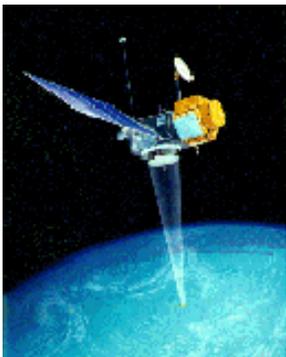


POD Splinter Summary



Frank Lemoine (NASA GSFC)
Sean Bruinsma (GRGS/CNES)
Alexandre Couhert (CNES)



**OSTST 2015 POD Splinter
Reston, Virginia, USA
October 20-23, 2015**





Session Summary (1)

- 9 oral talks; 4 posters.
- Updates by CNES, GSFC, JPL & GFZ
- Evaluation of orbit quality for new orbits (GDR-E, std1504); New project orbits offer significant improvements.
- Other detailed topics:
 1. New Time series of GRACE+SLR-based TVG solutions available from GRGS (*Richard Biancale, GRGS/CNES*).
 2. Recomputed South Atlantic Anomaly (SAA) model for Jason-1 DORIS data using Jason-2 payload (CARMEN). Validated previous results (*Hugues Capdeville, CLS*)
 3. Analysis of Satellite laser ranging data using geodetic satellites for multiple stations illuminates station-specific performance issues (*Sean Bruinsma, GRGS/CNES*)
 4. *Two papers looked at integrated treatment of geocenter, one in context of adjustment of reference frame (WIB) and the other in context of DORIS orbit (FM). Both showed that Jason-2 orbit centering can be improved.*

