Evaluation of Jason-2 GDR-D sea level and retracking parameters

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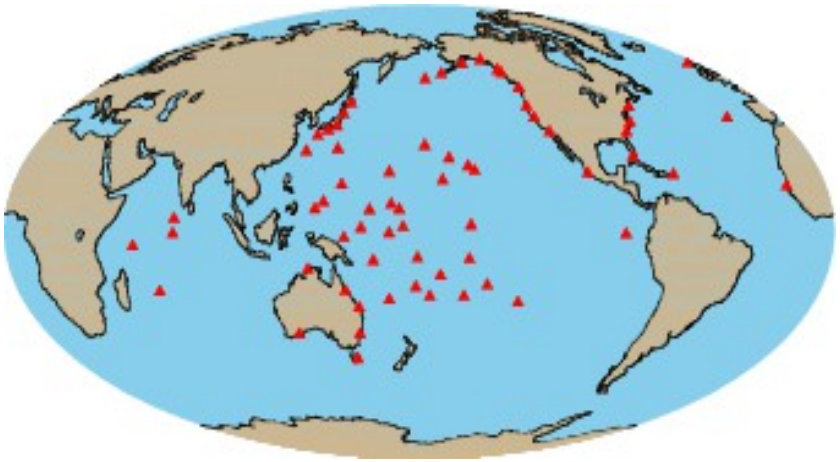
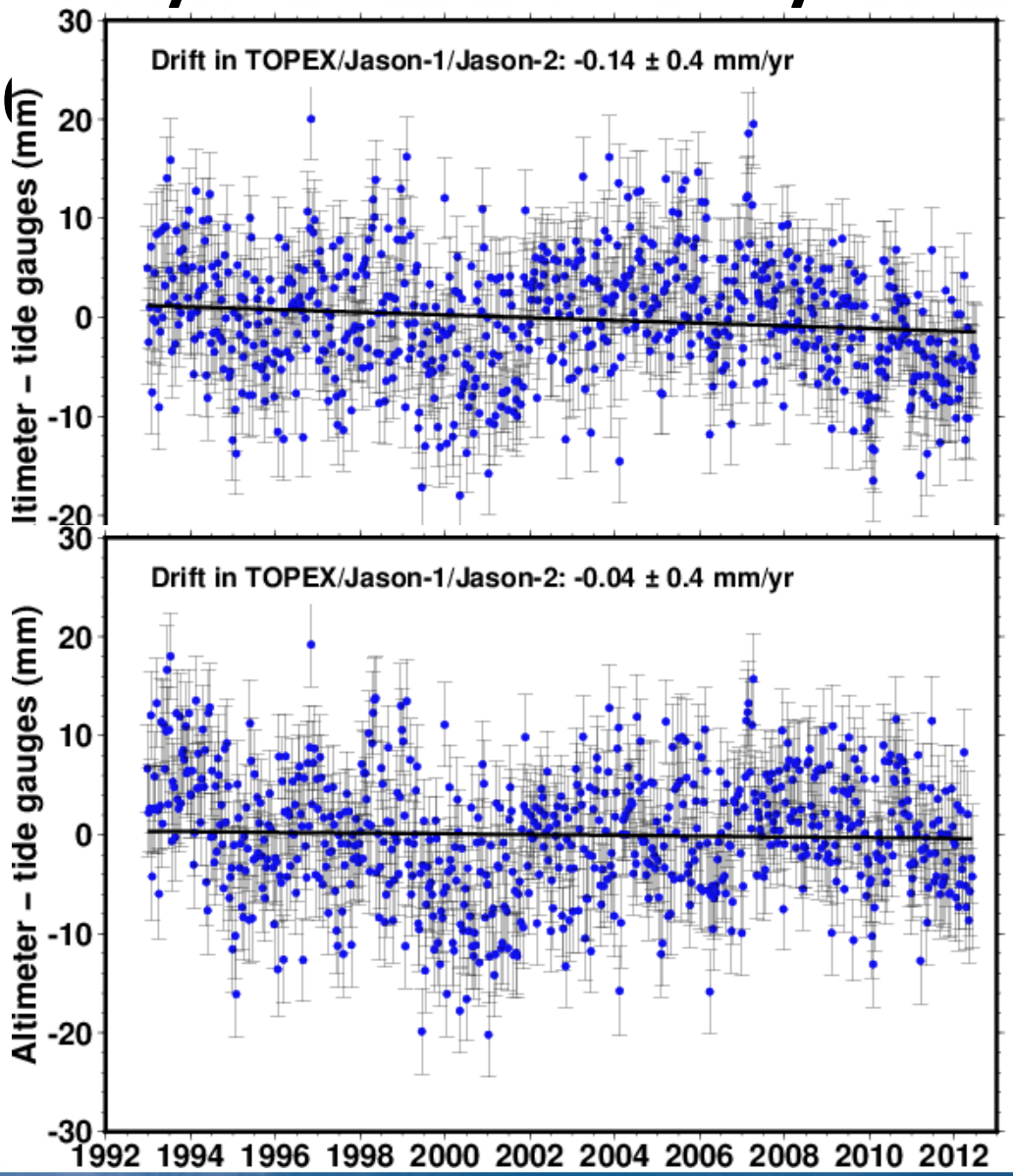
Outline

