CNES/CLS Analysis Center (LCA)
Status Report

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DATA ANALYSIS

Routine processing

The CNES/CLS AC (LCA) provides IDS Data Centers with the following products:

- weekly sinex (series wd24 and wd26, w/o and with Jason2 respectively)

- orbits for all the satellites

From October 2010 data,

- Jason-1 included in routine processing (but not in multi-satellite combination); orbits provided

- new naming convention adopted (lcaSATvv.bYYDDD.eyyddd.D_S.sp3.001.Z)

- new version of GINS used (10.3d1) including:
  - improved attitude models for Topex, Jason-1, Jason-2, Envisat
  - correction on frequency bias ajustment .

    (impact on orbits and vertical station positions)

Other products

Available at Data Centers for the whole Cryosat-2 period (starting from June 2010)

- Weekly multi-satellite series wd28 including Cryosat-2

In doris/products/sinex_series/lcawd/

- SP3 orbits for Cryosat-2

In doris/products/orbits/lca/cs2/

- Weekly single satellite SINEX for Cryosat-2, Spot-4, Spot-5, Envisat, Jason-2

In doris/products/2010campaign/lcawd/

Orbit residuals

[Doppler (mm/s)]

Spot4: 0.39
Spot5: 0.35
Jason2: 0.32
Cryosat-2: 0.35
Envisat: 0.38
Jason-1: 0.33

[Laser (cm)]

Cryosat-2: 1.0 - 1.5
Envisat: 1.0 – 1.5
Jason2: 1.5 – 2.5
Jason1: 1.5 – 2.5

JASON-2 « TWO-CHANNEL » LIKE

JASON-2 « two-channel like »

Purpose: process Jason-2 data using two channels and compare with using all channels.

Objective: ascertain if the strengthening in the determination of TZ is due to geometry (ie inclination), or the availability of more data, or both

Approach:

From the launch of *Jason*-2, in June 2008 up to February 2009, the both satellites *Jason*-1 (2 channels) and *Jason*-2 (7 channels) were on the same orbit with 55-second shift.

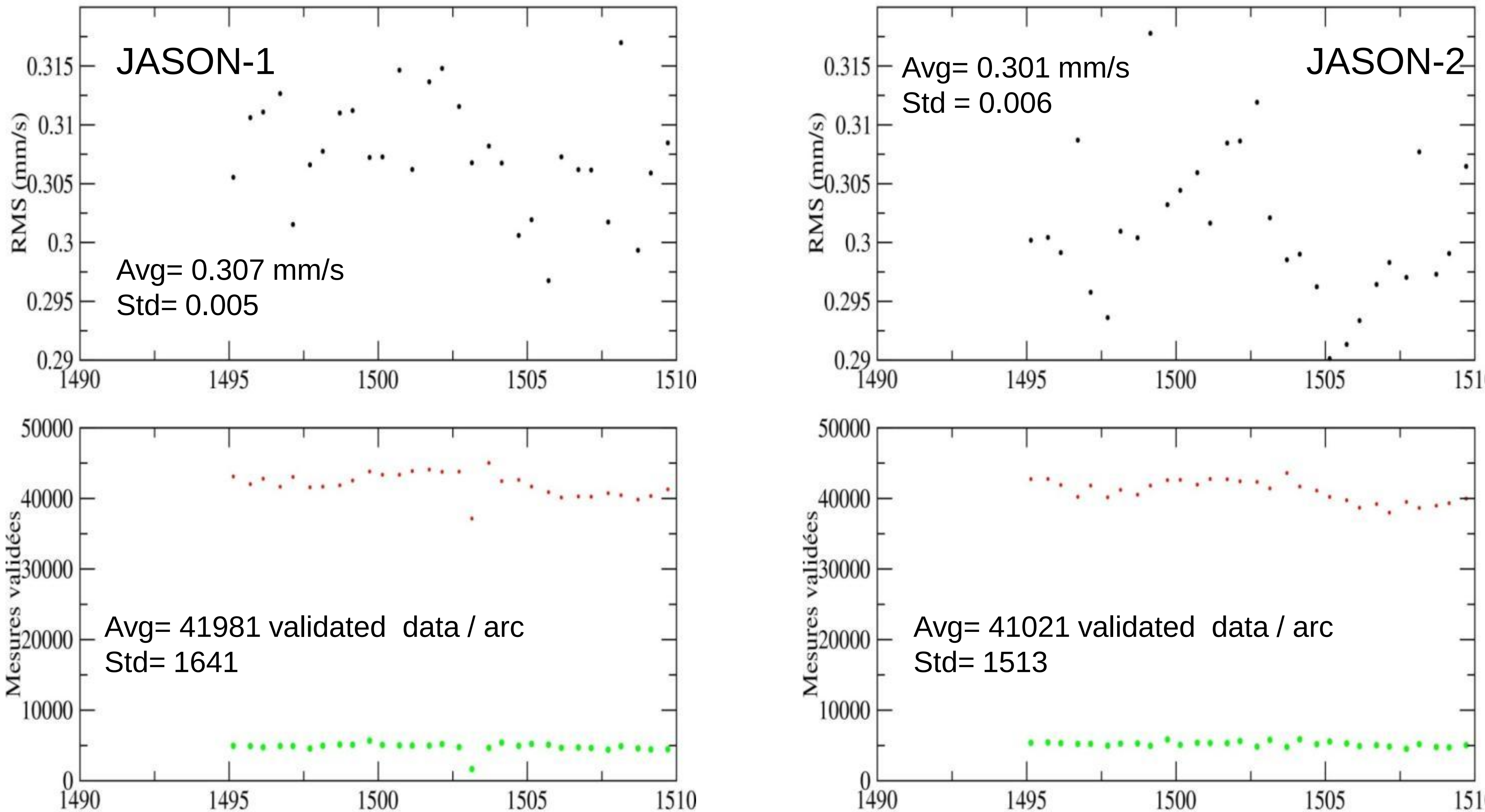
We use Jason-1's station acquisition sequence to select the data in Jason-2's files

Configuration processing: same as the routine processing (3.5-day arcs; cut-off angle 12 deg.)

