GSC Analysis Center Report

GSFC POD Team

IDS Analysis Working Group Meeting

Paris, FRANCE

March 26-27, 2014

Summary

1. Since October 2013, All DORIS data (1993-2013) reprocessed with a series of updates to gscwd20.

2. The new series (gscwd23) includes implementation of recommendations from the AWG meeting Toulouse (April 2013), implementation of the IERS 2010 standards; Application of the DORIS antennae phase laws; Application of a GSFC-derived model of time-variable gravity (1993-2013) on a week-by-week basis..,

3. New baseline series: gscwd23. Supercedes all previous series. Delivered to CDDIS and IGN data centers on Sept. 30, 2013. (See DORISReport 3536; Jan. 16, 2014).

4. gscwd24. A series to augment gscwd23: Includes Jason-1 data (Nov. 2004 – July 2008); HY2A data (Nov 2011 – Dec 2013).

Significant Changes wrt. ITRF2008

1. **Explicit modeling of the pole according to the IERS standards 2010, (Petit and Luzum, 2010; Table 7.7, pp. 115.)**
    - Cubic model to 2010; Linear model afterwards.

2. **C21, S21 is fully compatible with this pole model and uses long-term model based on standard values of C20, C22, S22.** (equation 6.5 IERS standards 2010, pp. 81).

Significant Changes wrt. ITRF2008

3. New *a priori* **DORIS station set (DPOD2008v1.12). Brings in data from newer stations towards the end of the series.**

4. Explicitly deleted in POD computations those stations with < 250 observations/week. (In gscwd18, these stations were deleted at the normal equation stage**).**

5. A DORIS timing bias model was added for TOPEX/Poseidon, based on SLR/DORIS solutions.

6. Use quaternions from E.J.O. Schrama to model attitude of Cryosat-2.

Significant Changes wrt. ITRF2008

7. More frequent cd adjustments as per recommendations of Laurent Soudarin; This affected the lower satellites: SPOT-2,3,4,5; Envisat, Cryosat-2.

8. "Newly ascertained" Pitch changes in Solar array of SPOT-5 (after March 2012).

9. Many (beaucoup) **week-by-week arc setup cleanups to avoid lengthy periods with no data in beginning, end or middle of arcs.**

Significant Changes wrt. ITRF2008

10. In weekly normal equations, satellite contributions had the following NEQ scale factors:

TOPEX	9.68980
SPOT-2	11.5398
SPOT-3	10.2811
SPOT-4	11.8906
SPOT-5	13.5913
ENVISAT	9.99860
CRYOSAT2	12.7550
JASON-2	17.6356

These scale factors are wrt. the GEODYN POD data weight of 2 mm/s, and as a result the effective data weight in the weekly solutions is closer to the intrinsic RMS of fit, by satellite, allowing for some residual systematic error.

→ This should be noticeable in the std deviations in the STCD plots for this series.

Significant Changes wrt. ITRF2008

11. Use SPOT-5 SAA Corrected DORIS data (2006-2013.0).
    (Data for 2013/SPOT-5 not yet processed; waiting for data).

GSC wd23 Processing Summary

Satellite	Narcs	avg obs/arc	avg/arcl	avg WRMS
			(days)	(mm/s)
SPOT-2	968	24854	5.93	0.4755
SPOT-3	165	26128	5.77	0.5000
TOPEX	668	36596	6.37	0.5163
SPOT-4	923	28824	5.92`	0.4728
SPOT-5	663	52955	6.34	0.4067
Envisat	557	39353	5.22	0.4912
Jason-1	188	74954	6.63	0.3239
Jason-2	294	112070	6.59	0.3767
Cryosat2	236	50860	5.46	0.4105
HY2A	137	56990	5.41	0.3880

GSC wd23 Radiation Pressure Models

Satellite	Model Applied & Source
SPOT-2	GSFC-derived macromodel. Retuned.
SPOT-3	GSFC-derived macromodel. Retuned.
TOPEX	Marshall & Luthcke, 1994; Marshall et al., 1995; Antreasian and Rosborough 1992.
SPOT-4	CNES-derived. Tuned for ITRF2008. Le Bail et al. 2010
SPOT-5	CNES-derived. Tuned for ITRF2008. Le Bail et al. 2010 Change in pitch of solar array modelled explicitly after 2008.
Envisat	UCL. Sibthorpe, 2006.
Jason-1	UCL. Cr=1.00. Ziebart et al. 2005.
Jason-2	CNES-derived. Cr=0.945.
Cryosat2	CNES, 7plate macromodel. Untuned.
HY2A	CNES model. GSFC-tuned (need to check)

