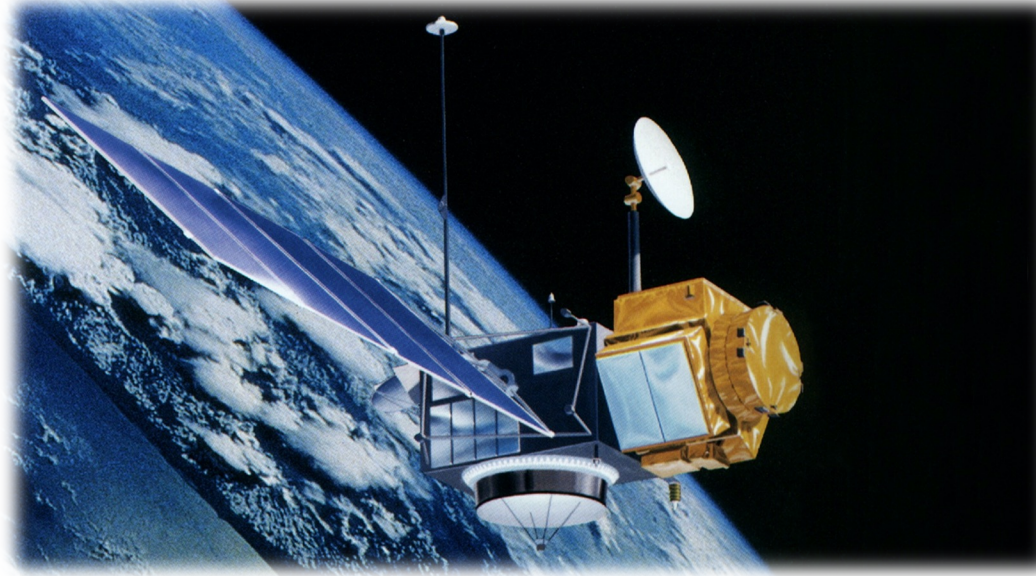


TOPEX/POSEIDON Reprocessing



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On behalf of NASA/JPL and CNES/CLS Teams

Acknowledgements: NASA GSFC, U. Colorado, U. New Hampshire

(1) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA / (2) Centre National d'Etudes Spatiales, Toulouse, France

(3) Collecte Localisation Satellites, Toulouse, France

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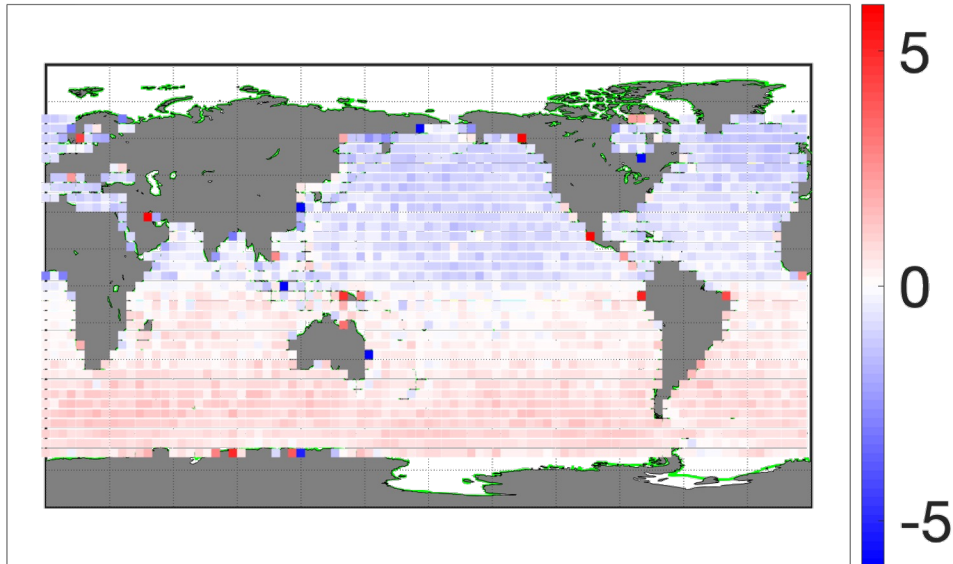
OSTST Venice, 2022

TOPEX Reprocessing

- Overall improvement of the data quality
 - Reduction of hemispheric bias
 - Synchronization of echo waveforms and altimeter tracker data
 - Use of MLE-4 to accommodate platform mis-pointing events
 - Similar crossovers performance as Jason missions
- Understanding the Wallops correction.

