IDS Evaluation of ITRF2008

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IDS Tests for ITRF2008

- Compute DORIS-only, SLR-only & SLR+DORIS orbits for TOPEX/Poseidon, Jason1, & Jason2 Altimeter satellites for select periods 1993 - 2010.
- Use RMS of fit and independent Altimeter Crossovers as metrics.
- Evaluate DPOD2005, ITRF2008, ITRF2008D complements globally and station-by-station.
- Evaluate orbit differences, esp. Mean-Z orbit differences, and radial orbit differences (including rates through time).
- Review horizontal and vertical station velocities for DORIS sites in ITRF2005, ITRF2008, ITRF2008d.

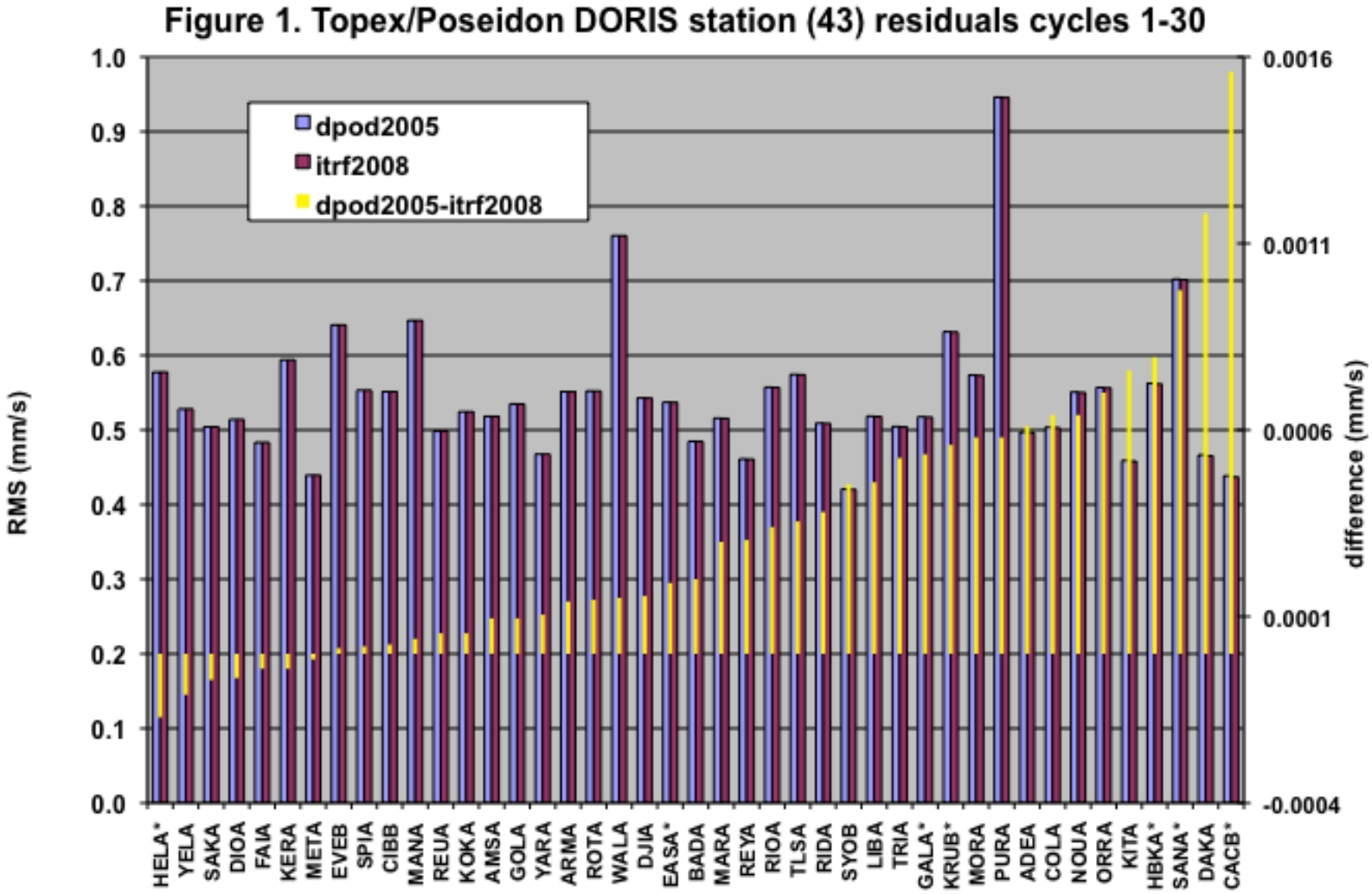
DORIS Complements: RMS of fit comparison vs. time for DORIS-only Altimeter satellite orbits

test DORIS-only	number stations	average points / cycle	average residuals per cycle		
			DORIS (mm/s)	SLR (cm)	Xover (cm)
TOPEX/Poseidon (Apr 19, 1993 – July 17, 1993)					
dpod2005	45	57135	0.5386	4.81	5.936
dpod2005*	42	54342	0.5393	4.94	5.939
itrf2008	42	54342	0.5391	4.90	5.942
itrf2008d	42	54342	0.5391	4.90	5.939
TOPEX/Poseidon (Jan. 15, 2002 – Aug. 11, 2002)					
dpod2005	53	57365	0.4733	4.16	5.622
itrf2008	51	56015	0.4736	4.20	5.621
itrf2008d	52	57251	0.4731	4.16	5.616
Jason-2 (Jan. 26, 2009 – Jan. 28, 2010)					
dpod2005 *	51	151295	0.3774	2.38	5.577
itrf2008	51	151307	0.3761	2.39	5.556
itrf2008d	51	151305	0.3766	2.39	5.559

