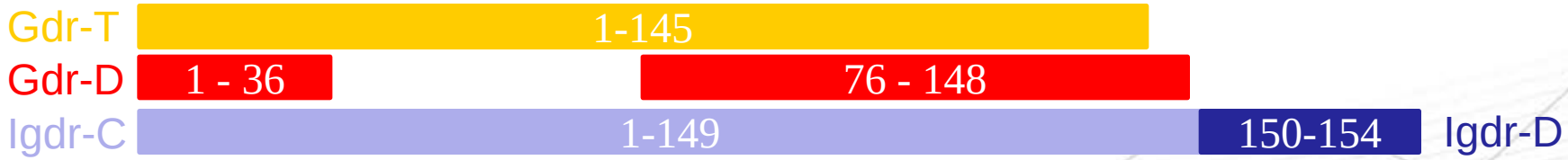
Global Jason-2 Data Quality Assessment including first results of GdrD reprocessing

S. Philipps & H. Roinard, M. Ablain, G.Valladeau (CLS)
N Picot (CNES)

Introduction

- Objective:
  - Assess Jason-2 data quality and system performances (GdrT/ GdrD – complete reprocessing will be terminated before end of 2012)
  - Comparison between different data types (Gdr, Igdr, Ogdr)
- Data used:
  - 1 Hz Jason-2



- Overview:
  - Analysis of missing and edited measurements
  - 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
  - Stability of Mean Sea Level

Evolutions between GdrT/ GdrD

Standard	Product Version « T »	Product Version « D »
Orbit	CNES POE standard C	CNES POE standard D
Jason-2 microwave radiometer parameters	Using ARCS	ARCS+ new calibration coefficients + enhancement in coastal regions + correction of 34 GHz anomaly
Sea state bias model	Empirical model derived from JA1	New look-up table, derived from Jason-2 data
Mean Sea Surface	CLS01	CNES CLS 2011
Tide Solution 1	GOT00.2	GOT4.8
Altimeter Wind	derived from Jason-1	Same table, but the inputs differ (JA2 sigma0 biased to align it to JA1 one's)
Update of the altimeter characterization file		• more precise PRF value • Bias of 18.092 cm applied on range (corrects the value of the distance between CoG and the reference point of the altimeter antenna) • Antenna aperture angle now 1.29 deg • MQE setting is applied
Other		• the origin of the constant part of the time tag bias was found and is directly corrected in the Gdr-D datation.

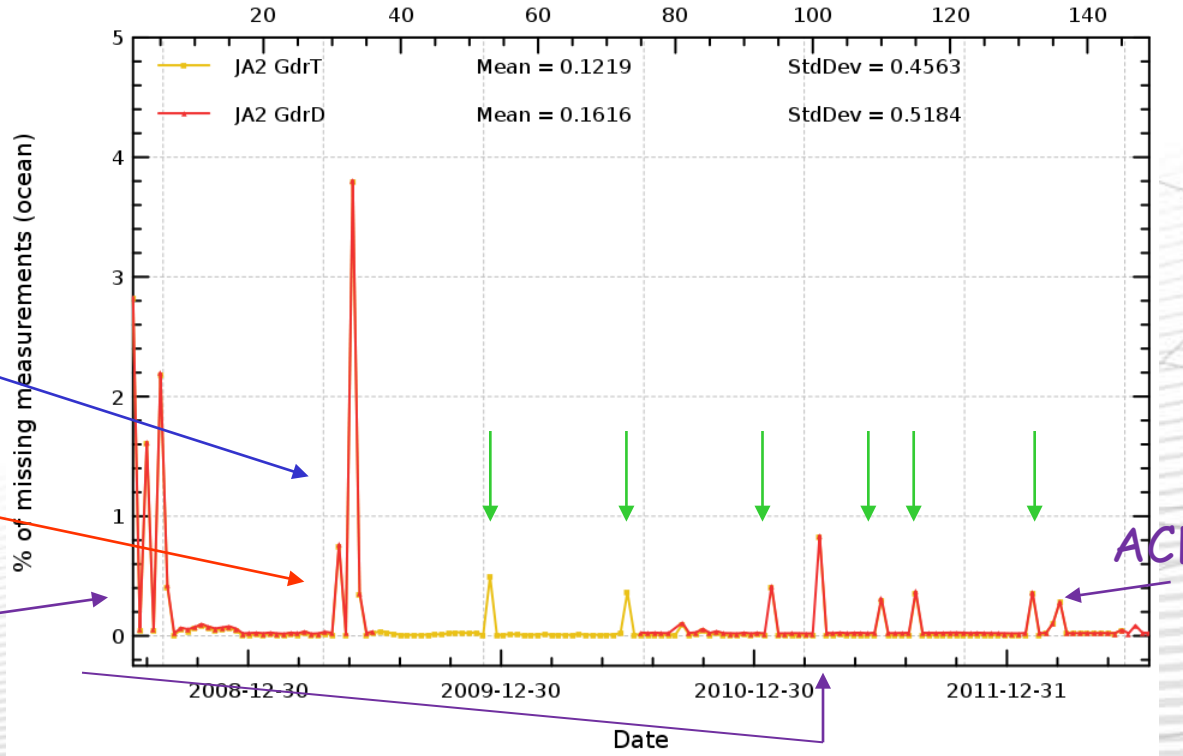
Data coverage

To verify data coverage, systematic monitoring of percentage of missing ocean data is performed. Verification is done, to assure that reprocessed Gdr-D data have equivalent data coverage as Gdr-T

