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CENTRO NACIONAL DE INFORMACIÓN GEOGRÁFICA

YEBL QC 2025 and1064 vs 532 nm

José C. Rodríguez

IGN-Yebes AAC

24th November 2025

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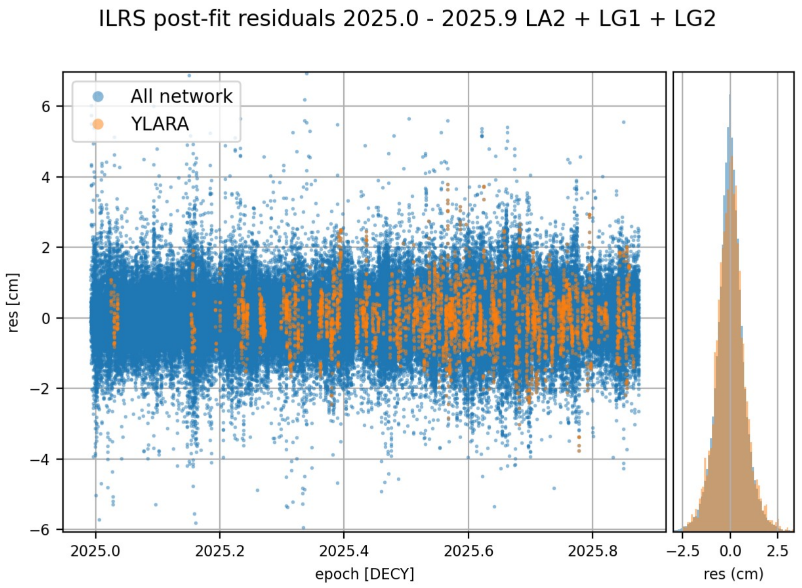
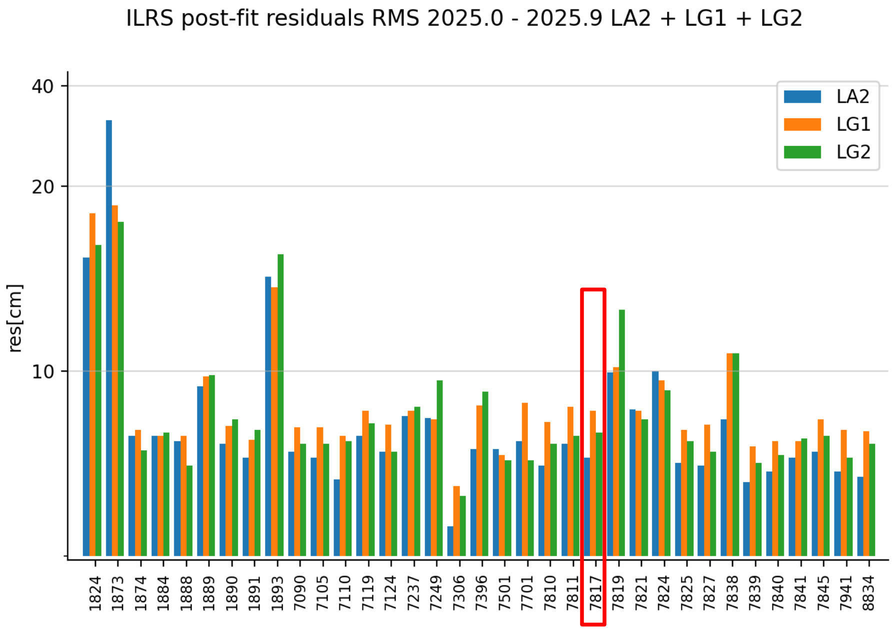
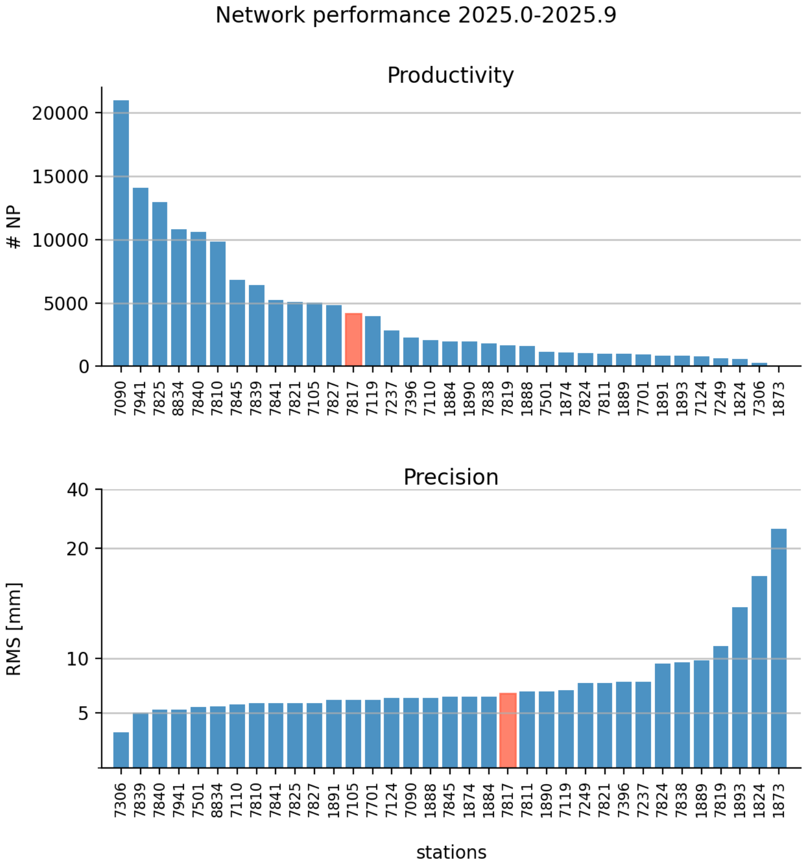
Network residuals

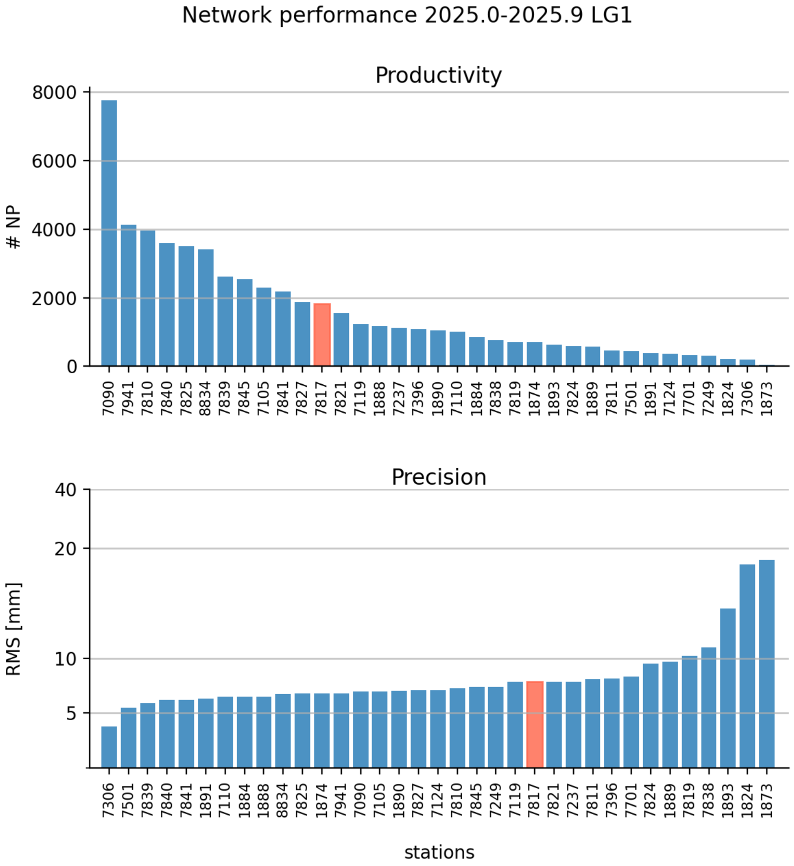




- Analysis of observations to main satellites used for ITRF determination by ILRS (LG1, LG2, LA2).
- YEBL 13/35 most productive station since 2025/01/01.
- Sub-cm precision (overall RMS 6.8 mm).
- Station included in 37/46 weekly solutions (data gap in early 2025 due to weather and engineering issue).