SLR & Xover fits are independent

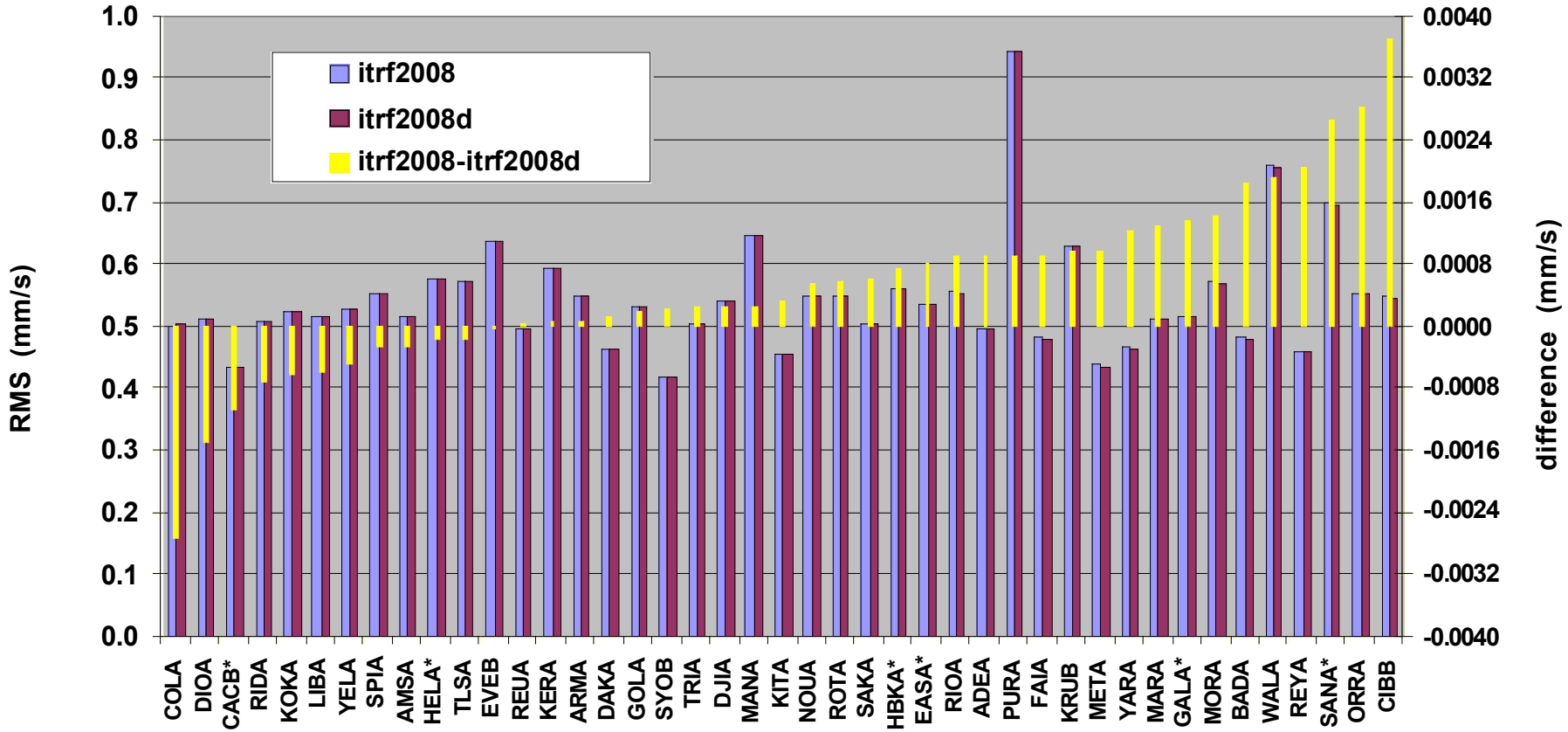
- ITRF2008 marginally better up to 2008. From 2008 (after DPOD2005 time span) ITRF2008 performs progressively better than DPOD2005.
- On a station-by-station basis, ITRF2008 slightly better than ITRF2008d.
- ~11-13 stations with coordinate diffs (2005.0) > 5 cm; Velocity diffs more significant
- Some glitches in ITRF2008d (SODB, Soccoro) has to be excluded from tests.

DORIS: station-by station comparisons, TOPEX: Sept. 1992-Apr. 1993, DPOD2005 vs. ITRF2008

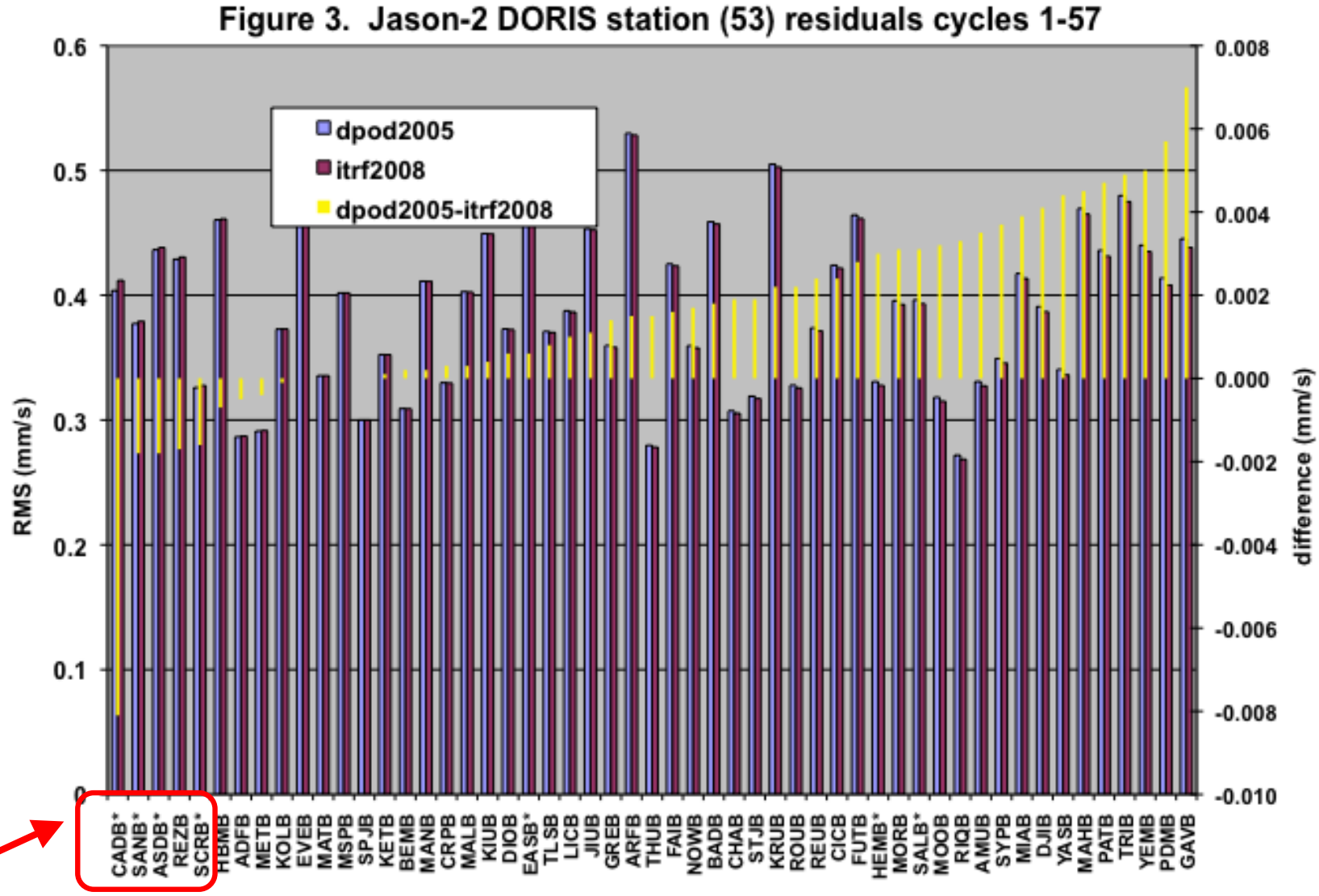


DORIS: station-by station comparisons
TOPEX: Sept 1992-July 1993, ITRF2008 vs. ITRF2008d

Figure 1. Topex/Poseidon 43 DORIS station residuals cycles 1-30 (positive implies improvement for itrf2008d)



