Jason-2 Mission Geodetic Phase

Alejandro Egido(1), Nicolas Picot(2), Cristina Martin-Puig(3), Shaileen Desai(4), Remko Scharroo(3), Eric Leuliette(1)

(1) NOAA
(2) CNES
(3) EUMETSAT
(4) NASA/JPL

Outline

- Intro
- LRO characteristics
- Data Availability, timeliness
- Data Quality in the LRO
  - AMR status
  - SSHA Cross-over analysis, statistics and spatial distribution
  - Mean sea-level stability
  - CNES-CLS MSS 2015 Analysis

Background Information

After several Safe Hold Modes, triggered by gyro malfunctioning, the Joint Steering Group decided to move Jason-2 to Long Repeat Orbit (LRO) and start the geodetic mission phase.

The new orbit was reached on July 8th and the onboard instruments have resumed nominal operations on July 11th.

The ground processing has also been resumed and the analysis of the instrument calibrations and Operational and Interim Geophysical Data Record (OGDR and IGDR) products demonstrate that everything is nominal on the spacecraft.

On September, 14th 2017, coinciding with the Jason-2 spacecraft entering in a high beta angle, a SHM was triggered immediately interrupting operations, which restarted operations on October 13th.

Low Repeat Orbit Characteristics

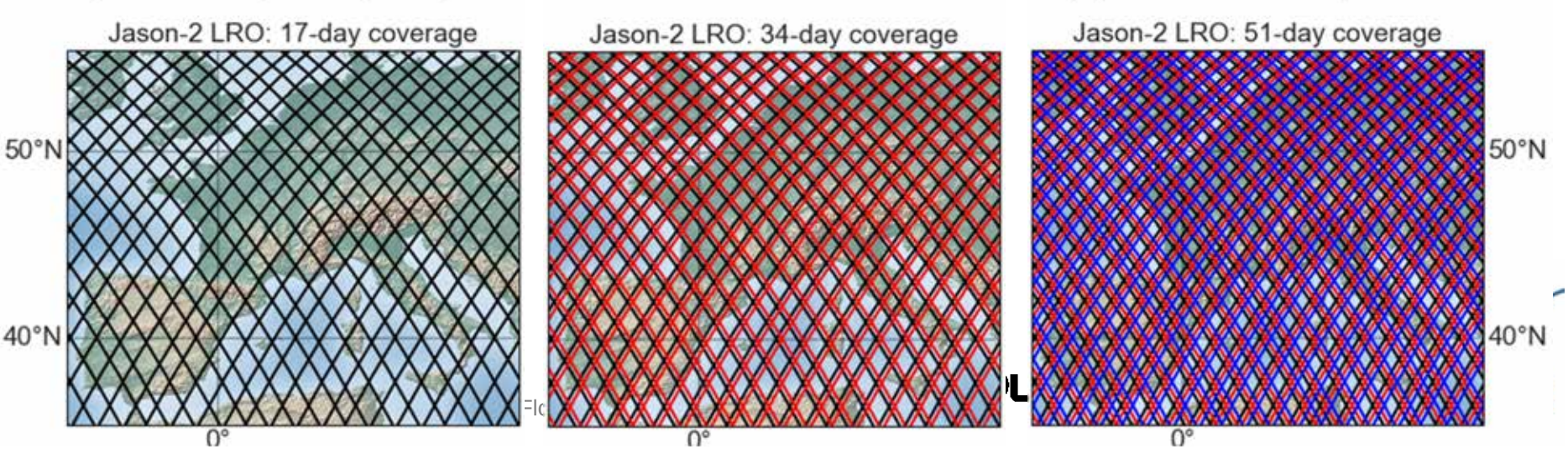
The Long Repeat Orbit

The Jason-2 **Long Repeat Orbit (LRO)** is approximately 27 km below the historical T/P orbit still used by Jason-3. It has the following sub-cycles (near repeat) and cycle (exact repeat) :

- Sub-cycle: 4 nodal days - 3.97 days - 51 revolutions
- Sub-cycle: 17 nodal days - 16.86 days - 217 revolutions (434 passes)
- Sub-cycle: 81 nodal days - 80.31 days - 1034 revolutions
- Sub-cycle: 145 nodal days - 143.77 days - 1851 revolutions
- Cycle: 371 nodal days - 367.84 days - 4736 revolutions

The first two sub-cycles are beneficial for sea-state and mesoscale operational applications respectively: they guarantee a nearly geographically homogeneous sampling for the temporal scales of interest (e.g. for operational model assimilation).

Each period of 17 days yields a geographically regular grid of 434 passes (approx. 180 km at the Equator). Due to the presence of the 81-day sub-cycle, subsequent grids are shifted in longitude by approximately 40 km (resolution of the 81-day sub-cycle). The same phenomenon exists with the 4-day and 17-day sub-cycles (780 km grid translated by 280 km every 4 days) and other sub-cycles.



The Long Repeat Orbit

- The very long repeat cycle yields a fine grid of approximately 8-km: it is beneficial for marine geodesy (e.g. improvement of bathymetry and mean sea surface models).

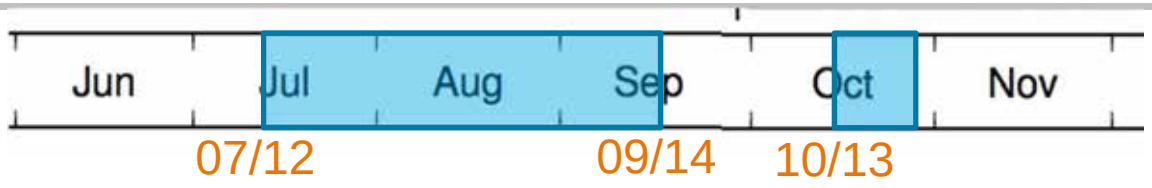
- The 145-day sub-cycle is also a "fallback geodetic sub-cycle". This sub-cycle was selected as a "coarse geodetic grid", i.e. as a safety net if full geodetic cycles cannot be completed. The strategy is inherited from Jason-1 EoL where we tried to optimize all sub-cycles (shorter ones for sea-state and mesoscale, and longer ones for geodesy).

- If Jason-2 LRO outlives its first geodetic cycle, it could be possible to let the ground track drift in longitude and to acquire a geodetic dataset with an unprecedented resolution of 4 km or less.

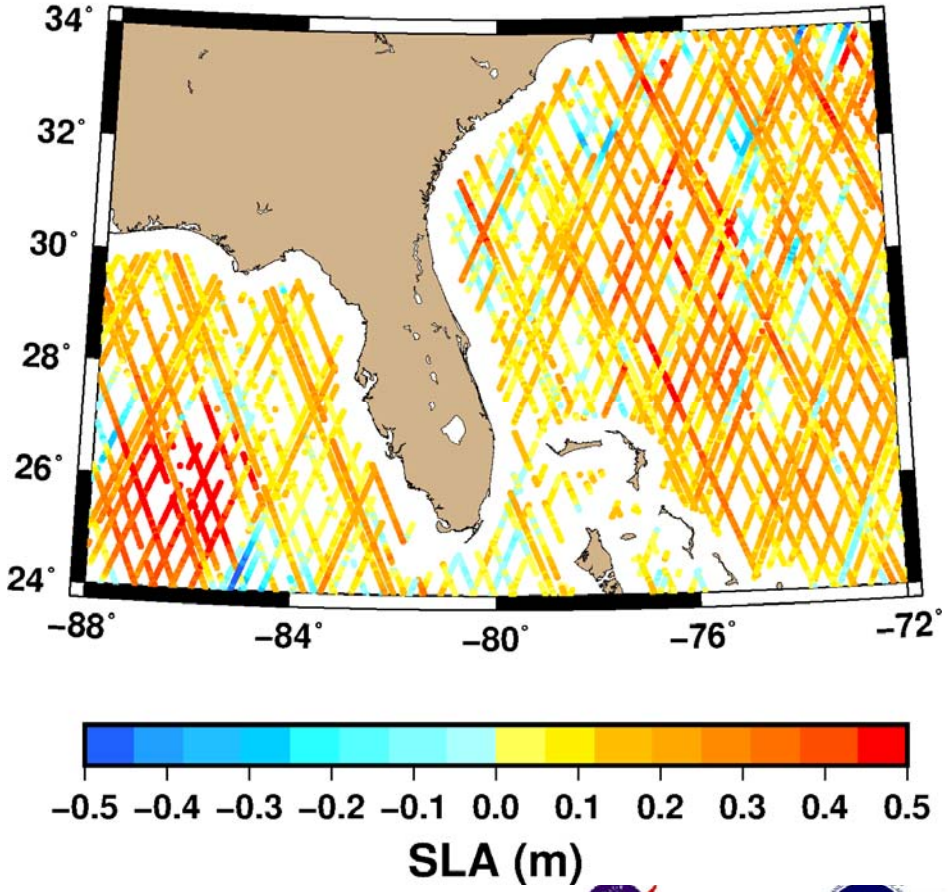
Data Availability and Timeliness

Data Availability

LRO Phase:

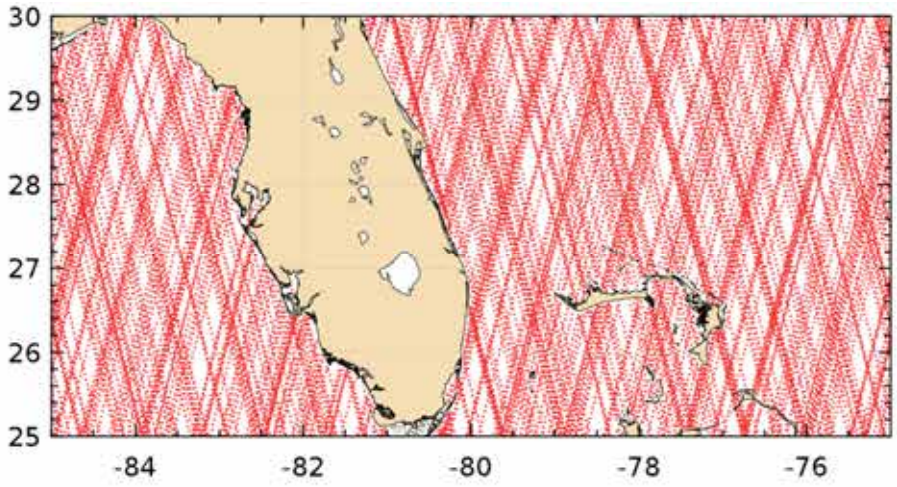


SLA 20170712 to 20171026

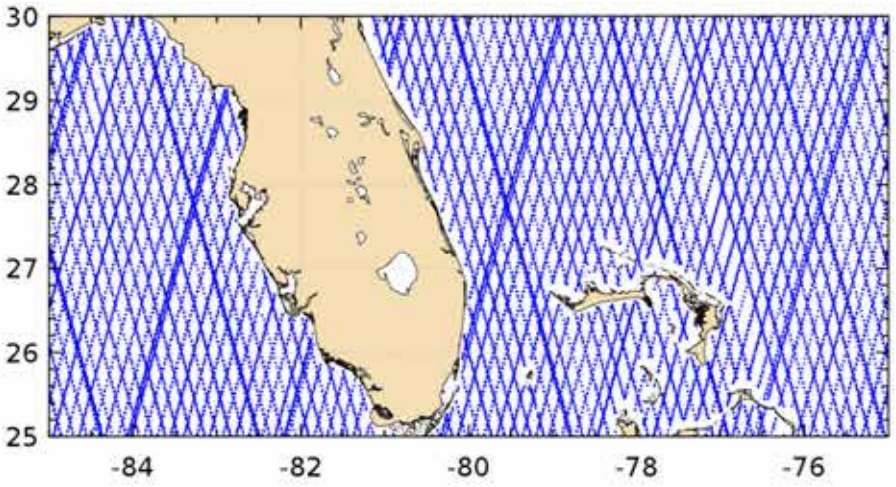


Coverage – other geodetic missions

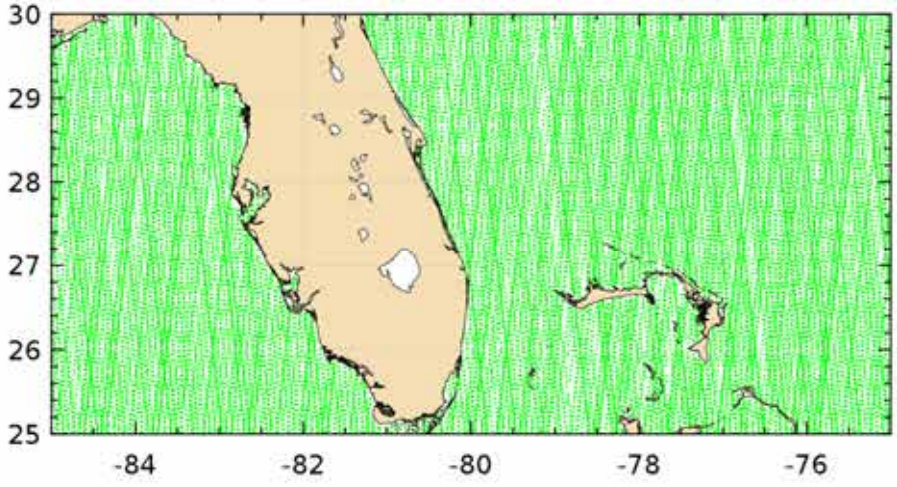
Altika



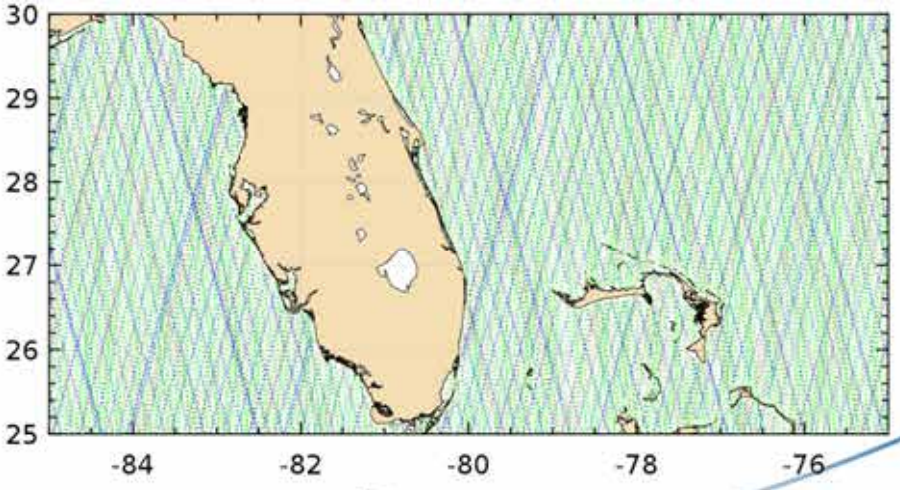
Hai Yang-2



CryoSat-2



AL + HY2 + C2



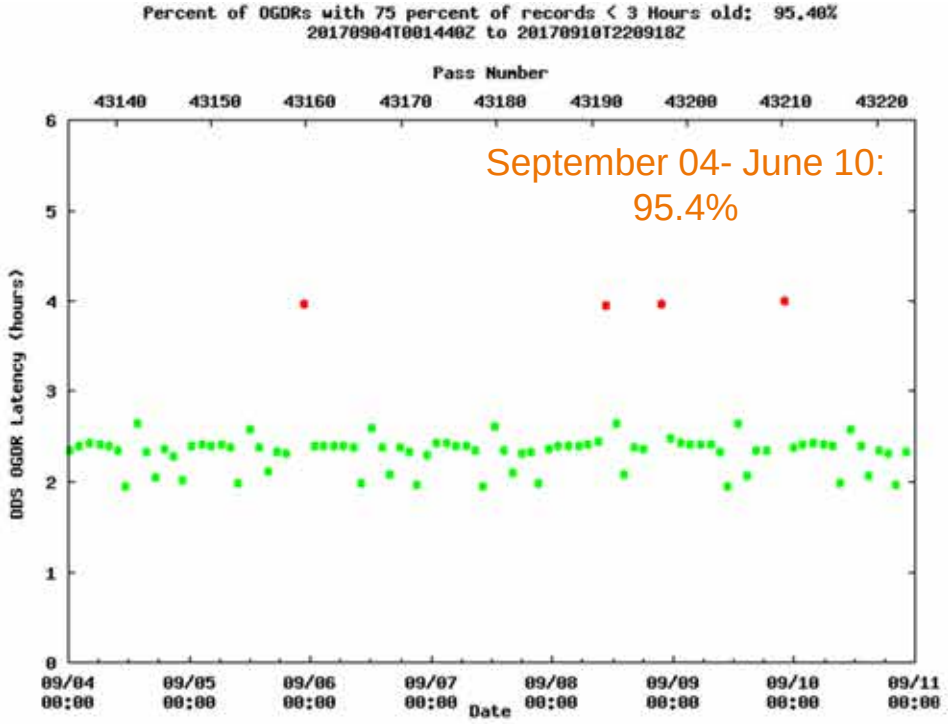
Images Courtesy, CNES/CLS

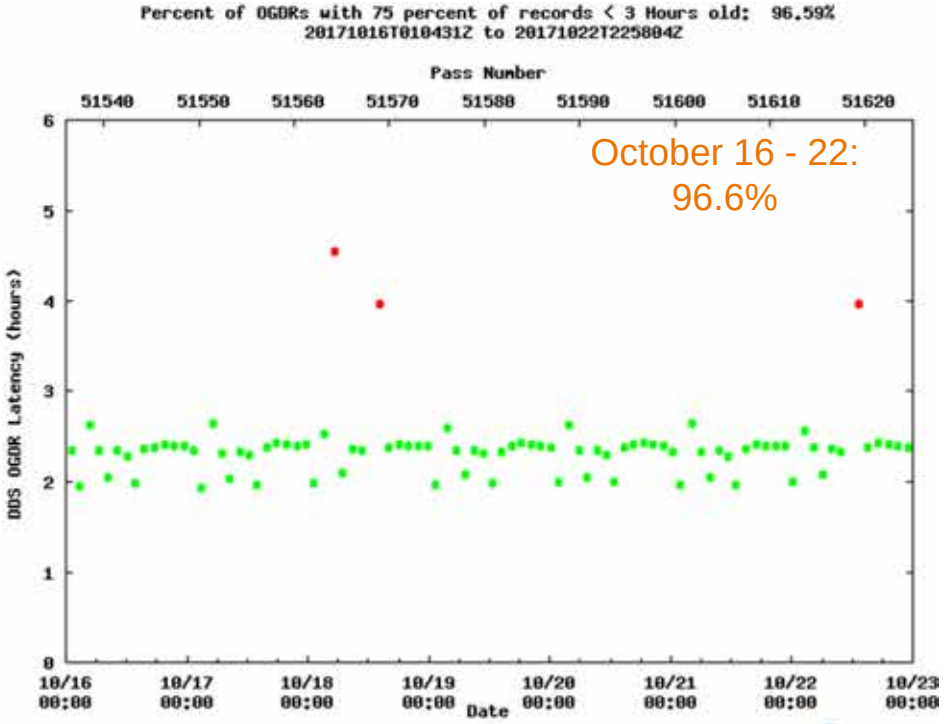
OGDR Latency

TP4-JS-STB-55-CNES: JASON-2 GROUND SYSTEM REQUIREMENTS, ARCHITECTURE AND OPERATIONS CONCEPTS

J2GS-PROPRO-005
From the beginning of the operational phase, except during satellite or instrument outage periods,
more than **90%** of the NRT products over any one month period shall meet the following requirement:
more than **75%** of the data inside the product shall have a latency of less than 3 hours.

