Assessment of the Jason-3 extension to the TOPEX/Poseidon/Jason Sea Surface Height Climate Data Record referenced to ITRF2014

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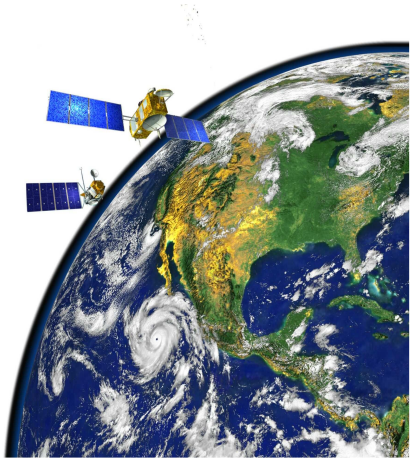


Ocean Surface Topography Science Team Meeting, La Rochelle, France, Nov. 01-04, 2016

Preview

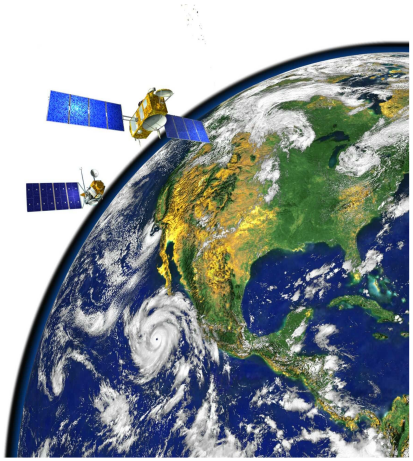
Can "operational" monitoring of global mean sea level proceed at the required level of acurracy with Jason-3 now that Jason-2 has been maneuvered.

- Determination of Jason-2/3 inter-mission bias from collinear SSH residuals.

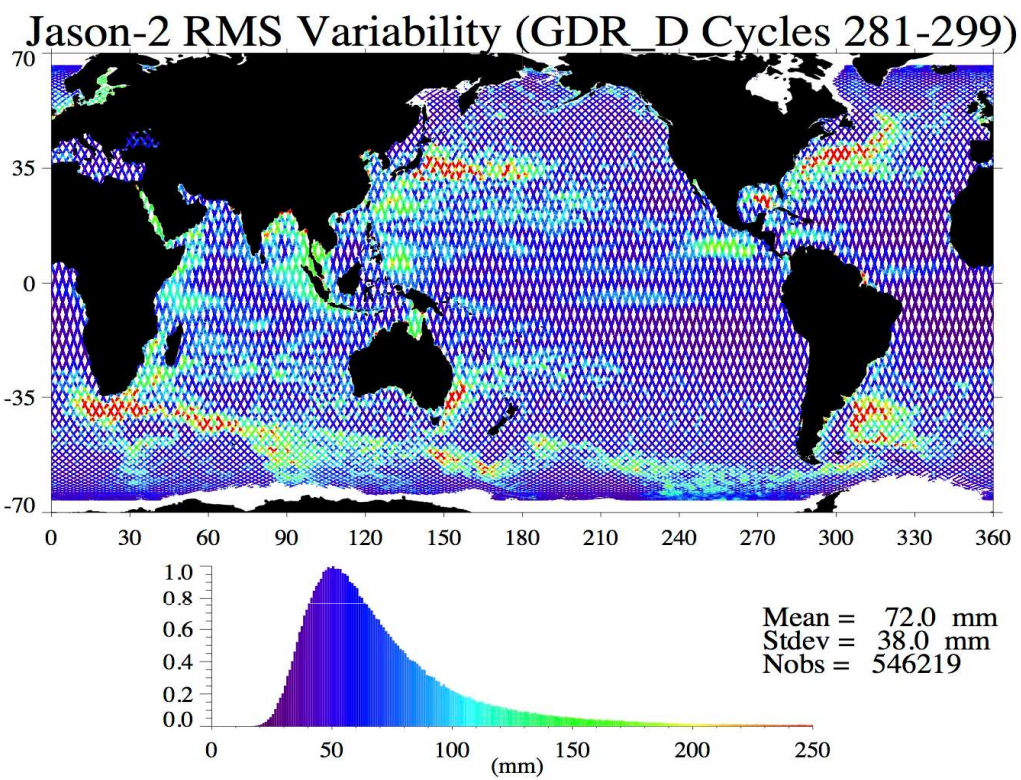
- Impact of revised Terrestrial Reference Frame (ITRF2014) on regional Mean Sea Level estimates.

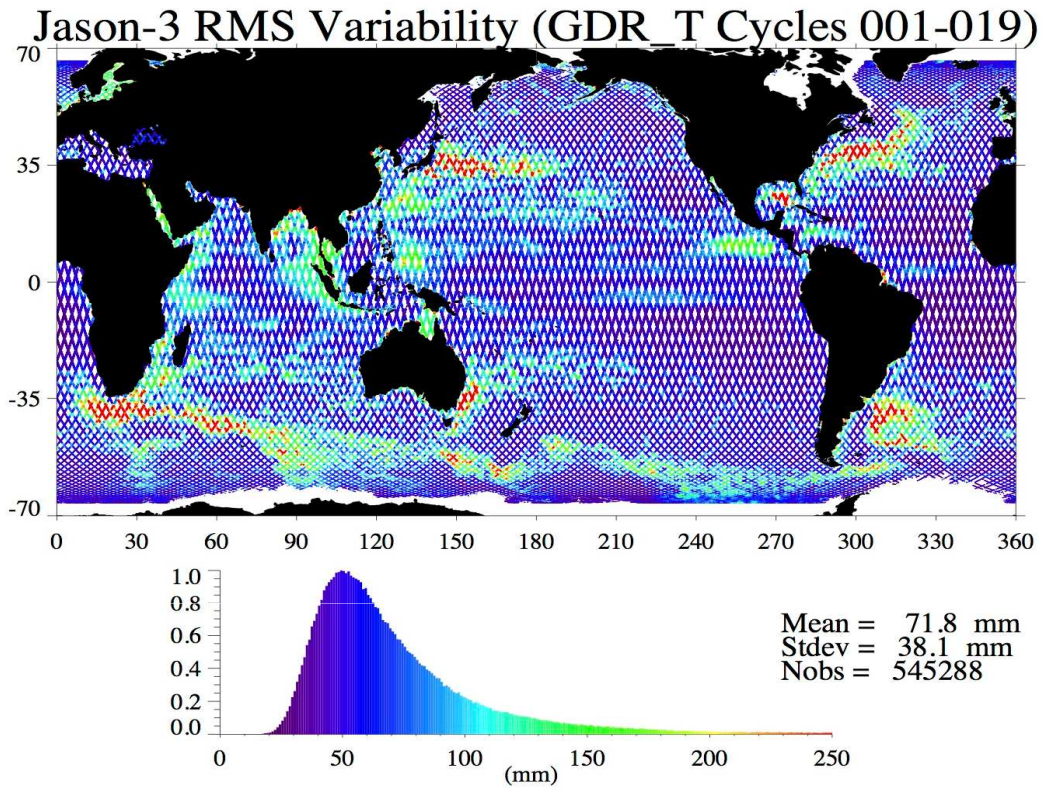
- Quantifying the stability of the SSH time series from Tide-gauge network comparisons.

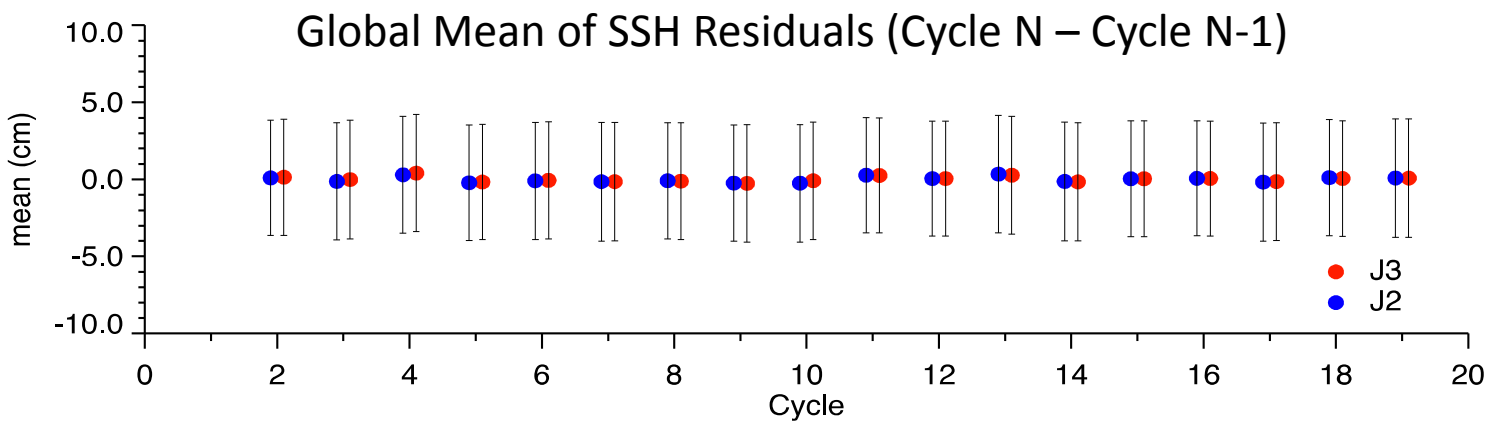
- Recent trends in global and regional mean sea level, mass budget analy



