

# Global multi-mission crossover analysis: performance of Jason-3 and other new data sets

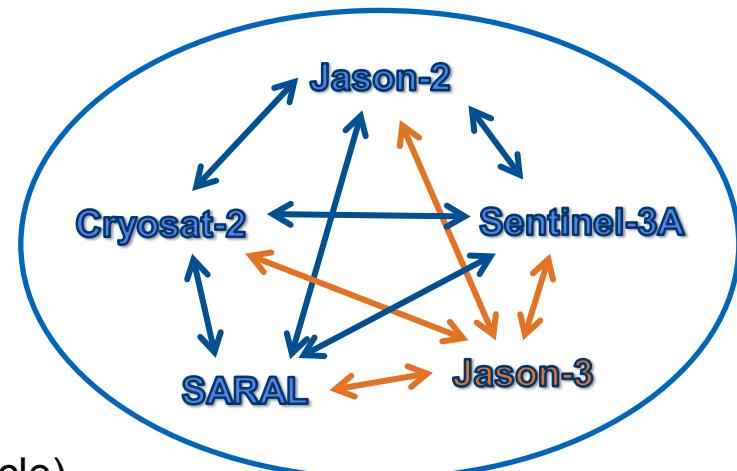
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# Approach: Multi-mission crossover analysis

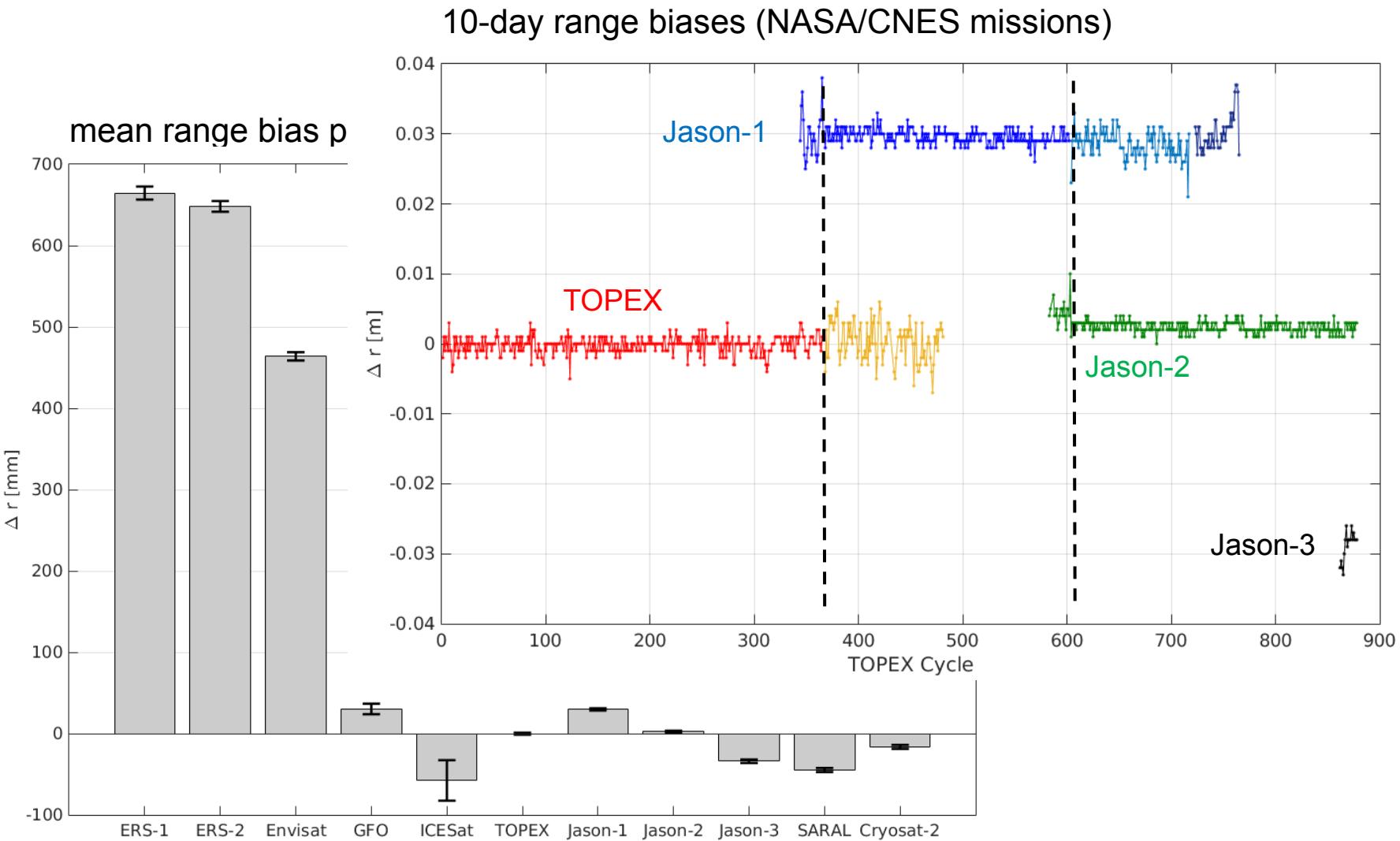
1. using all missions since 1992
2. building single- and dual satellite crossover differences in all combinations ( $\Delta t < 2$  days)
3. minimizing crossover differences and the along-track consecutive differences in a least squares adjustment
4. TOPEX (later Jason-1 and Jason-2) taken as reference mission