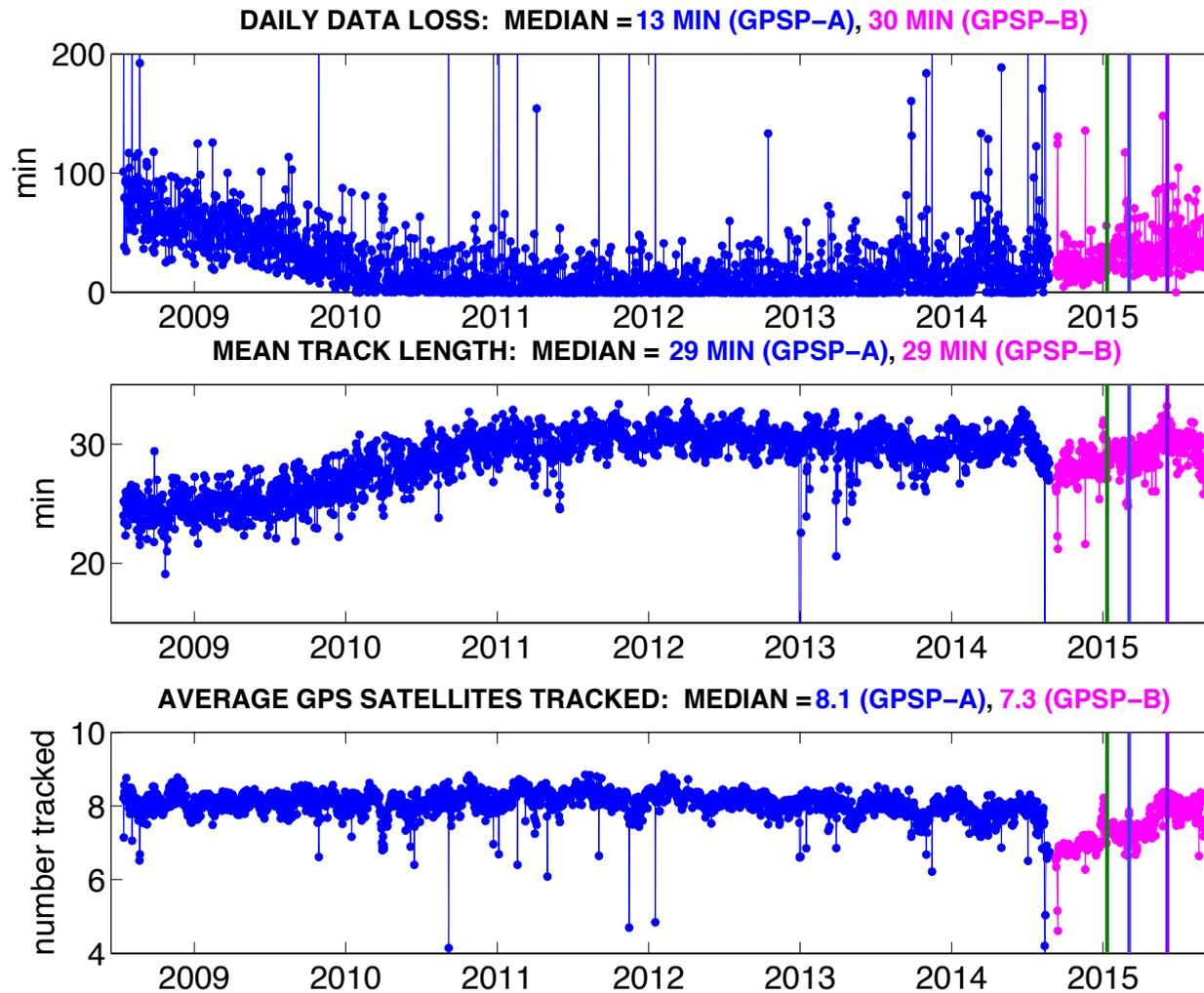


Session Summary (2)

- 1. SLR data is now independent for GDR-E orbits. Orbit computations based on DORIS (Saral, Cryosat-2), DORIS +GPS (Jason-2). (Core network RMS SLR residuals, high elevations ($< 1\text{cm RMS}$) [*Jalabert et al.*, CNES].**
- 2. CNES, JPL, GSFC orbits all agree to $< 8\text{ mm}$ radial RMS, but signatures remain in geographic representations of error, and at specific periods (*Bertiger et al.*, JPL; *Lemoine et al.*, NASA GSFC).**
- 3. GPS for Jason-2 operates on Side B since 2014-08-23; Performance initially not as good as Side A, but now has improved. (*Bertiger et al.*, JPL).**
- 4. We are monitoring performance of DORIS data on Jason-2. We see quasi-secular increase in RMS of fit since ~2012. Investigations are underway. (*Lemoine et al.*, NASA GSFC)**



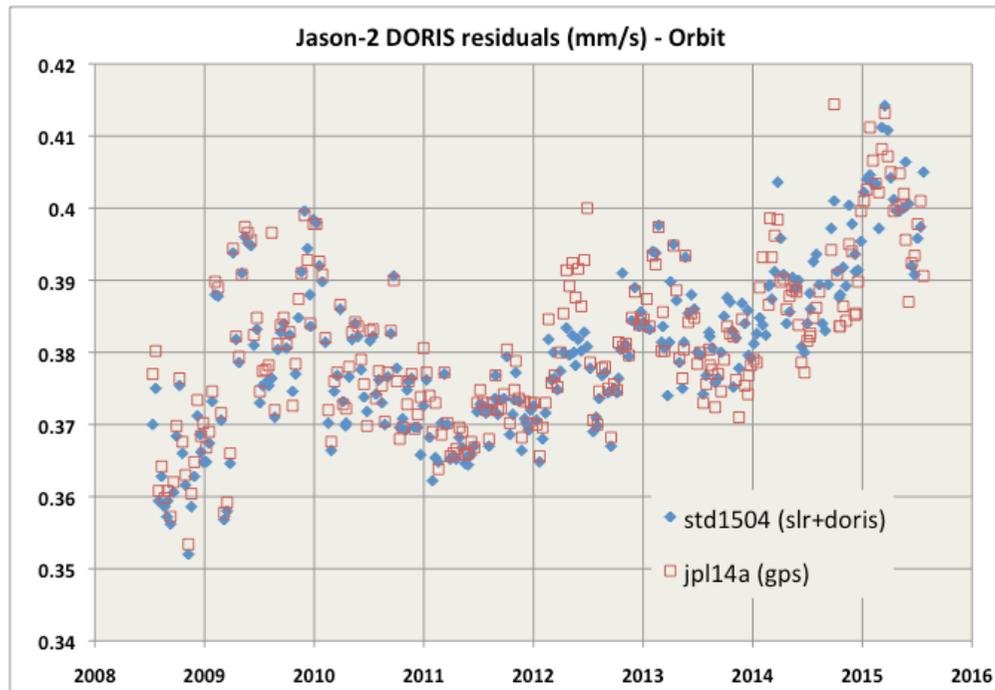
Jason-2 GPS Receiver Performance



(Bertiger et al. 2015)



Jason-2 DORIS Residuals



DORIS Residuals for NASA GSFC POD (SLR+DORIS) and using independent JPL/GPS orbits

