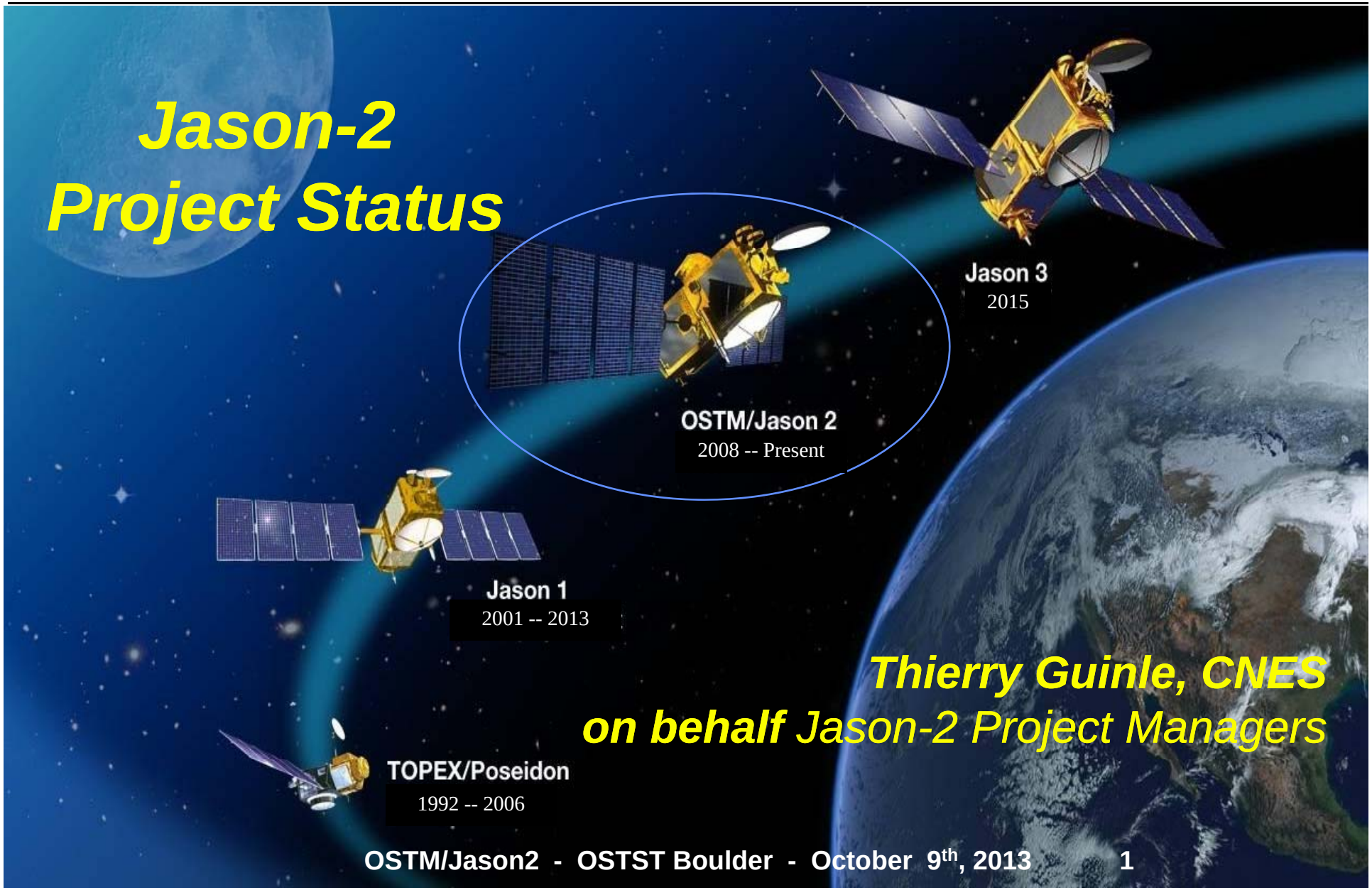
Jason-2 Project Status



Thierry Guinle, CNES
on behalf *Jason-2 Project Managers*

Major events since last OSTST (September, 2012)

- **Project Milestones**
  - Fifth Jason-2 REVEX : April 16-18, 2013 ➔ **successful**
  - Joint Steering Group for extension of mission : September 19 ➔ **successful**

- **Satellite major events : 3 safe hold mode (SHM) !**

  1/ March 25-29 / back to routine on PMA

  2/ March 30-April 5 / back to routine on PMB

  3/ September 5-12 / back to routine on PMB

- **Payload major events**
  - None

- **Ground major events**
  - Completion of GDR-D reprocessing ➔ **successful**
  - TM-NRT upgrade (HW + SW) in June 2013 ➔ **successful**

Current OSTM/Jason-2 mission Status is OK

Safe Hold Mode periods (1/2)

- **First SHM encountered by Jason-2 on March 25th, 2013**
  - At 03:31z, during a USG pass, Jason-2 transitioned to SHM mode (PMA ➔ PMB)
  - No BASICDIAG (or STACKSTATE) nor any FDIR packet was received
  - Didn't occur over the SAA, « normal » environment conditions, all equipments were OK

  Nominal SHM recovery operations on PMA

  Mission stopped for 4 days and 16 hours

  Cycle 174 impacted from passes 43 to 161

- **Second SHM occurred on March 30th , 2013**
  - At 22:37z, Jason-2 transitioned to SHM mode (PMA ➔ PMB)
  - No BASICDIAG (or STACKSTATE) nor any FDIR packet was received
  - Didn't occur over the SAA, « normal » environment conditions, all equipments were OK
  - RAM test on PMB was OK (no EDAC)

  Nominal SHM recovery operations on PMB

  Mission stopped for 5 days and 18 hours

  Cycles 174 impacted from passes 191 to 254

  Cycles 175 impacted from passes 1 to 83

- Root cause (identified in September) : faulty word in RAM

Safe Hold Mode periods (2/2)

- **Third SHM encountered by Jason-2 on September 5th, 2013**
  - At 09:26z, Jason-2 transitioned to safe hold mode (PMB ➔ PMA)
  - Root cause : a single memory error not corrected by EDAC process
  - Occurred on SAA exit, all equipments were OK

  Investigation on PMA; permanent error in RAM
  Investigation on PMB; no RAM error
  Nominal SHM recovery operations on PMB
  Mission stopped for 7 days and 5 hours
  Cycle 190 impacted from passes 185 to 254
  Cycle 191 impacted from passes 1 to 115

- **To be noticed :**
  - There was no change on the payload configuration (same instruments, no need to recalibrate)
  - Since 1st SHM in March, continuous activities with TAS to understand, investigate, develop tools….

