

Jason-2 Project Status



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on behalf Jason-2 Project Managers

Major events since last OSTST (October, 2014)

- Project Milestones
 - Seventh Jason-2 REVEX : May 5-6, 2015 → **successful**
 - 4P approval for extension up to 31st December 2017 → **successful**
- Satellite major events
 - None
 - PMA investigation made good progress : patch expected early 2016
- Payload major events
 - None
- Ground major events
 - NOAA ground segment transition to NJGS successful (30 September)
 - Orbits in GDR-E standard available - routine end May
 - Barrow antenna in operation since (16 June)

Current OSTM/Jason-2 mission Status is OK

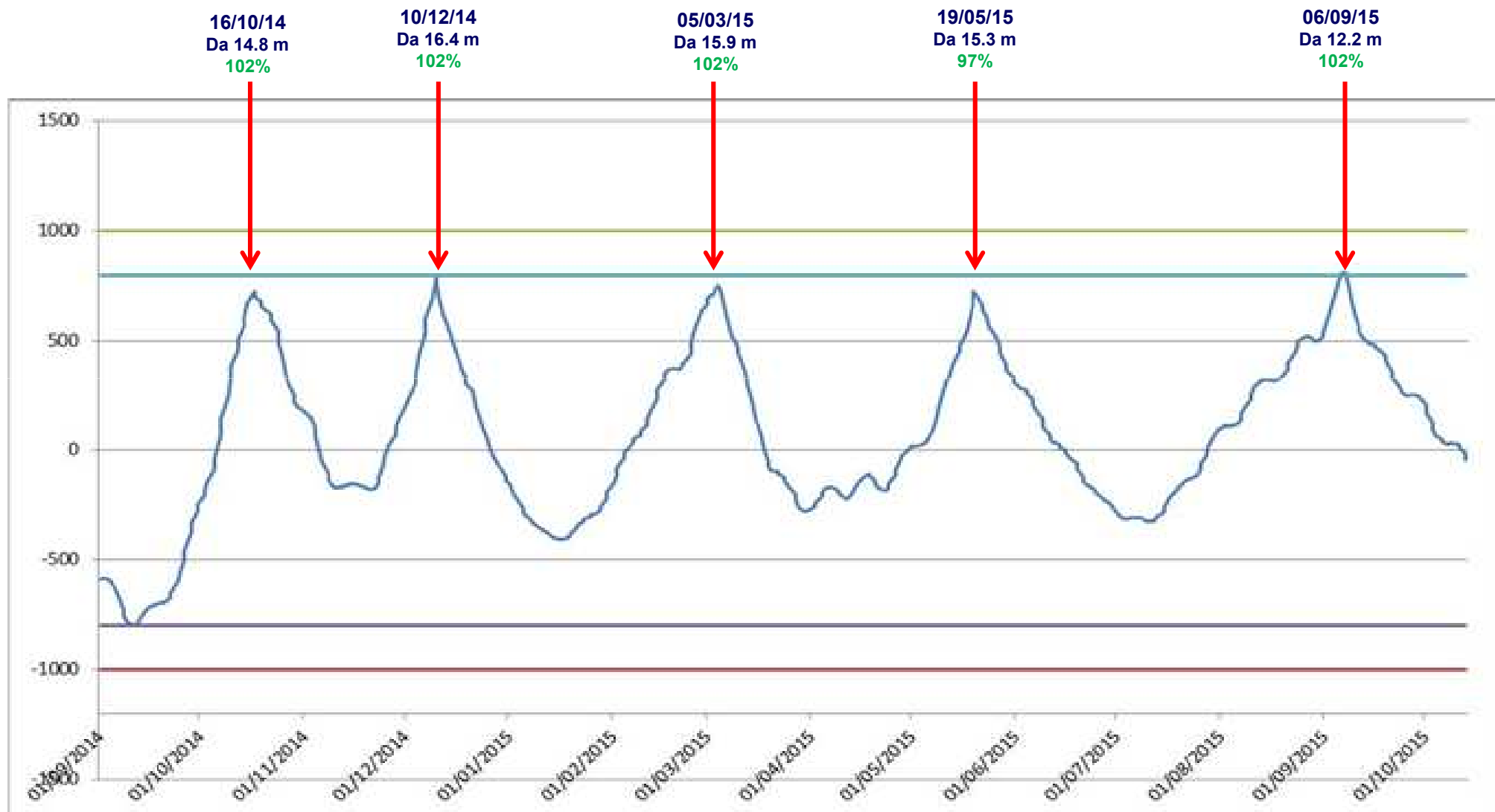
Platform Status

- The Jason-2 satellite bus is **OK**
 - Command / control , RF : **PMA availability : TBC, PMB operational** **OK**
 - On-Board Software, Mass Memory, Telemetry & Telecommand system
 - Thermal aspects: **OK**
 - Active thermal control works successfully and is sized with significant margins to meet further worst case conditions
 - Electrical aspects : **OK**
 - Satellite power and consumption are within the power, consumption and energetic budgets
 - AOCS (attitude and orbit control system) : **OK**
 - All AOCS units work nominally, AOCS control laws work as expected
- Exceptional activities :
 - Unused equipment destocking (gyro, STR) **OK**
 - STR monitoring **OK**
 - SADM expertise **OK**
 - Gyro calibration (last done in July 2014, next on Jan 2016) **OK**
 - PCE expertise **OK**

Jason-2 bus is fully operational after more than 7 years in orbit

Navigation and guidance

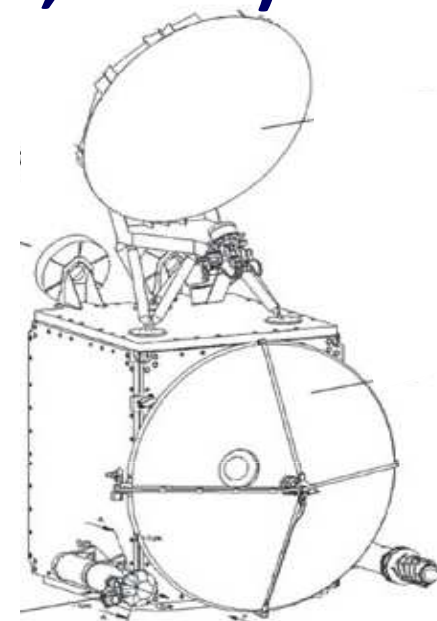
- **Station keeping maneuvers**
 - ground tracks are maintained within ± 1 km from the reference grid at Equator
 - station keeping maneuvers are made with only one thrust above land on any orbit
- **no collision avoidance maneuver**
- **propellant : ~24 kg (6 g/year)**



