(B) SSALTO CALVAL Consistency assessment between Jason-1 and TOPEX

Michaël ABLAIN (michael.ablain@cls.fr), Sabine PHILIPPS, Sylvie LABROUE, Joël DORANDEU, CLS
Nicolas PICOT, CNES

Context

Jason-1 (J1) GDRs were reprocessed in version 'B' from J1 cycles 1 to 21 and 128 to 135 in early 2006. The reprocessing of cycles from 22 to 127 is on-going at JPL. TOPEX data were reprocessed (RGDR) last year, a new delivery of these data has been performed this year. The objective of this study is to check the impact of the reprocessing on the sea surface height consistency between J1 and TOPEX over the 21 first Jason-1 cycle where J1 and TOPEX flew on the same track.

Data and processing

The main evolutions in the reprocessed data (GDR 'B' for J1 and RGDR for TOPEX) are the implementation of a new retracking algorithm (MLE4 for Jason-1 and MLE5 for TOPEX), a new precise orbit based on a GRACE gravity model and new geophysical corrections (tidal models, MOG2D, Sea State Bias). In order to get a significant data set, the following statistics are computed over the 21 cycles, excluding cycles TOPEX 361 (J1 18), which was not reprocessed and TOPEX 362, which was not available due to a problem in the reprocessing.

A) SLA consistency : Impact of orbit using GRACE data

SLA differences between J1 and TOPEX are plotted (figure A1) using former orbits and ranges from GDR 'A' for J1 and MGDR for TOPEX. Neither geophysical corrections nor SSB correction were applied for both satellites. Large structures of negative and positive differences are visible, as well as orbit passes.

Using the new orbits (GRACE family) provided by the GDR 'B' for J1 and RGDR for TOPEX, removes trackiness and decreases the particular pattern in North Atlantic (figure A2).

Thanks to the new orbits, large structures are detected in Indian ocean and close to the shores. Some part of these discrepancies correspond to SSB differences between the two missions.

Besides, a thick equatorial band is evidenced on figure A2 with negative differences. This is due to the ascending and descending SLA differences between J1 and TOPEX showing a large hemispheric signal (see figure B4).

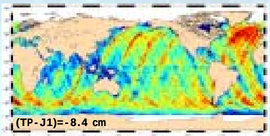


Fig. A1: SLA differences (without SSB) using old orbits and old ranges [cm]

Use of new orbits (GRACE)

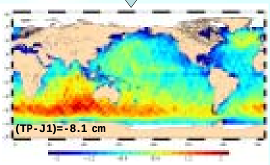


Fig. A2: SLA differences (without SSB) using new orbits, old ranges [cm]

Use of new TOPEX range (LSE)

D) SWH consistency

Mean differences between TOPEX MGDR and J1 GDR 'A' SWH estimates (figure D1) was about 8 cm, but this bias was higher for strong waves and smaller for small waves.

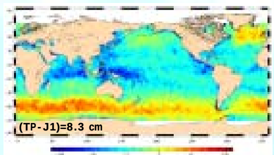


Figure D1: SWH differences for J1 GDR A and TOPEX MGDR [cm]

Using J1 GDR 'B' SWH allows us to significantly reduce theses differences even if the global bias is still about 8 cm (figure D2). New correction tables in GDR 'B' explain this better consistency.

The impact of new TOPEX SWH (MLE5) is less sensitive though the remaining discrepancies visible in previous map close to the coasts are removed.

Nevertheless, same as for the range, when separating ascending and descending passes, large hemispheric biases appear (not shown here) due to the TOPEX SWH.

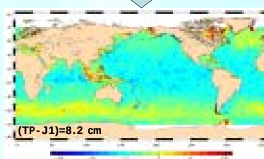


Figure D2: SWH differences for J1 GDR B and TOPEX MGDR [cm]

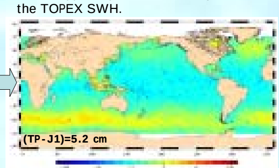


Figure D3: SWH differences for J1 GDR B and TOPEX RGDR [cm]

B) SLA consistency : Impact of new range

When using the new range (from LSE algorithm) for TOPEX, the patch in Indian ocean is strongly reduced (figure B1). Jason-1 and TOPEX SSB are probably more homogeneous from now on (see dedicated S. Labroue's talk).

Using the new MLE4 range for Jason (Figure B2) has weak impact on the mean differences, even if the consistency is slightly better in the Indian Ocean.