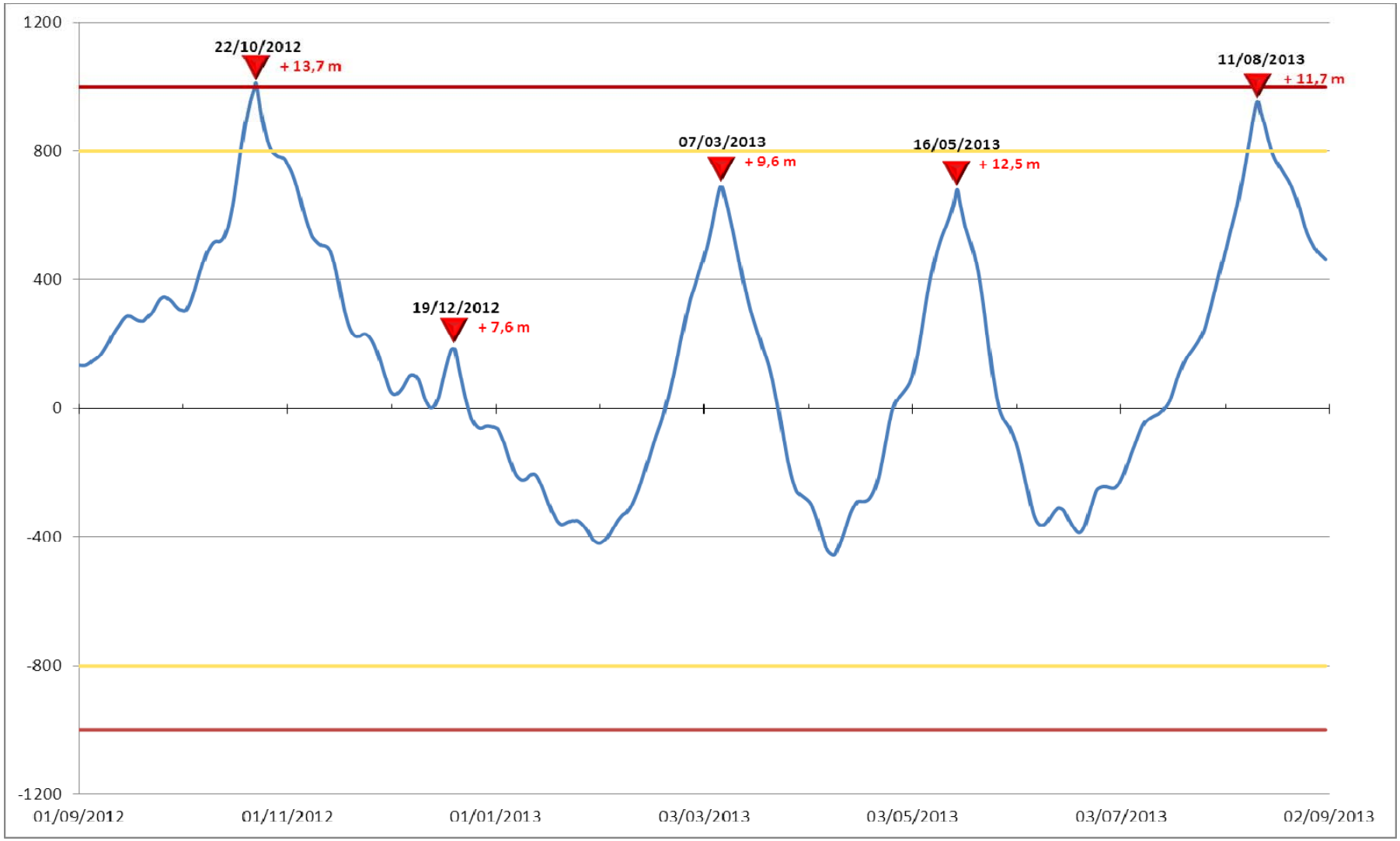
Satellite status

- **The Jason-2 satellite bus is OK despite 3 SHM**
  - Command / control , RF : **PMA : to be assessed** **PMB : OK**
    - On-Board Software, Mass Memory, Jason2 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

- **Satellite activities :**
  - Unused equipment destocking (gyro, STR) **OK**
  - STR monitoring **OK**
  - SADM expertise **OK**
  - Gyro calibration : **OK**

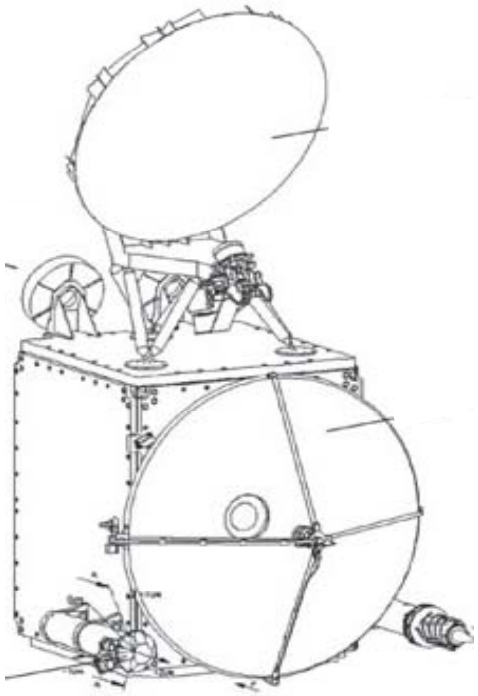
Jason-2 satellite is operational after more than 5 years in orbit

Navigation and guidance



Payload Status since last OSTST (September, 2012)

- **Core Payload**
  - POSEIDON3 **OK**
    - Upgrade DEM (Kantanos area) due to relocation of transponder
  - DORIS **OK**
  - AMR **OK**
  - GPSPA **OK**
    - 12 resets on the period. Procedure in place with OPS team with no impact on operation
- **No use of redundancy**
- **Same instruments since begining of mission**



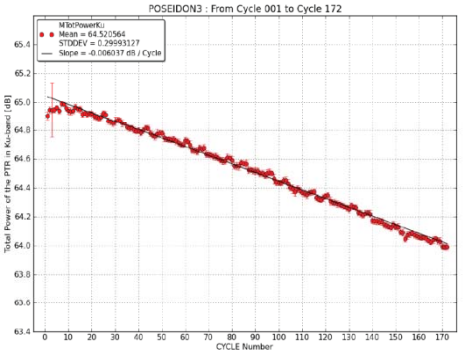
- **Passengers**
  - T2L2 **OK**
  - CARMEN2 **OK**
    - 2 occurrences of the Experiment board blocking. Requires OFF/ON
  - LPT **OK**

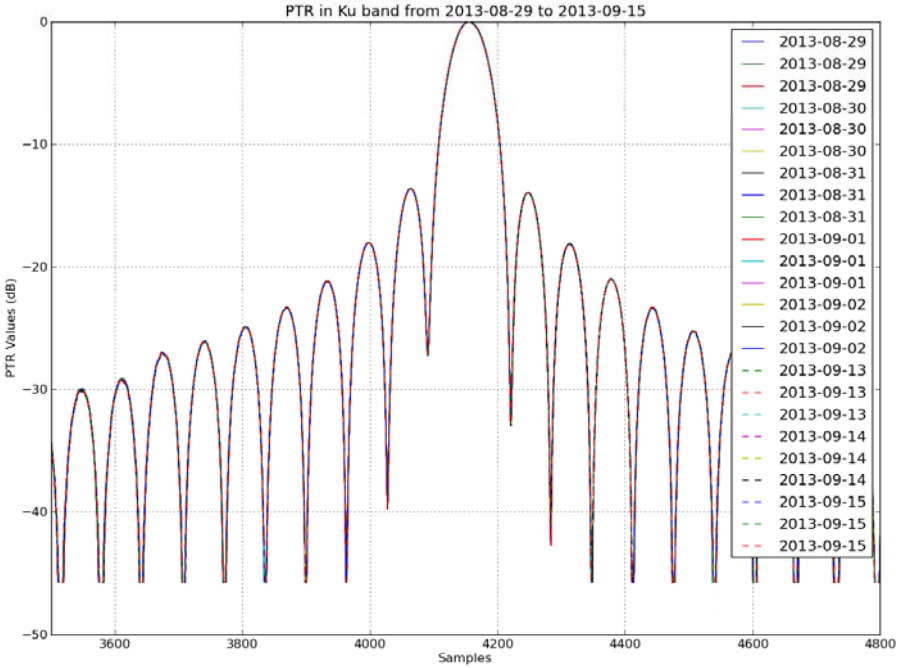
core payload FULLY OPERATIONAL after more than 5 years in orbit
passengers perform satisfactorily

