Assessment of Jason-2 and Jason-1 orbit quality from SSH analysis

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Introduction

- This presentation is a synthesis of different results linked to the Jason-2 and Jason-1 orbits presented in parallel Global Cal/Val splinter.

- In this presentation, we concentrate on:

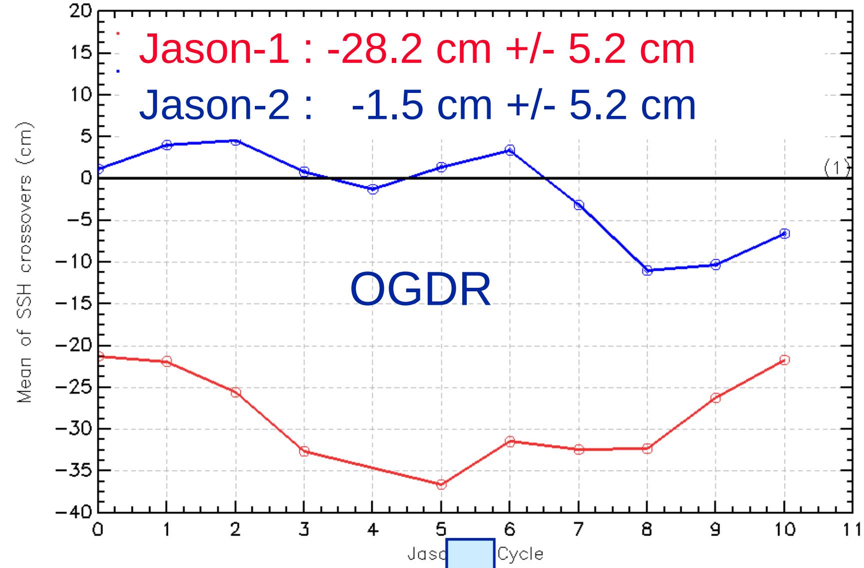
⇒ Analysis of the Jason-2 and Jason-1 orbit quality (DIODE, MOE and POE) from the SSH calculation during the Jason-2 CalVal phase

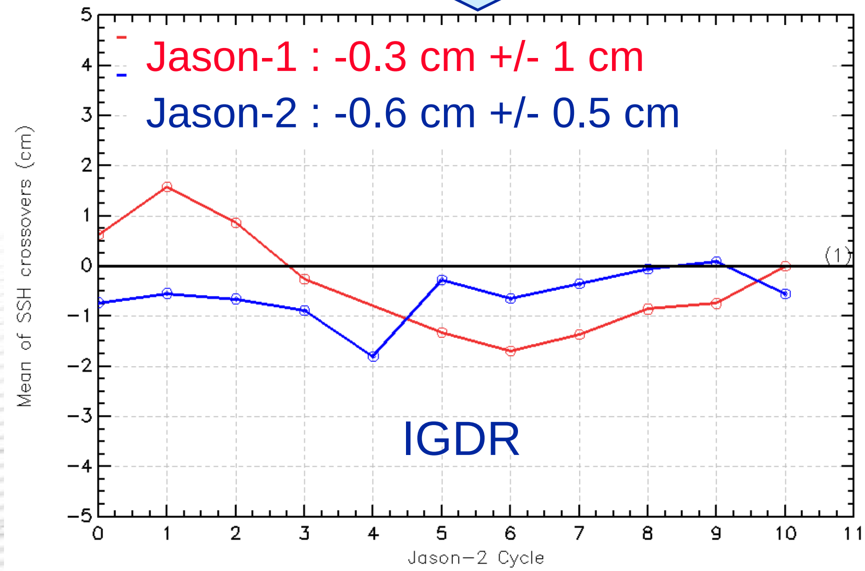
⇒ Analysis of the new GDR-C Jason-1 orbit performances for the SSH calculation in comparison with the Jason-1 GDR-B orbit

