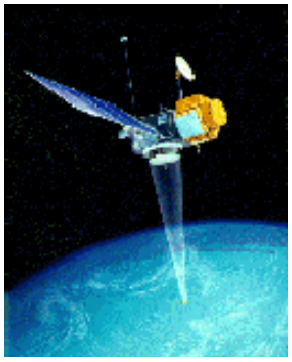
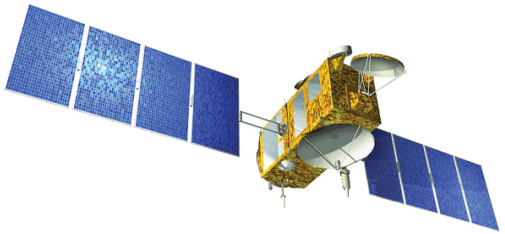
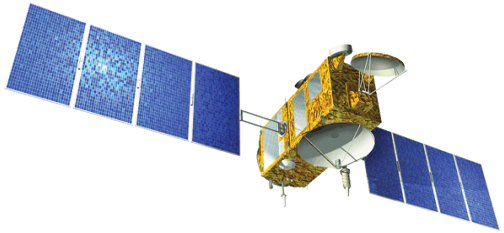
POD Splinter Summary

Luca Cerri (CNES)
Frank Lemoine (NASA GSFC)



OSTST 2011 POD Splinter
San Diego, California
October 19-21, 2011

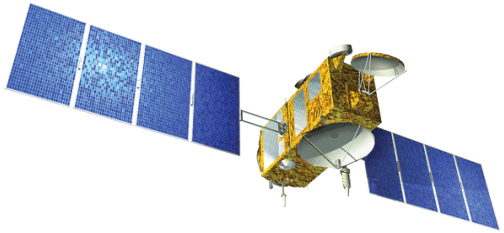




Session Summary (1)

- 8 oral talks; five posters.
- Updates by CNES, GSFC, JPL ESOC Analysis Centers (Status of POD on Jason-2; Assessment of Jason-2 Radial orbit quality; Reanalysis of Jason-1 and TOPEX; Status of GPS System performance).
- Discussion of proposed standards for GDR-D orbits (update to current GDR-C).
- Other detailed topics:

1. Updated reference frame DORIS sites (DPOD2008) (**166 DORIS sites, vs. only 130 in ITRF2008**) (*Pascal Willis, IPGP/IGN*).
2. Orbit Quality assessment through SSH Analyses (*Sabine Phillips, CLS*).
3. Multi-mission Crossover analysis to investigate geographically correlated error, center-of-origin offsets, orientation of rotation axes *(Denise Dettmering, DGFI)*



Session Summary (2)

1. Improvements in ERS-1, ERS-2 Orbits; ITRF2005-series orbits available from: ftp://dgn6.esoc.esa.int/reaper/

   (Poster by Michiel Otten et al.)

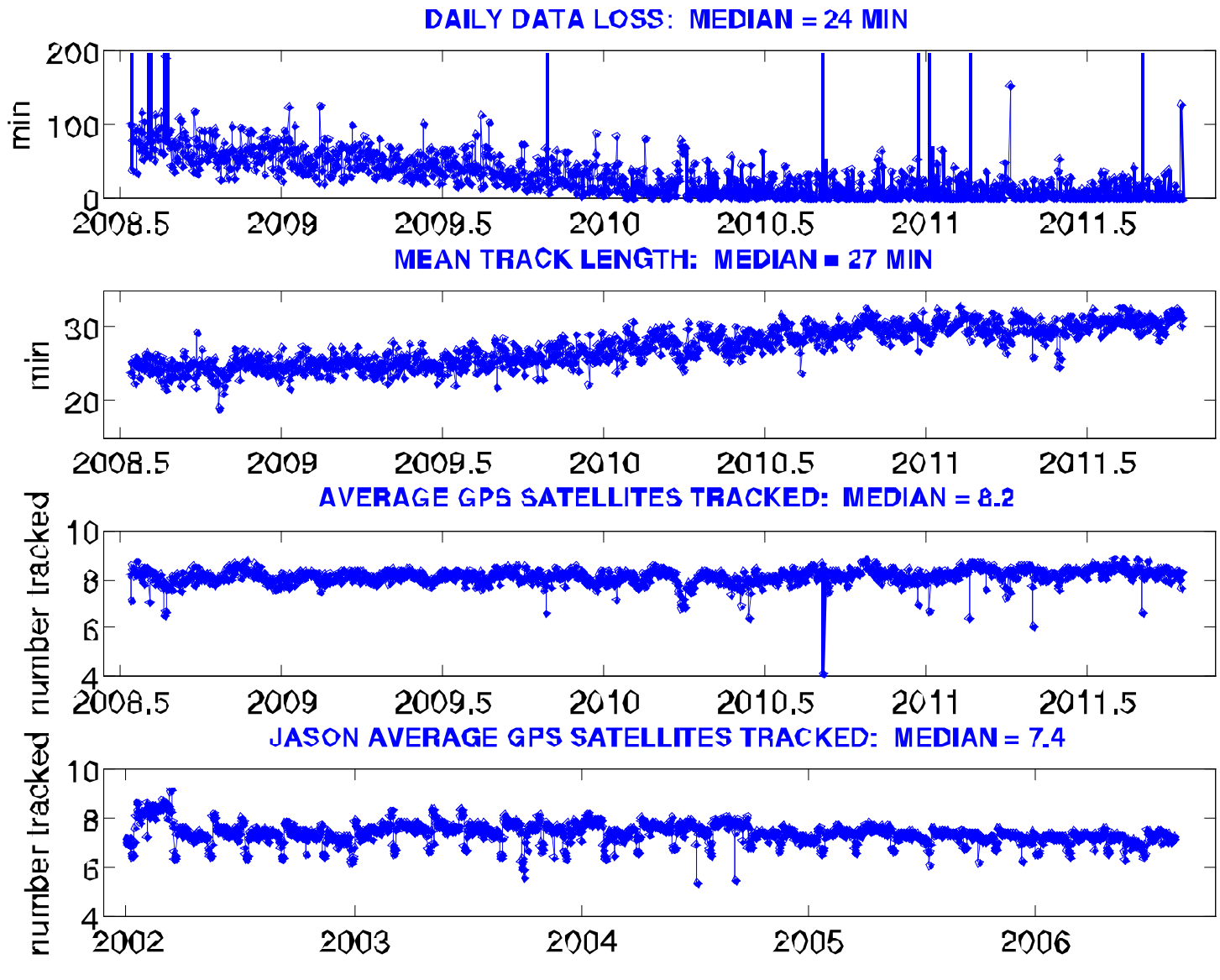
- Geographically correlated errors of **ERS** now in the same order of magnitude as TOPEX and Jason (2-3 mm RMS), thanks to new orbits (*Presentation by Denise Dettmering).*