Payload Status since last OSTST (October, 2014)

- Core Payload
 - POSEIDON3 OK
 - DORIS OK
 - AMR OK
 - GPSP-B OK
 - Patch to fix the week-counter overflow in July

- Passengers
 - T2L2 OK
 - CARMEN2 Partially OK
 - MEX module non operational pending instrument restart – will be done after Jason 3 launch. No impact on data (more than 99% still available)
 - LPT OK

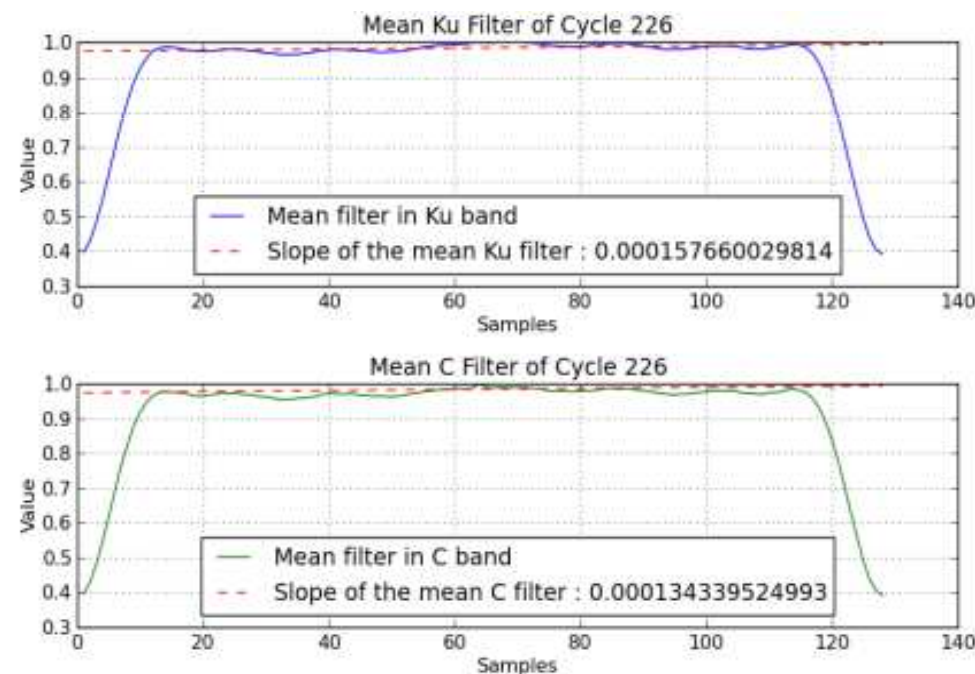
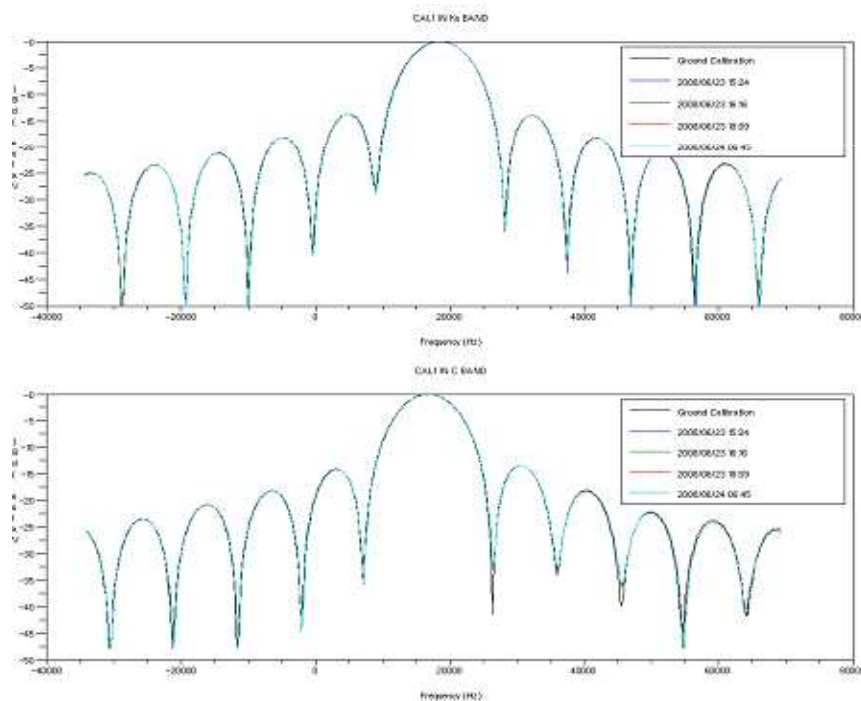


