Ocean Surface Topography Science Team Meeting (OSTST)
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"The 25th Anniversary of TOPEX/Poseidon"

Jason-3 mission performance for operational oceanography applications and long term Climate Data Record continuity

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Overview

- 20 months of Jason-3 measurements are now available

- Validation activities have been performing for (O)(I)GDR products on **CNES and JPL** to check and evaluate the quality of Jason-3 measurements. When precise, updates on some corrections are also studied.

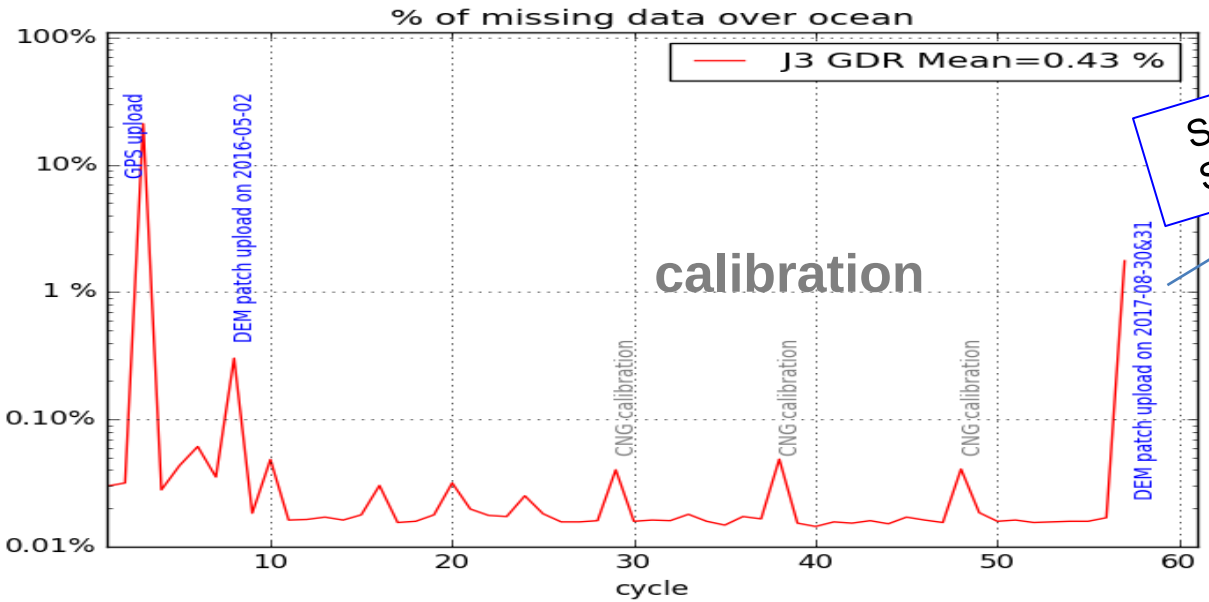
- Objectives of altimetry validation activities over ocean are :
  - To check the data availability and validity
  - To analyze the physical content quality of product parameters
  - To estimate the system performances in terms of sea level calculation
  - To contribute to a better knowledge of the sea-level physical content
  - To check and contribute to the system improvement
  - To provide information for users and production centre

- This talk aims at presenting the status of the Jason-3 sea-level performances

Performance metrics:
Data availability

Main performance metrics: Data availability

- Very good data availability over ocean: **99.60 % calibrations and uploads included**



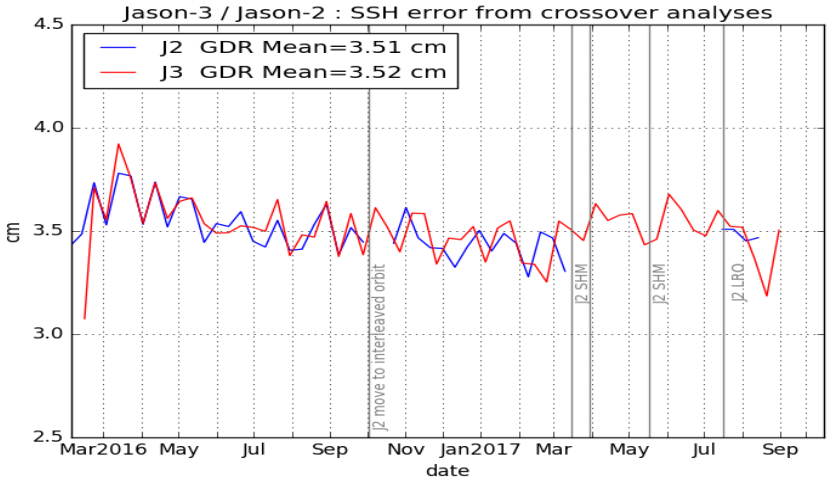
- After removing calibrations and uploads, **more than 99,9 % of data over ocean are available**

Performance metrics: Analysis at crossovers

Main performance metrics: crossovers

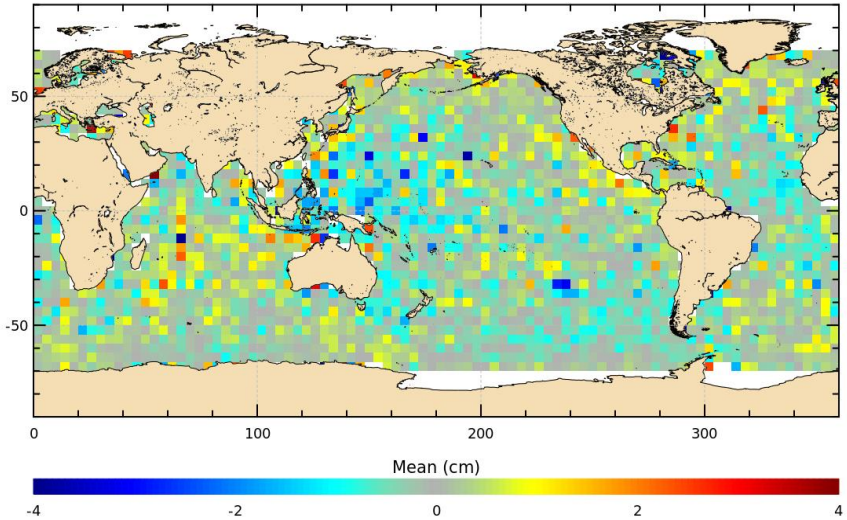
SSH error for Jason-3 is deduced from crossovers analyses,
after removing altimeter noise and when selecting |latitudes| < 50°, bathy<-1000m, oceanic variability < 20 cm

