

OSTST 2018

Sept. 2018 – Azores

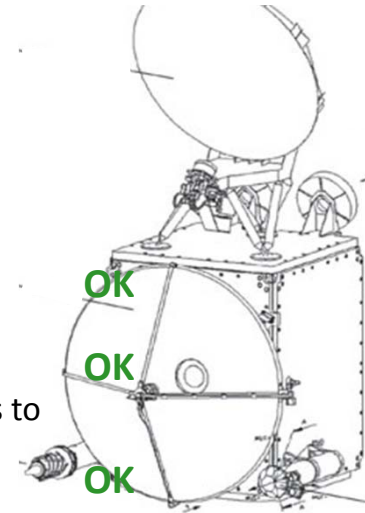
Jason-2 Project Status



Christophe MARECHAL, CNES
on behalf Jason-2 Project Managers

Platform Status

- The Jason-2 satellite bus is **OK**
 - Command / control , RF : **PMA : operational, PMB operational**
 - On-Board Software, Mass Memory, Telemetry & Telecommand system
 - Thermal aspects:
 - Active thermal control works successfully and is sized with significant margins to meet further worst case conditions
 - Electrical aspects :
 - Satellite power and consumption are within the power, consumption and energetic budgets
 - AOCS (attitude and orbit control system) : **Partially OK**
 - Gyros 1 and 2 fully operational ... between failures.
 - Other AOCS units work nominally, AOCS control laws work as expected when gyros OK
- Exceptional activities :
 - Unused equipment destocking (gyro, STR) **OK**
 - STR monitoring, SADM expertise, PCE expertise **OK**
 - Gyro calibration **OK**
 - 3 SHM recoveries **OK**



After more than 10 years in orbit, Jason-2 is currently operational with some unavailability periods

Payload Status

- **Core Payload**
 - POSEIDON3
 - DORIS
 - AMR
 - GPSP-B

OK
OK
OK
OK

- **Passengers**

- T2L2

- Not restarted after SHM in March 2018.

OFF

- CARMEN2

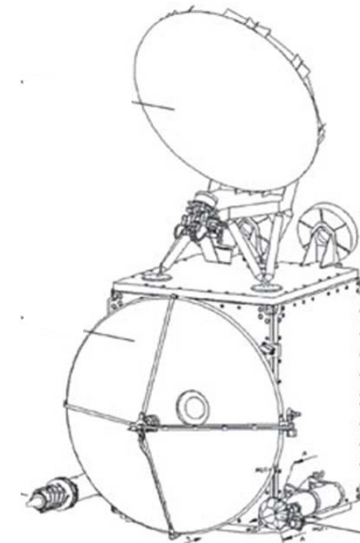
- Official announcement of Carmen 2 loss announced on April 26th, 2016 at REVEX.

OFF

- LPT

- 5 anomalies over the last year, solved by OFF/ON.

OK



➔ Fully OPERATIONAL with redundancy available for POS-3, DORIS & AMR

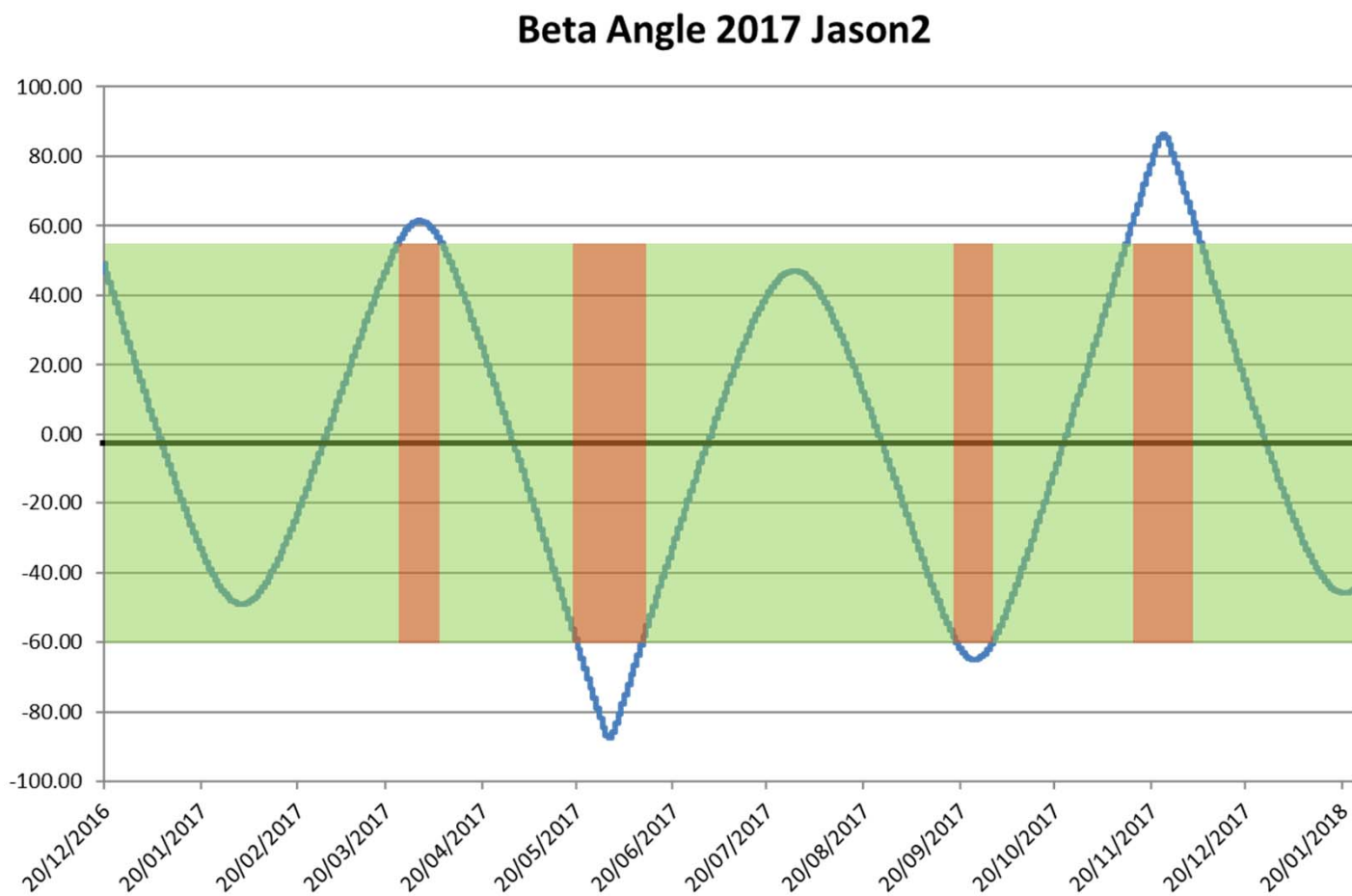
➔ Only 1 remaining passenger

Ground & Operations Status

- Earth terminals :
 - Usingen - USG1, + USG2 partial shadowing OK
 - Wallops, Fairbanks and Barrow (CDAS) OK
- Control Centers :
 - J2CCC CNES Control center OK
 - all the elements are OK
 - SOCC NOAA Control center OK
 - all the elements are OK
- Instrument Commanding and Monitoring Centers :
 - SSALTO for CNES instruments OK
 - JPL Mission facility for NASA/JPL instruments OK
 - Passengers Mission centers OK

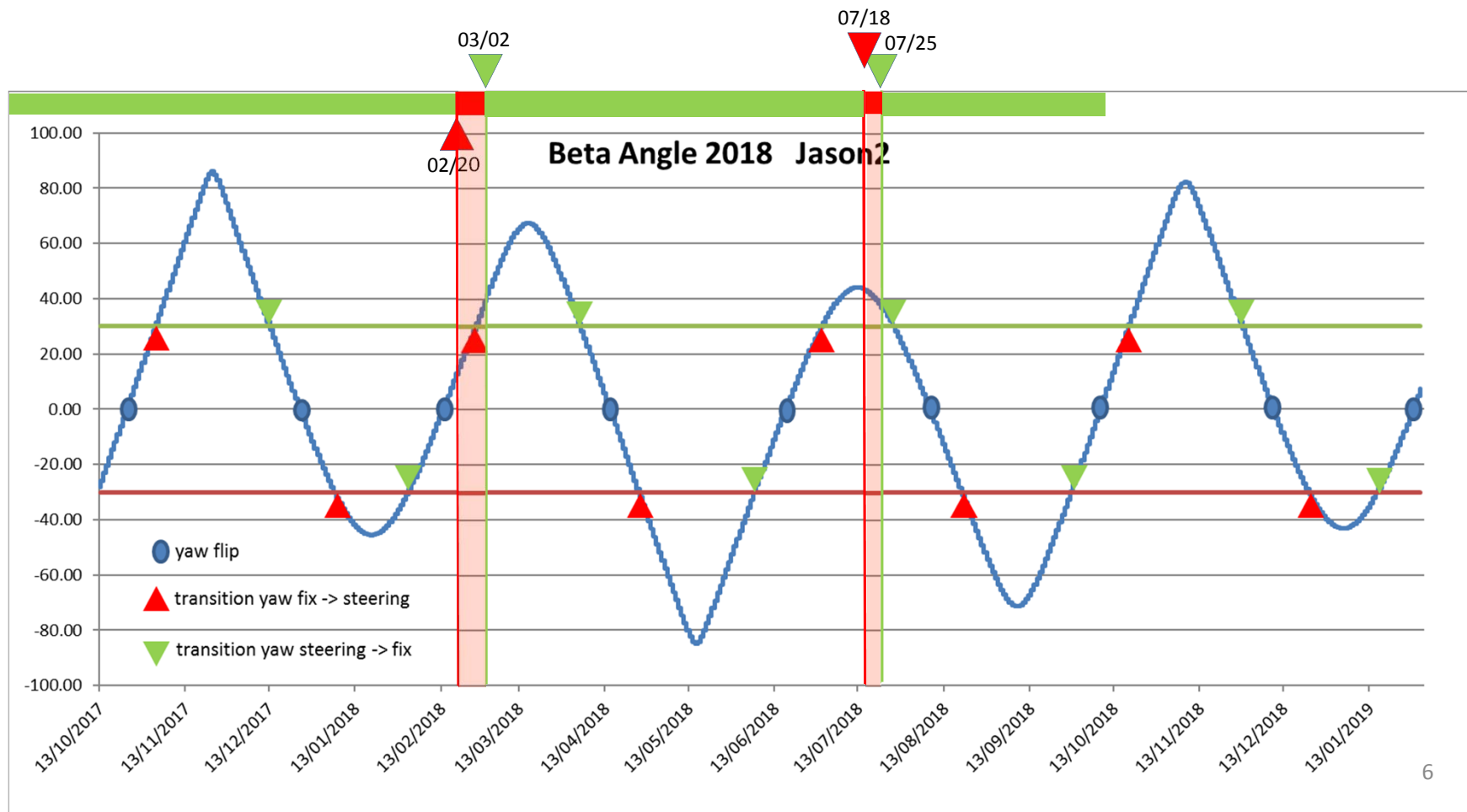
Gyro anomaly status (1/3)