ENVISAT Daily OPR Along-track Acc. Summary

(units of 1.0e-9 m/s^2, Jan 2004 to October 2005)

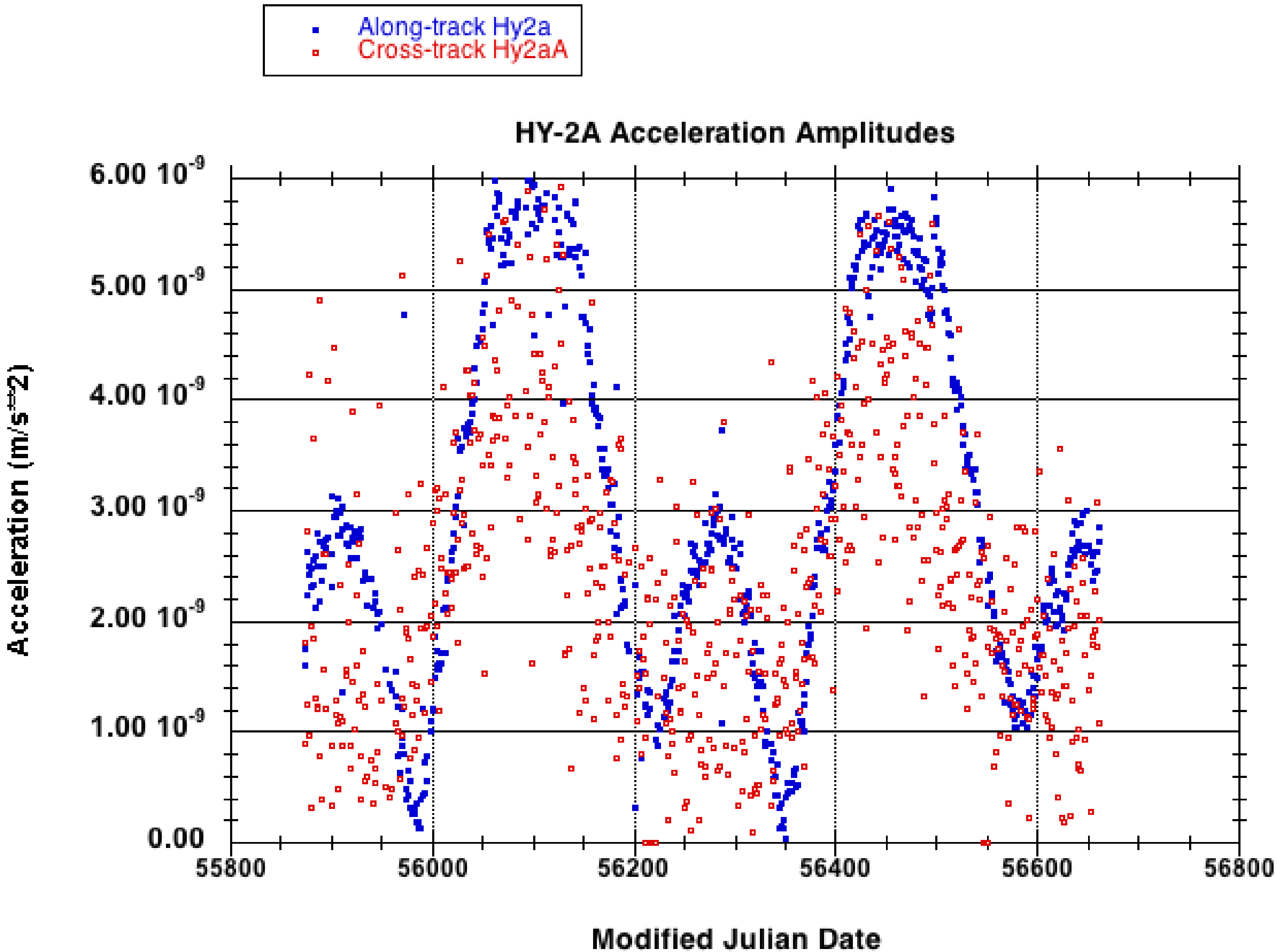
Test	Nplates	UCL model applied	Along-track OPR Ampl (1 x 10^{-9} m/s^2)		Cross-track OPR Amplitude (1 x 10^{-9} m/s^2)		Cr
Satellite			Avg.	Median	Avg	Median	
A priori (from itrf2008)	10	Y	10.29	9.98	2.573	2.204	1.00
mod (UCL itrf2008)	10	Y	1.517	1.418	1.980	1.661	1.00
mod_noucl	10	N	0.897	0.847	2.160	1.859	1.00
Ucltst1*	10	Y	1.096	1.032	1.946	1.629	1.00
Ucltst1_cr*	10	Y	1.076	1.007	1.945	1.622	1.00417
cnesmod	8	Y	1.571	1.475	1.958	1.633	1.00
cnesmod_noucl	8	N	1.337	1.265	2.119	1.796	1.00

