Jason-1&2 Data Quality Assessment and Cross-calibration between Jason-1 and Jason-2

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Introduction

- Objective:
  - Assess Jason-1/ Jason-2 data quality and system performances
  - Operational validation of each GDR cycle before release to users – JPL also performs a systematic validation of each GDR cycle.
- Data used:
  - 1 Hz Jason-2 (GDR-T) and Jason-1 data (GDR-C)
- Overview:
  - Analysis of missing and edited measurements
  - Using cross-calibration of Jason-2 with Jason-1 to
    - Analyze altimeter and radiometer parameters
    - Assess Sea Surface Height (SSH) performances and consistency at temporal scales less than 10 days
    - Assess along-track Sea Level Anomaly (SLA) performances and consistency

Data coverage

To verify data coverage, systematic monitoring of percentage of missing ocean data is performed.

Data coverage

Missing measurements

- Excellent data availability for Jason-2, only few missing measurements over ocean, mostly due to:
  - Planned uploads/ calibrations
  - Acquisition station problems
- In 2011, very good data availability for Jason-1
- Over ice, coastal and hydrological zones, Jason-2 better than Jason-1, thanks to new altimeter tracker algorithms

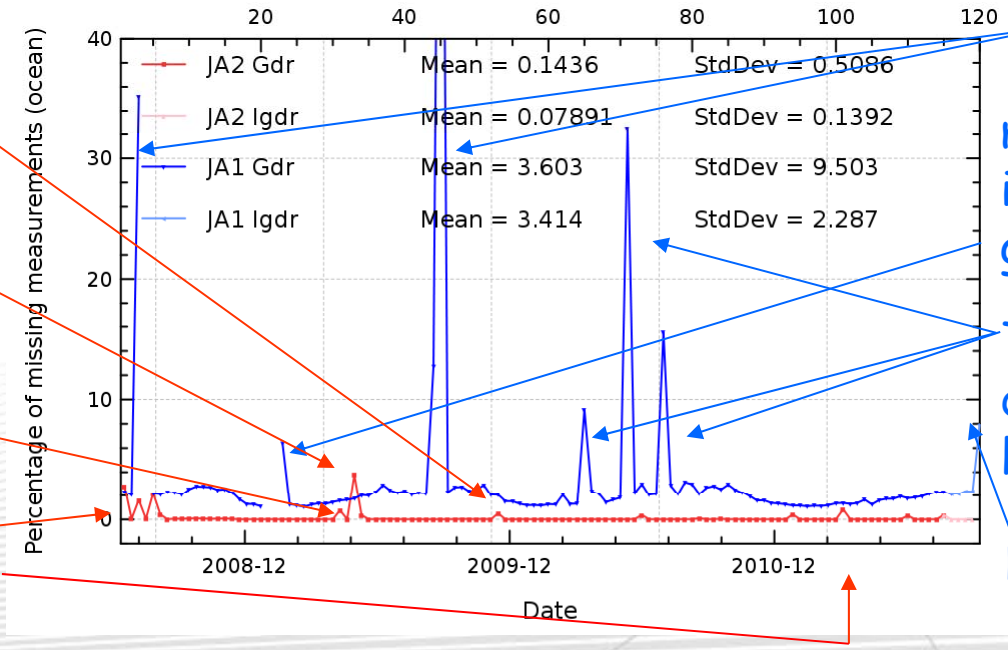
Jason-2 :

calibrations

upload of flight software

upload of DEM

acquisition station problem



Jason-1 :

Safehold

move to interleaved ground-track

Tracking problems due to star tracker low performance

Datation anomaly

Data coverage

Not all available data are useful for science applications.
Therefore an editing procedure is applied.

- using flags (sea ice flag)
- using thresholds on altimeter and radiometer parameters

Percentage of edited measurements is monitored.

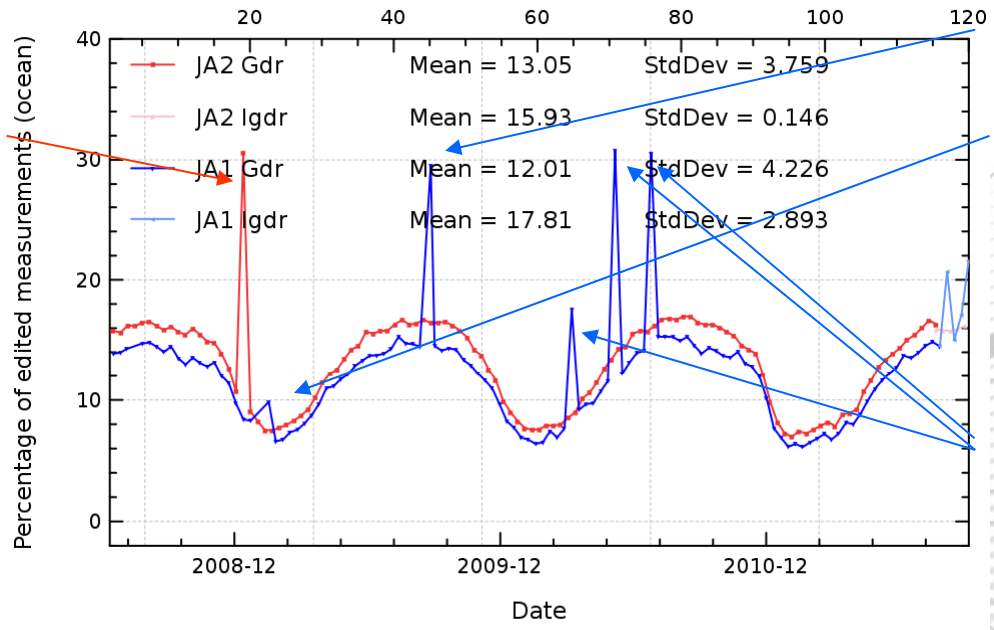
Data coverage

Edited measurements

- Percentage of edited measurements show an annual signal due to ice coverage
- Jason-2 edits more measurements than Jason-1 (principally ice). Due to higher altimeter tracking performances of JA2.
- Very few measurements edited due to anomalies

Jason-2 :

AMR unavailability



Jason-1 :

JMR switched on latter after Safehold

SLA out of threshold during maneuver

Tracking problems due to star tracker low performance -> altimeter parameters at default value