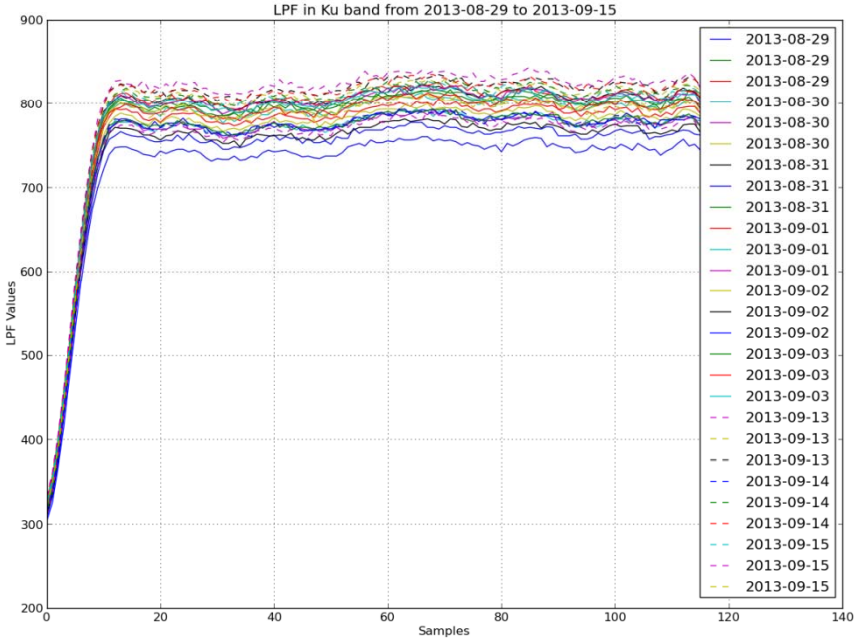
Poseidon-3

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

and altimeter not degraded by SHM…



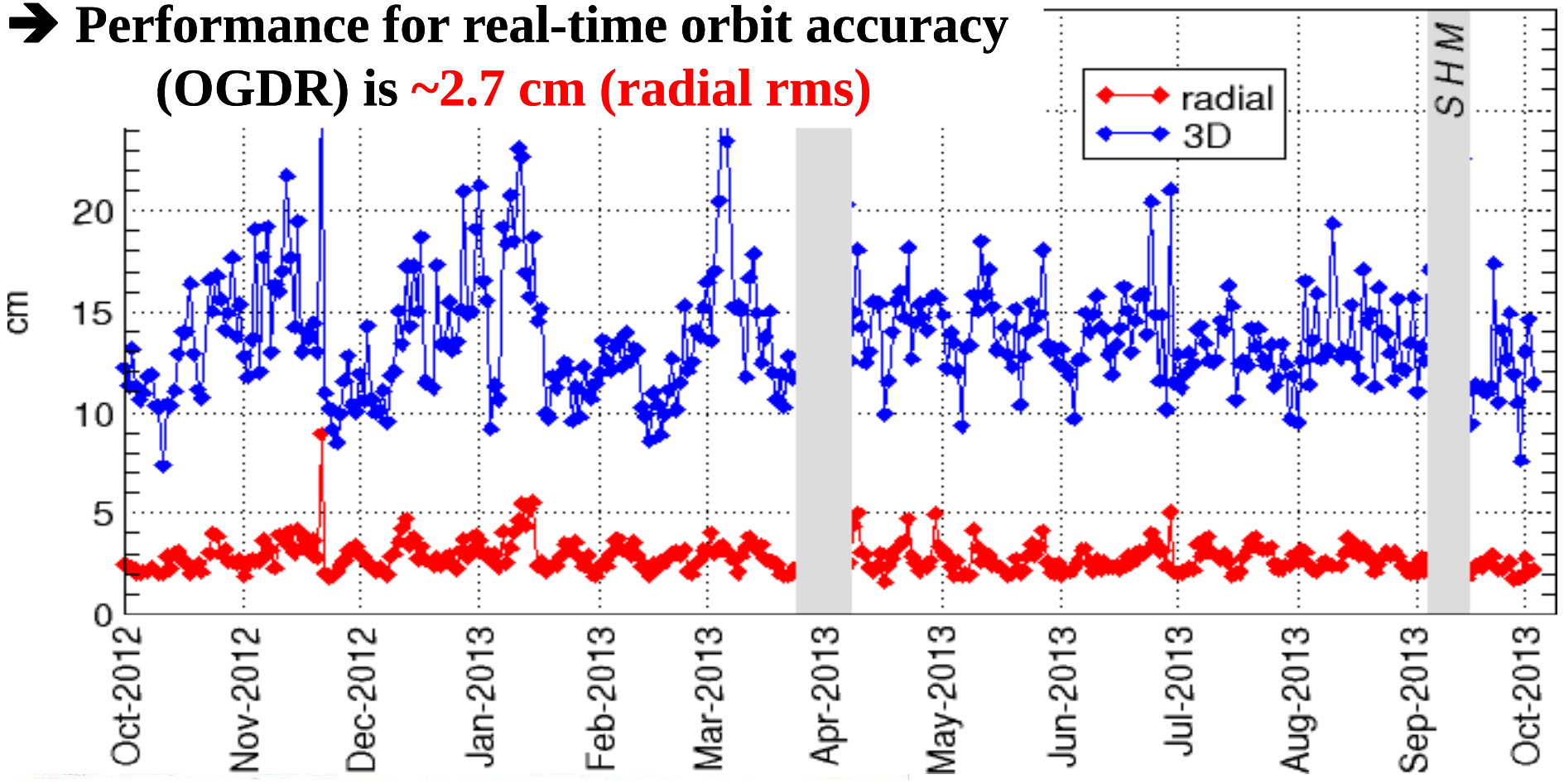




DIODE-MOE differences for Jason-2

daily RMS, maneuvers excluded

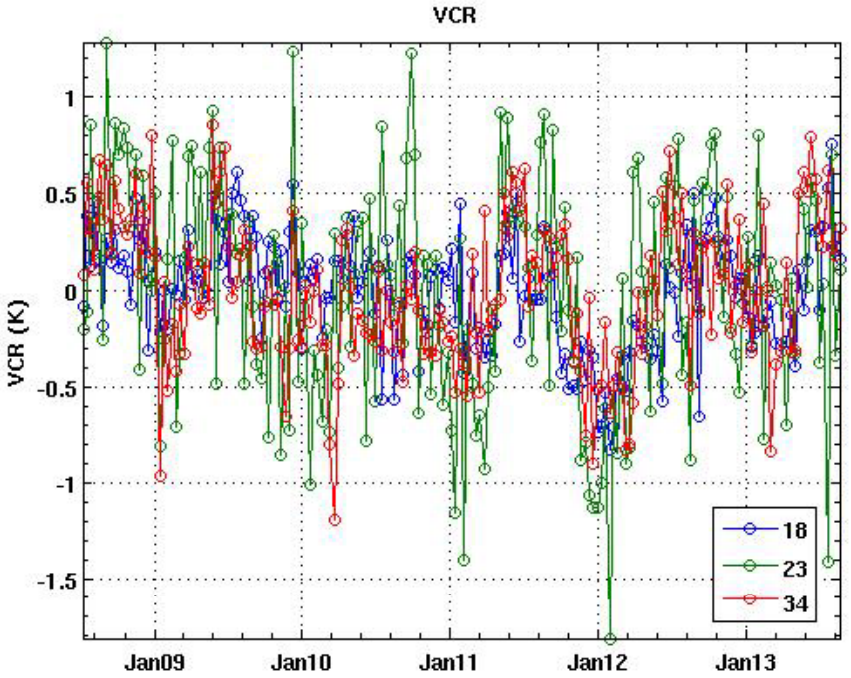
➔ **Performance for real-time orbit accuracy (OGDR) is ~2.7 cm (radial rms)**