Conclusions: (1) 10 –plate macromodel (includes SAR-array) slightly lower opr ‘residuals’ than 8-plate (CNES) model; (2) UCL-model improves after application of correction in surface area for thermal re-radiation of solar array.

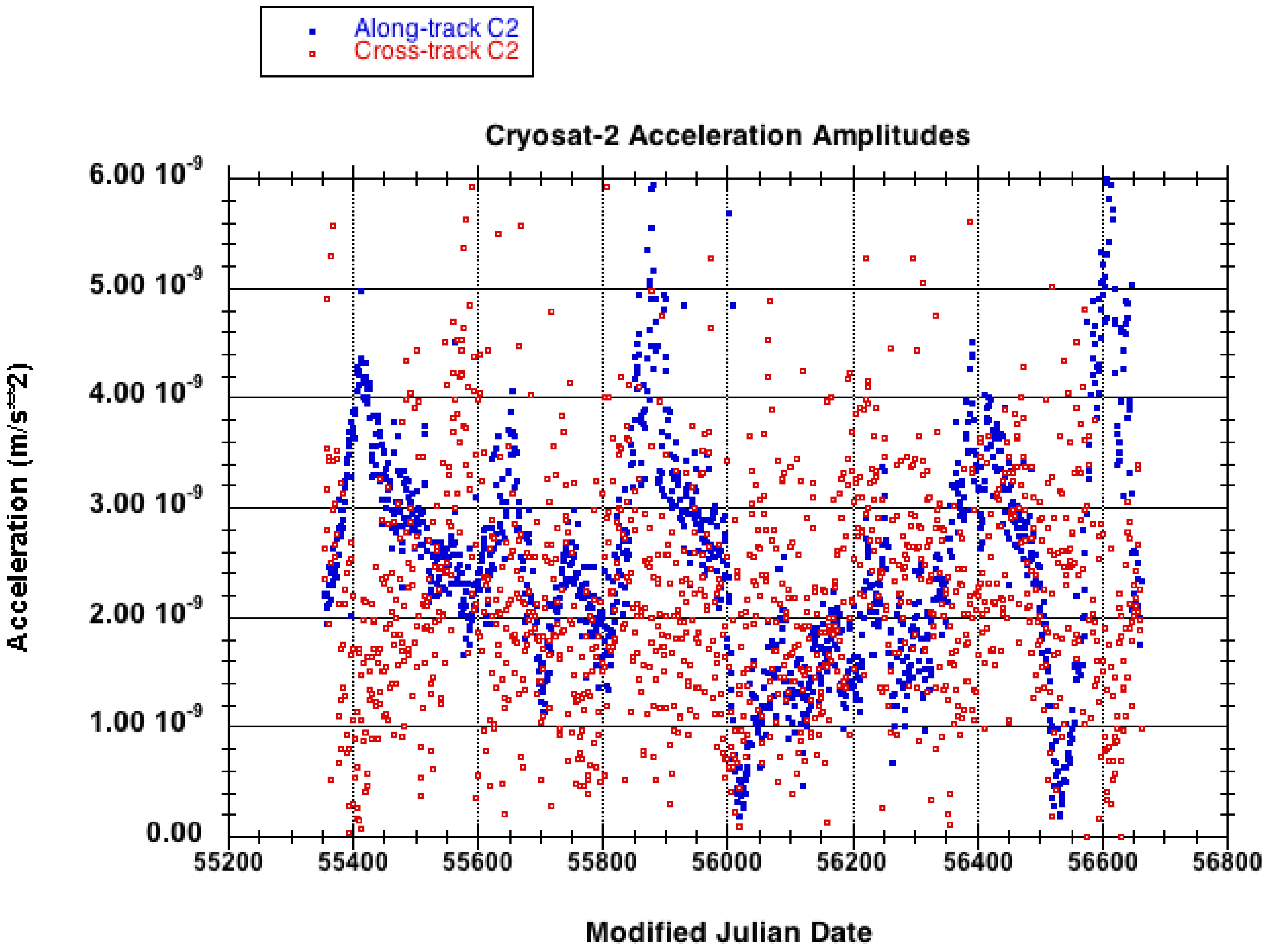
GSC wd23 Empirical OPR Summary
(over time span of data)

