Assessment over ocean of the last POSEIDON-1 reprocessing

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BACKGROUND

TOPEX /POSEIDON mission successfully collected valuable oceanographic data during 13 ½ years 1992 to 2005, alternatively using its two radar altimeters TOPEX (ALT) and POSEIDON-1 (SSALT).

POSEIDON-1 already proved to have an excellent instrumental stability making it valuable to contribute to the TOPEX A drift on going analysis in addition to being useful for the Global Mean Sea Level Determination.

In 2022, JPL and CNES/CLS release the TOPEX/POSEIDON data at GDR-F standard. On POSEIDON side, it includes the reprocessing of all internal calibration sequences, the retracking of the waveforms and an update of the instrumental corrections [Thibault, 2017] and an update of all geophysical corrections a GDR-F standard, with a special attention to consistency with TOPEX GDR-F data.

This reprocessing offered the possibility to enrich the long-term altimetry records with homogenized data set.

OBJECTIVE

The objective here is to give an overview of POSEIDON-1 data quality and assessing the performance of products at mono-mission crossovers and along-track. Comparisons to TOPEX GDR-F dataset are also presented.

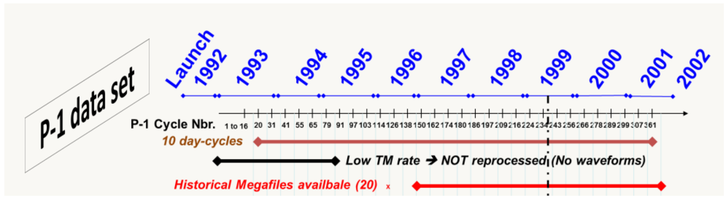
METHODS

CalVal methods are described at
https://www.aviso.altimetry.fr/en/data/calval/overview.html

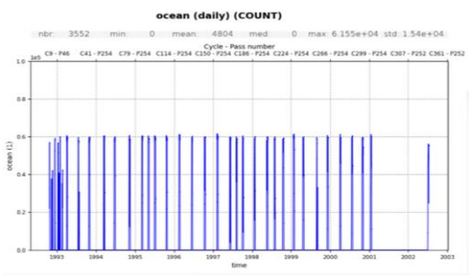
Data used : GDR-F at 1Hz	
Orbit	GSFC
Range	P1: MLE4 & MLE3 retk / MLE3 from MGDR TP: GDRF MLE4 numerical retracking
MSS	CNES/CLS 2015
SSB	P1: GDRF BM4 TP: GDRF 2D empirical solution
Iono	P1: DORIS solution TP: altimeter dual-frequencies (no filtering)
Wet Tropo	TMR reproc.
Dry Tropo	From ERA-Interim
DAC	MOG2D from ERA-Interim
Ocean Tide	FES14B (34 waves)
InternalTide	HRET8,1 / ZARON2019 (M2,K1,S2,O1)
Pole Tide	DESAI2015/ mpl2017
Solid Earth Tide	Cartwright and Edden [1973]

POSEIDON-1 datasets

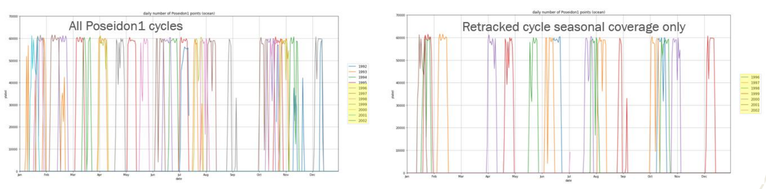
- New retracking only possible when historical megafiles are available.
- Until 1995, only low TM rate



- As Poseidon-1 and TOPEX altimeters shared the same antenna, Poseidon-1 on only near 1 cycle out of 10



- Not all seasons covered by Poseidon-1 data



(see also OSTST 2017 poster on POS1 retracking: https://ostst.aviso.altimetry.fr/fileadmin/user_upload/tx_ausyclsseminar/files/Poster_OSTST18_Retraitement_Poseidon-1.pdf).

