A Continuous Record of Global Mean Sea Level Change from TOPEX/Poseidon and Jason-1

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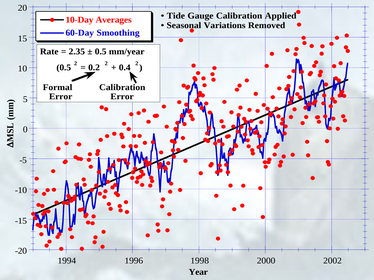
A-5

The Jason-1 radar altimetry mission was designed to resolve changes in global mean sea level to provide for studies of interannual sea level change. We have conducted an evaluation of the Jason-1 measurements to determine their readiness for continuing the 10-year time series of sea level change measurements compiled by the TOPEX/Poseidon (T/P) mission. During the calibration/validation phase of the mission (15 January 2002 — 15 August 2002) Jason-1 followed TOPEX/Poseidon along the same repeating groundtrack, trailing by about 72 seconds.

Preliminary evaluation of sea level change measurements made during the coincident 21 cycles show that the interim data from Jason-1 is of nearly the same quality as T/P, and there is every reason to expect that the final data will be of the same quality or better. Several data analysis issues have become clear, including the necessity to revisit the calibration of TOPEX side B before evaluating the cross-calibration of T/P and Jason-1.

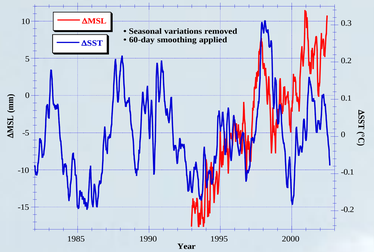
We have completed detailed comparisons of T/P and Jason-1 sea level measurements, including each of the measurement corrections using the latest instrument and geophysical corrections, including ITRF2000 orbits, and new radiometer and sea-state bias models. We have determined the relative bias and the residuals differences between Jason-1 and T/P and compared the results to the individual tide gauge calibration of each mission.

Global Mean Sea Level from T/P

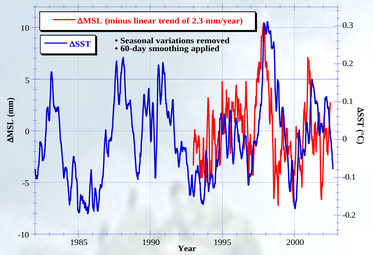


Global Mean Sea Level and SST Variations

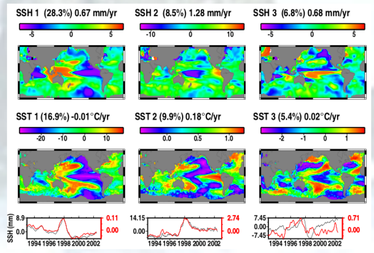
The correlation of global mean sea surface temperature and global mean sea level was strongly correlated from 1993 until the peak of each field during the last El Niño in 1998.



If the mean sea level time series is detrended, the coherency between the two fields is significant for interannual periods.



The two most significant modes of an EOF analysis of sea surface height and sea surface temperature have highly correlated temporal components and have strong spatial correspondence.



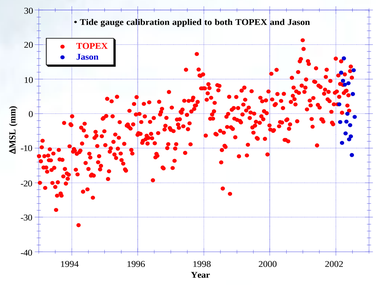
Processing

Except for the altimeter data used with the tide gauge calibrations, the results presented here use the TOPEX GDR Correction/Jason Compatibility Product with retracking applied, including

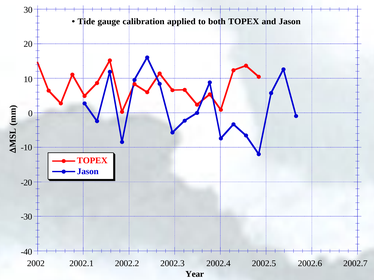
- **The total SSH correction, modified with**
- **Gaspar EMB G4 correction**
- **GOT99.2 tide model**

•Equilibrium tides were added to Jason IGDR tide
•Mean sea surface reference: GSFC001.MSS
•GSFC ITRF2000 orbits used for Jason-1 cycles 1–20 and T/P cycles 344–365.