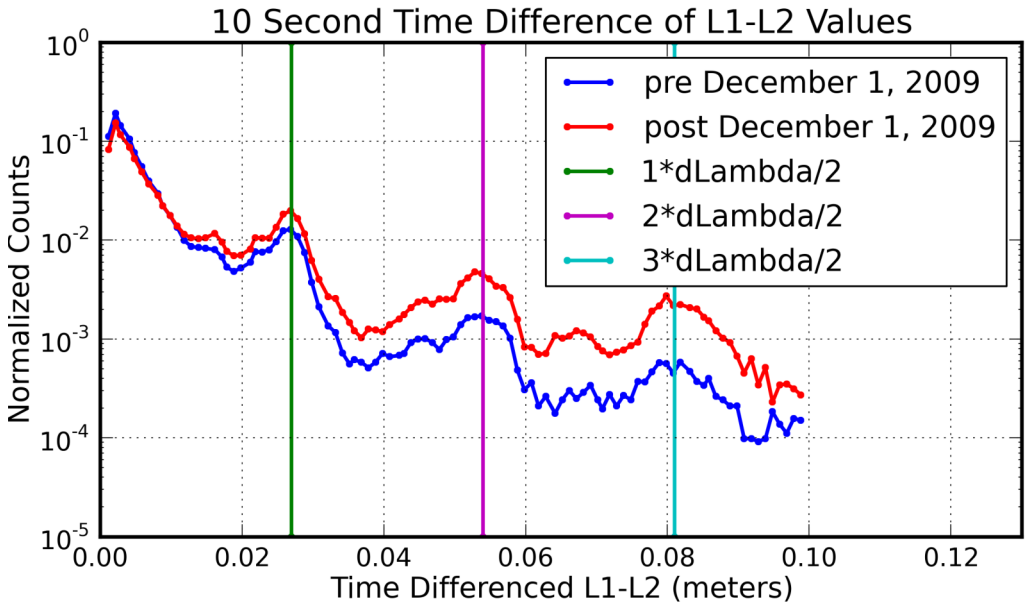
2. Improvements to DIODE Navigator (Real-time DORIS) for Jason-3, Sentinel-3 (*Poster by Christian Jayles).*

GPS Data Quality Over Time

JASON2/OSTM

JASON





$$d\lambda \equiv \lambda_{L2} - \lambda_{L1} = 24.44\,cm - 19.04\,cm = 5.40\,cm$$

Solution: Phase Break if L1-L2 >1.5cm over 10 seconds

Details: OSTMPODreport.pdf , email from Decarvalho June 14, 2011

Orbits comparison: radial component

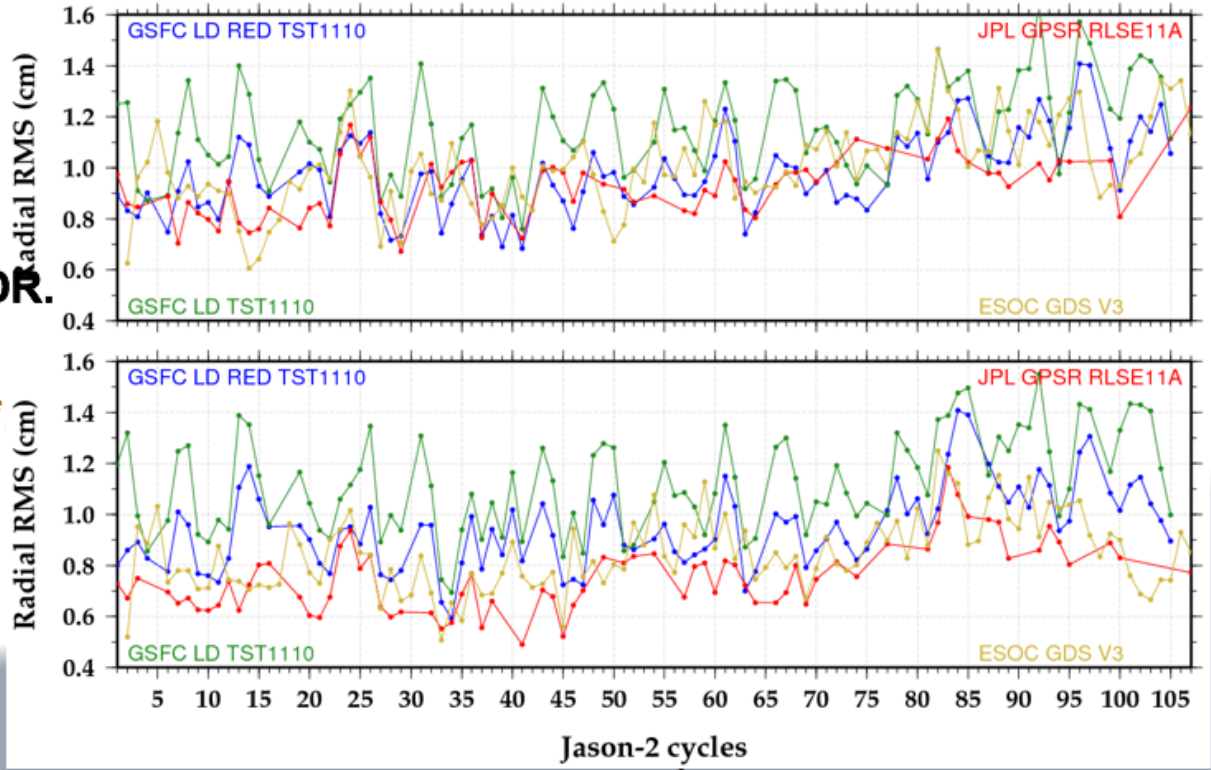
■ **RMS of radial orbit differences relative to the GDR/GDR-D* solutions**

