CENTRE NATIONAL D'ÉTUDES SPATIALES

JASON-2 POD: current status

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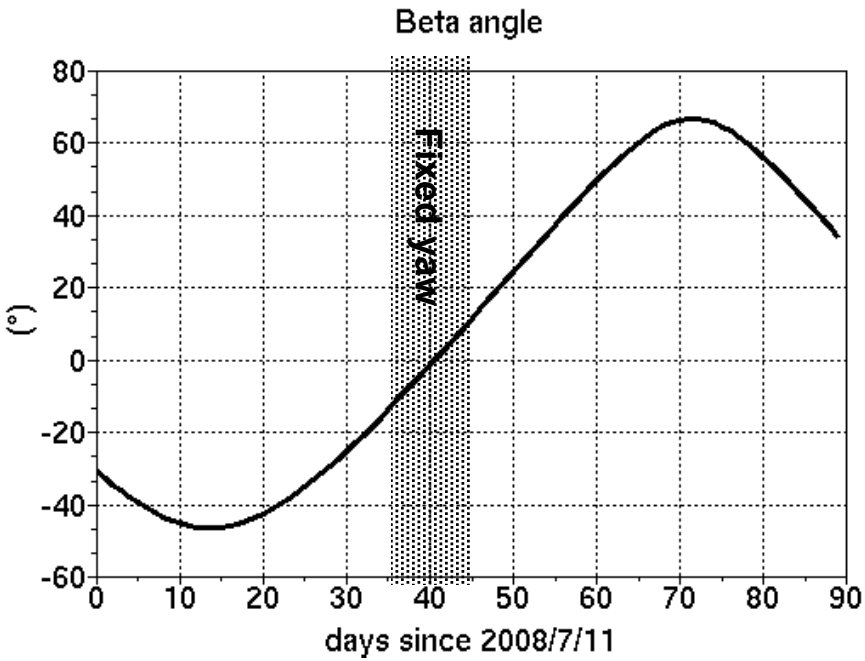
Introduction

_ Jason-2 cycles 1→9 currently processed with GDR-C standards

_ Subjects

- General performance:
  - Internal comparisons SLR, GPS, DORIS
  - External comparisons RTN and centering
- Other tests

_ Conclusions

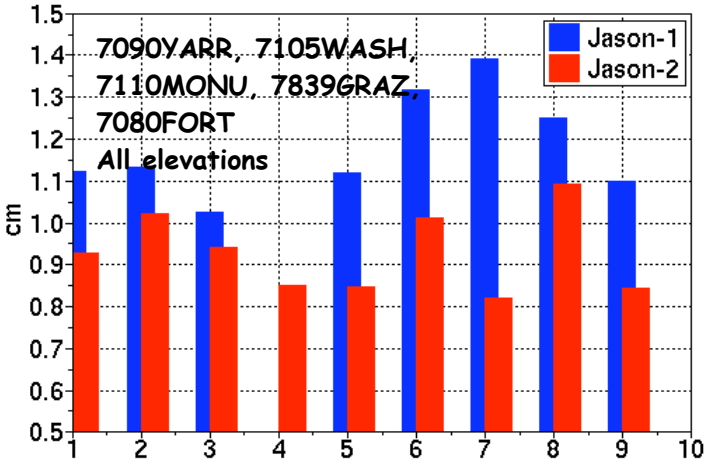


Post-fit SLR Residuals

_ Better fit for Jason-2: possible causes

- Radial accuracy probably increased by higher number of empirical forces (12 hr 1/rev thanks to GPS)
- SAA effect degrades Jason-1 orbit

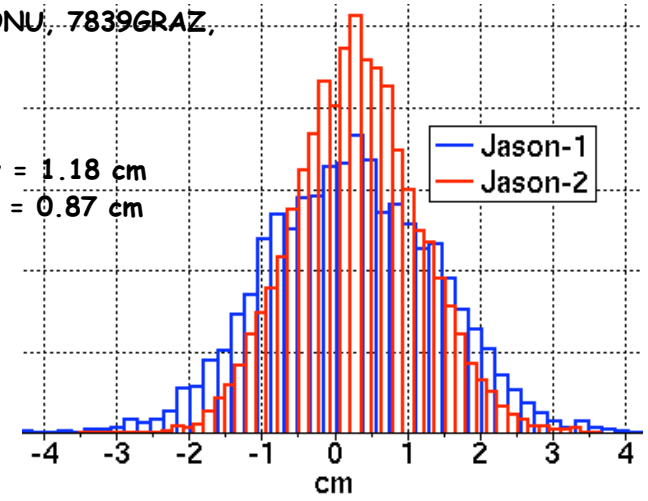
RMS of SLR residuals per cycle

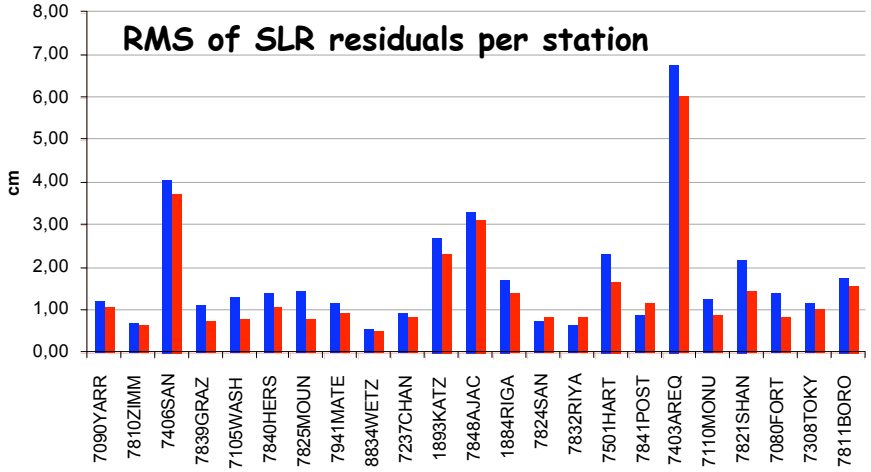


(SLRF 2005 coordinates and biases)

7090YARR, 7105WASH, 7110MONU, 7839GRAZ,
7080FORT
All elevations

Jason-1 mean = 0.23 cm , StDev = 1.18 cm
Jason-2 mean = 0.32 cm , Srdev = 0.87 cm