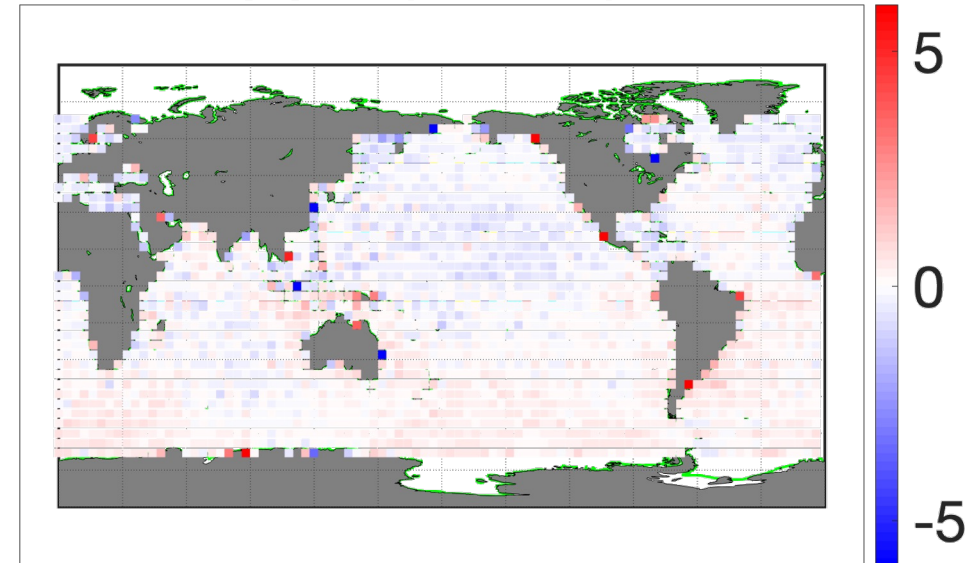
MGDR Results

TOPEX non-retracked
CrossOvers SSHA Differences (cm) - mean value
averaging over cycle: 235 to cycle: 480



MLE4 Retracking Results

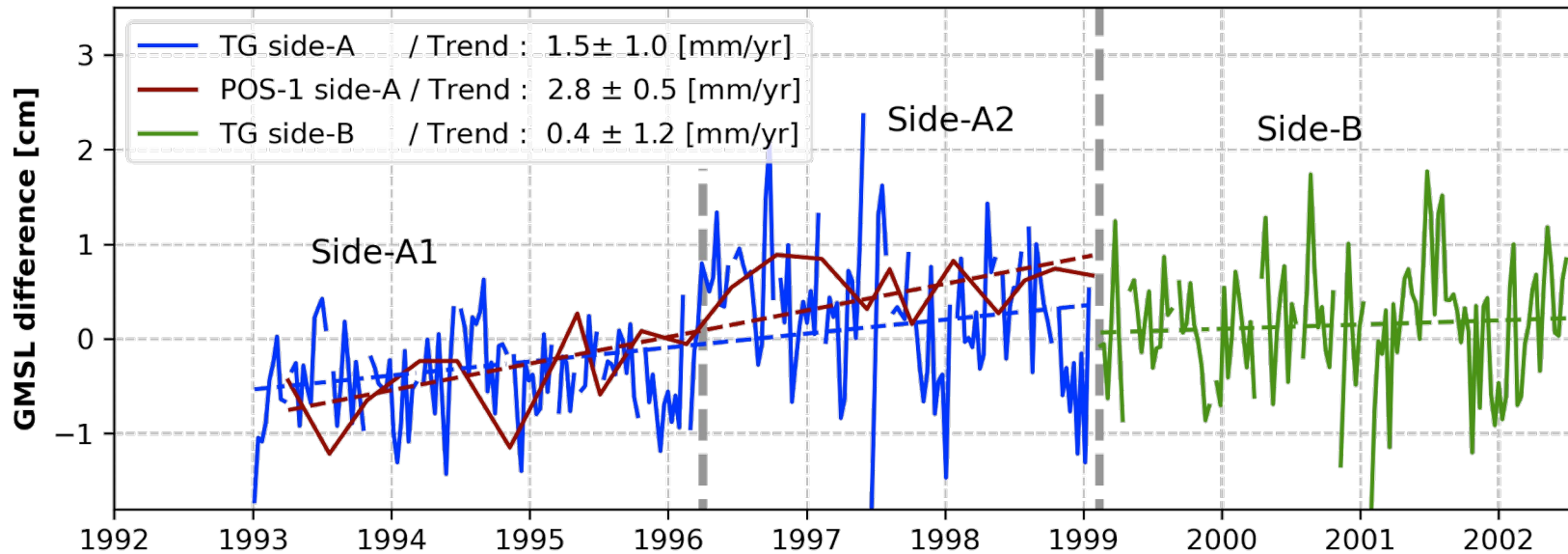
TOPEX MLE4
CrossOvers SSHA Differences (cm) - mean value
averaging over cycle: 235 to cycle: 480