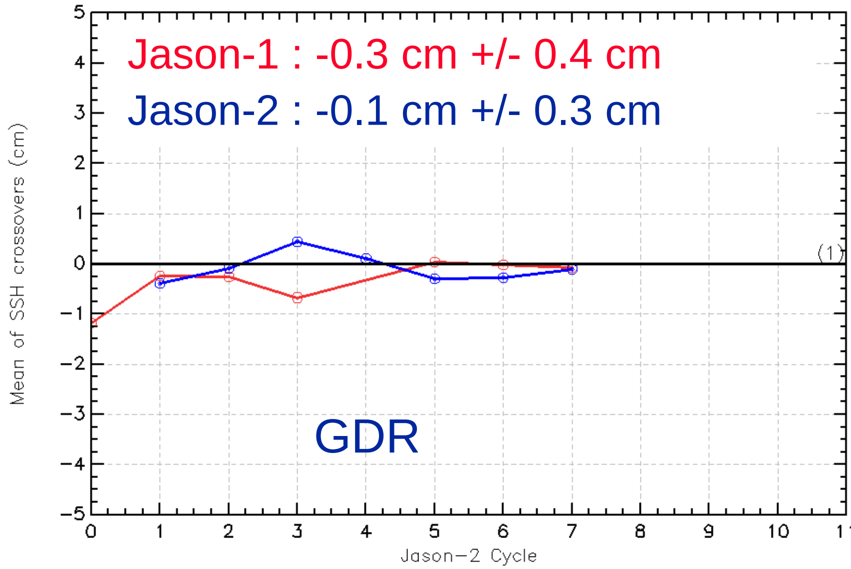
- Data used :
  - OGDRs and IGDRs from Jason-2 cycles 0 to 10 (corresponding cycles 239 to 249 for Jason-1)
  - Preliminary POE orbits (provided by CNES and GSFC) from cycles 1 to 7
  - Jason-1 GDR-C orbit overall the altimeter period

SSH Mean at crossovers

- OGDRs : strong improvement with J2 SSH thanks to the DIODE orbit
- IGDRs : slightly better stable with the MOE Jason-2.
- GDRs (using POE CNES for J2) : similar statistics for both missions.