Output:

- time series of radial errors
- relative range biases (global mean and per cycle)
- relative instrument drifts
- geographically correlated SSH errors

# Results: Range Biases



# Content



Jason-1 GDR-E



Jason-3 GDR and IGDR

Sentinel-3A



© ESA/ATG medialab

# Jason-1

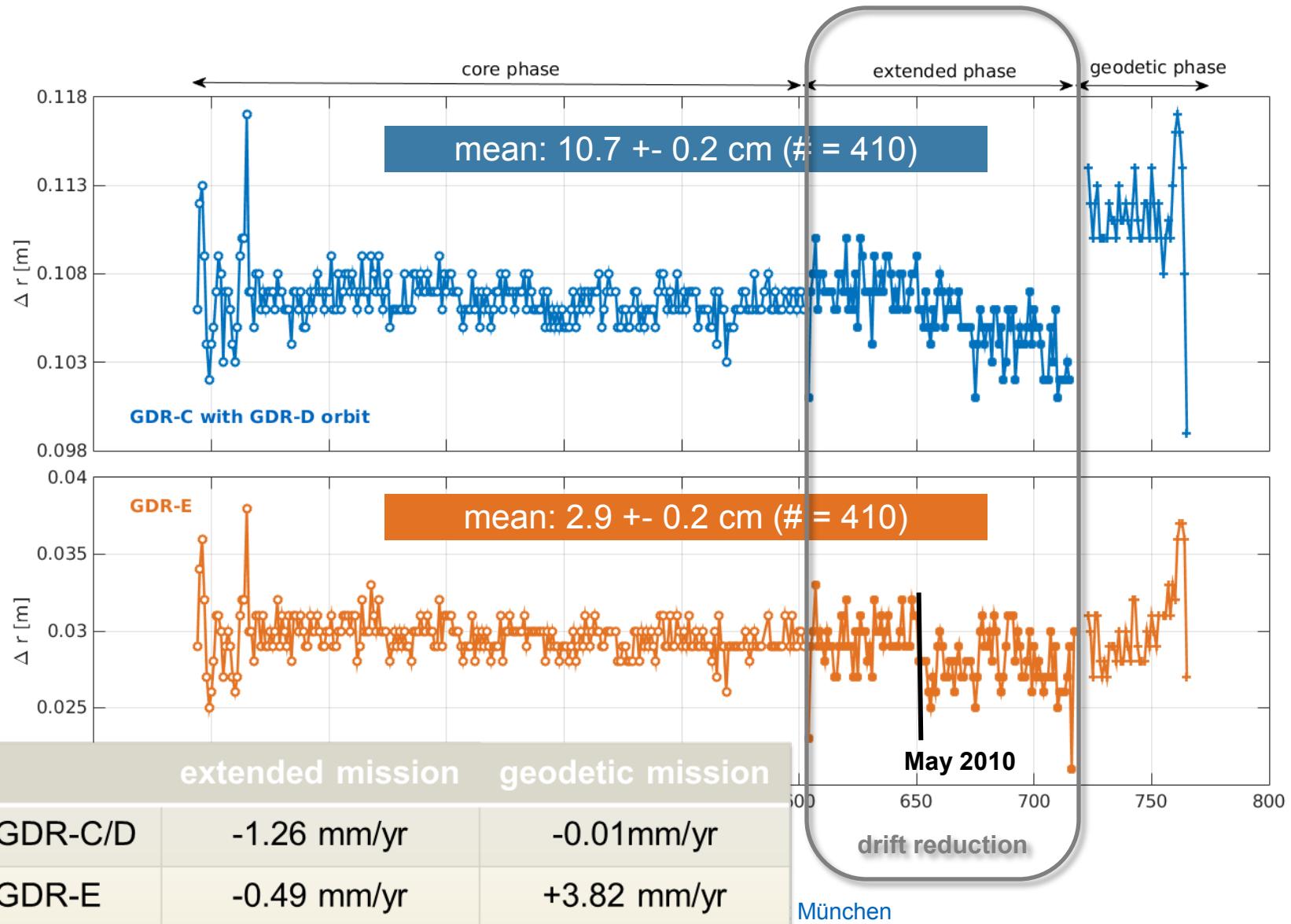
GDR-E reprocessed data set

1 Hz ocean data

01/2002 – 06/2013

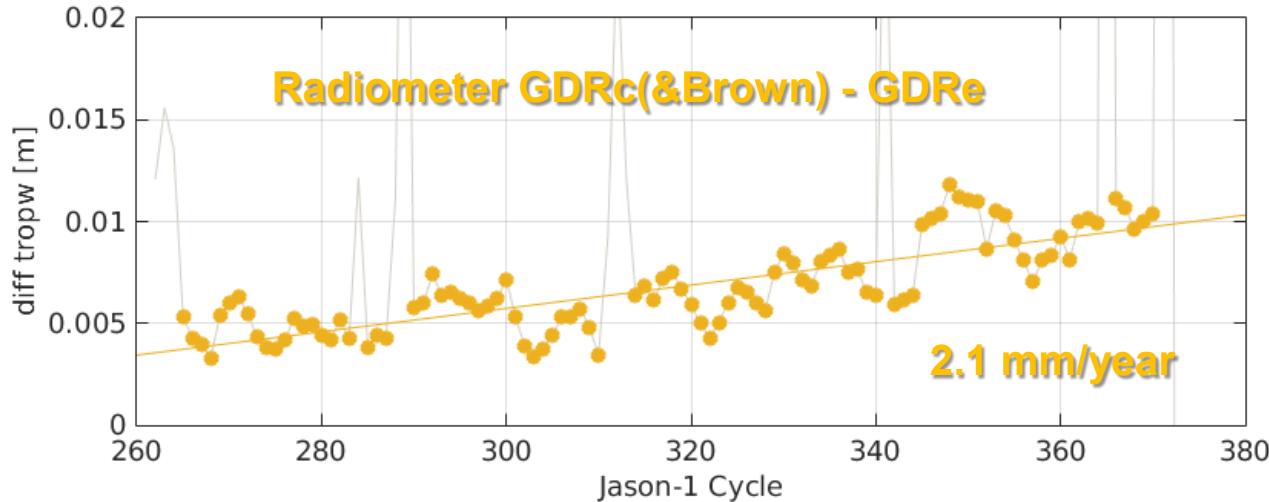


# Jason-1: Range Bias (w.r.t. TOPEX)



# Jason-1 EM: Wet Troposphere

Jason-1 extended mission phase 2009-2012