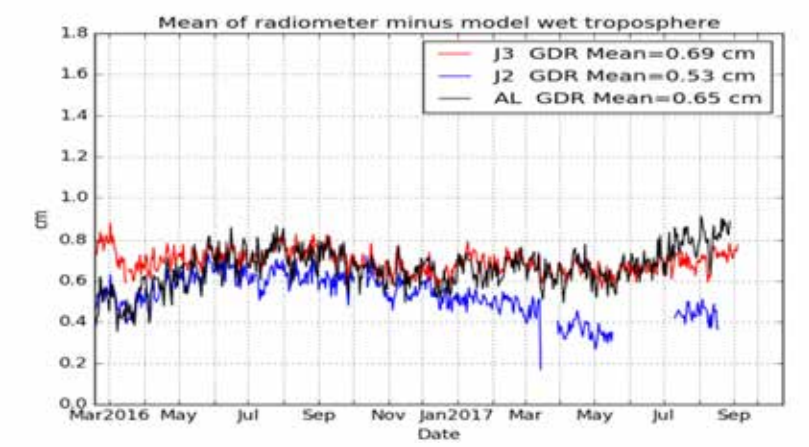
As a goal, this requirement will be met over any one week period.

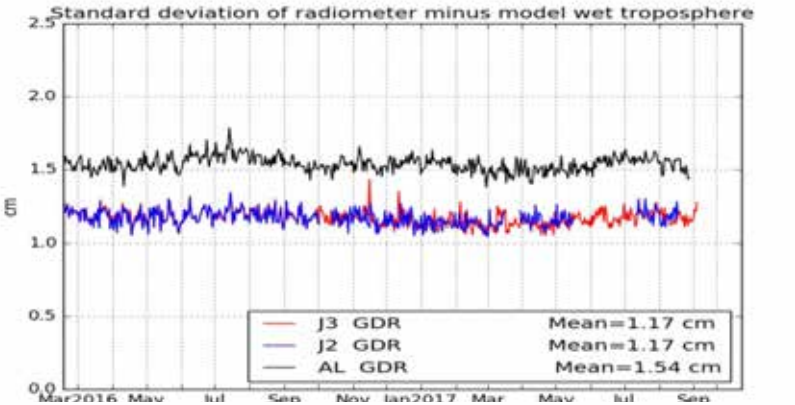


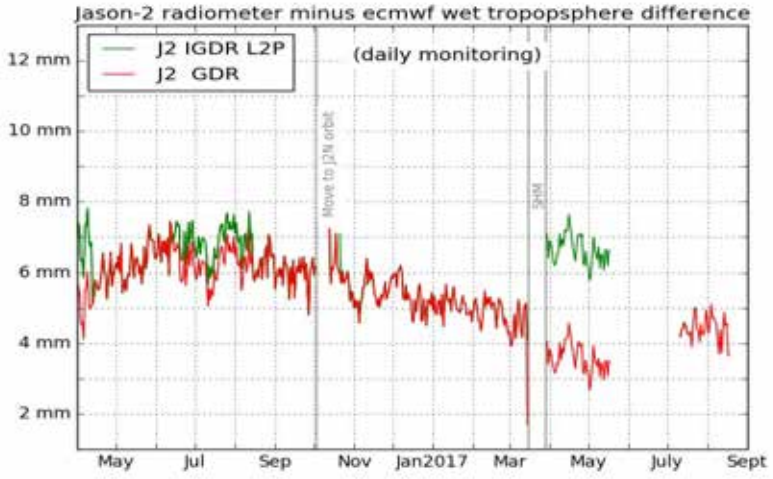


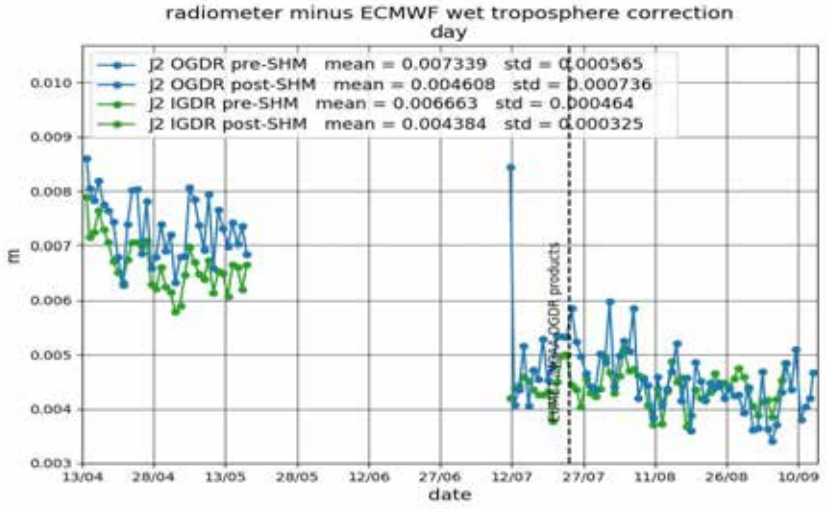
Jason-2 Data Quality in the LRO

AMR status (SD)





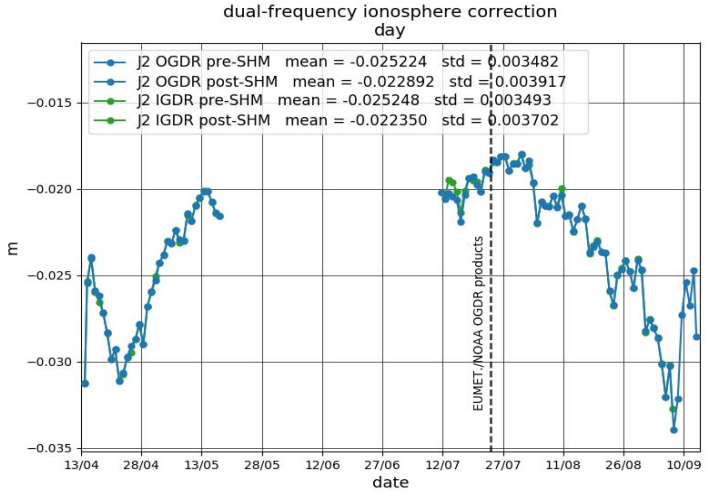


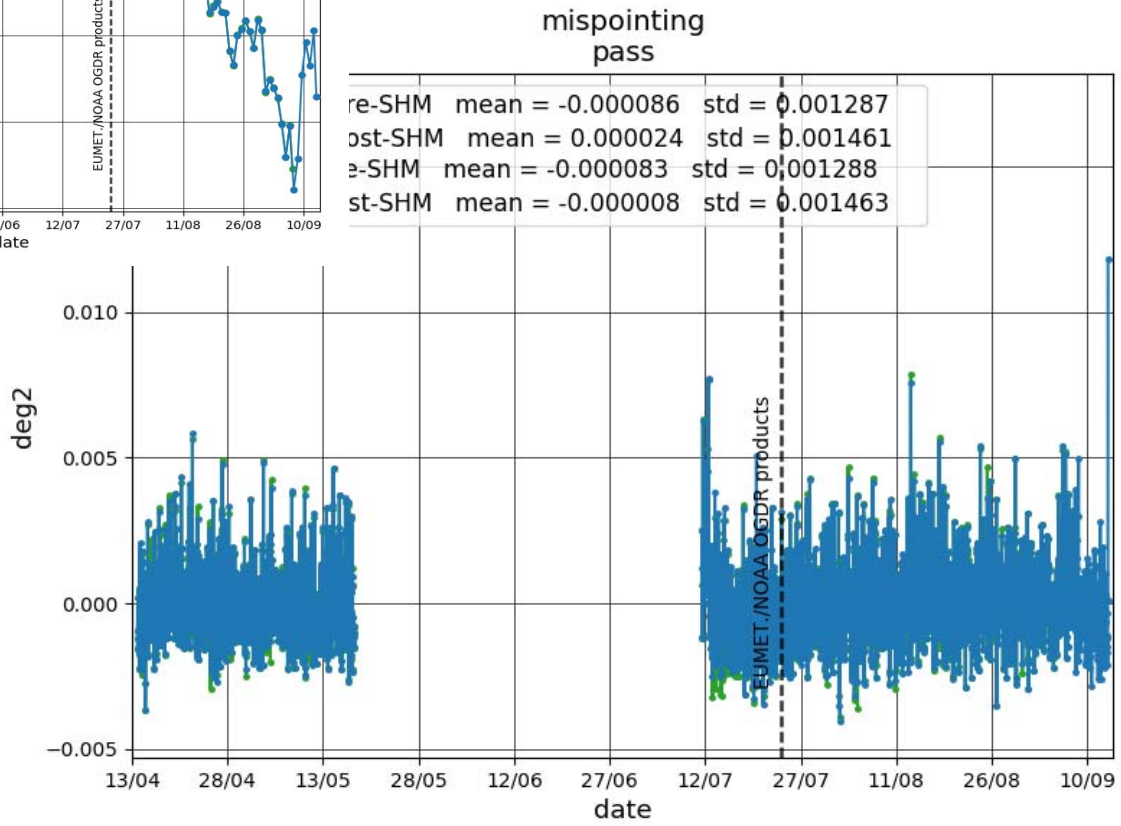


Global Jason-2 Data Quality Assessment on the new Long Repeat Orbit

H. Roinard[1], S. Labroue[1], N. Picot[2]
Contact: equipe-calval-jason@cls.fr
1. CLS, Toulouse, France
2. CNES, Toulouse, France