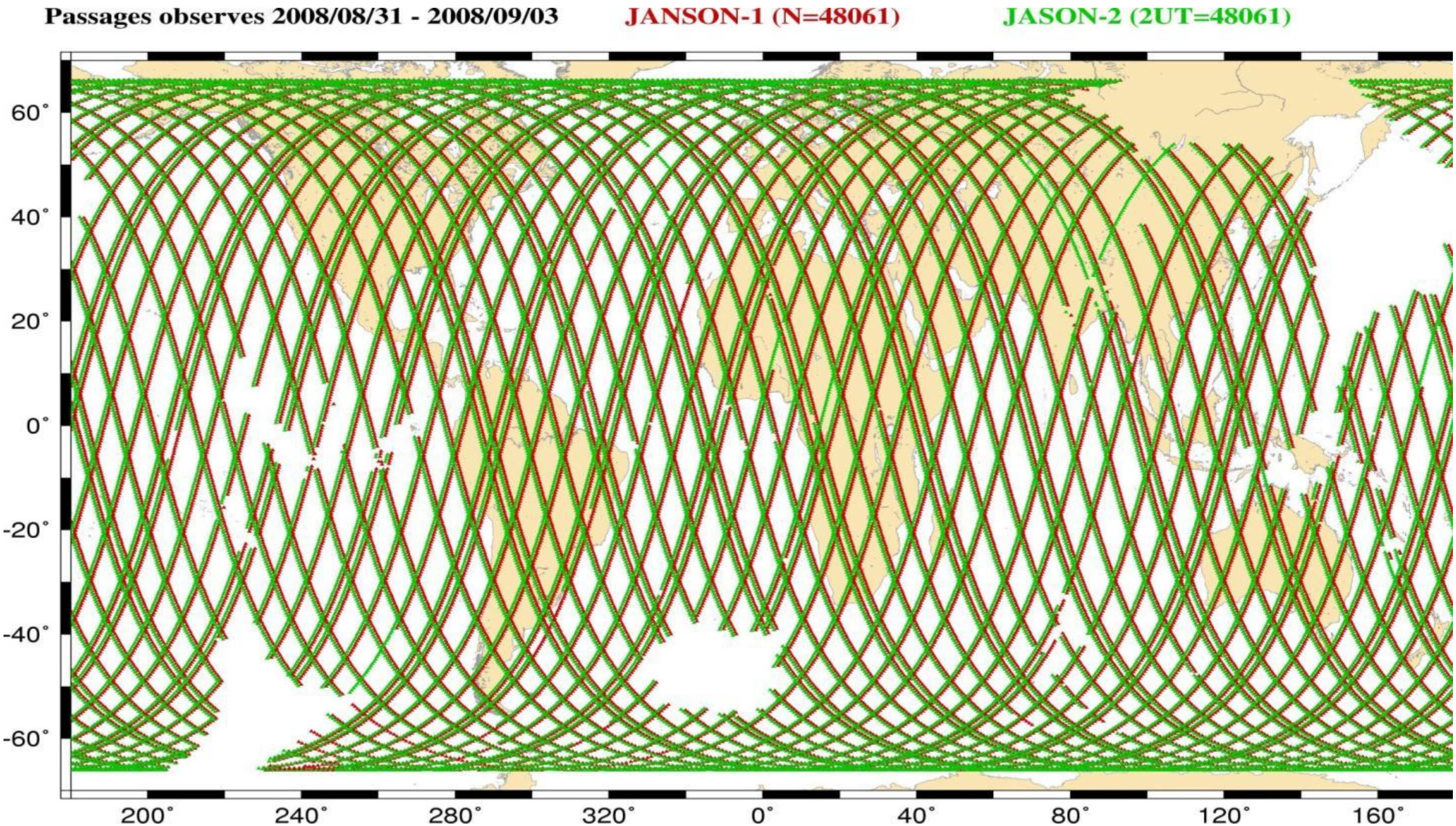
Period of study: September – December 2008

Results: Orbit →this presentation TRF → Guilhem Moreaux's presentation

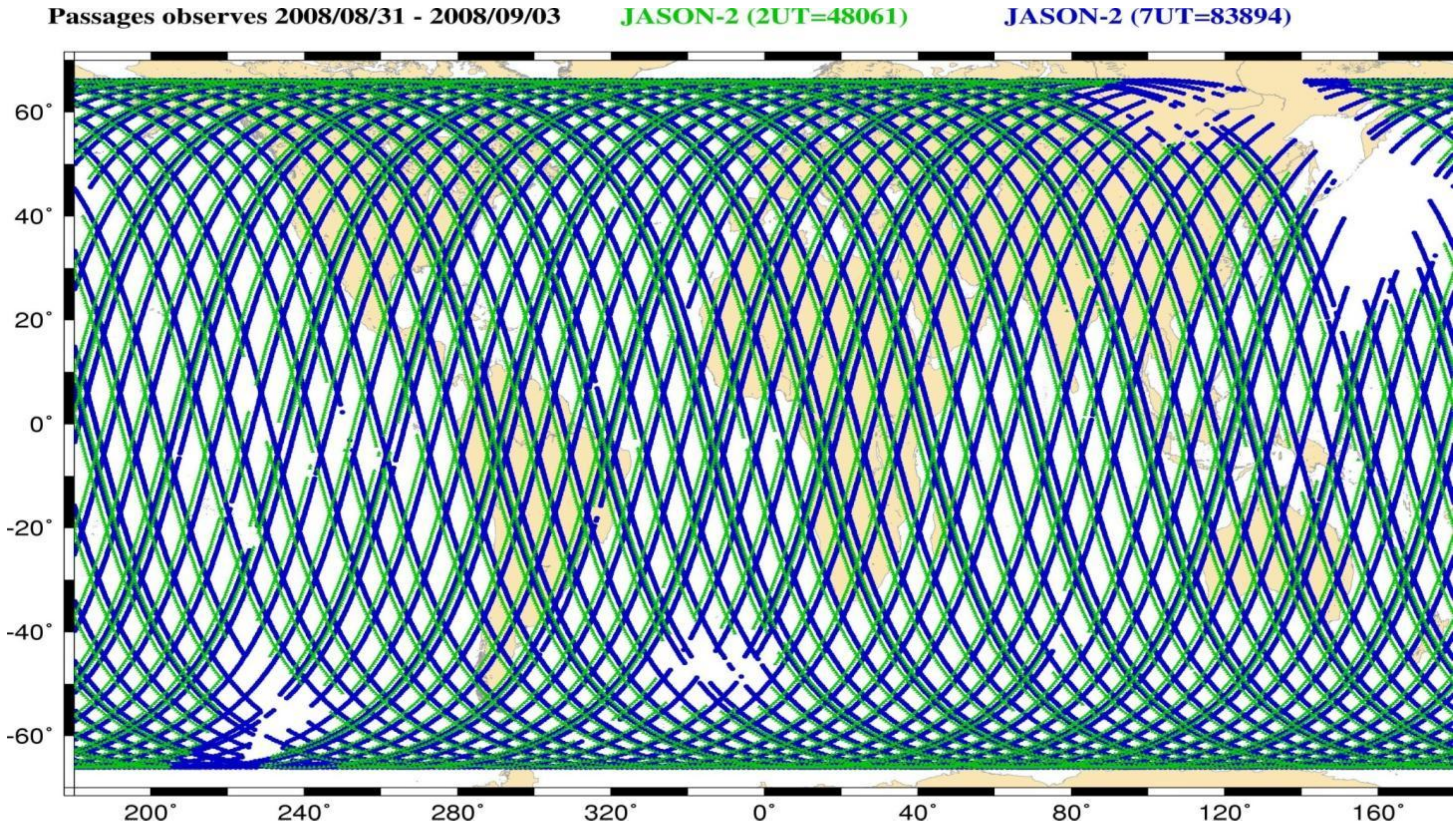
JASON-2 « two-channel like » vs JASON-1: data and orbit residuals



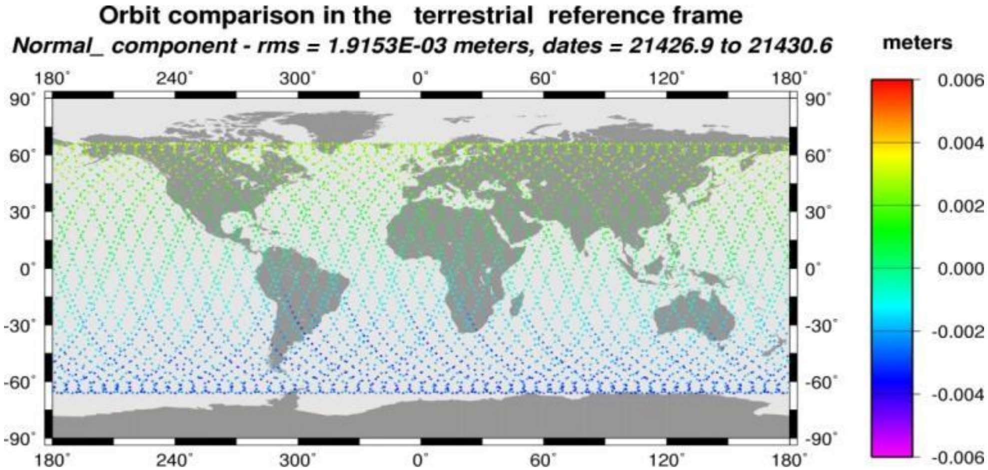
JASON-2 « two-channel like » vs JASON-1: valid data distribution

