

Jason-2 Project Status



Thierry Guinle
CNES Jason-2
Project Manager

- **Project Milestones**

- Fourth Jason-2 REVEX : May 9-11, 2012

→ **successful**

- **Satellite major events**

- None

- **Payload major events**

- DORIS OBS upgrade (Sept.19th 2012)

→ **successful**

- To provide an even more radial performance for real time products

- Passengers instruments :

- LPT off since early September – investigation by JAXA in progress

- **Ground major events**

- Upgrade to GDR-D standard

→ **successful**

- Jason-2 reprocessing in progress

→ **successful**

Current OSTM/Jason-2 mission Status is OK



- **The Jason-2 satellite bus is OK; no incident**

- 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

- Command / control , RF :

OK

- On-Board Software, Mass Memory, Jason2 Telemetry & Telecommand system : nominal behavior

- 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

- Cross maneuver : None (on request)

Jason-2 satellite is fully operational after more than 4 years in orbit



- **Station keeping maneuvers**

Equatorial Nodal Crossing requirement :
 ± 1 km from reference nodes

- Jason-2 ground tracks are maintained within ± 1 km from the reference grid
- Jason-2 station keeping maneuvers are made with only one thrust above land on any orbit
- **more activities due to Jason-1 orbit change**
 - If nadir separation is less than 100 km, Jason-1 emission stopped
 - If nadir separation is less than 1 km, Jason-2 in CAL mode
- **Remaining propellant : > 23 kg**

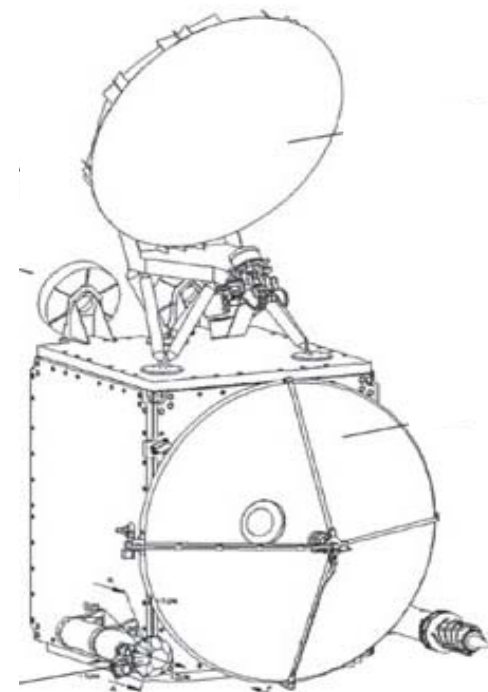


• Core Payload

- POSEIDON3 OK
 - New MNT (Kantanos area) for calibration over transponder
- DORIS OK
 - New OBS v11 uploaded September '12
- AMR OK
- GPSPA OK
 - 6 resets on the period. Procedure in place with OPS team with no impact on operation

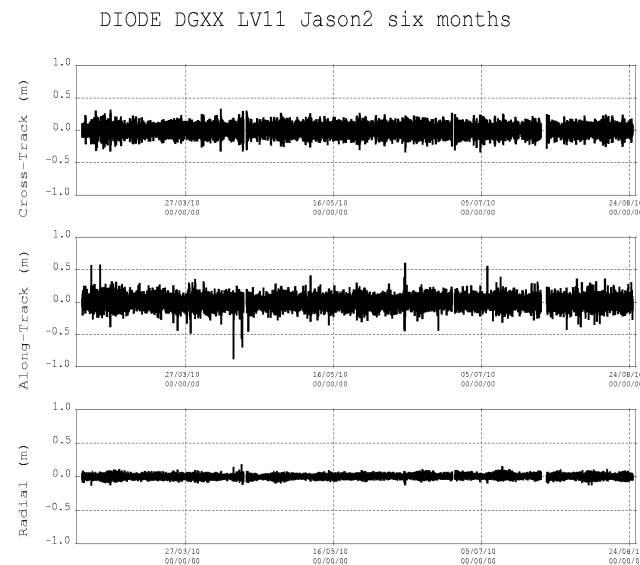
• Passengers

- T2L2 OK
- CARMEN2 OK
 - 2 occurrences of the Experiment board blocking. Requires OFF/ON
- LPT OFF
 - OFF from Sept 5/09 due to APS-A anomaly (latchup-TBC)
JAXA expects no damage on hardware and resume observations soon



core payload FULLY OPERATIONAL after more than 4 years in orbit
passengers perform satisfactorily

