Updated in situ validation results of satellite altimetry from the Bass Strait facility

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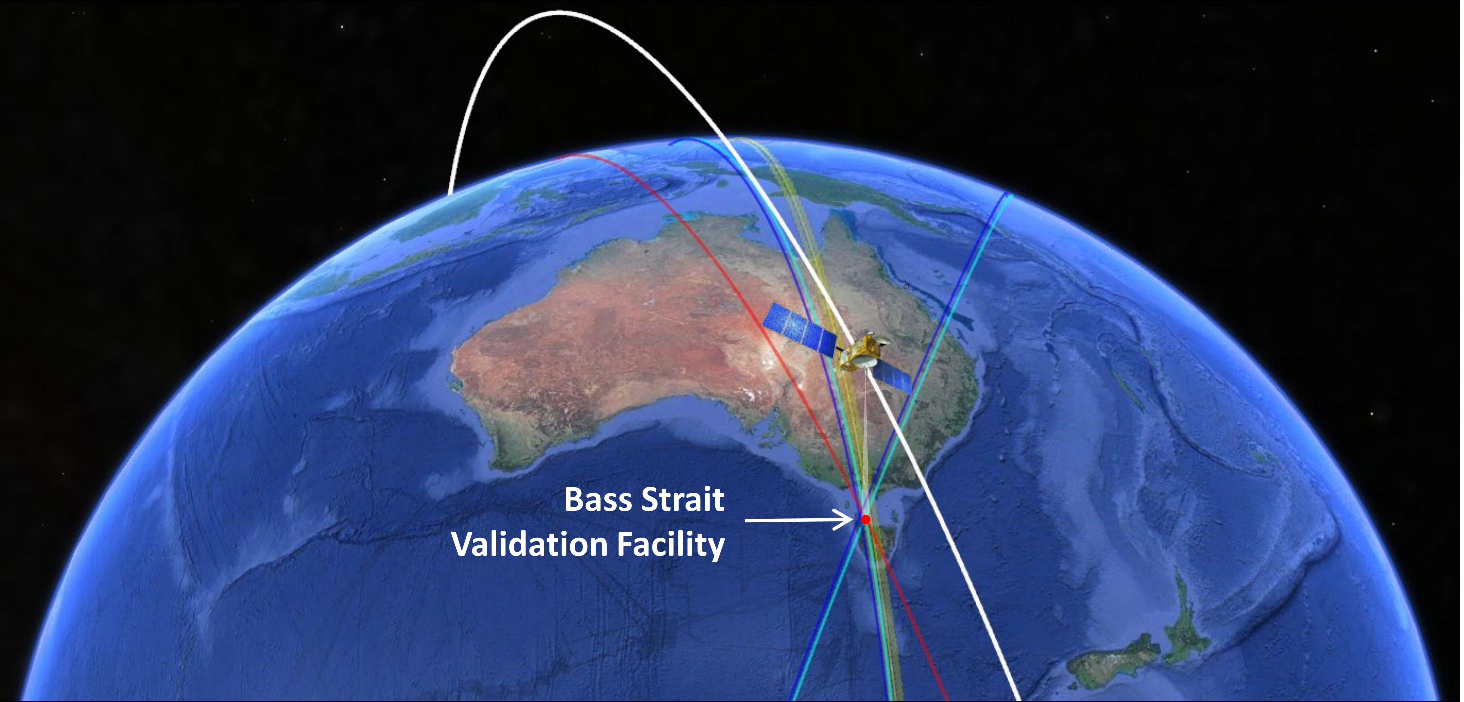
Benoit Legresy[3,2], (Benoit.Legresy@csiro.au),
Jack Beardsley[2], Matt King[1]. + CSIRO Moorings Team

1. University of Tasmania
2. Integrated Marine Observing System
3. CSIRO Environment



UNIVERSITY of TASMANIA

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SENTINEL-6B
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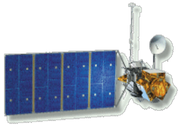
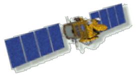
OSTST at S6B Launch
Buellton, CA, USA
November 15-16, 2025

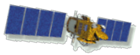
Overview from the Bass Strait Facility:



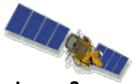
TOPEX / Poseidon
Aug 1992



Jason-1
Dec 2001

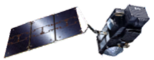


OSTM/Jason-2
June 2008

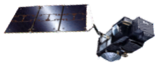


Jason-3
Jan 2016

- This presentation for the abbreviated OSTST 2025 provides a brief update of absolute bias results for **Jason-3** and **Sentinel-6 Michael Freilich** from the Bass Strait facility.
- For detailed results contact the authors for copies of the following recent presentations:
    - 30YPRA Meeting (Montpellier, France. 2024): *30 years of in situ altimeter validation: Results and perspectives from the Bass Strait facility.*
    - SWOT ST Meeting (Arcachon, France. 2025): *Contributions to SWOT validation from Bass Strait and the Southern Ocean.*
- **We expect to provide a comprehensive update across all missions at the regular OSTST to be held in Wiesbaden, Germany in June 2026.**

