Absolute bias estimates from the Australian in situ sites

Christopher Watson[1,2] (cwatson@utas.edu.au)
Benoit Legresy[3]
John Church[3]
Jack Beardsley[2]
Matt King[1]
Alvaro Santamaría-Gómez[1,4]

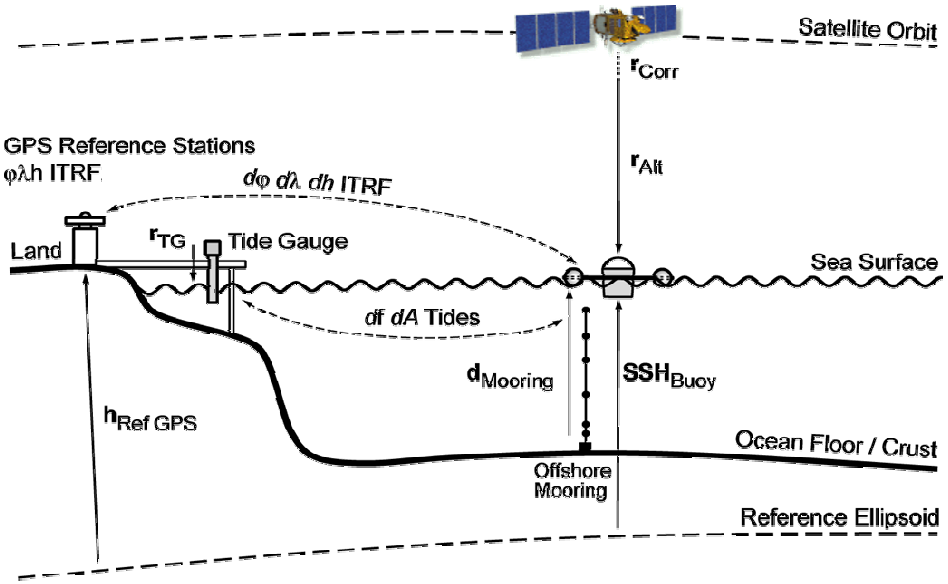
1. School of Land and Food, University of Tasmania, Hobart, Australia.
2. Integrated Marine Observing System
3. CSIRO Oceans and Atmosphere Flagship, Hobart, Australia.
4. Université de La Rochelle / CNRS, La Rochelle, France.

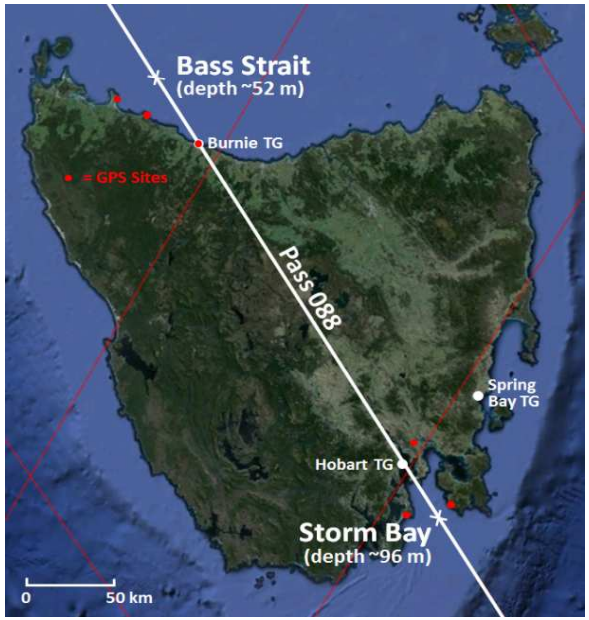
Ocean Surface Topography Science Team Meeting

October 20-23 2015
Reston, Virginia, USA

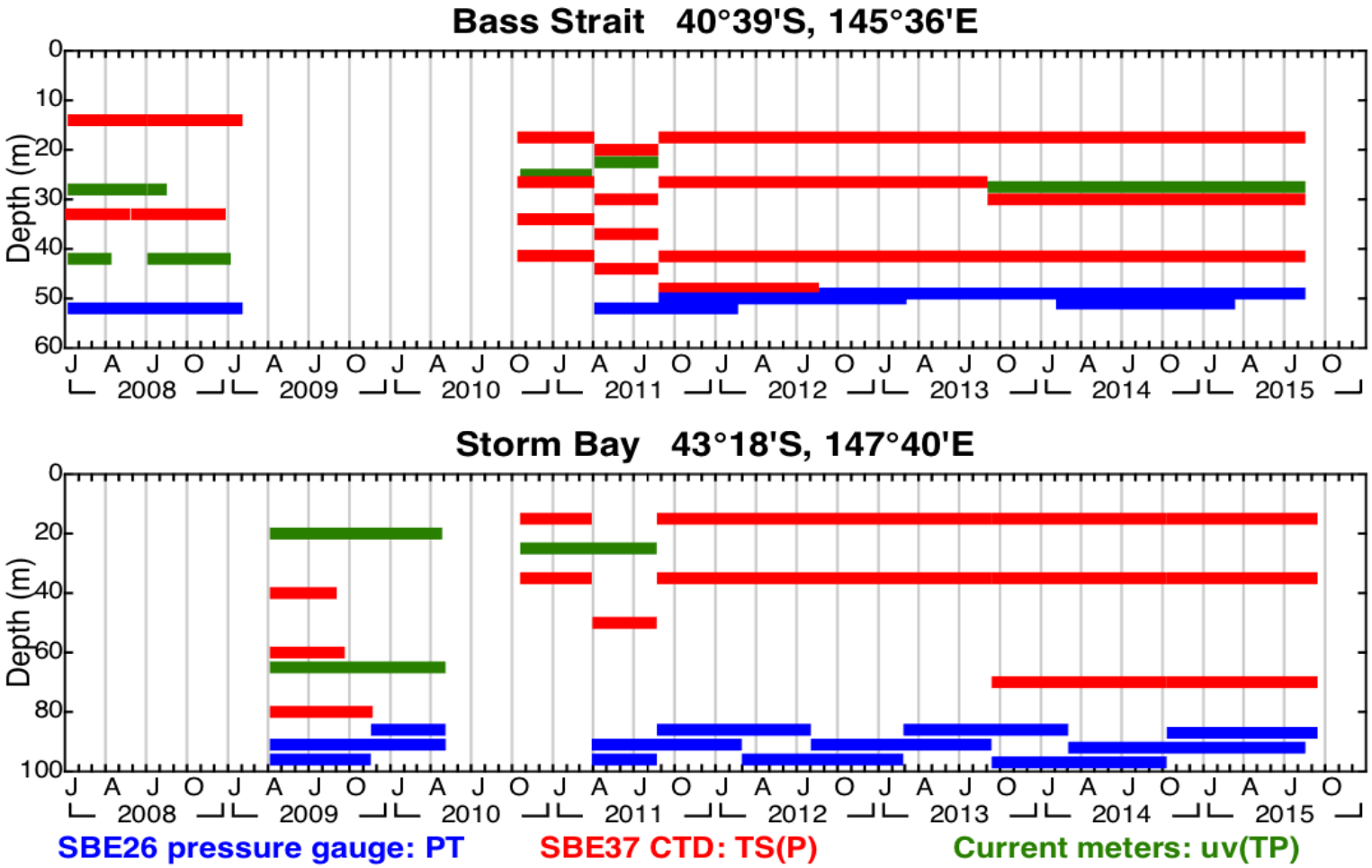
Overview

- **Bass Strait and Storm Bay in situ sites used moored oceanographic sensors and coastal tide gauges to derive relative sea level. GPS buoys are used to constrain the absolute datum.**
- **2014/15 focus has been on global bias drift work, then preparing the site for Jason-3 as well as for Sentinel-3A.**

