

# Global Assessment of TOPEX reprocessed products (Release 5)



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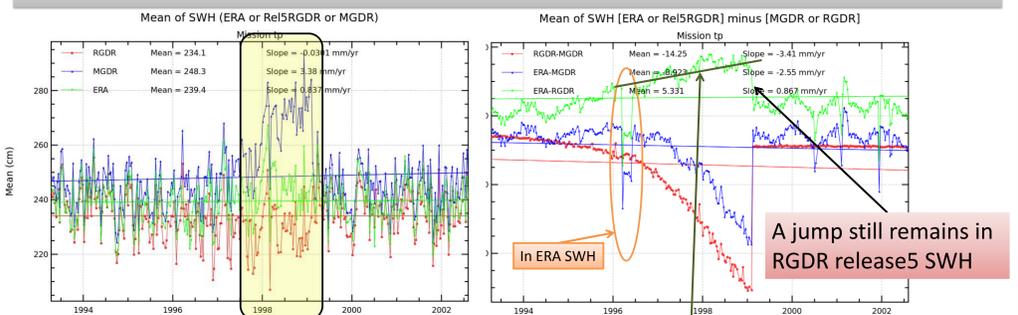
## Context

TOPEX altimeter data were first furnished by the side-A instrument (from 1992 onwards). Nevertheless changes in the side-A PointTarget Reponse (PTR) degraded (from mid-1996 onwards) progressively the altimeter measurements [Hayne and Hancock [R1a] [R1b]]. The main impacts were an increase of Significant Wave Height (SWH), an increase of range rms, and an error on range estimate. Sea State Bias (SSB) was also impacted (as it is based on SWH). In February 1999, TOPEX side-A was turned off and TOPEX side-B was turned on. A retracking of the data is necessary in order to correct for this PTR drift of TOPEX-A. Several retracking releases have been computed over the last years, those analysis have been presented in previous OSTST sessions.

## Data sets

The latest release "Retracked GDR Release 5.0" [R2] is an evaluation release of the TOPEX Retracked GDR (RGDR) covering cycles 21 to 364. Different solutions were computed for skewness : only results covering data with skewness equal to 0.1 are presented here. Retracking provides corrected SWH and range measurements and hereafter its impact is evaluated. Therefore only parameters from the retracking (range, SWH) or based on retracked parameters (SSB) are compared with previous data version. The reference parameters are non retracked data used in AVISO2014 [R3] products (which are based on MGDR products concerning altimeter parameters and updated geophysical and orbit standards).

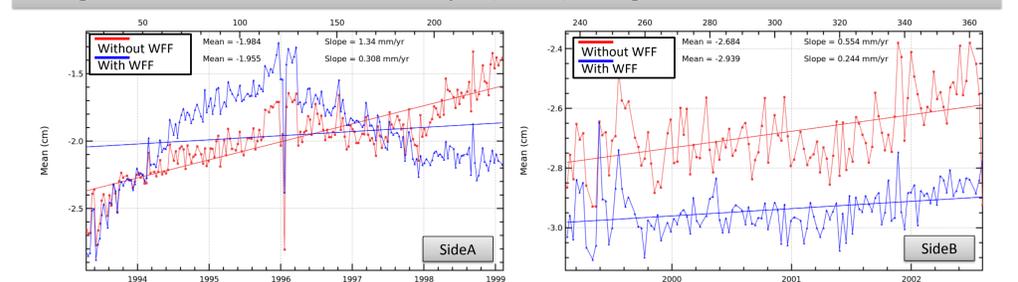
## SWH



The drift in MGDR SWH is reduced (from MGDR (blue) to RGDR (red) curve)  
 Drift on sideA between ERA and RGDR release5 SWH (opposite sign to MGDR SWH)  
 A jump still remains in RGDR release5 SWH