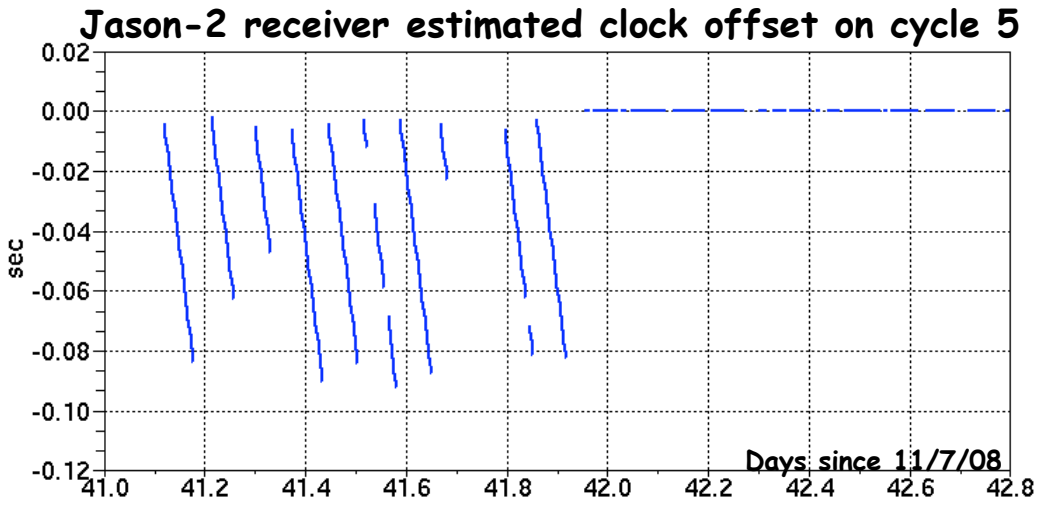


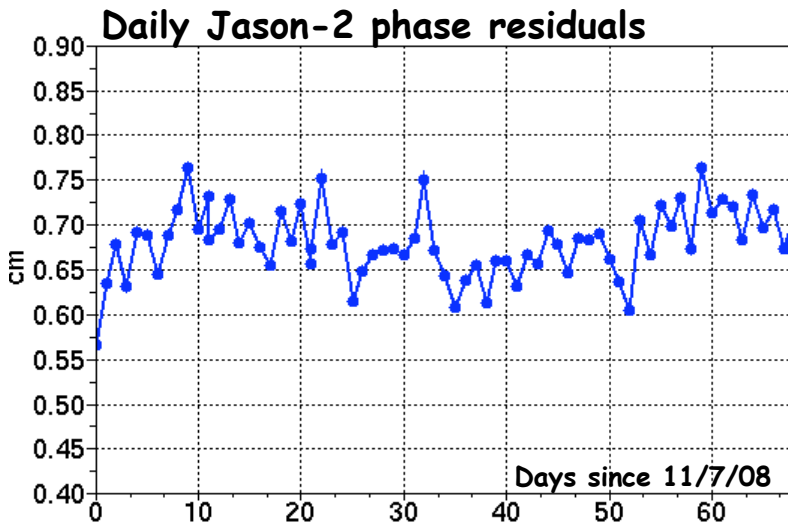


GPS

_ GPS: No major problem encountered in standard processing

- First 2 days of cycles 5: receiver clock steering shut off, manual intervention to correct and process RNX data
- RMS of phase residuals are similar to that observed on Jason-1
- Half cycle slips detected and new receiver phase maps computed (extending IGS emitter phase maps, not applied yet – see poster!)

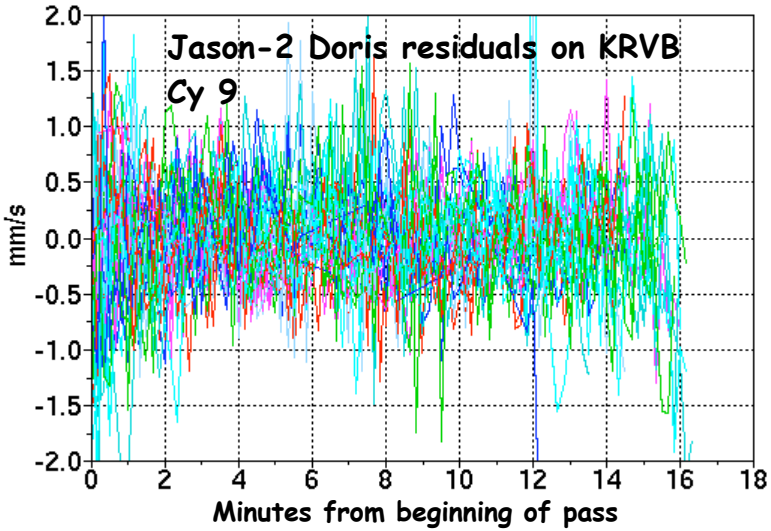


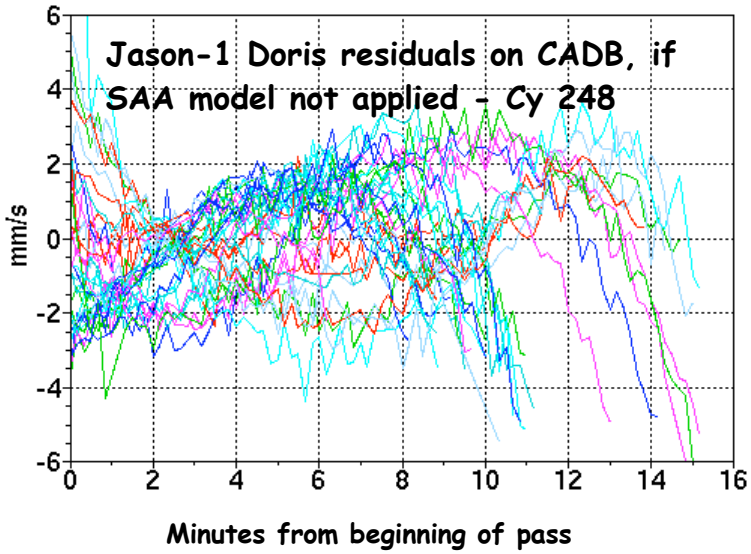


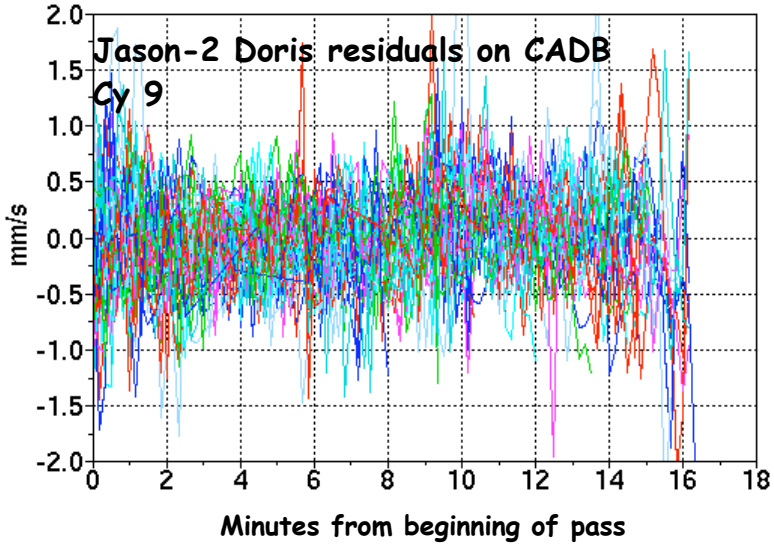
Doris

- Doris: stable residuals RMS ~ 0.4mm/s
- No particular signature found in the residuals of typical SAA stations
  - SAA stations are not underweighted in J2 processing
- New Rinex processing

(more details at IDS meeting !)