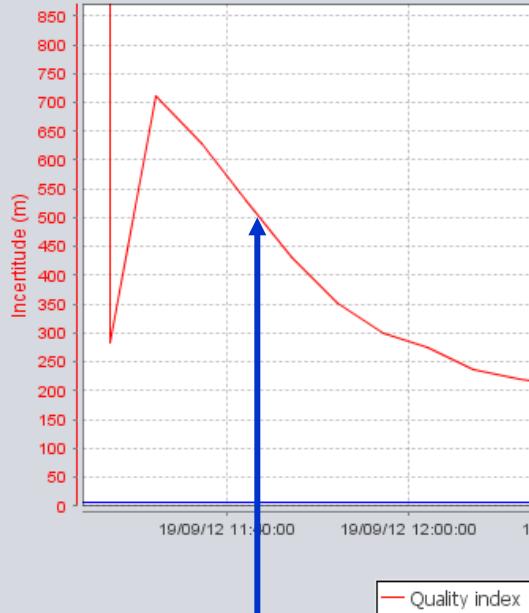
- As proposed and accepted in San Diego, a new release of DIODE software (v11) is now on-board. Main evolutions are :
 - PAPEETE as a Master Beacon
 - Hill along-track acceleration
 - OAP formula change
- This issue has been activated on September 19th
- Expected performance for real-time orbit accuracy (OGDR) is **2.7 cm (radial rms)**
=> 18 % improvement



To be confirmed with flight data in few days by comparison with POE orbit



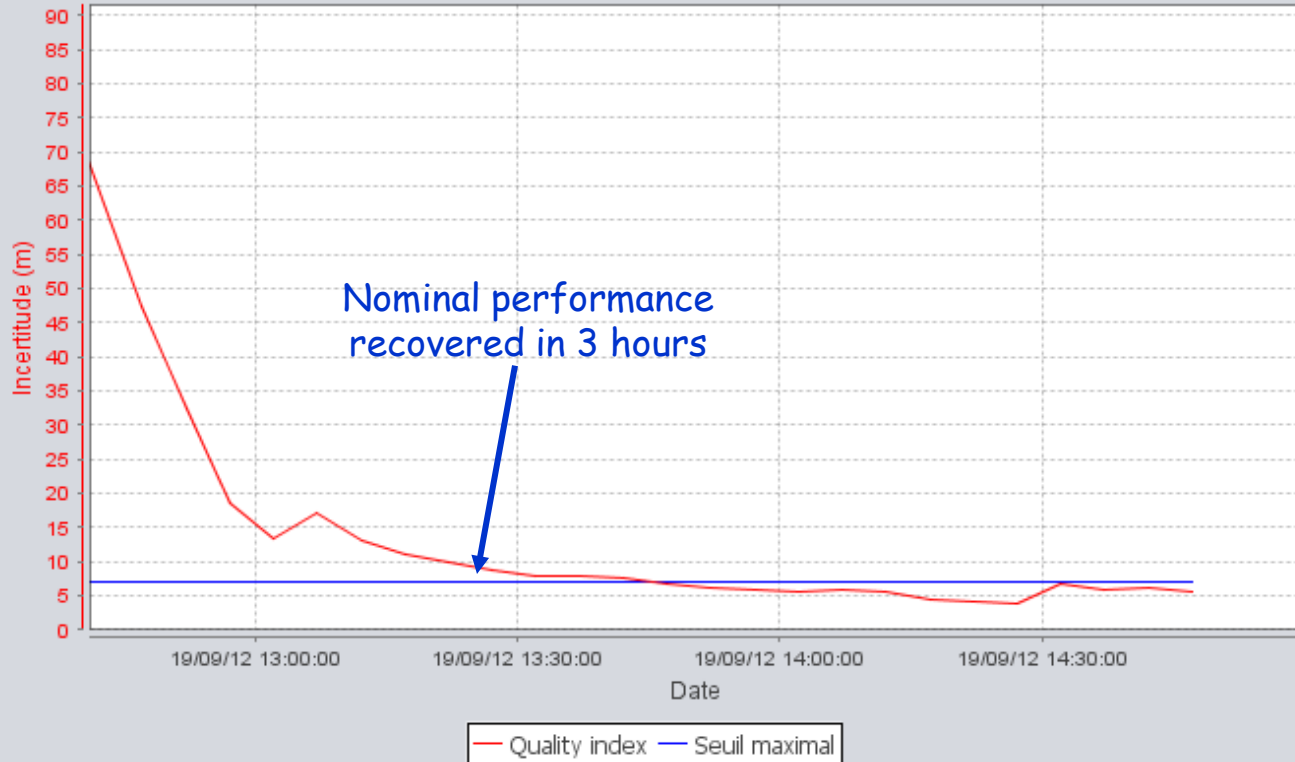
Tracé des données J2 du 15/09/2012 12:50:10 au 19/09/2012 12:50:10