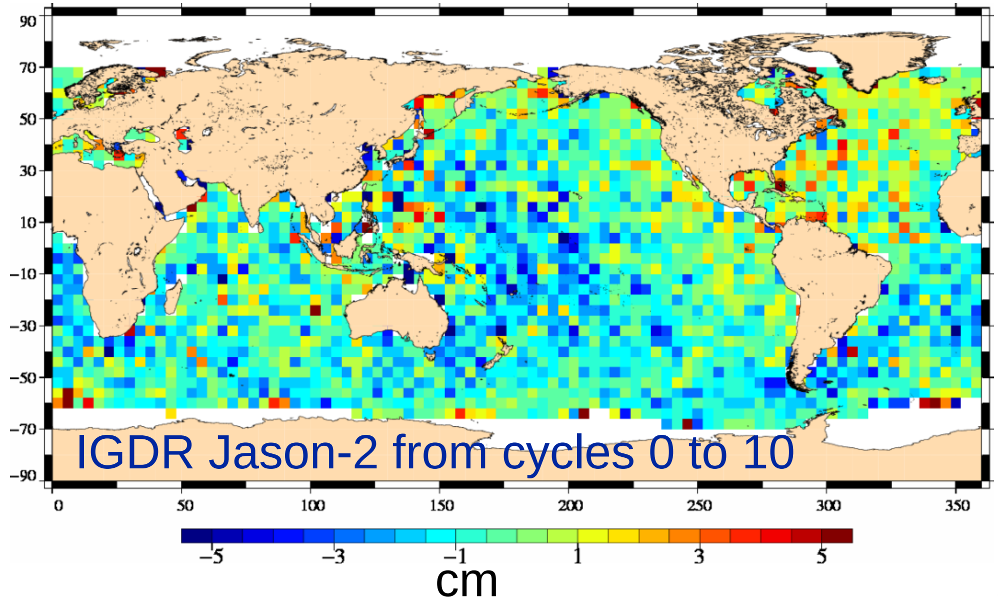






SSH mean at crossovers

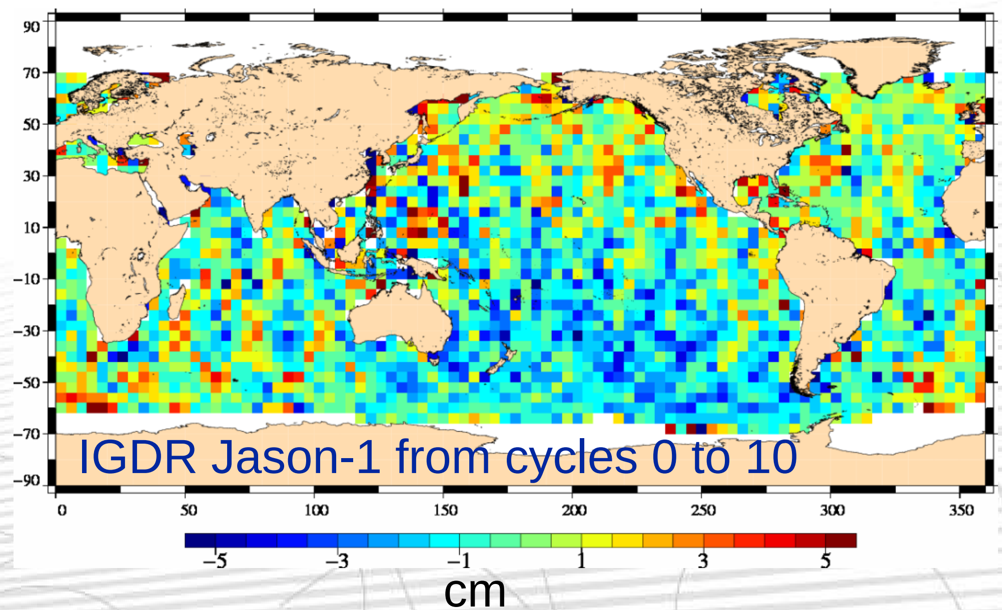
• Map of SSH mean at crossovers are performed from cycles 0 to 10 using IGDRs Jason-1 and Jason-2



• Positive and negative structures are visible for Jason-1 and Jason-2, however :