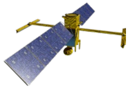


Sentinel-3A
Feb 2016



Sentinel-3B
Apr 2018

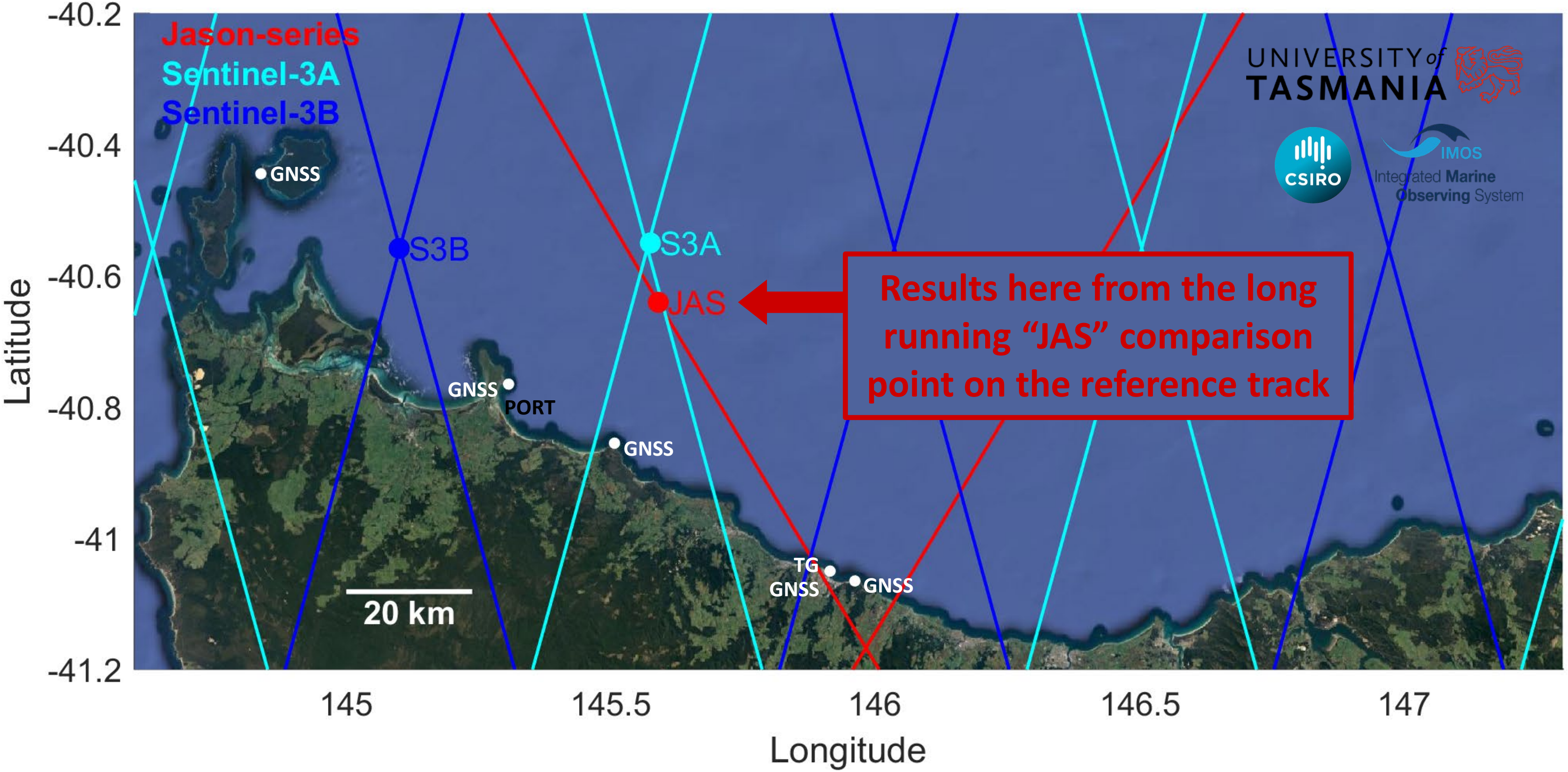
Sentinel-6 / Michael Freilich
Nov 2020



SWOT
Dec 2022

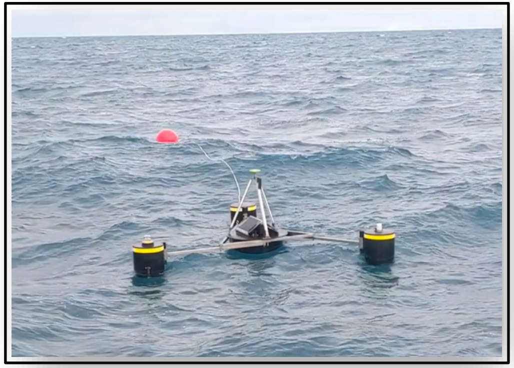
Sentinel-6B
Launching Nov 2025

Bass Strait Validation Facility:



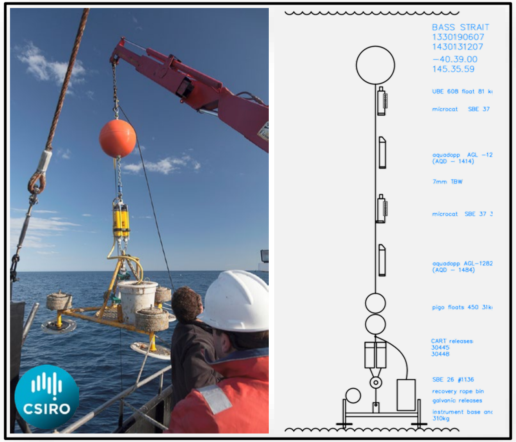
Recap: Bass Strait Validation Facility

- **Direct, geometric approach to in situ altimeter validation.**
- **In situ observations at offshore locations must keep pace with satellite developments.**



GNSS/INS Equipped Buoys

- Deployed episodically at comparison points to determine the absolute datum of in situ SSH time series.
- Extended to include inertial sensors (INS) for orientation.