- Tide gauge system drifts for the reference series and for Jason-2 GDR-D
- Evaluation of the GDR-D retrackers
  - Correlation analysis
  - Crossovers
  - Tide gauges

Reference series system stability

The drift in the 20-year reference series is –0.14 ± 0.4 mm/year. Using the ERA troposphere fields reduces the drift to –0.04 mm/year.



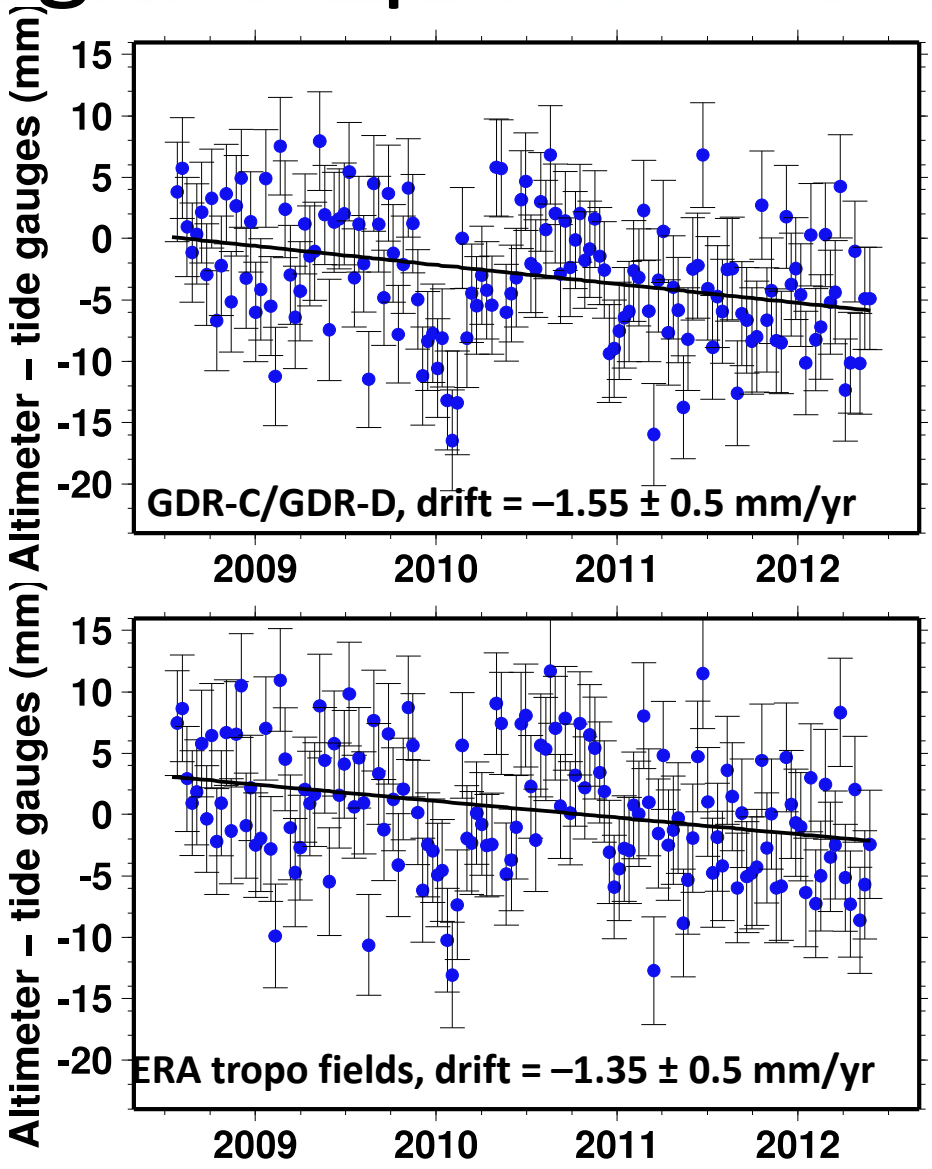


Jason-2 tide gauge comparison

The drift in Jason-2 GDR-C/GDR-D (MLE4) is –1.55 ± 0.5 mm/year.

(GDR-D: cycles 1-36, 93-146)

Using the ERA troposphere fields (dry and wet) reduces the drift slightly to –1.35 mm/year, but increases the average error bar from 4.1 to 4.3 mm. This may represent a trade-off between stability in the global mean and spatial accuracy.