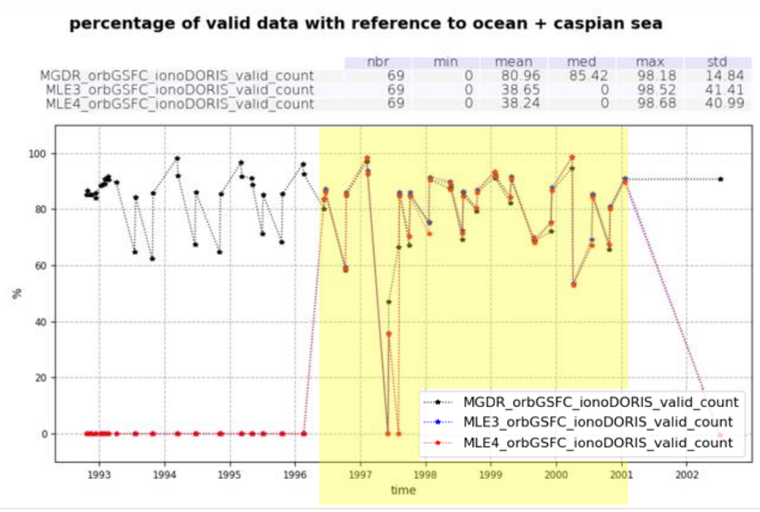
See also J-D. Desjonqueres's presentation :
Calibration and Validation of TOPEX GDR-F Products
(during Regional and Global CAL/VAL for Assembling a Climate Data Record session, on Wednesday)

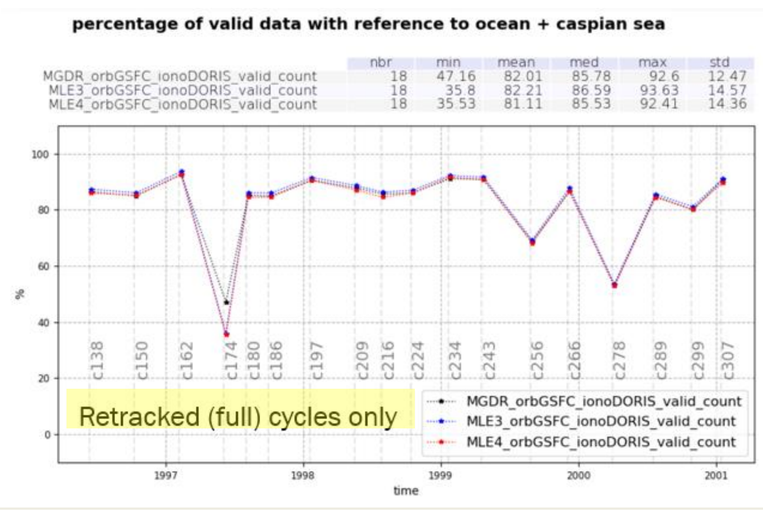
See also A. Guérou 's poster CVL2022_016 :
Cal/Val assessment of Topex reprocessing stability

OSTST Conference, Venice, ITALY
Oct 31st – Nov 04th, 2022

POSEIDON-1 data quality

New MLE4 and MLE3 retracking outputs only available over cycles 137 to 307
Except for cycle 174, number of valid data equivalent to MGDR dataset, quite higher with new MLE3

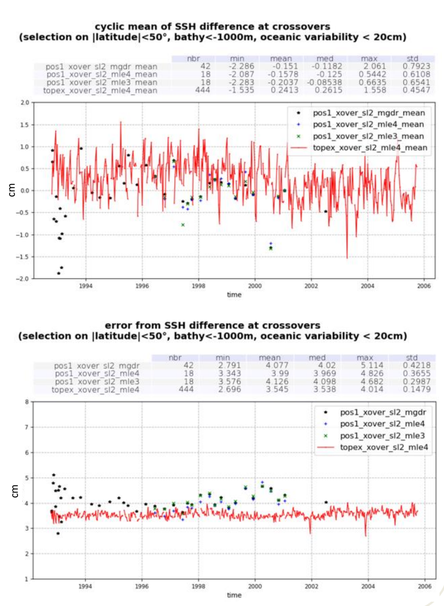




POSEIDON-1 performances at mesoscales

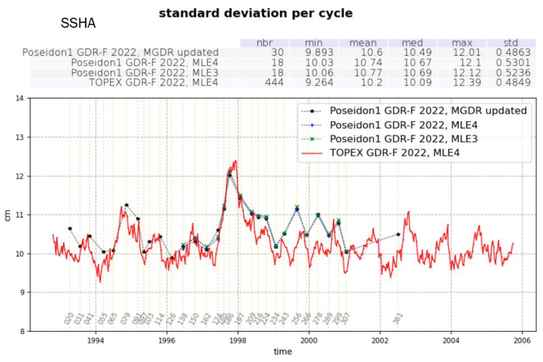
Except for the 20 first cycles (not entire cycles) and for cycle 278, cyclic mean of SSH differences at crossovers are quite equivalent for TOPEX and POSEIDON-1 cycles (lower than 1cm).