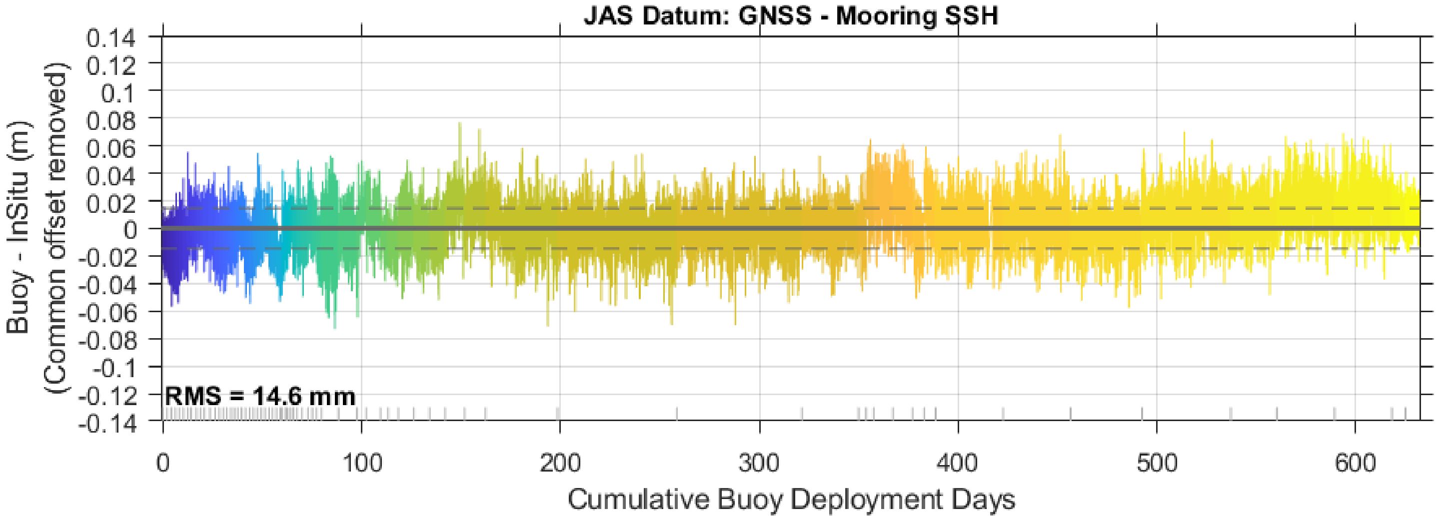
Moored Sensors

- Bottom pressure, temp and salinity to determine continuous SSH time series (datum from GNSS buoys).
- Current, waves, pressure inverted echo sounders (CWPIES) yield SSH as well as currents.
- Acknowledgements to Benoit Legresy (CSIRO) and moorings team for a massive sustained effort.

Tide Gauge / GNSS

- "Climate quality" coastal tide gauge (BoM).
- Numerous inland GNSS to provide vertical land motion (VLM).
- GNSS also offers insight into spatial/temporal evolution of the troposphere.

Bass Strait Datum from GNSS Buoys:



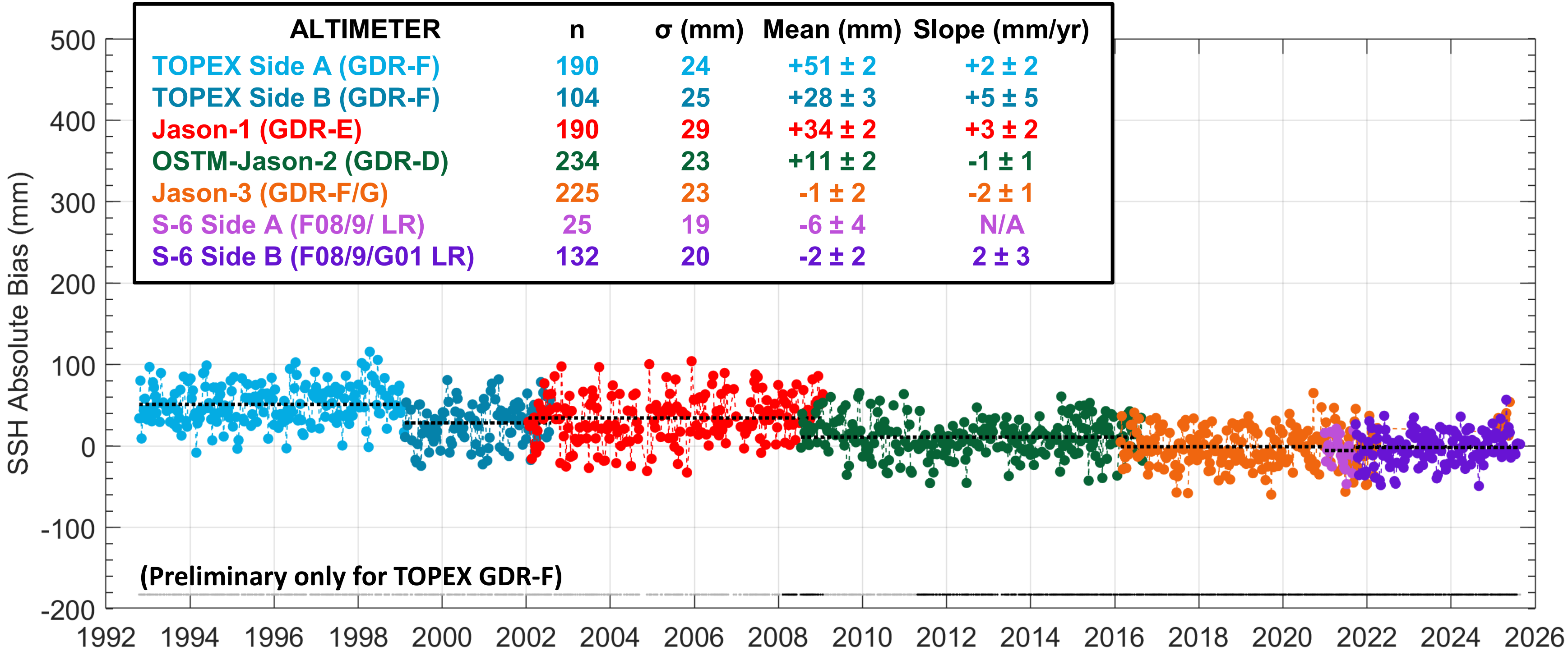
- Each colour represents a different GNSS buoy deployment over our moored in situ oceanographic sensors (each deployment delineated by vertical ticks along x-axis).
- Variability of this residual of 14.6 mm (buoy – in situ mooring) gives a sense of our in situ precision.

Results I:

Absolute Biases

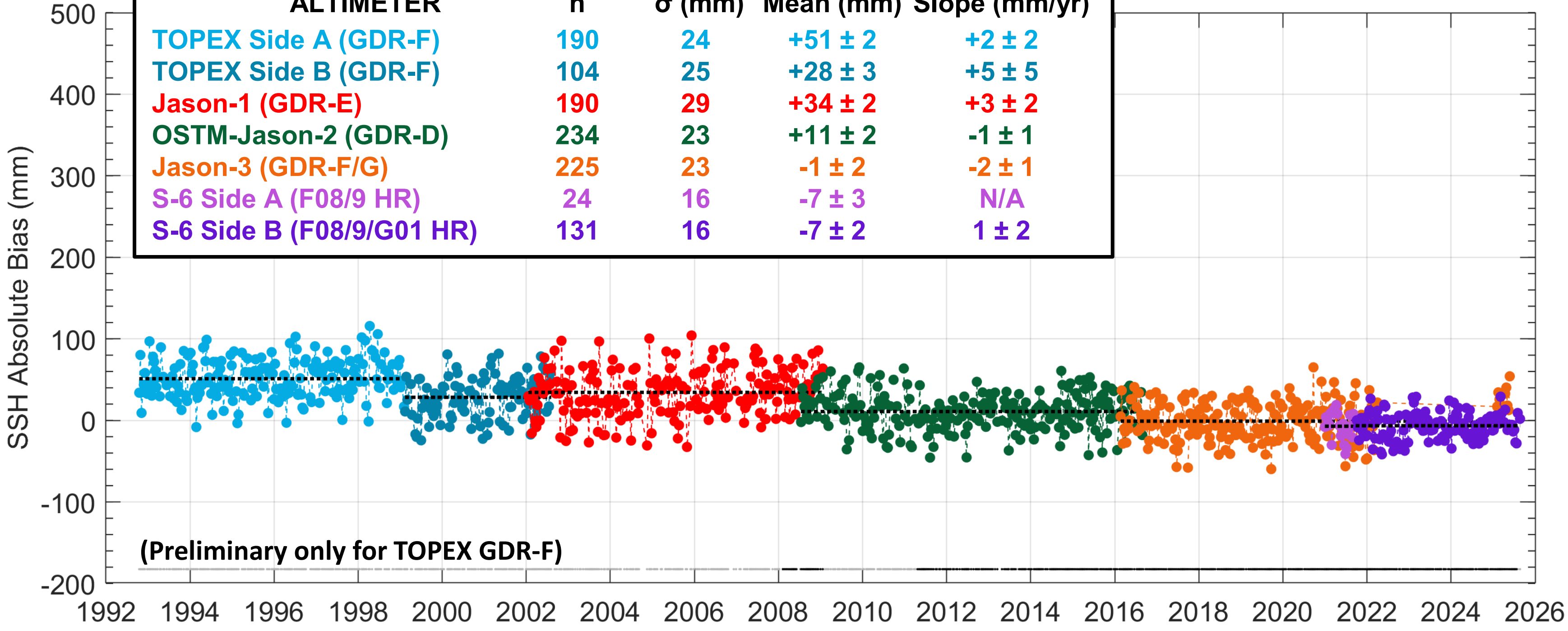
Absolute Bias Results

ALTIMETER	n	σ (mm)	Mean (mm)	Slope (mm/yr)
TOPEX Side A (GDR-F)	190	24	+51 ± 2	+2 ± 2
TOPEX Side B (GDR-F)	104	25	+28 ± 3	+5 ± 5
Jason-1 (GDR-E)	190	29	+34 ± 2	+3 ± 2
OSTM-Jason-2 (GDR-D)	234	23	+11 ± 2	-1 ± 1
Jason-3 (GDR-F/G)	225	23	-1 ± 2	-2 ± 1
S-6 Side A (F08/9/ LR)	25	19	-6 ± 4	N/A
S-6 Side B (F08/9/G01 LR)	132	20	-2 ± 2	2 ± 3



Caution: Note Jason-3 has mix of GDR F/G, and Sentinel-6 has a mix of F08/09/G01

Absolute Bias Results



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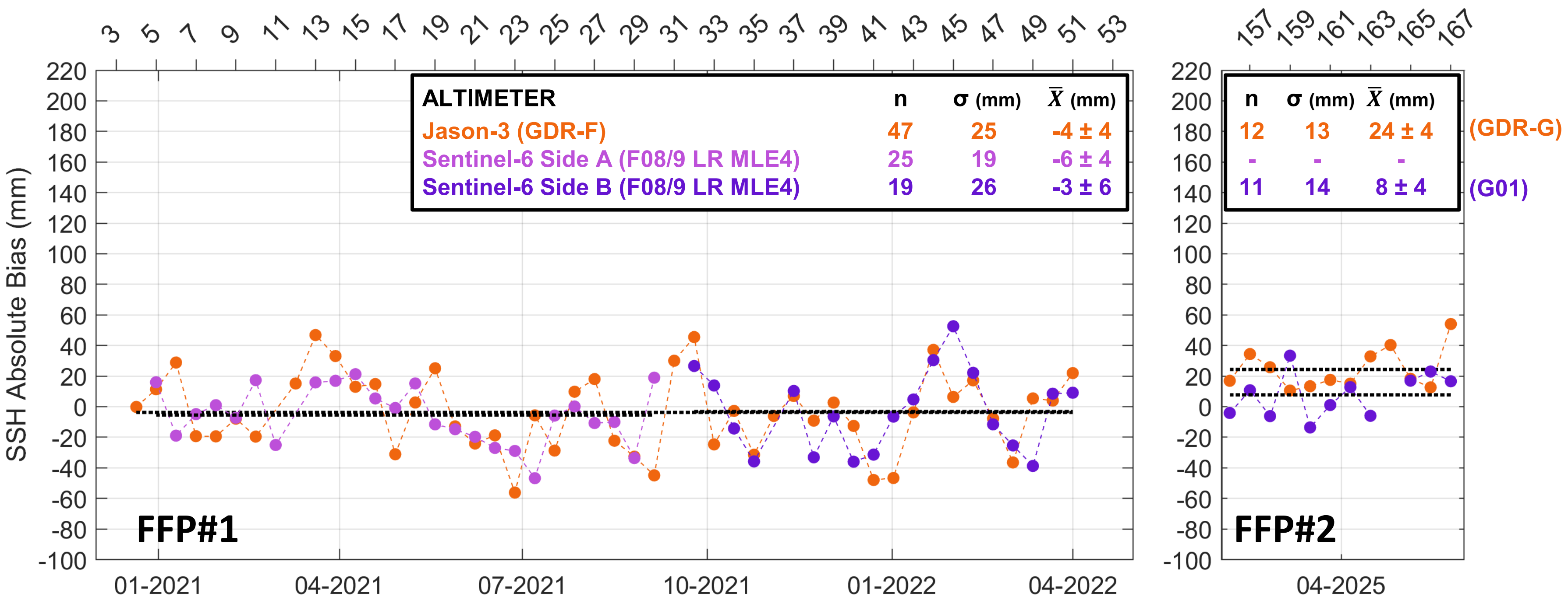
S-6 Side A (F08/9 HR)	24	16	-7 ± 3	N/A
S-6 Side B (F08/9/G01 HR)	131	16	-7 ± 2	1 ± 2

Caution: Note Jason-3 has mix of GDR F/G, and Sentinel-6 has a mix of F08/09/G01

Results II:

Jason-3 / Sentinel-6 Absolute Biases over Formation Flight Periods (FFP)