Satellite	Along-track (nm/s**2)		Cross track (nm/s**2)	
	Mean	Median	Mean	Median
SPOT-2	1.94	1.91	3.45	2.99
SPOT-3	0.72	0.66	2.31	2.03
TOPEX	0.77	0.54	4.31	3.63
SPOT-4	1.12	0.80	3.65	4.24
SPOT-5	1.20	0.66	1.48	1.32
Envisat	1.49	1.34	1.87	1.55
Jason-1	1.53	1.28	2.37	2.70
Jason-2	1.37	1.22	3.03	2.96
Cryosat2	3.07	2.47	3.21	2.13
HY2A	4.53	2.70	4.11	2.34

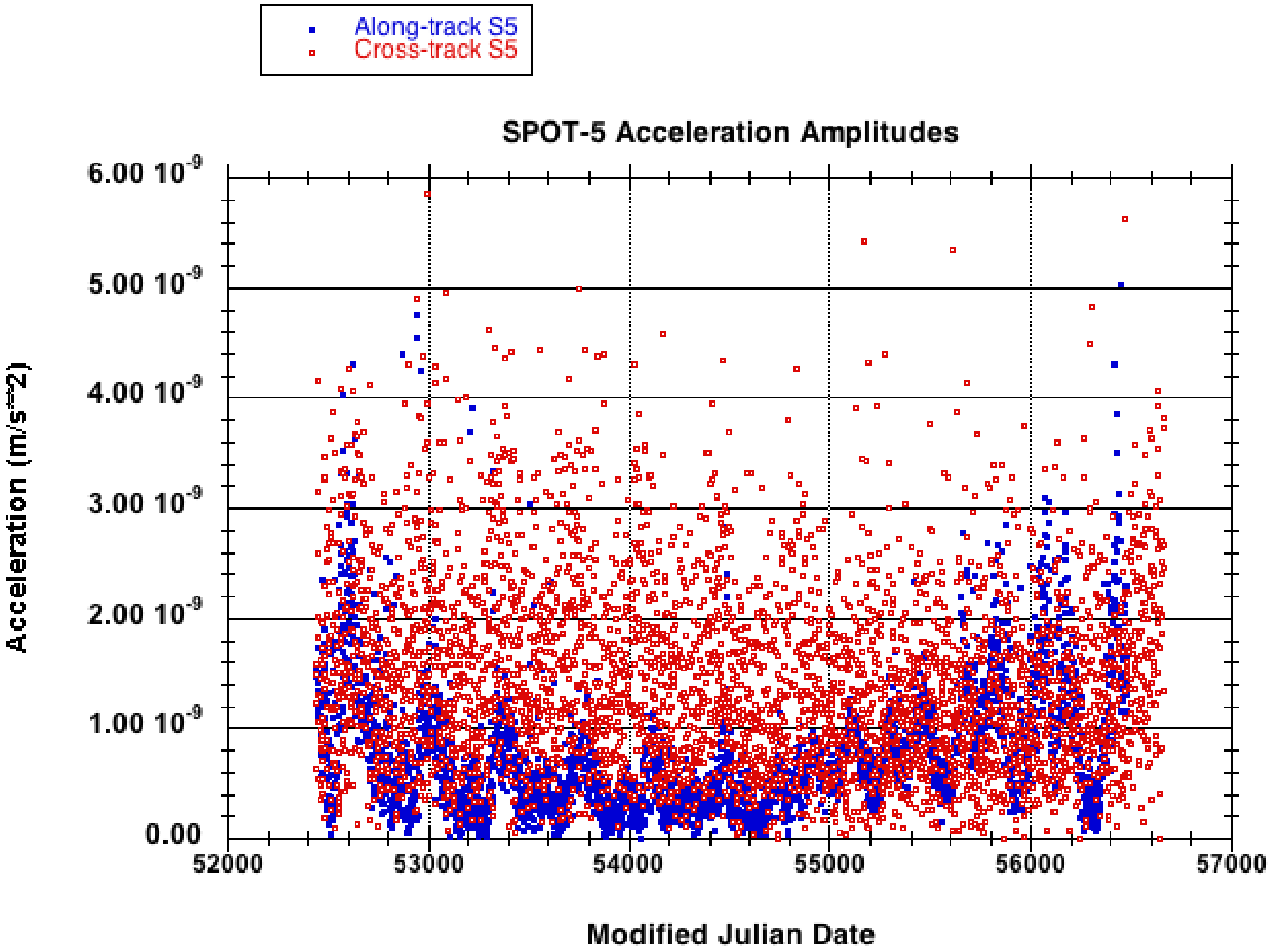