GDR – others:

- Similar behavior in **GSFC** & **JPL** reduced dynamic solutions when compared to GDR.

GDR-D* – others:

- **JPL** close to **GDR-D***
- ***60-day*** signal btwn **GSFC** & **GDR/GDR-D*** dynamic orbits.
- ***~1-cm*** agreement.

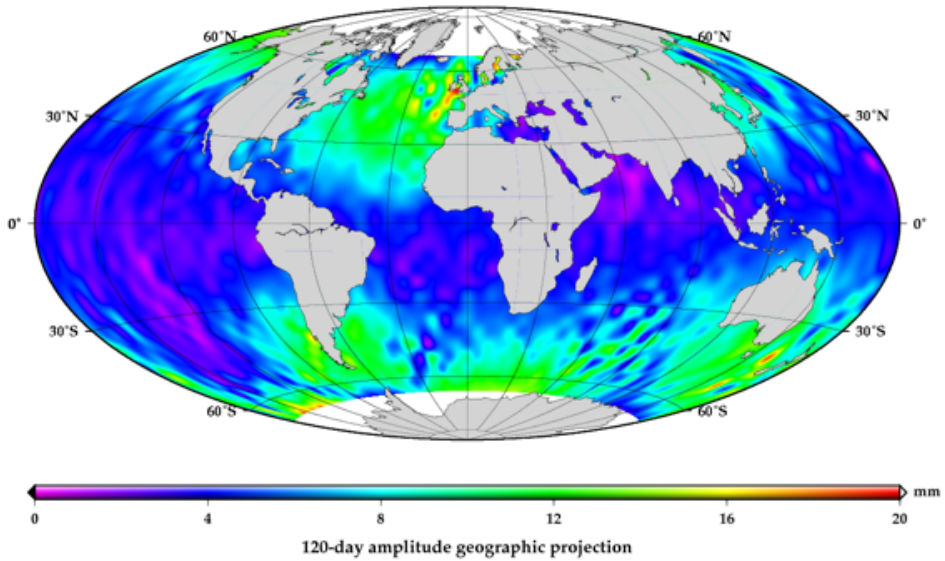


cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

120-day geographically correlated radial signal

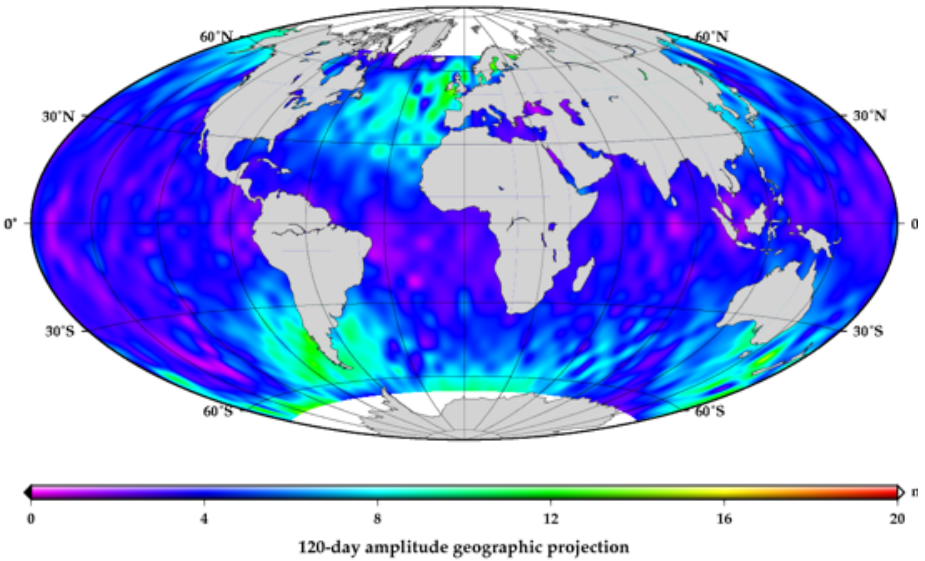
■Typical signature of SRP model differences locally exceeding *1-cm*

Jason-2 GDR - GSFC LD TST1110 radial differences, cycles 1-105



120-day amplitude geographic projection

Jason-2 GDR - GSFC LD RED TST1110 radial differences, cycles 1-105



120-day amplitude geographic projection

- GSFC reduced dynamic solution compensates for mismodeled SRP?

