Jason-2 DORIS orbit accuracy and stability

GSFC Analysis group

IDS Analysis Working Group meeting

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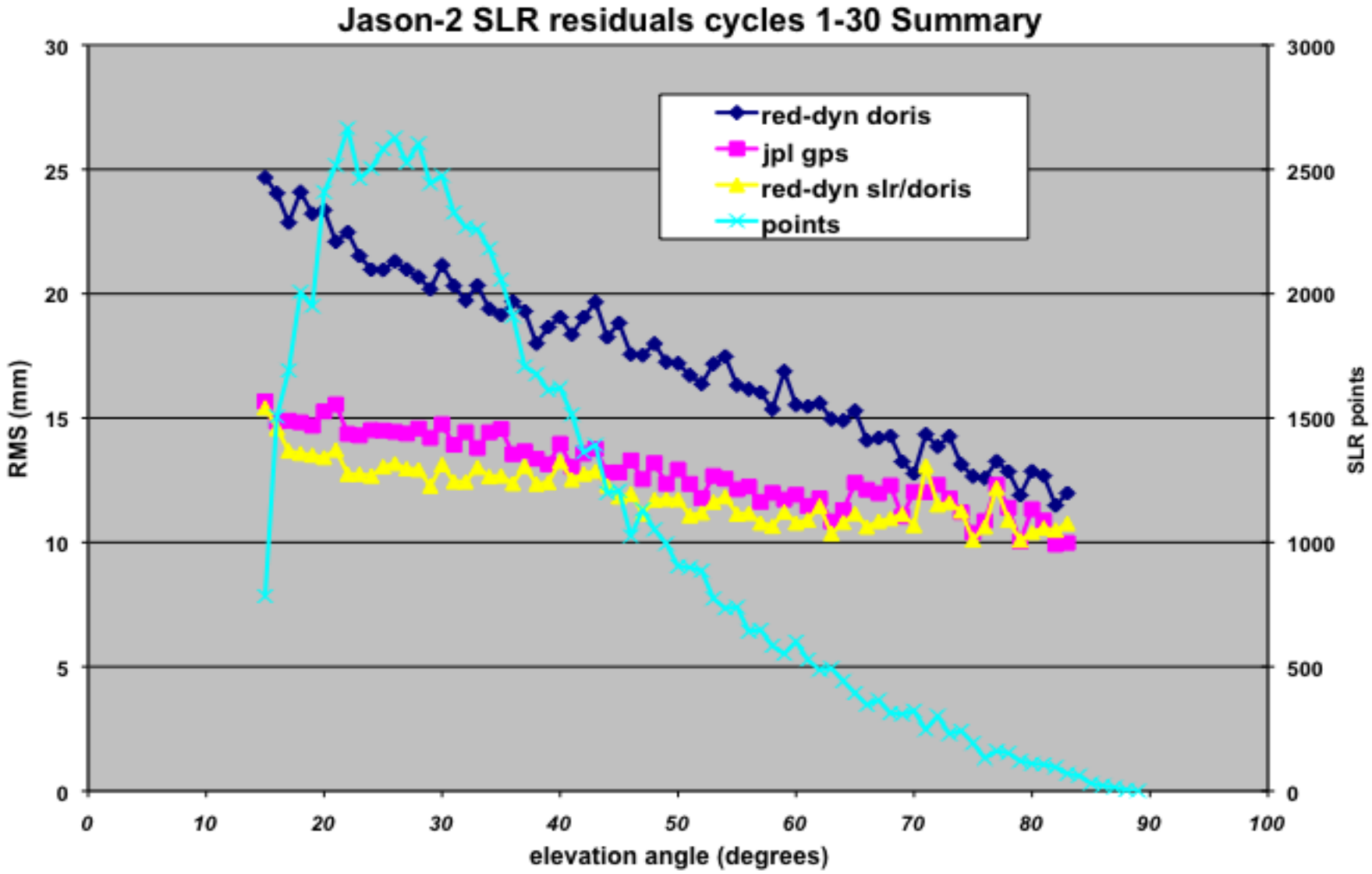
Reduced-dynamic (red) orbits are more accurate than the Dynamic (dyn)