SSH error is close to 3.5 cm for temporal scales < 10 days



Main performance metrics: crossovers

- Mean difference between ascending and descending tracks is near zero (-0.1 cm for GDR),
- Spatial distribution of mean SSH differences shows very small geographically correlated patches with differences remaining below 1 cm.
- Residual signal correlated with orbit patterns



map of mean Jason-3 SSH differences (cycle 001 to 055),

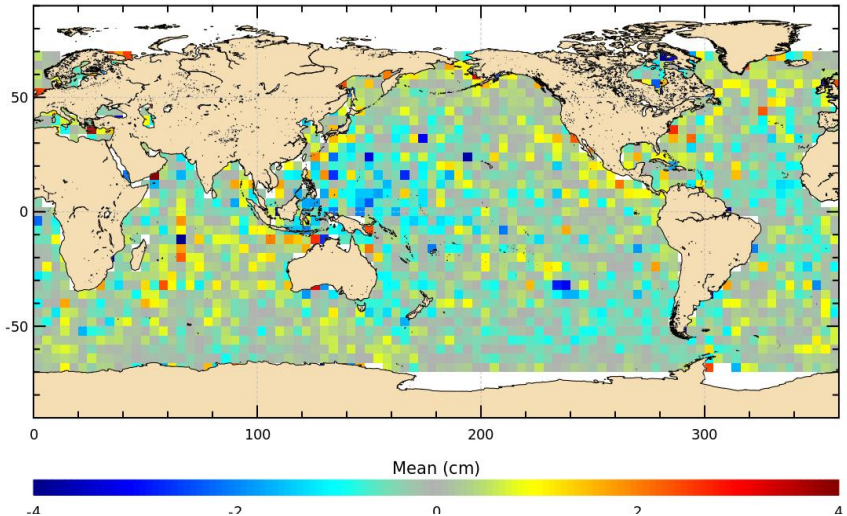
Main performance metrics: crossovers

- Sea Level performances: SSH error for Jason-3 is deduced from crossovers analyses using radiometer data (after removing altimeter noise and when selecting |latitudes| < 50°, bathy<-1000m, oceanic variability < 20 cm)

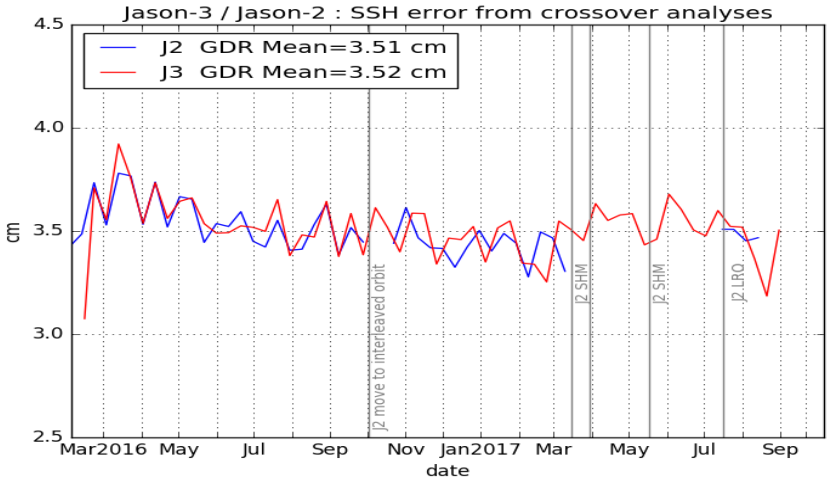
SSH error is close to 3.5 cm for temporal scales < 10 days

- Mean difference between ascending and descending tracks is near zero (-0.1 cm for GDR),
- Spatial distribution of mean SSH differences shows very small geographically correlated patches with differences remaining below 1 cm: residual signal correlated with orbit patterns

➔ mean, error, and spatial distribution crossovers analysis demonstrates the excellent performance of Jason-3



map of mean Jason-3 SSH differences (cycle 001 to 055).

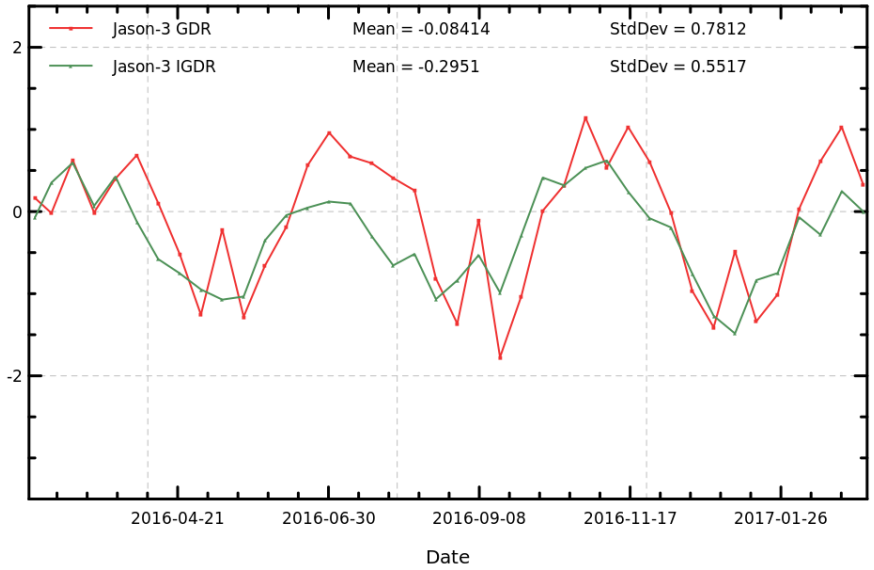


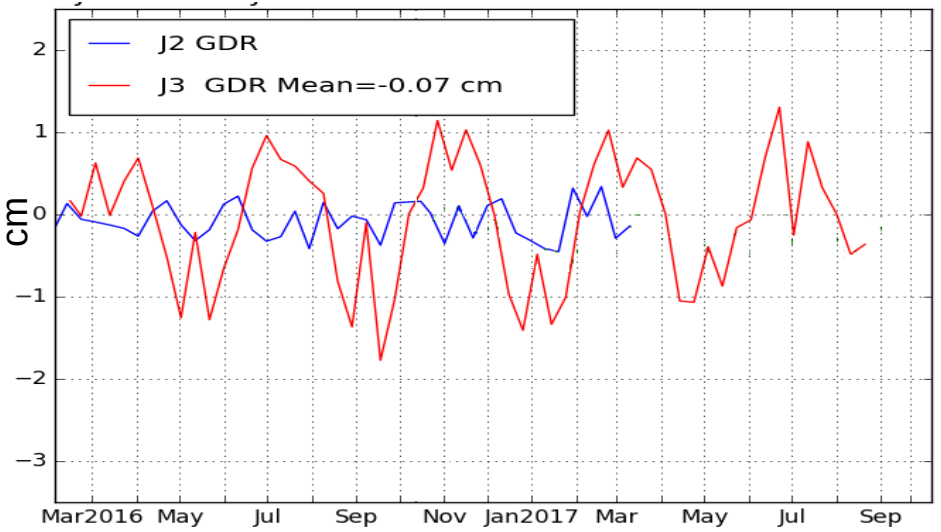
SSH error deduced from SSH crossovers

SSH differences at crossovers: 120-days signal

Nevertheless, a 120-days signal appears on Jason-3 SSH differences at crossover with GDR data.

