Reprocessing from CNES/CLS IDS Analysis Center for the contribution to the ITRF2013

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ITRF2013 REPROCESSING

Standards and Models

Gravitational forces:

Geopotential: EIGEN-6S2.v2.extended (with trend terms)

Ocean tides: FES2012

Atmospheric gravity: 3hr ERA-interim / ECMWF up to degree 50

(Atmospheric tides: none; considered through the ECMWF atmospheric data)

Non tidal oceanic gravity: TUGO R12 up to degree 50

Third body: JPL DE421 *(IERS conventions 2010)*

Non gravitational forces:

Atmospheric drag: DTM 2012

Geometry:

Troposphere: GPT2/VMF1 + one gradient per station in North & East directions (1/d)

Ocean loading: FES2012

Tidal atmospheric loading: S1/S2 Ray&Ponte *(IERS conventions 2010, ITRF2013 recom.)*

Others:

The phase law for STAREC and ALCATEL antennas given by CNES has been implemented in GINS and has been used for our ITRF processing

For Cryosat-2, we applied the CNES 7-plate macromodel

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Data processed

The Table gives the DORIS DATA used and the satellite combination for the different periods

Period	Satellite combination
1993/01-1994/01	s2t
1994/02-1996/10	s2s3t
1996/11-1998/04	s2t
1998/05-2001/12	s2s4t
2002/01-2004/10	s2s4s5tejc
2004/11-2008/06	s2s4s5ejc
2008/07-2010/05	s2s4s5eJc
2010/06-2011/10	s4s5eJc
2011/11-2012/04	s4s5eJch
2012/04-2013/06	s4s5Jch
2013/06-2013/12	s5Jch

t=Topex, j=Jason-1, J=Jason-2,
s2=Spot-2, s3=Spot-3, s4=Spot-4, s5=Spot-5,
e=Envisat, c=Cryosat-2, h=Hy2a

- For all missions the elevation cut off is 12°, and a downweighting law is applied for elevations <= 20°

- For Jason-1 :
  We compute new data set including SAA model correction from end of TOPEX (Nov. 2004) to start of Jason-2 (July 2008)
  Downweight SAA stations in POD
  We rename the SAA stations parameters for Jason-1 for the combination

- For SPOT5, since January 2006 we consider new data set including SAA model correction

- We add HY2A DATA

- We do not use the SARAL DATA

ITRF2013 REPROCESSING STATUS

DORIS and SLR Orbit Residuals

Satellites	DORIS RMS (mm/s)	SLR RMS (cm)
Spot-2	0.41	No
Spot-3	0.43	No
Spot-4	0.39	No
Spot-5	0.34	No
Topex	0.45	1.4
Jason-1	0.31	1.2
Envisat	0.39	0.97
Jason-2	0.31	1.2
Cryosat-2	0.34	0.94

Good level for DORIS and SLR orbit residuals

ITRF2013 REPROCESSING STATUS

OPR Acceleration Amplitude: Along-track and Cross-track Radiation pressure coefficient Cr

Satellites	Average Along-track (nm/s^2)	Average Cross-track (nm/s^2)	Cr
Spot-2	1.7	1.6	1.07
Spot-3	0.9	1.2	1.07
Spot-4	1.3	1.1	1.16
Spot-5	1.6	1.2	1.05
Topex	1.7	1.2	1.03
Jason-1	1.9	1.1	0.94
Envisat	1.1	1.1	1.05
Jason-2	2.6	1.5	0.97
Cryosat-2	3.3	2.3	1.0

Average OPR Acceleration amplitudes are < 4 nm/s^2
Cr values are close to 1

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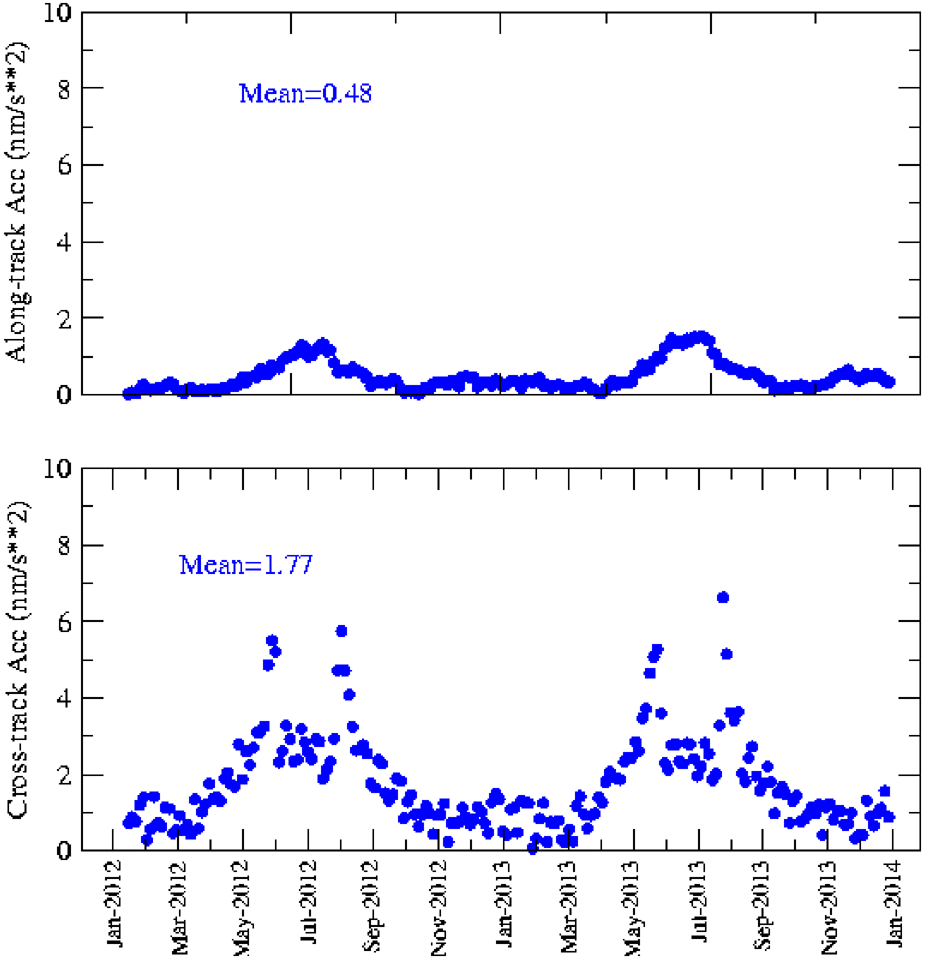
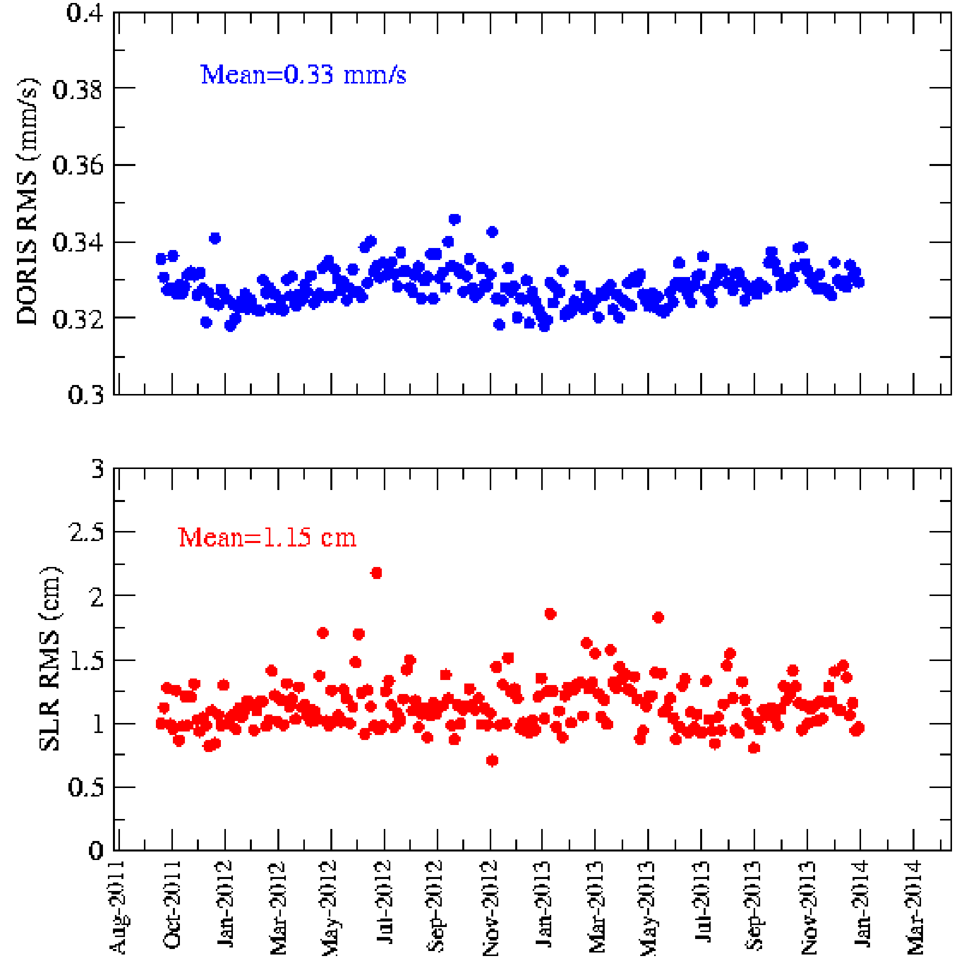
We added HY-2A data in our ITRF2013 contribution

