Reassessment of Jason-2 stability based on revised POD standards

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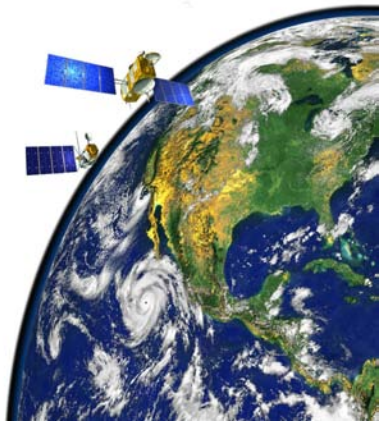


2012 OSTST Meeting, Global Cal/Val Session, Venice, Italy, September 27, 20102

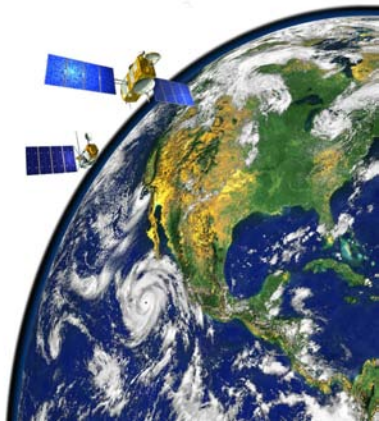
Preview

- **Status report of current Jason-2 (and the 20-yr record) drift estimation via comparisons to a global tide gauge network.**

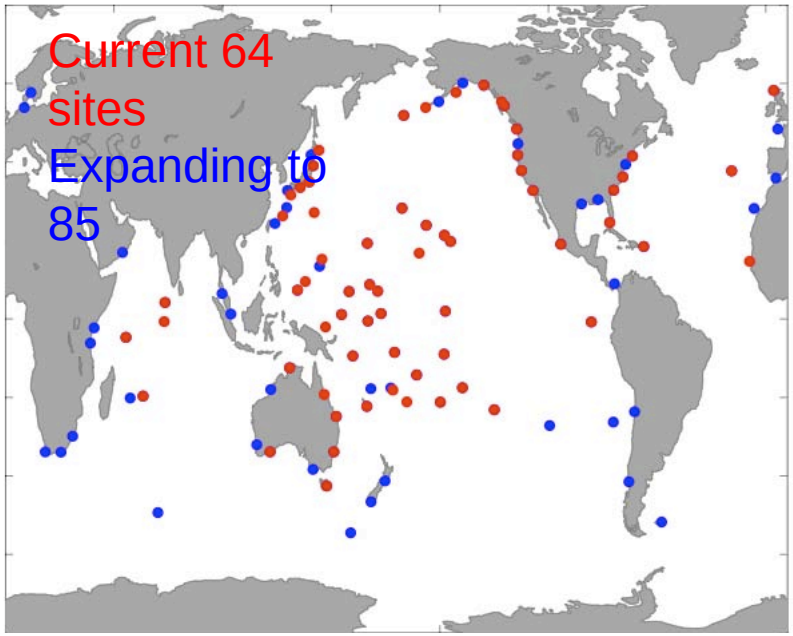
- **Overview of revised POD standards (time variable gravity (TVG) in particular).**

- **Impact of improved TVG estimates on POD accuracy and stability assessments.**

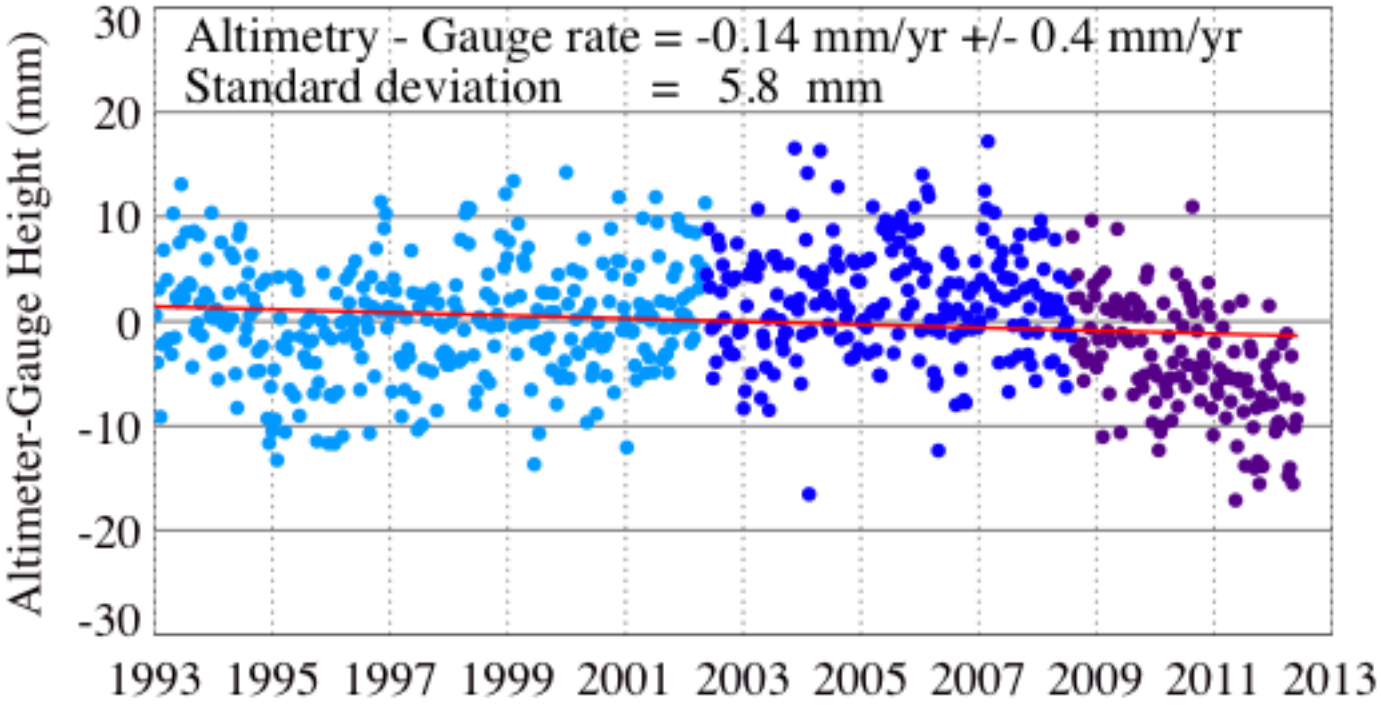
- **Monitoring and maintaining the fidelity of the “ground truth” network.**



Tide Gauge "ground truth" Network



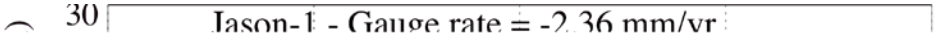
- ***Prof. Gary Mitchum provides independent assessments of SSH time series for GSFC, NOAA, and U. of Colorado.***
- ***Largest uncertainty in estimated rates arises from land motion at gauges.***
- ***Vertical land motion linear rates based on GPS solutions from Wöppelmann, et al., 2009.***



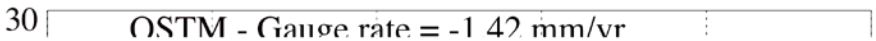
Stability estimate of the 20 year SSH record based on GSFC std1007 POD.

Altimeter SSH variations versus Tide gauge (64 stations) height variations

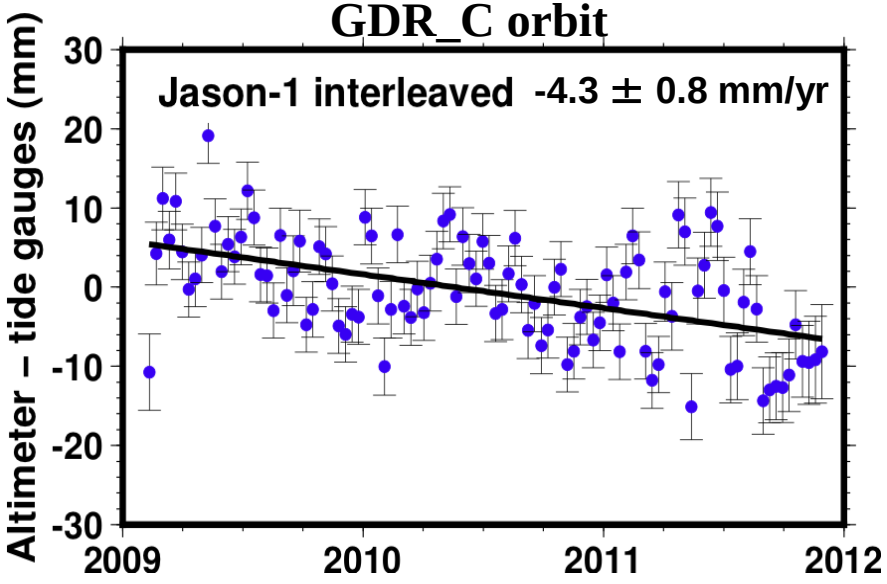
Jason-1 interleaved (GSFC std1007)