HY-2A gscwd23 OPR History



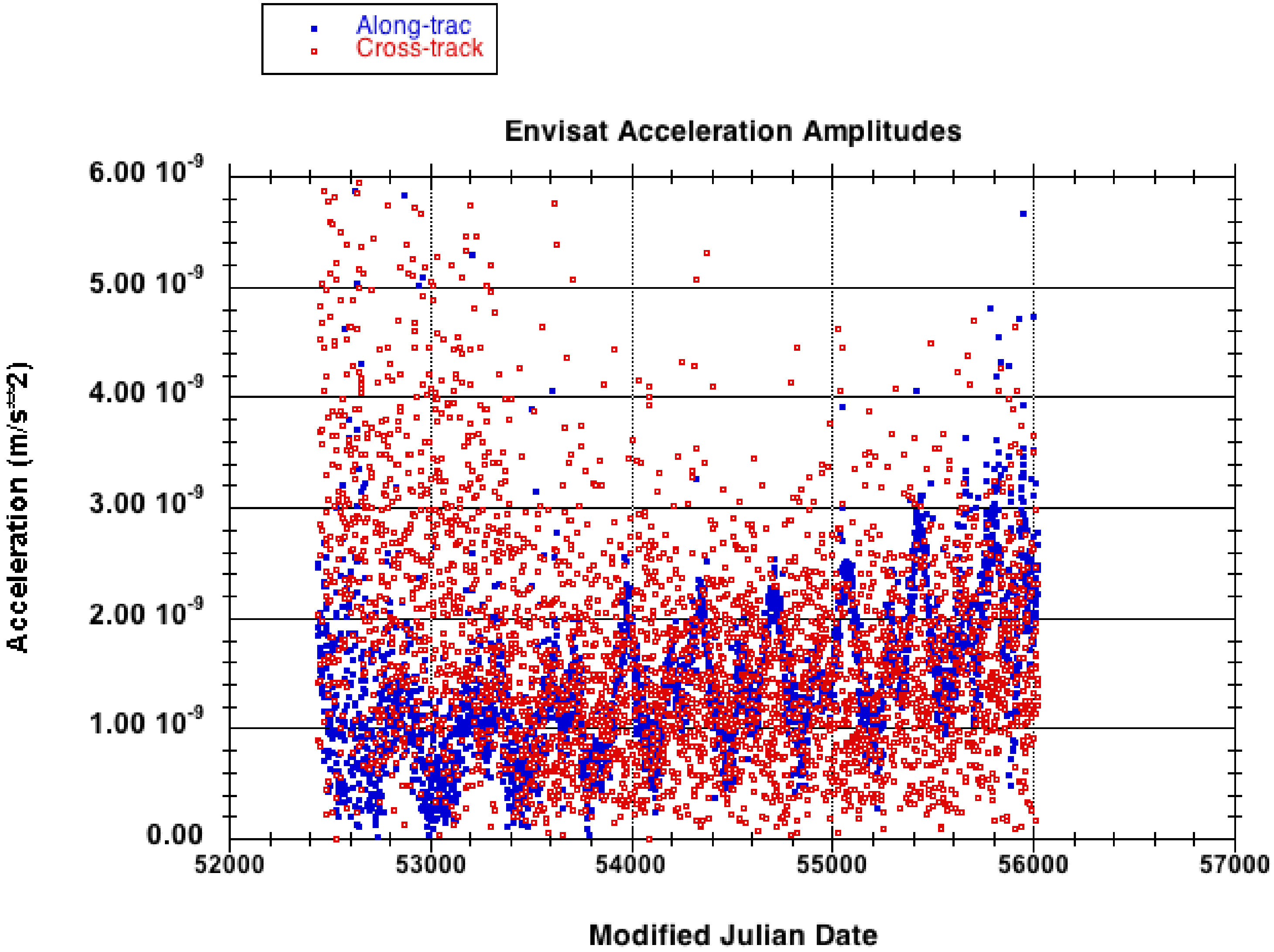
Cryosat2 gscwd23 OPR History



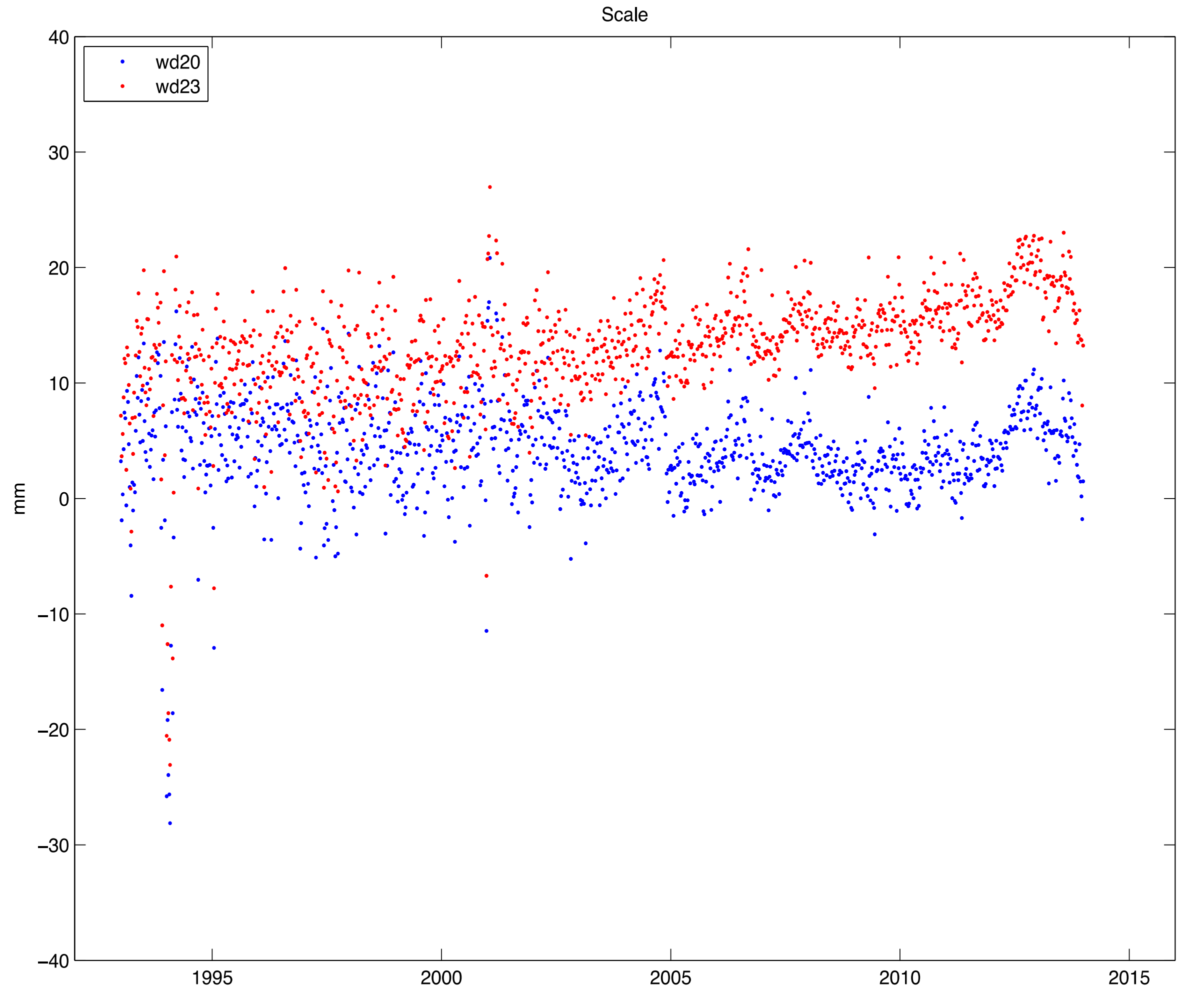
SPOT-5 gscwd23 OPR History



Envisat gscwd23 OPR History

