



CENTRE NATIONAL D'ÉTUDES SPATIALES

# HY-2A

## DORIS on HY-2A

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1 - *CNES, Centre National d'Etudes Spatiales, Toulouse, France*

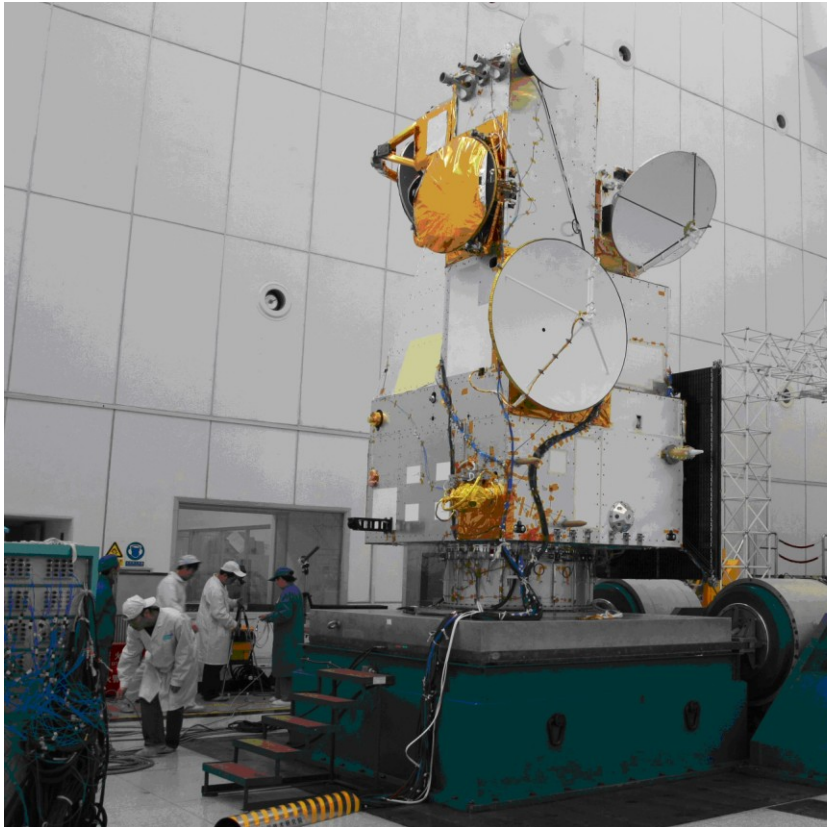
2 - *NSOAS National Satellite Ocean Application Service, Beijing, China*



## **French Chinese cooperation**

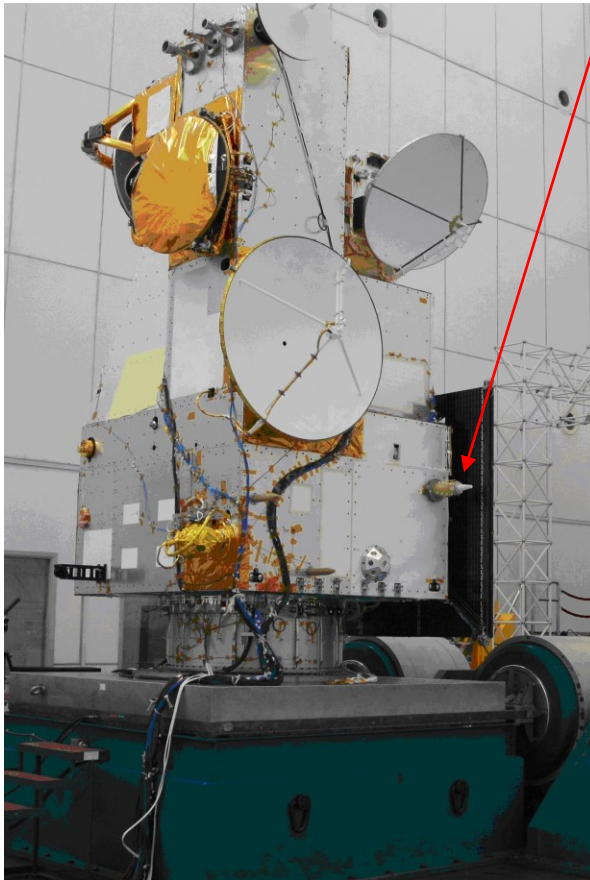
- **Hy-2A is Chinese spatial oceanographic mission**
- **Launcher and Satellite are under the responsibility of the CNSA and the NSOAS**
- **DORIS was purchase by the NSOAS to TSA**
- **The CNES is in charge of merging altimetry data in DUACS, of the DORIS data processing and the POD generation**

