Performance and consistency of different satellite altimeter systems assessed by means of global multi-mission crossover analysis

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Content

Multi-mission crossover analysis (MMXO)

Results for selected mission

Jason-2 GDR-D

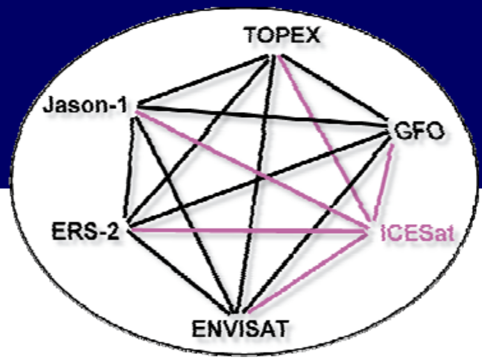
Jason-1 Geodetic Mission (GM)

Saral/Altika

HY-2A

Conclusions

Method: MMXO



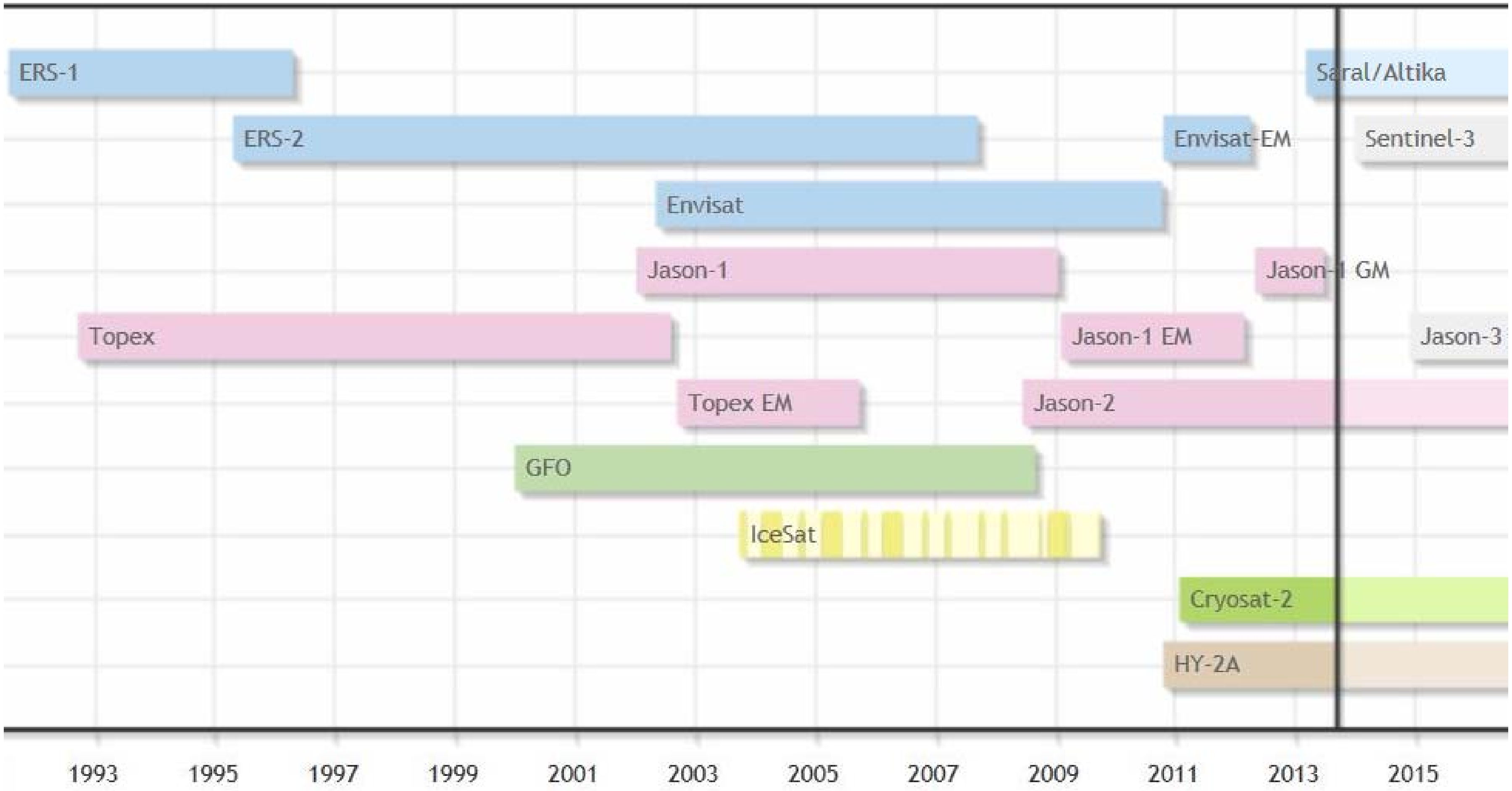
Basics

- single- and dual satellite crossover differences in all combinations
- using only crossovers close in time (Δt < 2 days)
- least squares adjustment of radial errors minimizing crossover and the along-track consecutive differences
- weighting of missions done by variance component estimation (VCE)
- TOPEX (later Jason1) taken as reference mission
- segmentation into 10-day cycles of reference mission plus 2 days overlap
- up to 120,000(240,000) crossovers (unknowns) per segment
- iterative solution with conjugate gradient algorithm

Results

- time series of radial errors per mission (w.r.t. reference mission)
- range bias (per 10 days period)
- geographically correlated error pattern
- differences in the realization of the origin of reference frame (first order harmonics)
- differences in the realization of the rotation axis (second order harmonics)