OPR Acceleration Amplitude (Cr=0.86)



Orbit Residuals

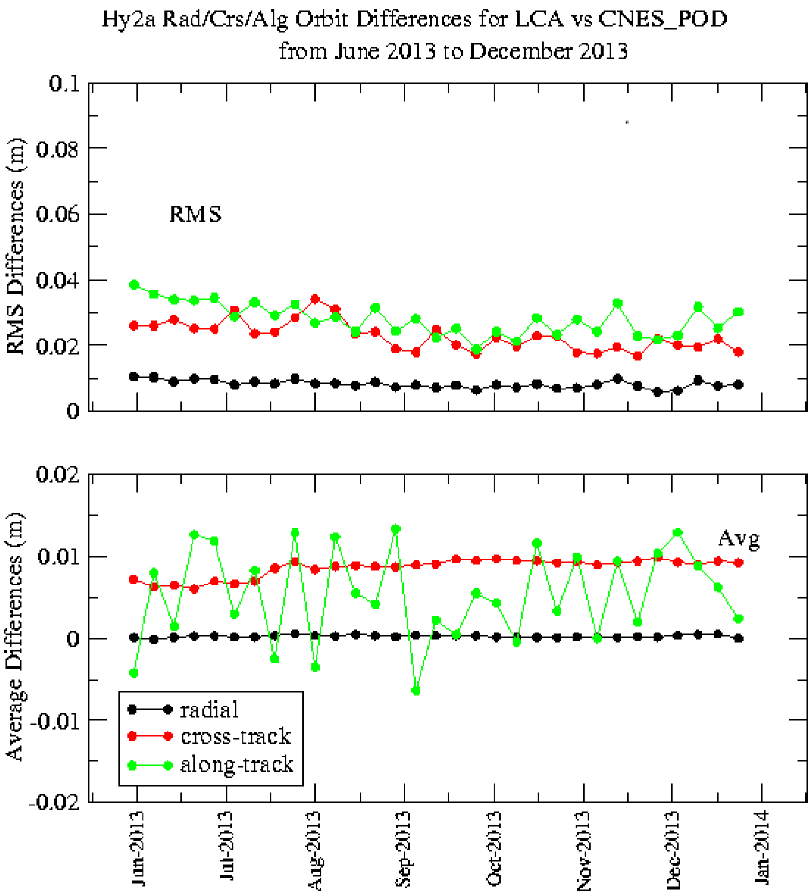


Good level for DORIS (0.33 mm/s) and SLR orbit residuals (1.15cm)
Average OPR Acceleration amplitudes are < 2 nm/s^2
Over the 2 years we note 2 periods with an amplitude increase (max values in July)