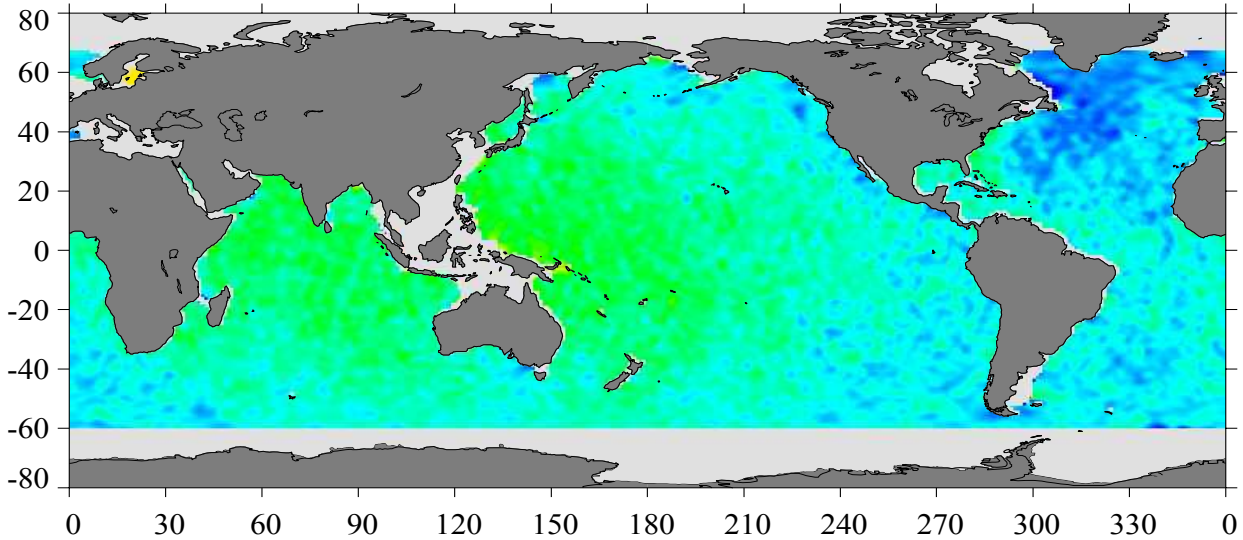
Jason-3 GDR_T Sea Surface Height Collinear Residuals (Cycles 001 -019)

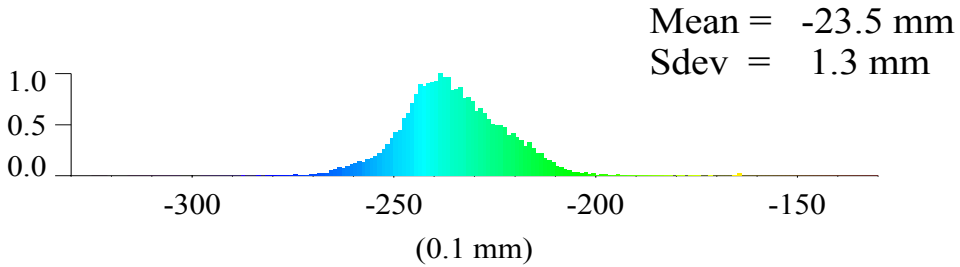


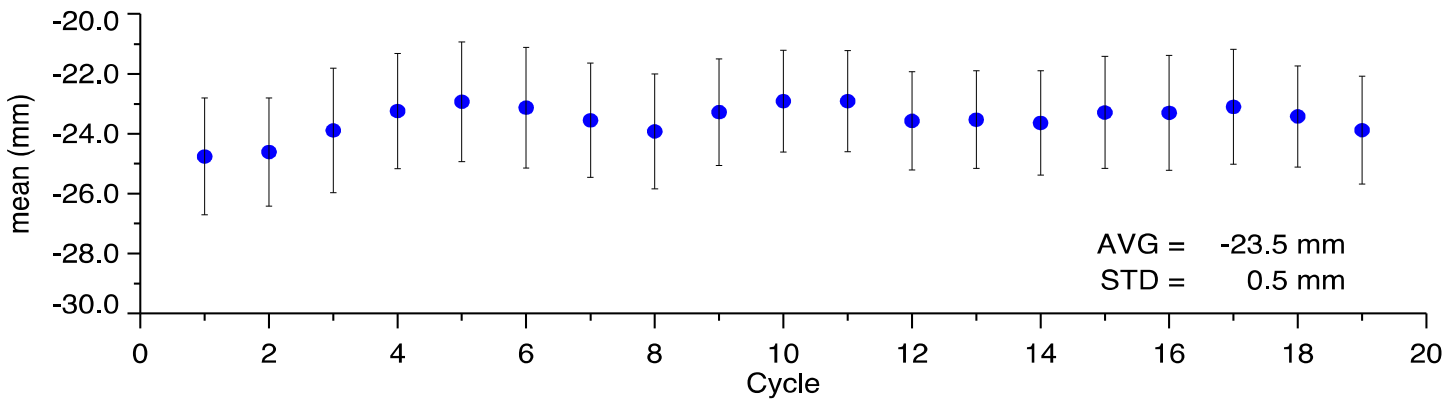




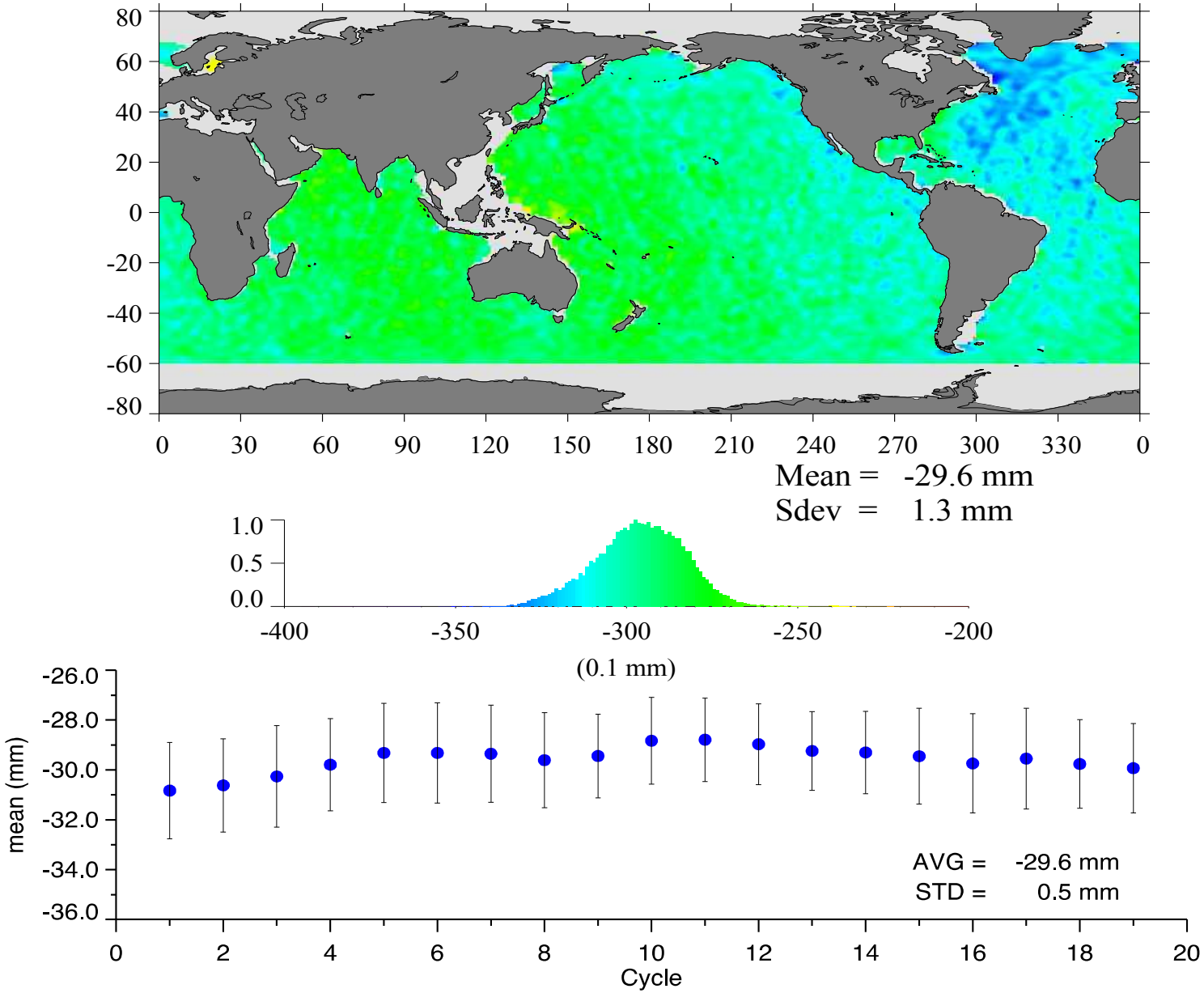
Jason-3 GDR_T – Jason-2 GDR_D (Orbit – range – MSS)



