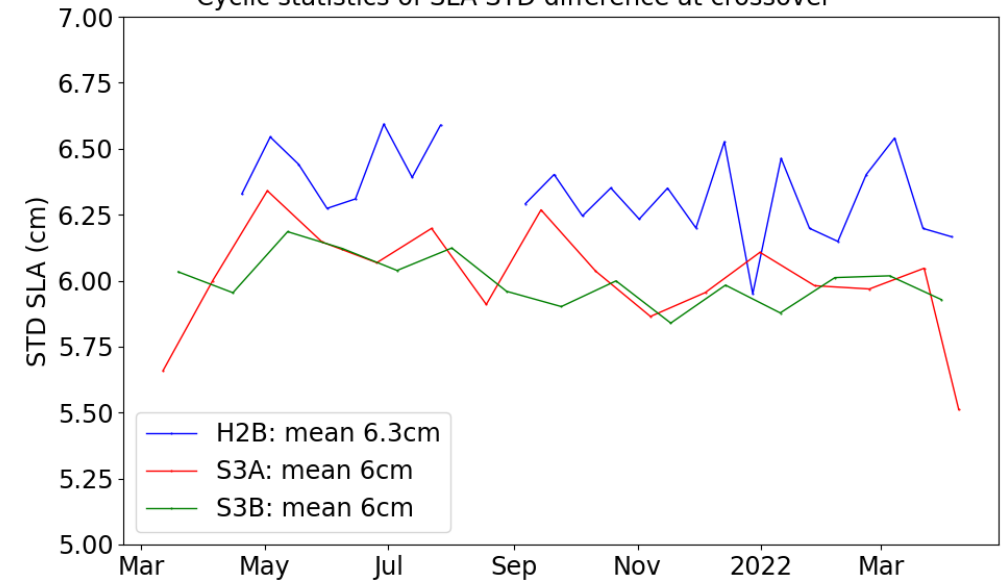
- Good consistency between ASC/DSC tracks: ± 2 cm amplitude
- Small time tag bias observed (still to be confirmed)
- Cyclic statistics stable over time. HY2B statistics are in line with other missions