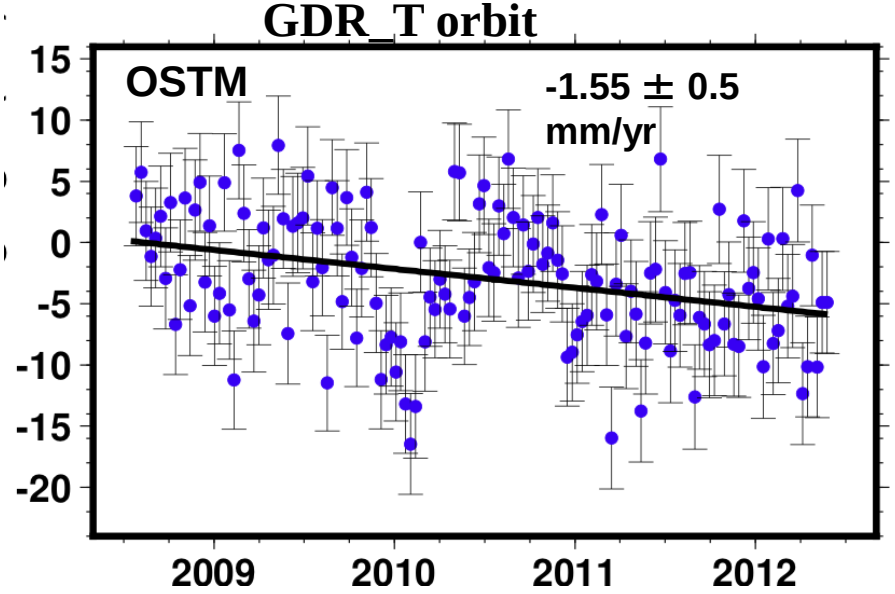
Jason-2 (GSFC std1007)



GDR_C orbit



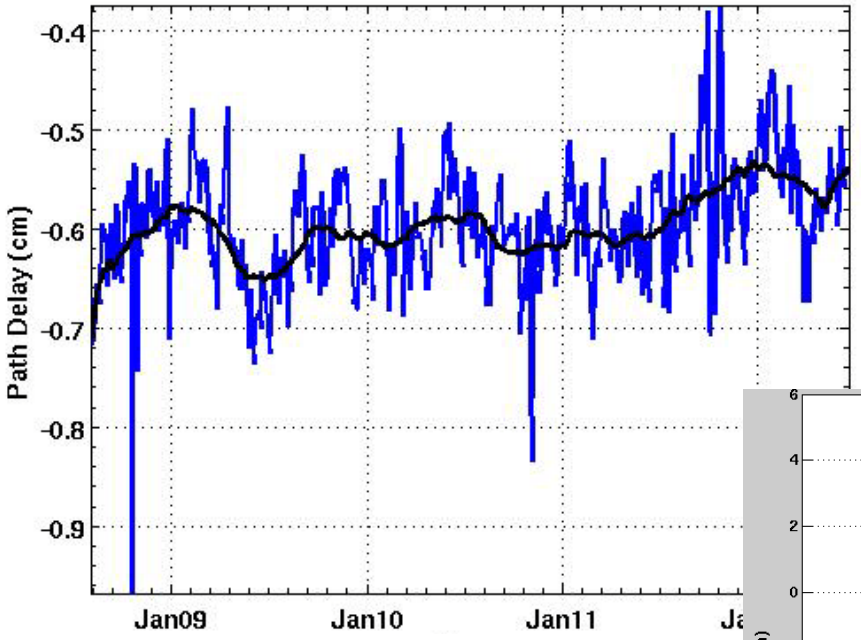
GDR_T orbit



Comparison plots courtesy of Eric Leuliette

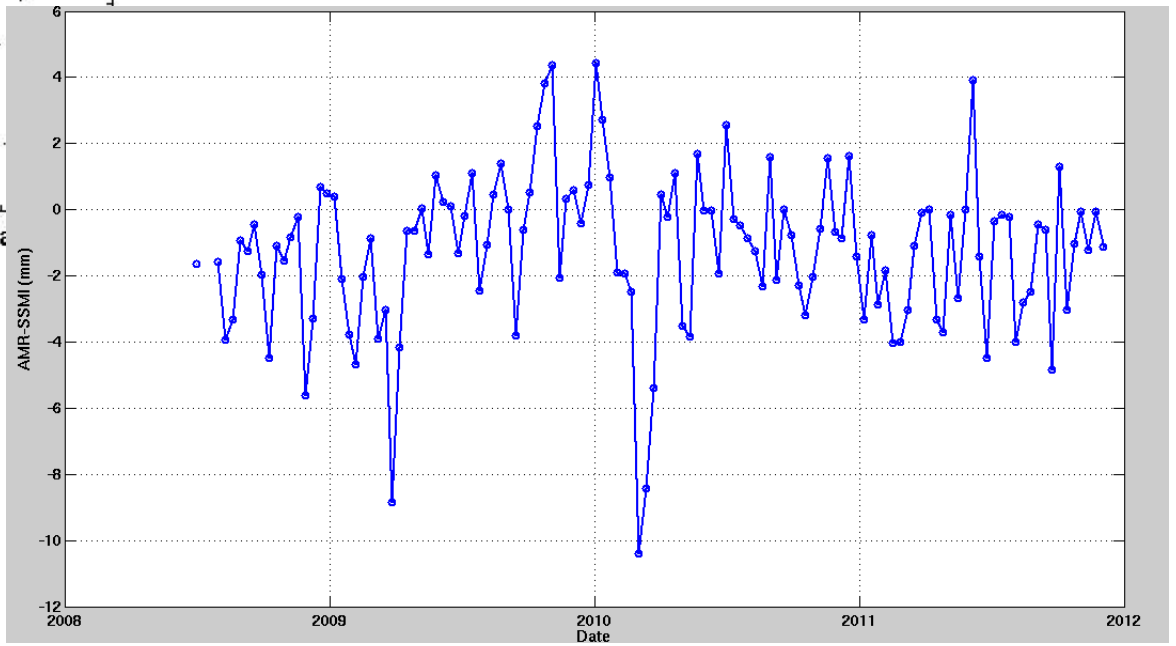
“ Is there a drift in the radiometer ? “

AMR – ECMWF model



Most recent calibration of AMR provided for NASA MEaSUREs and GDR_D release applied.