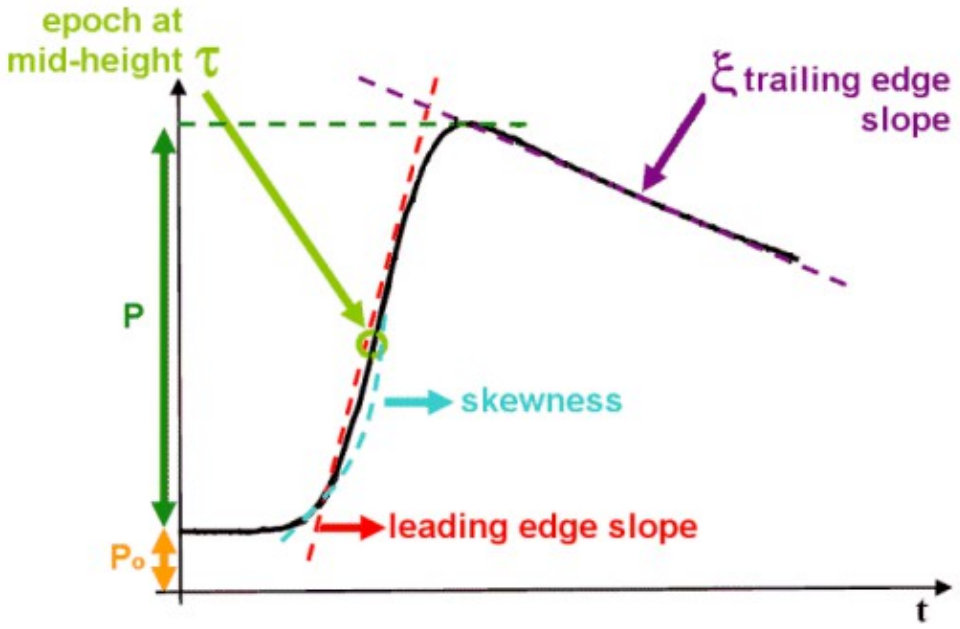
GDR-D adds MLE3 parameters

MLE3 tracking simultaneously retrieves the 3 parameters from a 1st order Brown analytical model that can be inverted from the altimeter waveforms:

- Epoch (tracker range offset) ⇒ altimeter range
- Composite Sigma ⇒ SWH
- Amplitude ⇒ Sigma0

MLE4 retracking from a 2nd order Brown analytical model retrieves the 3 MLE3 parameters and:

- Square of mispointing angle
  - (Ku band only)



MLE4 was introduced in Jason-1 GDR-B to compensate for true platform mis-pointing.

MLE3 was added to Jason-2 GDR-D to produce a better rain flag. All 1-Hz and 20-Hz MLE3 and MLE4 parameters have been included in SGDR-D.

MLE crossovers (3-day)

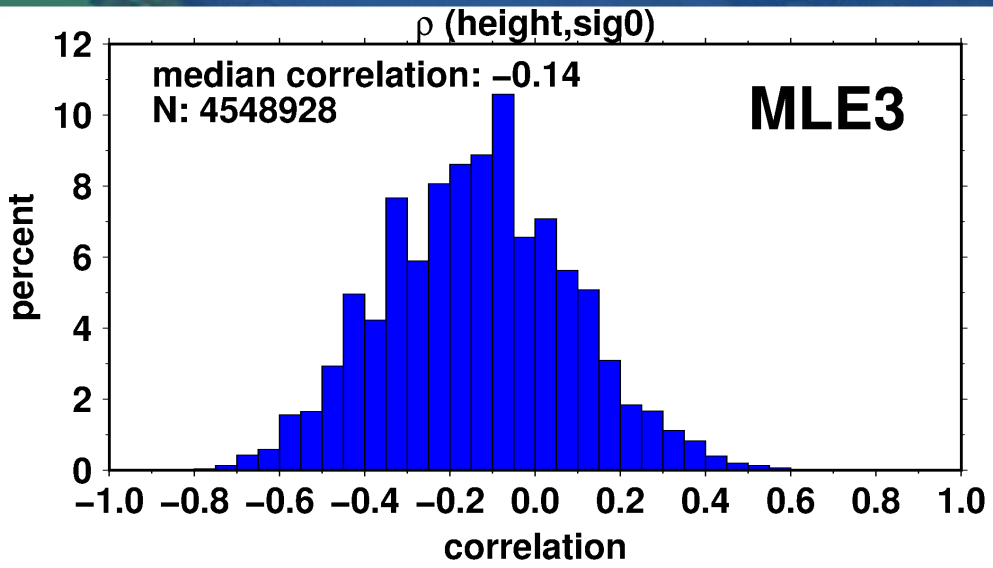
Crossovers of Jason-2 with Envisat sea level anomalies (< 3 days) generally show that MLE4 is in better agreement than MLE3.