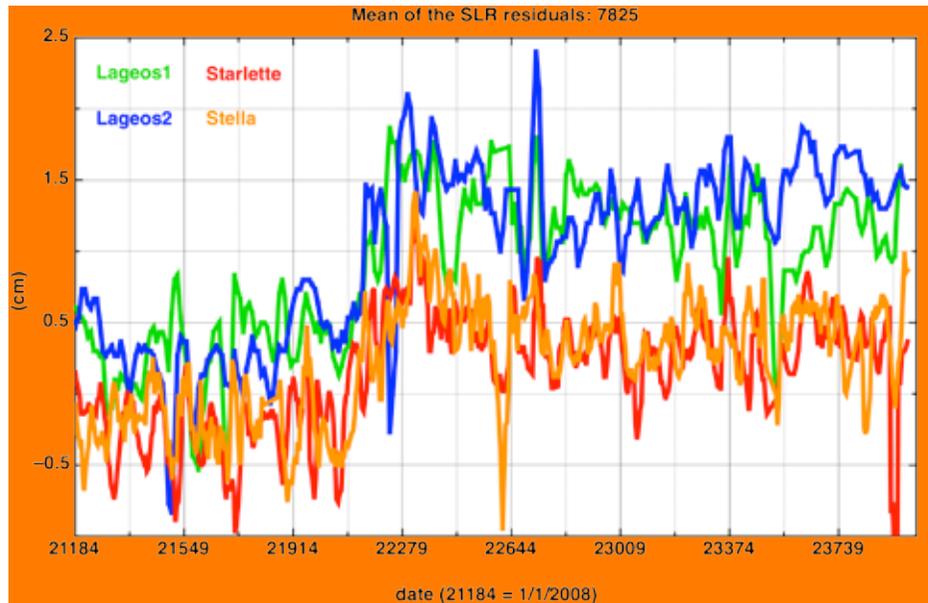
POD team will monitor this behavior.

Possibilities:

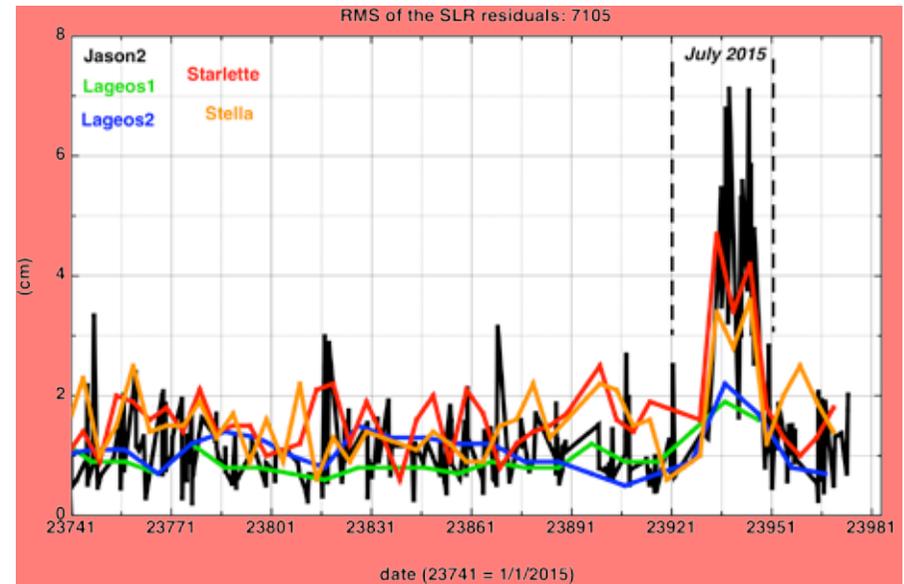
- **ITRF2008 degradation (test with ITRF2014).**
- **Time-variable gravity modeling**
- **performance issues with receiver;**
- **Correlate with DORIS performance on other satellites.**

(Lemoine et al. 2015)

SLR Station Performance Issues



Mean of SLR station bias
(Mt Stromlo, station 7825)