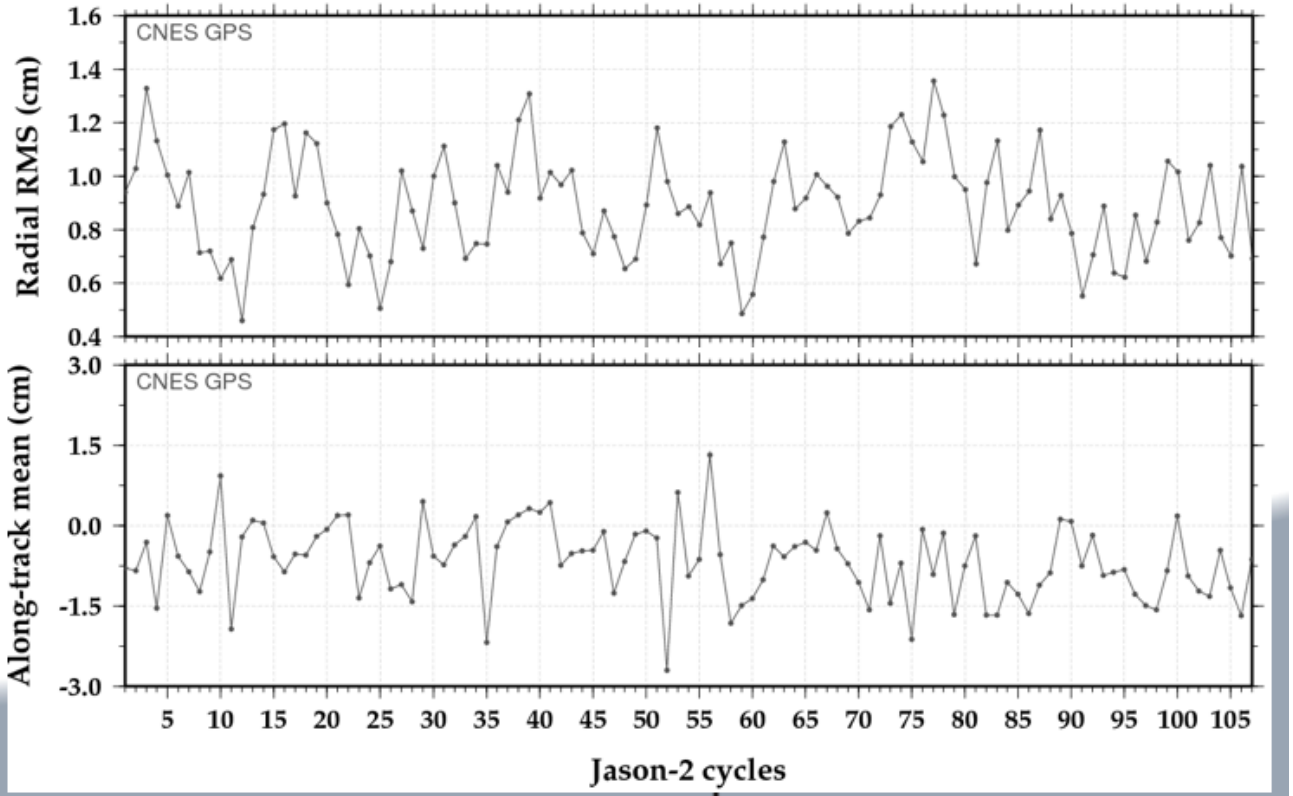
cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

How is CNES GPS-based dynamic solution affected?

■CNES GPS orbit differences relative to the CNES DORIS solution

- **No visible CNES GPS orbit degradation due to this effect.**

- **Likely reasons:**
  - Solution more dynamically constrained.
  - Rather conservative editing of the cycle slips.

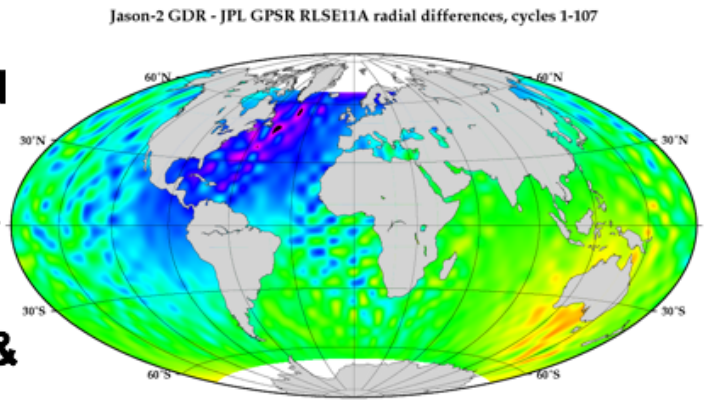


cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

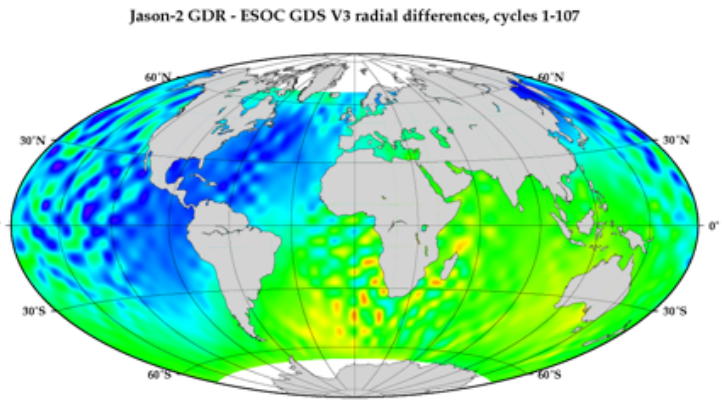
Jason2:Mean geographically correlated radial differences GDRC-GDRD vs JPL/ESOS