Monitoring of Parameters

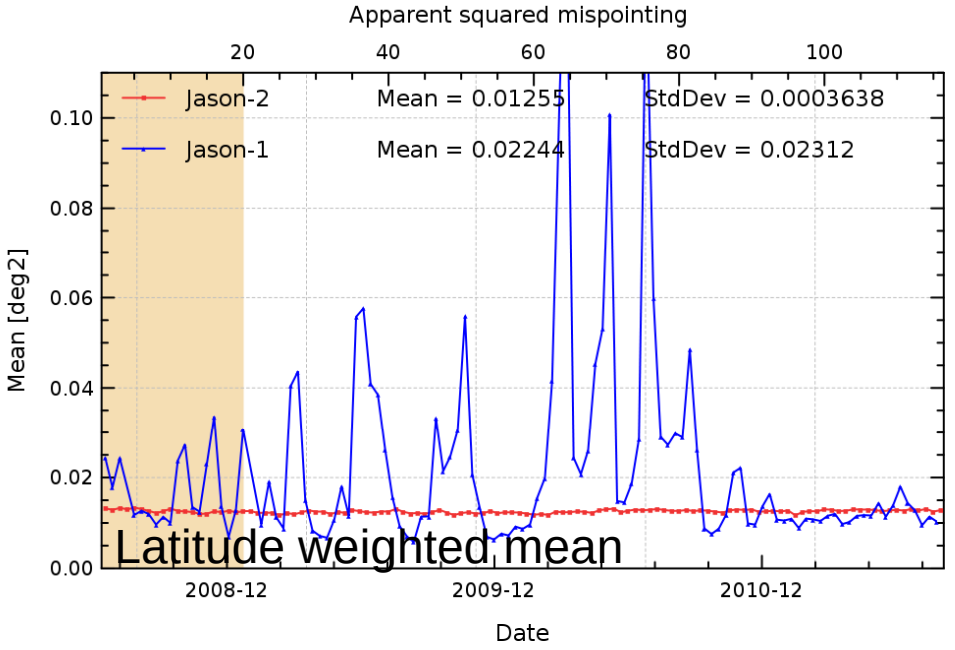
Monitoring of altimetric parameters is very important to

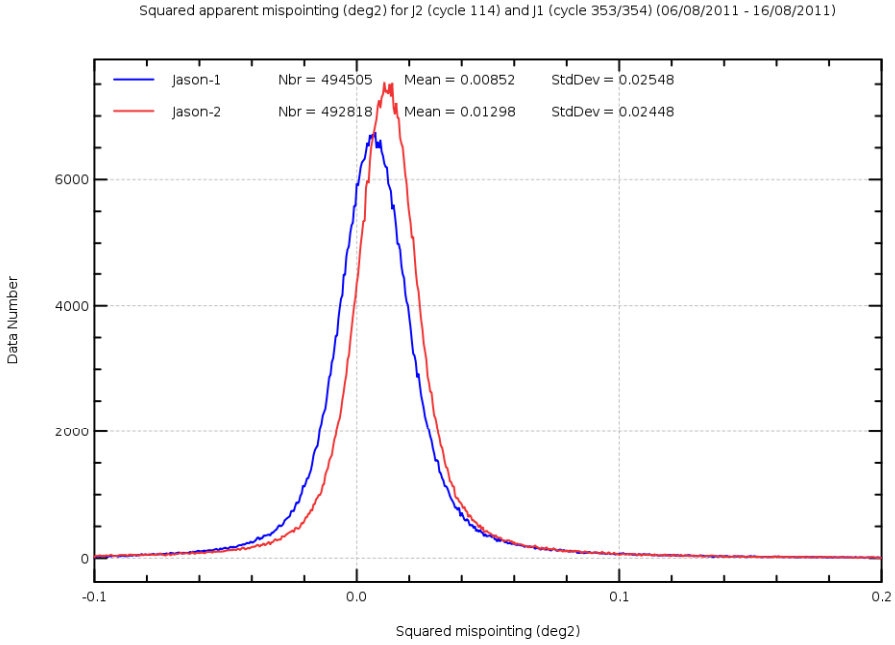
- Verify stability of measurements
- Detect anomalies (jumps, drifts)
- Monitor natural evolution of parameters

Monitoring of Parameters

Mispointing

- Apparent squared mispointing is stable for Jason-2 (about 0.012 deg2)
  - Small bias is related to antenna aperture (corrected in GDR-D)
- Jason-1 is periodically impacted by low star tracker performances related to beta angle value (environment conditions) - situation has been largely improved since end 2010 thanks to a calibration of the gyro wheels.