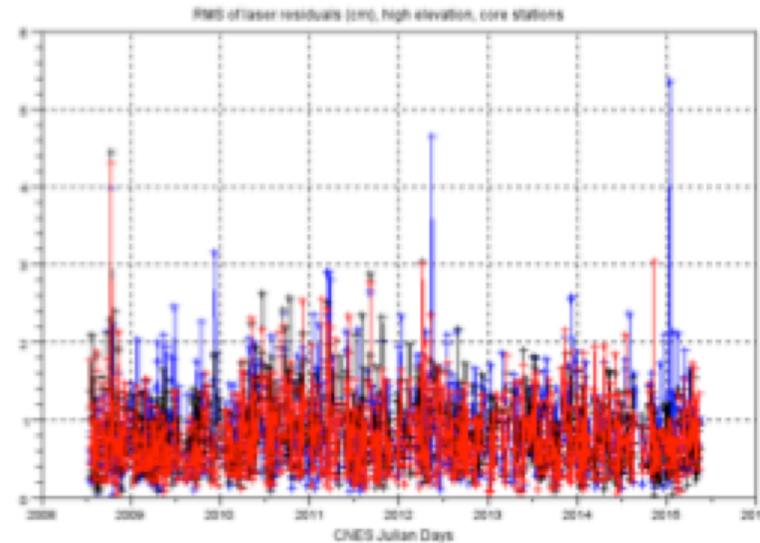
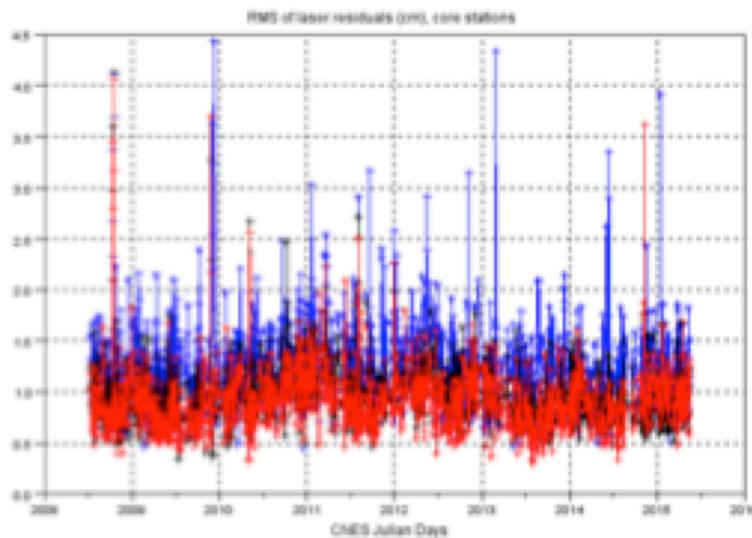


RMS of SLR Residuals
(Greenbelt, station 7105)

(Bruinsma et al. 2015)

JASON2 – COMPARISON WITH JPL AND GSFC SLR RESIDUALS

<u>Core network</u>  <u>RMS SLR residuals</u>	<u>GDR-E :</u> <u>Reduced dynamic orbit</u>	<u>GSFC :</u> <u>Dynamic orbit</u>	<u>JPL :</u> <u>Reduced dynamic orbit</u>
<u>All elevation</u>	0,95cm	1,19 cm	0,87 cm
<u>High elevation</u>	0,76 cm	0,77 cm	0,66 cm