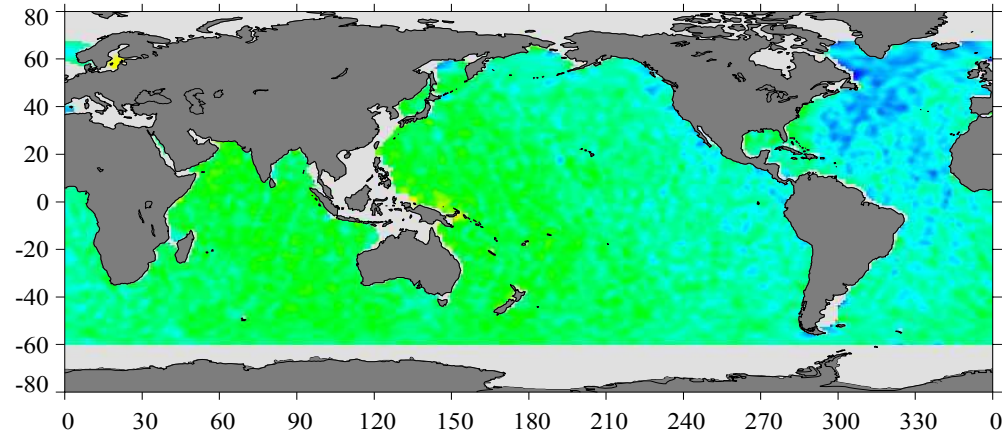


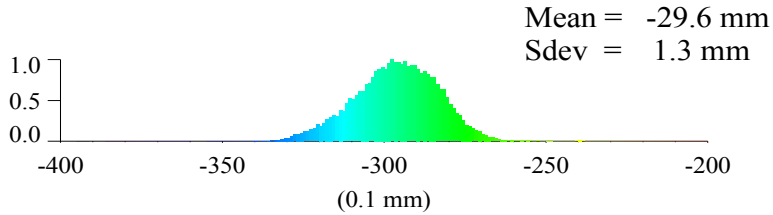


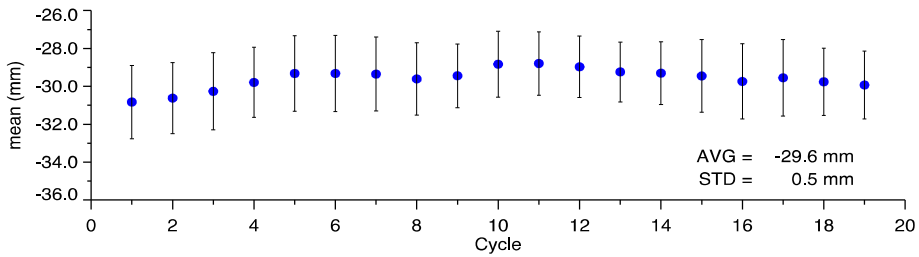
Global Mea Sea Surface Height Collinear Residuals
Jason-3 GDR_T – Jason-2 GDR_D (Orbit – range+all corr – MSS)



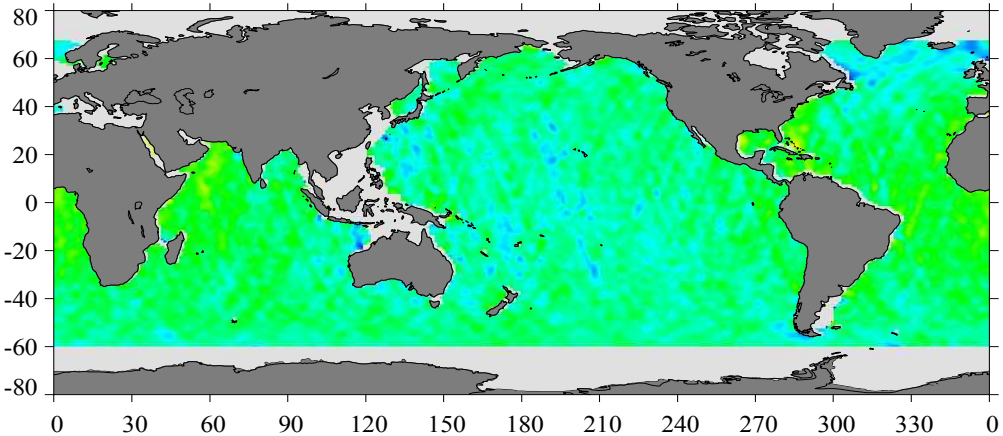
Jason-3 GDR_T – Jason-2 GDR_D
(Orbit – range+all corr – MSS)

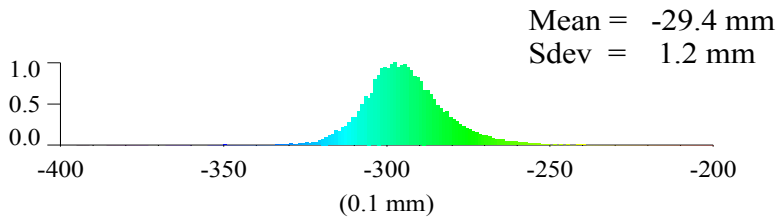


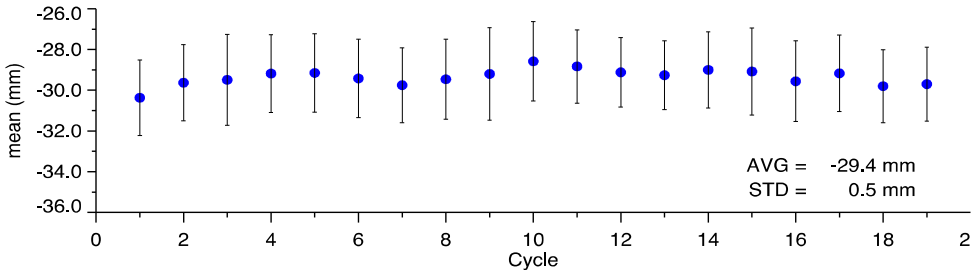




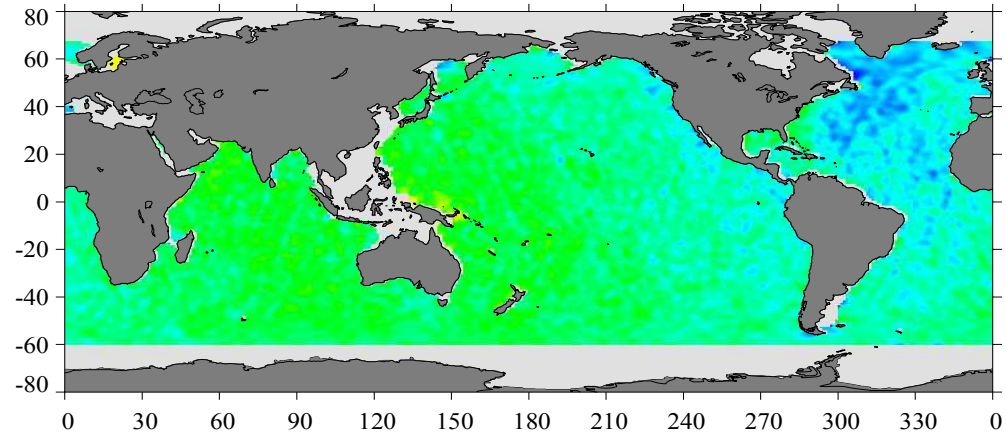
Jason-3 GDR_T – Jason-2 GDR_D
(std1504 Orbit – range+all corr – MSS)

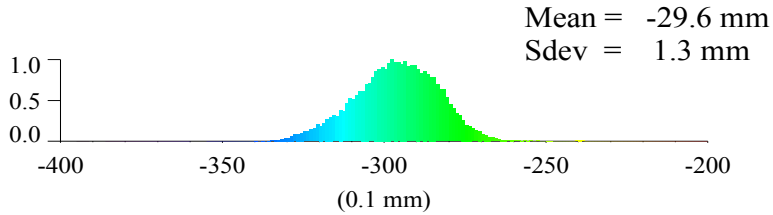


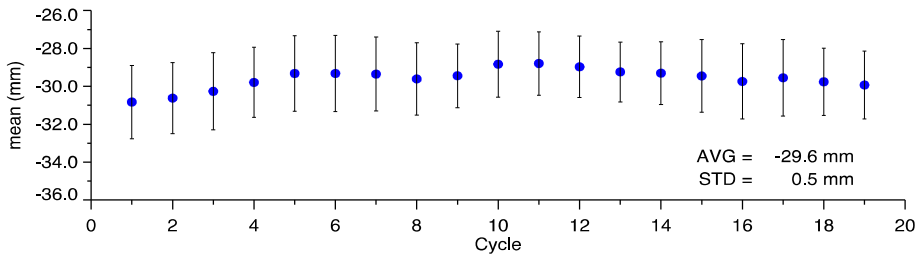




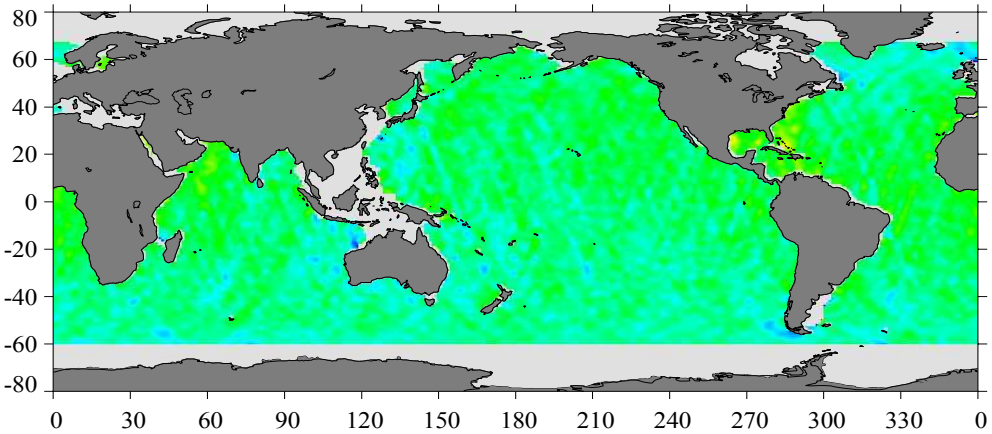
Jason-3 GDR_T – Jason-2 GDR_D (Orbit – range+all corr – MSS)