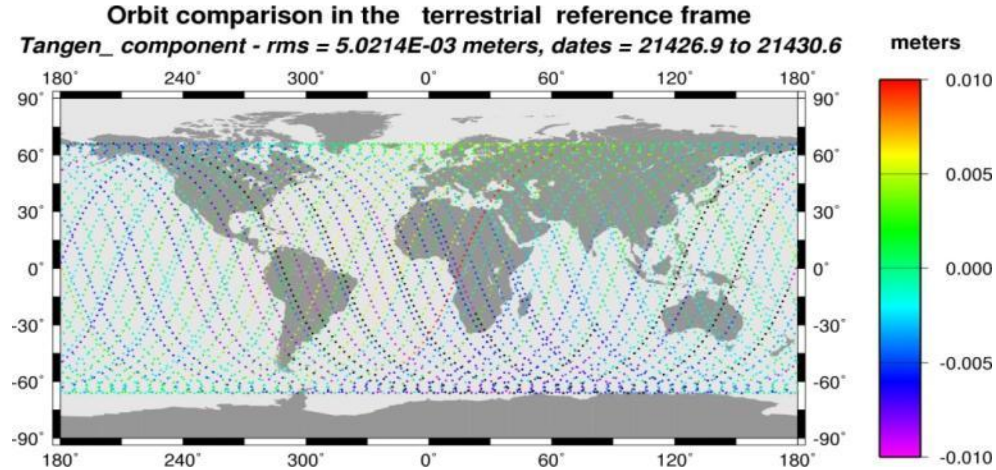


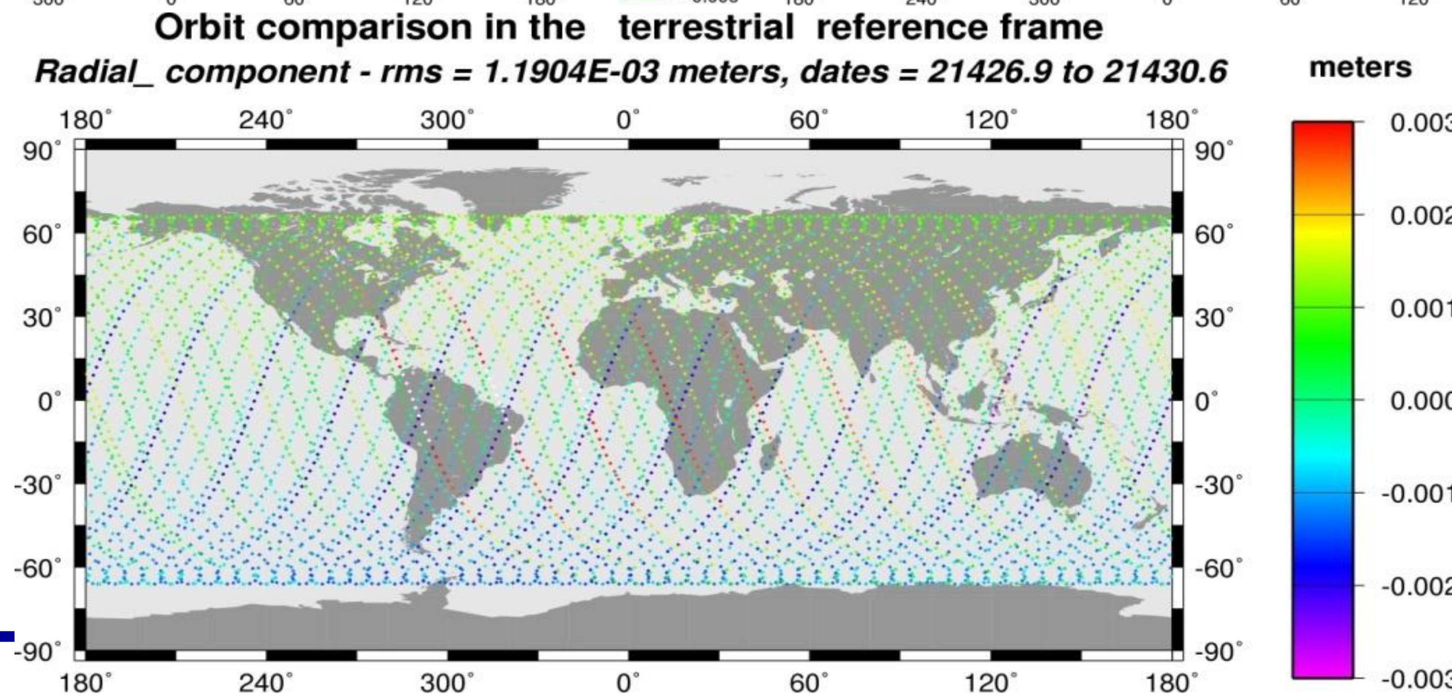
JASON-2 « two-channel like » vs JASON-2: valid data distribution



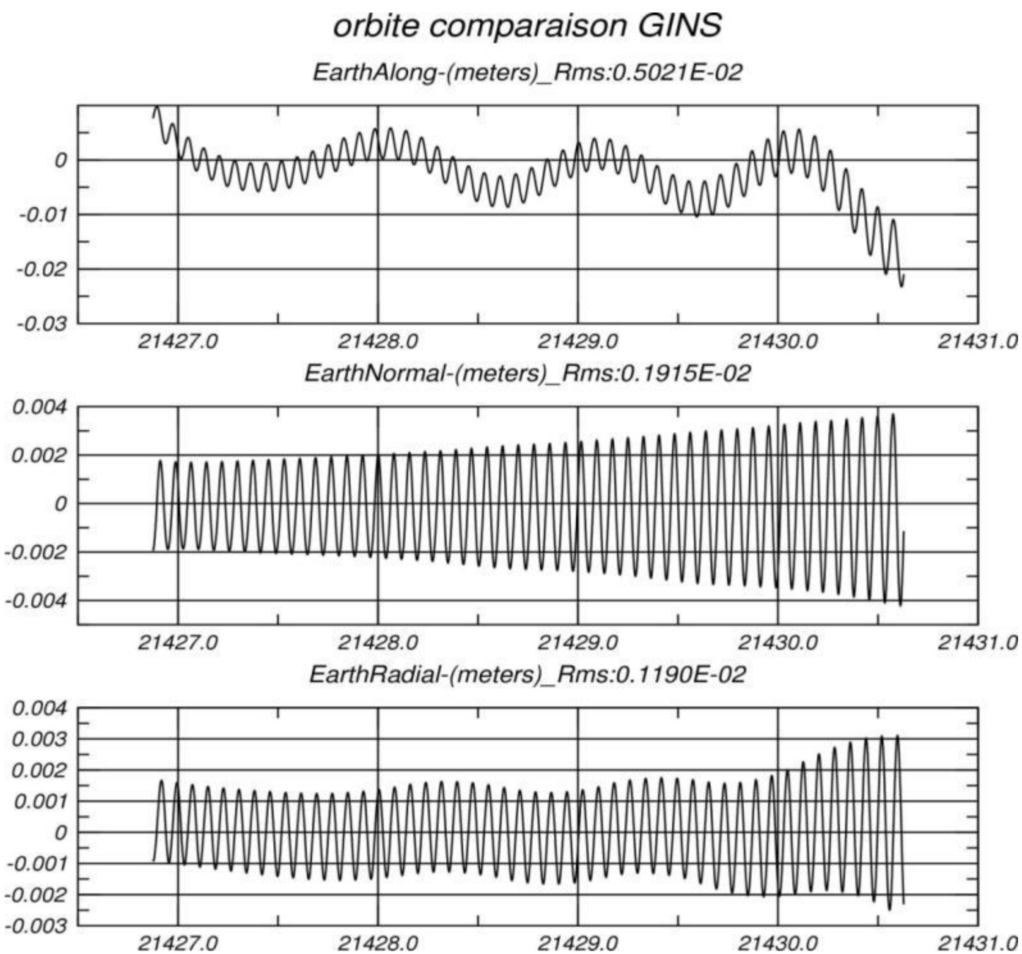
JASON-2 « two-channel like » vs JASON-2: orbit comparison







