

# Absolute Bias Results from the Australian In-Situ Sites: Bass Strait and Storm Bay

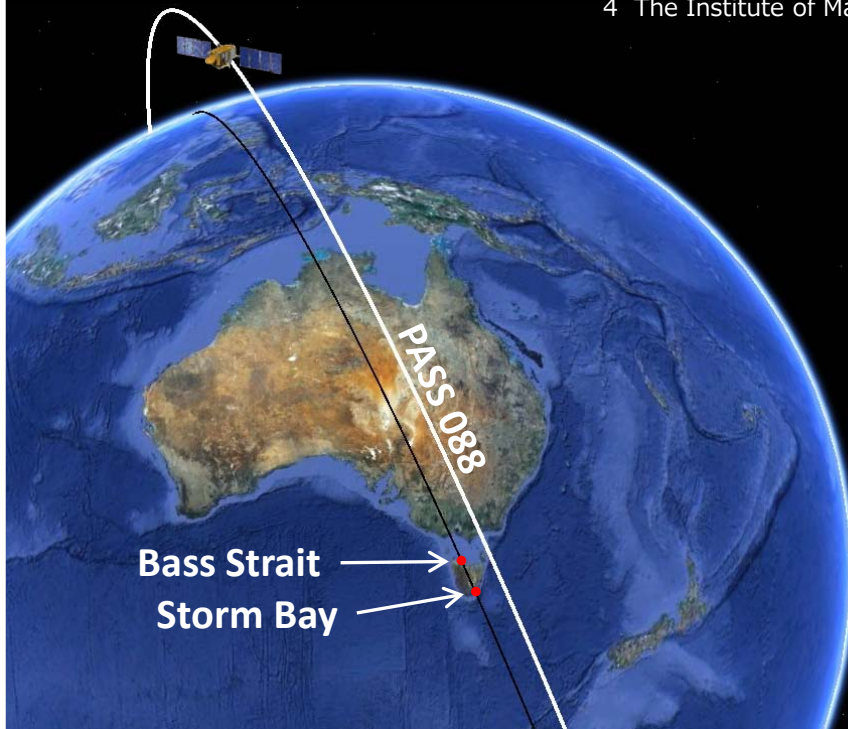
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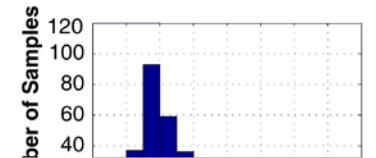
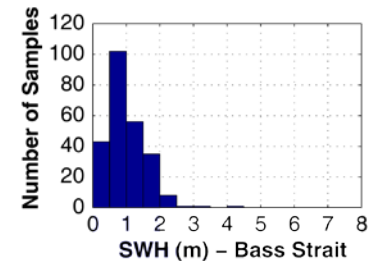
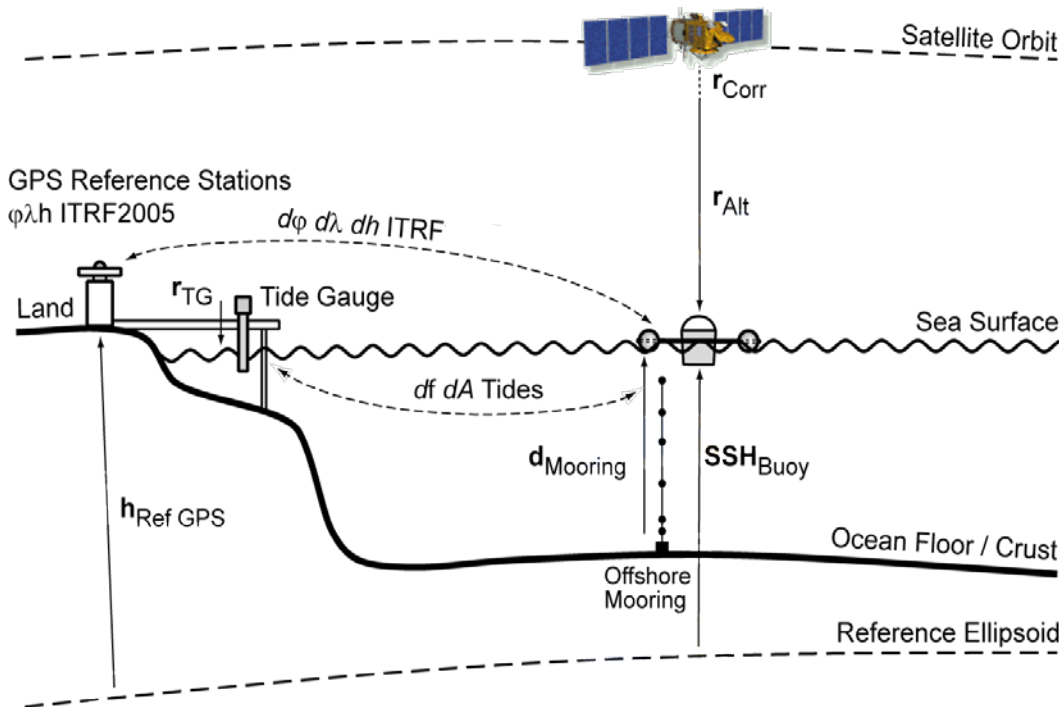


*OSTM/Jason-2  
OST Science Team  
Meeting*

Updated Data Stream Presentation  
Venice OSTST Meeting  
September 2012

# Review

- Primary site is located on Pass 088 in Bass Strait, with secondary site along track in Storm Bay.
- Bass Strait site has contributed to the SWT/OSTST since the launch of T/P.
- Geometric approach, precision ocean moorings, GPS buoys and coastal tide gauge.

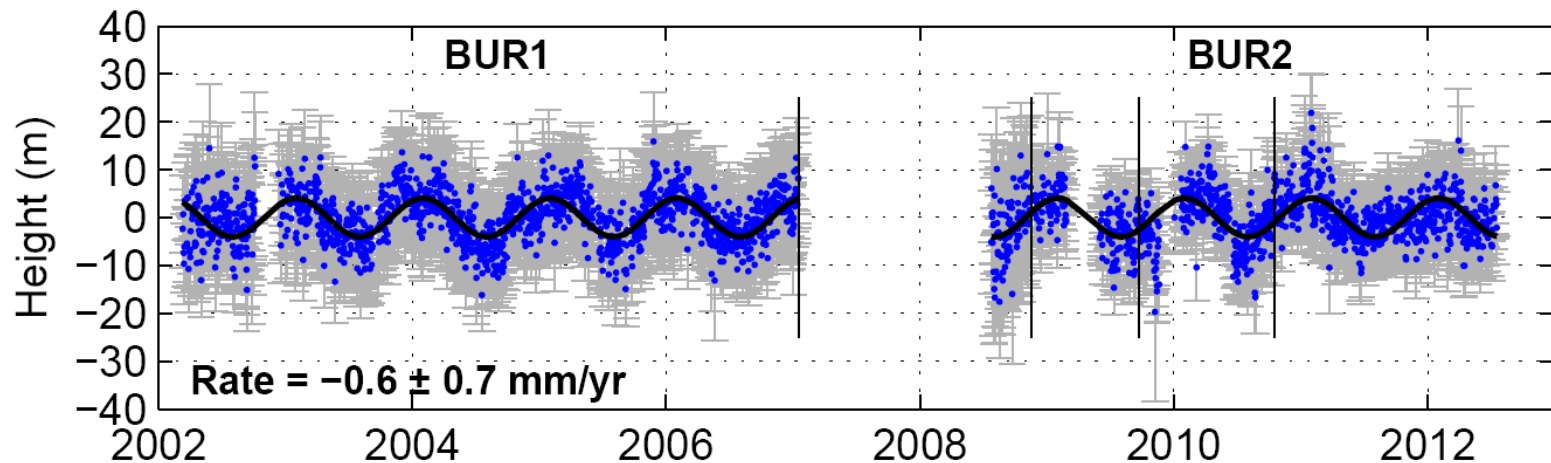


# Tide Gauge and CGPS

- Tide gauge is part of the Australian baseline array, located in Burnie.
- Vertical velocity not significantly different from zero.
- CGPS time series shows a quasi-annual periodic signal (amplitude  $\sim 3-4$  mm).