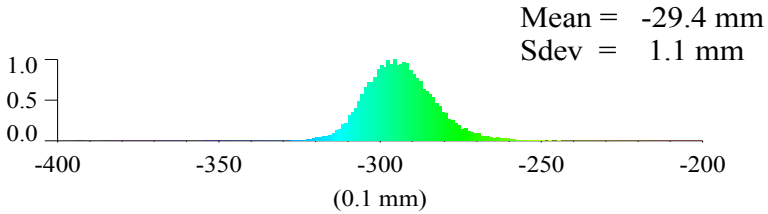


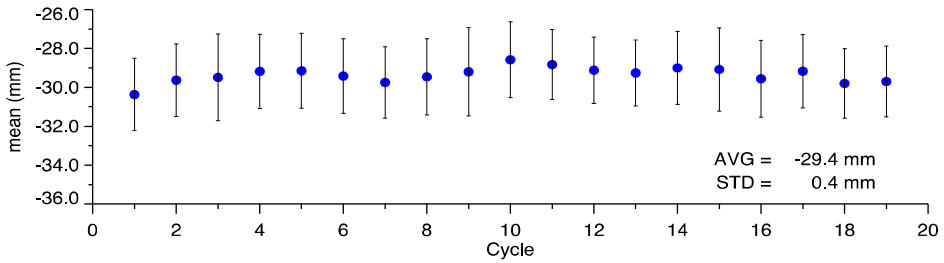




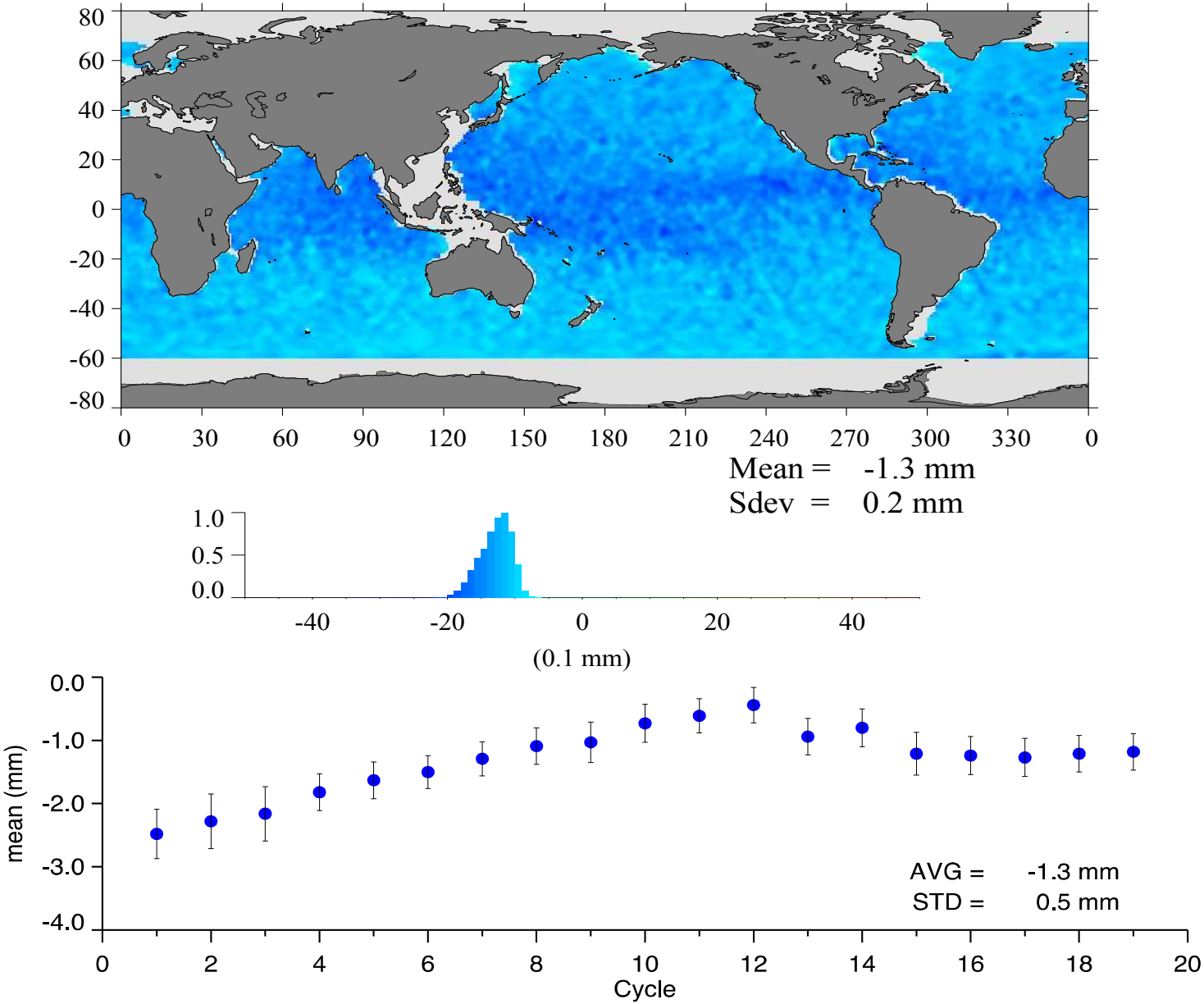
Jason-3 GDR_T – Jason-2 GDR_D (std1504_trf14 Orbit – range+all corr – MSS)