Cyclic statistics of mean SLA difference at crossover

nbr: 26 min: -0.6688 mean: -0.1387 med: -0.1647 max: 0.4408 std: 0.316



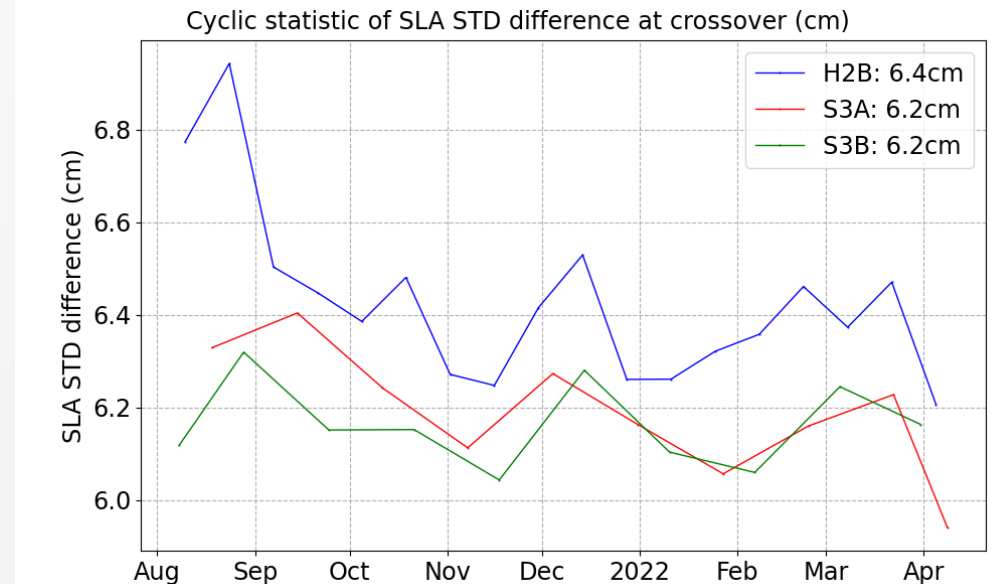
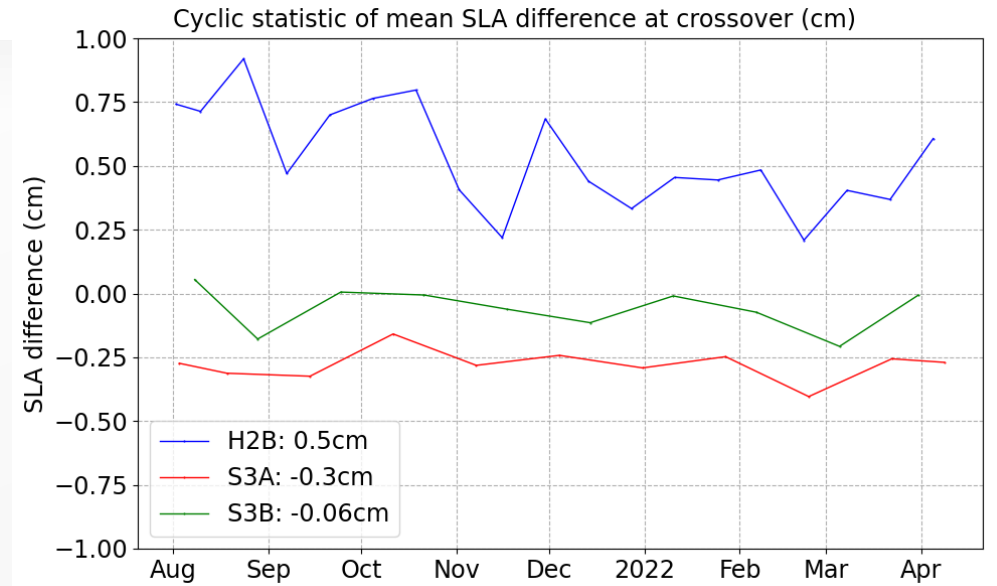
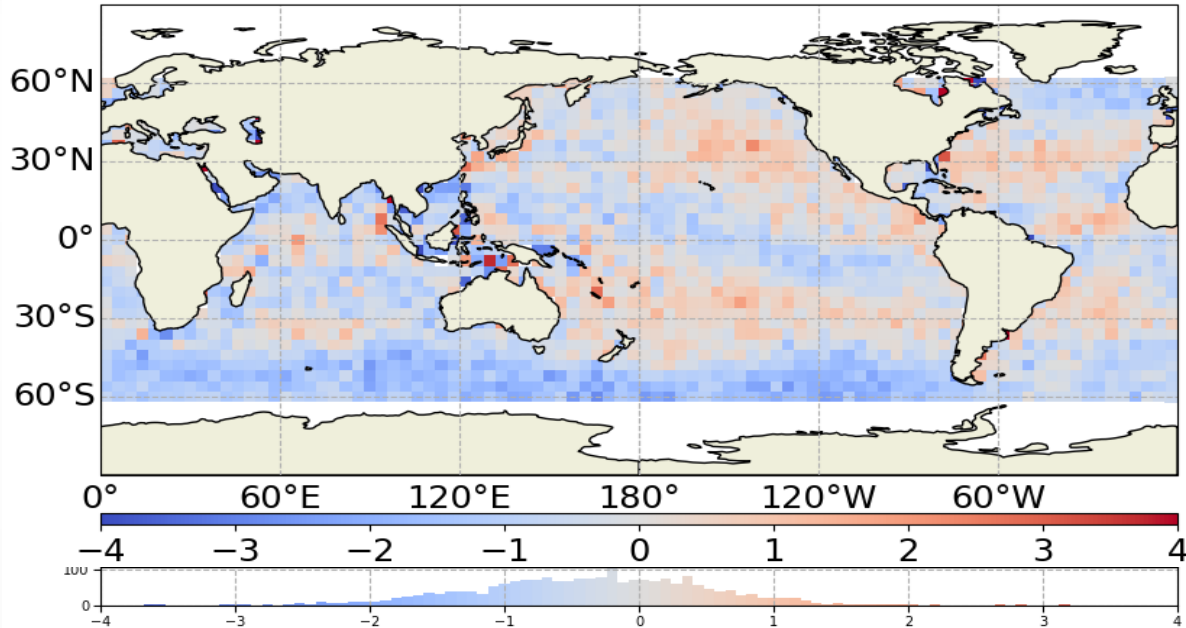
Cyclic statistics of SLA STD difference at crossover



