External Validation of DORIS Orbits (Jason-1)

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MOE Quality

Jason Cycle	Jason Mean (mm)	Jason RMS (mm)	TOPEX Mean (mm)	TOPEX RMS (mm)
3	-1.3	14.9	---	---
4	-1.6	14.1	---	---
5	0.9	15.6	---	---
6	8.6	24.1	---	---
7	9.2	34.8	---	---
8	2.8	15.7	-2.1	25.4
9	-0.3	15.2	-0.7	35.0
10	-1.1	19.4	-7.8	54.4
11	0.9	16.6	-2.8	61.6
12	9.3	26.6	5.9	33.5
Avg	2.7	19.7	-1.5	42.0

1 - Cycle 3, Passes 3-254 only because of OMM in Pass 1
2 - TOPEX Cycles 346-350 are GDR with POE

CNES Orbits

CNES (SLR/DORIS)

	Crossover (CSR)		Crossover (CNES)		Radial Diff		X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
3	-9	65	-2	64	12	2	-1	0	-2
4	-4	63	1	64	14	2	-4	-2	7
5	-3	64	4	65	16	3	-2	-3	1
6	-2	65	-3	63	17	4	0	2	4
7	3	71	-3	77	32	3	0	0	4
8	6	68	10	68	14	4	4	1	6
9	5	68	5	68	17	3	6	6	7
10	-3	68	-2	73	27	2	2	8	8
Mean	-1	66	1	68	19	3	0	2	4

CNES (GPS - DYN)

	Crossover (CSR)		Crossover (CNES)		Radial Diff		X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
3	-9	65	-14	66	26	-2	-18	-15	-8
4	-4	63	8	66	18	2	-2	-3	1
5	-3	64	18	70	25	3	-1	-6	-17
6	-2	65	5	71	23	5	0	-3	-21
7	3	71	11	74	29	4	6	-1	13
8	6	68	4	68	14	4	6	-1	0
9	5	68	-3	67	18	3	8	5	7
10	-3	68	-7	64	19	2	2	7	12
Mean	-1	66	3	68	21	3	0	-2	-2

CNES (GPS - ELFE)

	Crossover (CSR)		Crossover (CNES)		Radial Diff		X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
5	-3	64	18	69	25	3	9	-5	-14
6	-2	65	12	67	25	4	0	-2	-14
7	3	71	11	68	29	4	-3	1	11
8	6	68	9	68	16	4	5	-2	5
9	5	68	-2	67	17	3	2	-4	4
10	-3	68	-6	64	18	2	-3	3	12
Mean	1	67	7	67	22	3	2	-2	1

JPL Orbits

JPL (GPS)

	Crossover (CSR)		Crossover (JPL)		Radial Diff	X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
8	6	68	-1	66	17	1	6	10	5
9	5	68	3	66	16	0	10	5	6
10	-3	68	5	65	21	0	6	8	4
Mean	3	68	3	66	18	0	7	8	5

JPL/IGN (DORIS)

	Crossover (CSR)		Crossover (CNES)		Radial Diff	X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
3	-9	65	-9	64	17	-1	3	1	20
4	-4	63	0	63	17	-1	1	2	24
5	-3	64	-2	64	17	0	5	0	18
6	-2	65	-10	67	17	1	6	1	8
7	3	71	-13	66	24	1	-3	6	18
8	6	68	-2	68	20	0	3	4	24
9	5	68	-7	67	22	-1	-1	2	30
10	-3	68	-14	66	21	-1	-2	4	24
Mean	-1	66	-7	65	19	0	1	2	20

JPL/IGN (DORIS+GPS)

	Crossover (CSR)		Crossover (CNES)		Radial Diff	X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
8	6	68	0	66	16	1	1	6	12
9	5	68	0	66	16	0	3	4	11
10	-3	68	-2	64	20	-1	0	5	11
Mean	3	68	-1	65	17	0	1	5	11

SLR-only and DORIS-only Orbits

CSR (DORIS only)

	Crossover (SLR/DORIS)		Crossover (DORIS only)		Radial Diff		X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
3	-9	65	-8	64	9	0	0	1	-10
4	-4	63	4	63	8	0	-1	0	-5
5	-3	64	2	64	8	0	0	0	-8
6	-2	65	-3	67	15	-1	1	1	-17
7	3	71	-2	72	13	0	1	1	-9
8	6	68	8	68	10	0	0	0	-14
9	5	68	5	68	7	0	-1	0	-5
10	-3	68	-5	65	14	0	-3	4	-4
Mean	-1	66	0	66	11	0	0	1	-9

