

# Ocean Surface Topography Science Team Meeting (OSTST)

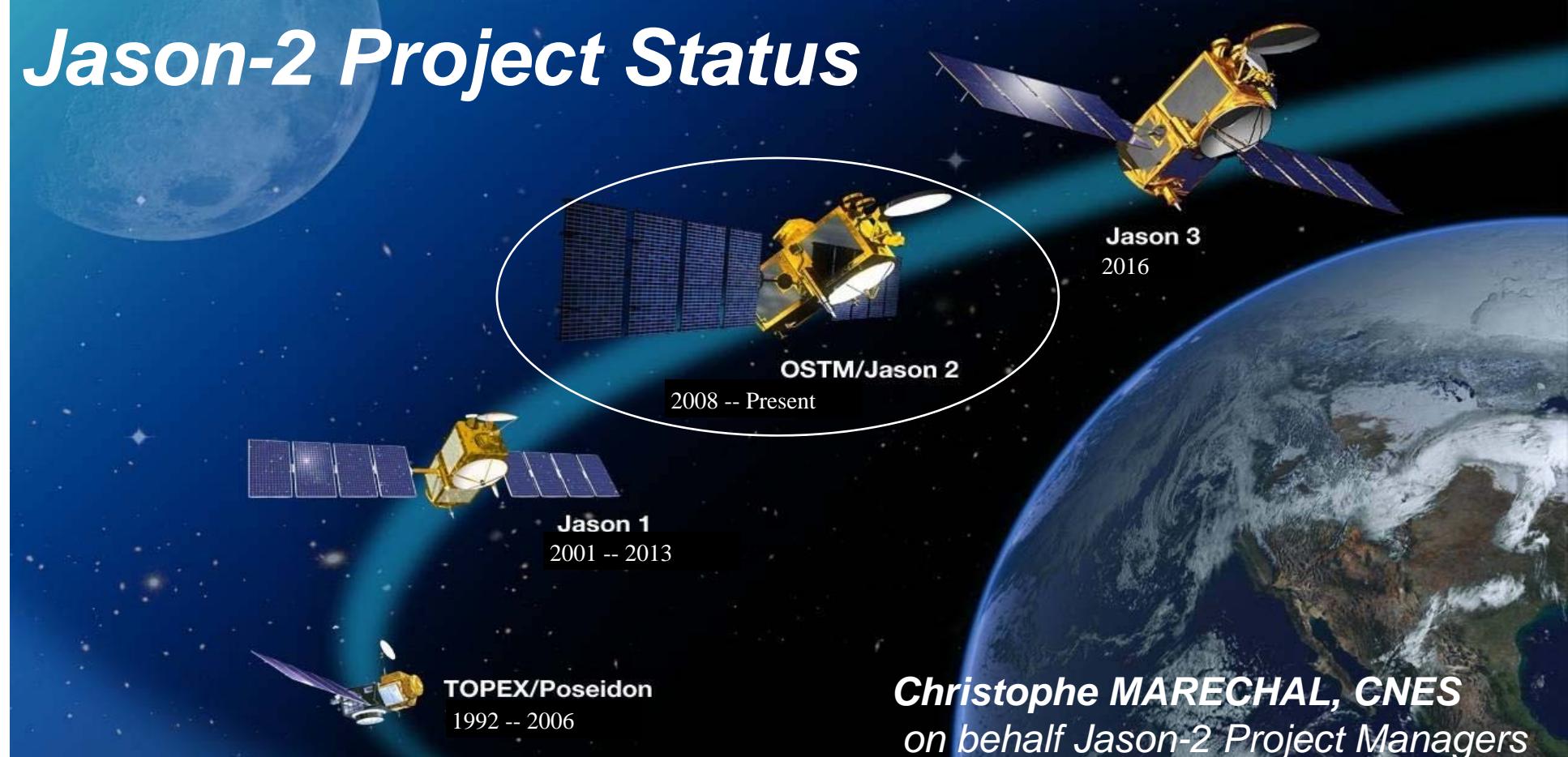
October 23-27, 2017

“The 25th Anniversary of TOPEX/Poseidon”



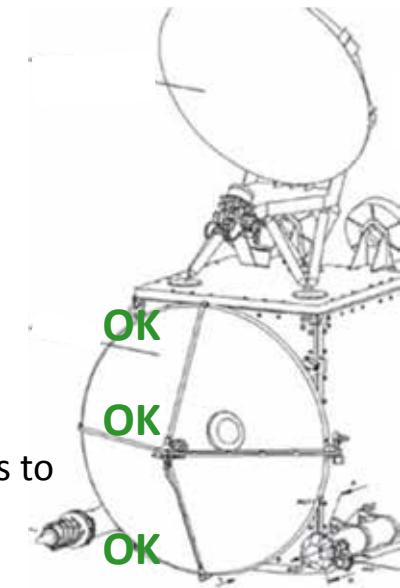
EUMETSAT

## Jason-2 Project Status



# Platform Status

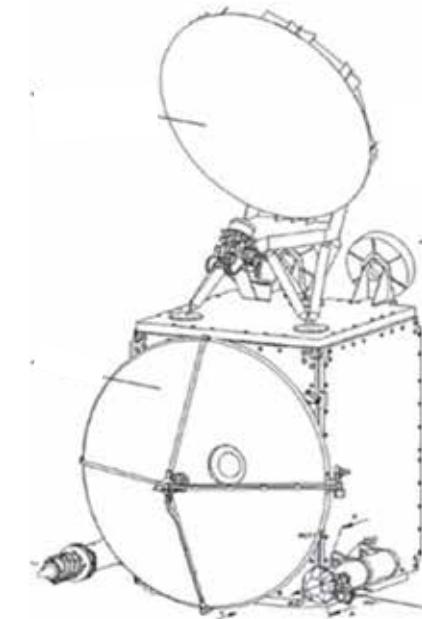
- The Jason-2 satellite bus is **OK**
  - Command / control , RF : **PMA : operational, PMB operational**
    - On-Board Software, Mass Memory, Telemetry & Telecommand system
  - Thermal aspects:
    - Active thermal control works successfully and is sized with significant margins to meet further worst 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 only under 25°C
    - 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 9 years in orbit, Jason-2 is currently operational only on specific time periods**

# Payload Status

- Core Payload
  - POSEIDON3 OK
  - DORIS OK
  - AMR OK
  - GPSP-B OK
  
- Passengers
  - T2L2 OK
  - CARMEN2
    - Formally declared lost on April 26<sup>th</sup>, 2017 at REVEX.
  - LPT
    - 5 anomalies over the last year, solved by OFF/ON. OFF

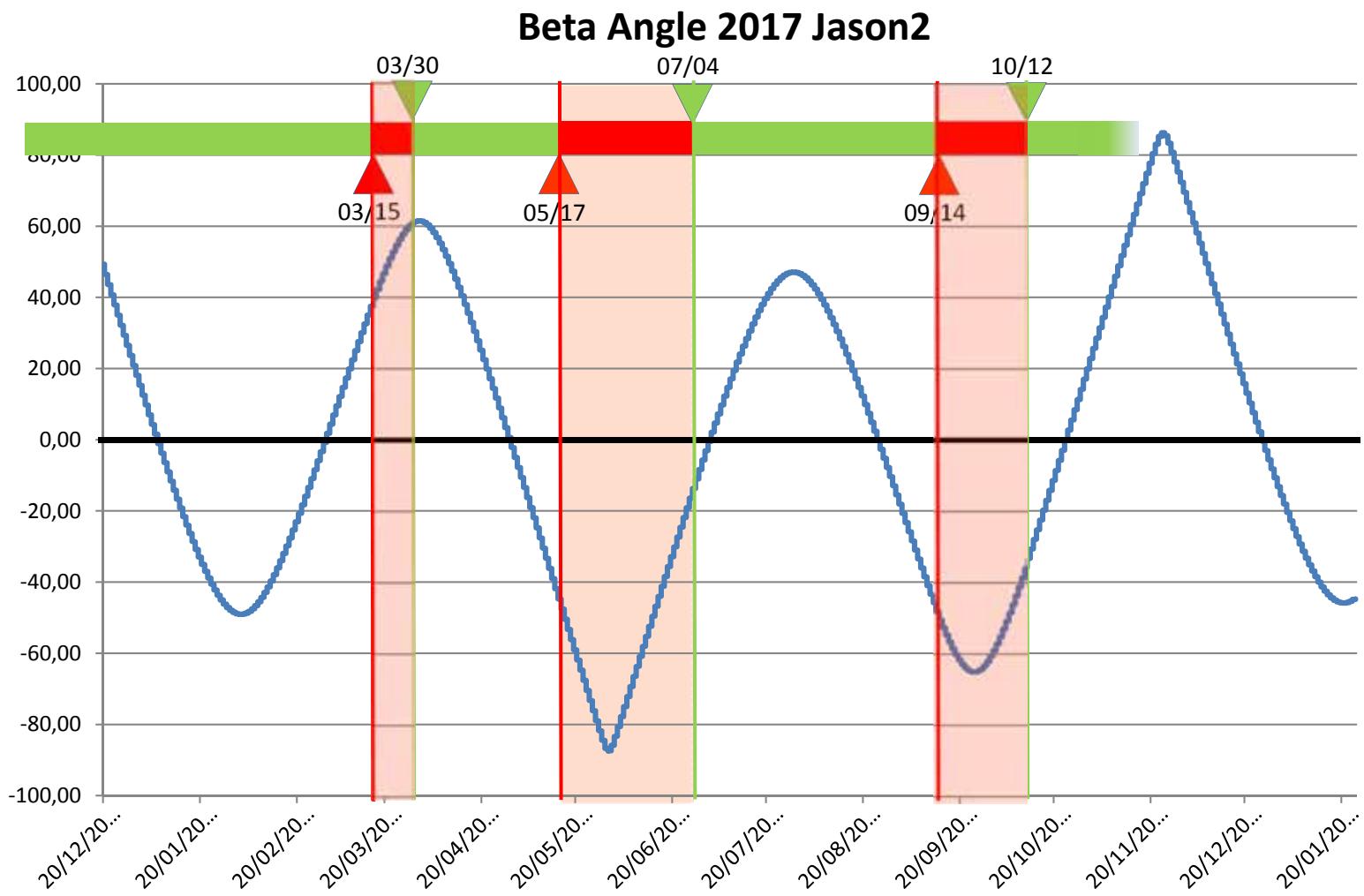


➔ Fully OPERATIONAL with redundancy available for POS-3, DORIS & AMR  
➔ Passengers are keeping on ageing