For the relatively few points with low-wave conditions, the crossovers suggest that MLE3 has less noise than MLE4.

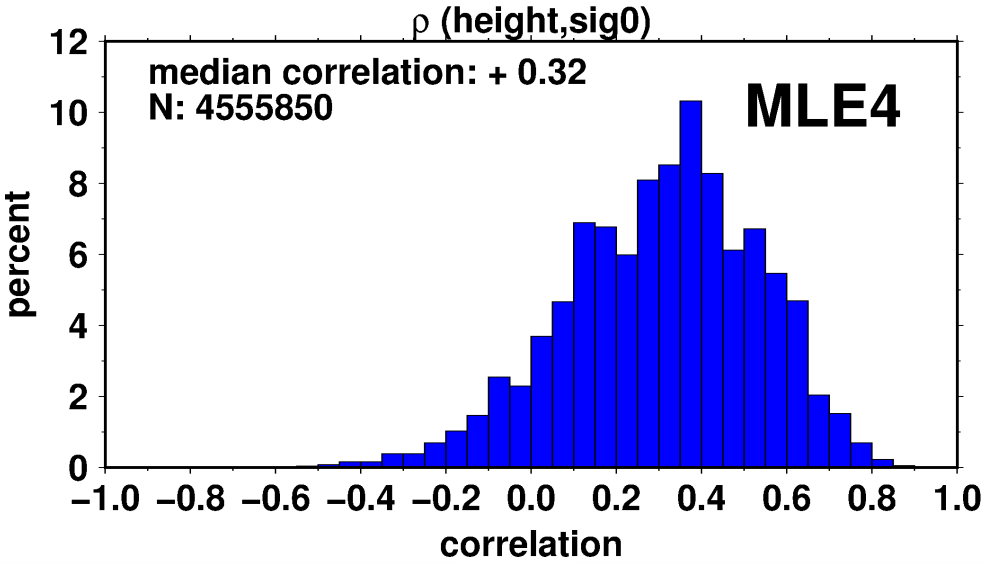
Crossovers with Envisat (Jason-2 cycles 1–36)			
Jason GDR	**SLA (cm)**	**SWH(m)**	**N**
GDR-T	5.41	1.12	301909
GDR-D MLE3	5.40	1.13	287773
GDR-D MLE4	5.26	1.12	281792
SWH < 1m			
GDR-T	8.18	0.45	6486
GDR-D MLE3	7.85	0.44	5670
GDR-D MLE4	7.97	0.42	5486
SWH > 6m			
GDR-T	6.15	1.25	3132
GDR-D MLE3	6.94	1.26	3648
GDR-D MLE4	6.16	1.26	2928

Correlations among retracking parameters

MLE3/MLE4 fields from GDR-D cycles 1 to 9 were used find the correlations among the 20-Hz fitted parameters (height, SWH, sig0, off-nadir angle, MQE, PPP) from each retracker.