➔ **fully OPERATIONAL with redundancy available for POS-3, DORIS & AMR**

➔ **passengers perform satisfactorily**

Poseidon-3

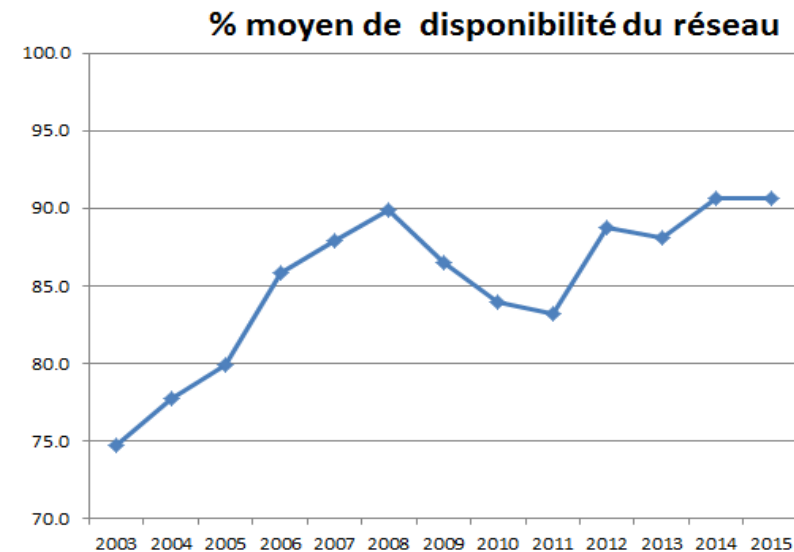
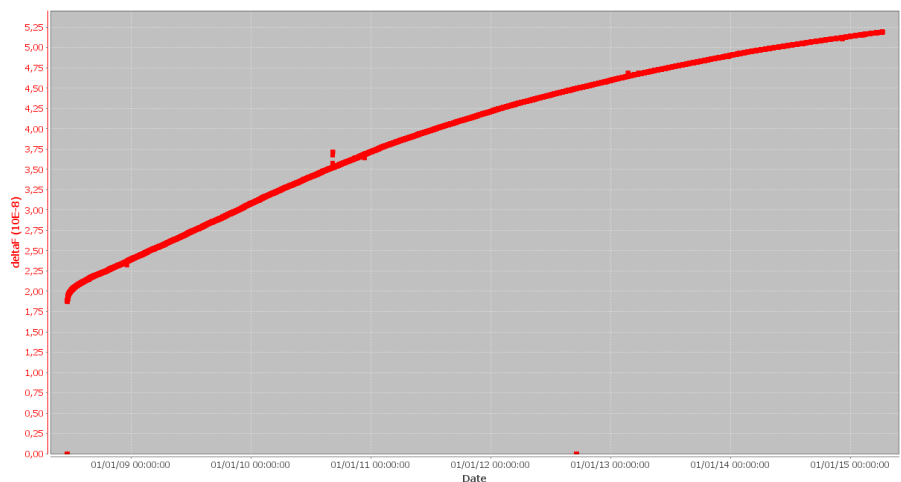
- Availability = **100% over the period**
- Routine/Exceptional calibrations are OK
- CNG : Good Stability (of the order of calibration accuracy)
- Suppression of “long CAL2” calibrations



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)

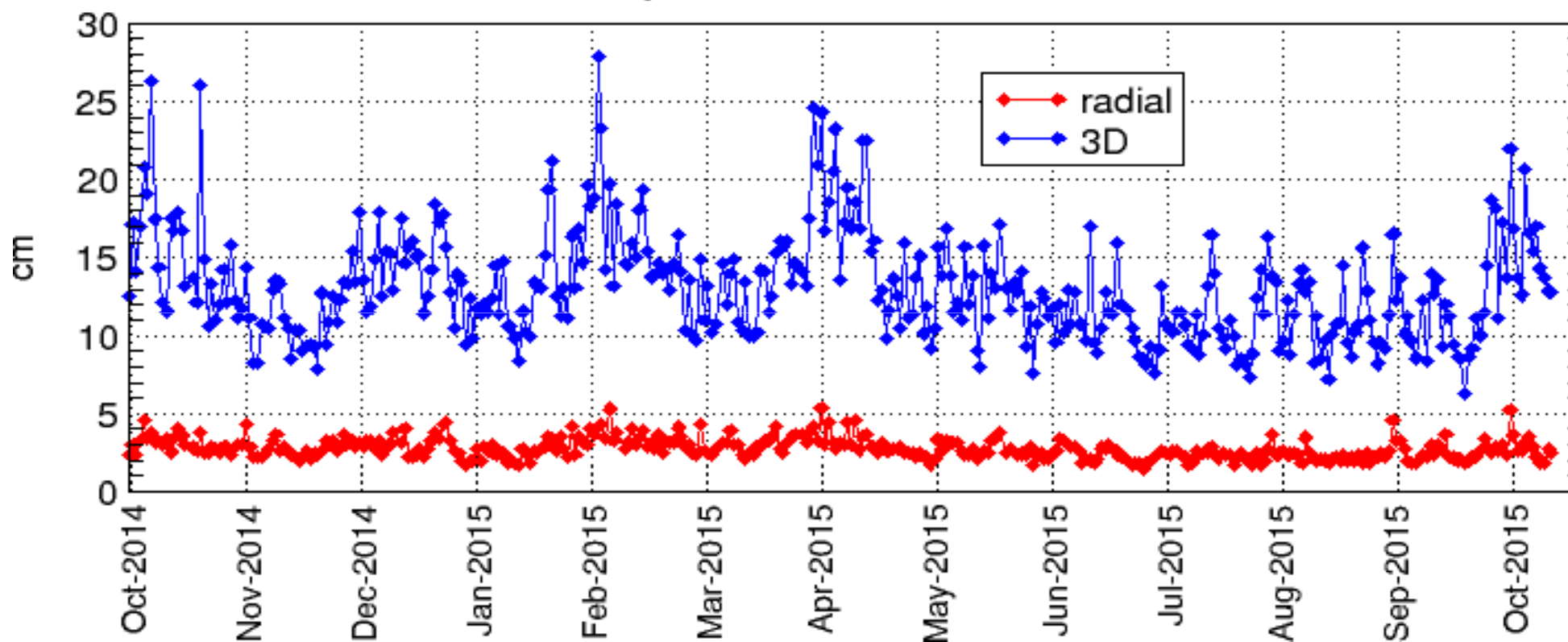
+ very good performance of the ground network ($\sim 90\%$ %)



DIODE-MOE differences for Jason-2

daily RMS, maneuvers excluded

DORIS



➔ Performance for real-time orbit accuracy over the period is :