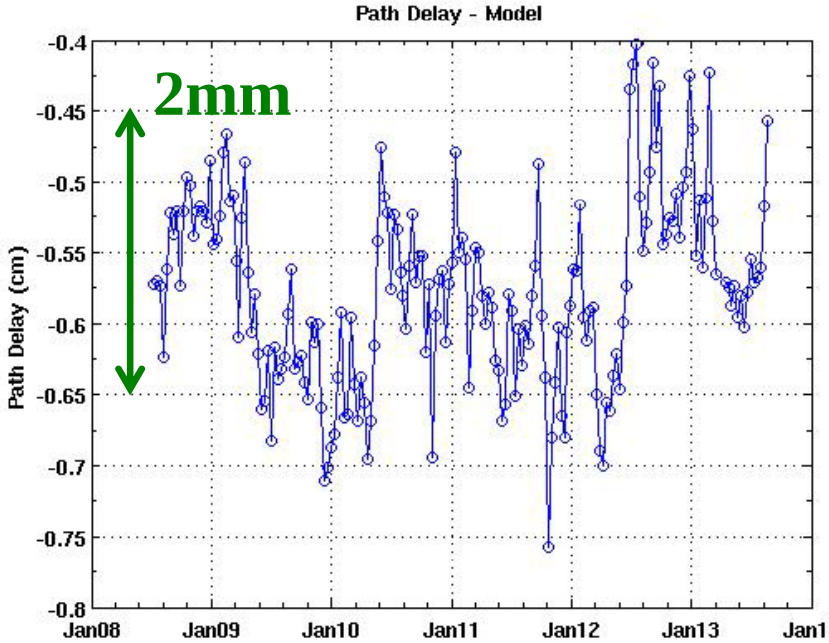
AMR

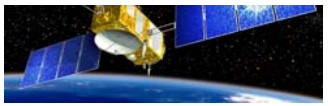
- AMR continues to perform nominally
- Availability = 100% over the period
- No calibration changes implemented since February 28, 2012
- With ARCS processing, the AMR is stable to < 1 mm/yr level over mission life *~ 6 mm/yr drift without ARCS processing*