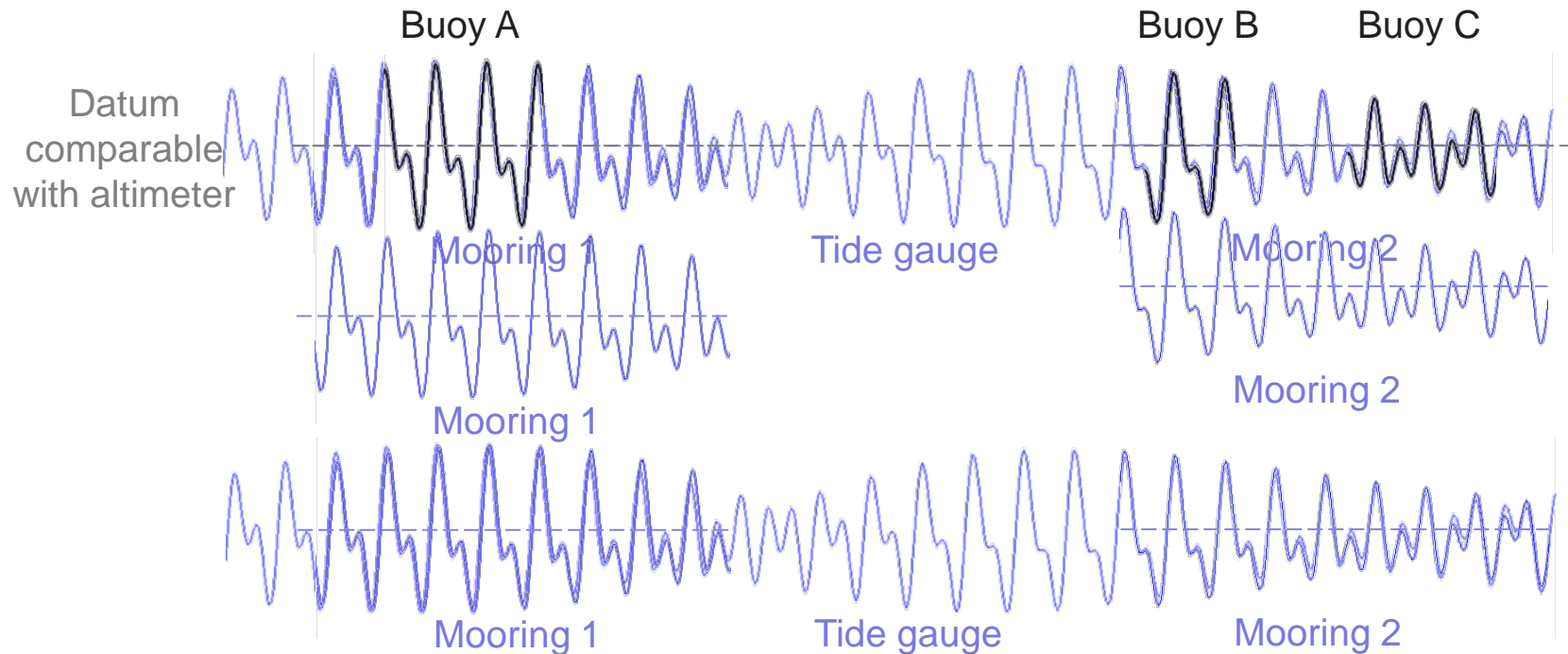


Burnie TG and BUR2 GPS



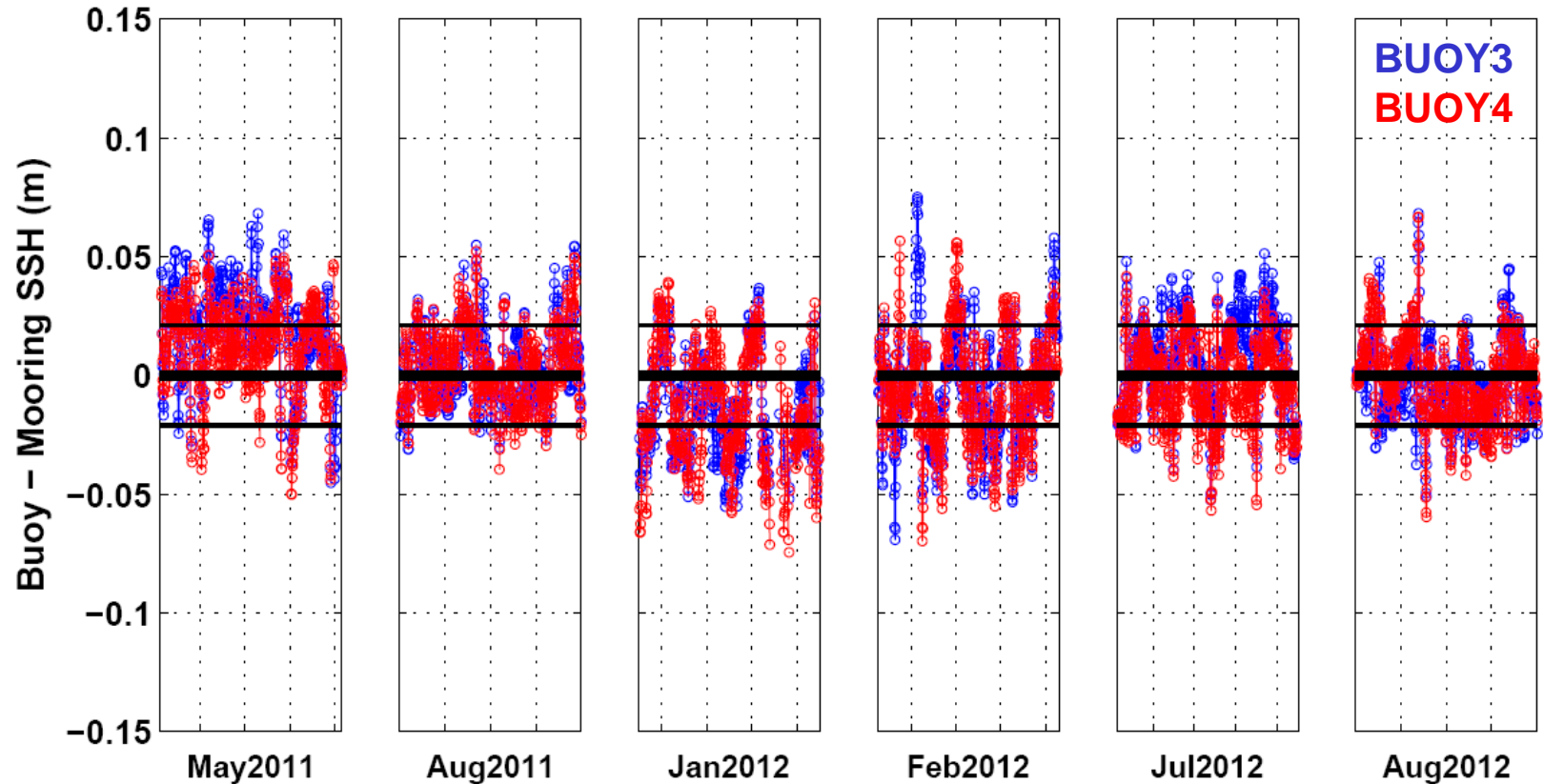


# Ocean Moorings, Tide Gauge & GPS Buoys



- Tidal difference between mooring and tide gauge is dominated by M2 (amp = 0.126 m, and N2 (amp = 0.030m). Computed using ~3 yr of common data.
- Non tidal differences are reduced by removing the (modelled) differential effect of atmospheric pressure between the mooring and tide gauge.
- The RMS of the final non tidal residual (mooring – tide gauge) is ~20 mm.
- Buoy deployments are typically ~50 hours duration. Min of 2 buoy deployments per 6 month mooring deployment.

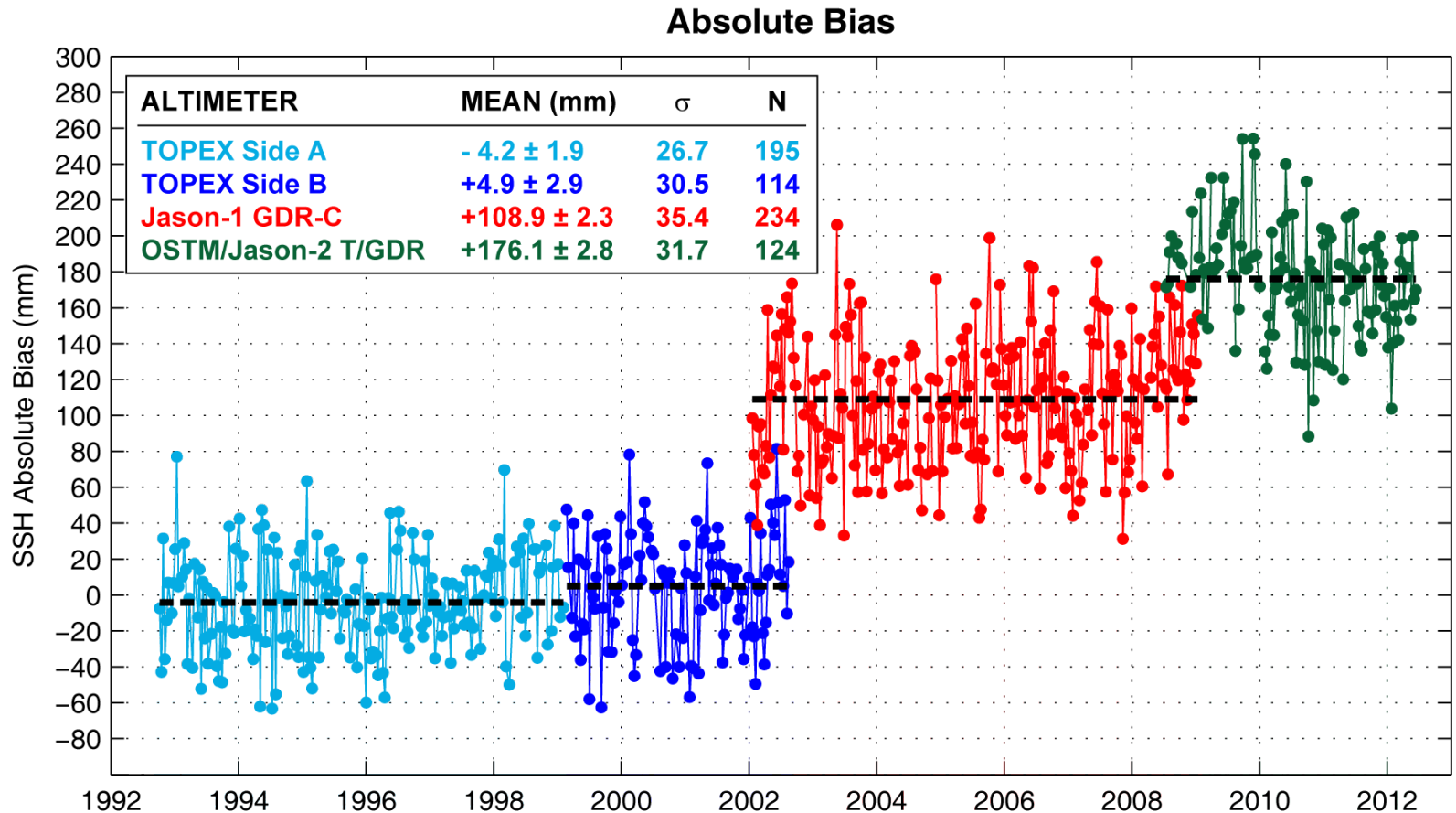
# GPS Buoy vs Mooring SSH: Bass Strait



- The residual time series (filtered Buoy SSH – Mooring SSH) shows a typical RMS of  $\sim 20$  mm. Slightly larger variability at Storm Bay due to deployment depth.