 Core network : L7090 L7105 L7810 L7839 L7840 L7941

OSTST 2015, Precise Orbit Determination Splinter, POD Status

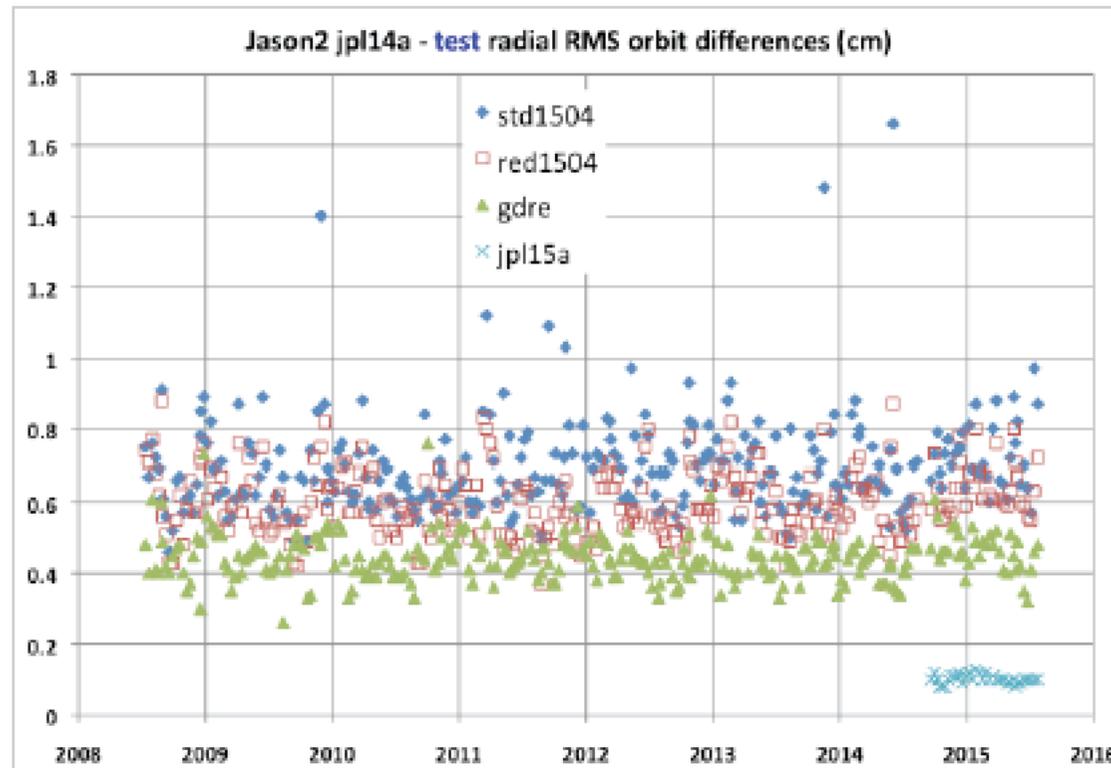
21/10/2015



(Jalabert et al. 2015)



Jason-2 Orbit Difference Summary (2)

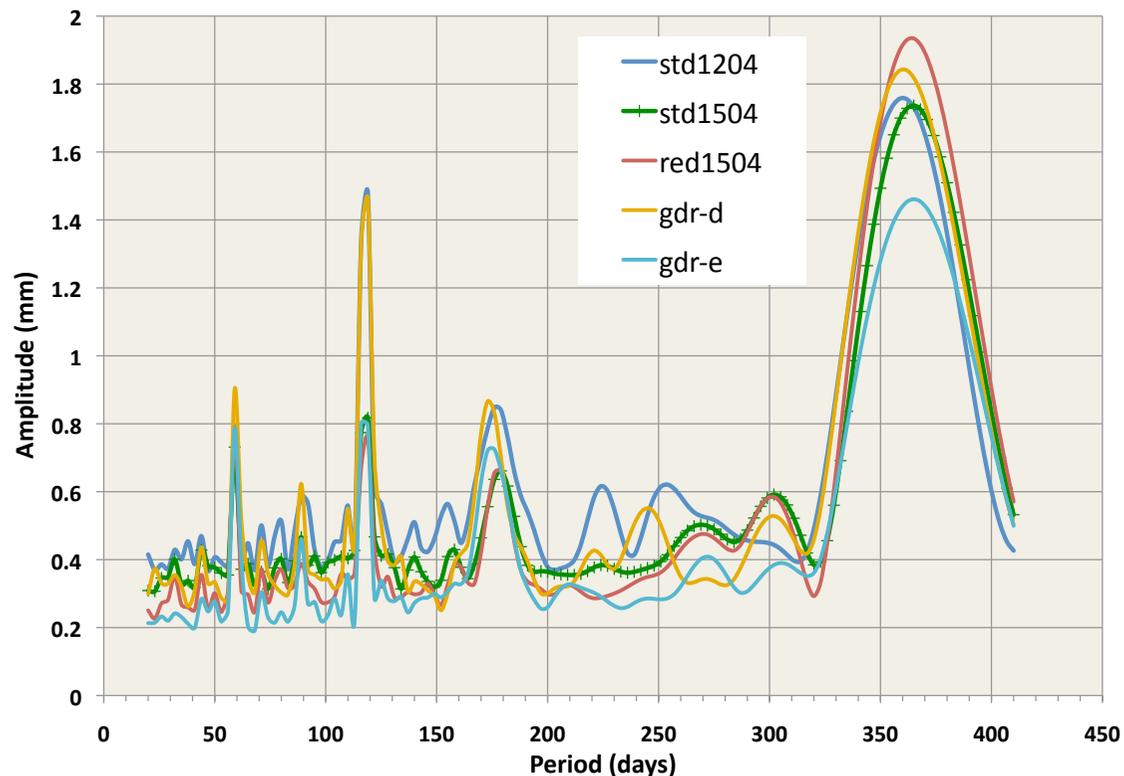


Lemoine et al., 2015; New POD Standards (std1504), OSTST, Reston, VA, U.S.A.