As concerned error deduced from SSH differences at crossovers, higher values are obtained from Poseidon cycles that for TOPEX cycles, the DORIS ionosphere correction degrades the crossover variability, essentially in the second part of the mission and explains why higher differences are found between TOPEX and Poseidon in the last years.



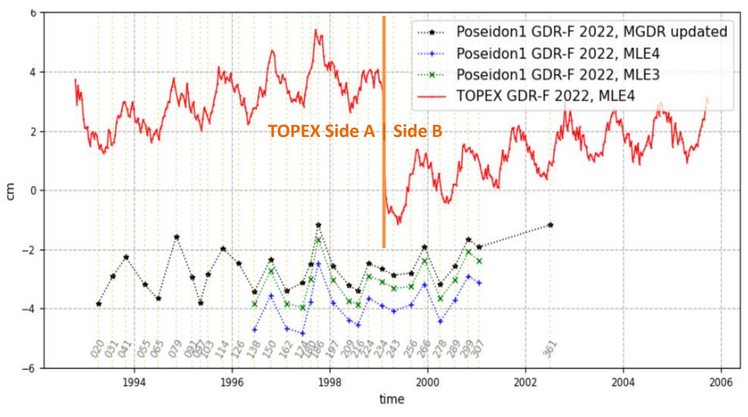
POSEIDON-1 along-track performance

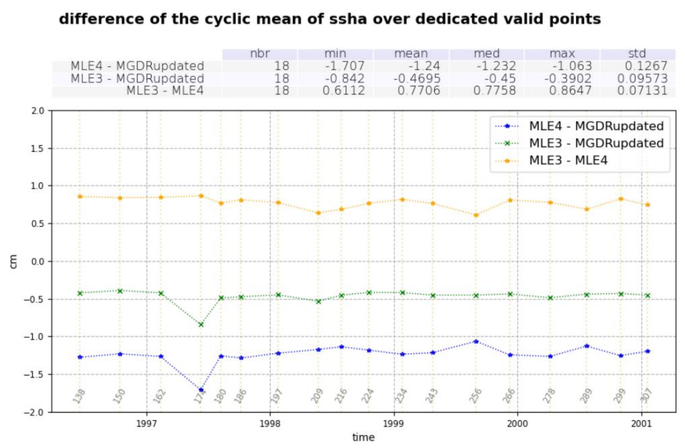
Standard deviation of Sea Surface Height Anomaly is quite equivalent for POSEIDON-1 cycles than for TOPEX cycles, slightly higher from 1999 onwards. It reaches more than 12cm during 1997/1998 due to *el nino* event.



Long-term monitoring and SLA biases

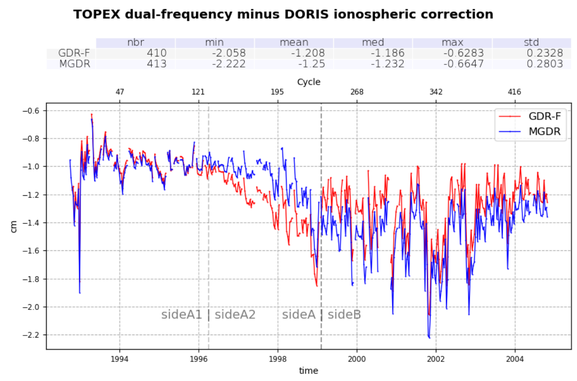
Differences between POSEIDON-1 versions of retracking are quite stable. Note that cycle 174 have coverage differences between new MLE3/4 retracking and MGDR updated versions that can explain the difference in computed bias.





Ionospheric correction specificities

POSEIDON is a single band instrument and so don't produce bifrequency ionospheric correction. DORIS correction have been used because of the lack of coverage of other solutions.
DORIS solution is sensitive to solar activities, so the mean difference between TOPEX and POSEIDON corrections is correlated to the sunspot activity, which directly impacts the relative bias between TOPEX and Poseidon SSH estimations, and particularly adding uncertainties on this bias.
Note that no adjustment has been included in the L2 GDR-F products.



CONCLUSIONS

POSEIDON-1 excellent instrumental stability making it valuable to contribute to the TOPEX A drift analysis in addition to being useful for the Global Mean Sea Level determination.
Poseidon GDR-F quality is a noticeable improvement over prior standard.