For Climate Studies

- SWH is much more stable
- Removed contribution of Cal-1 Range correction from retracking estimates
 - After analysis indicated instrument anomaly
 - Consistent with Beckley et al., 2017 (i.e., Cal-1 range correction effectively not be applied to Side A)
- External validation shows improvement in agreement with Tide Gauges and Poseidon
- **Recommend climate studies treat Side-A timeseries into two sides: A1 and A2**
 - Reprocessing exposed jump in calibration data at cycle 130 (April 1, 1996)

TOPEX SSH difference with references

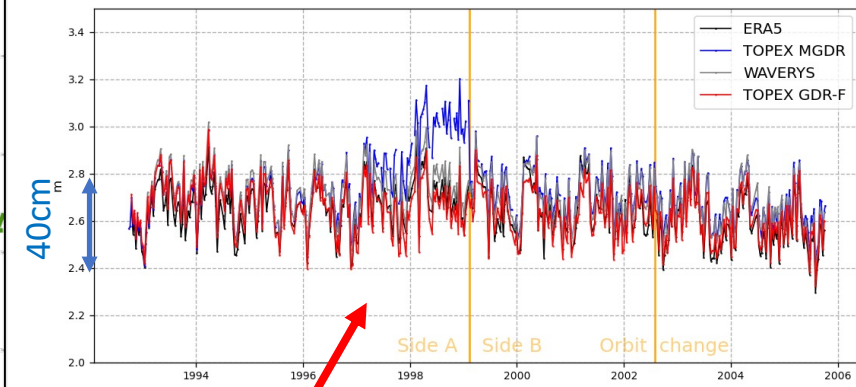


See Adrien Guérrou's poster

SWH stability improved

Along-track SWH - Mean by cycle

	nbr	min	mean	med	max	std
ERA5	444	2 297	2 636	2 638	2 939	0.1133
TOPEX MGDR	448	2 388	2 728	2 713	3 201	0.1368
WAVERY5	436	2 356	2 705	2 706	3 018	0.114
TOPEX GDR-F	444	2 325	2 64	2 64	2 987	0.1115



TOPEX GDR-F product

Poseidon

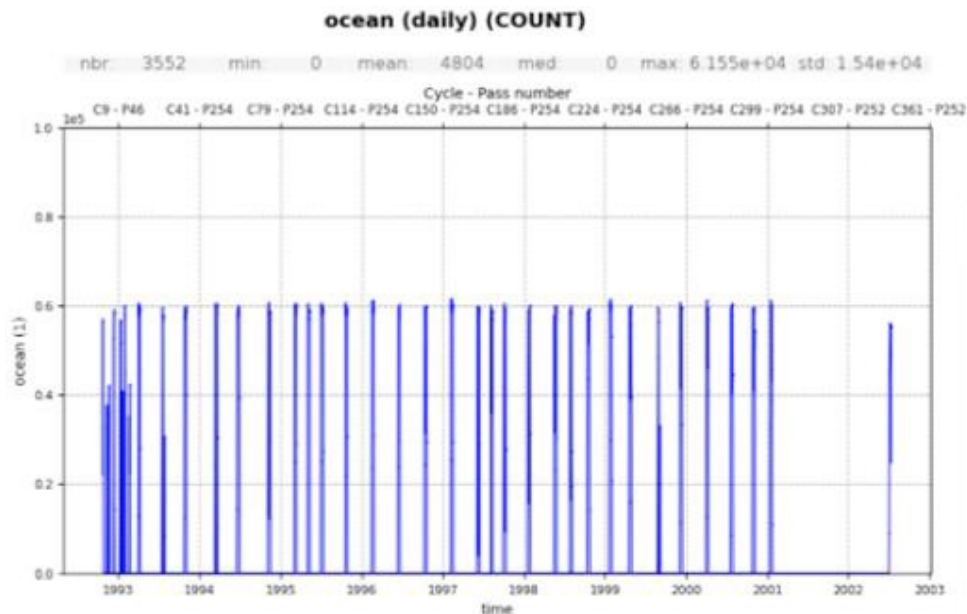
Poseidon was operated ~1 cycle every 10 cycles