- Radiometer correction shows a different behavior for GDR-C and GDR-E
- GDR-E radiometer and model corrections differ in terms of drift behavior

*Drift of wet tropo differences  
GDR-E*

GDR-C: J1 EM: +0.5mm/yr

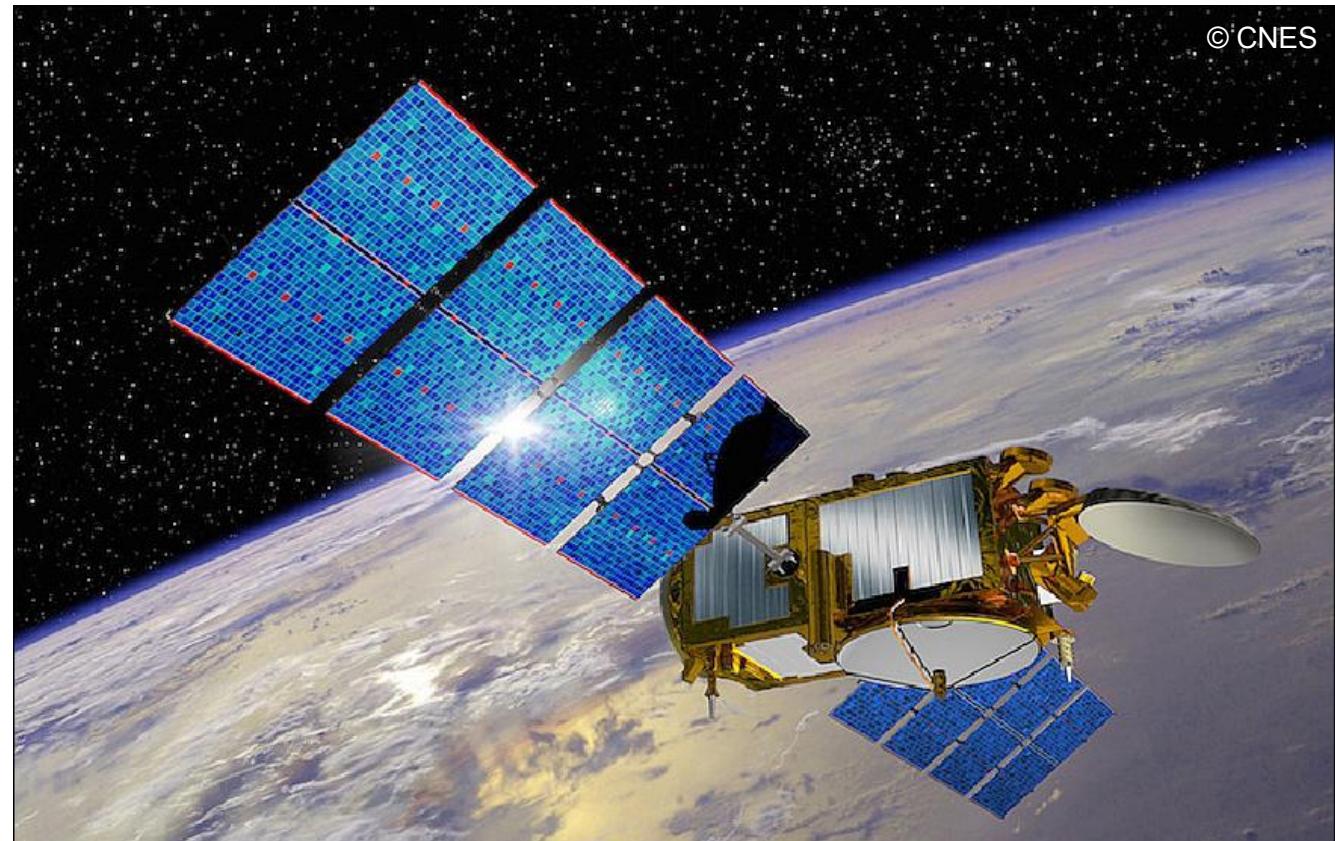
| drift [mm/yr]     | ECMWF-MWR  | ERA - MWR  |               |
|-------------------|------------|------------|---------------|
| Jason-1           | 0.0        | -0.1       | ~7 yrs        |
| <b>Jason-1 EM</b> | <b>2.5</b> | <b>1.6</b> | <b>~3 yrs</b> |
| Jason-1 GM        | 11.0       | 11.8       | ~ 1 yr        |