2 HY2B Assessment: J3/HY2B SLA Crossovers

SLA mean difference at crossover J3/H2B (cm)

nbr: 2172 min: -15.64 mean: -0.3703 med: -0.3312 max: 20.95 std: 1.221

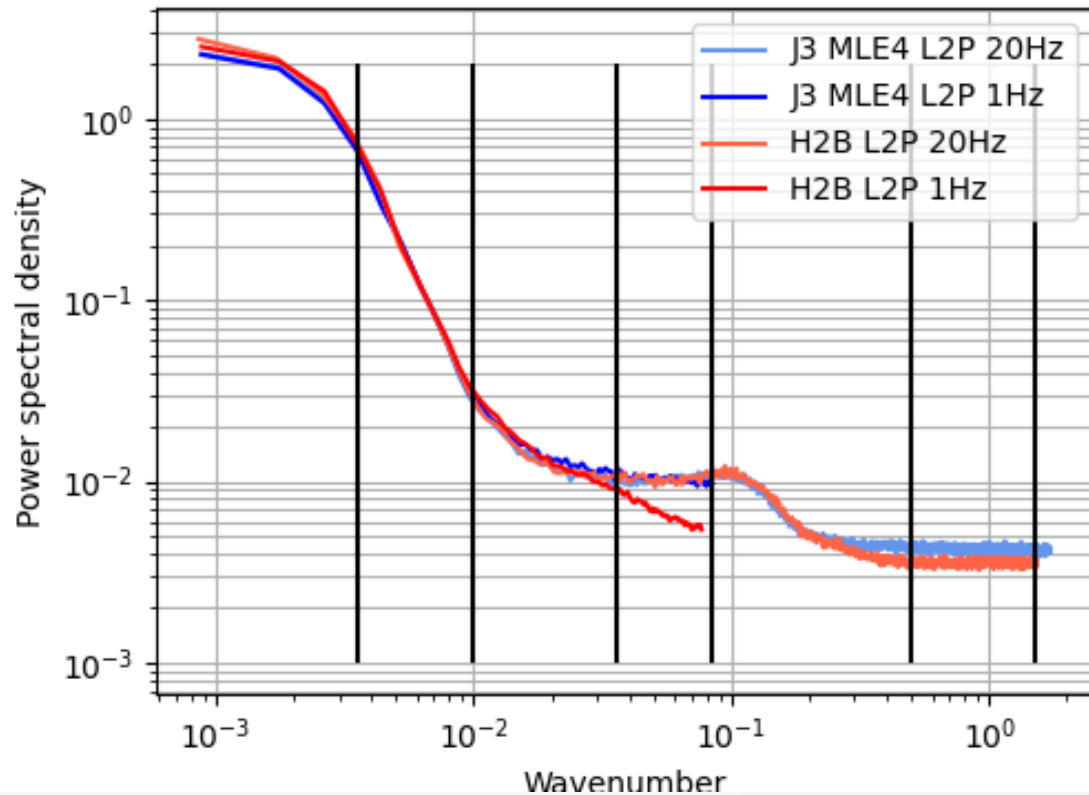


- Good consistency between J3 and HY2B, +/-2cm amplitude
- Cyclic statistics stable over time
- Bias on strong wave areas (shown in previous slide)
- Ionospheric correction patch
 - J3 filtered ionospheric correction
 - HY2B GIM ionospheric correction