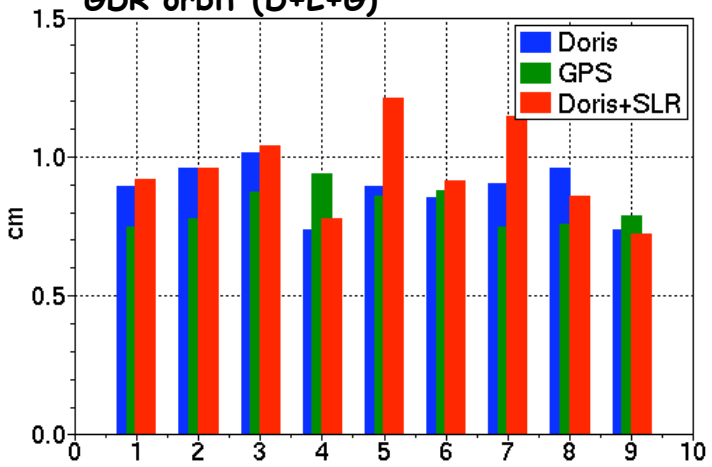




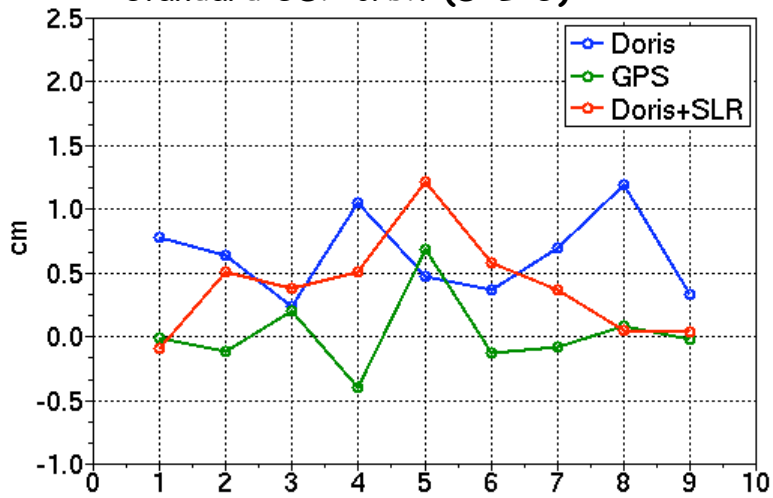
Internal tests: GPS, DORIS, D/L orbits

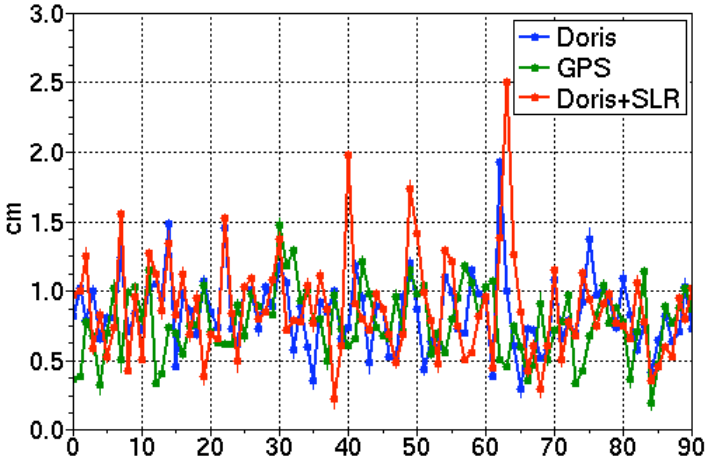
- GPS, Doris, and Doris+SLR orbits compare well to the standard GDR orbit (D/L/G)
- Along track mean per cycle is within 1 cm
  - No evidence of any particular along track bias between GPS and doris-only orbits

RMS of radial difference wrt standard GDR orbit (D+L+G)



Mean of along track difference wrt standard GDR orbit (D+L+G)

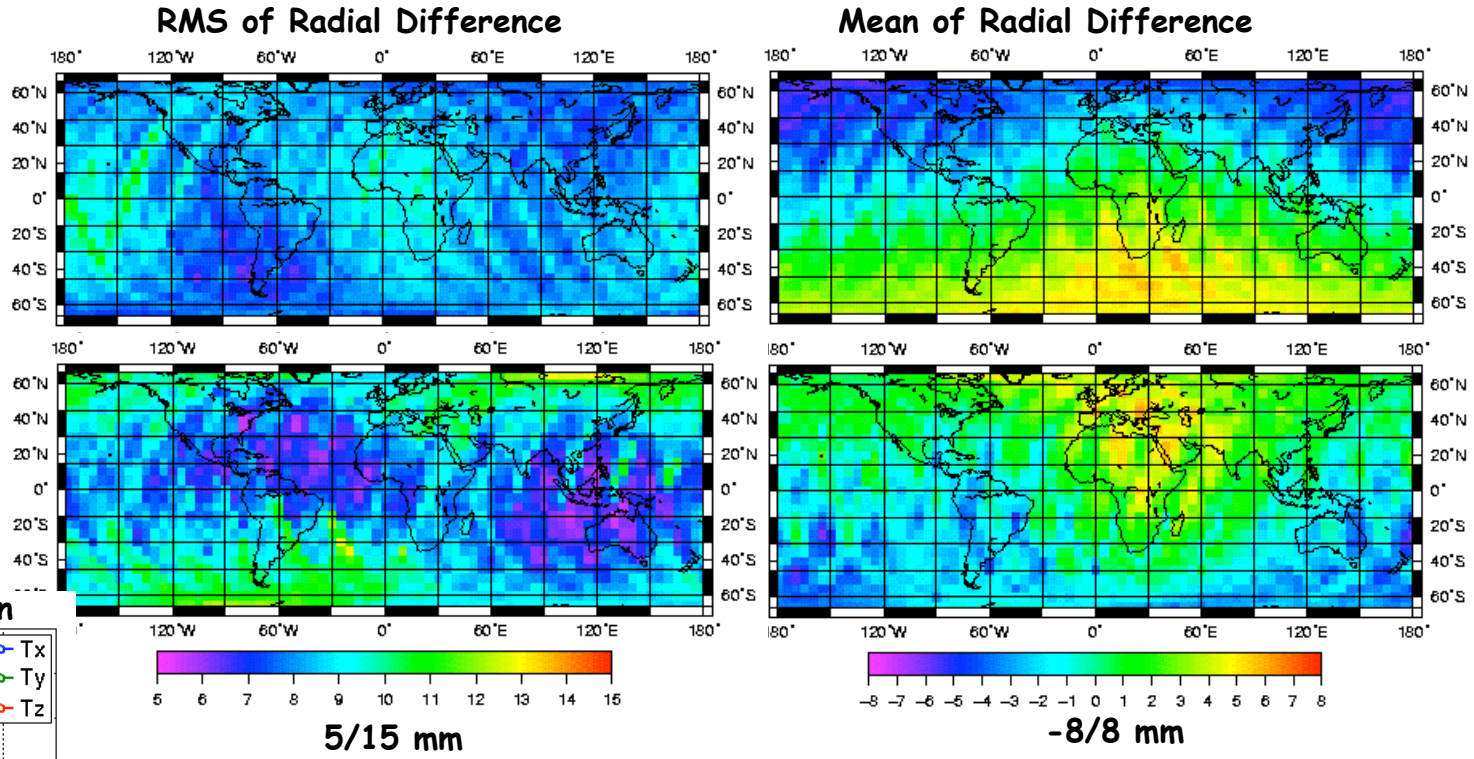


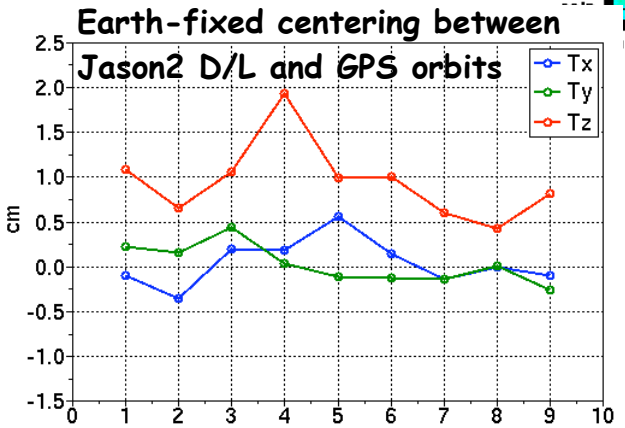


Internal tests: GPS, DORIS, D/L orbits

CNES D+L+G DYN
- CNES GPS only
(cycles 1-9)

CNES D+L+G DYN
- CNES D/L
(cycles 1-9)