Network performance





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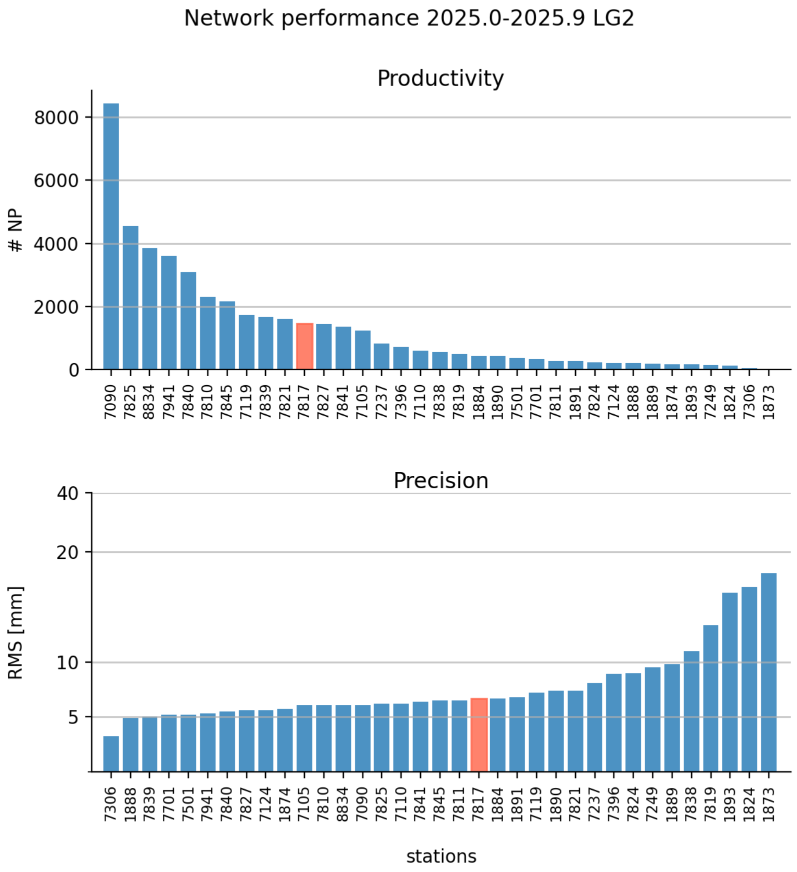
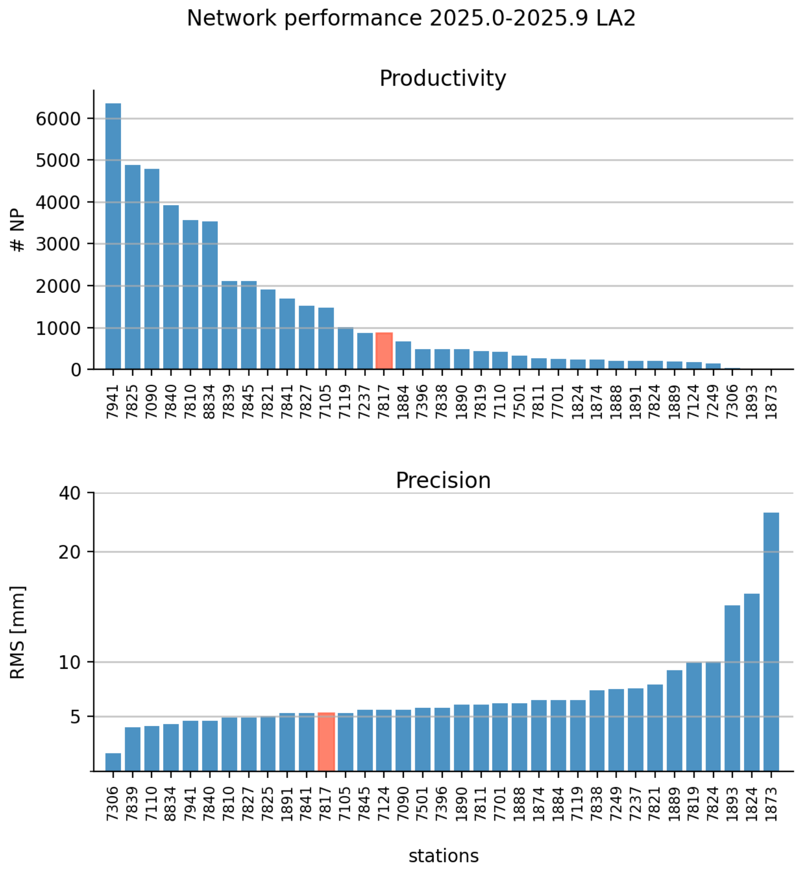
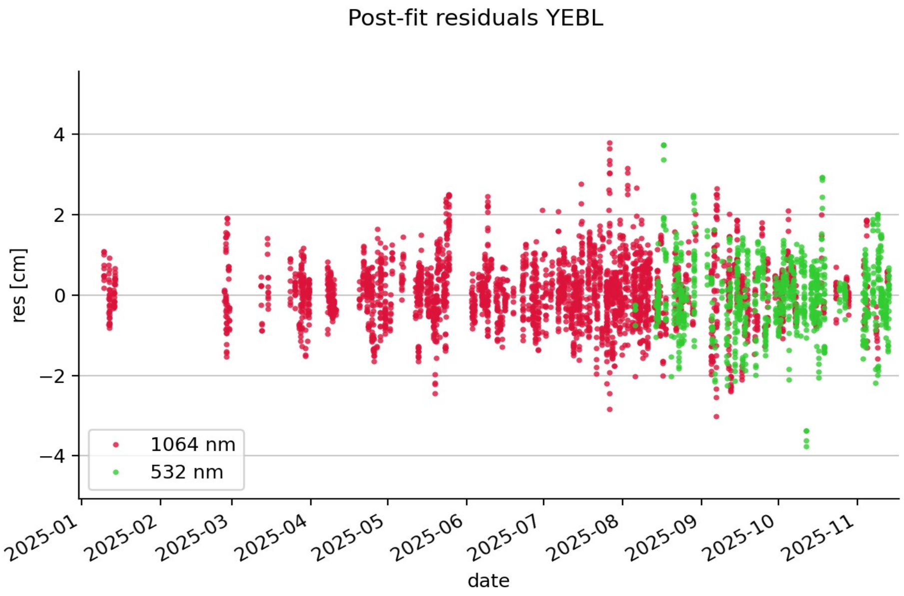
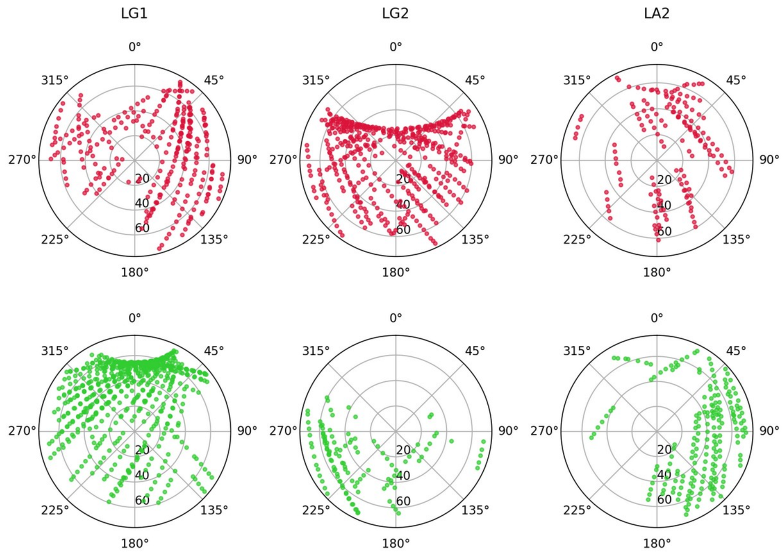




Green vs infrared observations

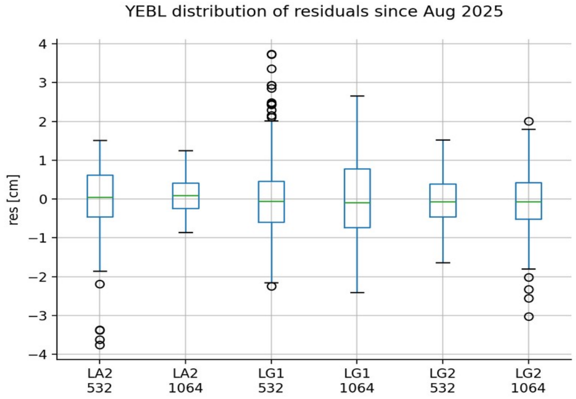


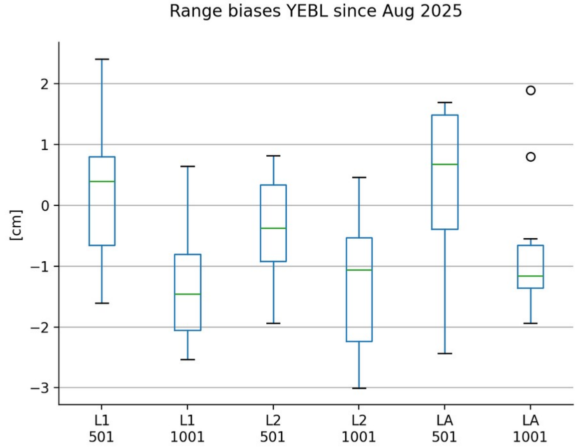


- Observations to geodetic satellites in green (532 nm) since August 2025, in addition to infrared (1064 nm).
- Uneven sky coverage for some combinations of satellite and wavelength (short time span).
- Good post-fit residuals, perfectly comparable with infrared data.

Green vs infrared observations

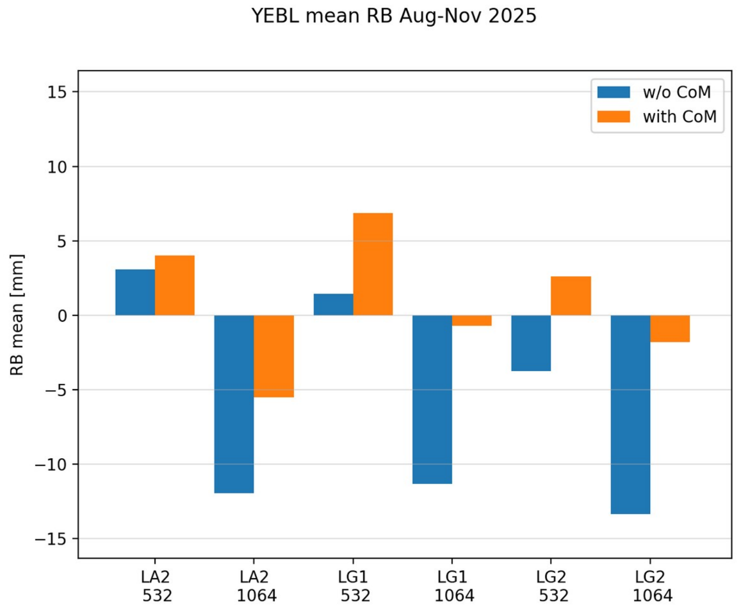
- Sufficient observations to draw reliable conclusions.
- Very **good post-fit residual** RMS at both colours.
- **No difference** between 1064 nm and 532 nm data in the distribution of residuals.
- Significant **range bias difference** between the two colours.
  - **Irrelevant** for the estimation of coordinates as long as range biases are included (the usual procedure).
  - Mostly related to the modelling of **centre of mass corrections** (next slide).





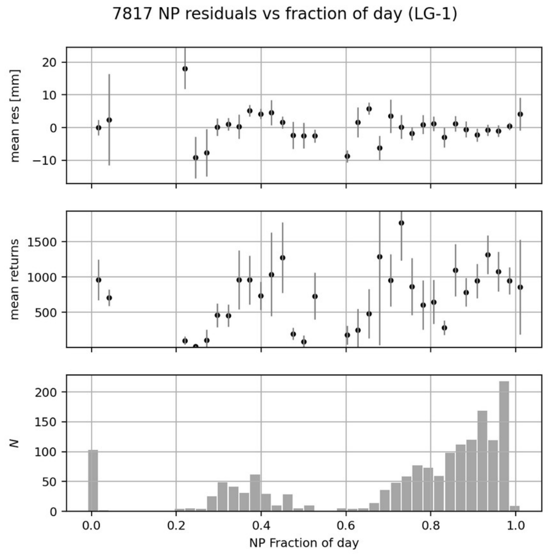
Preliminary centre of mass corrections

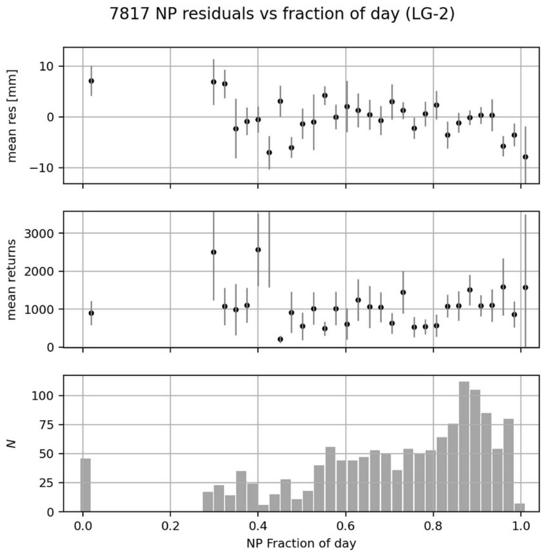
- CoM corrections computed from calibration data from the station.
- The calibration distributions are different in green and IR, as expected (different detectors).
- Calibrations convolved with the response function of the satellites → expected satellite distributions.
- The expected distributions are reduced like real data:
  - Leading edge filter for LG1, LG2, LA2 and Ajisai.
  - 2.2σ iterative rejection for the rest.
- **The mean range biases improve, overall**. In particular, the results for the primary wavelength (IR) are much closer to zero.
- TODO: CoM computation for 7701 Izaña and 7306 Tsukuba, very similar systems.