**The satellite (Chinese) is about 4m X 2.5m  
And the solar array is about 4.5mX2.5m**

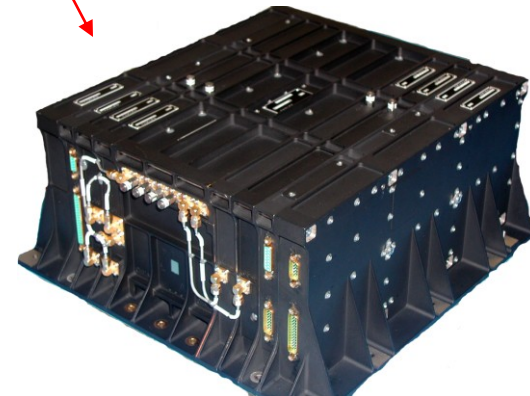


- A major Chinese oceanographic mission
  - ◆ Nadir Mission :
    - 3 frequency Radiometre
    - 2 frequency Altimetre
  - ◆ 5 frequency Radiometre
  - ◆ Ku-band scanning scatterometer
  - ◆ POD :
    - DORIS,
    - Precise GPS,
    - laser retro-reflector LRA

DORIS Antenna



DORIS BDR



## ***HY-2A Main Characteristics***

- ***Orbit : sun-synchronous***
- ***Attitude control : 3 axis stabilized  $<0.001^\circ/s$***
- ***Mass : ~1500 kg***
- ***Total Power : ~1200 w***
- ***Downlink frequency : X-band***
- ***TT&C link : S-band***
- ***Designed life time : 3 years***

## ***Scientifics Objectives***

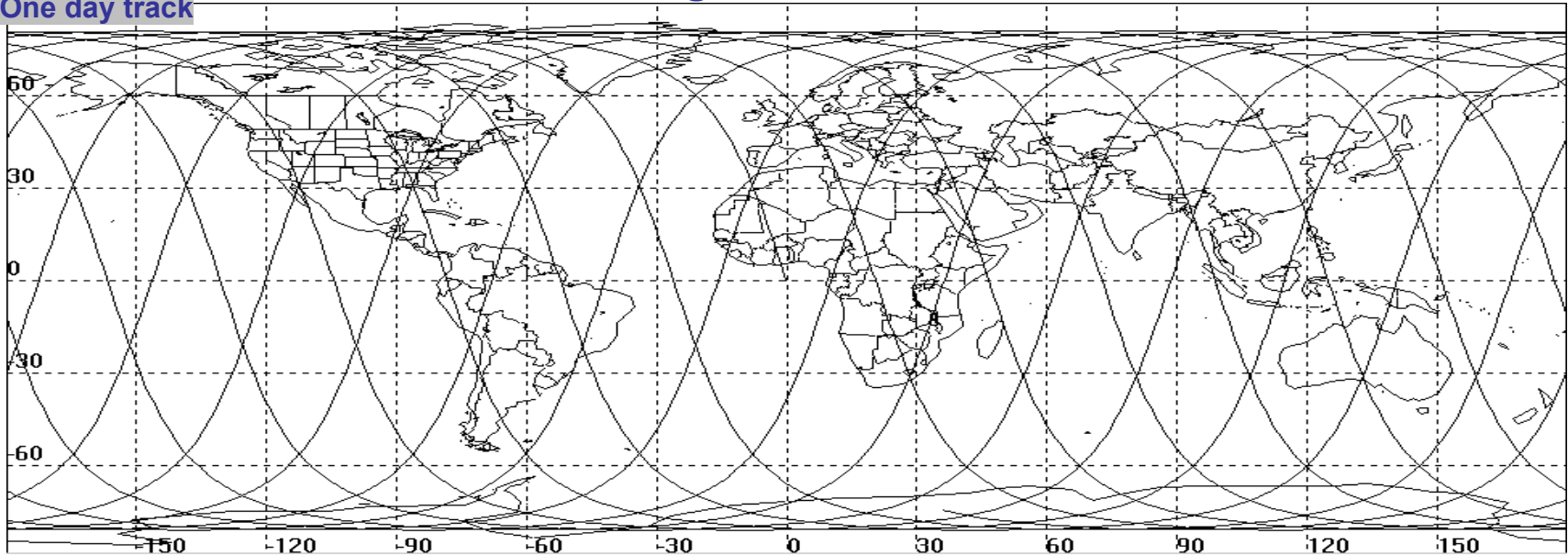
- ***Ocean mesoscale circulation;***
- ***Ocean dynamic environment and sea state monitoring;***
- ***Ocean operational forecasting and oceanography research;***
- ***Climate forecasting;***
- ***Ocean, Earth system and climate research;***
- ***Wind/wave measurements and associated research;***
- ***Marine dynamic environment parameters;***
- ***Marine environmental forecast.***

## Altimetry Orbit

For the first  
2 years

<b>Repeat cycle Days:</b>	<b>14</b>
<b>Half axis:</b>	<b>7341.732km</b>
<b>Average height:</b>	<b>970.732km</b>
<b>Inclination</b>	<b>99.34015°</b>
<b>Eccentricity rat</b>	<b>0.00117</b>
<b>Intersection period:</b>	<b>104.4560min</b>
<b>Cycle number :</b>	<b>193; 13+11/14 ring per day</b>
<b>Intercept in equator</b>	<b>207.64km</b>
<b>Descending time:</b>	<b>6:00 am</b>