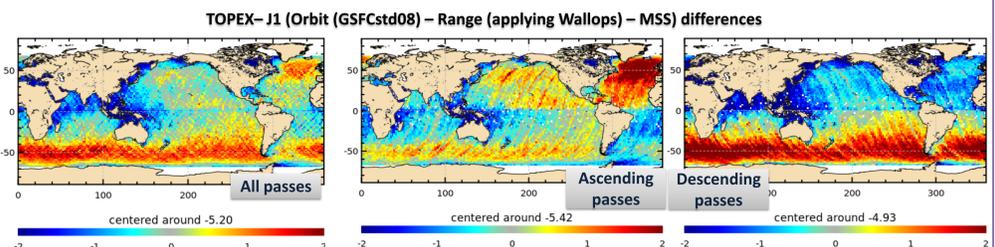
A strong PTR drift is observed for side-A on the MGDR SWH monitoring (blue curve on the left). It is reduced with RGDR (red curve on the left), but seems to be overcorrected when comparing to ERA interim model SWH (green curve on the right).

## Range : Question of the Wallops (WFF) range drift correction



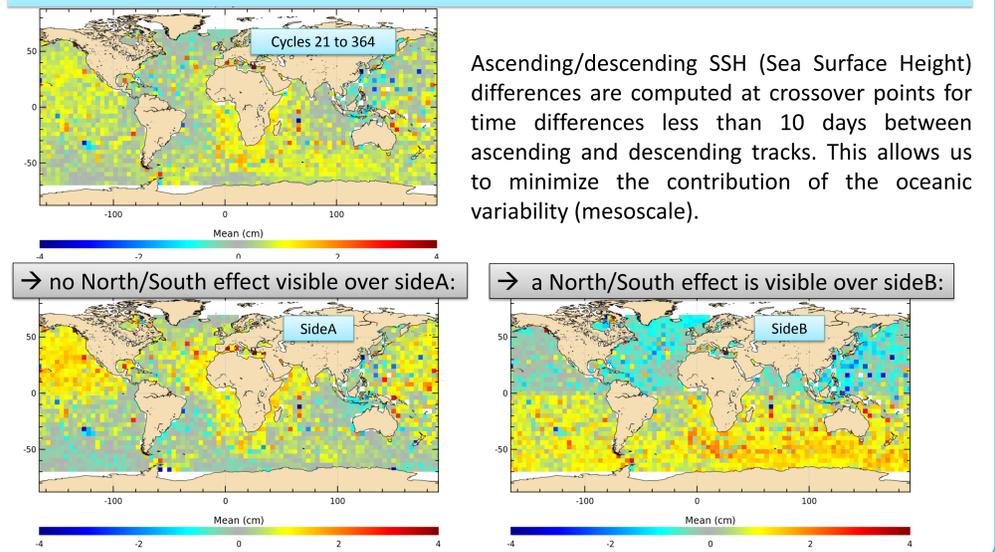
The WFF range calibration drift from CAL-1 was taken into account in the calculation of MGDR range but is not taken into account in RGDR release5. Without applying this correction to RGDR range, the difference RGDR range minus MGDR range leads to red curve. When applying it on RGDR range, it leads to blue curves. The impact of the WALLOPS correction on trends is about 1.03mm/yr on SideA and 0.31mm/yr on sideB.

## External comparisons : Jason-1 (tandem phase with J1 from TOPEX cycle 344 to 364)



The global analysis of the range differences between TOPEX and Jason-1 shows a correlation with sea state. Comparisons of SWH with Jason-1 shows the same behavior with RGDR data than with MGDR data.