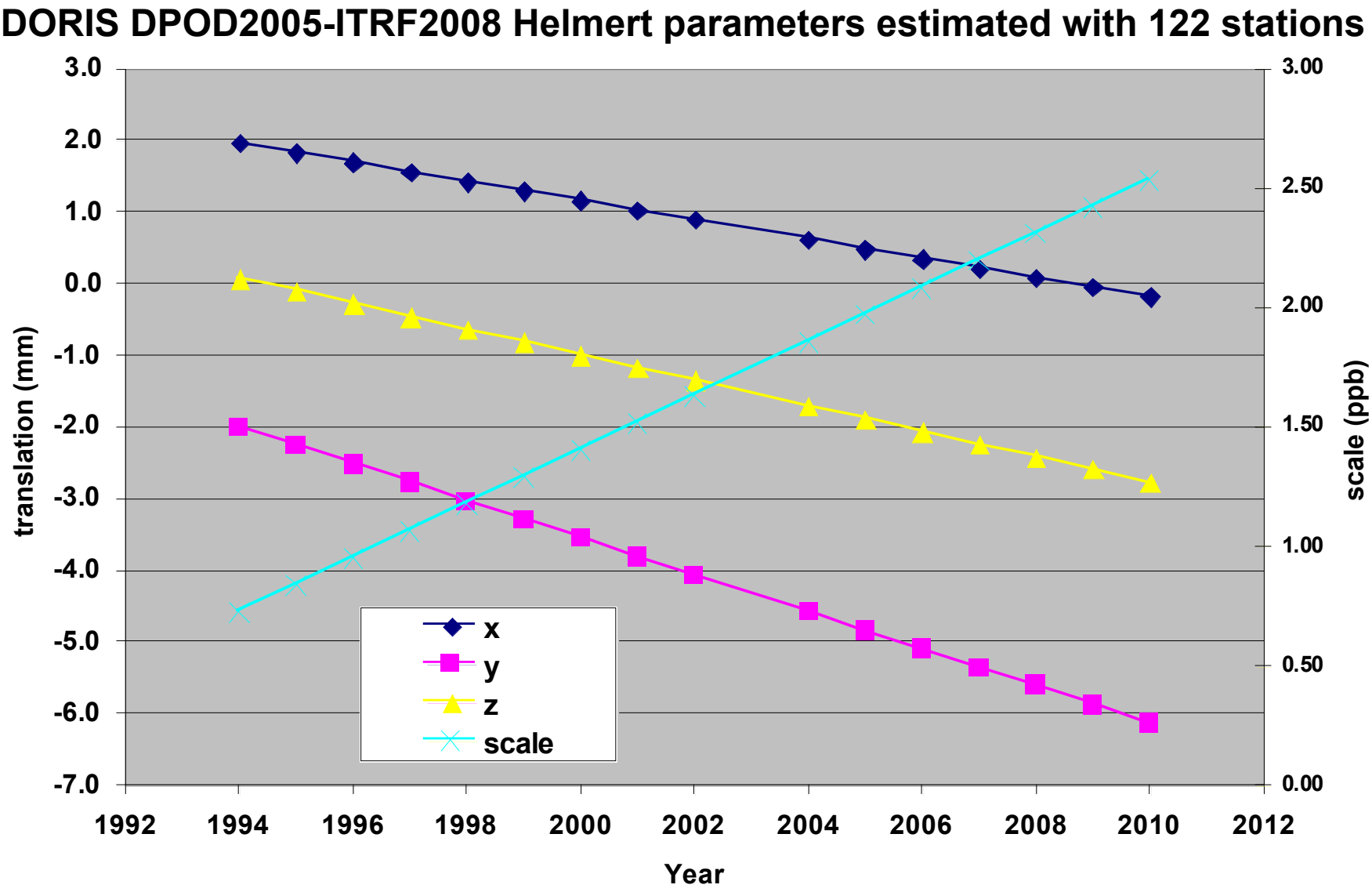
Jason-2 residual summary cycles 1-44			
DORIS-only orbit tests	DORIS mm/s	SLR* (cm)	Xover* (cm)
doris dyn dpod2005	0.3769	1.885	5.549
doris red dpod2005	0.3753	1.802	5.537
doris dyn itrf2008	0.3770	1.866	5.530
doris red itrf2008	0.3755	1.740	5.524
* independent data			