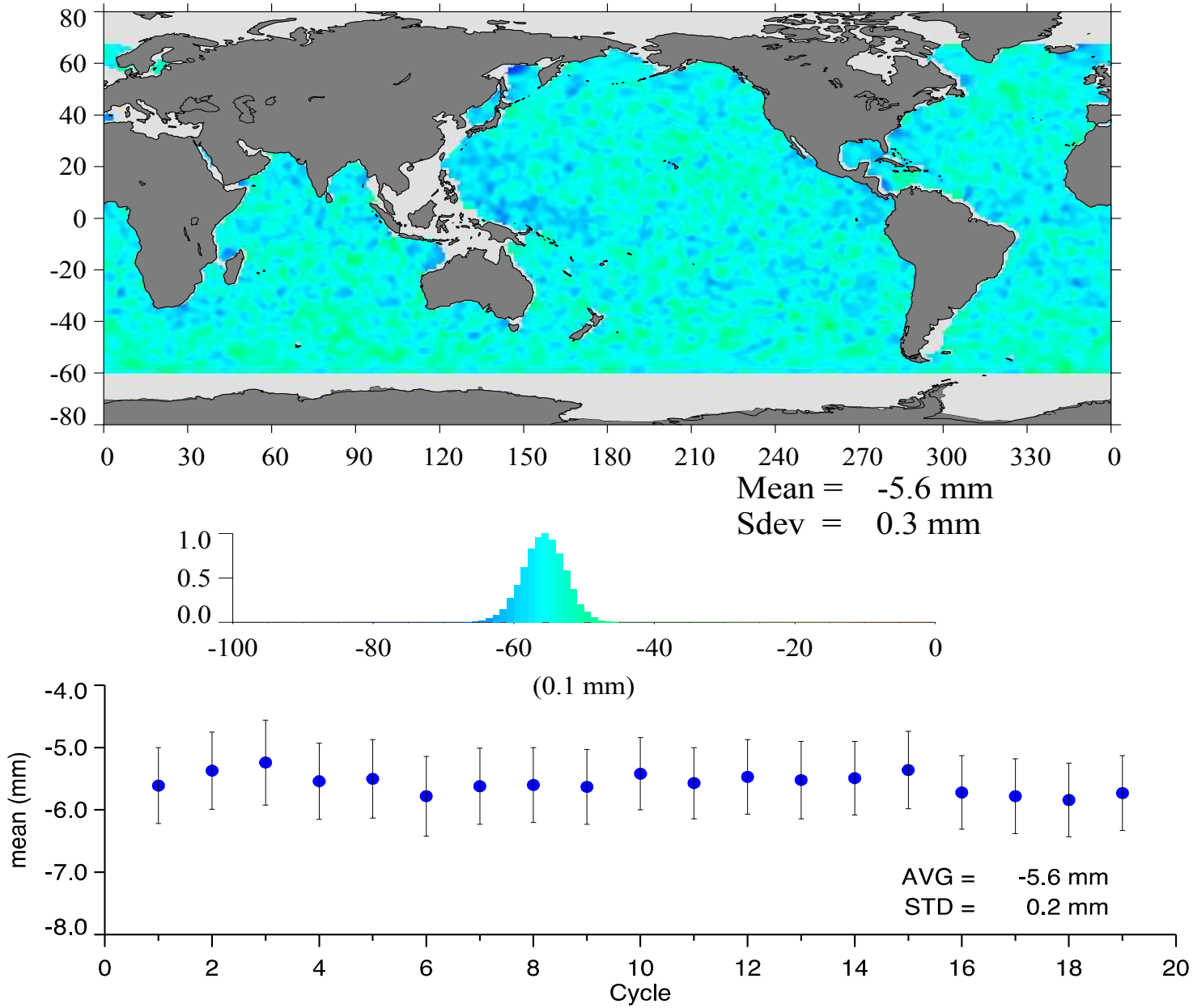




Jason-3 GDR_T – Jason-2 GDR_D radiometer wet trop range correction



Jason-3 GDR_T – Jason-2 GDR_D ionosphere range correction



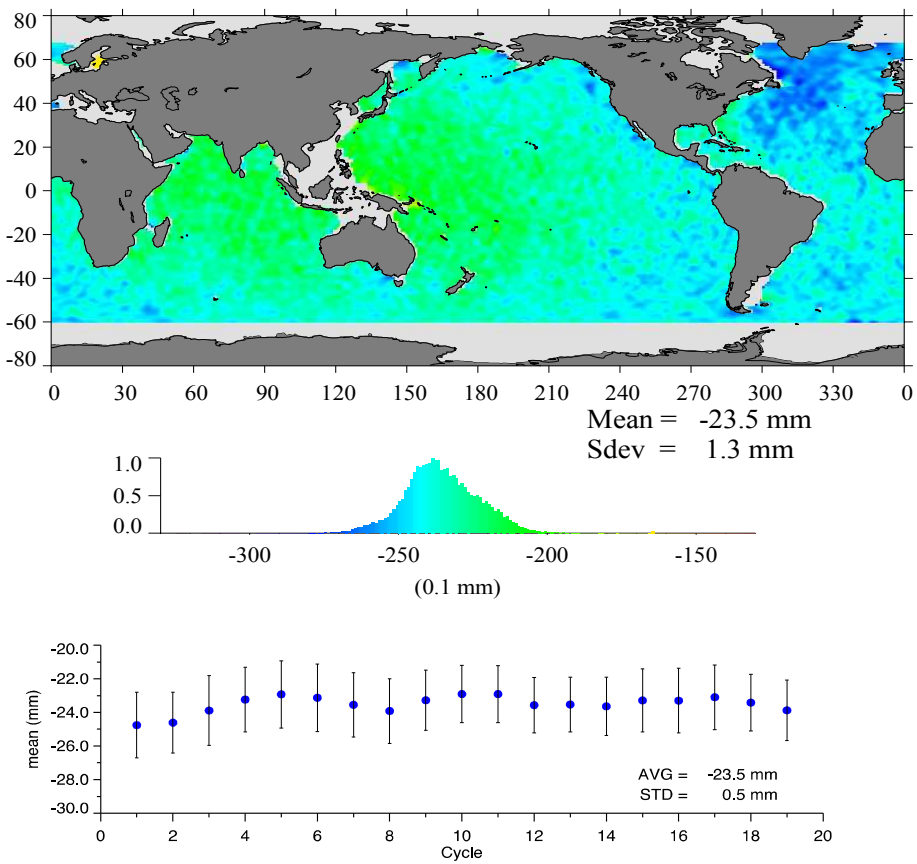
Reconciling Jason-2/3 Ionosphere Range correction bias
Jason-3 GDR_T – Jason-2 GDR_D (Orbit – range – MSS)

Ionosphere correction bias = ((Range Ku bias) – (Range C bias))/ (f_{Ku}^2/f_C^2-1)

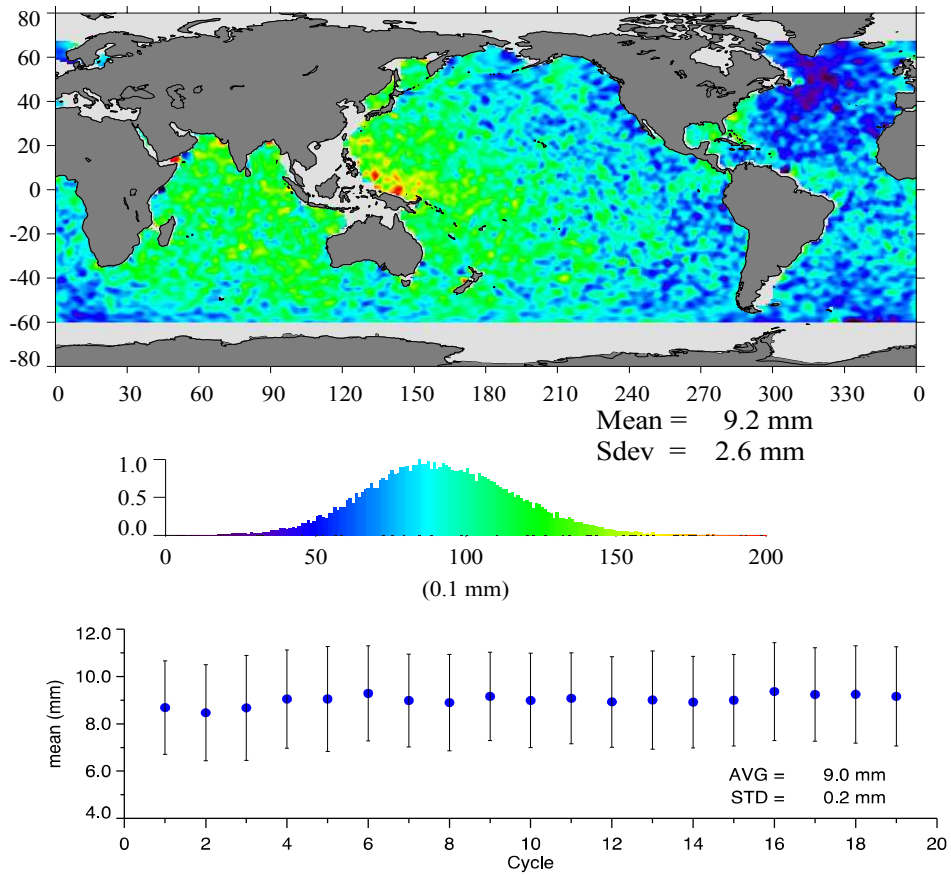
where f_C = 5.3 GHz and f_{Ku} = 13.575 GHz

