

Geodetic Observatory Pecný – recent and future DORIS solutions

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ITRF 2013 data re-processing

- dynamical orbit model – major change
- corrected error in ocean tides application
- SAA – data corrective model (?) discussed in the separate presentation
- gravity model, antenna law, – IDS proposals

New dynamic orbit model vs. old empirical-stochastic model

Modeling	For ITRF 2008	For ITRF 2013
Satellite attitude and geometry	Not considered	Nominal Box-Wing model
Atmosphere density model	Not applied	MSIS-86
Atmosphere drag	Absorbed by along track stochastic parameters	Scaling coefficients estimated
Solar radiation pressure	Absorbed by empirical constant parameter in sun-satellite direction	Scaling coefficient estimated
Earth radiation	Not applied	A priori model, visible and infrared radiation
1-per revolution empirical modeling	Sun-Satellite and Y-direction (constrained)	Along and cross track (?)
Additional empirical parameters	Constant Y-direction*	No

Modeling issues

- **testing campaign 2011.0-2012.0**
- **how frequently estimate the drag scaling coefficient for low satellites?**
 - 30 minutes better than 2 hours (30 minutes or 1 hour?)
- **are the cross track harmonics really helpful?**
 - no geocenter improvement
 - slight improvement of station RMS w.r.t. DPOD08 and std. dev.
 - pole Xp,Yp degradation

Sol.id.	Type of sol.	Drag/day (low sat)	1-rev harmonics	Annual mean		Std. dev.	
				Xp (mas)	Yp(mas)	Xp (mas)	Yp(mas)
D-1	dyn	48	along, cross	0.49	0.38	0.75	0.58
D-2	dyn	48	along	0.25	0.33	0.53	0.53
D-3	dyn	12	along, cross	0.44	0.38	0.74	0.57
D-4	dyn	12	along	0.19	0.36	0.52	0.53
E/S	emp-stoch	96 (stoch)	Sun-satellite	0.00	0.10	0.70	0.57

Sol.id.	Mean (mm and ppb)				Std. dev. (mm and ppb)				RMS (mm)	Std.dev. (mm)
	Tx	Ty	Tz	Sc	Tx	Ty	Tz	Sc		
D-1	-1.4	-4.9	1.3	0.10	4.1	4.9	12.3	0.31	16.38	11.62
D-2	-1.1	-4.7	-2.0	0.09	4.2	4.9	11.4	0.32	16.51	11.71
D-3	-0.4	-7.3	2.0	0.03	5.6	4.3	13.1	0.55	16.74	12.05
D-4	-0.3	-7.3	-0.9	0.02	5.6	4.2	12.1	0.54	16.91	12.14
E/S	-0.9	-5.9	3.2	0.36	3.5	4.9	9.9	0.34	16.79	11.86

fixed SRP scaling coefficient

Sat	SRP estimated	SRP Gobindass et al. 2009
SPOT-4	1.13 ± 0.03	1.13 ± 0.05
SPOT-5	1.08 ± 0.03	1.03 ± 0.01 *
Envisat	1.04 ± 0.02	1.02 ± 0.02
Cryosat-2	0.82 ± 0.04	-
Jason-2	0.98 ± 0.01	-