AMR - SSMI

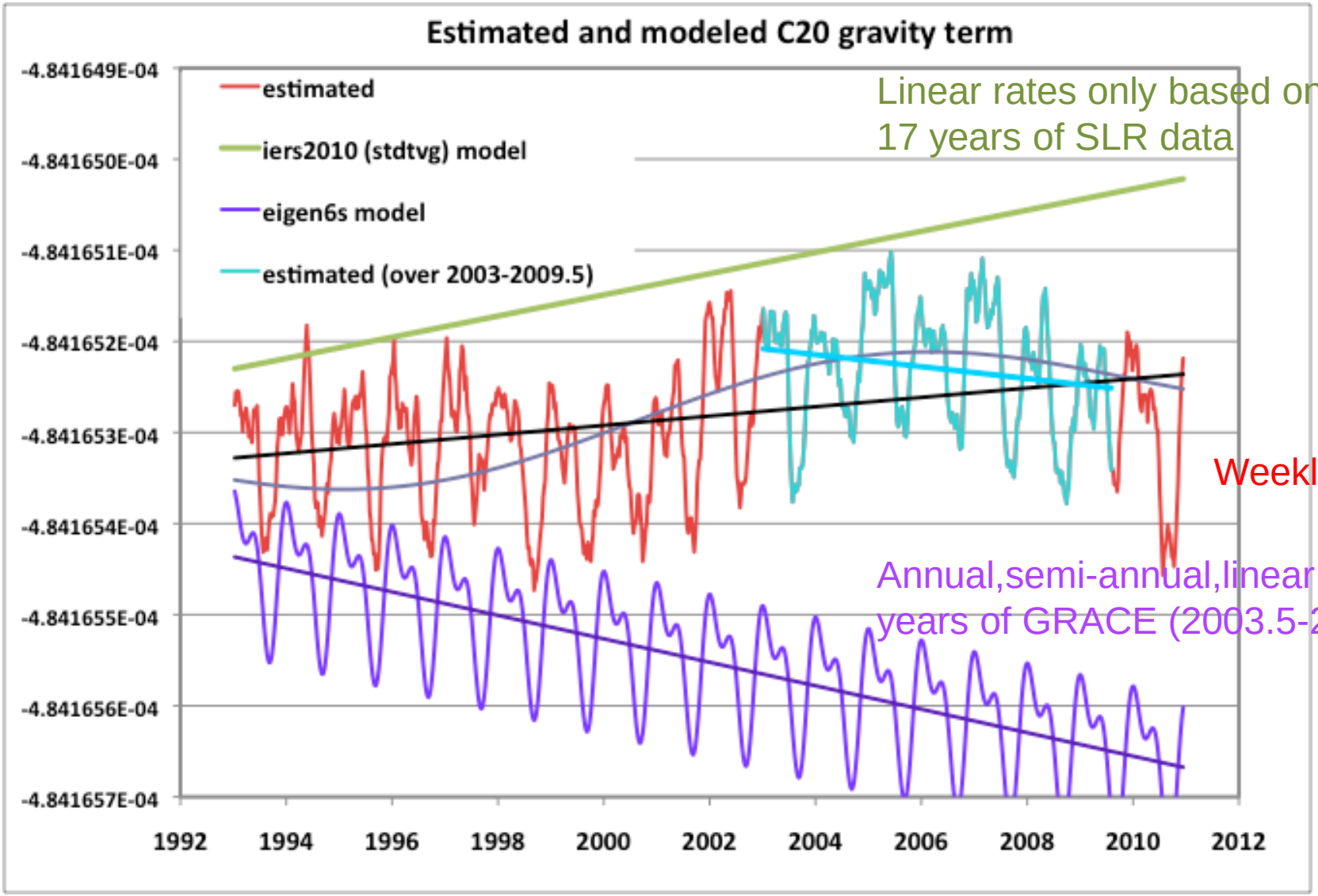


Time Varying Gravity (TVG) Modeling

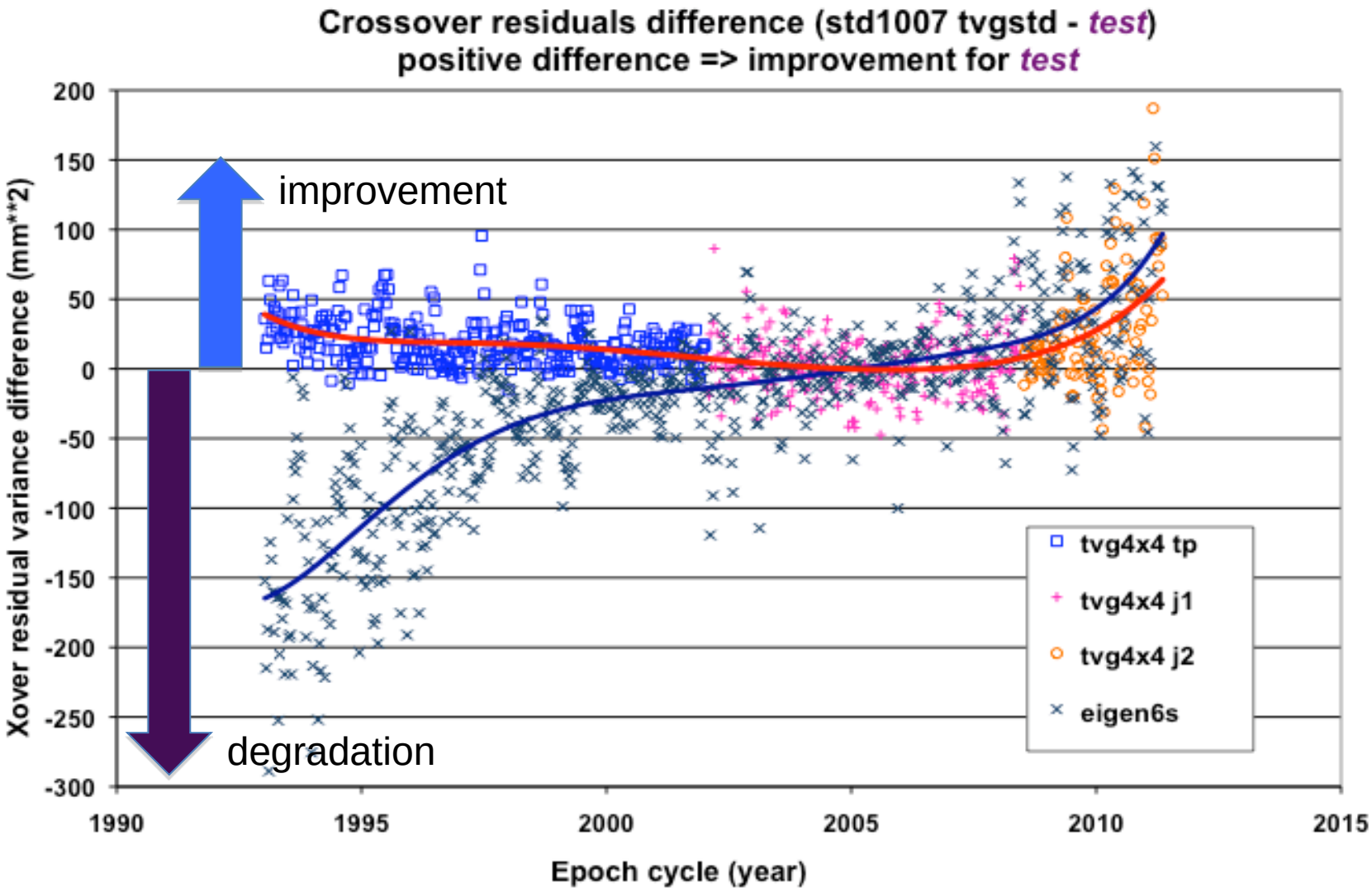
TVG	Description (atmosphere gravity is always forward modeled using ECMWF 6-hour pressure data)
stdtvg	Linear rates for C_{20}, C_{30}, C_{40}, C_{21}, S_{21}, (IERS 2010, 2003) based on 17 years of SLR data. Plus 20x20 annual field derived from GRACE data.
eigen6s	GFZ/GRGS 50x50 annual, semi-annual and linear terms estimated simultaneously with 240x240 static field determined over 6.5 years of GRACE+Lageos data (2003-2009.5), and includes GOCE data.
grgsmean	GRGS RL02 50x50 annual, semi-annual and linear terms estimated over 4.5 years of GRACE+Lageos data (2003.25 – 2007.75); GRGS RL02 mean static field (160x160).
grgs50x50	GRGS RL02 50x50 10-day time series estimated using GRACE+Lageos; GRGS RL02 mean is the reference field.
tvg4x4	GSFC 4X4 7-day time series from 1993 re-estimated using SLR/DORIS tracking to 10 satellites; GGM03S is the background field. Plus 20x20 annual field derived from GRACE data from degree/order 5x5.
goco2s_fit	GSFC annual, semi-annual and linear terms estimated from the 19-year tvg4x4 time series are applied depending on the coefficient . Plus 20x20 annual field derived from GRACE data with tvg4x4 fit annual terms replacing the 20x20 original. GOCO2S 250x250 static field estimated using GRACE (7 years), GOCE (8-12 months), CHAMP (8 years), and SLR (5 years) data (Goiginer et al., 2011)

See Zelensky et al. poster

Time Variable Gravity Parameterization Comparisons



Assess TVG model performance to satisfy Climate Data Record requirements.

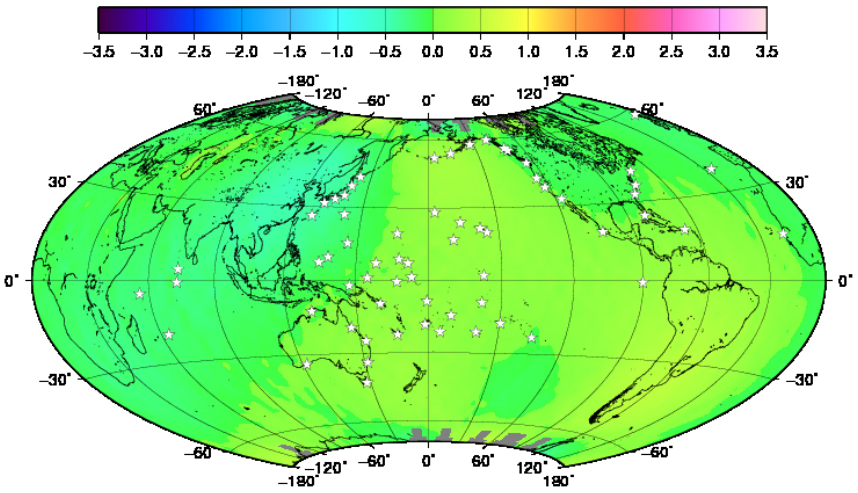


Regional Variability in trends of orbit differences based on various TVG models

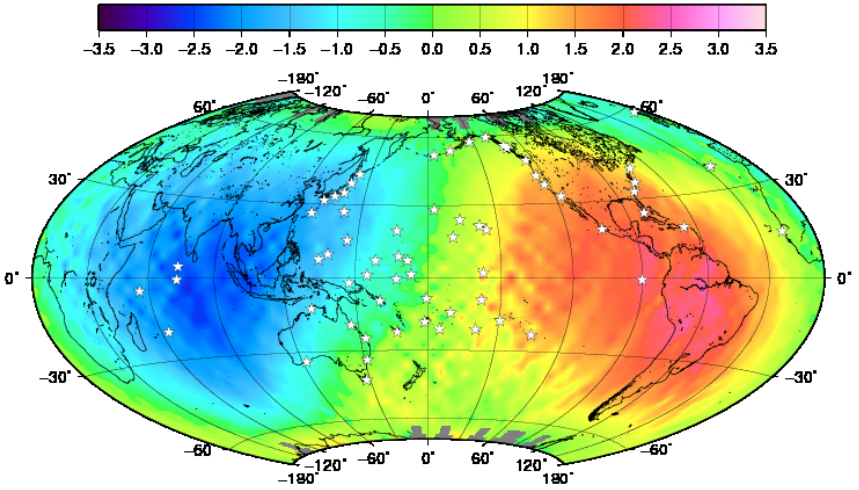
Jason-2 stdtvg – test orbit radial difference linear rates (mm/yr)