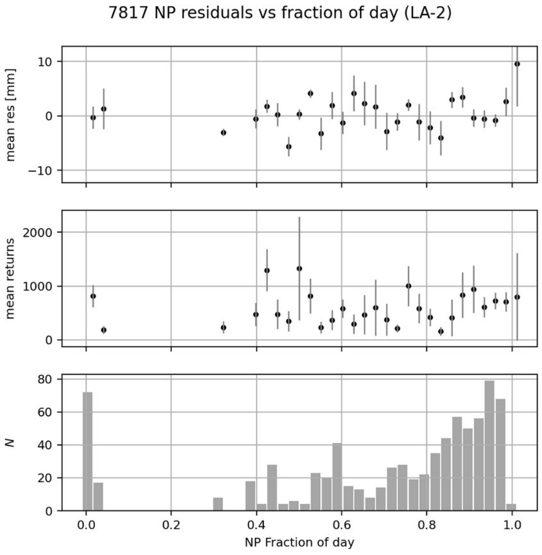


Analysis of aggregated residuals

Fraction of day



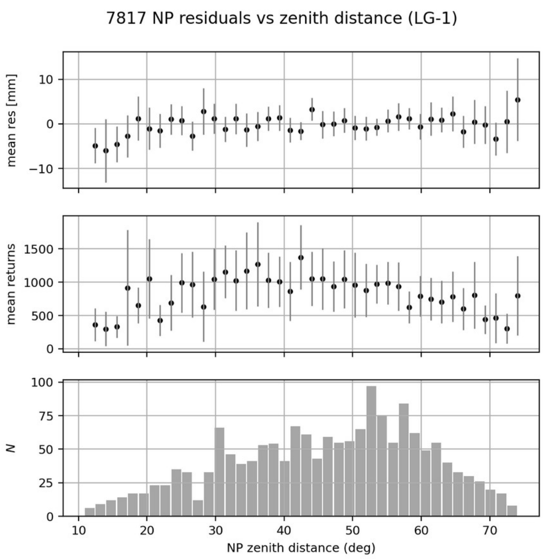


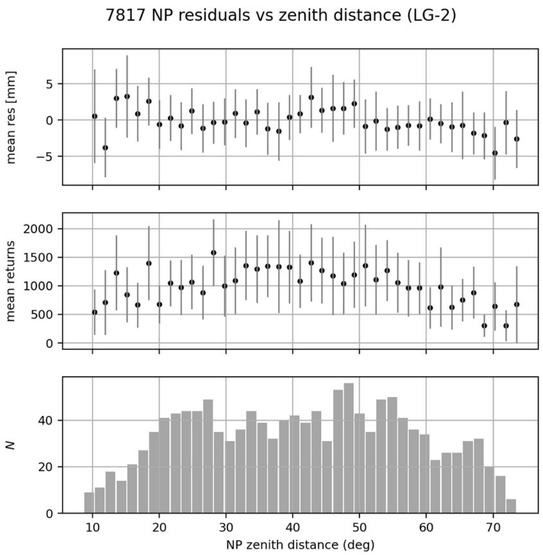


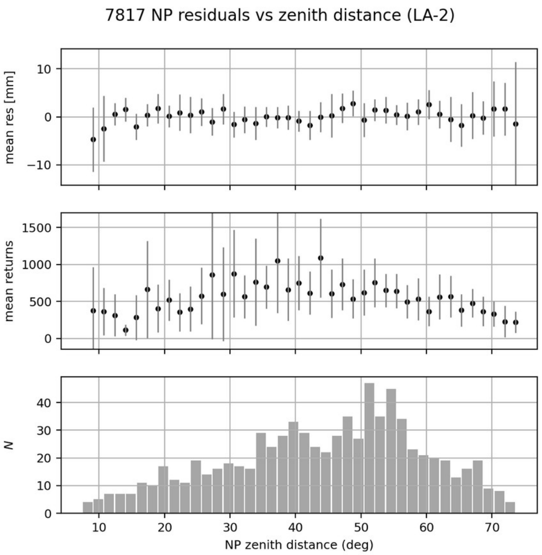
- Residuals aggregated **according to the variable at the bottom** in each plot (time of the day and zenith distance).
- The plots show the mean residual value (mm), the mean number of returns, and the bin count.
- The residual trends should be **as flat as possible**, with no dependencies on the time of the observations (day vs night effects) nor satellite elevation (e.g. weak vs strong signals, noise issues, etc).
- **No problems present**. Consistent performance: good observance of single-photon operations.

Analysis of aggregated residuals

Zenith distance







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Annex: numerical stats

- Post-fit residual and range bias statistics since August 2025 (cm). RB are weekly estimates (count are weeks).

Post-fit residuals statistics [cm]

sat	wl	count	median	mean	std
la2	532	201	-0.06	-4.706e-02	0.809
	1064	173	0.15	1.550e-01	0.452
lg1	532	691	-0.05	-3.391e-02	0.920
	1064	298	0.02	8.396e-02	0.946
lg2	532	124	-0.12	-4.879e-02	0.658
	1064	474	-0.02	1.055e-04	0.655

(per NP)

Weekly biases per wavelength [cm]

sat	wavelength	count	median	mean
L1	532	13	0.949	0.687
	1064	13	-0.389	-0.211
L2	532	8	0.159	0.263
	1064	13	0.062	-0.090
LA	532	7	0.793	0.400
	1064	10	-0.548	-0.026

(per weekly arc)

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Analysis of the apparently anomalous estimation of YARL height

IGN-Yebes AAC

Red de Infraestructuras Geodésicas

Geodetic Infrastructure Networks

10th October 2025

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA
INSTITUTO GEOGRÁFICO NACIONAL

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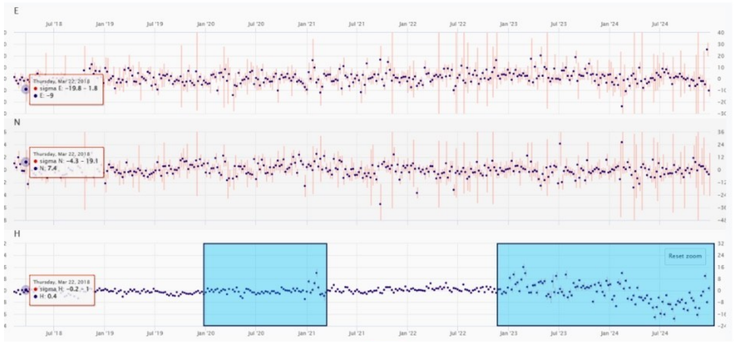
The issue

- The behaviour of the position estimates for YARL computed by the ASC were brought to the attention of the ILRS QCB by Peter Dunn.
- These positions show an obvious increase in the dispersion of the height residuals, as shown previously by Van Husson (see fig.)
- It coincides with the insertion in the data handling file (DHF) of the instruction to estimate range biases for YARL, beginning 2022:324 (20/11/2022).

7090 YARL ITRF2020_U2024 Weekly Residuals (Zoom)



DHF sorted by satellite, time

*	CODE	PT	START_DATE__	END_DATE___	M	__E-VALUE__	STD_DEV	UNIT	CMNTS
	7090	51	10:059:00000	14:208:00000					
	7090	51	14:208:00000	19:363:00000	R	2.0	0.2	mm	
	7090	51	19:356:00000	21:066:00000	E			mm	
	7090	51	21:066:00000	22:324:00000	R	2.6	0.3	mm	
	7090	51	22:324:00000	00:000:00000	E			mm	
	7090	52	10:059:00000	14:208:00000					
	7090	52	14:208:00000	19:363:00000	R	2.2	0.2	mm	
	7090	52	19:356:00000	21:066:00000	E			mm	
	7090	52	21:066:00000	22:324:00000	R	3.2	0.3	mm	
	7090	52	22:324:00000	00:000:00000	E			mm	
	7090	67	22:212:00000	00:000:00000	R	3.6	0.3	mm	
	7090	53	03:201:00000	14:208:00000	R	-7.8	0.3	mm	
	7090	53	14:208:00000	00:000:00000					
	7090	54	03:201:00000	14:208:00000	R	-7.8	0.3	mm	
	7090	54	14:208:00000	00:000:00000					

DHF Legend	
PT: Satellite ID	M: DHF Code
51: LAGEOS-1	R: Applied Fixed RB
52: LAGEOS-2	E: Estimate RB
67: LARES-2	Assume No RB (note: not in DHF)
53: Etalon-1	
54: Etalon-2	

❑ **Station height residuals highlighted in blue is where the LAGEOS-1 and LAGEOS-2 range biases were estimated**

The issue

- The strategy of introducing so-called mandatory range bias estimation for this station is questioned, in view of the seemingly degraded position estimates, which are also suspected to be biased.
- Some thoughts come to mind:
  - In an earlier period where ACs are instructed to estimate biases (2019:356–2021:066), the behaviour is different (and acceptable, other than a few outliers).
  - The idea of estimating RB is that the positions are unbiased, whether they are estimated on top of biases applied a priori. The DHF bias model comes from the analysis of the combined RB estimates from individual ACs. If things work normally the coordinates should be the same regardless of when RBs are estimated (albeit with different noise levels).
  - Correlation is not causation—and the correlation is about 50% anyhow, as per the first point.

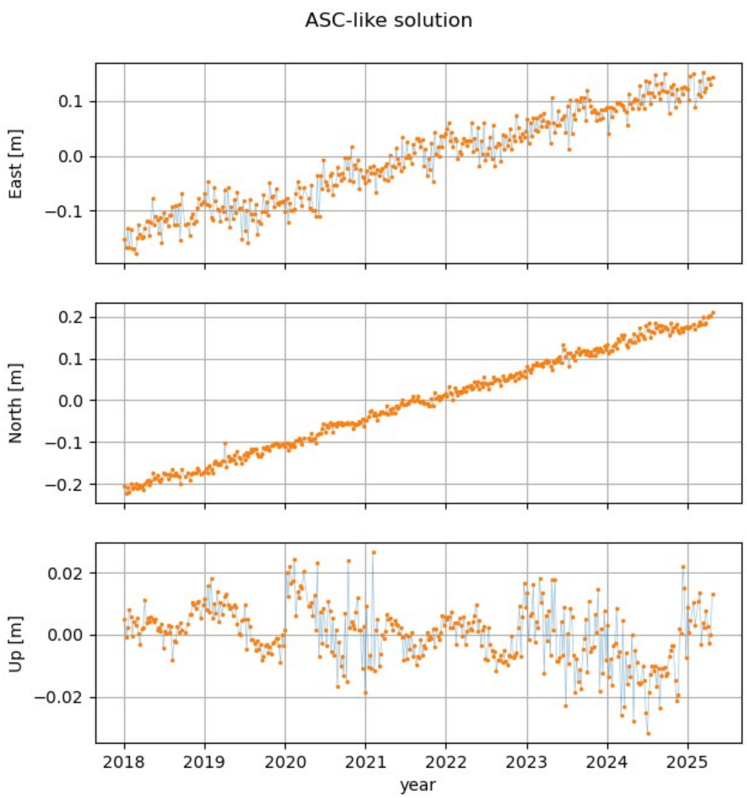
Analysis

- I computed various solutions (2018.0-2025.3) to see if we can understand all this:
  - 0: **ASC**. DHF **bias model** applied and **mandatory RB** instructions followed.
  - 1: **No bias model** and **no RB** estimation for 7090. Everything else the same.
  - 2: Same as above, but adding the Etalon satellites.
  - 3: **No bias model**, **RB** estimated for all stations. 7-day arcs.
  - 4: **No bias model**, **RB** estimated for all stations. 14-day arcs.
  - 5: **Extended bias model** for 7090 at all epochs, **no RB** estimated.

- First of all, adding the Etalon satellites (solution 2) had no effect whatsoever, so I won't discuss it.
- The a priori frame is ITRF2020 (2023.03.28). Not that it matters.
- ENU components are computed relative to the median coordinates in the period of analysis.
- All data were filtered with robust outlier detection techniques for plotting and computing trends.