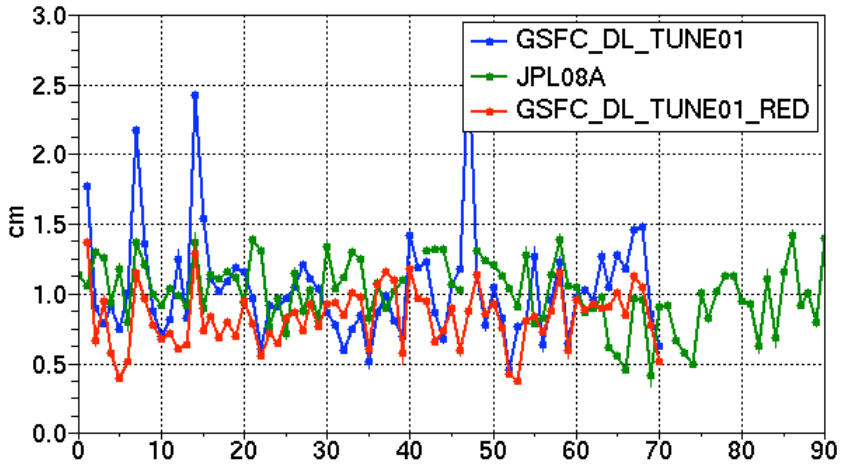


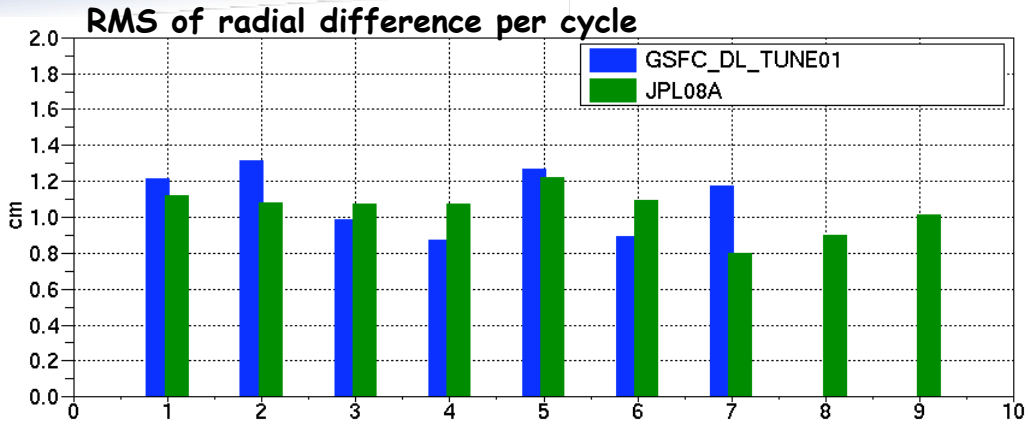


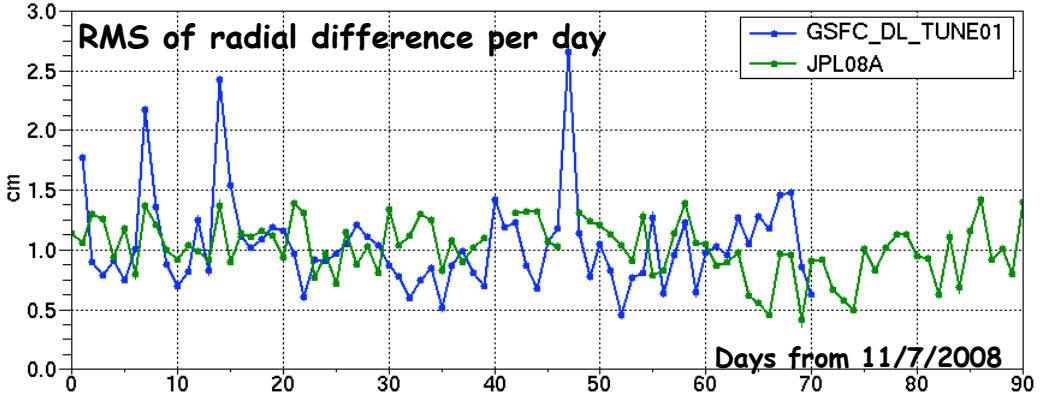
- Z bias between D+L and GPS orbits
- Increasing the weight of D+L helps in keeping Jason-1 (no gps) and Jason-2 orbits more consistent

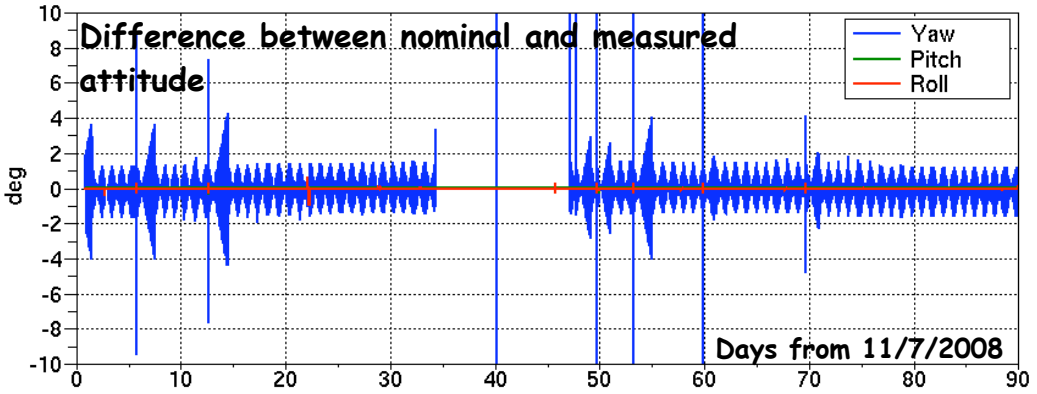
External comparisons 1/3

- CNES orbit compares to the cm level with JPL and GSFC
- Few exceptions mainly on GSFC dynamic orbit (attitude events?)
- Excellent agreement with GSFC reduced dynamic orbits (mean radial RMS=0.83 cm)







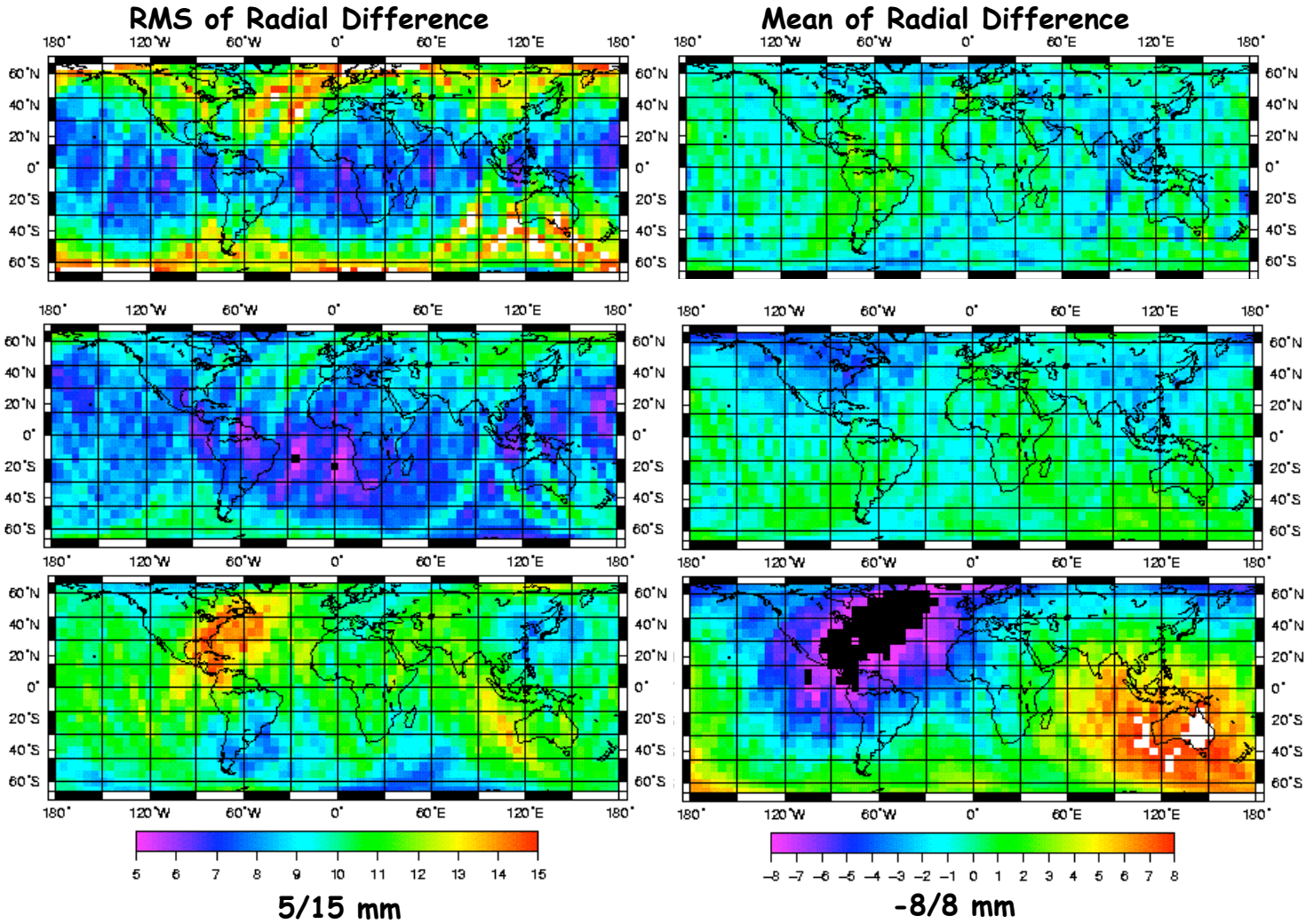


Orbit comparisons 2/3

CNES D+L+G DYN
-GSFC-TUNE01-DYN
(cycles 1-7)