Brightness Temperature Stability [K]
July 2008 – Aug 2013



AMR Path Delay – ECMWF [cm]
July 2008 – Aug 2013

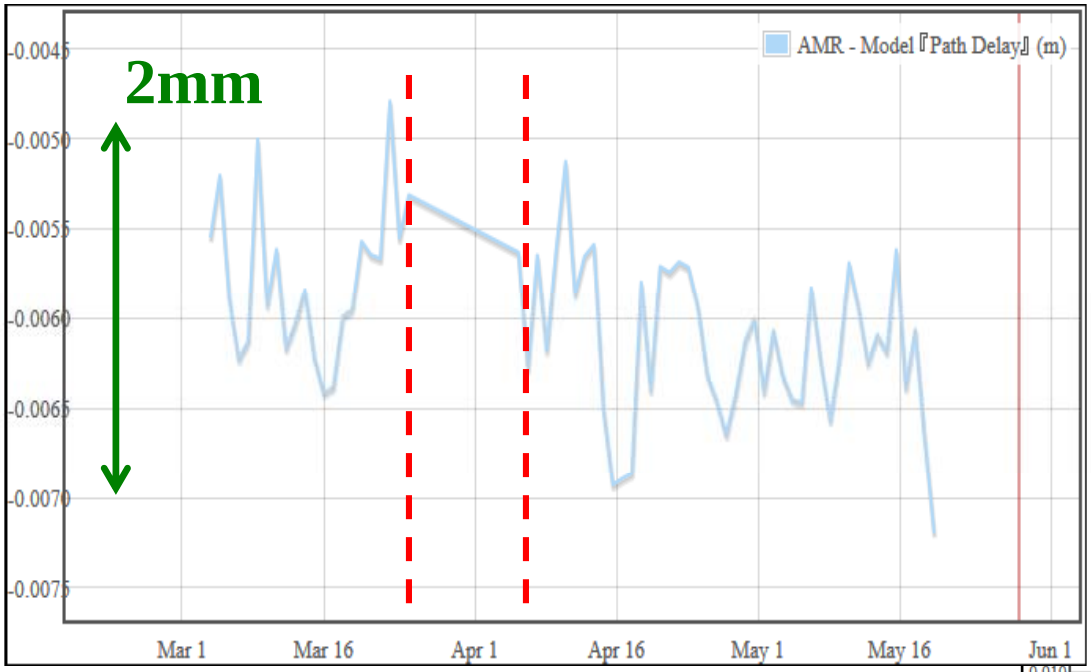




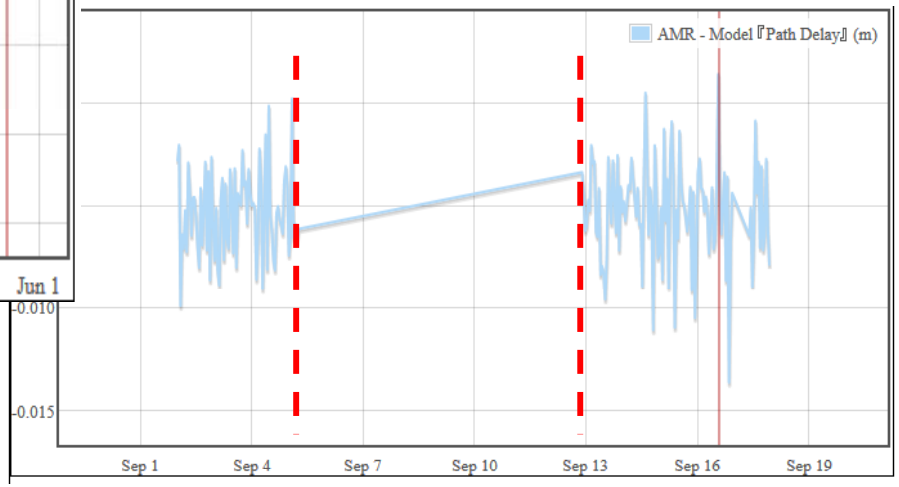
Safehold Events on AMR

- **No significant calibration changes observed after safehold events**

AMR – ECMWF PD [m] March 1 to May 20, 2013

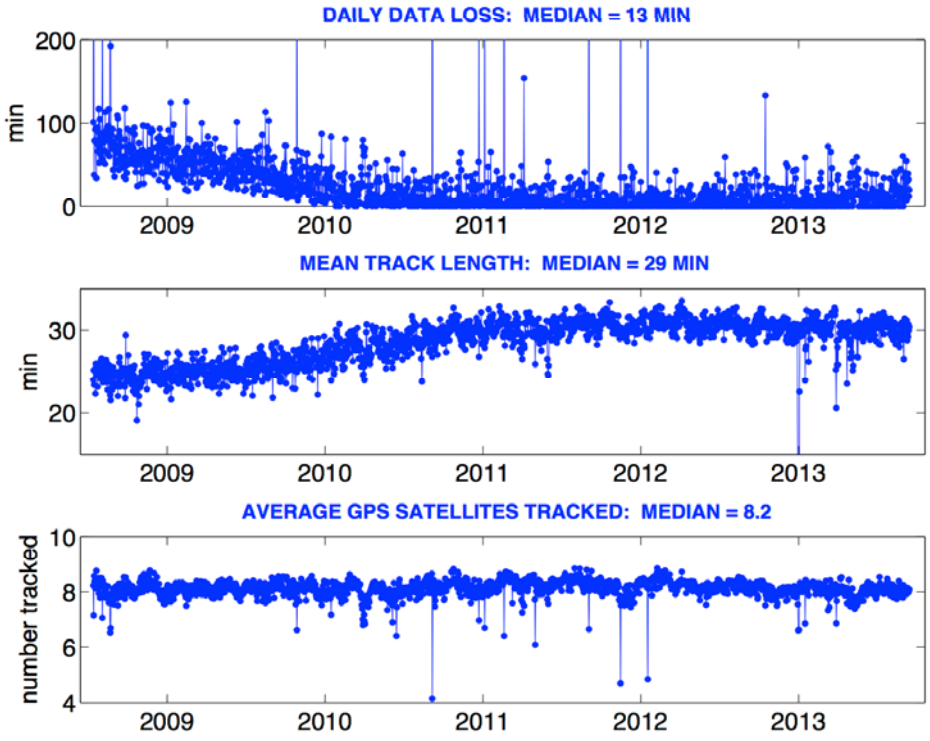


AMR – ECMWF PD [m] Sept 1 to Sept 19, 2013



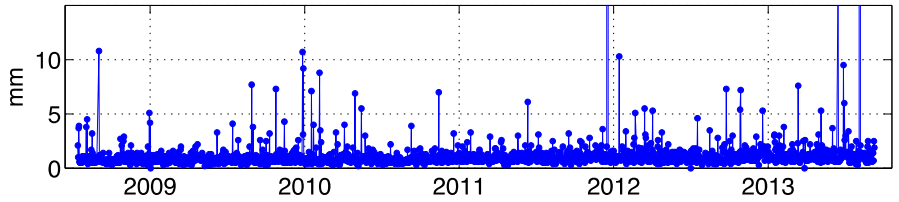
Tracking statistics

GPSP-A is healthy and is operating as expected



POD statistics

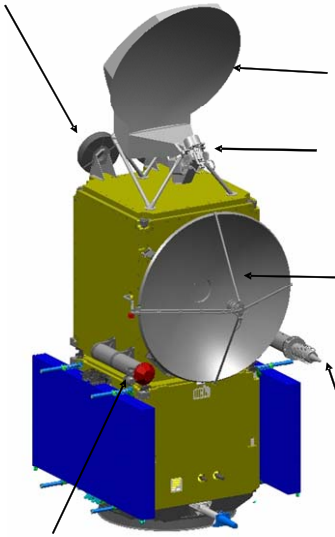
The GPSP continues to meet and exceed performance requirements

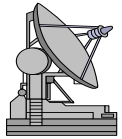


System Elements

NASA Elements
NOAA Elements
EUMETSAT Elements
CNES Elements

Dedicated Delta II
Launch Vehicle

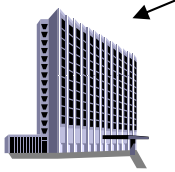




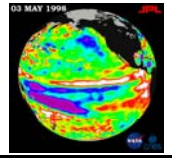
NOAA - Wallops/
Fairbanks - USA

NOAA S/C Operations
(Suitland, MD)

Operational product
processing and Science
Data archive &
Distribution

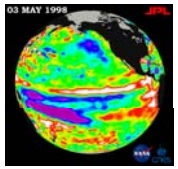


NASA/JPL
NASA Instrument
Ops



EUMETSAT – Usingen, Germany

Operational product
processing &
Distribution

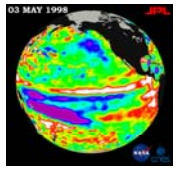


EUMETSAT

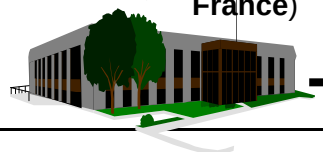
CNES

S/C Operations
(Toulouse,
France)

Science data
processing, archive &
Distribution



Passengers Ops and
mission centers
CNES- JAXA



Ground & Operations Status and performances

- **Earth terminals :**
  - Usingen (USG) : **OK**
  - Wallops and Fairbanks (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**

OGDR products
Status and performances

NRT products (OGDR)

produced by EUMETSAT Mission Center and NOAA/ESPC Mission Center

- Major changes in the period
  - **New hardware Linux 64 bits (same as Jason-3, ready for merge)**
    Operational in June 2013

- **EUMPC : ~99% OGDR successful for PLTM1 acquired at USG**
  - due to TM-NRT failure after September SHM ➔ NOAA EmergencyBackup Mode activated
- **NOAA ESPC : ~100% OGDR successful for PLTM1 acquired at CDAs**
  - And also 100% OGDR successful for PLTM1 acquired at USG

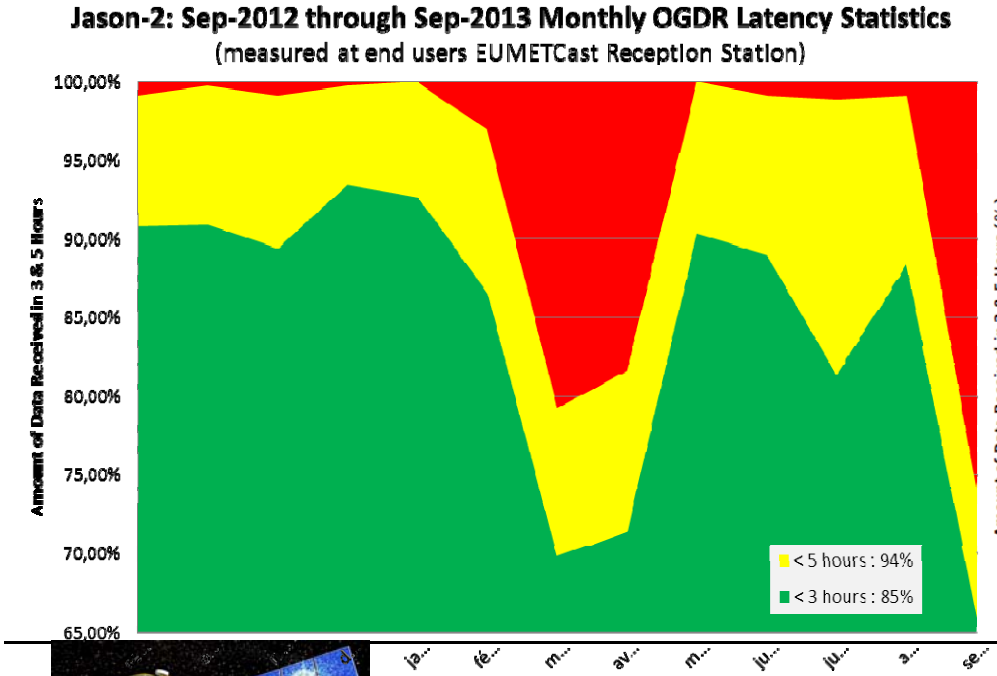
- **100 % OGDR products archived, all disseminated via EUMETCast and via NOAA dissemination services**