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
- Gdr-D : equivalent data availability as for Gdr-T



Data coverage

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

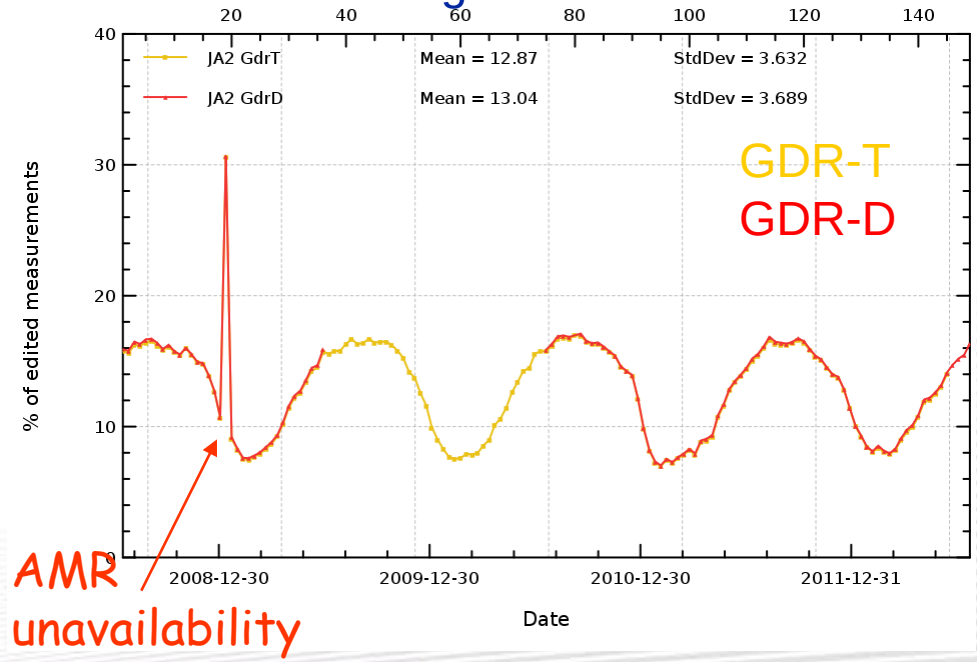
- using flags (sea ice flag)
- using thresholds on altimeter and radiometer parameters

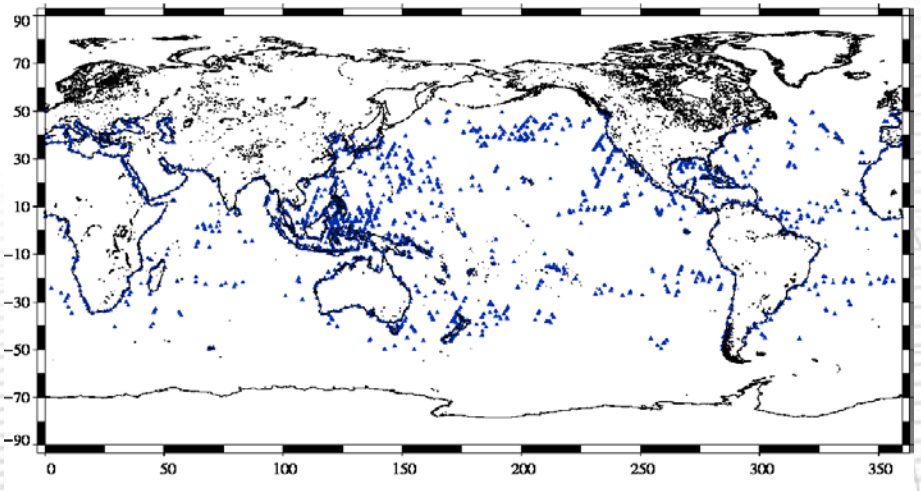
Percentage of edited measurements is monitored.

Data coverage

Edited measurements

- Percentage of edited measurements show an annual signal due to ice coverage
- Very few measurements edited due to anomalies
- Gdr-D edits slightly more measurements (0.1%) than Gdr-T due to use of MQE threshold in 20 Hz to 1 Hz compression => more data at default value in regions with disturbed waveforms due to sea state (rain cells, …)





