Jason-3

GDR Calval project synthesis

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SUMMARY

- Data coverage and editing
- Orbit accuracy (OGDR)
- Radiometer parameters
- Altimeter parameters
- Cross-Over points analysis
- SLA analysis
- MNT analysis

Note : most of the analysis are conducted by comparing Jason-3 toward Jason-2 thanks to the formation flight. Additional information are provided with tide gauges and SRAL & CY2

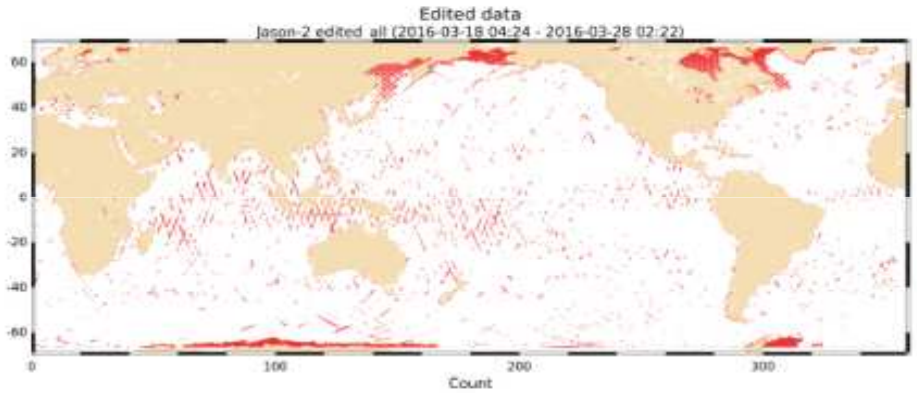
First GDRs

- CNES started to generate GDRs T' early September, following the implementation of the minor evolutions required during the O/IGDRs validation workshop held in June:
  - Computation of SSHA: not defaulted anymore when the rain flag is set and update of the corresponding netcdf comment
  - AMR Land Flag: implementation of the Lang Flag Algorithm proposed by JPL (impacts on the rain flag as demonstrated by J. Lillibridge presentation).
  - Modification of comments for altimeter rain flag & altimeter wind speed variables

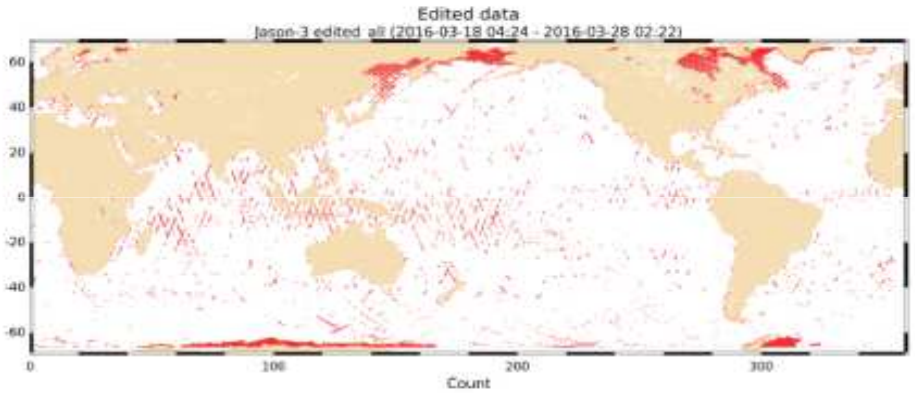
- GDRs obviously provide more continuous data records as the O/IGDRs were impacted by several patch applied (new CAL2, rain flag, wind, …)
- The GDR products were analyzed by all 4 partners before release to Pis on the relevant servers (refer to release note). 20 cycles have been released to prepare the OSTST meeting (Cycle 19 released mid October)

Data coverage and editing

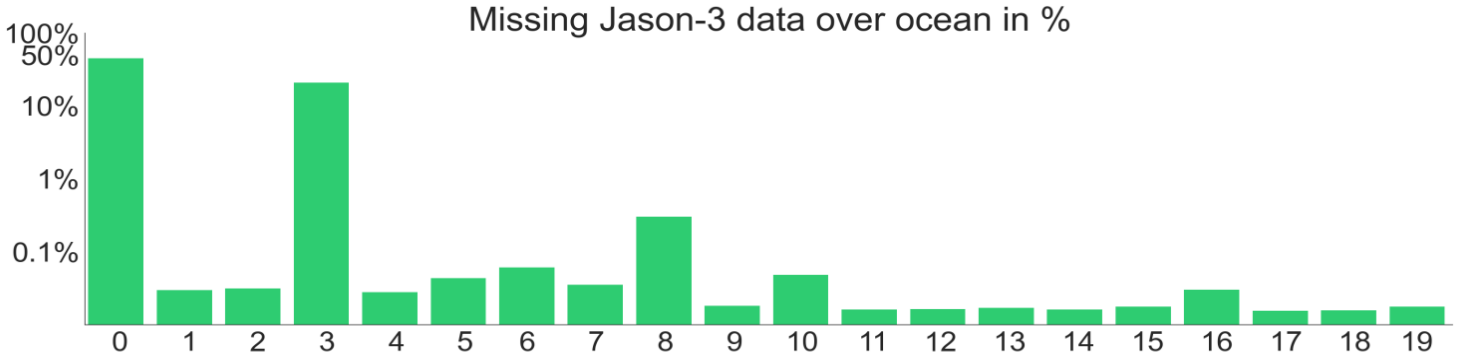
- The CalVal criteria defined in the Jason-3 User Handbook generates an editing nominal and inline with Jason-2. We have the same observation on IGDRs and GDRs products



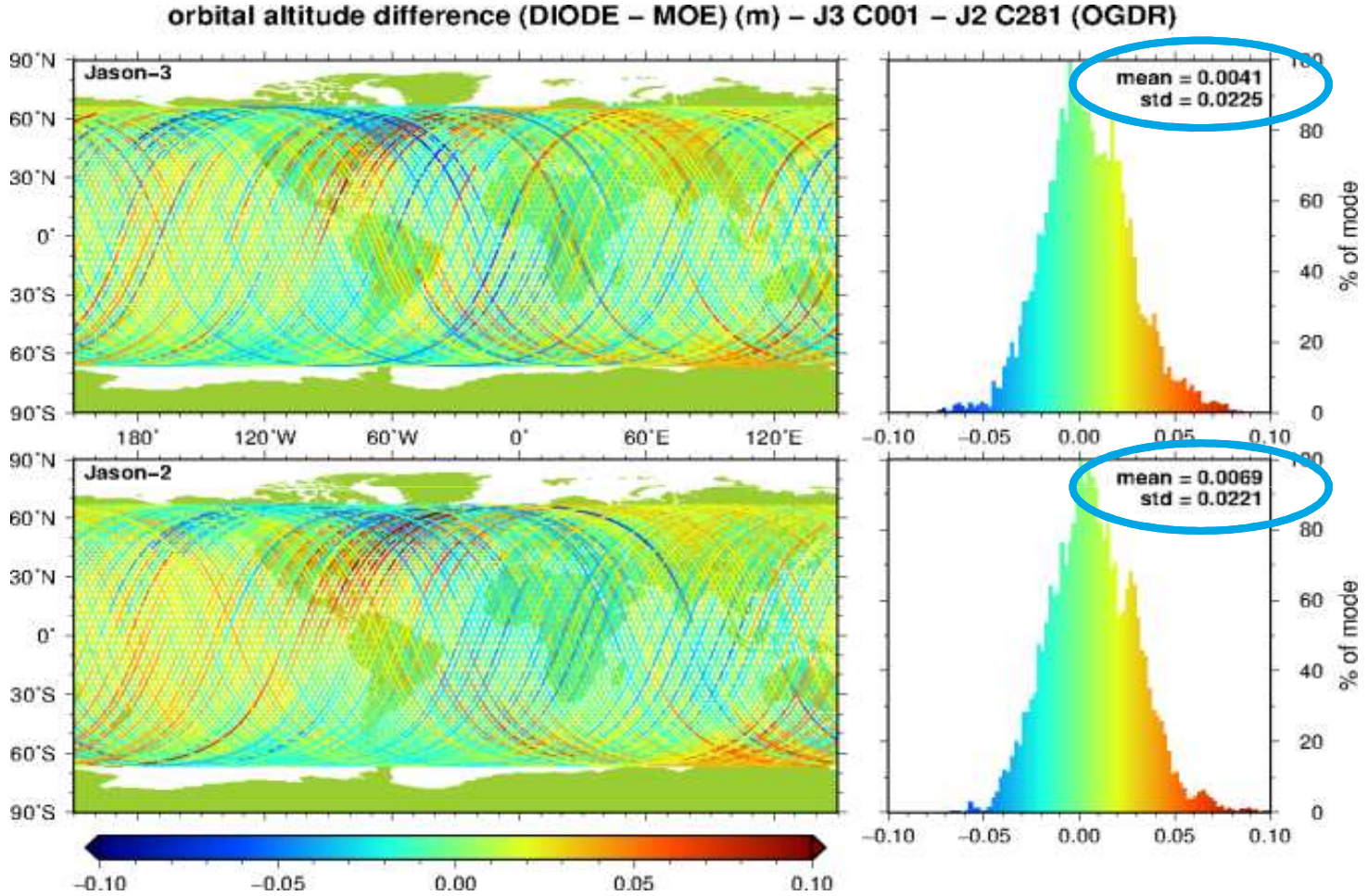
JASON 2



JASON 3



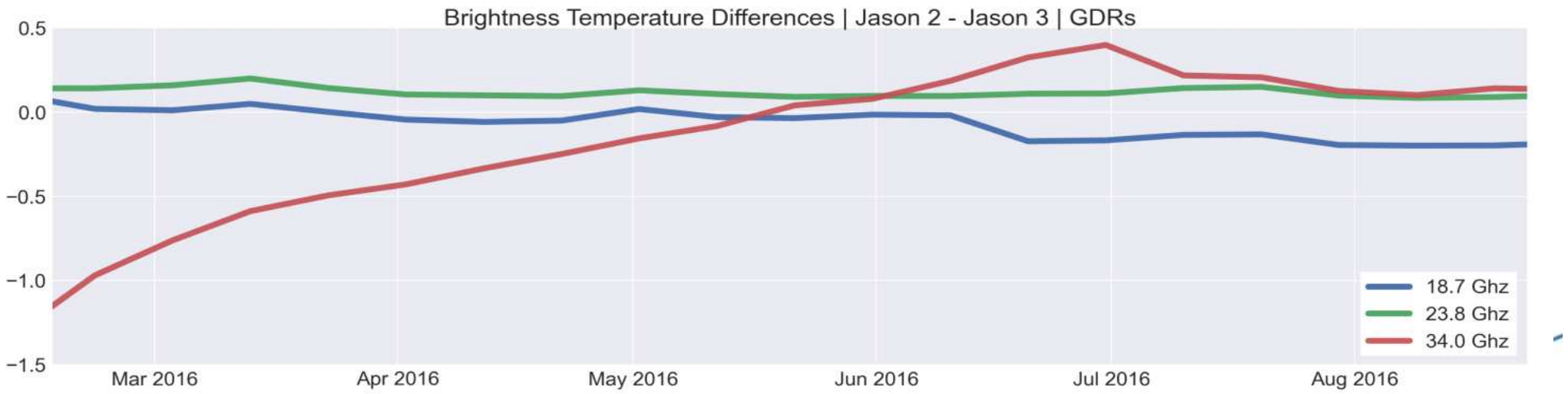
OGDR orbit accuracy



- **OGDR** orbit compares very well with MOE orbit (2.3 cm std dev) **(req. 5 cm)**
- **OGDR** orbit is high by 4 to 8 mm on average (varies by cycle)
- Jason-2 OGDR orbit is biased few mm more