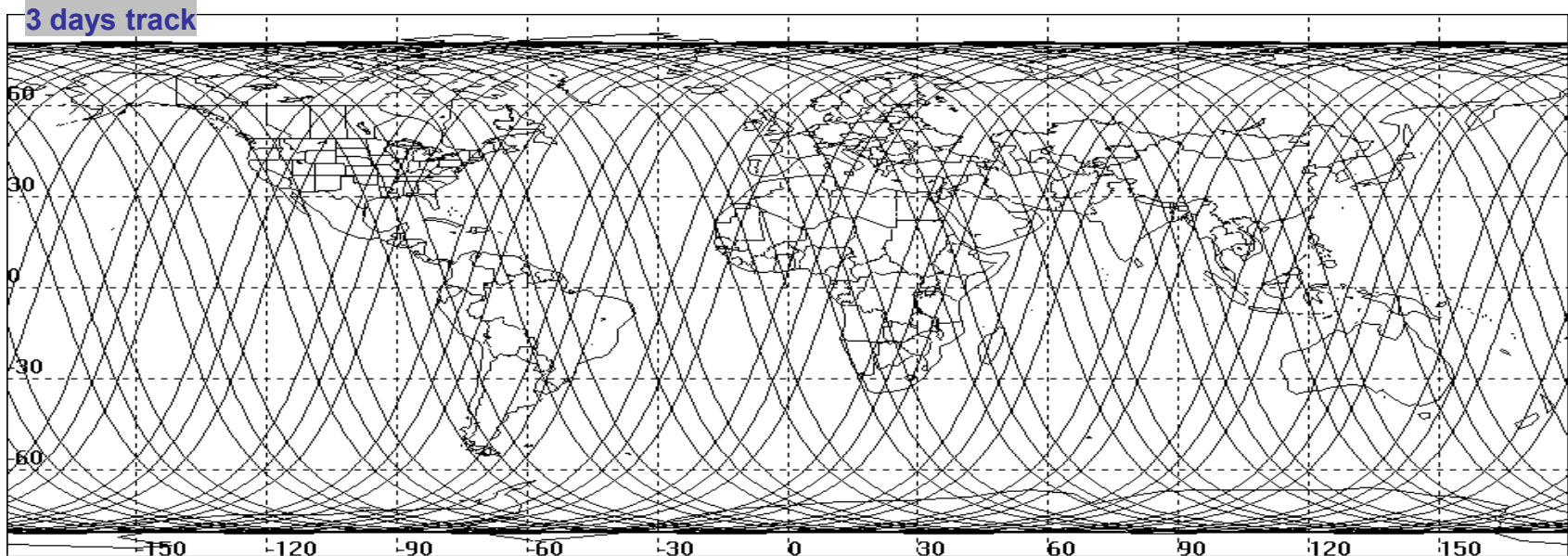
One day track





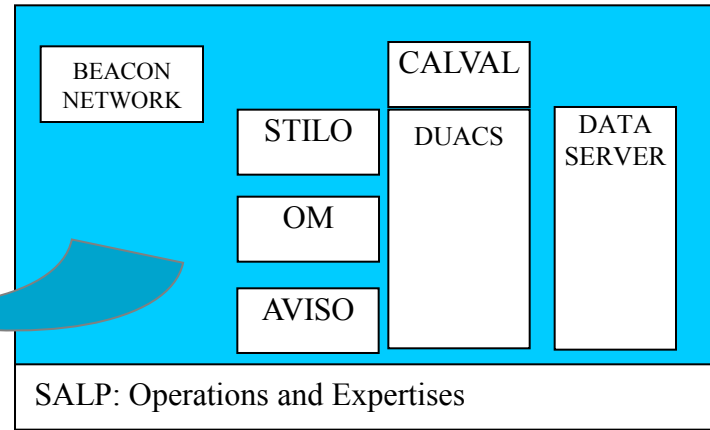
## Geodesic Orbit For the 3rd year

<b>Repeat cycle days:</b>	<b>168</b>
<b>Half axis:</b>	<b>7343.836km</b>
<b>Average height:</b>	<b>972.836km</b>
<b>Inclination :</b>	<b>99.34015°</b>
<b>Eccentricity rate:</b>	<b>0.00117</b>
<b>Intersection cycle:</b>	<b>104.5008min</b>
<b>Cycle number :</b>	<b>2315; 13+131/168 ring per day</b>
<b>Intercept in equator</b>	<b>17.31km</b>
<b>Descending time:</b>	<b>6:00am</b>