Monitoring of Parameters

Monitoring of altimetric parameters is very important to

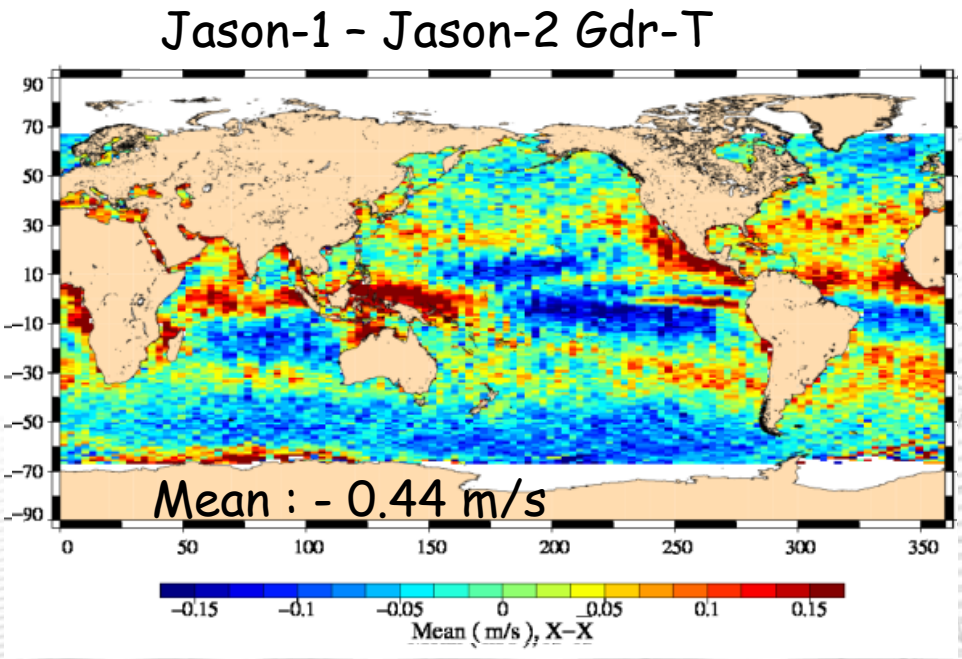
- Verify stability of measurements
- Detect anomalies (jumps, drifts)
- Monitor natural evolution of parameters

Comparison between Gdr-D and Gdr-T are done

Monitoring of parameters

Altimeter wind speed

- Jason-2 Gdr-T wind speed is slightly higher by about 0.4 m/s than Jason-1 one´s
- During formation flight phase (cycles 1 -20), Jason-1 minus Jason-2 Gdr-T wind speed show regional differences
- JA1 minus JA2 Gdr-D wind speed much more homogeneous (bias reduced to 0.07 m/s).