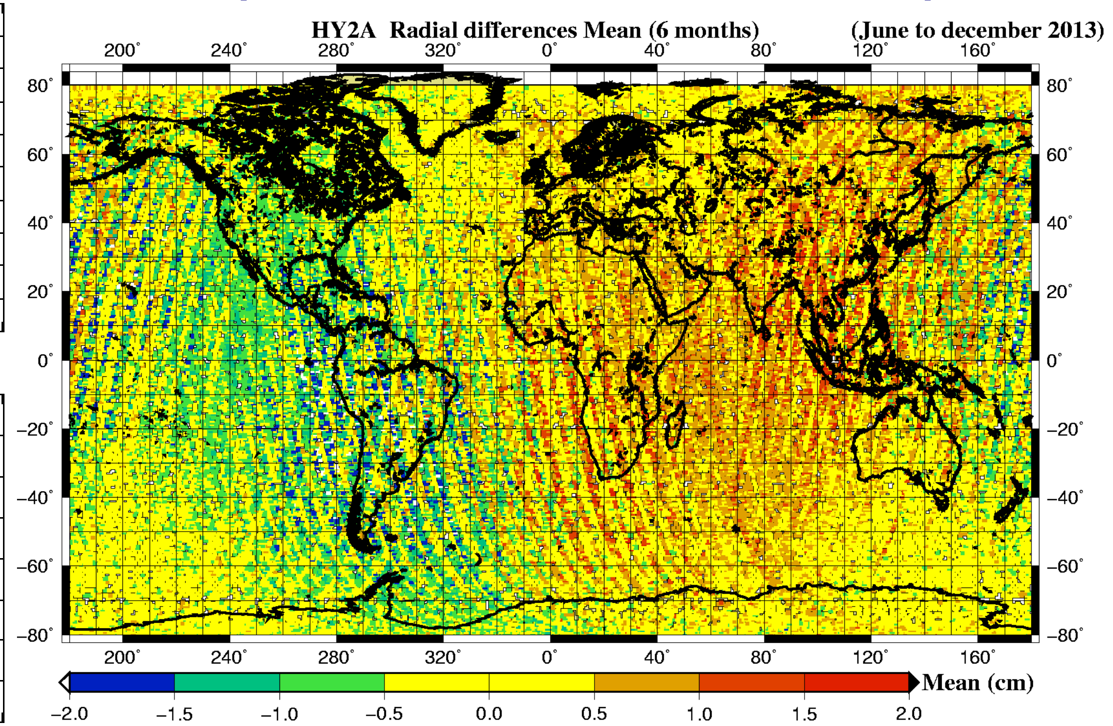
ITRF2013 REPROCESSING STATUS

HY-2A Orbit Comparison LCA vs CNES GDR-D POE

Radial/Cross-track/Along-track Orbit differences



Radial orbit differences Mean (6 months June to December 2013)



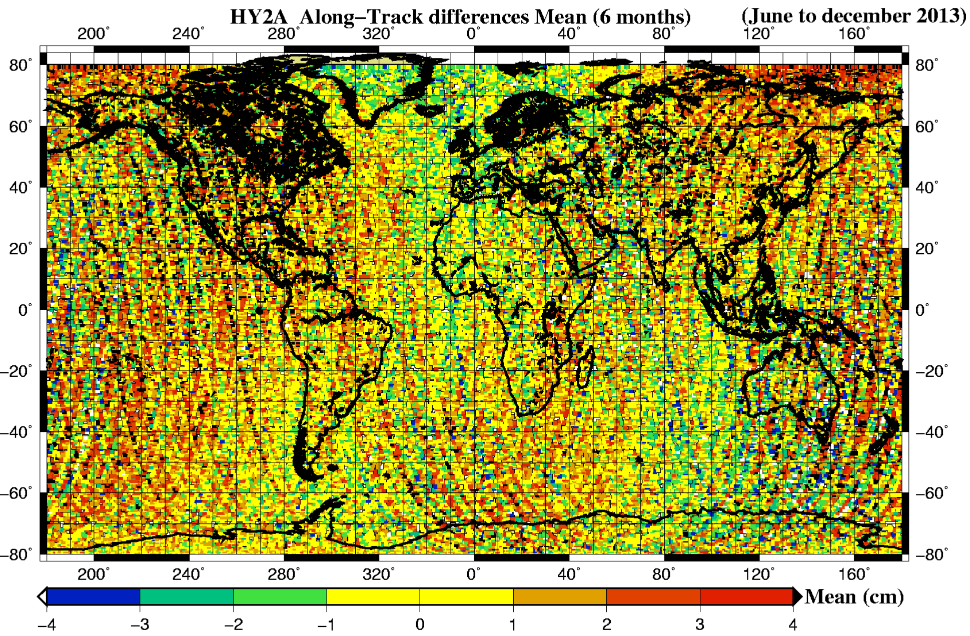
Good agreement between LCA orbits and CNES GDR-D POE (in particular in radial)

Radial geographical systematic differences East/West patches

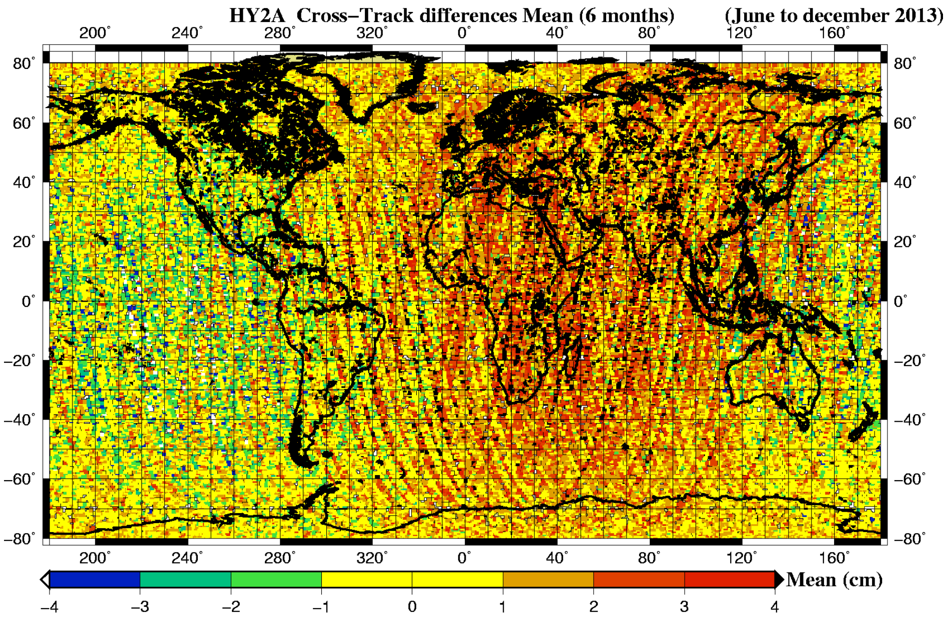
ITRF2013 REPROCESSING STATUS

HY-2A Orbit Comparison LCA vs CNES GDR-D POE

Along-track orbit differences Mean (6 months June to December 2013)



Cross-track orbit differences Mean (6 months June to December 2013)