# 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

# So what is happening to Jason 2 ?

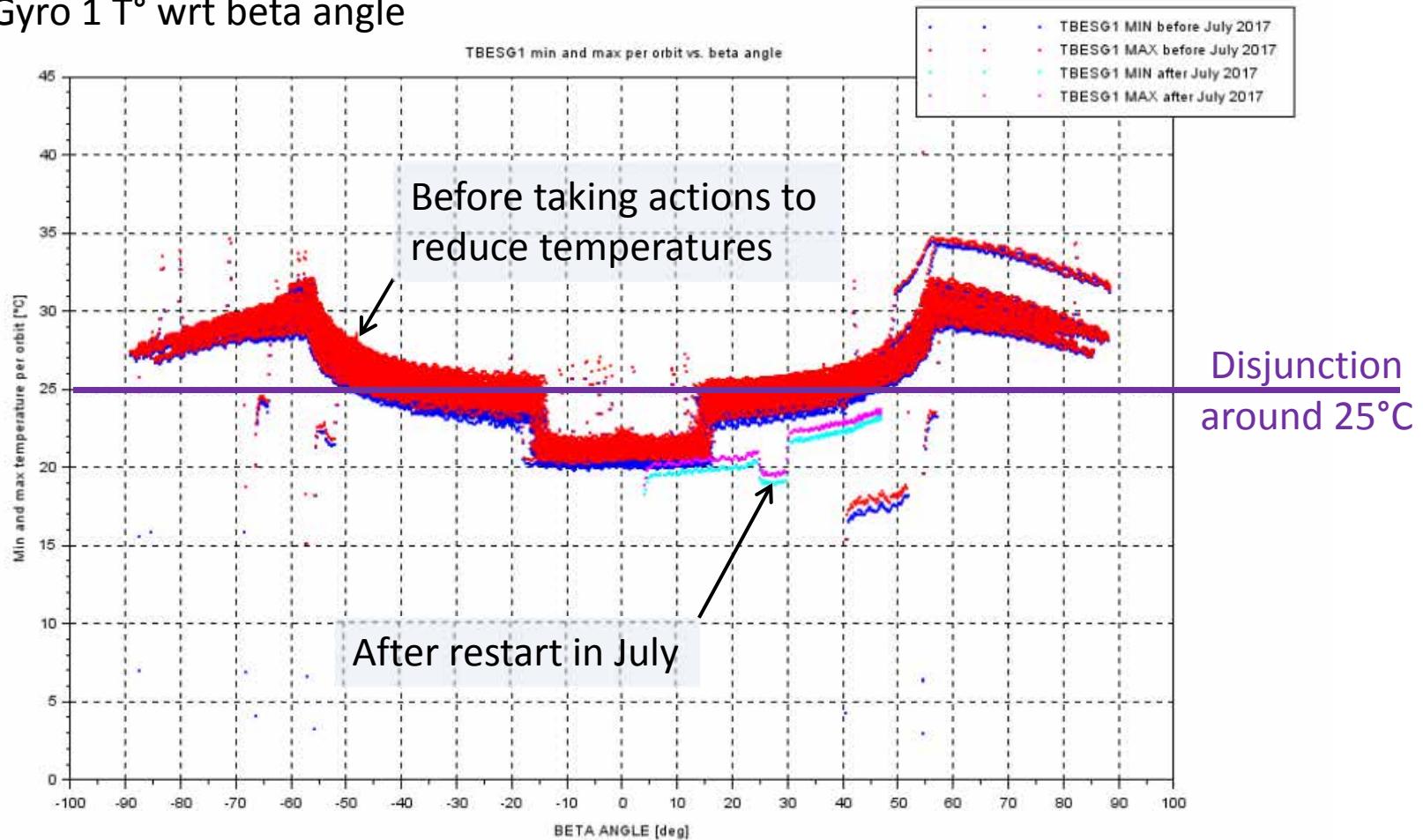


# Status

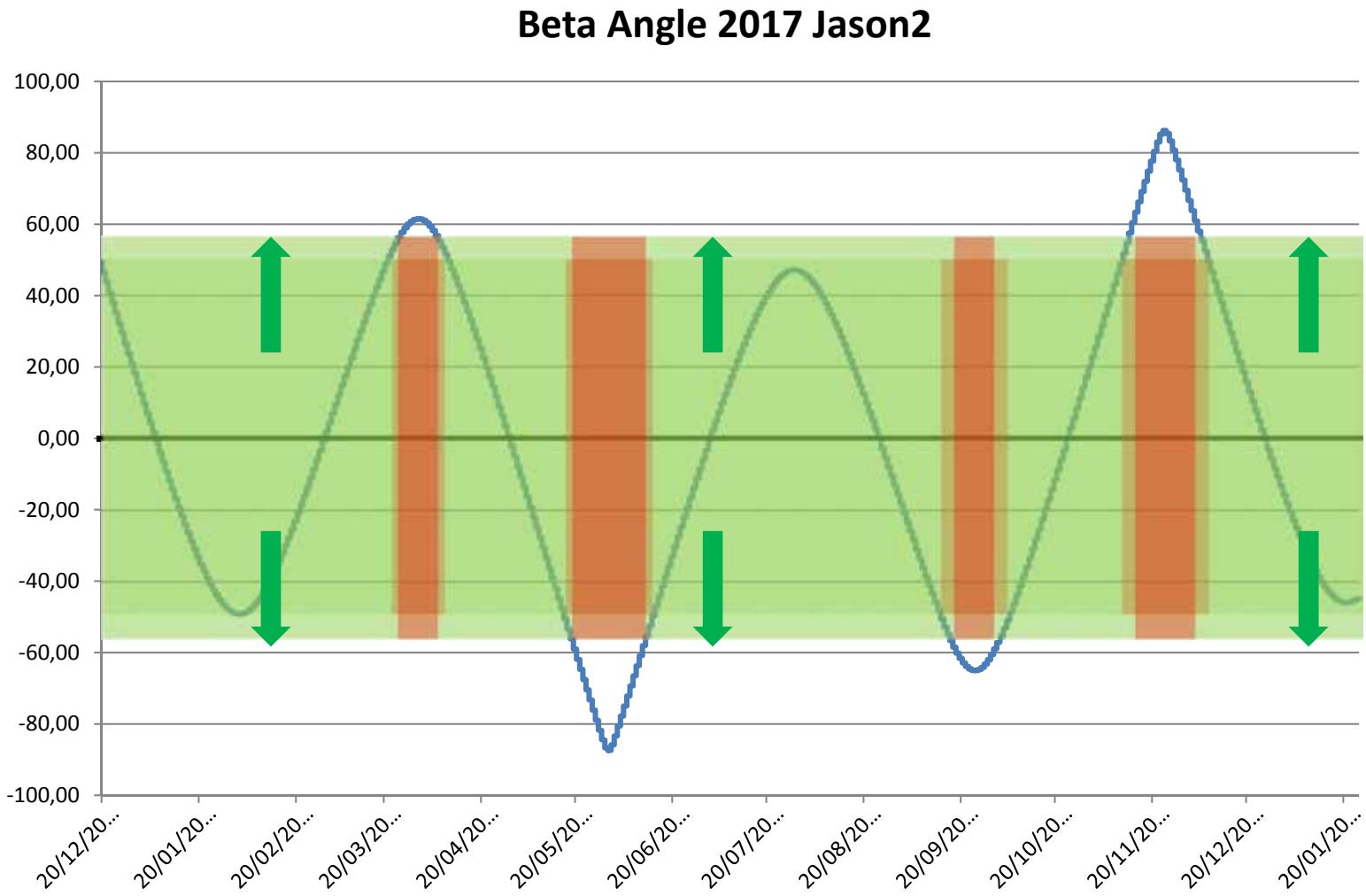
- In nominal mode, Jason 2 attitude control software uses on 2 types of sensors
  - Star trackers (2 redundant)
  - Gyrometers (3 2-axis gyros, need 2 to run nominally)
- Gyros 1&2 electronics behaviour has changed
  - When electronic boxes temperature rises above 25°C, gyros stop at high latitudes