⇒ Jason-2 map is more homogeneous

⇒ Positive structures are stronger for Jason-1

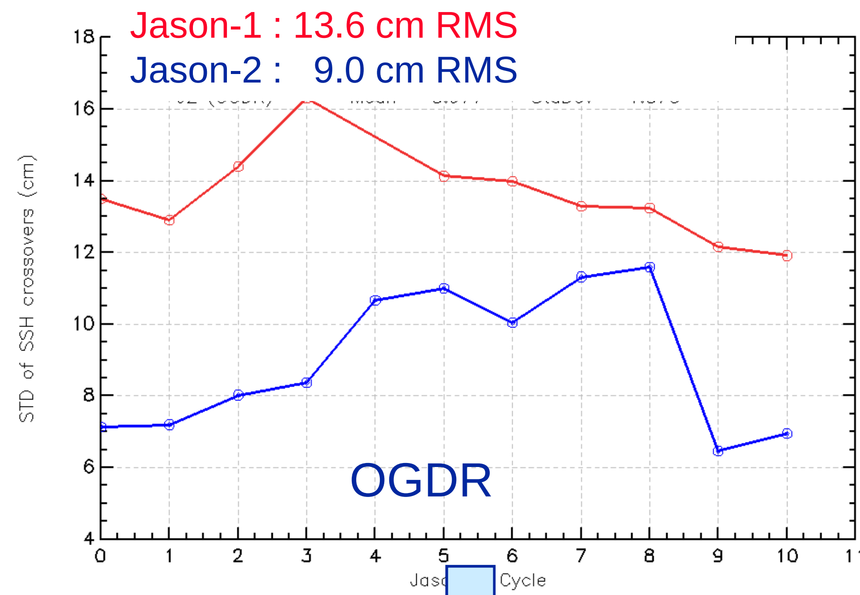


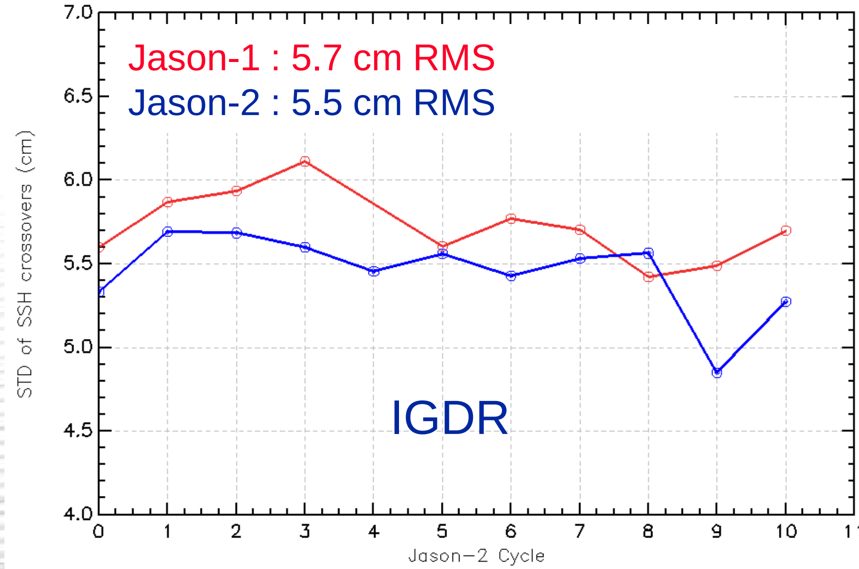
SSH STD at crossovers

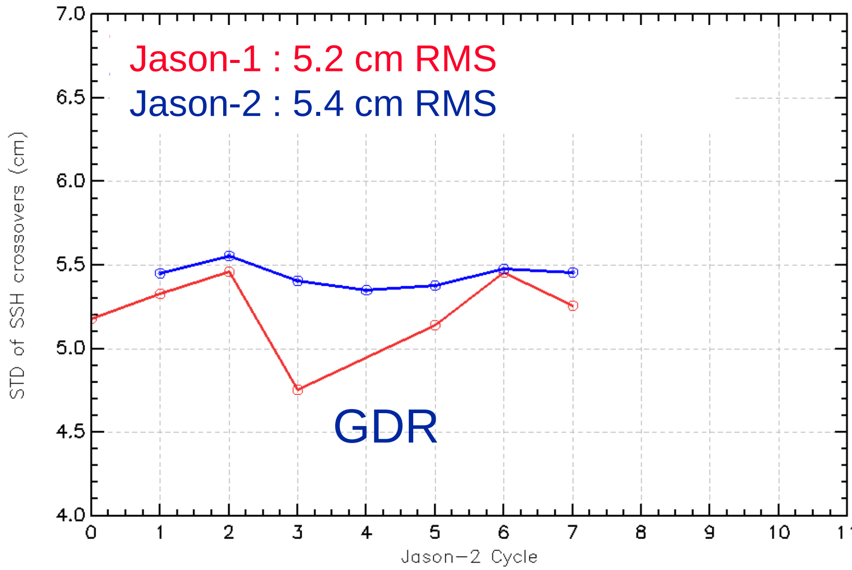
- OGDR : strong variance reduction with Jason-2 OGDRs thanks to the DIODE orbit

- IGDRS : Slightly better performances with the MOE Jason-2

- GDRs (using preliminary POE CNES for J2): slightly better performances with Jason-1 POE.







Summary of SSH crossovers analysis

• DIODE : Jason-2 DIODE orbit increases significantly the SSH performances in comparison with Jason-1

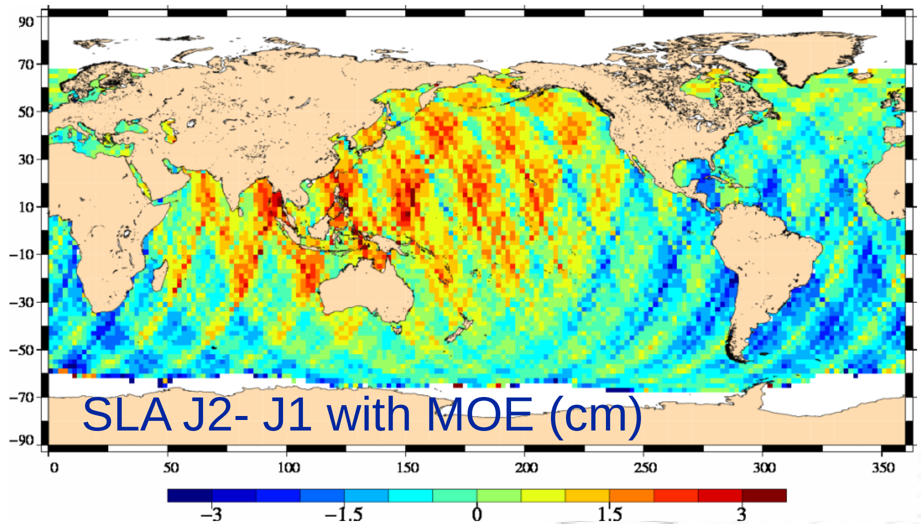
• MOE : Jason-2 MOE has slightly better performances than Jason-1 MOE