mean differences at crossovers



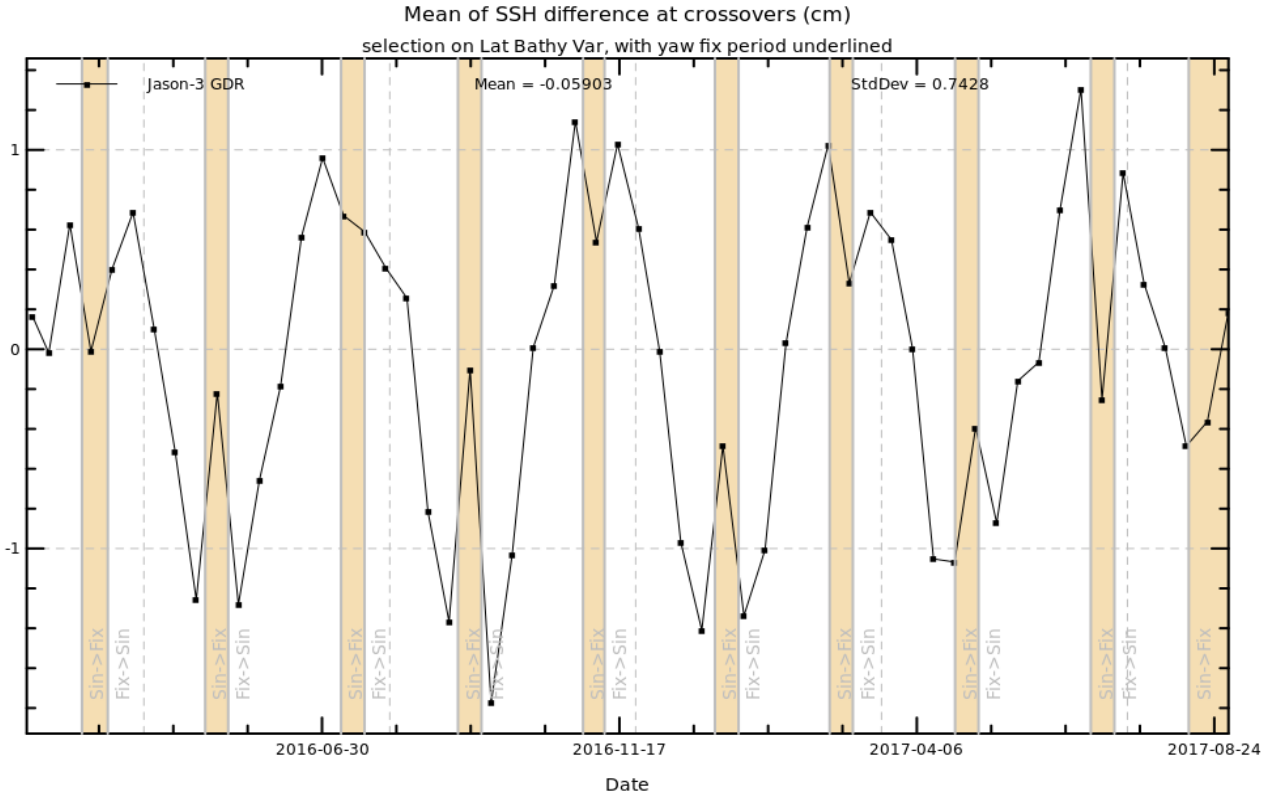


J3 IGDR vs **J3 GDR**:
Signal is more important with GDR than with IGDR

~120 days signal amplitude with **Jason-3** > with **Jason-2**

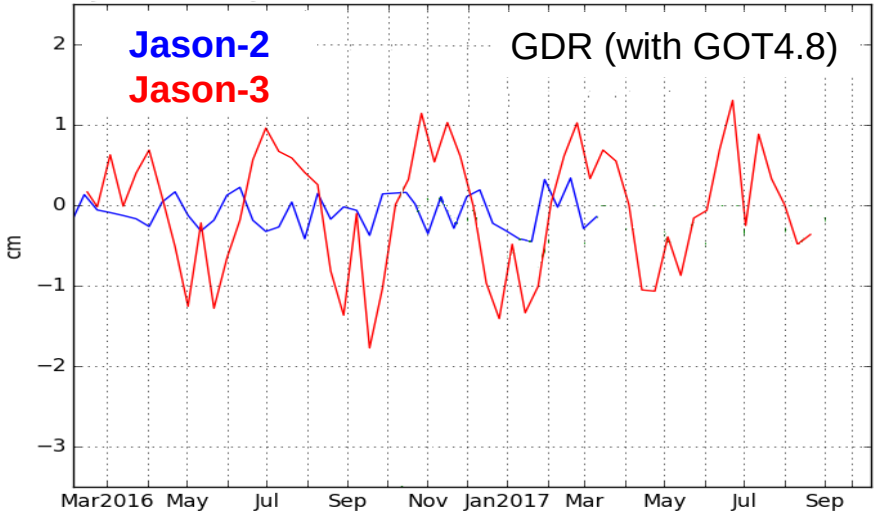
SSH differences at crossovers: 120-days signal

A dependence to fix yaw periods is identified ➔ under investigations

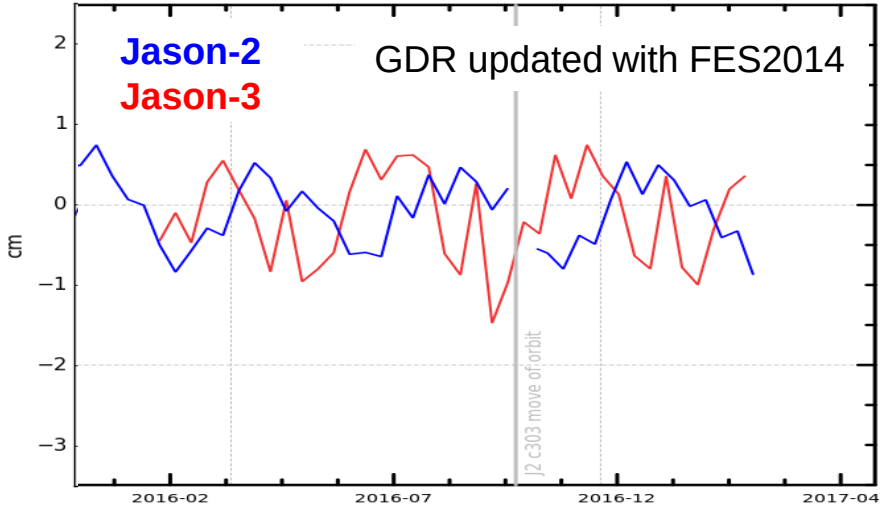


SSH differences at crossovers: 120-days signal

Caution about the **ocean tide** solution (assimilating J1 and J2 data) used to compute SSH