RINEX;  
MOE;POE for  
NSOAS



DORIS HY-2A  
Products

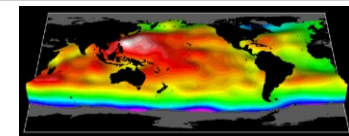
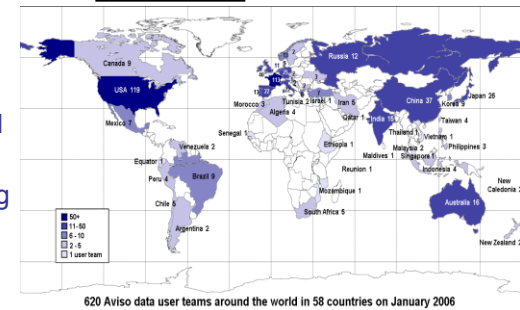


DUACS  
Products



- Data Centres
- Analysis Centres
- Analysis Coordination
- Products distribution
- Doris mail
- Doris report
- Analysis Forum
- Contribution to IERS/ITRF

- DORIS
  - ◆ Satellites Orbits
  - ◆ DORIS measurements and corrections
  - ◆ DORIS beacons positioning
- Altimetry products
  - ◆ Wave heights, wind speed (IGDR)
  - ◆ Geophysical data : altimeter measurements and corrections
  - ◆ Sea level anomaly