July 2008 – January 2012 (cycles 1-130)

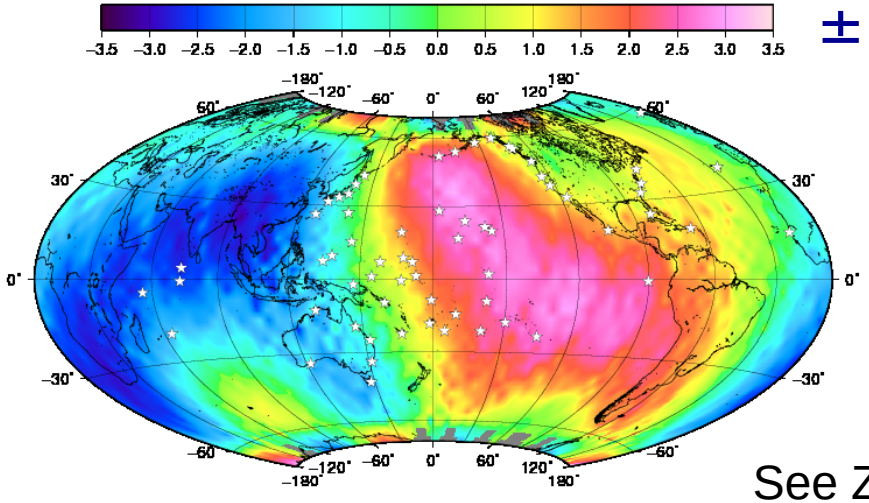
std1201_goco2s_fit



eigen6s



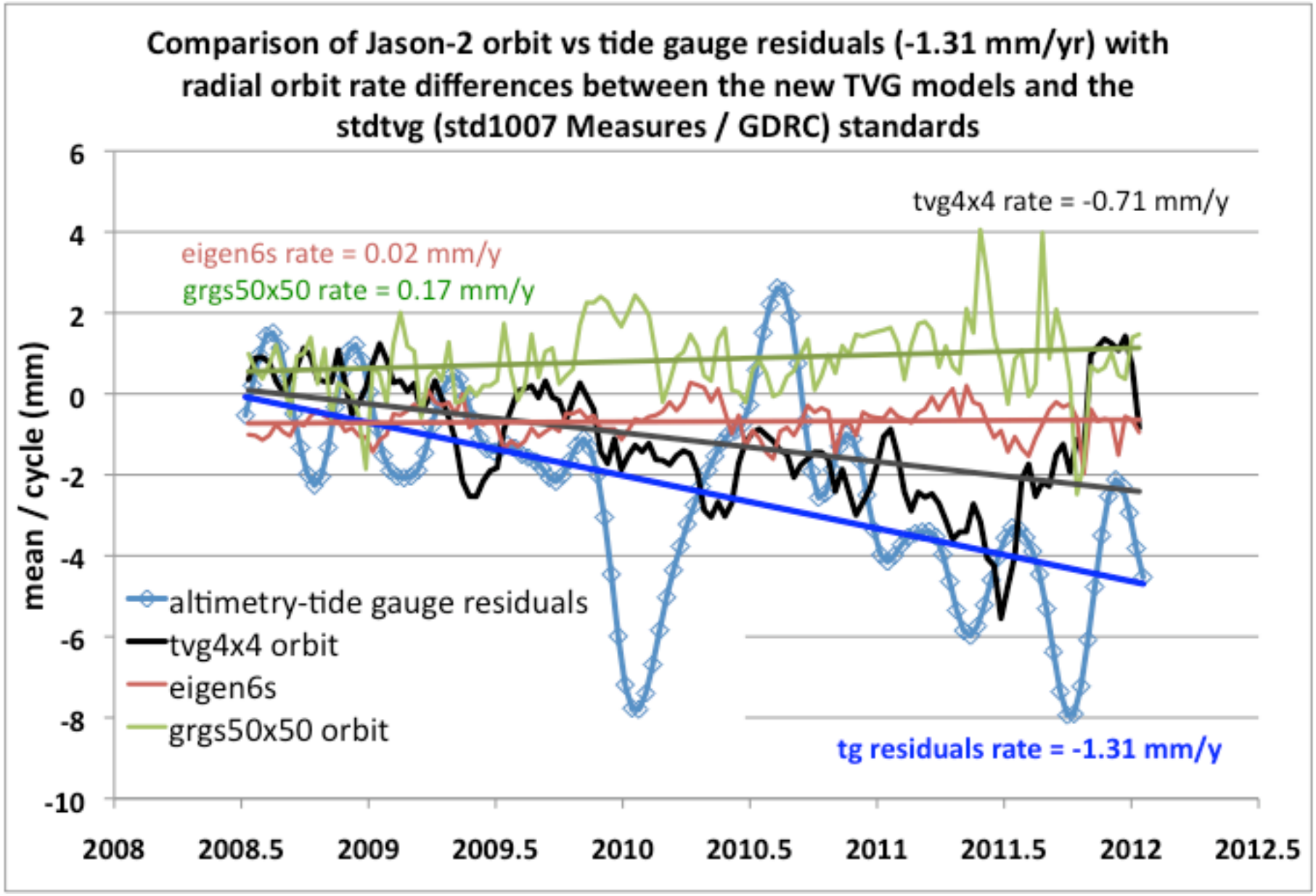
std1201_tvg4x4



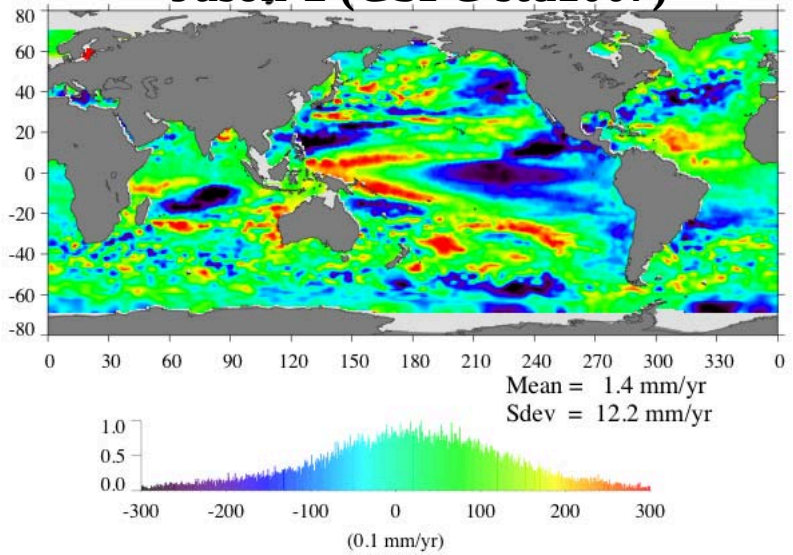
± 3.5 mm/yr

See Zelensky et al. poster

Estimation of TVG model efficacy to rectify Jason-2 apparent drift

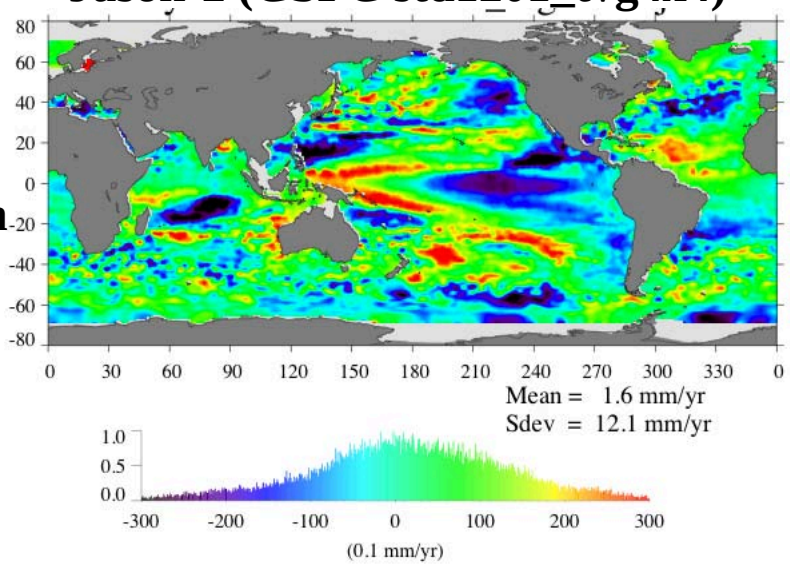


Jason-2 (GSFC std1007)