2 HY2B Assessment: wavelenghts

SLA = orbit - range - MSS

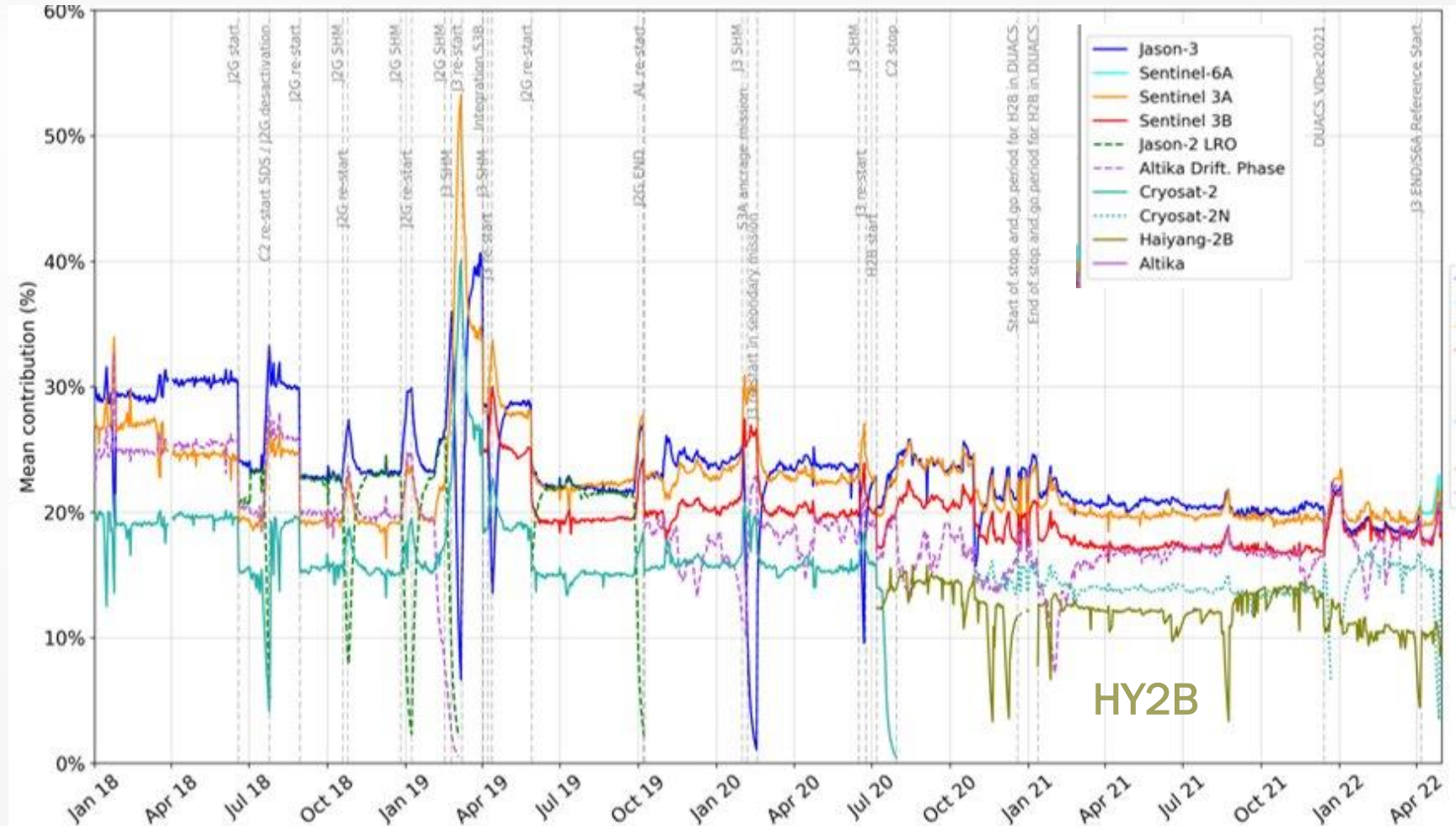
SLA nocorr



- 20Hz : Same performance bewteen HY2B and J3 but lower noise level on range for HY2B compared to J3
- 1Hz HY2B spetrum is not superimposed with other spectra below 30km wavelenghts
- Specific post-processing is applied to the 1Hz range available in the products