# Why is it beta-dependent ?

Gyro 1 T° wrt beta angle

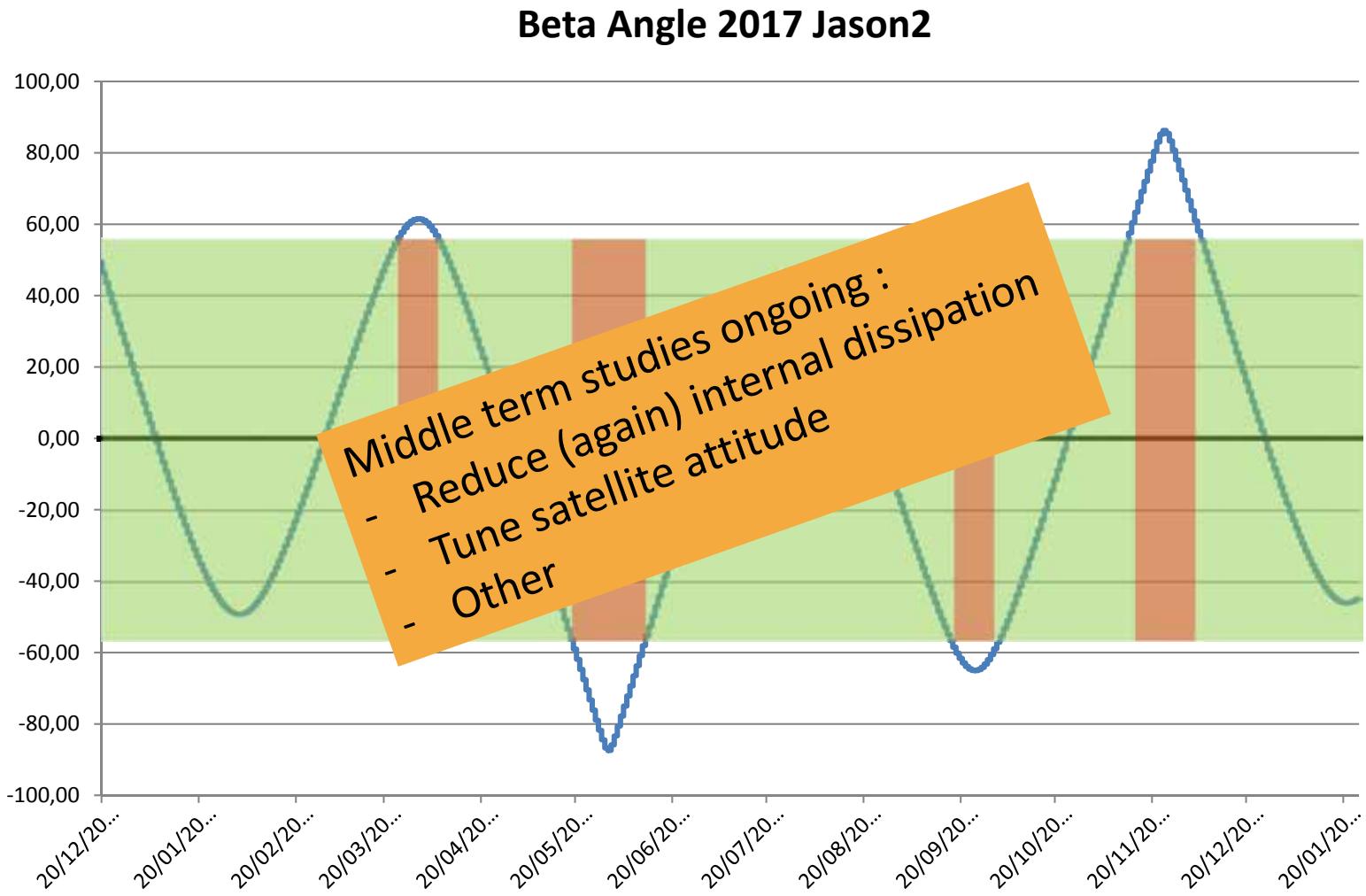


# Can we fix this ?



Decreasing the gyro environment temperature helps fixing the problem

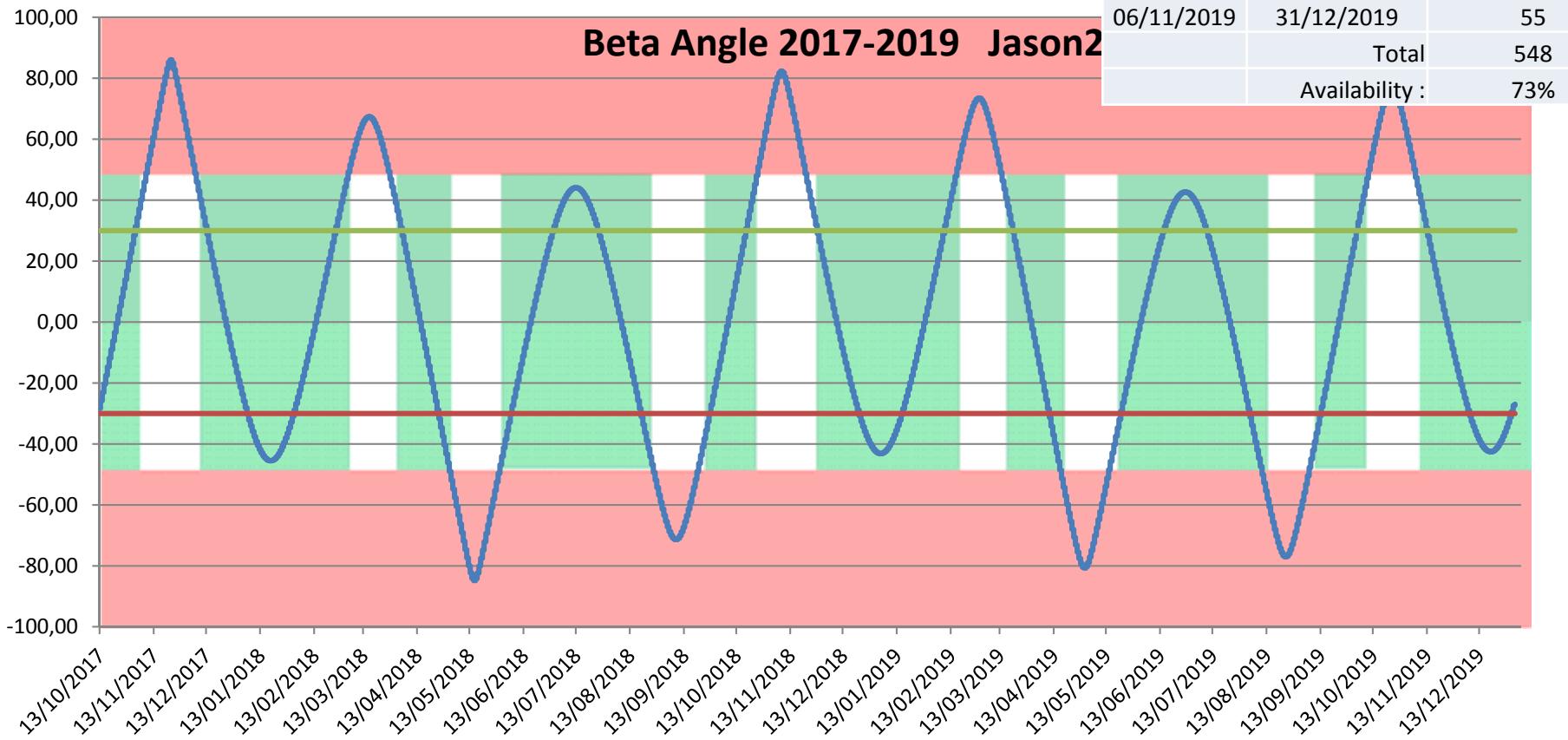
# Reduce gyro temperatures



# Suppress AOCS dependency to gyros



# What about the future ?

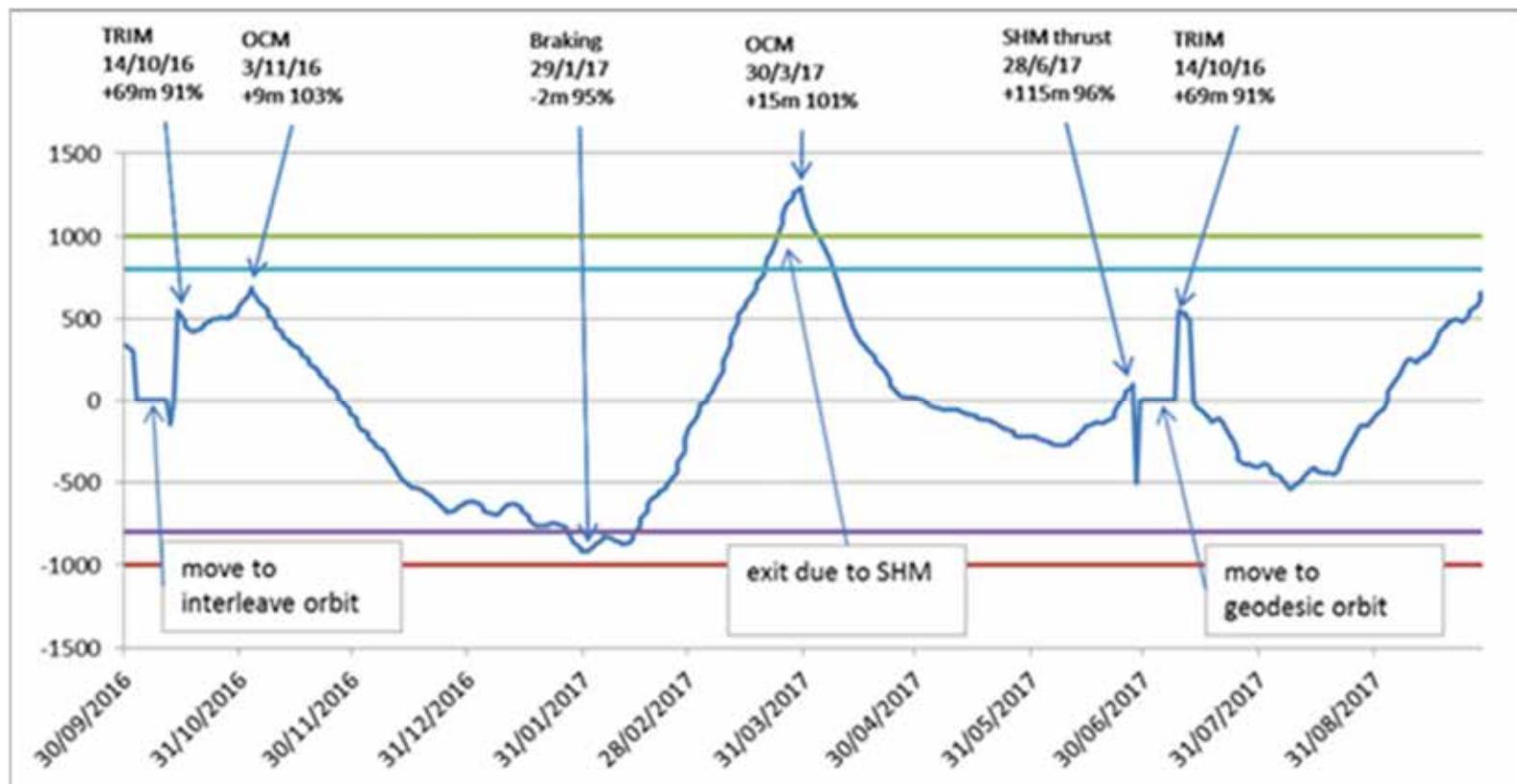
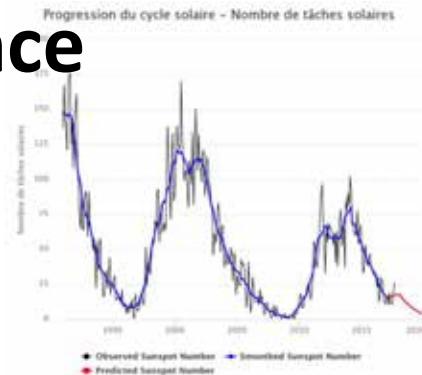


# Possible availability in 2017

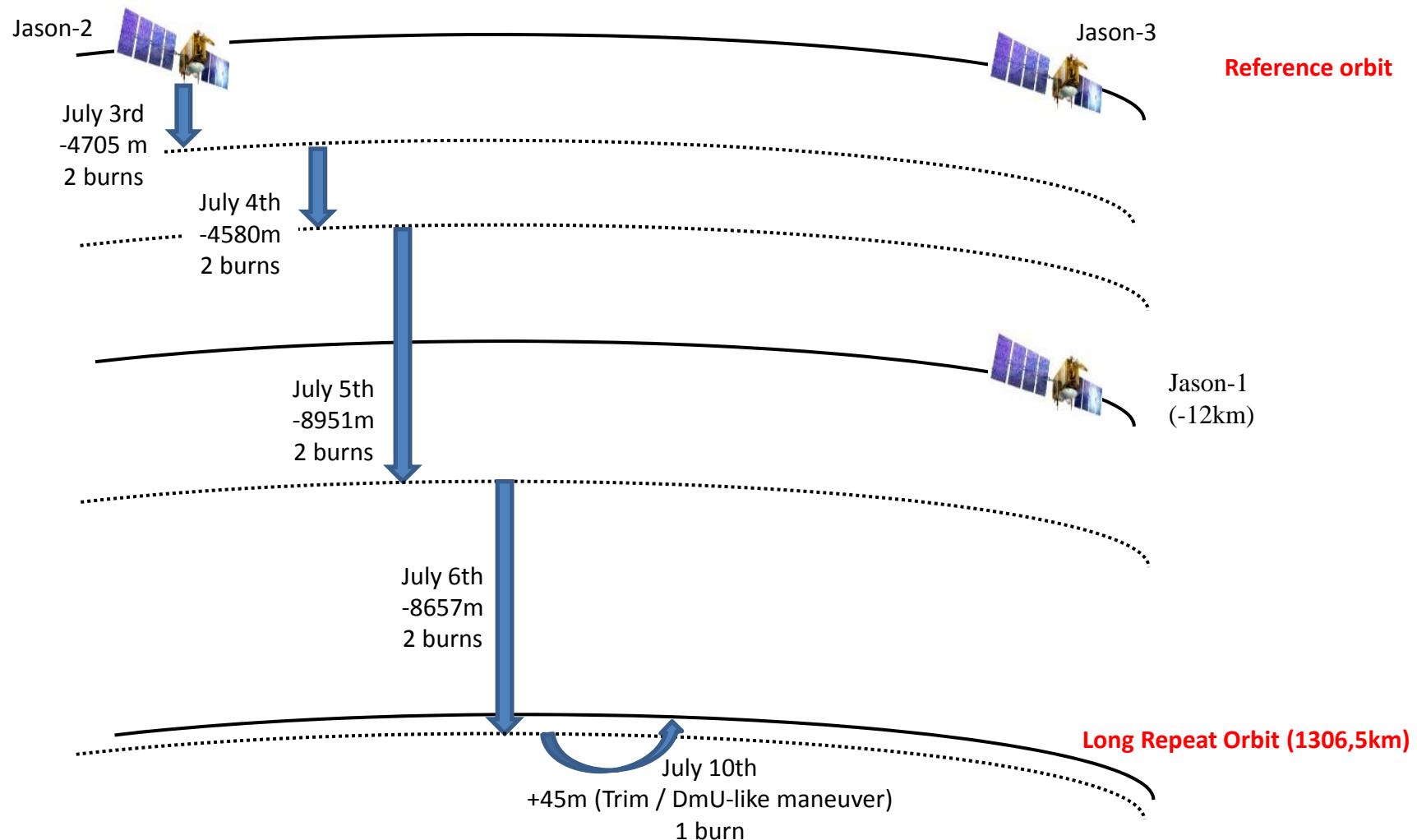
- Assuming
  - No further workaround
  - No further degradation of the gyros (?)
  - Restart ASAP (operational constraints not taken into account)
- 4 to 5 unavailability periods per year
- Approx. 73% availability

# Routine navigation and guidance

- Move to interleaved orbit : October 2016
- Braking maneuver in January 2017
- Window exit after SHM in March 2017
- Move to LRO in July 2017



# Transfer to LRO – July '17



# Orbit change synthesis

- Operations performed as planned
- Very good performance of the propulsion system
- ≈16kg of hydrazine still available
  - ≈4kg used to maneuver to LRO
- GDR generation was postponed for a few weeks
- No DEM on this orbit

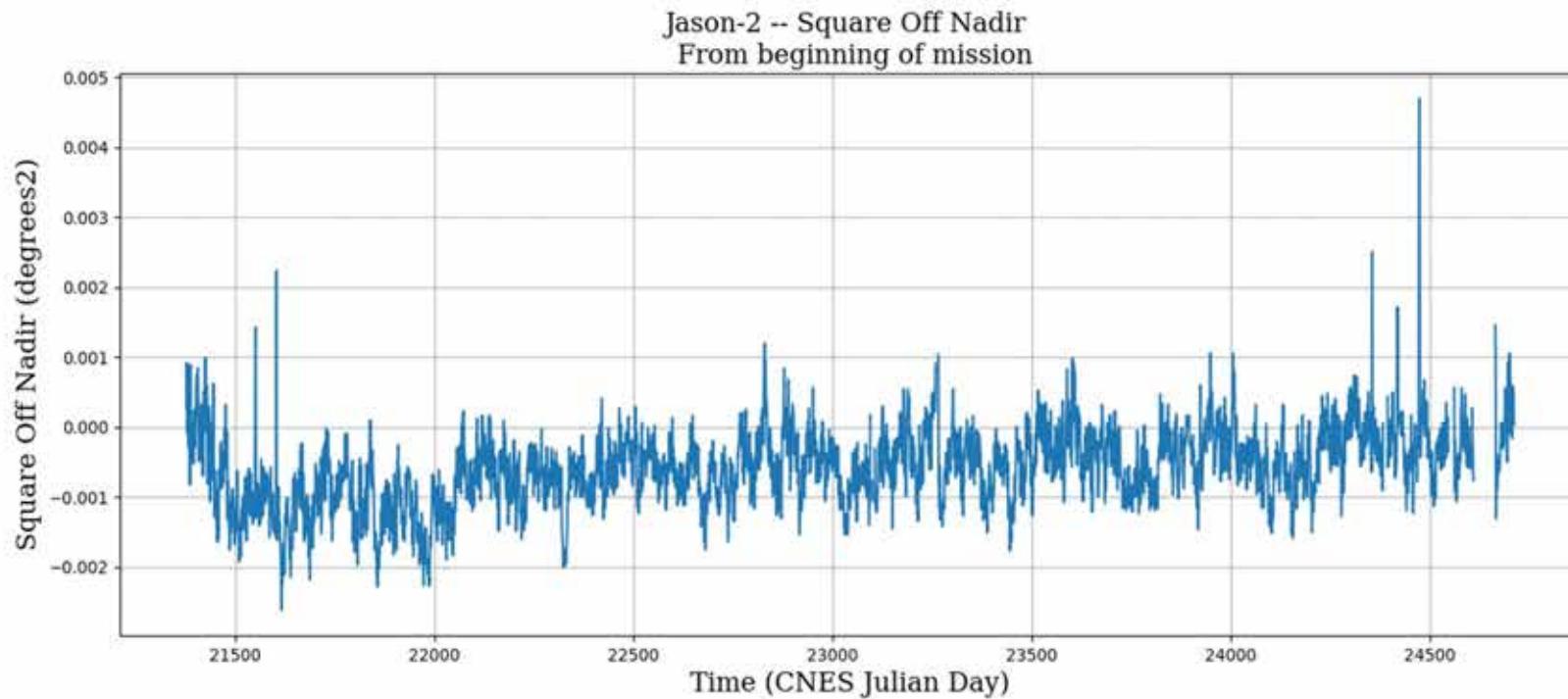
→ Next step : fuel depletion

→ Discussion started about the amount of fuel to leave onboard

→ Will be stated with 4 partners

# System Requirements and Performances

- Altimeter Antenna Pointing : **typical value below 0.002°**
  - Requirement < 0.2°
  - pointing performance stable since launch