JASON-2 « two-channel like » vs JASON-2: orbit comparison



Statistics over 104 days (31/08/2008 → 13/12/2008)

Along-track: 9.4 mm RMS

Normal: 1.8 mm RMS

Radial: 1.8 mm RMS

←Comparison for a 3.5-day arc

MULTI-SATELLITE COMBINATION WITH JASON-1

JASON-1 processing

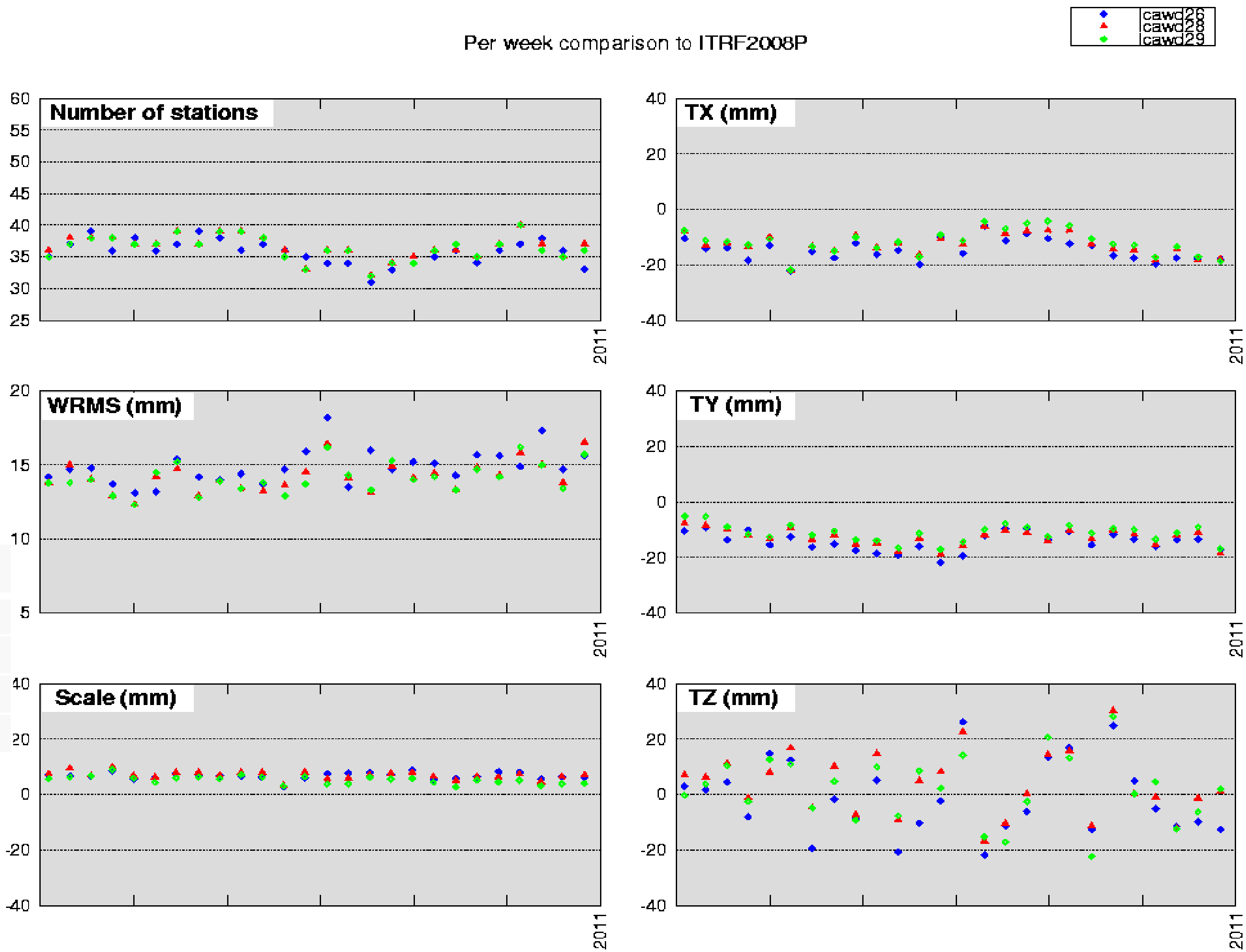
Same as for the other satellites

SAA corrective model applied

SAA station parameters renamed in the NEQ before stacking and so appeared as new stations in the weekly mutli-satellite solutions

JASON-1 in the combination

lca 26 (Env+Spot4+Spot5+Jason-2)
lca 28 (lca26+Cryosat-2)
lca 29 (lca 28 + Jason-1)



Statistics on last 6 months of 2010

	26	28	29
Scale	6.33 / 1.55	6.71 / 1.40	5.14 / 1.44
Tx	-14.86 / 4.01	-12.78 / 4.04	-11.70 / 4.48
Ty	-13.84 / 3.48	-12.44 / 3.15	-10.65 / 3.39
Tz	-2.70 / 13.24	3.00 / 11.20	1.19 / 11.57

+ Cryosat-2 ↓std
+ Jason-1 ↑std

SATELLITE ATTITUDE MODEL VALIDATION (EGU2011 POSTER)

Comparison of attitude model

To observe the behavior of the satellite due to its attitude motion, we compute the orbit ephemeris on one hand at the satellite mass center, and on the other hand at the reference center of one of the POD technique. The differences (calculated in RTN) between these two orbits will sign the attitude law.

These differences “mass center - reference center” are calculated with GINS orbits and also with ZOOM orbits.
The difference of the differences will show the agreement (or disagreement) between the attitude modeling of the two softwares.

ENVISAT
Orbit differences "center of mass - SLR optical center"