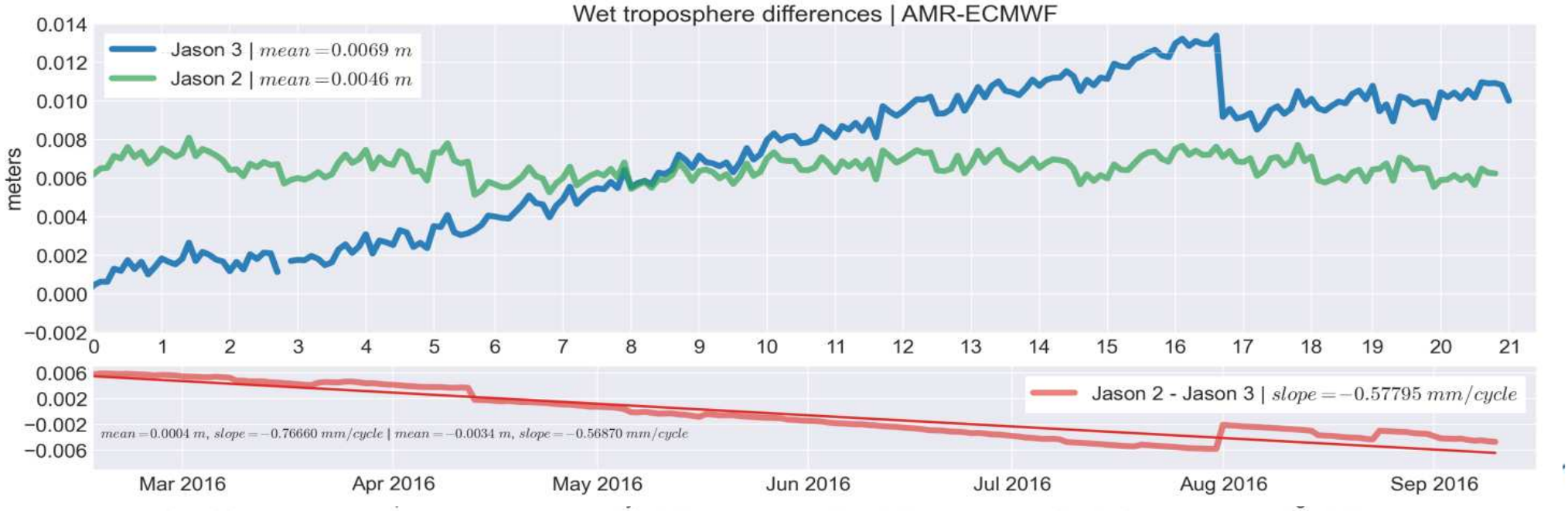
Radiometer parameters

- Instrument drift is routinely monitored by JPL instrument expert team. Impact of drift is corrected through ground calibration (ARCS) in GDRs, also accounting for the cold sky (pitch manoeuvre) calibration
- We observe a residual uncalibrated relative drift (0.13K/cycle) in 34.0 GHz channel from cycles 1-12, which explains relative drift in wet delay : ~ 2.4 mm (see next and JPL poster).



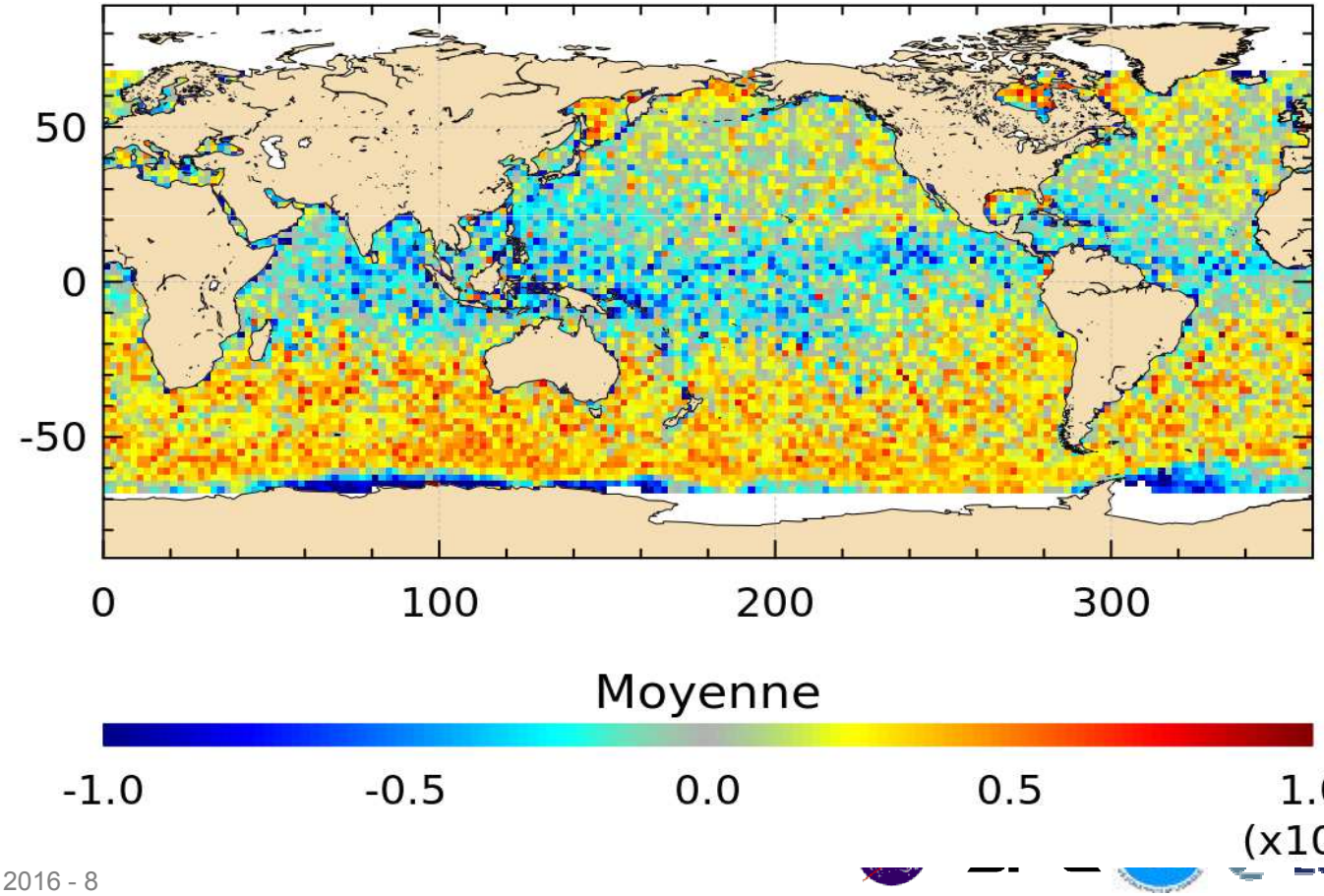
Radiometer parameters

- Jason-3 AMR BTs drift impacts some geophysical parameters : wet tropospheric correction (and so the SSH) relative drift in wet delay : ~ 2.4 mm. Largely reduced if compared to IGDR products



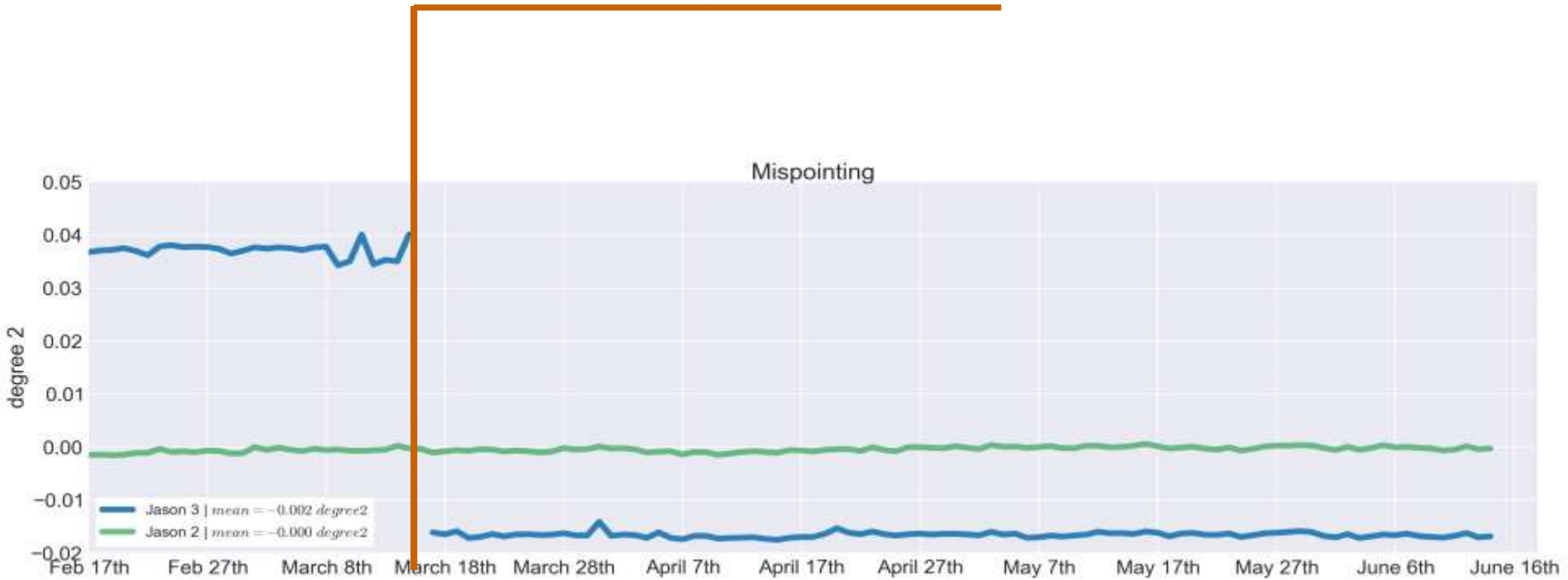
Radiometer parameters

- In terms of geographical patterns, we can highlight a very good consistency of wet tropospheric correction between JA2 and JA3 with very small residual signals (+/-1 mm)



Altimeter parameters

- Jason-3 altimeter **mispointing** (waveform retracking estimate) has been extensively analyzed to explain the negative values observed (see next). Platform **pointing** was modified following the update of the STRs coefficients



Altimeter parameters and mispointing

- Jason-3 altimeter **mispointing** is indeed related to the altimeter CAL2 Low Pass Filter measured on board that is sensible to the actual gain setting. Two technical notes have been released to explain this impact.