Reprocessed Altimeter Data with MLE-3/4 algorithms (see Helene Roinard's poster)

Reprocessed data are only slightly differences with MGDR dataset (mostly biased)

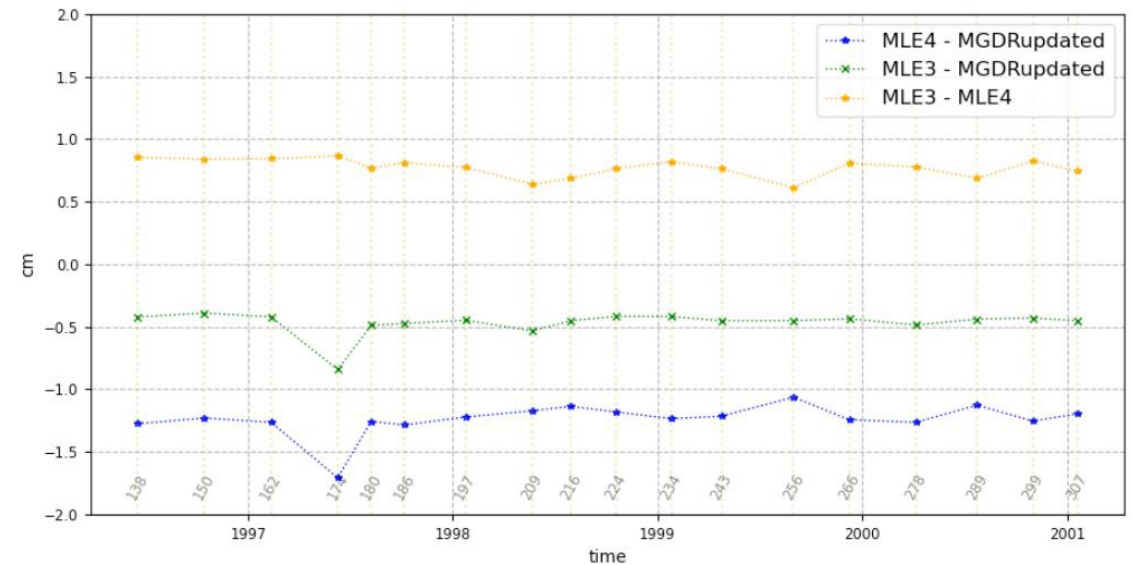
MGDR data are still provided for continuity

(Retracked data available starting cycle 137)



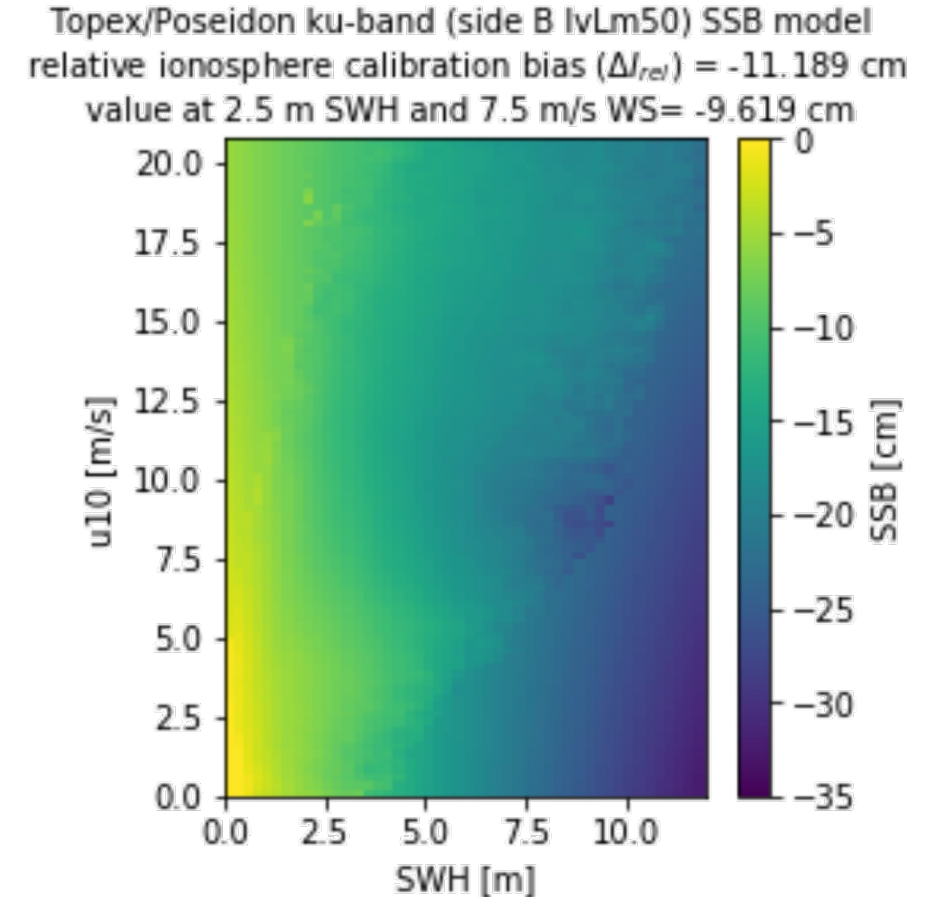
difference of the cyclic mean of ssha over dedicated valid points