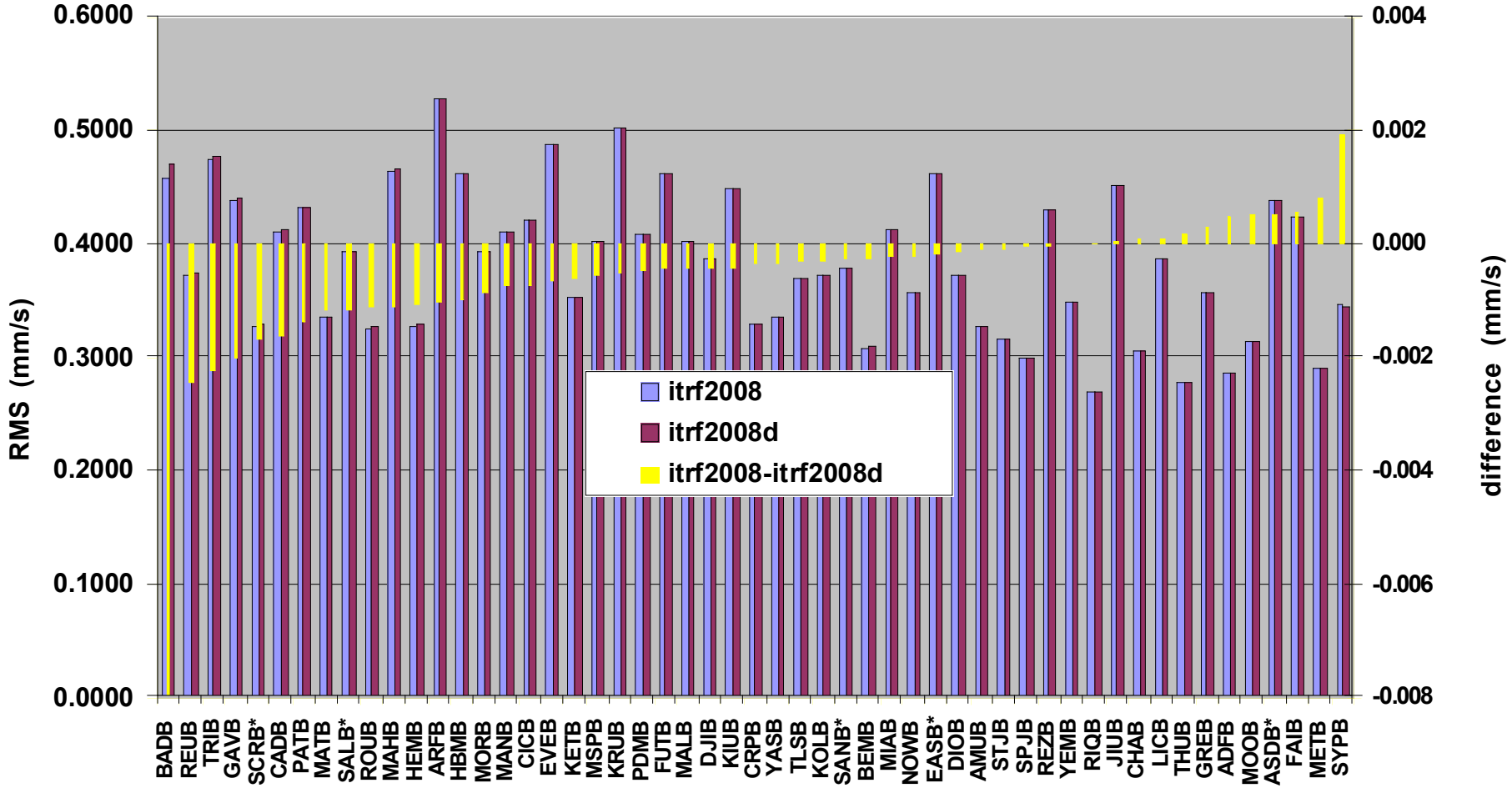
DORIS: station-by station comparisons, Jason-2: July 2008 - Jan. 2010, DPOD2005 vs ITRF2008

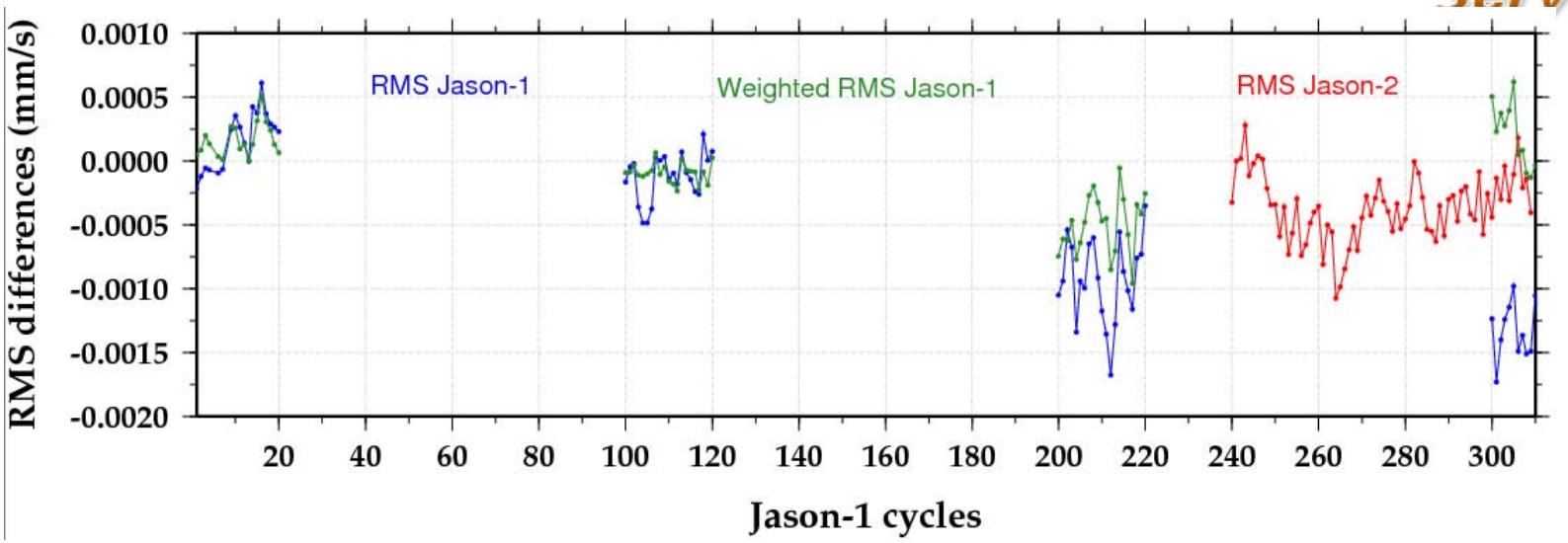


Predominantly SAA stations show degradation for Jason-2

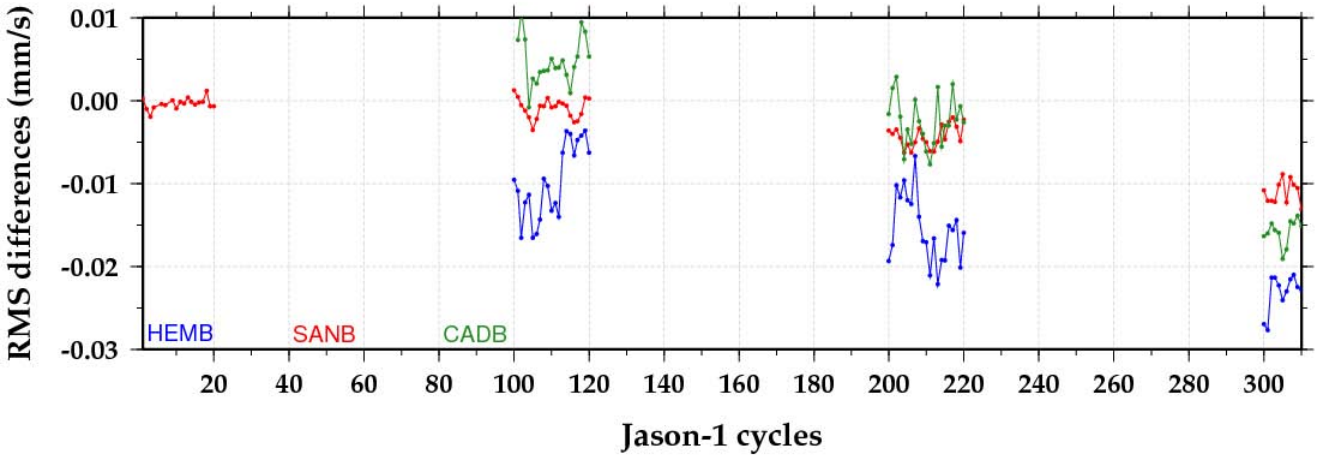
DORIS: station-by station comparisons, Jason-2: July 2008 - Jan. 2010, ITRF2008 vs. ITRF2008d