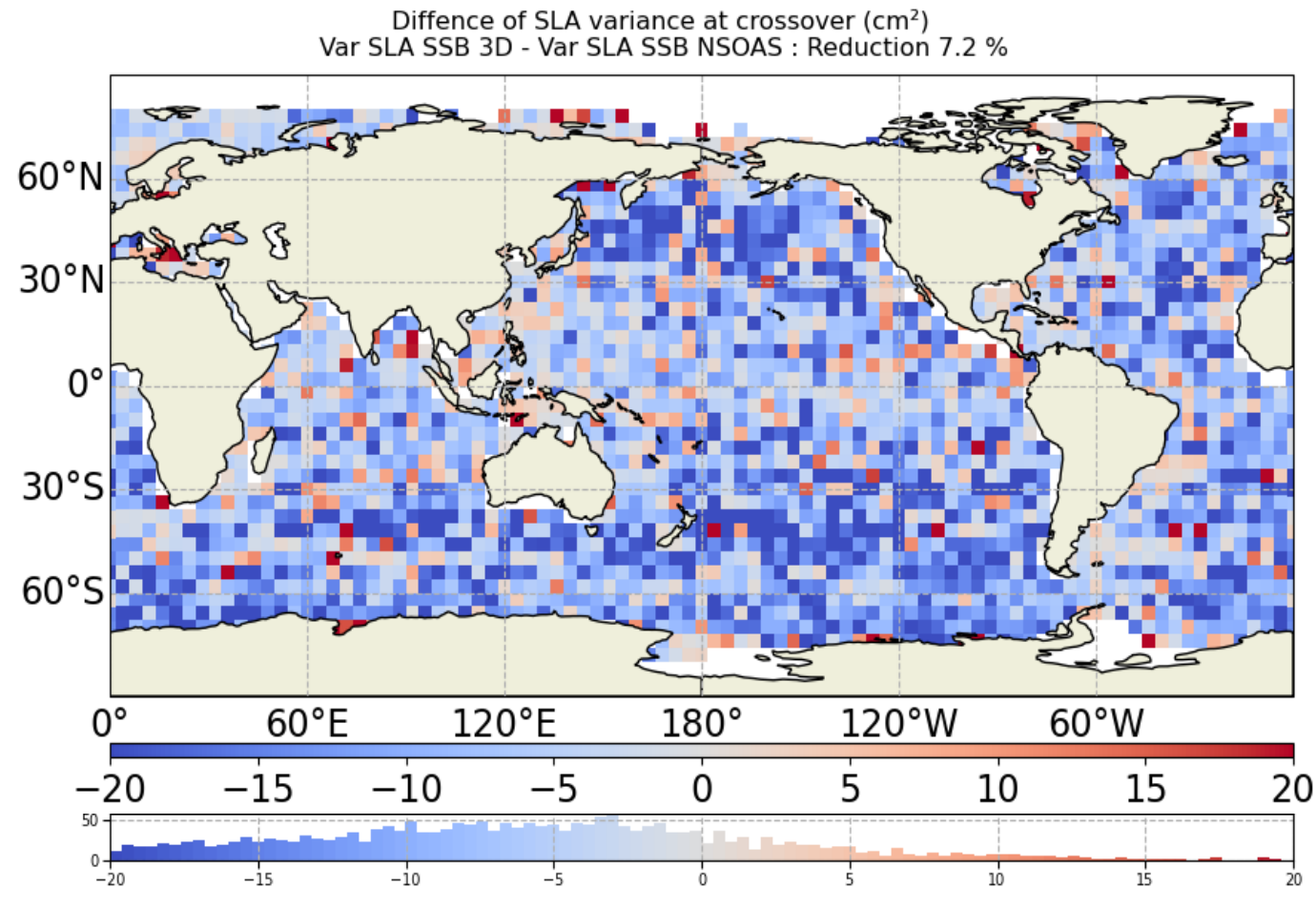
2: HY2B Assessment: DUACS L3/L4 contribution

- HY2B ingested in the DUACS system to produce the operational products disseminated in the Copernicus Marine Service
- It complements the altimetry coverage to improve the sea level maps at mesoscale
- Slightly lower than the other due to the lack of NRT/(OGDR Level-2 product)
- Best measurements of the January 2022 Tonga Tsunami (presentation in the Application Session)