= 0.1798 × ((23.5 mm) – (-9.2 mm)) = **<u>5.8 mm</u>**

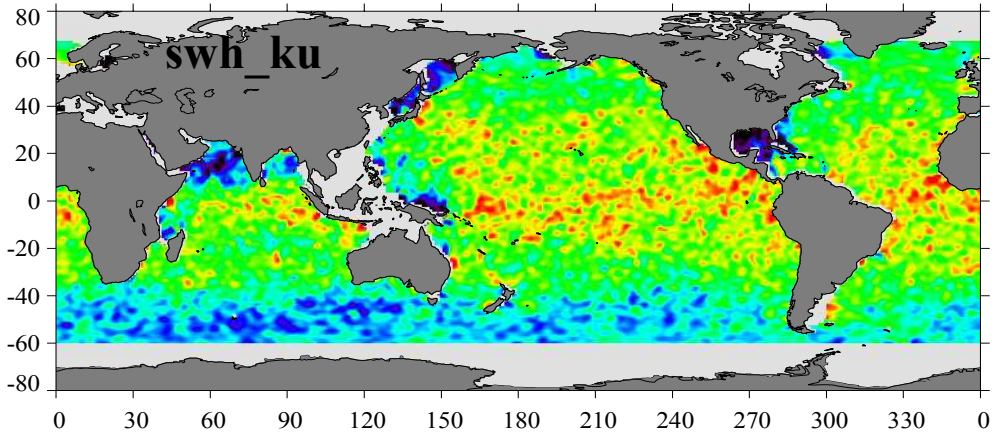
Ku band



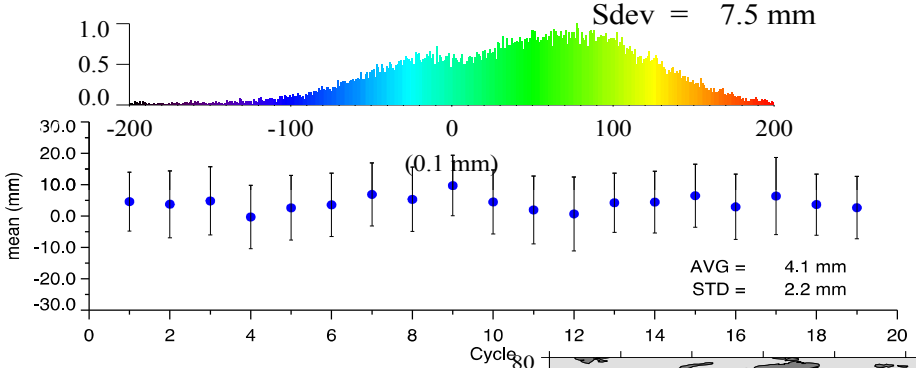
C band

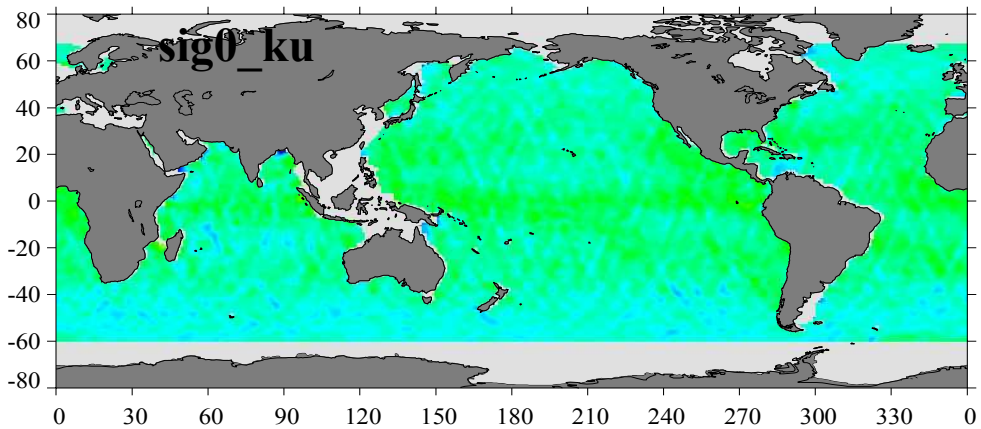


Sea State Bias Parameters

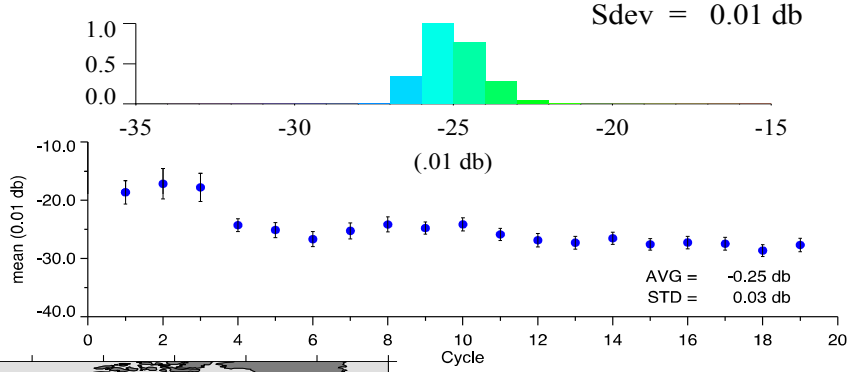


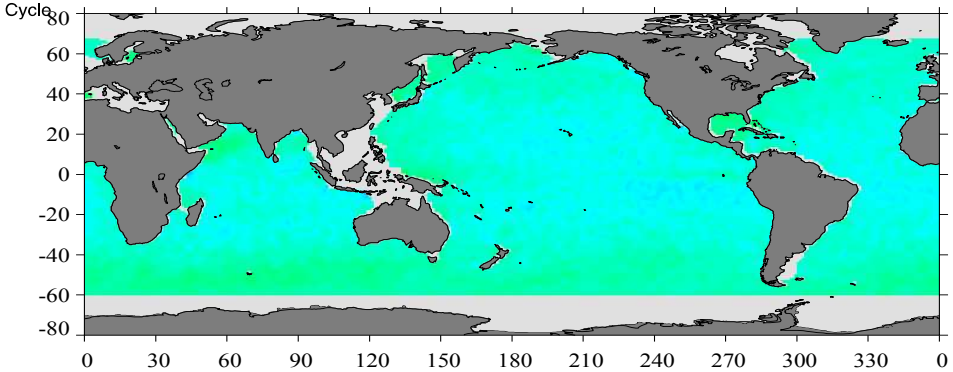
Mean = 4.2 mm
Sdev = 7.5 mm



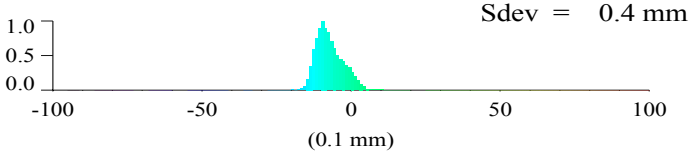


Mean = -0.25 db
Sdev = 0.01 db





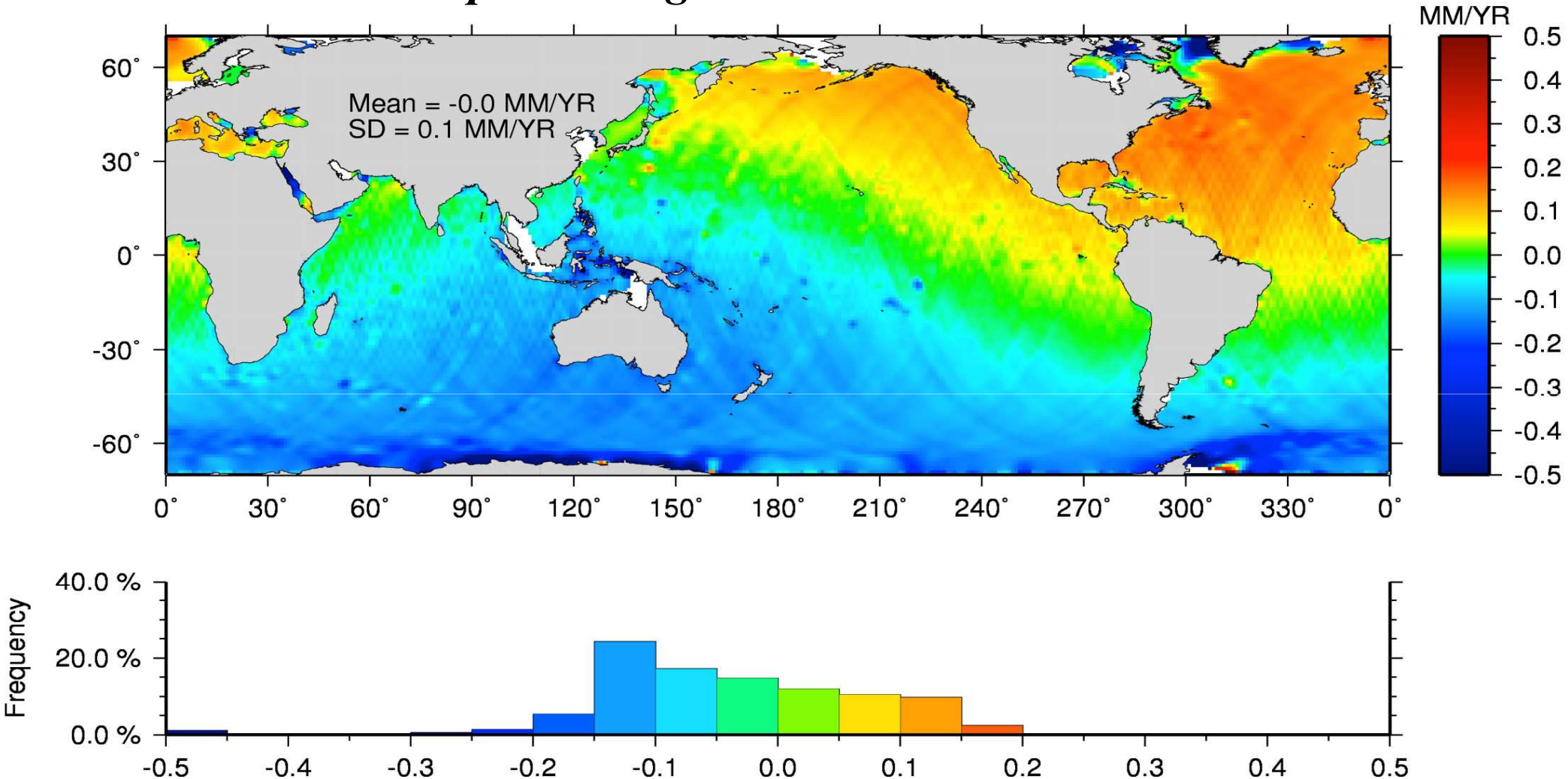
Mean = -0.7 mm
Sdev = 0.4 mm



Jason3 – Jason2
SSB Jason2 NP model,
(*Tran et al, 2012*)

Transitioning from ITRF 2008 to ITRF 2014

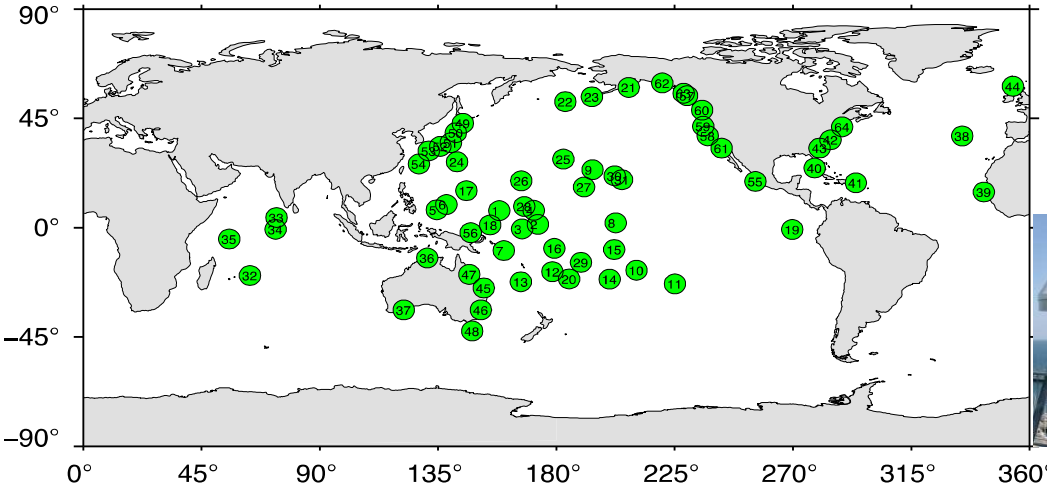
Impact on regional sea level estimates



"For the objective of 0.3 mm/yr in global sea level accuracy to be met, the reference frame drift should ideally be kept below 1 mm/yr. A goal of 0.5 mm/yr stability seems appropriate." Cazenave et al., 2009

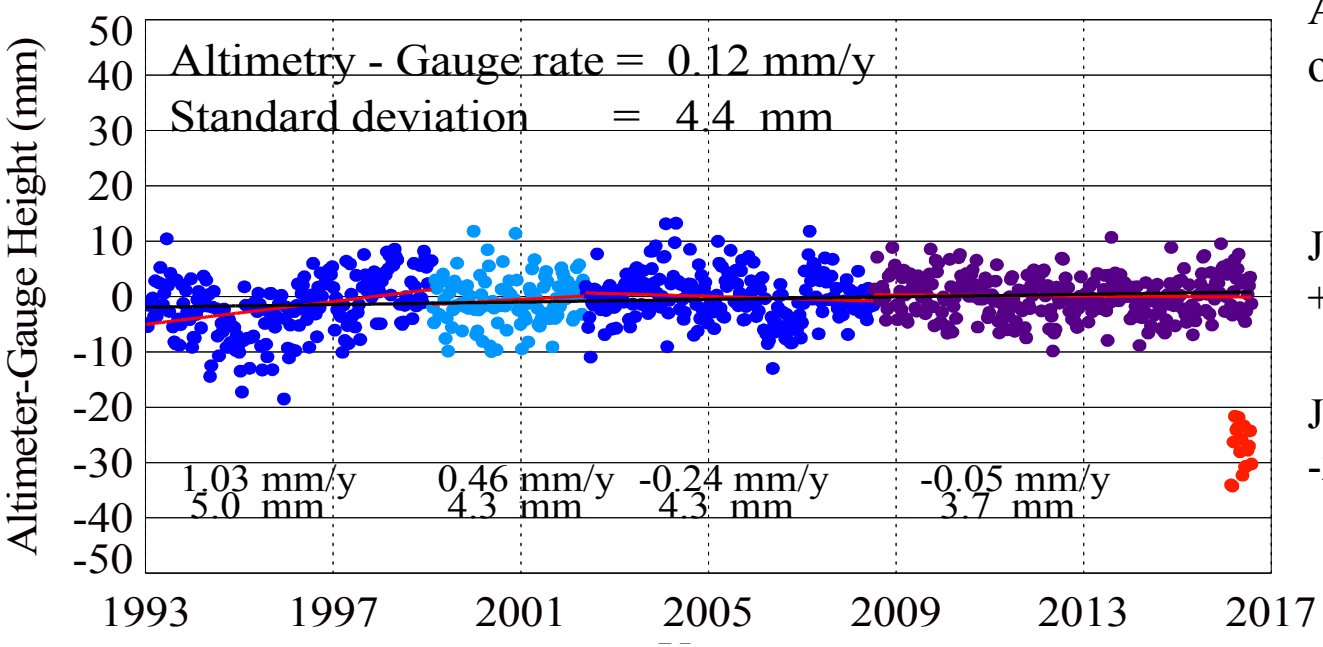
Tide Gauge Verification

Assessing altimeter stability and estimating Jason-2/3 inter-mission bias



G. Mitchum's 64-station network selection.

Vertical land motion estimates based on ULR5.



