Status of DORIS Processing at GSFC

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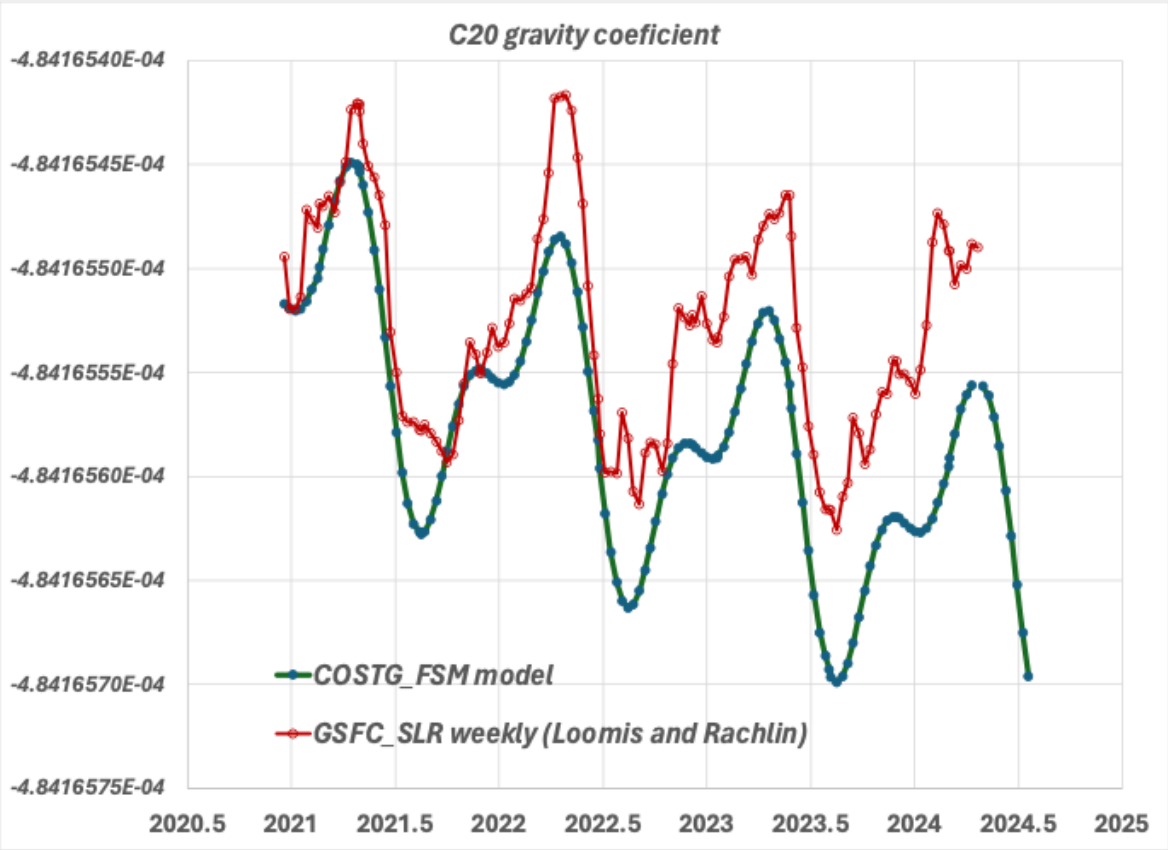
2025 IDS AWG (Virtual) Meeting

March 24, 2025

Summary of Recent SINEX Submissions Post ITRF2020

Series	Description	Comment
gscwd54	gscwd53 + replace GOCO05s/SLR+DORIS 4x4 solutions with **CNES_GRGS.RL05MF_COMBINED_GRACE_SLR_DORIS** gravity model, and resubmit SINEX files from 20160101 for the preparation of the ITRF2020 extension.	Deliveries started 2023-11-08. (Delivered from 2016-DOY003 to 2023-DOY365) by February 4, 2024.
gscwd55	gscwd54 + Sentinel-6A	Delivered 2021-2023 on 2024-0306 to 2024-0319.
gscwd58	gscwd55 + dpod2020 + Jason-3 downweighted w.r.t S6A + MSIS2 atmosphere density model + apply nutation corrections. (DORIS V2 for Saral + Cryosat-2)	Delivered 2021-0103 to 2024-12-24
gscwd59	Gscwd58 + replace DORIS/V2 normal eq. with DORIS/RINEX normal equations (Saral and Cryosat-2)	Test series, DORIS/RINEX only
gscwd60	gscwd59 + Use COSTG_FSM gravity model + Loomis et al. (2022) low-degree terms derived from SLR.	Delivered 2021-2024 on February 26, 2025 for ITRF2020-u2024

Low degree Comparison
(COSTG_FSM vs. SLR-derived: 2021-2024)