Figure 3. Jason-2 53 DORIS station residuals cycles 1-57 (positive implies improvement for itrf2008d)





Global DORIS RMS residuals differences per cycle (ITRF2005-ITRF2008)



Jason-1 DORIS RMS residuals differences per cycle (ITRF2005-ITRF2008)

From A. Couhert & L. Cerri (CNES)

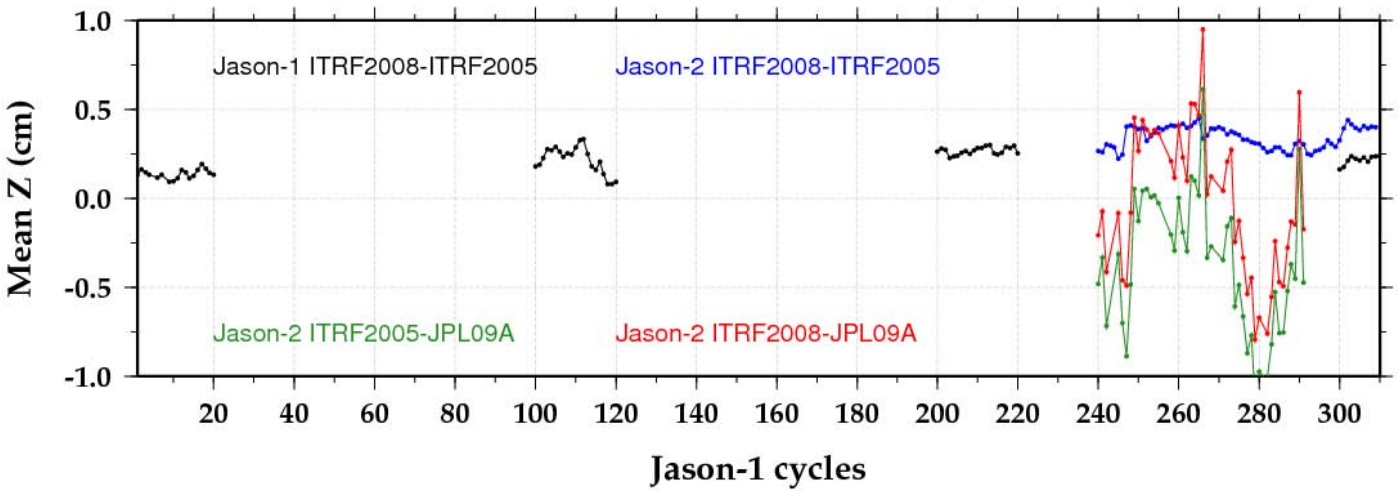
SLR Complements: RMS of fit comparison vs time for SLR-only altimeter satellite orbits

SLR-only, POD	number stations	average points / cycle	average rms residuals (cm)	
			SLR	XOVER
TOPEX/Poseidon Sept. 25, 1992 – July 17, 1993				
LPOD2005	36	4623	2.219	6.010
ITRF2008	36	4623	2.140	5.984
ITRF2008d	36	4623	**2.134**	**5.979**
TOPEX/Poseidon, Jan. 15, 2002 – Aug. 11, 2002				
LPOD2005	35	4102	1.537	5.565
ITRF2008	34	4095	1.448	5.548
ITRF2008d	34	4094	**1.423**	**5.542**
Jason-1, July 11, 2008 – Jan. 26, 2009				
LPOD2005	32	2690	1.029	5.555
ITRF2008	32	2690	1.014	5.531
ITRF2008d	32	2691	**0.990**	**5.521**
Jason-2, Jan. 26, 2009 – Jan. 28, 2010				
LPOD2005	32	5149	0.999	5.649
ITRF2008	32	5146	0.950	5.651
ITRF2008d	32	5145	**0.947**	**5.648**

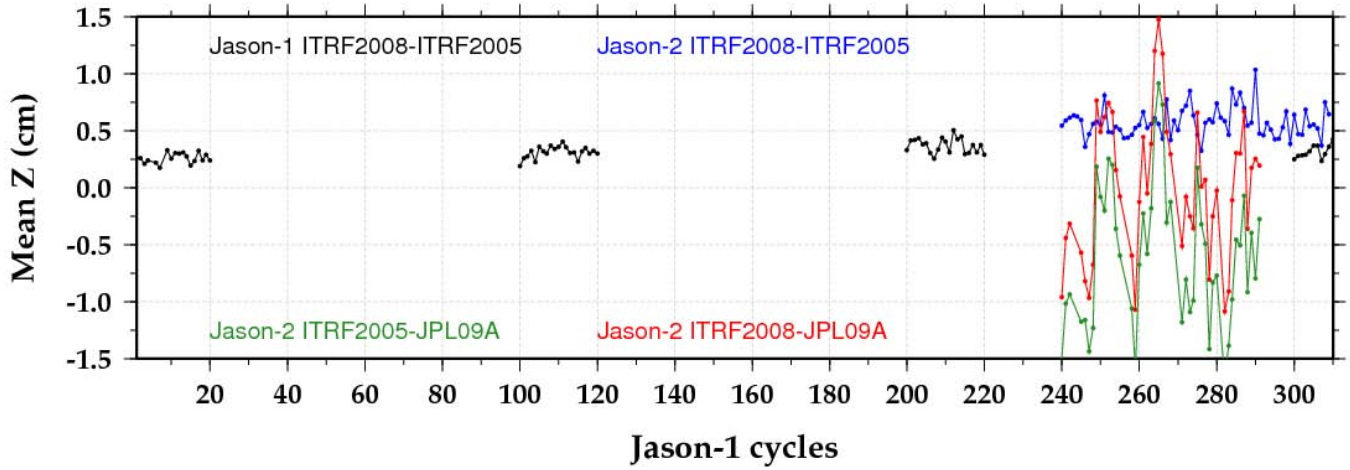
- Both ITRF2008 & ITRF2008d represent improvements wrt. LPOD2005. The few missing stations are not significant for POD.
- ITRF2008d does slightly better in the SLR & Independent Xover comparisons.
- BARG, SANF, KIEV are better (> 0.4 cm) for ITRF2008; SIME, BORO, SHAN are better (> 0. 4 cm), for ITRF2008d.