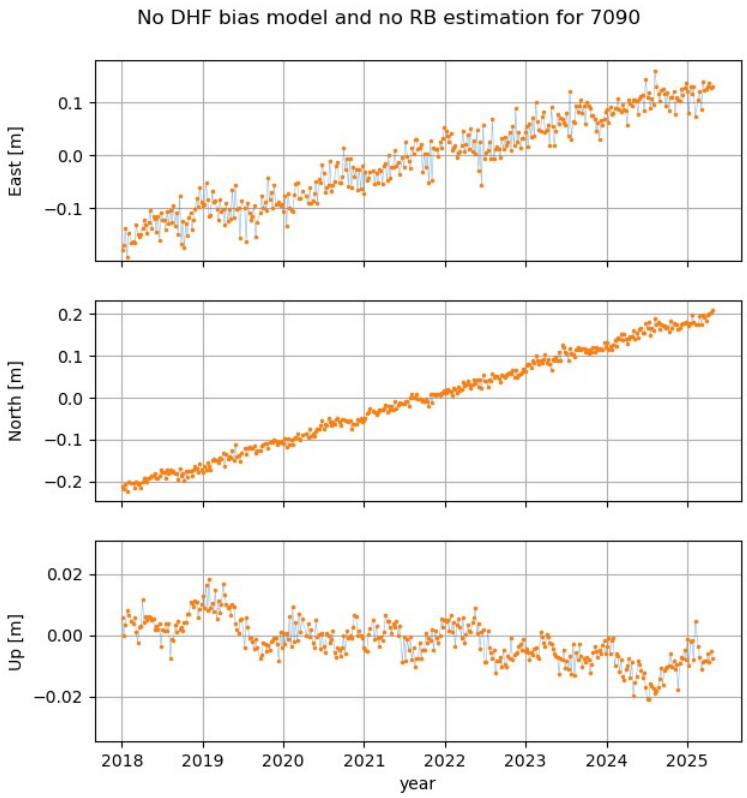
ASC-like solution

- The solution following the ASC strategy shows the noted behaviour in the UP component since the end of 2022.
- Also, in this individual solution there is a **discontinuity** at the beginning of 2020, when the mandatory RB starts. This is not seen in the combined product, apparently.



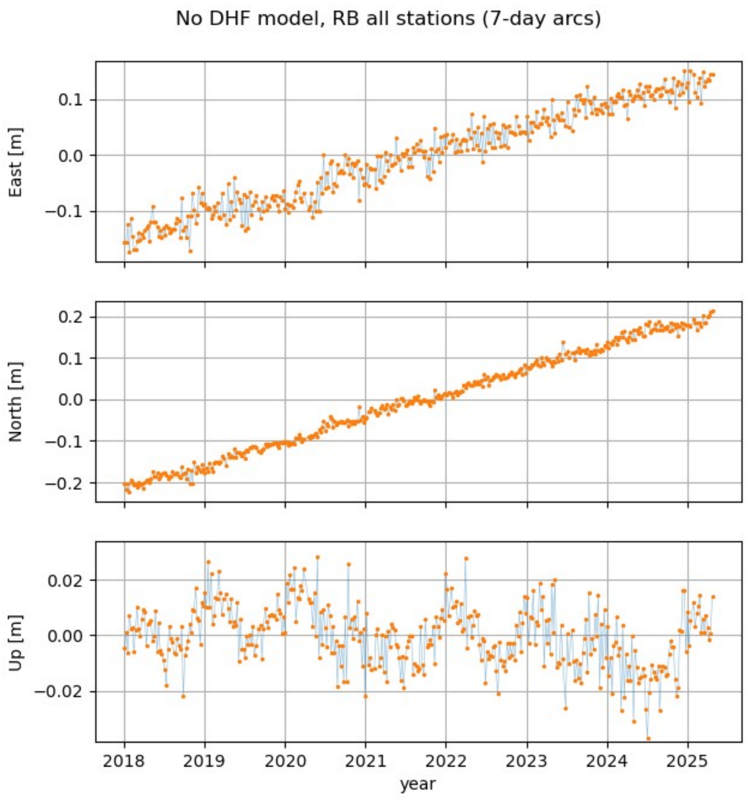
No DHF bias model, no RB for YARL

- The solution obtained disregarding the DHF for YARL, and not estimating RB, **does not show** the previous features.
- Although this particular solution is biased, it is useful to see the behaviour of the estimated positions when constant biases are applied a priori (in this case zero).
- The **negative trend** of the time series of the UP component is visibly **more pronounced** than in the standard ASC solution.



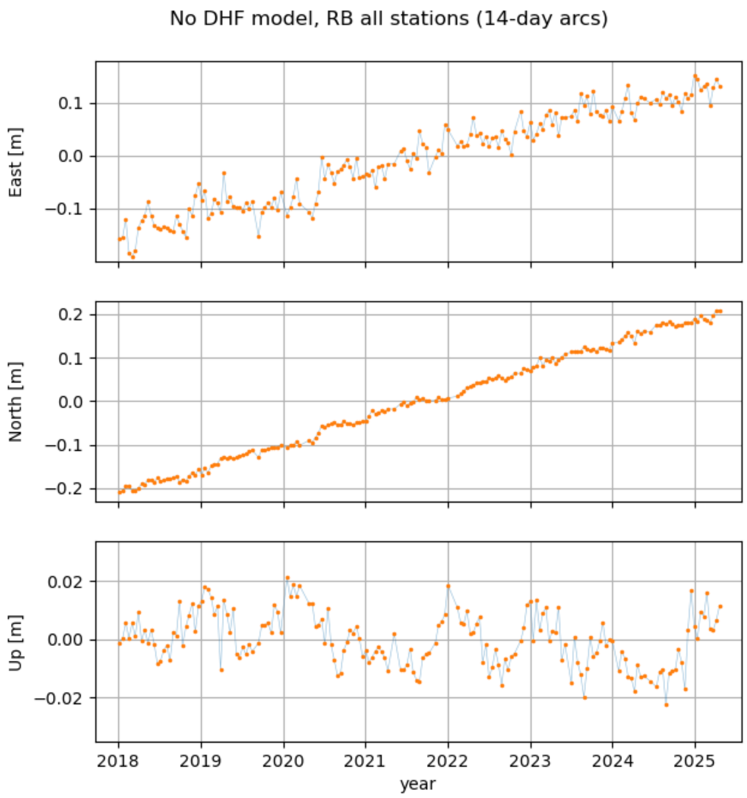
No DHF bias model, RB for all

- Disregarding the DHF and estimating RB for all stations, we obtain solutions **independent** of possible issues with the bias model.
- We also **avoid discontinuities** between periods when RB are estimated and periods when only the DHF bias model is applied.
- The expected downside is that the position estimates are noisier throughout.
- The negative trend in UP does not appear as pronounced as in the previous solution.



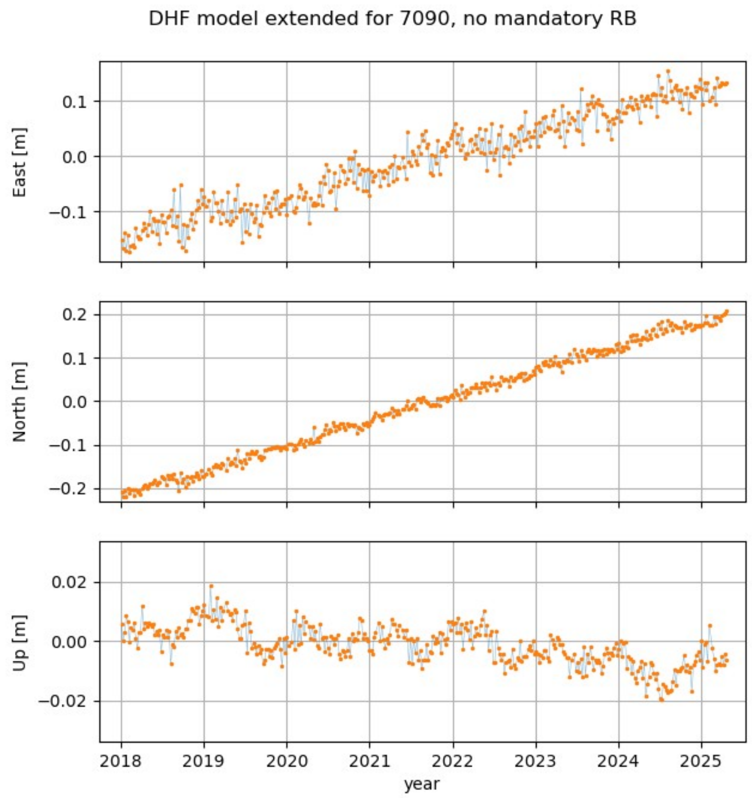
No DHF bias model, RB for all

- Increasing the **arc length to 14 days** results in cleaner estimates of RB and station positions.
- This is useful if noisy estimates were responsible for causing an apparent bias in certain periods.
- The trends and behaviour obtained are the same as those seen in the 7-day solutions.



DHF bias extension for YARL

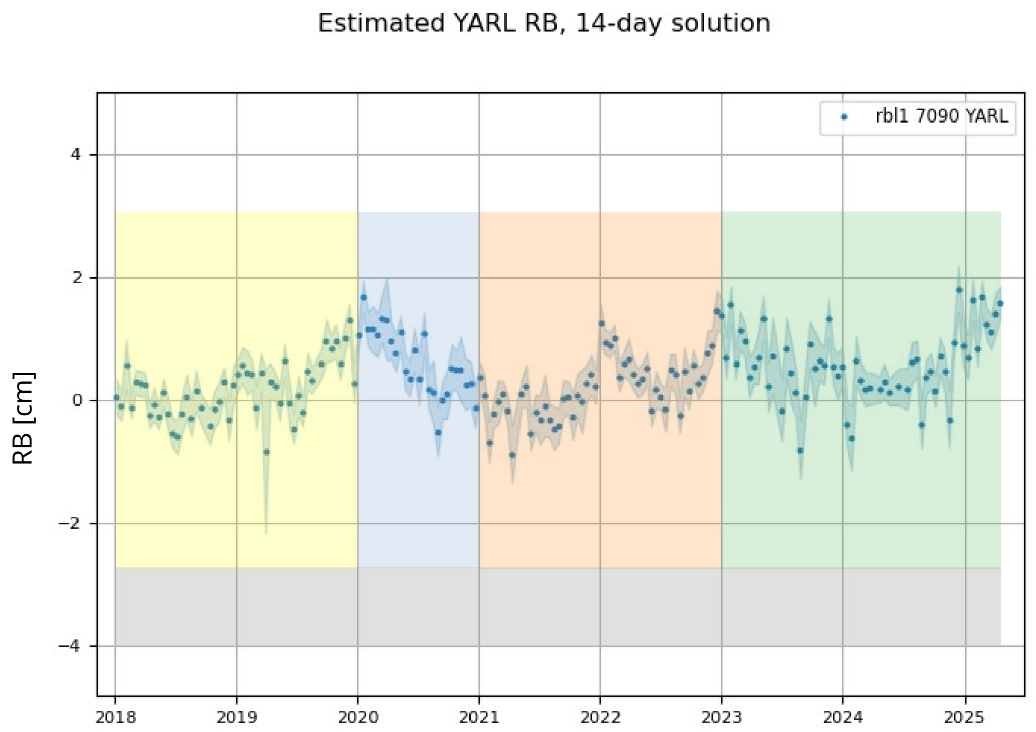
- It was suggested during QCB discussions that the DHF model should be extended and applied as normal, removing the mandatory RB periods.
- A simple extension of the DHF bias model **is not justified**, as it must be assessed on the basis of the combination of RB from individual ACs. Still, it is **useful as a test** to assess how much heights change under a business as usual scenario for YARL.
- The results are very similar to those where no DHF bias model is applied, nor RB estimated: **low noise**, **pronounced negative trend** in the heights.