J2 DORIS-only reduced-dynamic orbits have achieved 1-cm accuracy as shown by high elevation SLR residuals

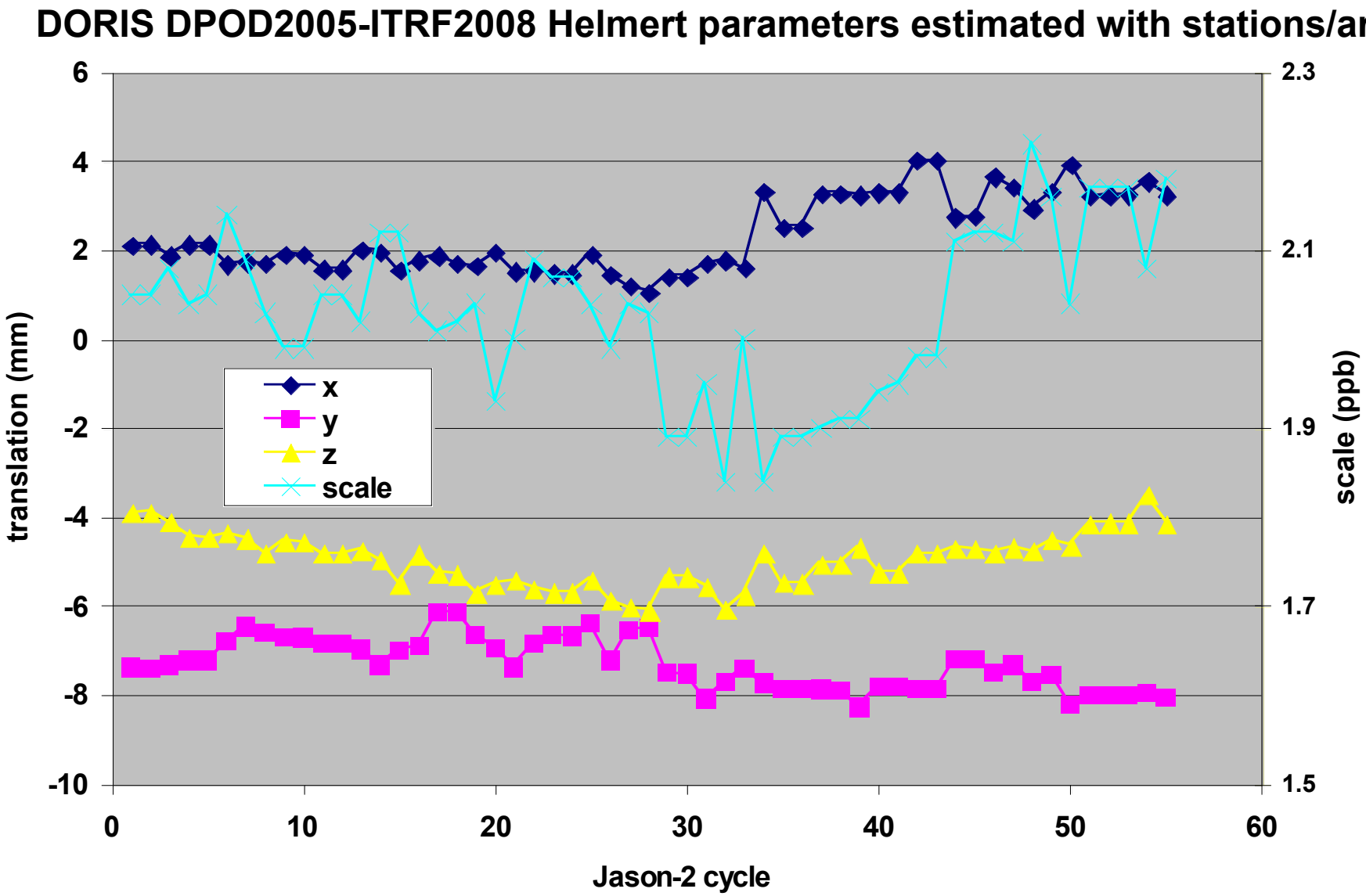
(Zelensky et al, 2010)