Summary of POD Results: RMS of fit for gscwd58/59/60

*(*results: DORIS V2 vs. RINEX & grgs_rl05 vs. costg_fsm)*

Satellite	First Arc	Last Arc	No of Arcs	Avg. No SLR obs	Avg. No DORIS obs	Avg. SLR fit (cm)	Avg DORIS fit * (WRMS, mm/s)
Cryosat-2 (wd58)	210103	241229	294	744	52,857	0.736	0.3796
Cryosat-2 (wd59)	210103	241229	294	744	54,435	0.747	0.3837
Cryosat-2 (wd60)	**210103**	**241229**	**294**	**744**	**54,438**	**0.719**	**0.3804**
Saral (wd58)	210103	241229	216	845	79,150	0.710	0.3589
Saral (wd59)	210103	241229	216	847	81,177	0.718	0.3604
Saral (wd60)	**210103**	**241229**	**216**	**847**	**81,175**	**0.702**	**0.3603**

* All arcs use elevation-dependent weighting; For simplicity DORIS WRMS is rescaled by 1/0.7 to report aggregate results by satellite.

Summary of POD Results: RMS of fit for gscwd58/60

*(*results: grgs_rl05 vs. COSTG_FSM)*

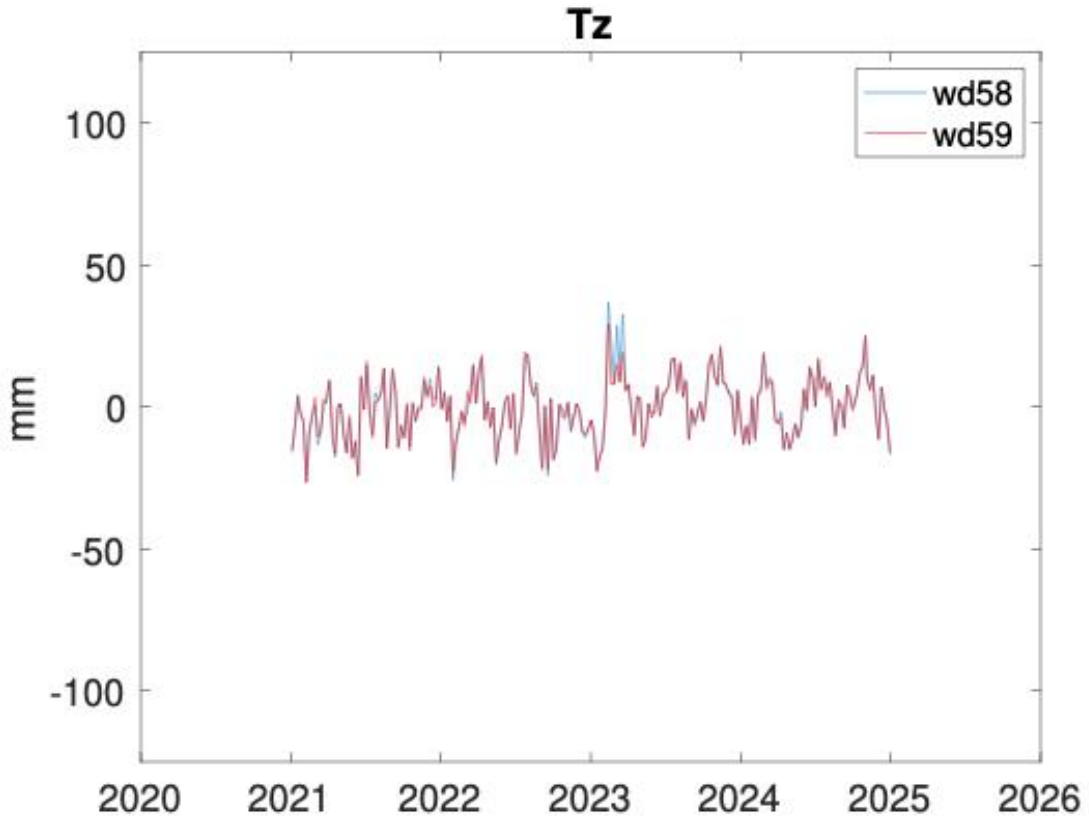
Satellite	First Arc	Last Arc	No of Arcs	Avg. No SLR obs	Avg. No DORIS obs	Avg. SLR fit (cm)	Avg DORIS fit * (WRMS, mm/s)
Jason-3 (wd58)	210103	241229	241	2152	127,519	0.748	0.3629
Jason-3 (wd60)	**210103**	**241229**	**241**	**2152**	**127,518**	**0.679**	**0.3627**
Sent. 6A (wd58)	210103	241229	239	1966	124,098	0.714	0.3551
Sent. 6A (wd60)	**210103**	**241229**	**239**	**1966**	**124,543**	**0.624**	**0.3549**
Sent. 3A (wd58)	210103	250102	280	727	67,479	0.727	0.3751
Sent. 3A (wd60)	**210103**	**250102**	**280**	**727**	**67,441**	**0.715**	**0.3750**
Sent. 3B (wd58)	210103	250102	288	711	65,793	0.754	0.3851
Sent. 3B (wd58)	**210103**	**250102**	**288**	**711**	**65,792**	**0.727**	**0.3850**