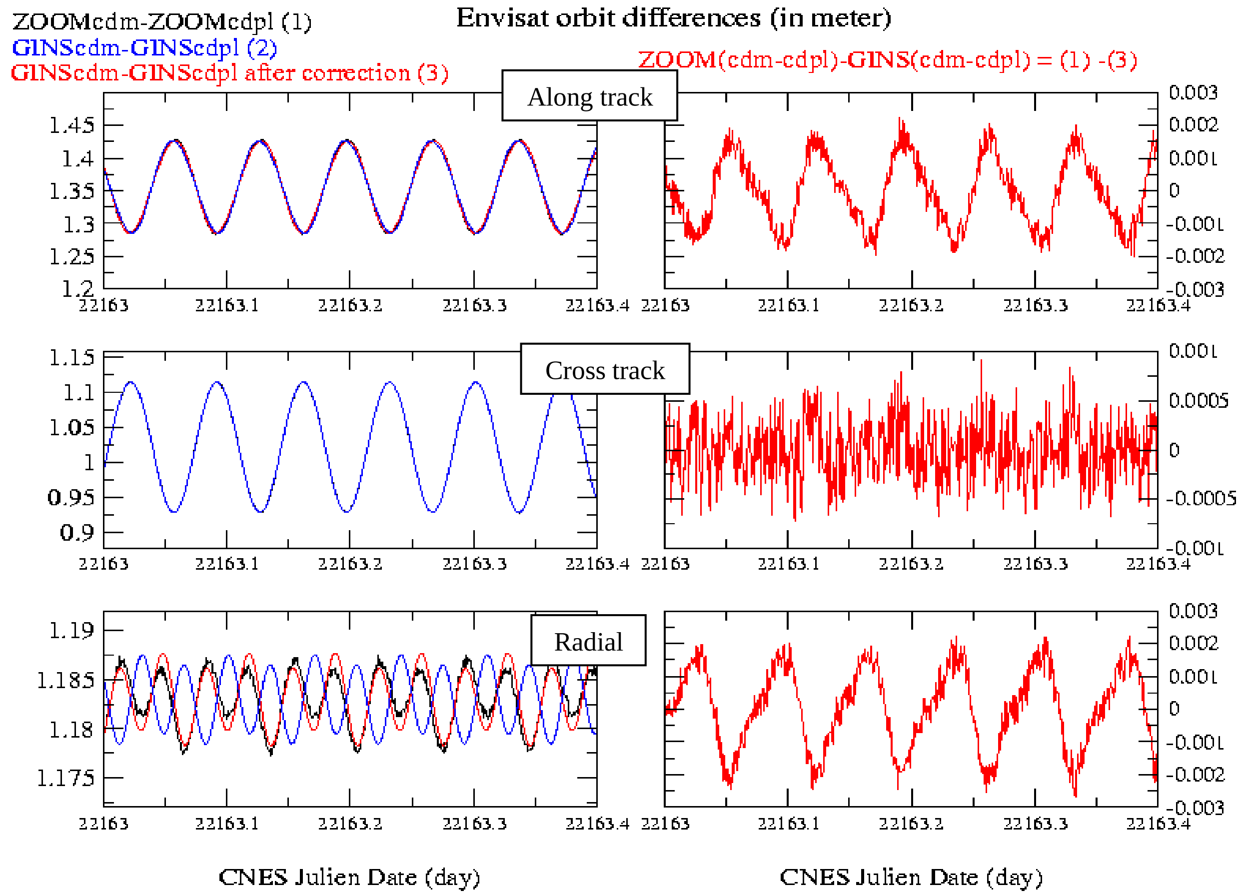
(Nominal attitude used)

<u>Left figures</u>:
-A phase shift observed in Radial between GINS (red) and ZOOM (black)

-Origin of the discrepancy identified (sign error in a rotation matrix) and corrected.

-after correction, better agreement between GINS corrected (red) and ZOOM (black)

<u>Right figures</u>:
-remaining differences are at a few mm level in Radial and Along-track

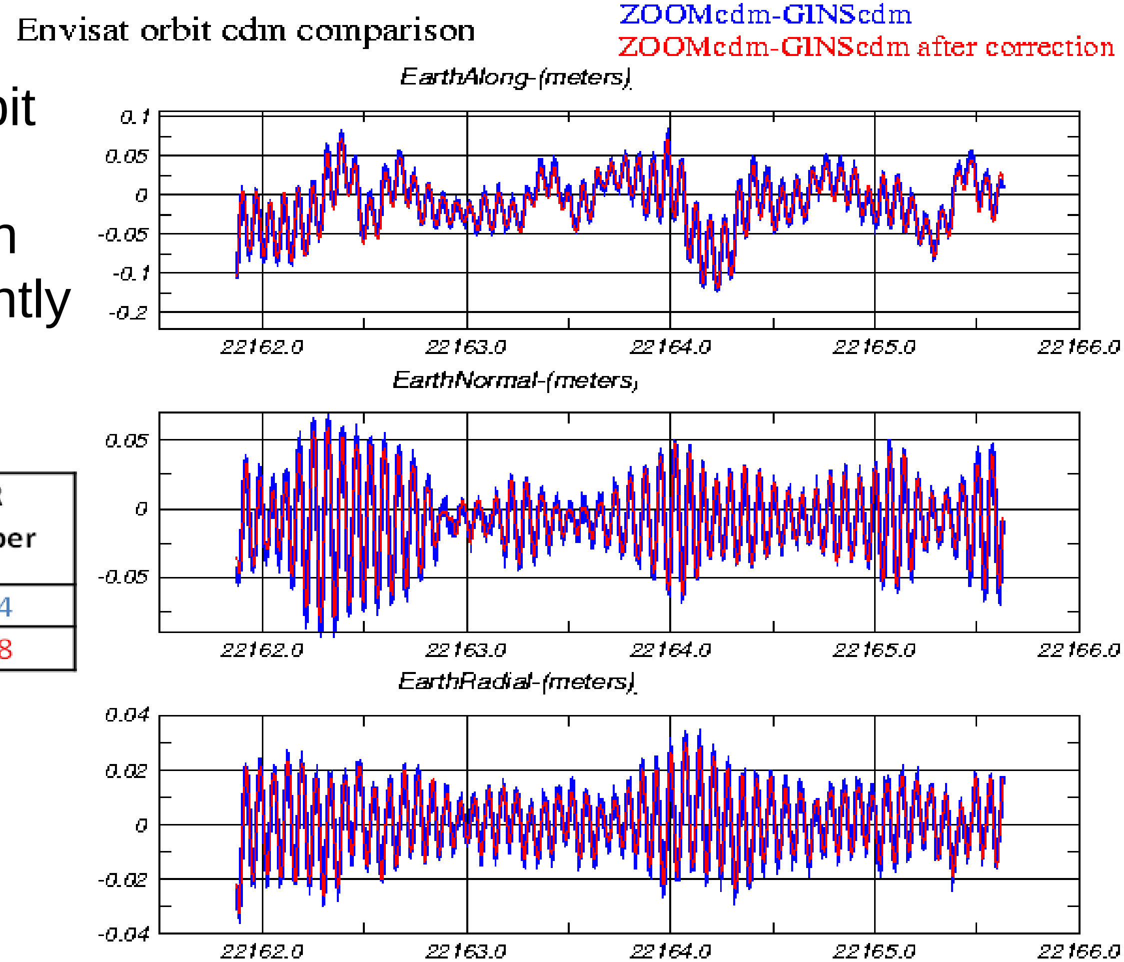


Cdm = center of mass
Cdpl = SLR optical center

ENVISAT
"center of mass" orbit comparison

A small improvement in GINS SLR orbit residuals is also noted (Table) but the classical mass center orbit comparison between ZOOM and GINS is only slightly changed (Fig.).

env S1600	DORIS RMS mm/s	DORIS Number	SLR RMS cm	SLR Number
Old model	0.378984	24766	1.7814	1494
New model	0.378598	24774	1.72	1498