Cross-track geographical systematic differences East/West patches

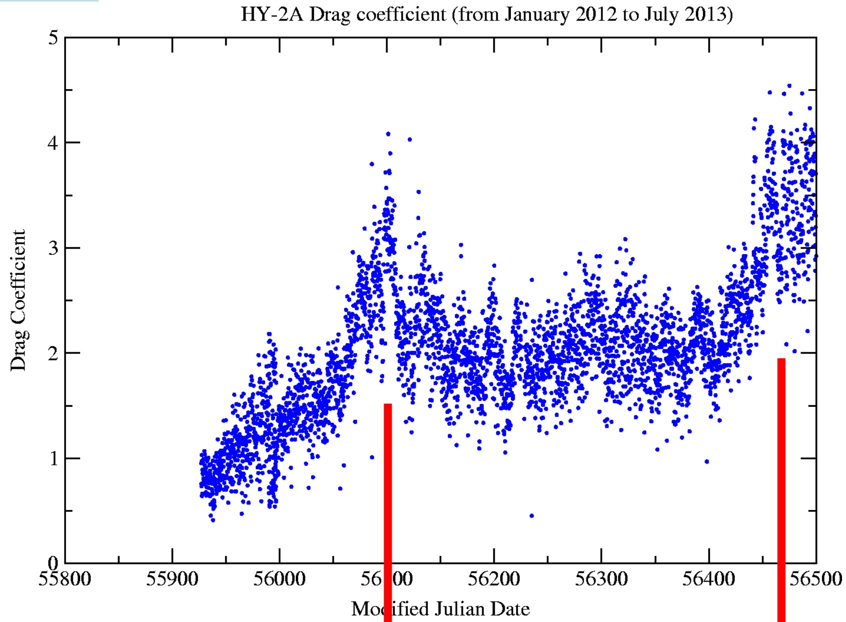
ITRF2013 REPROCESSING STATUS

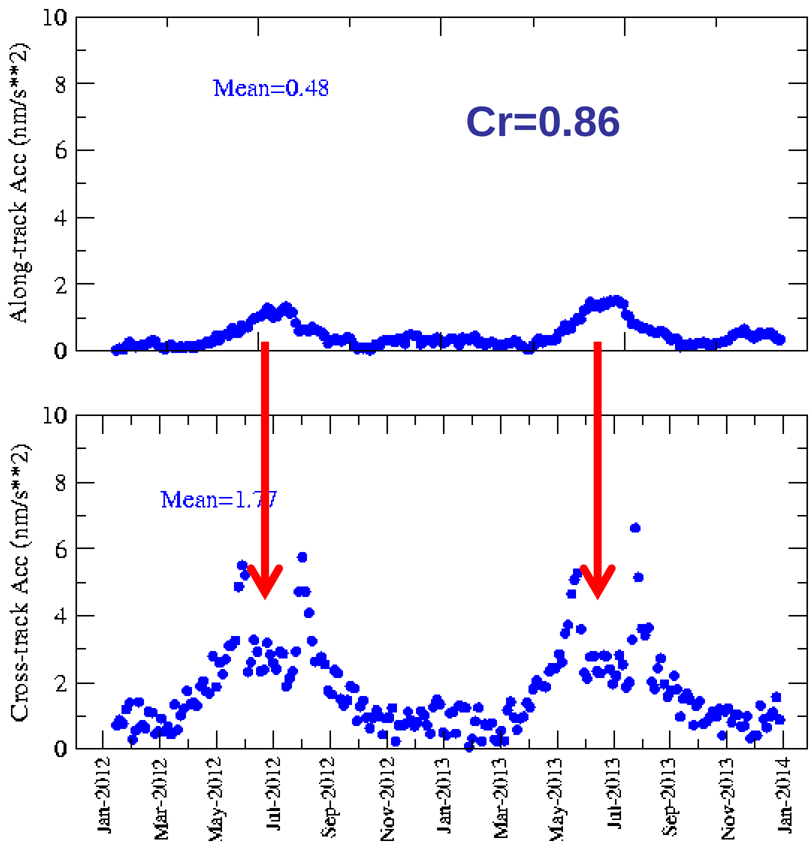
HY-2A drag coefficient

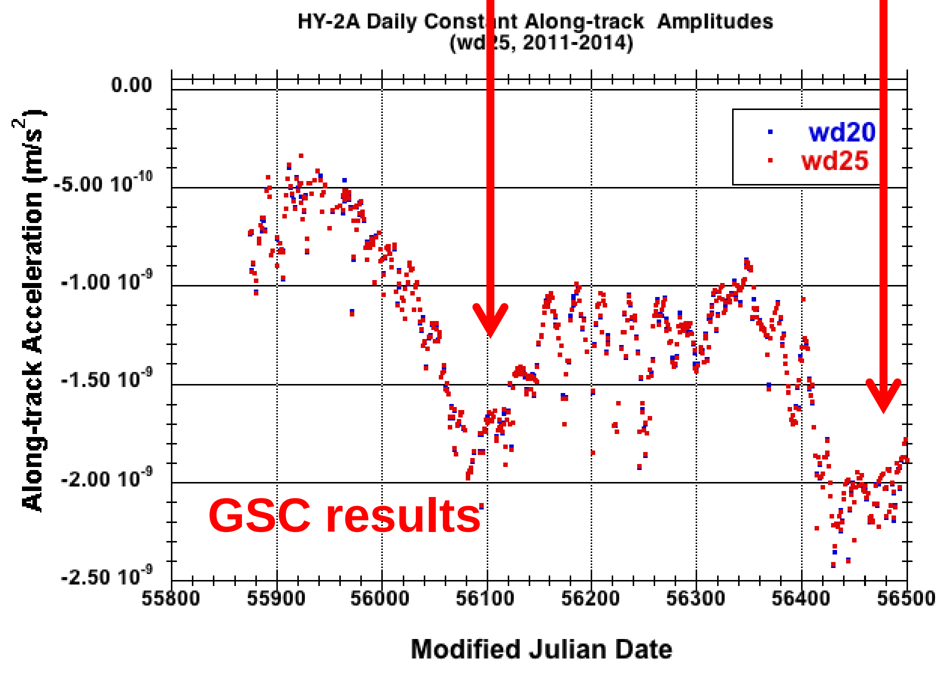
-we note a correlation with the daily Along-track constant acceleration adjusted by GSC in their processing