500m 1h30 later

DORIS restart at 10:20:00 UTC

Tracé des données J2 du 15/09/2012 14:48:20 au 19/09/2012 14:48:20



Nominal performance recovered in 3 hours

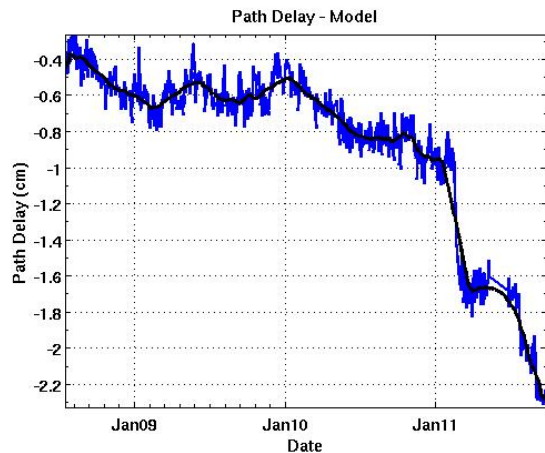


Path Delay Compared to Model

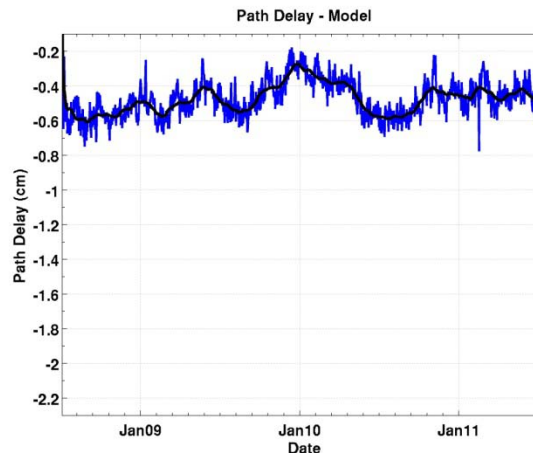
- Without ARCS processing, PDs would exhibit 7 mm/yr drift
- Drift on GDR-T product < 1mm/yr
- Drift on GDR-D product << 1mm/yr

GDR-D	Trend [mm/yr]
PD ECMWF	-0.1 ± 0.02
PD AMSR-E	$+0.6 \pm 0.04$
PD SSMI F15	$+0.3 \pm 0.1$
PD TMI	$+0.6 \pm 0.05$