120 days signal
on Jason-3 but not on Jason-2

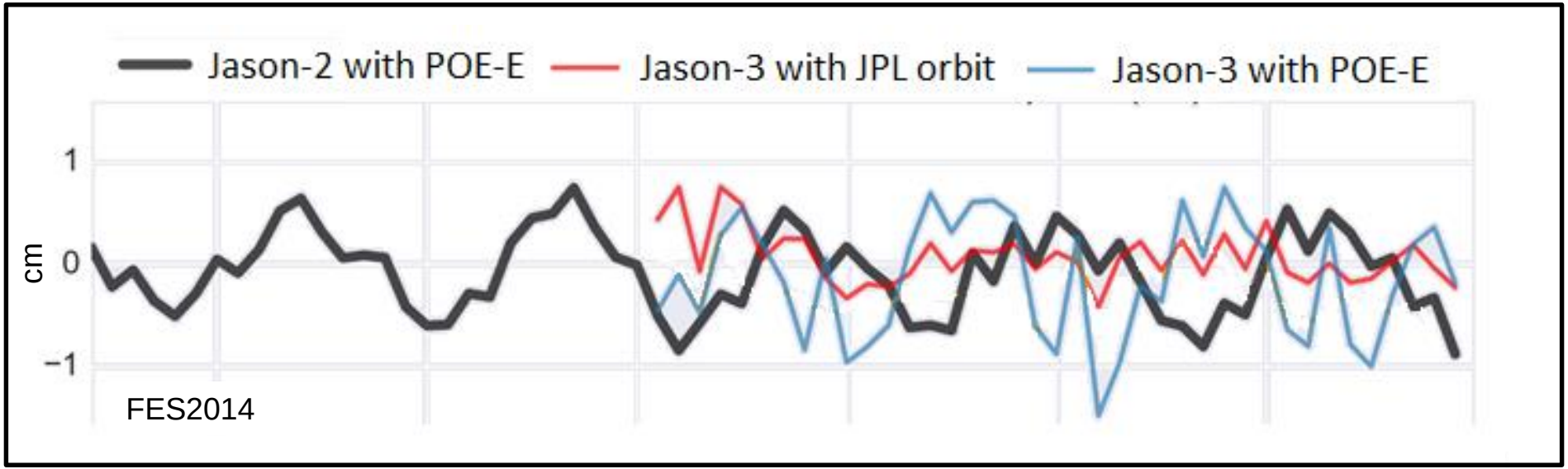


Amplitude equivalent for J2 and J3
Amplitude on J3 slightly reduced
compared to SSH with GOT4.8

We have to use FES tide model to analyse orbit signals at crossovers for Jason-2 and Jason-3

SSH differences at crossovers: 120-days signal

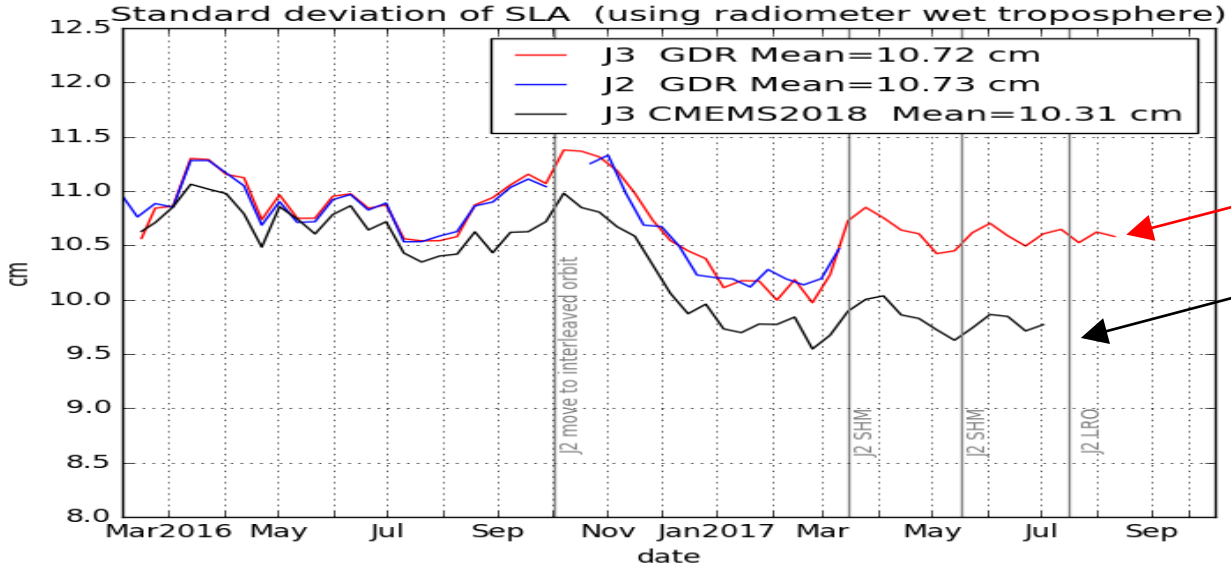
Using FES 2014 tide model the 120 days signal on Jason-3 disappears using JPL orbit solution.



These behaviors with different orbits and tides models (assimilating J1 and J2 data) **reminds the strong correlation between tides and orbit.**