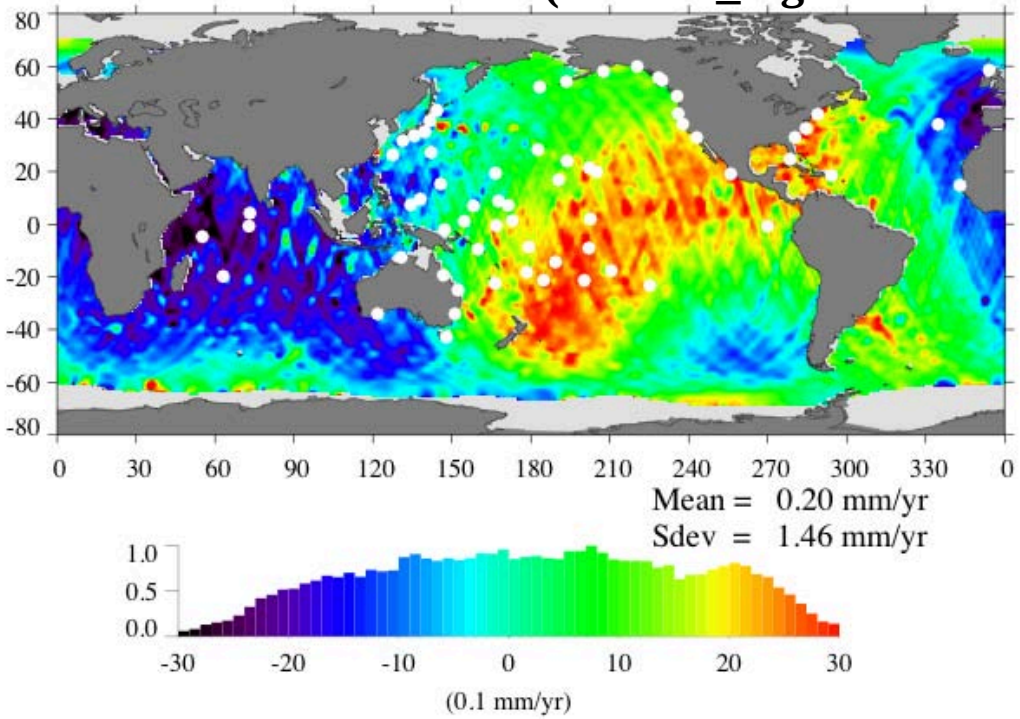


Global mean difference =0.2 mm/yr

Jason-2 (GSFC std1201_tvg4x4)



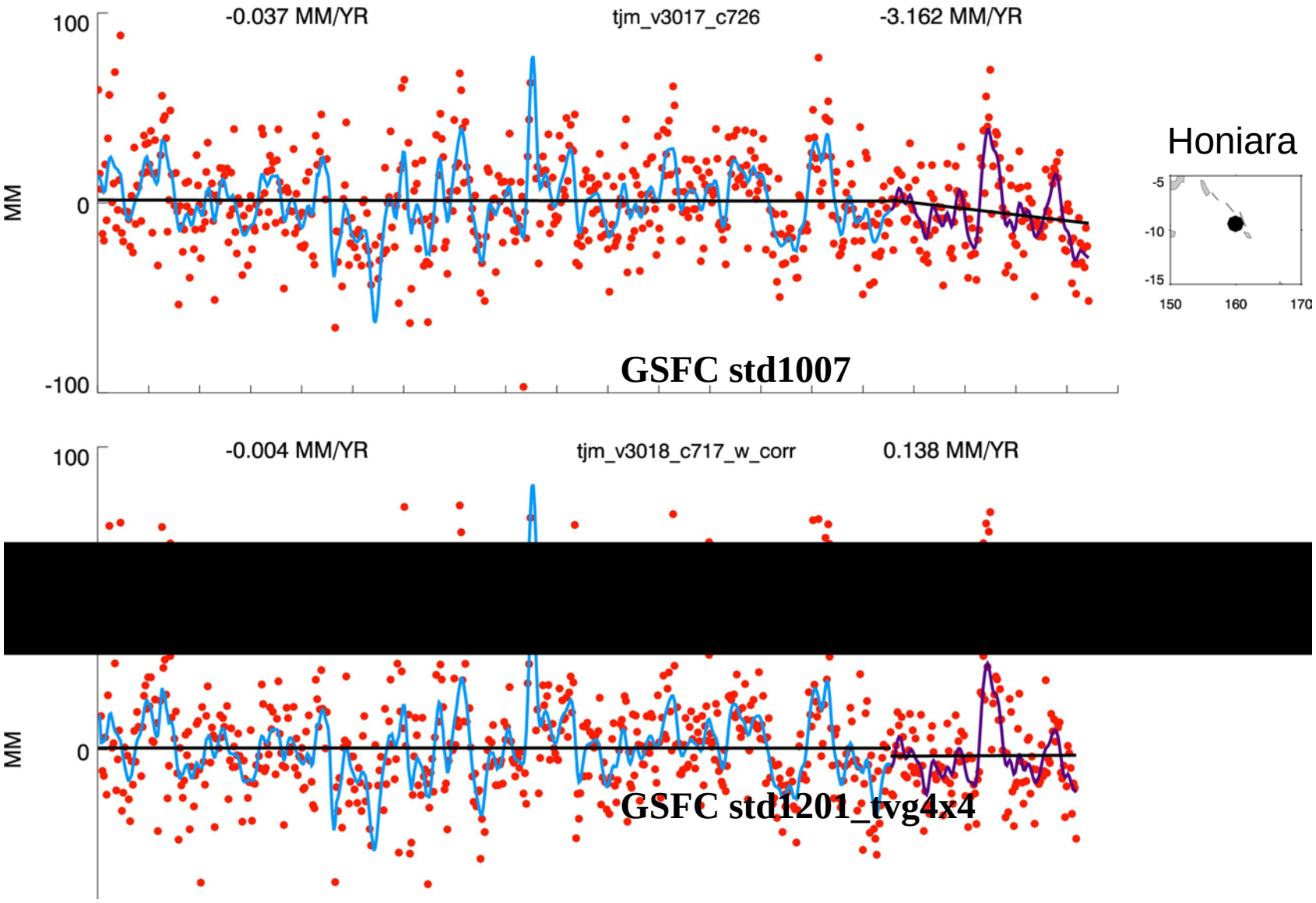
Jason-2 MSL rate differences (std1201_tvg4x4 – std1007)



Regional differences of ± 3 mm/yr

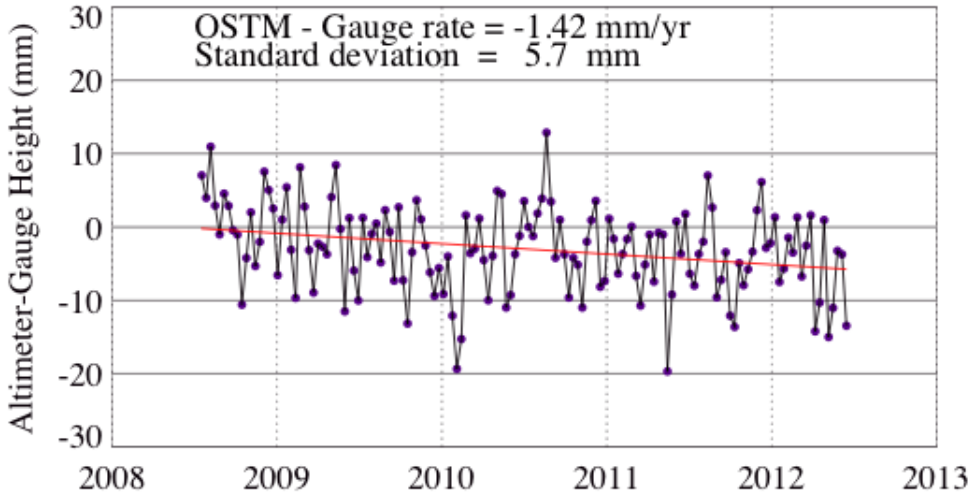
TVG induced geographically correlated error being aligned with the tide gauge network geometry is a plausible cause of the negative trend in the Jason-2 SSH versus tide gauge height variations.