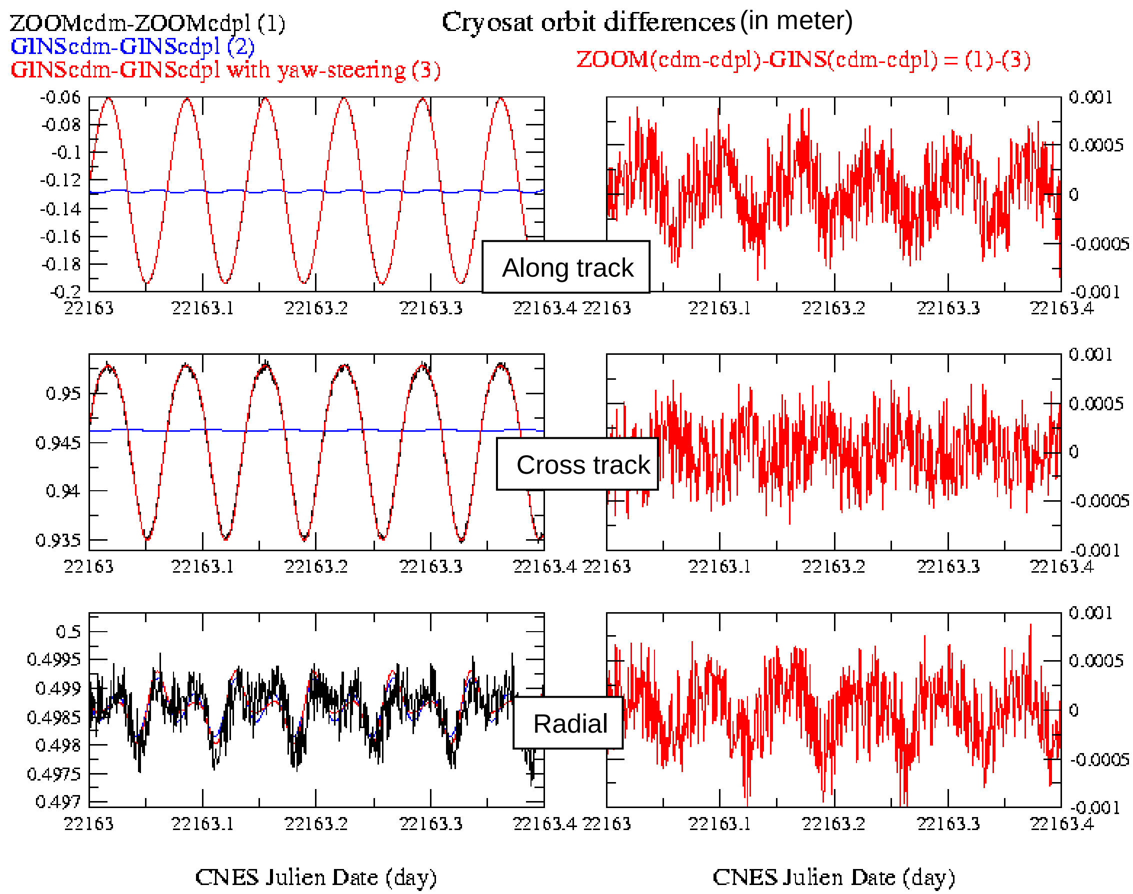
CRYOSAT-2
Implementation of the attitude model in GINS

The development of Cryosat-2 attitude model in GINS is based on the description given in CNES and ESA documents. It was implemented in 2 steps.

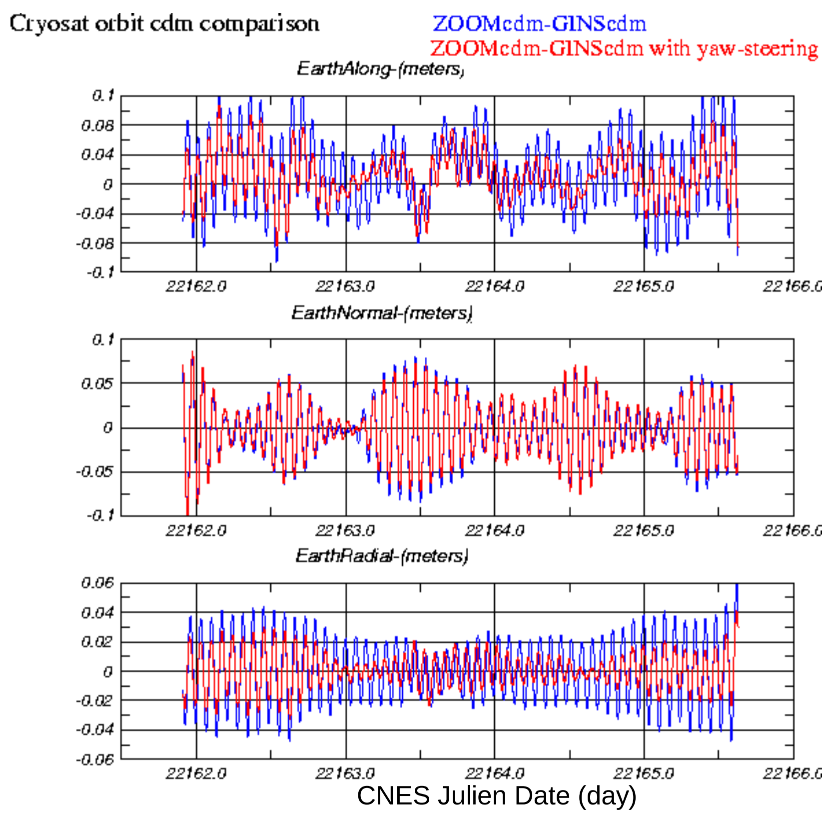
First version: only nose down configuration.

Second version: 4-degree yaw-steering added

CRYOSAT-2
Orbit differences "center of mass - GPS phase center"



CRYOSAT-2
"center of mass" orbit comparison



Arc cs2 S1600	DORIS RMS (mm/s)	DORIS Number	SLR RMS (cm)	SLR Number
without yaw-steering	0.356594	27009	1.9119	1143
with yaw-steering	0.351147	26991	1.7078	1141

BACK-UP SLIDES

JASON-1

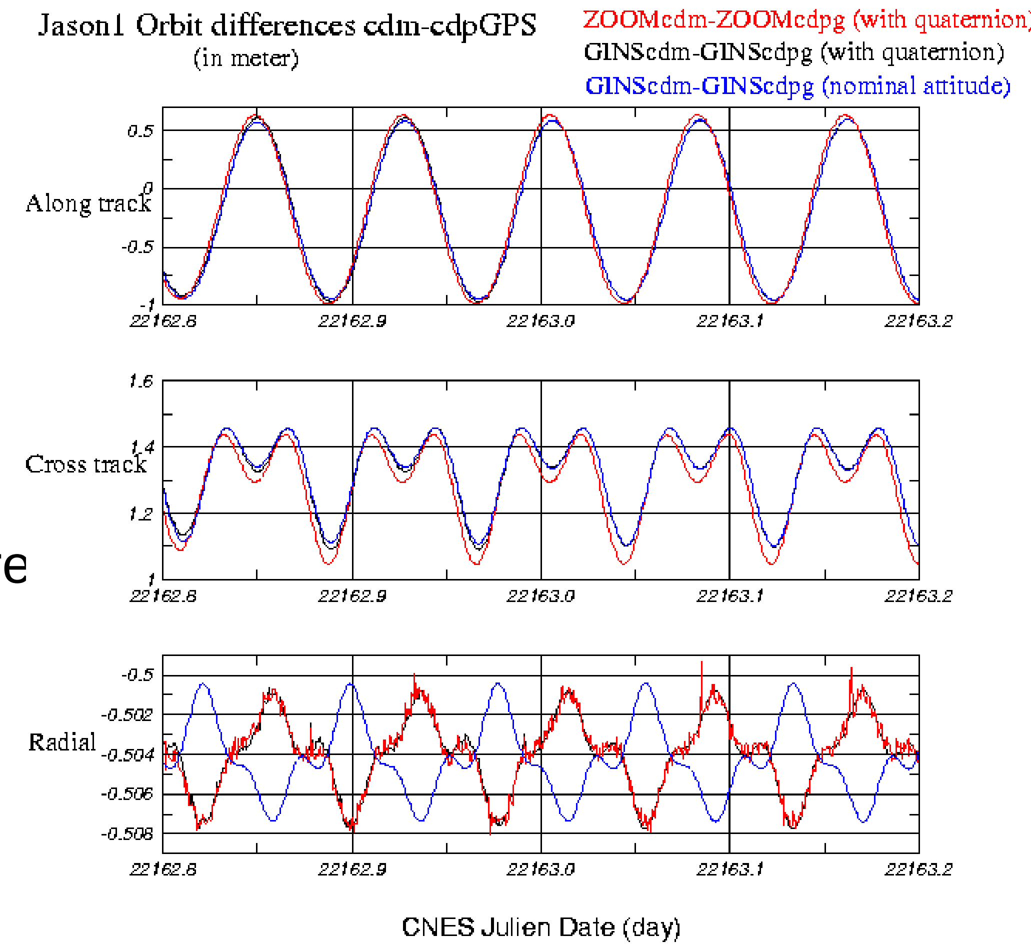
ZOOM: quaternions used (red)
GINS: nominal attitude (blue) or quaternions (black)

<u>First comparison</u>

- a phase shift is observed in Radial between GINS and ZOOM when the attitude model is used in GINS, but there is none when the quaternions are used

-discrepancies in Cross-track and Along-track

→ Origin of the discrepancy identified (sign error in a rotation matrix) and corrected.