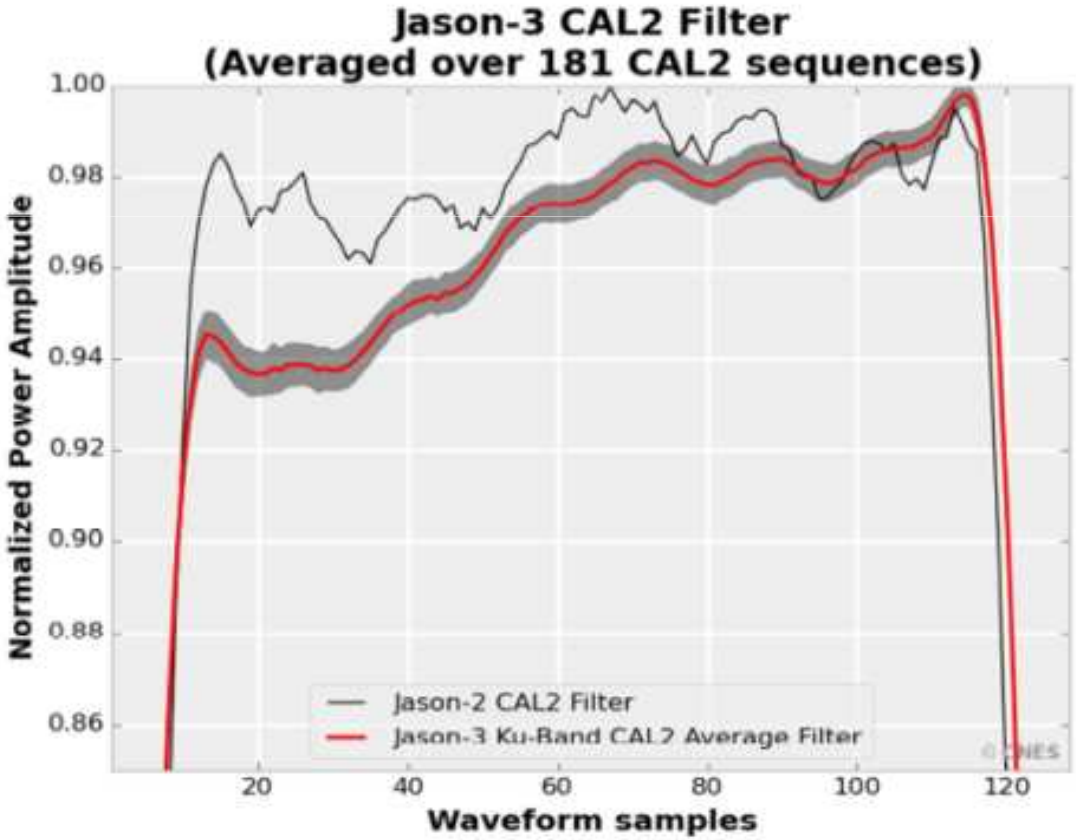
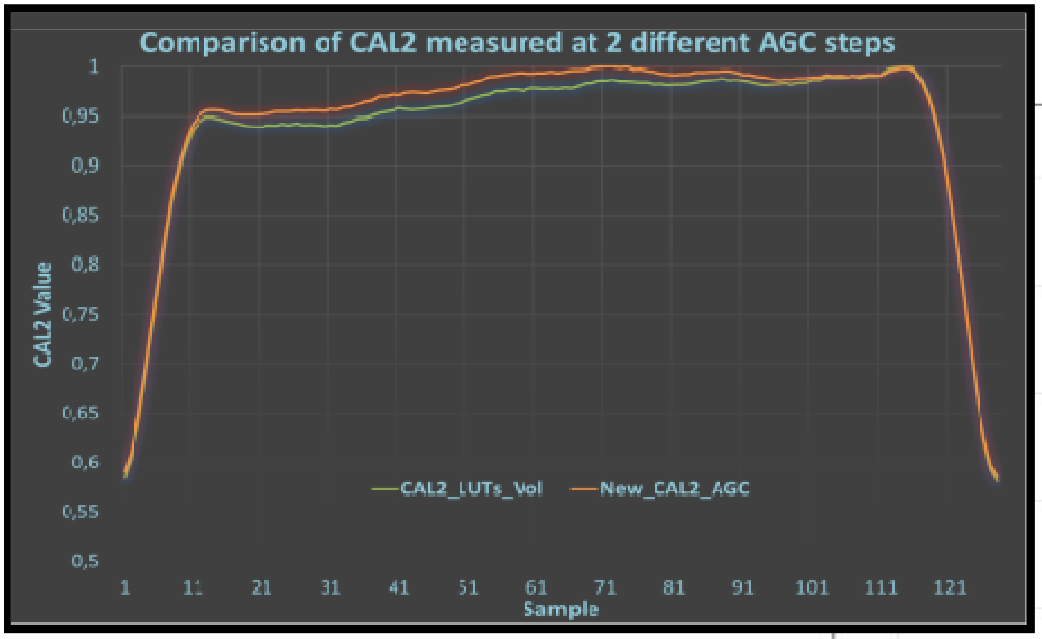
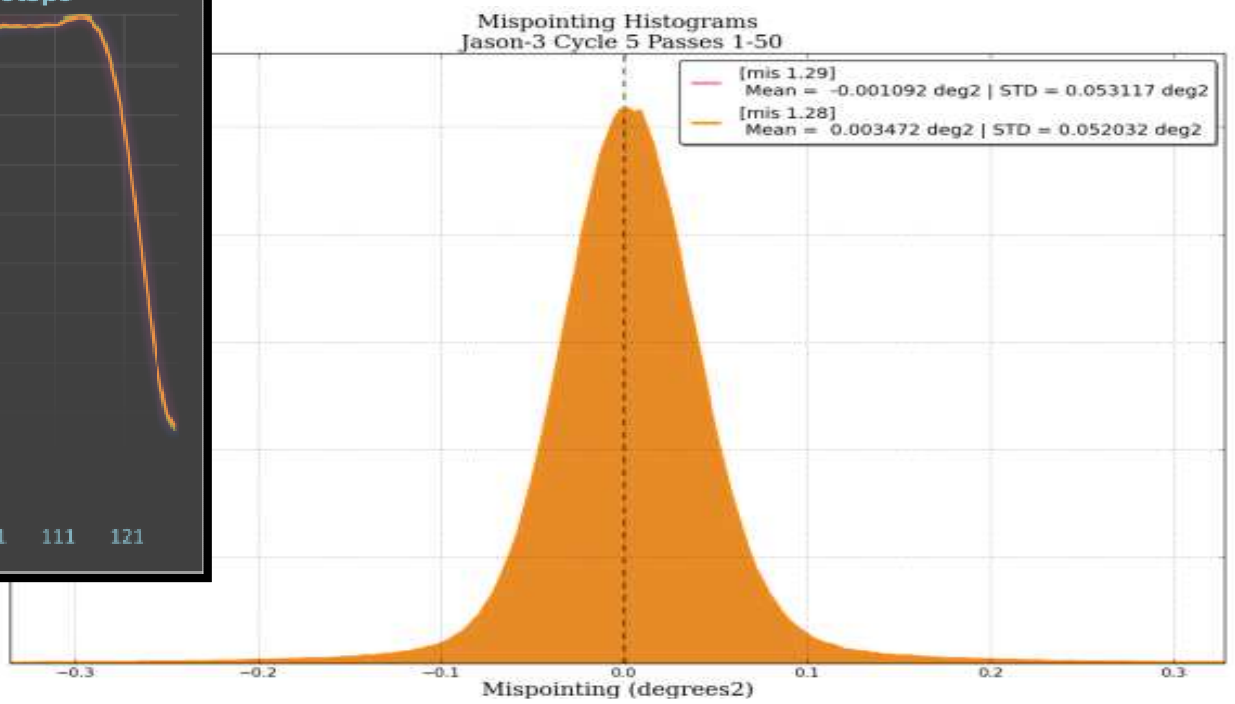


Figure 1: Averaged CAL2 filter for Jason-3 (average over 181 calibration sequences in red, standard deviation in grey) and for Jason-2 (black).

Altimeter parameters and mispointing

- During the first cycles, the in-flight CAL2 filters were measured using a different Automatic Gain Control (AGC) code than the on used during waveform acquisition over ocean. This was done to optimize the CAL2 measurement numerical accuracy (quantification optimization). It has however an impact on the filter slope and fully explains the mispointing values observed. This was modified in June and applied to all GDRs cycles.