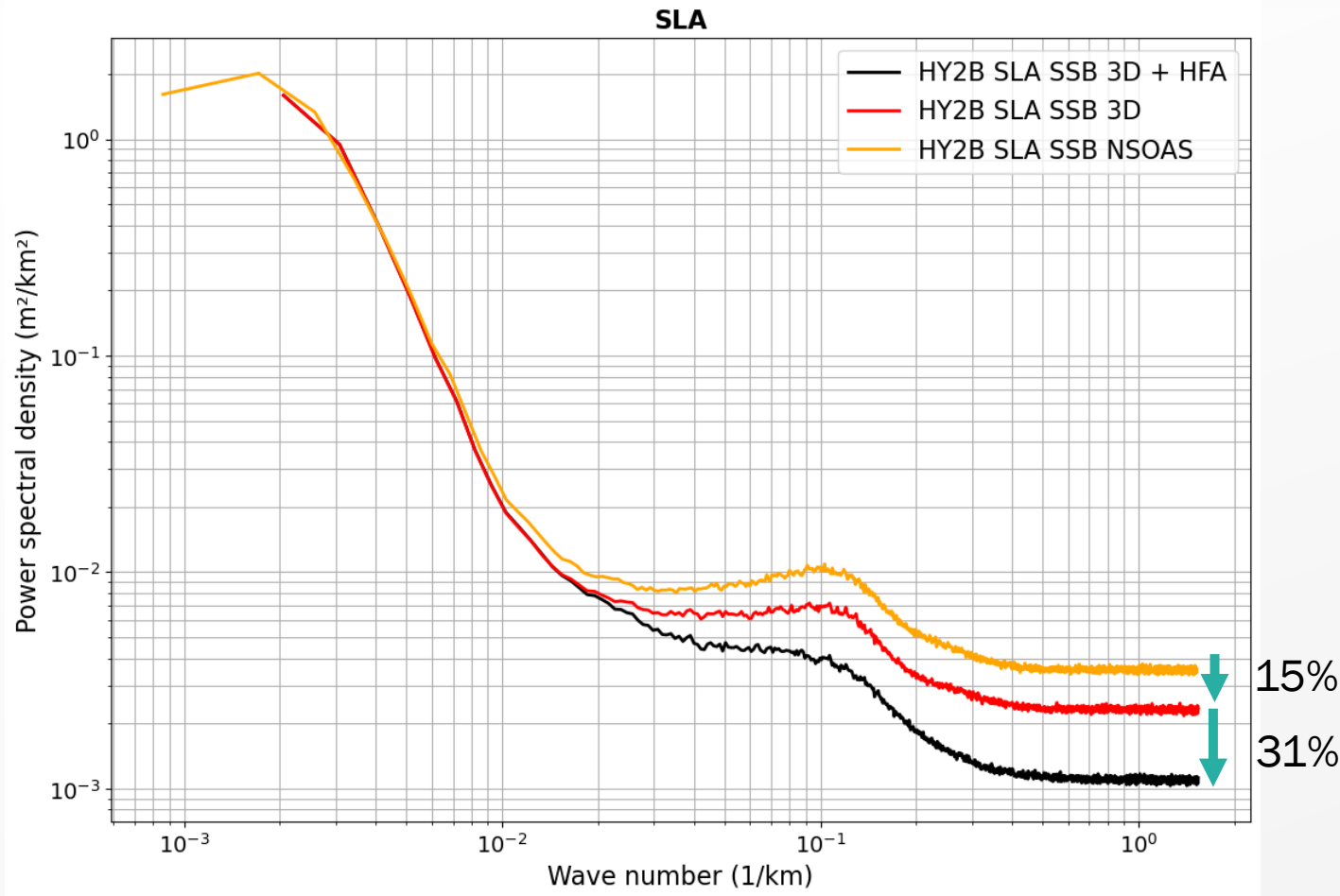
- Contribution above 10%

2 HY2B Assessment: SSB 3D



- SSB 3D show good performance on SLA
- Reduction of 7.2% of the SLA variance
- Recommended to apply instead the NSOAS solution for the next L2PDT24 reprocessing

2 HY2B Assessment: High Frequency Adjustment (HFA)



- Reduction of 15% on bump and noise level when using SSB 3D instead NSOAS solution
- Additional reduction of bump and noise level of 31% when HFA is applied
- Used for the future HY2B high frequency products

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3: conclusion perspectives

- HY2B part of Sea Level and Wind & Waves product in Copernicus Marine Services
- Good performances of HY2B,
- Huge improvement of NSOAS data processing is observed since HY2A

- Sea Level products quality could be improved
 - Radiometer wet tropospheric correction have been improved and show good performances (not shown)
 - Filtering and assessment of dual frequency ionospheric correction will be performed. Reduction of the signal observed in the geomagnetic equator is expected
 - Sea State Bias 3D made for HY2B
 - High Frequency Adjustment available

- Large constellation of satellites : HY2B/C/D and followers
- Similar performance is observed of HY2C, assessment shown in poster session
- HY2D have been launch 2021-05-19, assessment will be performed soon
- Usage of high frequency data



Thank you