Mispointing

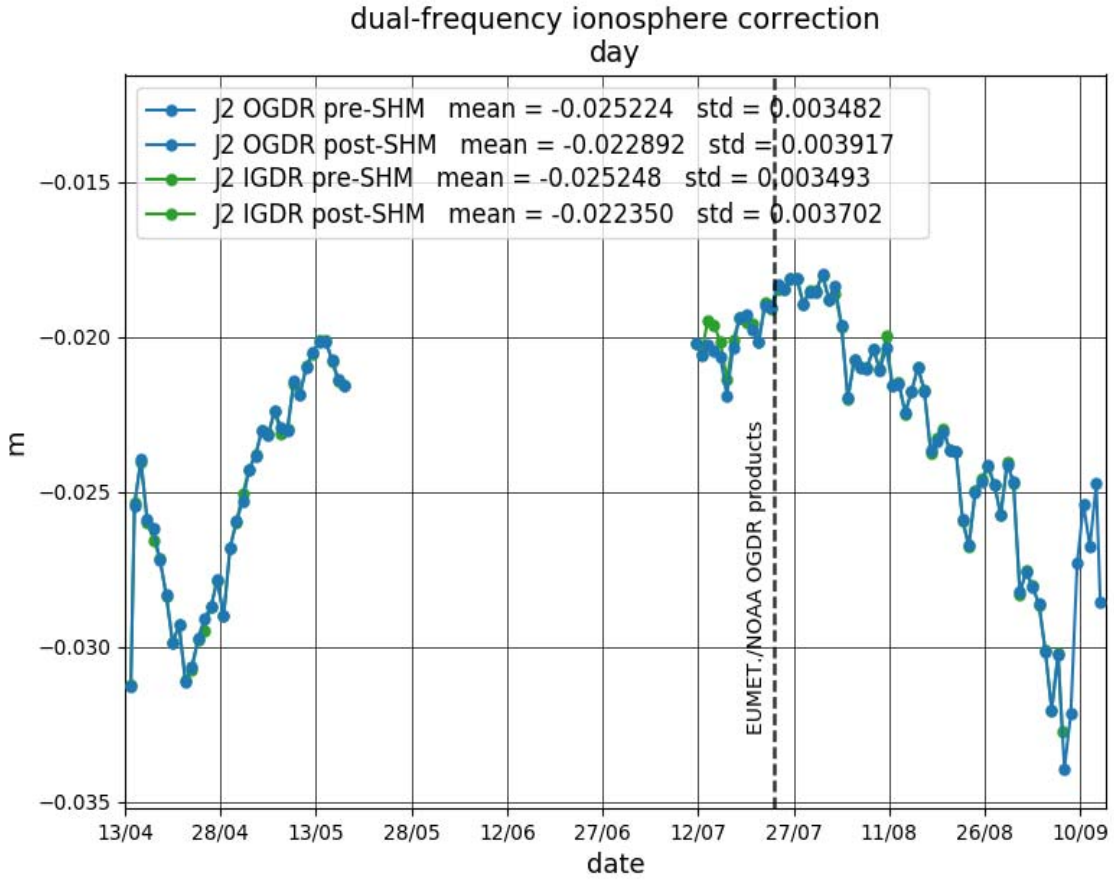




Global Jason-2 Data Quality Assessment on the new Long Repeat Orbit

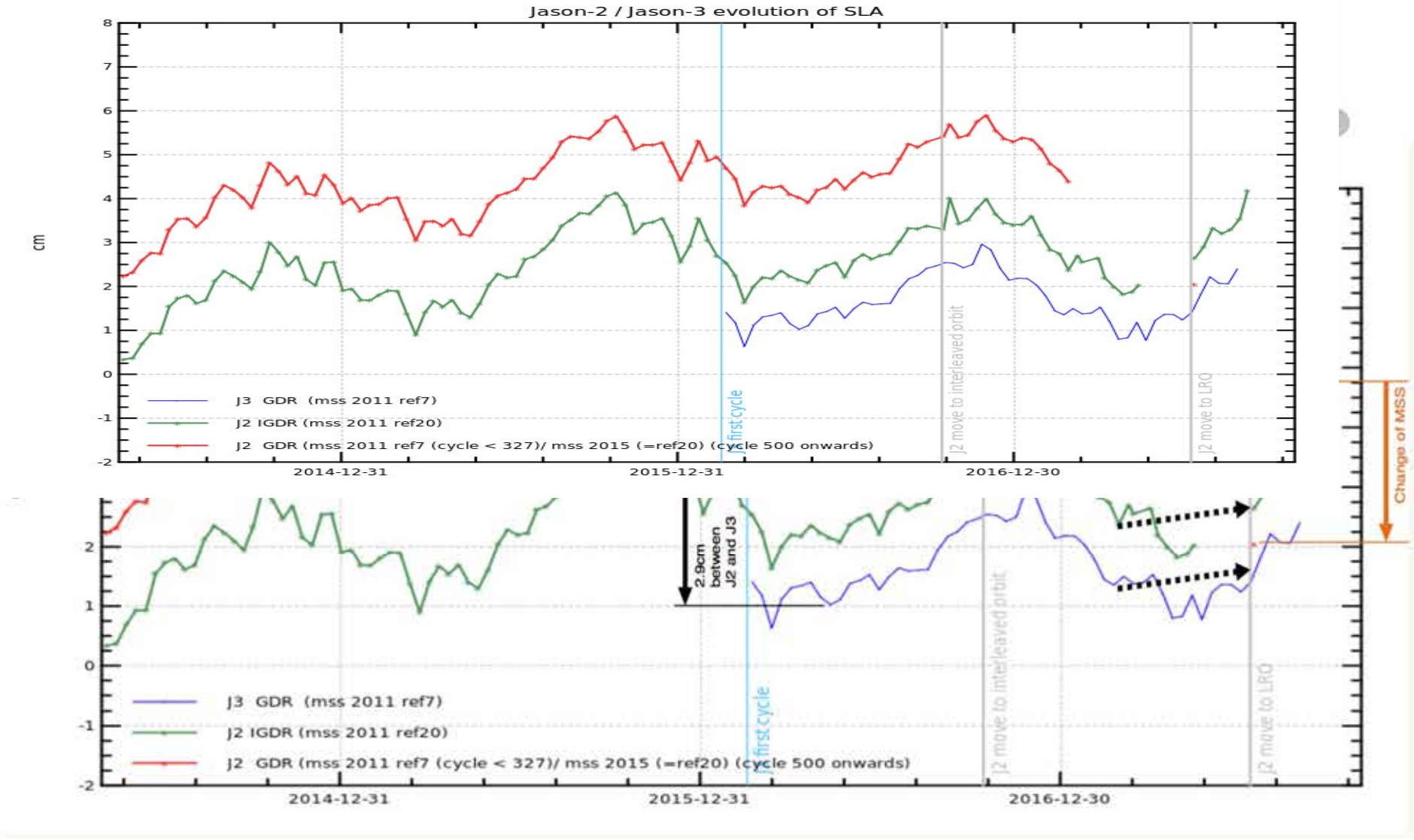
H. Roinard[1], S. Labroue[1], N. Picot[2]
Contact: equipe-calval-jason@cls.fr
1. CLS, Toulouse, France
2. CNES, Toulouse, France