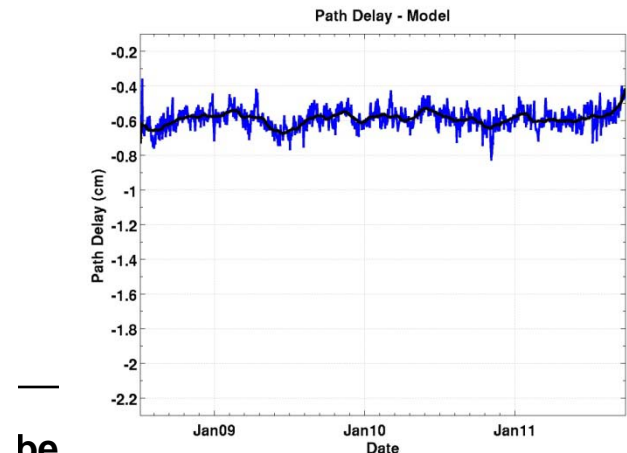
Without ARCS



GDR-T



GDR-D

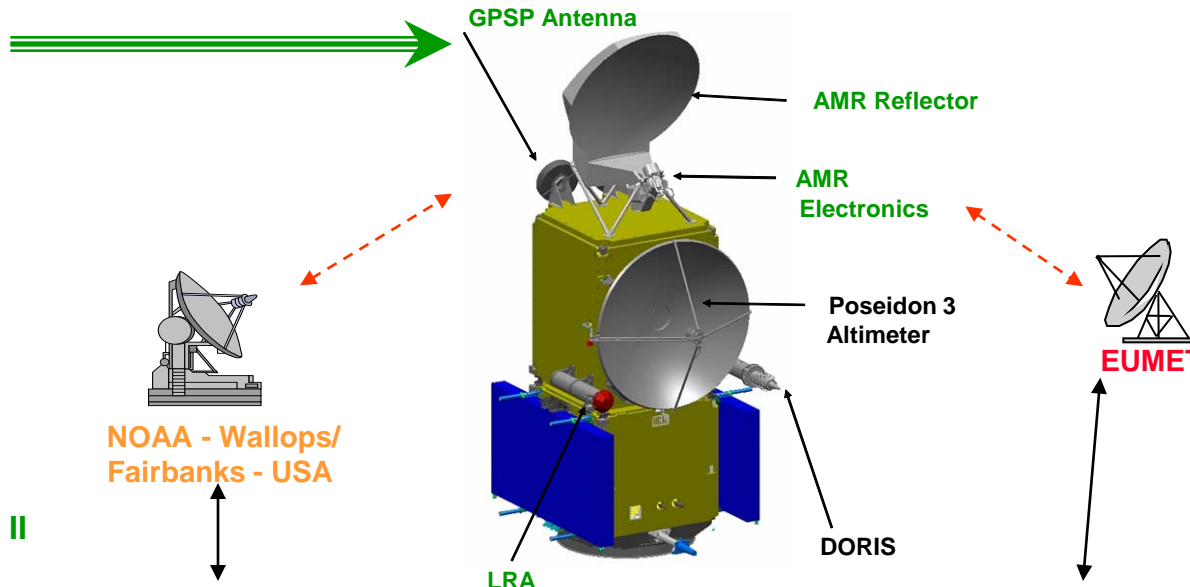


- Residual drift in GDR-D wet PD estimated to be <1mm/year
- ARCS processing mitigates large TB drift on operational GDRs
- GDR-D will also include new processing to produce valid PDs in the coastal zone in addition to radiometer rain and sea ice flags
 - Currently available on AMR enhanced product (via PO.DAAC)
- **AMR continues to provide excellent performance meeting and exceeding all requirements**





Dedicated Delta II Launch Vehicle



NASA Elements
NOAA Elements
EUMETSAT Elements
CNES Elements

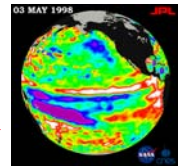
**NOAA - Wallops/
Fairbanks - USA**

**NOAA S/C Operations
(Suitland, MD)**

EUMETSAT – Usingen, Germany

**Operational product
processing &
Distribution**

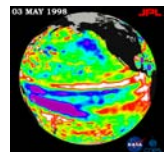
EUMETSAT



**NASA/JPL
NASA Instrument
Ops**

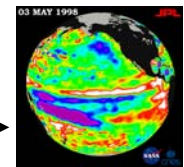


**Operational product
processing and Science
Data archive &
Distribution**



**CNES
S/C Operations
(Toulouse,
France)**

**Science data
processing, archive &
Distribution**



**Passengers Ops and
mission centers
CNES- JAXA**



OSTM/Jason2 - OSTST Venise - September 27th, 2012

- **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
 - successful DORIS on-board software upload
 - successful transfer of GPSP1 SW to ESPC

- **Instrument Commanding and Monitoring Centers :**
 - SSALTO for CNES instruments OK
 - JPL Mission facility for NASA/JPL instruments OK
 - Passengers Mission centers OK



NRT products (OGDR)

produced by **EUMETSAT Mission Center** and **NOAA/ESPC Mission Center**

- Major changes in the period
 - Update was applied to AMR characterization file: 5-January 2012
 - New N400 and N640 Gaussian grids and new ECMWF forecast and analysis model version: cyc1e 37r2 and upgrade of ECMWF model level output from GRIB1 to GRIB2: May 2012
 - GDR-D science upgrade implemented at EUMETSAT and NOAA: 31-July 2012.
- **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**
- NB : an annual data quality report is produced by NOAA, see ftp://ibis.grdl.noaa.gov/pub/johnl/ostm/j2_2011-2012_nrt_quality.pdf



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)