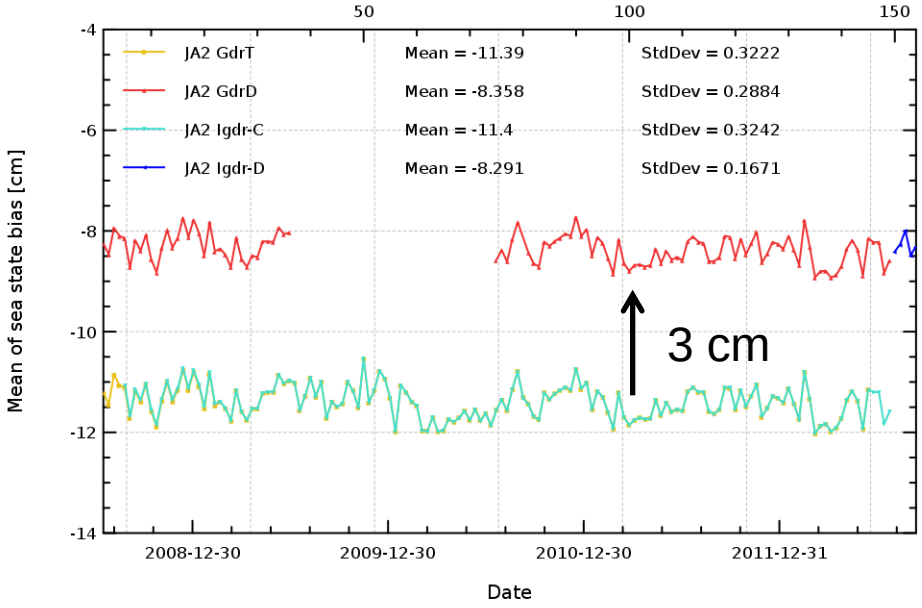
Monitoring of Parameters

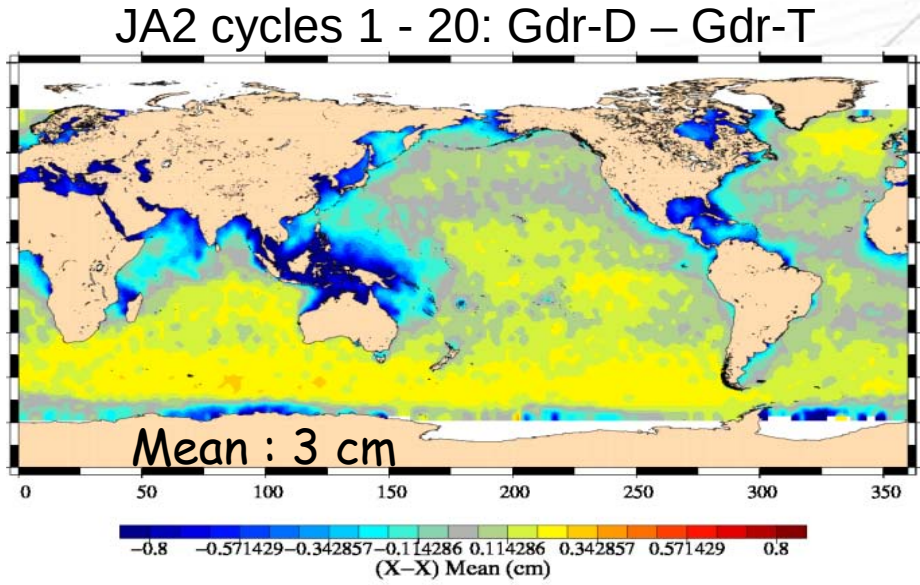
Sea State Bias

- A new sea state bias table is used for Gdr-D data :
  - It differs by about 3 cm from the GdrT sea state bias. Same behavior for Igdr's
  - Regional GdrD/GdrT differences

➢ GdrD SSB model was calculated with a different approach for low sea states (less stringent editing applied) than the Jason-1's one.

GDR-T
GDR-D

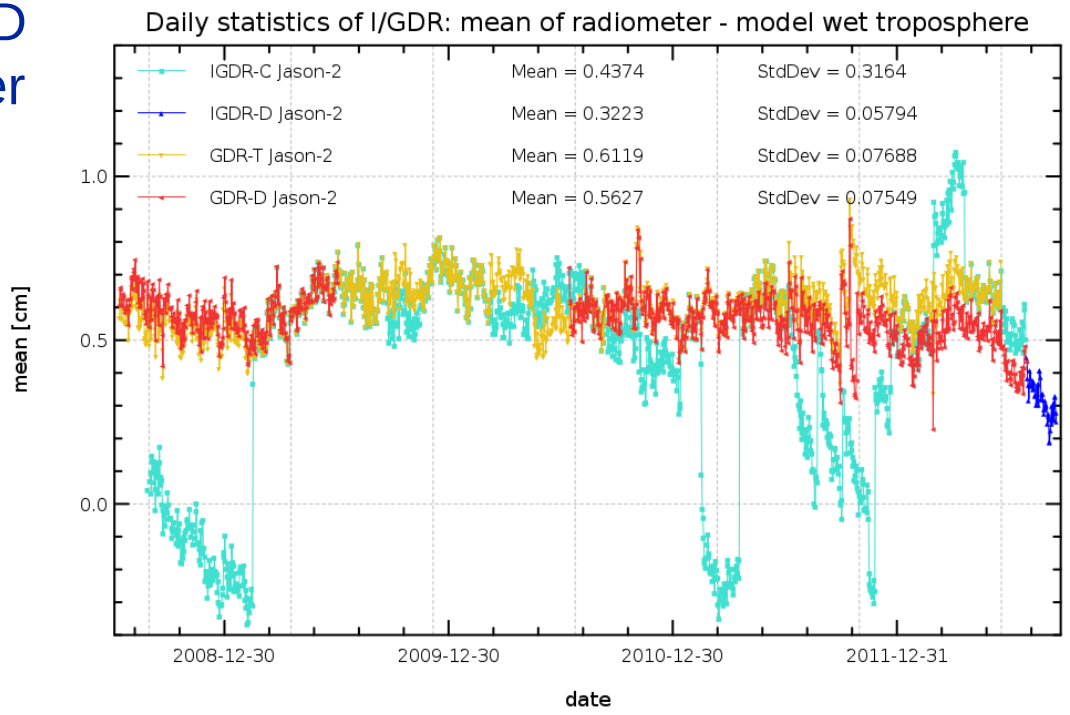




Monitoring of parameters

Stability of radiometer wet troposphere correction

- Radiometer – Ecmwf model wet troposphere correction shows:
  - drifts and jumps in Igdr
  - the jumps and most of the drifts are corrected in GDR-T with the ARCS system
  - AMR recalibrated for GDR-D -> evolution of ~1.5 mm over 4 yr between GDR-T and GDR-D



- JPL provided for GDR-D new radiometer wet troposphere correction with climate stability till cycle 113
- Cycles 114 – 140 intermediate quality
- > cycle 140: operational quality