Reminder : foreseen behaviour at last OSTST



Gyro anomaly status (2/3)

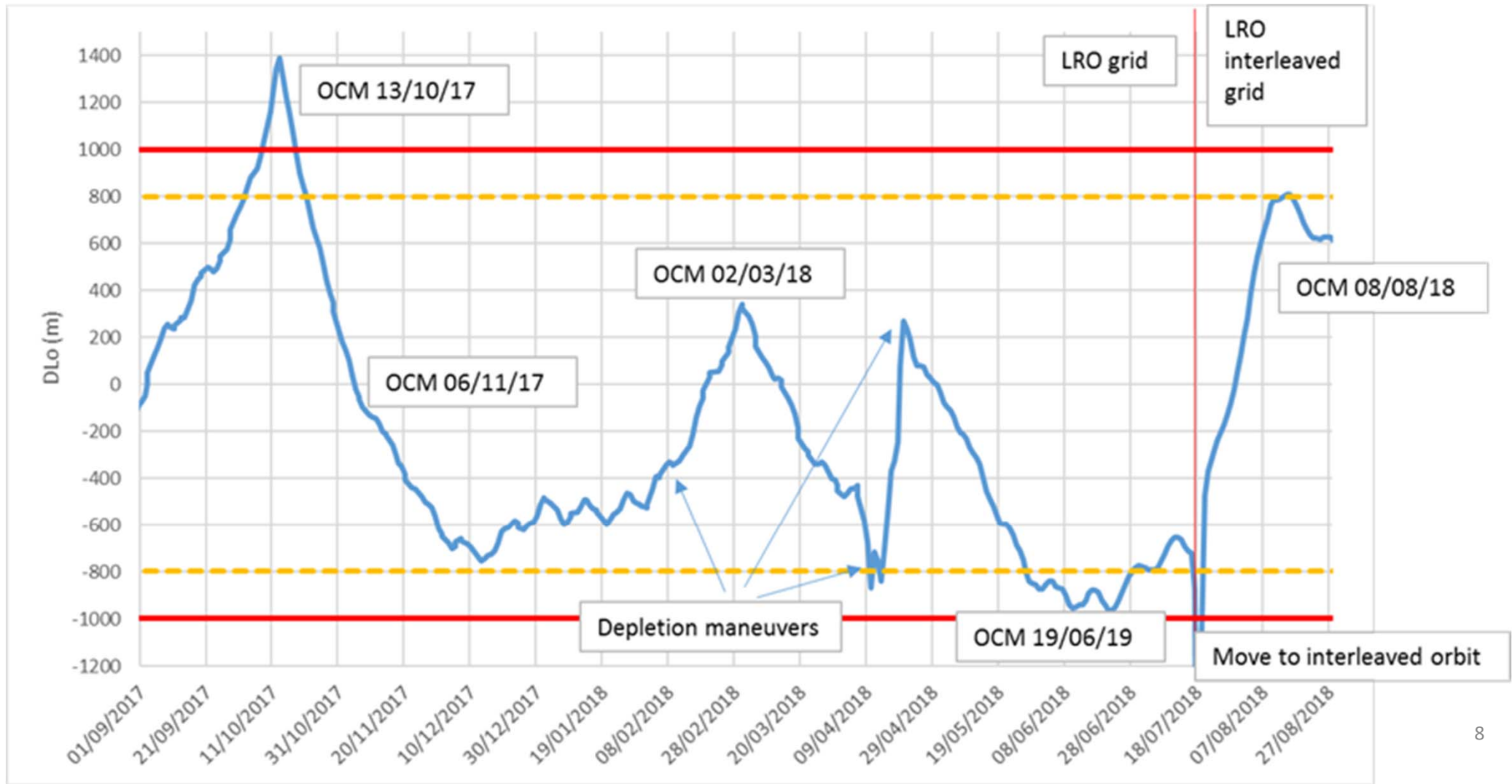
At last OSTST, the link between failures and gyro temperatures (i.e. beta angle) seemed quite clear... which doesn't seem to be the case anymore.



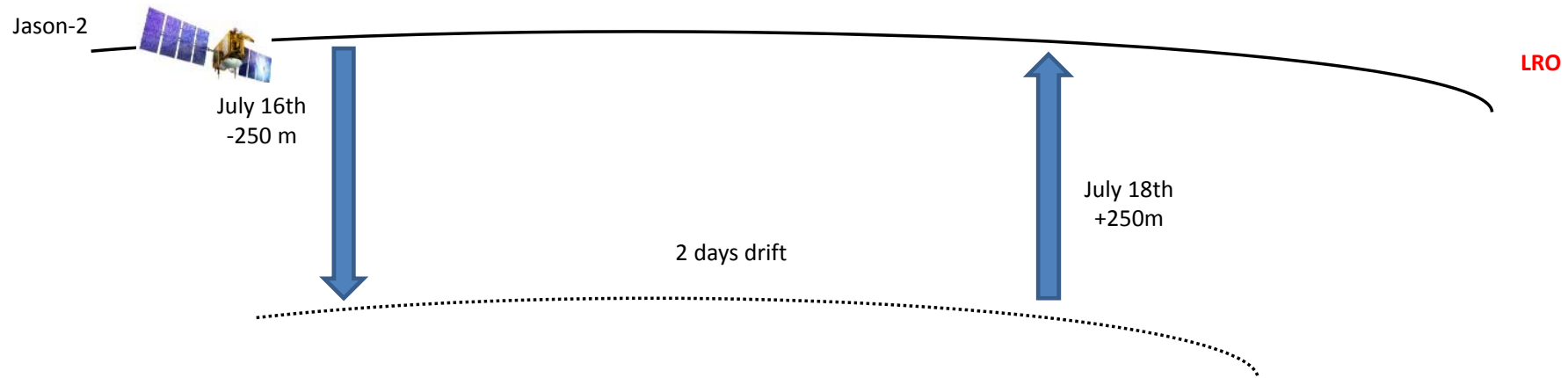
Gyro anomaly status (3/3)

- Gyro failures could not be foreseen with sufficient accuracy
 - No actually efficient workaround so far
 - Failure now seems to be linked with : (recovery time vs ON time) ratio
- It was decided at last JSG to swap between gyros 1&2 when failures happen, and restart ASAP (at least for 2 SHM occurrences)
 - After that, a better understanding of gyros behavior will hopefully be achieved, and some workarounds could be decided.
- Side benefits : overall availability is unexpectedly high (89% since last OSTST) 😊 !

Routine navigation and guidance



Transfer to i-LRO – July '18



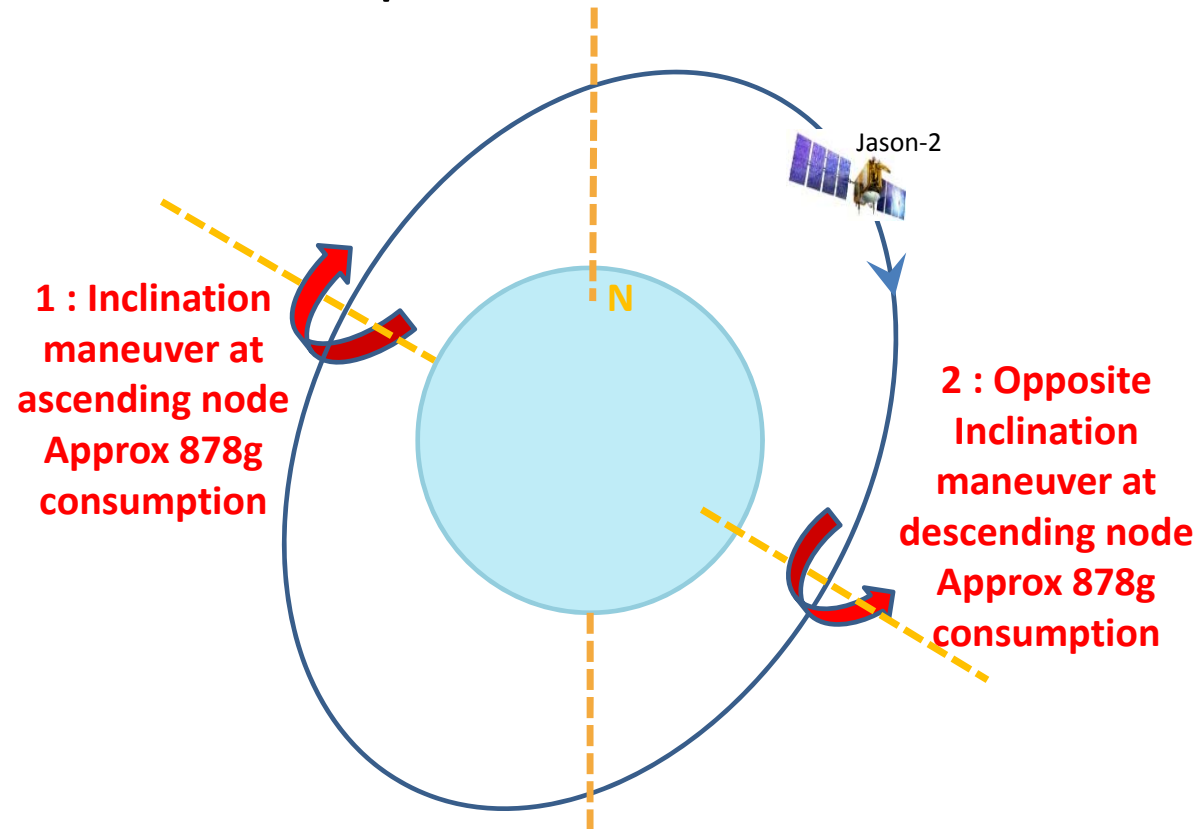
- Local Time at Ascending Node change on the same orbit
- Operations performed as planned
- Very good performance of the propulsion system
- $\approx 5,6\text{kg}$ of hydrazine still available
 $\approx 0,55\text{kg}$ used to maneuver to i-LRO