# Jason-3

GDR-E and IGDR-E data sets

1 Hz ocean data

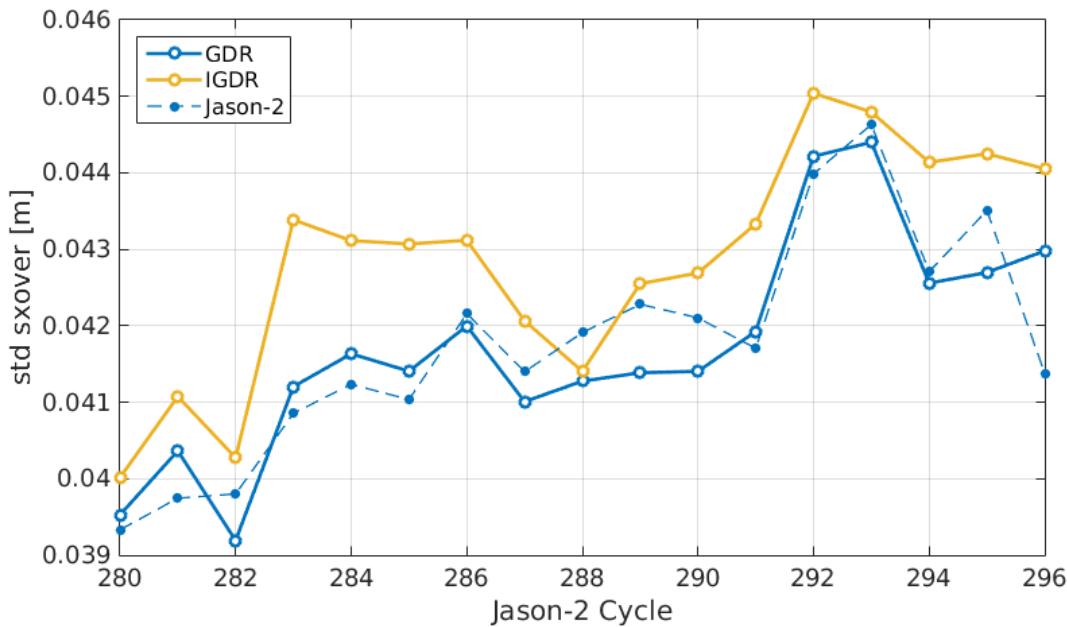
02/2016 – 07/2016 (tandem phase with Jason-2)



© CNES

# Jason-3: Single-Satellite Crossover Differences (Sxo)

Single-satellite crossover differences ( $\Delta t < 2$  days)