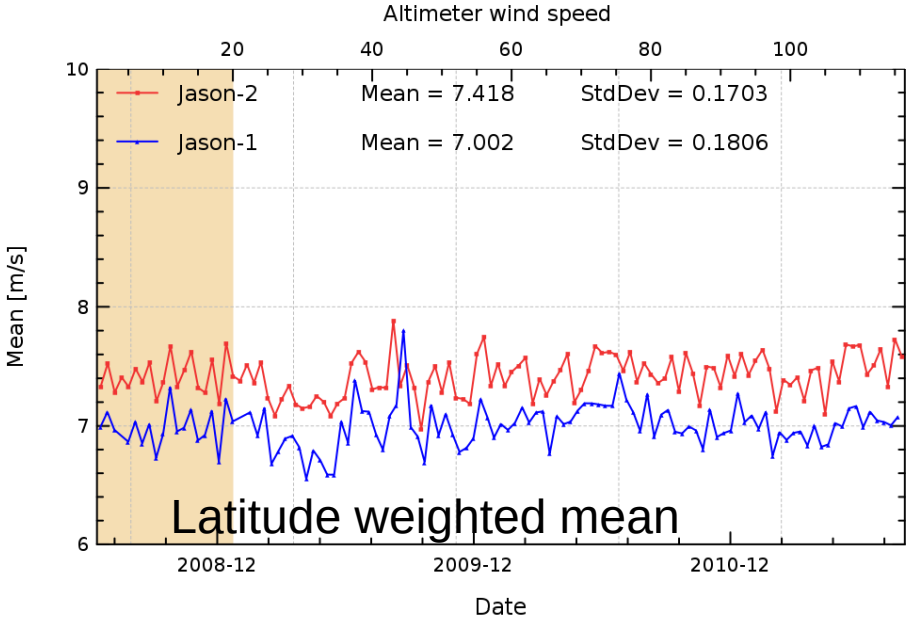


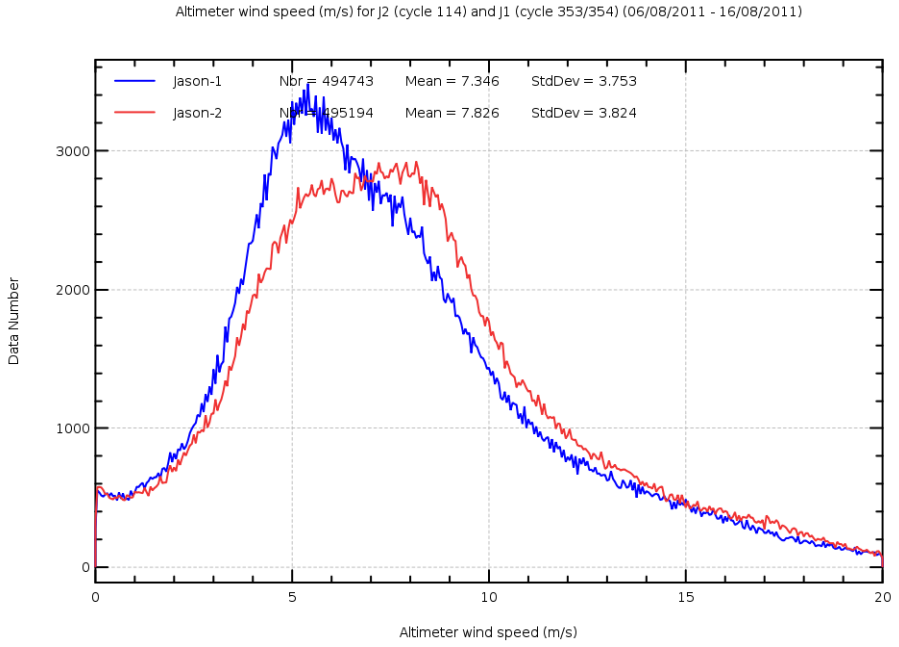
See also talk N. Picot: Jason-2 GDR-D standards

Monitoring of parameters

Altimeter wind speed

- Jason-2 wind speed is slightly higher by about 0.4 m/s than Jason-1 one´s
- Wind speed histogram have different shapes. Will be corrected in GDR-D





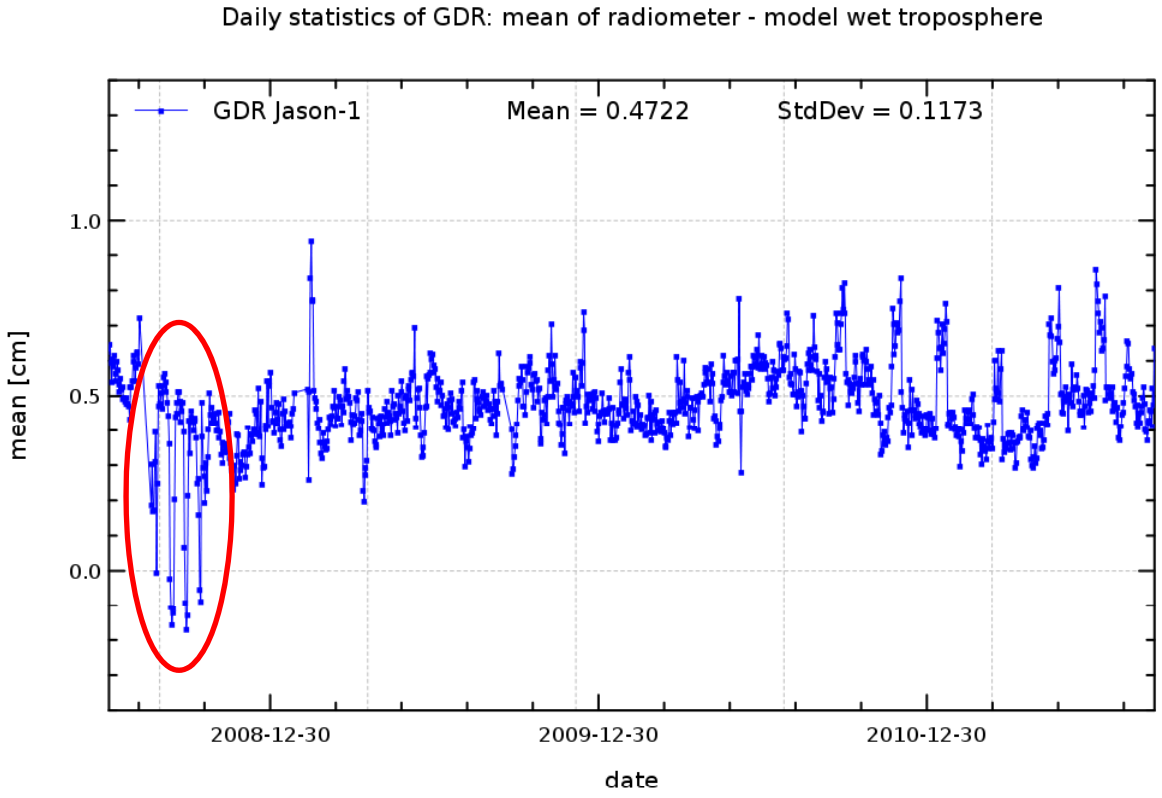
See also talk GDR-D

Monitoring of parameters

Stability of radiometer wet troposphere correction

- Radiometer – Ecmwf model wet troposphere correction shows:

- Instabilities during 2008, following safehold mode

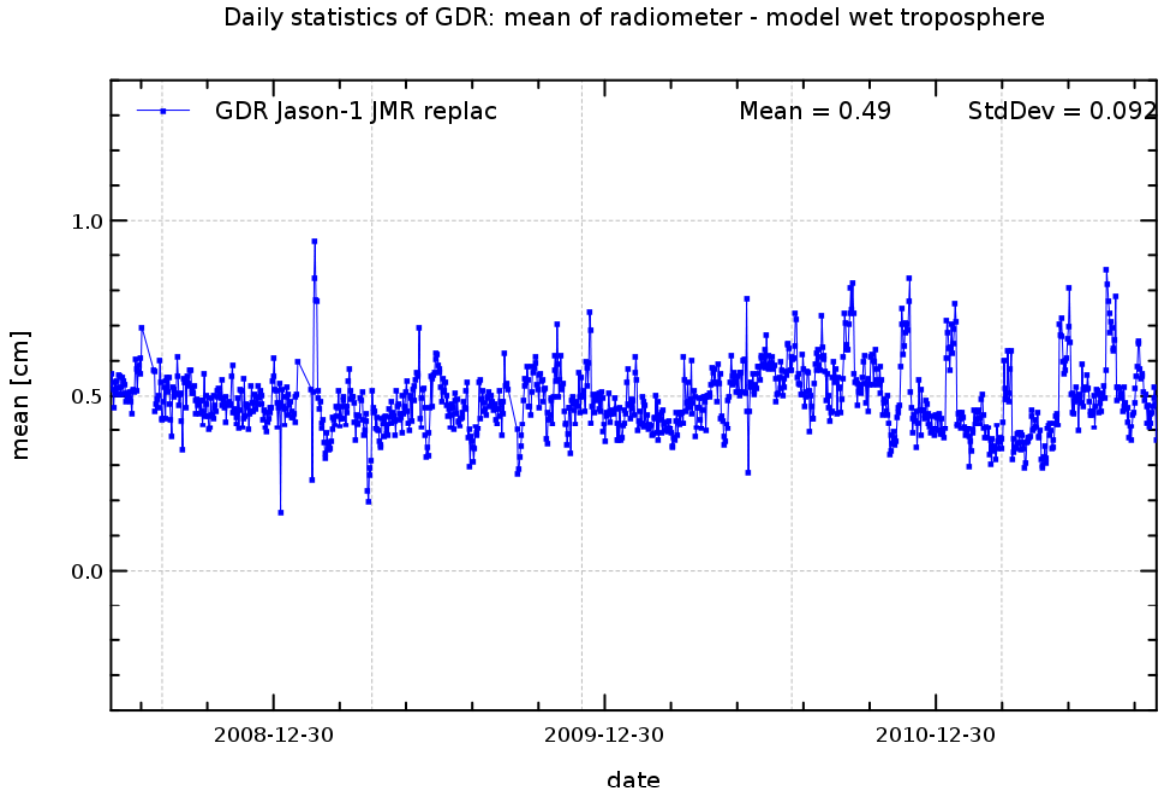


Monitoring of parameters

Stability of radiometer wet troposphere correction

- Radiometer – Ecmwf model wet troposphere correction shows:

- Instabilities during 2008, following safehold mode
- Is corrected by JMR replacement product (not included in JA1 GDR_C official products)

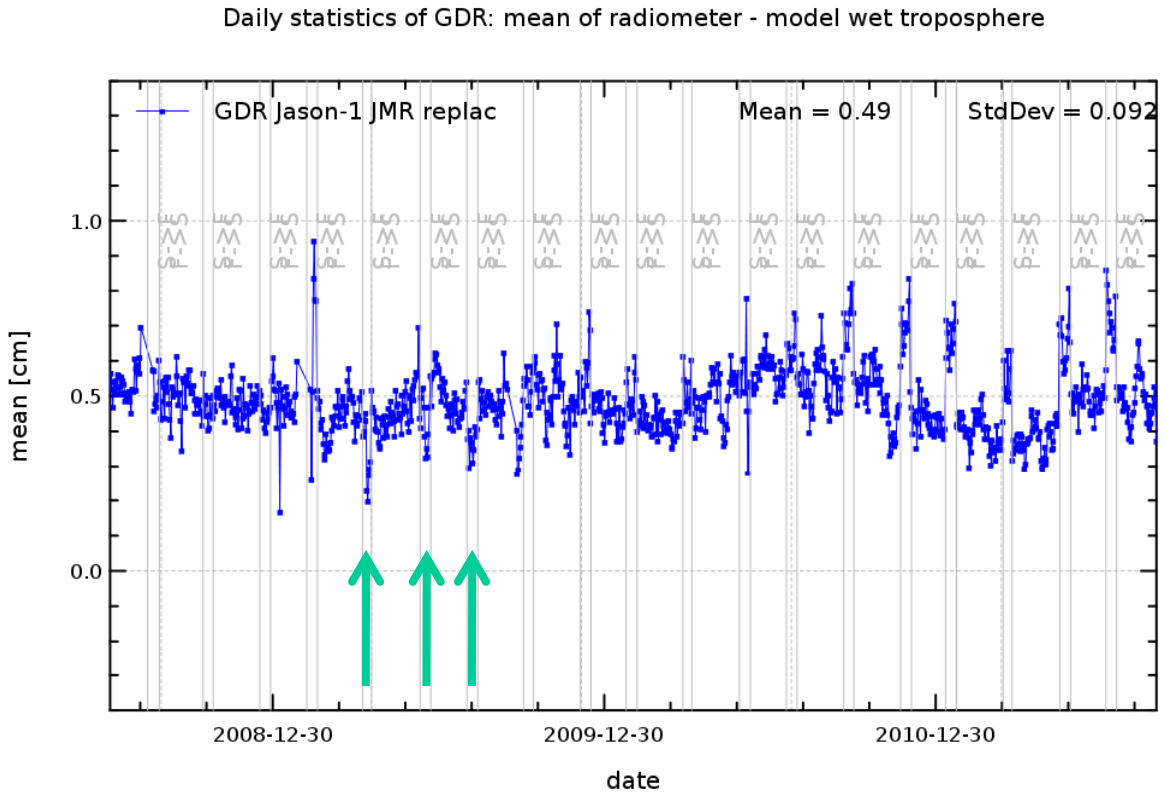


Monitoring of parameters

Stability of radiometer wet troposphere correction

- Daily Radiometer – Ecmwf model wet troposphere correction differences show:

  - JMR is impacted by yaw maneuvers
  - Since fall 2010, this impact increases (2-3 mm)