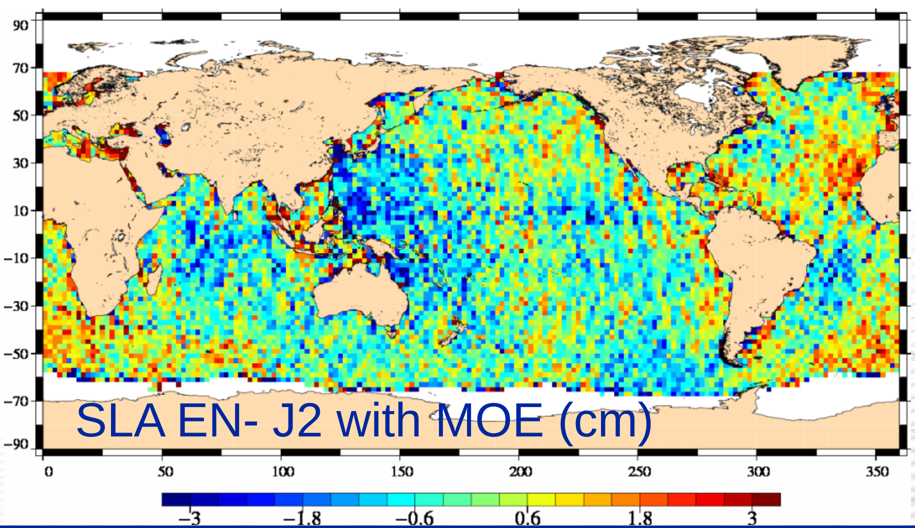
• POE : Slightly better performances with POE Jason-1, but POE Jason-2 is preliminary.

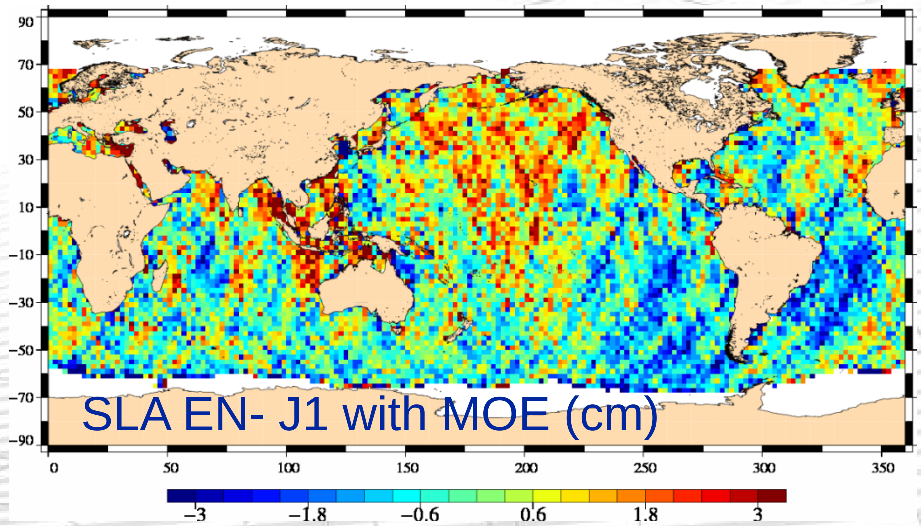
SLA consistency between J2 and J1 with MOE

- Map of J2–J1 SLA mean differences performed from cycles 1 to 10 (CNES MOE)

- SLA differences with CNES MOE orbits highlight large structures (+/- 3 cm)
- These biases vary in space and time (for each cycle) and they can reach +/- 5 cm.
- Cross-calibration with Envisat shows a better SLA consistency with Jason-2 than with Jason-1.
- Larges structures observed from EN/J1 are very well correlated with the J2/J1 map