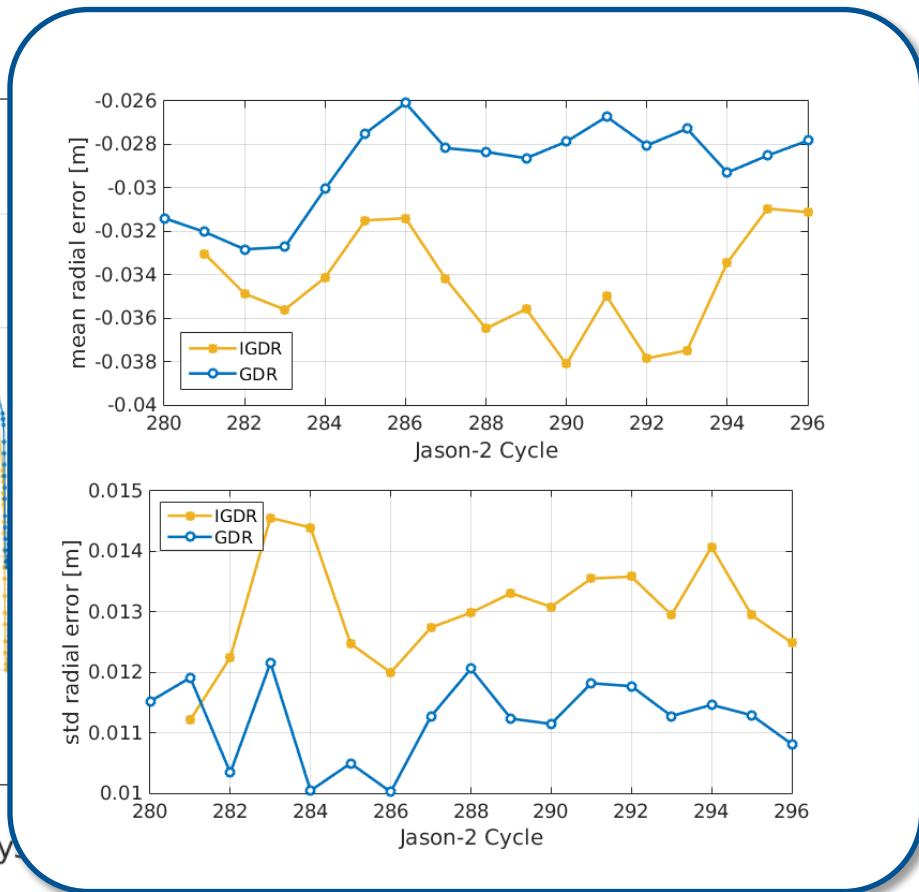
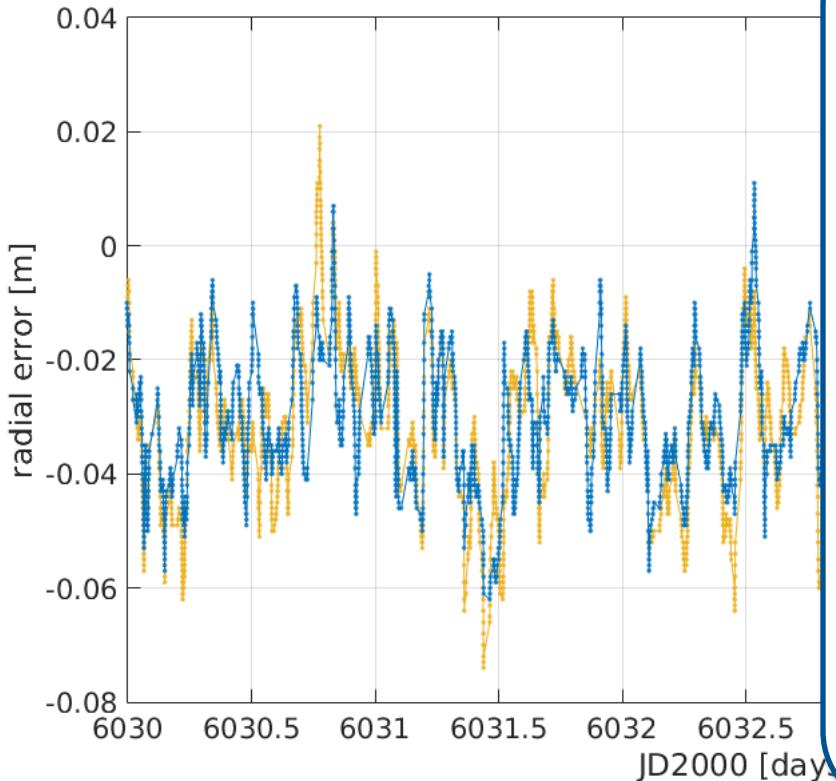


|              | mean<br>[mm] | std<br>[cm] |
|--------------|--------------|-------------|
| Jason-3      | 0.2          | 4.2         |
| Jason-3 IGDR | 1.2          | 4.3         |
| Jason-2      | 0.9          | 4.2         |
| Saral        | -1.5         | 4.5         |
| Cryosat-2    | 5.2          | 4.0         |

- Jason-3 xover differences similar to Jason-2
- Jason-3 IGDR data slightly worse than GDR data