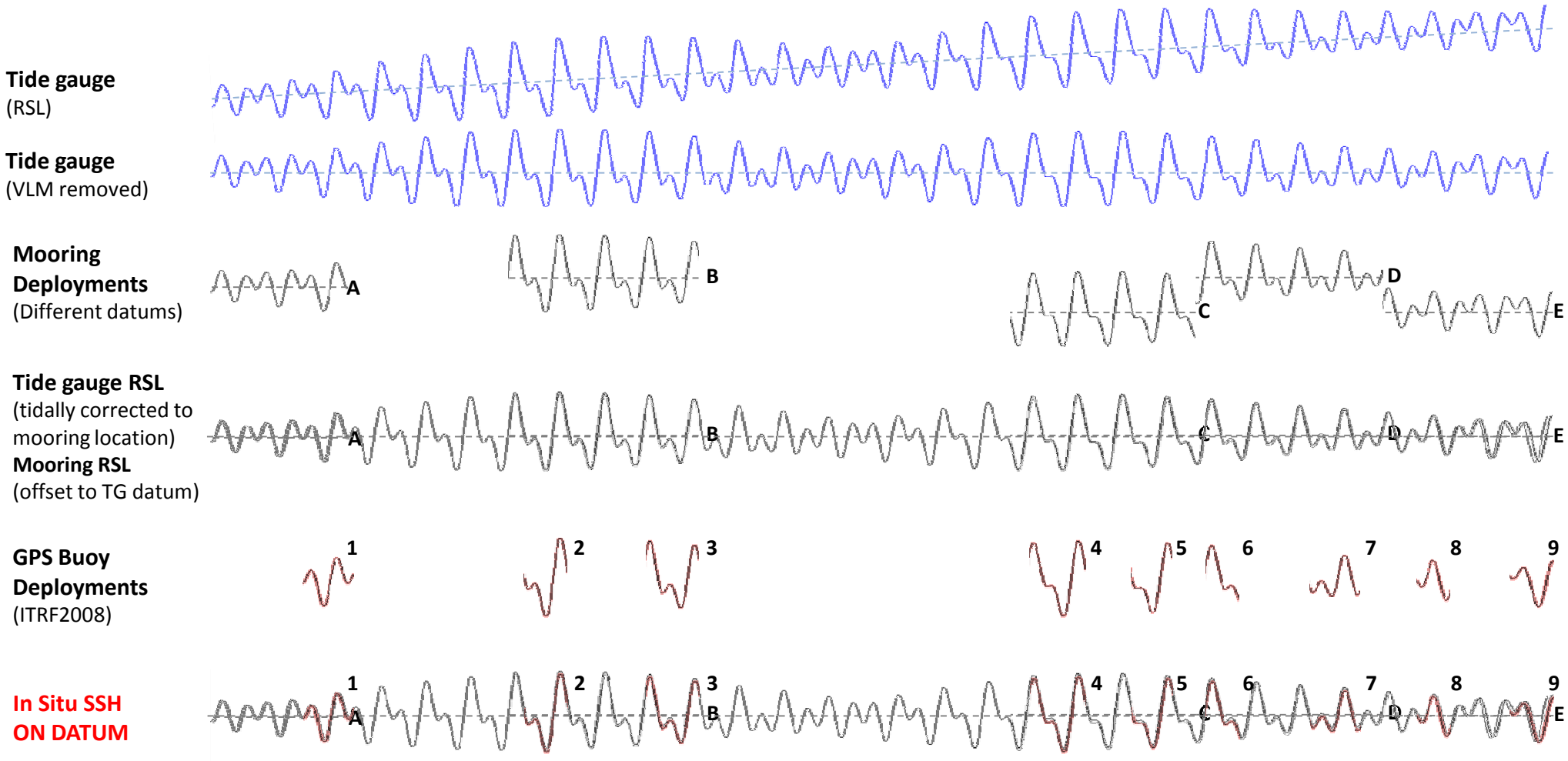




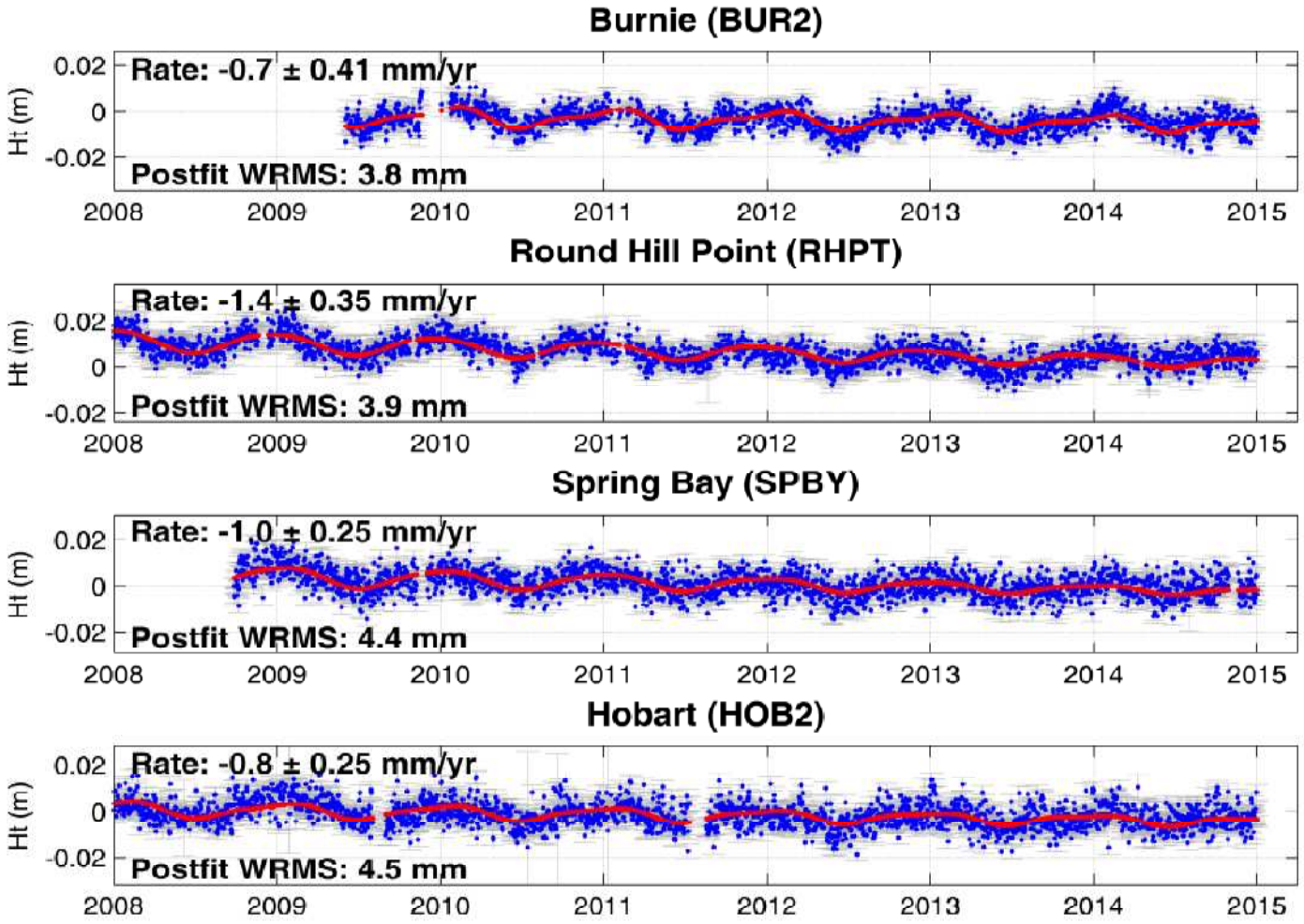
Mooring Inventory



In Situ SSH Generation

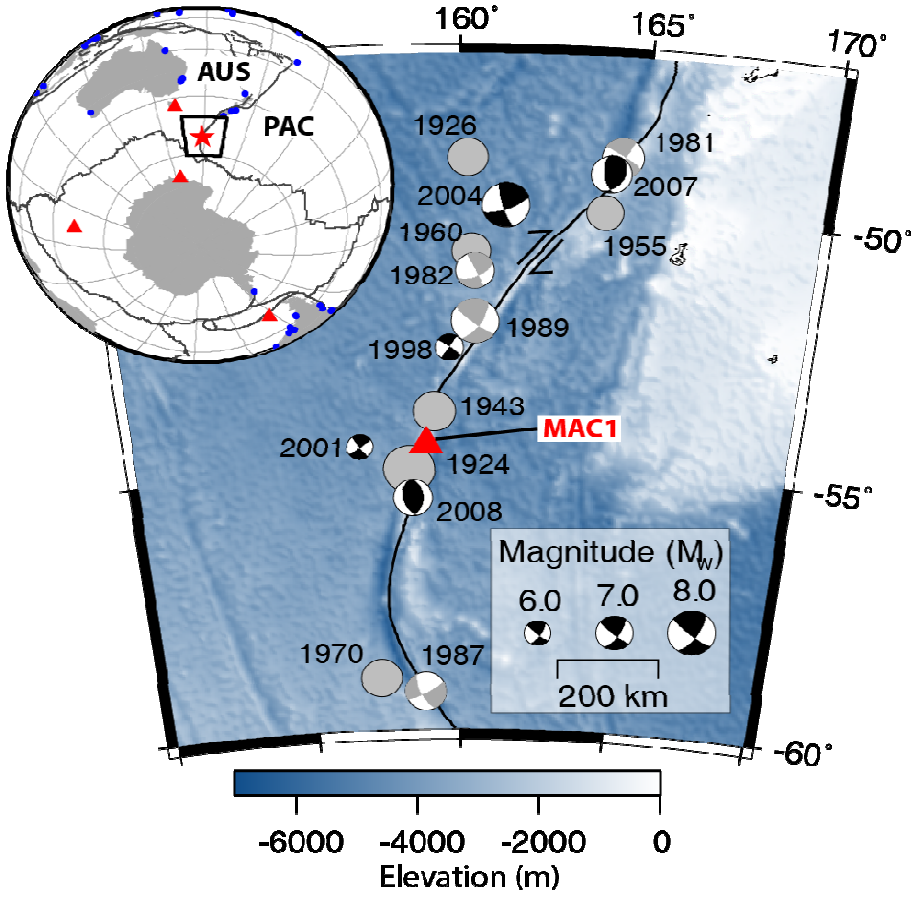


Vertical Land Motion



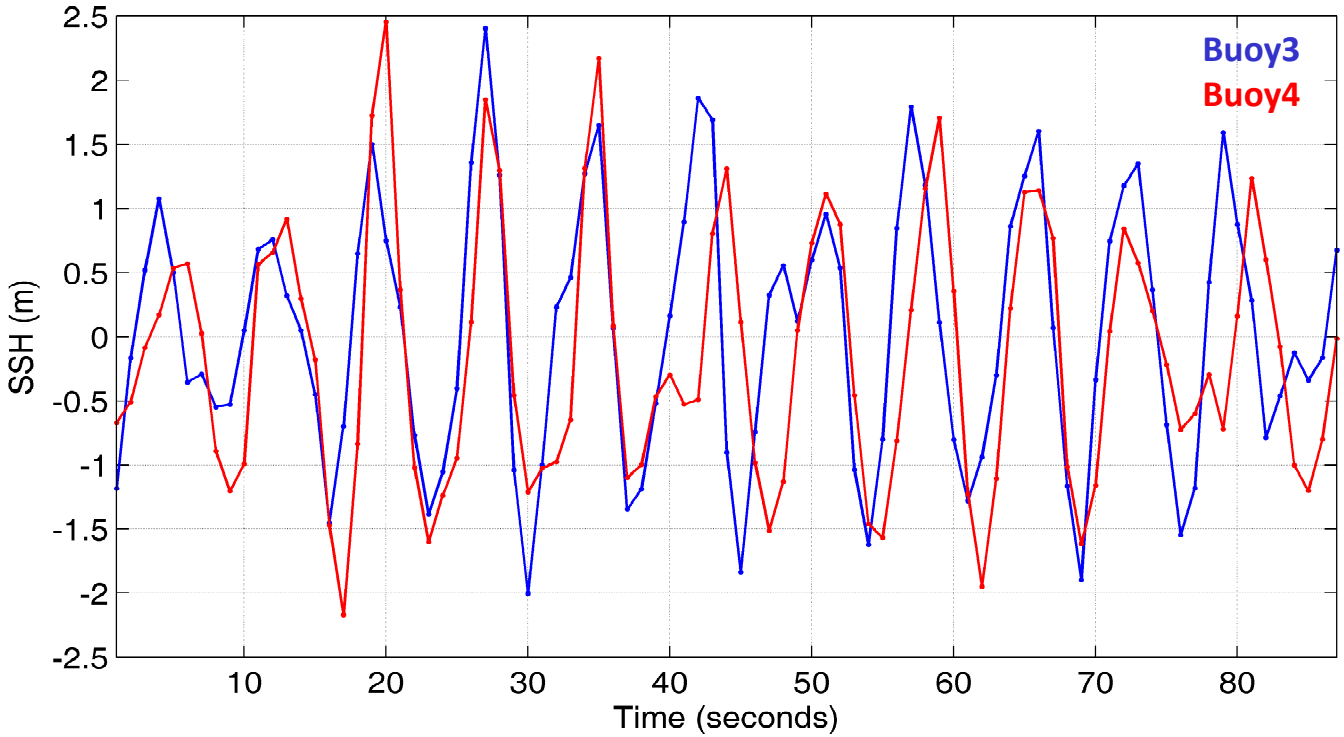
Vertical Land Motion

- **Geophysical mechanism behind the subsidence is not clear.**