Performance metrics:
Standard deviation of SLA

Main performance metrics: standard deviation of mean sea level



GDR :
MSS 2011 [ref 7yrs]
GOT4,8

Updated GDR :
MSS 2015 [ref 20yrs]
FES2014

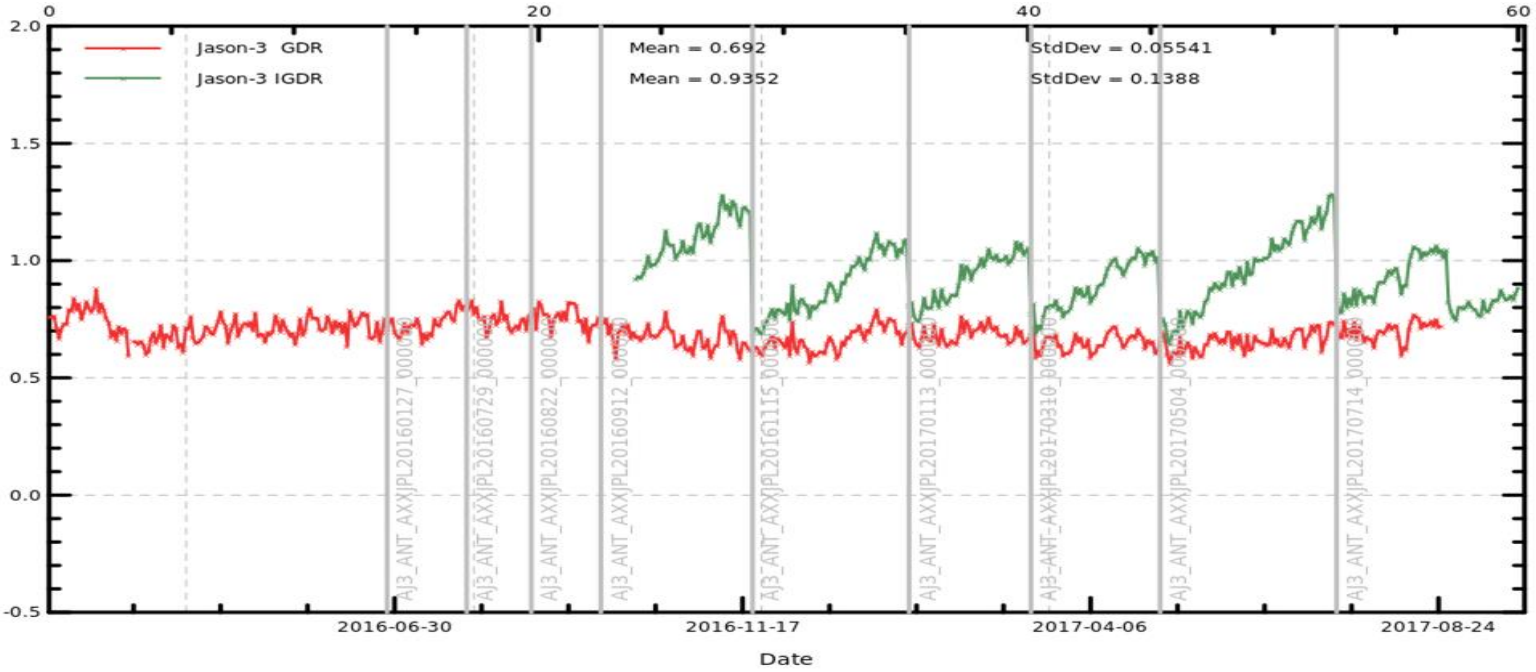
- The standard deviation of **Jason-3 GDR** product SLA is close to **Jason 2**.
- The use of **updated products** (CNES/CLS2015 solution for mean sea level and FES2014 ocean tide) improves this performance metric.

Performance metrics:
Stability of the mission

Stability : AMR monitoring

An AMR drift is corrected before GDR product generation via ARCS calibration steps.

➔ wet path delay correction stability in GDRs is largely improved thanks to the calibration performed.

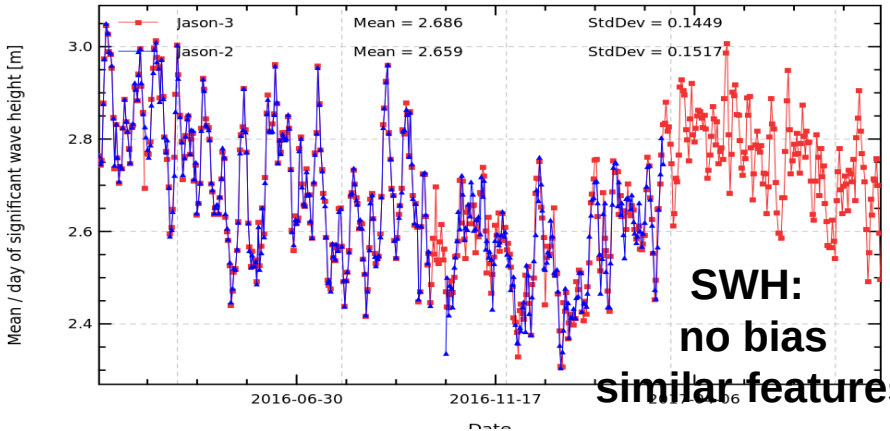


Mean of radiometer minus ECMWF model wet tropospheric correction (cm)
Vertical lines indicate IGDR change of radiometer calibration file

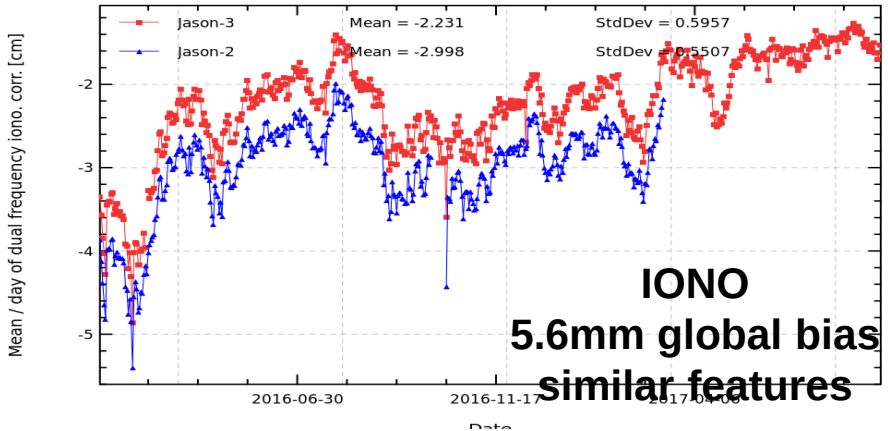
Global Mean Sea Level: continuity of the reference serie