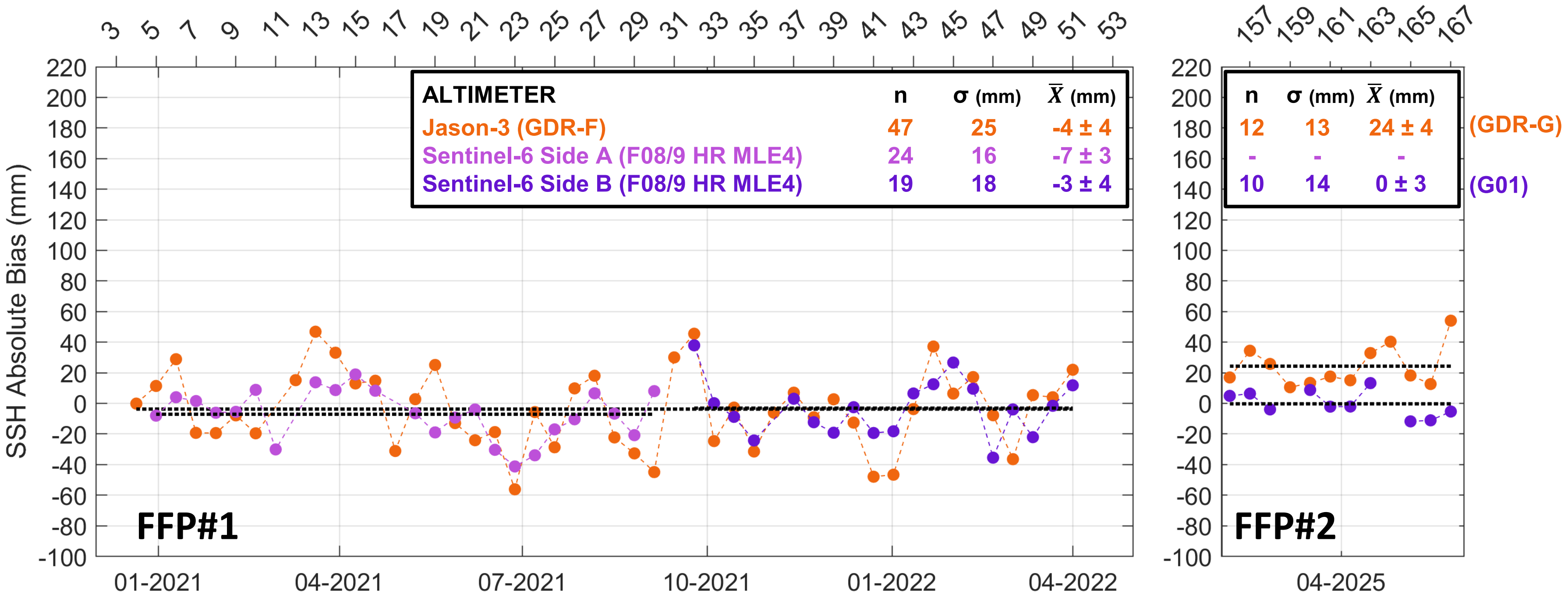
J3 / S6 (LR) SSH Bias, Formation Flight Periods



Caution: Jason-3 has a mix of GDR-F (FFP1) and GDR-G (FFP2)

Caution: Sentinel-6 has a mix of F08/09 (FFP1) and G01 (FFP2)

J3 / S6 (HR) SSH Bias, Formation Flight Periods



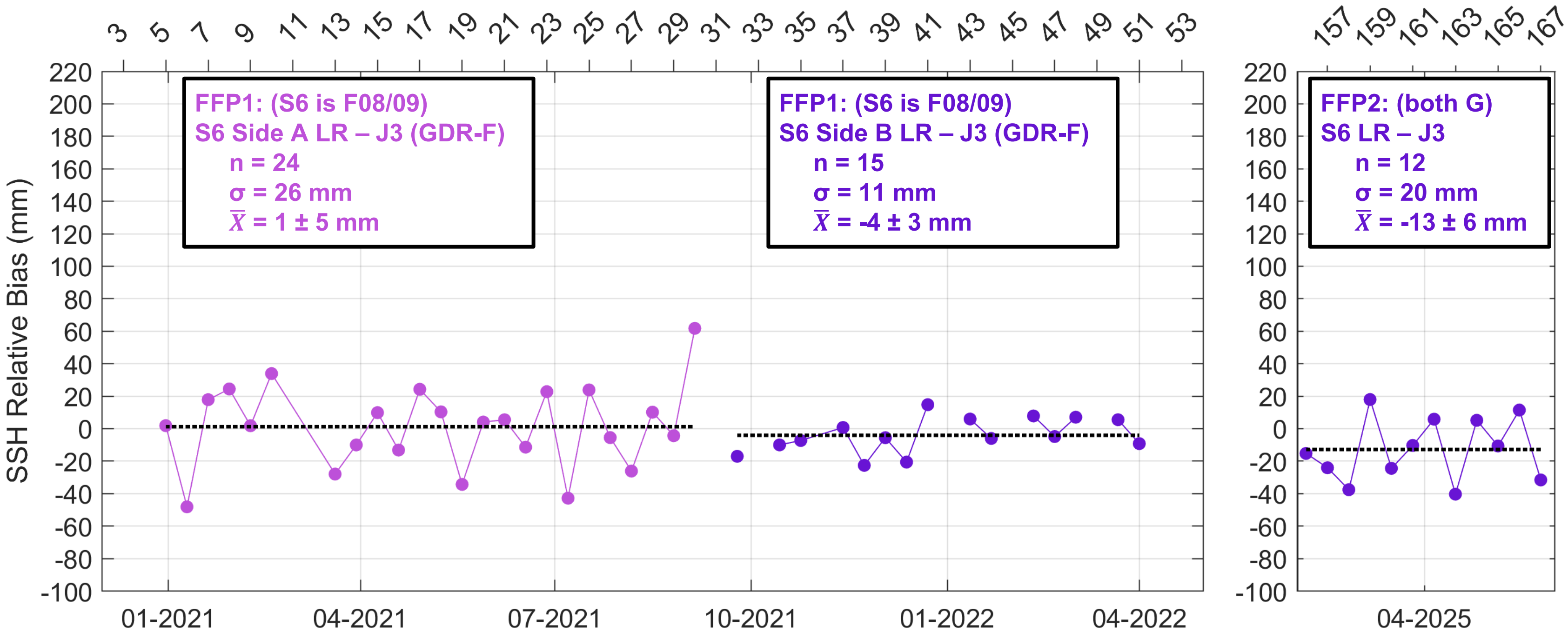
Caution: Jason-3 has a mix of GDR-F (FFP1) and GDR-G (FFP2)