Xover fits are independent

Jason-1 & Jason-2
Mean-Z orbit differences



DORIS-only orbits

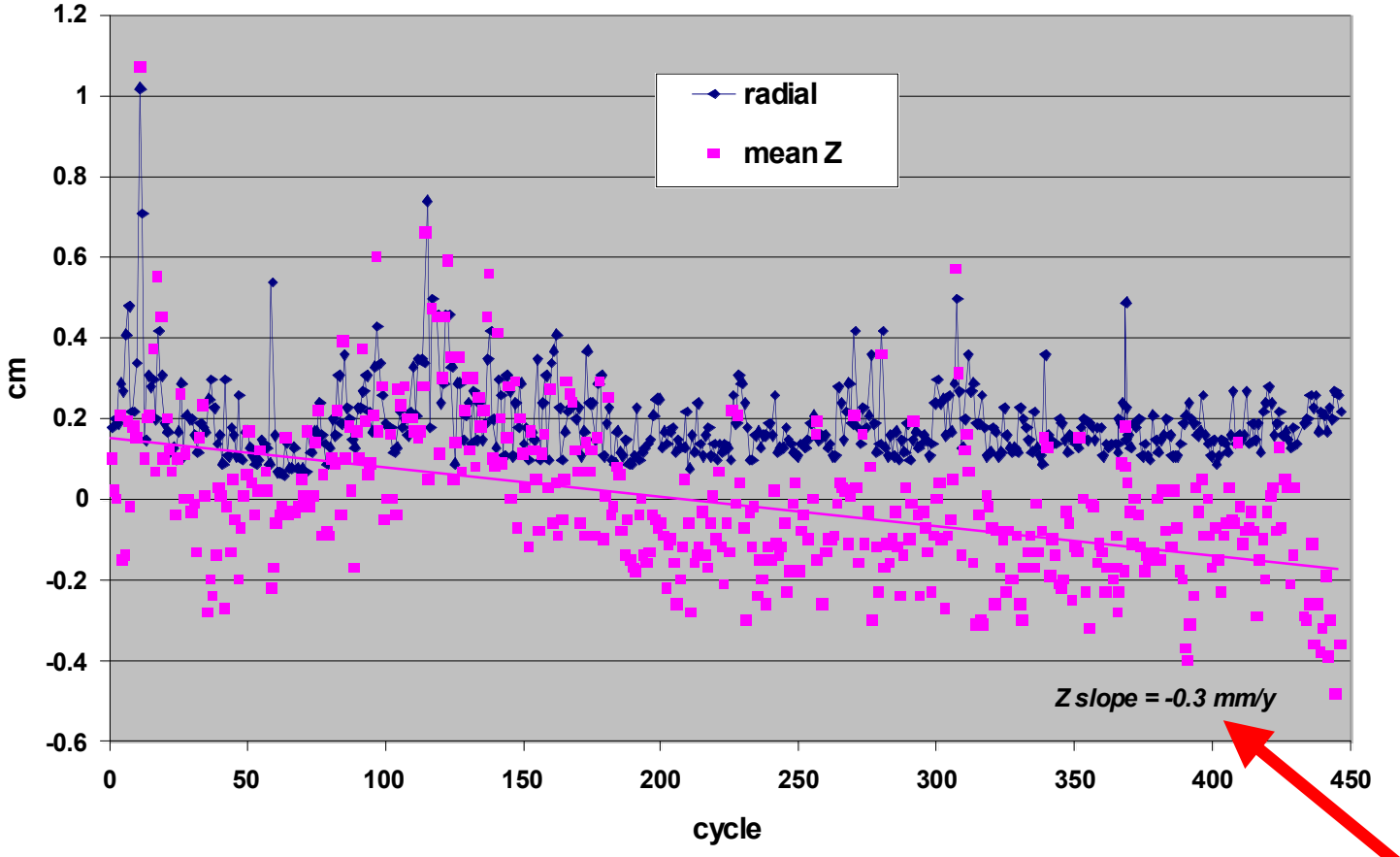


SLR+DORIS orbits

- **Zshift in ITRF2008 orbits consistent with published transformations**
- **ITRF2008 DORIS & SLR/DORIS orbits agree better in Z with JPL09A GPS orbits.**

From A. Couhert & L. Cerri (CNES)

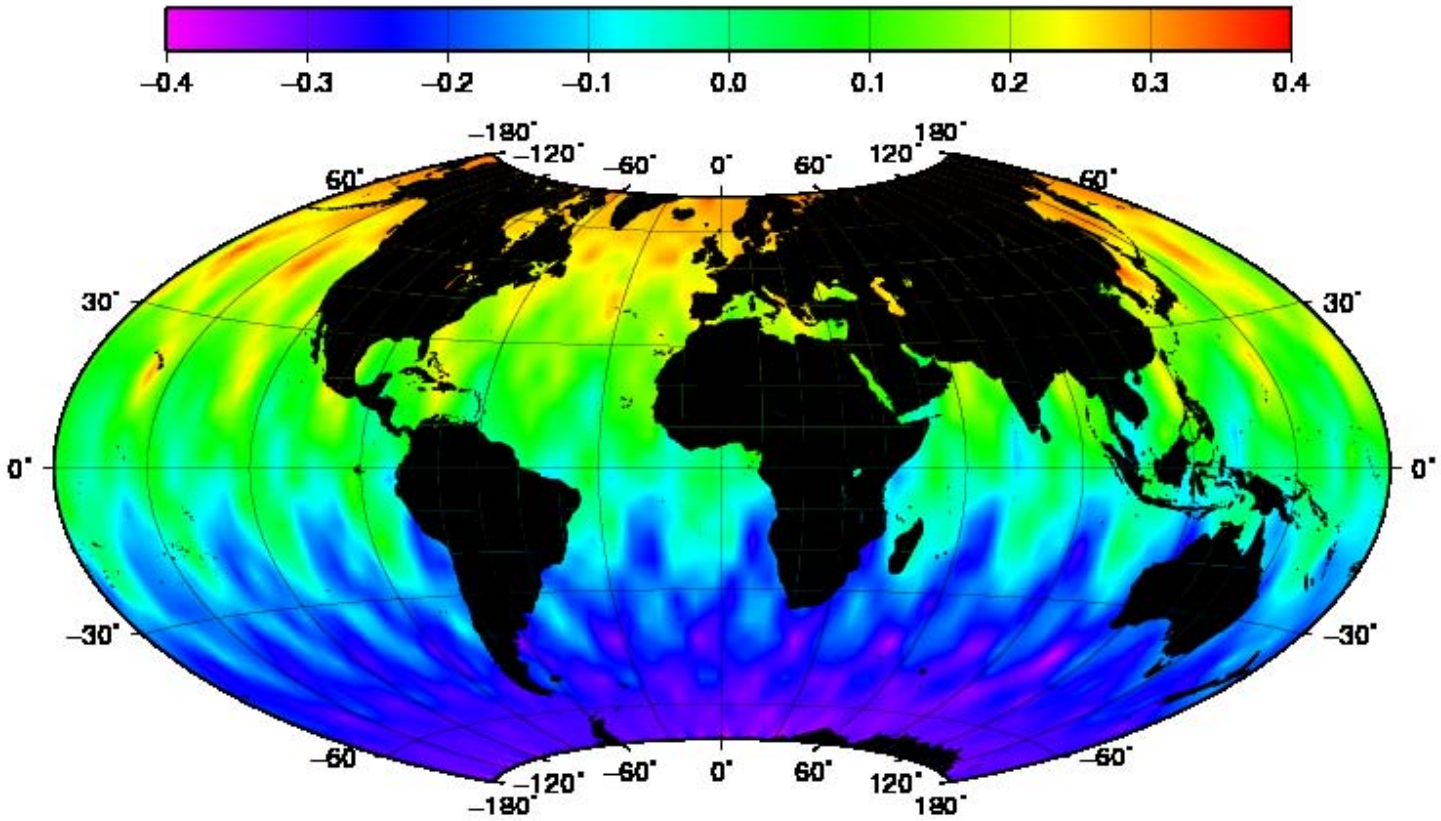
TOPEX SLR+DORIS Orbit Differences (ITRF2005 - ITRF2008)



Network effect in differences, centered ~1996?