# Jason-3: Radial Errors

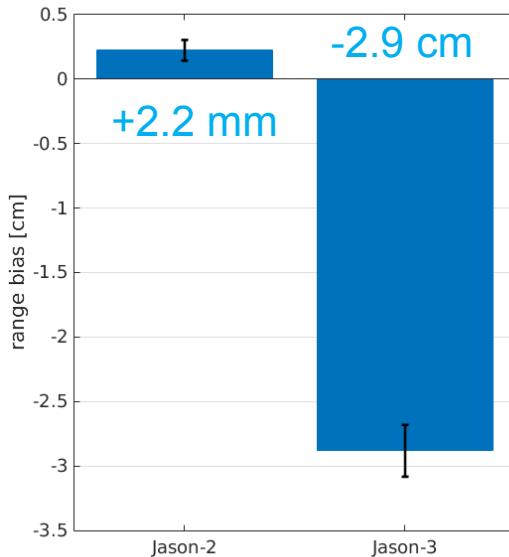
## Radial errors



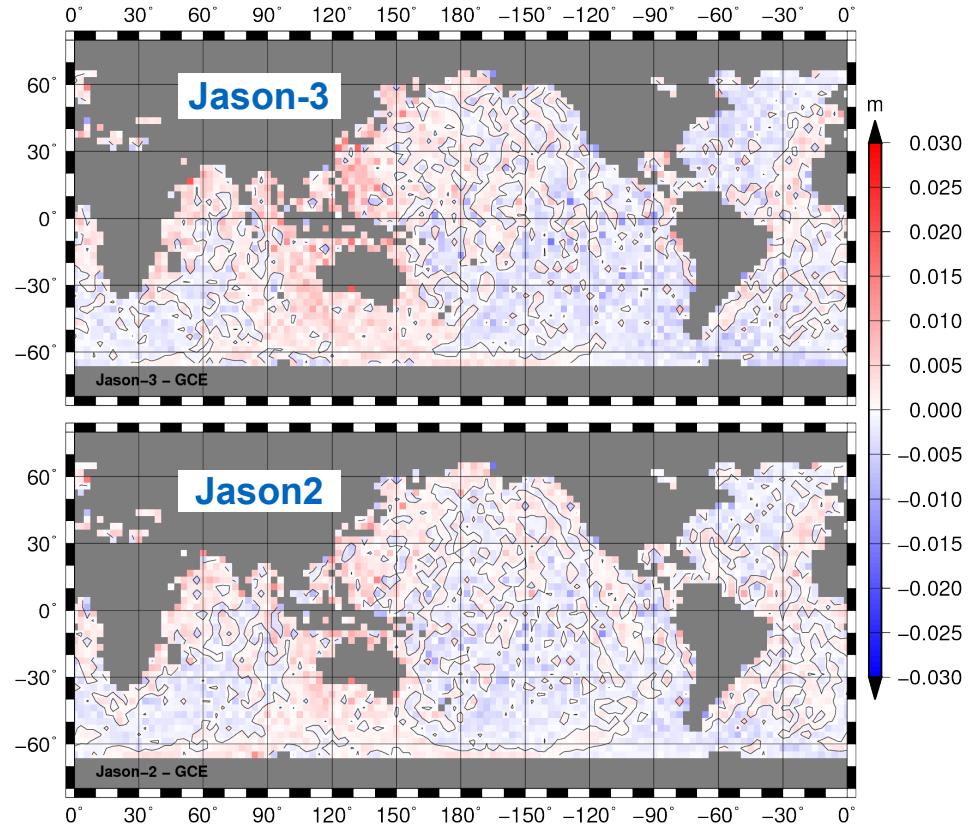
- Jason-3 GDR mean radial error:  $-2.88 \pm 1.14$  cm
- Jason-3 IGDR mean radial error:  $-3.45 \pm 1.32$  cm
- no clear temporal systematics

# Results: Jason-3 GDR (#17 cycles)

Mean range bias wrt. TOPEX [cm]



Geographically correlated mean error



- Offset between Jason-3 and Jason-2: -3.10 cm
- No significant GCE differences w.r.t. Jason-2 visible

# Sentinel-3A

EUMETSAT <ftp://oda.eumetsat.int>

NRT ocean products, L2\_WAT, enhanced\_measurement.nc, 1 Hz data

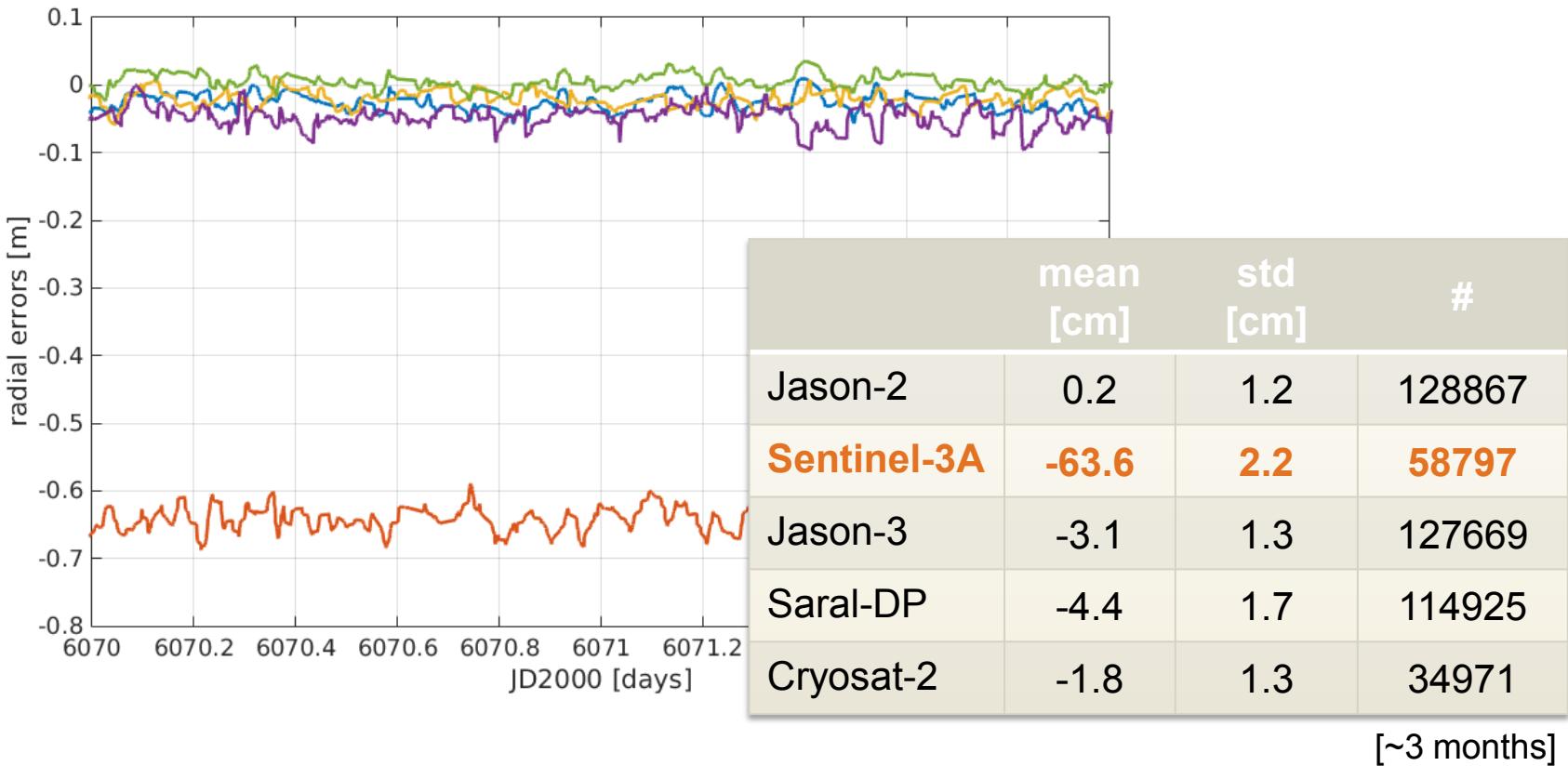
July 2016 to October 2016 (about 3 month), with data gap