* before change of solar panel orientation in 2008

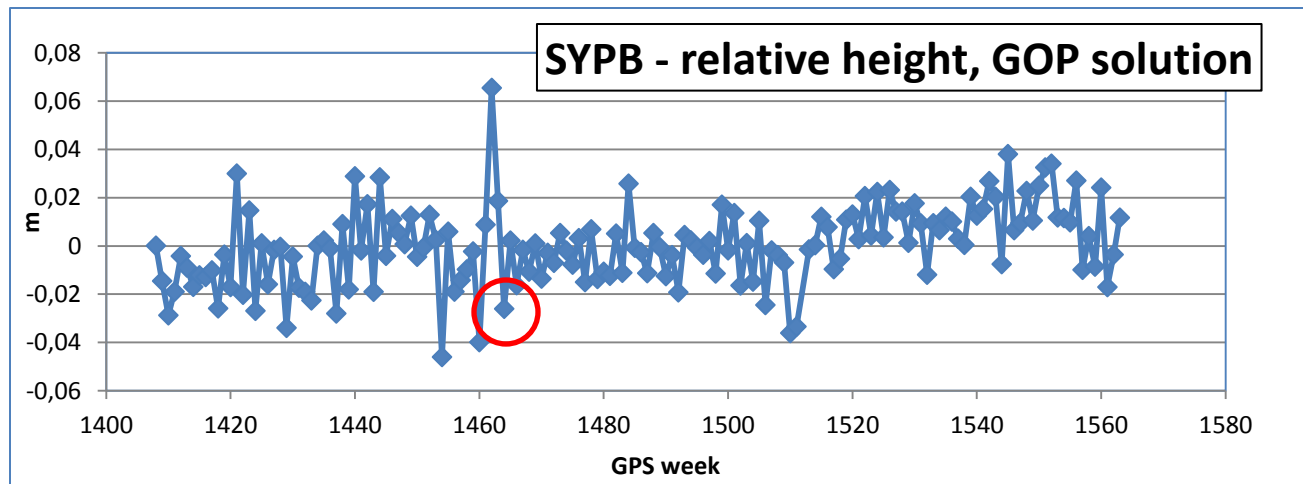
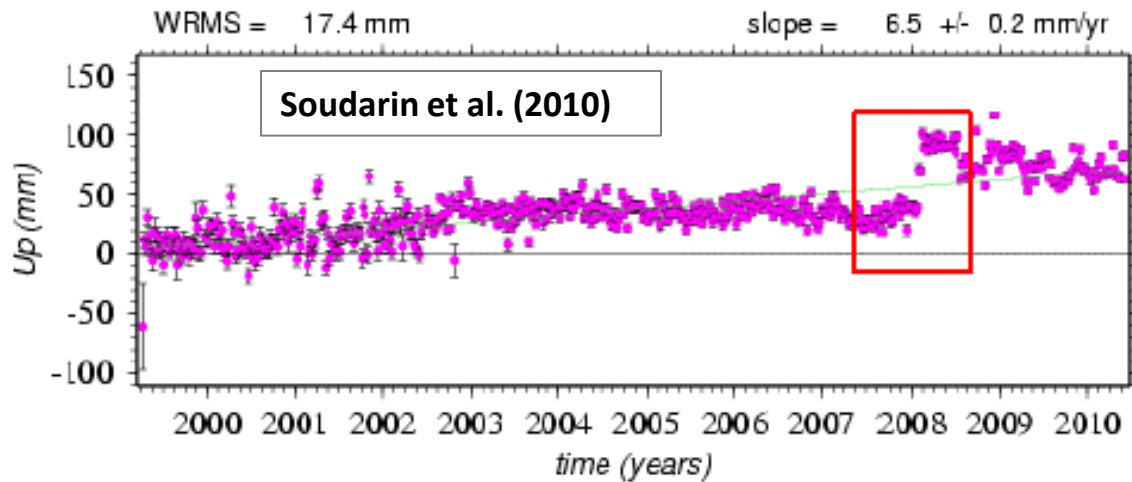
- surprisingly no significant impact
- Tz annual variations small
- only for recent satellite constellation?
- only outside strongest solar activity?

Sol.	Cross 1-rev	SRP fixed	Jason-2 Y/N	Amplitude (mm)	Phase (deg)
Dynamical	Y	N	N	6.3 ± 3.2	290 ± 30
Dynamical	N	N	N	12.1 ± 3.0	294 ± 14
Dynamical	Y	Y	N	9.2 ± 2.9	297 ± 18
Dynamical	N	Y	N	2.9 ± 3.0	327 ± 58
Empirical - stochastic	-	-	N	6.2 ± 3.2	181 ± 31
Dynamical	Y	N	Y	4.1 ± 2.4	316 ± 34
Dynamical	N	N	Y	4.5 ± 2.2	52 ± 28
Dynamical	Y	Y	Y	4.2 ± 2.0	14 ± 28
Dynamical	N	Y	Y	6.5 ± 2.4	27 ± 22
Empirical - stochastic	-	-	Y	4.3 ± 1.9	97 ± 25
ignwd05*	Y	N	-	27.3	112
ignwd07 *	Y	Y	-	4.9	116