CNES D+L+G DYN
-GSFC-TUNE01-RED
(cycles 1-7)

CNES D+L+G DYN
-JPL08A
(cycle 1-9)

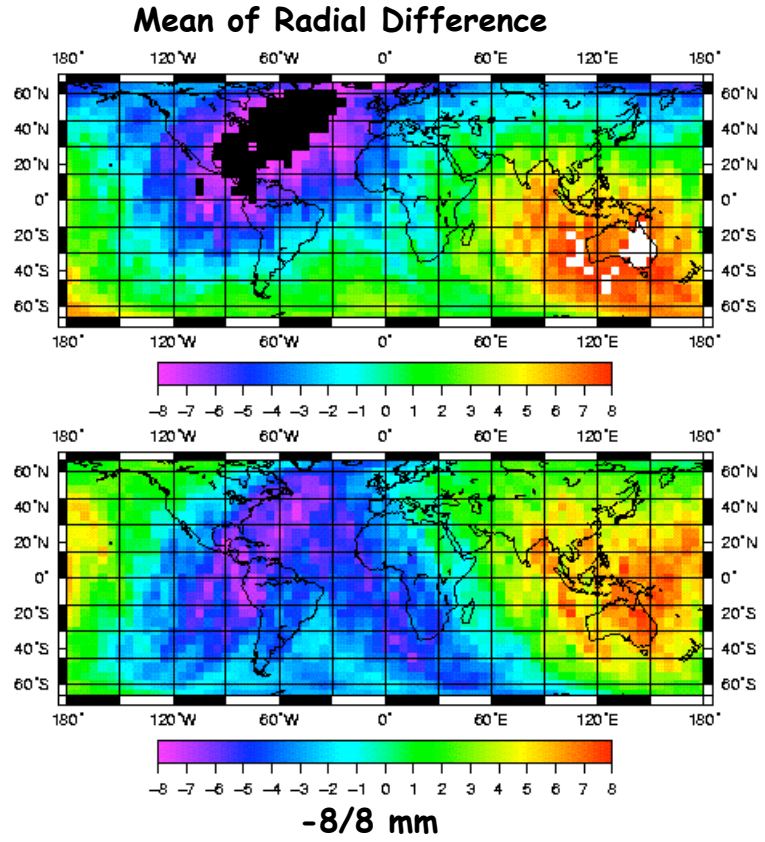


Orbit comparisons 3/3

- Same pattern between CNES GPS only orbits and JPL orbits (except for the Z shift !)
- Need to verify if this pattern is stable with time
- This is a crucial point that needs to be further investigated

CNES D+L+G DYN -JPL08A (cycle 1-9)

CNES GPS DYN -JPL08A (cycle 1-9)



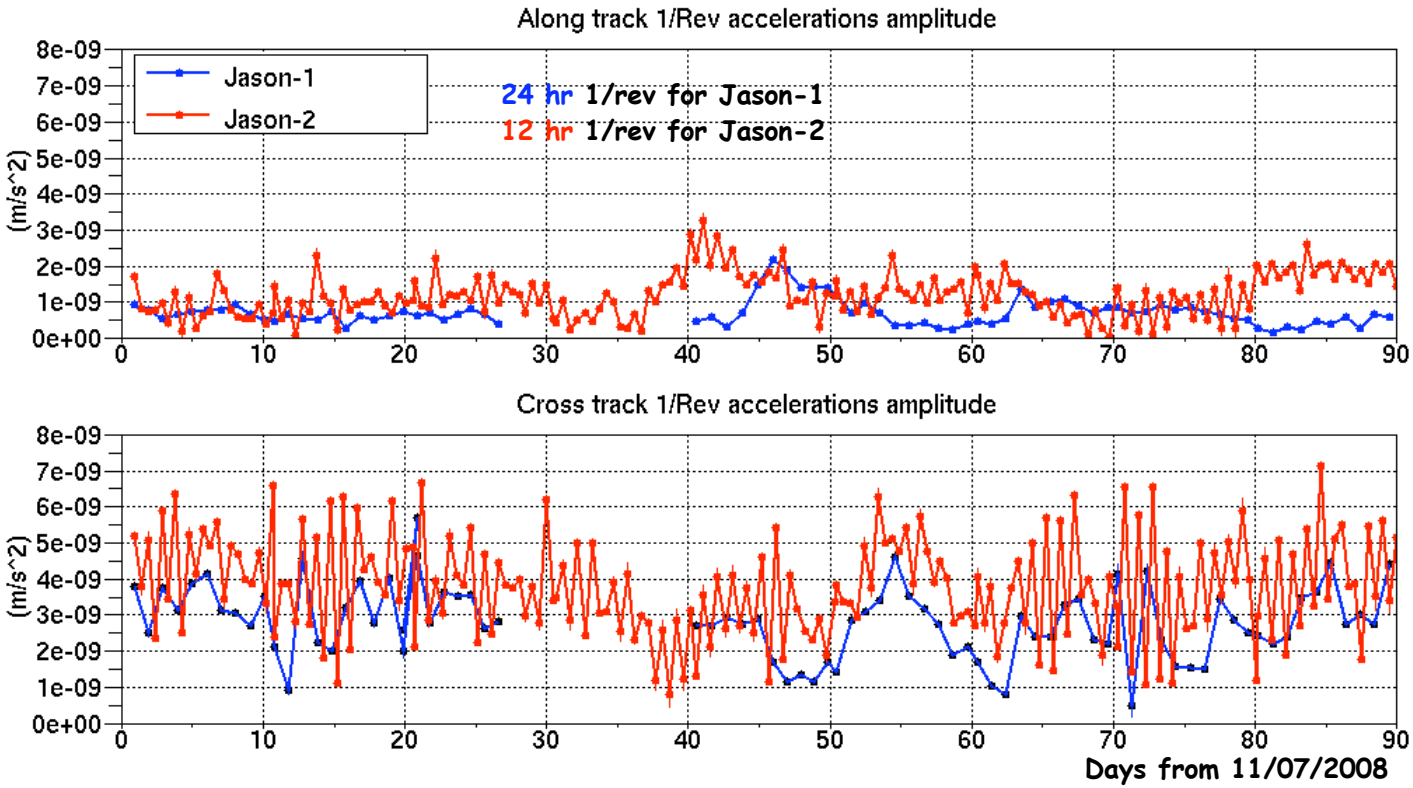
Satellite model

_ Currently used model

- Same as Jason-1 (corrected version used in GDRC reprocessing)
  - Scale coefficient =1 was found to work well for cycle 001

_ In general low empirical forces comparable to Jason-1 amplitude

_ Performance seems degraded for later cycles , cycle 9 in particular

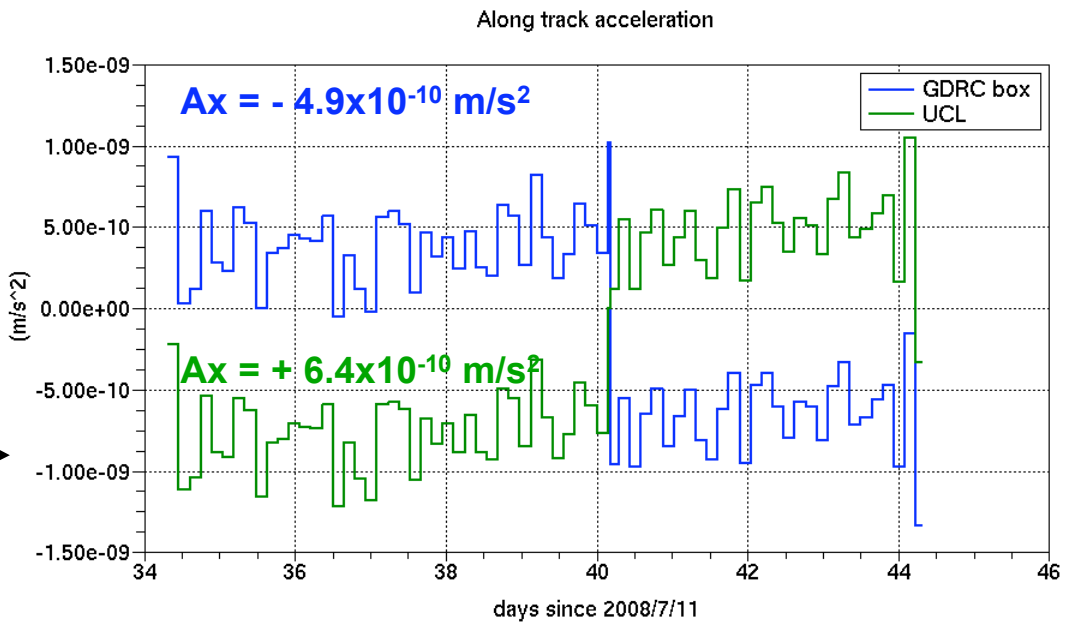


Satellite model

Other surface forces applied :