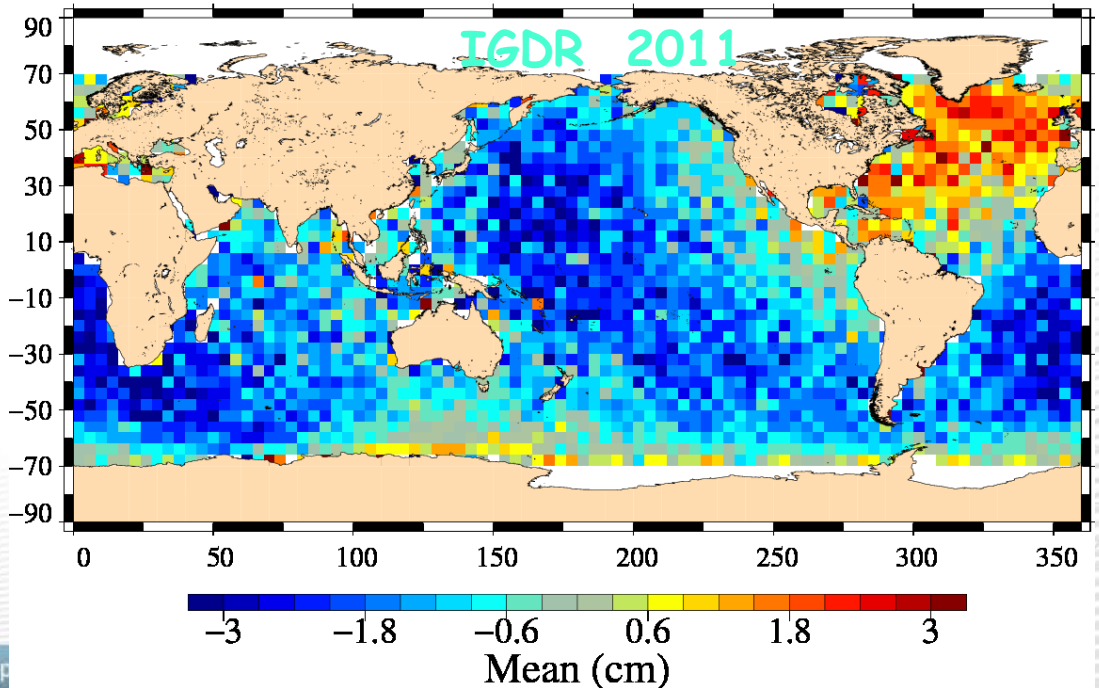
SSH performance and consistency

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 mean is slightly negative and shows geographically correlated patterns (Positive in North Atlantic, negative in South Atlantic)
  - quite strong for IGDR
  - reduced but still visible for GDR-T
  - almost disappeared for GDR-D (no longer systematically negative)



- Related to orbit computation

Very homogeneous, due to:

- New POE-D
- Correction of the time tag bias in GDR-D

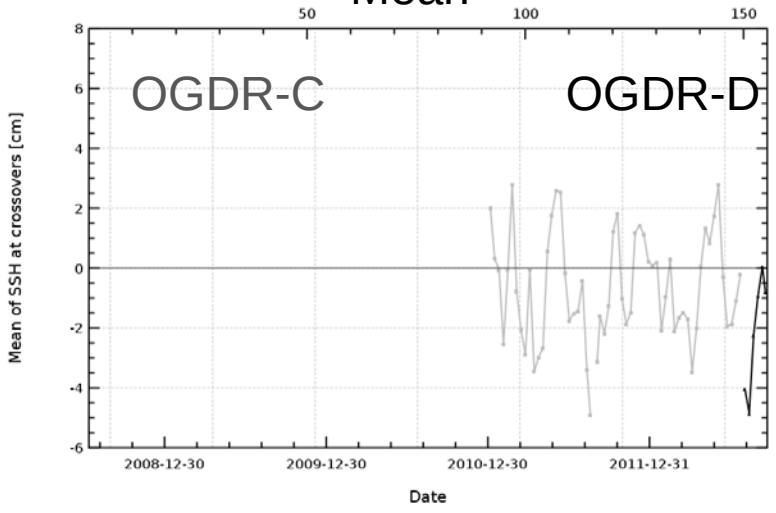
SSH performances and consistency

Temporal evolution of asc/desc SSH differences

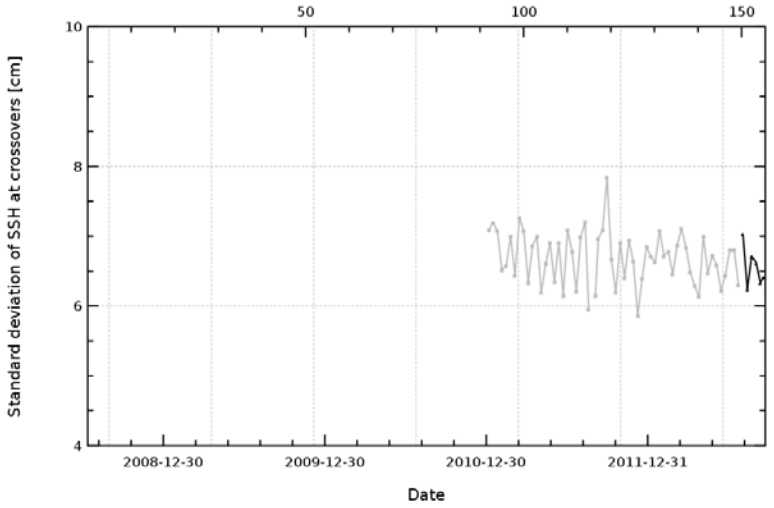
- Cyclic monitoring of mean SSH differences at crossovers are good, but:
  - Show a periodic 120 day signal, related to orbit
  - Are generally negative (reveals systematic ascending/descending differences)
  - Improved with GDR-D data