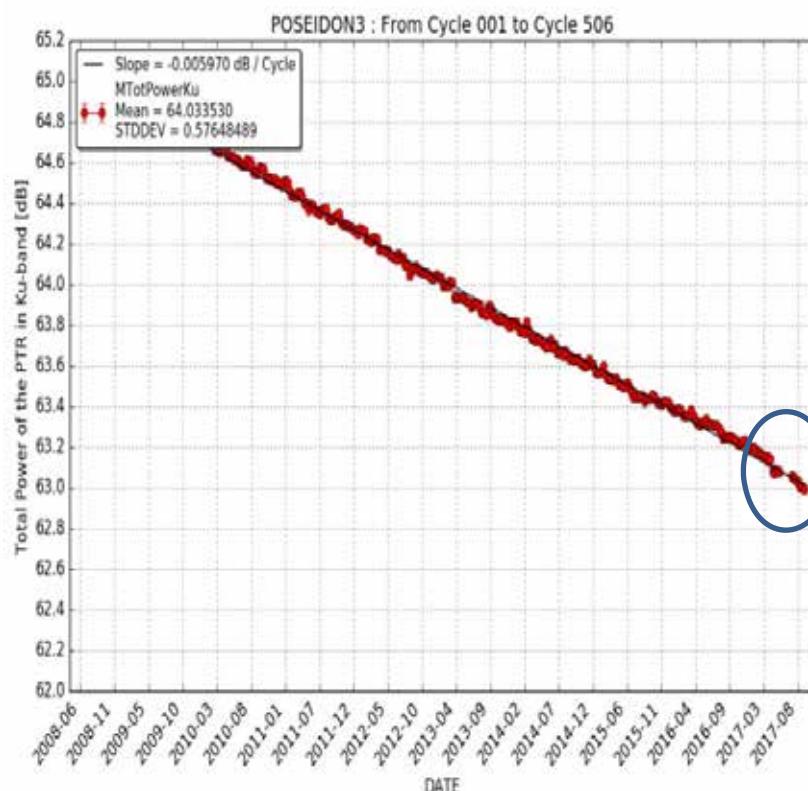


# Poseidon-3 / JASON-2

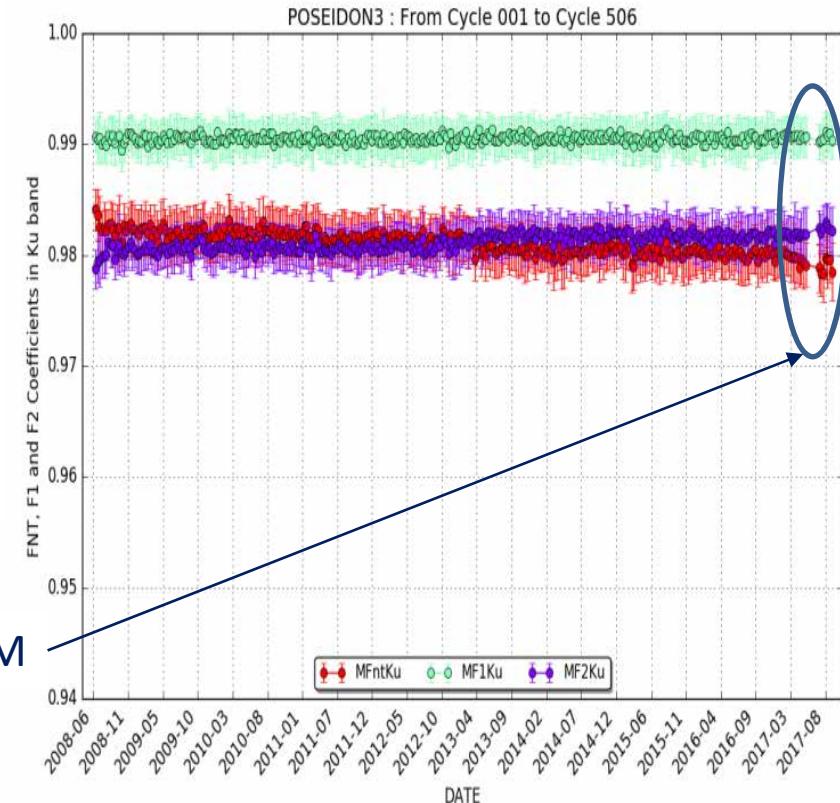
❖ Routine / Exceptional calibrations are OK

❖ Good stability even after SHM

➤ CAL1 Ku-band PTR power

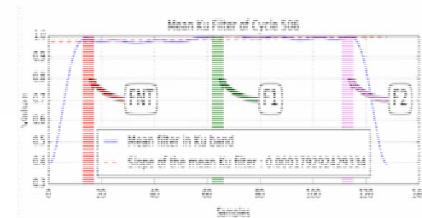


➤ CAL2 Ku-band LPF coeff.

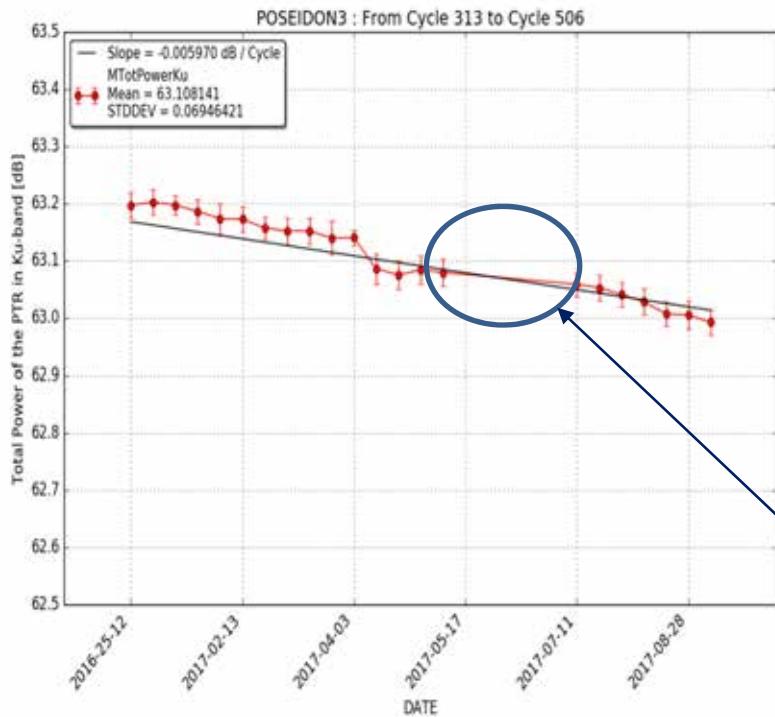


# Poseidon-3 / JASON-2

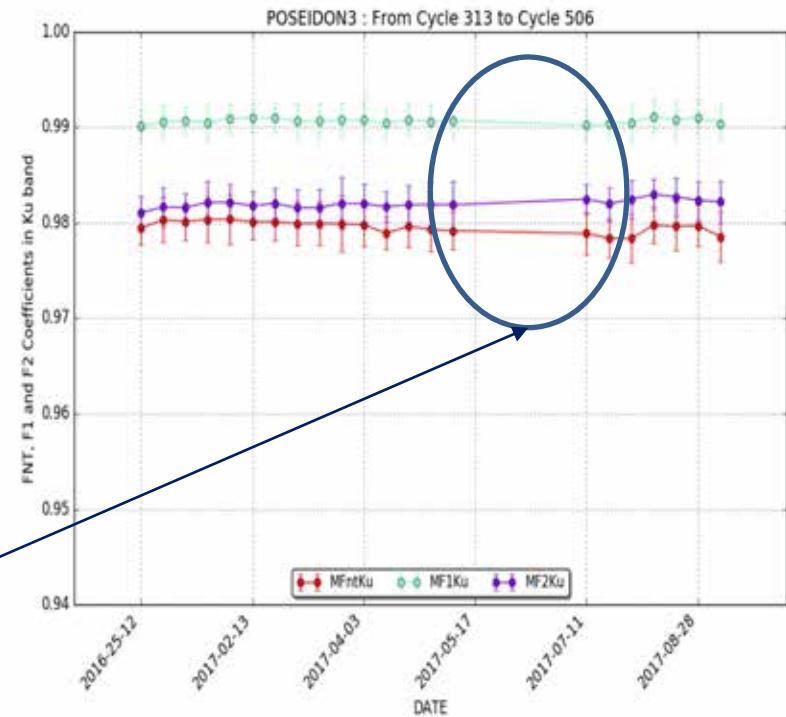
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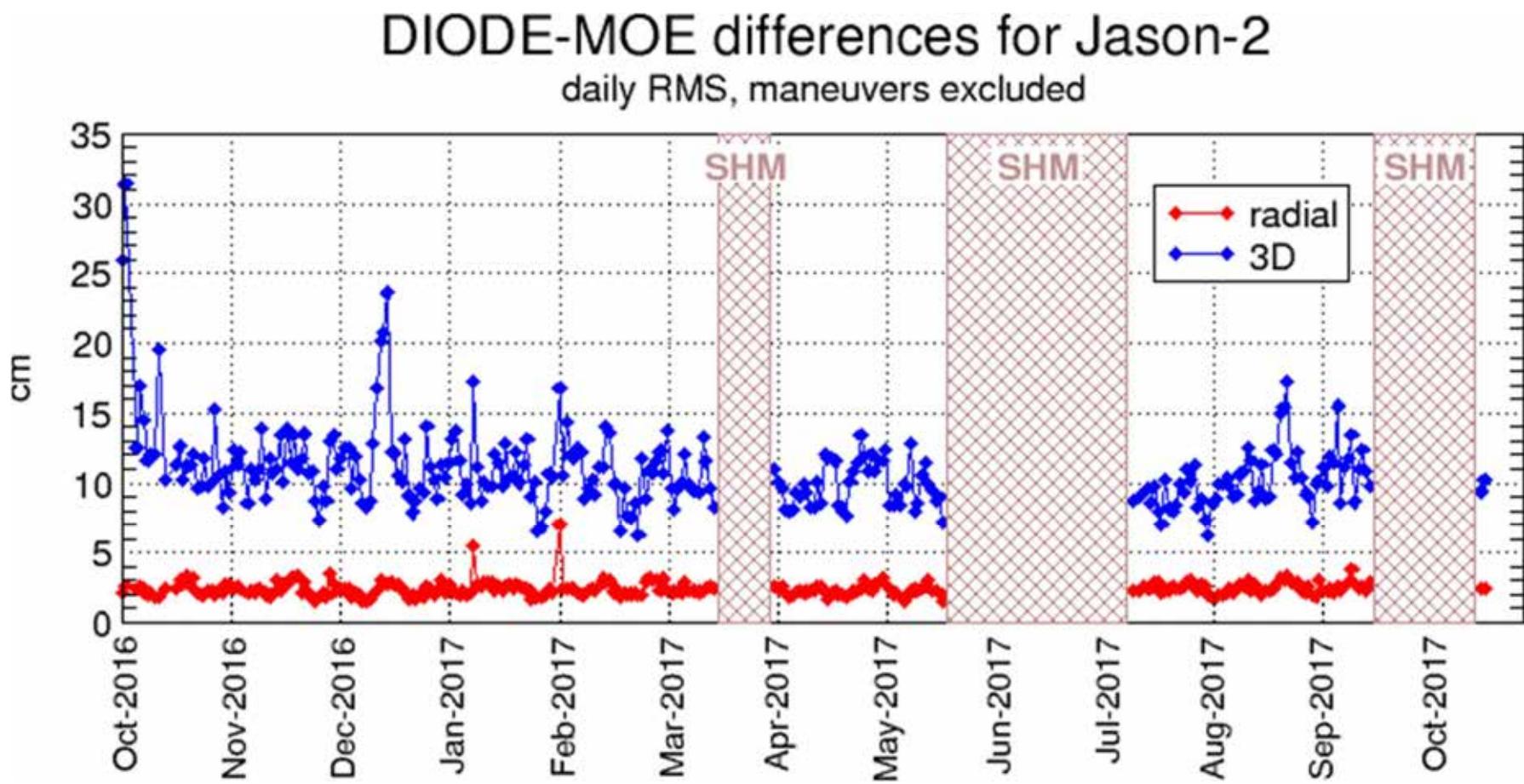