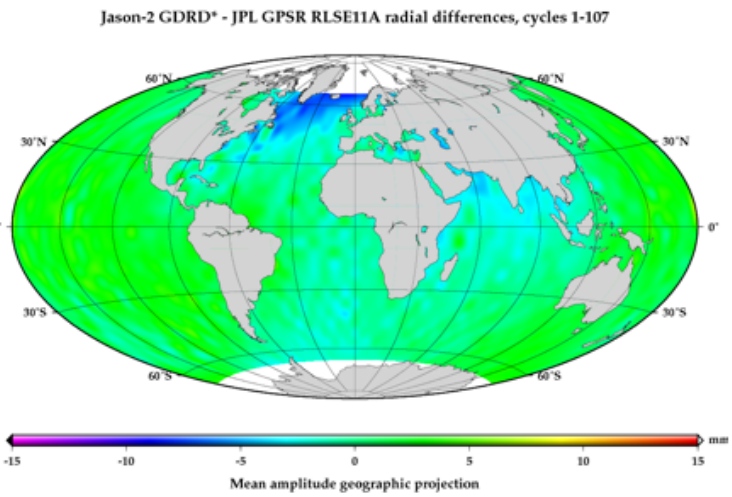
- Obvious gravity field modeling differences signatures btwn GDR & JPL/ESOC.
- GDR-D* completely clears the signatures.

GDRC vs. JPL

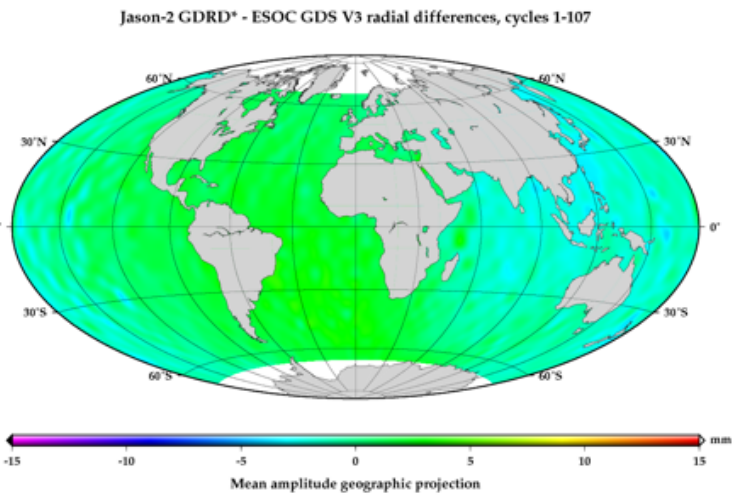


GDRC vs. ESOC





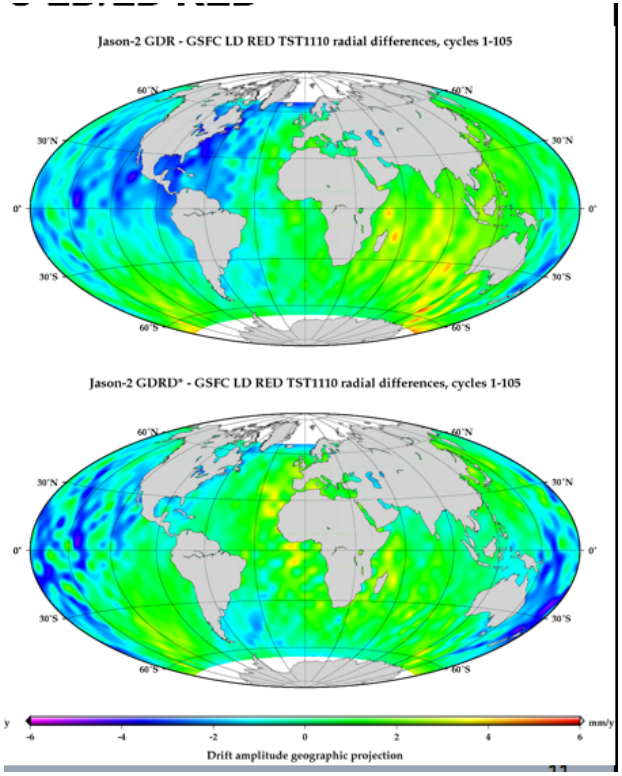
GDRD vs. JPL



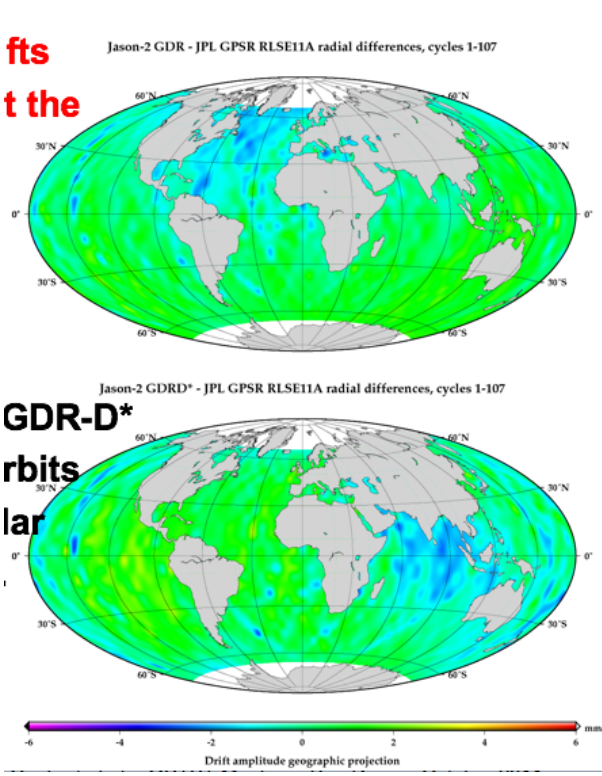
GDRD vs. ESOC

Jason-2 Geographic Radial Orbit Differences: Drift Between Orbit Series (mm/yr) *(2008.5 - 2011.5)*