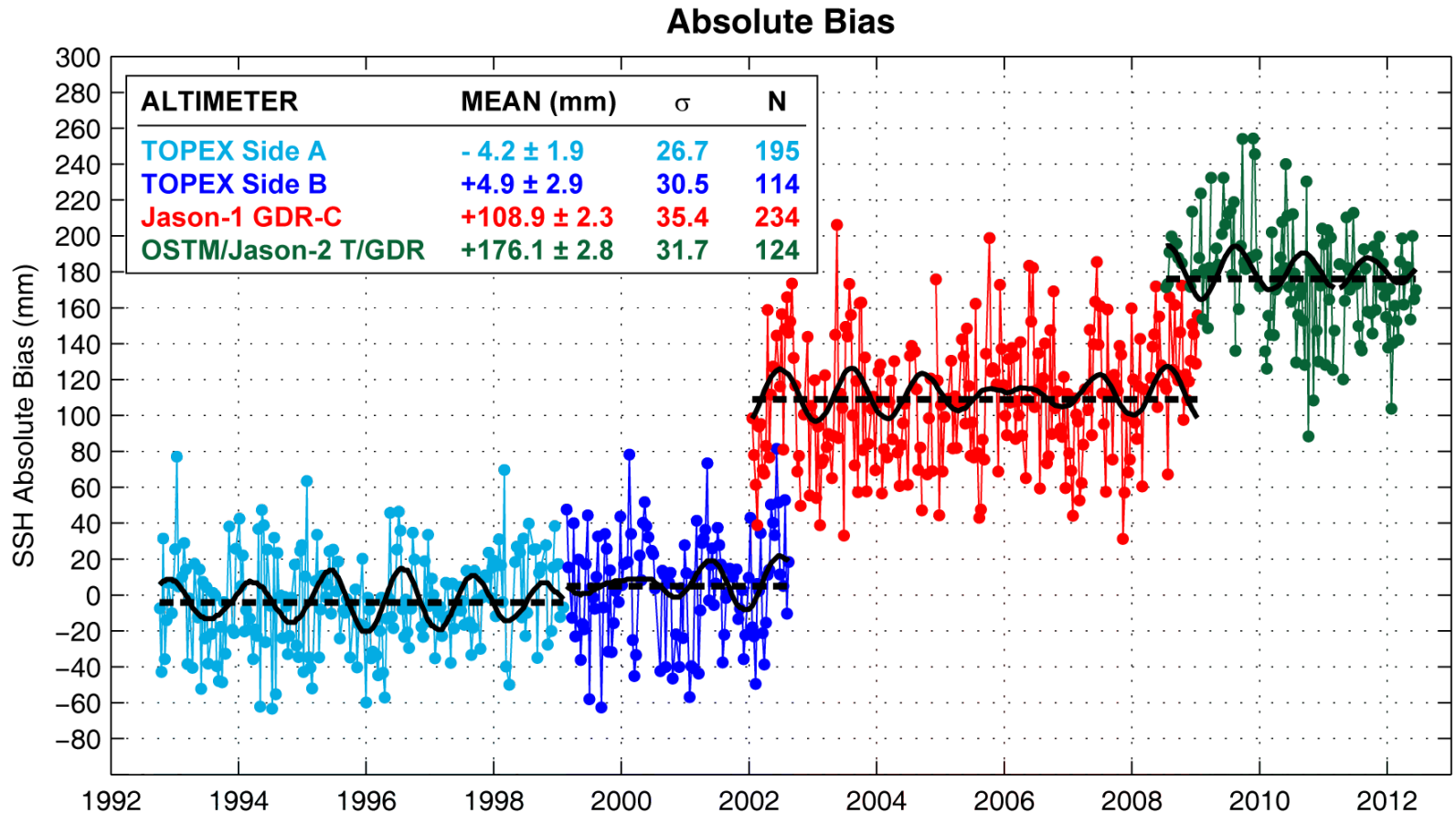


# Bass Strait Absolute Bias Record



Rates:  $+1.8 \pm 1.0$  mm/y       $+1.5 \pm 2.6$  mm/yr       $+2.6 \pm 1.0$  mm/yr       $-8.4 \pm 2.3$  mm/yr