- **Post-seismic relaxation following the 2004 8.1 Mw Macquarie Island earthquake (~1600 km SE of Tasmania) is known to affect the horizontal velocity across south-east Australia – not however expected to influence the vertical component.**



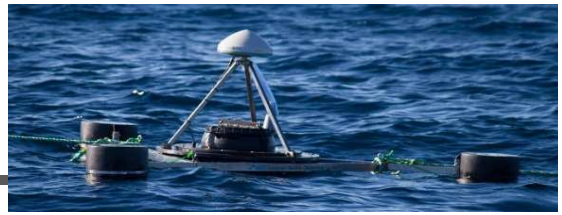
Watson et al., *GJI*, 2010

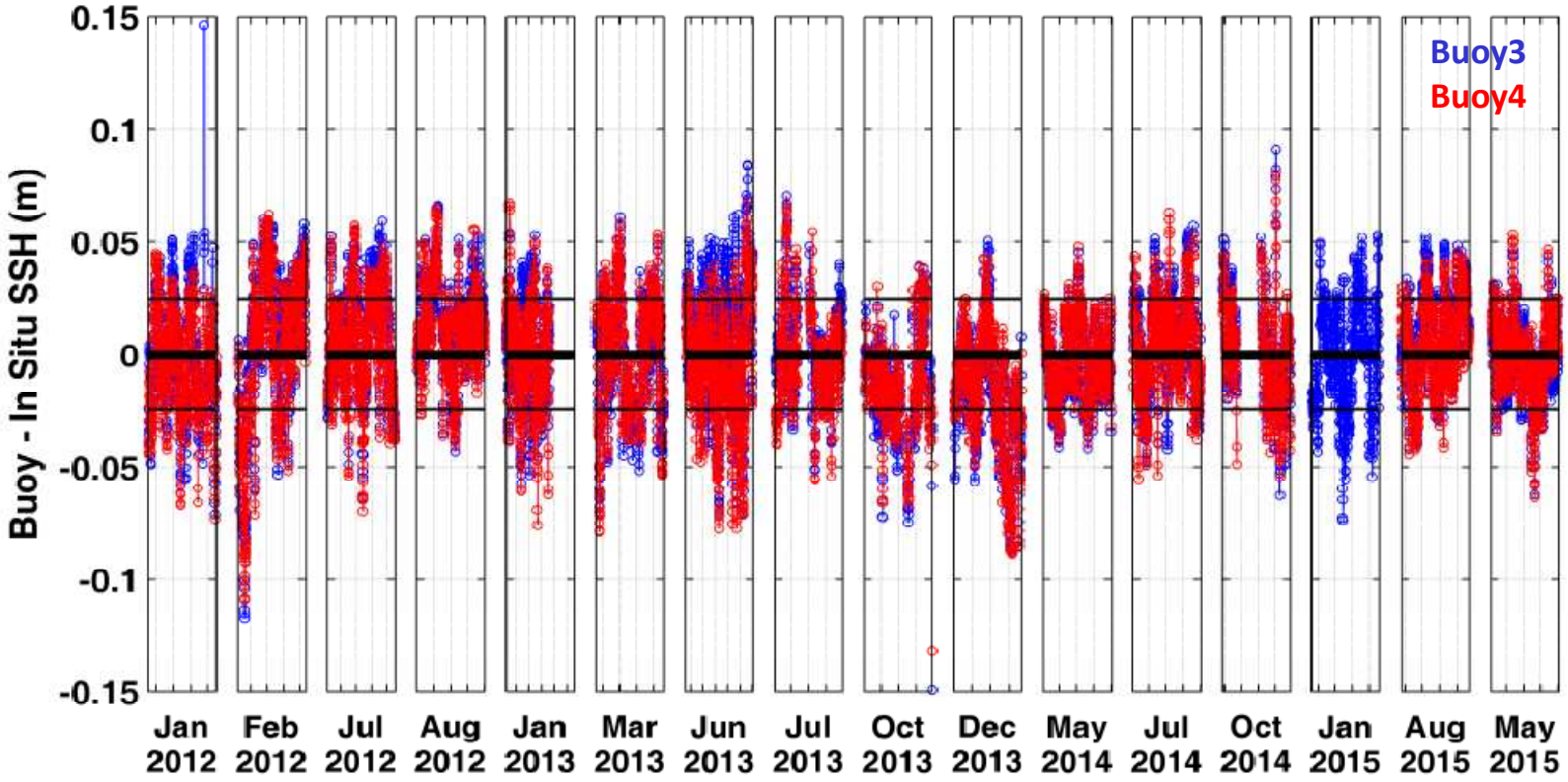
GPS Buoy Processing



- **Two buoys deployed episodically (50 m apart). Buoys performing quite well in rough conditions - peak to trough ~ 5 m in this example (period ~ 8 seconds, water depth ~50 m).**
- **Low pass filtered series used for solving for the in situ SSH datum solution**