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

Mean



Std



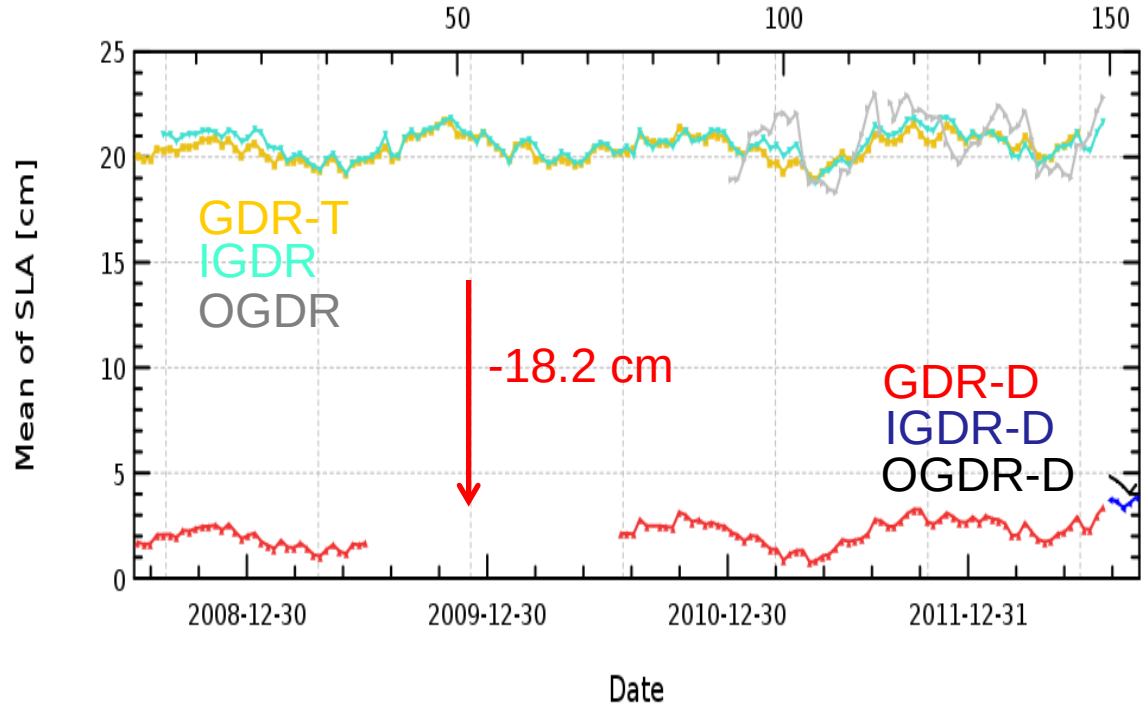
Along-track Sea Level Anomaly

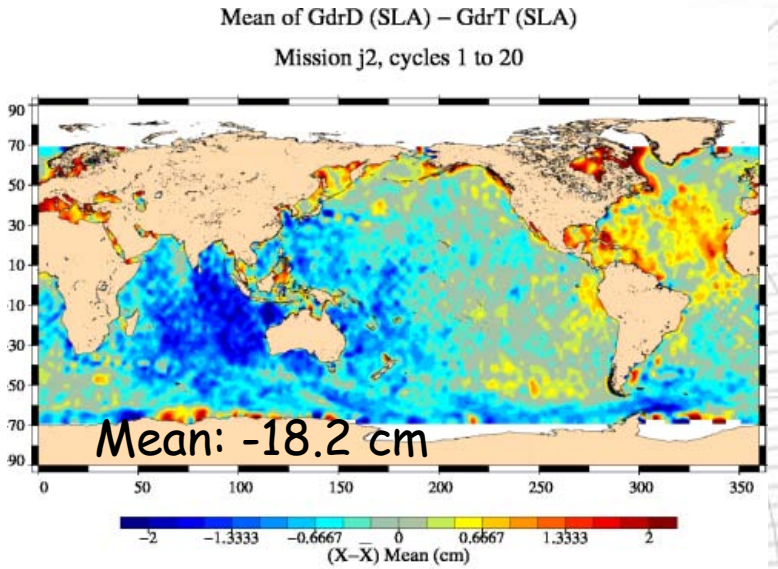
In order to verify, that there is no drift between Jason satellites, along-track sea level anomaly is computed for both Jason-1 and Jason-2 and compared. External comparison to tide-gauge measurements allow to assure stability.