91 % in less than 3 hours

98 % in less than 5 hours

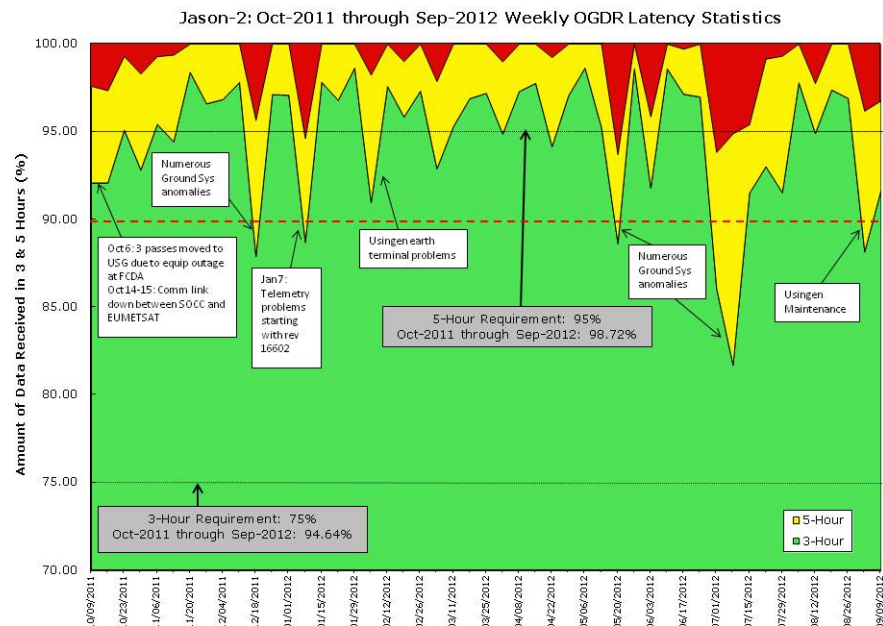
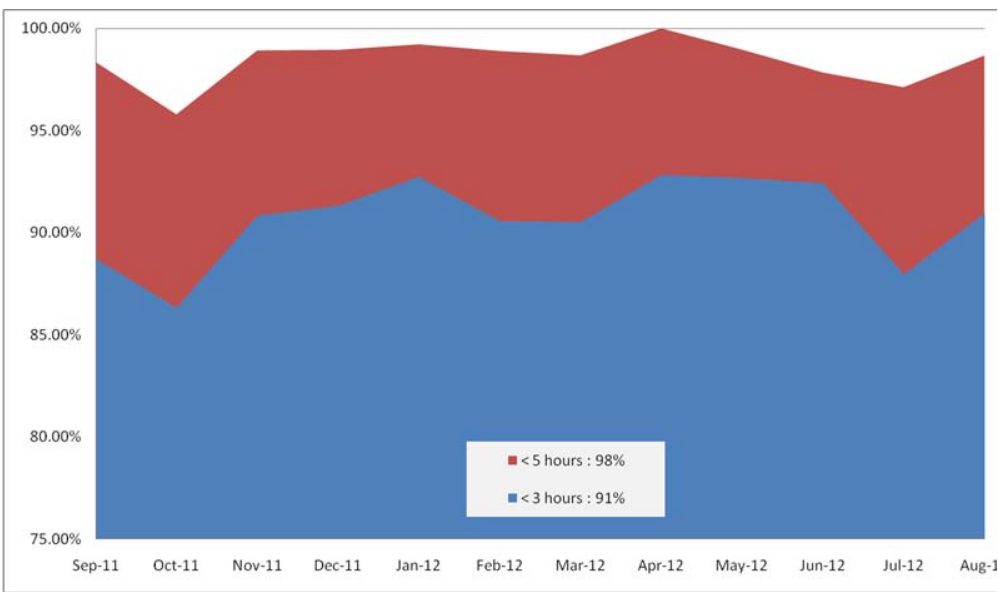
EUMETSAT's Inputs

Performance (measured at NOAA ESPC production level)

94 % in less than 3 hours

98 % in less than 5 hours

NOAA's Inputs

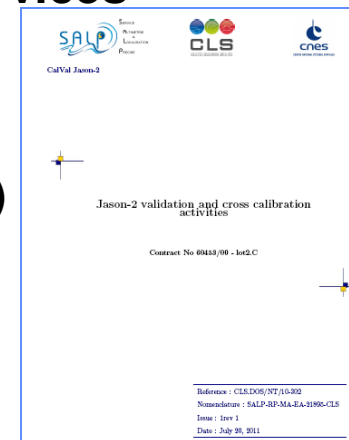


- Off line products produced by SSALTO CNES Mission Center
- Jason-2 IGDR processing is OK (CNES : 100% IGDR successful)
- Latency : more than 97% of products available in less than 1.5 day
- 100% IGDR products archived
- all disseminated via CNES AVISO and NOAA dissemination services

- Jason-2 GDR processing is OK (CNES : 100% GDR successful)
 - Systematic cross checked validation by CNES and JPL
 - 148 cycles of 152 have been generated and validated.
 - For each cycle, a full validation report is produced by CNES

→ see <ftp://avisoftp.cnes.fr/AVISO/pub/jason2/gdr>

- 100% GDR products archived
- all disseminated via CNES AVISO and NOAA dissemination services
- GDR_D reprocessing : available on AVISO ftp server



Yearly CALVAL
report available



- **Reprocessing status :**

- Started in April 2012 (should be completed by November)
- Cross validation CNES + NASA/JPL

Operating Steps	Cycles									
	1	2	3	4	5	6	7	8	9	10
1. Level 1 reprocessing completed	1	2	3	4	5	6	7	8	9	10
2. Level 2 reprocessing completed	11	12	13	14	15	16	17	18	19	20
3. CNES validation	21	22	23	24	25	26	27	28	29	30
4. JPL Validation	31	32	33	34	35	36	37	38	39	40
5. Level 2 products available on SEF Server	41	42	43	44	45	46	47	48	49	50
6. Level 2 products available on CLASS	51	52	53	54	55	56	57	58	59	60
* Problem: investigation in progress	61	62	63	64	65	66	67	68	69	70
	71	72	73	74	75	76	77	78	79	80
	81	82	83	84	85	86	87	88	89	90
	91	92	93	94	95	96	97	98	99	100
	101	102	103	104	105	106	107	108	109	110
	111	112	113	114	115	116	117	118	119	120
	121	122	123	124	125	126	127	128	129	130
	131	132	133	134	135	136	137	138	139	140
Last update : 25/09/2012	141	142	143	144	145					



- **Jason-2 data products are now available with GDR-D standard**
- **Major evolutions :**
 - **Correction of biases (Pseudo Datation + range)**
 - **Orbit GDR-D + last issue of MSS (2011), MDT (2009), tides (GOT 4.8)**
 - **New algo for wet trop correction**
 - **MLE3 retracking into products**
 - **Etc...**