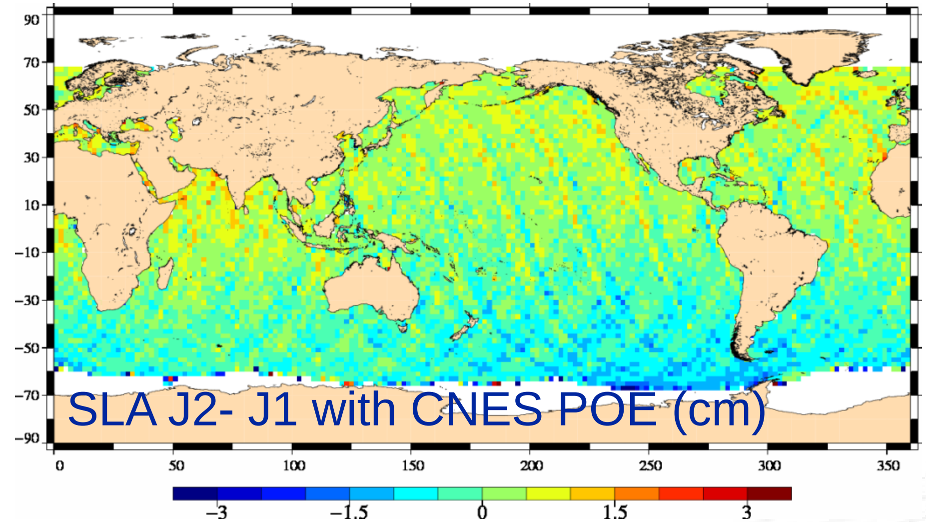


SLA consistency between J1 and J2 with POE

- Map of J2–J1 SLA mean differences performed from cycles 1 to 7

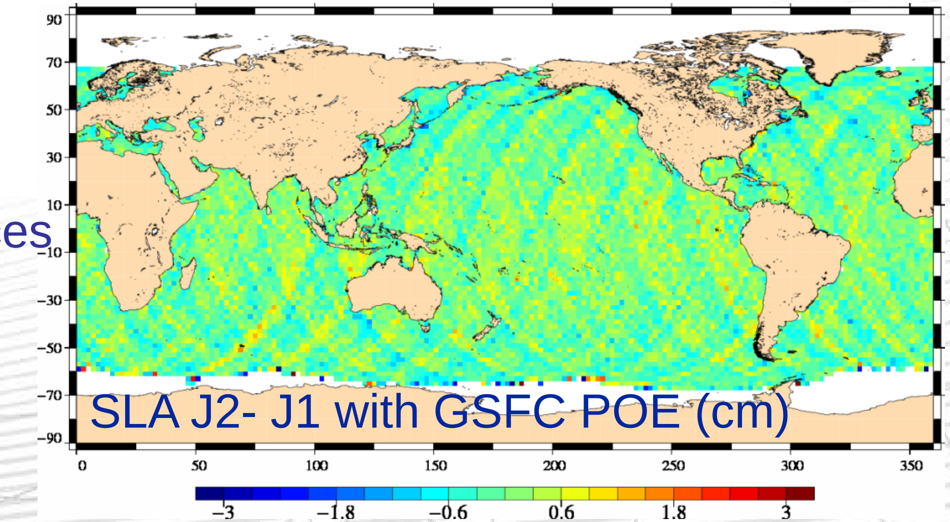
• Using CNES POE orbit, Jason-1/Jason-2 SLA consistency is strongly improved / MOE.

• However, weak hemispheric differences is close to 1 cm, stable in space and time.



• Using GSFC POE orbit, the hemispheric signal between Jason-1/Jason-2 is removed

⇒mainly due to GSFC and CNES POE differences from Jason-1



• SLA differences are lower than 0.5 cm and no abnormal feature is observed.