Continuity with Jason-2 : altimeter parameters

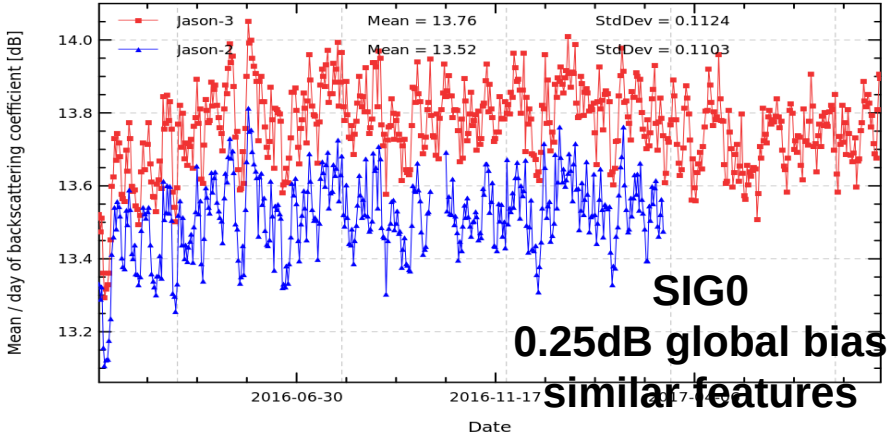
JASON-3
JASON-2



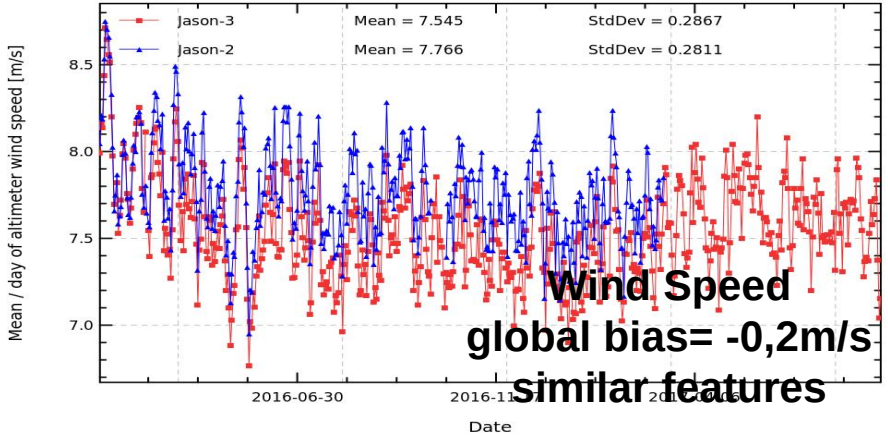
SWH:
no bias
similar features



IONO
5.6mm global bias
similar features



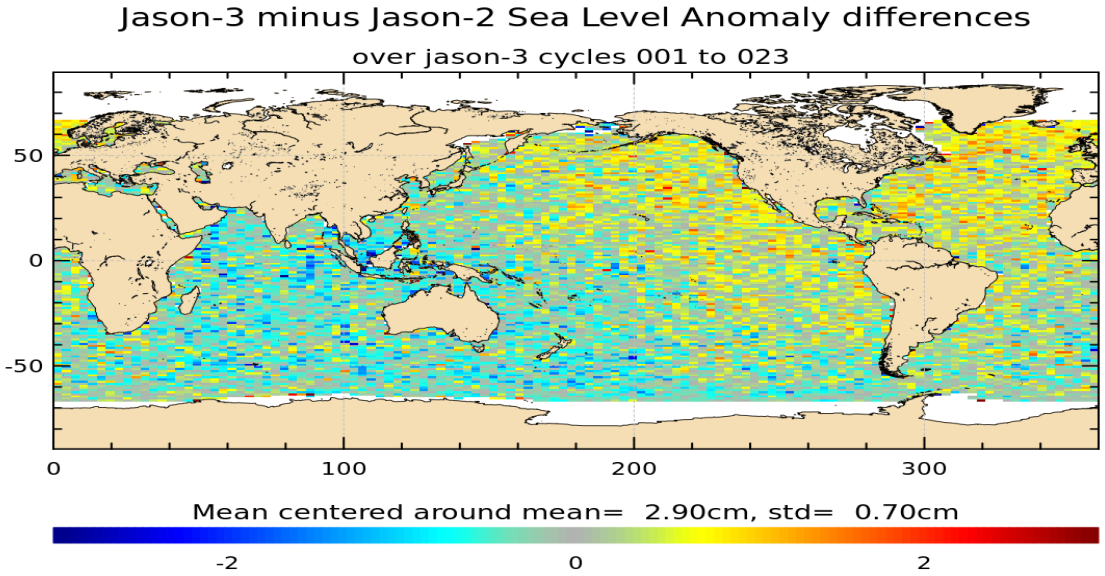
SIG0
0.25dB global bias
similar features



Wind Speed
global bias= -0,2m/s
similar features

Global Mean Sea Level

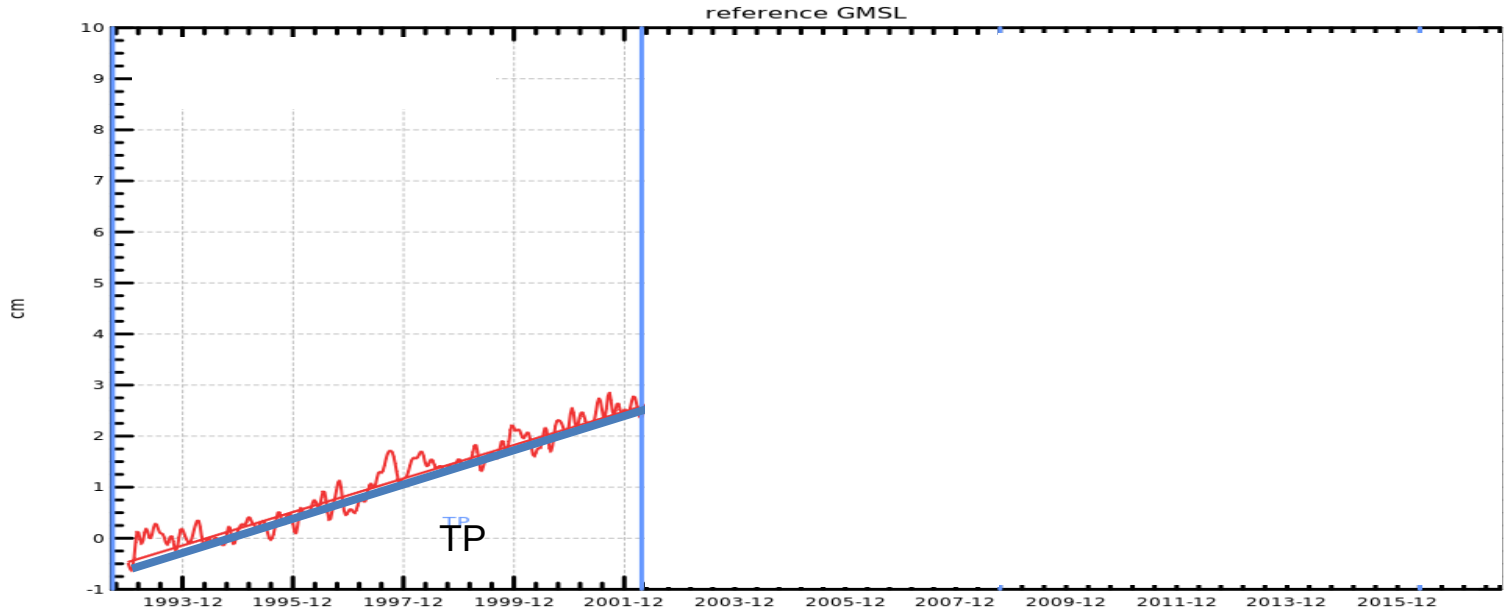
Tandem phase allows to accurate link both series:



→ only a weak hemispheric bias is visible (likely due to differences in orbit processing).