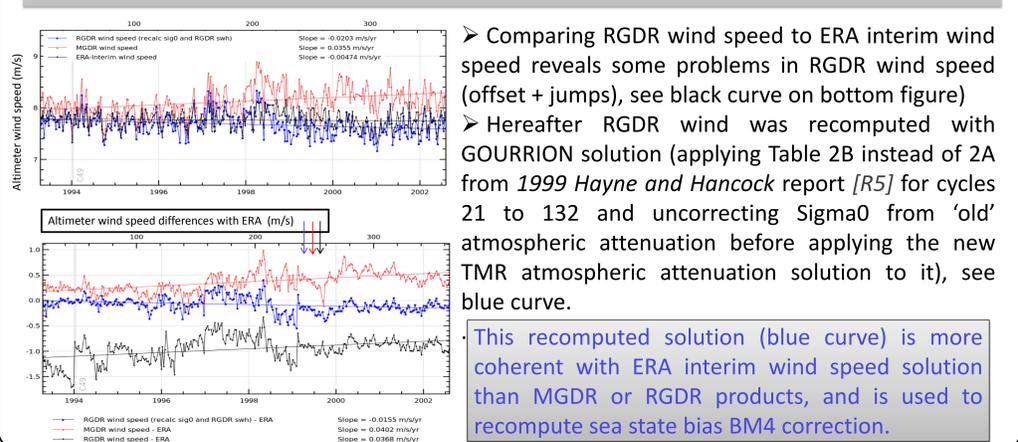
## Performances at crossovers



Ascending/descending SSH (Sea Surface Height) differences are computed at crossover points for time differences less than 10 days between ascending and descending tracks. This allows us to minimize the contribution of the oceanic variability (mesoscale).

## Wind speed

Note that some errors occurred during sigma0 and wind speed computation in RGDR release. So that it is necessary to recompute sigma0 and wind speed before using it in SSB.



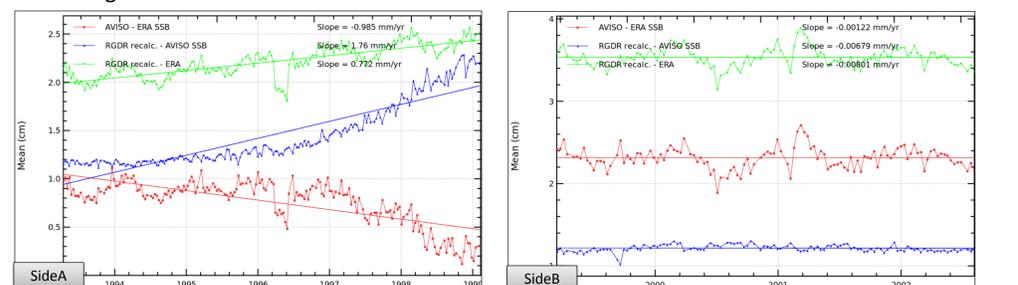
Comparing RGDR wind speed to ERA interim wind speed reveals some problems in RGDR wind speed (offset + jumps), see black curve on bottom figure)  
 Hereafter RGDR wind was recomputed with GOURRION solution (applying Table 2B instead of 2A from 1999 Hayne and Hancock report [R5] for cycles 21 to 132 and uncorrecting Sigma0 from 'old' atmospheric attenuation before applying the new TMR atmospheric attenuation solution to it), see blue curve.

This recomputed solution (blue curve) is more coherent with ERA interim wind speed solution than MGDR or RGDR products, and is used to recompute sea state bias BM4 correction.

## SSB

SSB recalculated from recal wind speed and new BM4 coefficients

BM4 SSB is hereafter recomputed using the recalculated wind speed, and the RGDR Significant Wave Height.



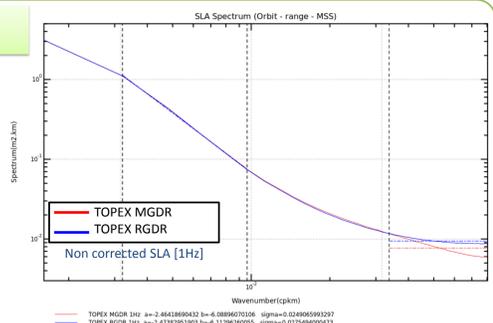
For side-A better agreement between recalculated RGDR SSB and SSB based on ERA interim.  
 Drift between ERA and RGDR SWH is still visible at the end of SideA period (about 3 mm)

Note that ERA SSB represents a BM4 sea state bias computed from ERA swh and ERA wind speed. (TOPEX data were not assimilated for ERA Interim SWH computation)