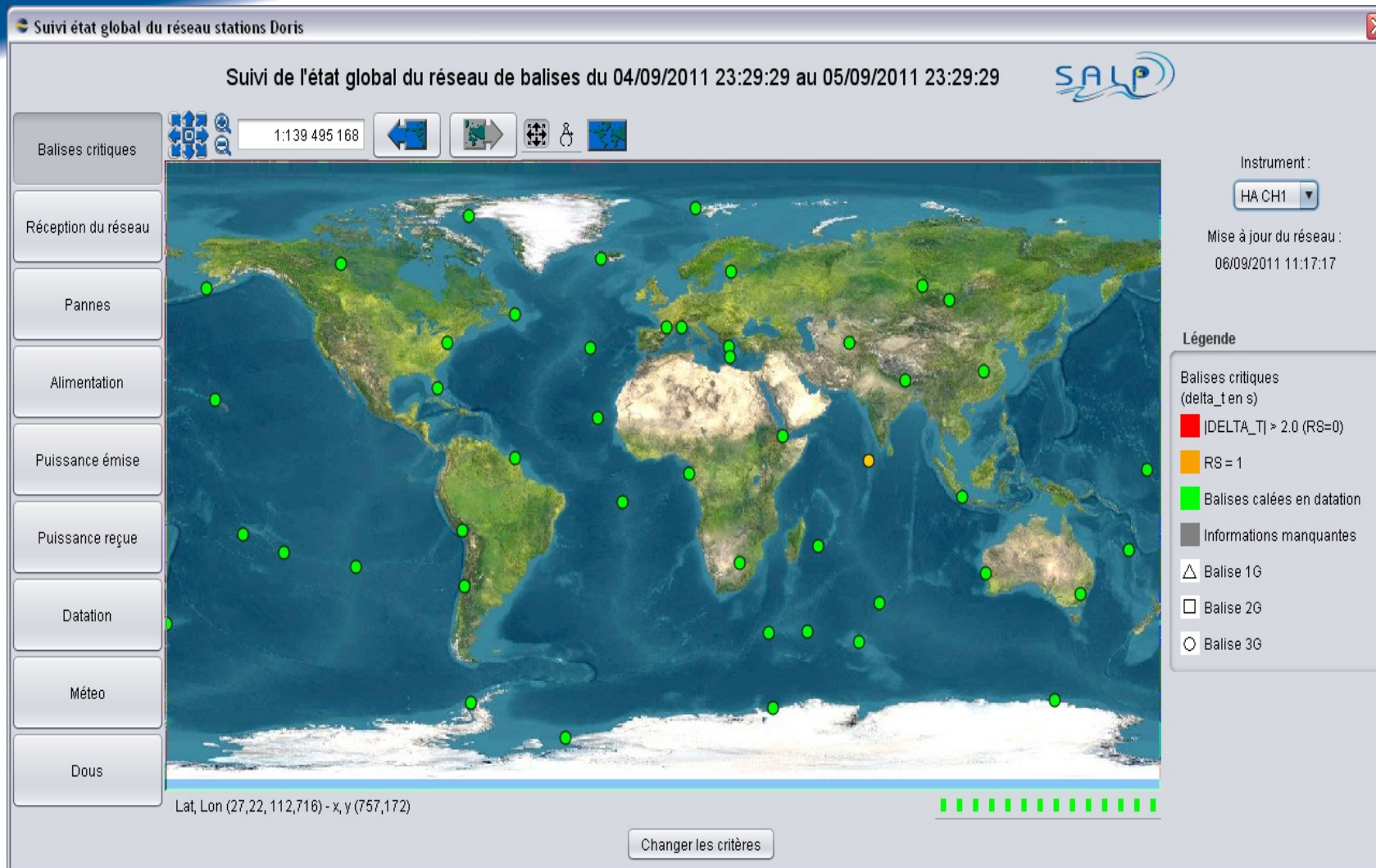


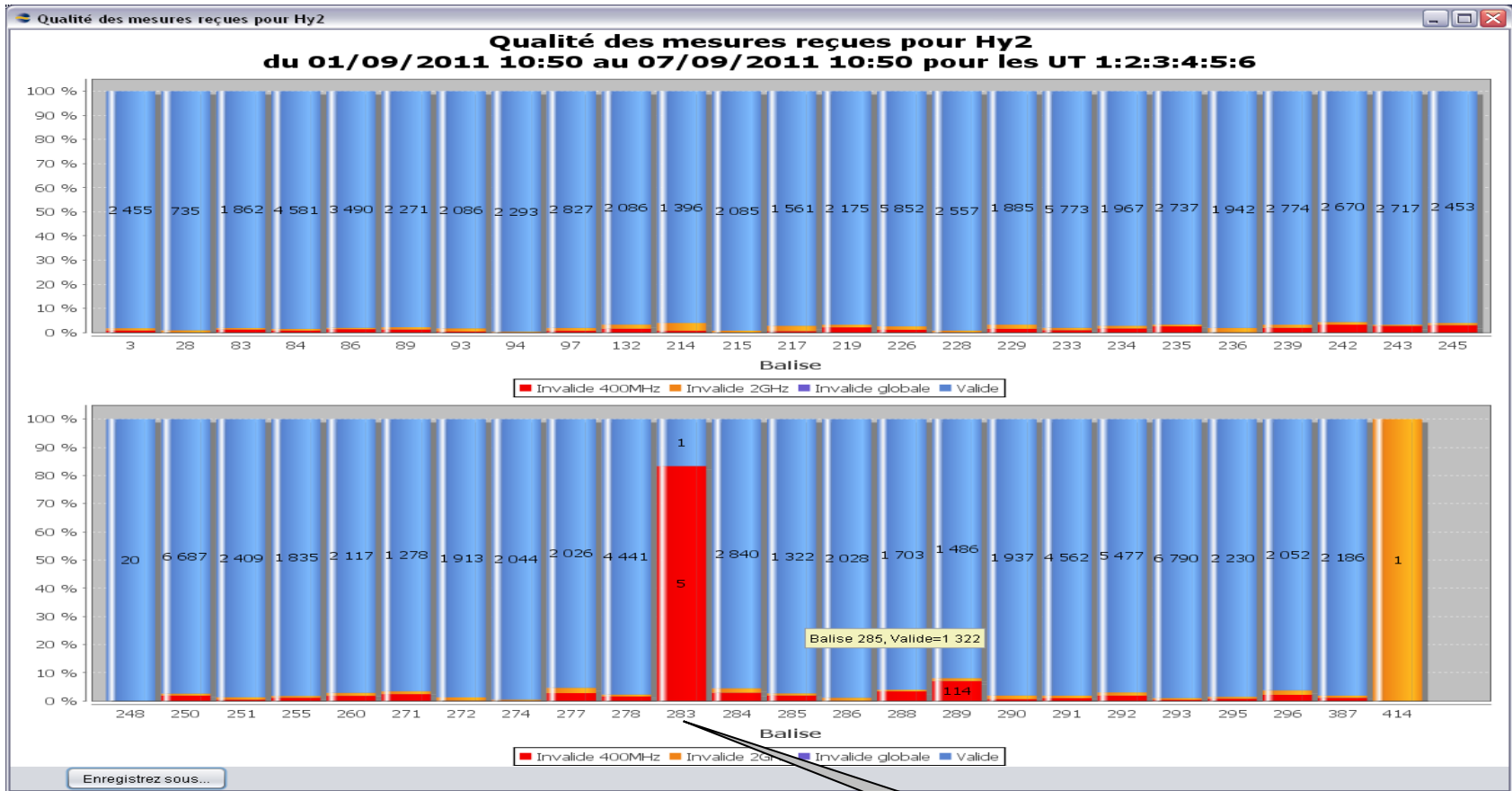
Launch with a “Long March” CZ-4B  
 August 15, 2011 at  
 22:57 TU



## Beginning of life .... short story

- **Launch August 15 2011 at 22:57 TU**
- **August 31, equipments turned on :**
  - ◆ Mass memory (240 Gb);
  - ◆ Precise GPS;
  - ◆ And DORIS (00h27 TU). **Complete Initialization in 4:29:58**
- **September 1, equipments turned on :**
  - ◆ X band telemetry;
  - ◆ Nadir altimeter;
  - ◆ Radiometer.
- **The first telemetry was received from NSOAS ground segment on September 1, dated August 31;**
- **Next day the CNES delivered the first DORIS RINEX et MOE to the NSOAS.**



