Jason-2 and Jason-1 SLA performances and consistency

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Introduction

• Objective : compare accurately the SLA performances and consistency between Jason-1 and Jason-2

• In this presentation, we concentrate on:
  – 1) Analyses at crossovers using OGDR, IGDR and preliminary POE orbits
  – 2) Along-track analyses of global SLA bias and geographically correlated biases between Jason-1 and Jason-2

• 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
SSH Mean at crossovers

- OGDRs: strong improvement with J2 SSH, better centered.
- IGDRs: slightly better centered and stable for 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 Jason-2
- **GDRs (using preliminary POE CNES for J2)**: slightly better performances with Jason-1 GDRs.

Jason-1:
- OGDR: 13.6 cm RMS
- GDR: 5.2 cm RMS
- IGDR: 5.7 cm RMS

Jason-2:
- OGDR: 9.0 cm RMS
- GDR: 5.4 cm RMS
- IGDR: 5.5 cm RMS
Summary of SSH crossovers analysis

• Jason-2 SSH performances are very good at crossovers

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

• Small differences detected from IGDRs and GDRs products are mainly due to orbit calculation differences:
  ⇒ Better performances with MOE Jason-2
  ⇒ Slightly better performances with POE Jason-1, but POE Jason-2 is preliminary.
Global SSH bias between Jason-1 and Jason-2

• During the verification phase, both satellites are spaced out by 54s
  ⇒ They measure exactly the same SSH
  ⇒ SLA differences are thus computed without applying any correction:
    \[ \text{SLA} = \text{Orbit} - \text{Range} - \text{MSS} \]

• Global bias between J2 and J1 is stable with weak variations: 8.3 cm +/- 0.2

• Weak impact using the MOE or POE orbits.

• Applying all the corrections, the bias is lower: 7.5 cm (due to ionospheric correction bias)
SLA consistency between Jason-1 and Jason-2

- Map of mean of J2 – J1 SLA differences performed over all the period
  ⇒ From cycles 1 to 10 with IGDRs (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 (see Ollivier’s talk).
SLA consistency between Jason-1 and Jason-2

• Map of mean of J2 – J1 SLA differences performed over all the period
  ⇒ From cycles 1 to 10 with IGDRs (MOE)
  ⇒ From cycles 1 to 7 using GDRs for Jason-1 and preliminary POE CNES for Jason-2

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

• However, weak hemispheric differences remain close to 1 cm

• Correlated geographically biases are stable in space and time.
SLA consistency between Jason-1 and Jason-2

- Map of mean of J2 – J1 SLA differences performed over all the period
  - From cycles 1 to 10 with IGDRs (MOE)
  - From cycles 1 to 7 using GDRs for Jason-1 and preliminary POE CNES for Jason-2
  - From cycles 1 to 7 using POE GSFC for Jason-2 and Jason-1

- Using GSFC POE orbit, the hemispheric signal between Jason-1/Jason-2 is removed, no abnormal feature is observed.

- SLA differences are lower than 0.5 cm
STD of SLA differences

• The global standard deviation of SLA differences is very stable and weak

• The standard deviation map of SLA differences depending on the SWH as expected

• No abnormal feature is highlighted showing the good consistency of both SLA.
Summary of along-track SLA analyses

• The SLA consistency between both missions is already very good just 4 months after the launch.

• The weak remaining differences observed between both SLA are mainly due to the orbit calculation:
  ⇒ Using POE GFSC orbit for J1 and J2, differences are lower than 0.5 cm demonstrating there is no significant correlated geographically biases due to altimeter range between Jason-1 and Jason-2.
Conclusion

• Parameter and SLA performances and consistency is very good between Jason-1 and Jason-2:
  ⇒ In comparison, J1/J2 SLA consistency using POE from 6 cycles is comparable to the SLA consistency between Jason-1 and T/P during all the verification phase (21 cycles), using new orbit standards and similar reTracking.
  ⇒ The very stable SSH bias between J2 and J1 (<0.2 cm RMS) allows us to link both MSL series very accurately.

• Additional Jason-2 cycles will not be useful to better analyze the Jason-2 SSH performances and the SLA consistency with Jason-1. From this Cal/Val point of view, and in order to better benefit from these both missions for scientific applications, Jason-1 satellite can then be moved to its new interleaved orbit as soon as possible.