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All orbits agree in radial direction at < 8 mm RMS.
(Different data, POD software and techniques)

2D projection spectral analysis jpl14a-*test* radial orbit differences sampled at fixed geographic locations



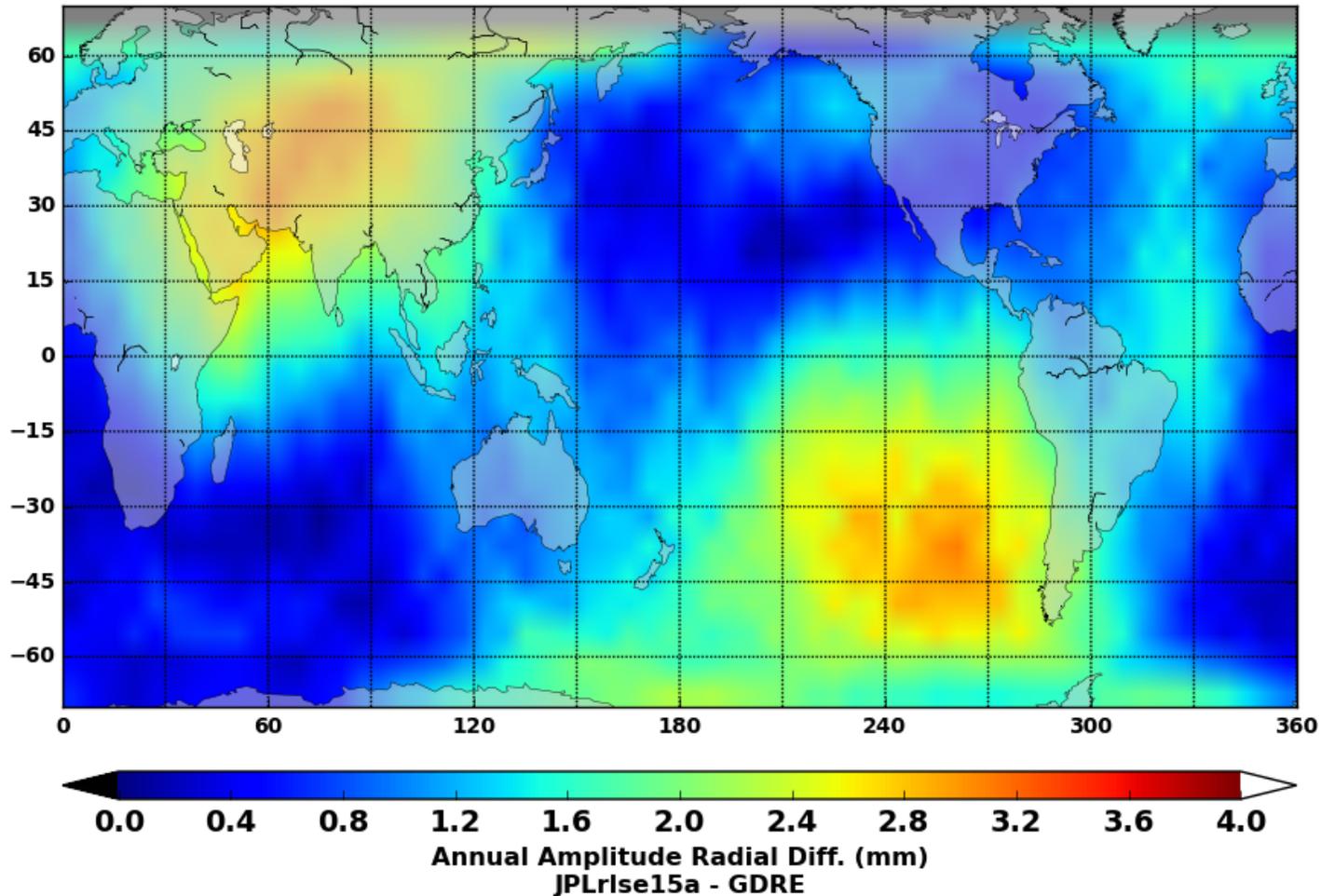
Both GDRE/CNES and NASA/GSFC std1504 show big reduction in signal at ~118 days. (1.4-1.5 mm \rightarrow ~0.8 mm)

Remaining signals are at 59 days & 118 days (~0.8 mm) and at annual period (~1.5-2.0 mm).