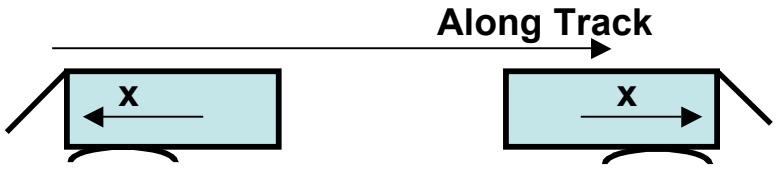
_ In fixed yaw, there is clear bias in the body-fixed X direction (as for Jason-1)

A_x = -4.9x10^{-10} m/s^2 (estimated over cycle 4/5 fixed yaw)



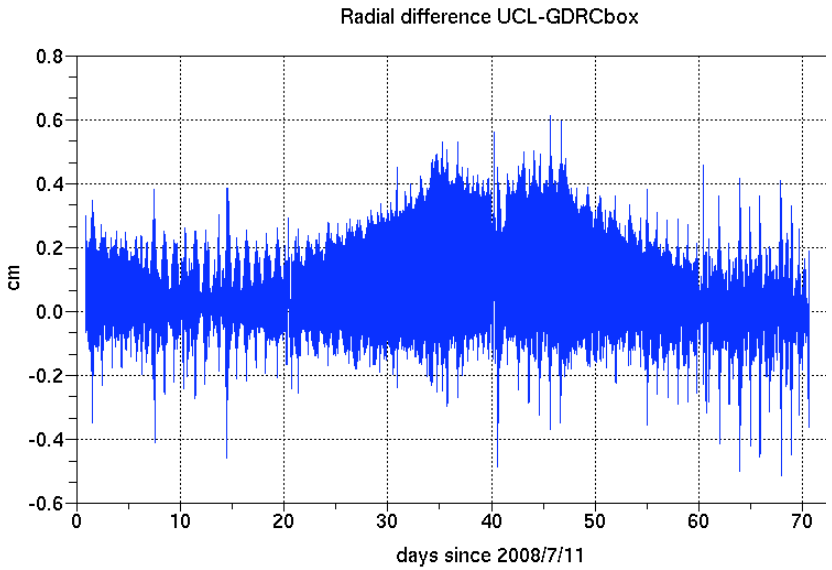
_ A Y-bias is also applied (based on pre-launch satellite model)

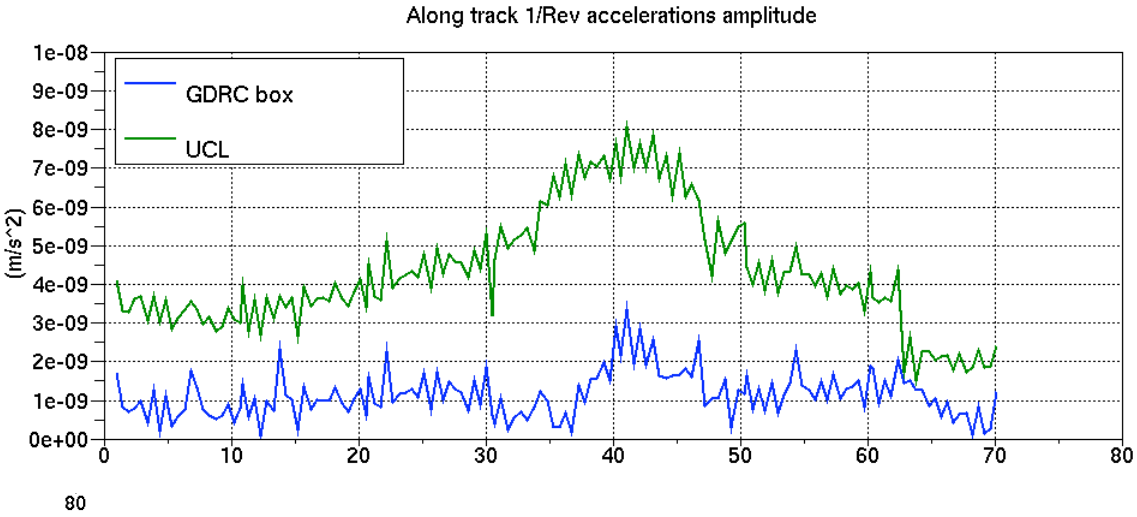
A_y = -2.7x10^{-10} m/s^2

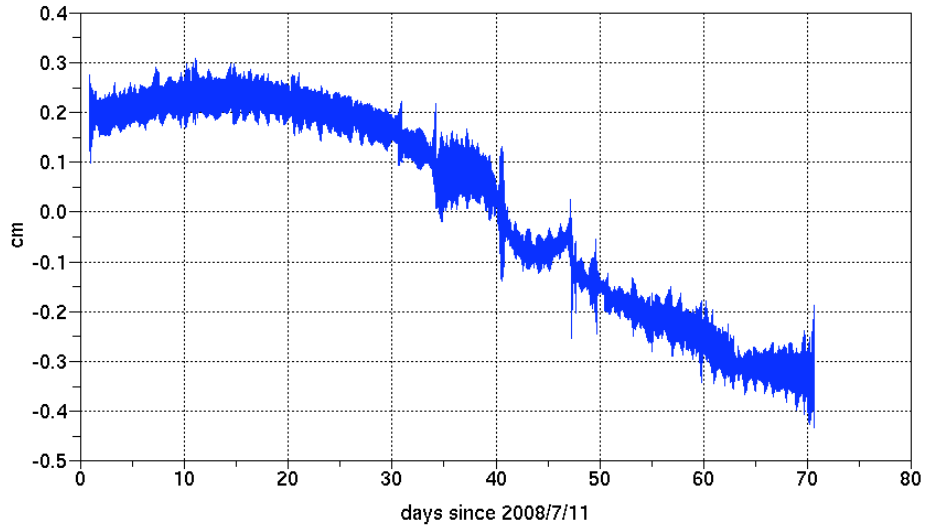


Test of a preliminary UCL model for Jason-2

(model provided by Ant Sibthorpe @ UCL)