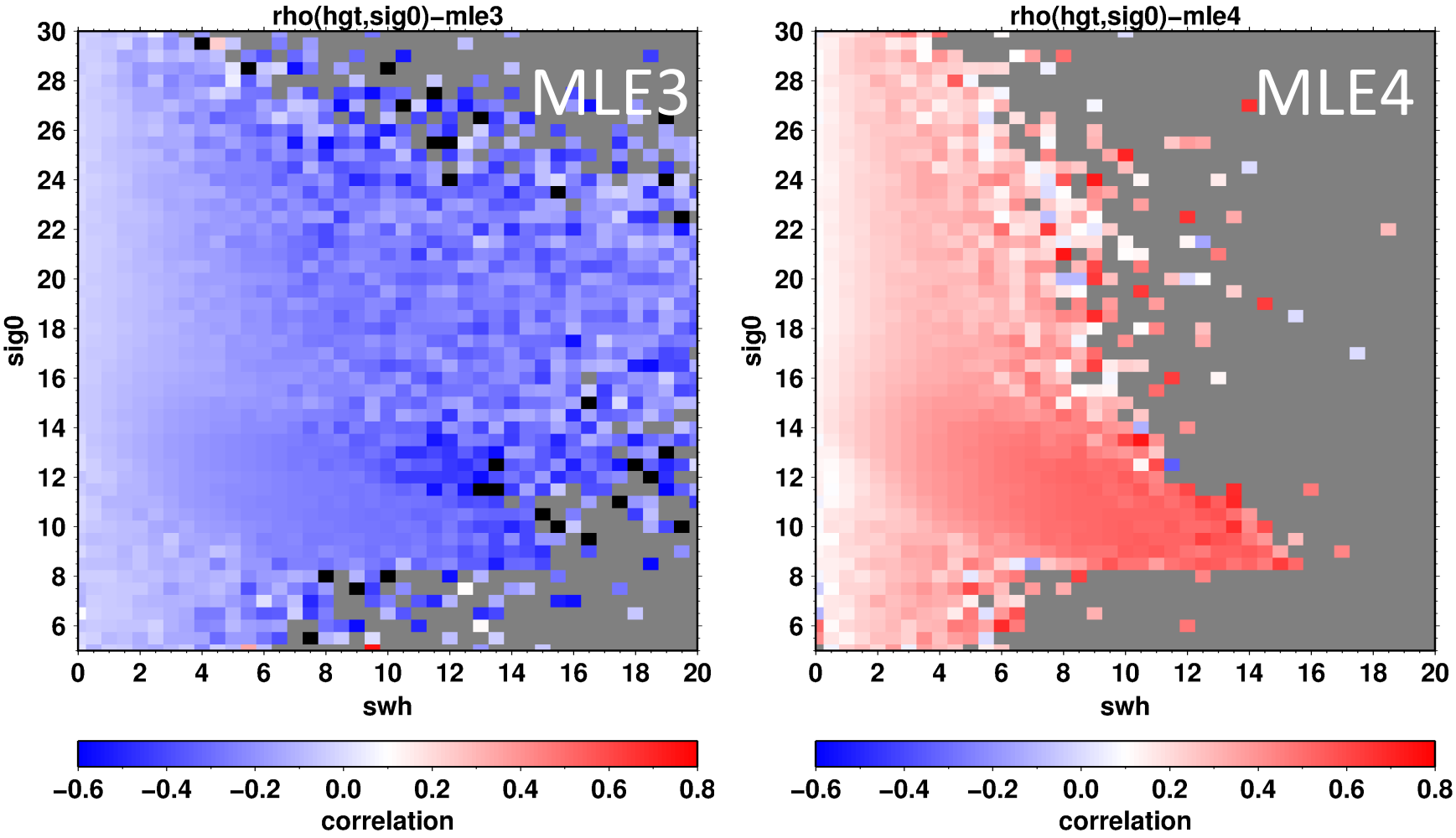


The correlation between the error in height and the error in sigma0 and wind speed reverses sign between MLE3 and MLE4.



Correlations among retracking parameters

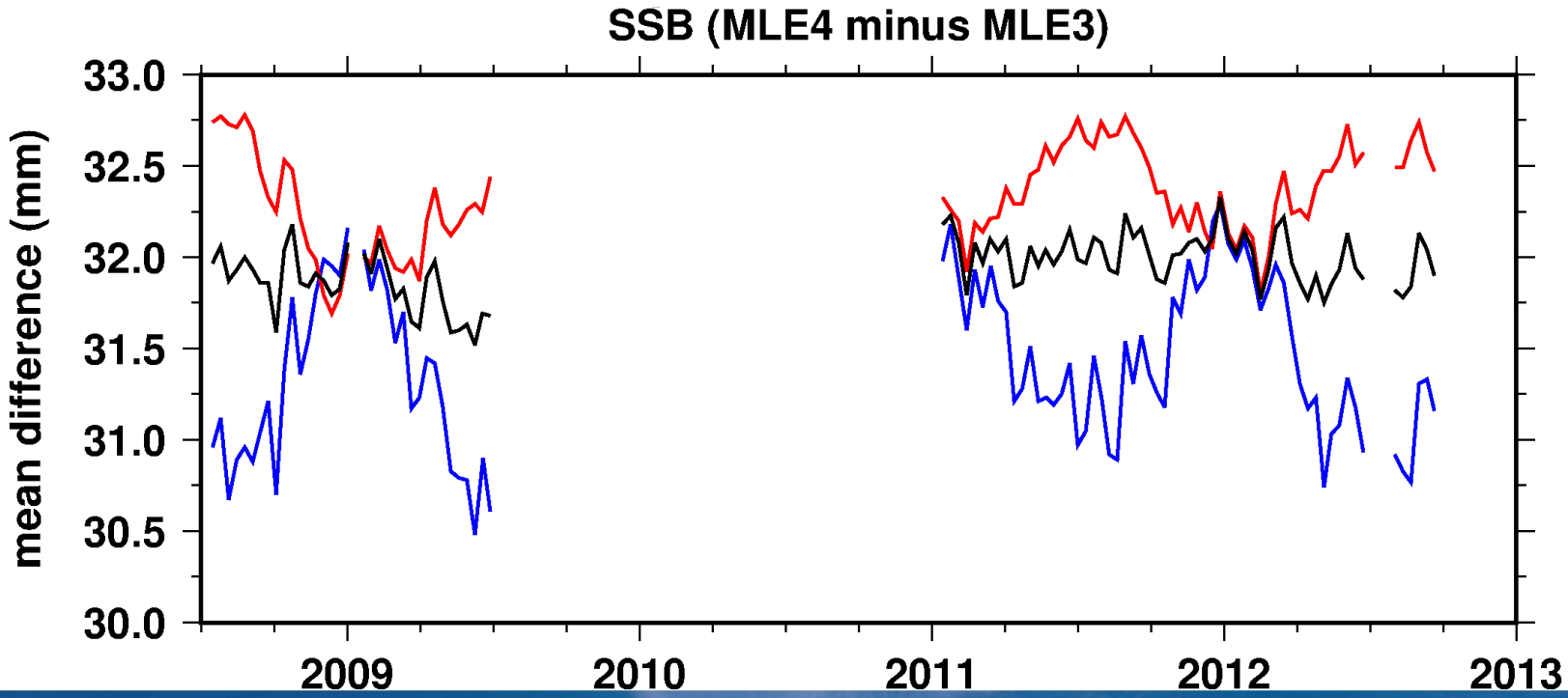
Correlations between height and sigma0 binned by sigma0 and SWH.