Input Data



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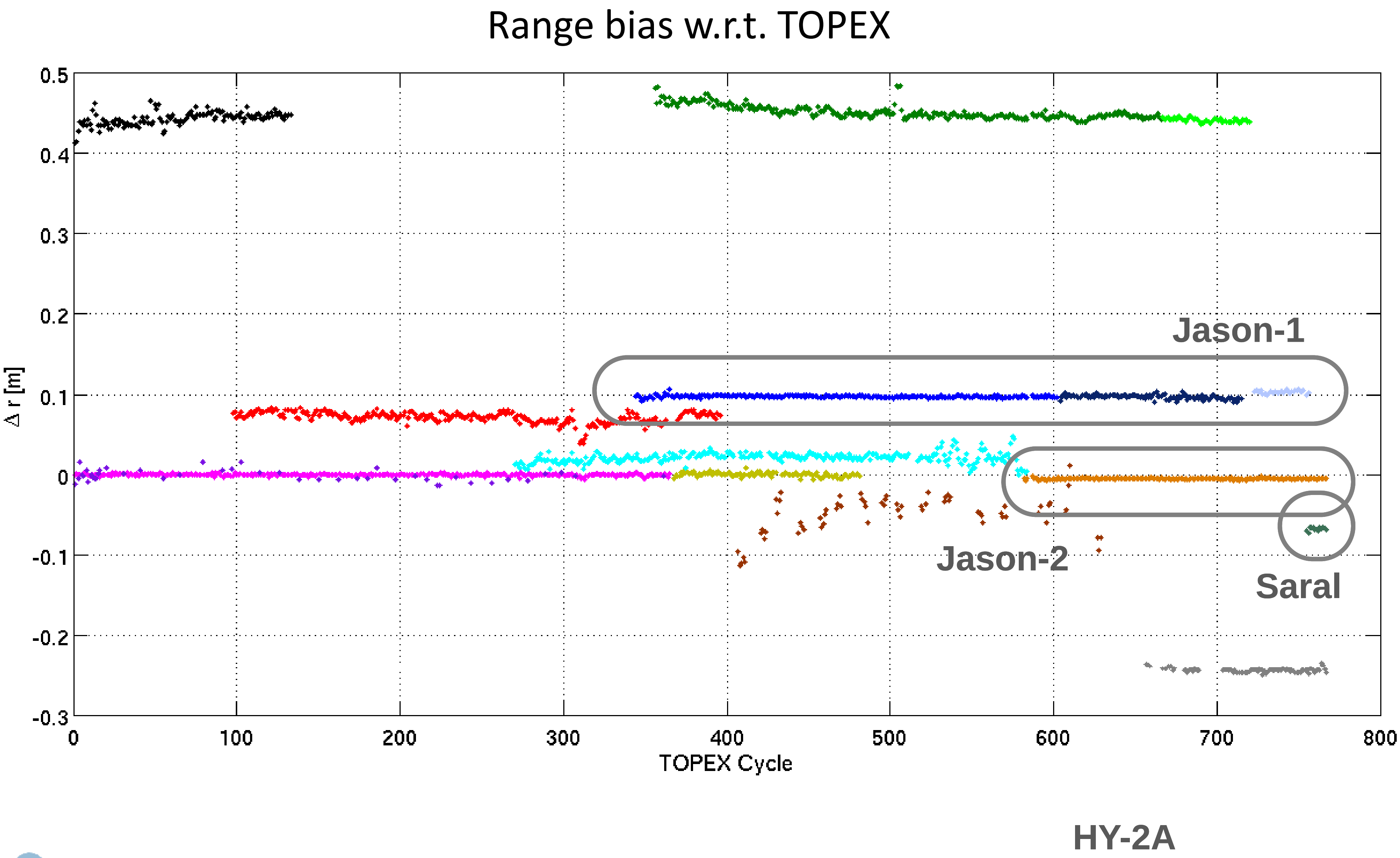
Results: MMXO14



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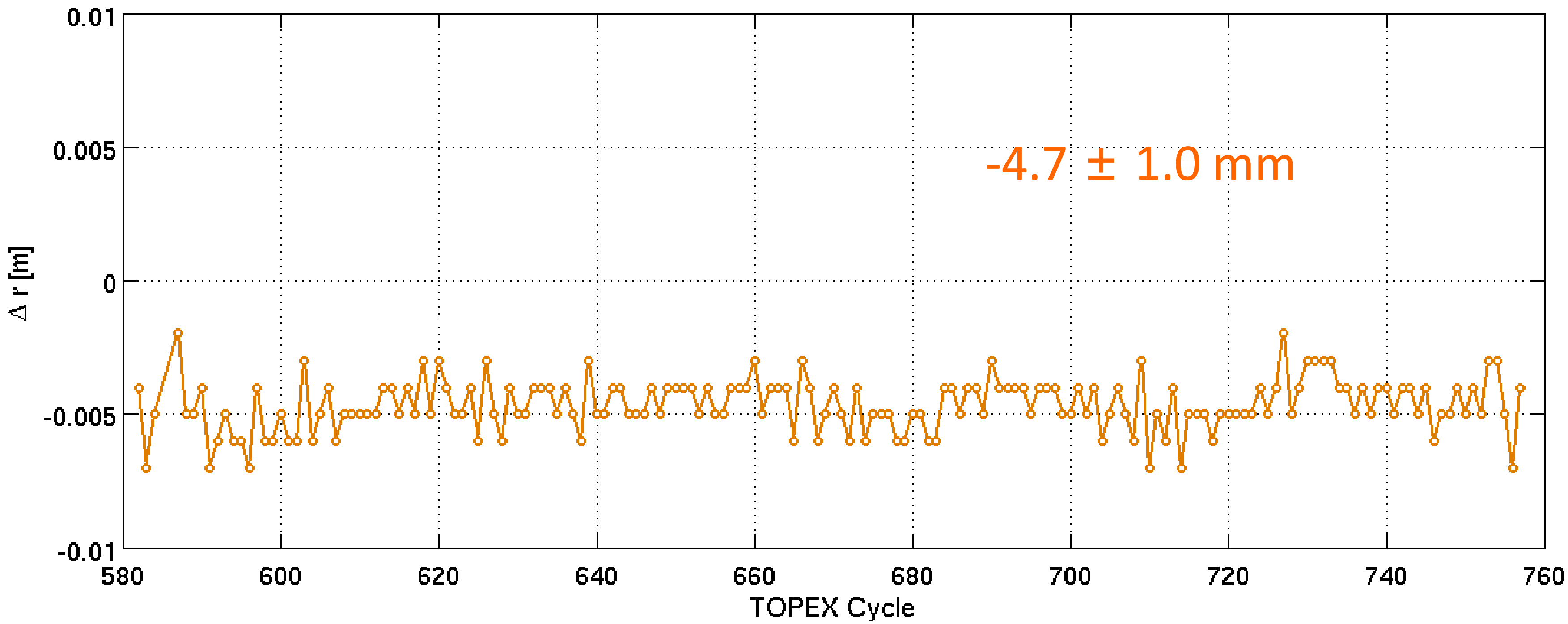
Jason-2