- for LCA this daily Along-track bias is mainly absorbed by drag coefficient

-when GSC along-track acceleration is higher the OPR amplitudes increase







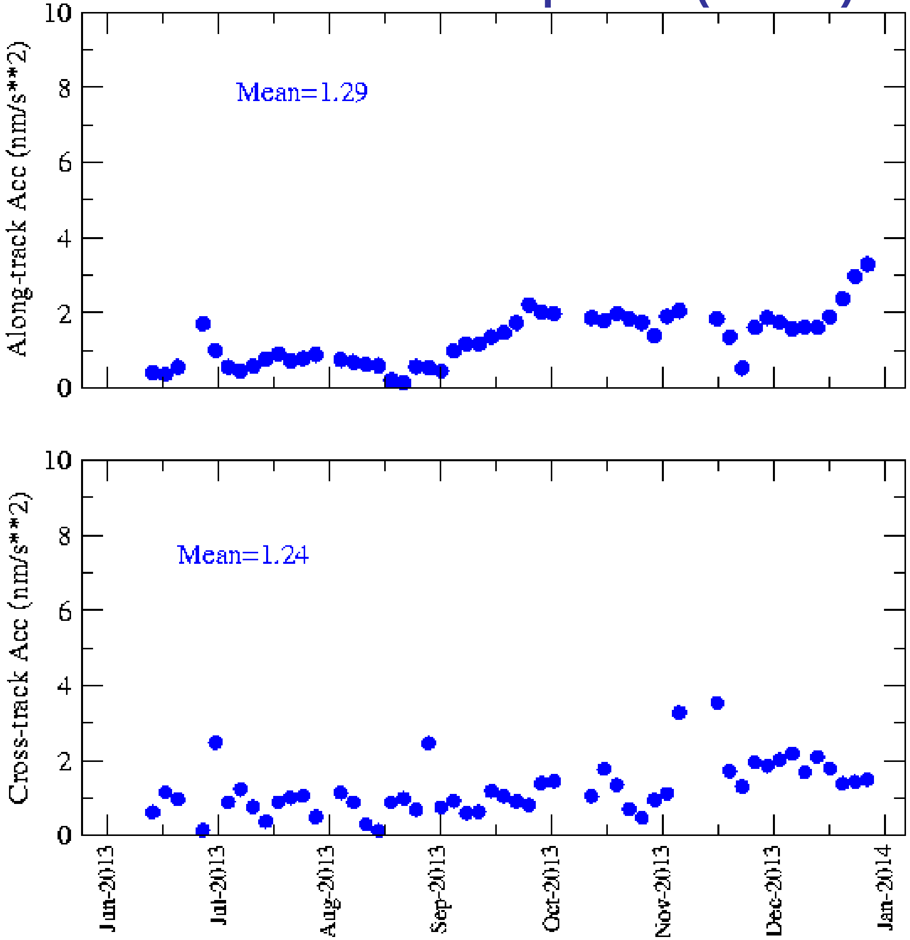
SARAL FIRST PROCESSING

We have corrected SARAL CoM after value adjusting

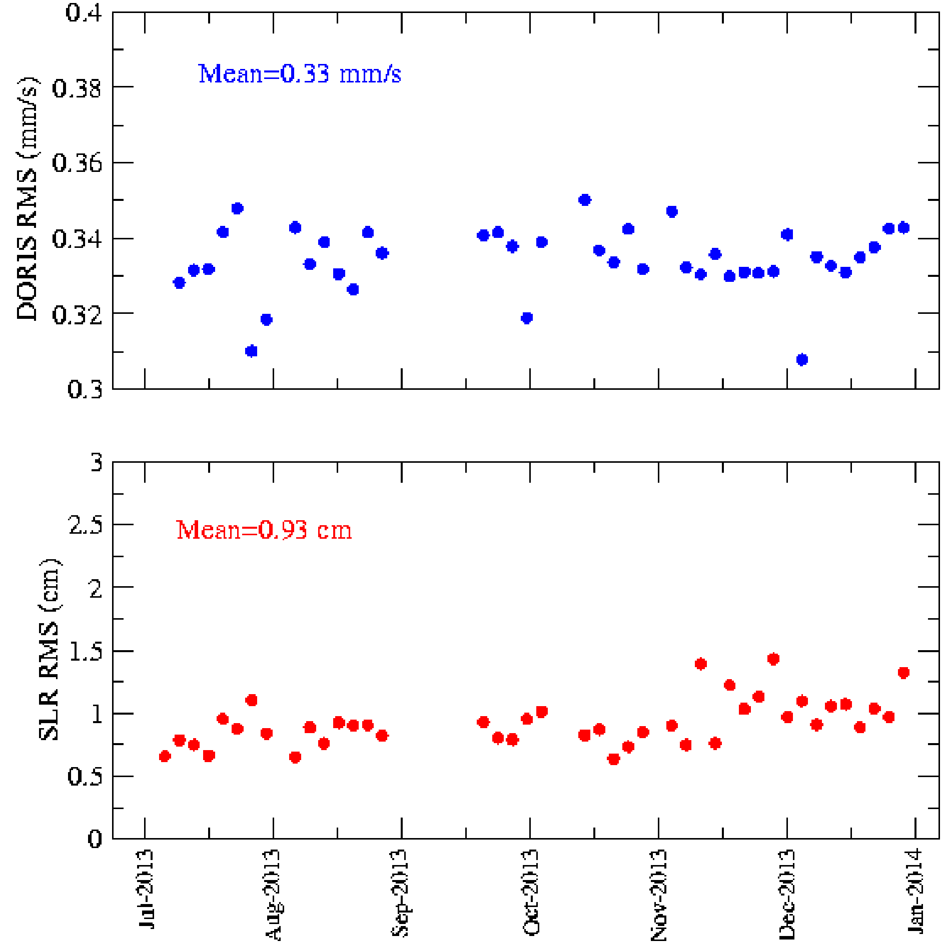
We found the same value as the one found by GSC AC

- **a correction~4cm on the Along-track component (new:-0.6152 m / old: -0.6563 m)**

OPR Acceleration Amplitude (Cr=1.0)



Orbit Residuals



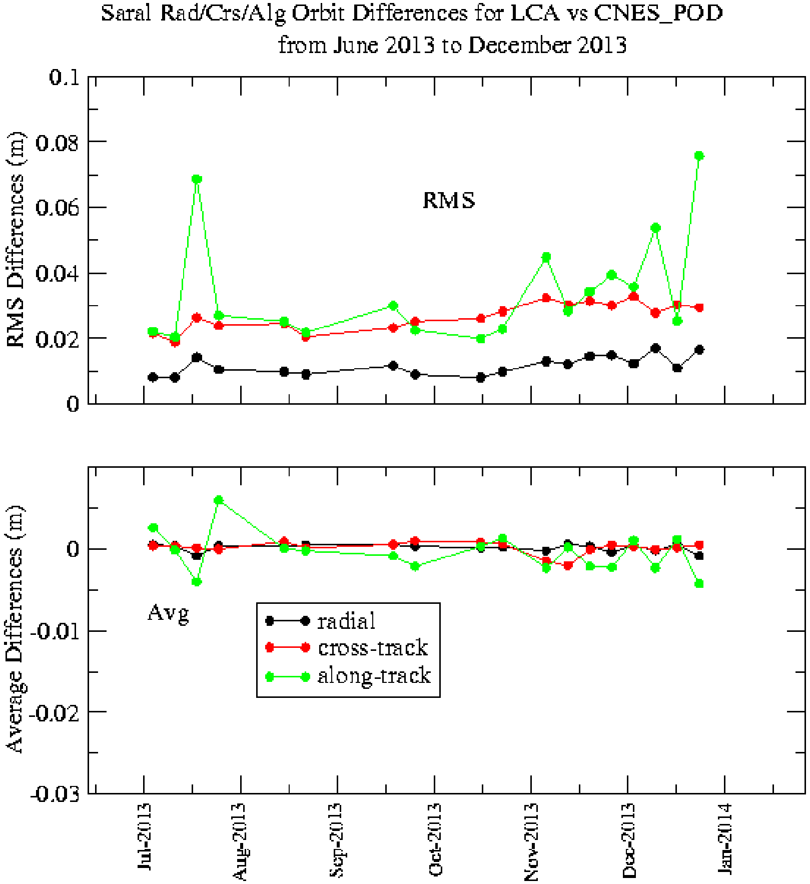
Good level for DORIS (0.33 mm/s) and SLR orbit residuals (< 1.cm)