✓ **Radial : aver. 2.8 cm (std dev. +/- 0,7 cm)**

✓ **3D : aver. 13,1 cm (std. dev +/- 3,5 cm)**

AMR

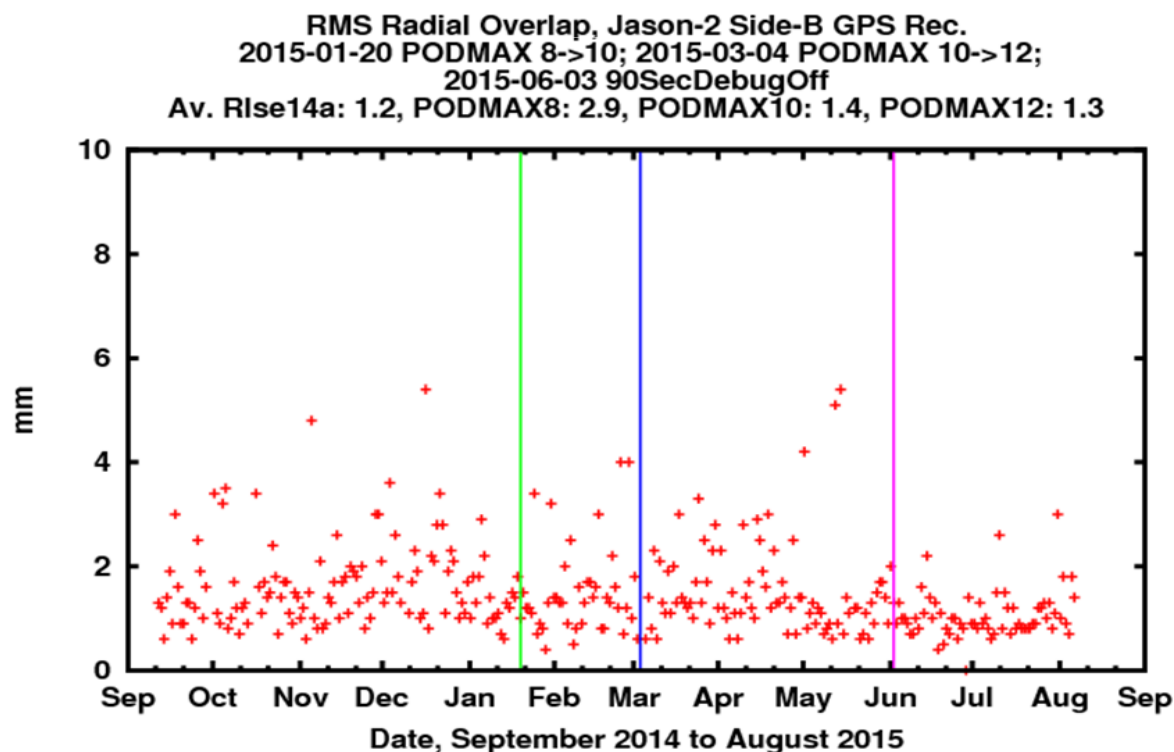
- AMR Availability = **99.7% over the period**
 - AMR performance remains nominal
 - 18.7 GHz calibration updated by ARCS on 7/24/2015 to remove slight positive drift (last calibration update was January 2014)
- GDR-D calibration stable to 1mm/year over the mission

AMR-ECMWF PD (m) September 2014 to September 2015



GPSP-B

- Powered on 26 August 2014, since then patches for MaxSat, week-counter overflow, 90sec debug ...
- Degradation of the L2 frequency when the instrument temperature increases by 1°-2°C
 - GPSP-B has become less sensitive to high temperatures and no significant degradation has been observed in recent data



Performance

B-side : May-Aug. 2015

A-side : 2008-2014

Av. RMS Overlap : **1.2 mm** vs **1.2**

Av. Daily RMS :

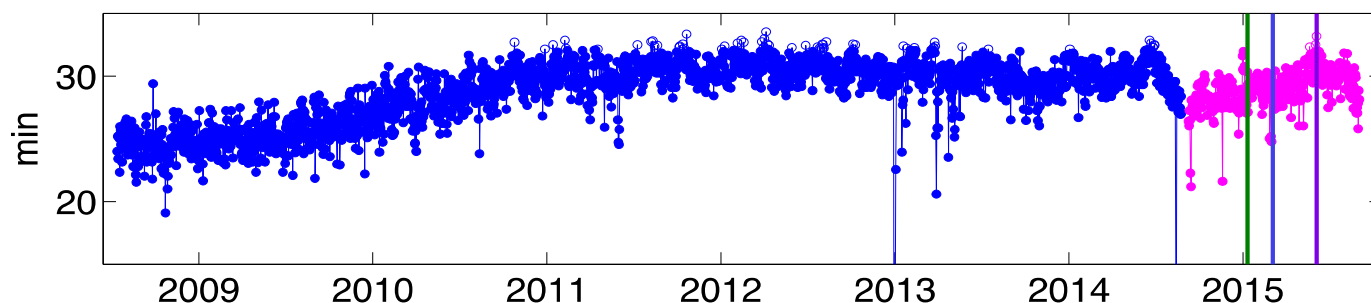
Range Residual: **20.8 cm** vs **23.3**

Phase Residual: **3.7 mm** vs **3.4**

➔ **B-side** recent performance is now probably as good as **A-side**

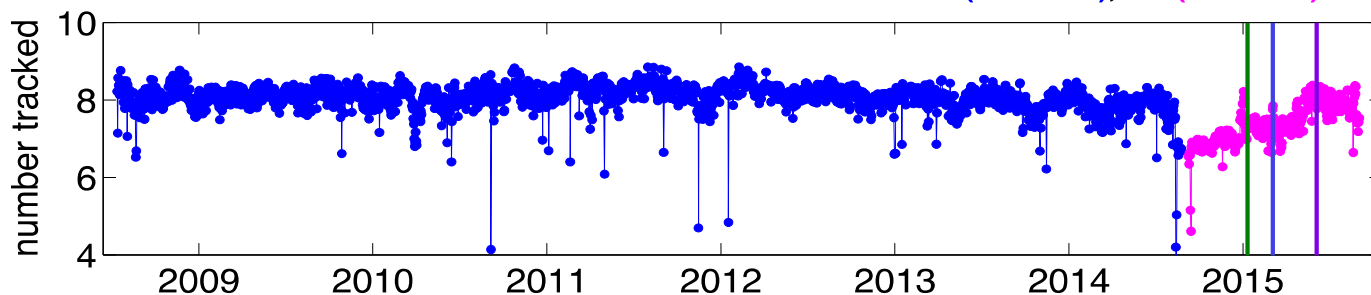
Jason-2 GPS Tracking Performance

2015-01-20 Max Sats 8 -> 10
2015-03-04 Max Sats 10 -> 12
2015-06-03 90-sec debug removed



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AVERAGE GPS SATELLITES TRACKED: MEDIAN = 8.1 (GPSP-A), 7.3 (GPSP-B)