Fuel depletion

- Objective : ensure that as few propellant as possible is left in the tank once Jason-2 becomes non-operational
- Agreed at JSG
- Schedule :
 - 05/02/2018 (Test maneuver) : -1kg (14,9kg remaining)
 - 06/04-23/04/2018 : -6,6kg (8,3kg remaining)
 - 25/09-05/10/2018: -3,72kg (*goal 3,9kg – operations ongoing*)
- After the ongoing depletion, enough fuel remains for 2 years of exploitation (+ 1kg margin *equivalent to 166 years of drag make-up maneuvers*)

Fuel depletion

Principle of the maneuvers

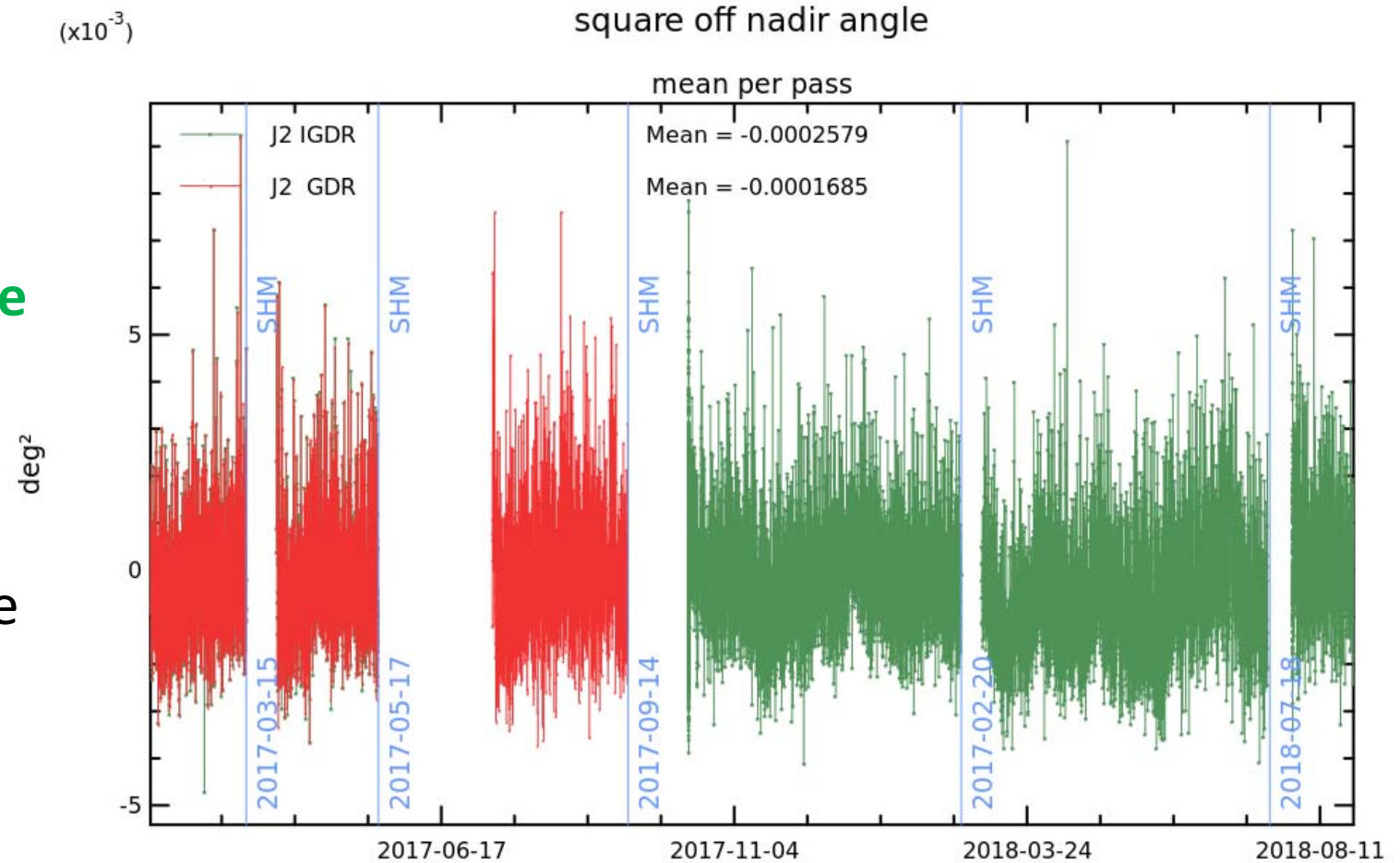


Minimal impact on the ground track

System Requirements and Performances

Altimeter Antenna
Pointing : **typical value**
below 0.002°
(Requirement < 0.2°)

pointing performance
stable since launch

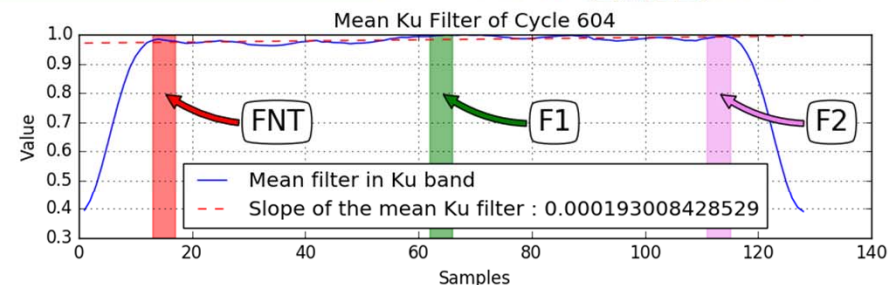


Poseidon-3 / JASON-2

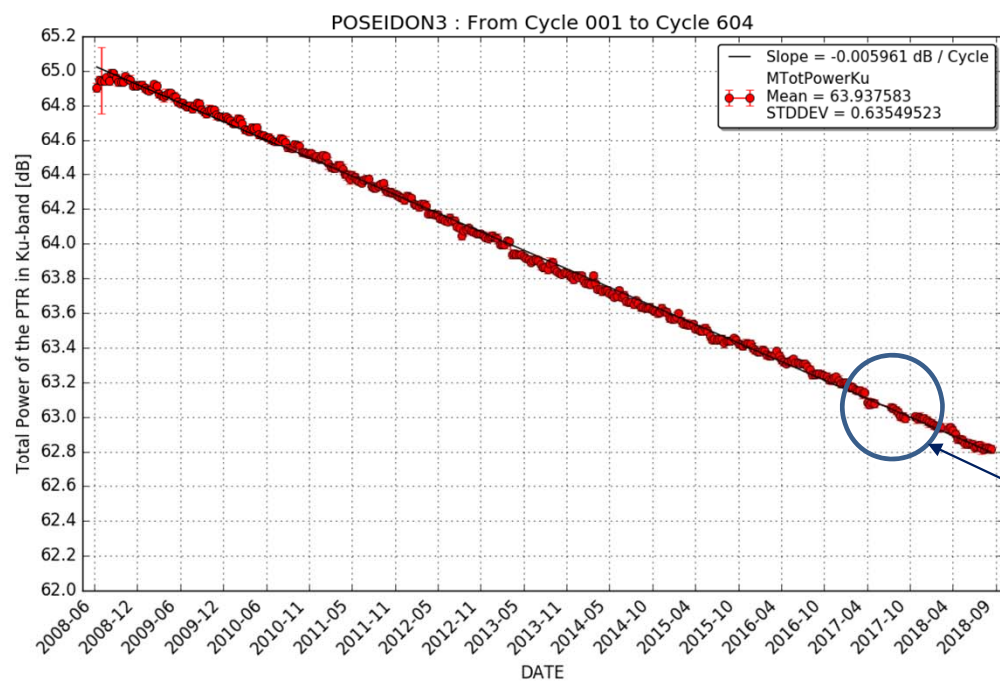
❖ Routine / Exceptional calibrations are OK

❖ Good stability even after SHM

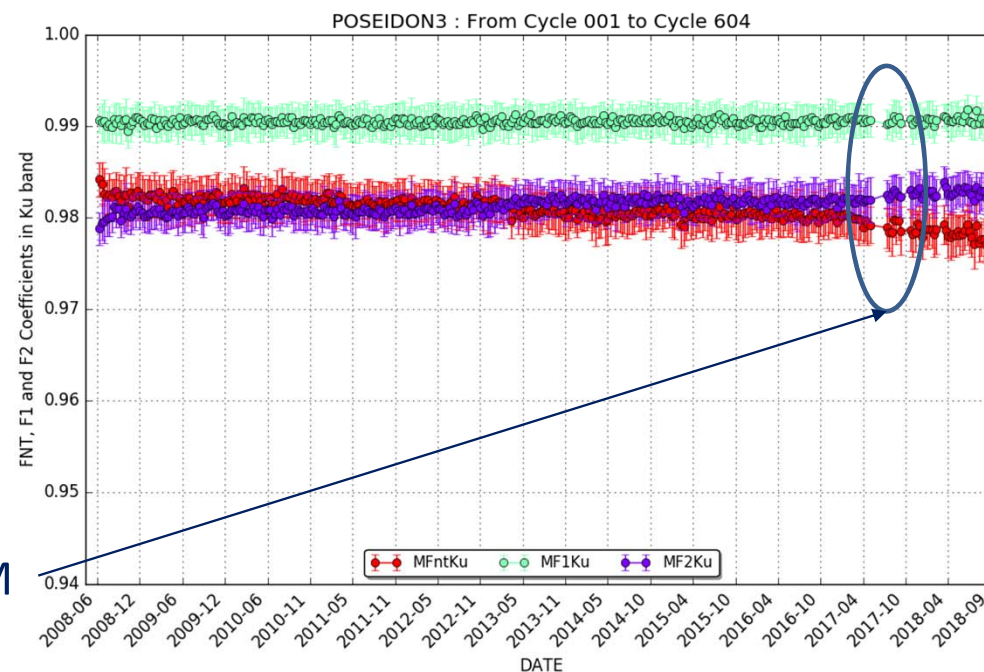
➤ CAL1 Ku-band PTR power



➤ CAL2 Ku-band LPF coeff.