Average OPR Acceleration amplitudes are < 2 nm/s^2

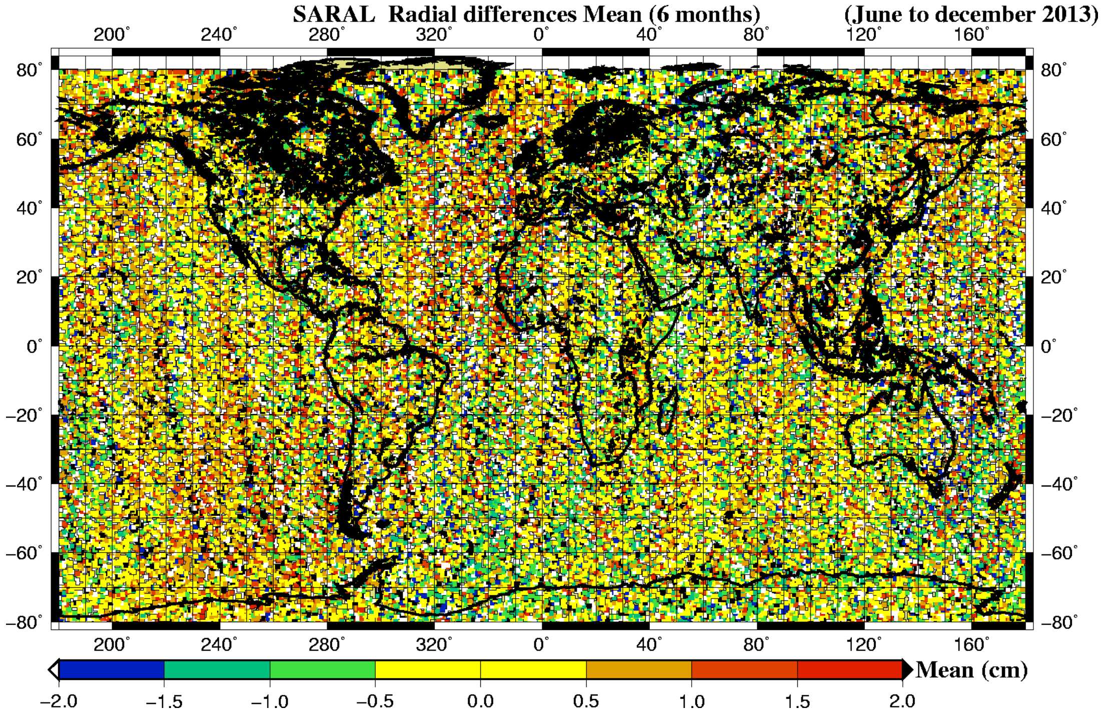
SARAL FIRST PROCESSING

Saral Orbit Comparison LCA vs CNES GDR-D POE

Radial/Cross-track/Along-track Orbit differences



Radial orbit differences Mean (6 months June to December 2013)



Good agreement between LCA orbits and CNES GDR-D POE (in particular for radial)
No clear radial geographical systematic differences

CONCLUSIONS AND PERSPECTIVES

Conclusion

Good agreement between LCA orbits and CNES GDR-D POE
(in particular radial)
First SARAL processing give good results

Perspectives

Back to routine Delivery in the same processing context
Exploitation of the ITRF reprocessing to improve models
(as solar pressure models, …)
Understand scale jump in 2012
Use RINEX data files
To check the good implementation of attitude law
(by using quaternions, by comparison to CNES POE)