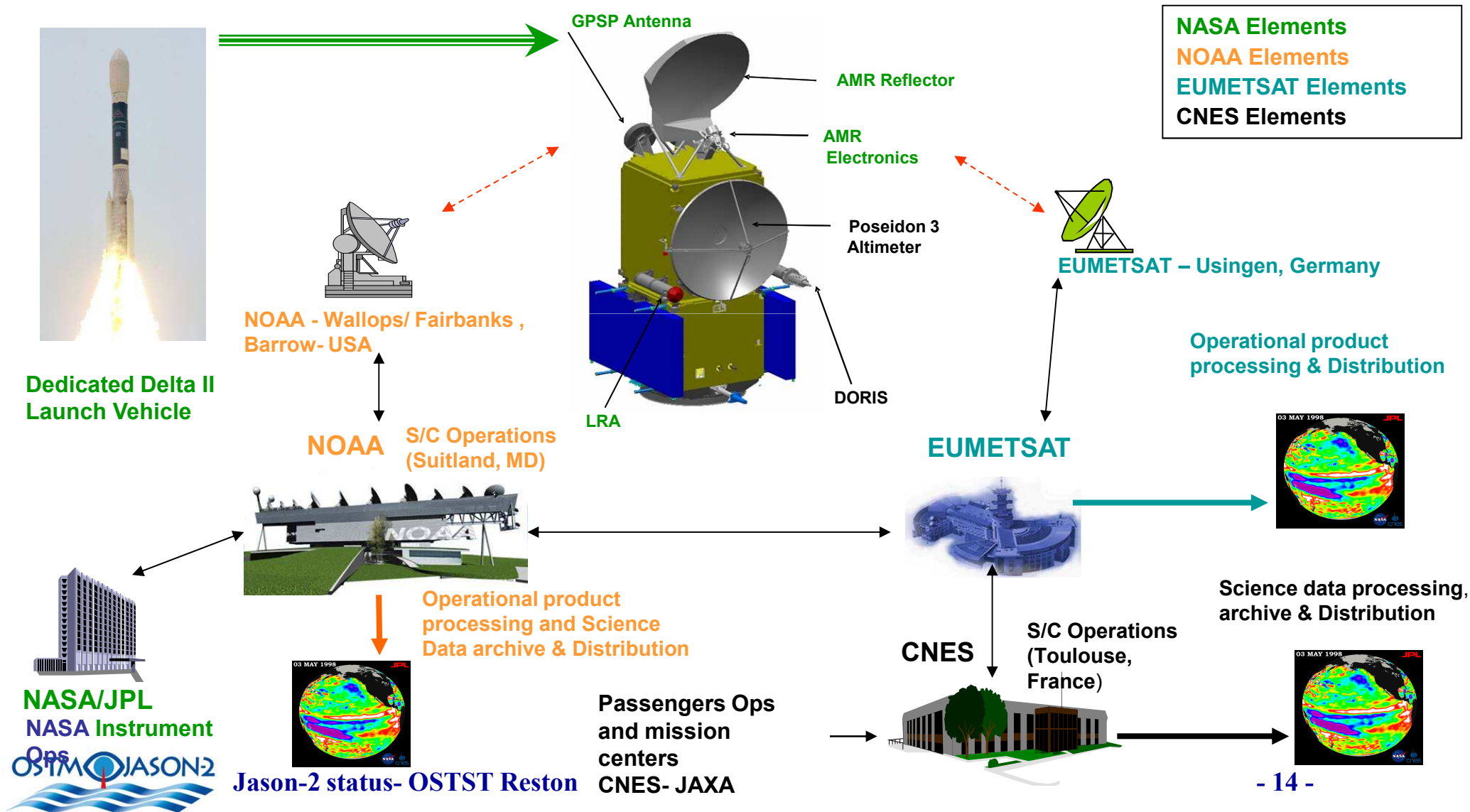
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SLR/LRA

- The LRA continues to provide returns adequate for tracking
- 100% availability since launch
- SLR tracking of Jason-2 has been nominal
- The top 5 stations for Jason-2 tracking :
 - Yarragadee** (*Australia*)
 - Greenbelt** (*USA*)
 - Changchun** (*China*)
 - Zimmerwald** (*Switzerland*)
 - Wettzell** (*Germany*)



System elements



Ground & Operations - Status and performances

- Earth terminals :
 - Usingen (USG1) : **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
 - transition to NJGS performed successfully
- Instrument Commanding and Monitoring Centers :
 - SSALTO for CNES instruments **OK**
 - JPL Mission facility for NASA/JPL instruments **OK**
 - Passengers Mission centers **OK**

OGDR products Status and performances

- NRT products made by **EUMETSAT** and **NOAA/ESPC** Mission Center
- Major changes in the period
 - **None on the products**
 - 2 TM-NRT versions deployed @EUM & NOAA
- **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

Requirements are:

- 75% of OGDR data within 3 hours from sensing
- 95% of OGDR data within 5 hours from sensing

Performance (measured at EUMETCast **end user level**)

90 % in less than 3 hours

99 % in less than 5 hours

EUMETSAT's Inputs

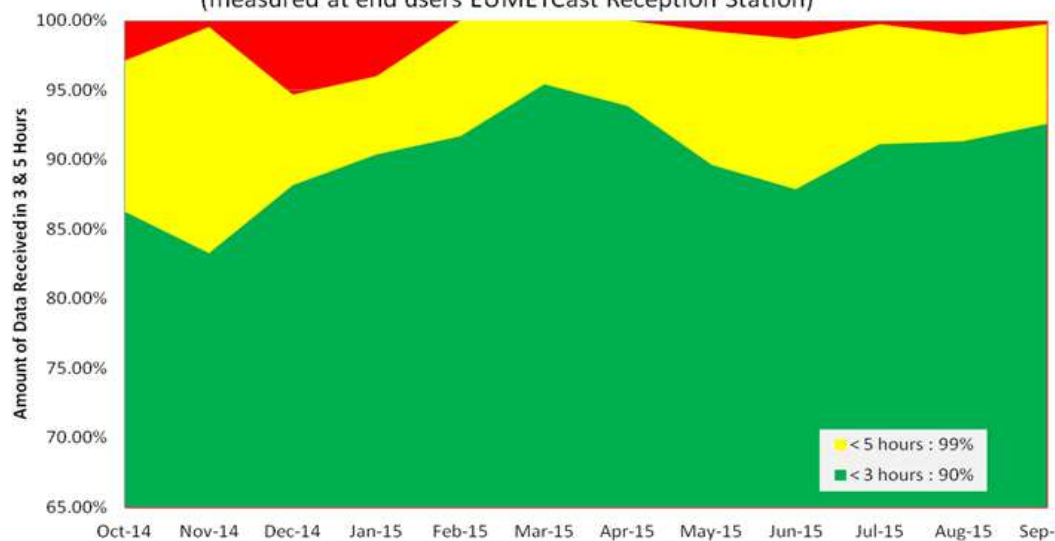
Performance (measured at NOAA ESPC **production level**)