GDR-D data set

Range bias w.r.t. TOPEX



⇒ no systematics

⇒ range bias is reduced from 17.5 cm (GDR-C) to -0.5 cm (GDR-D)

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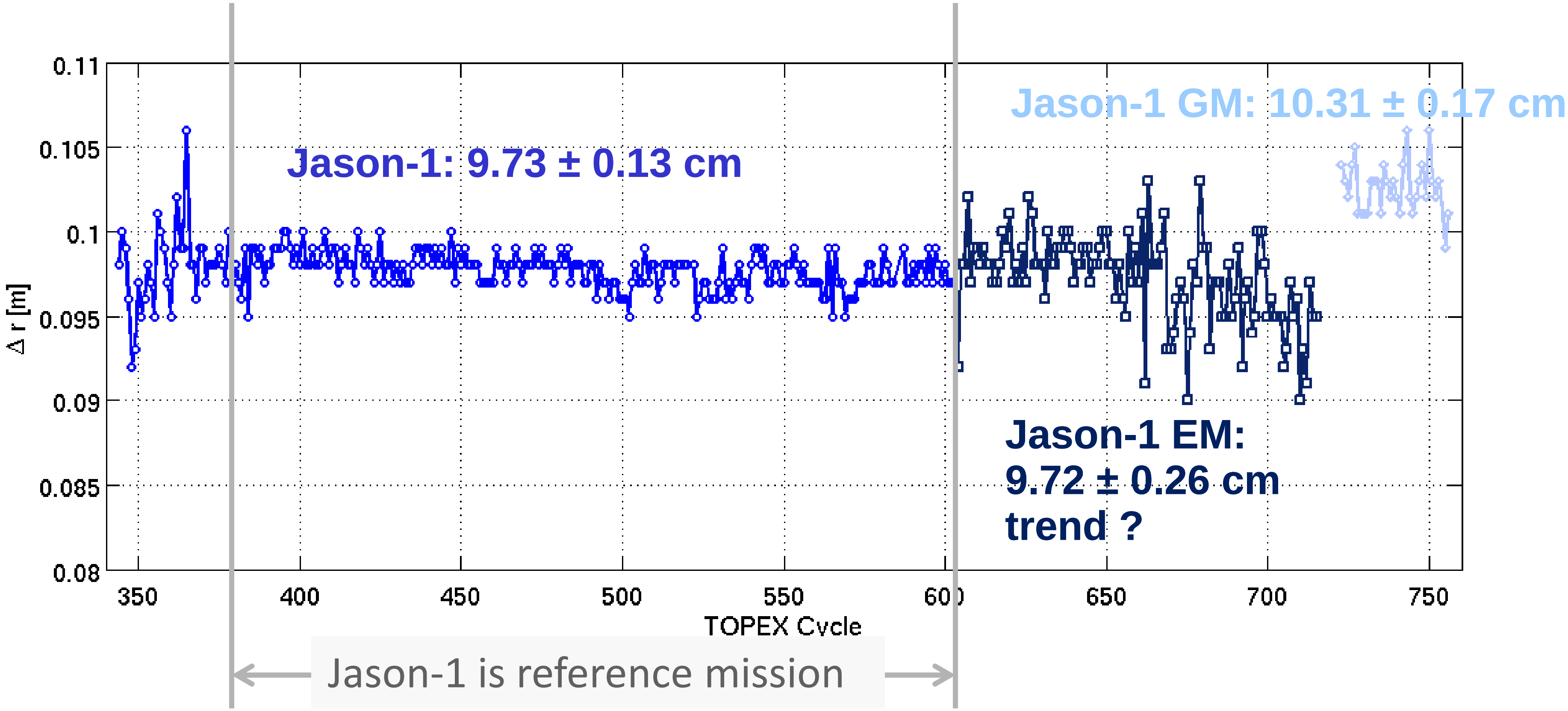
Jason-1