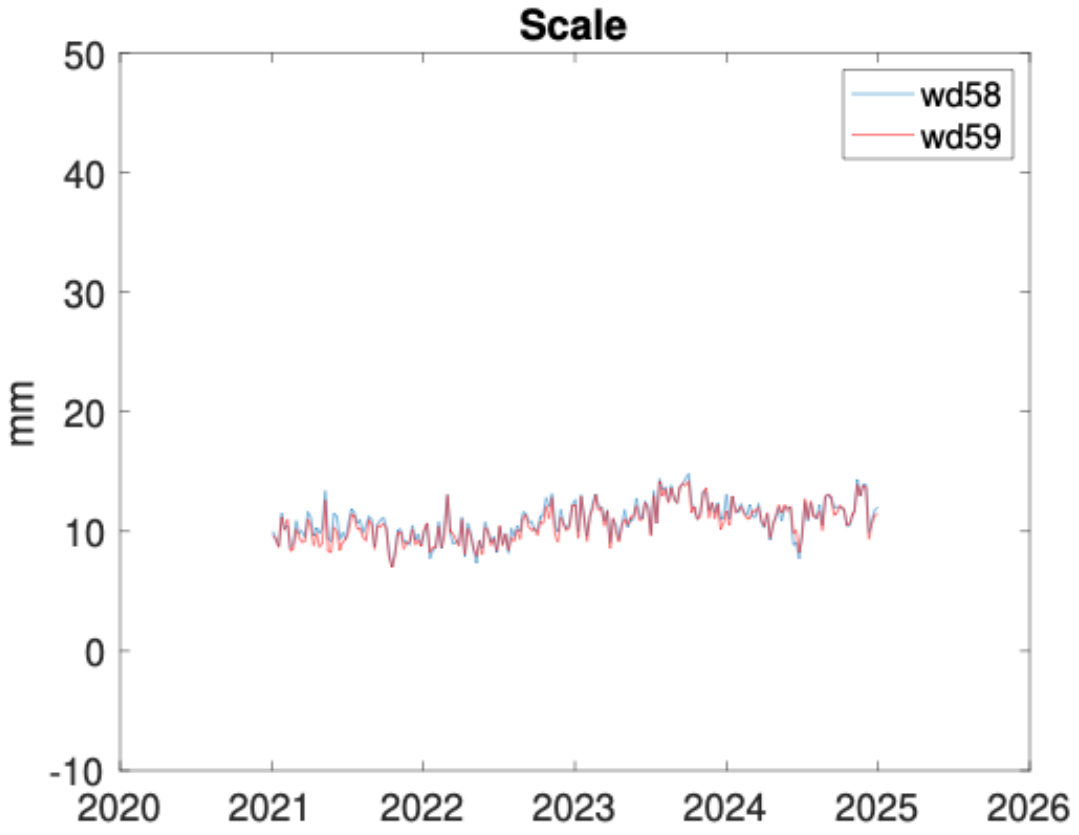
* All arcs use elevation-dependent weighting; For simplicity DORIS WRMS is rescaled by 1/0.7 to report aggregate results by satellite.

Summary of POD Results (2021 – 2024): Empirical Accelerations: (satellite data for ITRF2020-u2024. wd60)