Cross-calibrated with: Jason-2 IGDR, Jason-3 IGDR, Saral DP IGDR, Cryosat-C IGDR



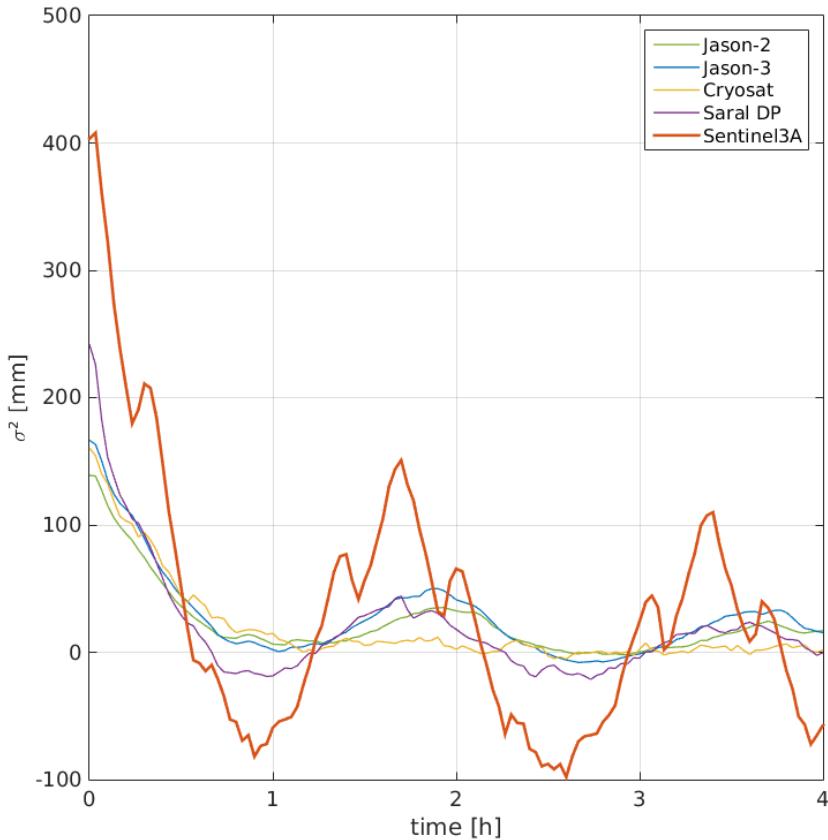
# Sentinel-3A: Radial Errors

Radial errors (2 days around August 15<sup>th</sup>, 2016)