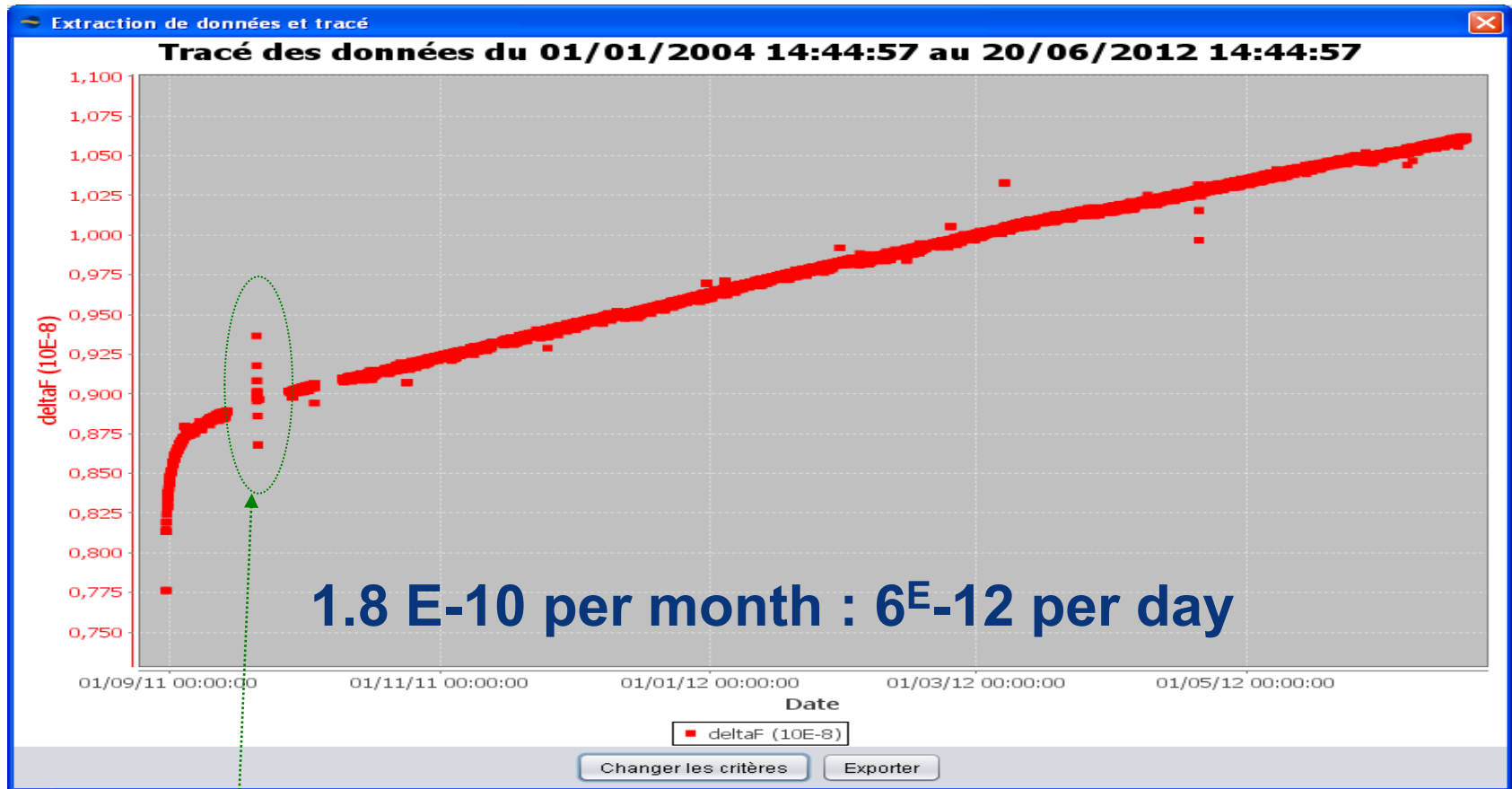


Rio grande :  
change of antenna

## Health of Doris on board

- **Analysis of the HKTМ shows that the instrument is in perfect health.**
- **The evolution of the estimated frequency of the USO is as expected (see next slide) .... and better.**