TRF instability can directly impact the orbit *(Morel and Willis 2005, simulation)*



Consider tracking variability: compare stations used in each 10-day orbit solution



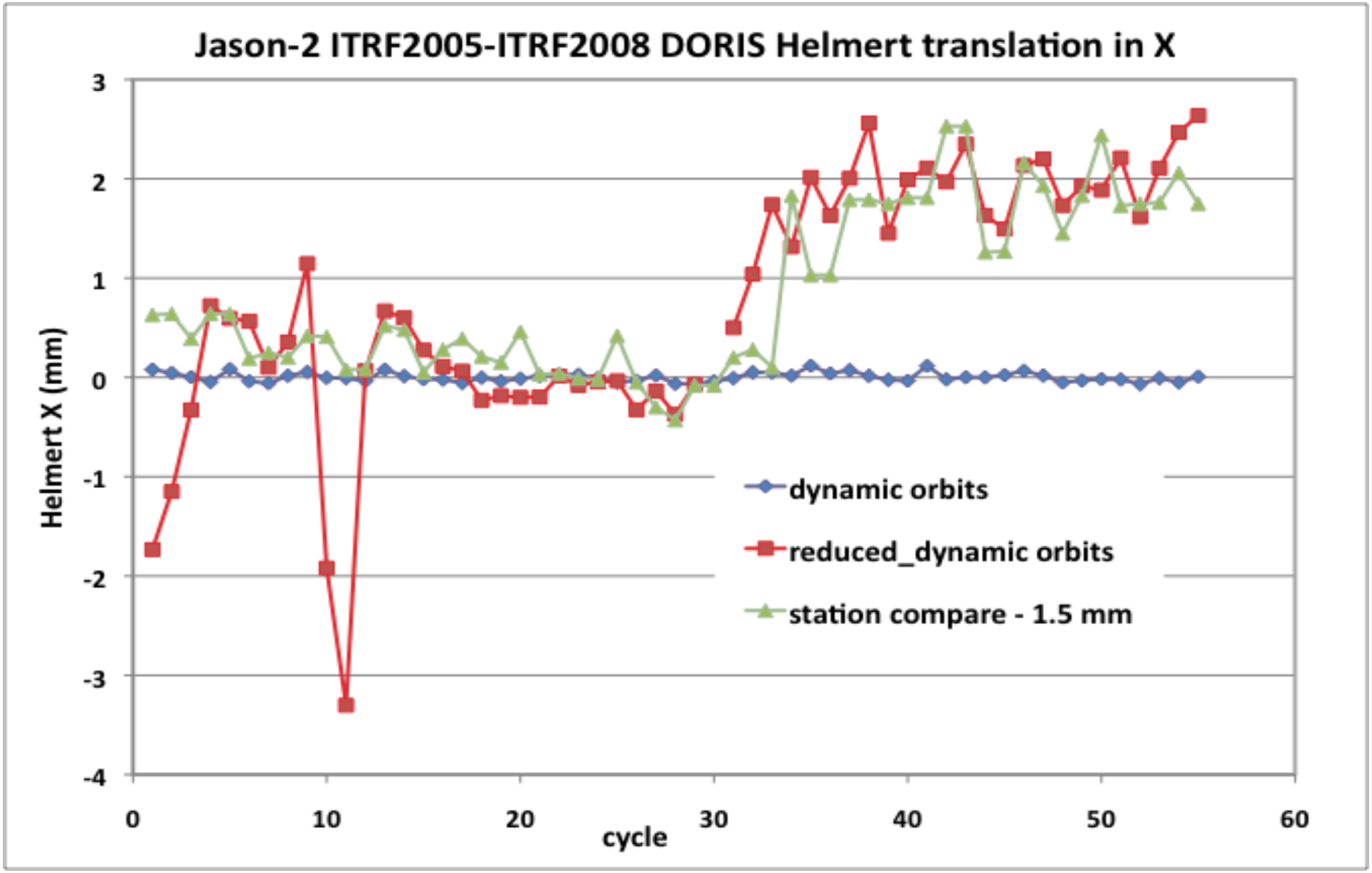
Summary ITRF2008 to DPOD2005 7_parameter transform estimates