Summary of along-track SLA analyses

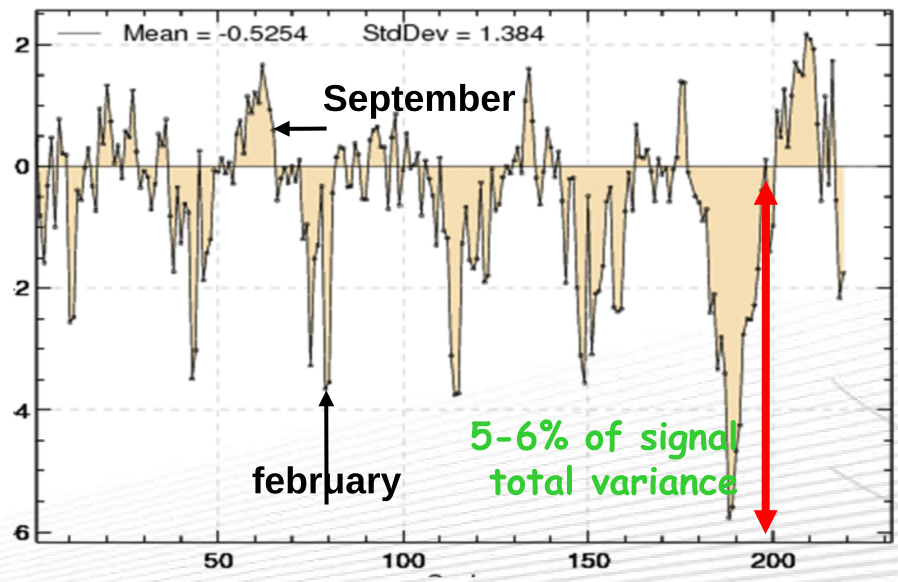
- MOE : The analyze of SLA consistency from multi-satellites cross-calibration highlights some correlated geographic bias stronger with MOE Jason-1 than for MOE Jason-2.

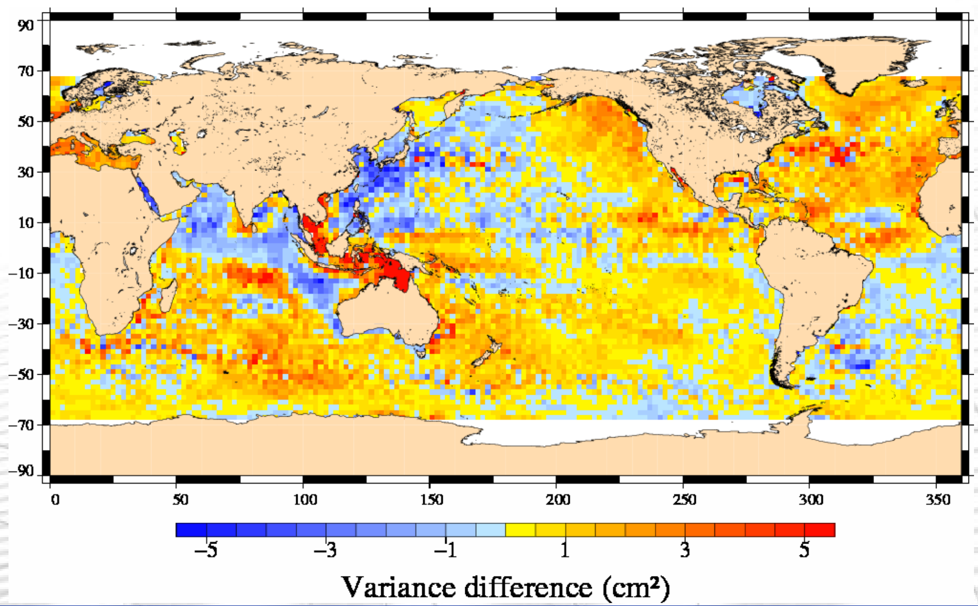
- POE : J1/J2 SLA consistency are very good applying POE orbit : +/- 1 cm with POE CNES, and +/- 0.5 cm with GSFC orbits.

Performances of new GDR-C Jason-1 orbit over all the J1 period

- GDR-C orbit : SLR/DORIS/GPS orbit (as GDR-B), with EIGEN-GL04C gravity field (annual and semi-annual time variability, atmospheric contribution of the gravity field and ocean pole tide effects), new reference frame ITRF2005.