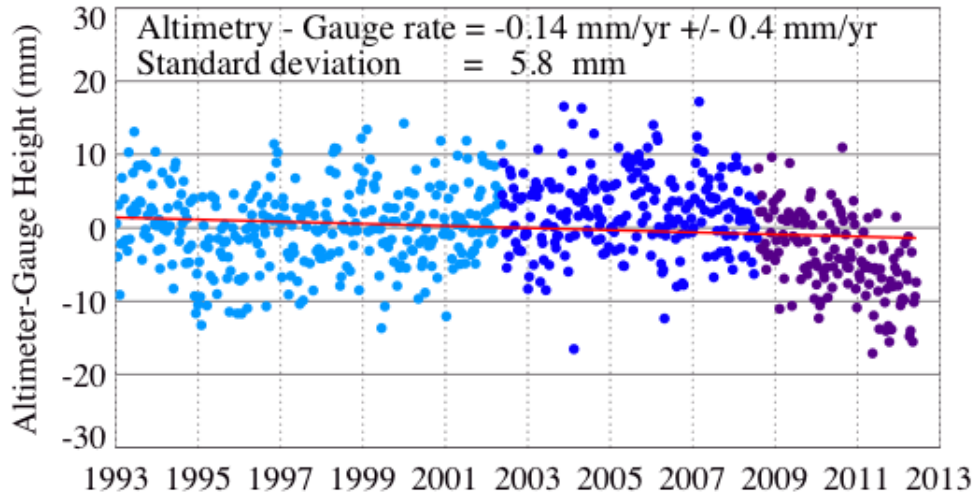
Altimeter SSH variations versus Honiara Tide gauge height variations



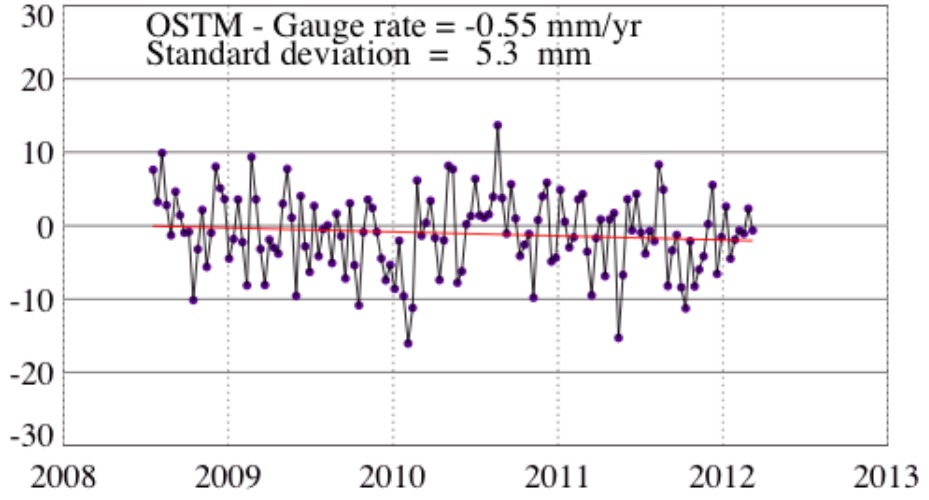
Impact of revised TVG on Jason-2 and 20-yr altimeter SSH stability assessment