Along-track Sea Level Analysis

Evolution from Gdr-T to Gdr-D

- Difference of -18.2 cm between GdrT and Gdr-D (mainly due to correction of range bias, more precise PRF, SSB)
- There also regional differences (due to orbit, SSB, MSS), which intensify over time (due to orbit)
- Difference Jason-2/Jason-1 before reprocessing: 7.6 cm, -10.6 cm after reprocessing (computed using AVISO method, corrections applied)



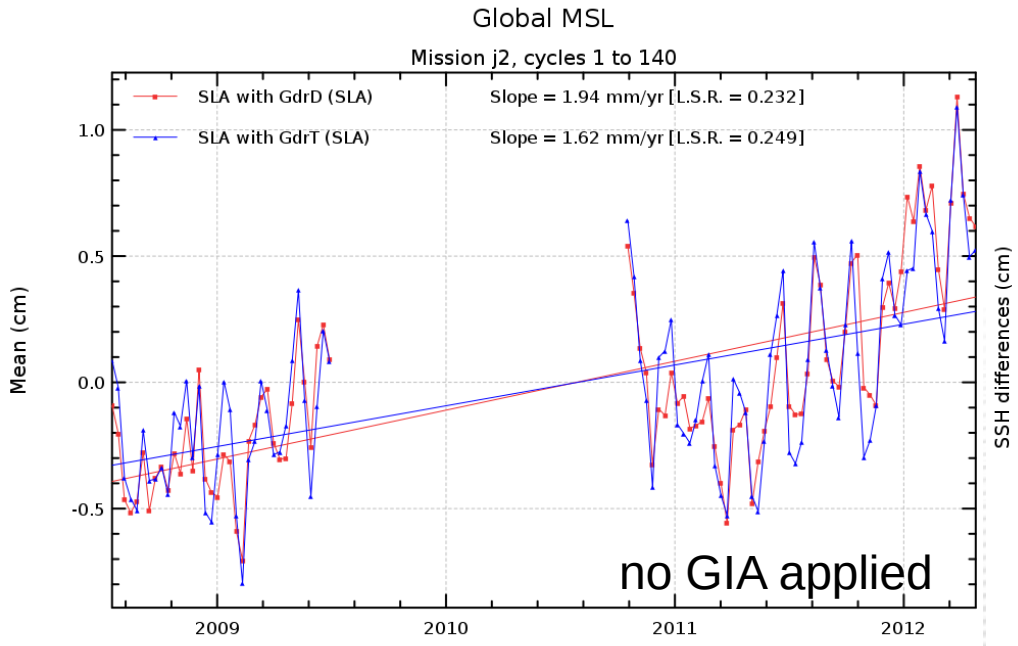


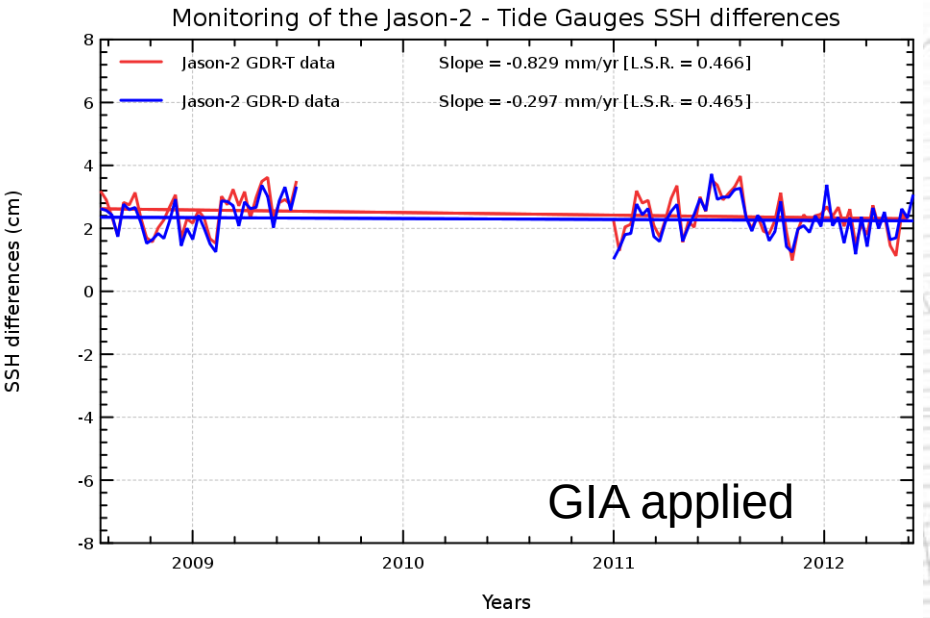
Along-track Sea Level Analysis

Global Mean Sea Level trend

- 2.5 year of reprocessed data is quite short for GMSL trend computation
- Gdr-D SLA trend shows an increase of about +0.3 mm/yr versus Gdr-T trend
- Comparison to Tide-gauge suggests an homogenization (-0.8 mm/yr -> -0.3 mm/yr)

➢ Results have to be confirmed after the availability of the whole time-series in Gdr-D



