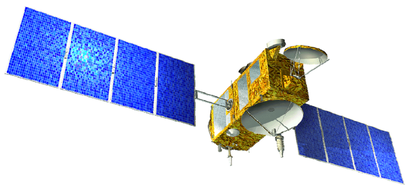
Calval Analysis of Latest Release of TOPEX Retracked Data



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Context

Topex retracked data sets (RGDR products) have already been released in 2006 and 2007 and reduced data sets (one year of side B data spanning Jason-1 verification phase) have been analyzed by CLS Calval team.
The comparison exercise is redone with the latest 2009 release focusing on two items:

1. Non regression for side B period compared to previous results obtained in 2006 and 2007
2. Analysis of longer time series on side A and side B in order to insure that the drift on range and SWH at the end of side A is now corrected thanks to the PTR drift accounted for in the retracking processing.

Data Sets

The 2009 RGDR data are analyzed over:

- Side B Data (cycles 328-364) spanning Jason-1 verification phase. RGDR products are compared to Jason-1 GDRC products and TOPEX MGDR products.
- Side A Data (cycles 1-235) spanning the whole time series of side A, focusing on the last year which encountered instrumental drift, especially observed on SWH parameter. RGDR products are compared to TOPEX MGDR products.

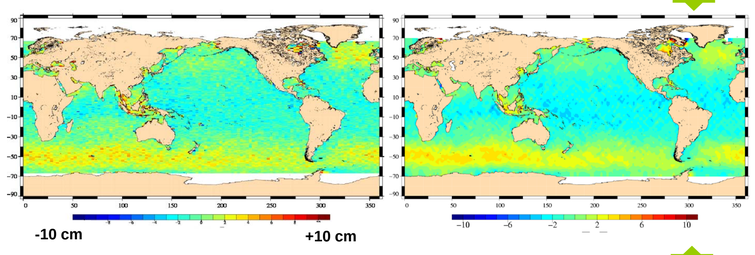
Non Regression compared to previous RGDR release

Consistency with Jason-1 data (Cycles 344-364)

Global analysis

During Jason-1 verification phase, Jason-1 and TOPEX range measurements can be directly compared and reflect the agreement between Jason-1 and Topex SSB. The global analysis of the range differences between Topex and Jason-1 (Fig. 1) shows a 3 cm signal correlated with sea state with 2009 RGDR data whereas the same analysis performed with 2007 RGDR products presented nearly no correlation but rather a Est/West orbit error signal. The SWH maps (Fig. 2) exhibit the same behavior between 2007 and 2009 products.

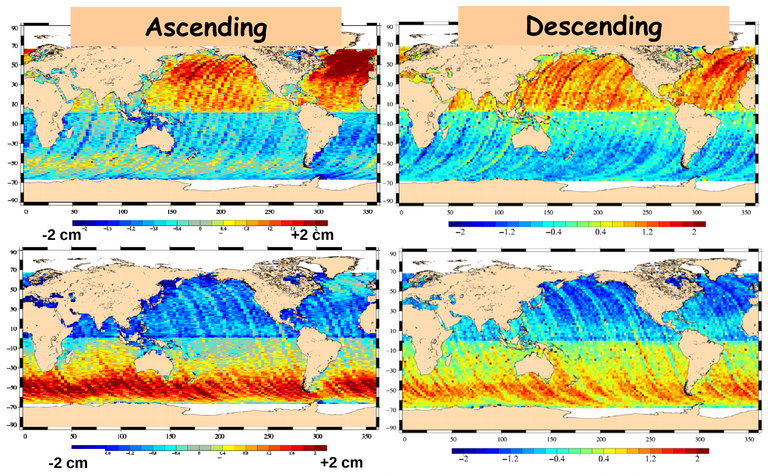
Topex – J1 SLA differences, no SSB (cm) Fig1



Topex – J1 SWH differences (cm) Fig2

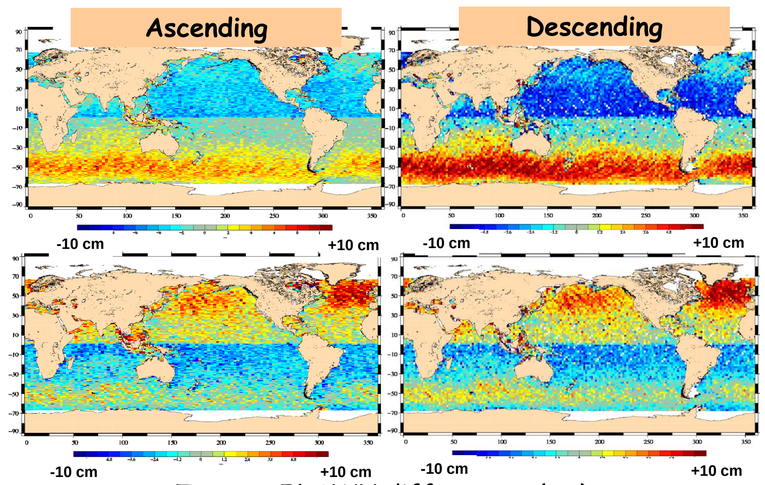
Quadrant analysis

The analysis of the range consistency per quadrant confirms the correlation with sea state observed with 2009 RGDR data (Fig. 3). SWH data show different behavior for ascending and descending passes, with a better agreement between Jason-1 and TOPEX with 2009 RGDR products for ascending passes (Fig. 4).