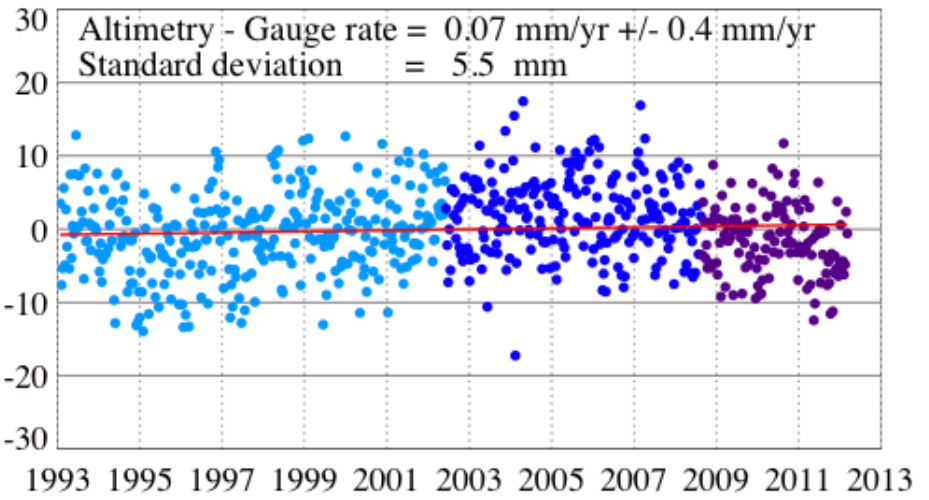
GSFC std1007



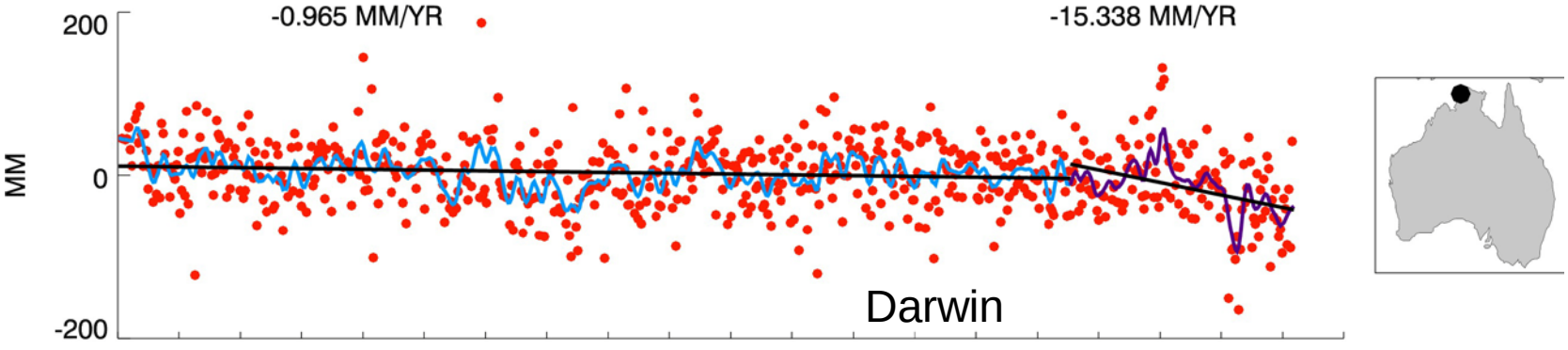


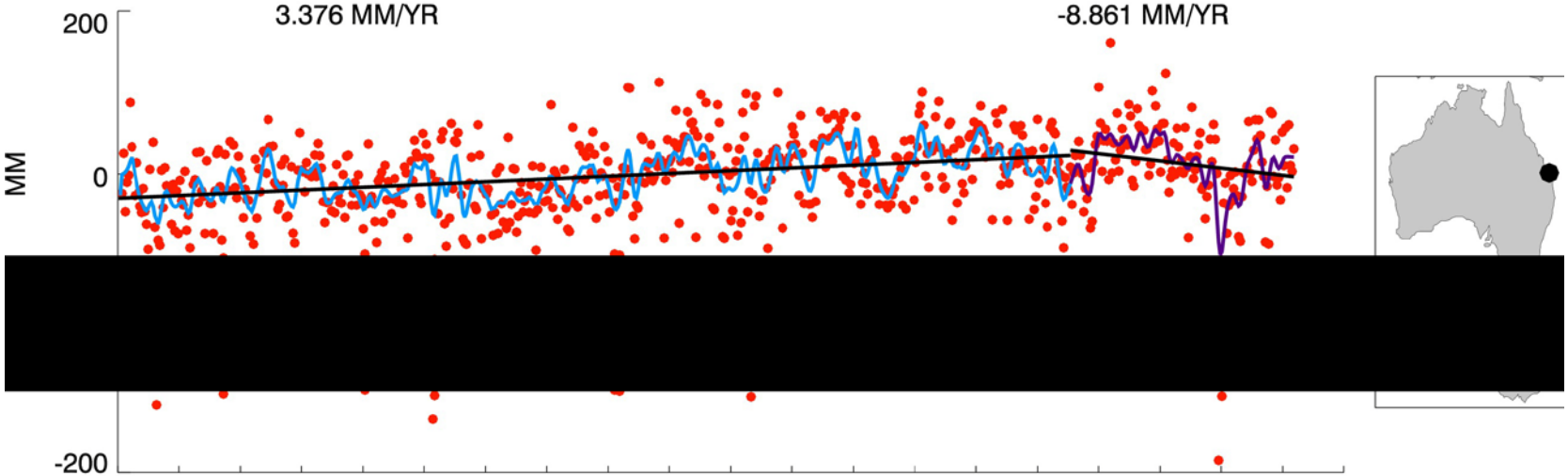
GSFC std1201_tvg4x4

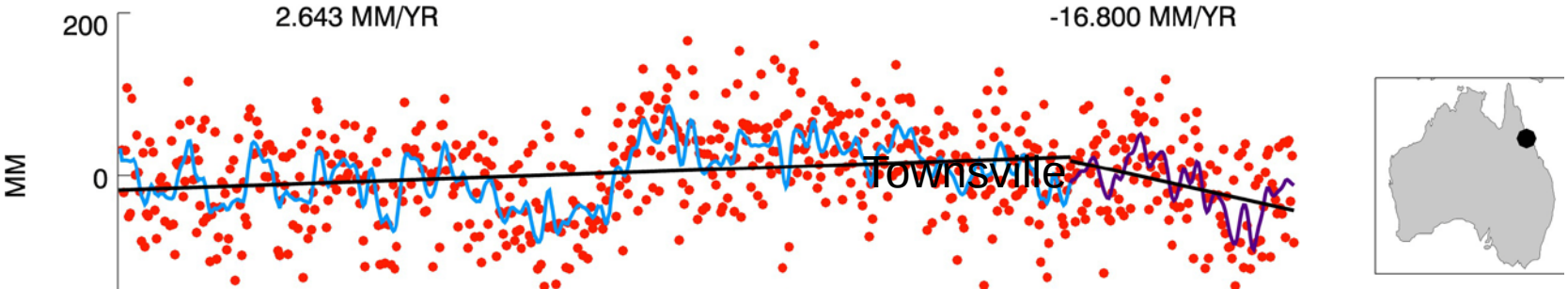


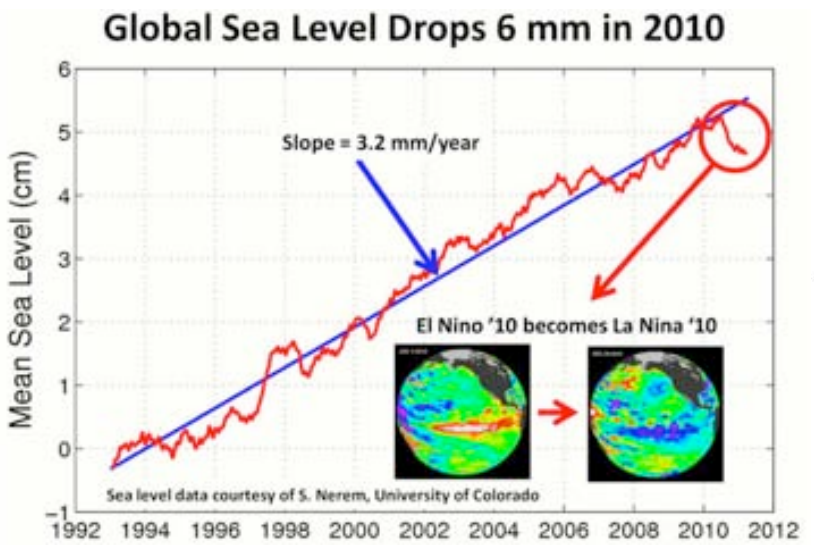


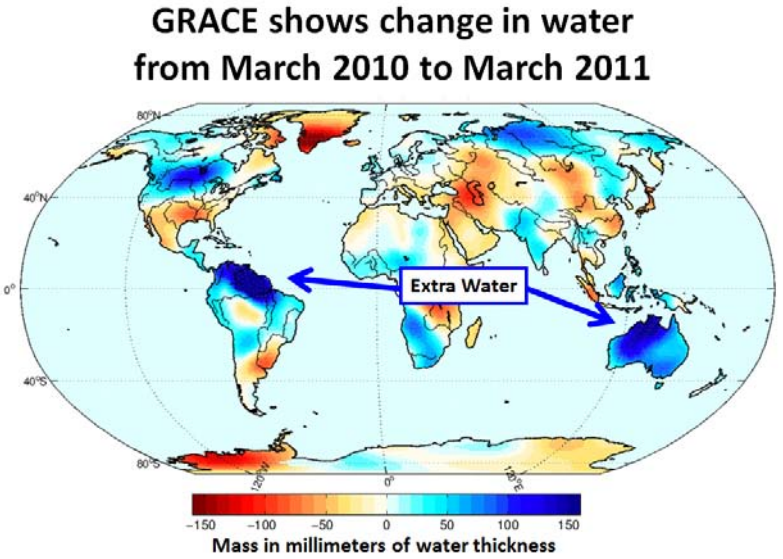
Interrogation of tide gauge stations in Northern Australia



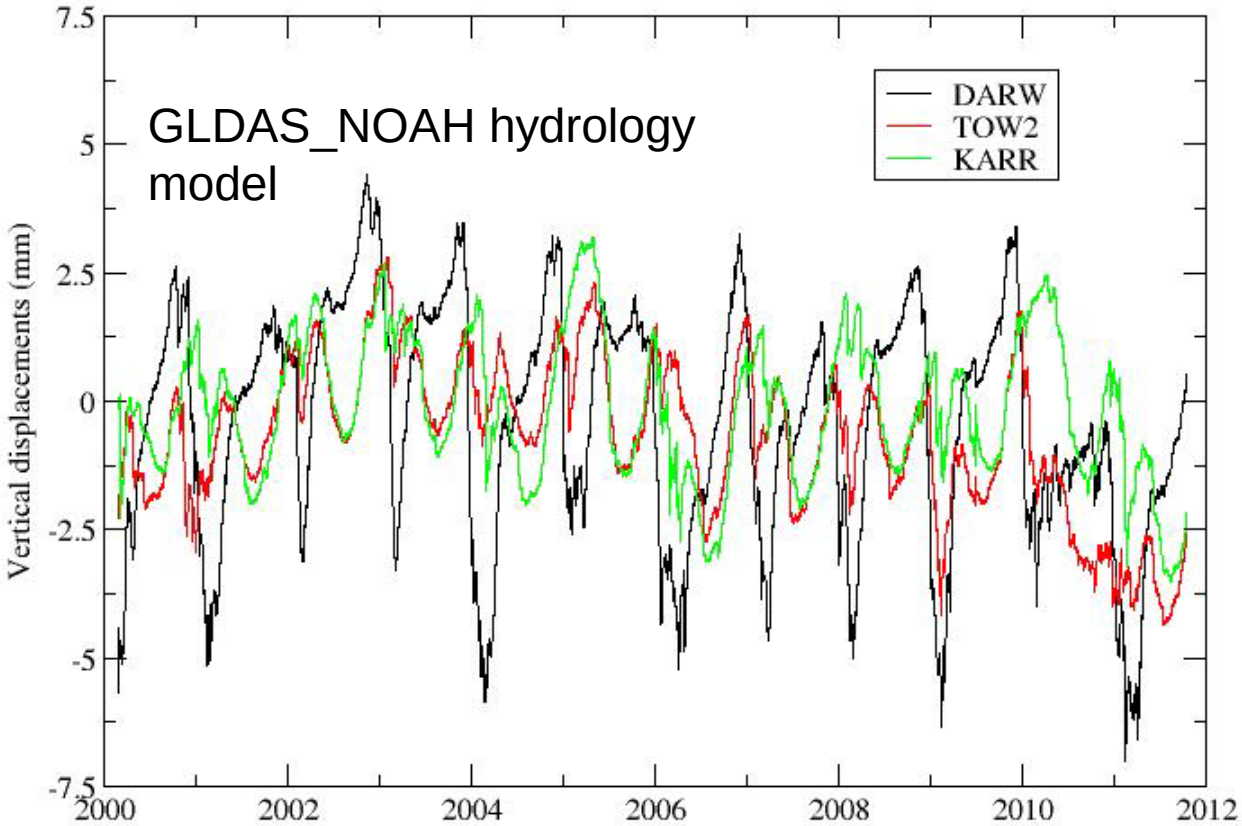








Figures adapted from (http://www.jpl.nasa.gov/news/news.cfm?release=2 011-262),



Boening et al., 2011, *GRL*, in press.)