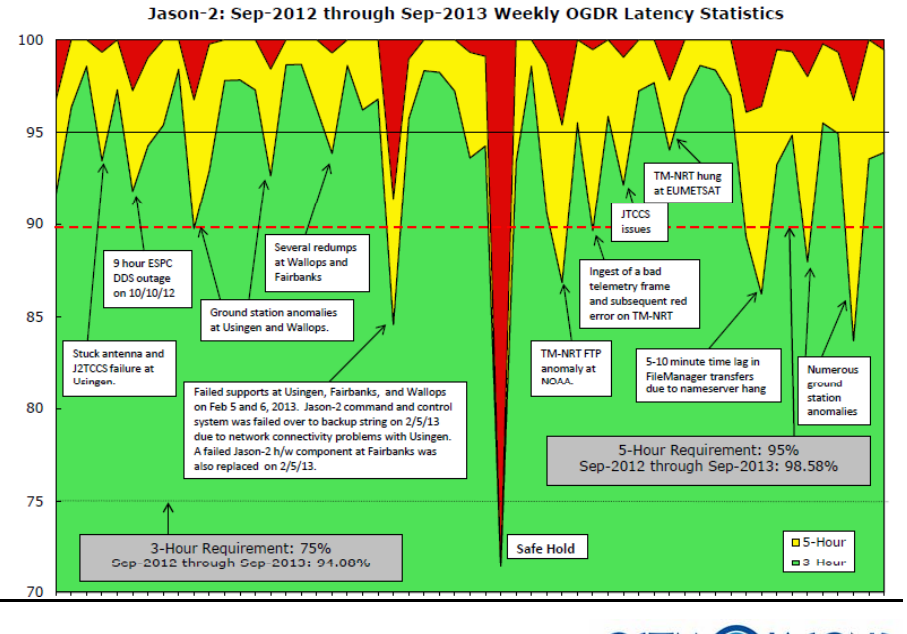
- NB : an annual data quality report is produced by NOAA, see
  ftp://ibis.grdl.noaa.gov/pub/johnl/ostm/j2_2012-2013_nrt_quality.pdf

OGDR products
Status and performances

- **Operational Geophysical Data Record OGDR 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**)	Performance (measured at NOAA ESPC **production level**)
85 % in less than 3 hours	**94 % in less than 3 hours**
94 % in less than 5 hours	**98 % in less than 5 hours**
EUMETSAT's Inputs	**NOAA's Inputs**

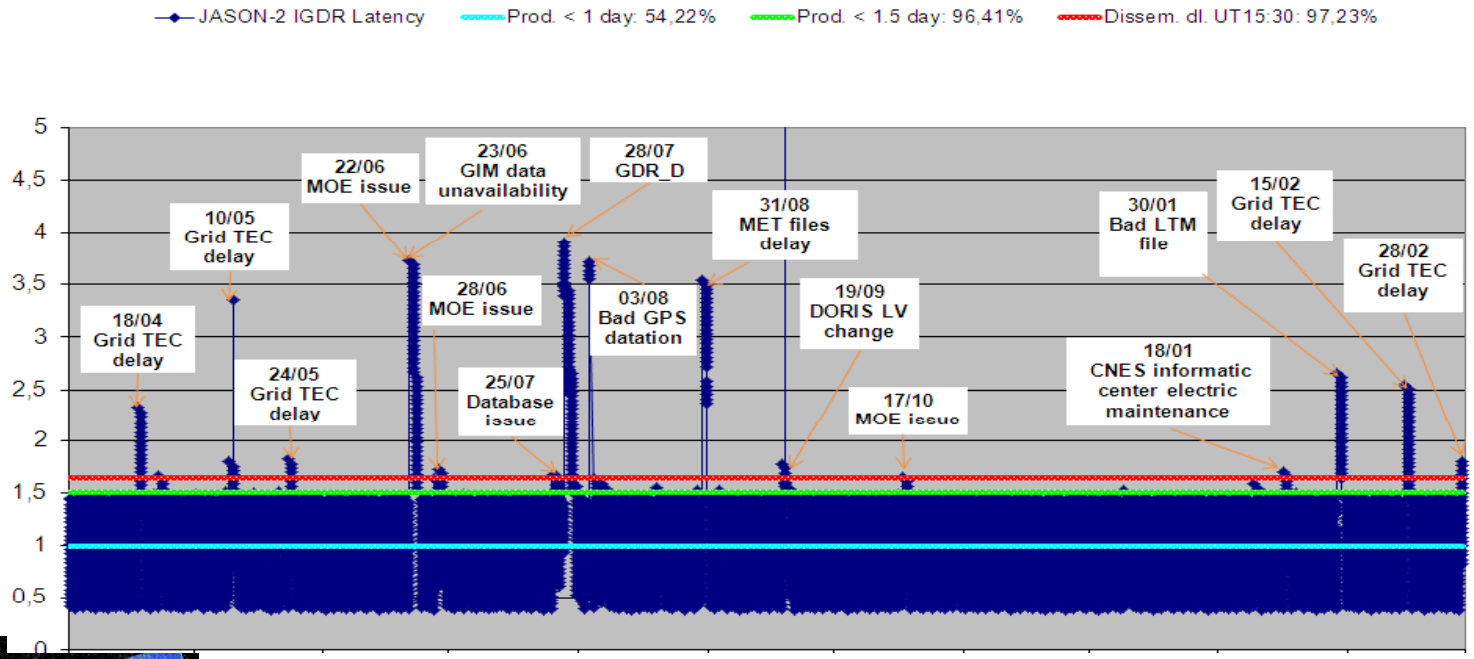




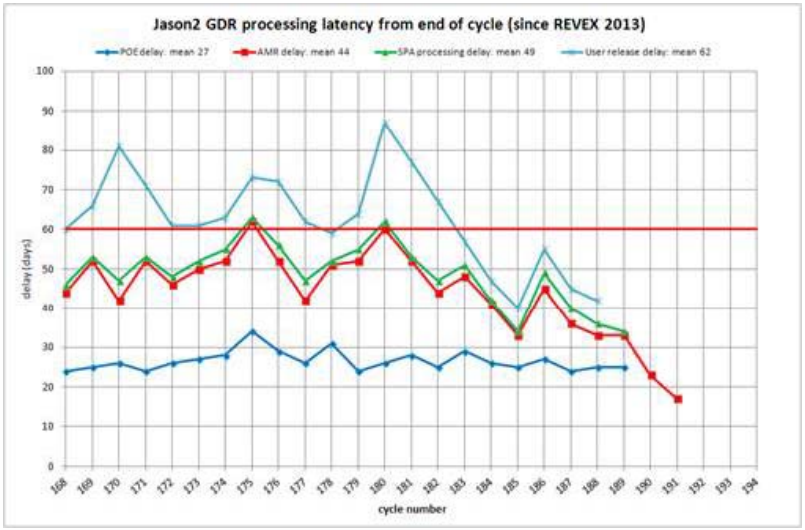
IGDR products
Status and performances

- **Off line products produced by SSALTO CNES Mission Center**

- **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 products
Status and performances



- **GDR produced by SSALTO Mission Center**
- **Jason-2 GDR processing is OK (latency OK)**
  - Systematic cross checked validation by CNES and JPL
  - Cycle per cycle validation report made available to users on AVISO
  - Yearly validation report: http://www.aviso.oceanobs.com/fr/calval/index.html