* Gobindass et al. 2009

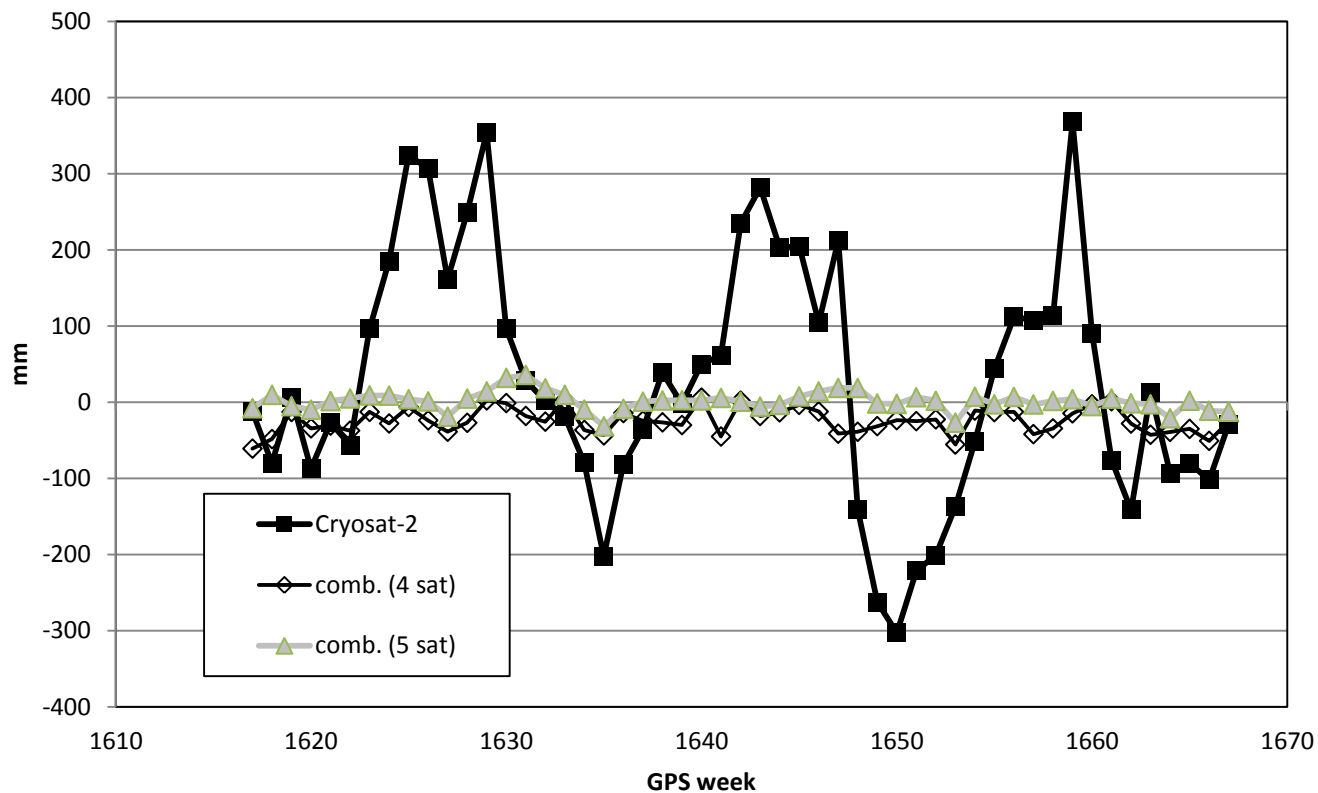
Station height „jumps“ due to the change of frequency bias