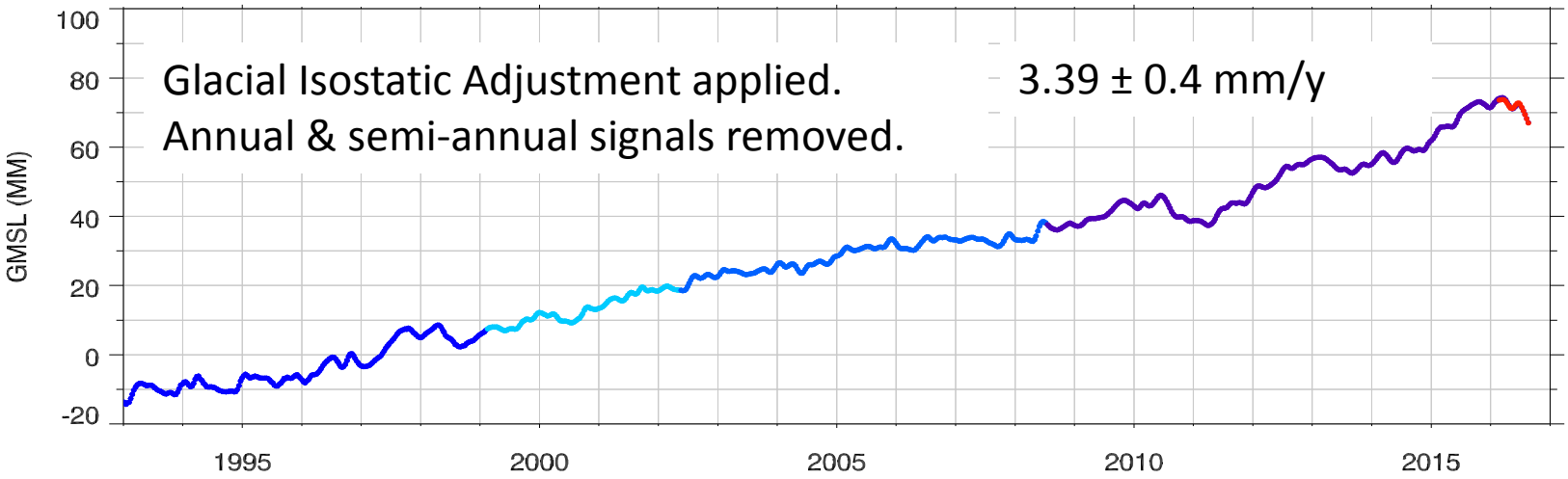
Altimeter sea surface height based on GSFC *std1504_itrf2014* orbit.

Jason-2 cycles 281-297
+0.9 ± 3.8 mm

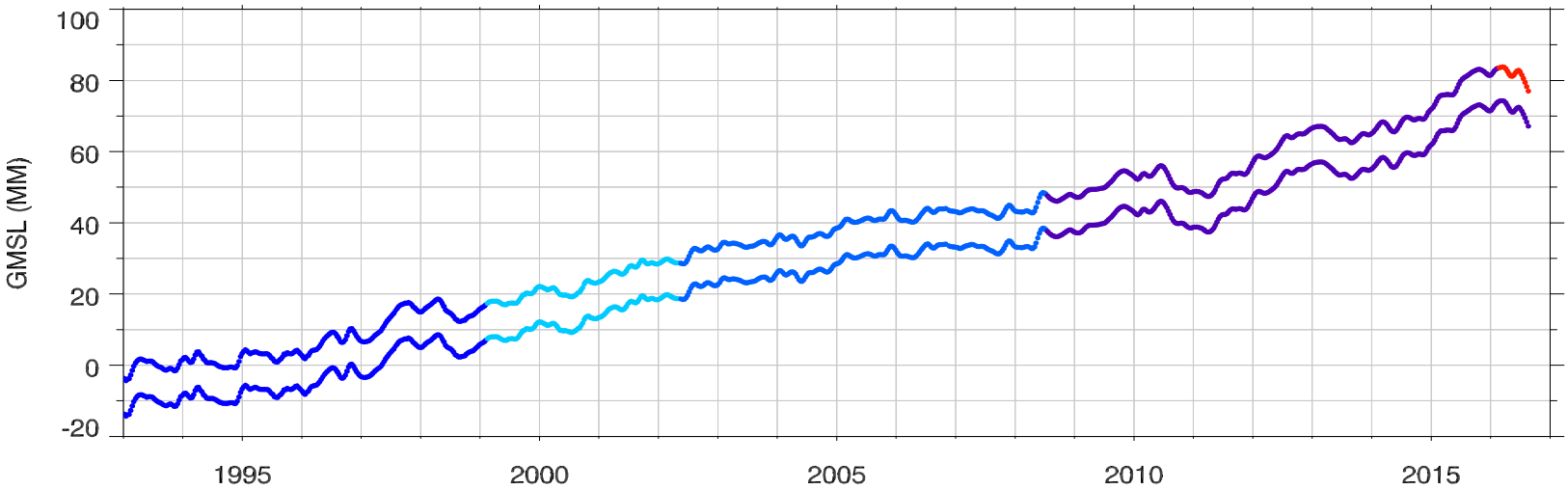
Jason-3 cycles 01-17
-27.4 ± 4.0 mm

Global Mean Sea Level Variations

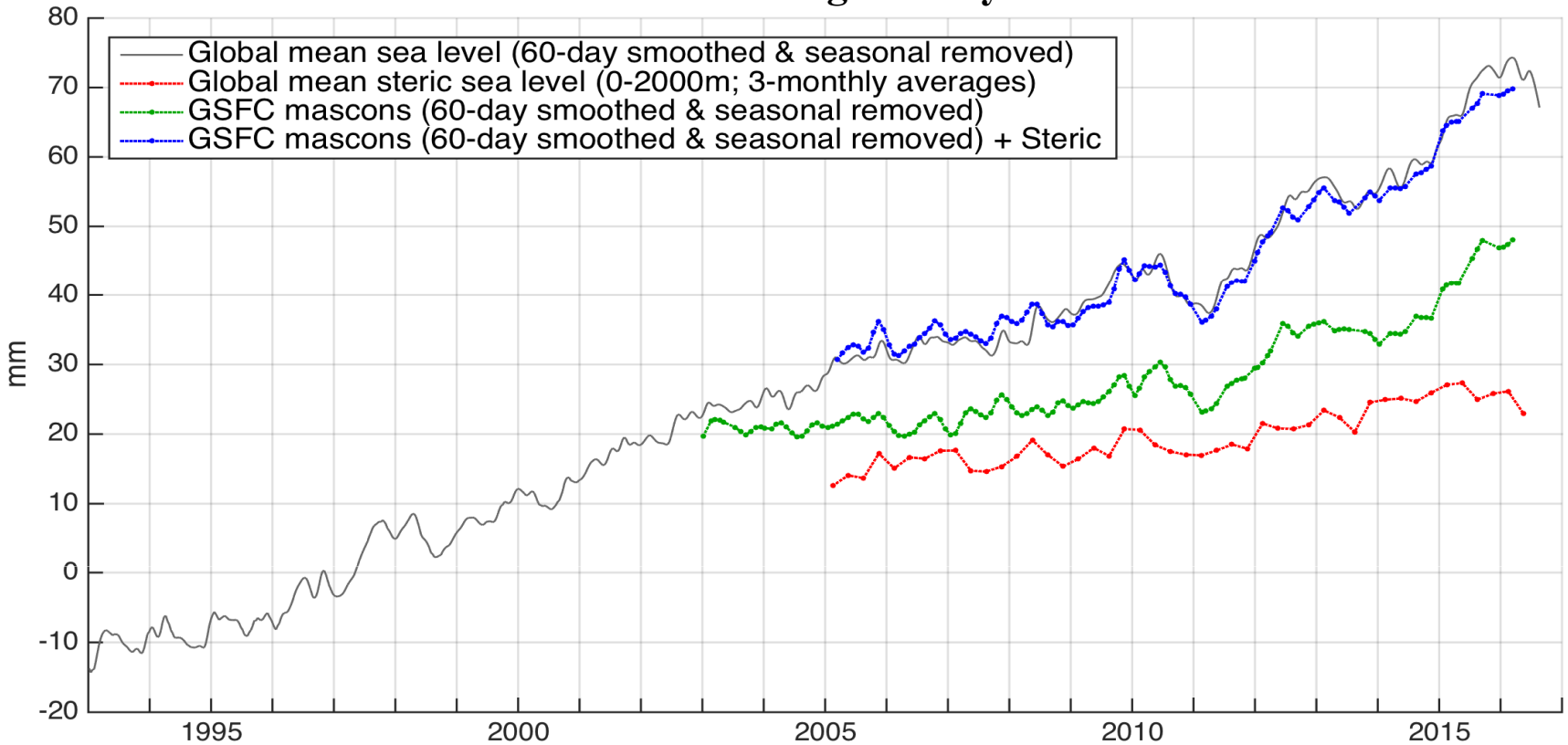
Jason-2 (cycles 281-289) vs Jason-3 (cycles 001- 019)