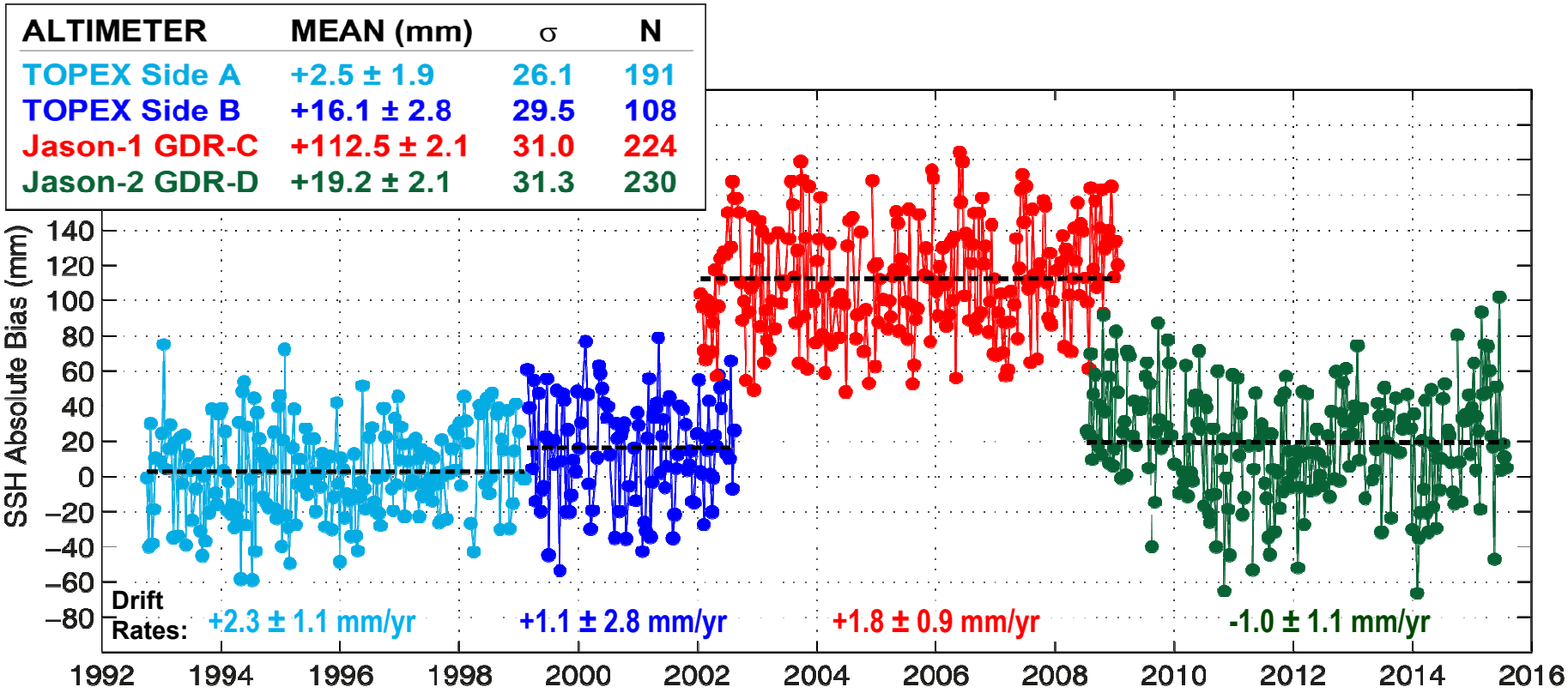
Buoy SSH - In Situ SSH





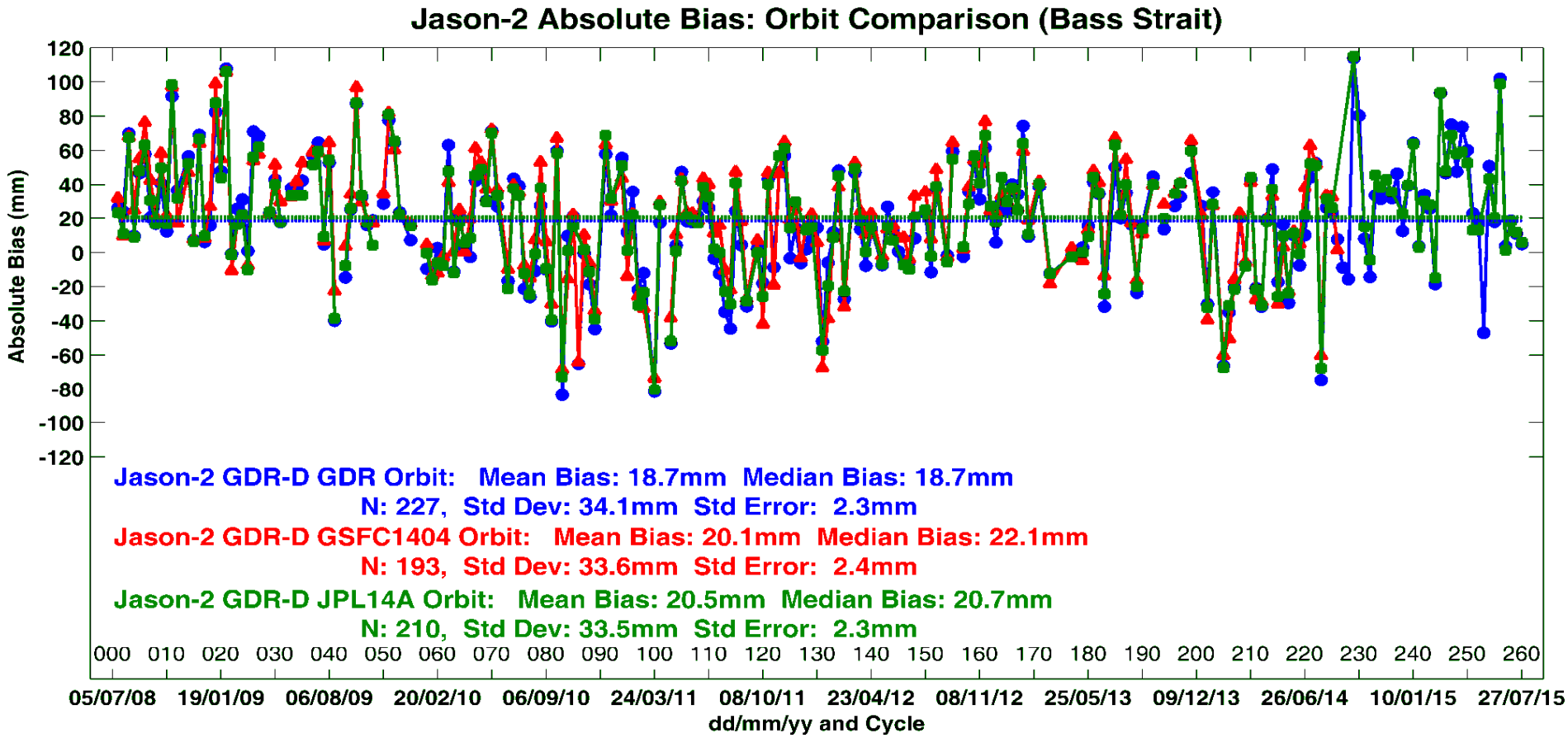
- GPS buoy SSH defines the absolute datum of the in situ record
- Close agreement between the primary and redundant buoy (red, blue)
- Standard deviation ~ 24 mm. (Note common offset removed in Figure)