Current figures :

		Requirements
– RMS Orbit (radial component) DIODE (vs POE) :	OGDR : 3 to 4 cm	10 cm
– RMS Orbit (radial component) POE :	GDR : 1 cm	2 cm
– RMS Orbit (radial component) MOE (vs POE) :	IGDR : 2 cm	2.5 cm
– Altimeter noise (from RMS from 20Hz Ku range) :	1.8 cm	1.8 cm
– Wet troposphere (J2-J1) RMS results :	0.1 to 0.8 cm	1.2 cm
– Total RSS sea surface height (J2-J1) RMS results :	IGDR : 3.9 cm	3.9 cm
– Significant wave height (J2-J1) RMS results :	IGDR : 0.12 to 0.24 m	0.4 m
– Wind speed (J2-J1) RMS results :	IGDR : 0.2 to 0.8 m/s	1.5 m/s



- **Altimeter Antenna Pointing :**

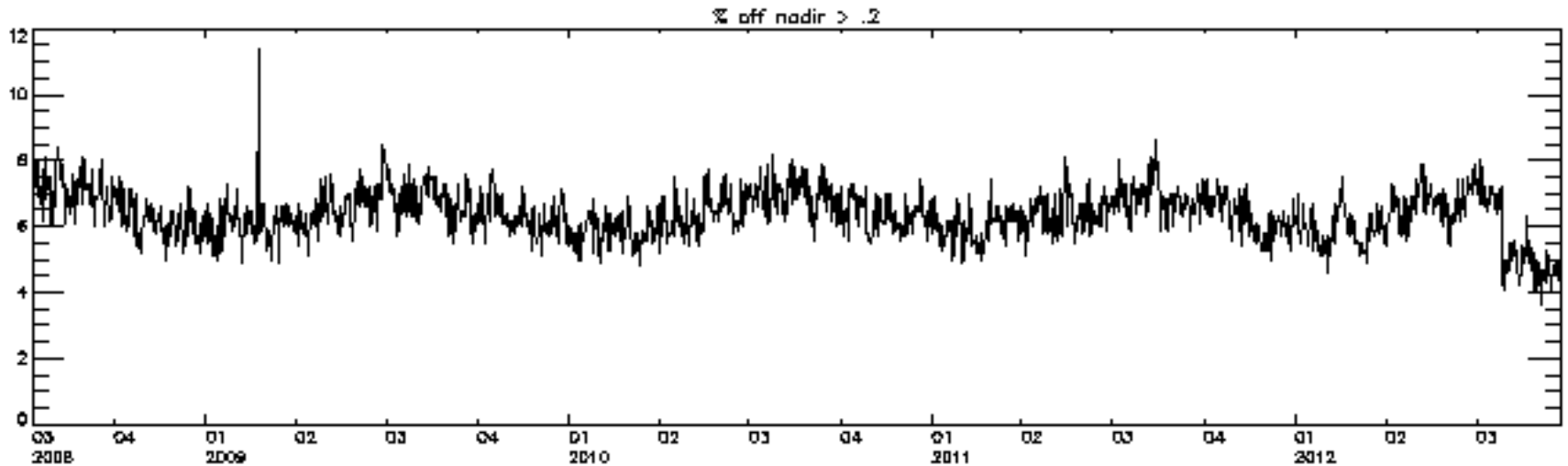
- Requirement : $< 0.2^\circ$
- pointing performance stable since launch

Typical pointing value below 0.07°

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

OFF Nadir

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



- **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** **0.01%** **< 4% req**

- bus : 0% altimeter : 0.01% Doris : 0% AMR : 0%
- POS3 : routine calibration + Gavdos
- POS3 : exceptional calibrations

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

loss of data at station level

➔ **Global Jason-2 system availability : 99.9 %**

➔ **GDR data availability vs theory**

All surfaces : **96.3 %**

Over Ocean : **99.8 %**



- Jason-2 satellite has an excellent behavior
- All satellite and system performances requirements are fulfilled with large margins
- Operational Routine Phase is nominal
- Successful REView of EXploitation (REVEX) : May 9-11, 2012
- All products in GDR-D standard

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

➔ the process for a mission extension is started



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

- **CNES**

- C. Maréchal
- A. Krauss
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- N. Picot
- Jean-Damien Desjonquères
- Christian Jayles
- Cédric Tourain
- P. Guillemot
- E. Lorfèvre
- O. Okudaira

• NOAA

– D. Donahue

• EUMETSAT

– S. Dieterle

• JPL

– G. Shirliffe

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Backup slides



OSTM/Jason2 - OSTST Venice - September 27th, 2012



21

- **POS-3 current configuration :**

- Turn-On of chain #1 on 22 June 2008 (Chain #2 is redundant)
- POS3-1 availability is **100%**. No anomaly.
 - no measurement data when extra operations are made (daily calibrations, specific calibrations, EEPROM modification and check)
- **Tracking mode: Autonomous Tracking Mode only (Median Tracker since beginning of cycle 35 : June 14, 2009 4h30)**