Retracker hemisphere differences in mean sea level

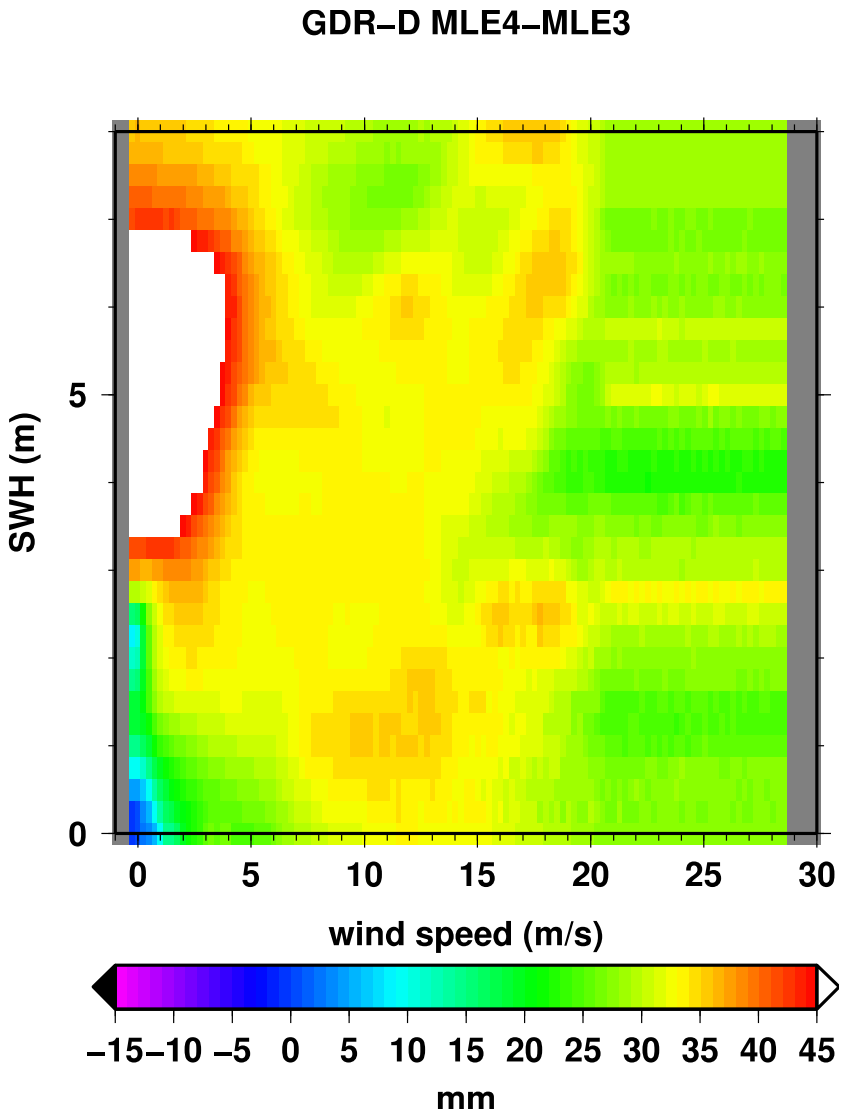
While the choice of retracker (MLE3 versus MLE4) has minimal impact on global mean sea level (black), there is a seasonal bias in the N/S hemispheres (blue and red).

This suggests that the MLE3 and MLE4 sea state biases contain tracker biases for some wind/wave conditions.



MLE3/4 sea state bias

The differences between the MLE3 and MLE4 sea state bias corrections in GDR-D are > 1 cm at low wind/high wave conditions.