	nbr	min	mean	med	max	std
MLE4 - MGDRupdated	18	-1.707	-1.24	-1.232	-1.063	0.1267
MLE3 - MGDRupdated	18	-0.842	-0.4695	-0.45	-0.3902	0.09573
MLE3 - MLE4	18	0.6112	0.7706	0.7758	0.8647	0.07131



Sea State Bias Solutions

- TOPEX
 - Non Parametric 2D Model from U. Colorado, Boulder (A. Putnam et al.)
 - Non Parametric 3D Model from U. New Hampshire (H. Feng and D. Vandemark)
 - Using Wave Period (T02) as input in addition to Windspeed and SWH
- Poseidon
 - 4 coefficients Parametric Model (BM4) solutions for MLE-3/4 and MGDR range data



Orbits

- 2 solutions provided
 - NASA Goddard Space Flight Center
 - CNES
- Reference ellipsoid switched to WGS84 (consistent with GDR-F)
 - Height difference between TOPEX ellipsoid and WGS84 ellipsoid provided on product.

Environmental corrections

- GDR-F standard
 - Mean Sea Surface:
 - MSS_CNES-CLS15
 - DTU18
 - Tides
 - FES 2014b
 - GOT4.10c
 - HRET Internal tide (Zaron)

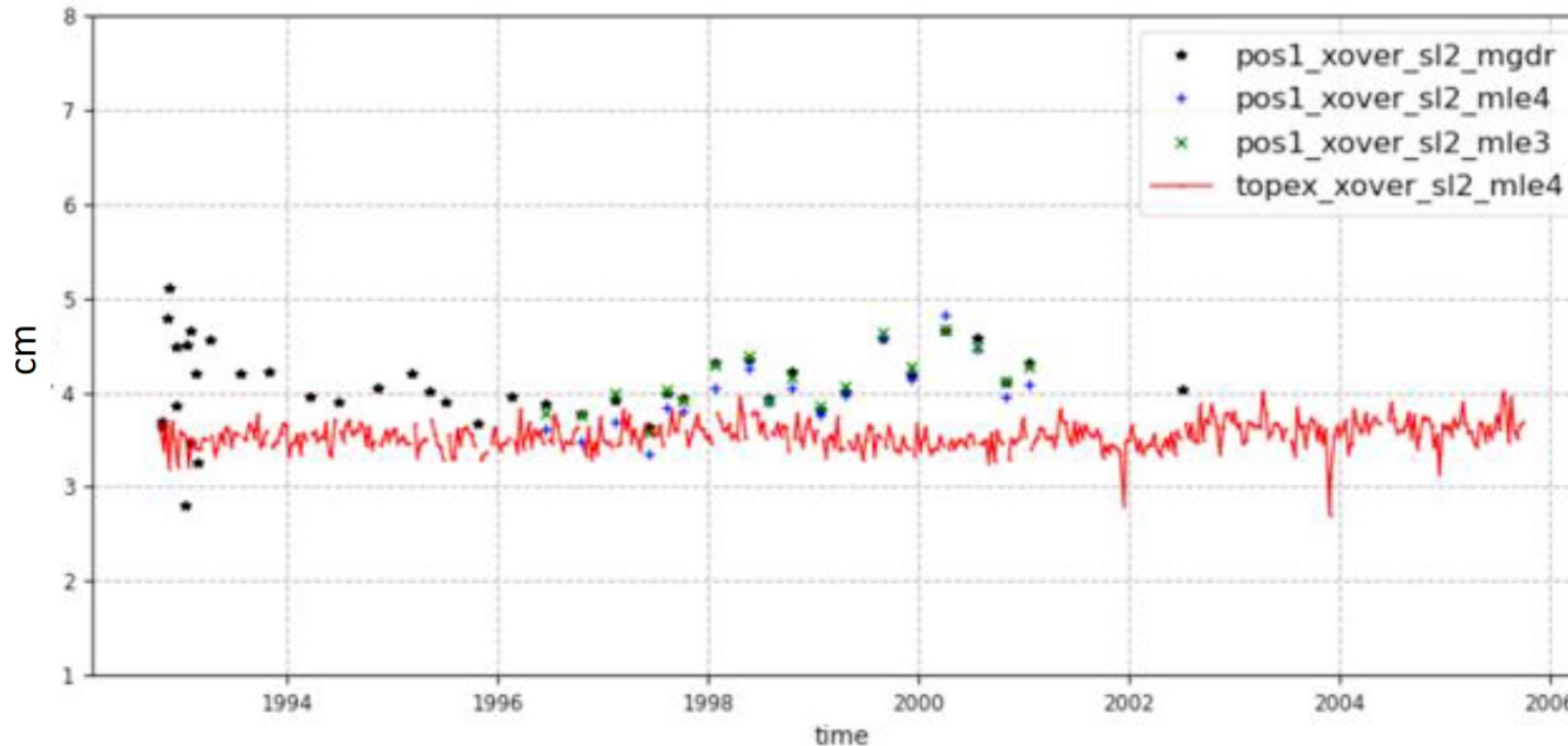
Crossovers performance

Jason like performances

error from SSH difference at crossovers
(selection on $|\text{latitude}| < 50^\circ$, bathy $< -1000\text{m}$, oceanic variability $< 20\text{cm}$)

	nbr	min	mean	med	max	std
pos1_xover_sl2_mgdr	42	2.791	4.077	4.02	5.114	0.4218
pos1_xover_sl2_mle4	18	3.343	3.99	3.969	4.826	0.3655
pos1_xover_sl2_mle3	18	3.576	4.126	4.098	4.682	0.2987
topex_xover_sl2_mle4	444	2.696	3.545	3.538	4.014	0.1479

mean noise
TOPEX:
3.54cm
Poseidon:
3.99cm



Conclusion?

- Long way...
 - Numerous iterations between all partners involved in this reprocessing
- Poseidon and TOPEX altimeter waveform retracking (+new SSB solutions)