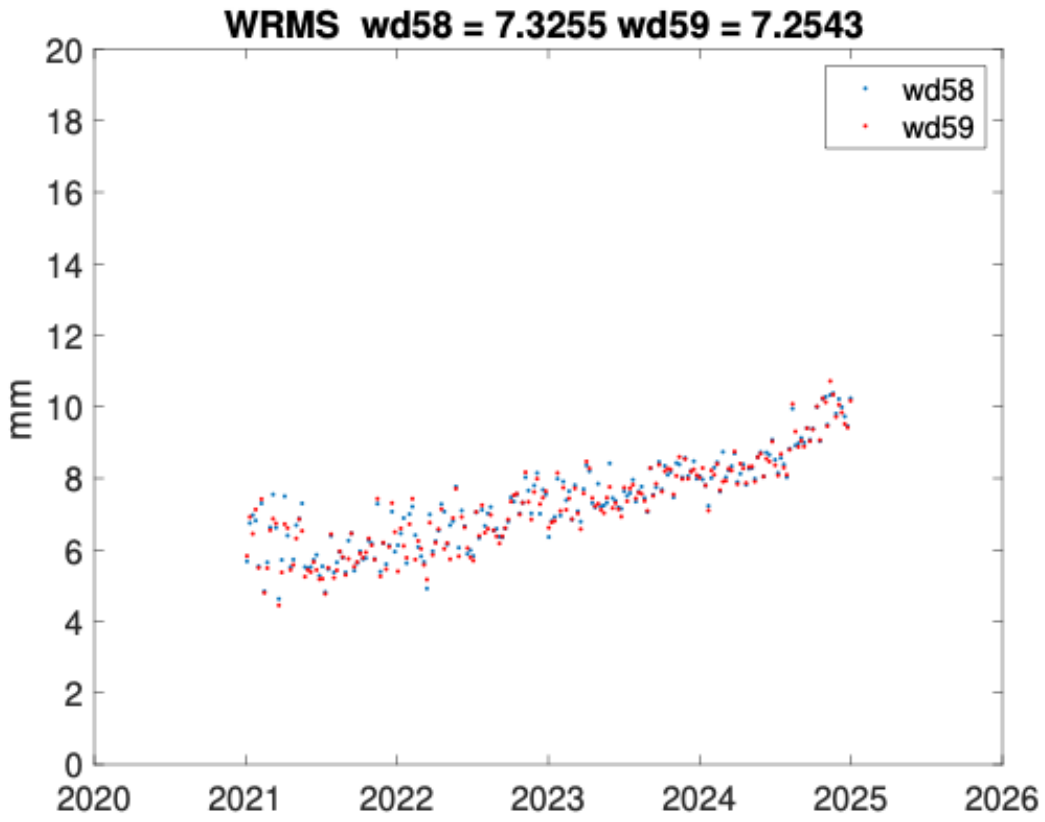
Satellite	First Arc	Last Arc	No of Values	Along-track Accels (nm/s^2)		Cross-track Accels (nm/s^2)	
				Average	RMS	Average	RMS
Cryosat-2	210103	241229	1586	3.068	3.896	2.656	3.734
Jason-3	210103	241229	1537	0.847	1.129	1.691	2.385
Sentinel-6A	210103	241229	1487	1.764	1.951	1.712	2.263
Sentinel-3A	210103	250102	1614	0.874	1.581	1.635	2.959
Sentinel-3B	210103	250102	1588	1.438	1.873	1.648	2.959
Saral	210103	241229	1512	2.708	4.168	1.494	9.491

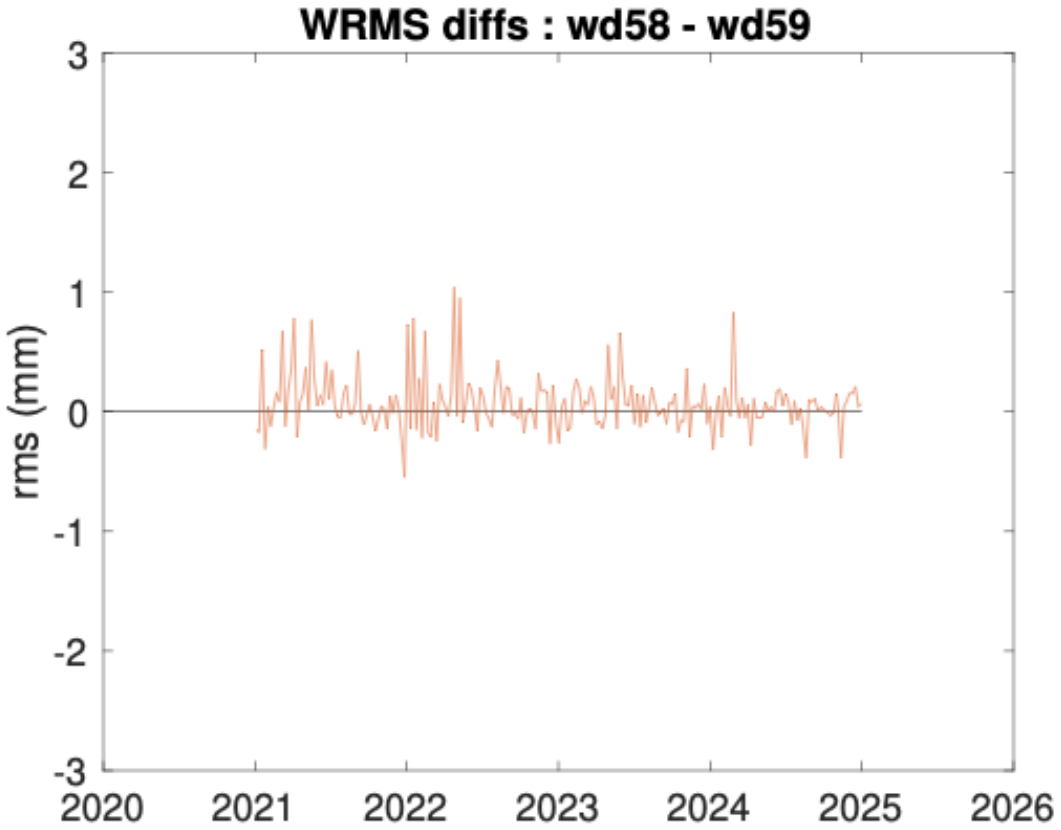
Helmert Parameters (wd58 vs. wd59)