(Lemoine et al. 2015)



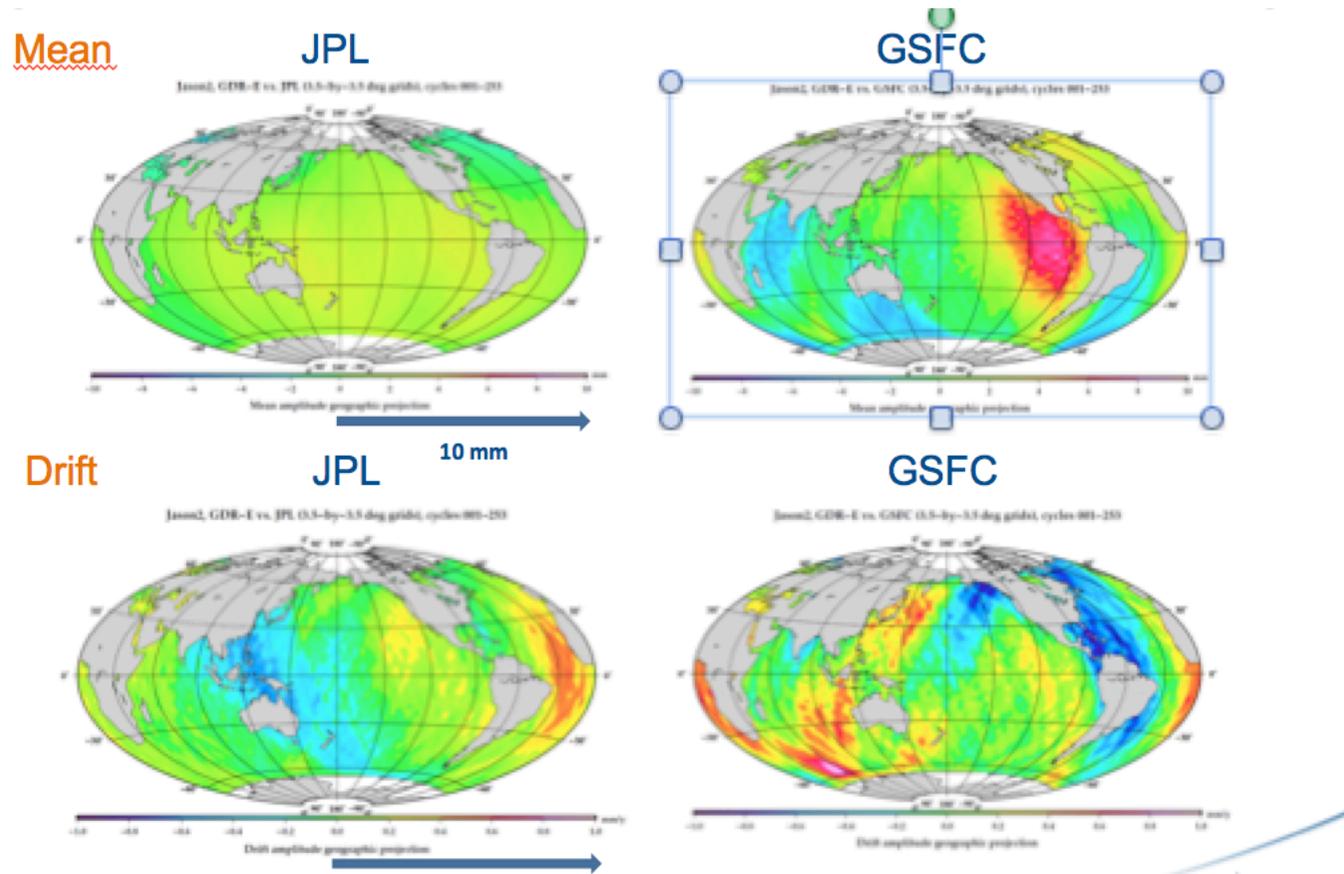
Radial Difference Annual Amplitude, JPLr15a – GDRE, 6°x6° Bin Average



(Bertiger et al. 2015)

- Differences in Geocenter realization?
- GPS/Bias fixing, DORIS?

JASON2 – Comparison for CNES/GDRE with JPL/jpl14a and GSFC/std1504 geographically correlated radial differences



(Jalabert et al. 2015)

Summary from POD Round Table (1)

1. Continue to monitor performance of DORIS on Jason-2 and ascertain cause of increase in RMS of fit. (an “SAA-effect” is not excluded; but there are other possibilities).
2. Continue to monitor and diagnose SLR station performance. Can exhibit biases – some that are even episodic in nature. (GRGS, CNES, and NASA GSFC will look at this issue).
3. Jason-CS. Questions about RUAG/GPS performance due to issues on Swarm and GOCE. Solution: Team members will analyze Sentinel-3 data to understand updated RUAG receiver; POD team members will compile list of questions based on experience with GOCE & Swarm for Jason-CS project.