- New GSFC and CNES orbit.
- Radiometer calibration consistent with end-of-mission calibration.
- Update of environmental corrections in line with Jason/Sentinel-6 GDR-F standard
- Products for Poseidon and TOPEX are as close as possible in terms of content and format homogeneity.
 - Remaining differences are inherent to instrument differences
- Data quality has improved with this reprocessing
- **Products are fully generated (on the way to PODAAC and Aviso+)/ User Manual is in progress.**
- **Target Release Date: January, 2023.**

Back-up slides

Parameter	Approach
Altimeter measurements (Range, SWH, Sigma0)	TOPEX Side-A: MLE3 and MLE4 retracking.
	TOPEX Side-B: MLE3 and MLE4 retracking.
	POSEIDON: MLE-3 retracking completed.
Orbit	GSFC (dpod2014v04) and CNES (POE-F) ITRF2014 solutions
Radiometer (TMR)	End-of-mission calibration and coastal delays consistent with Enhanced Path Delay Product
Model Dry and Wet	ERA Interim
Sea State Bias	Topex: 2-D SSB (U. Colorado) and 3-D SSB (U. New Hampshire) Poseidon: 4 coefficients Parametric Model (BM4) for MLE-3/4 and MGDR range data
Altimeter Wind Speed	Collard (2005) with sigma0 calibration.
Reference Ellipsoid	WGS84 (height difference with Topex ellipsoid provided)
MSS	CNES/CLS 2015 and DTU18 (w.r.t. WGS84)
Geoid	EGM2008 (w.r.t. WGS84)
MDT	CNES/CLS 2018
Ocean Tides	FES2014b and GOT4.10c
Solid Earth Tide	Cartwright and Edden (1973) (no change)
Internal Tide	Zaron (2019)
Pole Tide	Desai et al. (2015) with linear mean pole (Ries and Desai, 2017).
IB and DAC	ERA-Interim and Mog-2D from ERA-Interim

**Geophysical Models
consistent with GDR-F
Products.**

Timeline