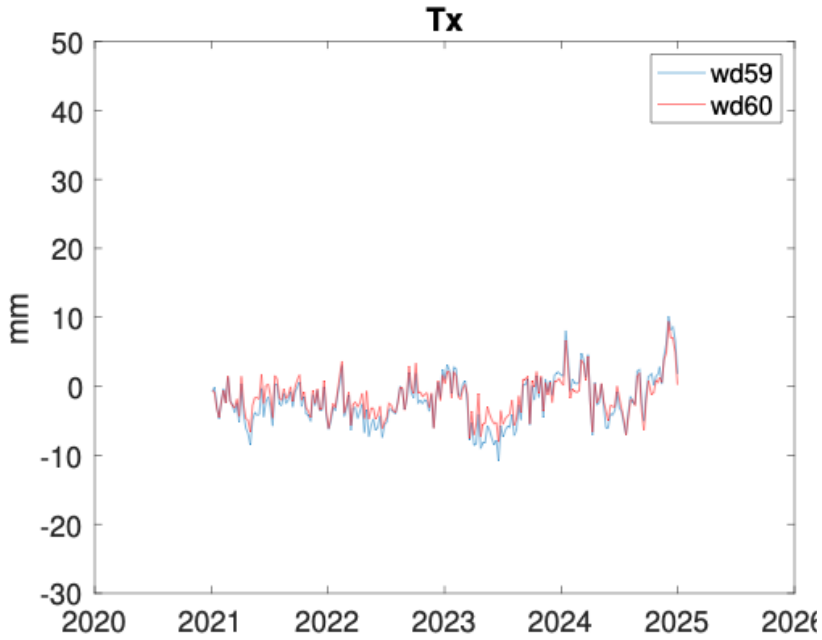


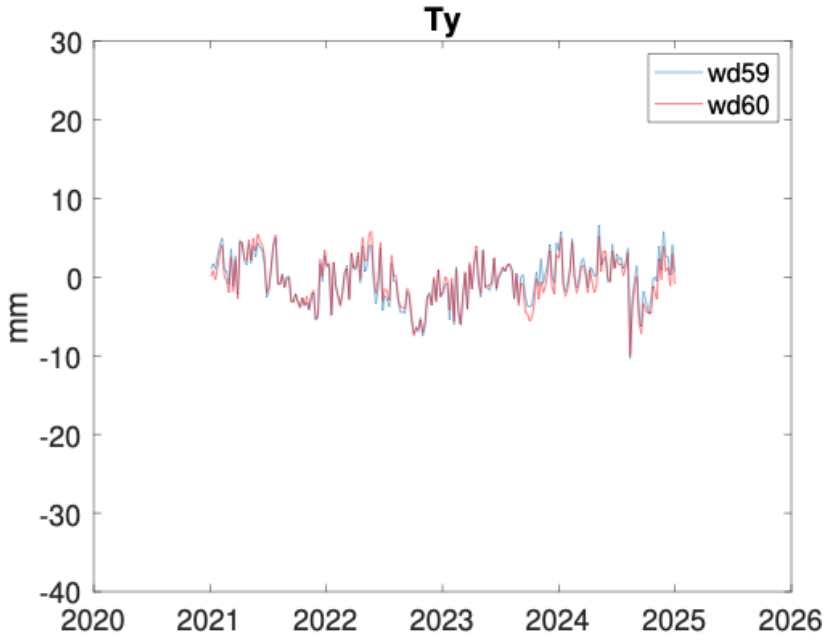
WRMS comparison (wd58 vs. wd59)
(*wrt. dpod2020_015*)