SHM

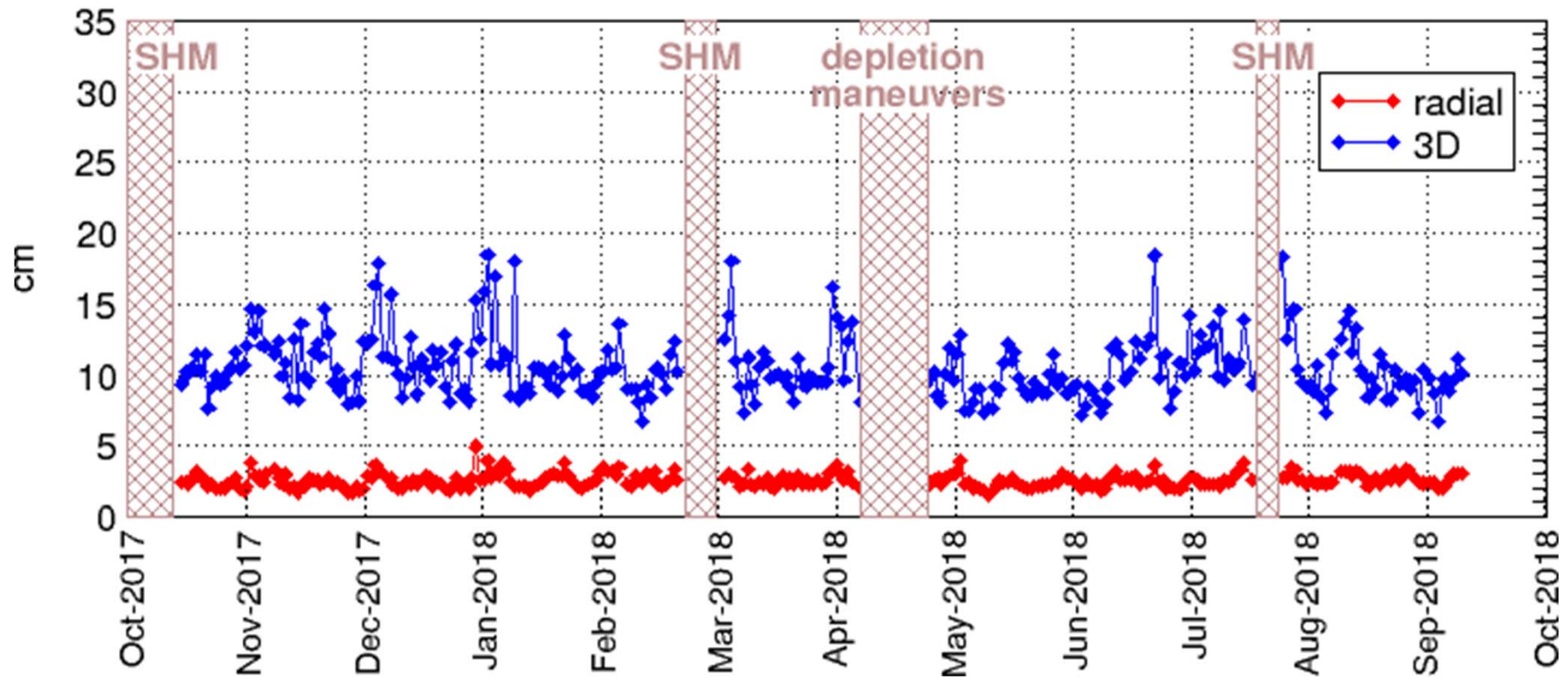


DORIS

Availability = **100%** over the period (special events excluded)

DIODE-MOE differences for Jason-2

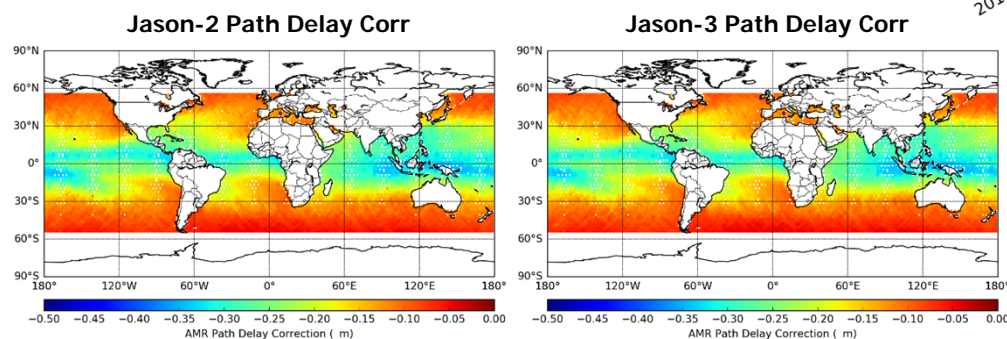
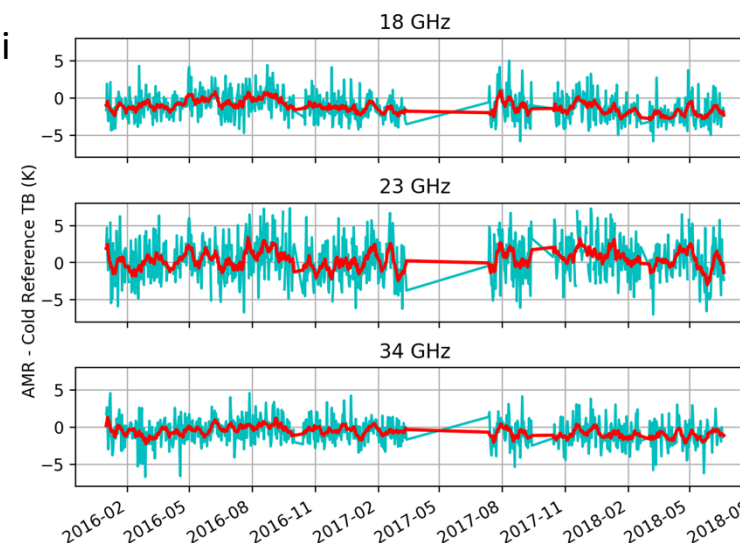
daily RMS, maneuvers excluded



AMR

- **Jason-2 AMR performance remains nominal**

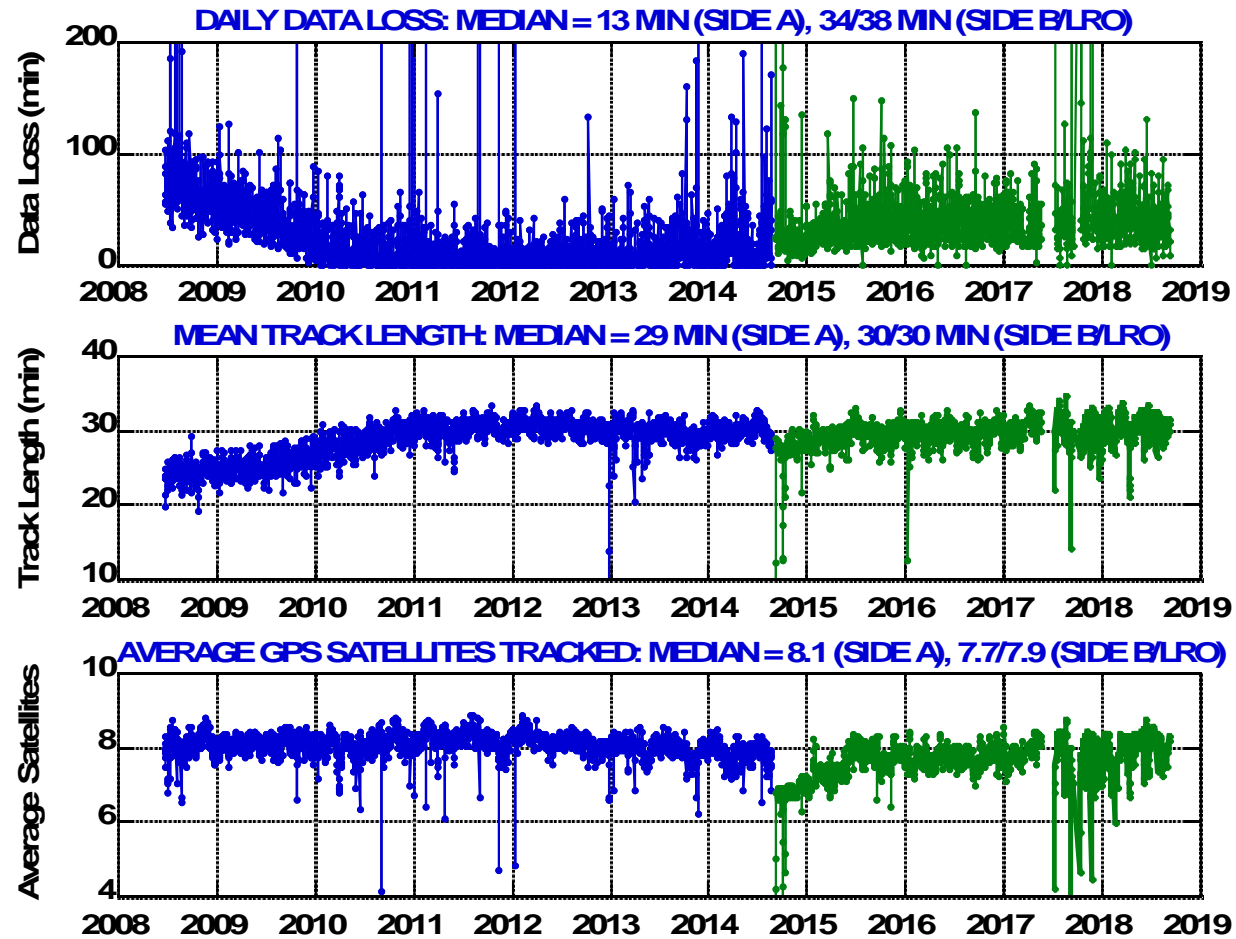
- Jason-2 AMR performance remains nominal i maintaining stable long-term path delay estimates
- Several “safeholds” and “aging” of the instrument are impacting the calibrations
- New calibration coefficients with the help of cold-sky and on-Earth references have stabilized the performance
- Both Jason-2 and Jason-3 are in good agreement