Time aggregated range biases (as per DHF epochs)

Median RB at different periods

LG1 RB 2018–2020: +1.4 mm
LG2 RB 2018–2020: +3.1 mm
LG1 RB 2020–2021: **+5.3 mm**
LG2 RB 2020–2021: **+7.5 mm**
LG1 RB 2021-2023: +1.7 mm
LG2 RB 2021-2023: +2.3 mm
LG1 RB 2023–2025: **+5.7 mm**
LG2 RB 2023–2025: **+6.3 mm**
LG1 RB 2018–2025: +3.4 mm
LG2 RB 2018–2025: +3.8 mm



DHF: 2.0 / 2.2 mm | | 2.6 / 3.2 mm | (LG1 / LG2)

Station velocities

- The time windows marked in the DHF for mandatory RB estimation have **positive biases at x3** the level of the other periods.
- The average RB in the problematic periods is **6 mm**, reaching well **over 1 cm** at their peak.
- These biases, if not accounted for, are absorbed in the station positions, mainly in height.
- The consequence is that biased station heights would give **biased height trends**.

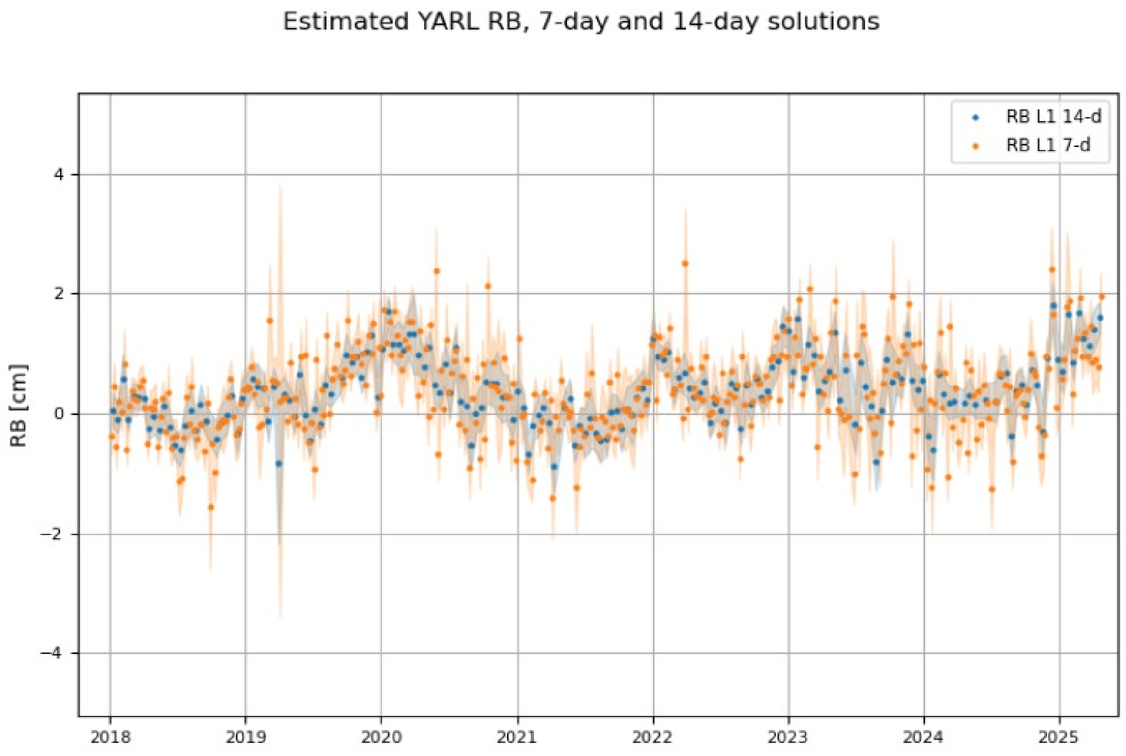
[mm/yr]	**ASC**	**No DHF, no RB**	**No DHF, RB all (7-d)**	**No DHF, RB all (14-d)**	**DHF extended**
Vx	39.2	39.1	39.9	39.9	39.1
Vy	57.3	57.6	57.8	57.8	57.4
Vz	-1.6	**-2.3**	-1.5	-1.3	**-2.1**

Conclusions

- YARL shows significant **positive RB** at several periods of the latest years.
- The ASI CC, **on the basis of the combined RB estimated by all ACs**, correctly identified the problematic periods, stopped the application of the static bias model previously determined for YARL, and flagged the station for RB estimation.
- This approach gives the same height trend as straightforward RB estimation for the whole time series.
- Ignoring these biases and simply extending the DHF results in **spurious negative trends** that are nowhere to be seen in previous long-term heigh estimations.
- The starting date of the first mandatory RB estimation (2020) **probably lags** the onset of the positive RB by 3–6 months, as seen in the RB plots. This causes an obvious discontinuity present in my ASC-like solution. This is not seen in the combined product, perhaps because of the averaging effect of the combination.
- The ASC-like solution **does not look great**. I think that it is just the changes between analysis strategies with different noise levels. There is a case for just estimating RB, maybe with an increased arc length, or applying a RB averaged over a time window (e.g. 2-3 months), instead of switching between bias model and RB estimation.