Global Mean Sea Level

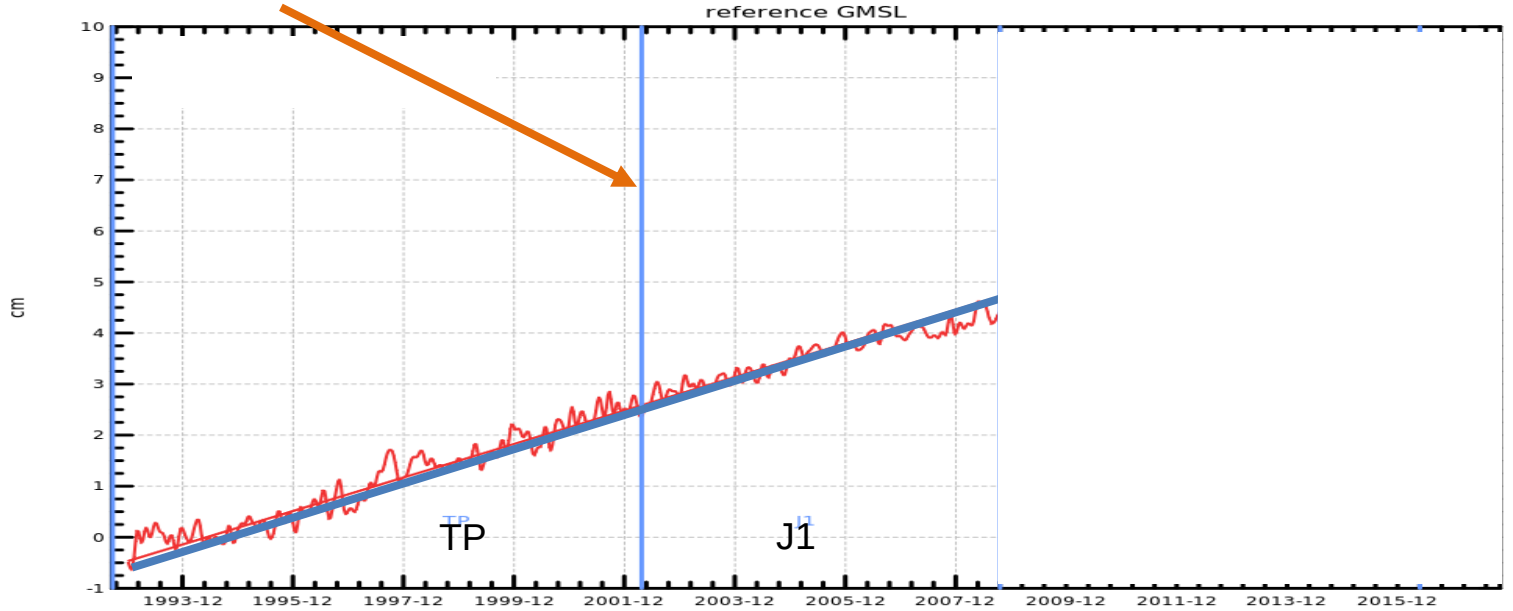
The reference GMSL began 25years ago with TOPEX



Global Mean Sea Level

The data series are linked together accurately thanks to the tandem flying phases.
The following global bias are applied :

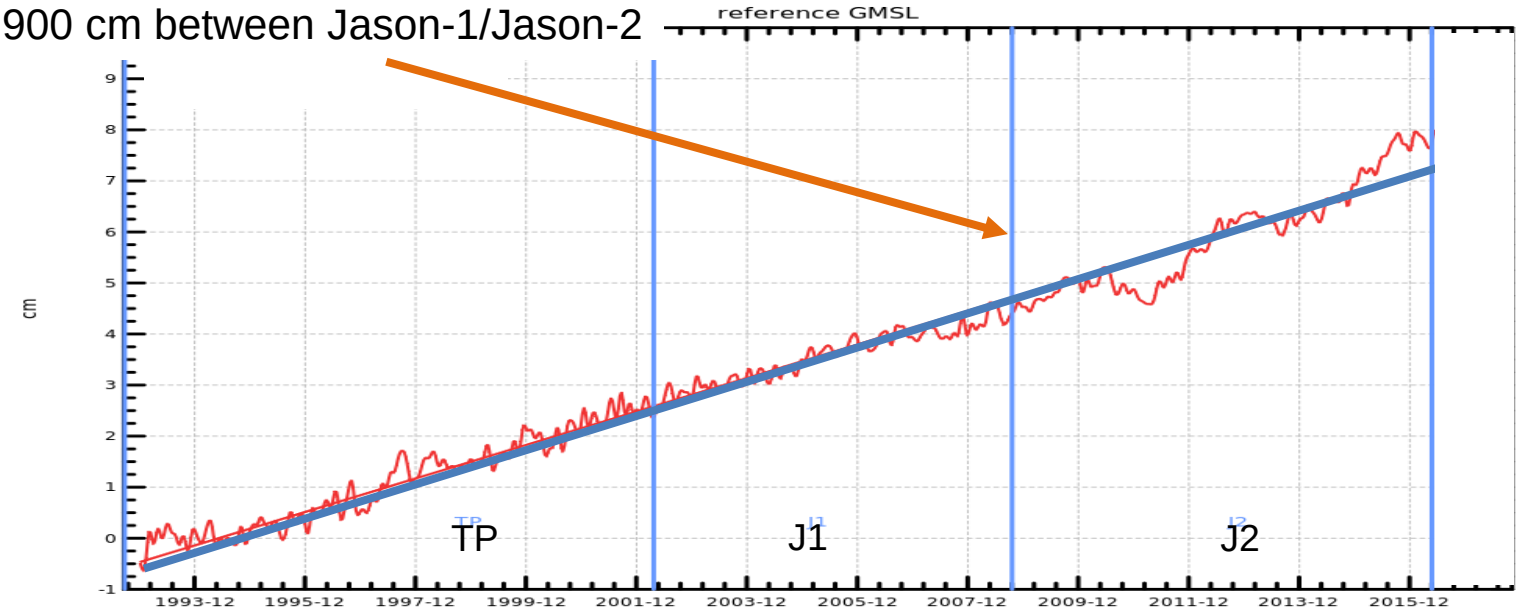
- -2.260 cm between T/P&Jason-1



Global Mean Sea Level

The data series are linked together accurately thanks to the tandem flying phases.
The following global bias are applied :