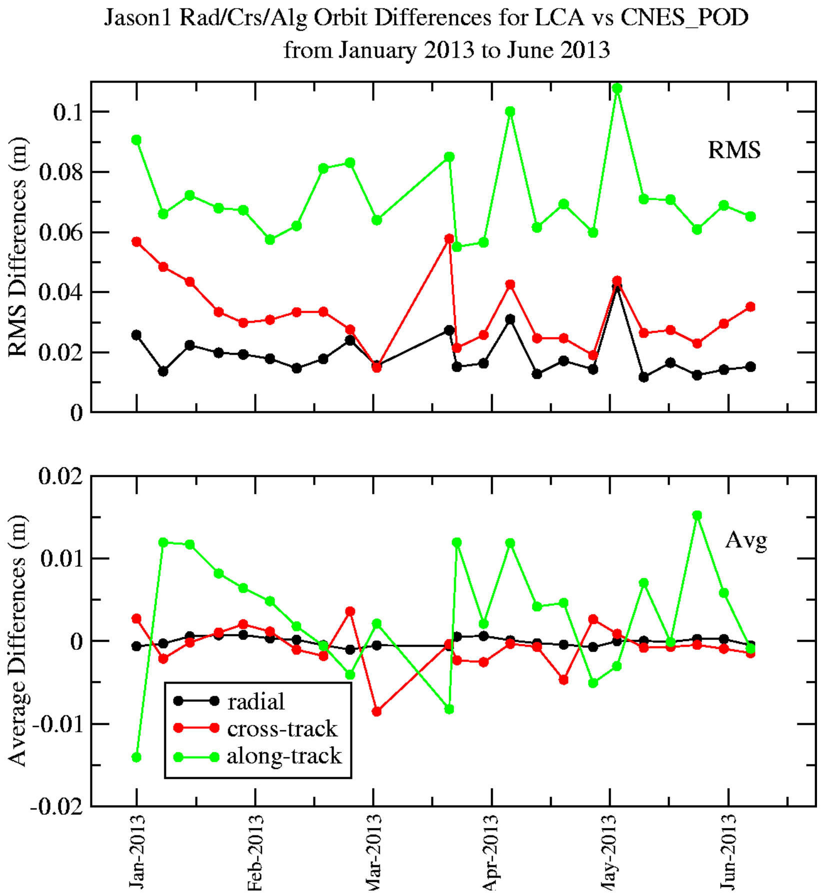
…

BACK SLIDES

COMPARISON TO THE POE USED FOR ALTIMETRY

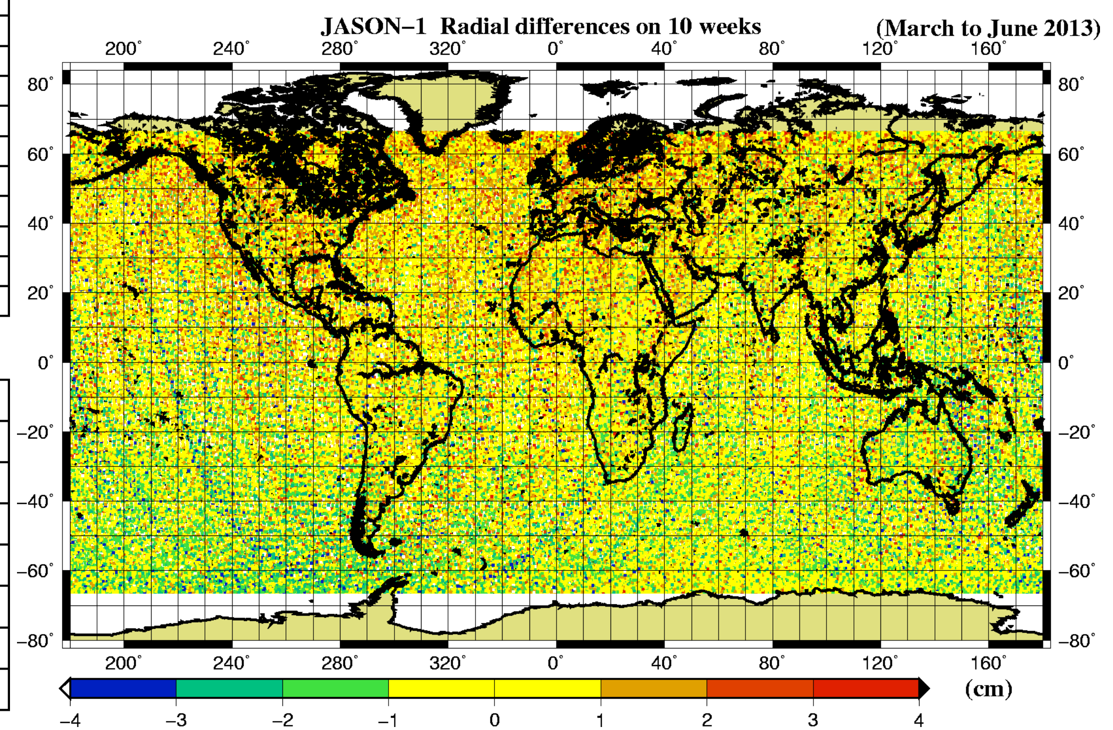
Jason-1 Orbit Comparison LCA vs CNES GDR-D POE

Radial/Cross-track /Along-track Orbit differences



Orbit geodetic period

Radial orbit differences (on 10 weeks from March to June 2013)



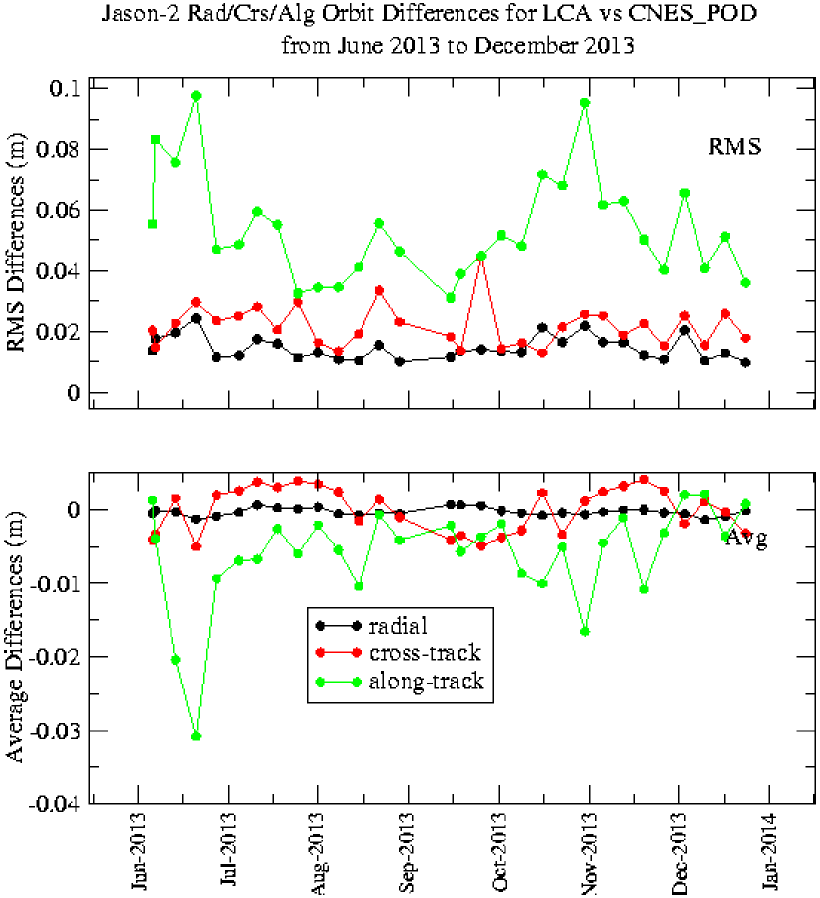
Good agreement between LCA orbits and CNES GDR-D POE (in particular radial)

No clear Radial geographical systematic differences:(slightly N/S)

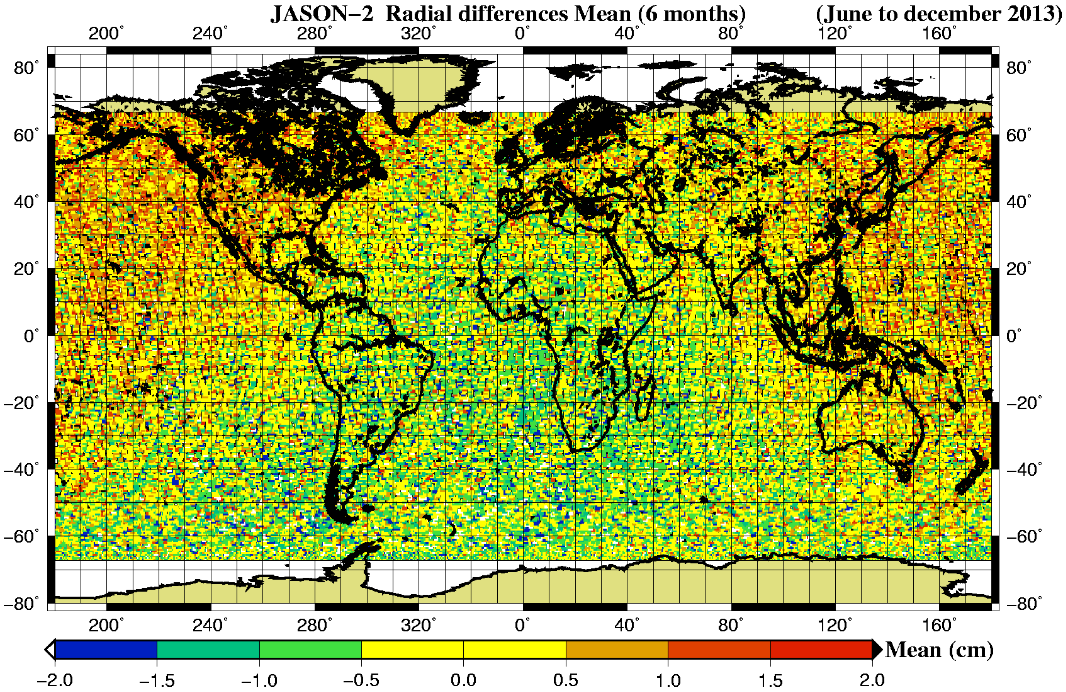
COMPARISON TO THE POE USED FOR ALTIMETRY