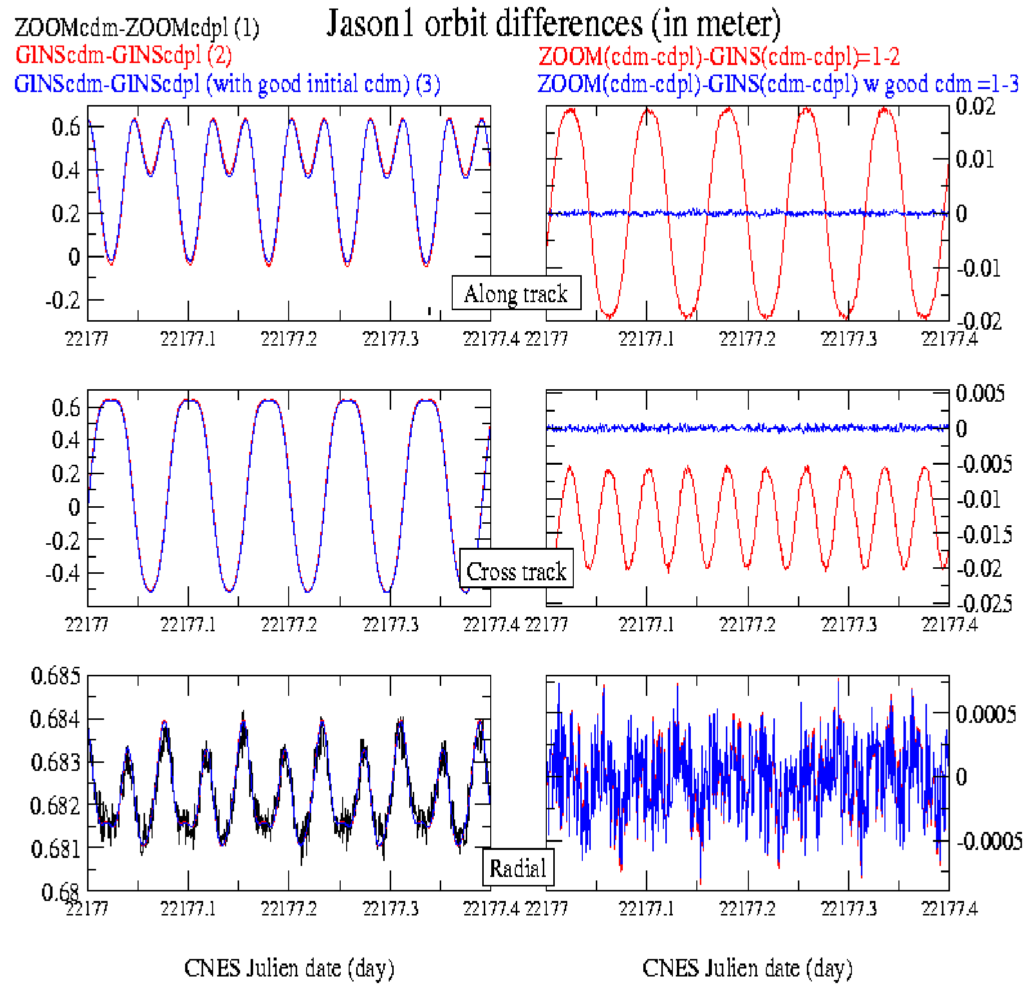


JASON-1

<u>Second comparison after attitude correction</u>
- the phase shift on radial component has disappeared thanks to correction
- but remaining discrepancies in along- and cross-track components (red curves; right)

→Change of the initial coordinates of the mass center (2-cm difference on X component)

(See impact on blue curves on right figures after change)

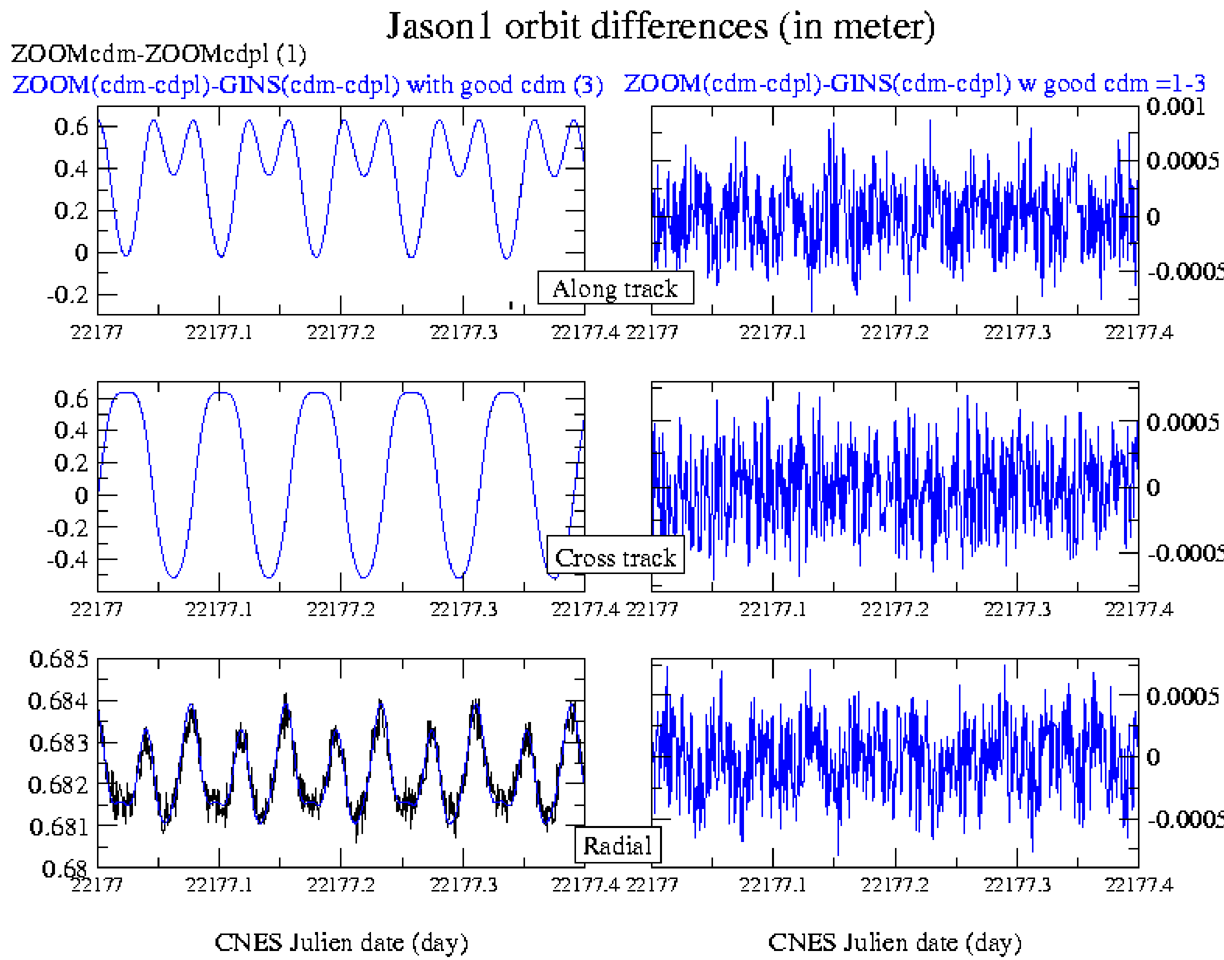


JASON-1

<u>Third comparison after mass center change</u>

-discrepancies on along and cross track components are removed after change of mass center coordinates.