Ionospheric Corrections



Global Jason-2 Data Quality Assessment on the new Long Repeat Orbit

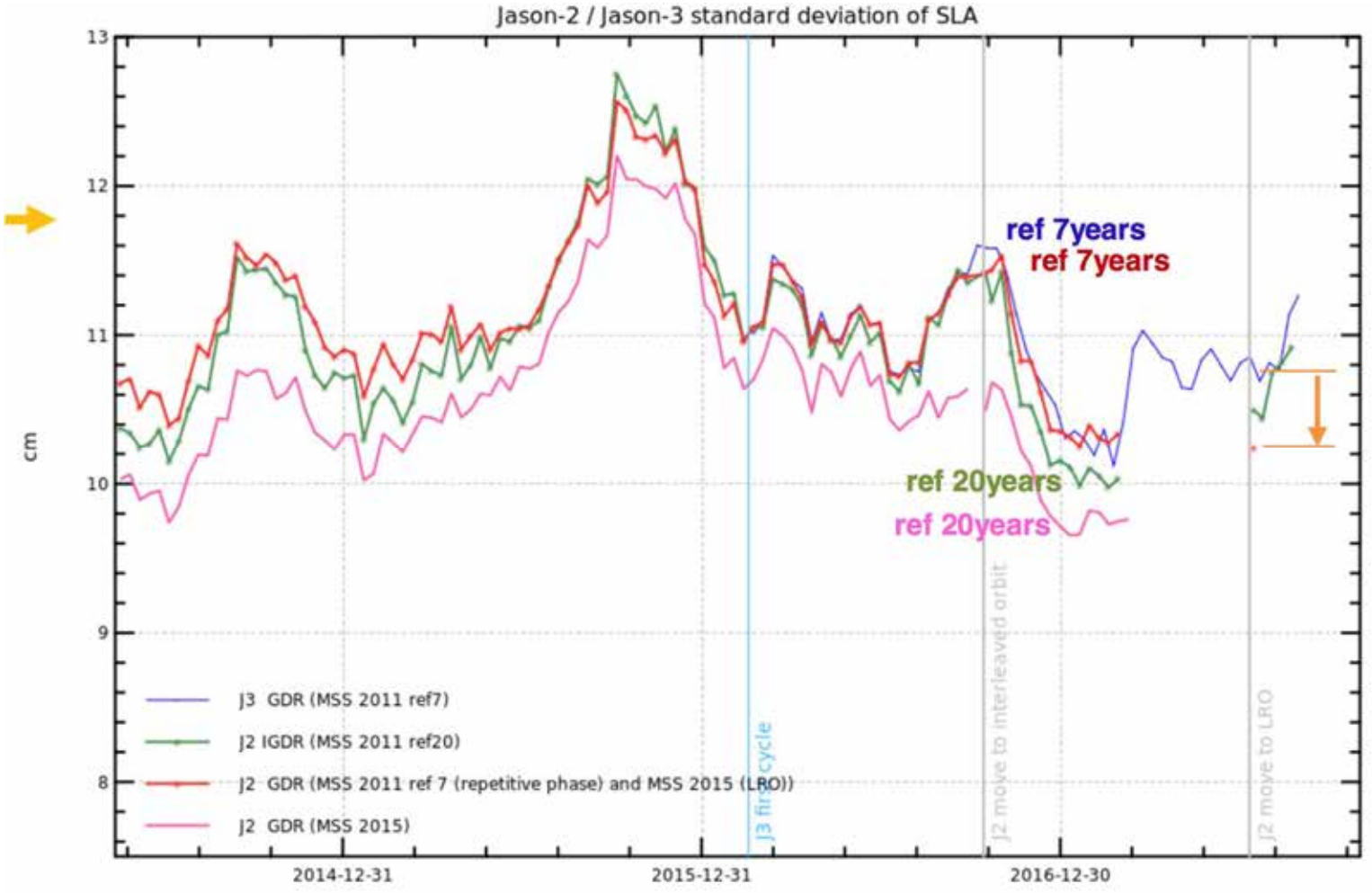
H. Roinard[1], S. Labroue[1], N. Picot[2]
Contact: equipe-calval-jason@cls.fr
1. CLS, Toulouse, France
2. CNES, Toulouse, France



Global Jason-2 Data Quality Assessment on the new Long Repeat Orbit

H. Roinard[1], S. Labroue[1], N. Picot[2]
Contact: equipe-calval-jason@cls.fr
1. CLS, Toulouse, France
2. CNES, Toulouse, France

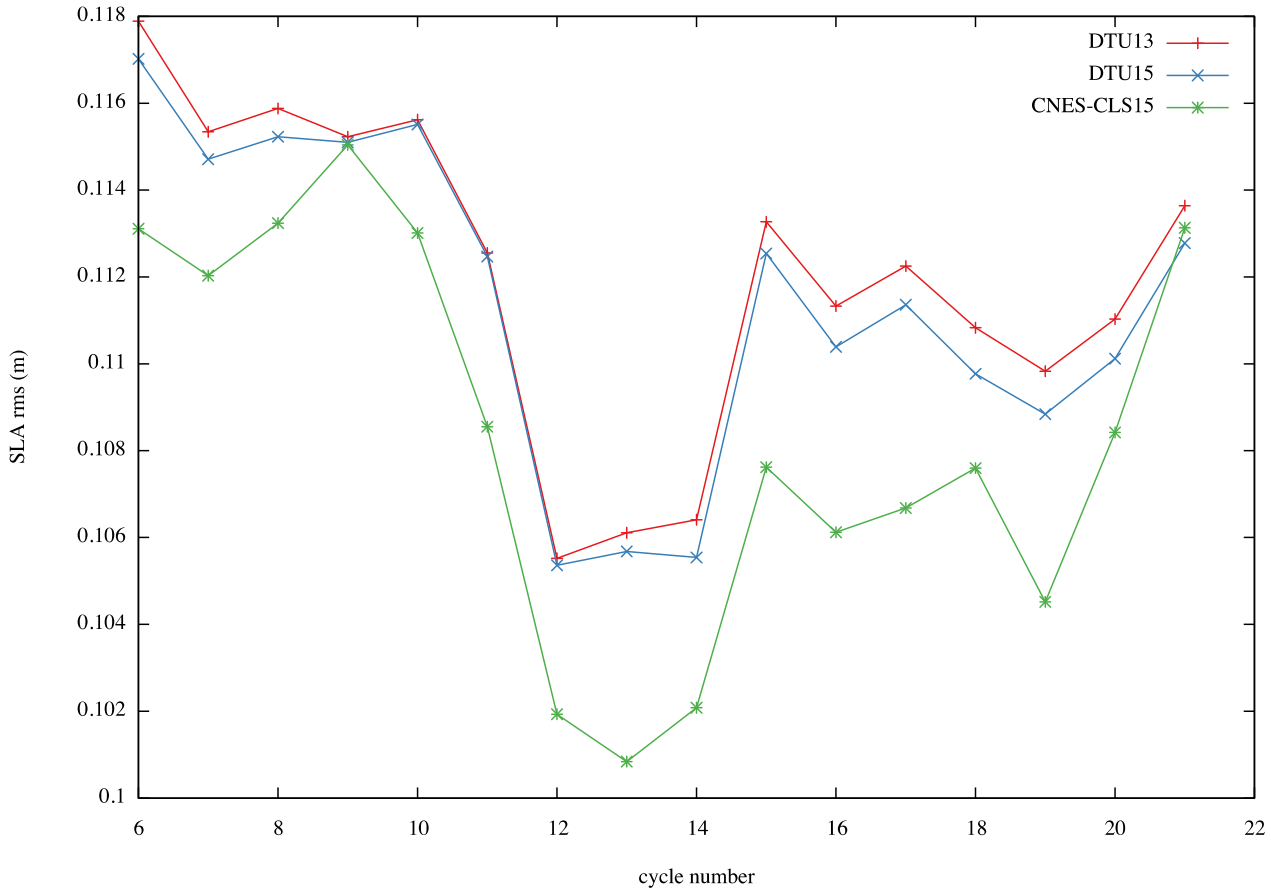
CNES-CLS MSS 2015 Analysis



Global Jason-2 Data Quality Assessment on the new Long Repeat Orbit

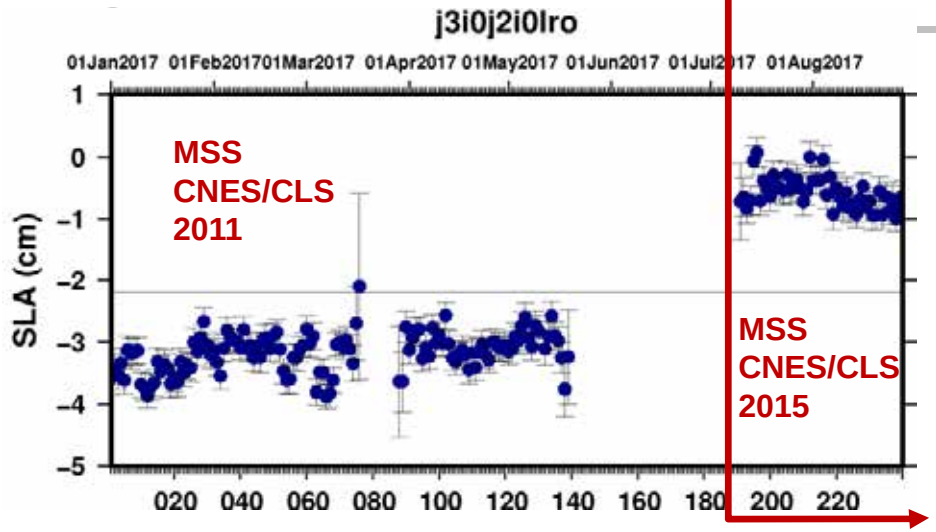
H. Roinard[1], S. Labroue[1], N. Picot[2]
Contact: equipe-calval-jason@cls.fr
1. CLS, Toulouse, France
2. CNES, Toulouse, France