## Spectral results

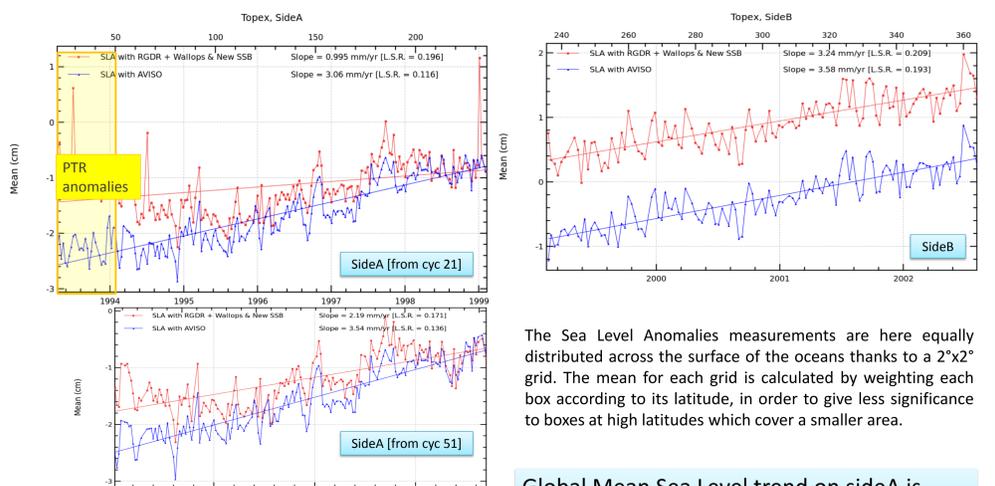
1Hz spectra compute over cycles 344 to 364 for TOPEX, and over cycles 1 to 20 for Jason-1

RGDR solution presents a white noise plateau (not MGDR).  
 This quite good result on 1Hz spectrum is to be confirmed with a study of 10Hz spectra.



## Global Mean Sea Level

GMSL computation using recalculated SSB solution and WALLOPS correction for range :



The Sea Level Anomalies measurements are here equally distributed across the surface of the oceans thanks to a 2°x2° grid. The mean for each grid is calculated by weighting each box according to its latitude, in order to give less significance to boxes at high latitudes which cover a smaller area.

Global Mean Sea Level trend on sideA is strongly reduced by 1.3 mm/yr (for cycles 51 to 235).

## Conclusions

Most of SWH drift on TOPEX-A is reduced, but drift seems to be over-corrected (compared to ERA-interim).

There are some jumps and an offset in RGDR release 5 wind speed. With recomputed wind speed using correct sigma0 and RGDR SWH, jumps disappear and wind speed is close to ERA interim wind speed.

The SSB, recomputed with the corrected wind speed and RGDR release5 swh, shows a reduced drift on TOPEX-A (compared to ERA interim), but it seems a little bit over-corrected.

The Wallops drift correction should probably be applied to RGDR release5 range.

Finally, Global Mean Sea Level trend on side A is strongly reduced by 1.3 mm/yr (for cycles 51 to 235) : this result may be realistic (C.Watson [R4]).

References:  
 [R1a] [http://topex.wff.nasa.gov/files/documents/eng\\_assmt\\_a\\_off.pdf](http://topex.wff.nasa.gov/files/documents/eng_assmt_a_off.pdf)  
 [R1b] [http://topex.wff.nasa.gov/files/documents/fall\\_agu\\_tpx.pdf](http://topex.wff.nasa.gov/files/documents/fall_agu_tpx.pdf)  
 [R2] Updated retracked TOPEX data from PODAAC at <ftp://PODAAC.jpl.nasa.gov/>  
 [R3] Aviso standards: <http://www.aviso.altimetry.fr/en/data/products/ocean-indicators-products/mean-sea-level/processing-corrections.html>  
 [R4] C. Watson: <http://www.nature.com/nclimate/journal/v5/n6/full/nclimate2635.html>  
 [R5] Hayne and Hancock: "TOPEX Sigma0 Calibration Table History for All Side A Data" [http://topex.wff.nasa.gov/files/documents/Sigma0Cal\\_A\\_All.pdf](http://topex.wff.nasa.gov/files/documents/Sigma0Cal_A_All.pdf)