Fine

7-day vs 14-day RB estimation

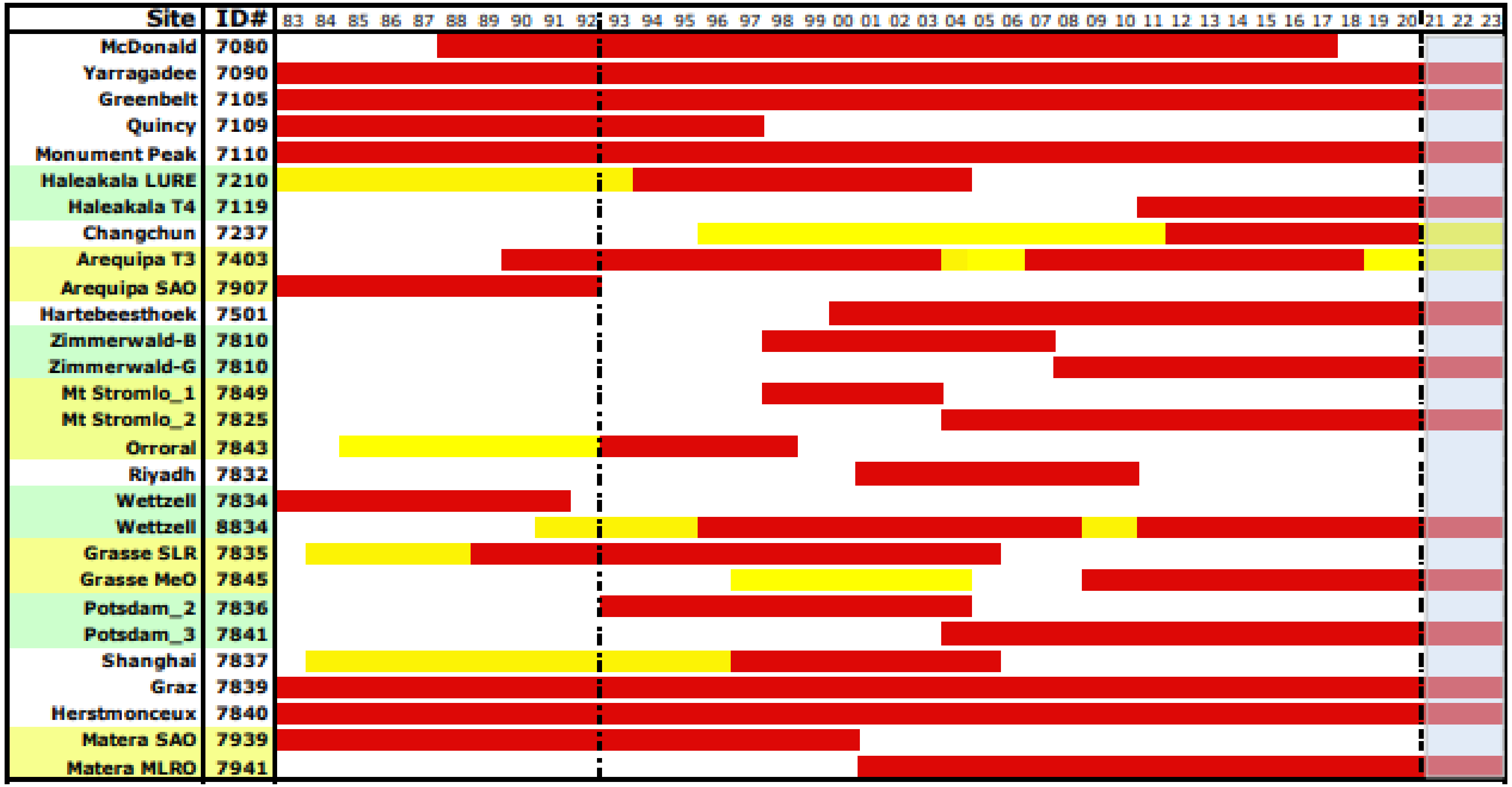


Noisy Core Station Heights in ITRF2020_2024

ILRS QCB

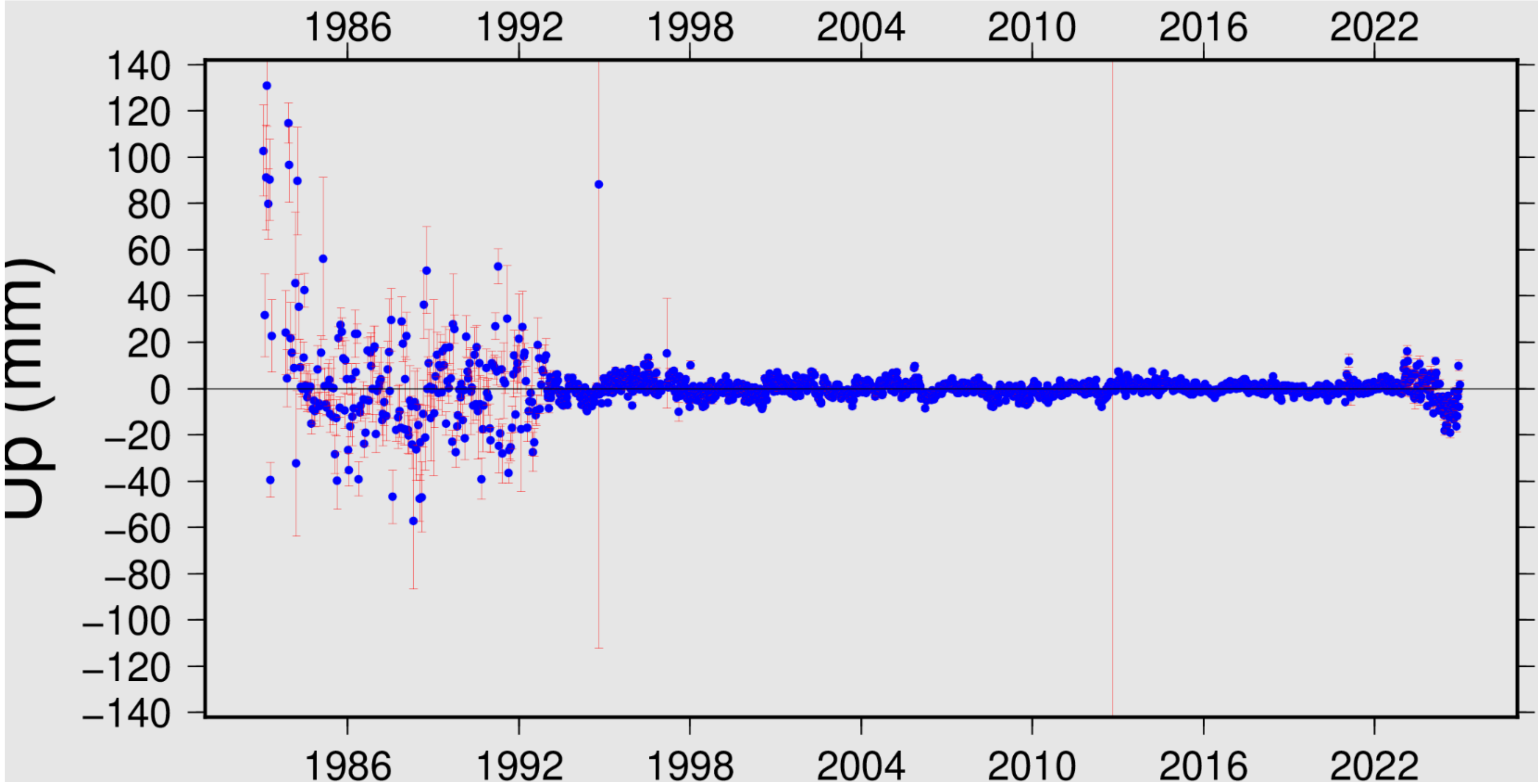
Van Husson

ILRS Core Sites in ITRF2020_2024



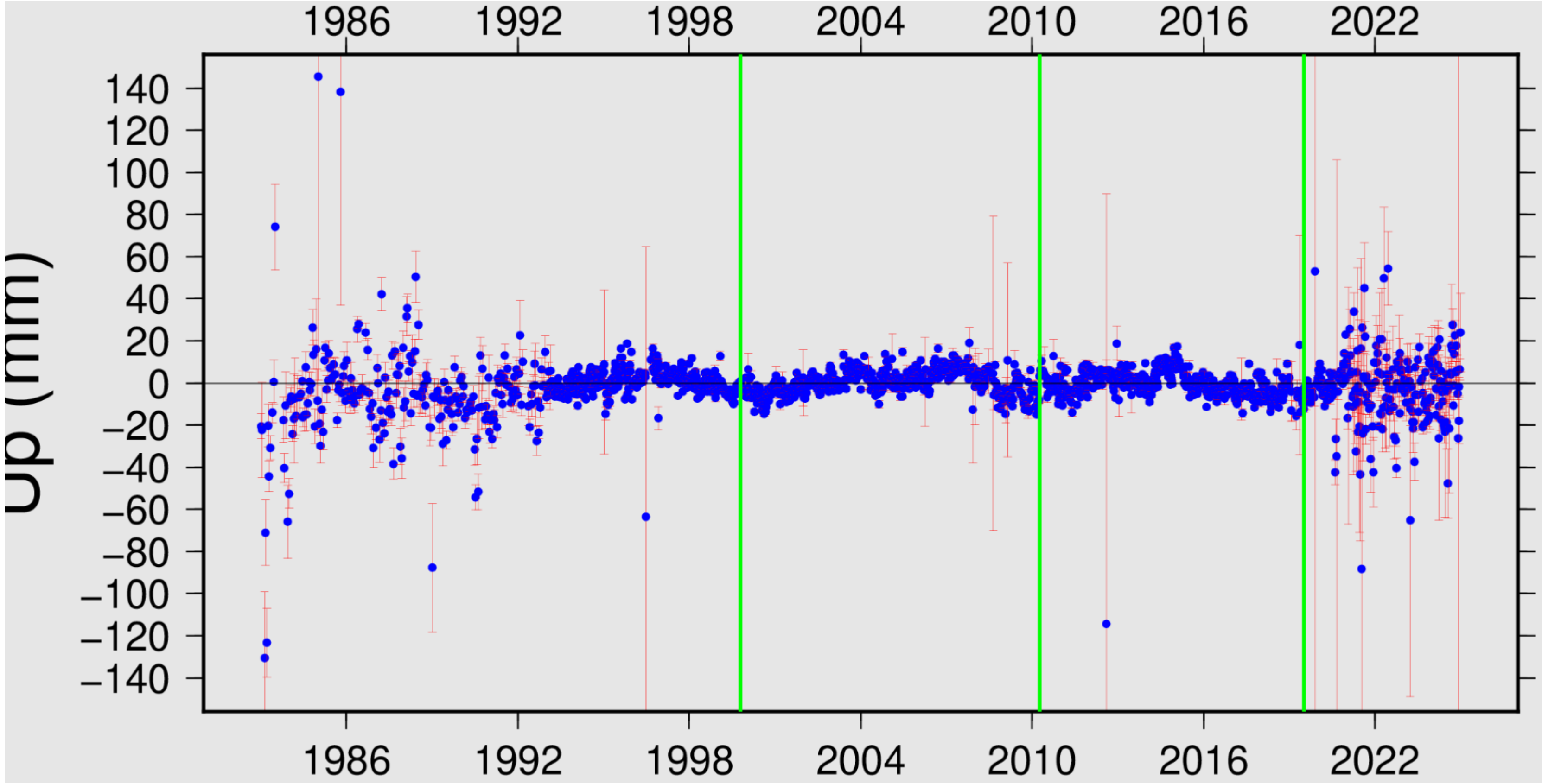
- **Many of these core sites are no longer active (i.e. 7080, 7109, 7210, 7907, 7810-B, 7849, 7843, 7832, 7834, 7835, 7836, 7837, 7939)**
- **Six of the fifteen active core sites are currently assigned LAGEOS Mandatory Bias Estimation (MBE) and two core sites have unknown height discontinuities in ITRF2020**
- **Below are the start dates of LAGEOS MBE:**
  - 7090 Yarragadee: 20-Nov-2022
  - 7110 Monument Peak: 19-Jul-2020
  - 7124 Tahiti: 14-Apr-2018
  - 7237 Changchun: 26-Mar-2023
  - 7501 Hartebeesthoek: 01-Jan-2021
  - 7810 Zimmerwald: 01-Mar-2023

7090 YARL ITRF2020_2024 Up Residuals (Velocity Removed)



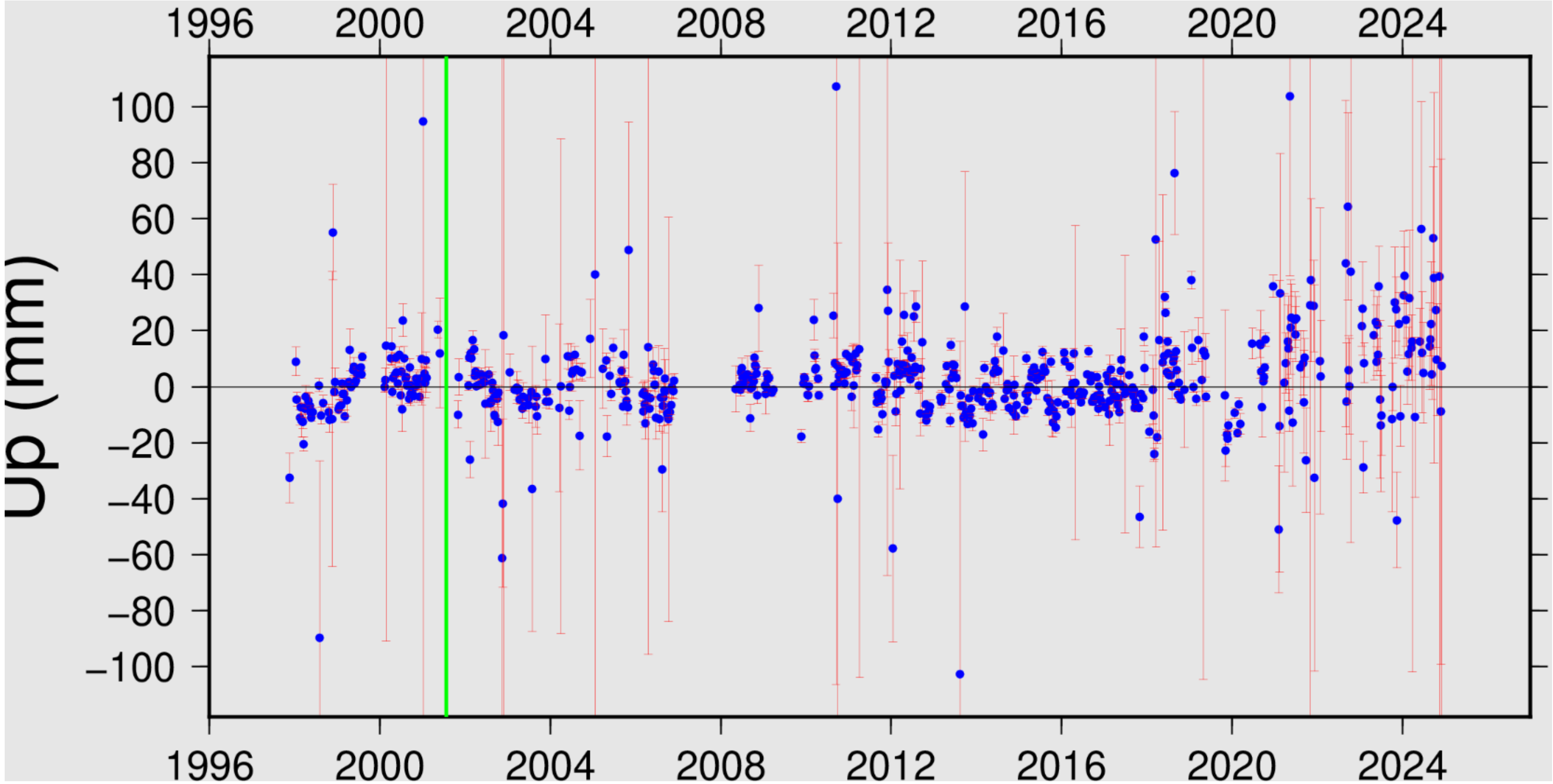
- ❑ **MBE started 20-Nov-2022**
- ❑ **Notice the large dip in UP residuals at the end of the time series**