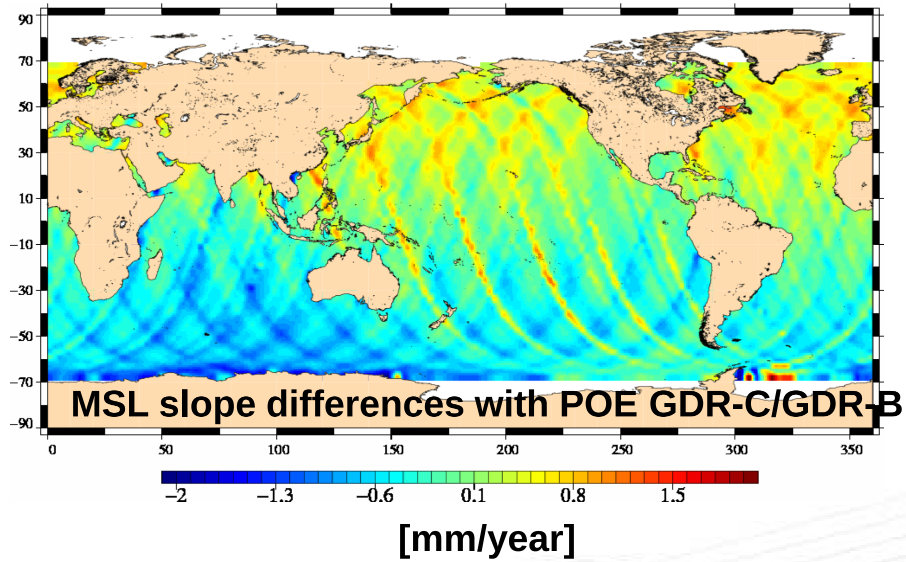
  - Strong reduction of SLA variance is observed :
    - ⇒ Annual cycle with strong reduction of variance in September (-6cm²), also detected analyzing the SLA consistency with in-situ measurements (TG, T/S profiles)
    - ⇒ Map of SLA variance reduction is heterogeneous

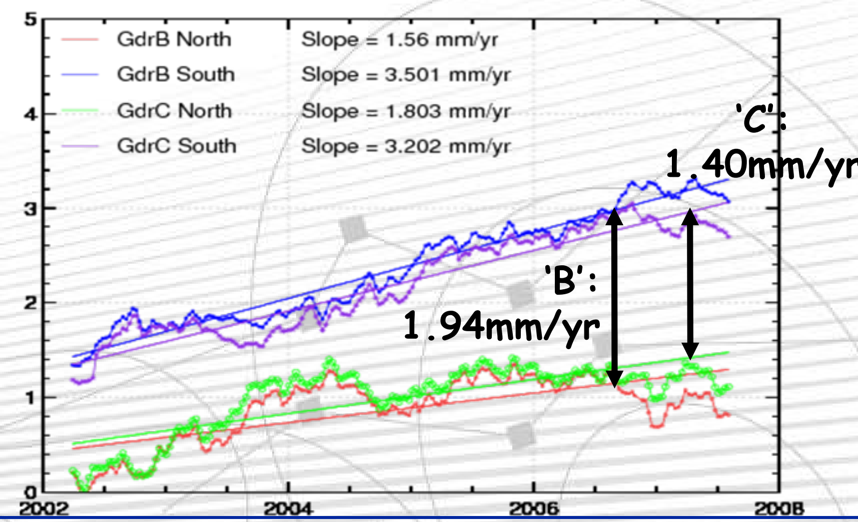




Impact of new GDR-C orbit on MSL trends

- Impact on global MSL < 0.1 mm/yr
- Impact on regional MSL trends is -1.5 mm/yr (south) and +1.5 mm/yr (due to new TRF2005).
- MSL trend differences between North and South hemispheres are reduced
- Previous studies have shown a stronger impact on hemispheric MSL trends using GSFC orbit (Beckley et al 2008).





Summary of new GDR-C performances

- GDR-C performances are significantly better but they have to be analyzed thoroughly to better understand the SLA variance reduction (annual signal).

- The impact on MSL trends is weak for the global MSL, but significant for the regional MSL trends.

- However the regional trend differences observed with GFSC orbits (using ITRF2005) shows the orbit calculation is still a main source of uncertainty for the MSL trend calculation.

Conclusion

• This study highlights the good performances of DIODE, MOE and POE Jason-2 orbits.

• Concerning Jason-1, some correlated geographical biases have been detected in the MOE orbit. But the new POE (GDR-C) displayed better performances in comparison with GDR-B orbit (along-track SLA variance reduction), though uncertainties remain on the regional MSL trends calculation.

• Finally this study shows that the small residual differences observed on the J2/J1 SLA consistency are mainly due to the orbit calculation