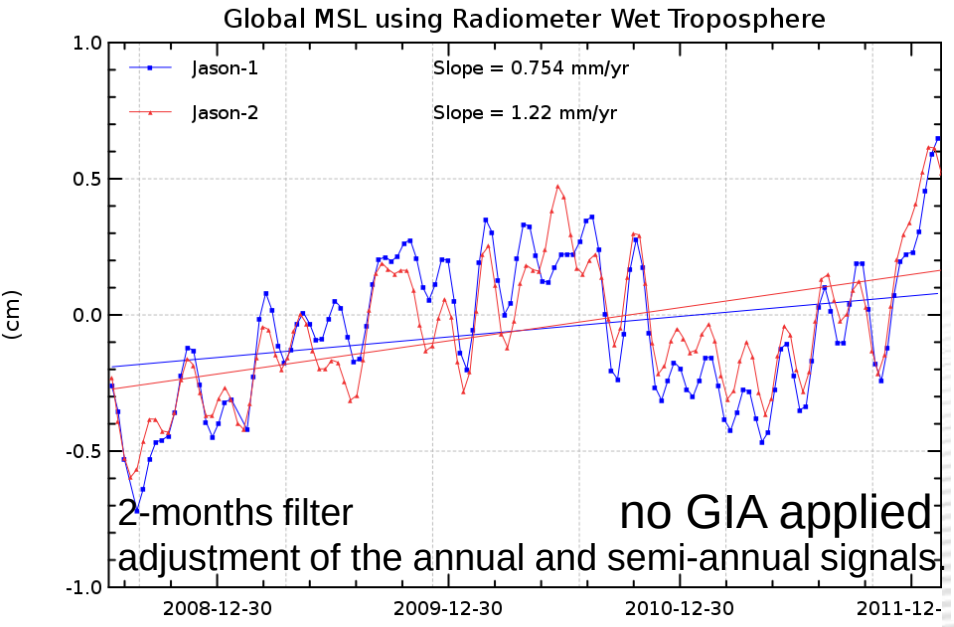


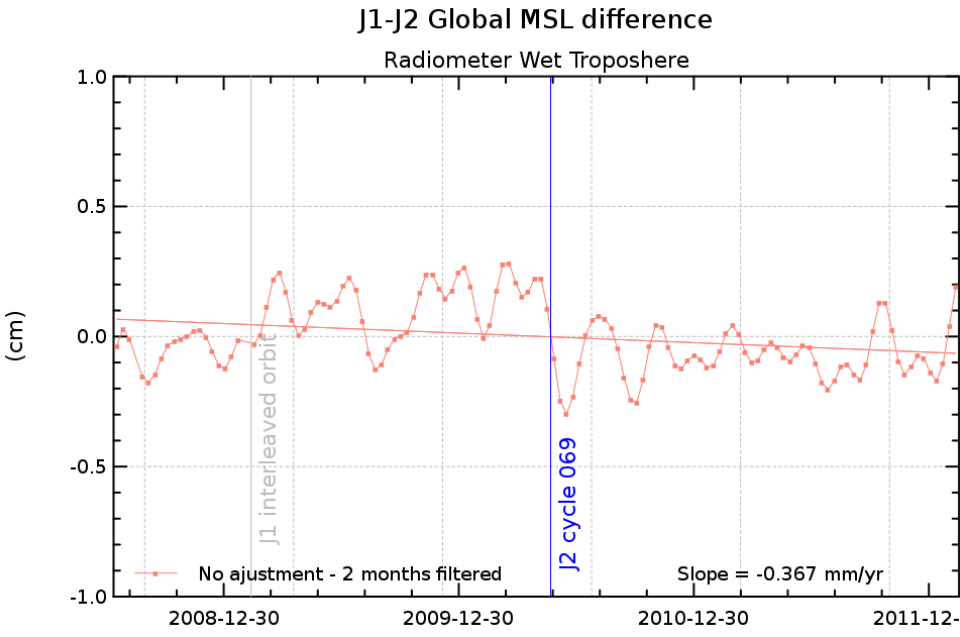
Stability of Mean Sea Level

Comparison between Jason-1 and Jason-2 GMSL

- Global Mean Sea Level computed over common period of Jason-1 and Jason-2 (~3.5 years (July '08 -> February '12) shows differences of about 0.4 mm/yr
- Jason-1 minus Jason-2 GMSL differences seems to reveal a change of behavior around JA2 cycle 069

➢ 0.4 mm/yr trend difference value is not significant over such a short time period due to strong interannual signals, but this difference will likely be increased after Jason-2 GdrD reprocessing





Summary

- Jason-2 has excellent data availability, as well as in Gdr-T, as in Gdr-D
- Jason-2 altimeter parameters show very good quality. Due to reprocessing of Gdr-D, most radiometer and altimeter parameters have changed between GdrT and Gdr-D. The Gdr-D parameters show improvements or equivalent quality as Gdr-T parameters.

- SSH performances at crossovers are good, the geographically correlated patterns observed with Gdr-T are strongly reduced for Gdr-D.
- Gdr-D products are corrected for the pseudo datation bias -> hemispheric north/south bias disappears
- Impact of GDR-D parameters/corrections on GMSL due to :
  - Orbit : low global impact (-0.1 mm/yr), strong regional impact (homogenization of asc/dsc MSL trends)
  - Radiometer: global impact of + 0.4 mm/yr

Gdr-D reprocessing is still on-going. Results have to be confirmed after the completion of reprocessing

See also :

Poster n° 8 ”Global Jason-2 Data Analysis of Reprocessed Gdr-D Products”

Report ftp://avisoftp.cnes.fr/AVISO/pub/jason-2/documentation/gdr_d_calval_report/JA2_GDR_D_validation_report_cycles1to20_V1_1.pdf