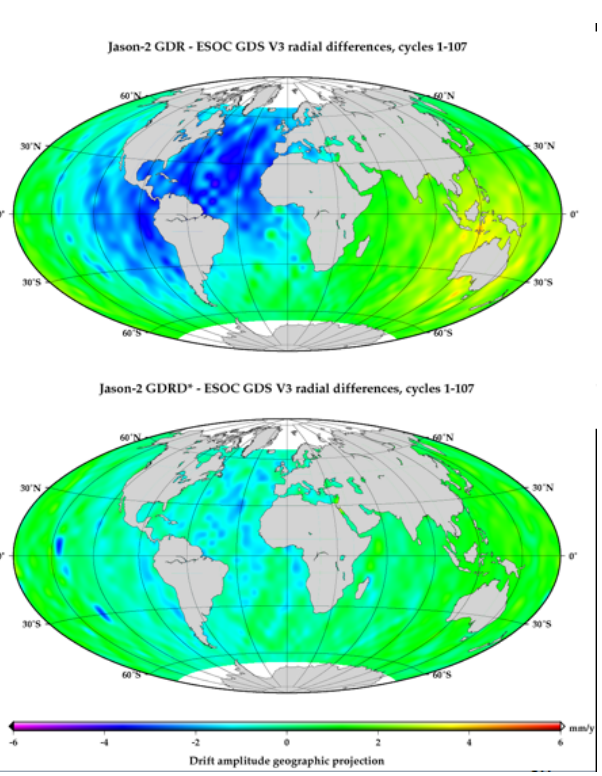
GDRC vs GSFC



GDRC vs JPL/GPS



GDRC vs ESOC



GDRD vs GSFC

GDRD vs JPL/GPS

GDRD vs ESOC

Gravity Field Modelling for Jason-1 & Jason-2 Orbits.

• GRACE-based solutions determined over as long a period as possible are the best candidates to use for Jason GDR production.

• Time-variable gravity (rates and to a lesser extent annual, semi-annual terms) will not *necessarily* be applicable at periods outside the GRACE mission - so a hybrid gravity solution is probably needed to span the full altimetry period (1993-2011).

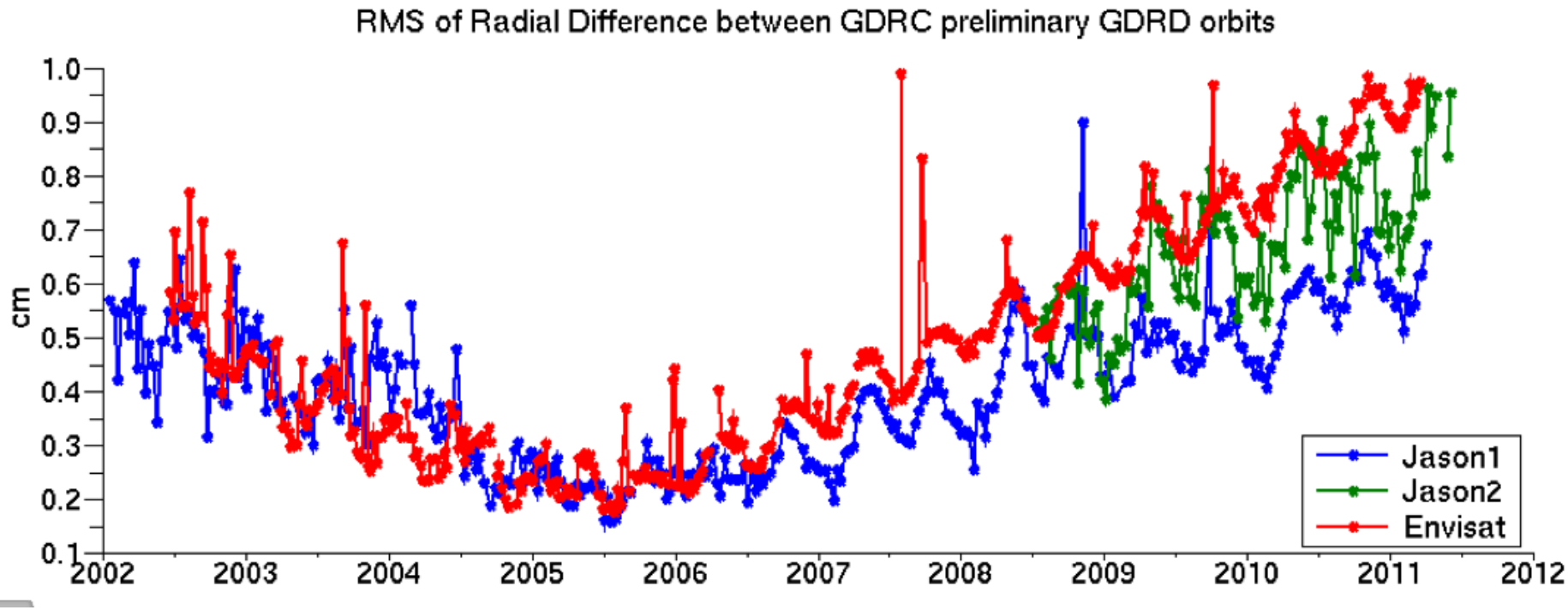
• These GRACE-based secular and other terms do not capture all the variations in the gravity field that are observed.

• GDRC: EIGEN-GL04S static; annual + semiannual terms (*Determined 2003-2005*) (…+ ITRF2005)

• GDRD: EIGEN-GRGS-RL02bis_Mean_Field; rate, annual, semiannual to 50x50; (*Determined 2003-2010*) (….+ ITRF2008).