GDR-C data set with GDR-D orbit

Range bias w.r.t. TOPEX



⇒ geodetic mission phase: offset in range bias of 6 mm

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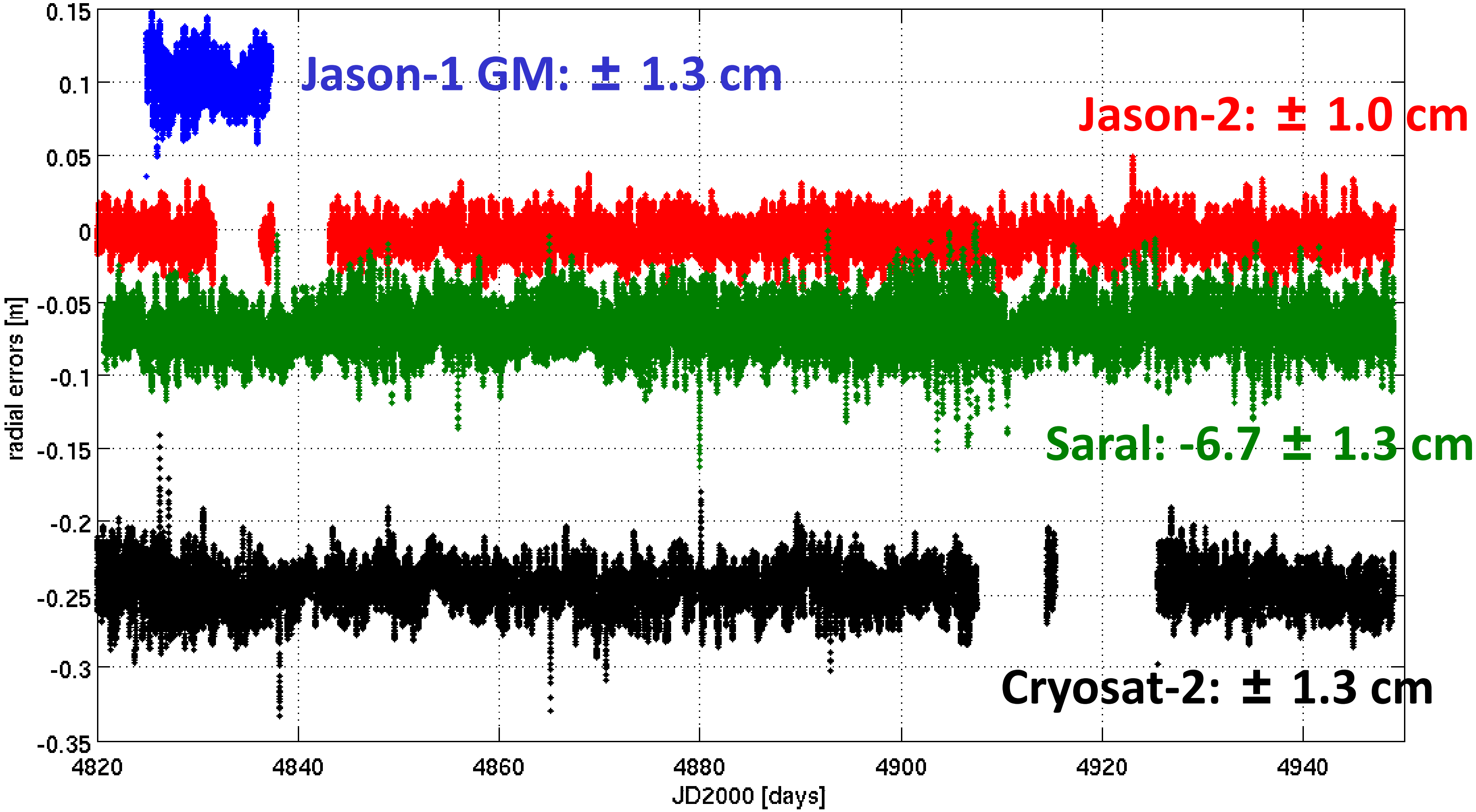
Saral

GDR-T data set

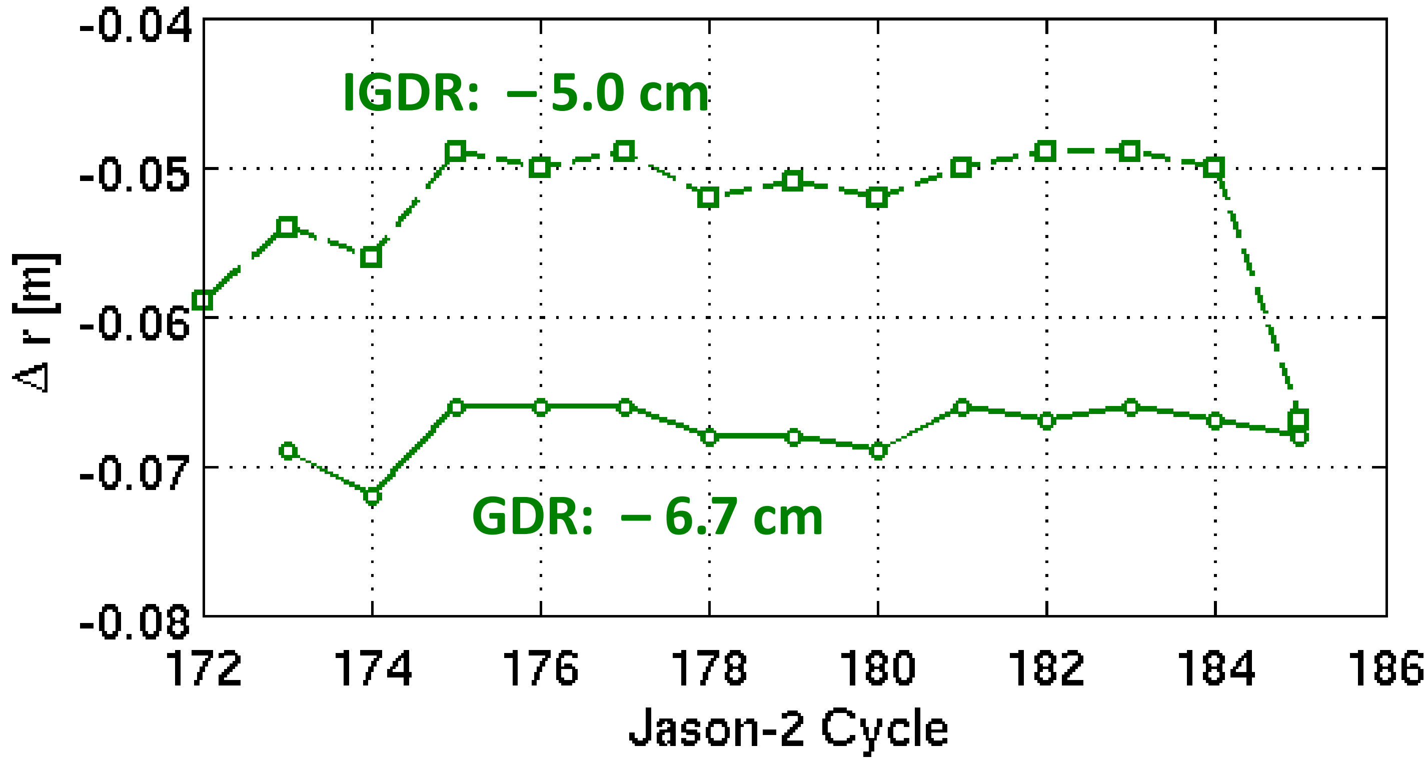
Radial errors w.r.t. TOPEX



⇒ similar noise level than other missions

Saral

Range bias w.r.t. TOPEX



GDR: mean range bias of – 6.7 cm w.r.t. TOPEX

IGDR: offset of 1.7 cm wrt GDR
removed within in cycle 4 (July, 11 2013)