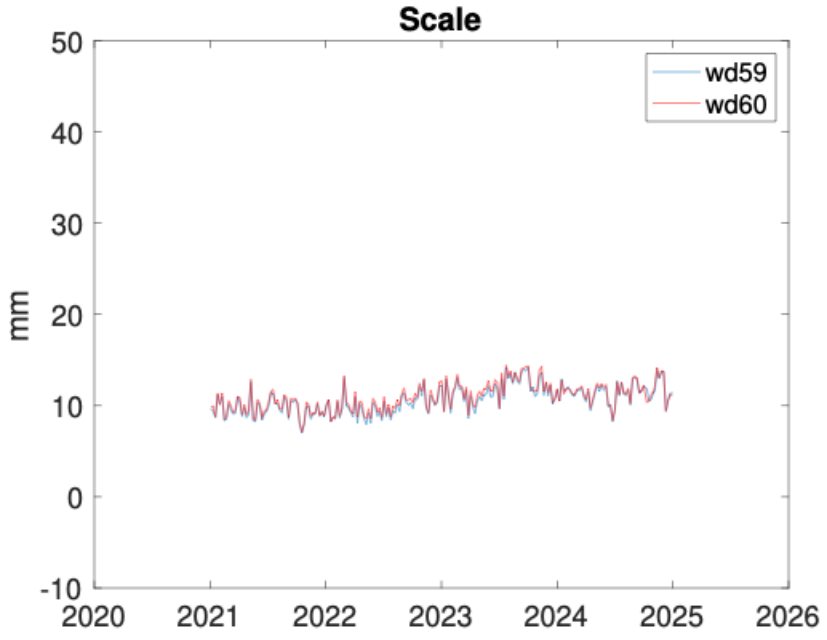




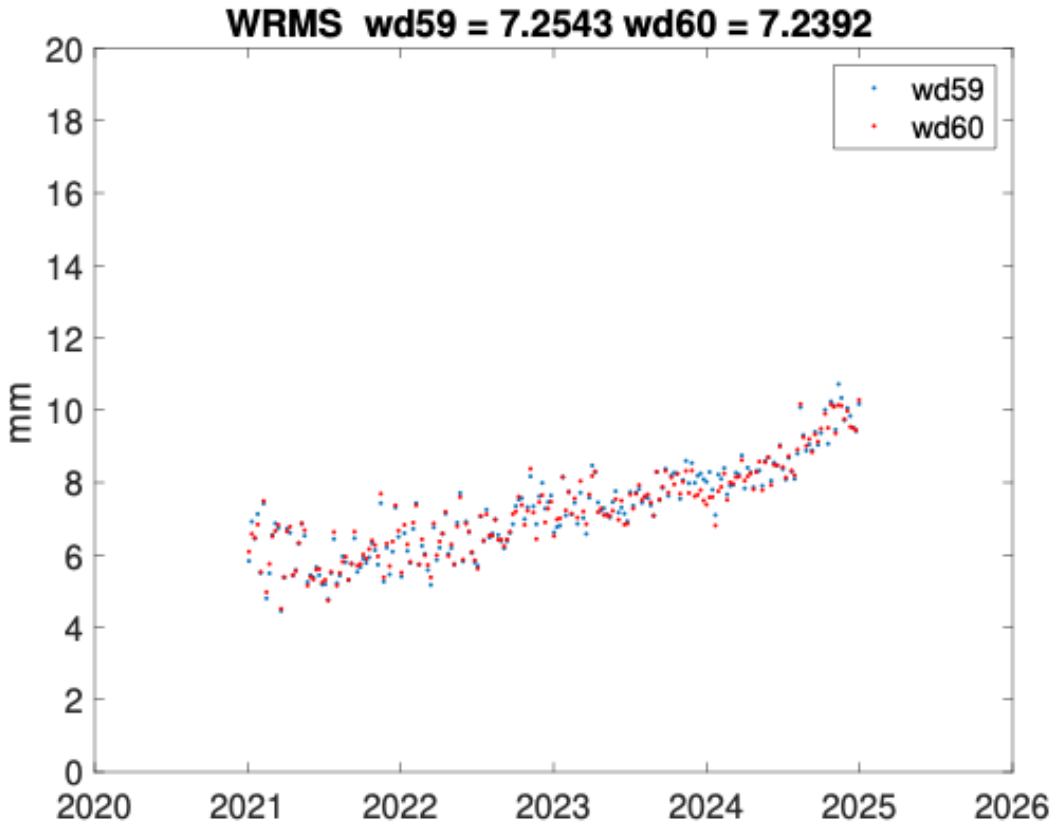
Helmert Parameters (wd59 vs. wd60)