96 % in less than 3 hours

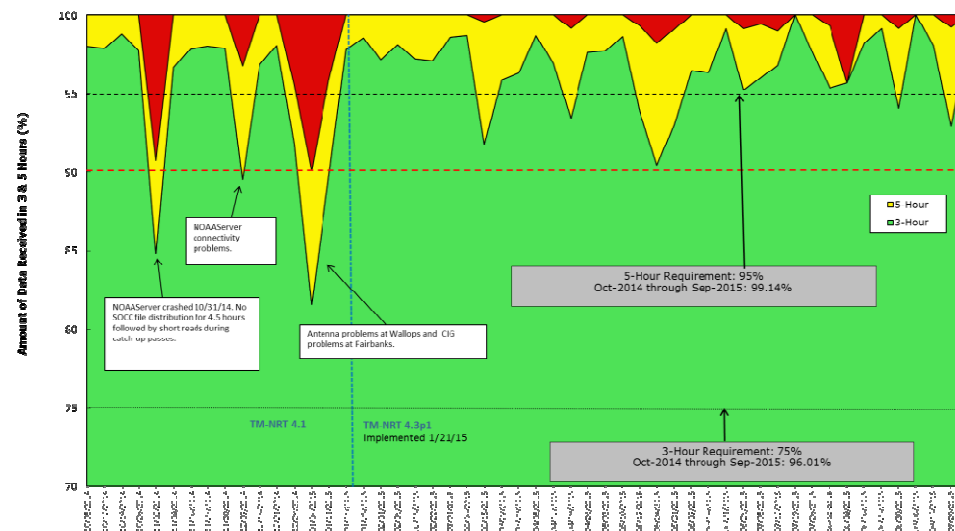
99 % in less than 5 hours

NOAA's Inputs

Jason-2: Oct-2014 through Sep-2015 Monthly OGDR Latency Statistics
(measured at end users EUMETCast Reception Station)