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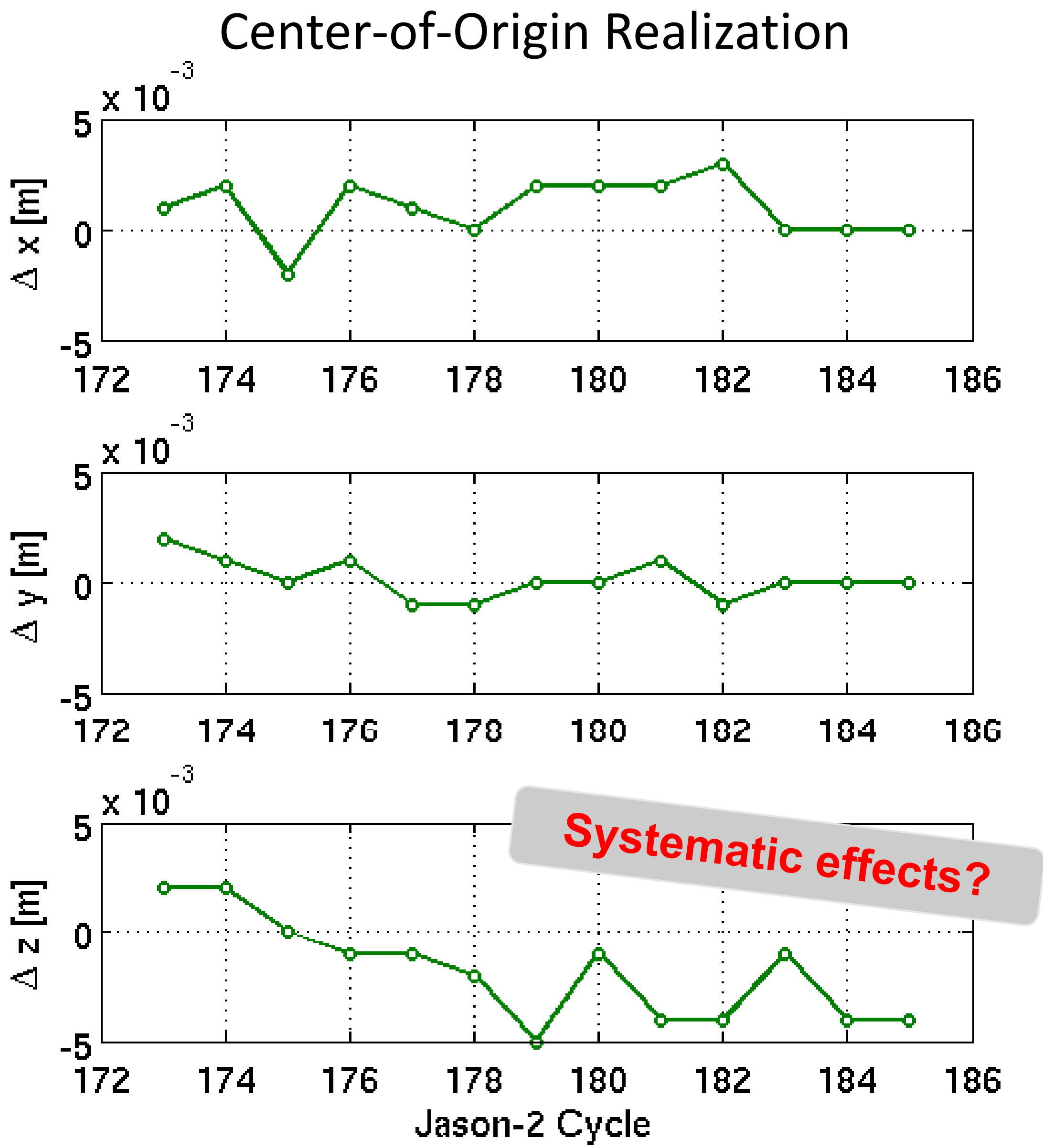
Saral



mean of #13 cycles:

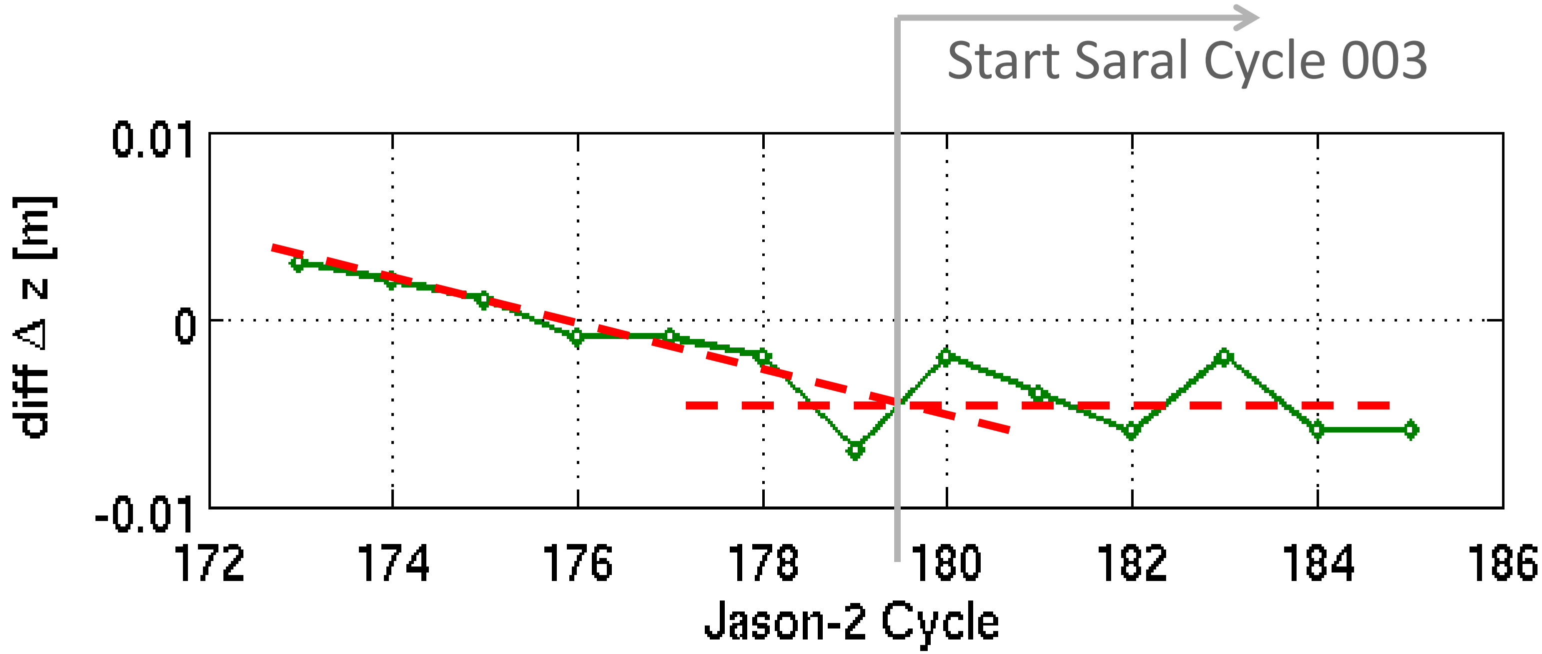
+1.0 ± 1.3 mm

+0.1 ± 0.9 mm

-1.8 ± 2.2 mm

Saral

Relative differences in z-component between Saral and Jason-2

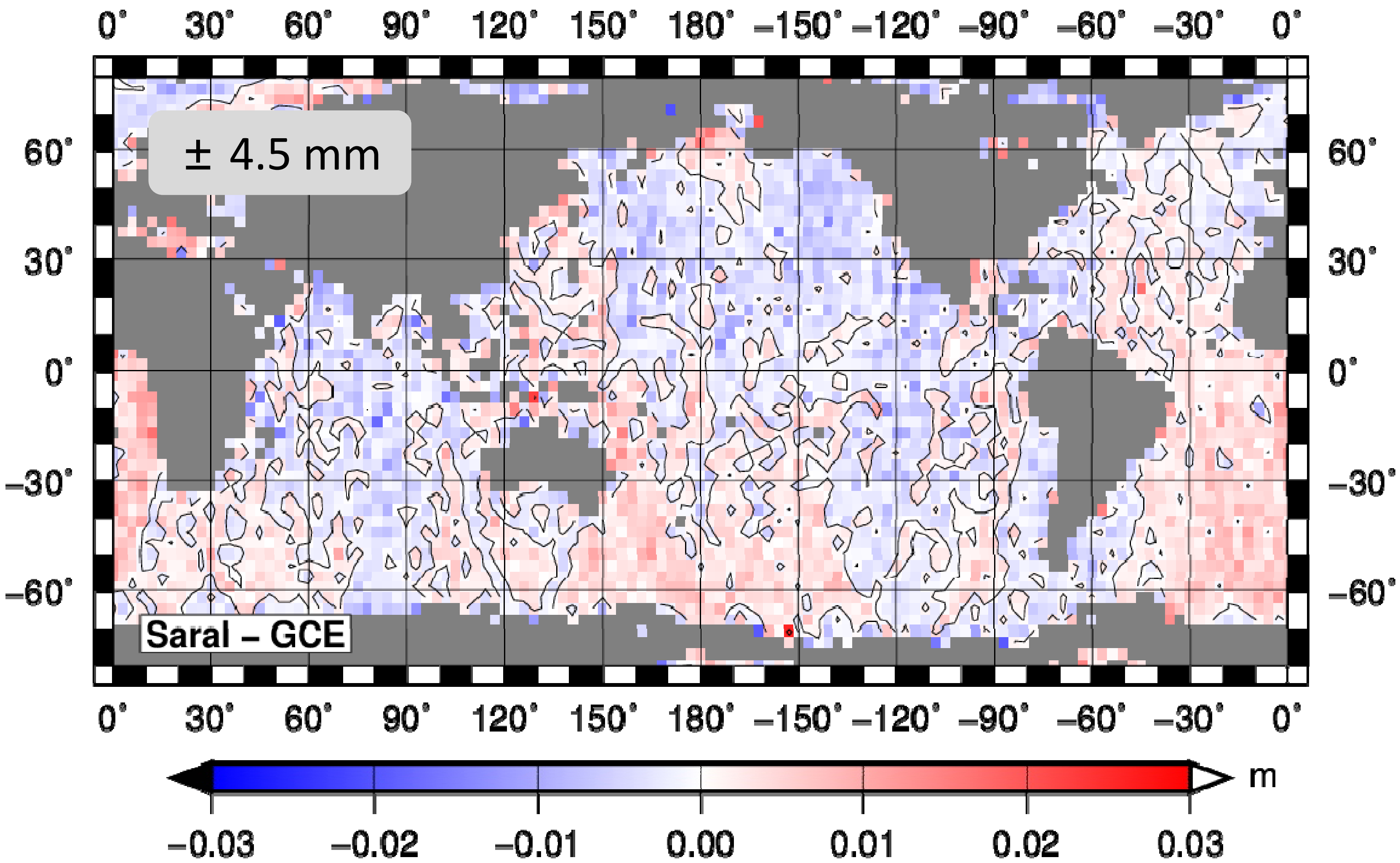


First mission phase: trend of appr. **-1.4 mm/cycle**