Results



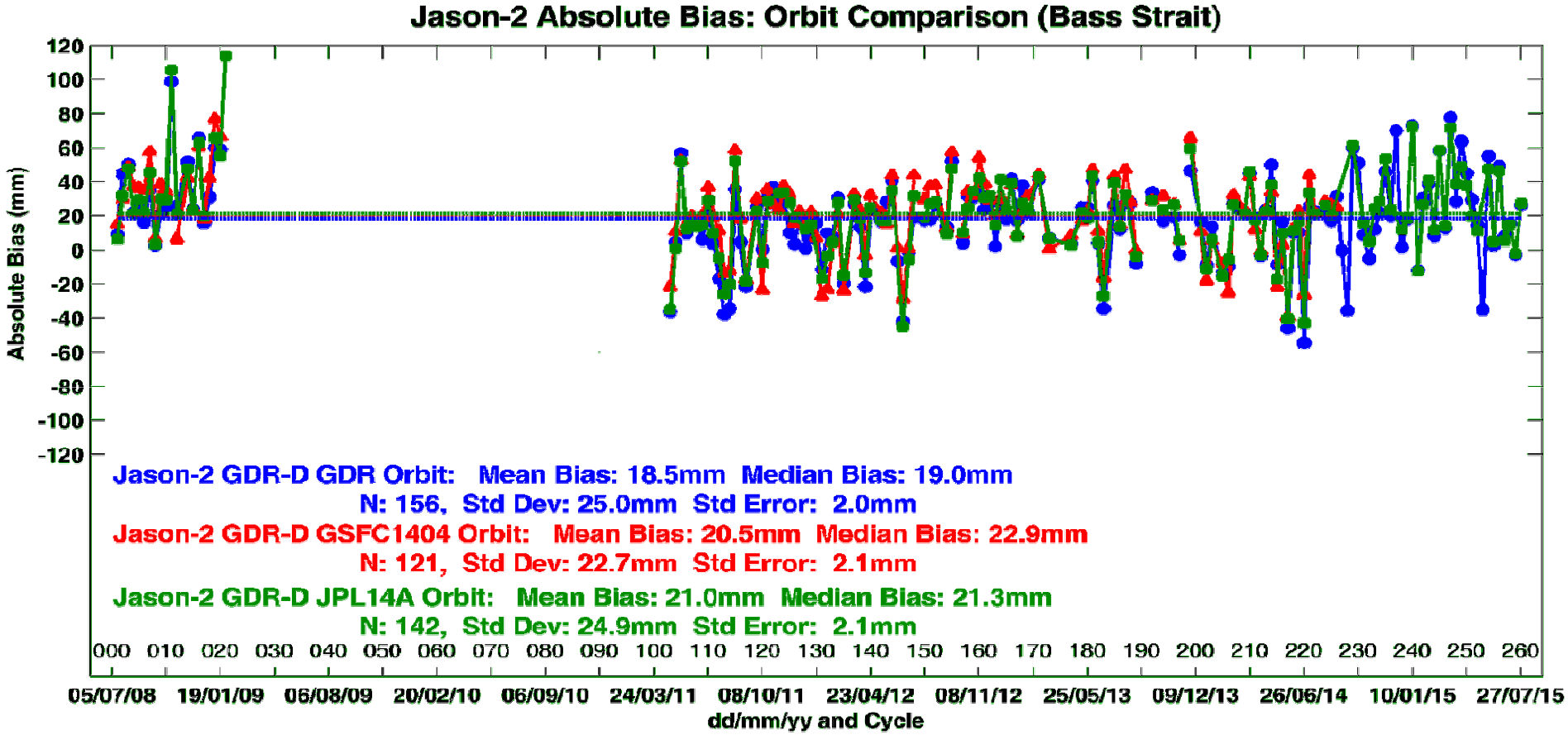
- **Awaiting complete Jason-1 GDR-E to refine our Jason-1 time series**
- **Jason-2 appears non-linear and temporally correlated.**

Orbit Comparison (vs Tide Gauge)



- **Will be updating to the std1504 over coming months**

Orbit Comparison (vs Mooring)



- **Negligible change to the mean (expected) but reduction in variability when using just the mooring SSH. DAC between tide gauge and mooring under investigation.**