From Beckley et al., 2007; Morel & Willis, 2005, change in sea level rate will be ~0.06 mm/yr.

TOPEX SLR+DORIS Mean Radial Orbit Difference trends over cycles 11-360 (ITRF2008 - ITRF2005) (mm/yr)



RMS over water: +0.06 mm/yr

Figure 8. Jason-2 ITRF2005-ITRF2008 mean radial orbit difference trends over cycles 1-75 (mm/y)

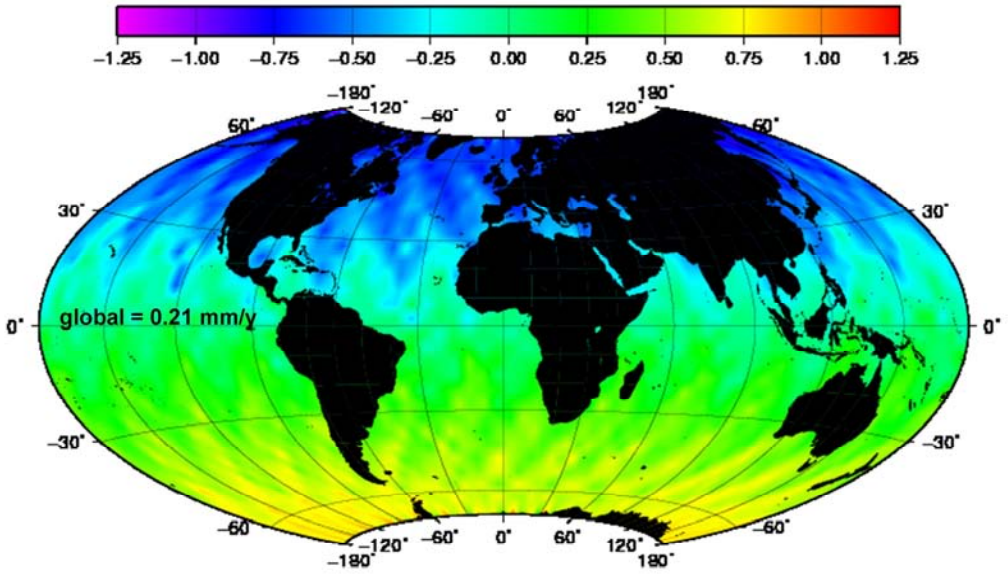
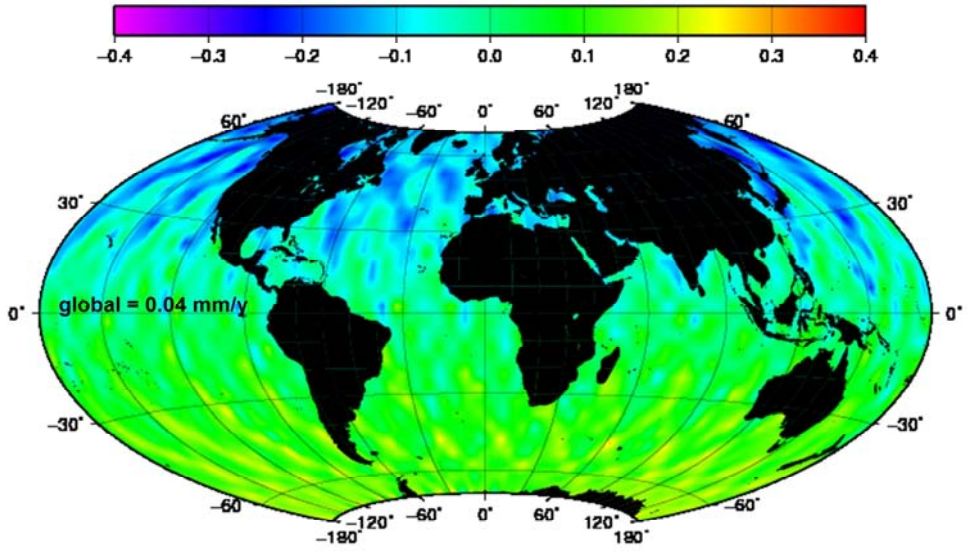
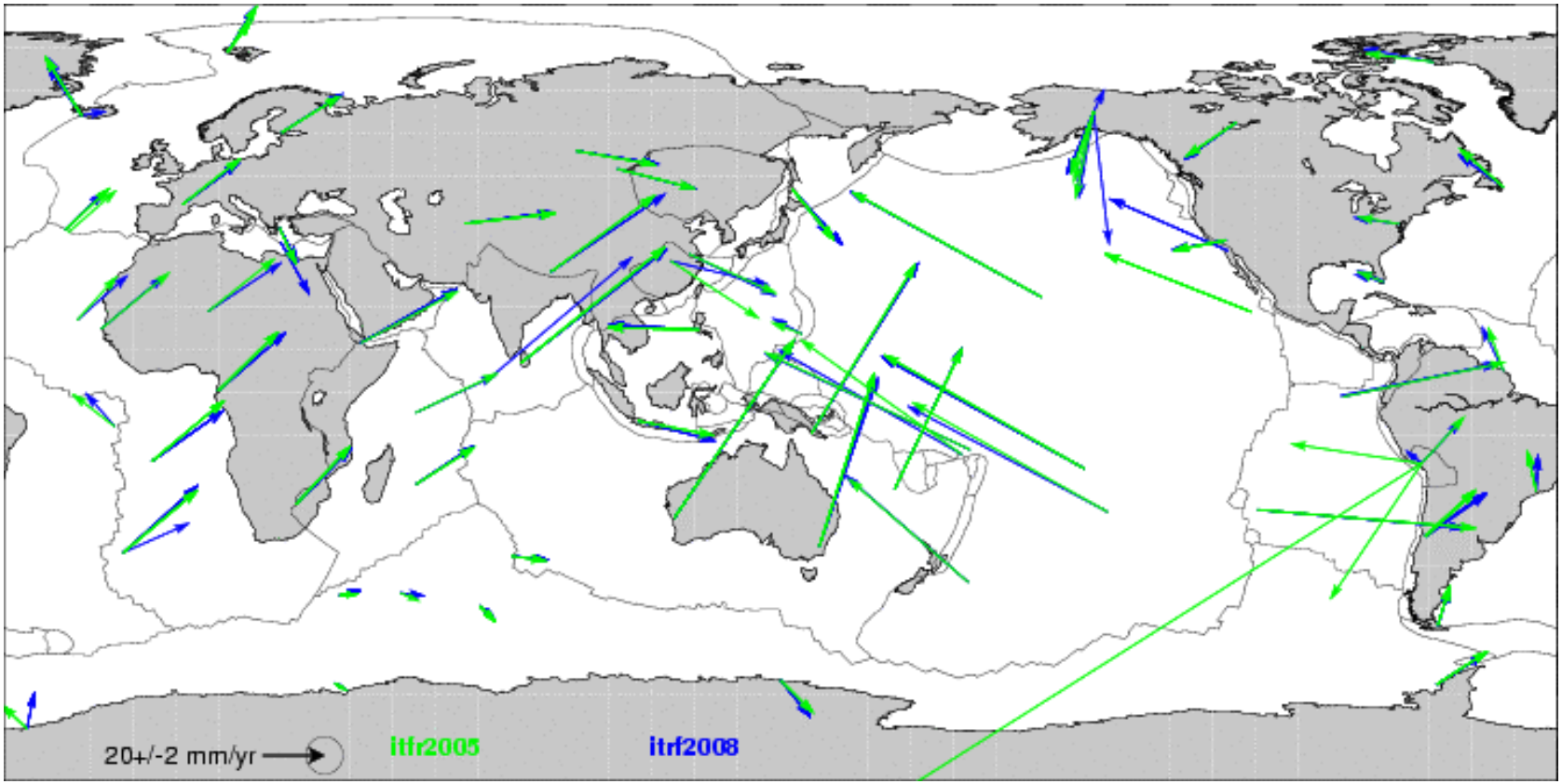