Jason-2 AMR Ocean
Brightness Temperatures
Stability

Jason-2 GPSP-A stopped 2014-08-23 – GPSP-B started 2014-09-08

GPSP



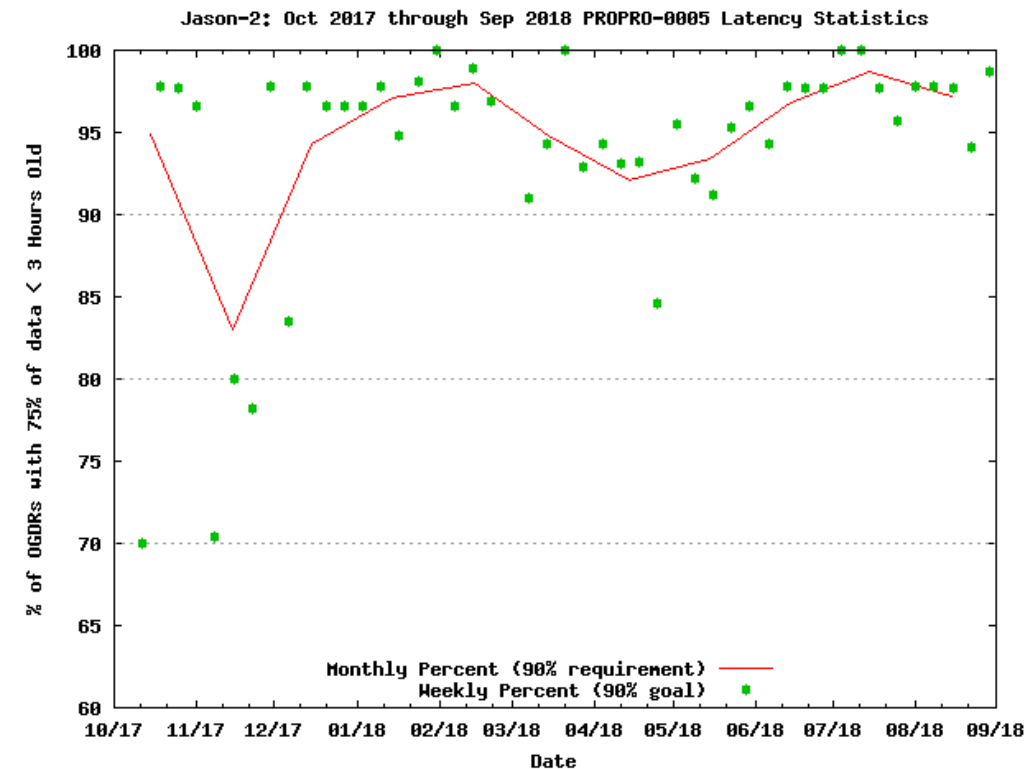
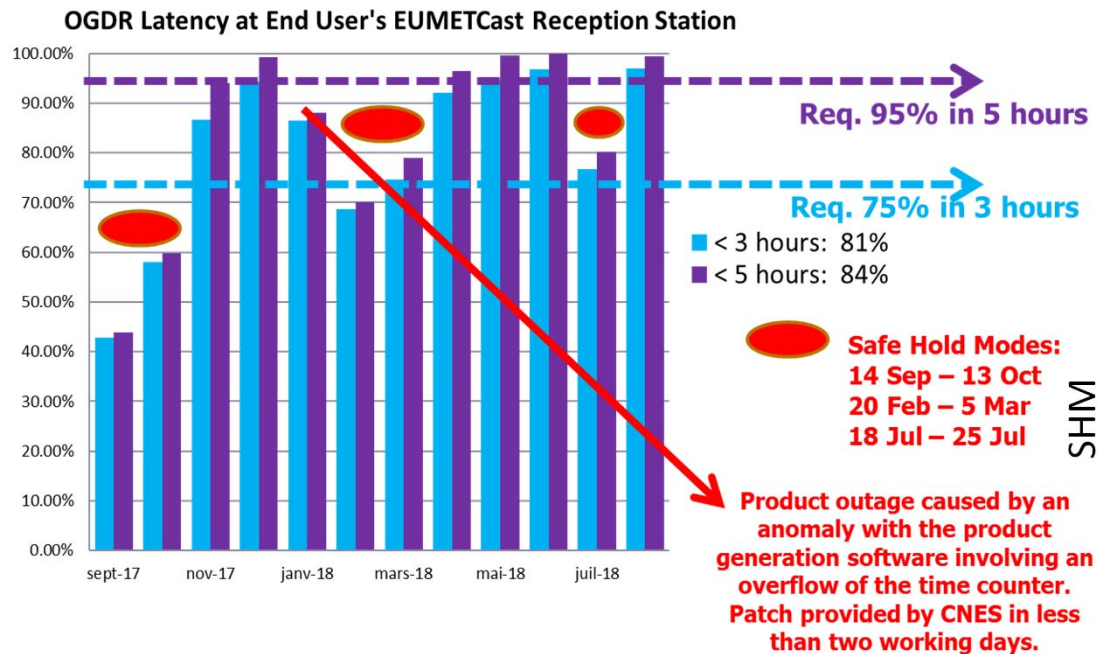
OGDR products Status and performances

- NRT products made by **EUMETSAT** and **NOAA/ESPC** Mission Center
- Major changes in the period
 - **None on the products**
 - No products during SHMs :
 - February 20th to March 2nd 2018
 - July 18th to July 25th 2018
- **EUMPC : ~100% OGDR successful for PLTM1 acquired at USG**
- **NOAA ESPC : ~100% OGDR successful for PLTM1 acquired at CDAs**
- **100 % OGDR products archived, all disseminated via EUMETCast and via NOAA dissemination services**

Operational Geophysical Data Record data latency

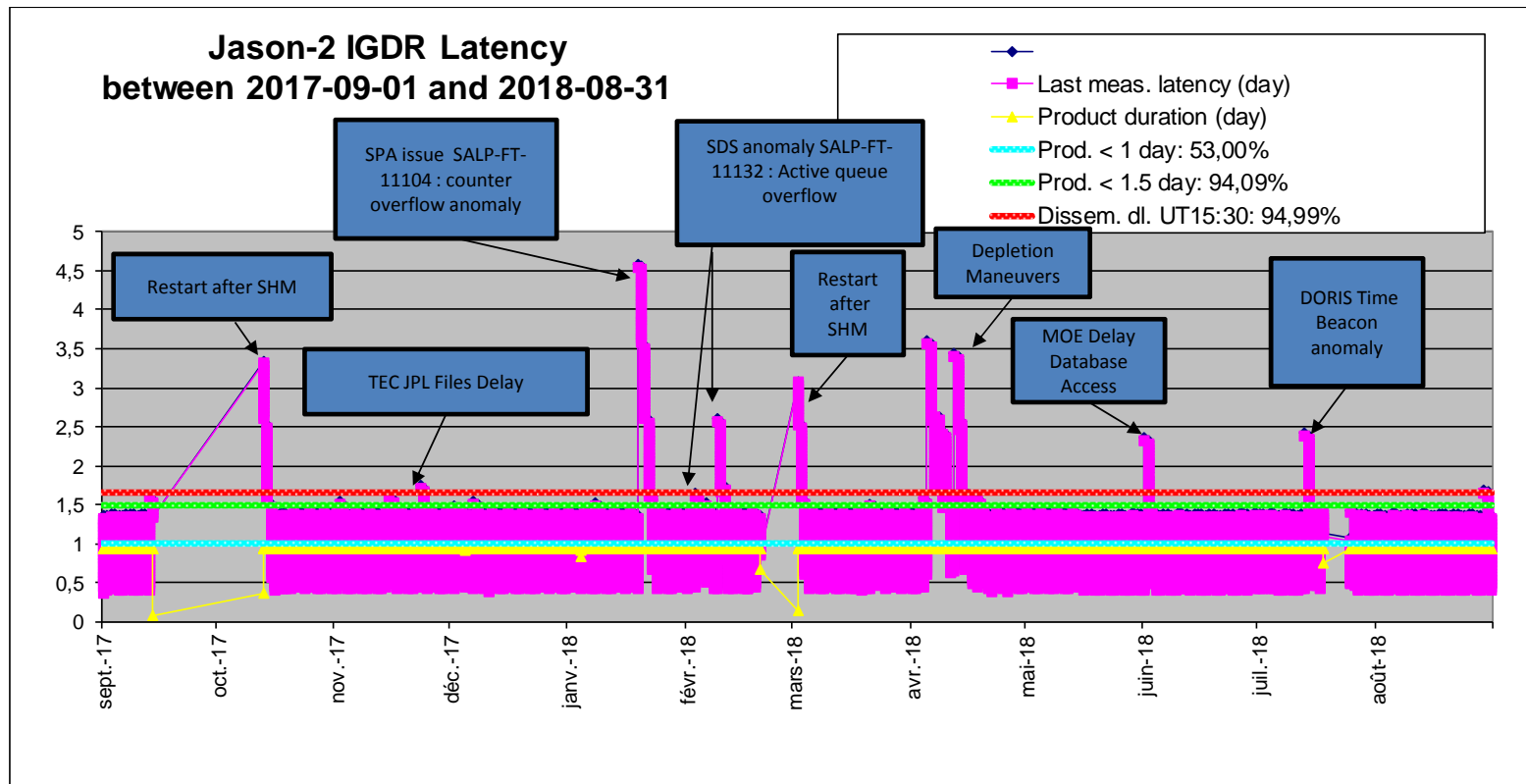
NOAA

EUMETSAT



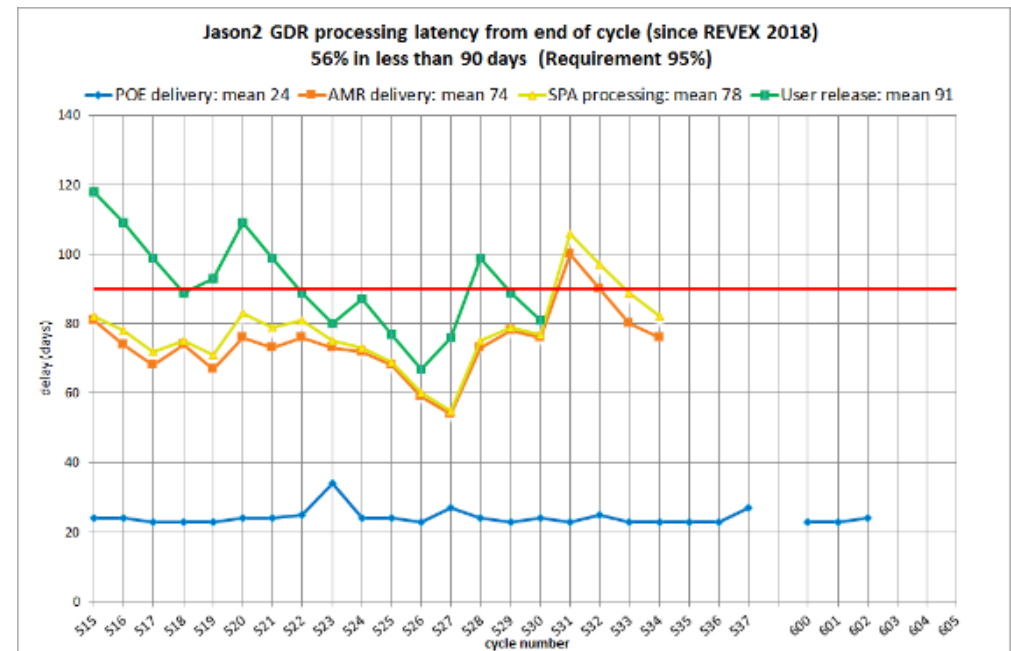
IGDR - status and performances

- Jason-2 IGDR processing is OK (CNES : 100% of possible IGDR successful)
- Latency : 94,09% of products available in less than 1.5 day
- 100% IGDR products archived
- All disseminated via CNES AVISO+ and NOAA dissemination services