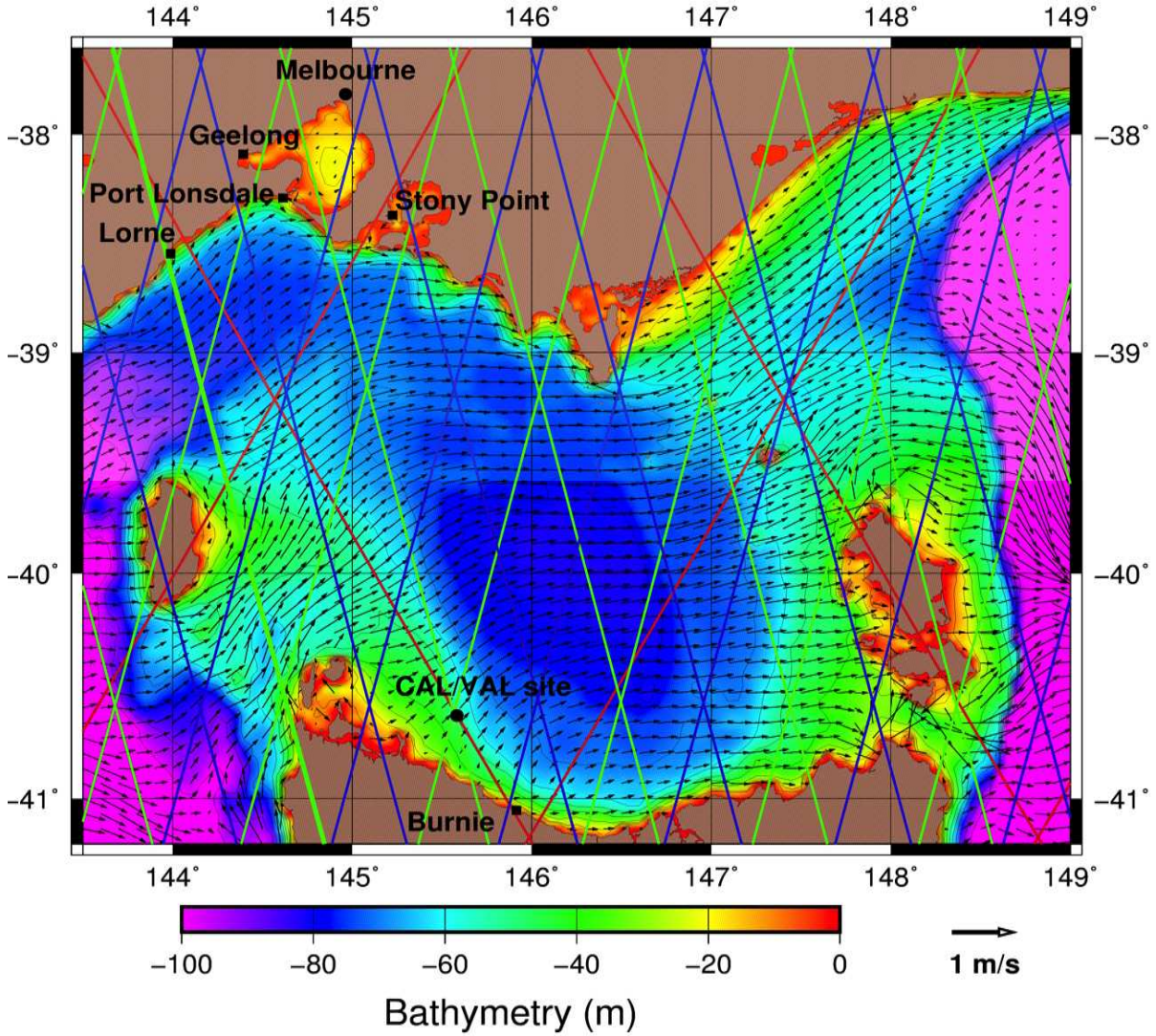
Part II – Developments at Bass Strait

1. “Regional extension” of the Bass Strait data to EnviSat and SARAL (Cancet et al.)
2. New mooring deployment and model investigations in preparation for ESA Sentinal-3A and 3B.
3. Early planning for SWOT

Model Integration

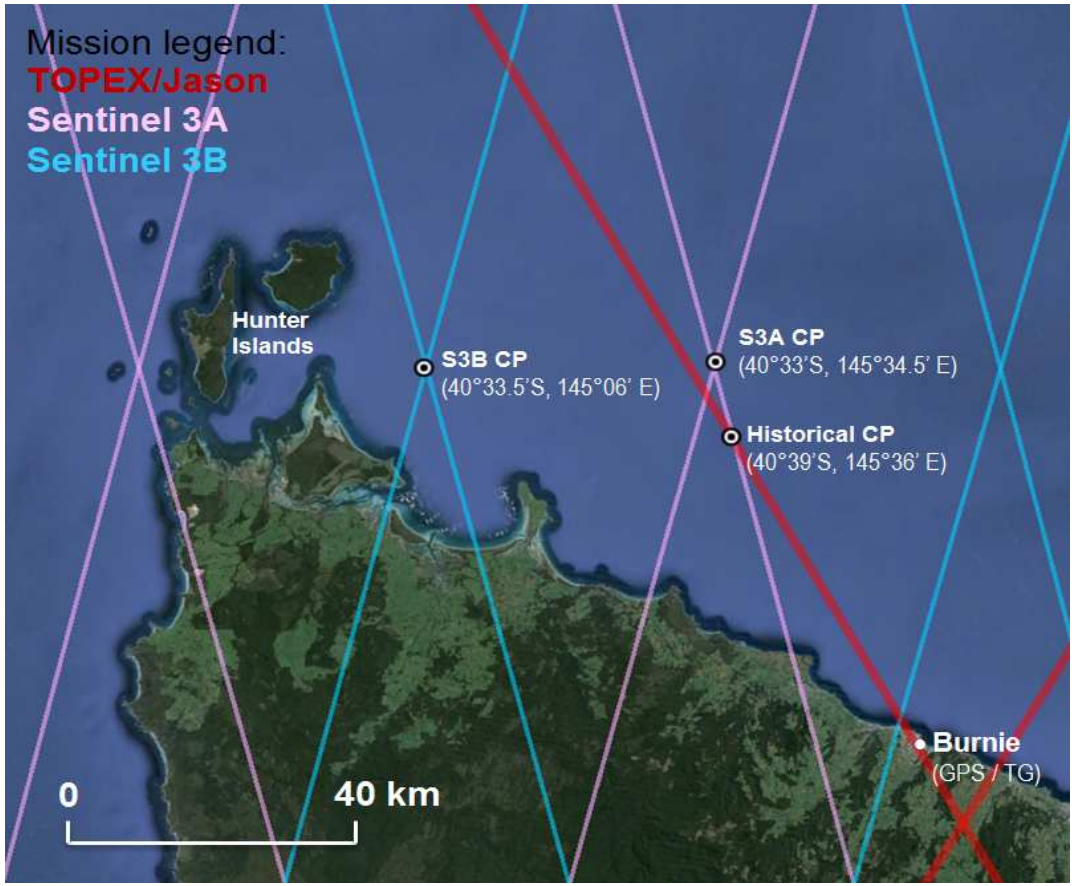
- **Currently investigating the combination of moored instrumentation with the Sparse Hydrodynamic Ocean Code (SHOC5) model for Bass Strait developed at CSIRO (Herzfeld, 2006) for extending existing calval site to other comparison points.**

- **SHOC-Bass is 3D fully thermo-dynamic, has ~2.5 km horizontal resolution and 8 layers on a curvilinear grid, has a free surface and is embedded into the large scale operational model and forced with the atmospheric operational model.**