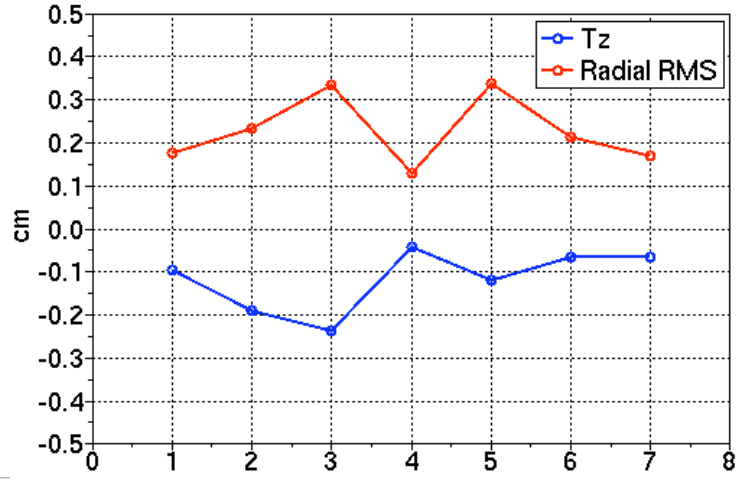


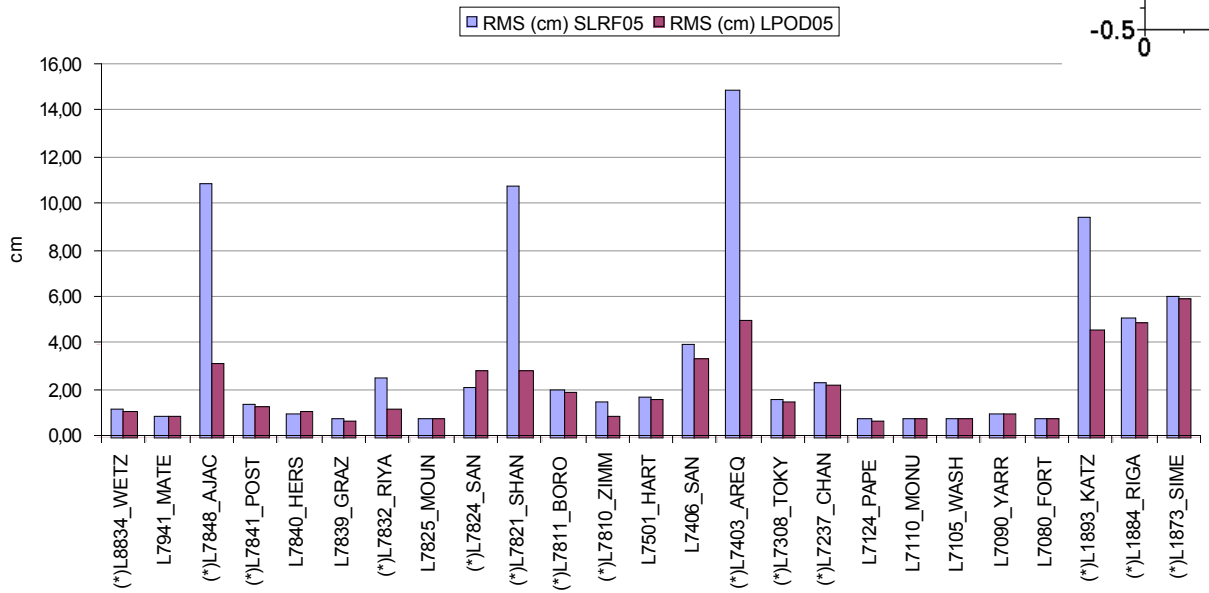
- Model tested on GPS-only orbits with identical solar panel and scale=1
- Very close orbits (thanks to the estimated empiricals) and equivalent SLR residuals
- Cross track bias between the two orbits
- Very similar results as those observed with Jason-1 model

Test of a preliminary version of LPOD2005

(coordinates and biases provided by J. Ries)

- Significant improvement over many good stations (7810ZIMM, 7406SANJ…)
- Limited impact on the GDR orbit (bias solved for few stations)





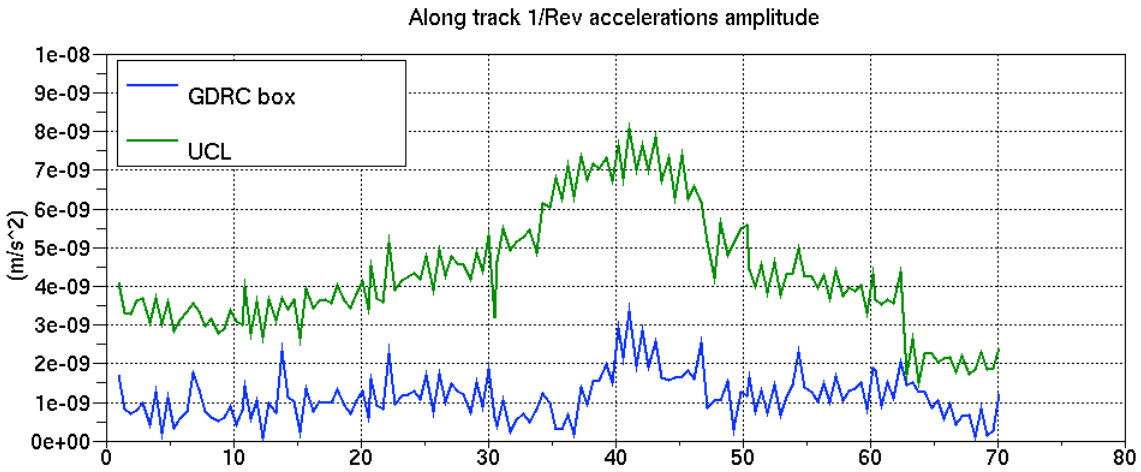
Conclusion

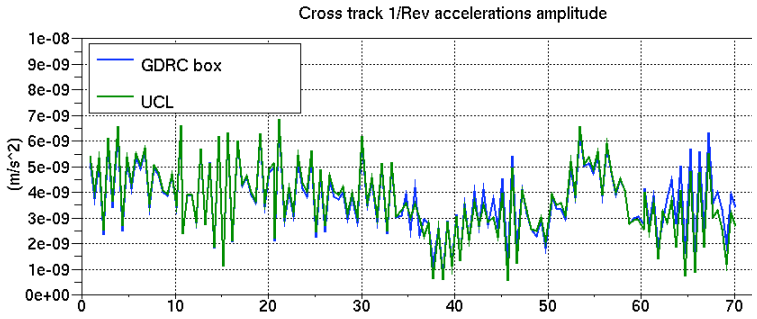
- Jason-2 POE global radial accuracy seems equivalent or better than that of Jason-1
  - Needs to be confirmed by altimetry results
- Some margin of improvement is given by
  - The use of the LPOD2005 coordinates and biases
  - A better tuning of satellite model (surface forces, antenna reference point positions, phase maps, …)
- Internal and external orbit comparisons are satisfactory, but some significant geographic difference exist
  - In particular the comparison wrt JPL

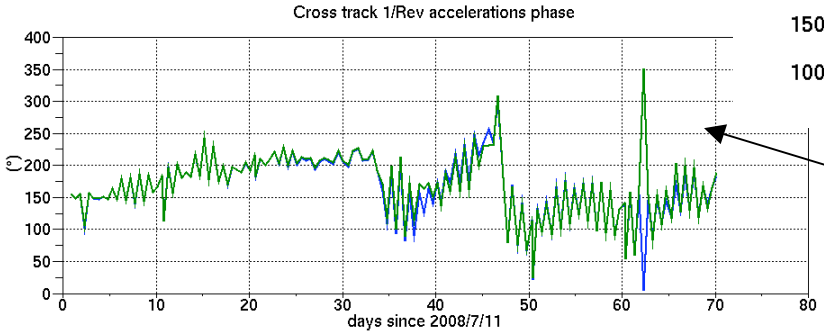
Backups

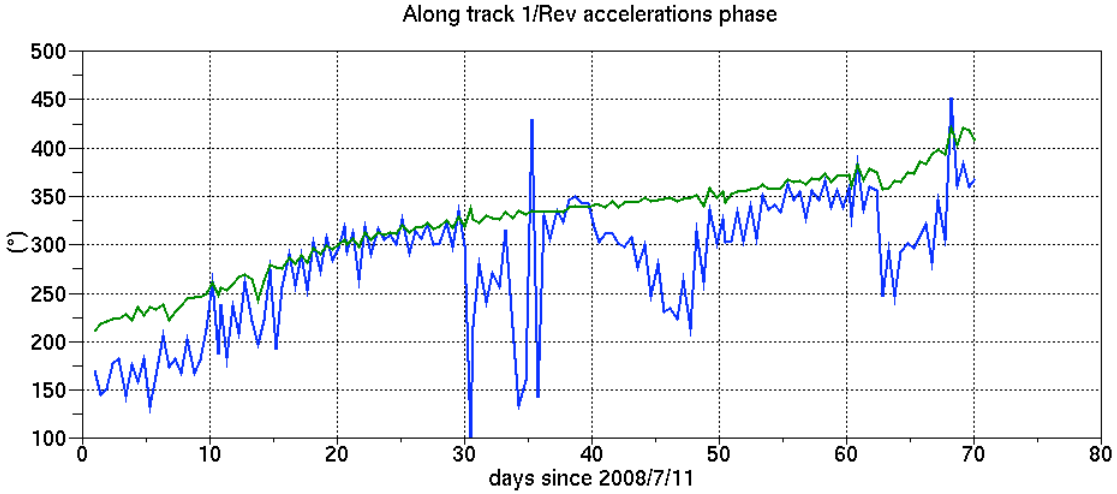
SRP Model test : 1/revs

- The amplitude of the along-track 1/rev is systematically higher in the UCL case
- Lower noise on UCL phase (due to the higher amplitude)