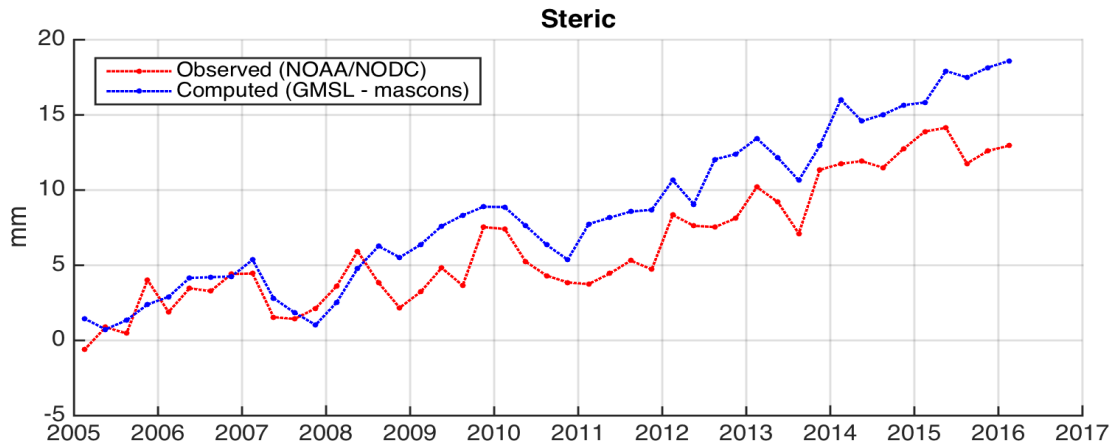


0.09 ± 0.34 mm



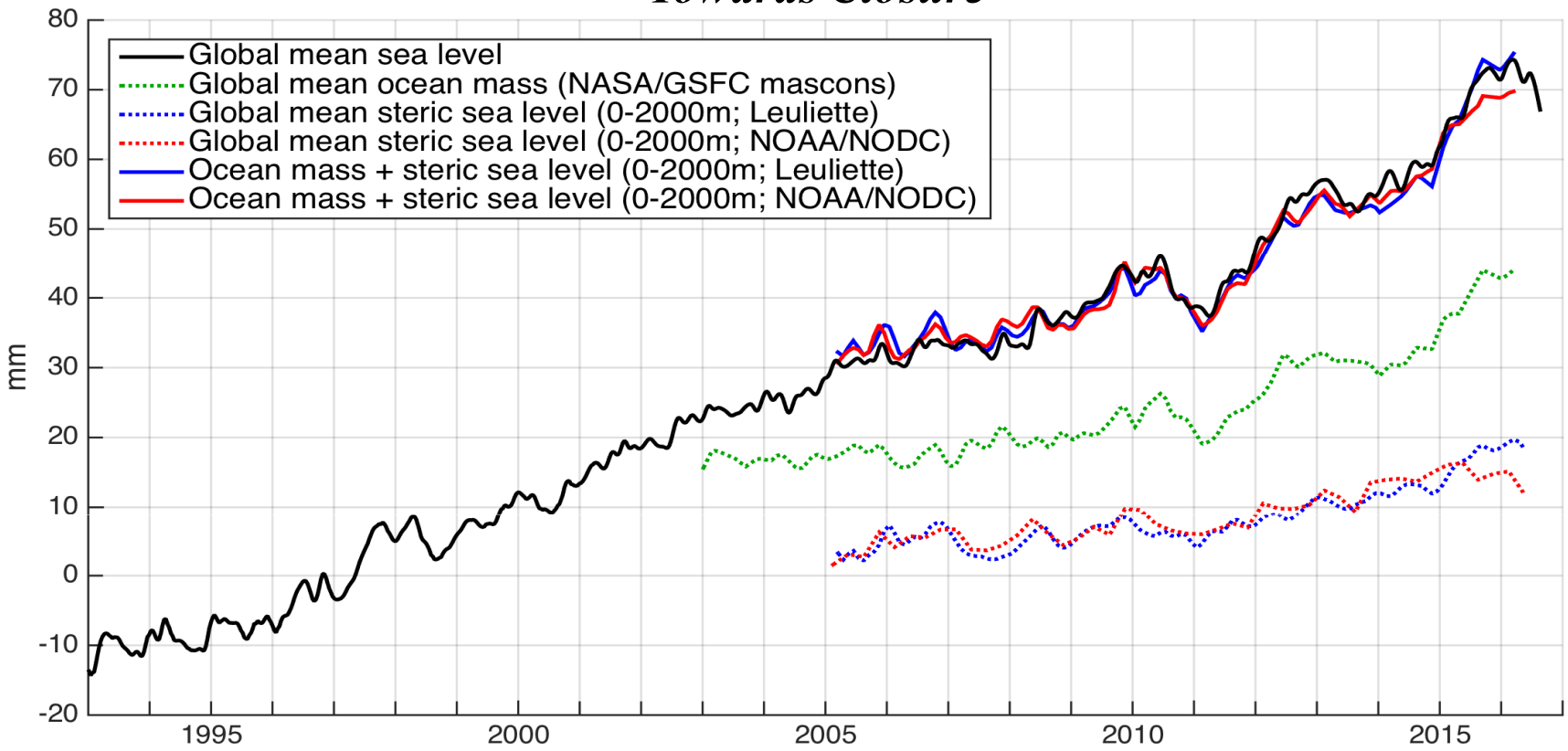
Ocean Mass Budget Analysis



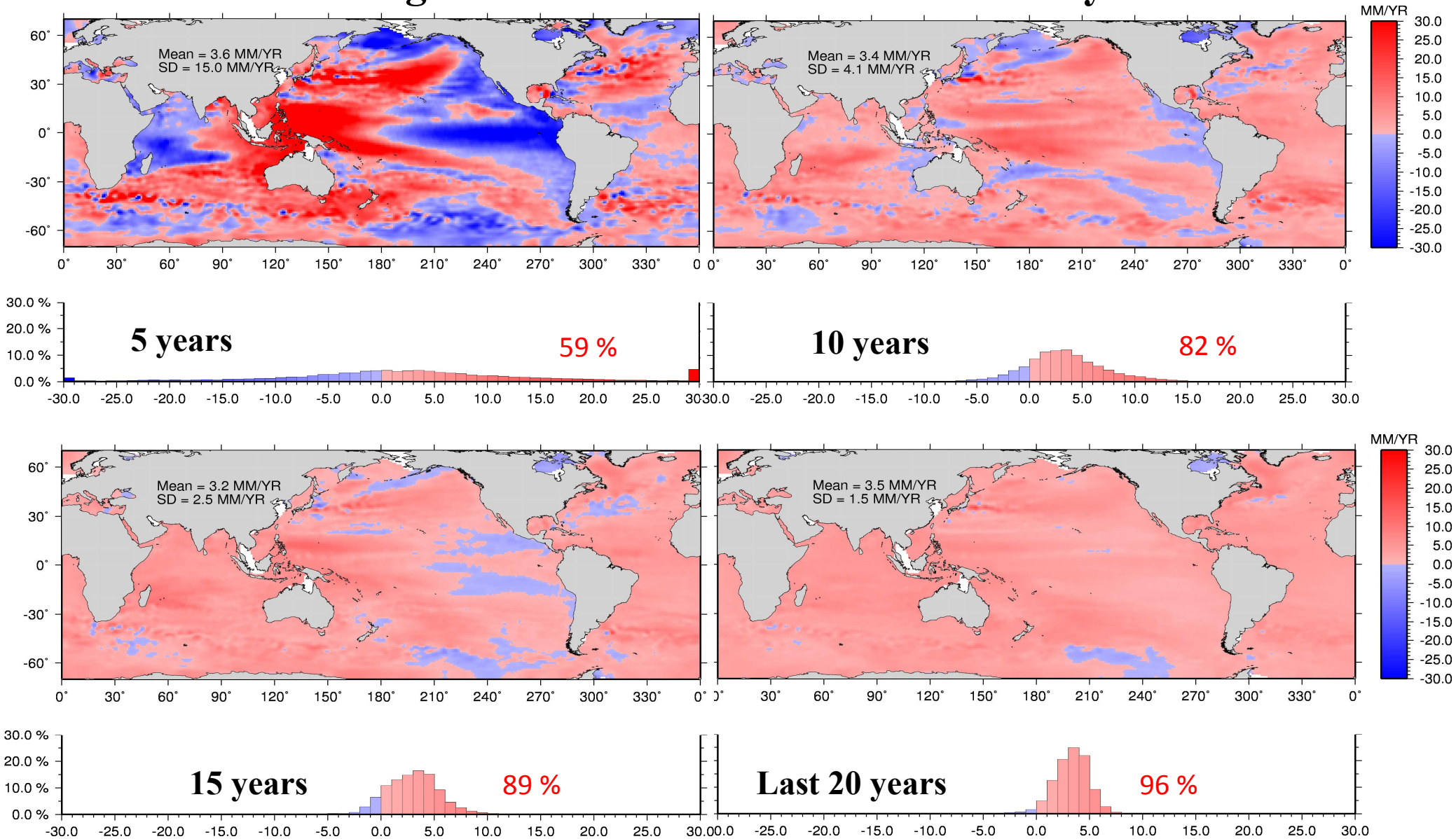


Mass Budget Analysis

"Towards Closure"



Regional sea level rise distribution tally



"The future ain't what it used to be." - Lawrence ("Yogi") Berra (1925-2015)

Summary/Conclusions

- 23.5 ± 1.3 mm Jason-3 range bias wrt Jason-2 based on GDR_T (c001 –c019) SSH collinear residuals. *No significant regional biases.*

- Instrument dependent correction bias tally:
- Ionosphere : 5.6 ± 0.3 mm
- Wet troposphere: 1.3 ± 0.5 mm
- Sea state bias:: 0.7 ± 0.4 mm

- GMSL near seamless transition from Jason-2 to Jason-3.