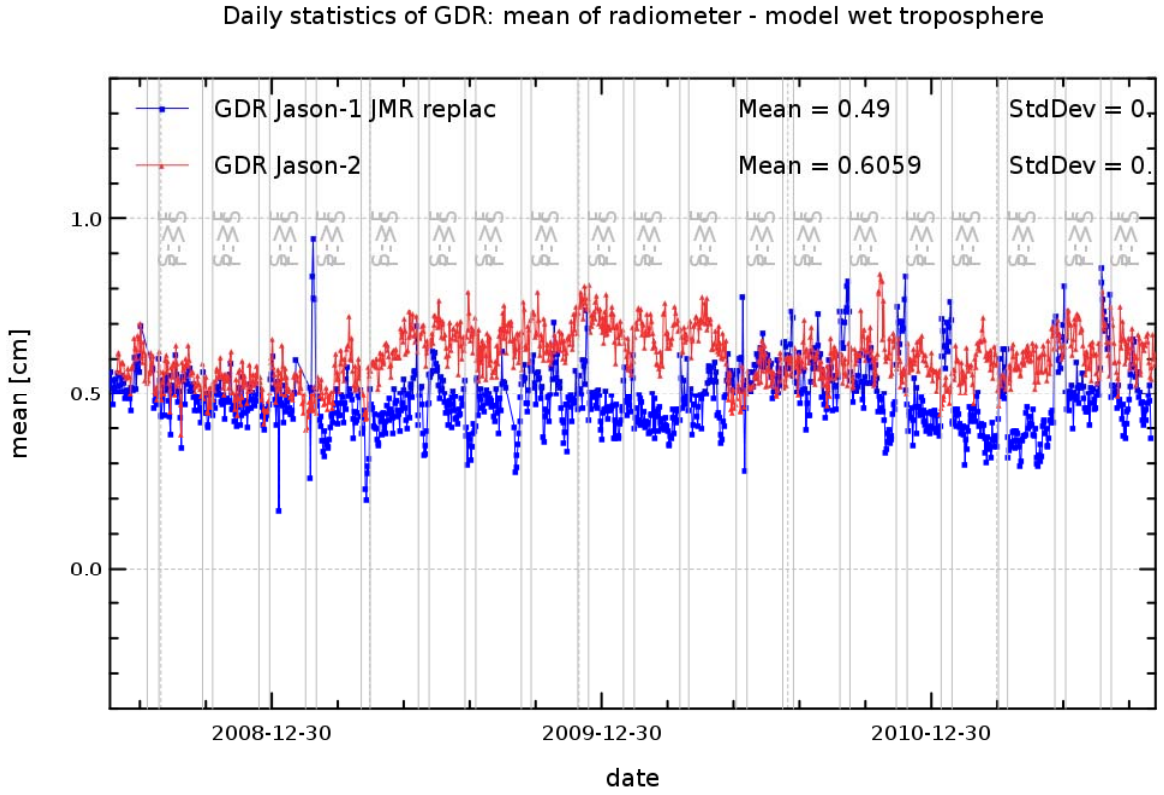


Monitoring of parameters

Stability of radiometer wet troposphere correction

- Daily Radiometer – Ecmwf model wet troposphere correction differences show:

  - JMR is impacted by yaw maneuvers
  - AMR is less sensitive to yaw maneuvers
  - AMR versus Ecmwf shows temporal evolution of up to 2 or 3 mm

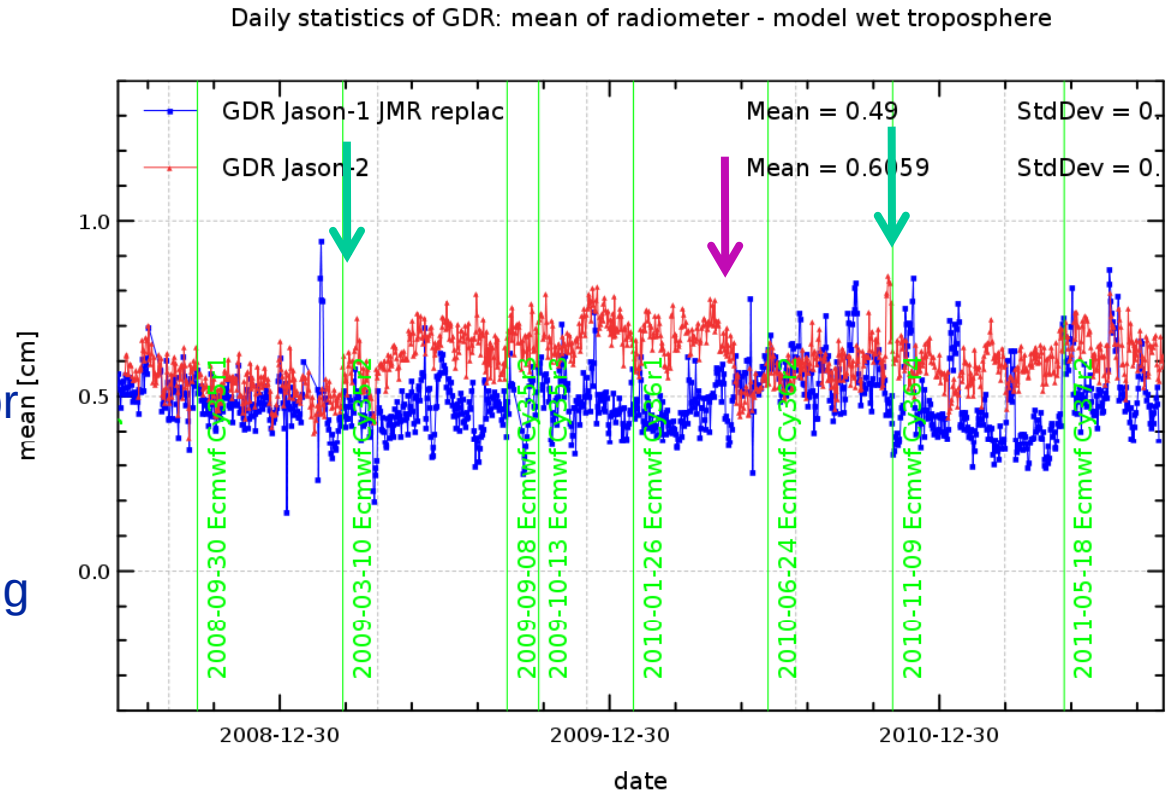


Monitoring of parameters

Stability of radiometer wet troposphere correction

- Daily Radiometer – Ecmwf model wet troposphere correction differences show:

  - JMR is impacted by yaw maneuvers
  - AMR is less sensitve to yaw maneuvers
  - AMR versus Ecmwf shows temporal evolution of up to 2 or 3 mm, sometimes related to evolution of Ecmwf model
  - Decrease of about 2 mm during cycle 69: related to ARCS recalibration