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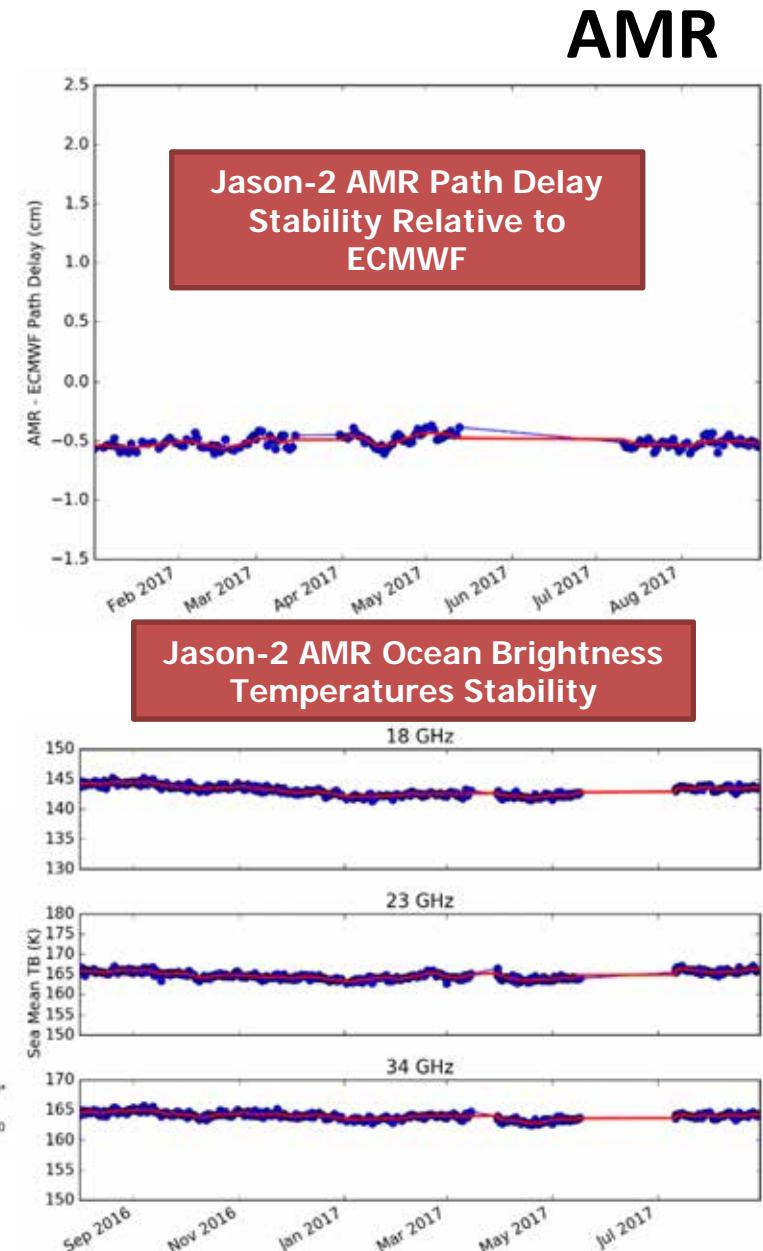
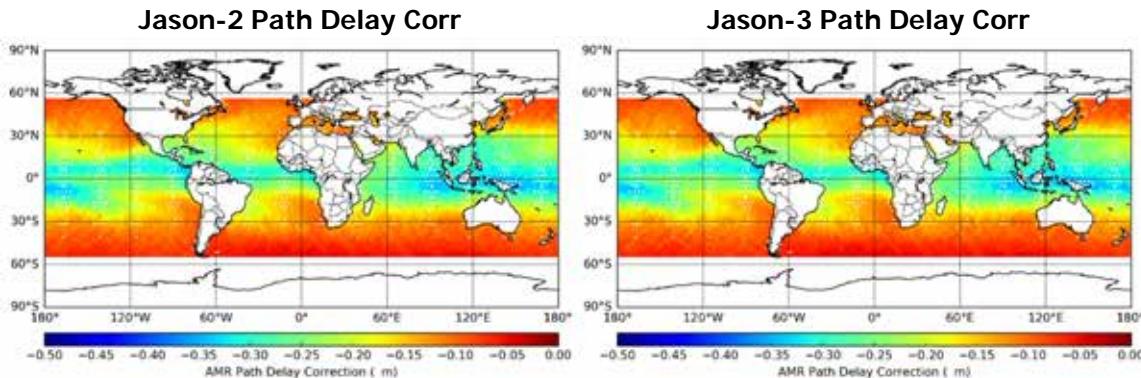
Availability = **100% over the period**

**DORIS**



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

- Jason-2 AMR performance remains nominal in maintaining stable long-term path delay estimates
- The 15-Mar-2017 safehold has impacted the radiometer calibration
- 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 excellent agreement



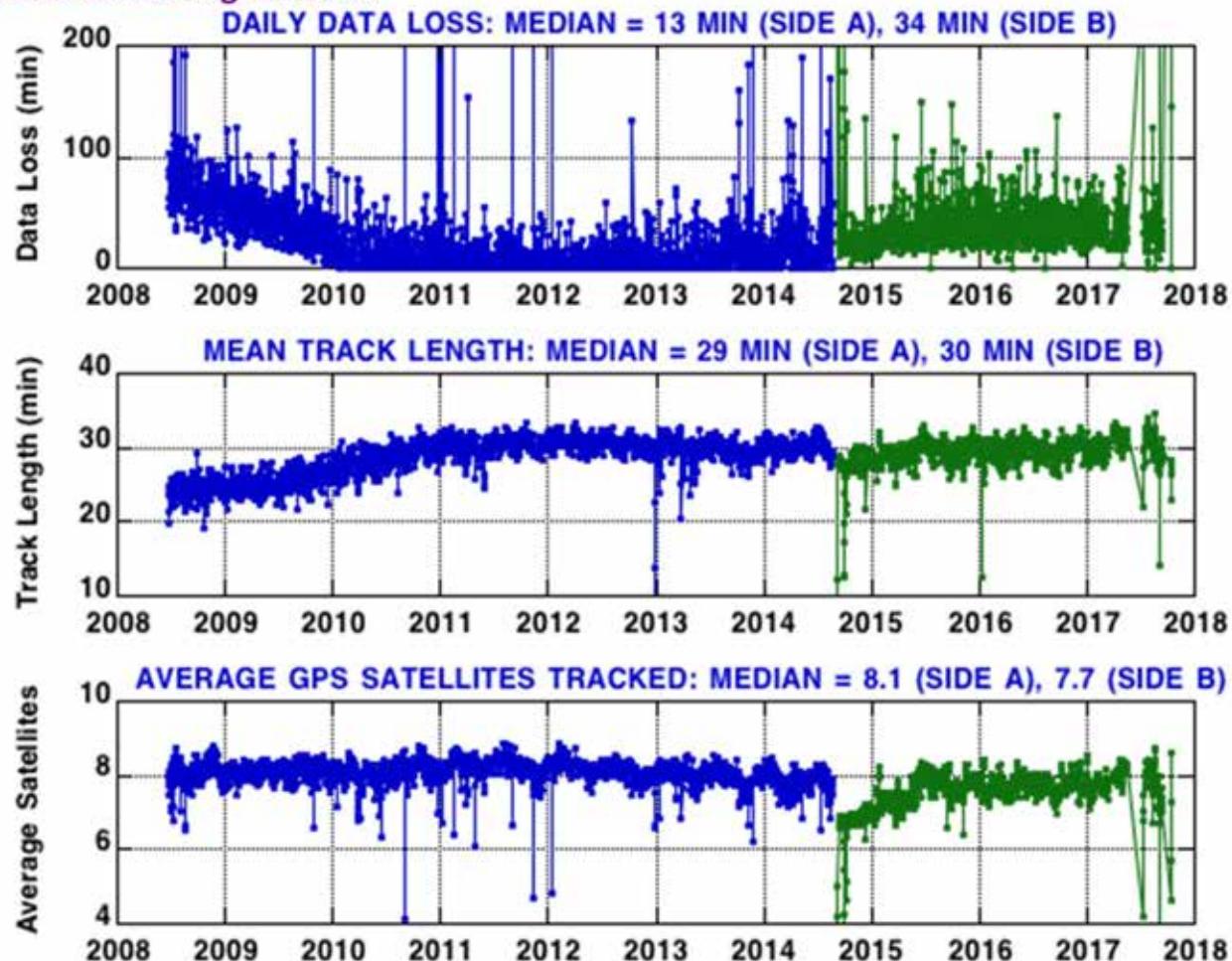
Jason-2 GPSP-A stopped 2014-08-23 – GPSP-B started 2014-09-08

**GPSP**

2015-01-20 Max Sats 8→10

2015-03-04 Max Sats 10→12

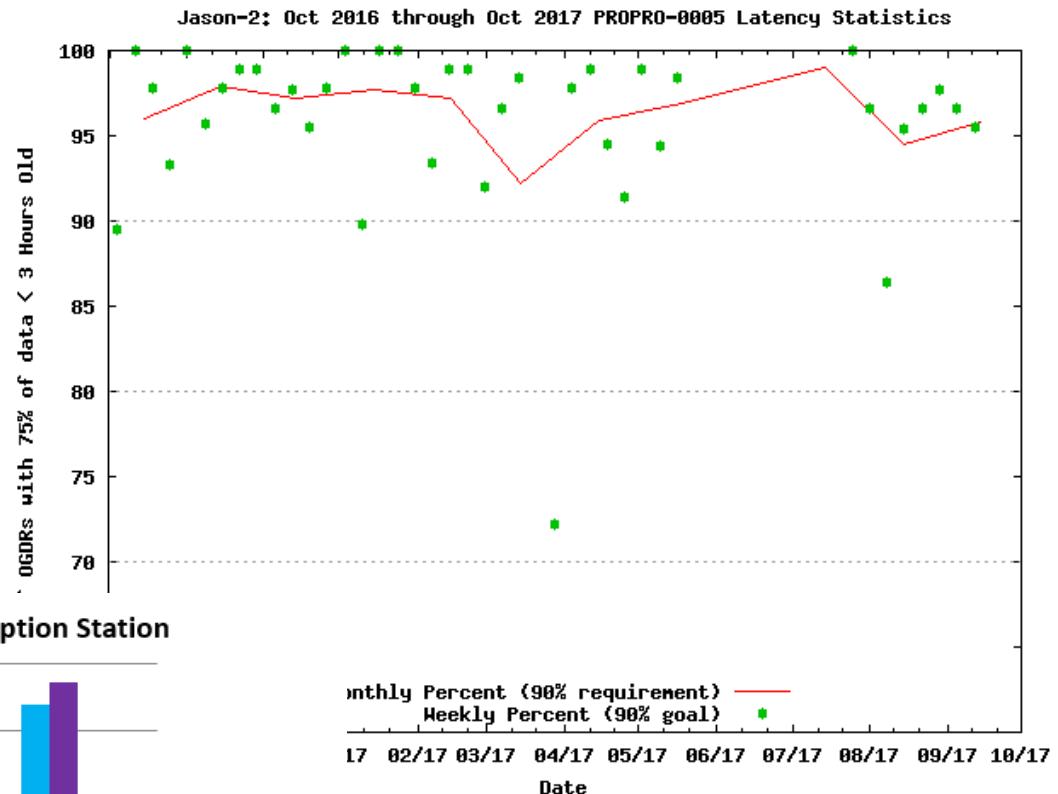
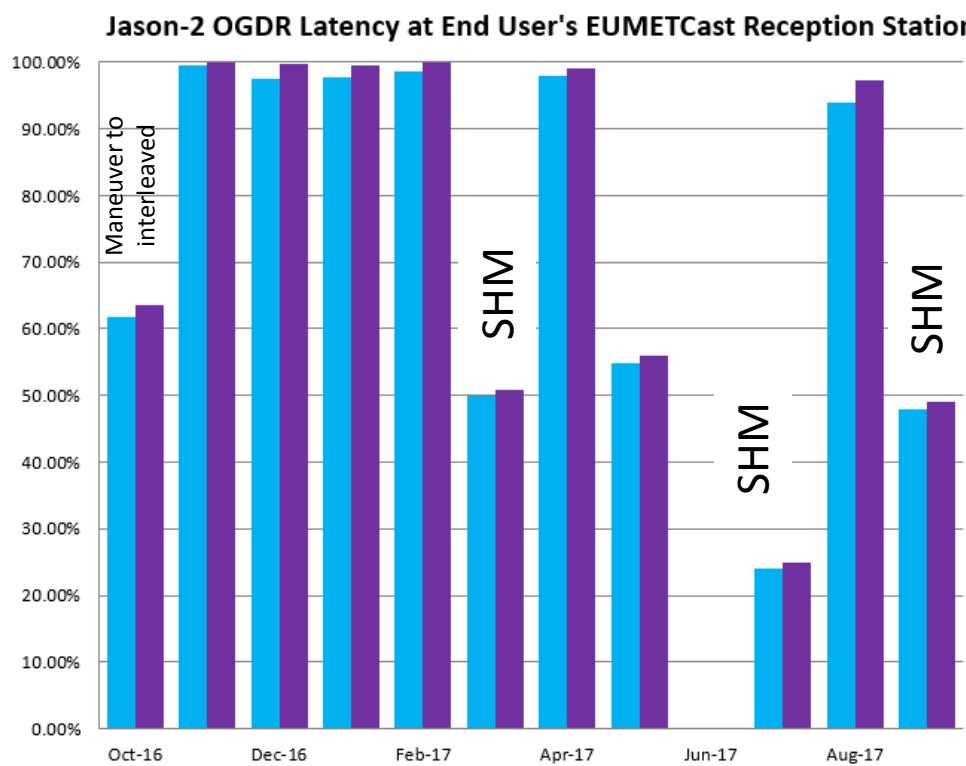
2015-06-03 90-sec debug removed