-remaining differences between GINS and ZOOM attitude models lower than 1mm for the three components.



JASON-2
Orbit differences "center of mass - GPS phase center"

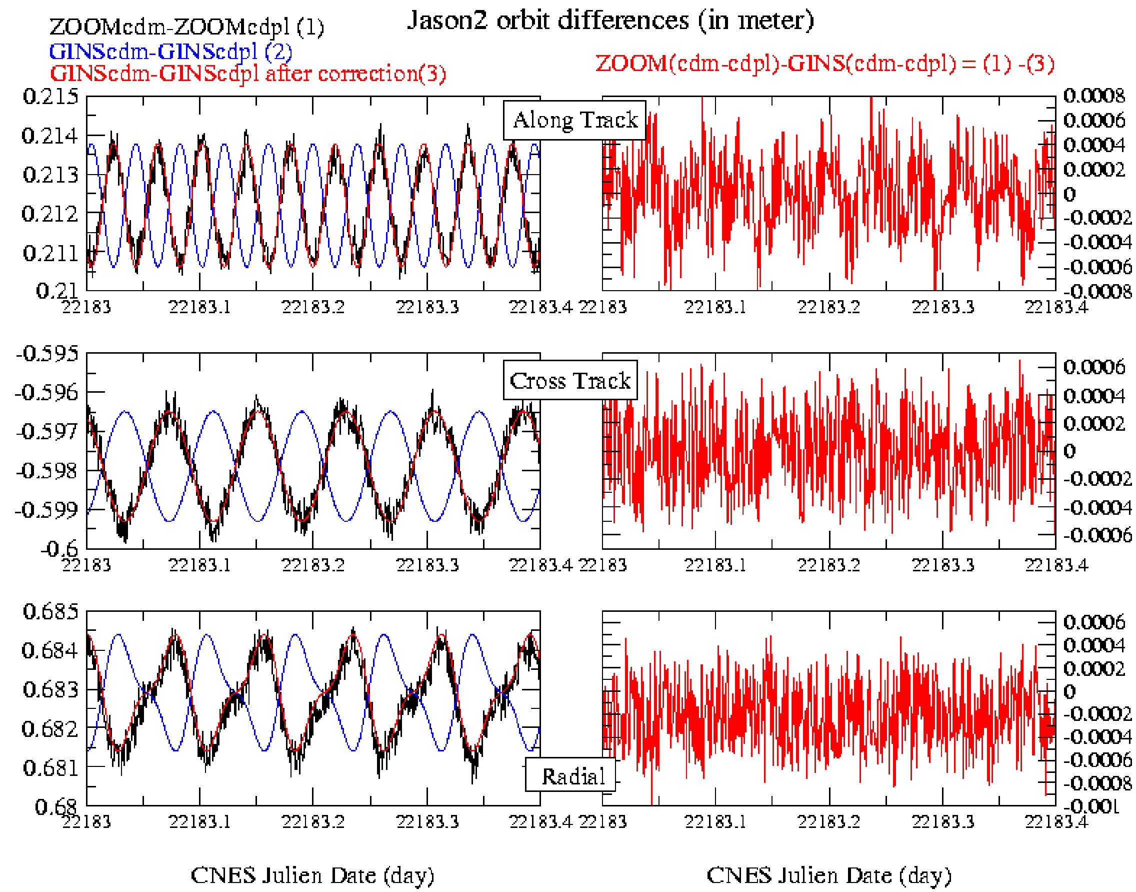
Orbit differences center of mass (cdm) and GPS phase center (cdpg) on RTN components for:

-ZOOM with quaternion/nominal attitude (black curve)

-GINS with nominal attitude (blue curve) and GINS with nominal attitude corrected (red curve)

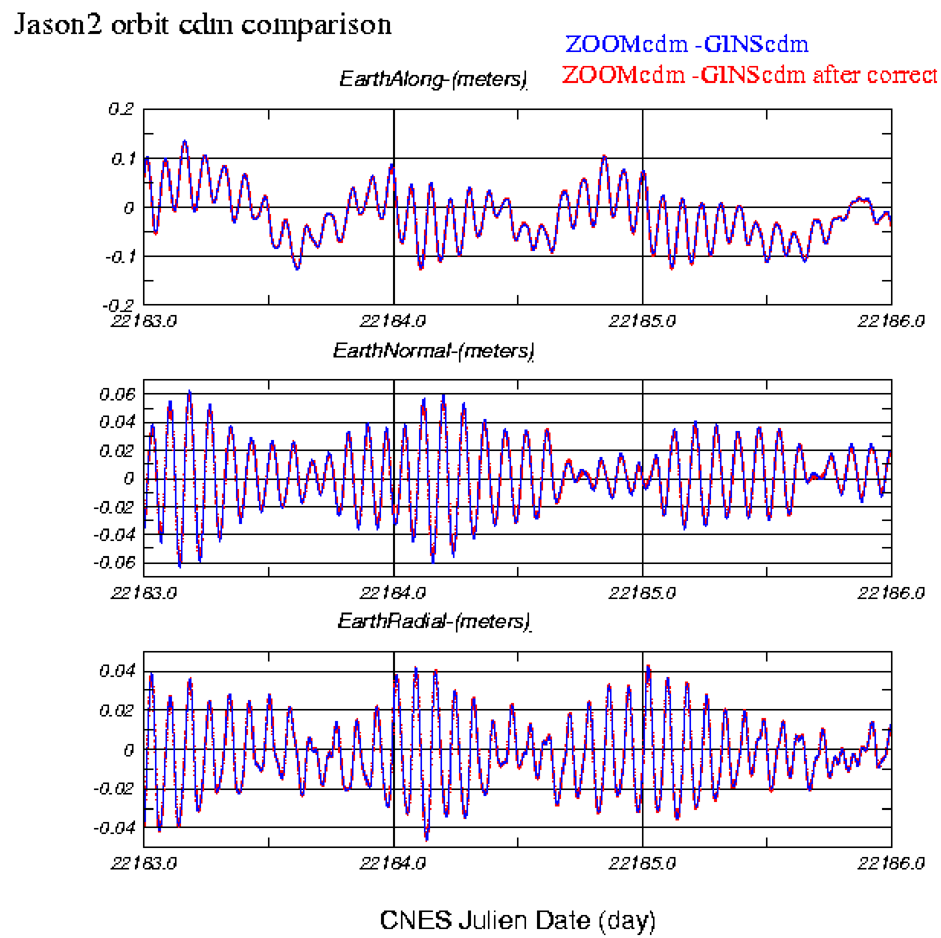
GINS orbits computed with nominal attitude, shows a phase shift on the radial component which we corrected (see red and blue curves).

After correction, GINS and ZOOM are consistent (black and red curves)



JASON-2
"center of mass" orbit comparison

Comparison between GINS and ZOOM When we compare orbit cdm GINS with orbit cdm ZOOM with and without correction in the model attitude we have similar results. It's very difficult to see this kind of error in a classical orbit comparison or/and in the residuals orbit



Ja2 S1603	DORIS RMS mm/s	DORIS Number	SLR RMS cm	SLR Number
Old model	0.333761	49647	1.5657	2062
New model	0.333570	49642	1.5734	2065