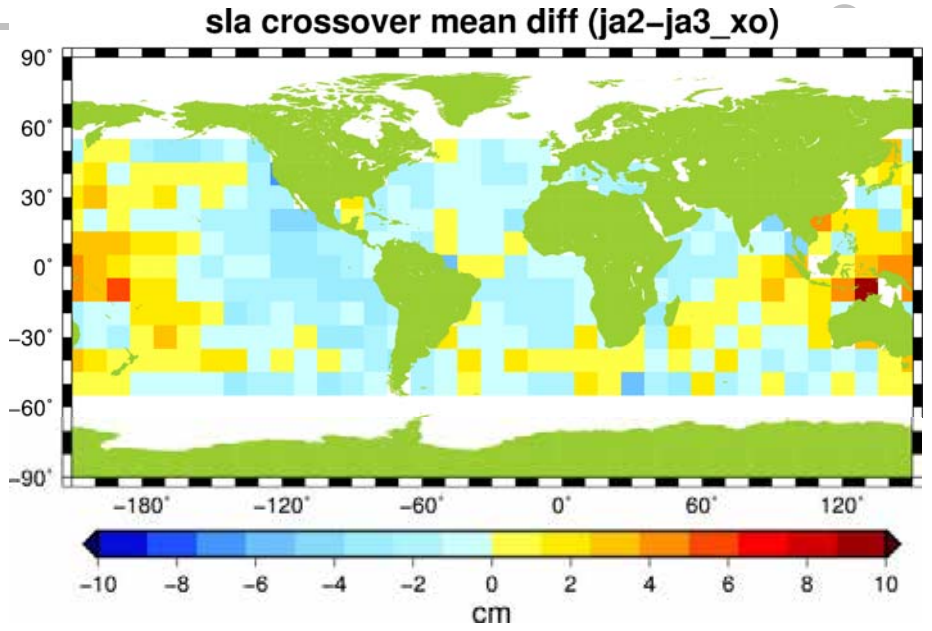
CNES-CLS MSS 2015 Analysis

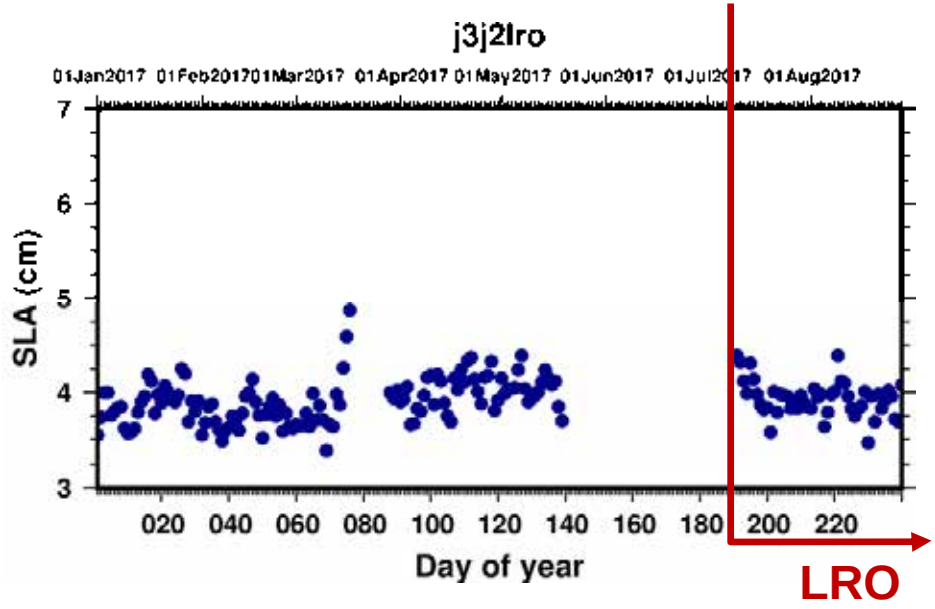


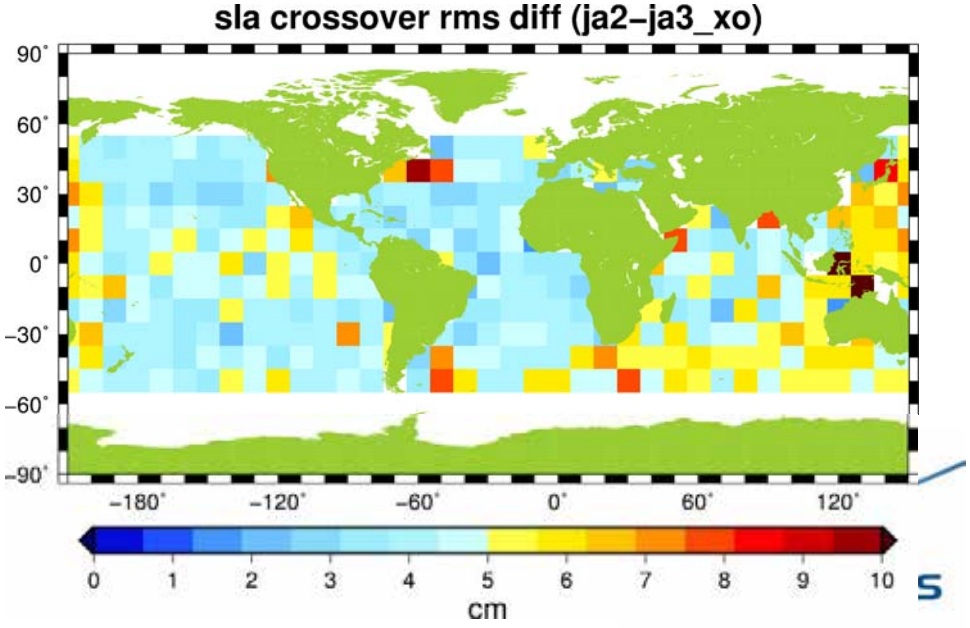
MSS evaluation with S3 data between -66/+66 deg.
Courtesy, EUMETSAT