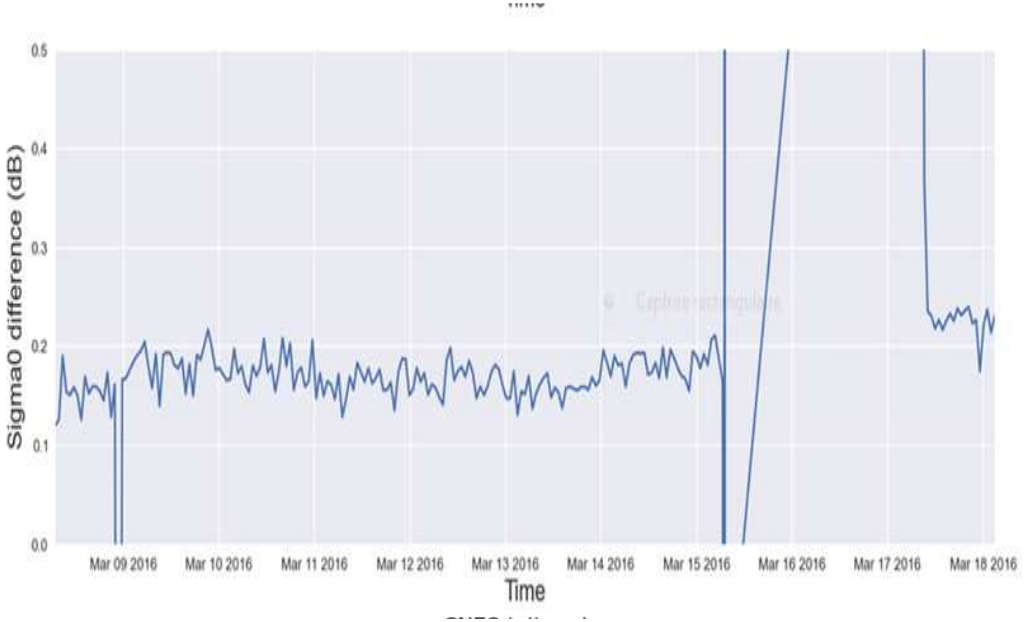


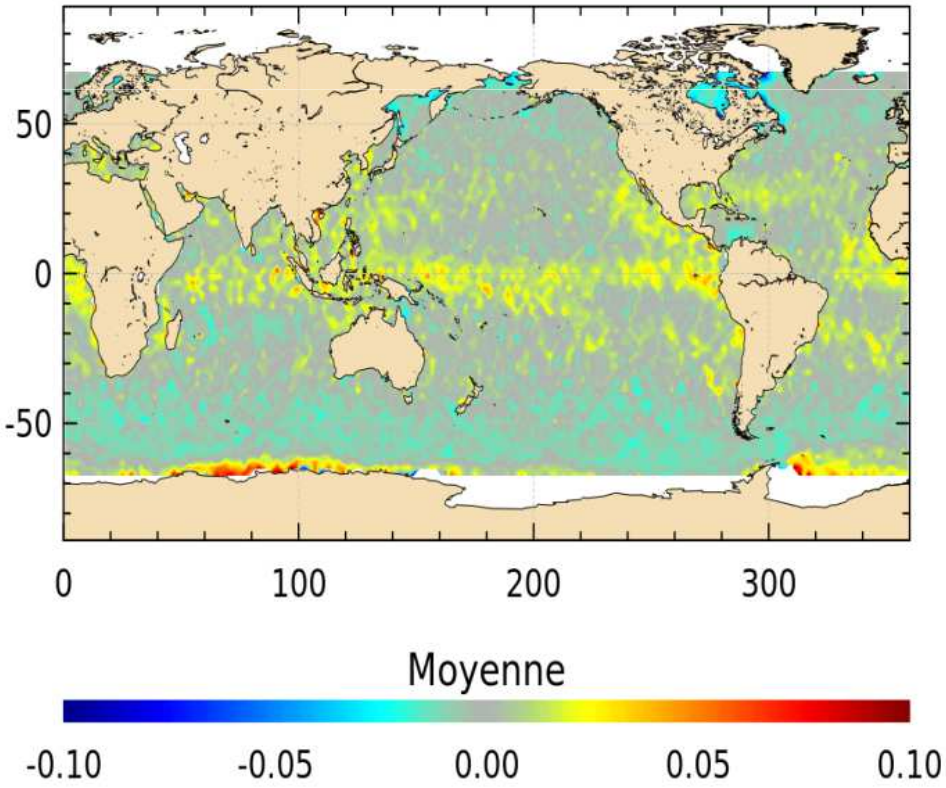
Altimeter parameters sigma0

- Jason-3 altimeter **backscatter** has been modified with the new altimeter Characterization file, the update of the look up tables (Patch 6) and the new CAL2 filter.

- We still observe a slight impact of the platform pointing (about 0.05 dB), related to MLE4 algorithm used.

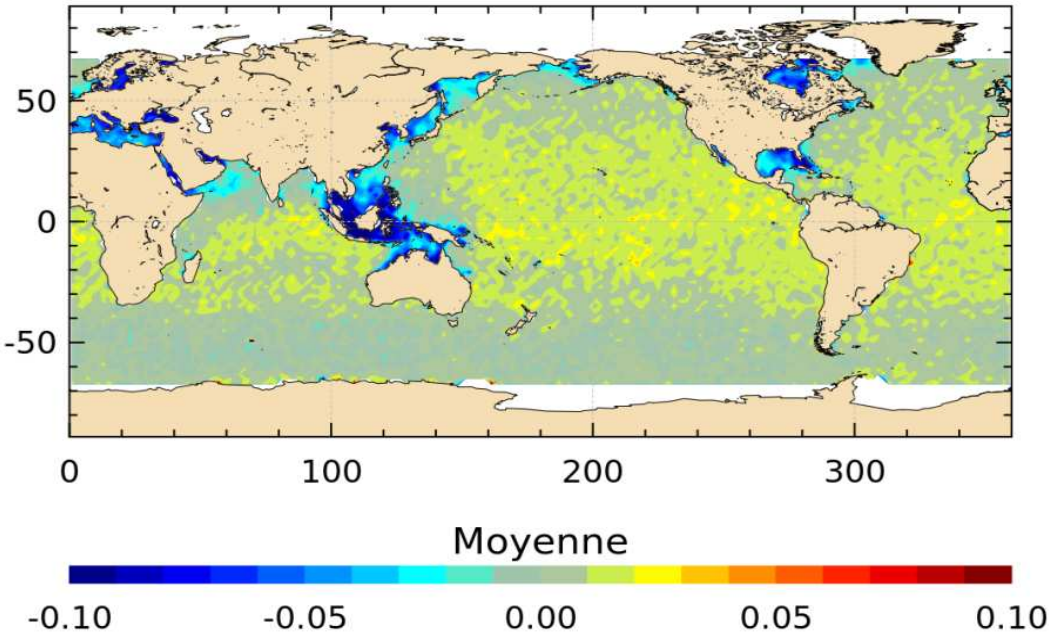
- And we can highlight a good consistency between JA2 and JA3 sigma0 with very small residual signals (+/- 0.03 dB) potentially related to Altimeter gains and/or radiometer atmospheric attenuation

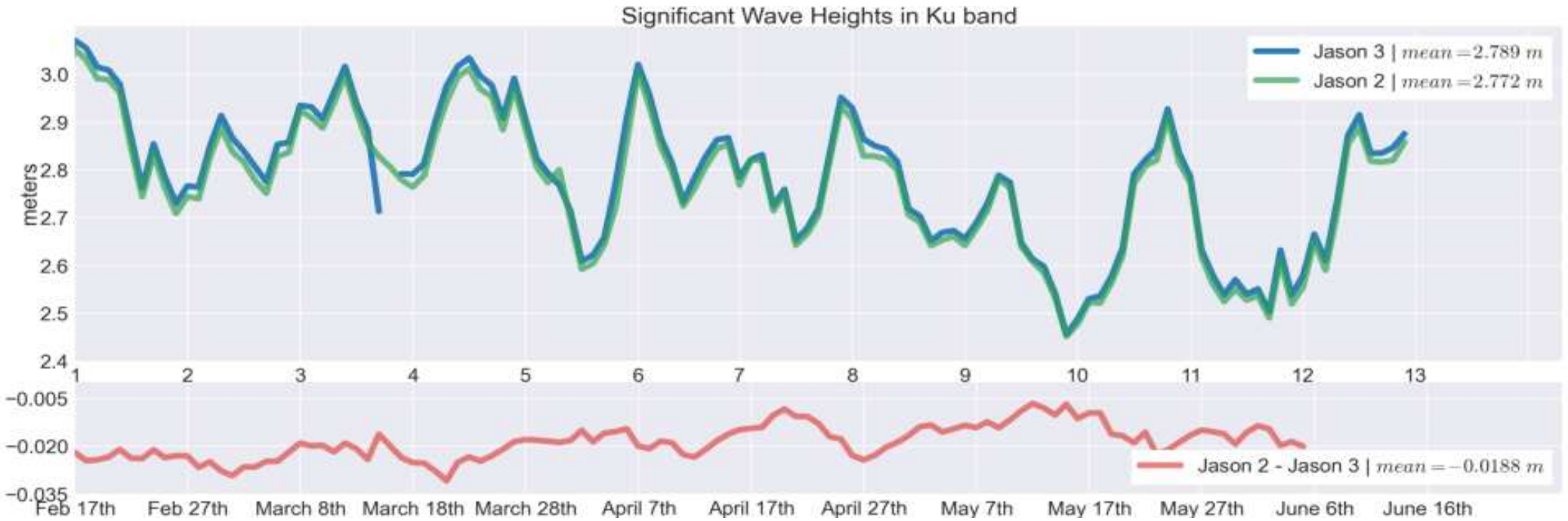




Altimeter parameters SWH

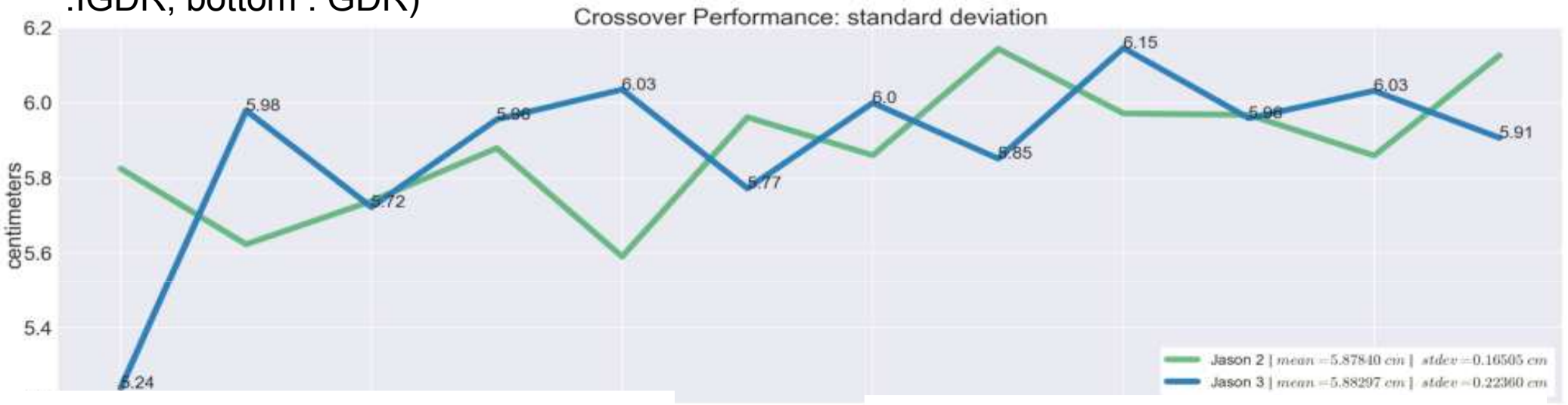
- Jason-3 altimeter SWH are very close to Jason-2 (within 2 cm !) with small geographical patterns which could be related to the LUT applied on both missions.

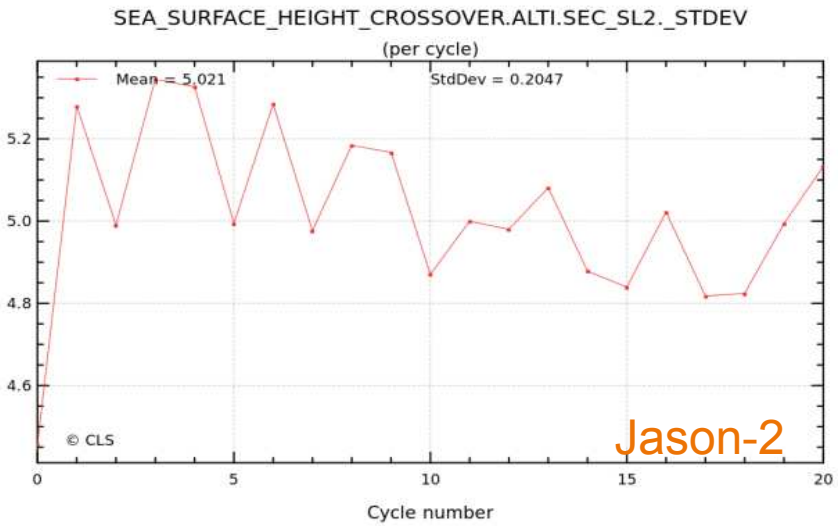


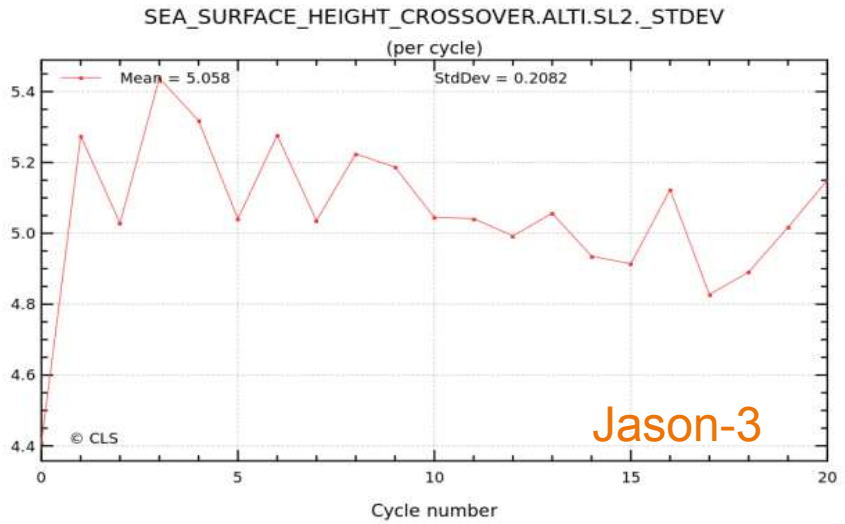


Cross-Over points analysis

- Jason-3&Jason-2 cross over points metrics are equivalent for both missions (top :IGDR, bottom : GDR)