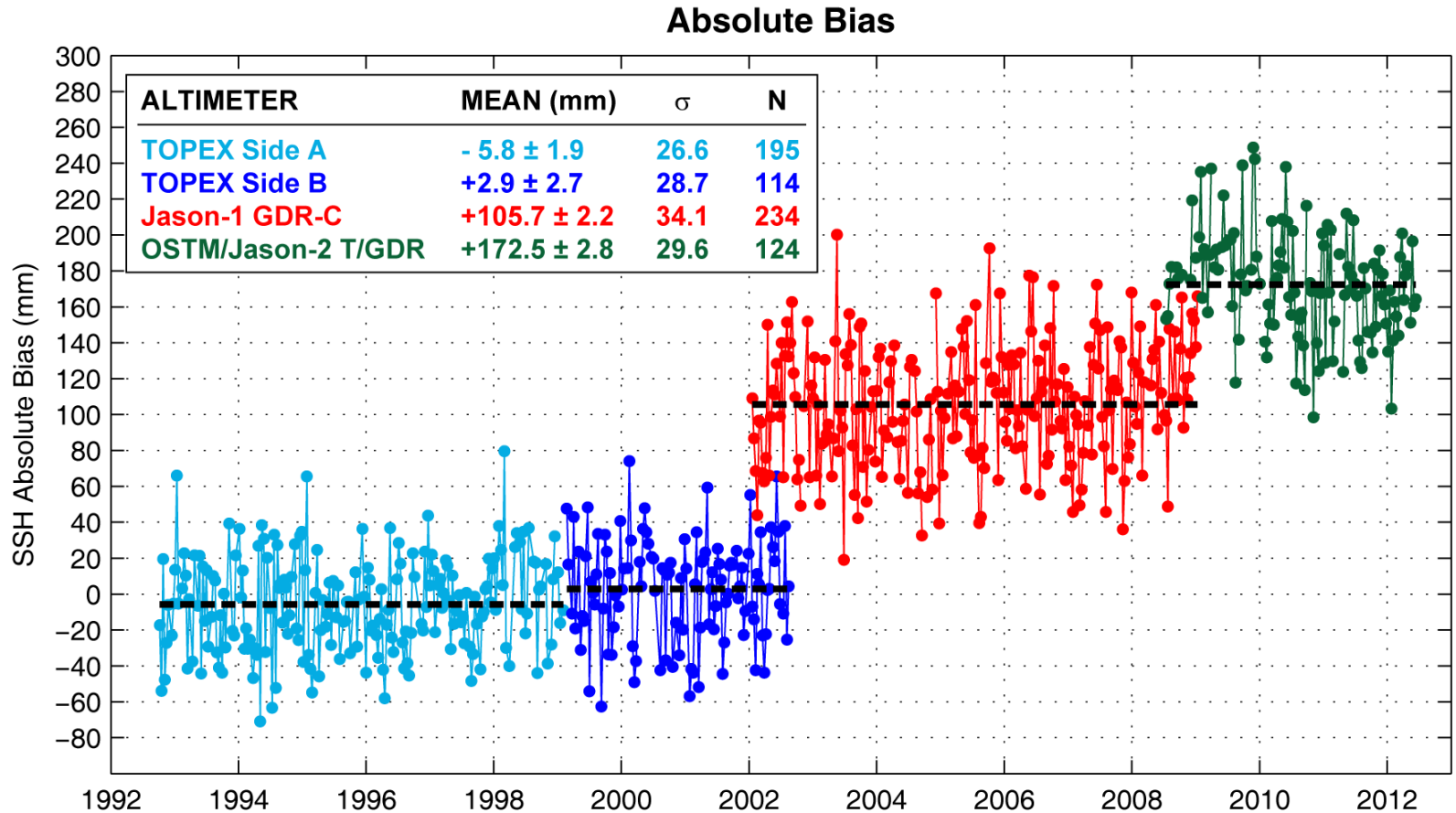
# Bass Strait Absolute Bias Record



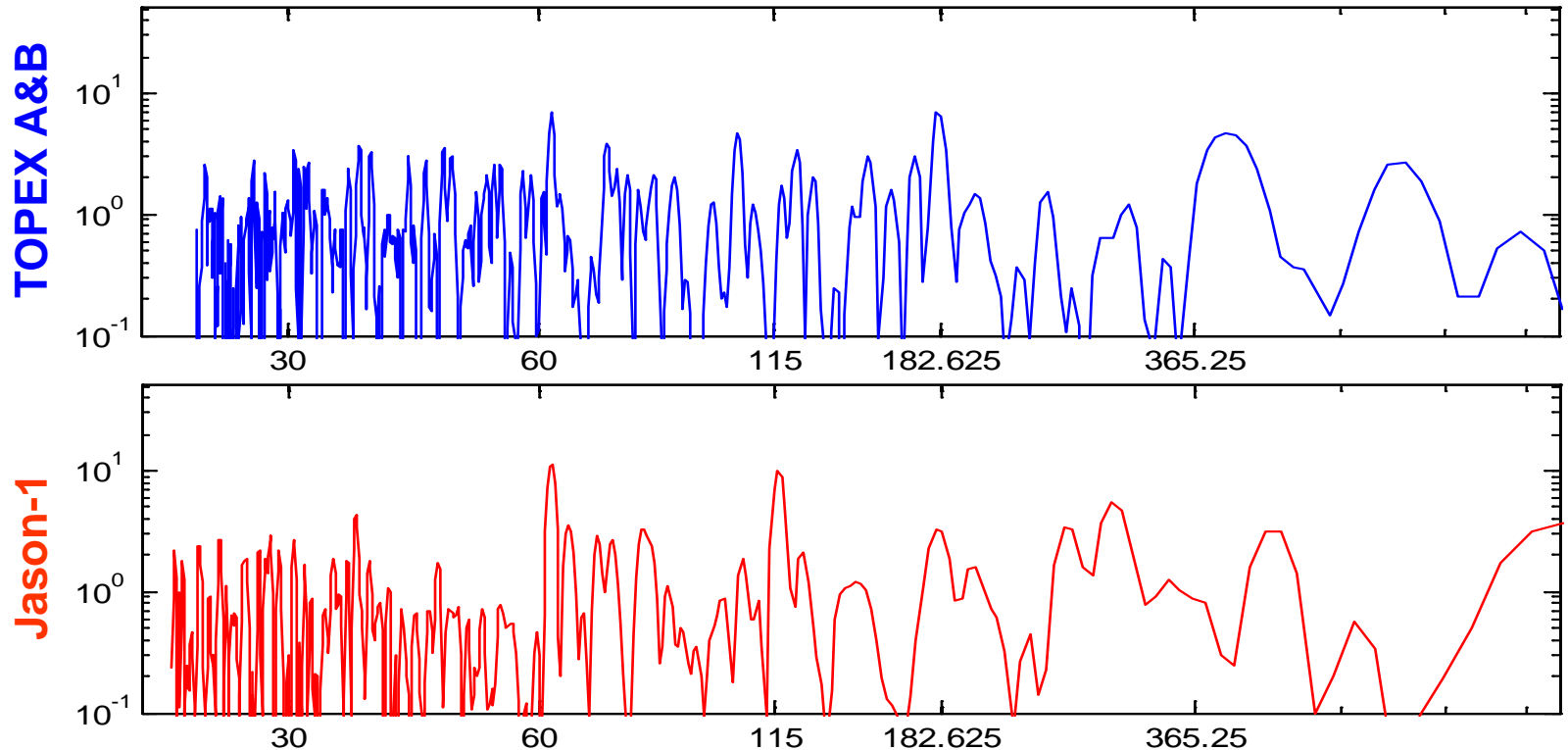
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# Bass Strait Absolute Bias Record



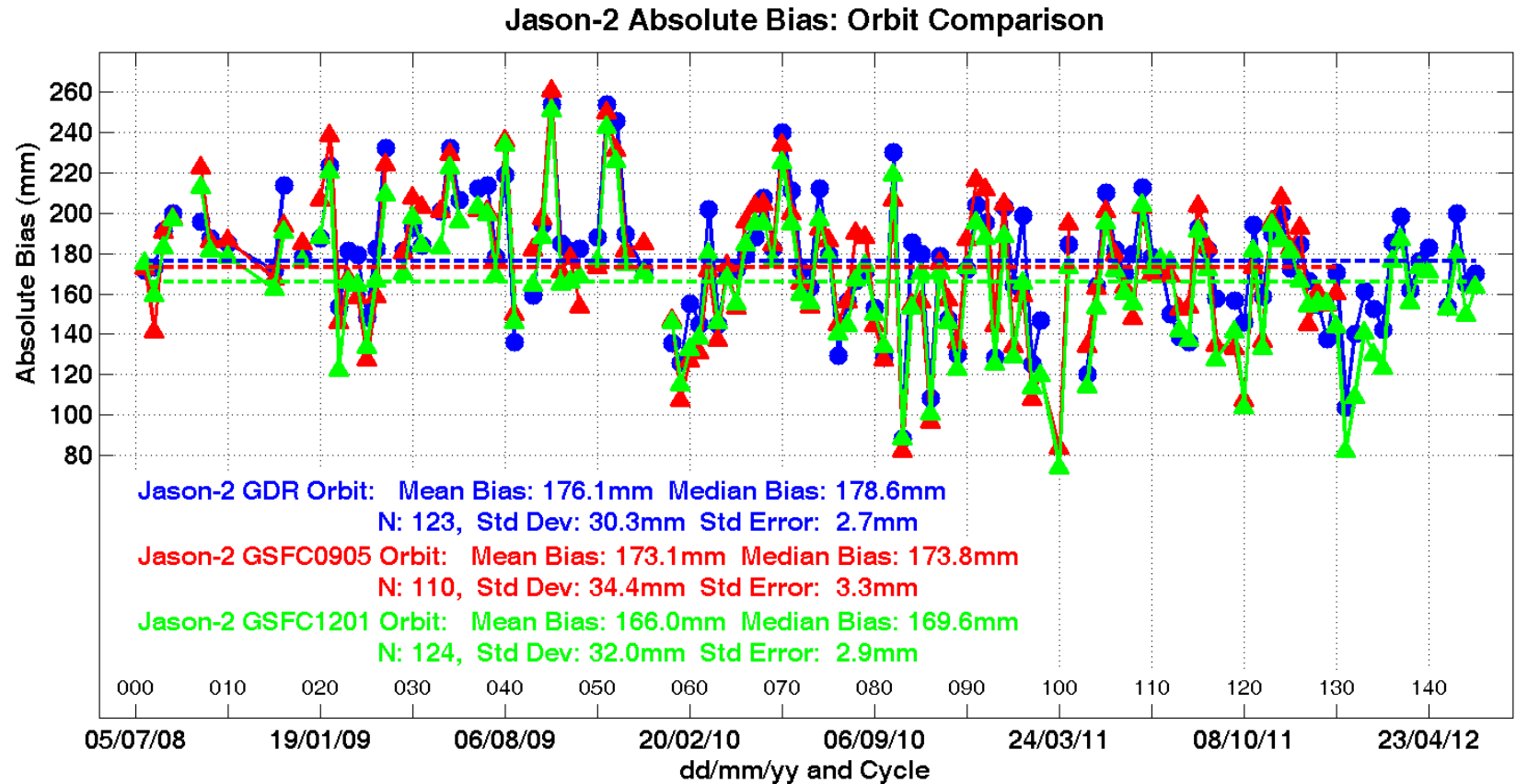
# Periodic Energy – Pole tide not applied



## Open questions:

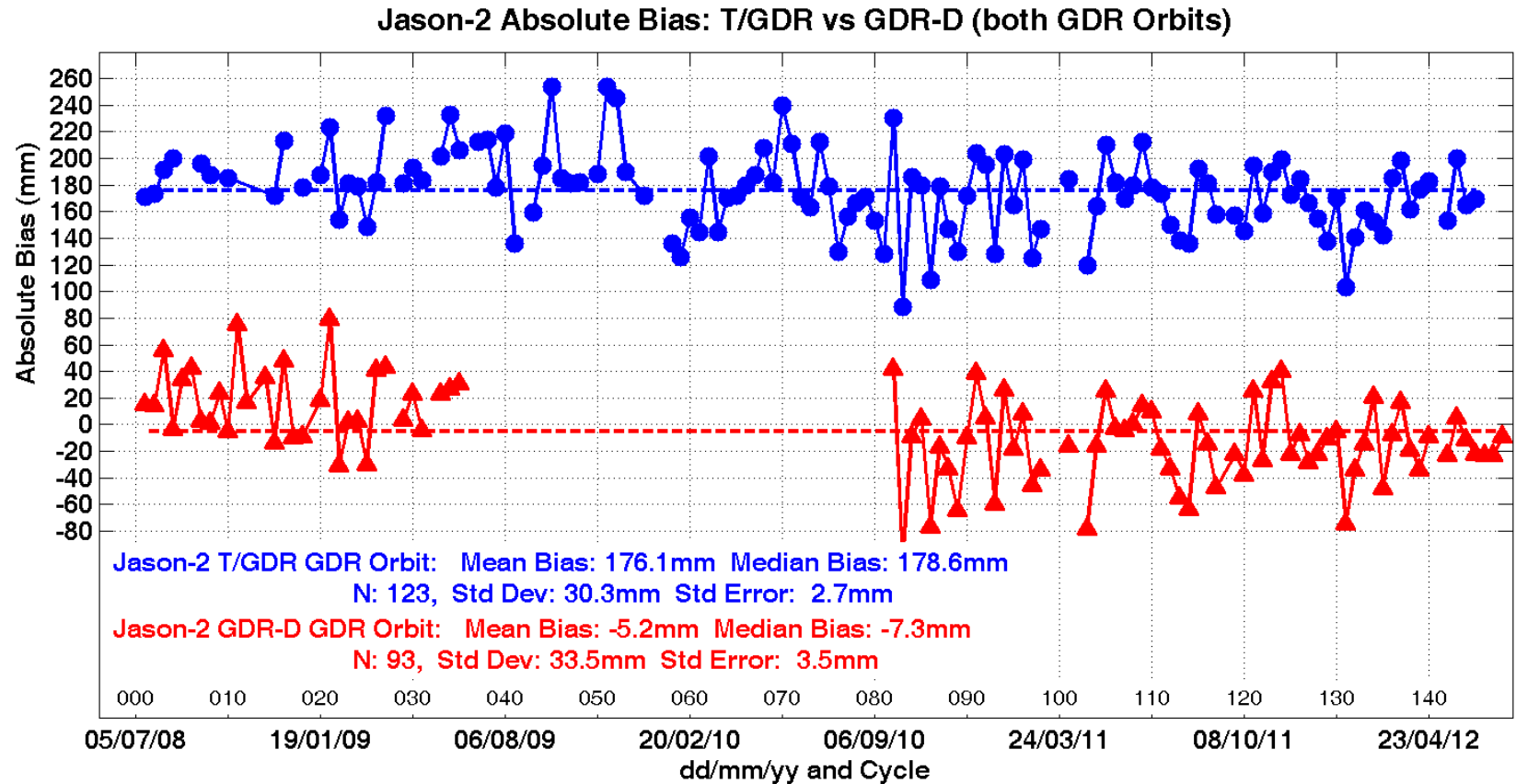
- Do we have an issue with the pole tide (or how we apply it) from the GDR product?
- What else could alias to a similar low frequency?