# OGDR products Status and performances

- NRT products made by **EUMETSAT** and **NOAA/ESPC** Mission Center
- Major changes in the period
  - **None on the products**
  - TM-NRT : 1 version deployed @EUM & NOAA
  - No products during SHMs and move to LRO :
    - March 15th to 30th 2017
    - May 17th to July 11th
    - Sept 14th to Oct.13th
- **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**

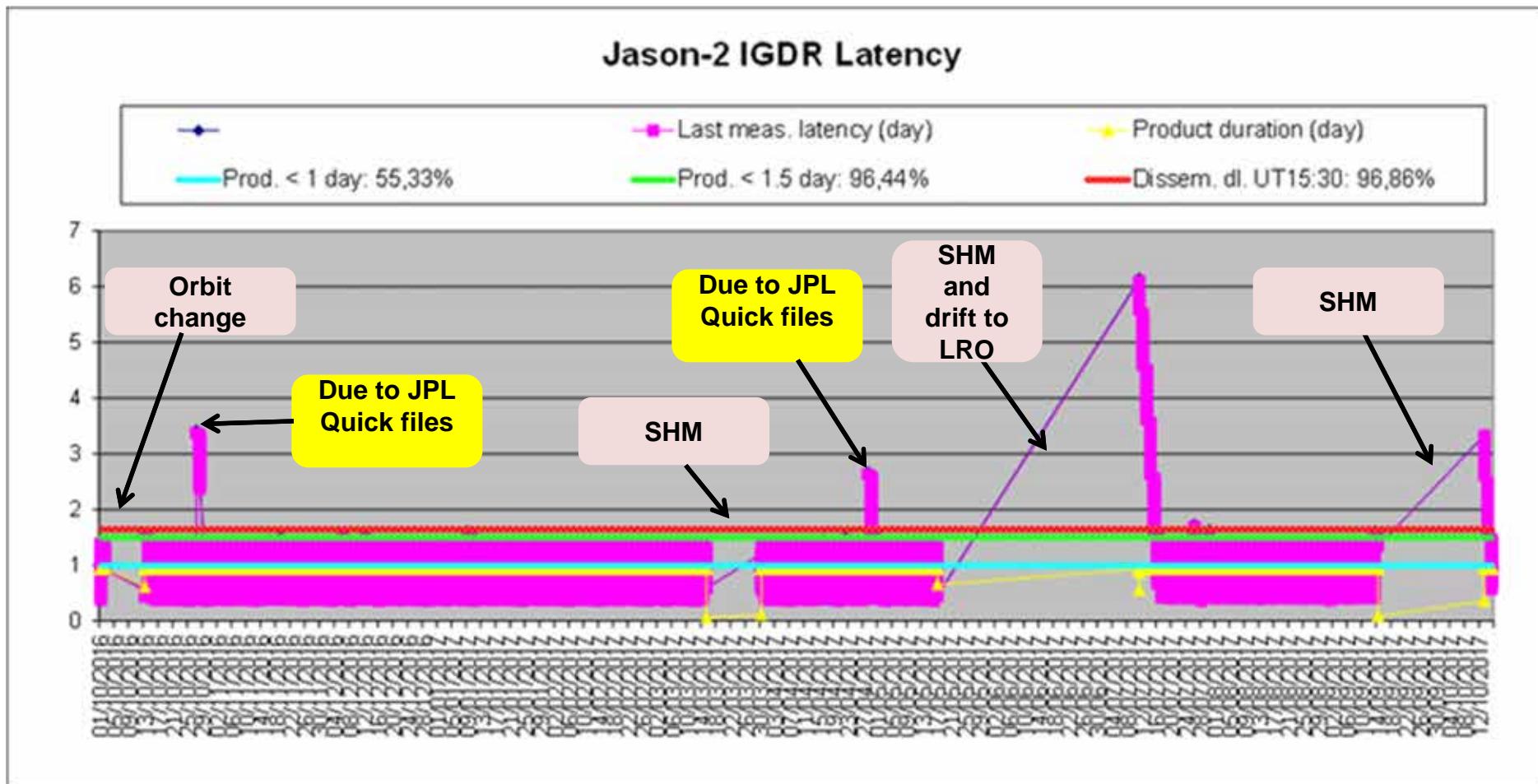
# Operational Geophysical Data Record data latency



EUMETSAT

# IGDR - status and performances

- Jason-2 IGDR processing is OK (CNES : 100% IGDR successful)
- Latency : 96,44% of products available in less than 1.5 day
- 100% IGDR products archived
- All disseminated via CNES AVISO+ and NOAA dissemination services

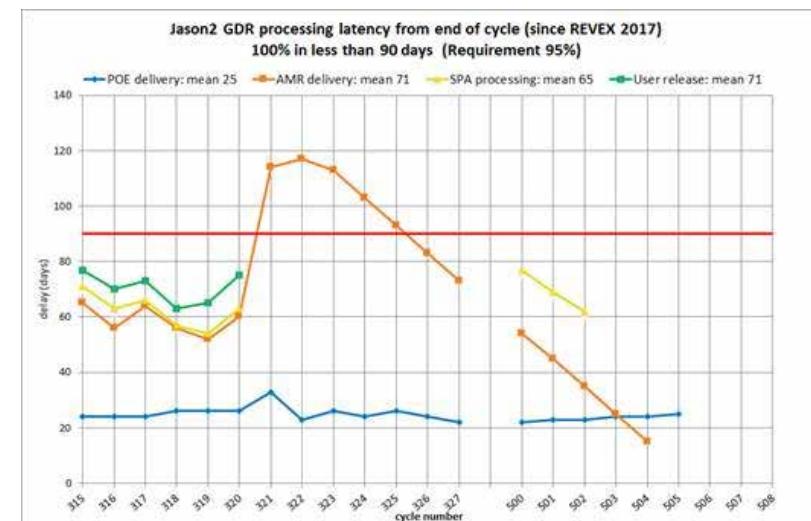


# GDR - status and performances

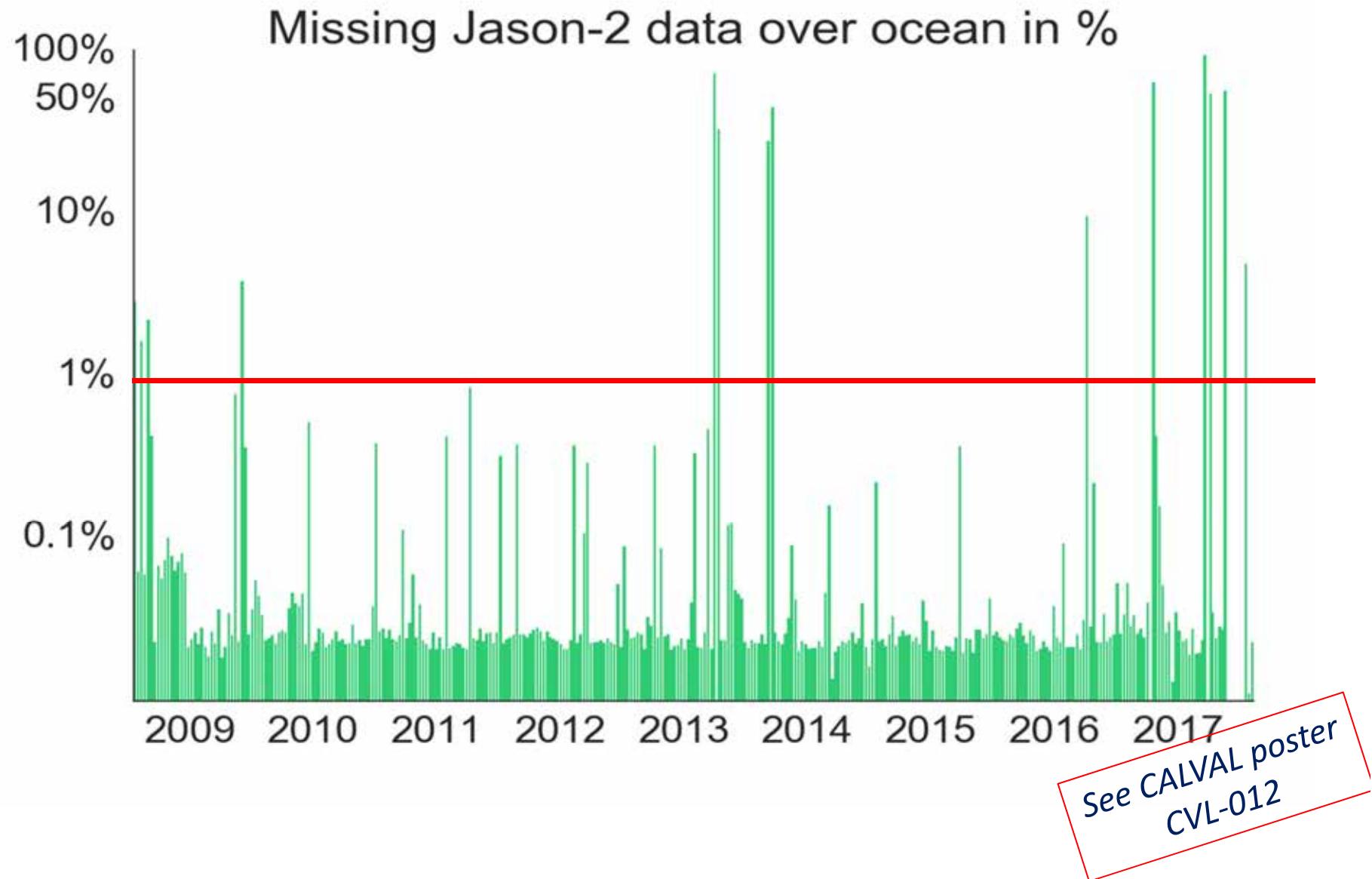
- GDR produced by CNES/SSALTO
- Jason-2 GDR processing is OK
  - Data availability & latency OK
  - Systematic cross checked validation by CNES and JPL
  - Cycle per cycle (and yearly) validation reports available on AVISO+  
<http://www.aviso.altimetry.fr/en/data/calval/systematic-calval.html>

See CALVAL poster  
CVL-012

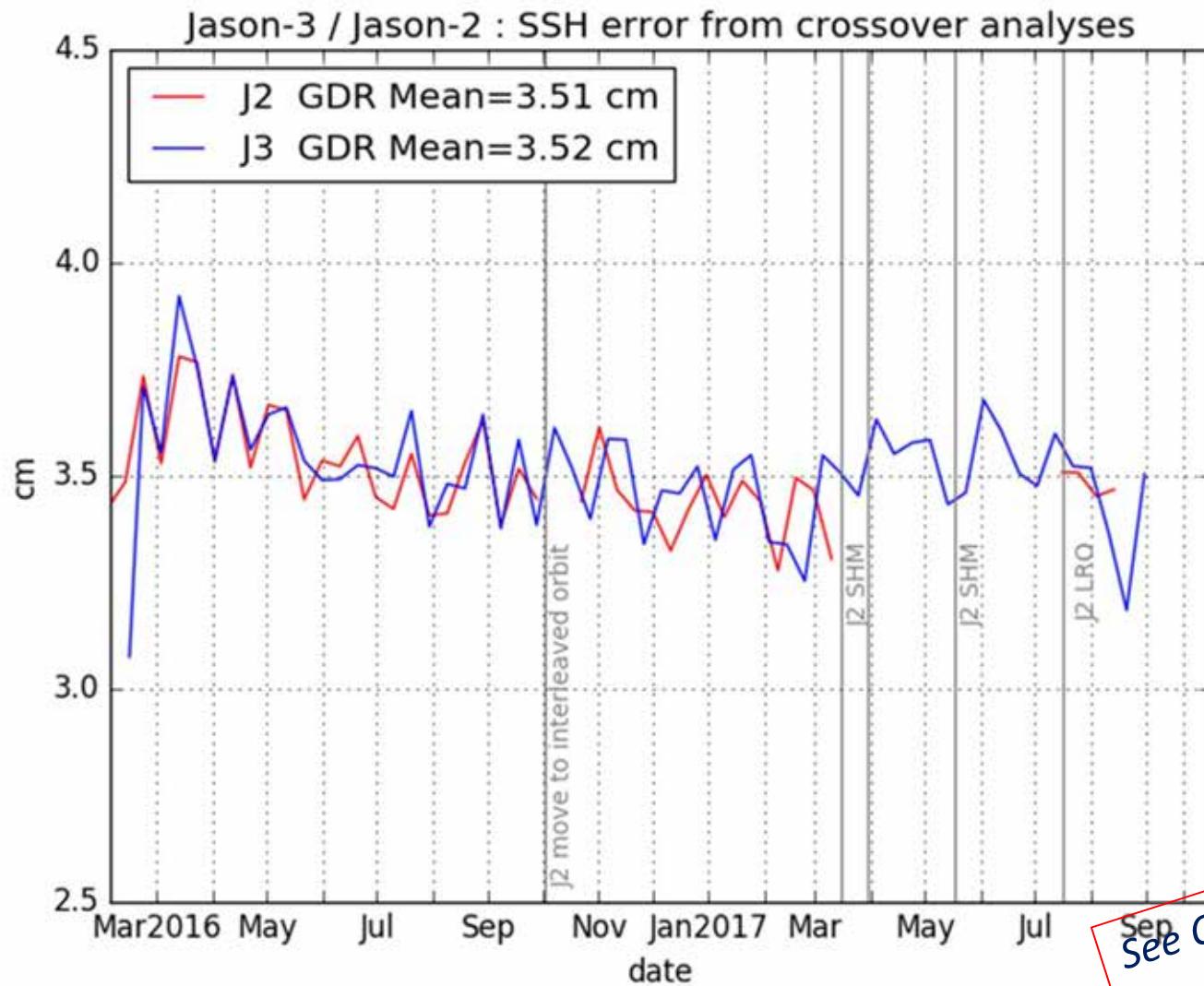
- 100% GDR products archived
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# Performances – missing measurements