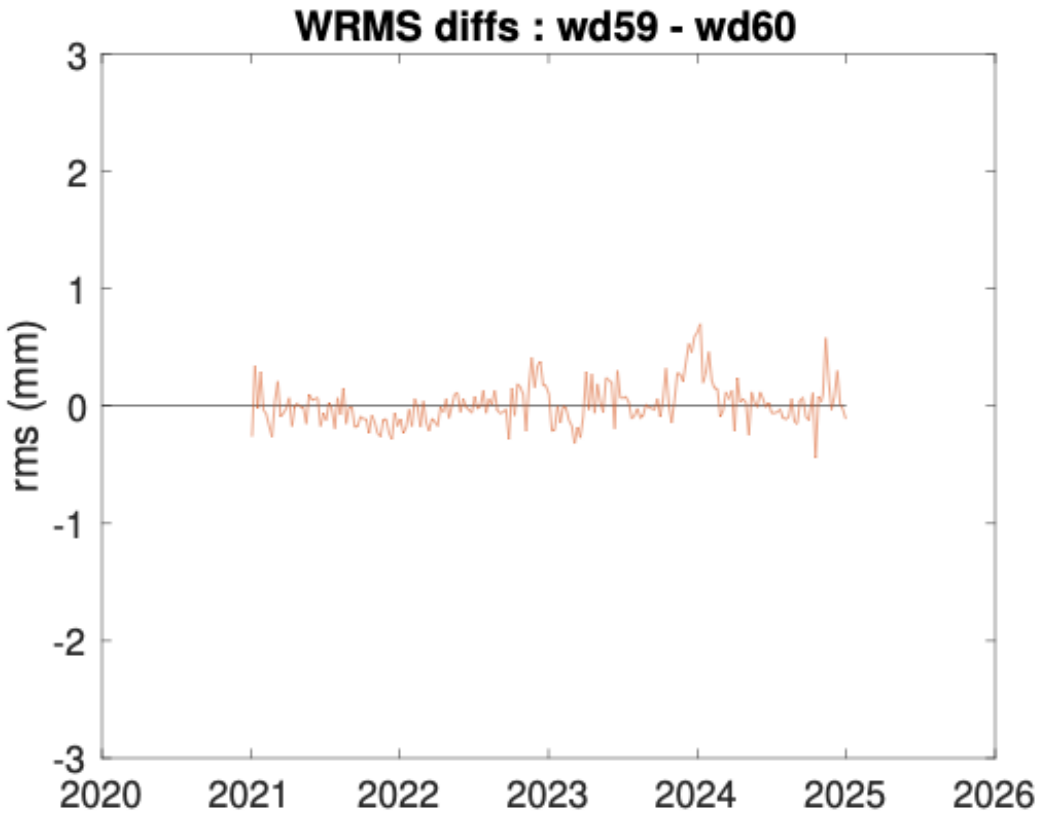






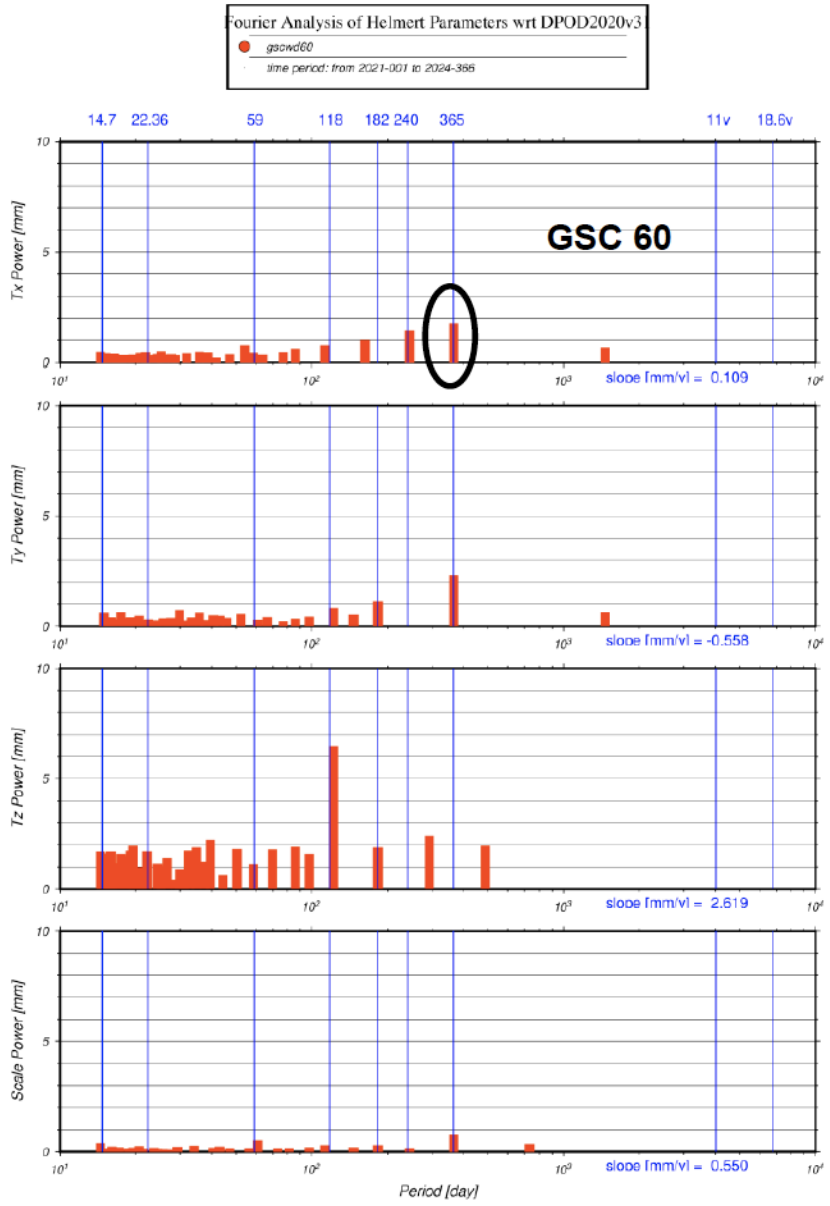
WRMS comparison (wd59 vs. wd60)
(*wrt. dpod2020_015*)