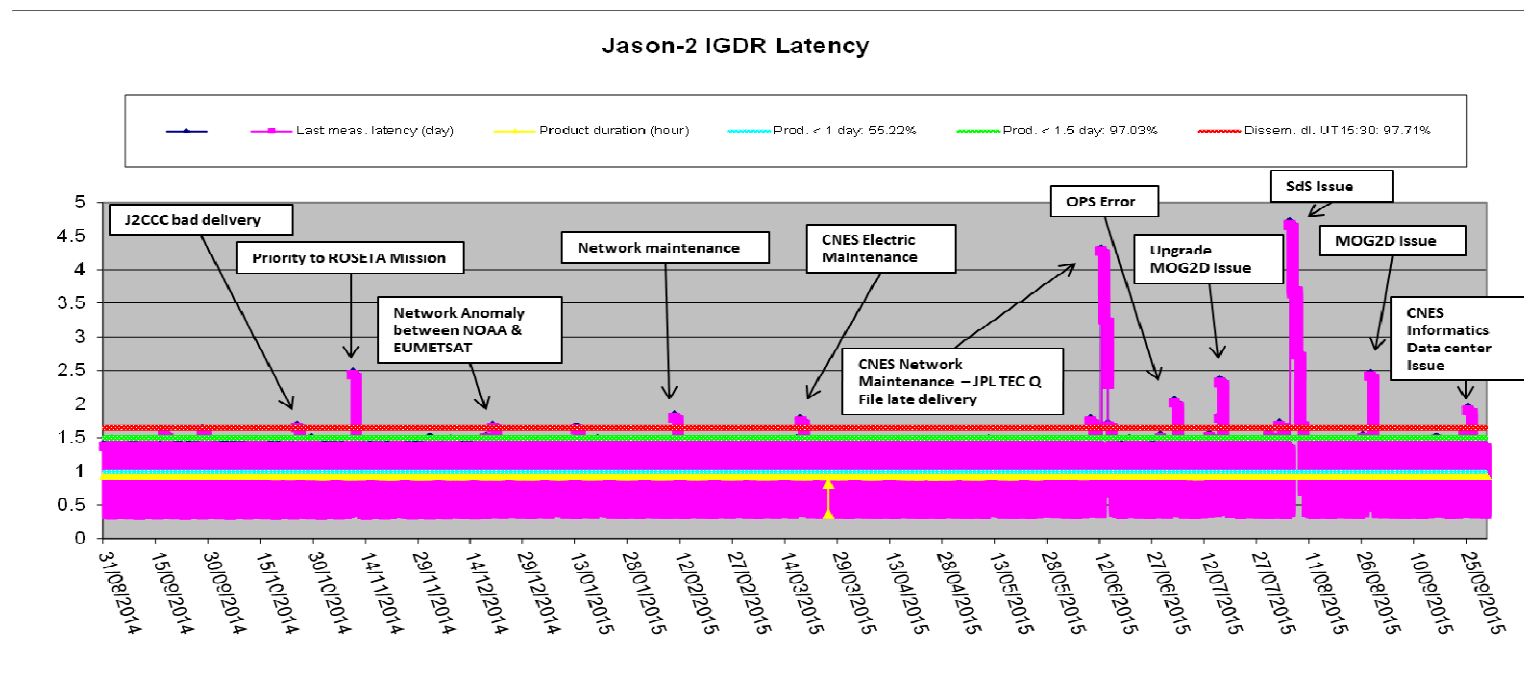


Jason-2: Oct-2014 through Sep-2015 Weekly OGDR Latency Statistics



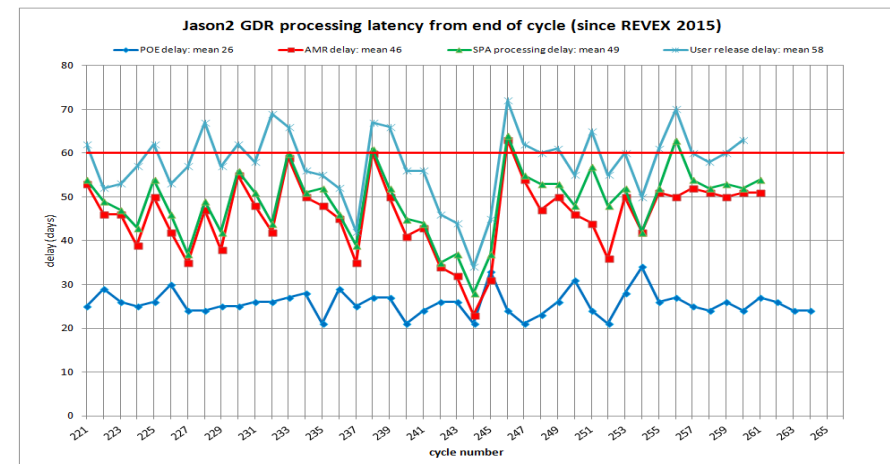
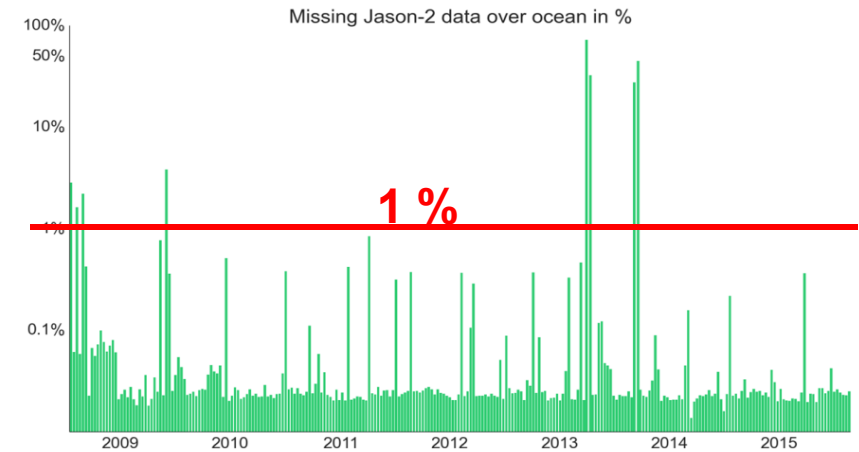
IGDR - status and performances

- Jason-2 IGDR processing is OK (CNES : 100% IGDR successful)
- Latency : more than 97% 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
- **GDR-E orbit from cycle 254**
- 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>
- 100% GDR products archived
- all disseminated via CNES AVISO+ and NOAA dissemination services



System Requirements and Performances

- Altimeter Antenna Pointing : **typical value below 0.07°**
 - Requirement $< 0.2^\circ$
 - pointing performance stable since launch