Since May 2013: offset of about **-5 mm** w.r.t. Jason-2

Saral

Geographically correlated errors

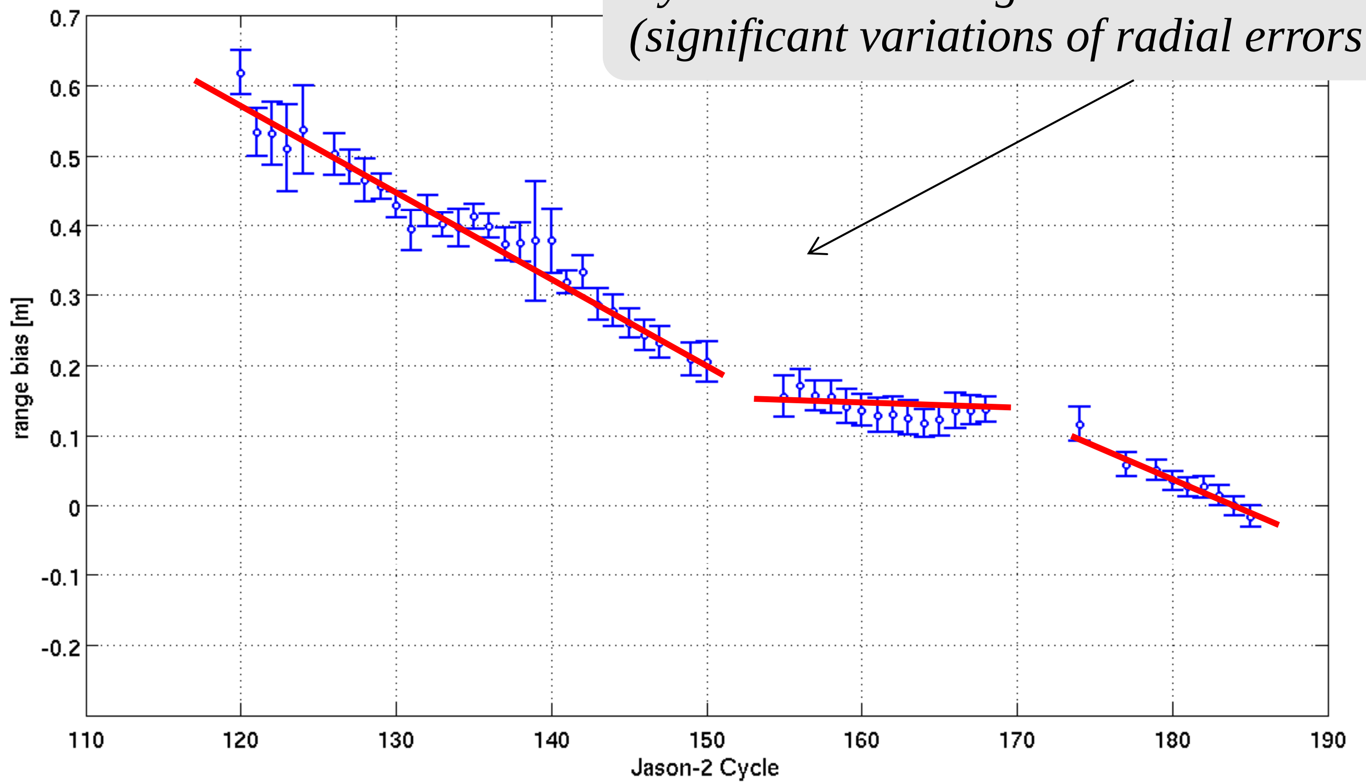


HY-2A

IGDR Cycle 1...49 (Oct. 2011 to Aug. 2013)

Range bias w.r.t. TOPEX

Cycles with time tag bias
(significant variations of radial errors with latitude)