# Sentinel-3A: Radial Errors

Auto-Covariance function of radial errors

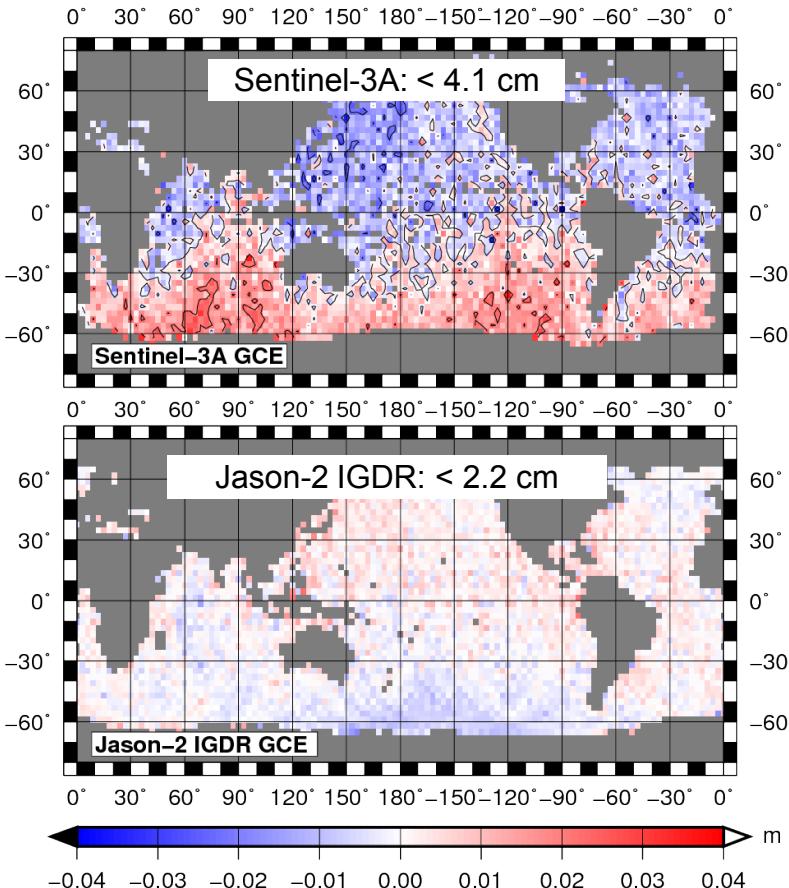


**Dominant Frequency:**  
max. amplitude: 4.6 cm  
at orbit revolution period

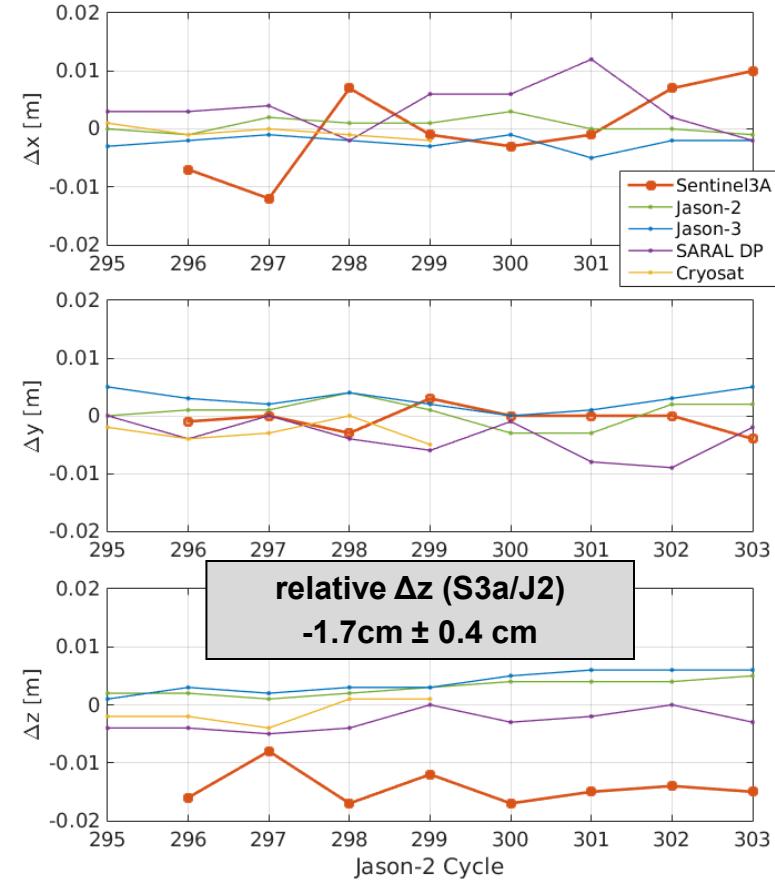
[other missions < 1 cm]

# Sentinel-3A: Geographical Patterns

Geographically correlated (mean) errors



Center-of-origin realization



# Summary

## Jason-1 GDR-E

- Offset w.r.t. TOPEX reduced from 10.7 cm to 2.9 cm
- Interleaved mission phase 2009-2012: drift w.r.t. Jason-2 has been reduced probably due to improved wet troposphere correction

## Jason-3

- Scatter of radial errors: 1.1 cm for GDR and 1.3 cm for IGDR
- Offset between Jason-3 GDR and Jason-2: -3.1 cm
- Offset between Jason-3 GDR and Jason-1: -5.8 cm
- No significant GCE differences w.r.t. Jason-2 visible

## Sentinel-3A

- Scatter of radial errors: 2.2 cm
- Offset w.r.t. TOPEX: -63.8 cm / w.r.t. Jason-2: -64.1 cm
- Systematic offset in realization of the z-component of the origin resulting in North/South geographical error pattern (up to 4 cm)