# Performances – Xover



See CALVAL poster  
CVL\_012

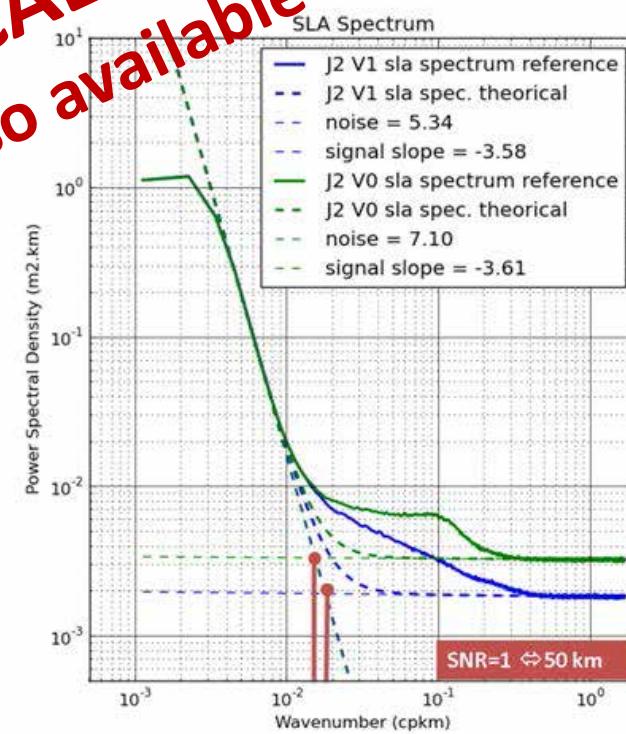
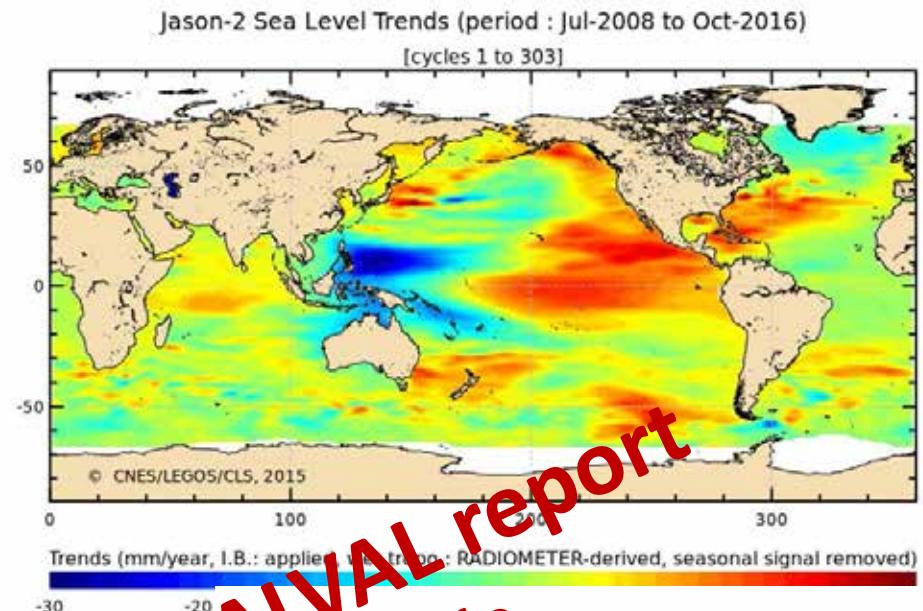
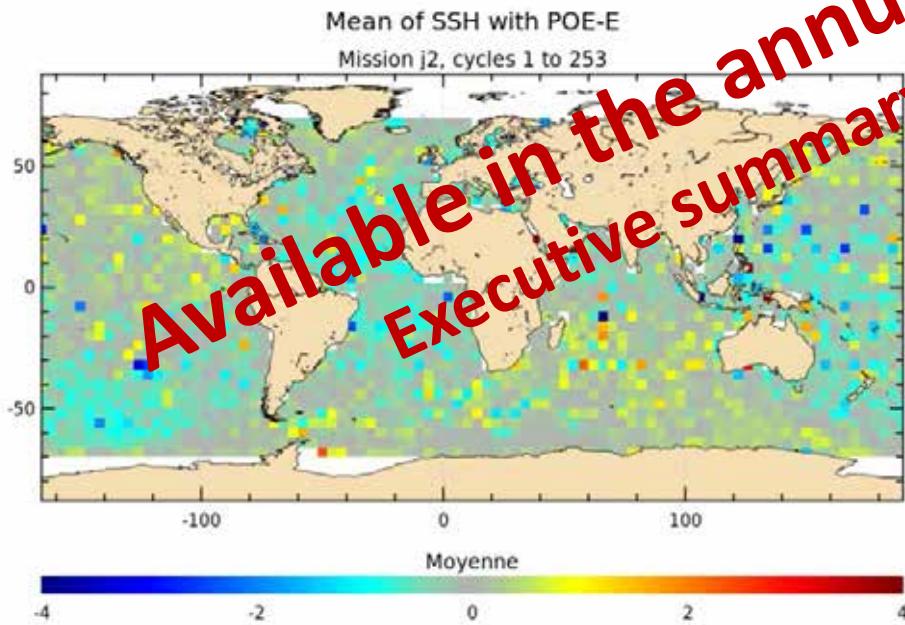


CalVal Jason-2



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

Contract No 160182-14026/00 Lot 1.6.3



Available in the annual CALVAL report  
Executive summary also available

# 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 November 2016 until October 2017
  - ⇒ **satellite unavailability**                    **~27,5 %**                    **> 4% req**
    - bus : 26,8%      altimeter : 0.01%      Doris : 0%      AMR : 0.07%
  - with planned activities***                    **~0 %**                    **< 4% req**
  - ⇒ **ground unavailability**                    **~0.00 %**                    **< 1% req**

→ Global Jason-2 system availability : ~ 72,5 %

# Conclusion – Jason-2 at a glance

- 9<sup>th</sup> Jason-2 Exploitation Review (REVEX) : successful in April 2017
- S/C PMA investigation : patch is operational
- **S/C maneuvers to LRO from July 3<sup>rd</sup> to July 10<sup>th</sup>**
- No more POS3 DEM mode
  
- Still excellent measurements quality after 9.5 years in orbit, but availability currently reduced to approx. 70%
- Mission extension until end of 2019 agreed at NOAA, NASA and EUMETSAT / to be decided at CNES by December.
  
- Last year's OSTST recommendations : see Jason-3 slides

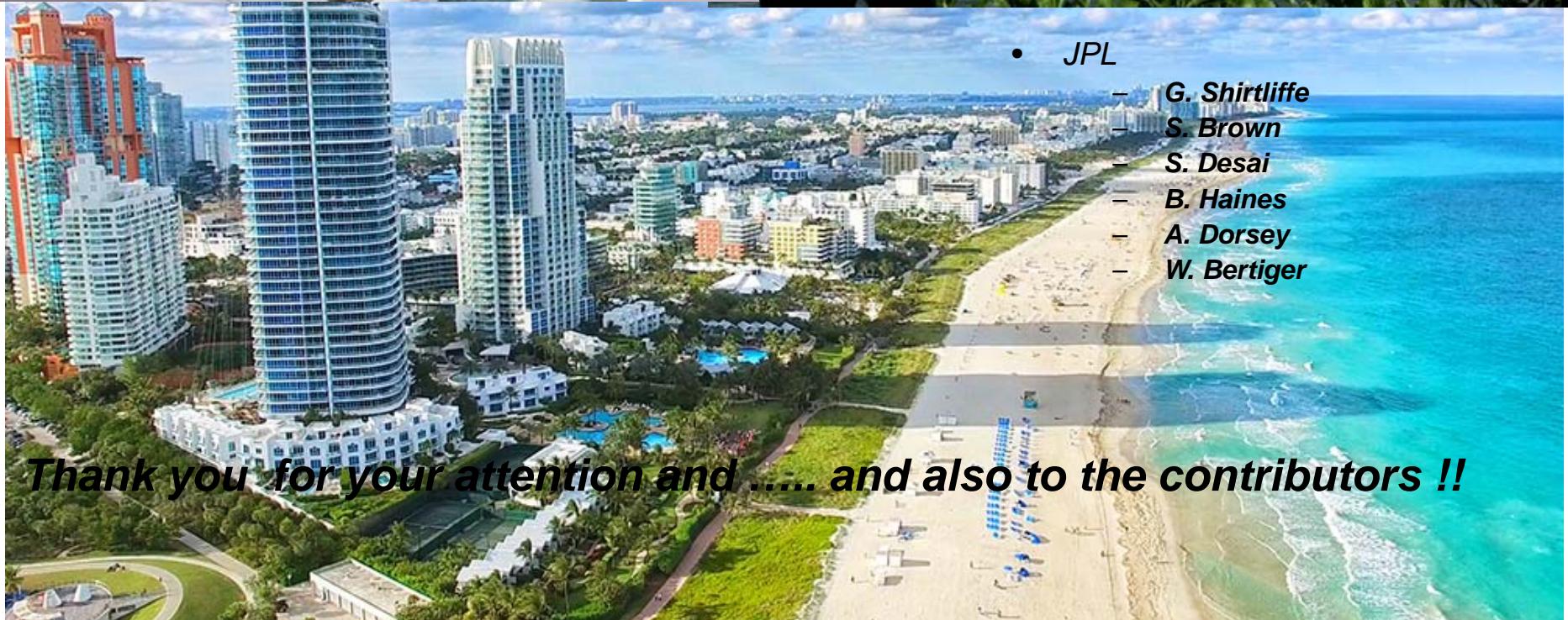
**Thank you to all the teams from CNES, NOAA, EUMETSAT & NASA/JPL**

CNES

- *Th Guinle*
- *T. Médina*
- *B. Modave*
- *C. Ferrier*
- *E. Bronner*
- *F. Bailly-Poirot*
- *N. Picot*
- *Jean-Damien Desjonquères*
- *A. Gerrin*
- *S. LeGac*
- *Christian Jayles*
- *F. Didelot*