7110 MONL ITRF2020_2024 Up Residuals (Velocity Removed)



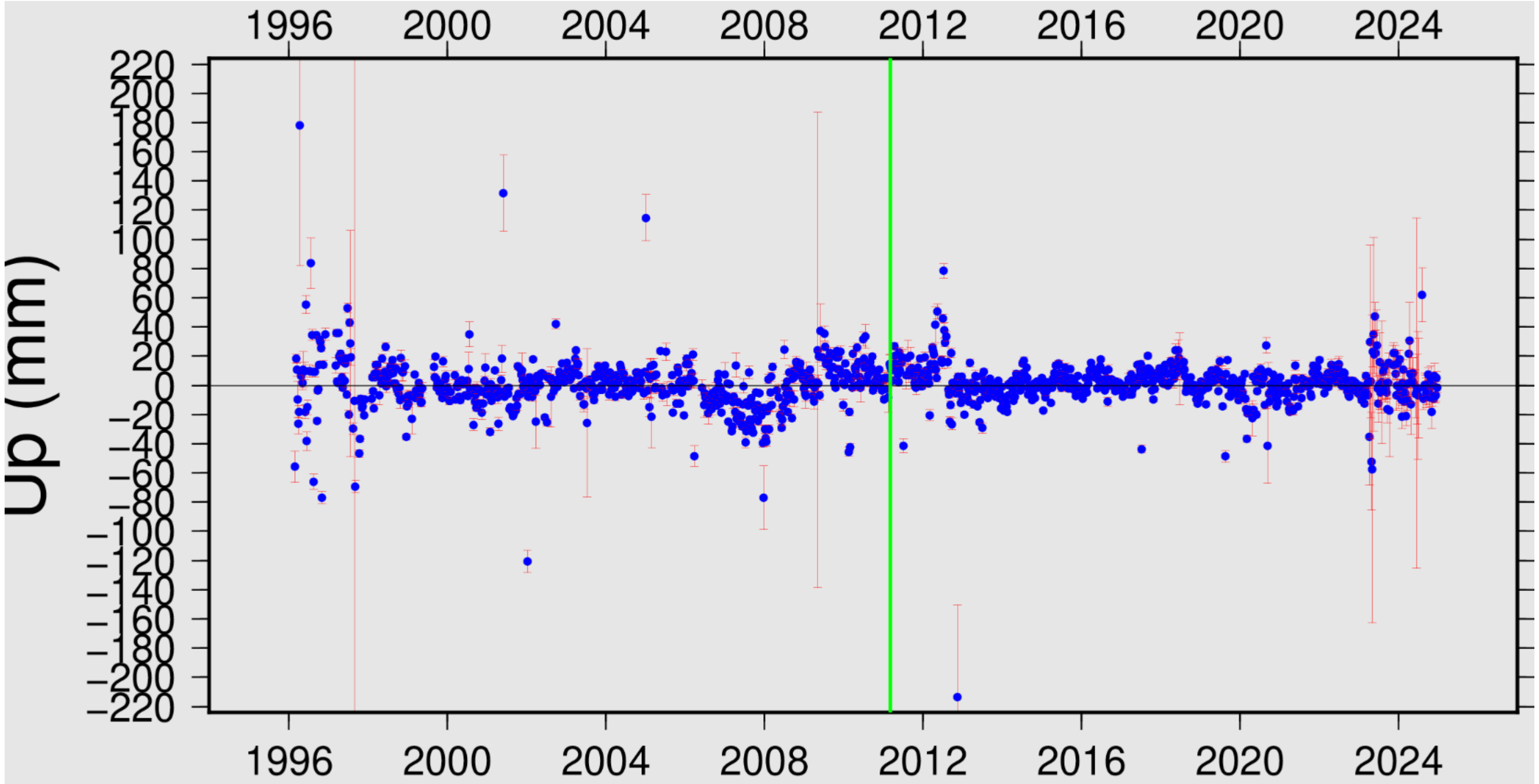
- MBE started 19-Jul-2020
- The green vertical lines are seismic events

7124 THTL ITRF2020_2024 Up Residuals (Velocity Removed)



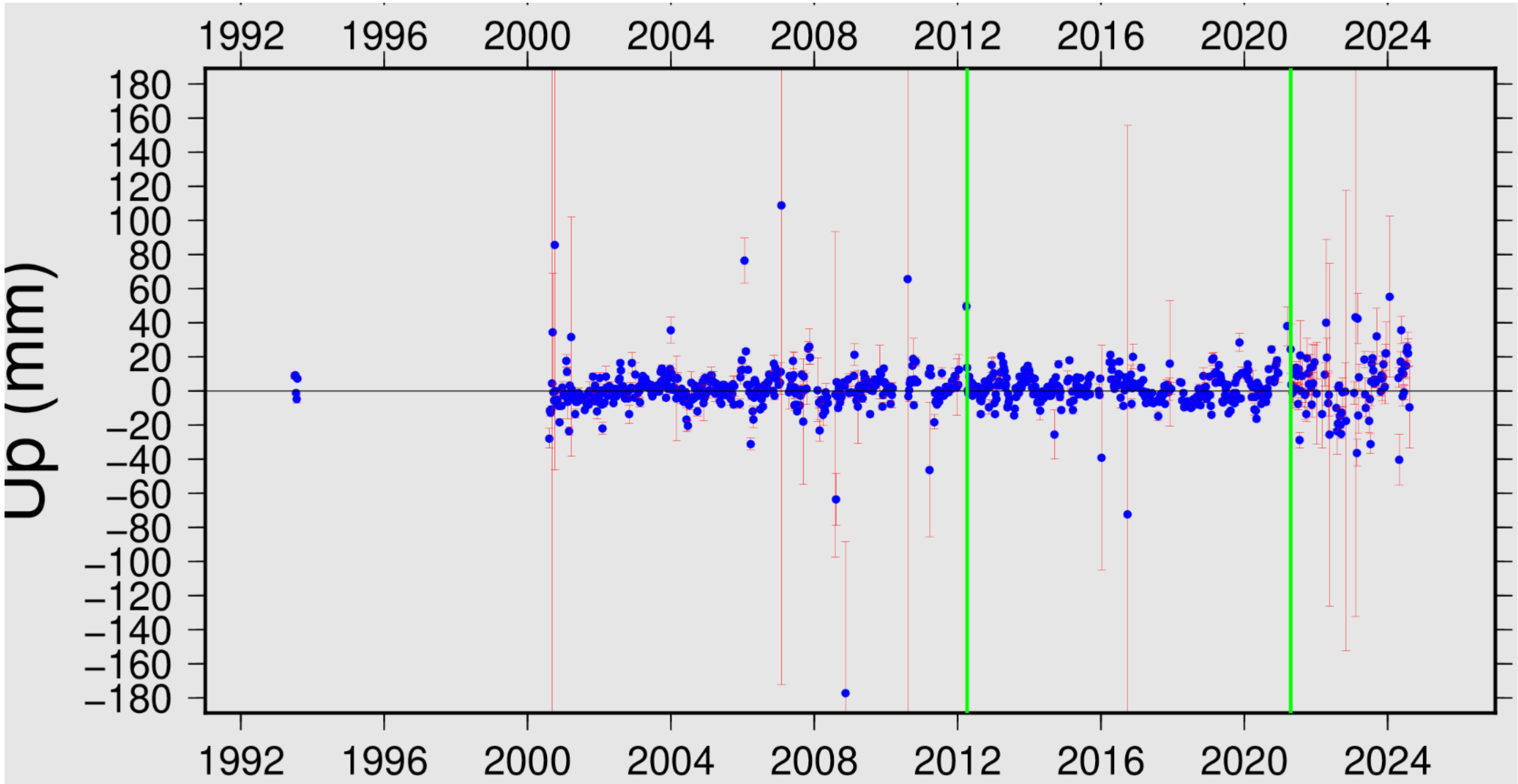
- ❑ **MBE Started 14-Apr-2018**

7237 CHAL ITRF2020_2024 Up Residuals (Velocity Removed)



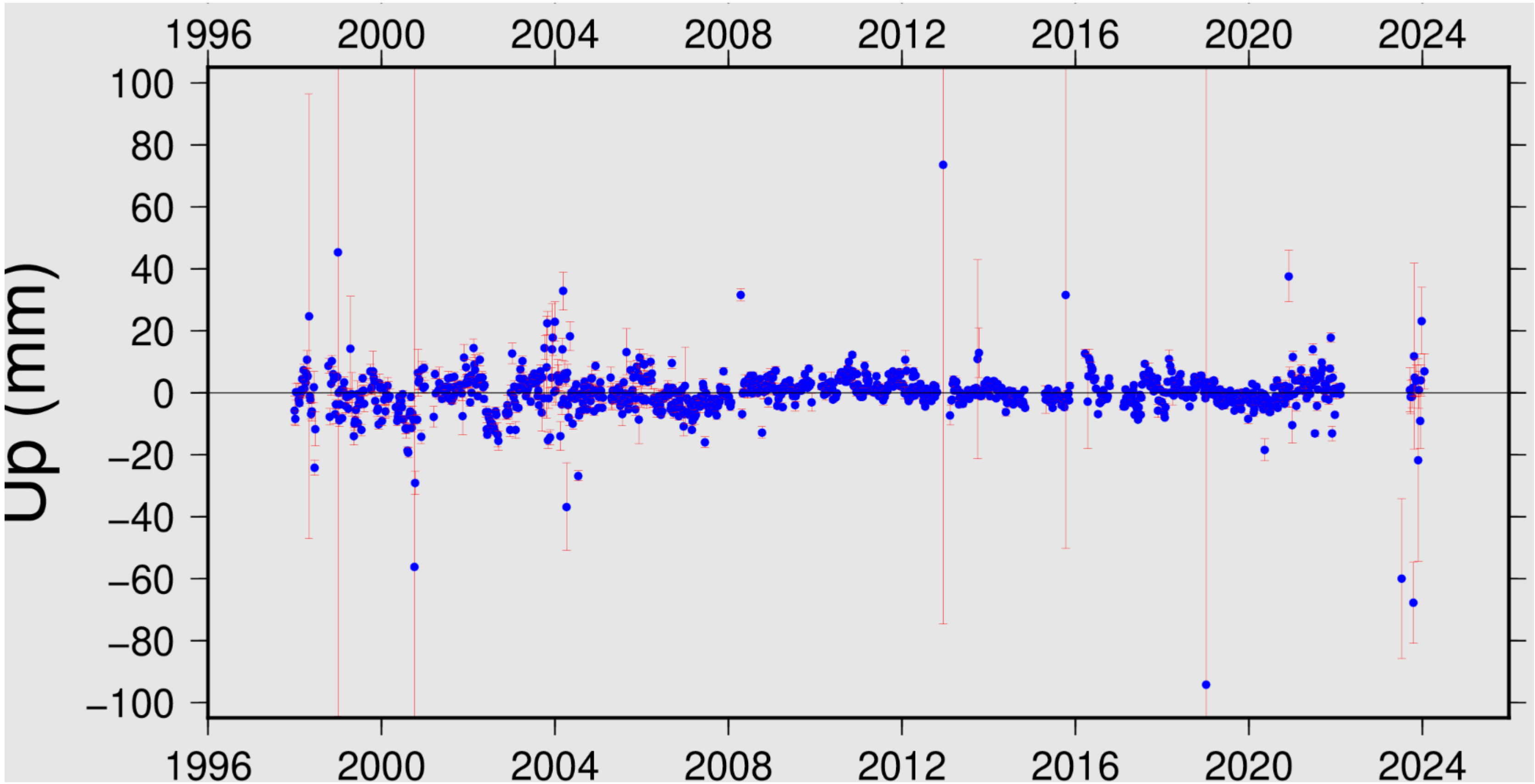
- MBE Started 26-Mar-2023
- Green vertical line was a seismic event
- Also, 7237 implemented a Leading Edge (LE) Filter requiring updates to the Center of Mass corrections. LE implementations were
  - LAGEOS-1/-2 on 19-Dec-2023
  - LARES, LARES-2, Stella, Starlette on 28-Jan-2024