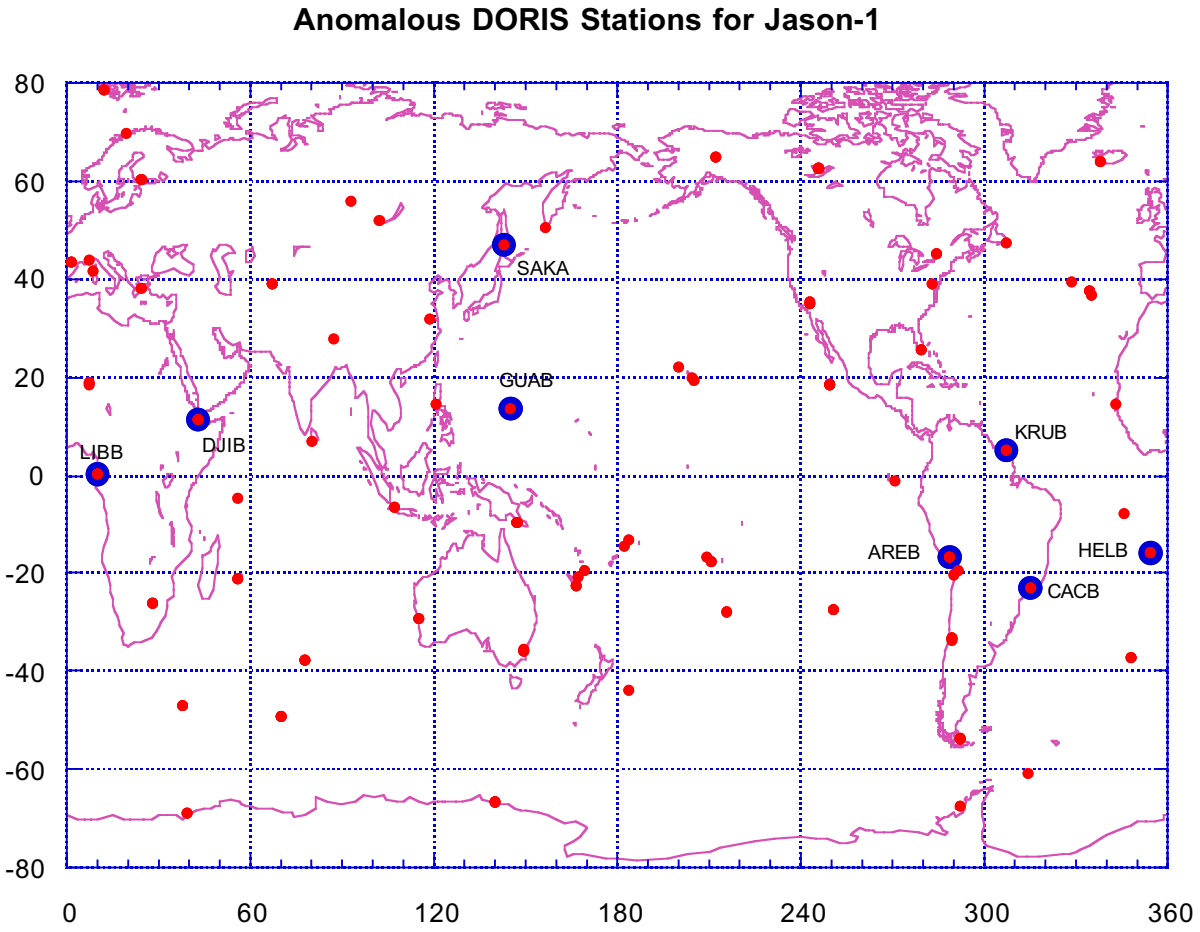
CSR (SLR only)

	Crossover (SLR/DORIS)		Crossover (SLR only)		Radial Diff		X	Y	Z
Cycle	Mean (mm)	RMS (mm)	Mean (mm)	RMS (mm)	RMS (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
3	-9	65	0	68	21	0	-3	-1	-4
4	-4	63	-7	64	5	0	1	0	1
5	-3	64	-6	67	12	0	-1	0	9
6	-2	65	-2	67	11	1	1	0	5
7	3	71	6	74	16	0	1	1	10
8	6	68	3	68	7	0	1	0	3
9	5	68	3	68	8	0	0	0	5
10	-3	68	4	71	21	1	-1	2	6
Mean	-1	66	0	69	13	0	0	0	4