Helmert 7-parameter transform DPOD2005-ITRF2008 estimates	translation (mm)			scale (ppb)	rotation (mas)		
	x	y	z		Rx	Ry	Rz
IGN combined (epoch 2005)	-0.5	-0.9	-4.7	0.94	0.0	0.0	0.0
DORIS 122 sites (epoch 2005)	0.5	-4.8	-1.9	1.97	-0.2	0.0	-0.2
DORIS 122 sites (epoch 2009.3)	-0.1	-5.9	-2.6	2.45	-0.2	0.1	-0.2
DORIS cycles 1-55 mean (2009.3)	2.3	-7.3	-4.9	2.03	-0.2	0.0	-0.1

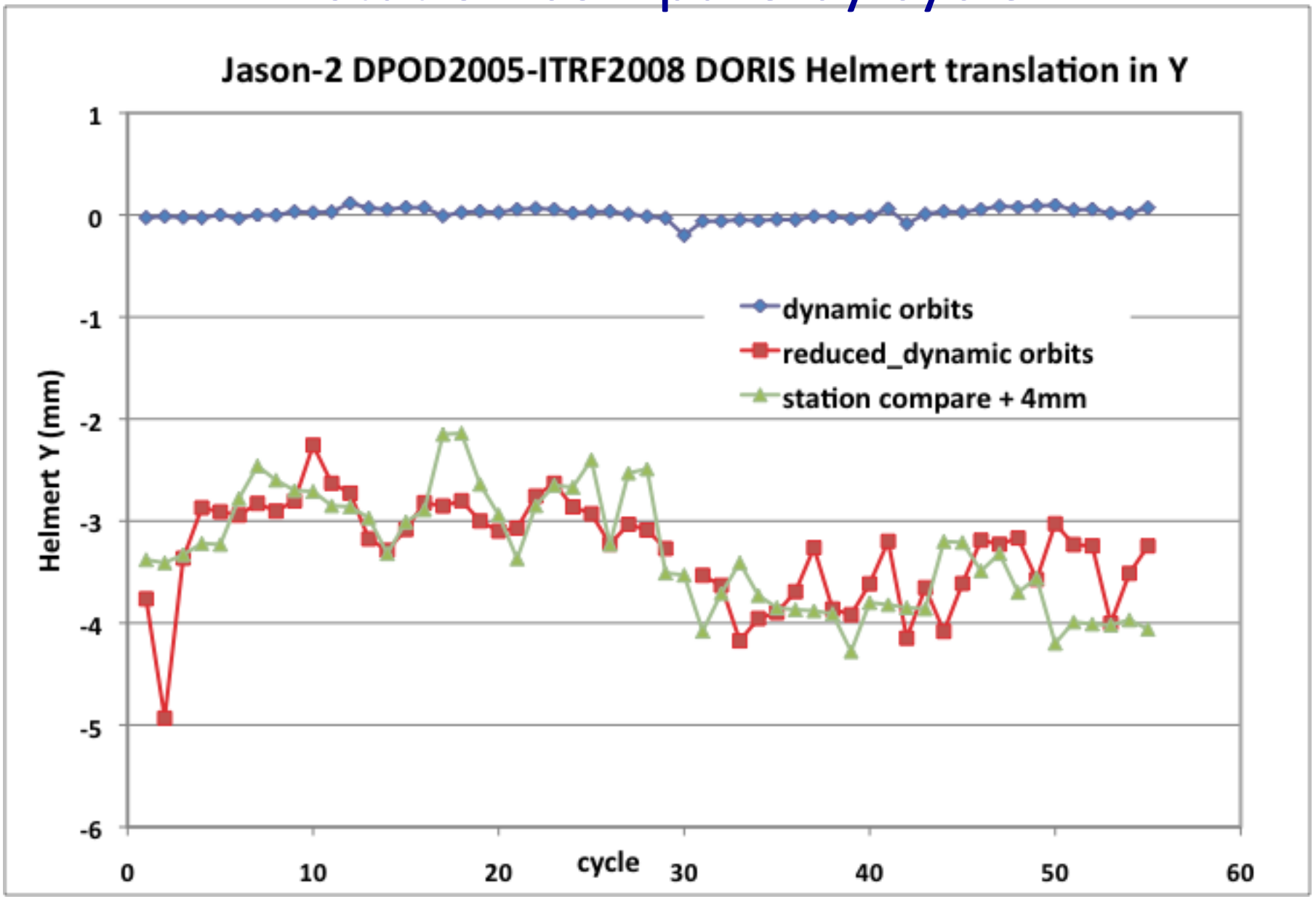
Helmert 7-parameter transform DPOD2005-ITRF2008 rates	translation (mm/y)			scale (ppb/y)	rotation (mas/y)		
	x	y	z		Rx	Ry	Rz
IGN combined	0.3	0.0	0.0	0.00	0.0	0.0	0.0
DORIS 122 sites	-0.1	-0.3	-0.2	0.11	0.0	0.0	0.0
DORIS cycles 1-55 time series*							