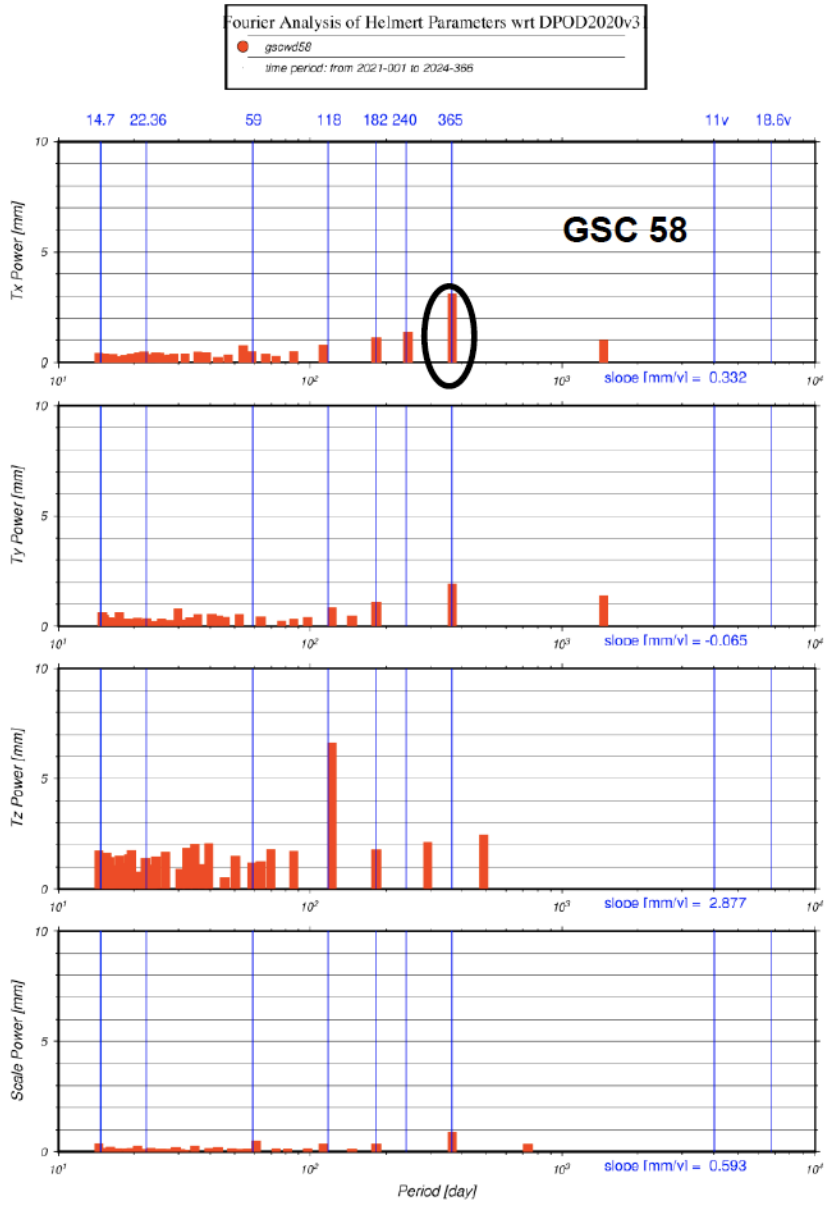




FFT Analysis Helmert Parameters (wd58 vs. wd60)

(provided by IDS CC, G. Moreaux)





Conclusions

- We have re-processed the DORIS data from 2021.0-2025.0 in support of the latest update of the ITRF2020. We adopted a new background gravity model (COSTG_FSM) + applying low-degree terms applied from SLR. The advantage is that we can use geopotential models that are ”relatively recent”. (Latency for COSTG_FSM model is quarterly; Latency for the SLR solutions is of order one month).
- The change in processing and background models, did not significantly change the performance of the series in terms of station repeatability or of EOP. We must look elsewhere for further improvements (e.g. new satellites, clock modelling, mode of troposphere estimation).