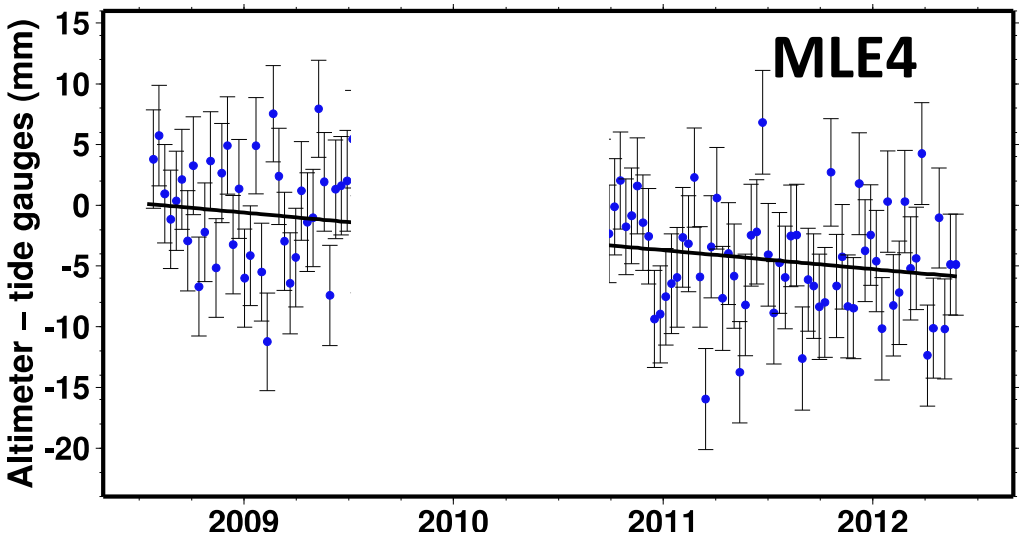
MLE3/MLE4 tide gauge comparison

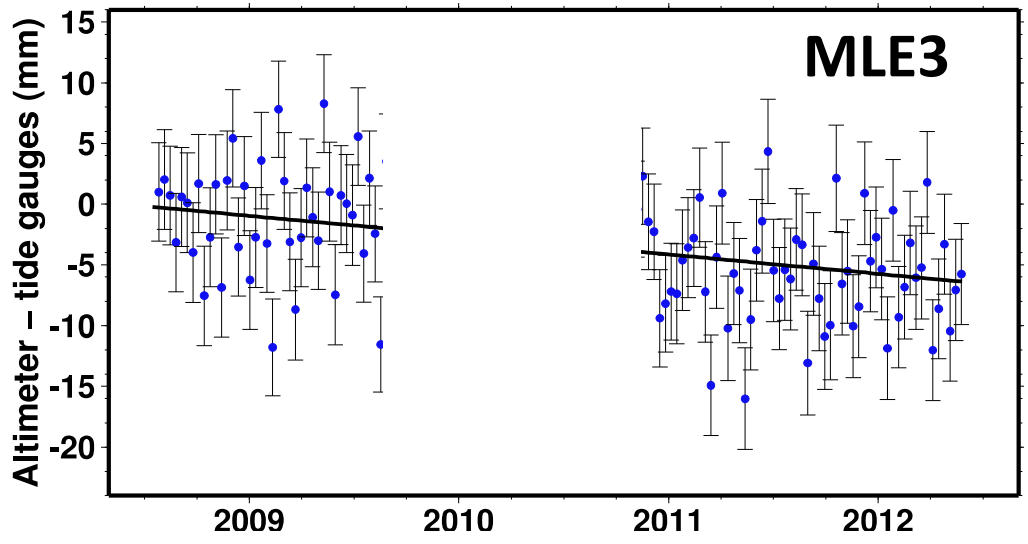
The scatter of the residuals of SLA differences with the tide gauge network is slightly smaller for MLE3, (st. dev. 4.91 mm) than for MLE4 (st. dev. 5.05 mm).

5.5% reduction in variance

The scatter about the trend line is also smaller for MLE3 than MLE4.

From the 20-year reference series comparison. Seasonal signals removed.