Topex – J1 SLA differences, no SSB (cm) Fig3

2009 2007

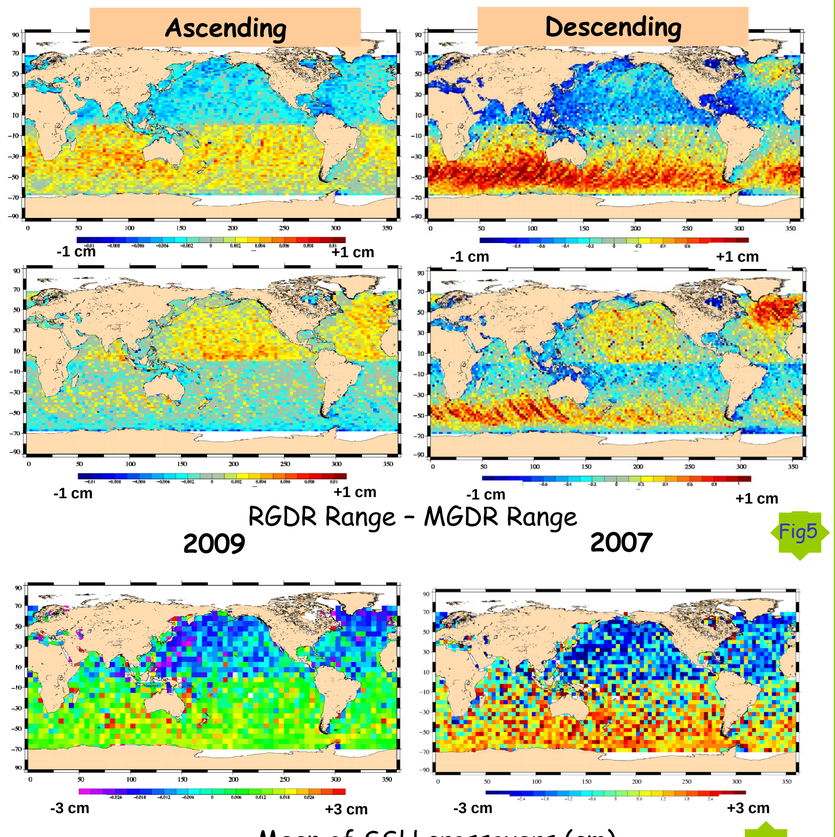


Topex – J1 SWH differences (cm) Fig4

2009 2007

Consistency with MGDR data (Cycles 344-364)

The RGDR data are compared to MGDR data. The quadrant maps between RGDR and MGDR range (Fig. 5) confirm the conclusions obtained with Jason-1 comparison. They show that 2009 retracking does not change Topex SSB and it simply adds a constant bias for each quadrant. This results is completely different from 2007 RGDR data, where retracking modified the Topex SSB, making it closer from Jason-1 SSB. Maps of crossover SSH mean show the same behavior between 2007 and 2009 versions.



RGDR Range – MGDR Range Fig5

2009 2007

Mean of SSH crossovers (cm) Fig6

2009 2007

Analysis of RGDR time series

SWH monitoring

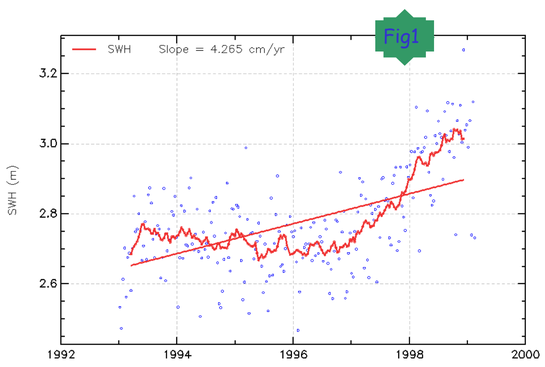


Fig1

MGDR SWH drift, Topex side A (m)

Side A PTR drift is observed on the MGDR SWH monitoring on a cycle basis (Fig. 1). The drift is clearly evidenced after removing the SWH seasonal cycle. The retracking should remove the linear trend of 30 cm that begins in 1997.