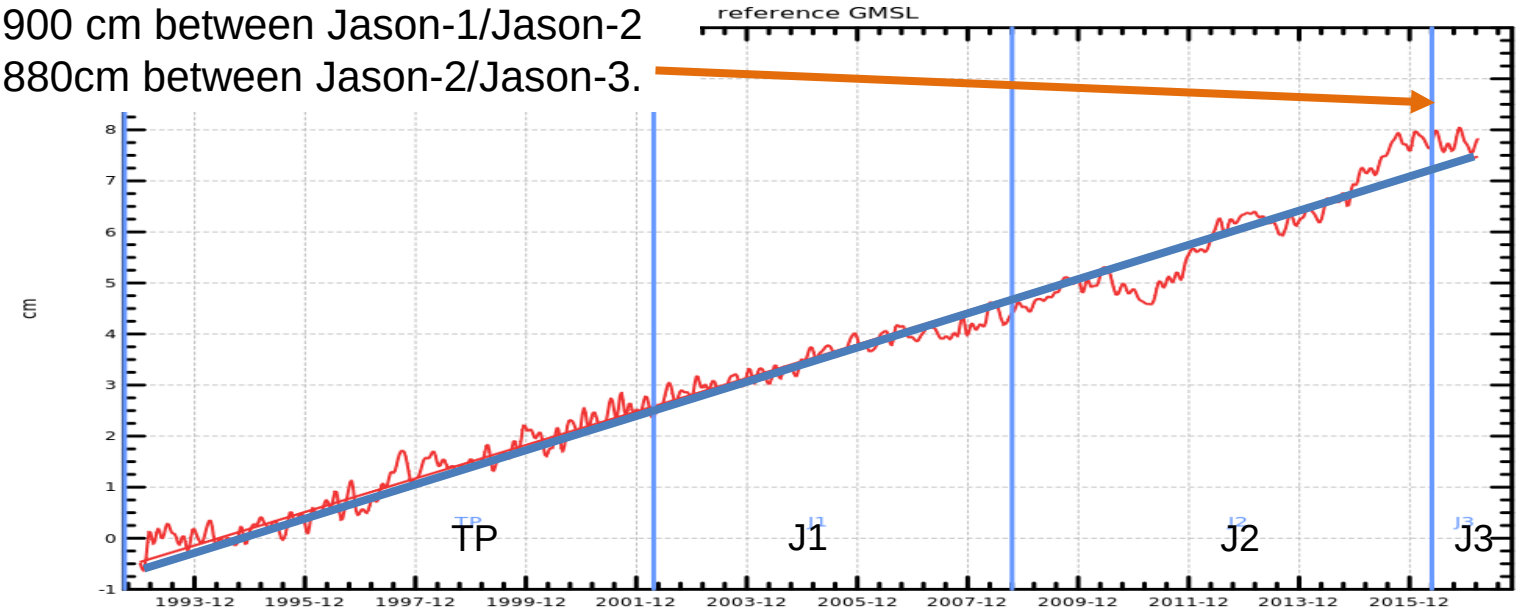
- -2.260 cm between T/P&Jason-1,
- 3.900 cm between Jason-1/Jason-2



Global Mean Sea Level

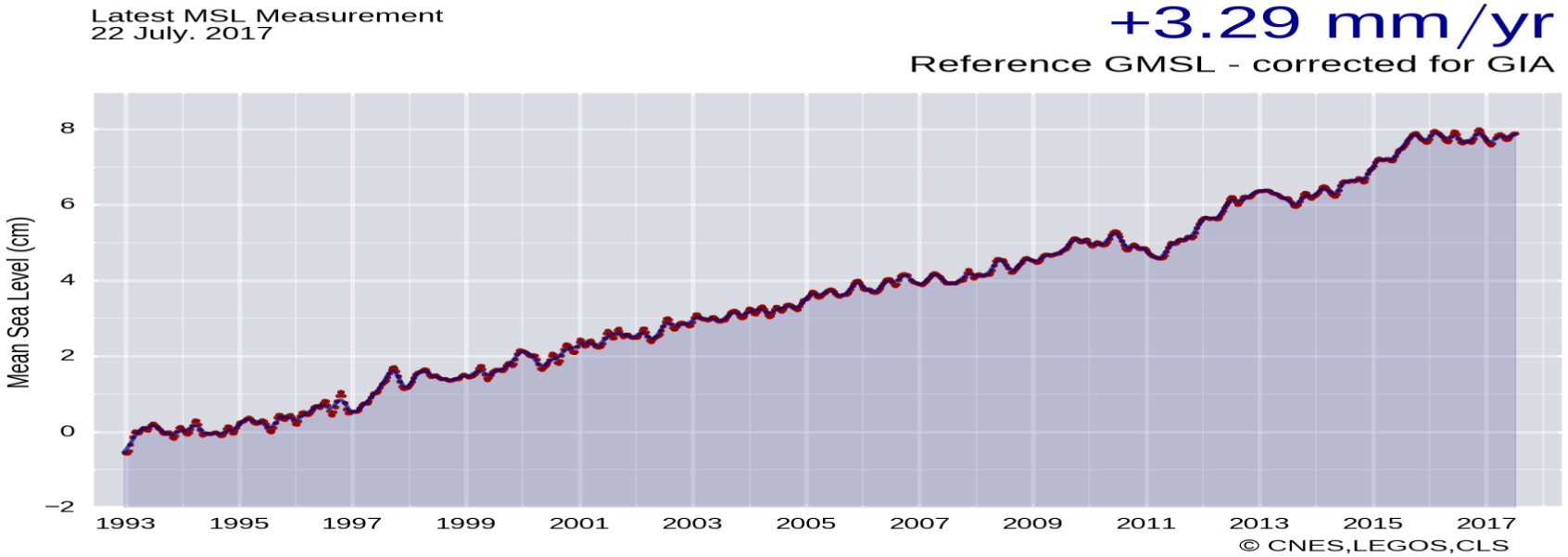
The data series are linked together accurately thanks to the tandem flying phases.
The following global bias are applied :

- -2.260 cm between T/P&Jason-1,
- 3.900 cm between Jason-1/Jason-2
- 2.880cm between Jason-2/Jason-3.



Global Mean Sea Level

Since 2016, Jason-3 has been the reference altimetry mission
to estimate the Global Mean Sea Level (GMSL), instead of Jason-2
(continuity on the historical TOPEX/Poseidon Jason-1 and Jason-2 ground track).



[*see Aviso+ website, MSL : http://www.aviso.oceanobs.com/msl*]

Conclusions

- ✓ **The Jason-3 mission gives data of excellent quality on the historical TOPEX/Poseidon, Jason-1 and Jason-2 ground track**
- ✓ **A 120days signal appears on mean at crossovers, probably linked to orbit computation (need further investigations)**
- ✓ **Jason-3 agreement with Jason-2 was very good during tandem phase … and even after**
- ✓ **Thanks to these results, Jason-3 has been declared the reference satellite altimetry mission in Copernicus CMEMS, and insure the continuity of the GMSL on historical TOPEX ground track.**

Thanks for your attention