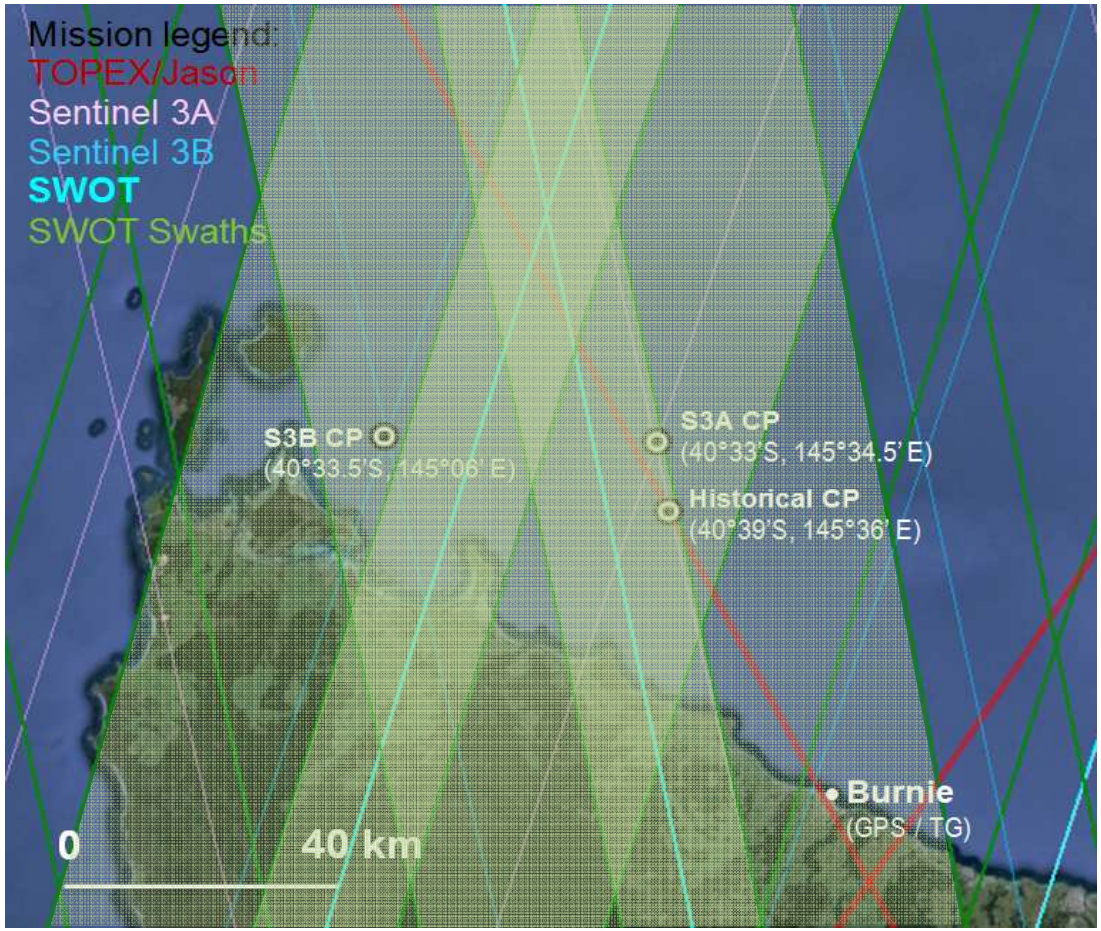
Sentinel-3A

- Sentinel-3A cross over (S3A CP) is located ~ 7 km north of the historical Jason-series comparison point.
- S3A CP instrumented with a pressure gauge in August 2015.
- Buoy deployments from Oct 2015 will be at historical CP and S3A.
- Plans to instrument S3B site in late 2016.



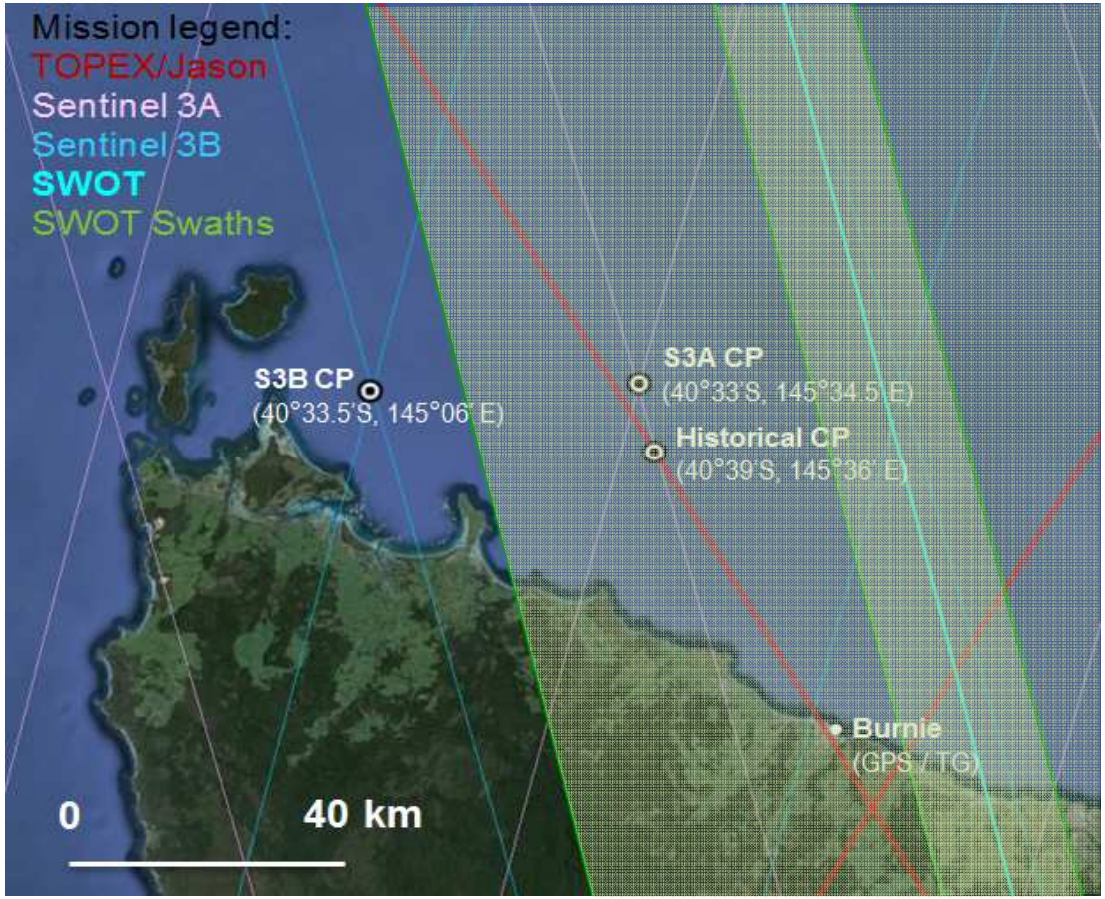
SWOT – Proposed 21 day orbit

- **SWOT X-over ~50 km to the north of historical CP (difficult to instrument given sea floor sediment at this location).**
- **Historical and S3A CPs within inner swath of Desc Pass 65 (9 km from nadir).**
- **S3B CP just outside inner swath of Asc Pass 328 but suitable for KaRIN of Asc Pass 328 and Desc Pass 65.**



SWOT – 1 day orbit

- **SWOT 1 day orbit nadir is 30 km east of our historical comparison point. Suitable for KaRIN.**
- **Considering options for how we could contribute more than just point wise calval during this period.**



Conclusions

1. Updated datum solution includes new buoy deployments as well as consideration of subsidence across south east Australia.
2. OSTM/Jason-2 absolute bias is stable at ~ 2 cm at the Bass Strait cal/val site. Variability is at the 3 cm level.
3. Comparable results obtained from the Storm Bay site, albeit with slightly larger variability.
4. Regarding likely uncertainty, non-time averaging systematic errors are likely to be order ~ 15 mm.
5. Well prepared for the launch of Jason-3 and Sentinel-3A with moorings in place. Considering options for SWOT.

Questions?

Christopher Watson[1,2] (cwatson@utas.edu.au)
Benoit Legresy[3]
John Church[3]
Jack Beardsley[2]
Matt King[1]
Alvaro Santamaría-Gómez[1,4]

1. School of Land and Food, University of Tasmania, Hobart, Australia.
2. Integrated Marine Observing System
3. CSIRO Oceans and Atmosphere Flagship, Hobart, Australia.
4. Université de La Rochelle / CNRS, La Rochelle, France.

Ocean Surface Topography Science Team Meeting

October 20-23 2015
Reston, Virginia, USA