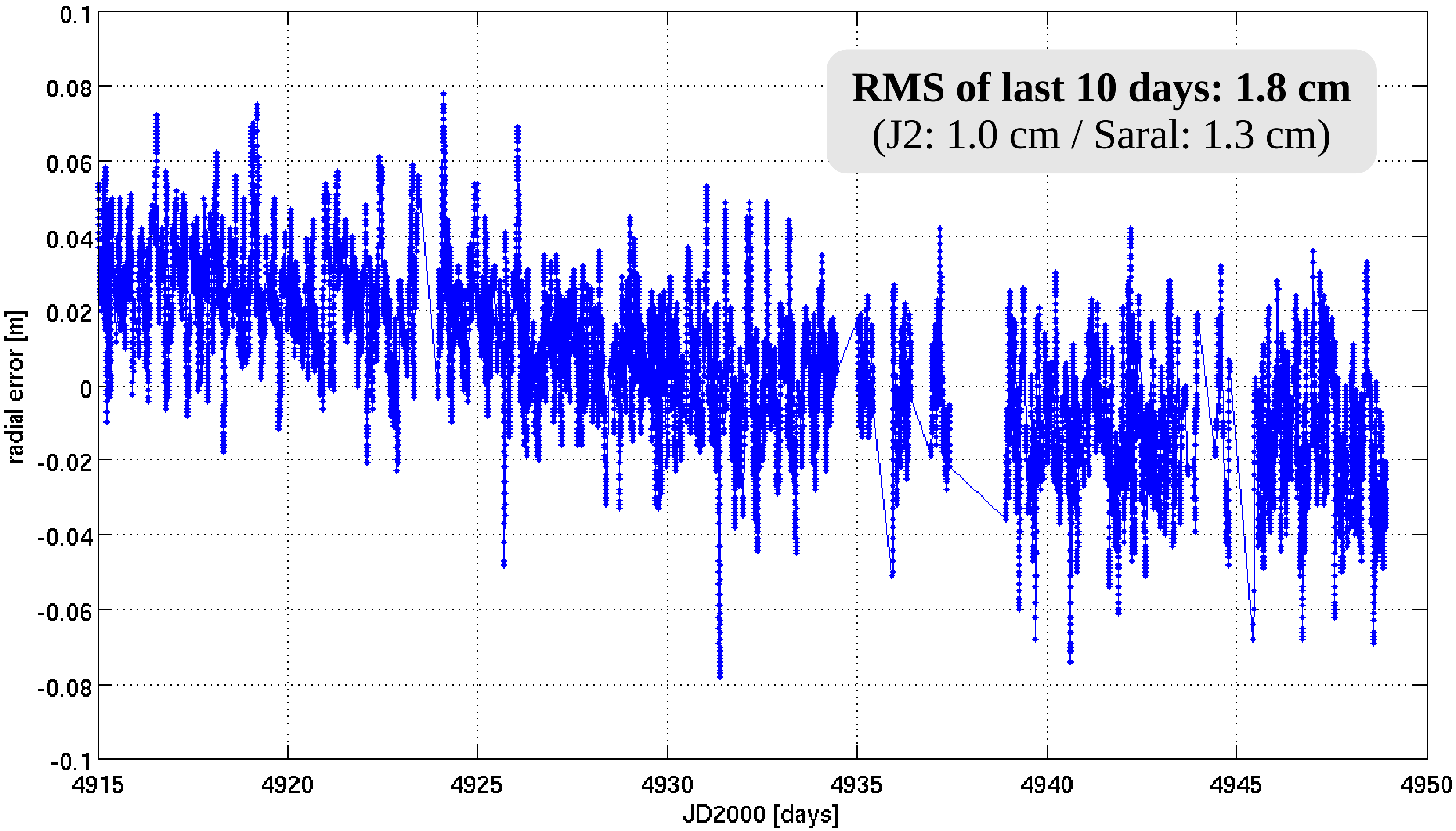


⇒ Range bias with significant trends

⇒ Some cycles with strong time tag bias (about 55 ms)

HY-2A

Radial errors w.r.t TOPEX (July/Aug. 2013)



⇒ Most recent results look promising!

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Conclusions

- Approach for global relative calibration of altimeter missions
  - Easy detection of biases, drifts, systematics, … coming from the instruments, the orbit or the geophysical corrections
  - Possibility to compute geographically correlated errors
  - Independent of orbit type
- Cross-calibrated mission data is mandatory for many applications with the need for **long-term time series** and **high spatial and temporal resolution**.
- Resent results for selected altimeter missions
  - **Jason-2 GDR-D**: stable results; small offset w.r.t. TOPEX; no systematics
  - **Jason-1 GM**: offset of about 6 mm w.r.t. other mission phases
  - **Saral**: early results are good, first IGDR Cycles show offset of about 1.7 cm w.r.t. GDR
  - **HY-2A**: be careful with IGDR L2 products; most recent cycles look promising

Questions ?

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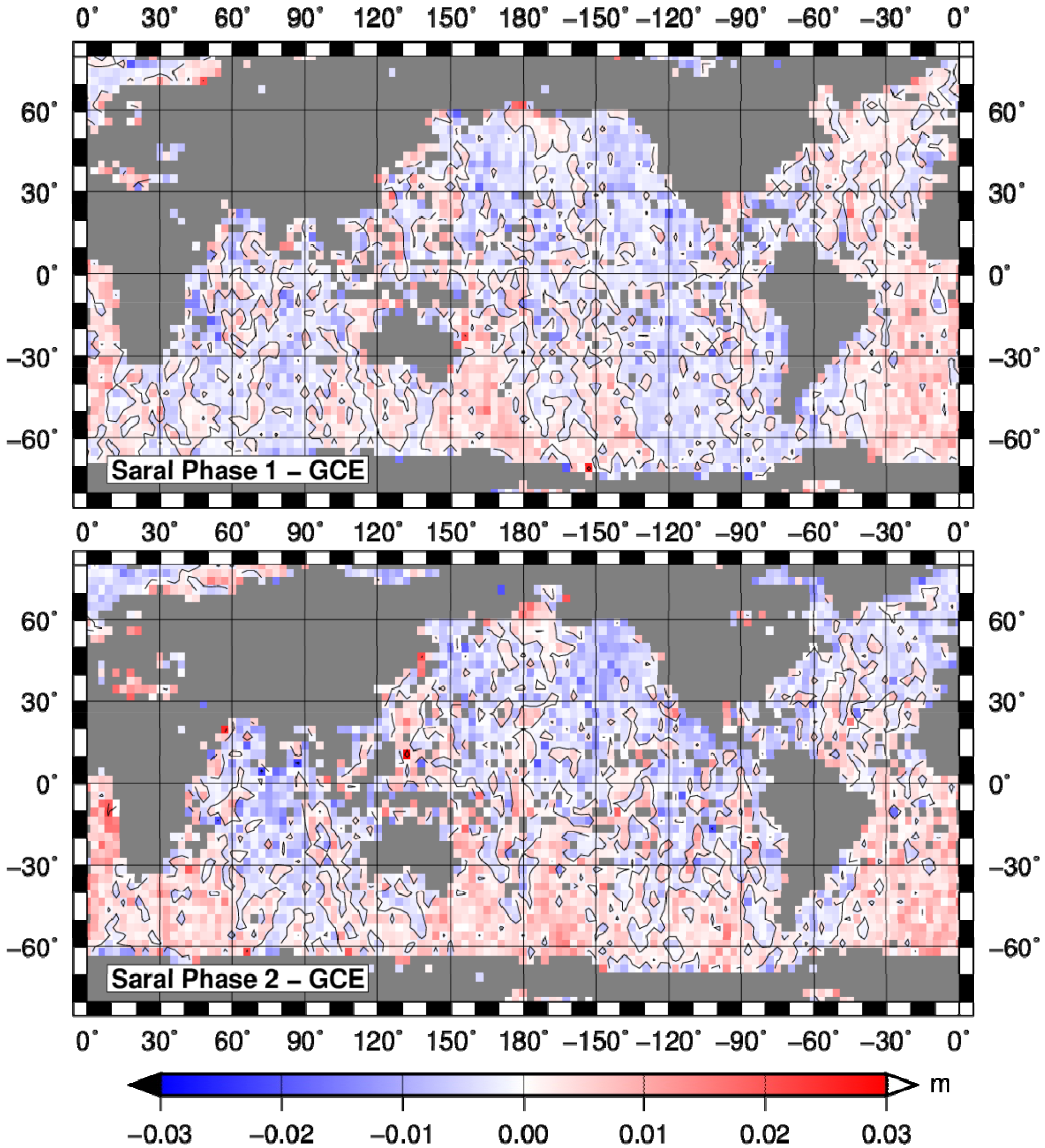
Saral



± 5.1 mm

± 6.0 mm