Figure 9. Jason-2 ITRF2008-ITRF2008D mean radial orbit difference trends over cycles 1-75 (mm/y)



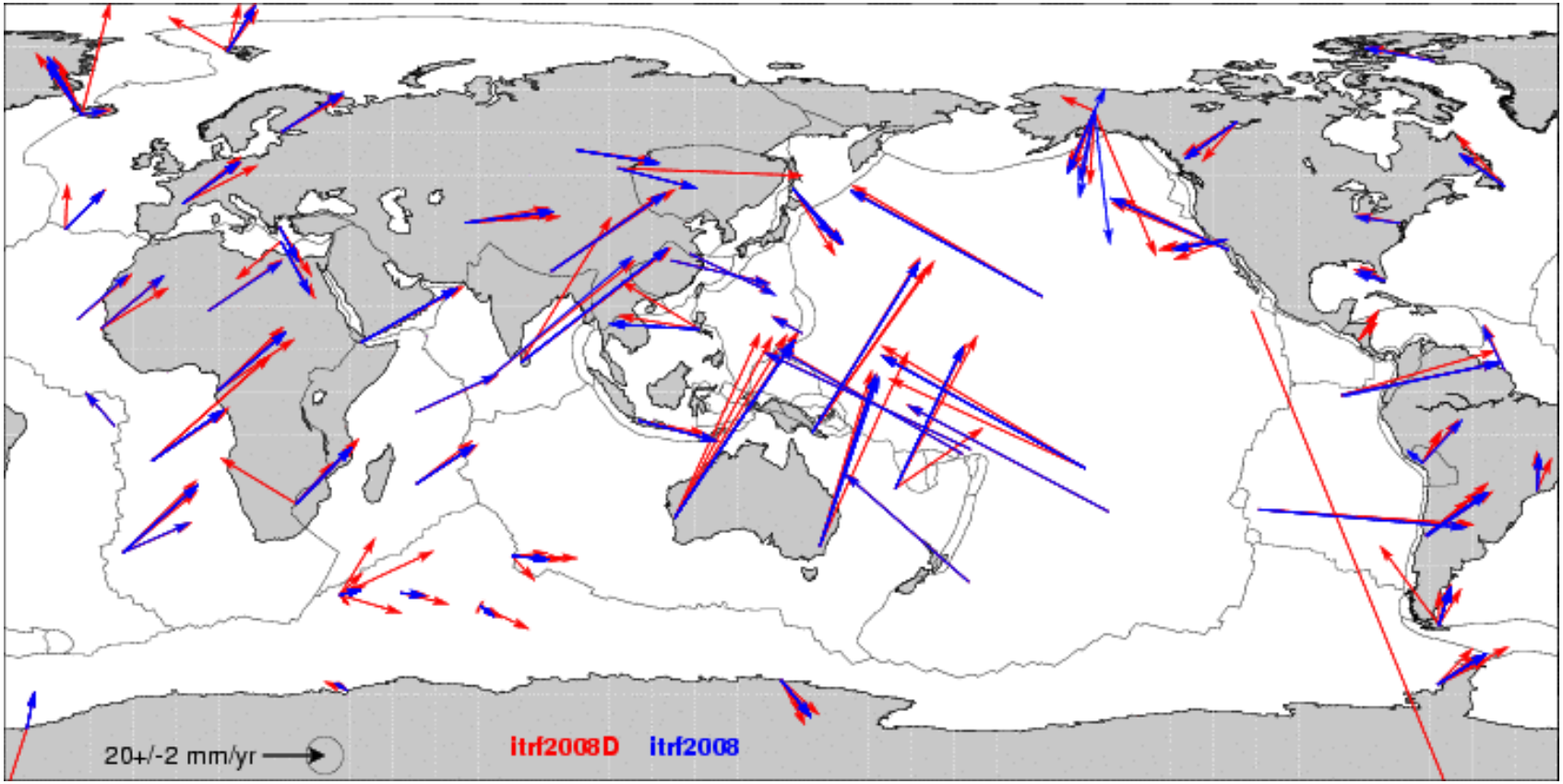
¨RF2008"

Station horizontal velocities (ITRF2005 vs. ITRF2008)