# OSTM/Jason-2 Absolute Bias: Bass Strait



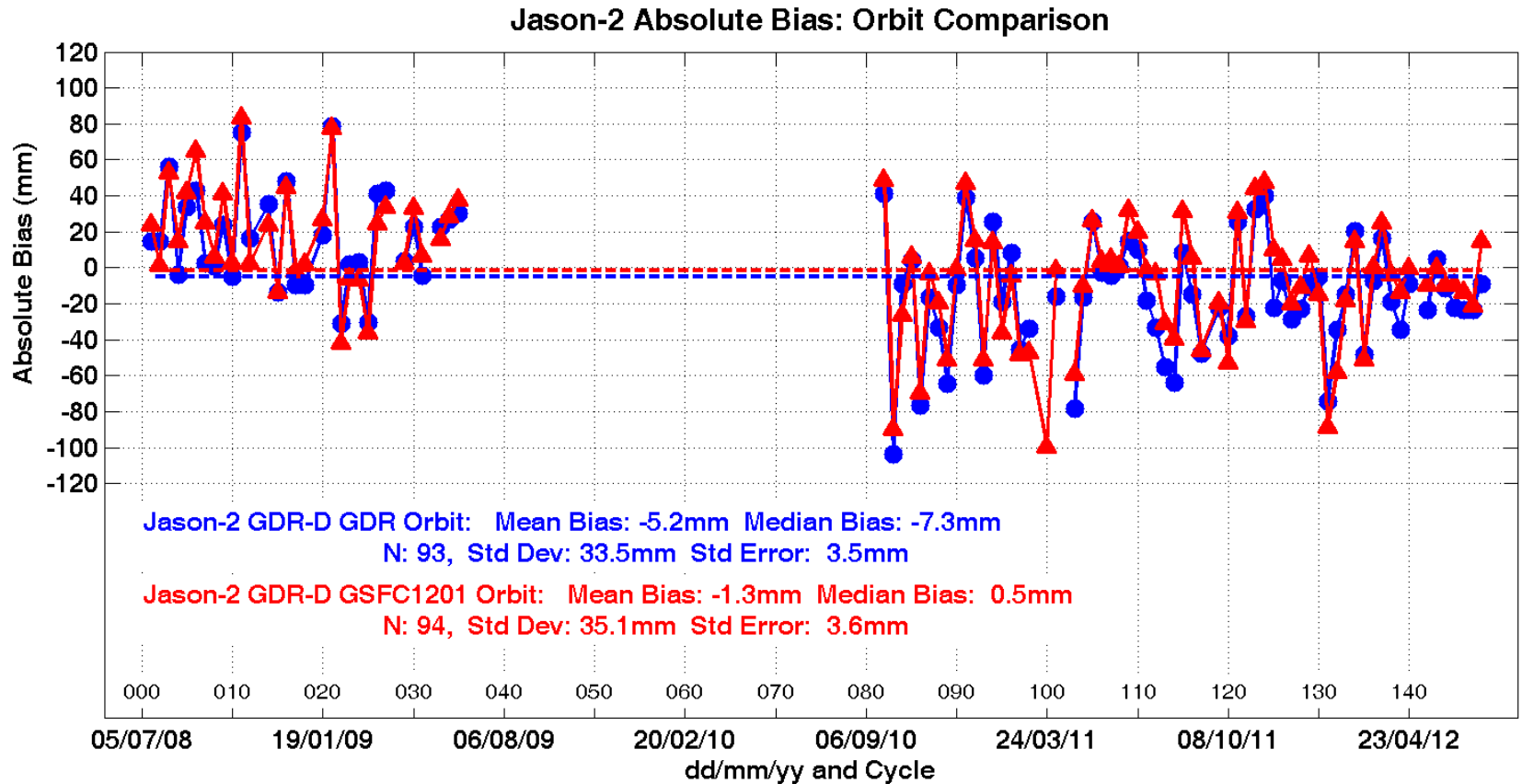
- Small decreases in bias from GDR to GSFC0905 orbits
- Larger reduction (~10 mm) from GDR to GSFC1201 orbit.

# OSTM/Jason-2 Absolute Bias: Bass Strait



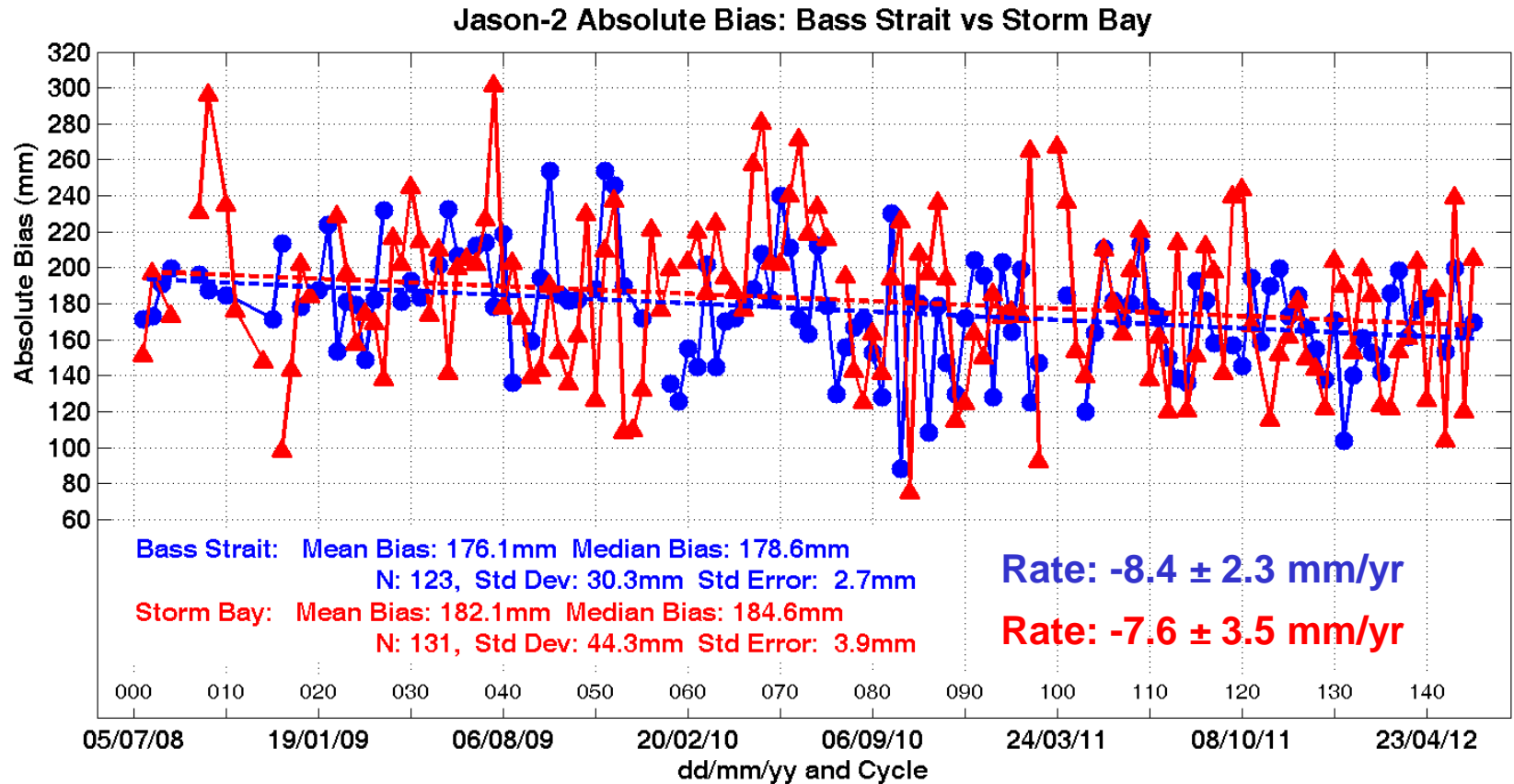
- T/GDR to GDR-D, both with GDR orbits reduces bias by 181.3 mm.
- (Thanks to Nicolas Picot et al for making extra cycles available).