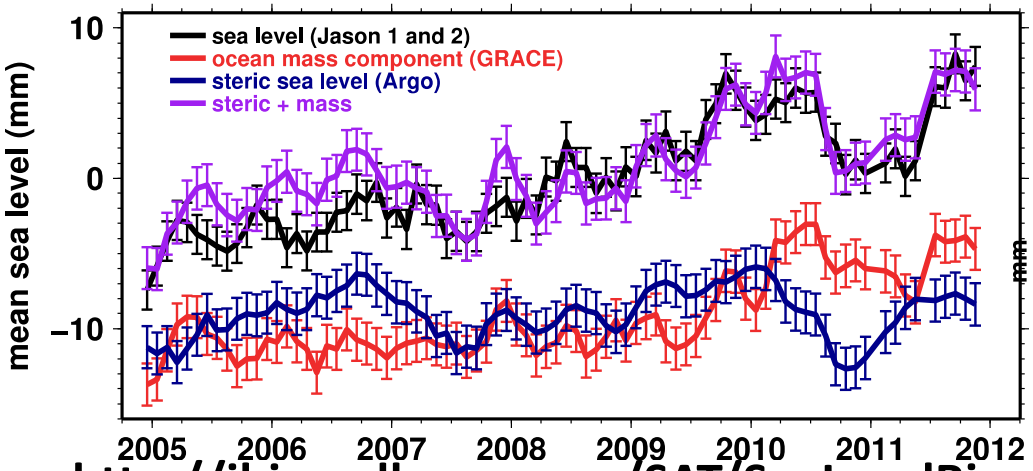


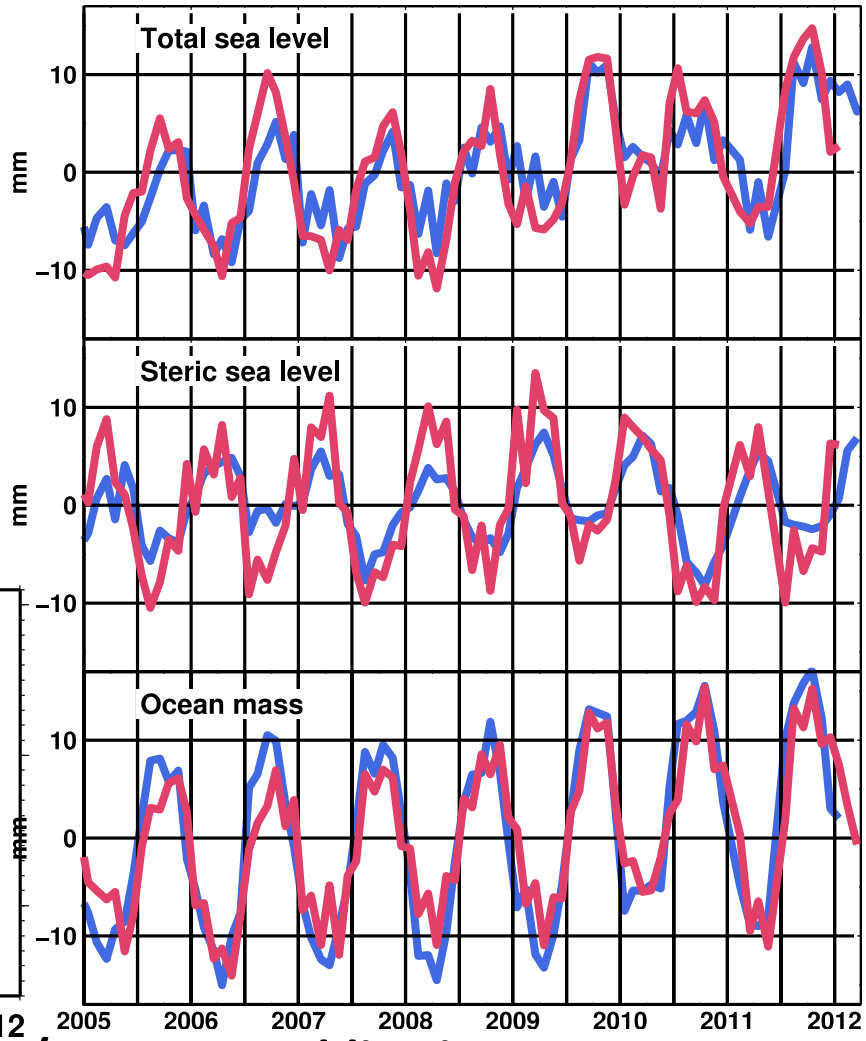
Attribution: Assessments of the sea level budget

- The Budget of Recent Global Sea Level Rise annual reports

	Trend (mm/year)
Steric (Argo)	0.2 ± 0.8
MASS (GRACE, Paulson GIA)	1.0 ± 0.2
Steric + mass	1.2 ± 0.9
Total sea level (Jason-1, Jason-2)	1.6 ± 0.8

Error interval 95%





http://ibis.grdl.noaa.gov/SAT/SeaLevelRise/LSA_SLR_publications

Conclusions

- The GDR-D/GDR-C tide gauge calibration results show significant drifts greater than the goal of limiting the system drift to less than 1 mm/year.
  - See Beckley et al. for time-varying gravity field results.
- From the tide gauge calibration MLE3 has 5.5% less variance than MLE4.
- While the choice of retracker (MLE3 versus MLE4) has minimal impact on global mean sea level, there is a seasonal bias in the North/South hemispheres.
  - May need to use caution when combining altimeter data from different retrackers.