SSHA Cross-over analysis, statistics and spatial distribution

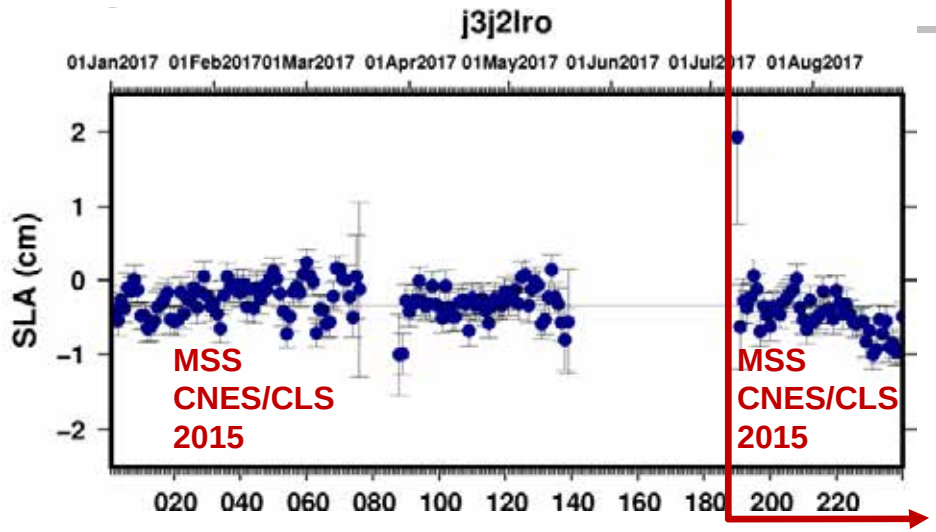


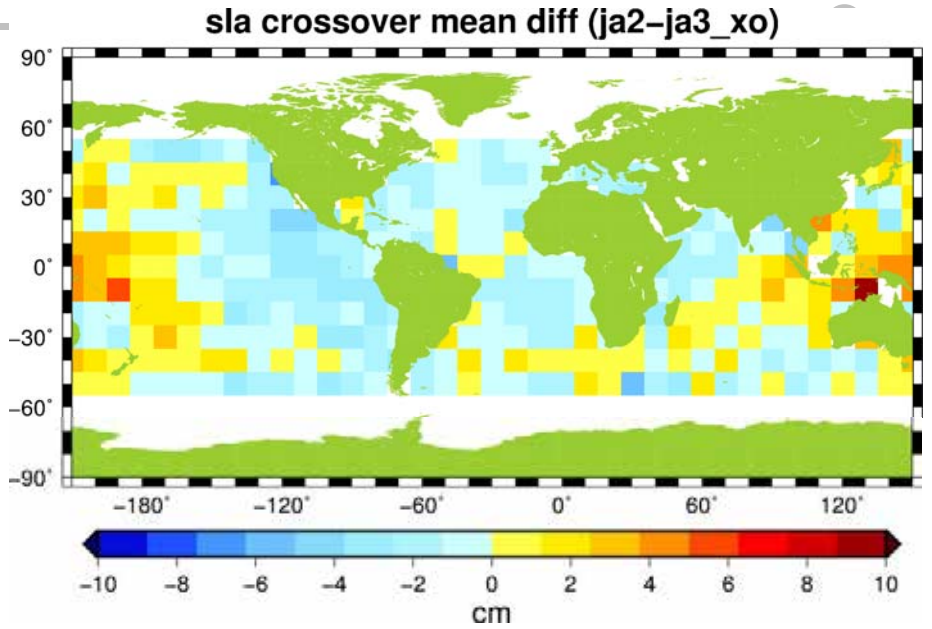


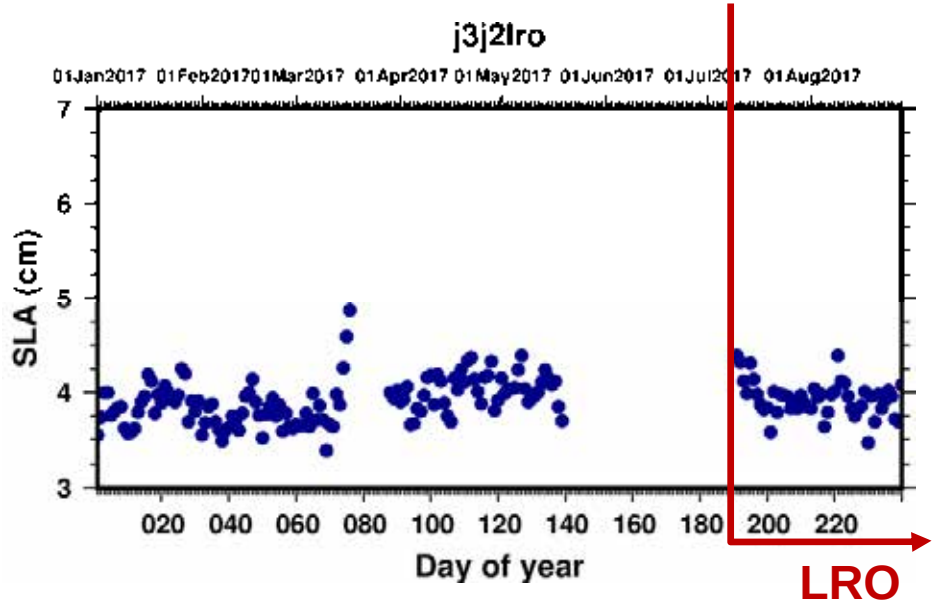


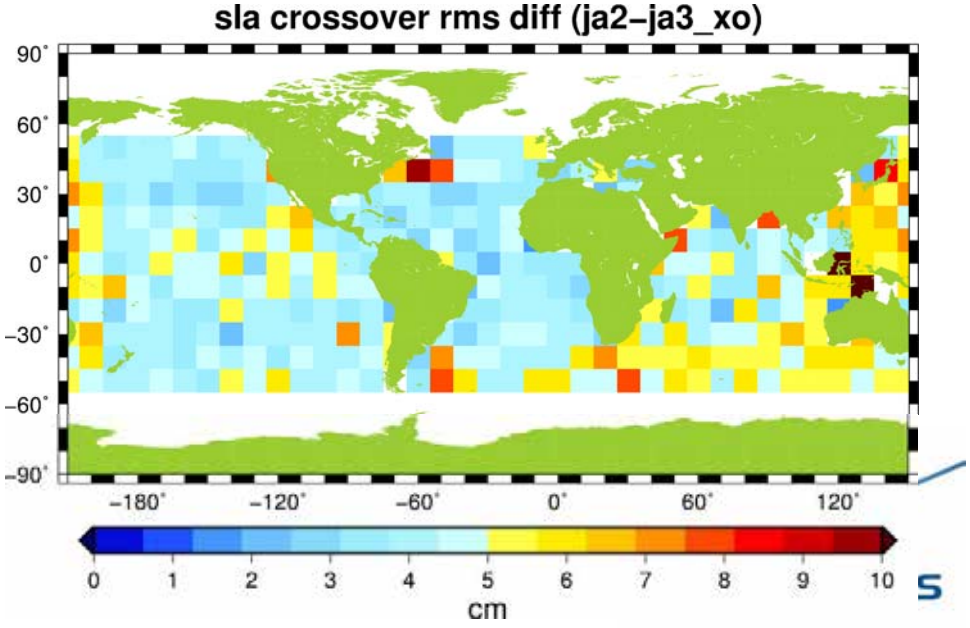


SSHA Cross-over analysis, statistics and spatial distribution

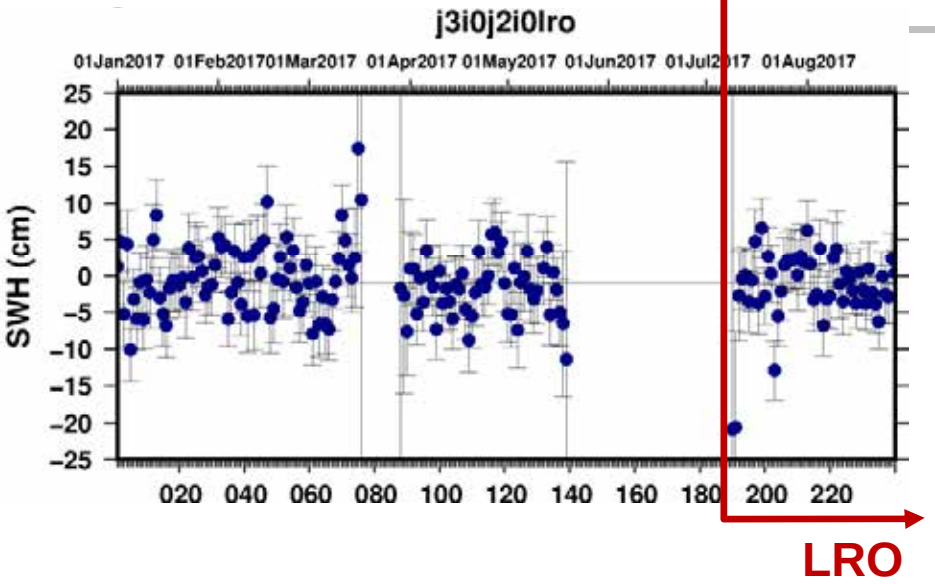


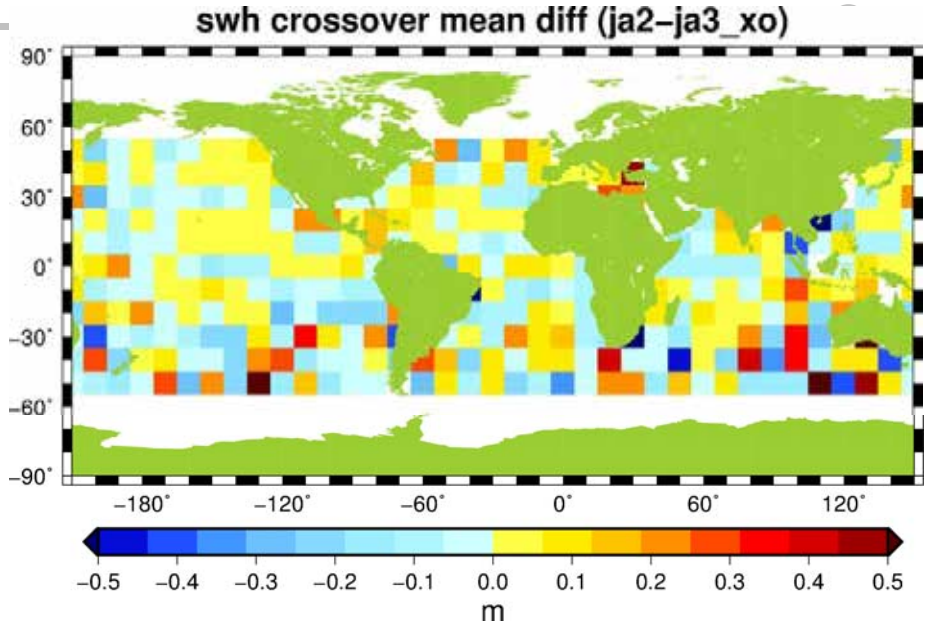


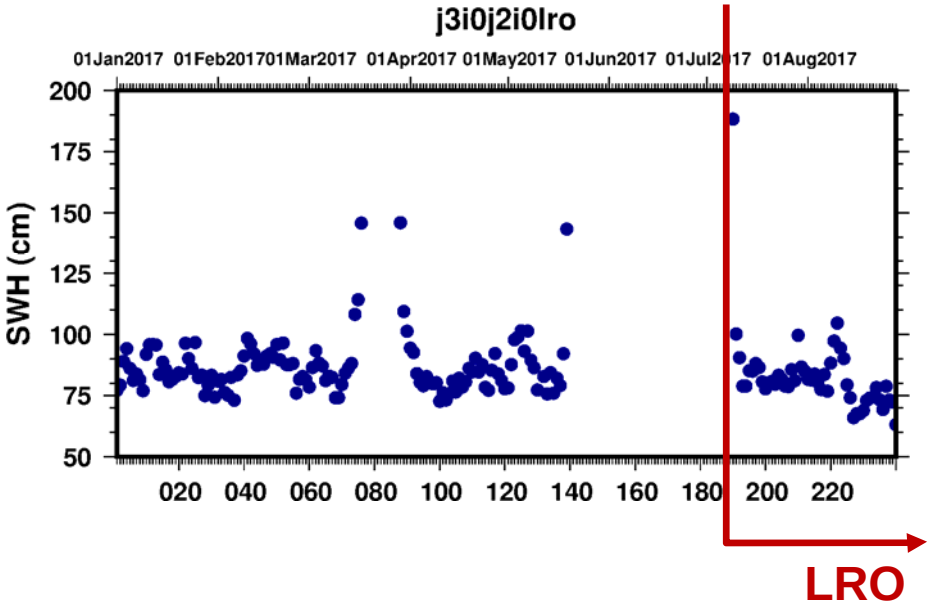


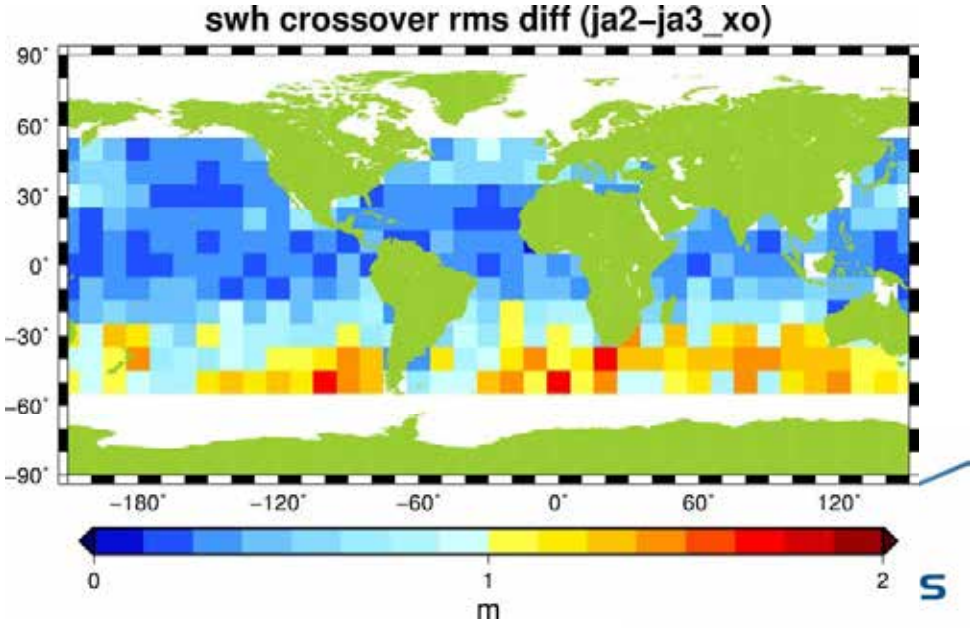


SWH Cross-over analysis, statistics and spatial distribution

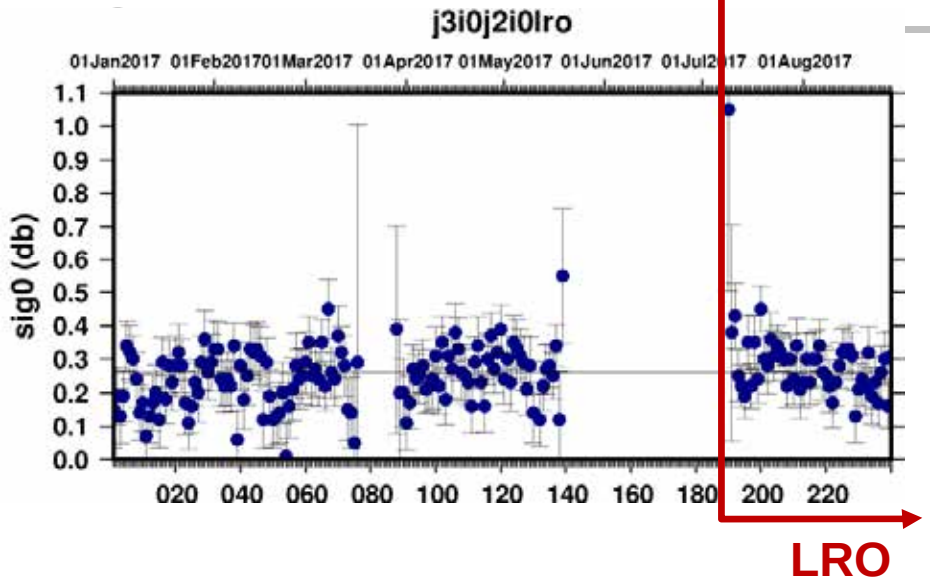


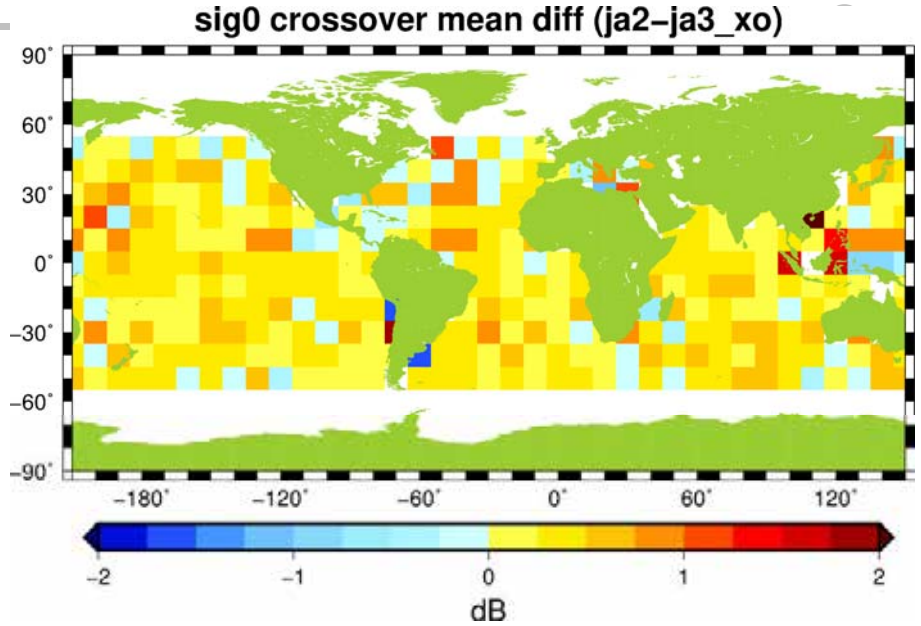


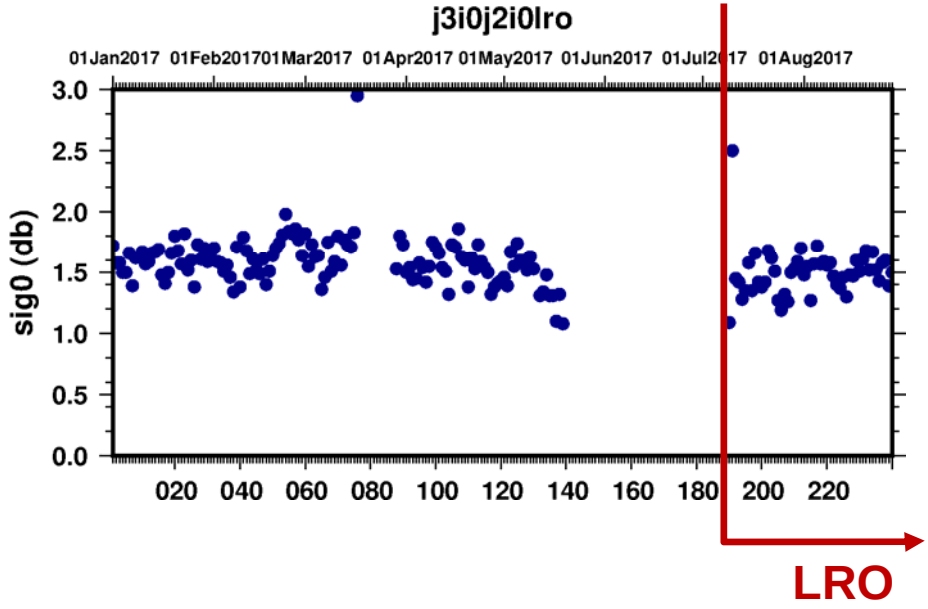


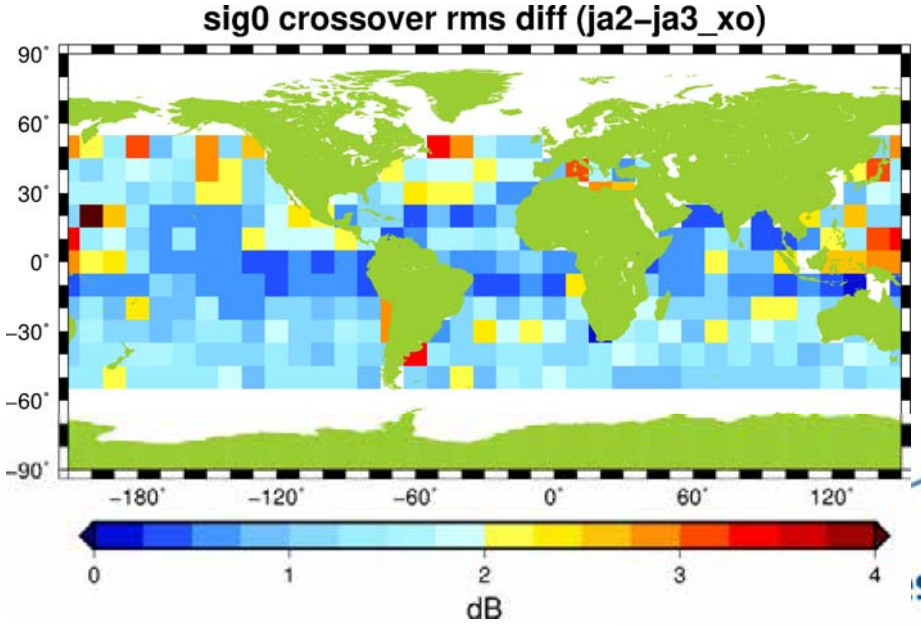


SWH Cross-over analysis, statistics and spatial distribution









Conclusions

- The Jason-2 geodetic mission phase started on July 12th 2017.
- A Safe Hold Mode event, triggered by gyro malfunction on Sept. 14th, led to the loss of almost one month of data.
- The data gaps could be covered by other altimeter geodetic missions, or by “rewinding” the LRO…
- Despite of that data gap, the mission is providing high quality data, which is both useful for operational oceanography and geodetic applications, with noise levels, and latencies comparable to the reference mission.
- The introduction of the new CNES/CLS-2015-MSS model for the production of xGDRs “creates” a jump of ~2.4cm in the SLA record, that can be avoided in the same MSS model is used.
- Jason-2 remains a very important mission for operational oceanography, and given its orbit characteristics and low inclination, it will provide a unique dataset for the MSS/geoid computation.