# OSTM/Jason-2 Absolute Bias: Bass Strait



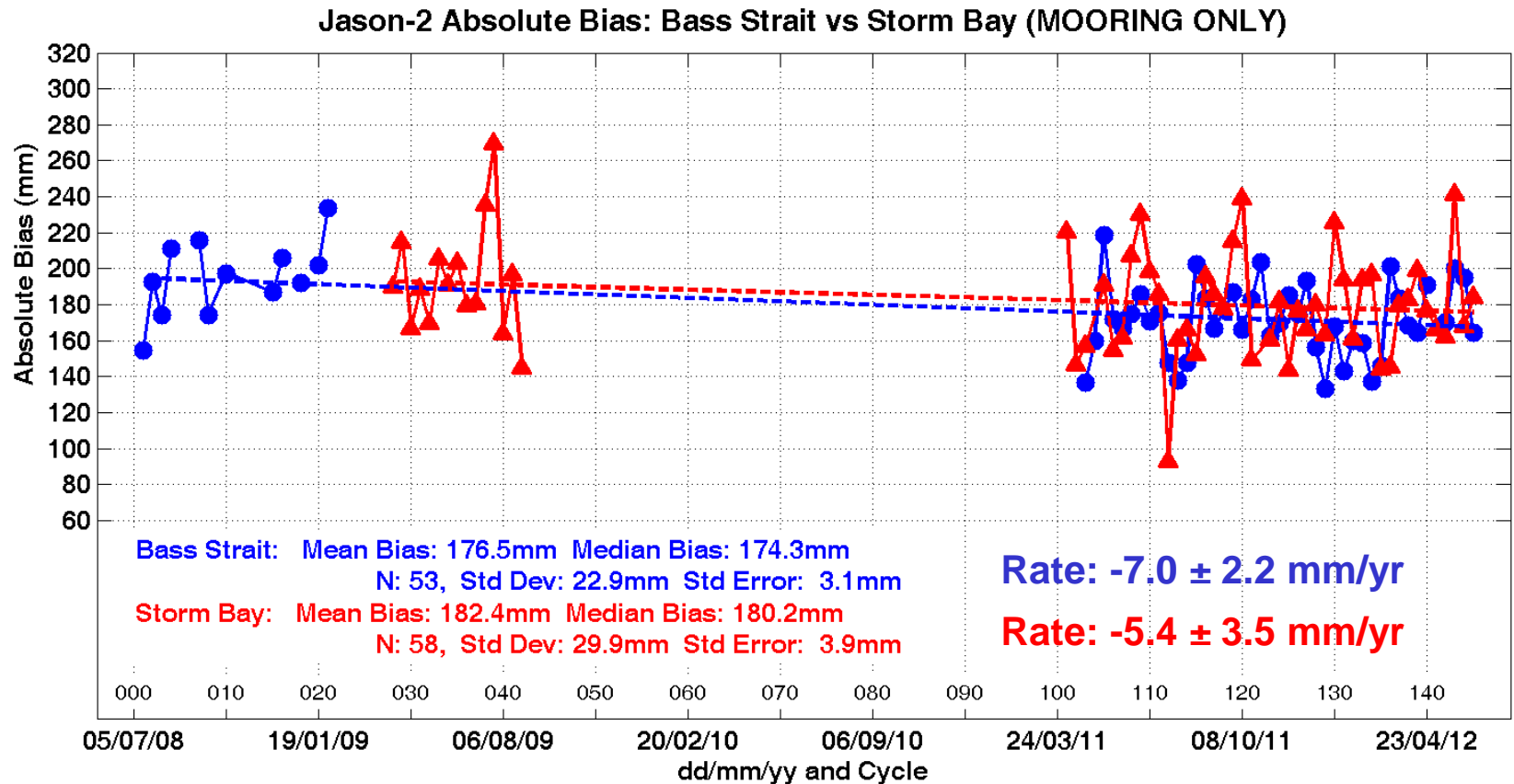
- Slight improvement in the trend when using GSFC1201 orbit on GDR-D.
- Absolute bias now no longer significantly different from zero.
- BUT there is a clear negative trend in the bias.

# Bass Strait v Storm Bay



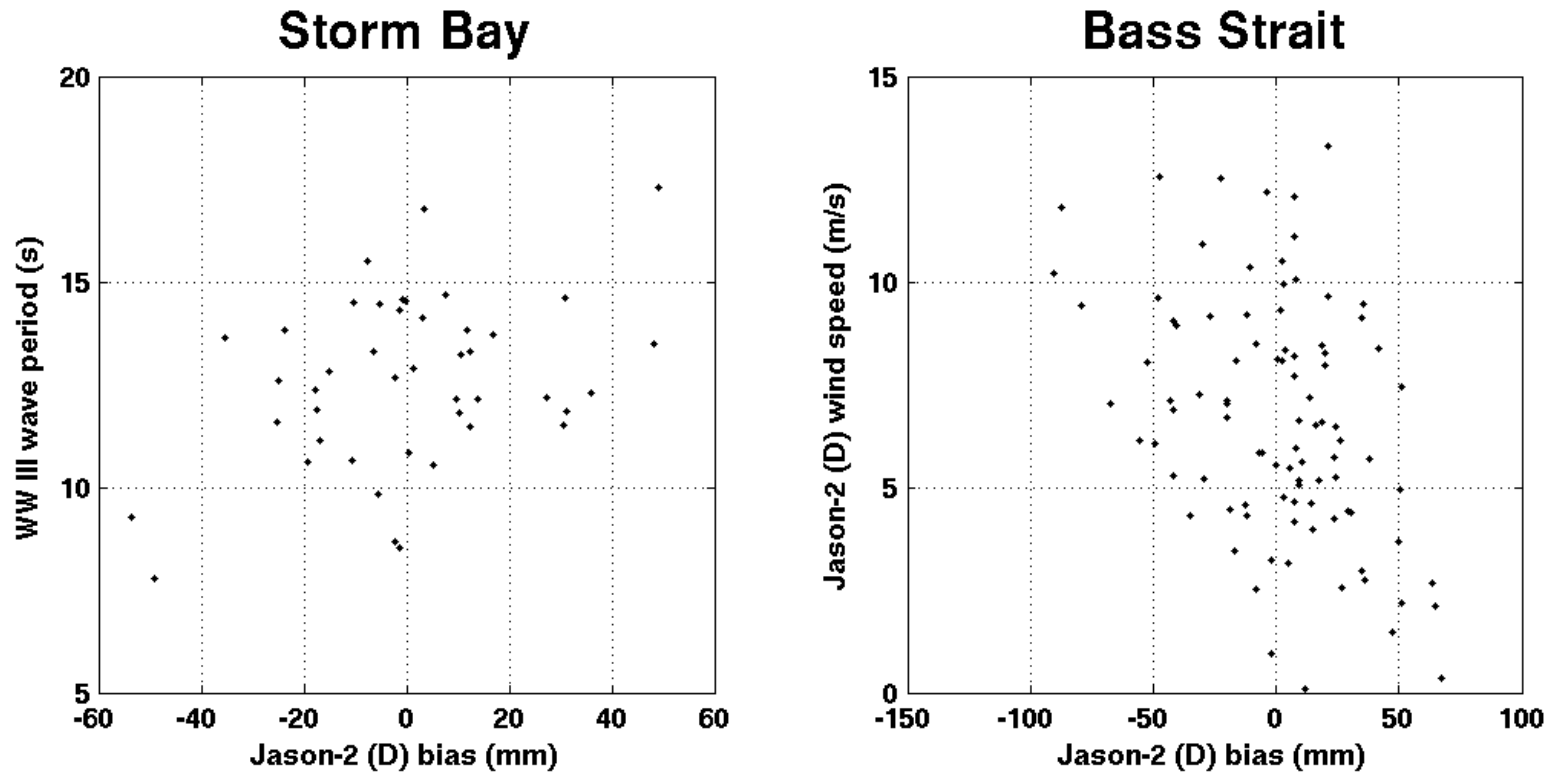
- Comparable absolute biases b/w sites using preliminary Storm Bay data.
- Interestingly, comparable linear rates between sites.

# Bass Strait v Storm Bay



- Improved precision when using only mooring data.
- Again, good agreement between rates => unlikely a tide gauge issue.
- Our bias drift work shows this is geographically correlated as far north as Darwin (also pass 088). Not limited to 088 (e.g. ascending pass near Burnie).