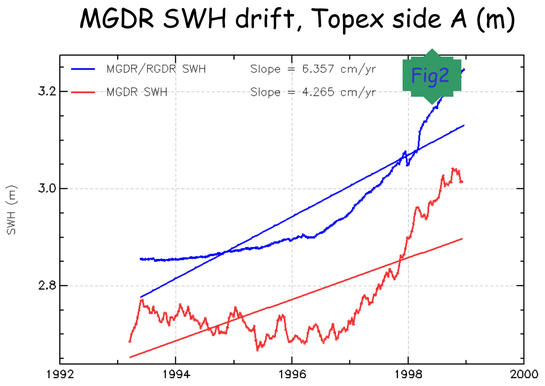


Fig2

MGDR SWH drift (red), MGDR-RGDR SWH (blue), Topex side A (m)

RGDR SWH are compared to MGDR SWH and the difference is monitored for the whole time series of side A altimeter (Fig. 2). This difference should contain the PTR drift corrected by the retracking. The retracking has well captured the linear trend between 1997 and 1999. Nevertheless, retracking corrects for a slightly positive trend between 1993 and 1997 whereas the SWH monitoring rather shows a negative slope during this period.

Range and MSL monitoring

The cycle per cycle difference of RGDR and MGDR range is monitored for side A (Fig. 3). The 2009 retracking makes a -2.2 mm/year trend appear on side A range . In order to compare consistent measurements, we should take into account the SSH measurements with all corrections (especially the SSB correction that corrects the PTR part associated to SWH, which appears to be well corrected with retracking at the end of side A (Fig2)).

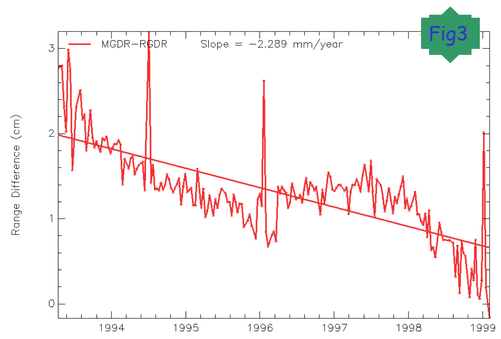


Fig3

Mean of MGDR – RGDR Range (cm), SideA

A MSL calculation is performed for side A and side B (Fig. 4 and 5) with MGDR and RGDR data. Data have been corrected with a SSB model estimated over RGDR data (simple BM4 model). The MSL trend for side B is lowered by 0.6 mm/year by RGDR retracking. Since sides B altimeter is known to be very stable (calibration with tide gauges, comparison with Jason-1), the MSL difference suggests that RGDR retracking introduces a false drift on Topex side B data. The MSL calculation for side A shows that the MSL curve (and trend!) found with RGDR data is completely erroneous.

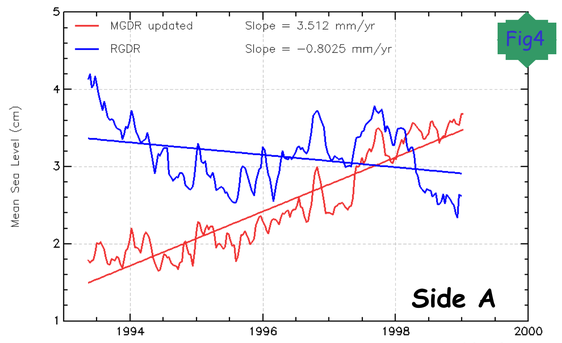


Fig4

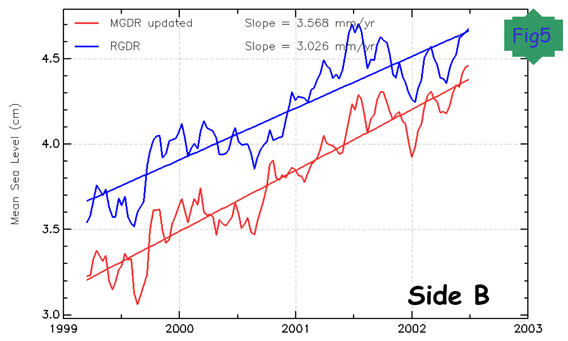


Fig5

MSL Analysis (cm)

Conclusion

In this study, we showed that the 2009 release of RGDR products is different from the 2006 and 2007 versions and strange features are observed.

1. The RGDR range is very close to the MGDR range, regarding the sea state correlation. This feature implies that the SSB obtained from 2009 RGDR products is the same than the one obtained from MGDR products. Whereas 2006 and 2007 analyses showed that retracking Topex made Jason-1 and Topex SSB agree at the mm level, Topex SSB derived from 2009 RGDR products shows a SSB lower than Jason-1. This change in the SSB behavior clearly evidences that the retracking algorithm changes the Topex tracker bias.
2. The time series analysis shows that the 2009 RGDR products show an unexpected trend for the range measurement for side A and side B. The MSL trend obtained with RGDR data is lowered by 0.6 mm/year for side B and the MSL trend found for side A is completely erroneous with a trend of -0.8 mm/year over 7 years! The 2009 RGDR products cannot be used for MSL studies.

Regarding MSL studies, further work is needed on TOPEX retracking, especially for side A altimeter, since MSL trend is very sensitive to PTR drift correction.

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