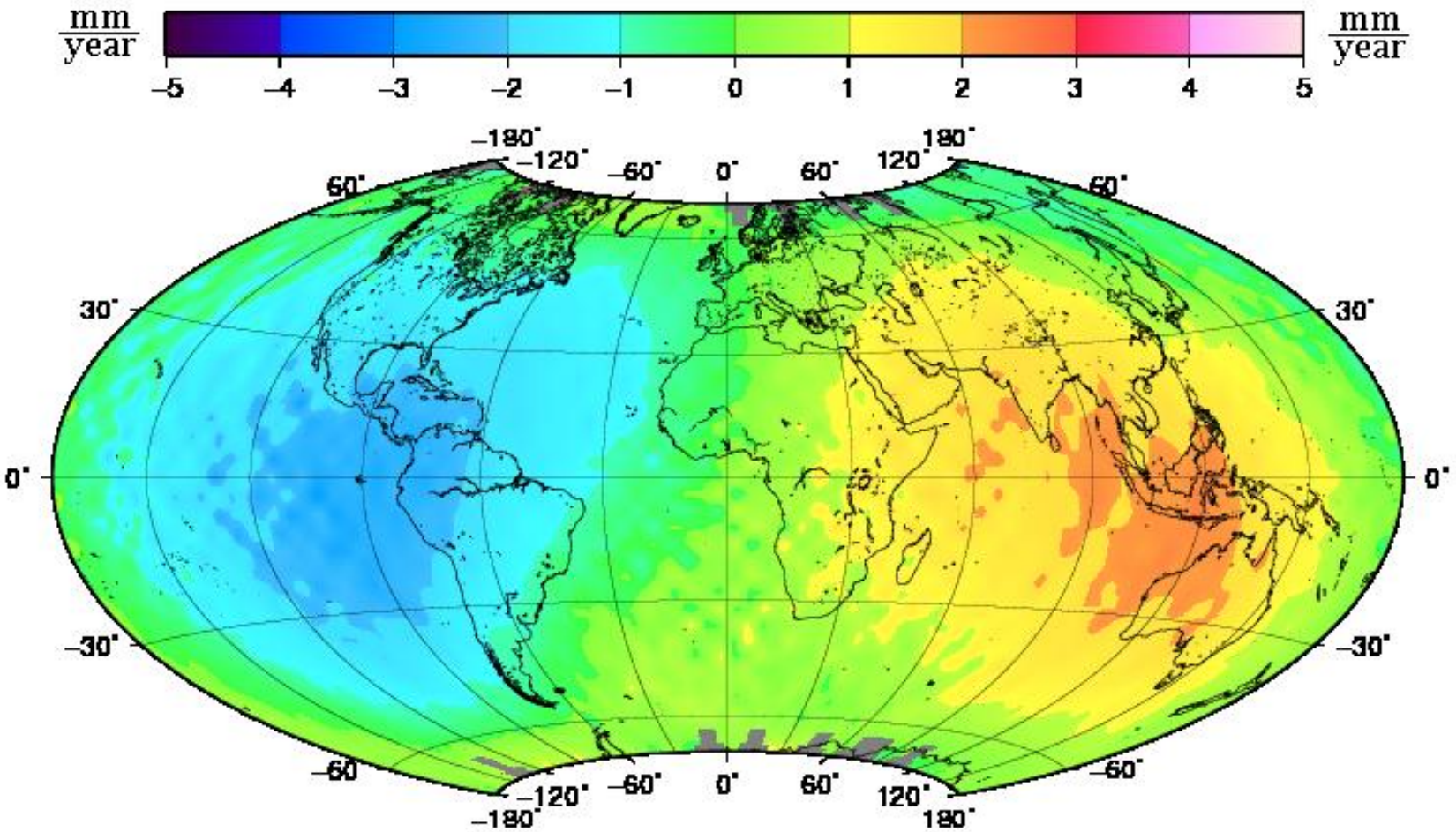
Radial orbit difference between GDR-C and GDR-D

- RMS of radial differences is mostly driven by the new variable terms in the gravity field
- Below 1 cm RMS for Jason, reaches 1 cm on Envisat



Jason2 std1007 (tvgstd–Eigen6s)
Radial Orbit Rates, cycles 1-105

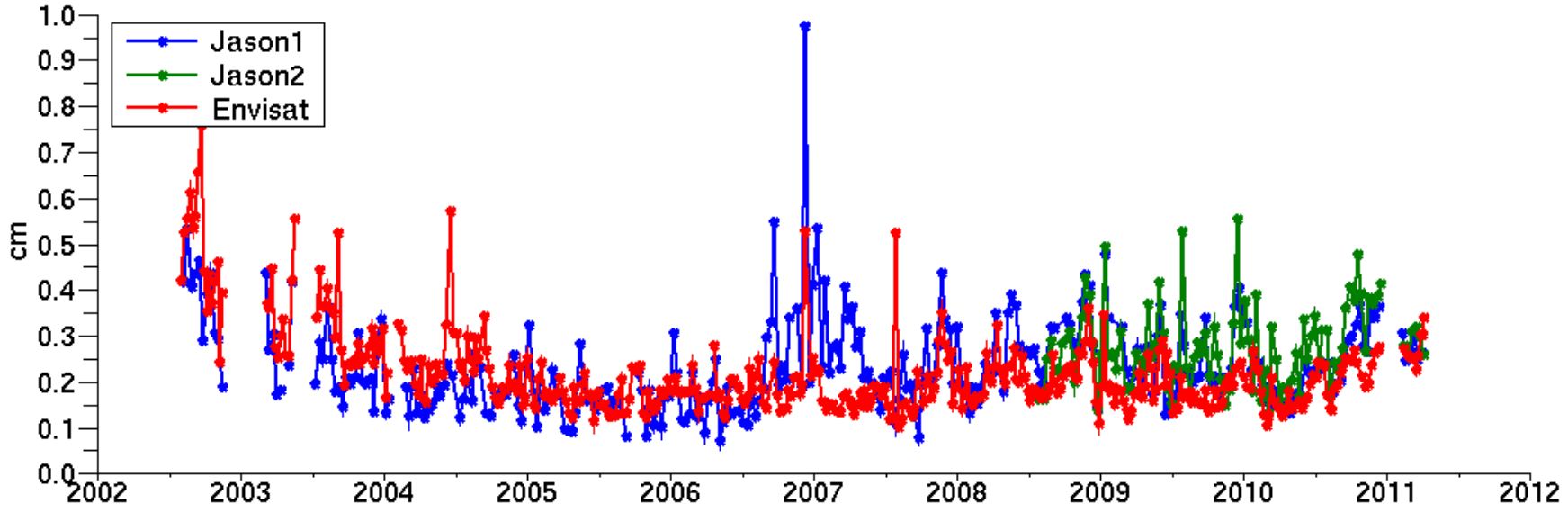
(annual and semi-annual terms removed)