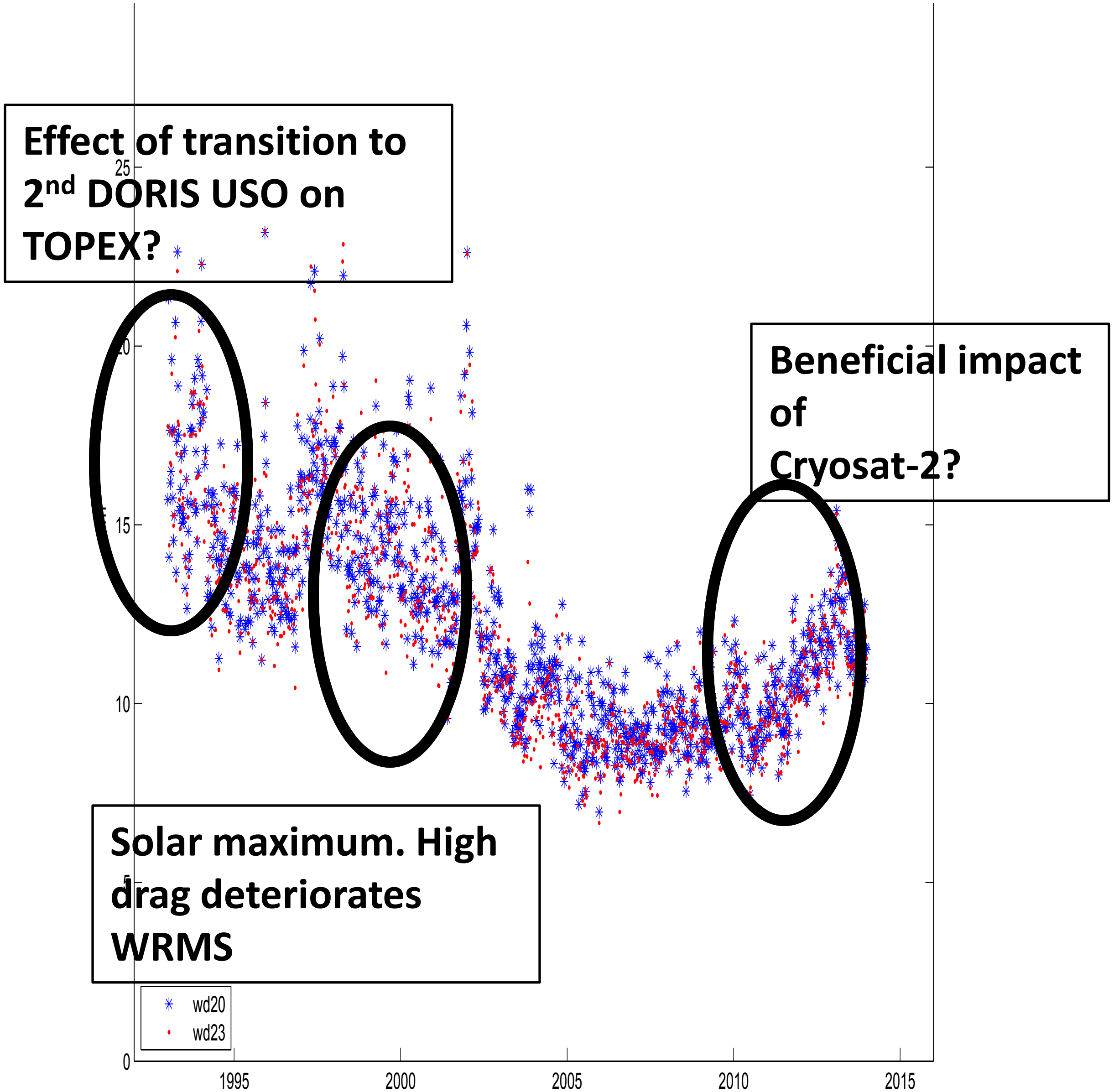


Scale of new solution, wd23 vs wd20

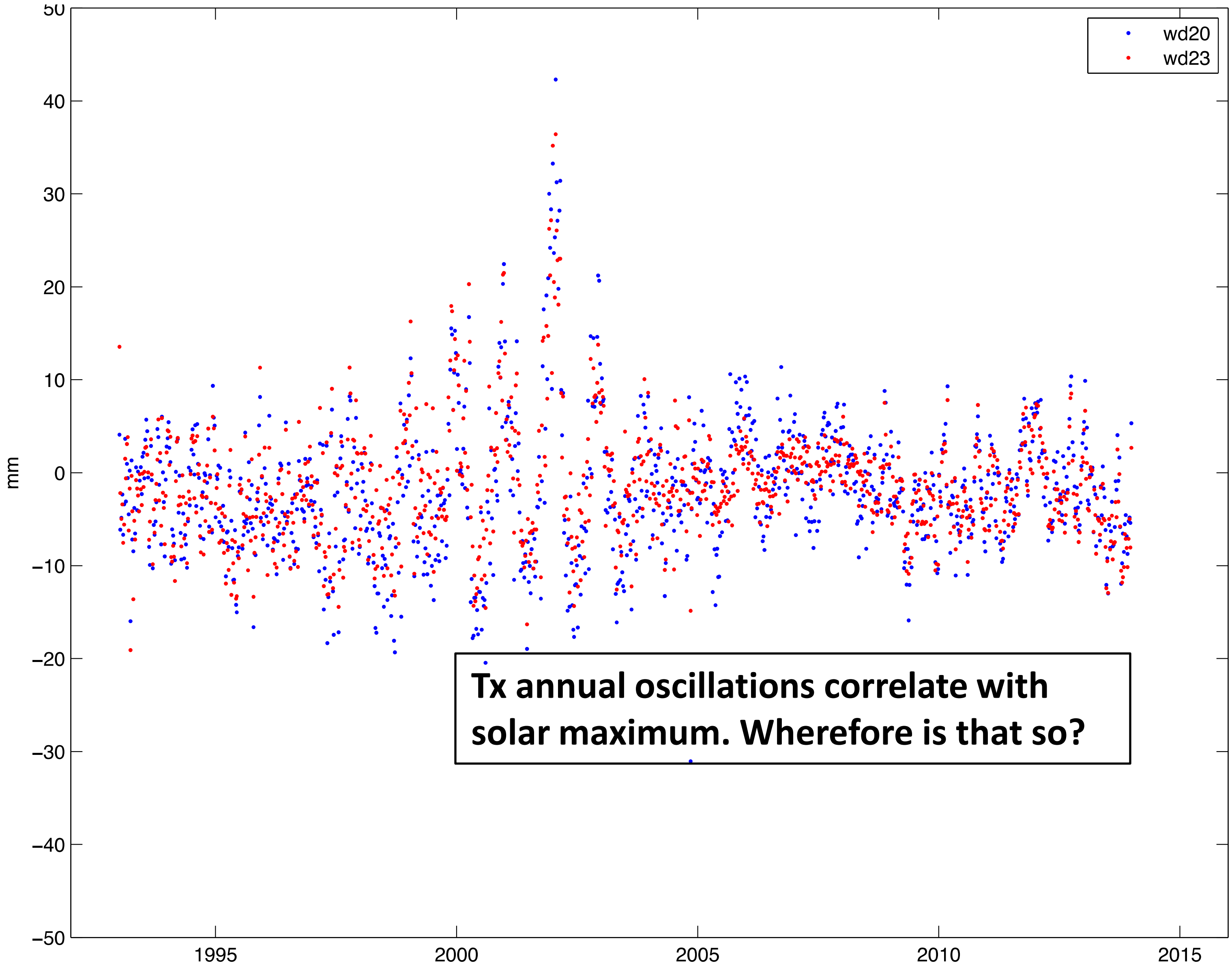


Effect of Implementation of Phase Laws.

WRMS of wd23 vs wd20.



Tx for wd23 & wd20



Tx annual oscillations correlate with solar maximum. Wherefore is that so?

Next steps

1. **Review any anomalies detected by Combination Center.**

2. **Check macromodel implemented for HY-2A.**