# OSTM/Jason-2: Bass Strait v Storm Bay

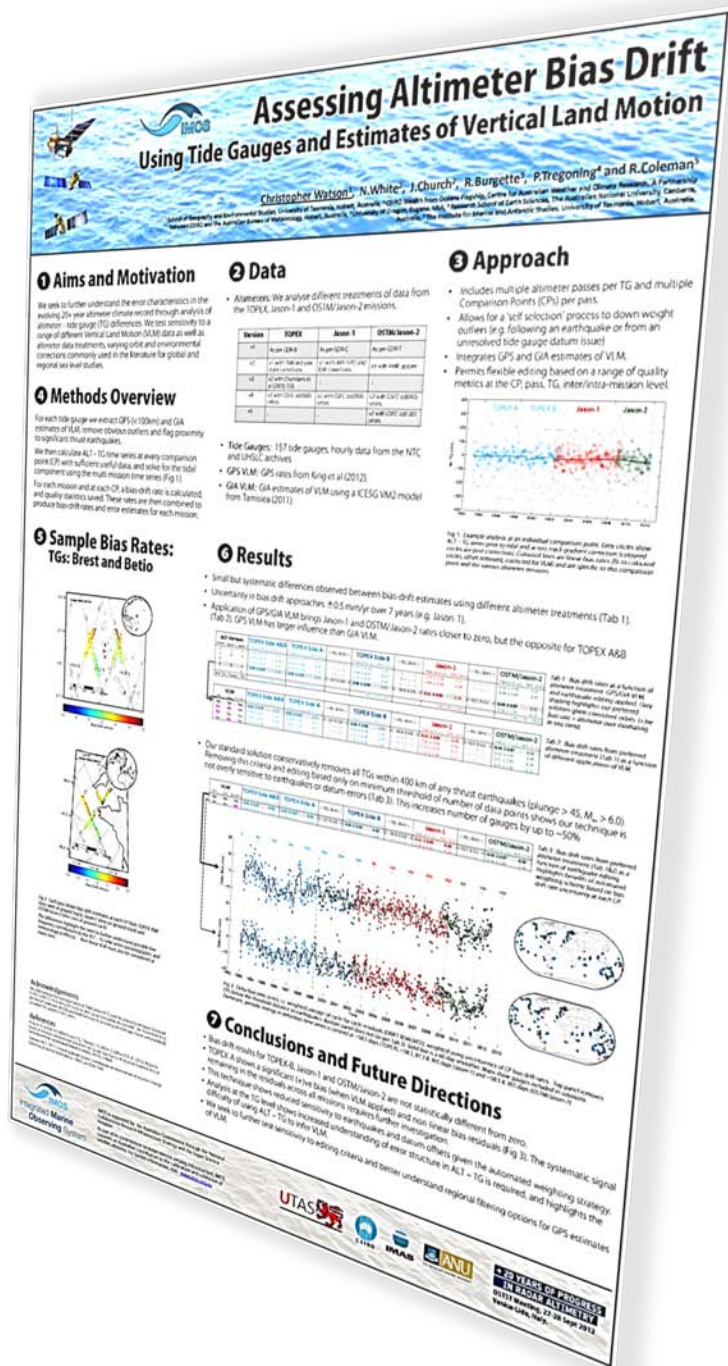


- Storm Bay: marginal positive correlation between altimeter bias and wave period (Wave Watch III model). Largest waves are a fairly unidirectional ocean swell.
- Bass Strait: significant negative correlations with wind speed and positive correlations with (altimeter) SSB correction and (WWIII) wave period.
- Some of this may be related to coastal setup effects which require further investigation.
- We await further mooring data from Storm Bay before we make further inference.



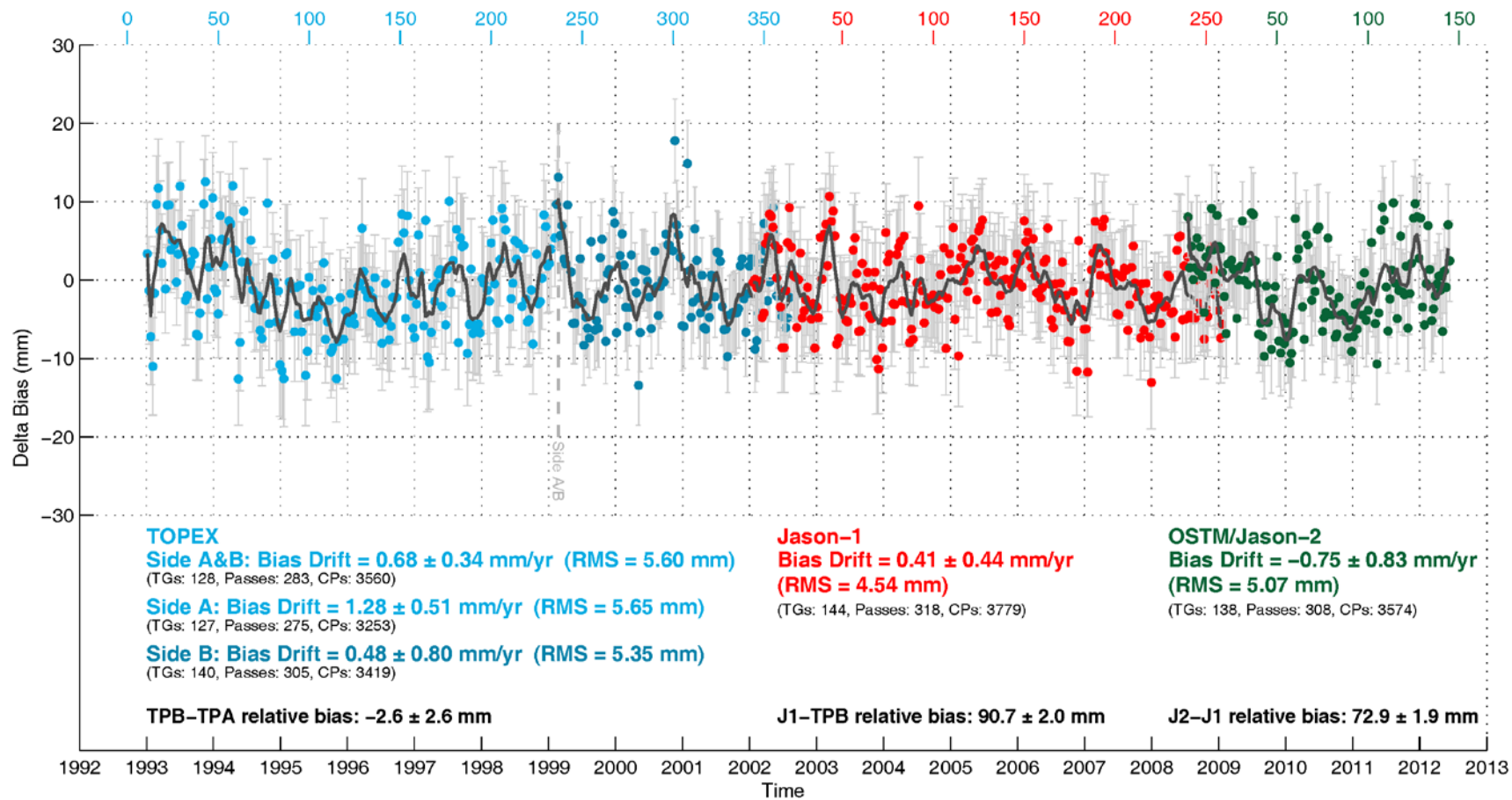
# Altimeter Bias Drift

- Come and see our poster!
- We investigate the evolving 20+ year altimeter climate record through analysis of altimeter – tide gauge differences.
- Our alternate technique incorporates GPS/GIA vertical land motion, multiple altimeter passes per TG and multiple comparison points per pass.
- Similar ingredients + different recipe = opportunity to further understand and develop validation techniques for the climate record.



# Altimeter Bias Drift

- See poster for our initial results.



# Conclusions

Data	Cycles	N	Mean Bias $\pm$ Std Error
<b>Jason-1 GDR-C</b> (GSFC Orbits, enhanced JMR)	001-259	234	<b>+108.9 <math>\pm</math> 2.3 mm</b> Decrease by $\sim$ 10 mm if using GDR JMR
<b>OSTM/Jason-2 T/GDR</b> (GDR Orbits, enhanced AMR)	001-149	124	<b>+176.1 <math>\pm</math> 2.7 mm</b> Decrease by 2.9 mm if using GDR AMR
<b>OSTM/Jason-2 T/GDR</b> (GSFC1201 Orbits, enhanced AMR)	001-149	124	<b>+166.0 <math>\pm</math> 2.9 mm</b>
<b>OSTM/Jason-2 GDR-D</b> (GDR Orbits, enhanced AMR)	001-149 (gap 36-81)	94	<b>-5.2 <math>\pm</math> 3.5 mm</b>
<b>OSTM/Jason-2 GDR-D</b> (GSFC1201 Orbits, enhanced AMR)	001-149 (gap 36-81)	94	<b>-1.3 <math>\pm</math> 3.6 mm</b>

- Recall that non-time averaging systematic error contributions likely dictate that the “absolute” error is 10-15 mm for these estimates.
- We observe a negative rate in Jason-2 bias estimates, consistent between Bass Strait and Storm Bay. Low frequency variability (pole tide?) requires further investigation.
- Further analysis of Storm Bay site is in progress as we obtain more mooring data.