- **POS-3 configuration change : None since last OSTST**

- **POS-3 performances : Identical, still very good**

- **POS3-1 operations :**

- Regular transponder calibration (#109 & #18) stopped due to GAVDOS transponder unavailability
- New possible transponder site tested in July (suitable also for Sentinel3)



- **DORIS configuration and availability**

- No configuration change since last OSTST
 - Nominal chain : DORIS #1 (since June 2008)
 - OBSW DGXX V11.0 (on EEPROM-A since Sept. 2012, EEPROM-B will be aligned soon)
 - Redundant Chain : DORIS #2 (OBSW DGXX V4.0)
- **DORIS availability is 100%**

DORIS receiver is functioning nominally

- **DORIS performances**

- DOPPLER MEASUREMENT
 - mean value for noise is **4.2- 5.0 mm** (POE residuals, over a 10 seconds period)
- DORIS Time-tagging of PPS performances (used for altimeter data)
 - accuracy is **1-2 microseconds** as compared to on-board GPS (bus)
- Navigator (DIODE) performances
 - daily radial RMS : **3 to 5 cm**
 - daily 3D-RMS : **10 to 20 cm**

- **DORIS operations and DORIS beacon network**

- On board software upload (12-14 Sept.) and restart on Sept. 19th – No measurements during 4 hours
- Very good availability (~90%)
- 4 Master beacons since 2009



OSTM/Jason-2 SLR/LRA Status

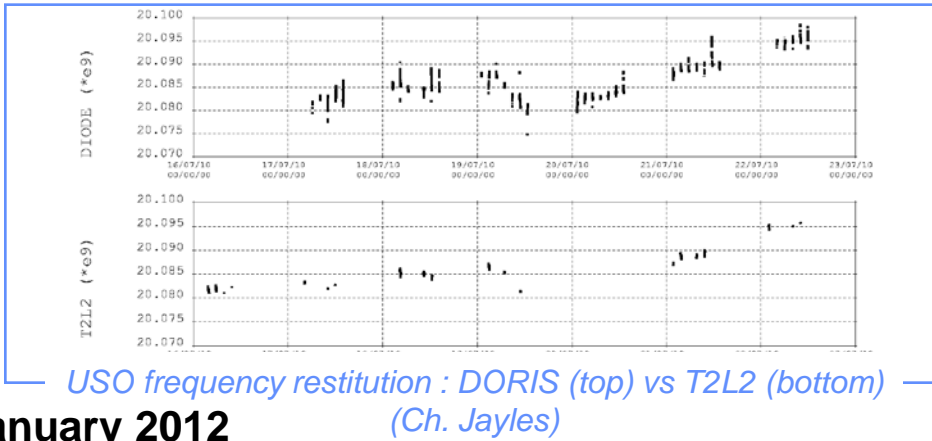
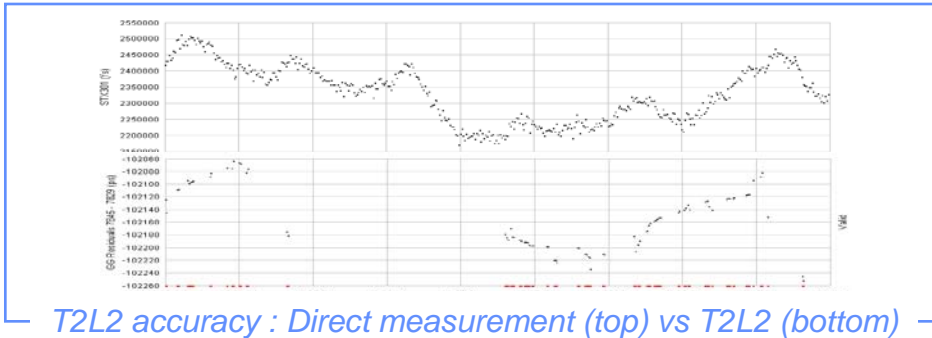
Summary:

- The LRA continues to provide returns adequate for tracking.
- SLR Tracking of Jason-2 has been nominal.
- LRA Returns are the same power as Jason-1.
- The top five stations for Jason-2 tracking are:
 - Yarragadee** (*Australia*)
 - Zimmerwald** (*Switzerland*)
 - Mt. Stromlo** (*Australia*)
 - Changchun** (*China*)
 - Graz** (*Austria*)