GDR - status and performances

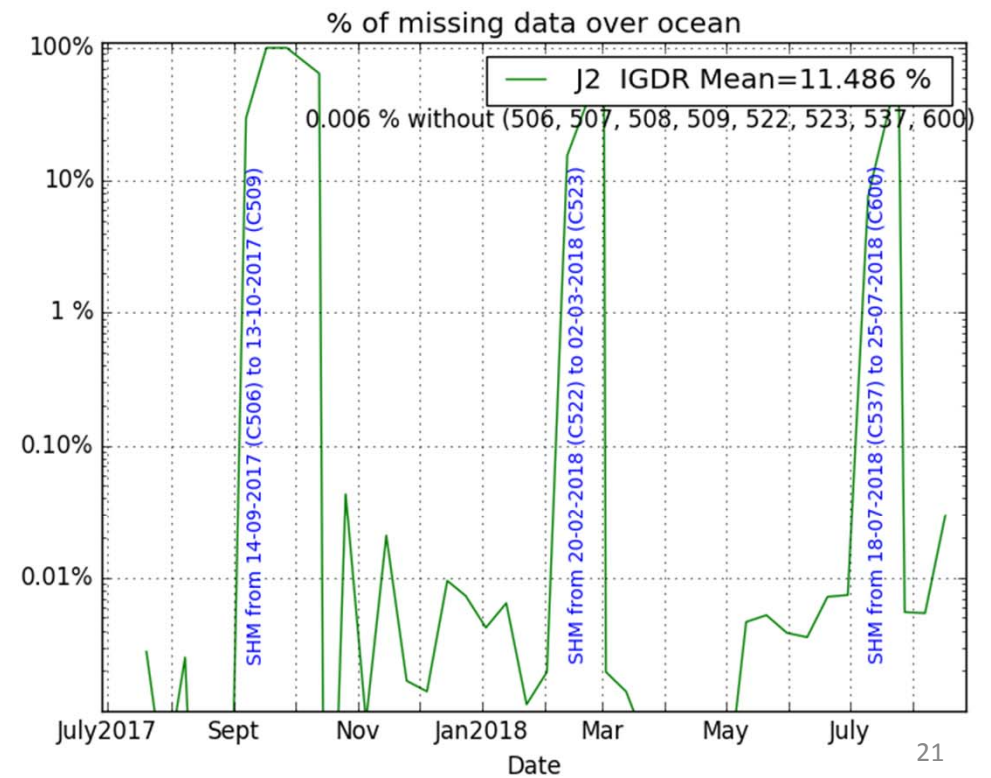
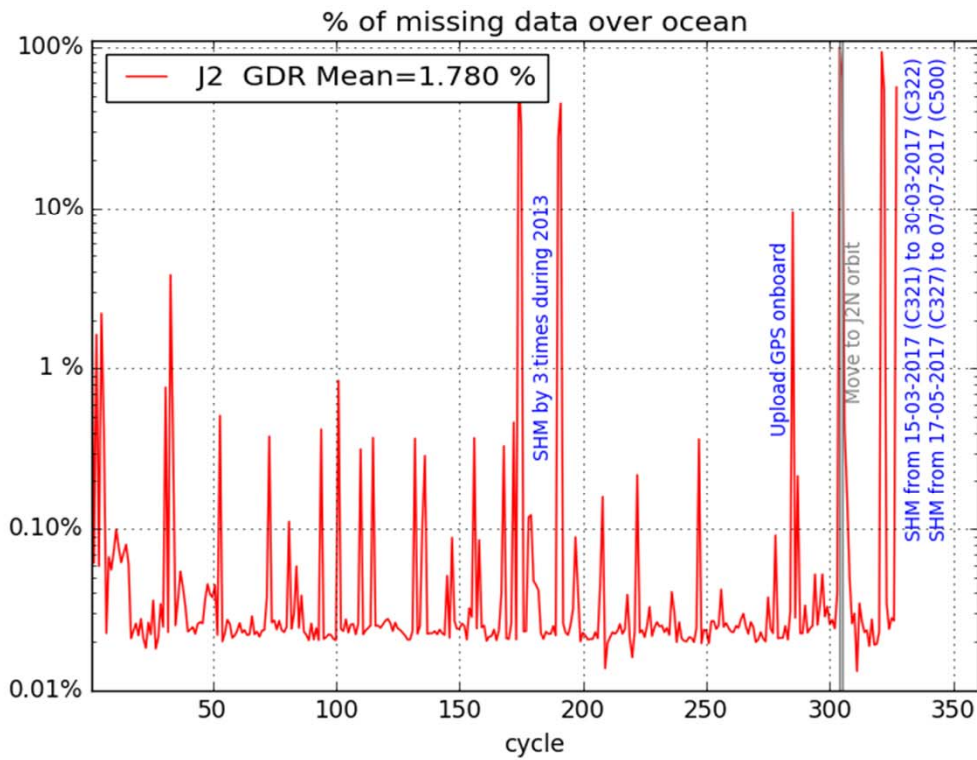
- GDR produced by CNES/SSALTO
- Jason-2 GDR processing is OK
 - Data availability & latency OK
 - Systematic validation by JPL
 - Yearly validation reports until end of 2017 available on AVISO+
<http://www.aviso.altimetry.fr/en/data/calval/systematic-calval.html>
- 100% GDR products archived
- All disseminated via CNES AVISO+ and NOAA dissemination services



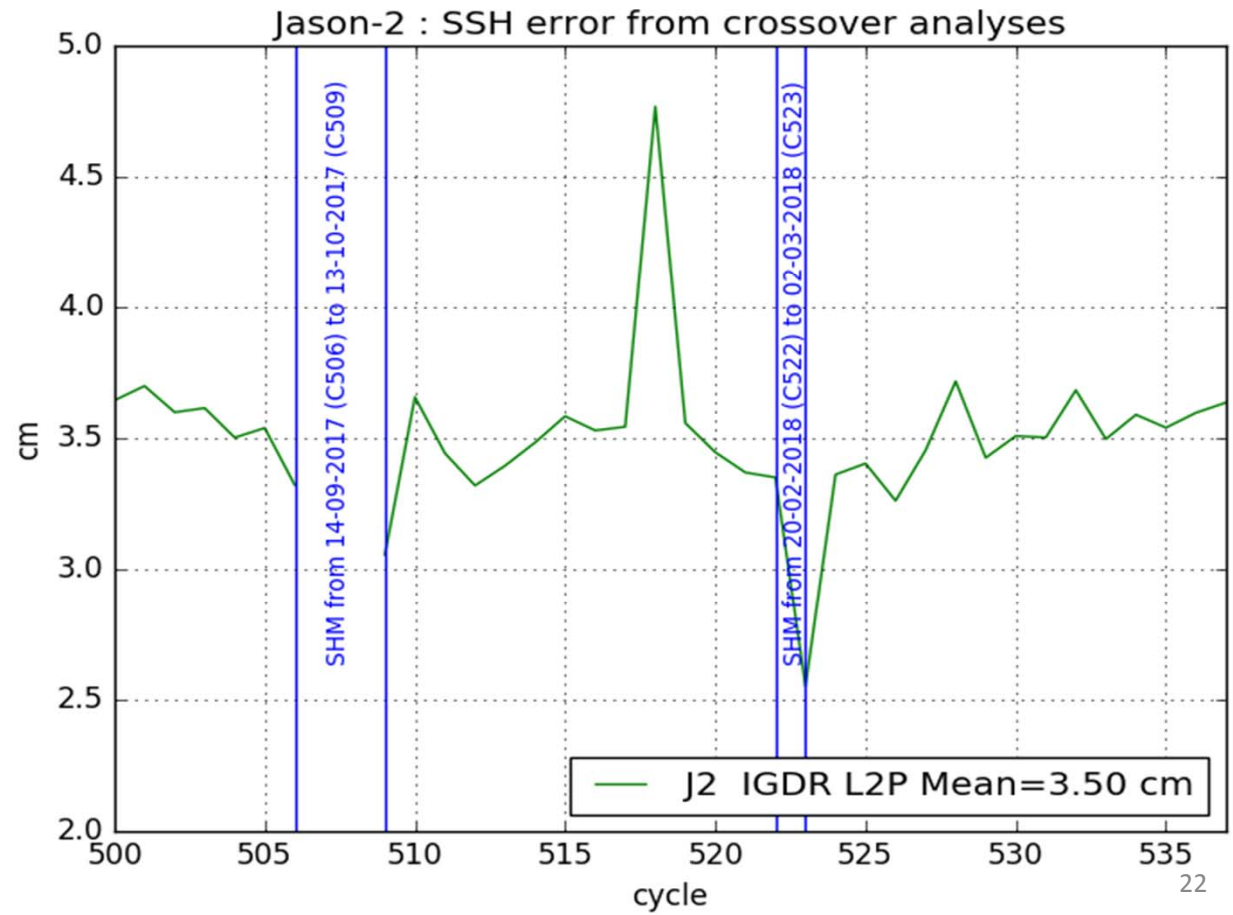
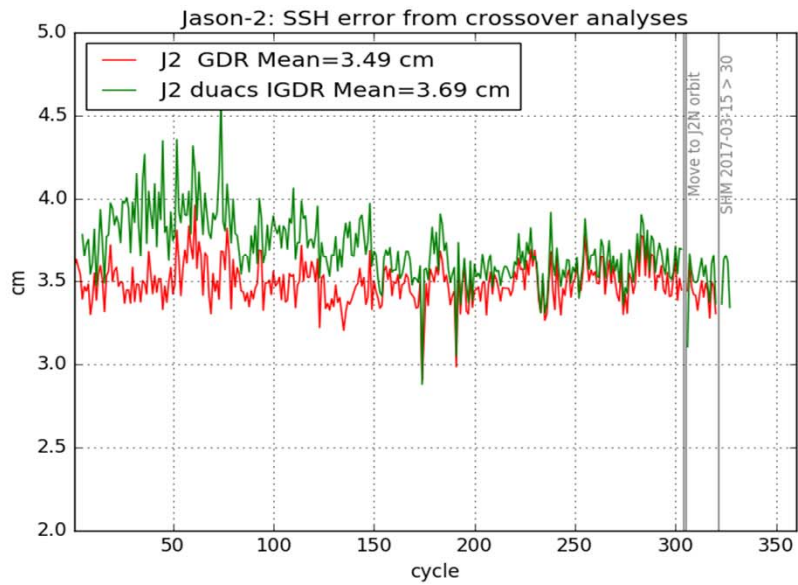
Performances – missing measurements