# Questions?

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## Acknowledgements:

Integrated Marine Observing System

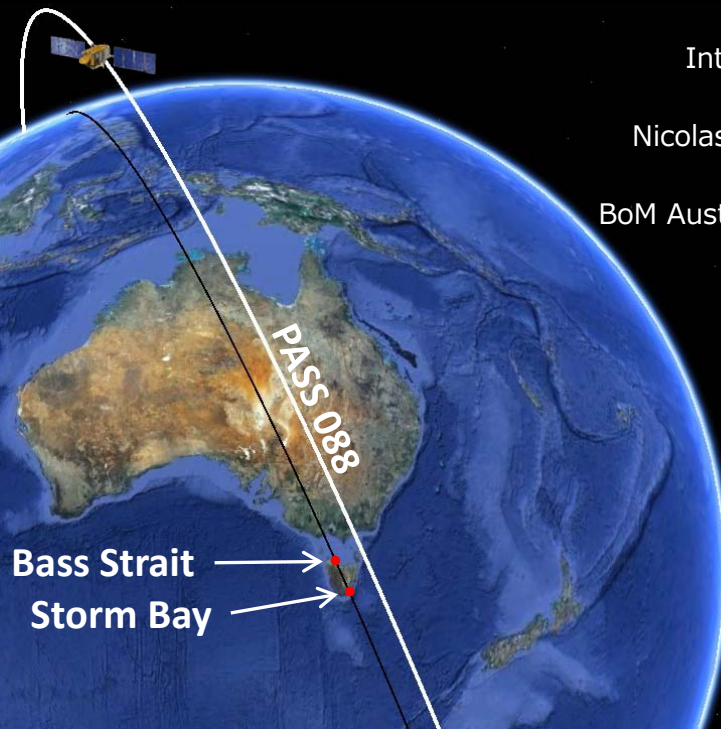
CSIRO coastal moorings team

Nicolas Picot et al for efforts with GDR-D

Frank Lemoine for GSFC orbits

BoM Australia for TG and atmospheric data

NOAA/NWS for WWII data

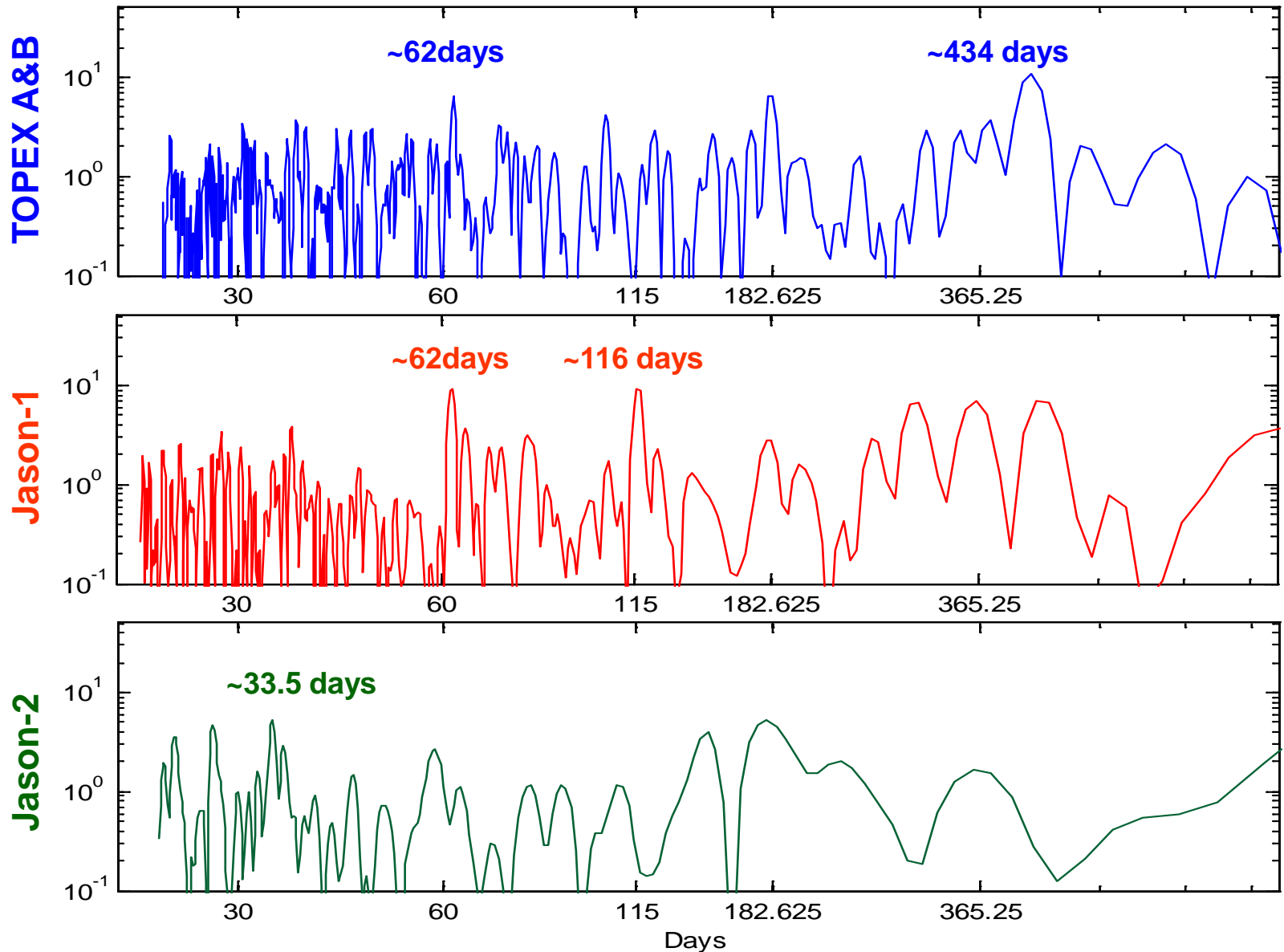


**OSTM/Jason-2  
OST Science Team  
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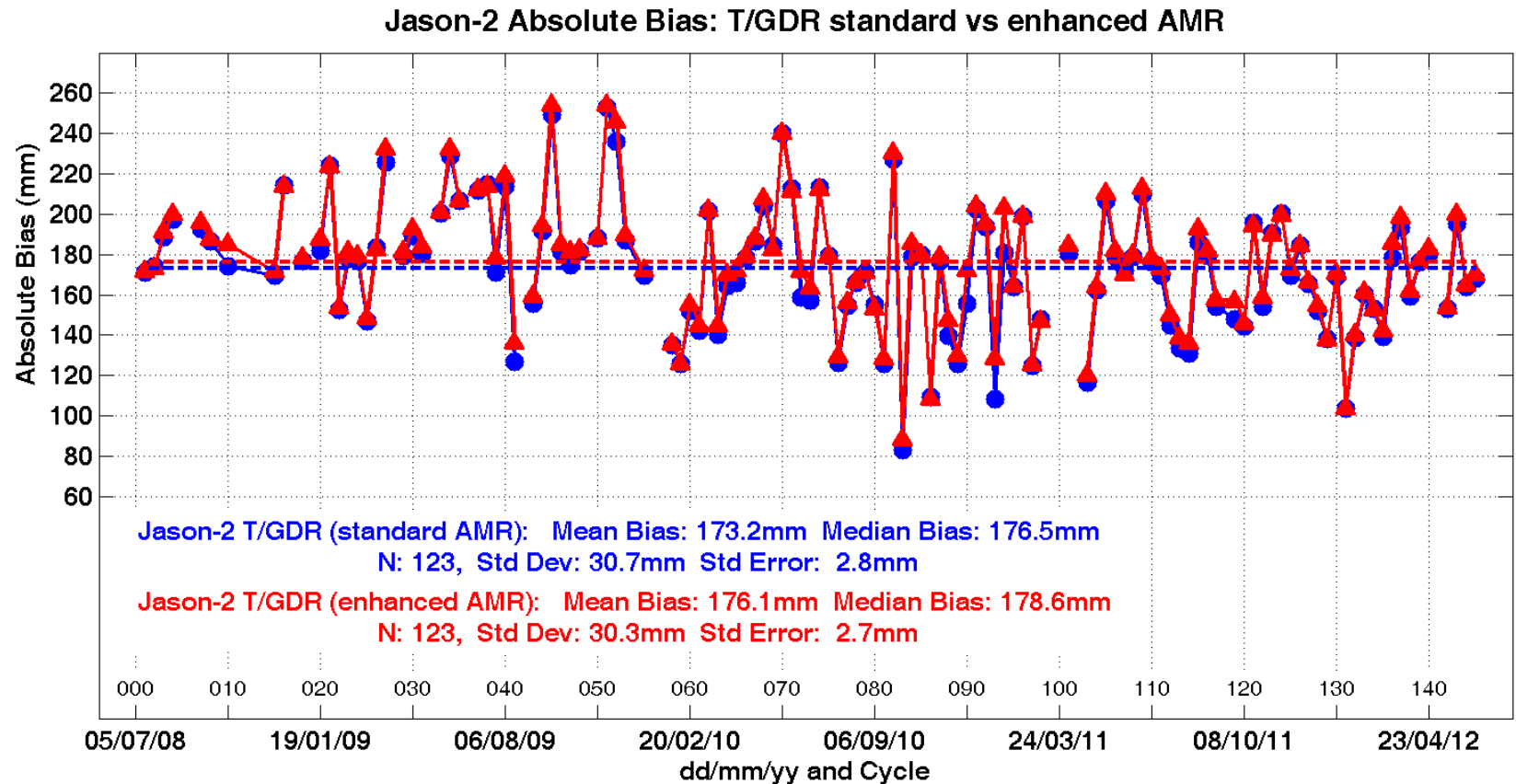
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September 2012

# Spare

# Periodic Energy



# OSTM/Jason-2 Absolute Bias: Bass Strait



- Using the enhanced AMR product increases the bias by 2.9 mm (standard deviation of the difference time series is 3.8 mm).

# Example 1Hz Buoy Data