* 1.5 year time series is likely too short for reliable trend estimates

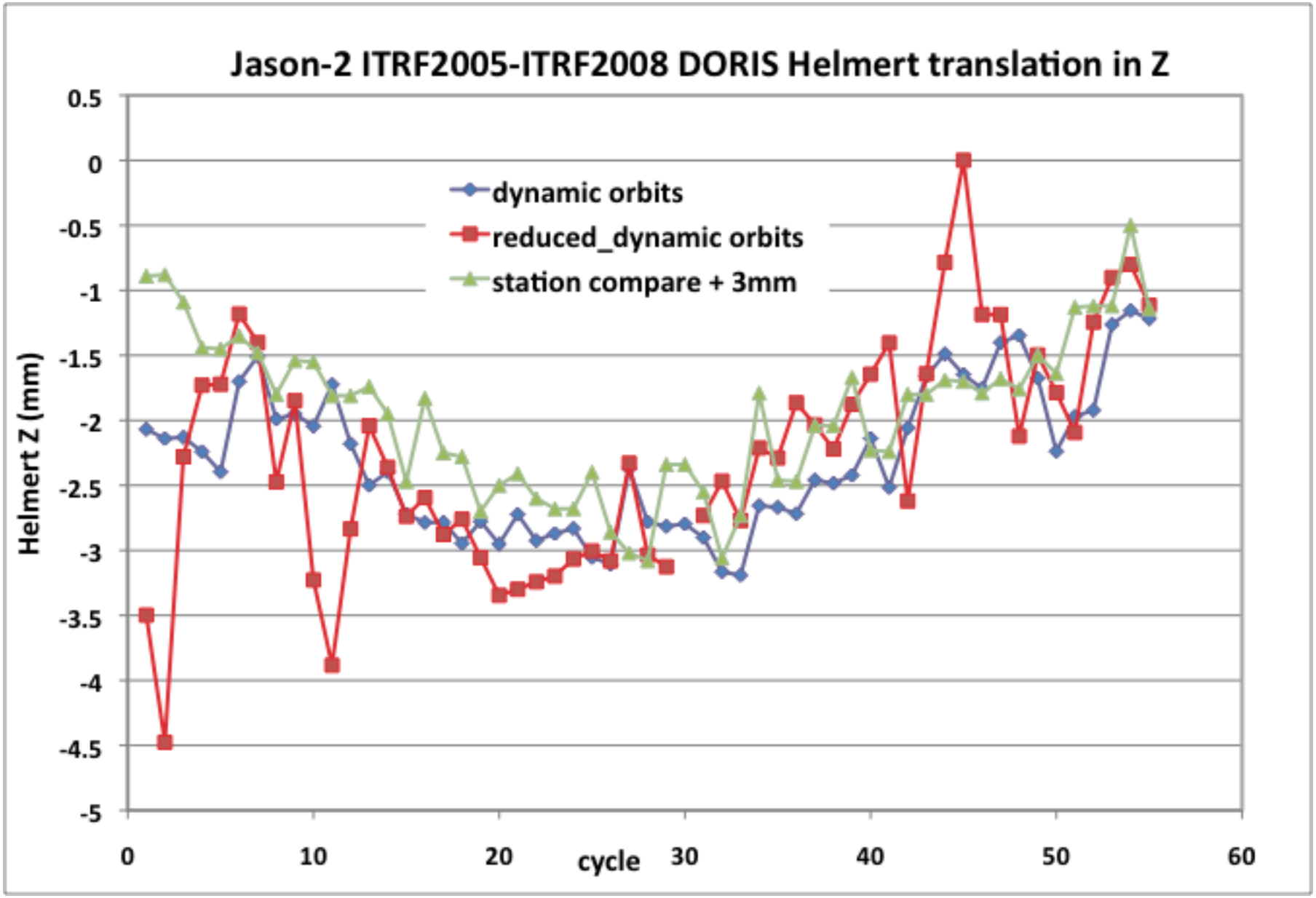
Red Orbit translation in X corresponds to station compare by cycle



Red Orbit translation in Y corresponds to station compare by cycle



Red & Dyn Orbit translations in Z correspond to station compare by cycle



Reduced-dynamic orbit centering less stable than dynamic orbit

Jason-2 station and orbit Helmert translation parameter estimates						
cycles 1-55 (Jul 2008 – Dec 2009)	Mean (mm)			standard deviation (mm)		
Station DPOD2005-ITRF2008	x	y	z	x	y	z
doris station compare by cycle	2.3	-7.3	-4.9	0.8	0.6	0.6
Orbit DPOD2005-ITRF2008	x	y	z	x	y	z
doris dynamic	0.0	0.0	-2.3	0.0	0.1	0.6
slr+doris(2mm/s) dynamic	0.0	0.0	-3.2	0.0	0.0	1.0
doris reduced-dynamic	0.8	-3.3	-2.3	1.3	0.5	0.9
slr+doris(1mm/s) reduced-dynamic	-0.2	-1.3	-3.0	0.3	0.3	0.7

Conclusions

- Reduced Dynamic (RD) are more accurate than the dynamic DORIS orbits, however…

- RD orbit centering is less stable than that of the dynamic orbit, and is much more sensitive to systematic XY error in the TRF. Changes to the RD empirical acceleration span of 28 min (1/4 rev) may affect this sensitivity. Both orbits sensitive to TRF error in Z.

- Results suggest the dynamic orbits are perhaps better centered about the Earth's CoM, and not the origin of the particular station network polyhedron assumed for each orbit solution.

- SLR+DORIS RD orbit centering appears a little more stable than DORIS - only.