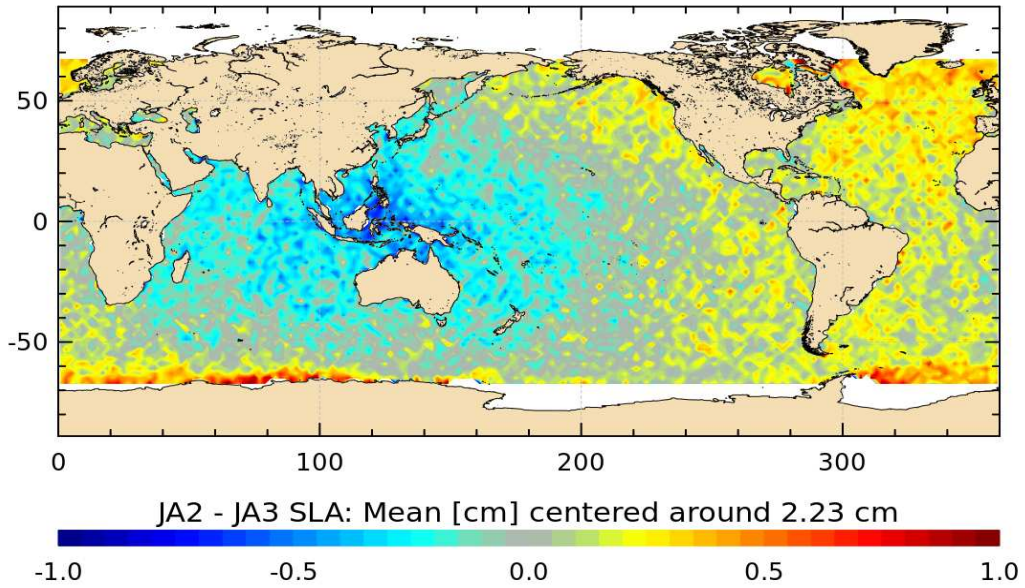


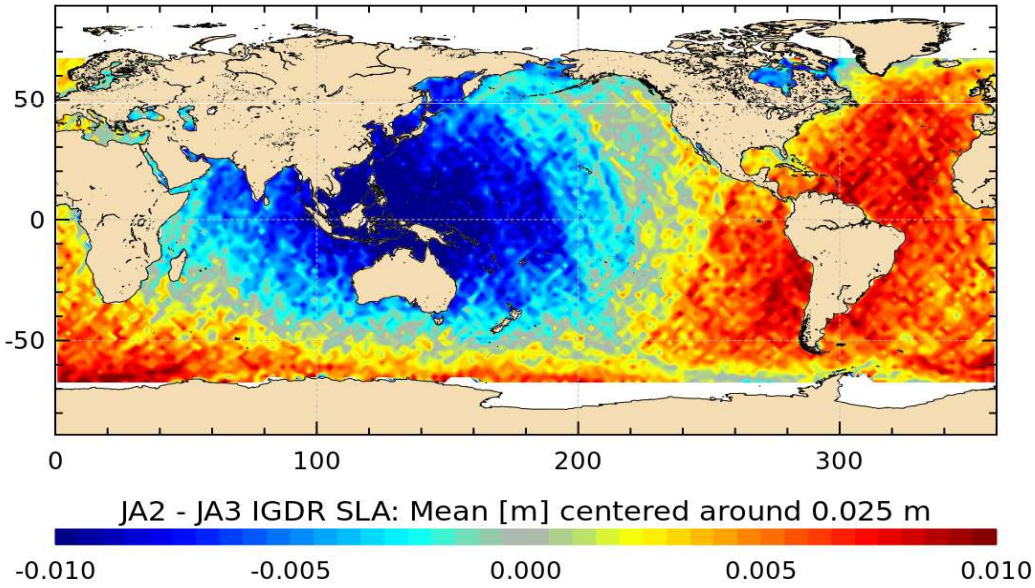




Sea Level analysis

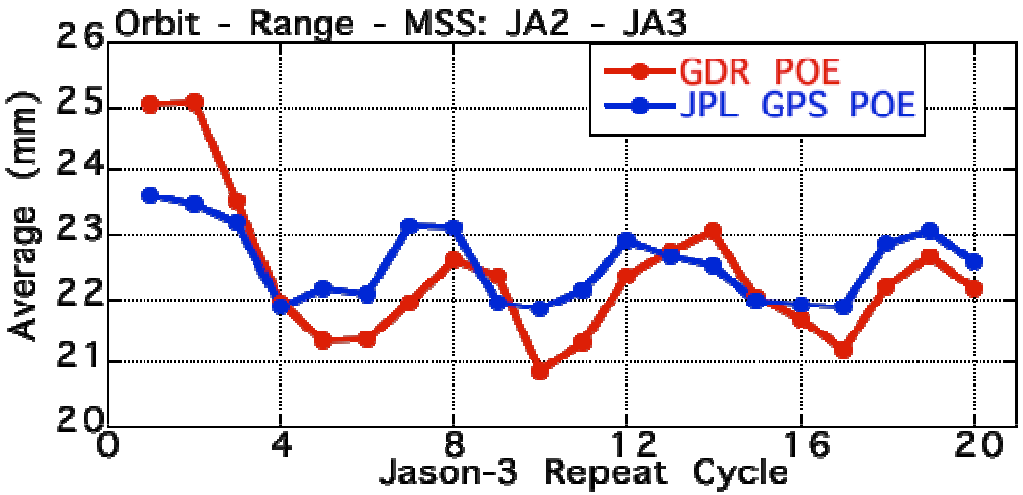
- Jason-3 / Jason-2 SSH agree within 3 centimeters, related to instrument internal path delay on both Ku and C band. The bias is very stable and the geographical patterns are very small (+/- 1 cm). Geographical patterns are largely reduced in GDRs products



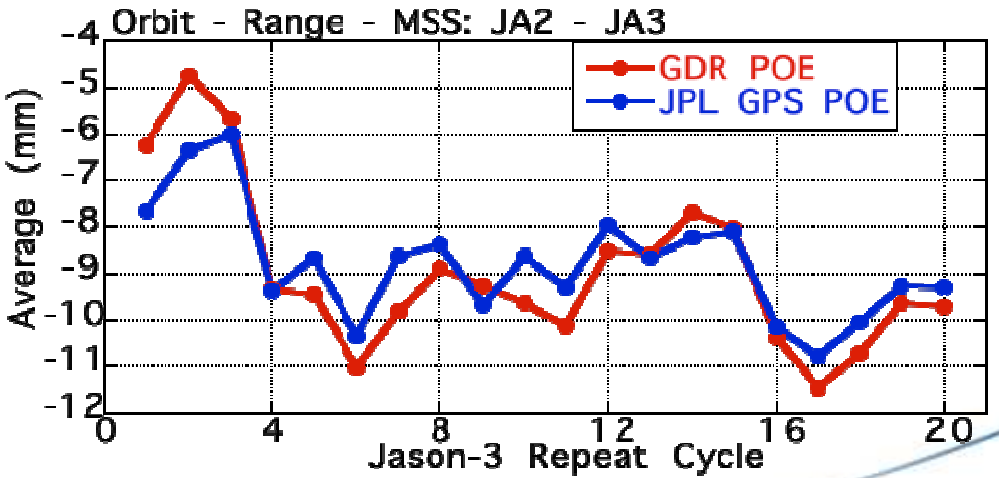


Altimeter internal path delay
Ku and C band relative bias

- Jason-3 Ku-Band range is **longer** by 22.4 mm (using cycles 6-20).~60-day variation observed in average of Orbit – Range – MSS differences.

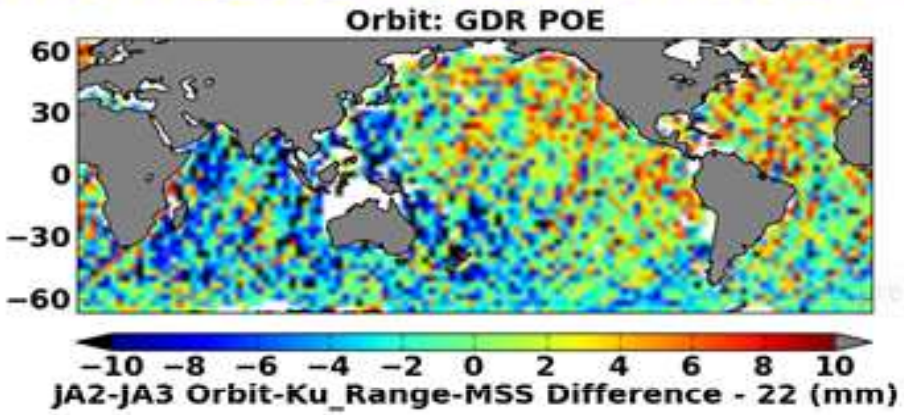


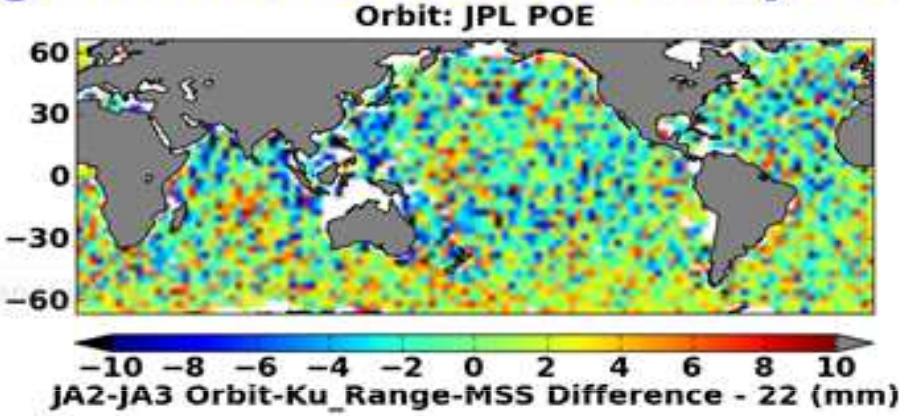
- Jason-3 C-Band range is **shorter** by 9.2 mm (using cycles 6-20). Cycles 1-3 have different behavior due to platform mis-pointing error.