*STR1 locked in standby on
2009/02/23*

OFF Nadir

% of the points per day with mispointing $> 0.2^\circ$

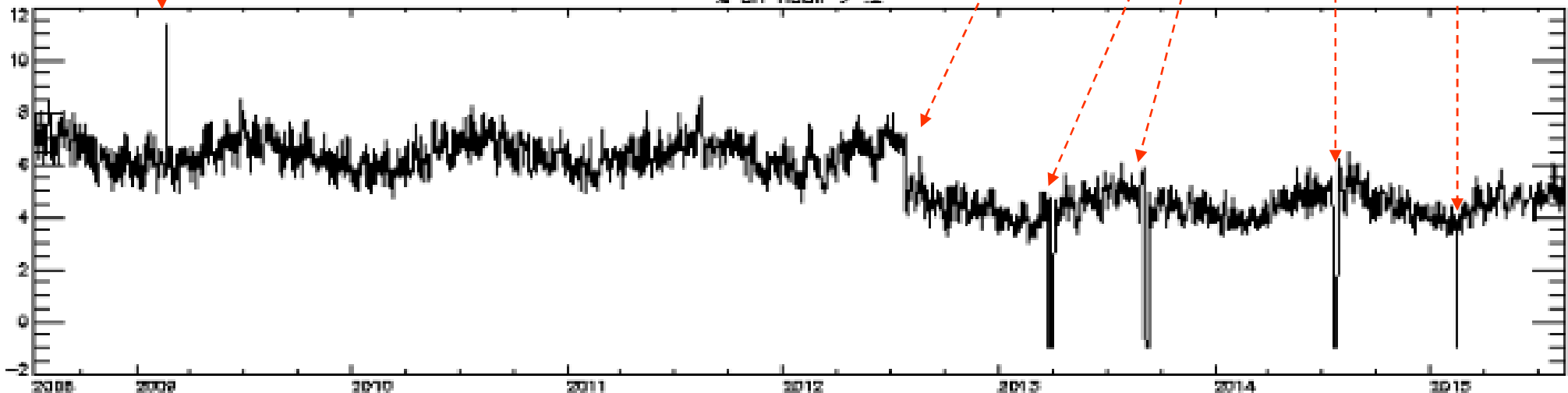
GDR-D standard

Gyro CAL

SHM

*STR unavailability
before tuning NEN0*

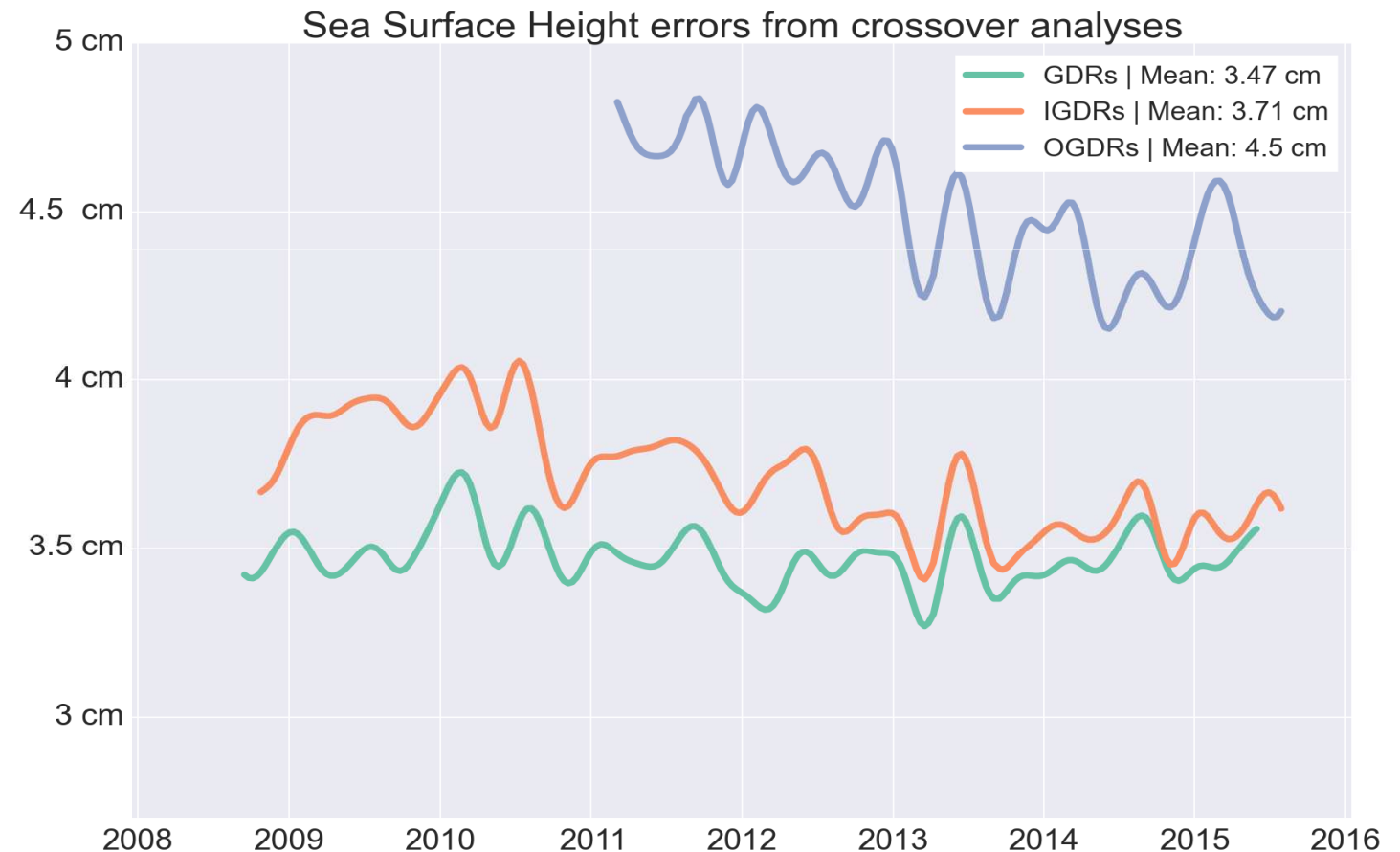
% off nadir > .2



Sea-level performances

- SSH error for Jason-2 is deduced from crossovers analyses using radiometer data
 - selecting $|\text{latitudes}| < 50^\circ$, bathy $< -1000\text{m}$, oceanic variability $< 20\text{ cm}$

Product	Jason-2
GDR	3.47 cm
IGDR	3.71 cm
OGDR	4.5 cm



Sea-level budget error (error < 10 days)

	Error budget	Specifications			Error (<10 days)			GOAL
		OGDR	IGDR	GDR	OGDR	IGDR	GDR	
Parameters and corrections for raw sea surface height calculation	Altimeter range	>1.7 cm ^{a,b,c}			>1.6 - 1.7 cm			1.5 cm ^{a,b,c}
	Ionosphere	1 cm ^{d,c}	0.5 cm ^{d,c}		>1 cm ^h / >0.2 cm ⁱ			0.5 cm ^{d,c}
	Sea State Bias	3.5 cm	2 cm		>0.4 cm			1 cm
	Dry troposphere	1 cm	0.7 cm		0.4-0.7 cm	0.3-0.7 cm		0.7 cm
	Wet troposphere	1.2 cm			>0.2 cm			1 cm
	Rms Orbit (radial component)	10 cm ^e	2.5 cm	1.5 cm	>3.7 cm	>1.7 cm	>1.0 cm	1.5 cm
Corrections for final sea surface height	Ocean tide	?			?			?
	Polar tide	?			?			?
	Terrestrial tide	?			?			?
	DAC	?	?		?	?		?
Altimeter parameters	Significant wave height	10% or 50 cm ^f	10% or 50 cm ^f		13 cm			5% or 25 cm ^f
	Wind speed	1.6 m/s	1.5 m/s		1 m/s			1.5 m/s
	Sigma0 (absolute)	0.7 dB			0.11 dB			0.5 dB
Raw sea surface height		11 cm ^A	3.9 cm ^A	3.4 cm ^A	> 4.2 cm ^A / -	> 2.6 cm ^A - 2.8 cm ^B	>2.1 cm ^A - 2.4 cm ^B	2.5 cm ^A
Final sea surface height		?	?	?	< 5.0 cm ^C	< 4.1 cm ^C	< 4.0 cm ^C	

Available in the annual CALVAL report

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 October 2014 until October 2015

⇒ **satellite unavailability**

~0 % **< 4% req**

– bus : 0% altimeter : 0.01% Doris : 0% AMR : 0.03%

⇒ **ground unavailability**

~0 % **< 1% req**

➔ **Global Jason-2 system availability : 99.6 %**

NB : GDR data availability vs theory (from 2014 annual CALVAL report)

All surfaces : 95.4 %

Over Ocean : 99.2 %

Conclusion

- Jason-2 satellite has still an excellent behavior
- All satellite and system performance requirements are fulfilled with large margins
- Extended Operational Routine Phase up to 31st December 2017

→ One question : “**what will be the Jason-2 EoL orbit ?**”
(after tandem and interleaved phases)

**thanks to all the teams (CNES, NOAA, EUMETSAT, NASA/JPL) a
system running fine, with an excellent availability**

- CNES

- C. Maréchal
- S. Haouchine
- C. Ferrié
- JL. Mestre
- E. Bronner
- F. Bailly-Poirot
- N. Picot
- Jean-Damien Desjonquères
- Christian Jayles
- F. Didelot

- NOAA

- D. Donahue
- J. Lillibridge

- EUMETSAT

- S. Dieterle

- JPL

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

Thanks for your attention and many thanks to the contributors !!

And... after Jason-3 launch & commissioning ???

- Jason-2 team will continue to serve as usual with
 - Regular OCG, REVEX, etc...
 - Careful monitoring of the engineering trend data for the platform and payload instruments.
 - Careful monitoring of orbital debris collision risks by NASA GSFC CARA and CNES Caesar teams.
 - Safe mode rehearsals and operational training, etc. etc.
 - Only **mandatory** activities or uploads to the S/C or the instruments.
 - Extending team support for Jason-2 beyond 2017 (REDEM, Senior Review, Exchange of letters, etc.)

Jason-1 GDR-E reprocessing

- Activity decided at Jason-1 close-out meeting
- Details defined during Boulder OSTST (2013)
- Not a complete reprocessing; just updating main parameters
- Conducted jointly by CNES and JPL
- Standard « E » for orbits, « D » for altimetry
- Schedule
 - release of the entire data set end 2015