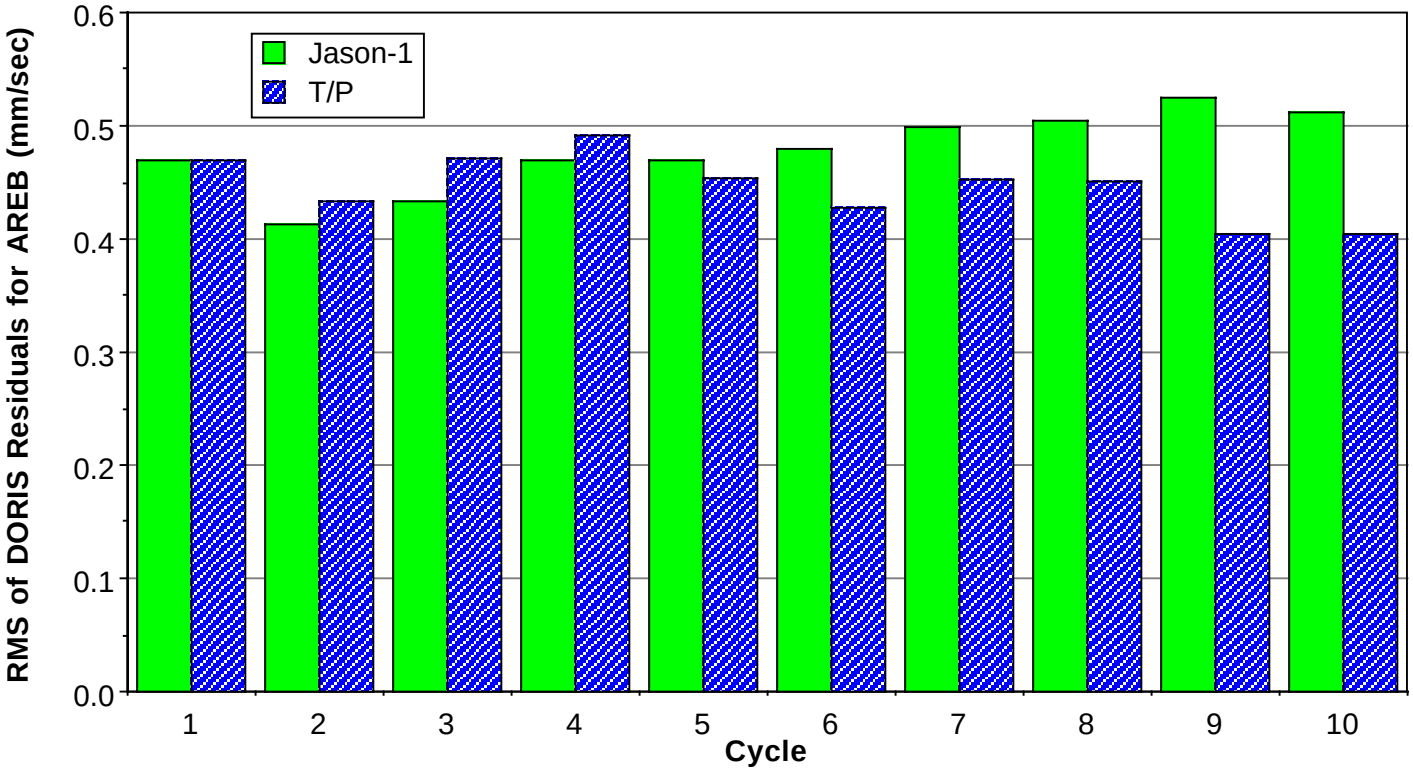
Improved Fits on Jason-1 vs T/P

Topex/Poseidon Cycle	DORIS RMS (mm/s)	Jason-1 Cycle	DORIS RMS (mm/s)
344	0.462	1	0.367
345	0.458	2	0.364
346	0.456	3	0.366
347	0.466	4	0.370
348	0.468	5	0.377
349	0.455	6	0.371
350	0.459	7	0.382
351	0.463	8	0.369
352	0.449	9	0.381
353	0.461	10	0.381
Average	0.460		0.373

DORIS Anomalies on Jason-1



Arequipa Particularly Affected



Summary

- Comparing the results among the various institutions, we note that most of the orbits have a mean X and Y that agrees with the CSR orbits within 2 mm, and within 5 mm for Z
  - Some orbit solutions, however, exhibit either significant biases or scatter in the centering, especially in Z
  - Almost all orbit solutions have a mean crossover of only 1 mm, although the cycle to cycle average is usually several mm.
- RMS radial agreement typically better than 20 mm
  - The radial bias in the CNES orbits is distinct from all other orbit solutions.
- Need to understand DORIS anomalies on Jason-1 before it can be used for precise geodetic applications
  - May impact how T/P DORIS data is processed