- **100% GDR products archived**

- **all disseminated via CNES AVISO and NOAA dissemination services**

Multi-mission analysis

Global MSL monitoring

Difference of Jason-2 GMSL – Jason-1 GMSL computed over Jason-2 cycles

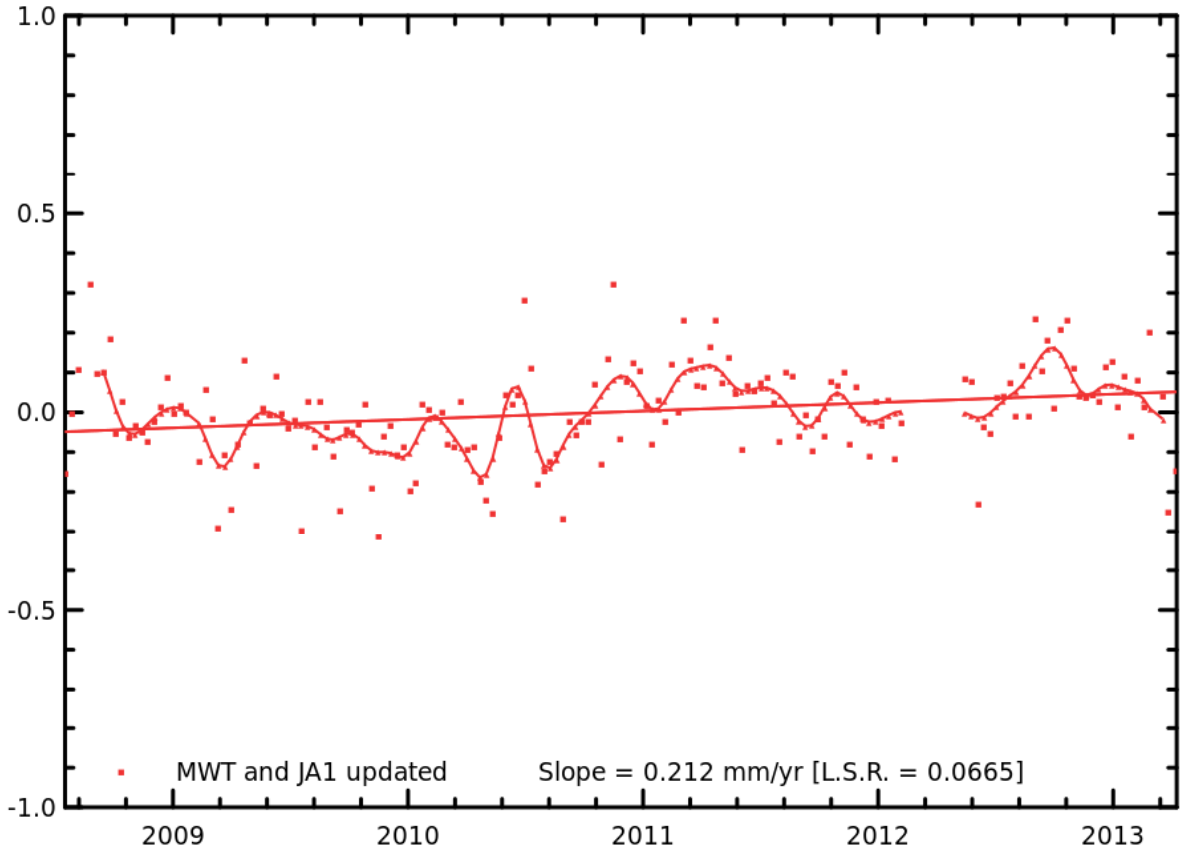
JA1 updated, homogeneous solutions for:

- POE-D orbit,
- GOT4.8 tide,
- MSS 2011

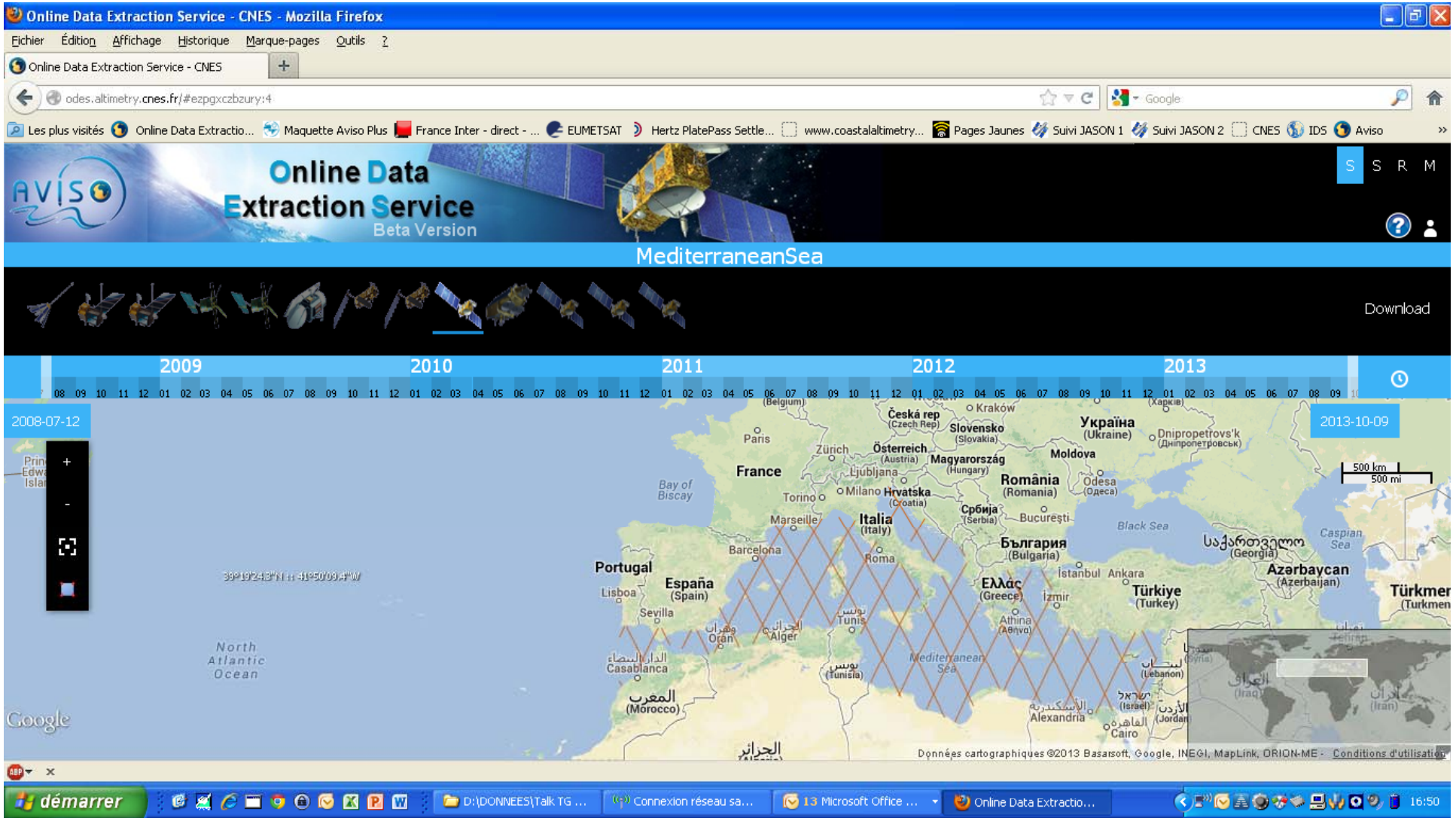
Radiometer Wet Troposphere + JA1 product data **0.71mm/yr**

Radiometer Wet Troposphere **+ JA1 updated** **0.63mm/yr**

Model Wet Troposphere + JA1 updated **0.21mm/yr**



ODES


Online Data Extraction Service - CNES - Mozilla Firefox
Fichier Édition Affichage Historique Marque-pages Outils ?
Online Data Extraction Service - CNES
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Online Data Extraction Service
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2009
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2013
2008-07-12
2013-10-09
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Portugal
España (Spain)
Italia (Italy)
Česká rep (Czech Rep)
Slovensko (Slovakia)
Österreich (Austria)
Magyarország (Hungary)
Hrvatska (Croatia)
Srbija (Serbia)
România (Romania)
Moldova
Україна (Ukraine)
България (Bulgaria)
Ελλάς (Greece)
Türkiye (Turkey)
Azərbaycan (Azerbaijan)
საქართველო (Georgia)
North Atlantic Ocean
Mediterranean Sea
Black Sea
Caspian Sea
Données cartographiques ©2013 Basarsoft, Google, INEGI, MapLink, ORION-ME - Conditions d'utilisation
démarrer
16:50