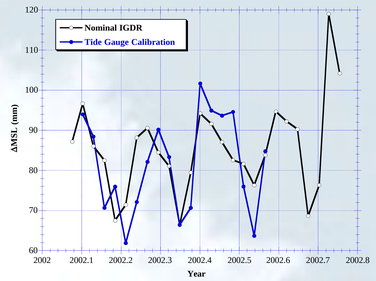
Tide gauge calibration results



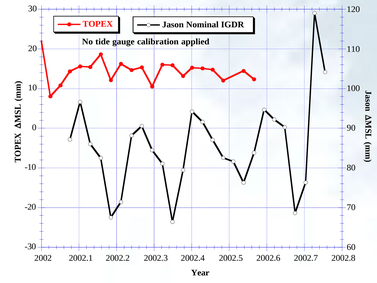
Comparison of T/P and Jason MSL



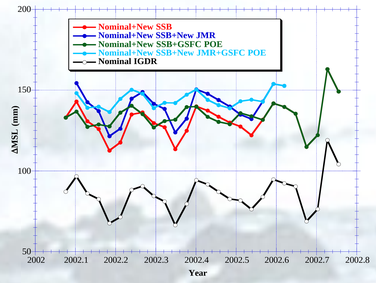
Jason Global Mean Sea Level Variations



Comparison of TOPEX and Jason MSL



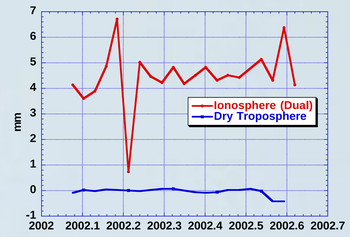
Jason Global Mean Sea Level Variations



Differences in T/P and Jason Corrections

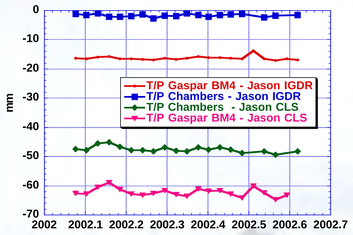
We have evaluated the global mean differences of T/P and Jason GDR corrections and new corrections. As expected, the dry troposphere path delay has essentially no difference. The dual-frequency ionosphere delay has a bias ~4 mm and a rms difference < 1 mm.

Dry Troposphere and ionosphere differences



While the cross-calibration of T/P and Jason-1 is necessary to construct a continuous record of mean sea level, the calibration of TOPEX side B. We have intercompared T/P Gaspar BM4 SSB with retracked GCP and a side-B parametric SSB (see Chambers et al., poster C-1) with both the Jason IGDR and the CLS SSB models.

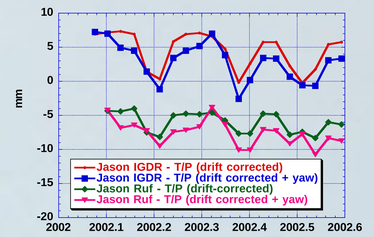
Sea-state bias model differences



Wet Troposphere Differences

C. Ruf supplied Jason-1 wet troposphere path delays from calibrated JMR brightness temperatures. Brown, Ruf, and Keihm have suggested yaw-dependent corrections to the TMR path delay of -2.4 mm (sinusoidal yaw) and +1.4 mm (fixed yaw). We have evaluated the effect of both of these corrections on mean sea level estimates.

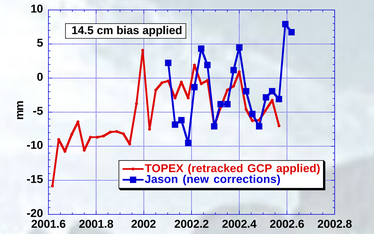
Comparison of TMR and JMR wet troposphere



Relative bias

ITRF2000 POE	JMR PD	CLS SSB	bias (mm)	rms (mm)
N	N	N	84.9	7.8
N	N	Y	130.8	7.9
Y	N	N	88.5	3.4
Y	N	Y	134.4	3.7
N	Y	N	96.5	9.4
N	Y	Y	142.4	9.6
Y	Y	N	99.4	3.0
Y	Y	Y	145.4	3.5

Jason-1 and T/P MSL with latest corrections



Acknowledgements

C. Ruf and S. Brown provided the calibrated JMR wet troposphere path delay data for Jason cycles 1-22. N. Zelensky provided the GSFC ITRF2000 orbits and interpolating software.