Figure courtesy of J-P. Boy (NASA/GSFC)

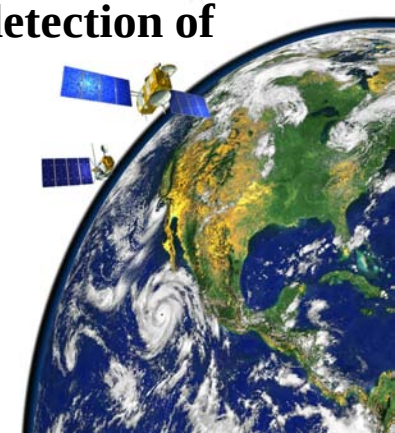
Conclusions – Future Work

✓**An improved estimate of TVG (based on weekly SLR solutions) in the POD (std1201_tvg4x4) provides ~1 mm/yr improved agreement of Jason-2 with global tide gauge ground truth network.**

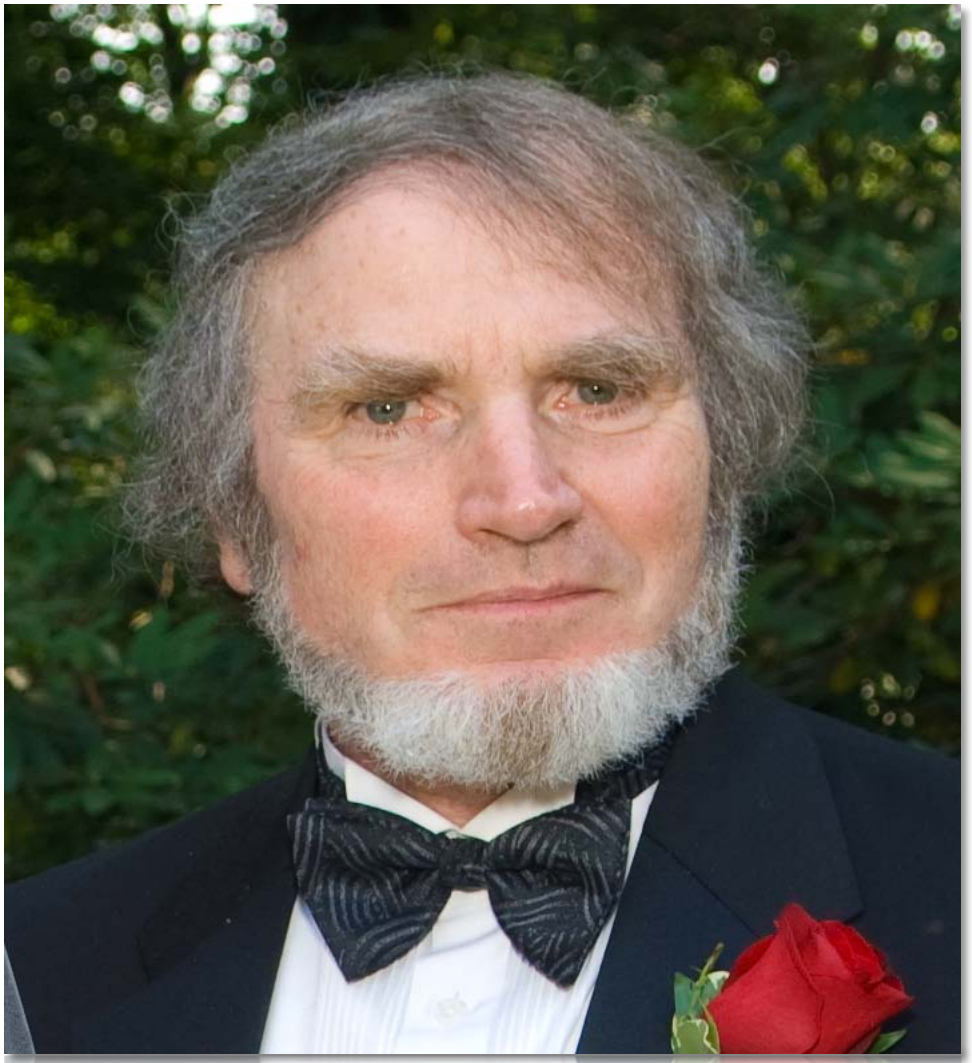
✓**However there are several models under consideration and our POD group has not arrived at a consensus as to which TVG model provides the best realization. Several presentations tomorrow at POD and Quantify Errors splinters will be addressing TVG issues.**

✓**Vigilant monitoring of altimeter geophysical and environmental corrections to provide an accurate accounting of drift estimates.**

✓**Monitor and maintain the fidelity of the tide gauge network by turning the problem around and using the geocentric altimeter derived sea level based on the most current TRF (ITRF2008) and POD standards to provide early detection of potential problematic stations.**



Dedicated to the memory of Steven M. Klosko



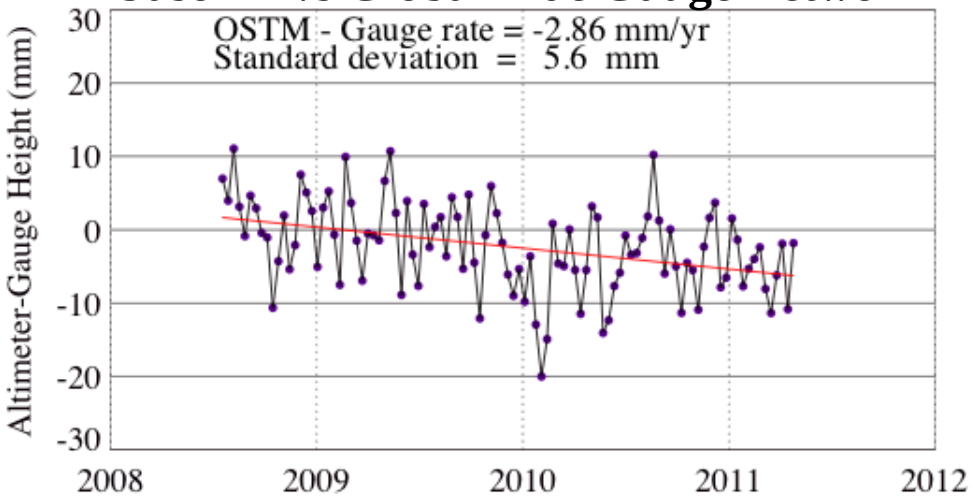
1947 - 2012

Backup

Tide Gauge Vertical Motion Estimation

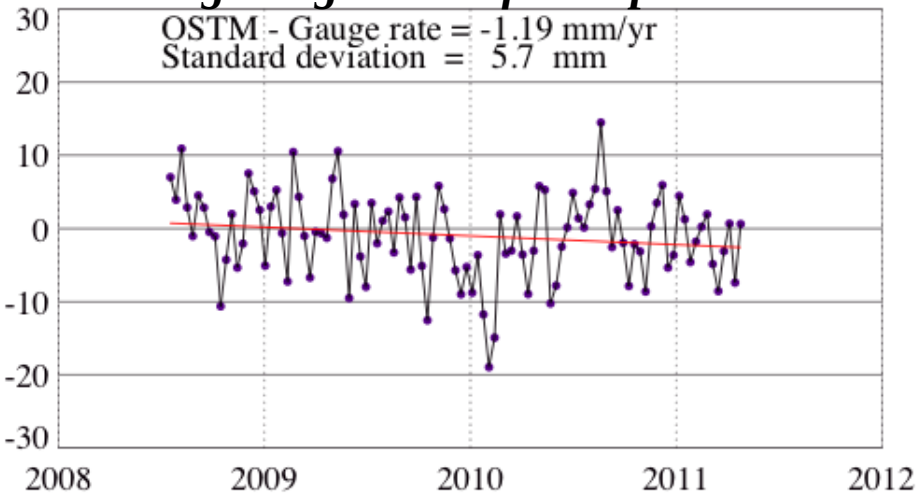
Mis-modeling at Pago Pago

Jason-2 vs Global Tide Gauge Network

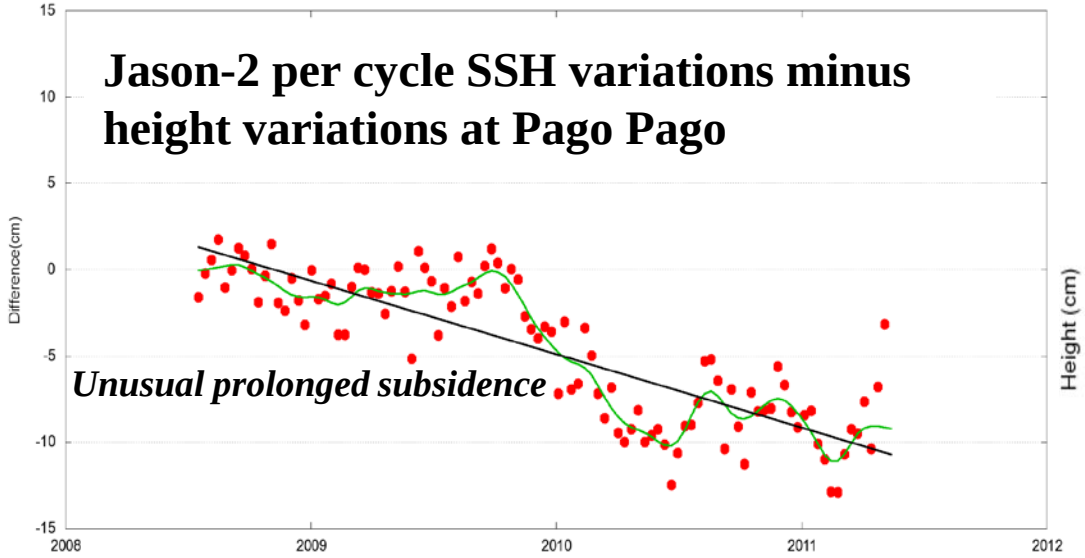


Jason-2 vs Global Tide Gauge Network

Pago Pago edits after Sep. 2009



Jason-2 per cycle SSH variations minus height variations at Pago Pago



GPS time series from NGS Continuously Operating Reference Station (CORS)