Caution: Sentinel-6 has a mix of F08/09 (FFP1) and G01 (FFP2)

Results III:

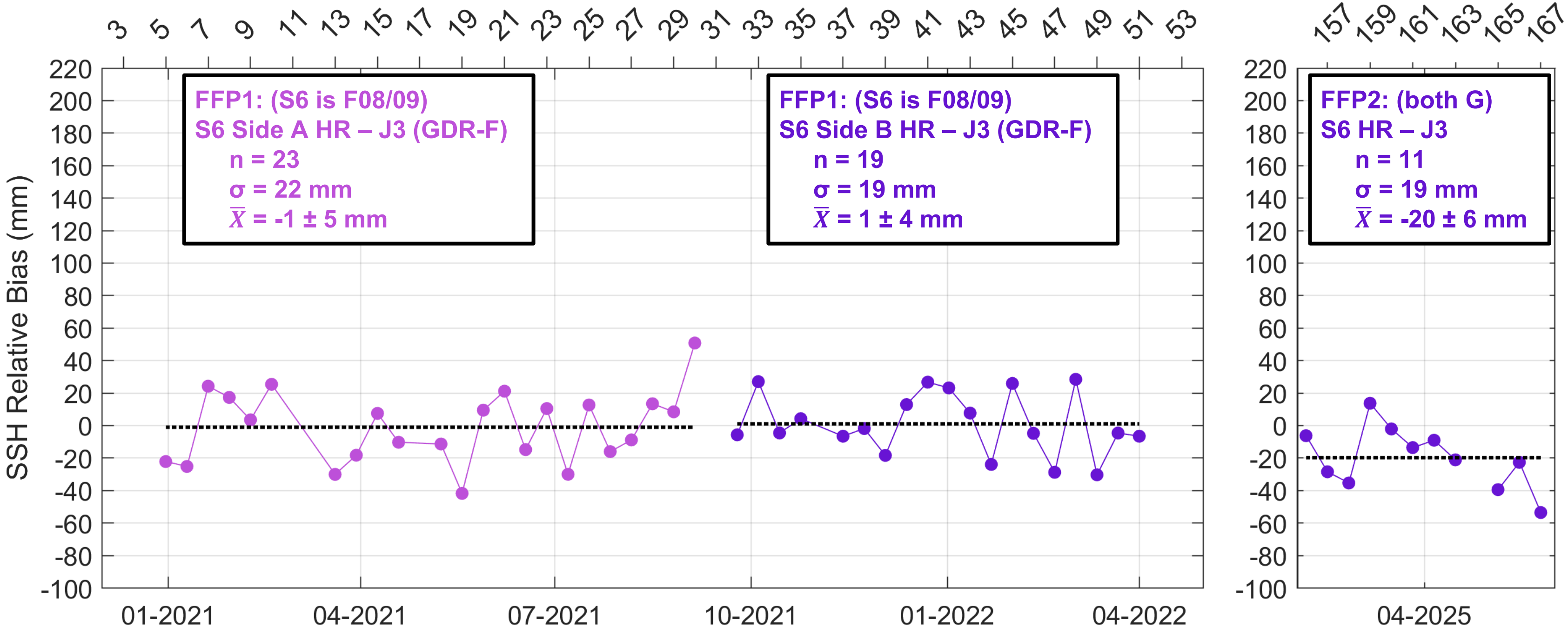
Jason-3 / Sentinel-6 Relative Biases over Formation Flight Periods (FFP)

J3 / S6 (LR) Relative Bias, Formation Flight Periods



There is a suggestion here that that relative bias between S6 (LR) and J3 has changed between FFP1 and FFP2, ***however products are not consistent*** (mixture of F08/09/G01 for Sentinal-6, and GDR-F/G for Jason-3).