- The problem has never been present in GOP solutions
- Example – SYPB 28.1.2008



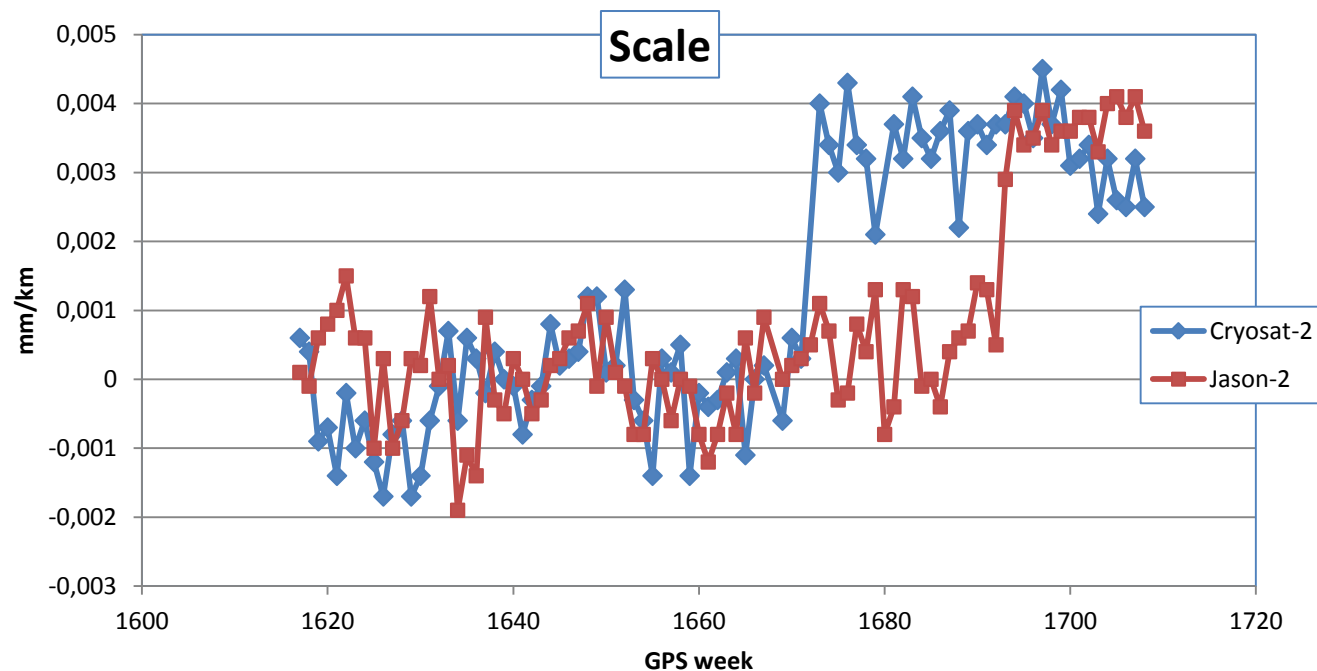
Strong Tz signal in Cryosat solution

- Period 106.2 ± 0.8 days, amplitude 193 ± 24 mm (2011.0-2012.75)
- For the multisatellite-solution without Jason-2 the amplitude is only 9.1 ± 3.2 mm (2011.0-2012.0)
- For the **multisatellite**-solution including Jason-2 the amplitude is not significant 3.0 ± 2.3 mm (2011.0-2012.0)



Scale increment

- From August 2011 to August 2012 the scale of GOP solution w.r.t. ITRF 2008 increased about 17 mm
- For the other ACs the increment is not so strong (7-14 mm, 10 mm in average)
 - *only visual check of combination center plots (created by Guilhem Moreaux)*
- Hy-2A single addition in the solution explains about 9 mm of the scale increment in the multi-satellite solution
- some minor scale increment could be present due to the Envisat data termination
- In GOP single-satellite solutions were found about **20 mm scale „jumps“ for Cryosat-2 and Jason-2**
- Cryosat -2 week 1672/1673 (January/February 2012), Jason-2 week 1694/1695 (June/July 2012)



Thanks for your attention