Jason-2 Orbit Comparison LCA vs CNES POE

Radial/Cross-track /Along-track Orbit differences



Radial orbit differences Mean (6 months June to December 2013)



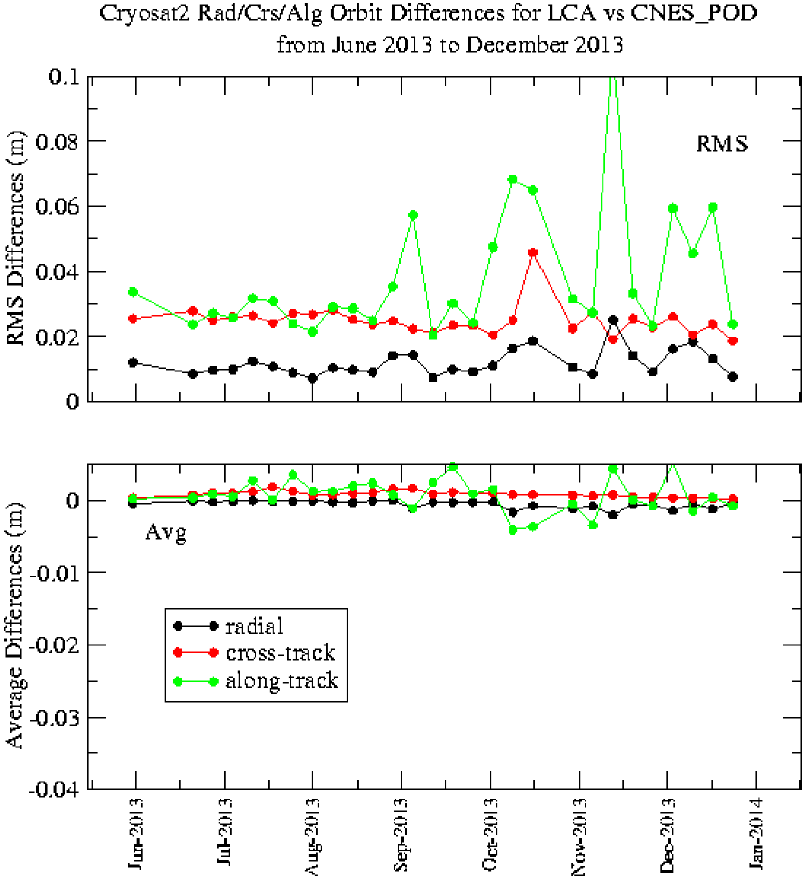
Good agreement between LCA orbits and CNES GDR-D POE (in particular radial)

Radial geographical systematic differences: south Atlantic patch (N/S)

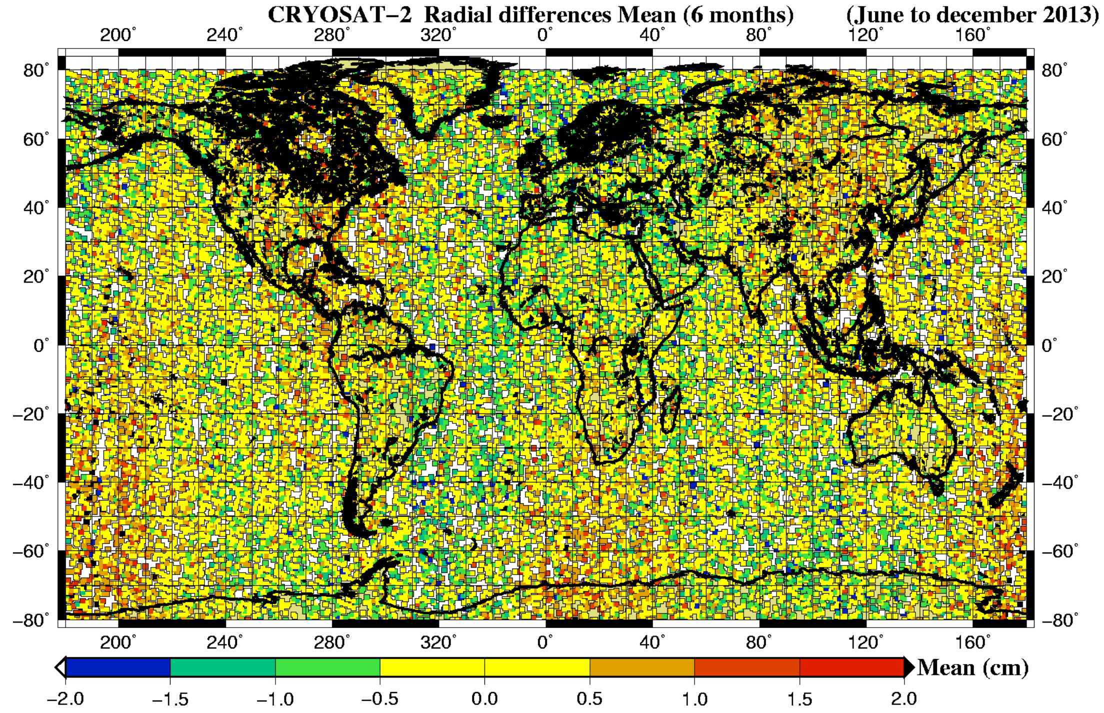
COMPARISON TO THE POE USED FOR ALTIMETRY

Cryosat-2 Orbit Comparison LCA vs CNES GDR-D POE

Radial/Cross-track /Along-track Orbit differences



Radial orbit differences Mean (6 months June to December 2013)



Good agreement between LCA orbits and CNES GDR-D POE (in particular radial)

No clear radial geographical systematic differences