Error budget

A detailed document on Jason-2 error budget is available
Updated every year for REVEX

	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
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]	

System Requirements and Performances

- **Altimeter Antenna Pointing :**
  - Requirement : < 0.2°
  - pointing performance stable since launch

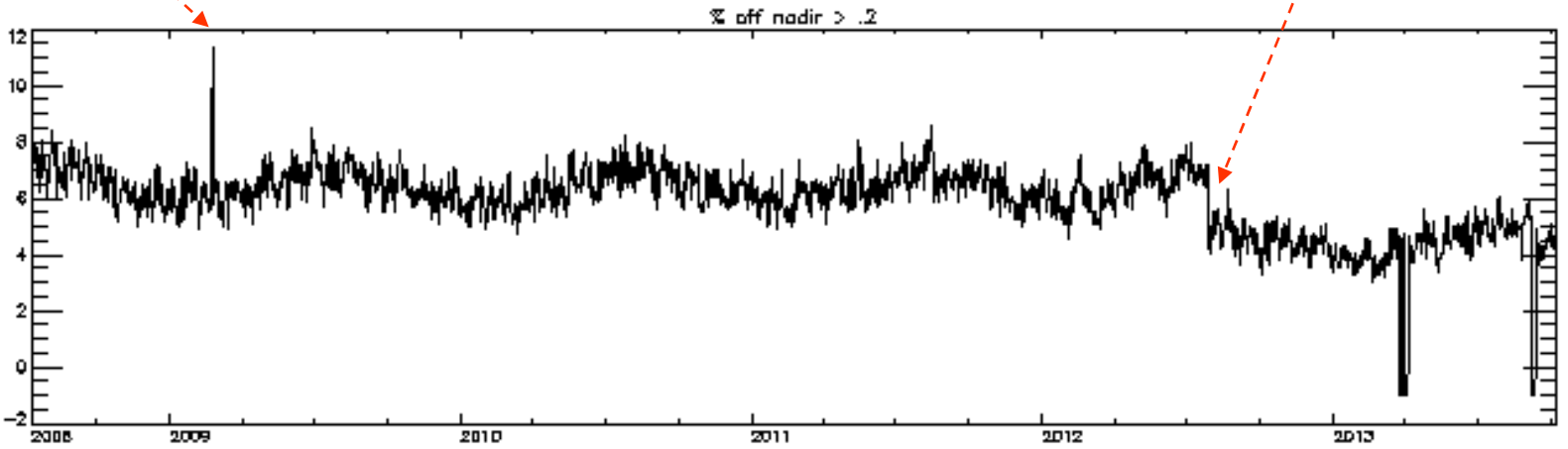
Typical pointing value below 0.07°

STR1 locked in standby on 2009/02/23

GDR-D standard

OFF Nadir

% of the points per day with mispointing > 0.2°



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 2011 until August 2012**

  ⇒ **satellite unavailability** **3.5%** **< 4% req**

  – bus : 3.5% altimeter : 0.01% Doris : 0% AMR : 0.01%

  ⇒ **ground unavailability** **~0 %** **< 1% req**

  loss of data at station level

➔ Global Jason-2 system availability : 96.5 %

➔ **GDR data availability vs theory (from annual CALVAL report)**

All surfaces : 96.2 %

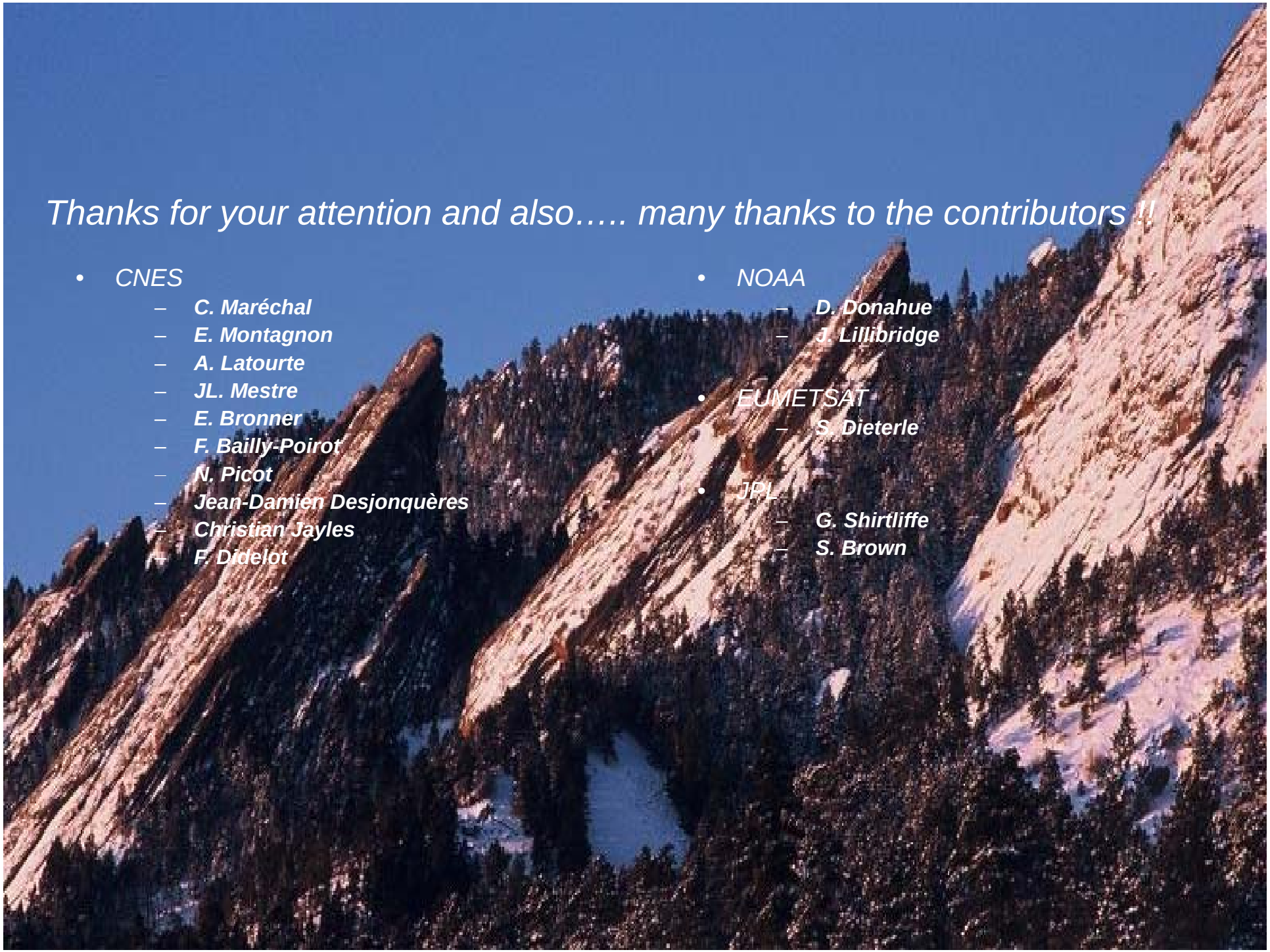
Over Ocean : 99.1 %

Conclusion

- **Jason-2 satellite has still an excellent behavior**
- **All satellite and system performances requirements are fulfilled with large margins**
- **Operational Routine Phase is nominal**
- **All data available in GDR-D standard**

➔ the mission is extended for 2 years ➔ June 2015

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



Thanks for your attention and also….. many thanks to the contributors !!

- *CNES*
  - ***C. Maréchal***
  - ***E. Montagnon***
  - ***A. Latourte***
  - ***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***