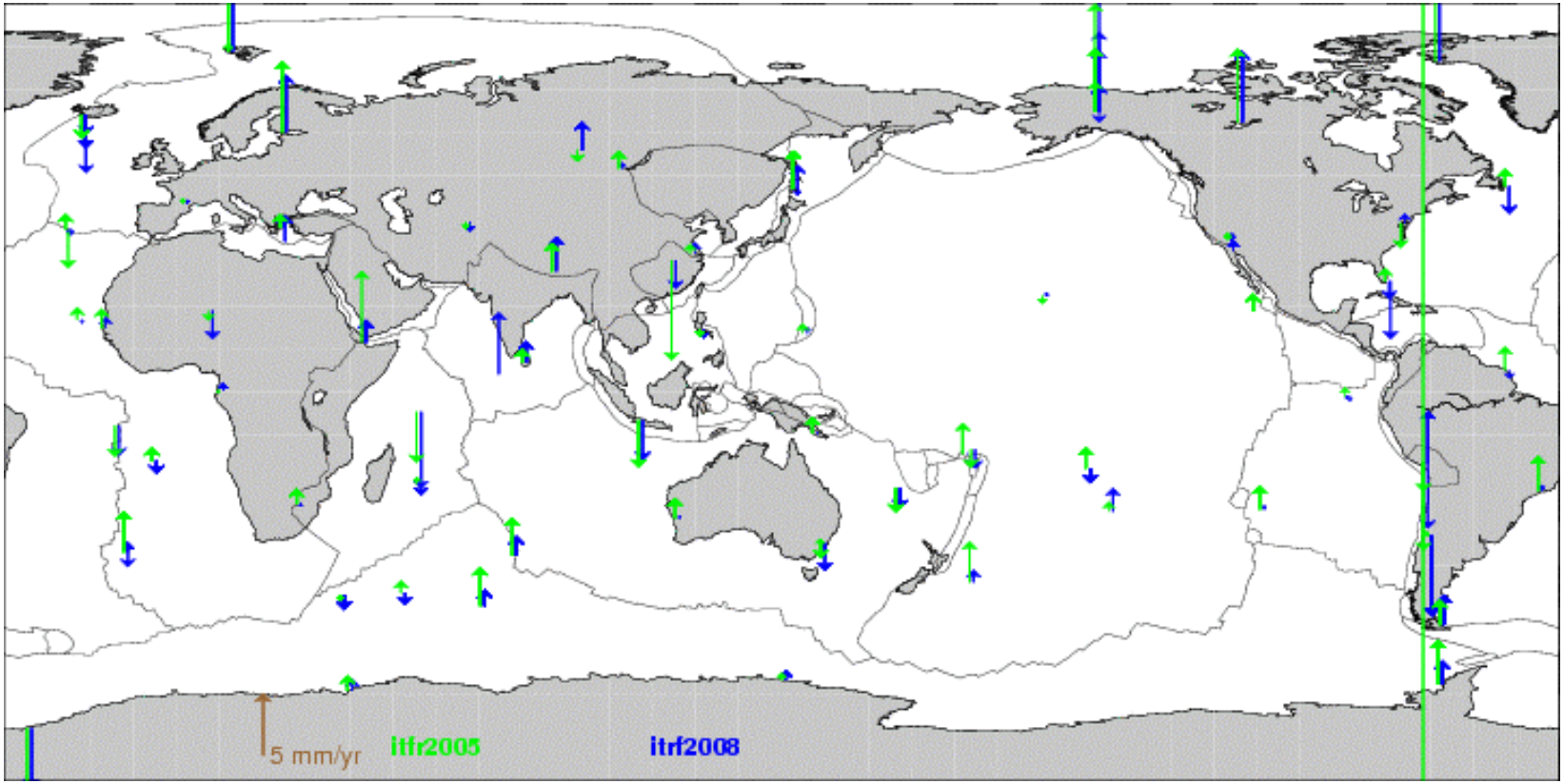
From L. Soudarin (CLS)

Station horizontal velocities (ITRF2008 vs ITRF2008d)



From L. Soudarin (CLS)

Station vertical velocities (ITRF2005 vs ITRF2008)



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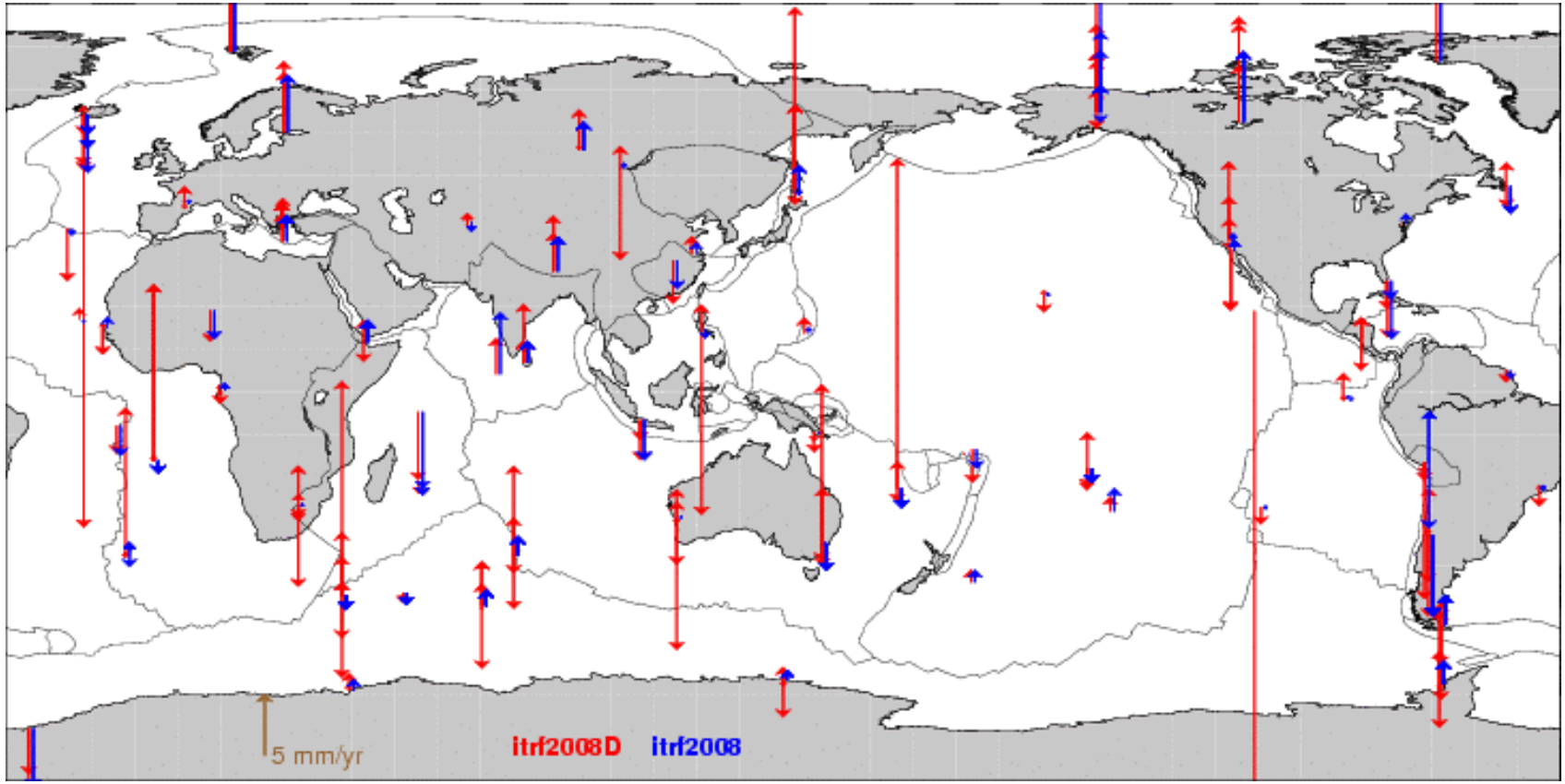
Station vertical velocities (ITRF2008 vs ITRF2008d)



From L. Soudarin (CLS)

Summary

DORIS:

- ITRF2008 appears to be an improvement over ITRF2005 (DPOD2005)- improvement for many stations.
- When ITRF2008d is compared to ITRF2008, it appears ITRF2008 has better fits for most DORIS stations (this may be related to station velocity issues at some sites in ITRF2008d).

SLR:

- ITRF2008 is an across the board improvement compared to ITRF2005 (LPOD2005). ITRF2008d SLR complement may be slightly better centered than that of ITRF2008 - hence the reason for the improved xover fits (eg. RSS difference in Xover variances corresponds to ~2mm of radial orbit improvement for TP in 2002)

DORIS+SLR

- Over 1993-2002 (TOPEX); Total Zrate is -0.3 mm/yr; change in radial orbit diff trends (over oceans) is -0.06 mm/yr
- Over 2008-2010 (Jason2) mean radial orbit diff. trends (over oceans) is 0.2 mm/yr for ITRF2005-ITRF2008, and 0.04 mm/yr for ITRF2008-ITRF2008d

DORIS Ground Network