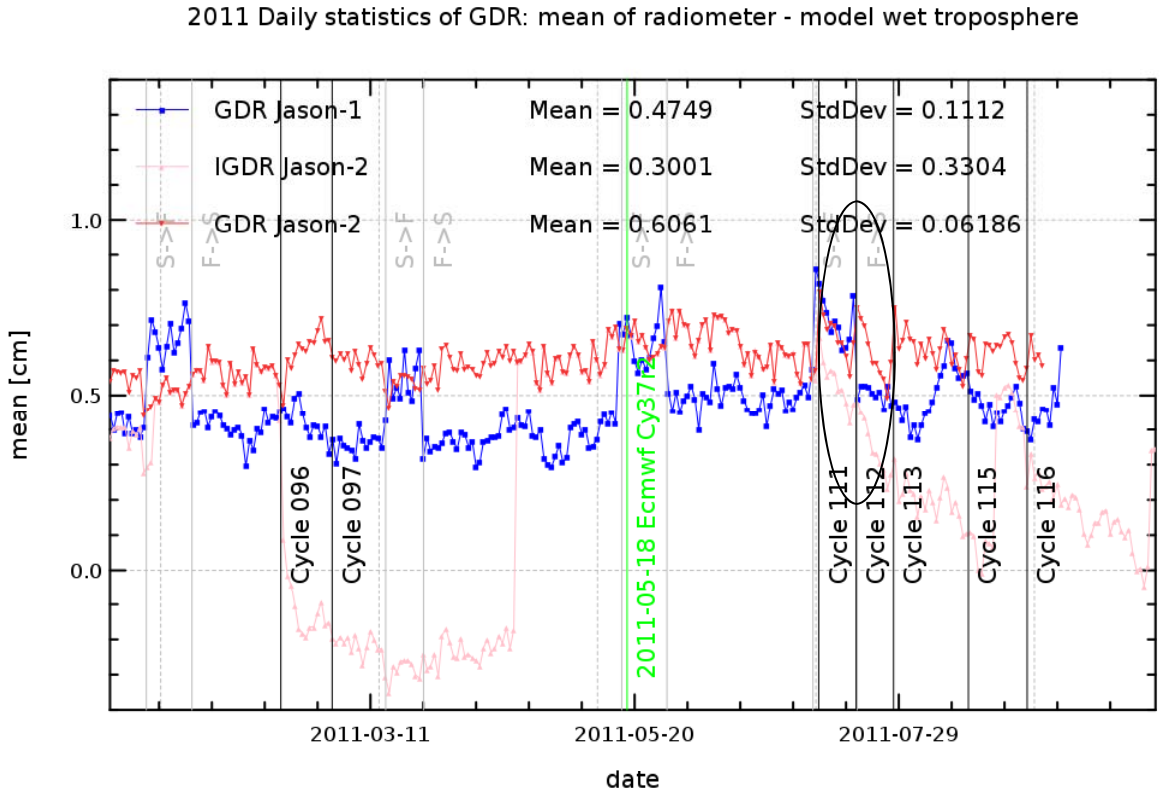
Monitoring of parameters

Stability of radiometer wet troposphere correction

- Daily Radiometer – Ecmwf model wet troposphere correction differences show:

– AMR versus Ecmwf shows temporal evolution of up to 2 or 3 mm, sometimes related to evolution of Ecmwf model

– Number of Arcs calibrations increases especially during 2011 – but this does not allow to correct for all fast evolutions (see cycle 111 for example)



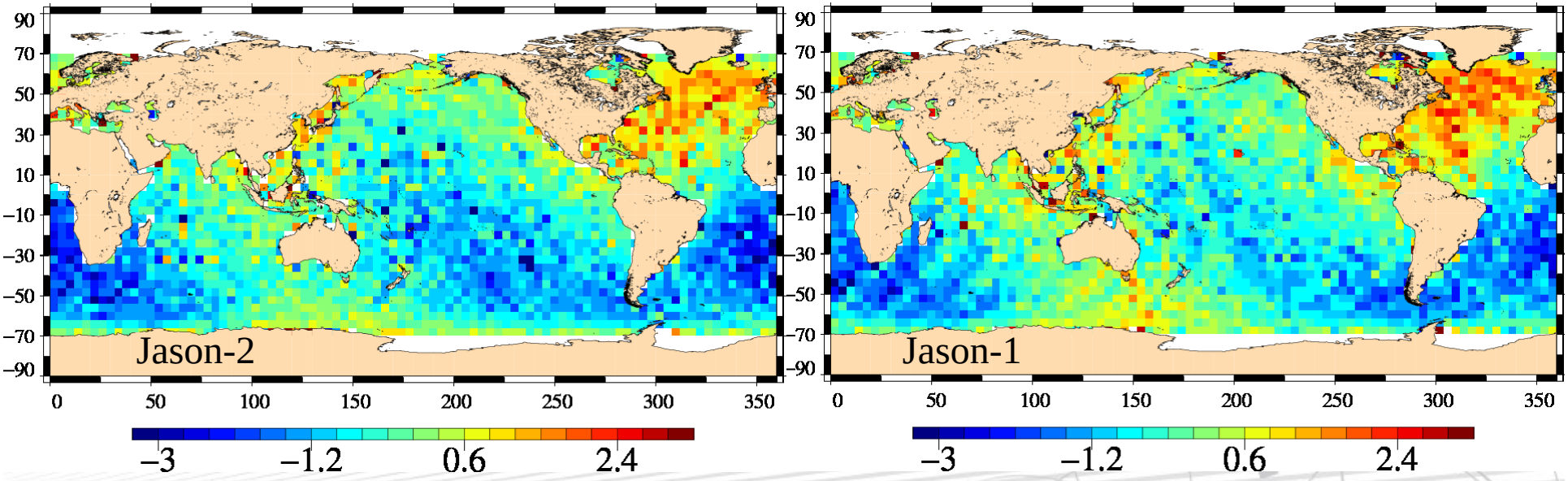
SSH performance and consistency

In order to verify the quality of the sea surface height:
• coherence of ascending / descending SSH differences at crossover points is monitored

SSH performance and consistency

Spatial distribution at crossovers

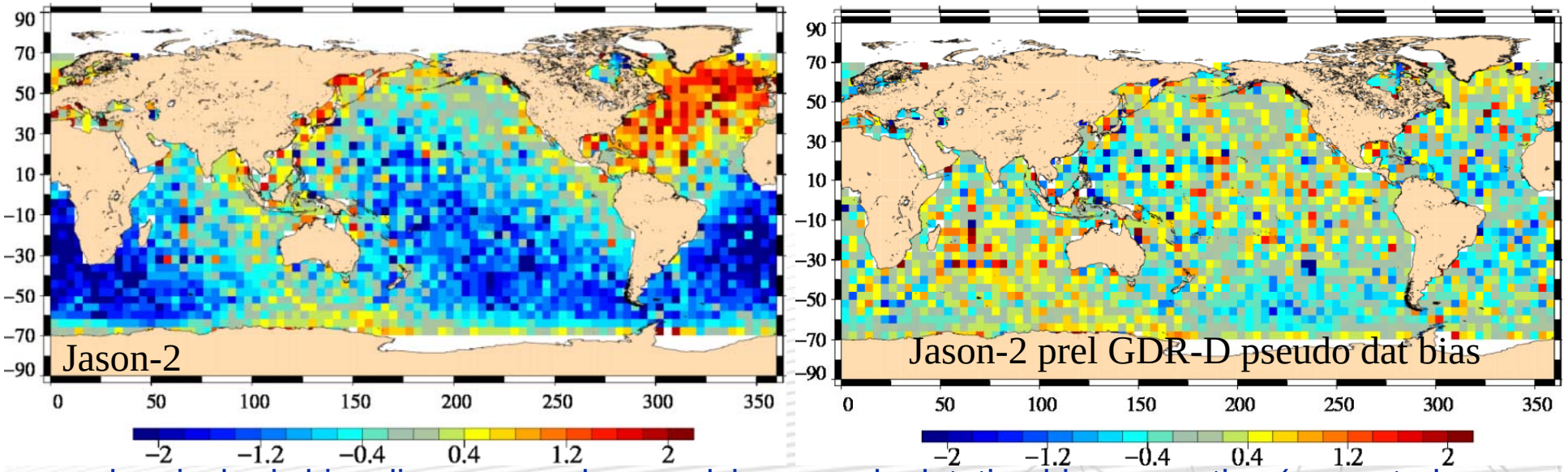
- SSH performances at crossovers are good, but show geographically correlated patterns up to +/- 2 cm amplitude:
  - Positive in North Atlantic, negative in South Atlantic
- Same patterns for Jason-1