Nevertheless a great hemispheric bias (between -2 cm and +2 cm) is highlighted when separating the ascending and descending passes (figure B4) :

- This bias is mainly due to TOPEX data. It was present on TOPEX M-GDR data alone (figure B3, left), but it is greater using new range (MLE5 from RGDR) as shown at the TOPEX crossovers (figure B3, right). This needs more investigation.

- To a lower extent, such a signal is also visible at Jason-1 crossovers in the GDR 'B' (see CalVal poster 'A') probably due to time tag bias. But it is much weaker than for TOPEX.

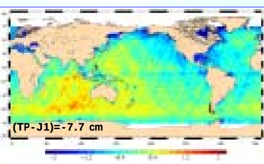


Fig. B1: SLA differences (without SSB) using new orbits and new TOPEX range [cm]

Use of new J1 range (MLE4)

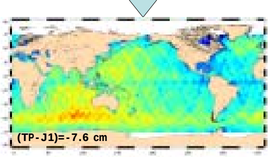


Fig. B2: SLA differences (without SSB) using new orbits and new ranges [cm]

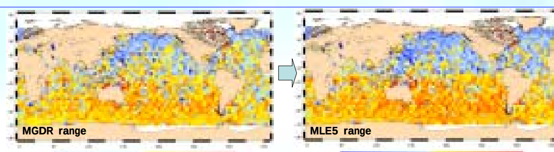


Fig. B3: SSH differences at TOPEX crossovers with the MGDR Range (left) and MLE5 range (right).

TOPEX MLE5 range increases the hemispheric ascending/descending differences

J1/TP hemispheric ascending/descending differences are mainly due to TOPEX data

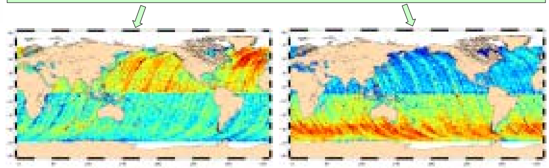


Figure B4: SLA differences using new orbits (GFSC200 for J1 and T/P) and new ranges for ascending (left) and descending (right) passes [cm]

C) SLA consistency: Impact of new SSB

New SSB corrections have been computed for J1 using GDR 'B' and for TOPEX using RGDR, with the collinear method. For more details, see dedicated talk by S. Labroue. These new TOPEX and J1 SSB models are now much closer than before. When applying them in the SLA calculation in addition to the new orbits and the new ranges (figure C1), the discrepancies between J1 and T/P are reduced. However, an East/West patch (< 1cm) remains, but it is not correlated with SWH.

The origin of this signal is explained by CNES and GSFC orbit, used respectively for J1 and T/P. Indeed, using GSFC orbit for Jason-1 similar to those used in RGDR T/P data, allows us to removed this East/West signal (see figure C2).

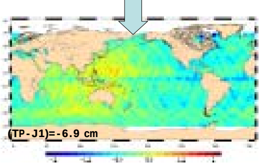


Fig.C1: SLA differences (with new SSB) using new orbits and new ranges [cm]

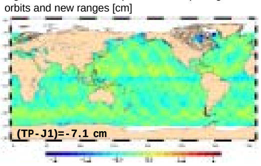
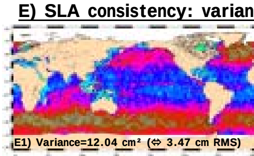


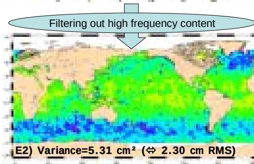
Fig C2: SLA differences (with new SSB) using new orbits and new ranges [cm]

E) SLA consistency: variance of T/P / J1 differences

The variance of T/P / J1 differences is quite large (fig. E1) in strong waves areas where the 1-Hz SSH noise is higher due the ground processing (see Faugere's talk). Filtering out SLA signals smaller than 50 km allows us to remove the SSH high frequency content (fig.E2) and to bring out small variance differences between J1 and T/P (5.31 cm²). This statistic increases by 2 cm² using the former range, SSB and orbits with differences significantly larger in strong waves areas showing now the better SSB consistency.



Filtering out high frequency content



Using new range,SSB,orbits

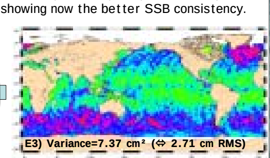


Fig.E1: Variance of SLA differences [cm²] using new orbits and new ranges; fig.E2 : same fig.E1 after filtering out SLA signal smaller than 50 km; fig.E3: same fig.E2 using old orbits and old ranges.