- Cross track: identical empirical forces

SRP Model test : SLR Residuals

_ Very similar SLR residuals, results don't show any clear improvement nor any degradation

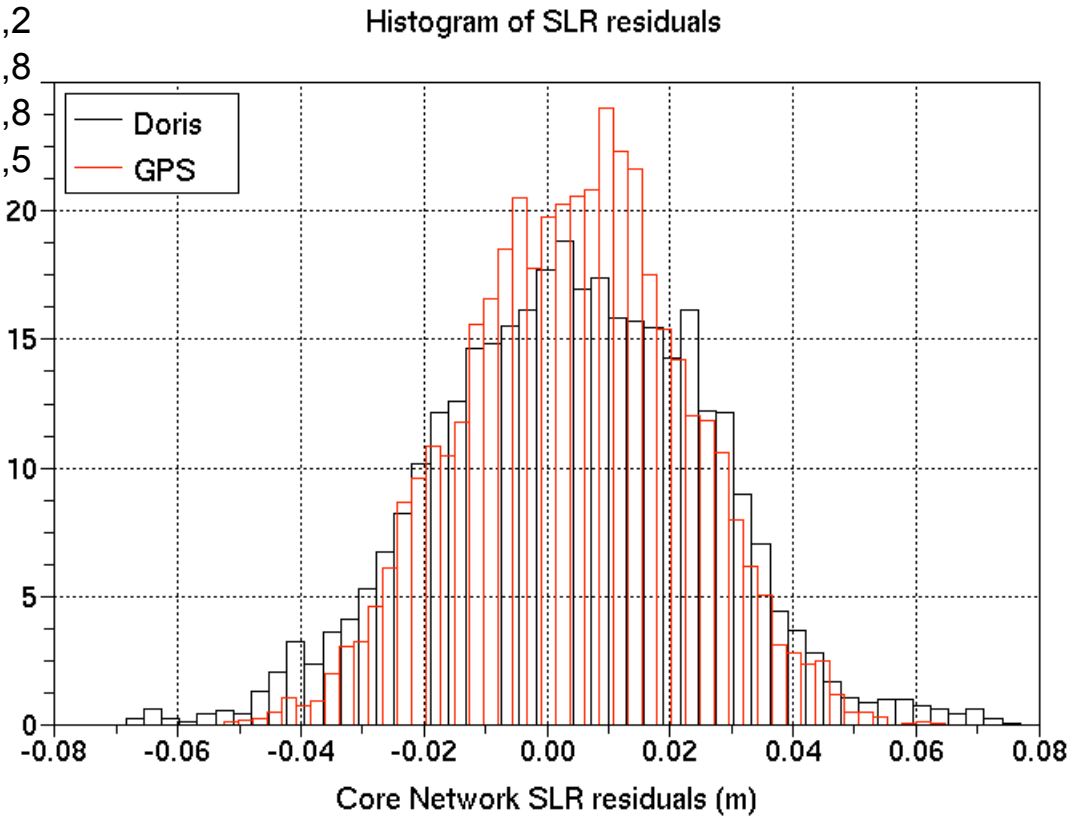
	RMS	STDEV	MEAN	MEDIAN	
GDRCbox	3,66	3,62	0,54	0,44	All non-edited residuals
UCL	3,65	3,61	0,53	0,43	(18242)
GDRCbox	1,80	1,75	0,44	0,51	Good residuals on reference
UCL	1,83	1,78	0,43	0,52	stations (7259)
GDRCbox	1,69	1,62	0,50	0,63	Reference stations; elevation
UCL	1,71	1,65	0,48	0,61	> 50°; (1115)

_ These results need to be confirmed once the final configuration for Jason-2 will be decided (position of SLR reference points)

SLR (slrf05) residuals on Doris-only and GPS-only orbits

		Mean (mm)		RMS (mm)	
STA	Nr points	Doris	GPS	Doris	GPS
7090	3306	8,5	12,1	21,8	20,2
7105	1062	7,4	3,5	22,0	14,1
7110	170	3,7	-0,5	17,4	15,2
7839	1904	-6,6	-7,5	24,3	17,8
7080	98	2,8	5,7	24,4	16,8
8834	717	7,3	3,3	18,3	16,5

- Lower RMS on GPS orbits
- Lower mean on Doris orbit



LPOD2005 on Jasson-2

(*) Indicates that a bias per pass was estimated in V01 test. The estimated value was then added back to the residuals to allow a direct comparison

Station	Weight	Points	Mean (cm)		Median (cm)		Stdev (cm)		RMS (cm)	
			V01	V02	V01	V02	V01	V02	V01	V02
(*)L8834_WETZ	0,3	717	0,55	0,63	0,59	0,64	1,04	0,94	1,18	1,13
L7941_MATE	0,7	347	-0,45	-0,46	-0,43	-0,40	0,76	0,70	0,88	0,84
(*)L7848_AJAC	0,1	320	10,03	2,26	10,26	2,59	4,07	2,22	10,83	3,17
(*)L7841_POST	0,5	329	-0,53	-0,38	-0,56	-0,41	1,28	1,25	1,38	1,31
L7840_HERS	1	1065	0,65	0,73	0,60	0,71	0,79	0,79	1,02	1,08
L7839_GRAZ	1	1904	-0,34	-0,30	-0,33	-0,30	0,67	0,65	0,75	0,72
(*)L7832_RIYA	0,2	238	2,20	0,11	2,34	0,07	1,32	1,24	2,56	1,24
L7825_MOUN	0,8	2169	-0,16	-0,17	-0,19	-0,20	0,76	0,75	0,78	0,77
(*)L7824_SAN	0,1	418	-0,37	-1,74	-0,67	-2,09	2,06	2,26	2,09	2,85
(*)L7821_SHAN	0,5	155	-10,51	-2,37	-10,18	-2,24	2,41	1,62	10,78	2,87
(*)L7811_BORO	0,5	78	0,46	0,54	0,37	0,44	1,99	1,87	2,03	1,94
(*)L7810_ZIMM	0,7	2400	1,05	-0,34	1,06	-0,35	1,14	0,85	1,55	0,92
L7501_HART	0,1	216	0,55	0,41	0,65	0,40	1,59	1,52	1,68	1,57
L7406_SAN	0,1	1483	0,93	0,93	0,64	1,00	3,91	3,19	4,02	3,32
(*)L7403_AREQ	0,3	394	8,25	2,37	10,77	2,55	12,36	4,40	14,85	5,00
(*)L7308_TOKY	0,1	40	0,18	0,26	-0,14	0,00	1,58	1,51	1,57	1,51
(*)L7237_CHAN	0,1	804	-0,45	-0,40	-0,39	-0,31	2,29	2,21	2,33	2,24
L7124_PAPE	0,5	83	0,22	0,16	0,20	0,02	0,73	0,66	0,75	0,68
L7110_MONU	1	170	0,19	0,14	0,18	0,17	0,73	0,73	0,75	0,74
L7105_WASH	1	1091	0,29	0,35	0,26	0,35	0,69	0,67	0,75	0,76
L7090_YARR	1	3421	0,66	0,66	0,65	0,64	0,80	0,80	1,04	1,03
L7080_FORT	1	117	0,01	0,03	-0,04	-0,01	0,75	0,77	0,74	0,77
(*)L1893_KATZ	0,1	243	-8,48	-2,83	-9,38	-3,64	4,19	3,66	9,46	4,62
(*)L1884_RIGA	0,2	28	5,04	4,86	4,91	4,73	0,88	0,88	5,11	4,94
(*)L1873_SIME	0,1	12	3,10	3,07	2,20	2,17	5,34	5,34	5,98	5,96