- *NOAA*
  - *D. Donahue*
  - *J. Lillibridge*
- *EUMETSAT*
  - *M. Tahtadjiev*



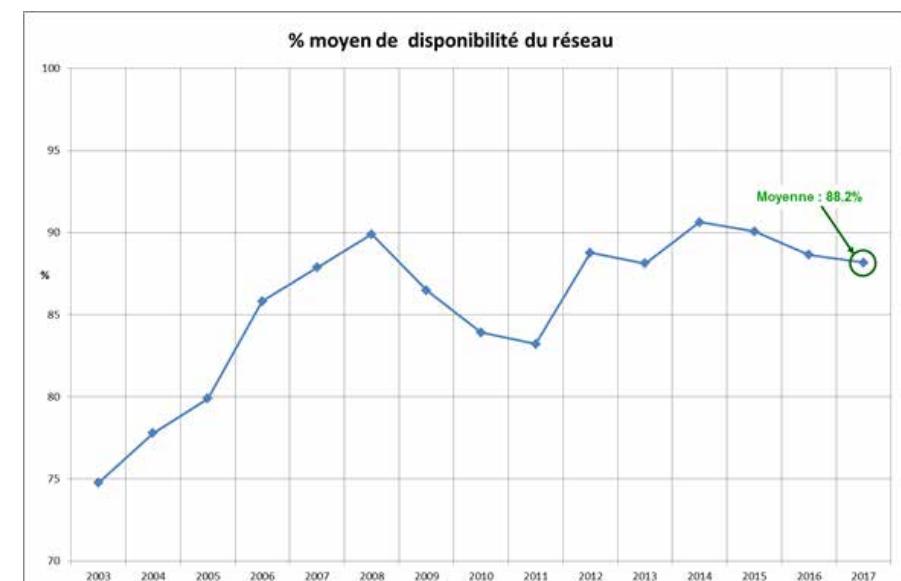
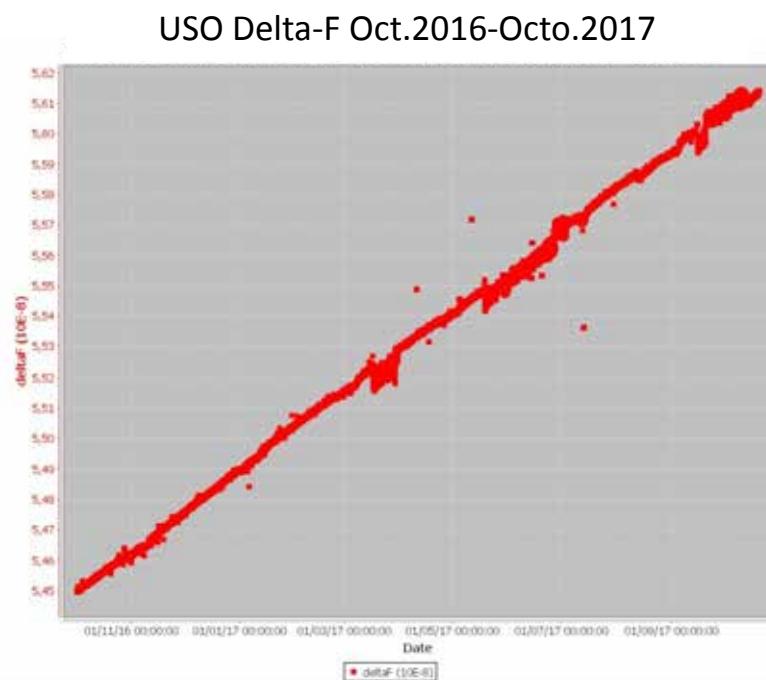
- *JPL*
  - *G. Shirtliffe*
  - *S. Brown*
  - *S. Desai*
  - *B. Haines*
  - *A. Dorsey*
  - *W. Bertiger*

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

# Backup slides

# DORIS

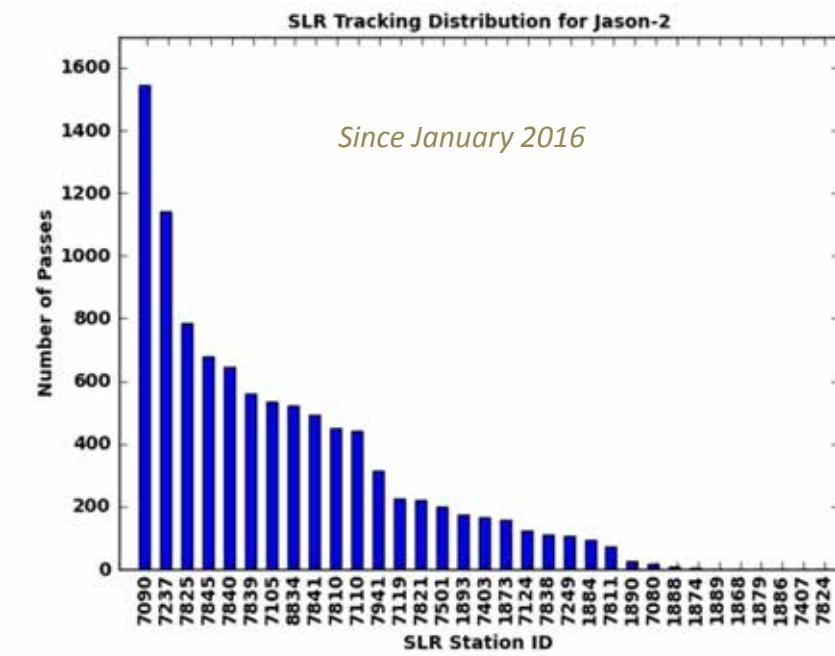
- DORIS Availability = **100% over the period**
  - No anomaly over the period
  - Effective accuracy as compared to on-board GPS (platform) is stable :
    - $1.8 \mu\text{s}$  (OGDR & IGDR)
    - $\sim 1.5 \mu\text{s}$  (GDR)
- + very good performance of the ground network ( $\sim 90\%$ )



# SLR/LRA

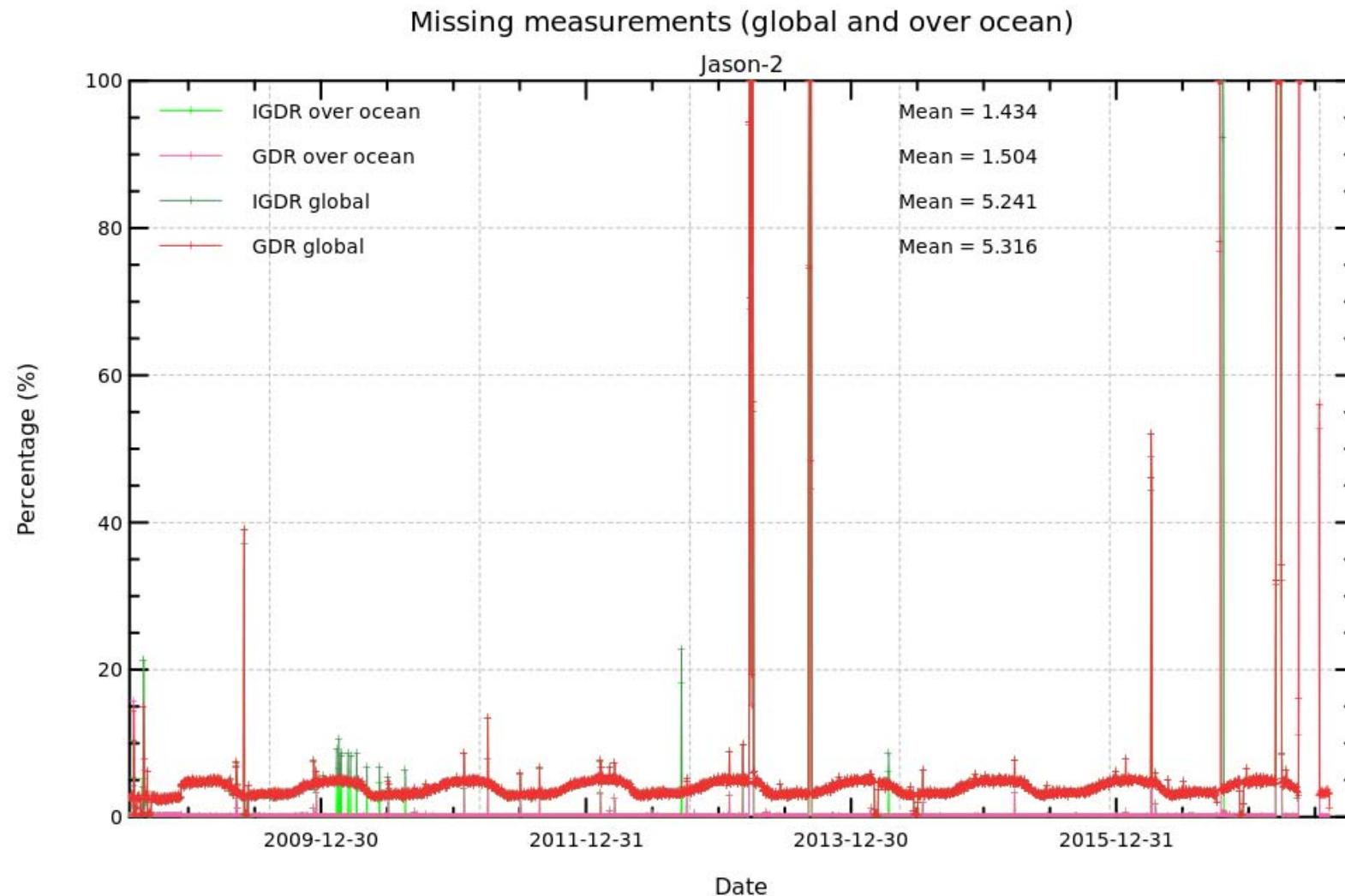


- Laser ranging array (LRA) is passive (No electronics or software)
- Copy of Jason-1 LRA system, supporting cm-level ranging
- Tracking of Jason-3 and Jason-2 high priority for International Laser Ranging Service (ILRS)
- Performance of Jason-2 LRA has been nominal

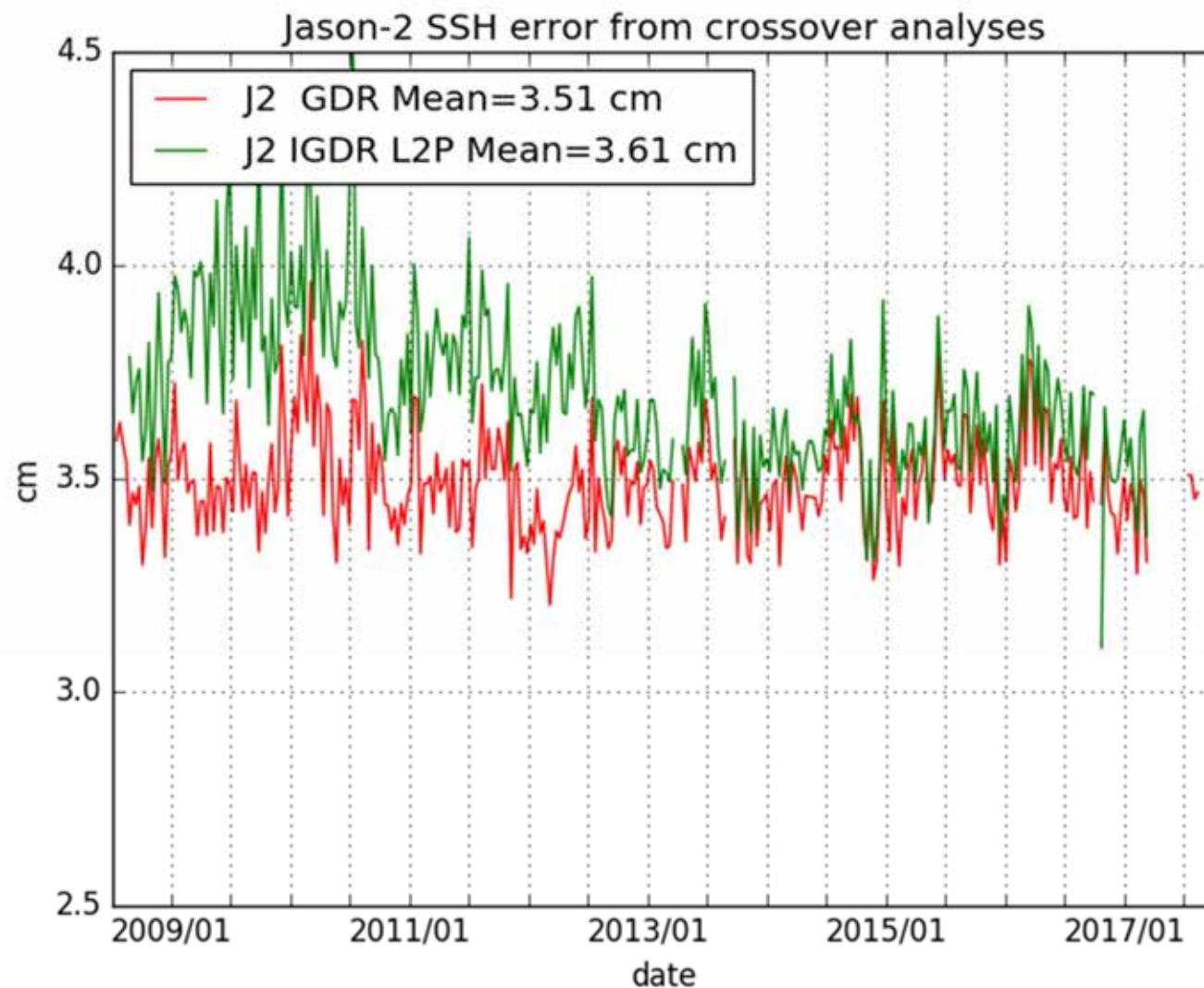


- Top stations by pass volume:
  - ***Yaragadee, Changchun, Mt. Stromlo, Grasse, and Herstmonceux***

# Performances – missing measurements



# Performances – Xover



# Conclusion – items to consider

- Is there an acceptable minimal availability?
- Do we try and fill-in the gaps on the geodetic groundtracks ?
- Fuel depletion will have impacts on future choices