## Health of Doris on board



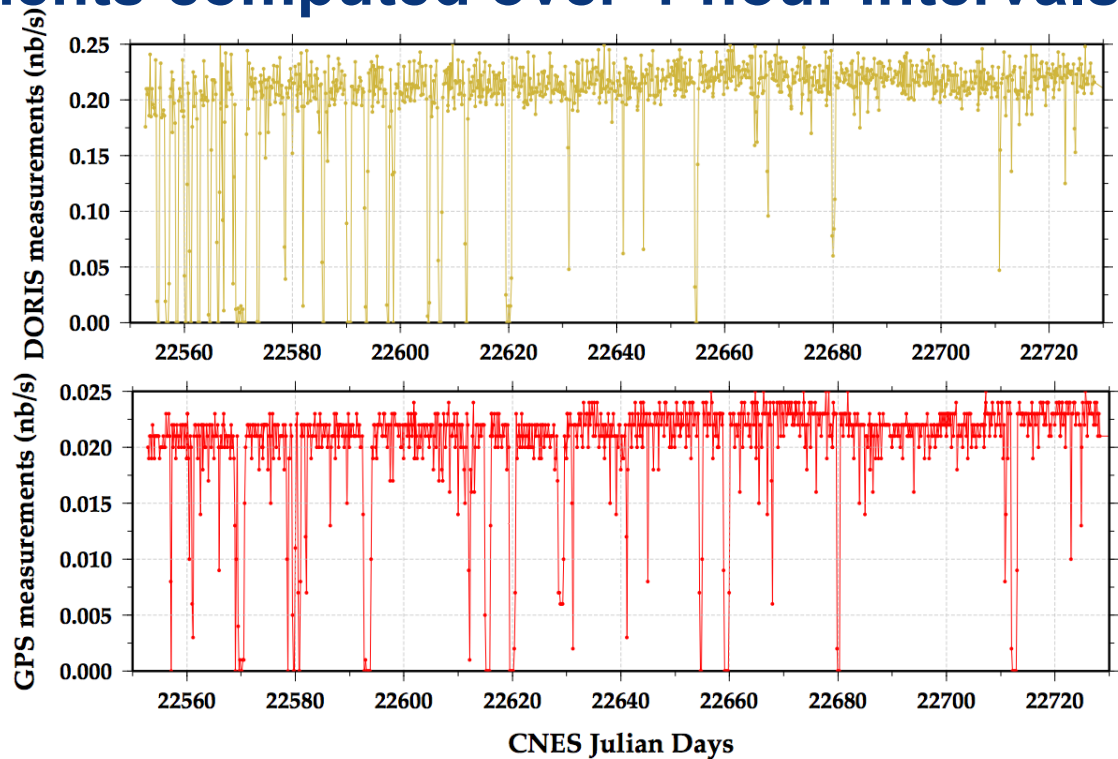
*Lack in frequency estimation due to a huge maneuver*



## DORIS and GPS Available Measurements

### ■ Number of measurements computed over 4-hour intervals\*

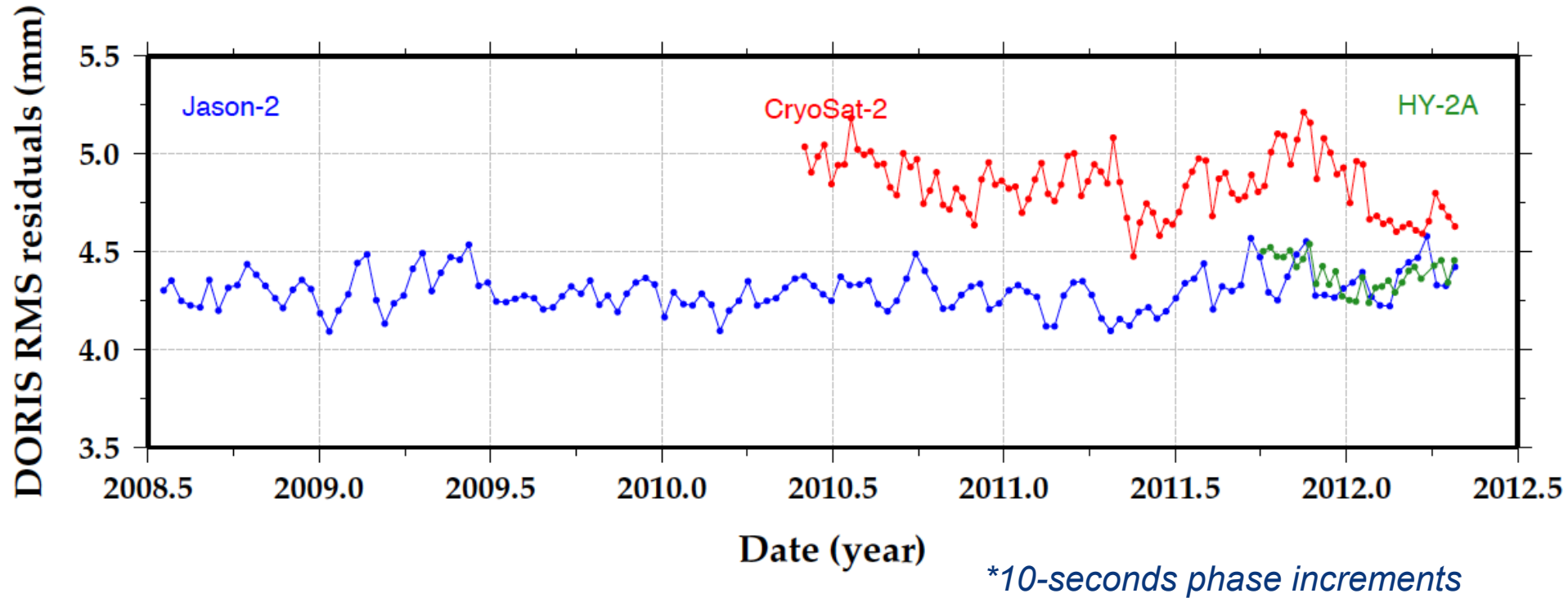
- ◆ Several gaps at the beginning of life of HY-2A
- ◆ Only five parameters estimated per day (1-cpr along-track, cross-track and a bias along-track)