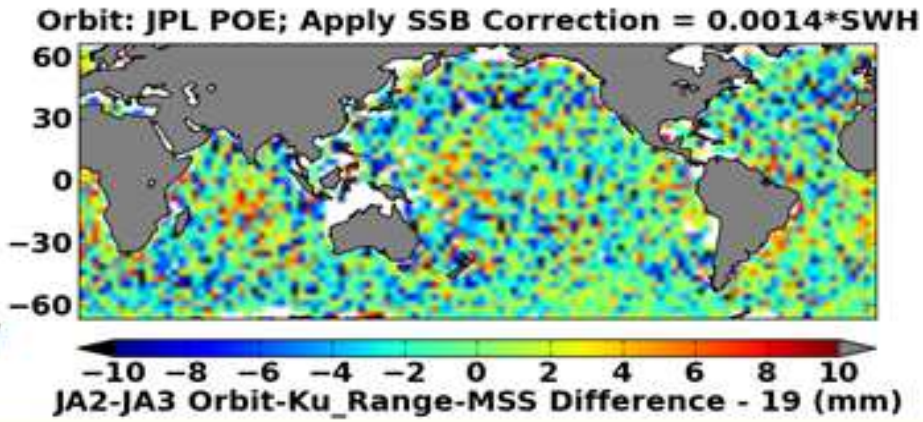
Sea Level analysis

Uncorrected Sea Surface Height Differences: JA3 Cycle 6





- GDR POE: East/West pattern in JA2-JA3 differences.
- JPL POE: Larger JA2-JA3 differences in Southern Hemisphere.
- **JPL POE with relative SSB correction (0.0014*SWH) eliminates geographically correlated errors in differences.**



Multi-mission Analysis – Cross-over

Crossovers < 3 hours; latitude < 50° ; bathymetry > 1000 m; 3.5 sigma edit
IGDR : 20160217 to 20160615, GDR : cycles 1-19

Jason-3/SARAL (IGDR)	
	Stdev
J3 IGDRs (n=2031)	
SLA (cm)	3.66
SWH (cm)	18.7
Wind speed (m/s)	0.91

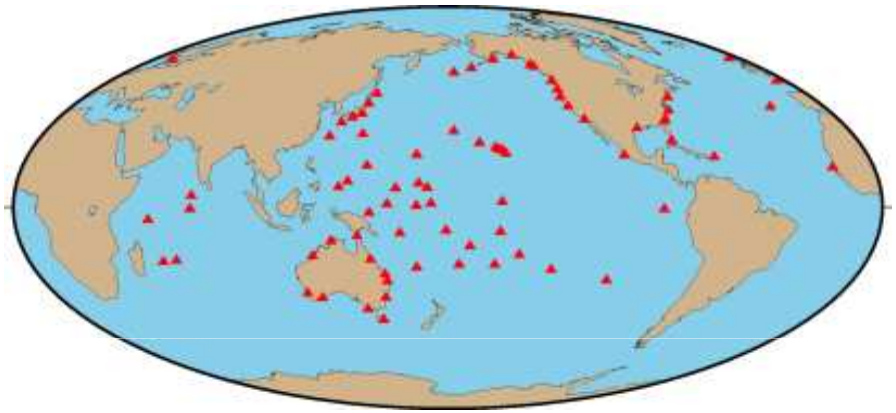
Jason-3/CryoSat-2 (RADS)	
	Stdev
J3 IGDRs (n=1366)	
SLA (cm)	4.72
SWH (cm)	24.2
Wind speed (m/s)	1.14

Jason-3/SARAL (GDR)	
	Stdev
J3 GDRs (n=3593)	
SLA (cm)	3.28
SWH (cm)	17.2
Wind speed (m/s)	0.91

Jason-3/CryoSat-2 (RADS)	
	Stdev
J3 GDRs (n=2966)	
SLA (cm)	4.09
SWH (cm)	23.2
Wind speed (m/s)	0.93

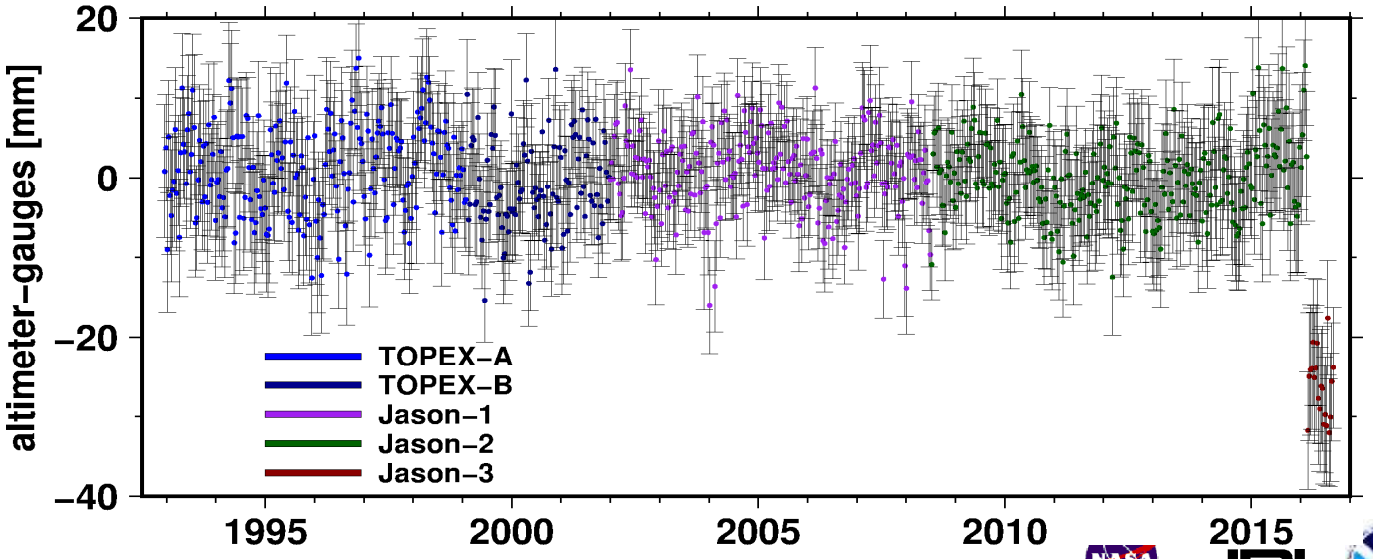
Tide gauge comparison

- SYS-R-965: Accuracy of globally averaged sea level relative to levels established during the cal/val phase will be verified by comparison with no less than 50 tide gauges that provide the widest possible geographic coverage.



75 gauges in NOAA/LSA analysis
Fast delivery gauges available: 57–64

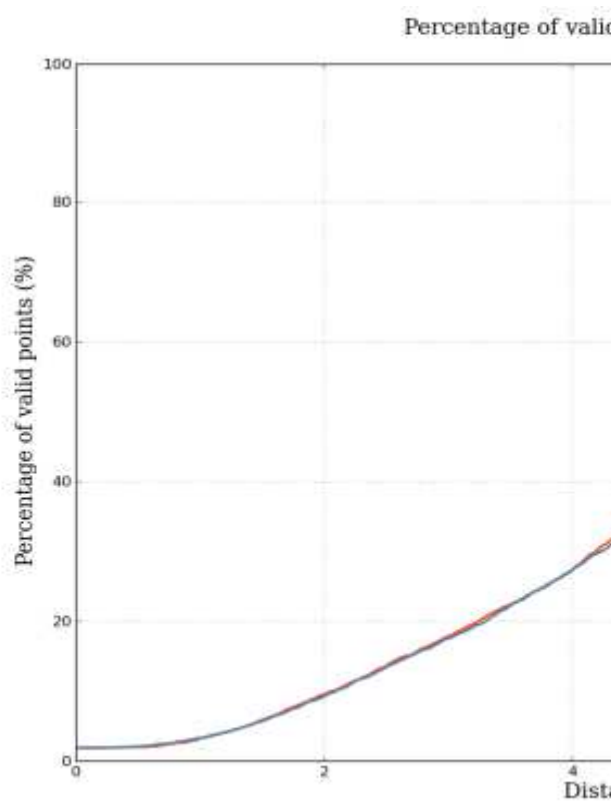
For cycles 1 to 19:
Bias (w.r.t. to TOPEX-A): –26.0 ± 0.9 mm
For cycles 5 to 19:
Bias (w.r.t. to TOPEX-A): –26.7 ± 1.1 mm

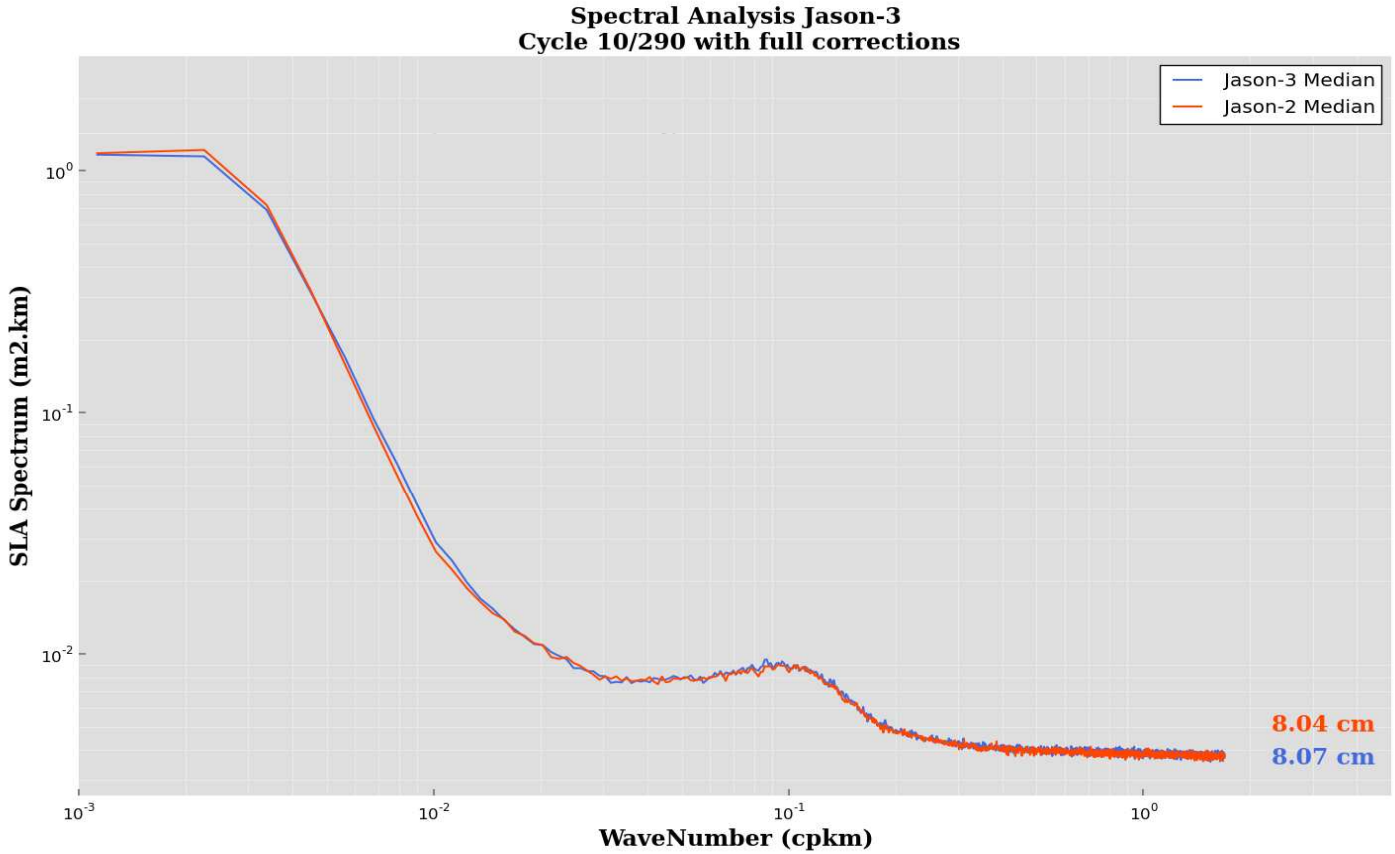


Leuliette and Plagge

MNT

An upload table was uplinked to increase the number of inland water targets following a request from LEGOS PIs. Several cycles have been acquired since then. Over ocean, the data coverage is slightly better and the data quality appears at least as good. (Cycle 6 = DEM mode)