SSH performances and consistency

Spatial distribution at crossovers

- SSH performances at crossovers are good, but show geographically correlated patterns up to +/- 2 cm amplitude:
  - Positive in North Atlantic, negative in South Atlantic
- Patterns are related to orbit computation
- Patterns are strongly reduced when using preliminary GDR-D orbit, thanks to new gravity field → reveals small hemispheric bias



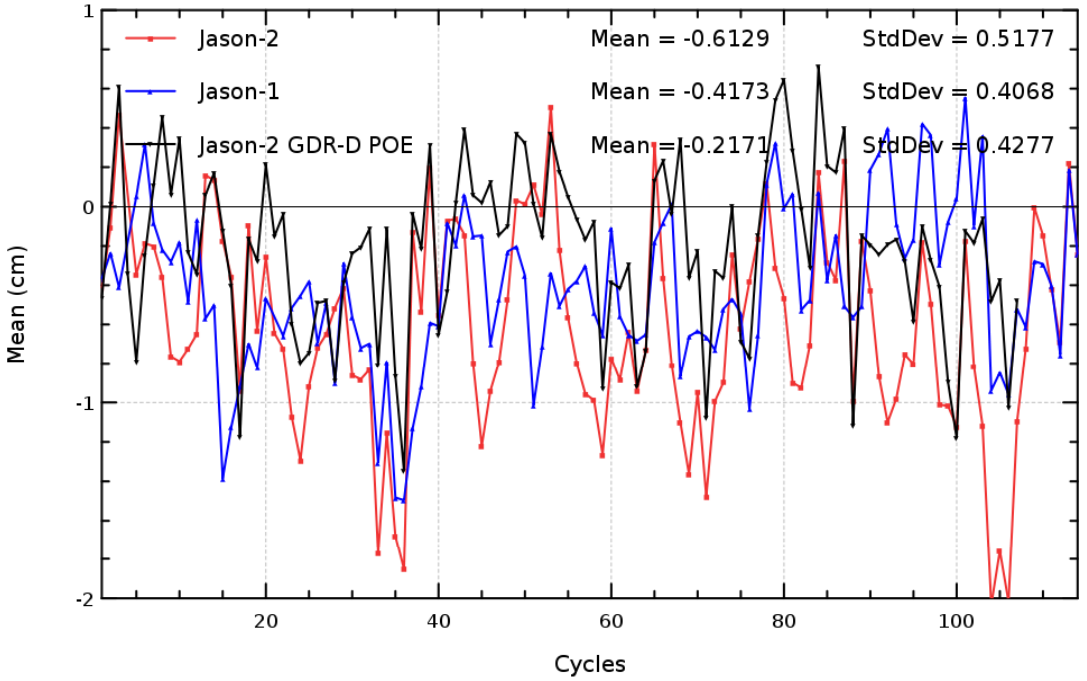
- hemispheric bias disappears when applying pseudo datation bias correction (computed similar to the one available in Jason-1 GDR-C). This will be corrected in GDR_D products

SSH performances and consistency

Temporal evolution of asc/desc SSH differences

- Cyclic monitoring of mean SSH differences at crossovers are good, but:
  - Show a periodic 120 day signal, related to orbit
  - Are generally negative (reveals systematic ascending/descending differences)
  - Improved with preliminary GDR-D orbit

Selecting data with |latitude| < 50°, bathymetry < -1000m, low ocean variability (<20cm)



Along-track Sea Level Anomaly

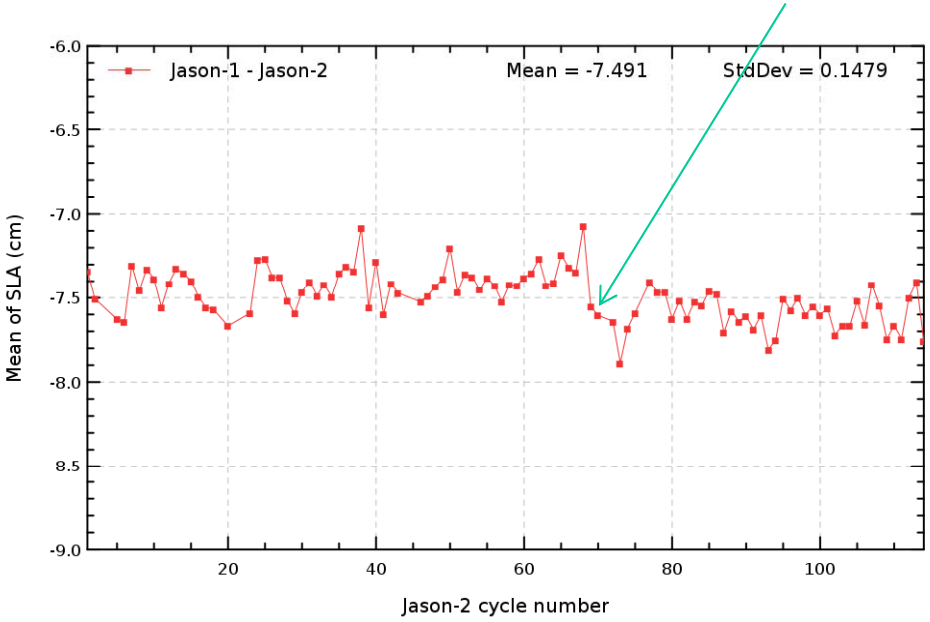
In order to verify, that there is no drift between Jason satellites, along-track sea level anomaly is computed for both Jason-1 and Jason-2 and compared. External comparison to tide-gauge measurements allow to assure stability.