J3 / S6 (HR) Relative Bias, Formation Flight Periods



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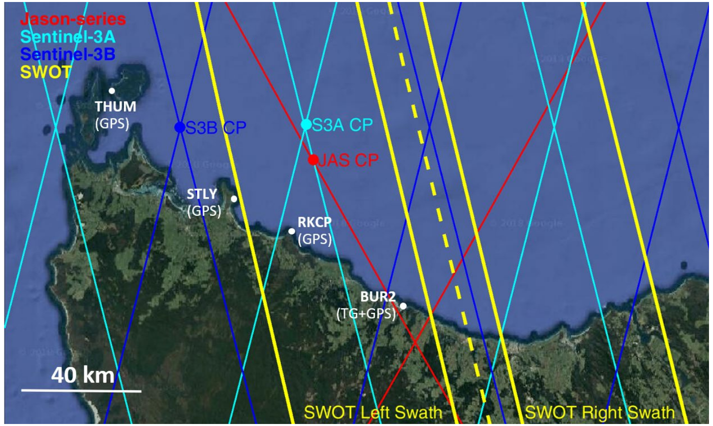
Summary and Preparations for Sentinel-6B

- Jason-2, Jason-3 and Sentinel-6 **each have biases insignificantly different from zero** at the Bass Strait facility.
- Variability of S6 HR bias just 16 mm (compared to 20 mm for LR).
- We see a suggestion of a change in the relative bias between S6 and J3 from FFP1 and FFP2, however we can't discount this being simply caused by **inhomogeneous product versions** currently available.
- The Bass Strait facility has redundant pairs of moorings at three comparison points, combined with longer buoy deployments to control the vertical datum. We are **ready for Sentinel-6B.**



Next steps before OSTST 2026:

- We will be recomputing our datum solution to consider latest estimates of vertical land motion and ~650 buoy-days of GNSS buoy data at the reference-mission comparison point.
- We plan to homogeneously reprocess all missions using latest standards (e.g. recomputing Jason-3 and Sentinel-6 biases with consistent "G" standards once released).
- We look forward to providing our first estimates of Sentinel-6B biases from Bass Strait.

SENTINEL-6B
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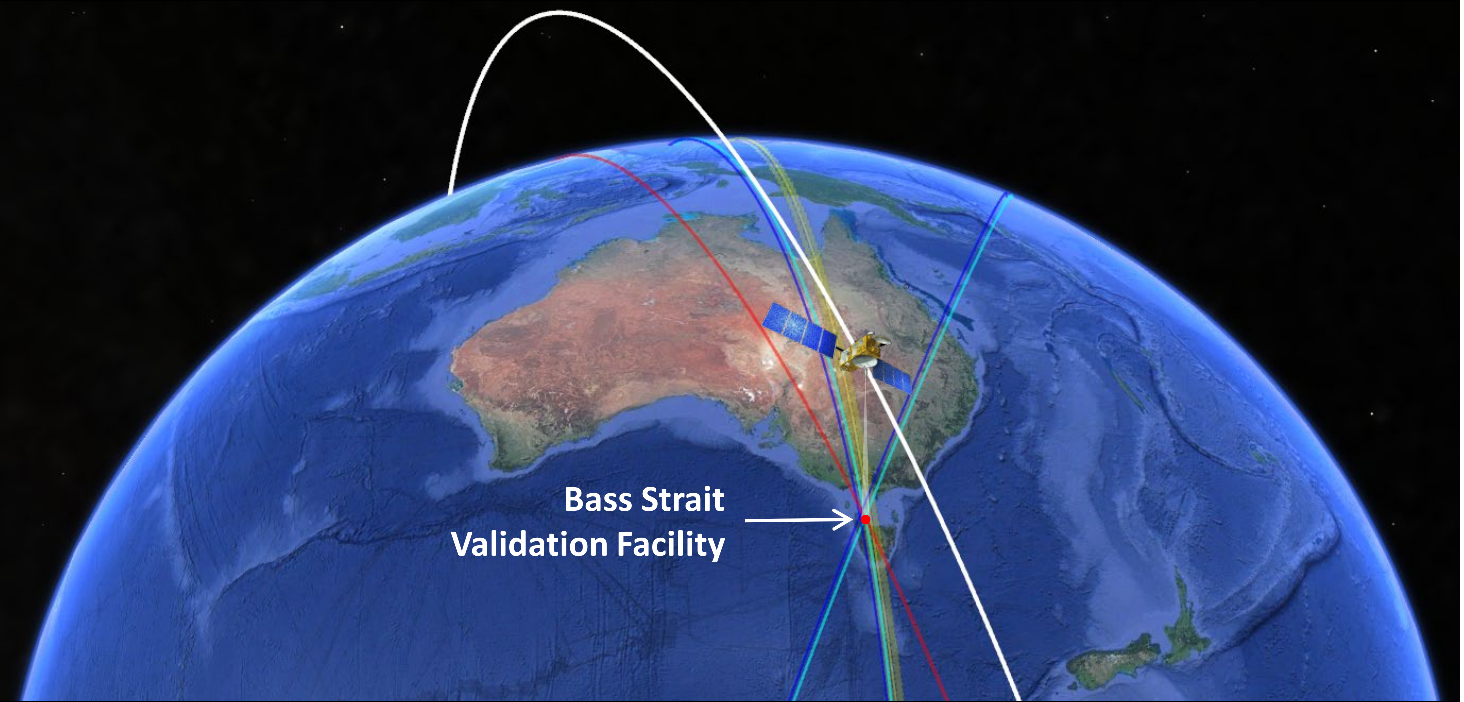

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