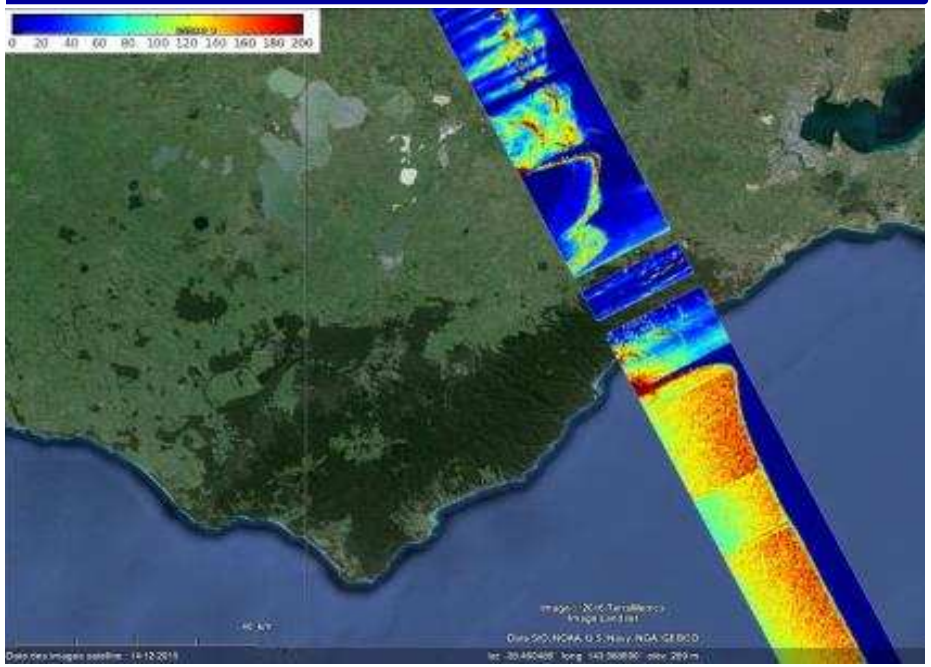




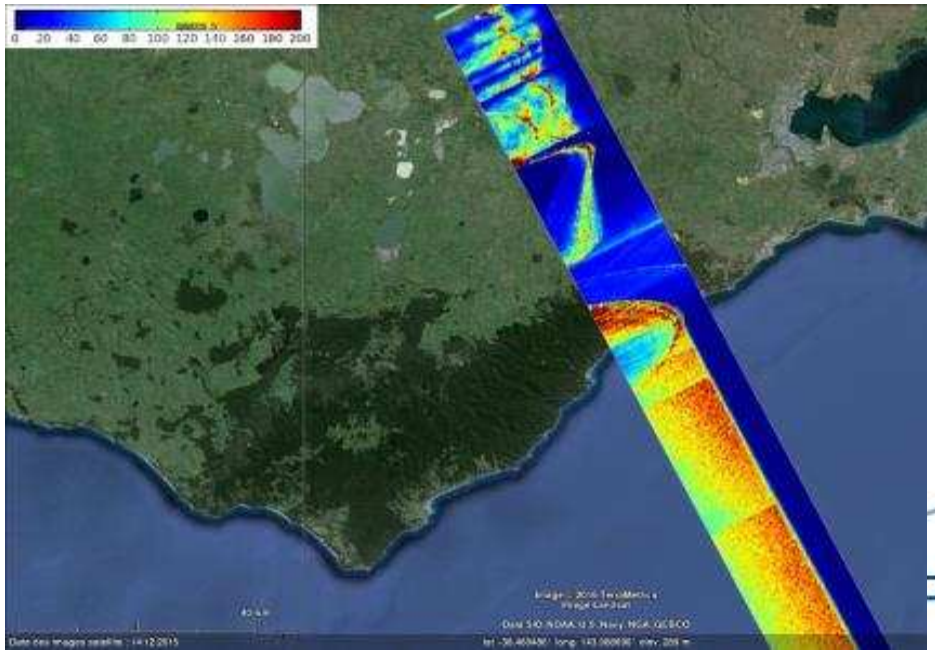
MNT

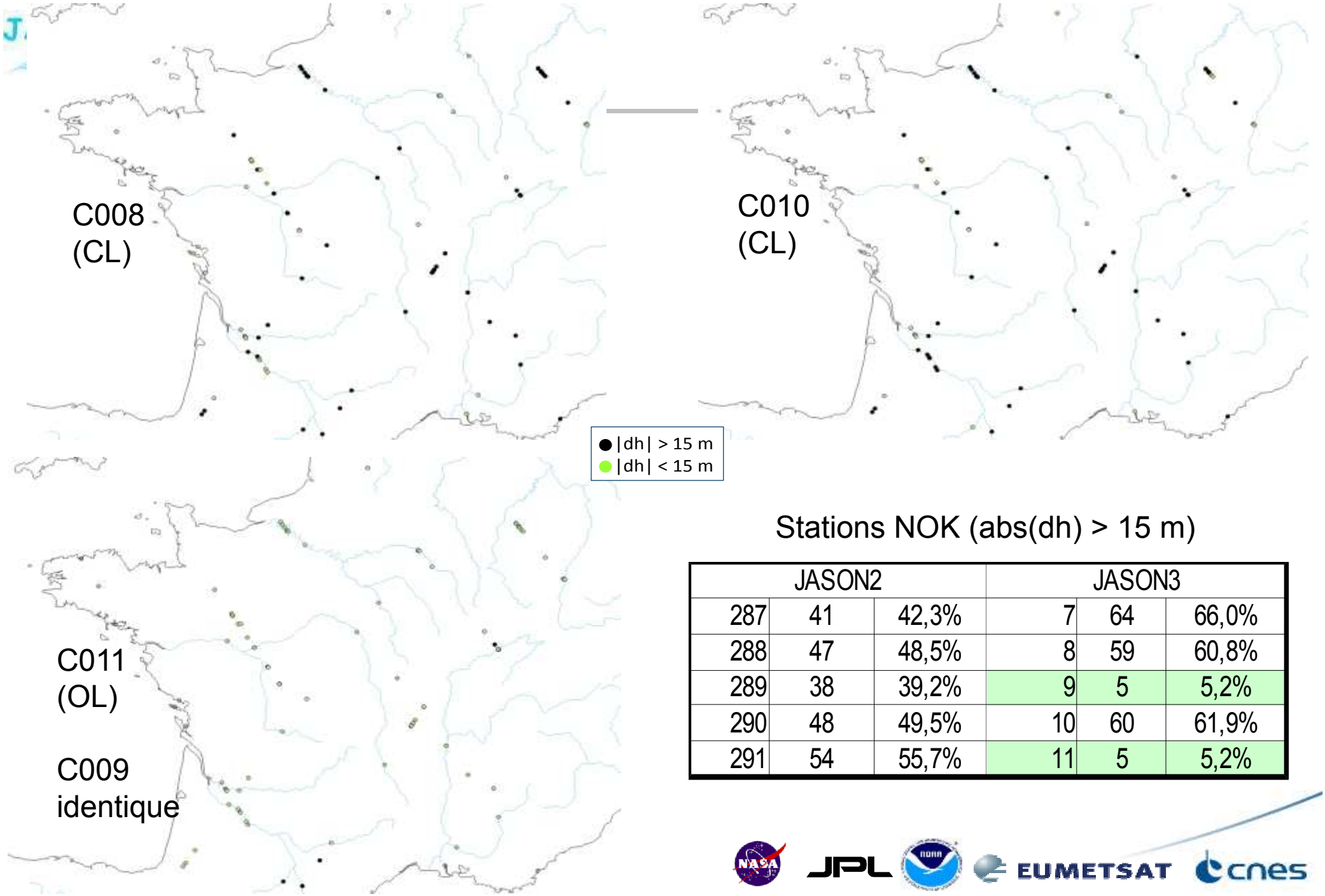
Example on a land → ocean transition demonstrate the better coverage of the coastal area. (Cycle 6 = DEM mode)

Cycle 5 Trace 88 – Australie– Land → ocean



Cycle 6 Trace 88 – Australie– Land → ocean





Stations NOK (abs(dh) > 15 m)

JASON2			JASON3		
287	41	42,3%	7	64	66,0%
288	47	48,5%	8	59	60,8%
289	38	39,2%	9	5	5,2%
290	48	49,5%	10	60	61,9%
291	54	55,7%	11	5	5,2%