T2L2 : Time Transfer by Laser Link

- **Availability : 100%**
 - No new anomaly since June 2011.
- **Performance : Nominal**
 - No aging of the instrument
 - No degradation of the performances
 - Optical fiber : Loss of transmission due to radiations ~9% per year, no impact
- **Operations : Nominal**
- **Science : Level 4 products available since January 2012**
 - New assessment of T2L2 time transfer accuracy : < 200 ps
 - New comparison between T2L2 and DORIS : within 10^{-12} , **first independent validation of the DORIS USO frequency restitution.**



Instrument is still fully operational after more than 4 years of continuous operations, exploitation agreed until end of 2014



CARMEN-2 : to study the influence of space radiation on advanced components (a spectrometer and an Experiment Module "MEX")

• CARMEN-2 current configuration

- no change since last OSTST

• Availability :

- spectrometer 98%
- MEX 98% : 2 anomalies (communication loss between MEX and CARMEN-2 processors → instrument restart)

• Performances :

- Spectrometer: correctly calibrated, satisfies technical specifications (particles, energies) → *Several solar events have been well observed.*
- MEX: according to the experiments, good correlation between expected behavior and measurements. *Correlation with CARMEN-1 instrument in progress.*

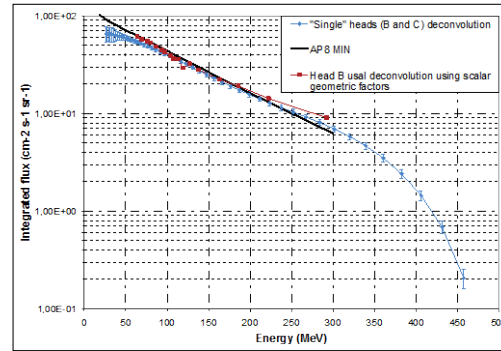
• Operations

- nominal

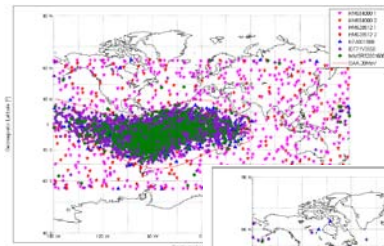
Instrument is performing well

Last year Activity: L-Diagram (Nb of magnetic field line versus time) for 86MeV protons & >1.6MeV electrons

IPSAT-V5,2b-SVN:379

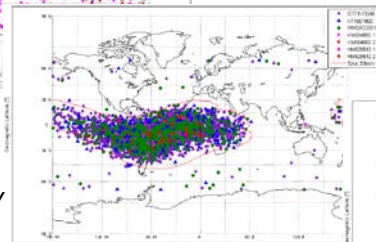


Improvement: Method of energy range extension

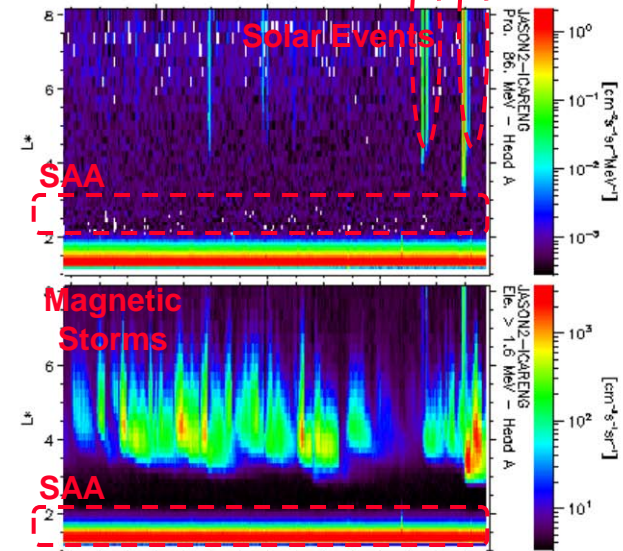
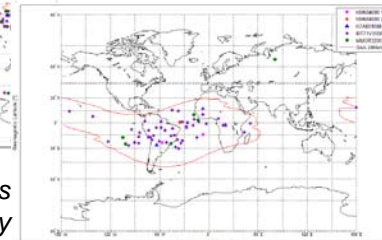


All errors

Upsets only



Multiple Upsets only



Data Processing (ex):
Mapping of errors observed on a memory under in-flight test



LPT : Light Particle Telescope (to measure radiation environment around the Jason-2 S/C : Electrons, protons, 4He particles)

Instrument is performing well since launch and is working properly

- **LPT current configuration**
 - No change
(trigger mode of ELS-B (electron sensor) changed in 2008)
- **Availability : ~100%**
 - 1 OFF/ON required on Nov '09
- **Performances :**
 - Observed radiation enhancement due to solar flare and magnetic storm.
 - Level 1 and 2 data in CDF format are available by user's request.
 - Level 2 data will be served in JAXA's website "SEES".
- **Operations :**
 - On September 5th, 2012, LPT is halting observation because of APS-A anomaly. It was probably due to a single event latchup. So JAXA is expecting LPT has no damage on its hardware and will be able to resume observation after a power-on operation.