Very good data availability over ocean 98.39 % over repetitive phase, calibrations and incidents included
 89% over LRO due to SHMs

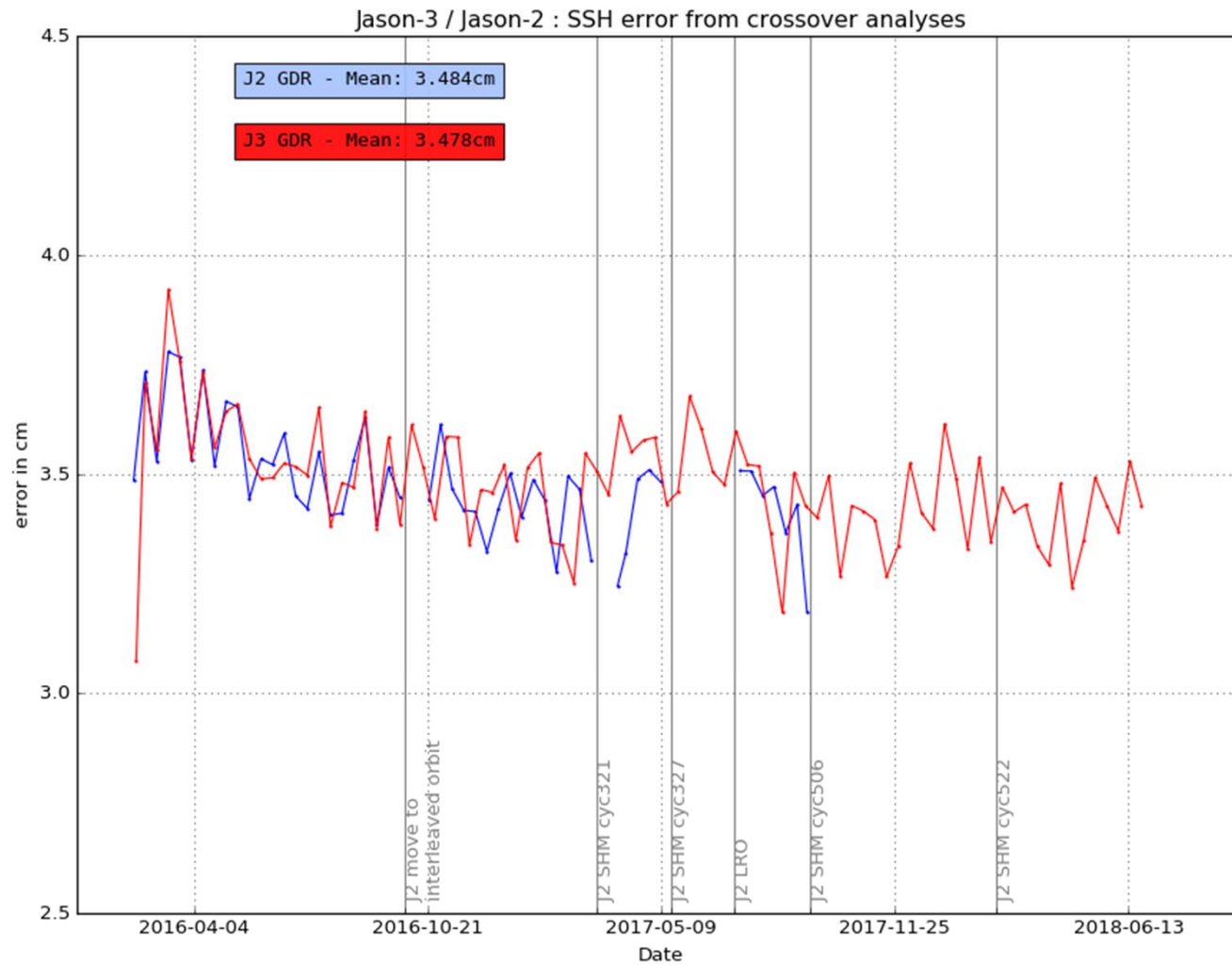
After removing calibrations and incidents: >99.9 % data are available over ocean



Performances – Xover



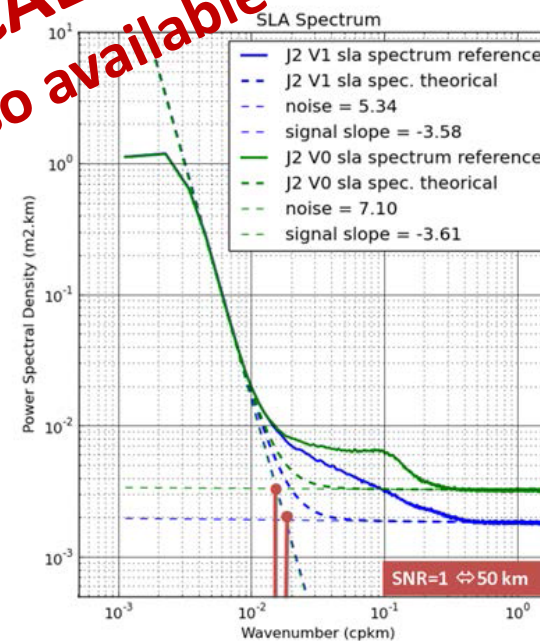
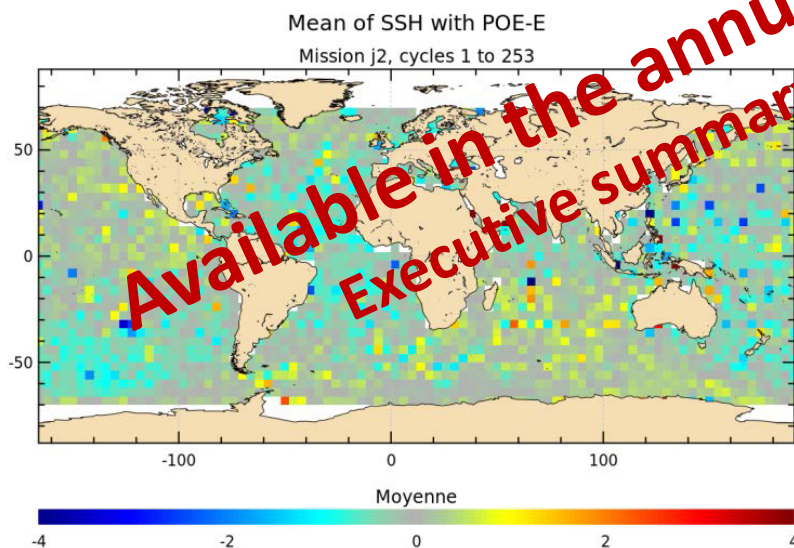
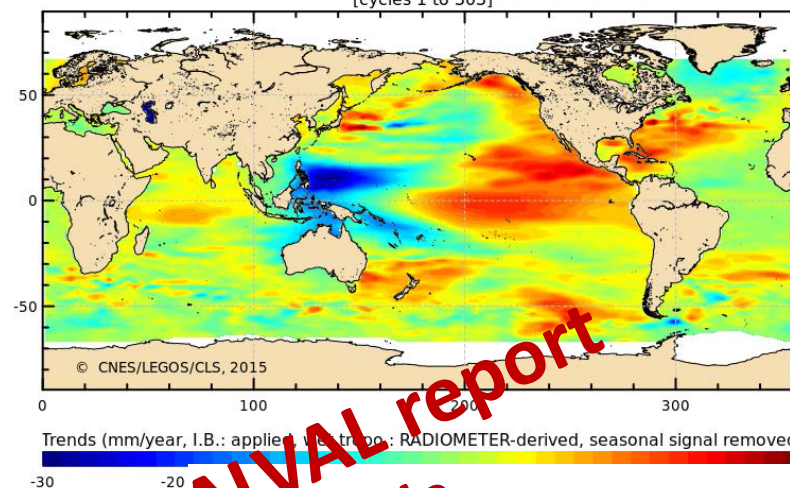
JA2/JA3 performances – Xover



Jason-2 validation and cross calibration activities (Annual report 2016)

Contract No 160182-14026/00 Lot 1.6.3

Jason-2 Sea Level Trends (period : Jul-2008 to Oct-2016) [cycles 1 to 303]



System Requirements and Performances

- Data availability :
 - Requirement : The GDR shall contain 95% of all possible over-ocean data (acquisition and archive) during any 12 month period, with no systematic gaps.
- from July 2017 until July 2018 (i.e. over 1st LRO cycle)
 - ⇒ **satellite unavailability** ~11 % > 4% req
 - bus : 11% altimeter : 0.01% Doris : 0% AMR : 0.07%
 - with planned activities* ~0.02 % < 4% req
 - ⇒ **ground unavailability** ~0.00 % < 1% req