\*Zero-density values mean 4-hour measurement gaps (more than two orbits)

# HY-2A DORIS Residuals Relative to Other Missions

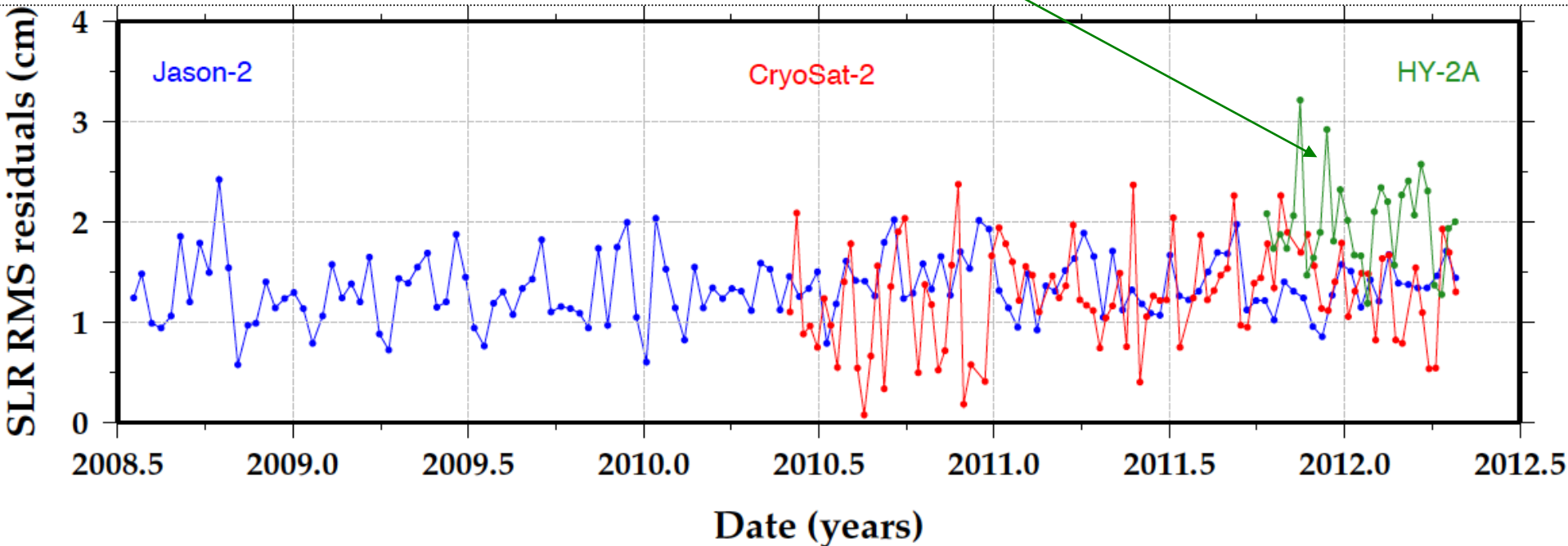
■ RMS of DORIS post-fit residuals\* on the GDR-D solutions



# Independent SLR validation of HY-2A DORIS-based orbit radial accuracy

- High elevation\* SLR reference stations residuals on DORIS-only solutions

*This offset may due to an misunderstanding on SLR phase center position*



*\*Above 70 degrees*

## **DORIS/HY-2A : IDS**

- **DORIS HY-2A data are available since march 6 , 2012**
- **The information was made by Doris email, march 5 , 2012**
- **The period of the delivered data starts on October 1 2011, arc 01, when HY-2A has reached a stable configuration (nominal attitude and orbit maneuvers completed)**
- **On IDS DATA Centers (CDDIS/IGN): at**
  - ◆ **<ftp://cddis.gsfc.nasa.gov/pub/doris/> and**
  - ◆ **<ftp://doris.eng.ign.fr/pub/doris/>**

## Mission auxiliaries DATA

**At the IDS ftp server:**

■ **HY-2A macromodels:**

<ftp://ftp.ids-doris.org/pub/ids/satellites/DORISSatelliteModels.pdf>

■ **mass & center of mass history file:  
h2amass.txt**

<ftp://ftp.ids-doris.org/pub/ids/satellites/>

■ **manoeuver history file: h2aman.txt at  
<ftp://ftp.ids-doris.org/pub/ids/satellites>**

## More information :

- **At the NSOAS :**

- ◆ [http://www.nsoas.gov.cn/NSOAS\\_En/index.html](http://www.nsoas.gov.cn/NSOAS_En/index.html)

- **At the CNES :**

- ◆ <http://smc.cnes.fr/HY-2A/>