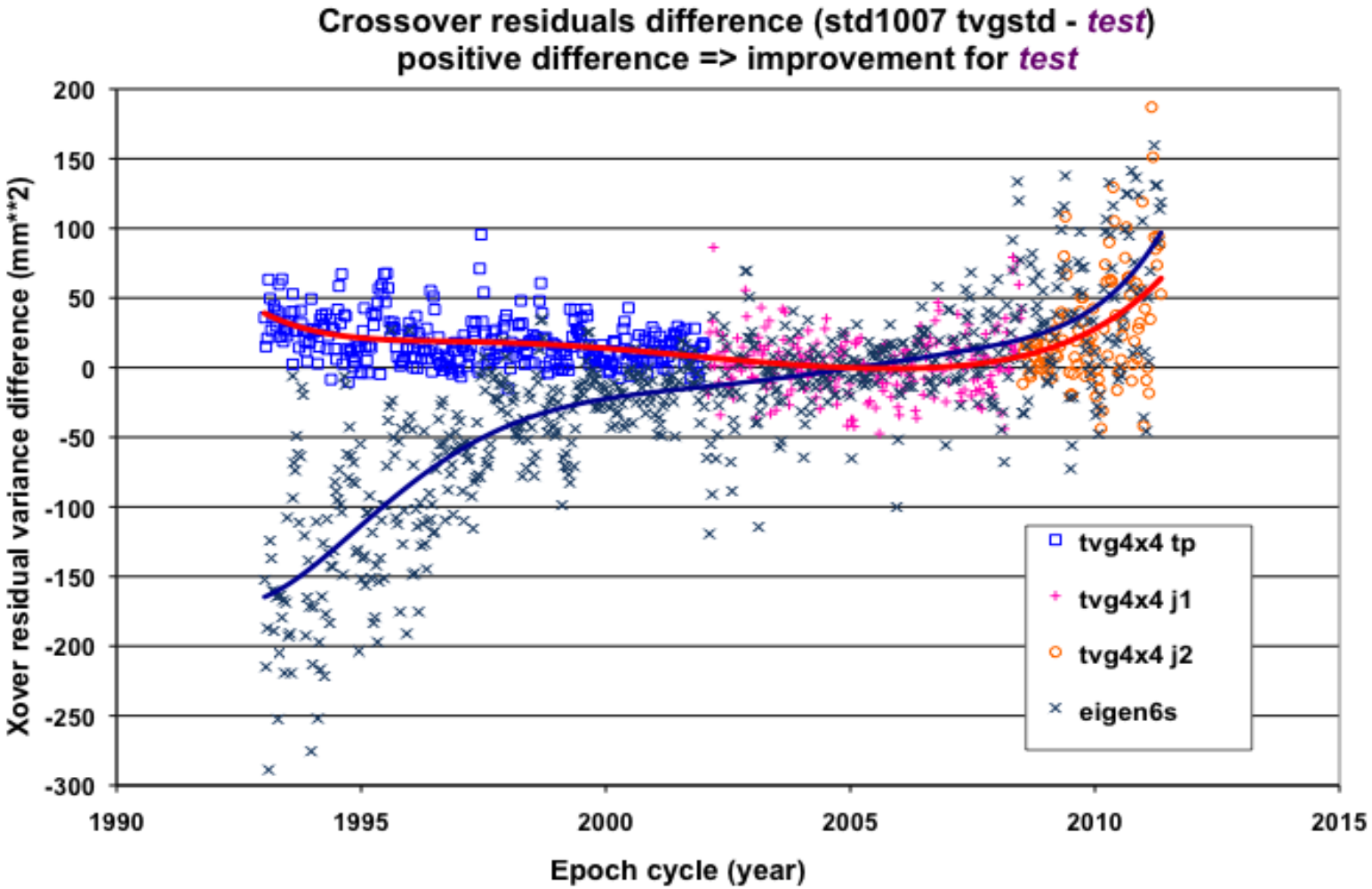
How does the mean model compare to the 10-day series

- When the same series of 10-day gravity field test orbit is compared with the GDRD orbits, the comparison is quite stable through the 2002-2011 time span
- This indicates that the new mean model captures most of the variability

RMS of Radial Difference between GDRD orbits (using the new mean field) and GDRD orbits using the 10-day series



tvg4x4 Shows Orbit Improvement Across TP, J1, J2; Eigen6s only after about 2005



Conclusions

- Jason-2 radial orbit accuracy remains at 1 cm level; Agreement between centers & techniques at level of 6-9 mm.
- Gravity model (EIGEN-GL04S) is no longer adequate for Jason-2 POD in GDRC. In GDR-D a new gravity model using more GRACE data will be used -- but we must monitor continued evolution & changes in the Earth's time-variable gravity field.
- Open issues:

(1) How to maintain consistency & stability in time (TP->J1->J2->J3) and across different missions?

(2) Radiation pressure mismodellling an open issue for Jason2 & other satellites.

(3) Modelling of geocenter (3-4 mm/yr in X-Y, 5 mm/yr Z) not included in present modesl -- no consensus model exists; Indications this signal is present in differences between POD centers.