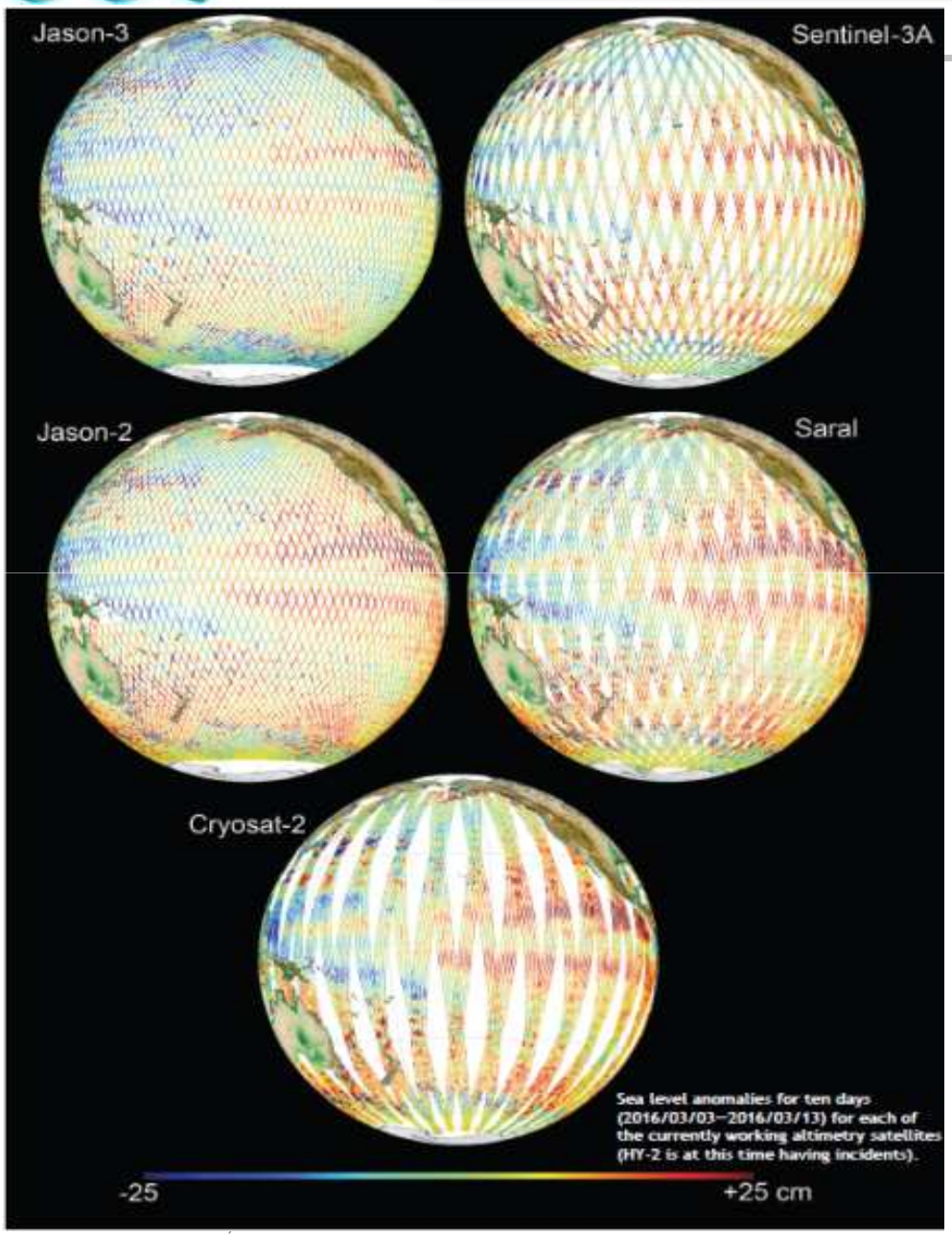
Conclusion

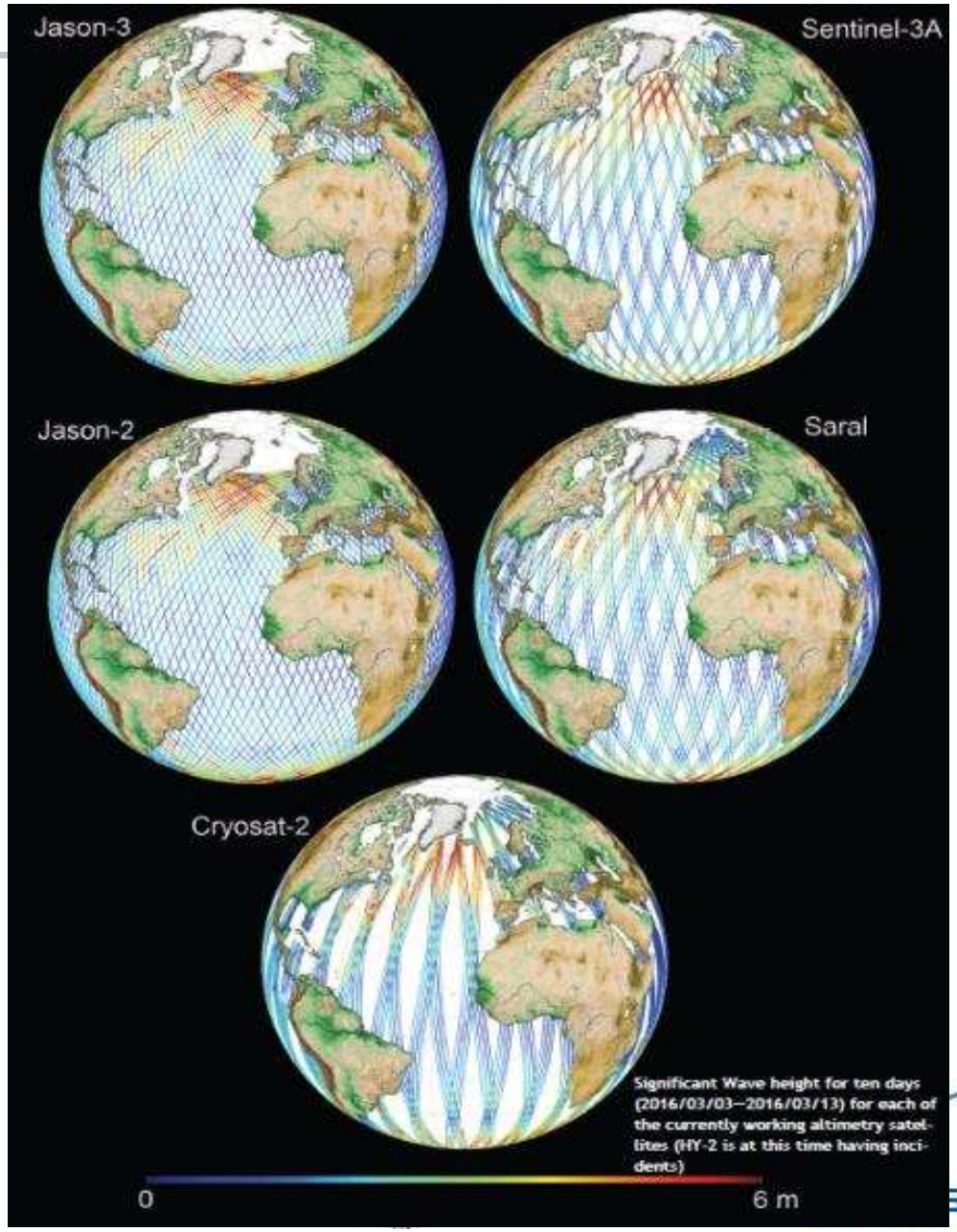
- Jason-3 GDRs products are fully inline mission requirements in par with Jason-2 mission.

- Most important issues during the CalVal period were :
  - Update of the Star Tracker coefficients (mispointing, sigma0, wind, SSB, rain flag, SSH, …)
  - Drift of the AMR instrument, corrected thanks to the calibration of the AMR with ARCS system and the new cold sky calibration.
  - Analysis of the mispointing observed on the altimeter parameters leading to the update of the CAL2 filters acquisition scheme with ocean gain
  - Update of the DEM tables → improved coverage over inland water.
  - Update of the rain flag values (align JA3 sigma0 values to the on expected by the look up table).

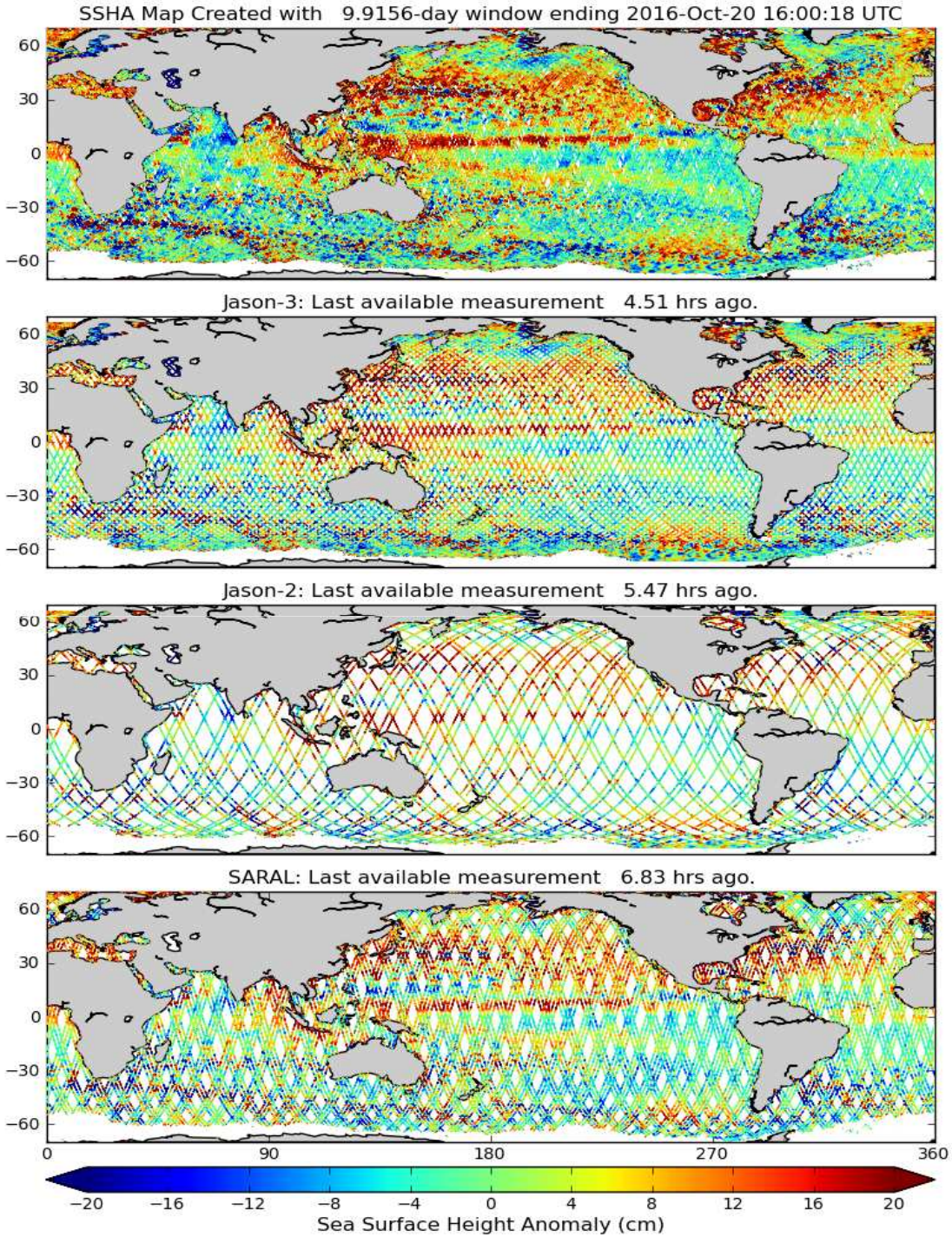
- Few remaining points needs to be further addressed:
  - Remaining geographical patterns are observed on SSH (related to POE), SWH and Sigma0/wind deserve additional analysis.
  - Additional validation of DEM/OLTC mode over inland water targets.

Altimetry Constellation





- JPL NRT L3 products : As expected, using J2 in the new ground track, along with J3 and SARAL, provides impressive results. .
- Maps generated using NRT data with GPS orbits for J2 and J3 (SSH biased by 3 cms), and xover-based orbit adjustment for SARAL.



- NOAA/NWS/NCEP/OPC is using J3 AND has the capability to use S3 data in their high seas SWH monitoring.