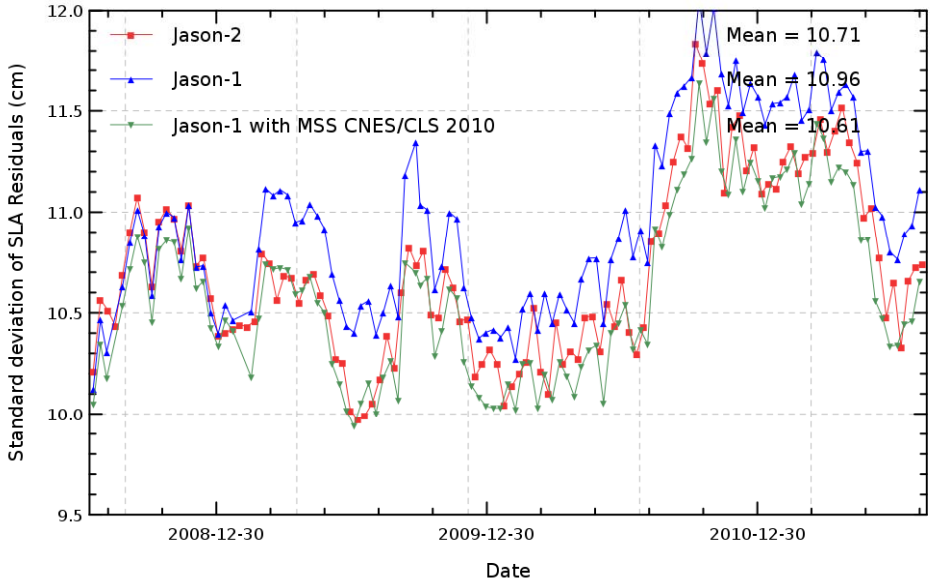
Along-track Sea Level Analysis

Coherence between Jason-1 and Jason-2

- Mean difference of SLA between Jason-2 and Jason-1 about 7.5 cm
- Standard deviation of SLA about 10.7 cm
  - Std of Jason-1 SLA increased since orbit change February 2009
  - Using MSS CNES/CLS2011, reduces significantly std of Jason-1 SLA even for interleaved ground-track

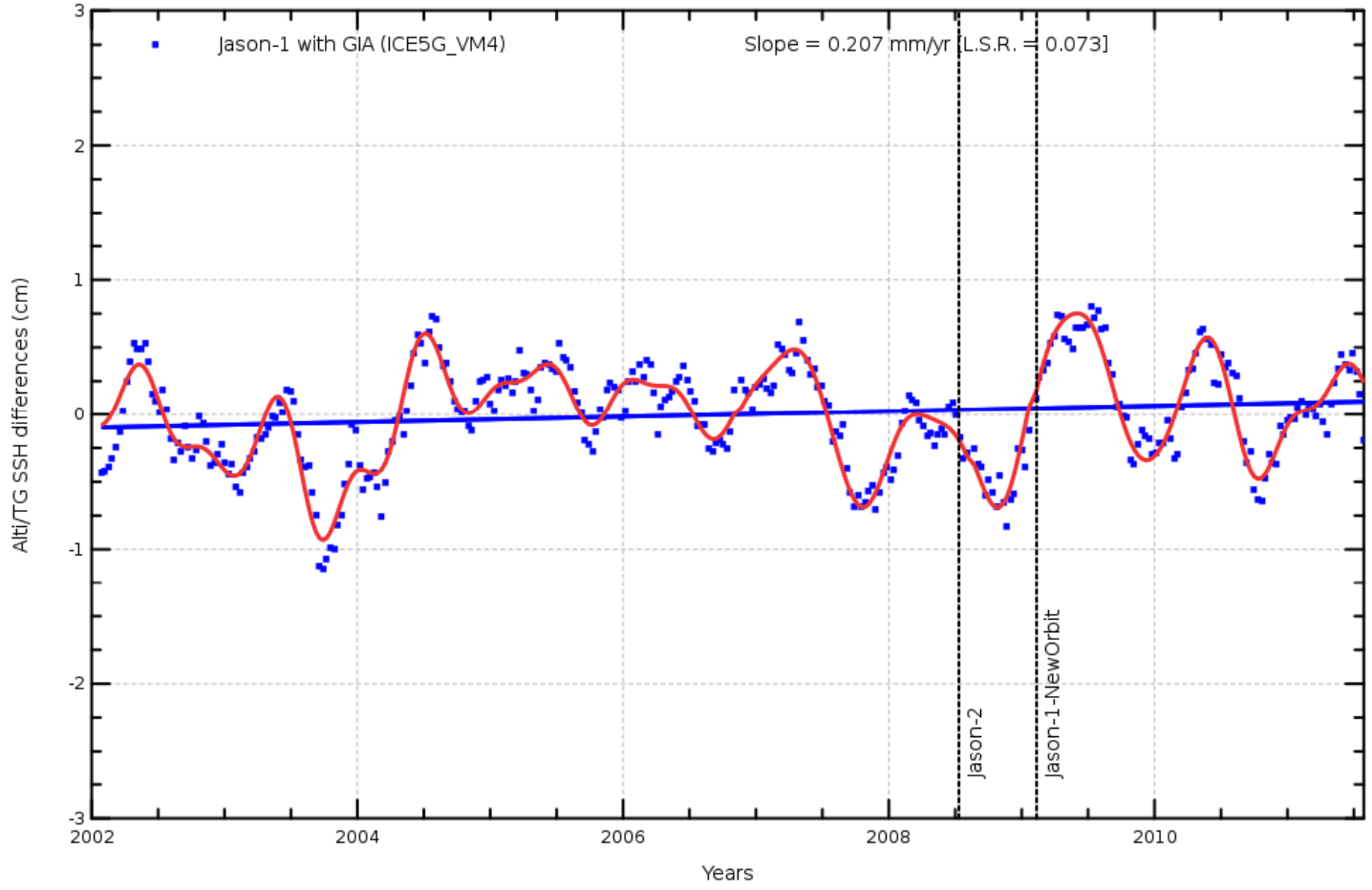
Cyc 69: New calibration coefficients for AMR





Along-track Sea Level Analysis

- Comparison between Jason-1 SLA and Tide-gauges show only trend differences of 0.2 mm/yr (within the errors of the method)



Summary

- Jason-2 has excellent data availability. Jason-1 has for 2011 also excellent data availability, but recently a few tracks were not produced due to degraded datation related to fuel depletion maneuvers
- Jason-2 altimeter parameters show very good quality. In order to further improve data quality:

➢ Wet troposphere correction shows discrepancies depending which radiometer or model is considered. Note that IGDR data show for 2011 important jumps and drifts -> largely improved with ARCS in GDR release

➢ SSH performances at crossovers are good, but show geographically correlated patterns up to +/- 2 cm amplitude (will be corrected in GDR-D products) and periodic 120 day signal, related to orbit.

➢ Applying pseudo datation bias (as already used for Jason-1) would reduce hemispheric bias -> will be corrected in GDR-D release