Other POD Issues

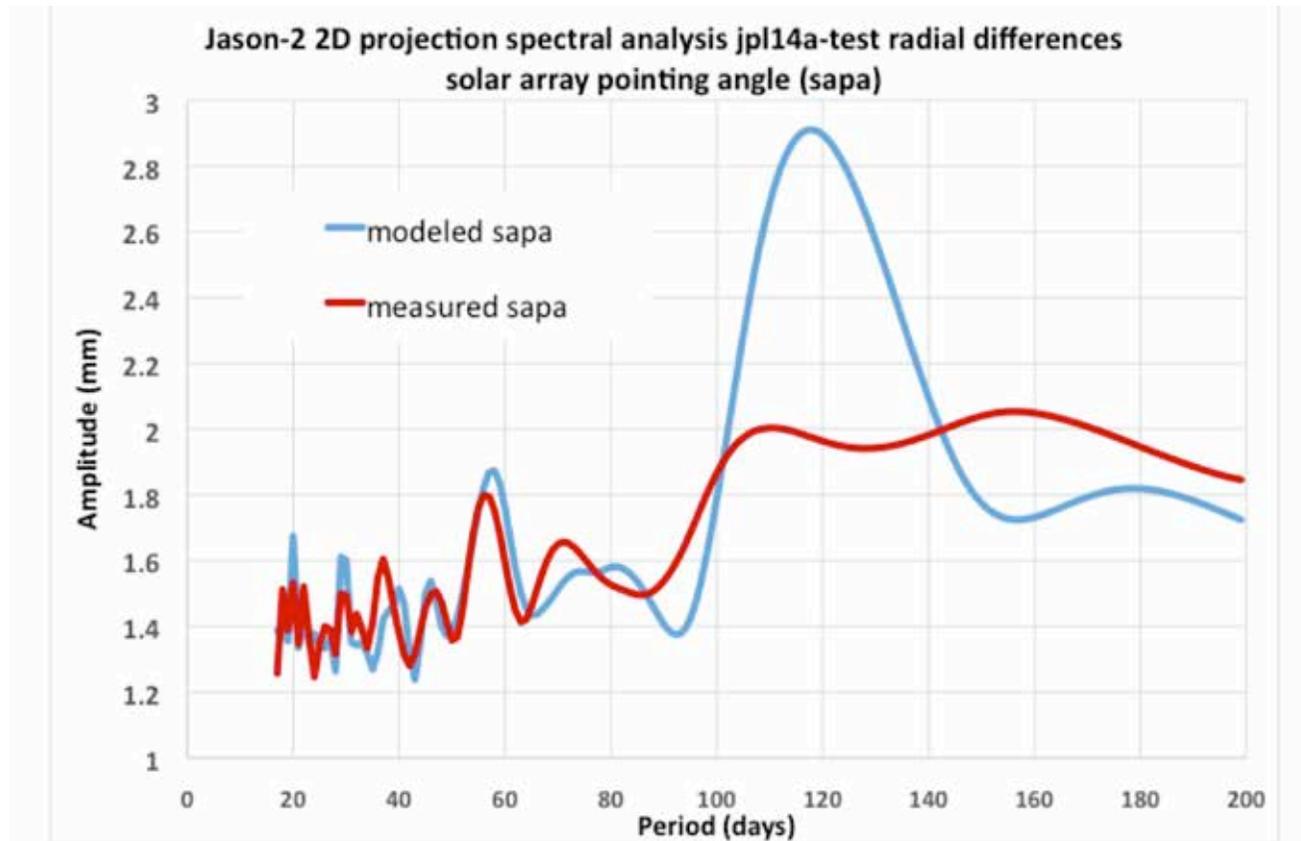
4. Jason-CS: Center-of-mass (COM) modeling due to large propellant tank (200 kg). Questions about specifications.
5. Perform Detailed Tests on all realizations of ITRF2014 (IGN, JPL, DGFI). At some point the GDRE/std1504 orbits will need to be updated with the new reference frame.

Other POD Issues

"The POD team of the OSTST recommends for all existing (Saral, HY2A...) and future altimeter missions (Sentinel-3, Jason-CS, SWOT) that the quaternions of the spacecraft bus and movable appendages (e.g. solar panels) be made available to the community.

The availability of quaternions is beneficial for altimeter data evaluation since it offers an independent way to estimate the pitch roll and yaw of the platform, moreover this data helps to model solar radiation pressure effects which are relevant during Precise Orbit Determination."

Jason-2 jpl11a/GPS – GSFC/SLR+DORIS test orbits 118-day signal (cycles 5-45)



Improvements for NASA GSFC orbits arise solely from correcting few degree misorientation of solar arrays from nominal model. This is why solar array orientation knowledge is critical.