➔ **Global Jason-2 system availability : ~ 89 %**

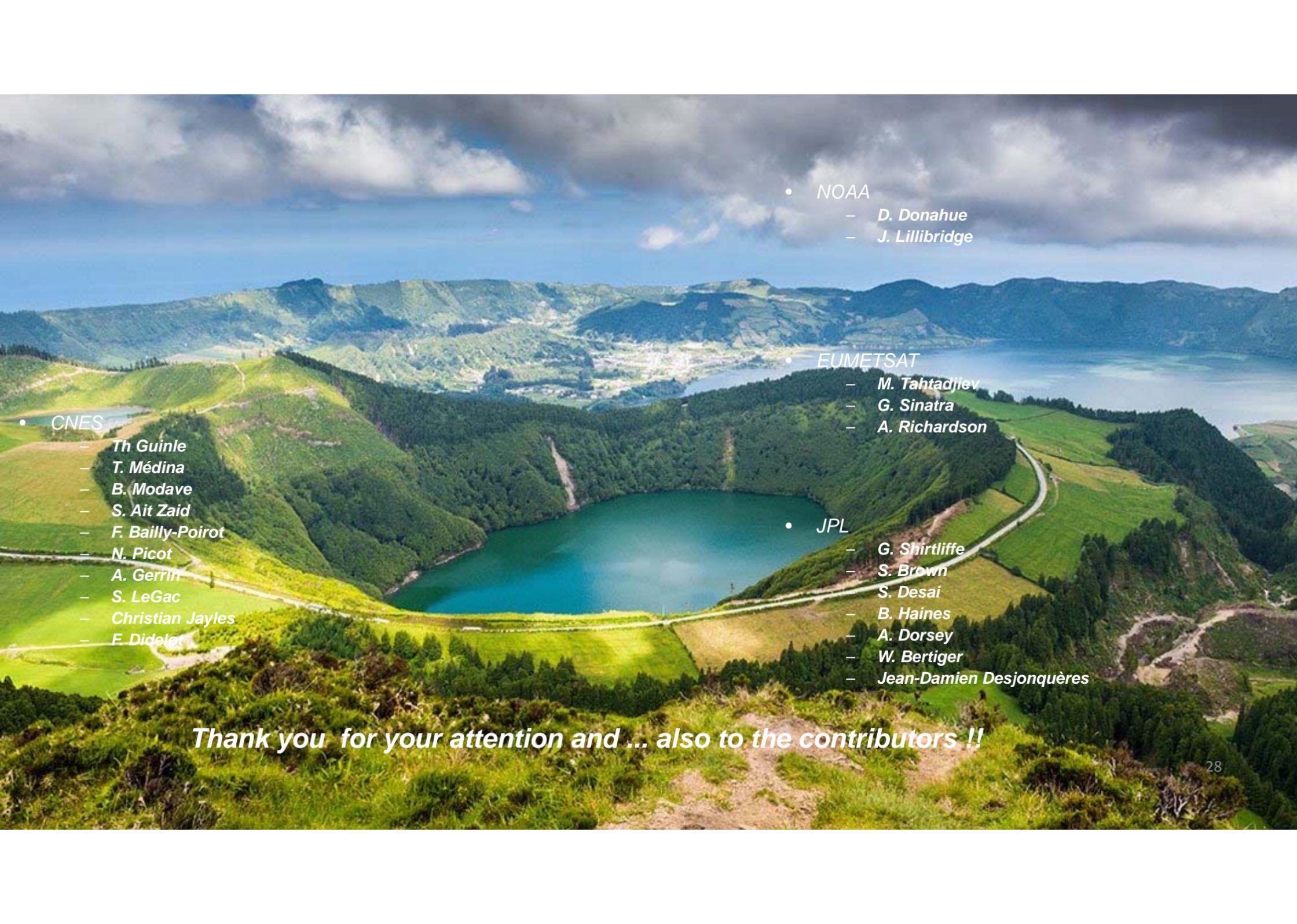
Conclusion – Jason-2 at a glance

- 10th Jason-2 Exploitation Review (REVEX) : successful in May 2018
- S/C maneuvers to i-LRO on July 16th and July 18th
- Fuel depletion process ongoing
- Still excellent measurements quality after 10.5 years in orbit, with availability currently reduced to approx. 89%
- Extended Operational Routine Phase up to 31st December 2019.

Thank you to all the teams from CNES, NOAA, EUMETSAT & NASA/JPL

Items to consider

- ➔ **Jason-2 mission extension is granted until December 2019**
 - ➔ **Roughly geodetic cycle 2 + 6 months**
- ➔ Provided the availability scheme stays approximately the same, is Jason-2 production still satisfactory to users ?
- ➔ Will we still need Jason 2 after 2019 ?
- ➔ If yes, what is the requirement after cycle 2 ?
 - ➔ After cycle 2, a 4km grid should be achieved (with small gaps) : 3rd geodetic cycle with 2km groundtrack translation ?



- CNES

- Th Guinle
- T. Médina
- B. Modave
- S. Ait Zaid
- F. Bailly-Poirot
- N. Picot
- A. Gerrin
- S. LeGac
- Christian Jayles
- F. Didelot

- NOAA

- D. Donahue
- J. Lillibridge

- EUMETSAT

- M. Tahtadjev
- G. Sinatra
- A. Richardson

- JPL

- G. Shirtliffe
- S. Brown
- S. Desai
- B. Haines
- A. Dorsey
- W. Bertiger
- Jean-Damien Desjonquères

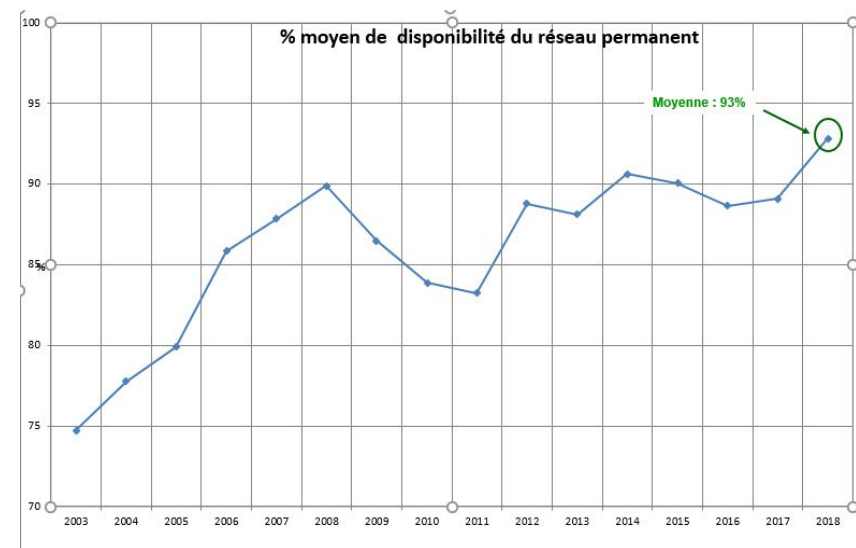
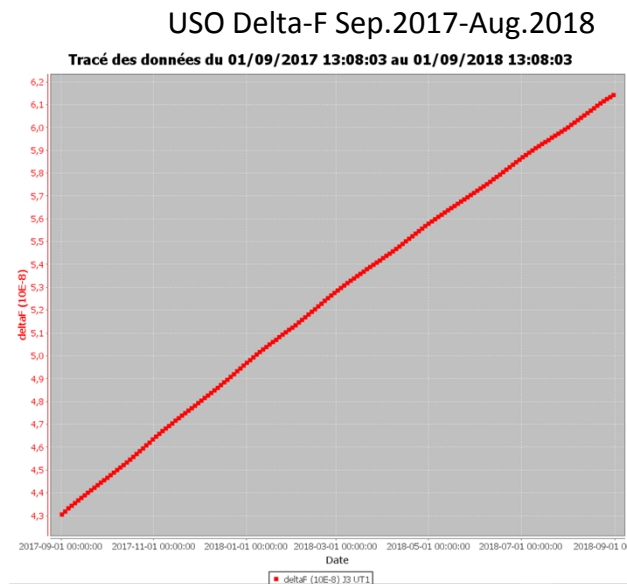
Thank you for your attention and ... also to the contributors !!

Backup slides

DORIS

- DORIS Availability = **100% over the period**
 - No anomaly over the period
 - Effective accuracy as compared to on-board GPS (platform) is stable :
 - 1.8 μs (OGDR & IGDR)
 - $\sim 1.5 \mu\text{s}$ (GDR)

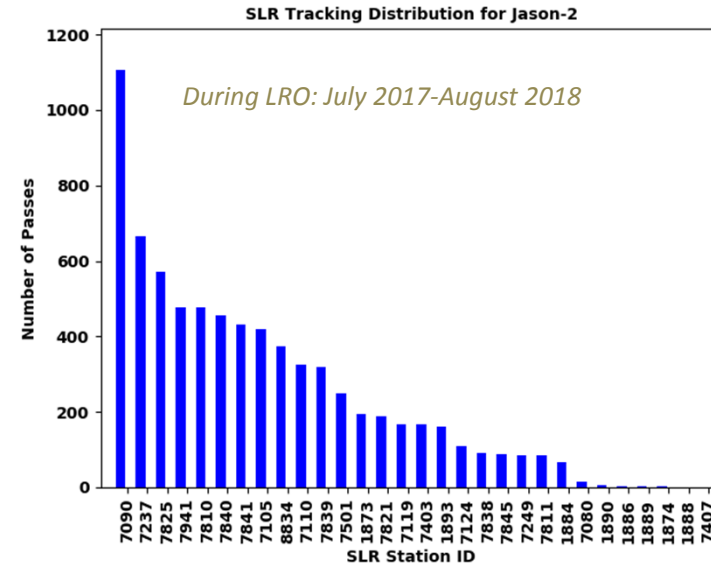
+ very good performance of the ground network ($\sim 90\%$)



SLR/LRA



- Laser ranging array (LRA) is passive (No electronics or software)
- Copy of Jason-1 LRA system, supporting cm-level ranging
- Tracking of Jason-3 and Jason-2 high priority for International Laser Ranging Service (ILRS)
- Performance of Jason-2 LRA has been nominal



Cumulative Passes Per Station for Jason-2

- Top stations by pass volume during Long Repeat Orbit (LRO):
 - *Yaragadee, Changchun, Mt. Stromlo, Matera, Zimmerwald*