7501 HARL ITRF2020_2024 Up Residuals (Velocity Removed)



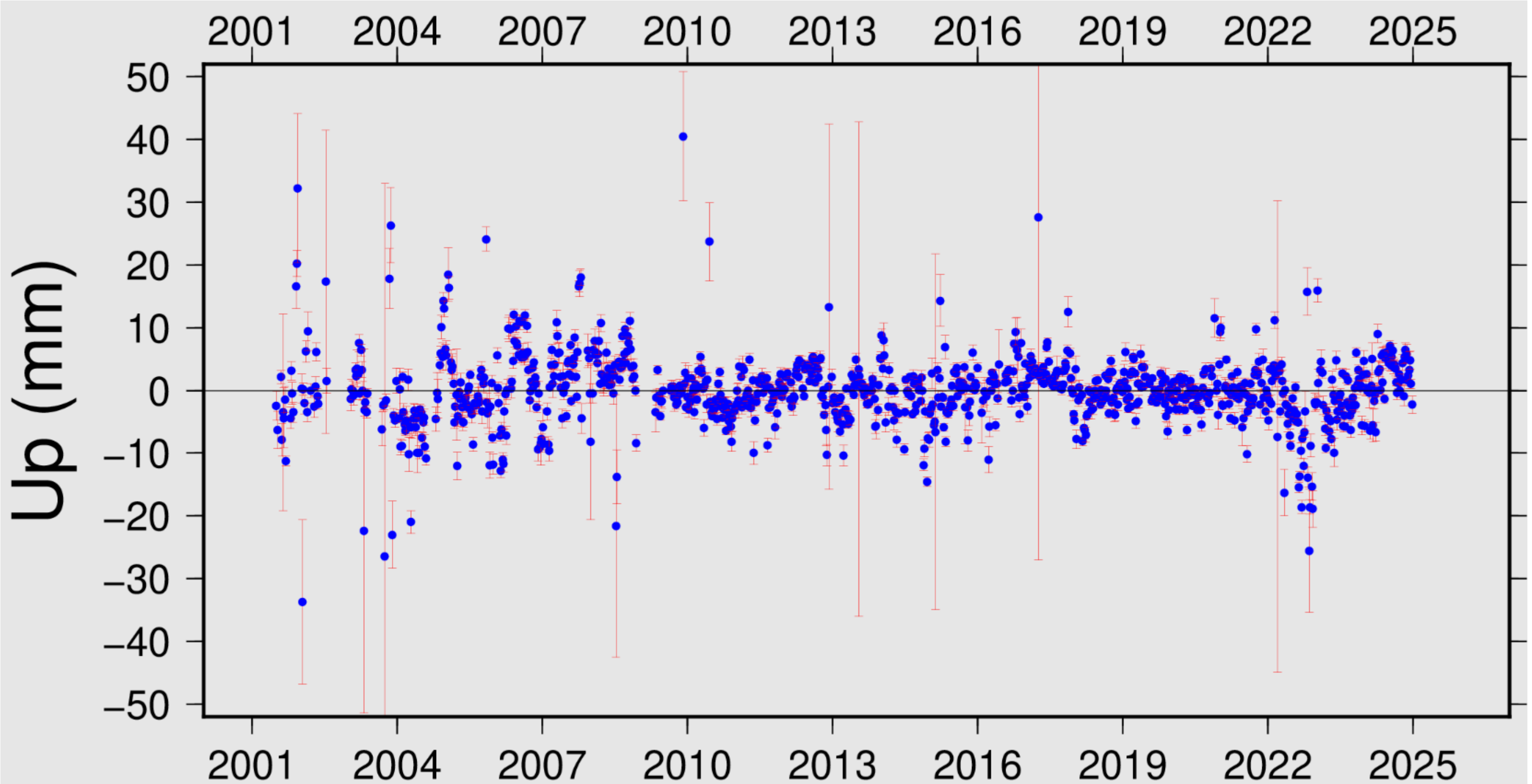
- MBE Started on 01-Jan-2021
- Also, the two vertical green lines represent 'unknown' height discontinuities, the last one being 14.7 mm

7810 ZIML ITRF2020_2024 Up Residuals (Velocity Removed)



- ❑ MBE Started on 01-Mar-2023

7941 MATM ITRF2020_2024 Up Residuals (Velocity Removed)



- The station exhibited high RMSs starting in 2022 that were discussed in previous QCB meetings
- Based on the DHF, 7941 LAGEOS-1/-2 data is assumed to be bias free since day 301, 2007 (28-Oct-2007). Therefore any bias change since then will be absorbed into station height. See the large dip in height residuals in 2022

Conclusions/Discussion

- ❑ Does MBE bias the heights or only induce random scatter with larger error bars?
- ❑ Does the recent trend in 7090 up residuals, indicate a systematic error than is not removed by MBE?
- ❑ Based on the ILRS contribution to ITRF2020 document, the minimum number of combined LAGEOS (-1,-2) Normal Points (NPs) in a week to estimate station coordinates is 10 (i.e. 20 minutes of data). Should that minimum be increased?

VMF News

ILRS QCB

Van Husson

VMF3o Updates

- In August 2025, the VMF3o time series (El and OP) were updated to fix some SLR station height errors and added the following 6 new sites
  - 7306 Tsukuba
  - 7329 Xian
  - 7396 Wuhan
  - 7701 Izana
  - 7807 Metsahovi
  - 7817 Yebes
- System Up eccentricities were considered in this update

VMF3o_El Data (New – Old)

ILRS Core Sites

Pad	Site	Avg Pressure Difference (hPa)	StdDev	Up Ecc (m
7080	McDonald	-0.11	0.01	1.756
7090	Yarragadee	-0.29	0.01	3.183
7105	Greenbelt	-0.30	0.01	3.138
7109	Quincy	-0.21	0.01	3.184
7110	Monument Peak	-0.24	0.01	3.190
7119	Haleakala	0.82	0.01	2.630
7210	Haleakala	-0.01	0.00	0.849
7237	Changchun	0.08	0.01	0.000
7403	Arequipa	-0.16	0.00	2.679
7501	Hartebeesthoek	-0.25	0.01	3.227
7810	Zimmerwald	0.04	0.00	0.000
7825	Mt Stromlo	0.07	0.01	0.000
7832	Riyadh	0.07	0.00	0.000
7834	Wettzell	0.08	0.00	0.000
7835	Grasse	0.07	0.00	0.000
7836	Potsdam	0.08	0.00	0.000
7837	Shanghai	0.08	0.01	0.000
7839	Graz	0.08	0.00	0.000
7840	Herstmonceux	0.09	0.00	0.000
7841	Potsdam	0.07	0.00	0.000
7843	Orroral	0.07	0.00	0.000
7845	Grasse	0.07	0.00	0.000
7849	Mt Stromlo	0.07	0.00	0.000
7907	Arequipa	0.07	0.00	0.000
7939	Matera	0.08	0.00	0.000
7941	Matera	0.07	0.00	0.000
8834	Wettzell	0.07	0.00	0.000

Large Pressure Differences

Pad	Site	Avg Pressure Difference (hPa)	StdDev
1874	Mendeleevo	3.63	0.17
1879	Altay	-12.00	0.70
1888	Svetloe	3.81	0.16
1889	Zelenchukskya	-16.64	0.50
1890	Badary	-83.34	4.07
7035	Otay Mountain	121.07	3.21
7062	Otay Mountain	1.42	0.03
7119	Haleakala	0.82	0.01
7307	Isigaki Sh	2.32	0.05
7823	San Fernando	3.38	0.08

- **Core Sites where the Up Eccentricity is zero, the pressure differences are slightly positive (<+0.1) hPa**
- **Core Sites where the UP Eccentricities are positive, the pressure differences are negative except for 7119 were the old 7119 heights were off by several meters**

7090 YARL Etalon Range Bias Investigation

ILRS QCB

Van Husson

MOBLAS System Configurations

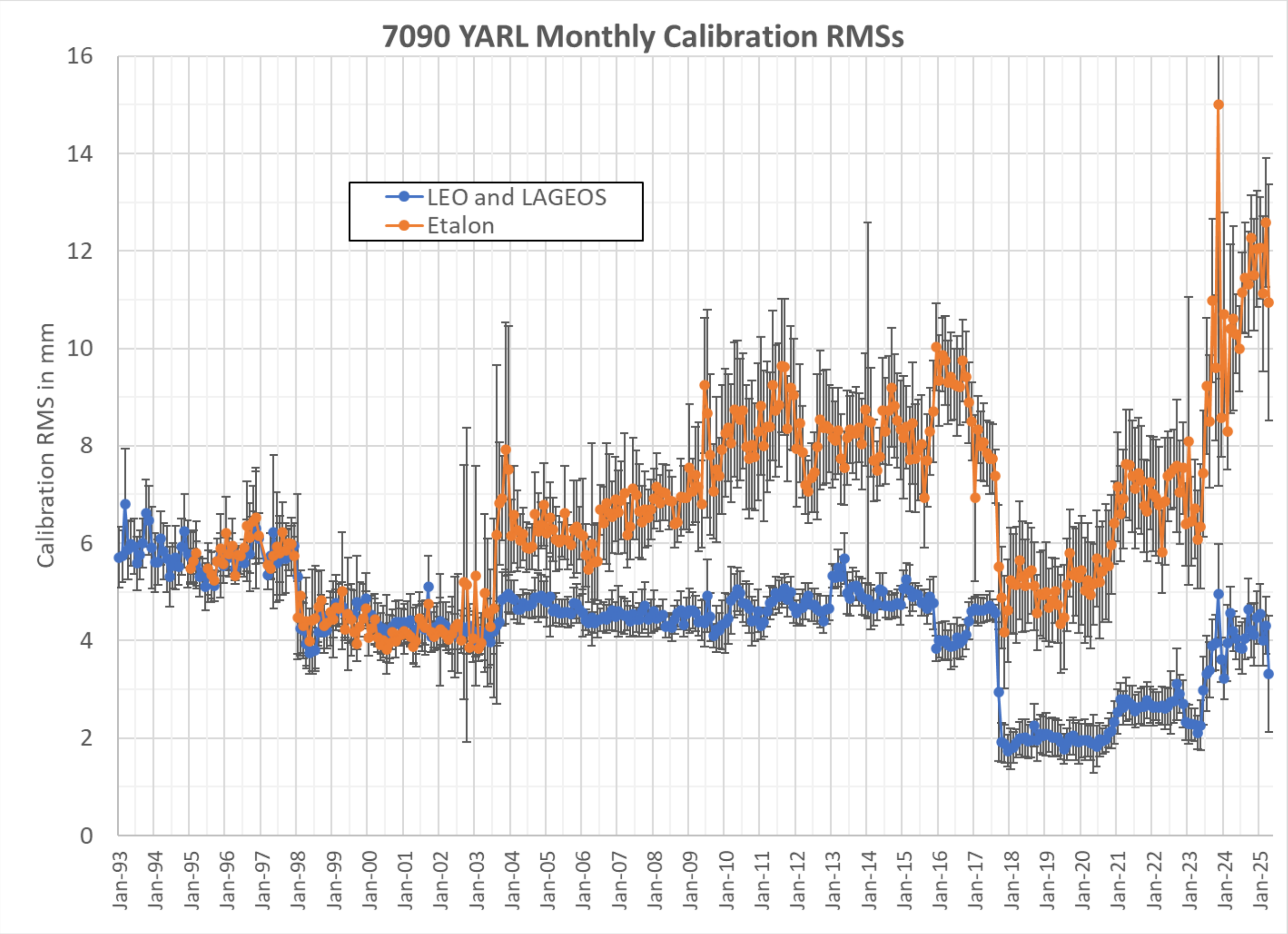
- The MOBLAS systems (7090, 7105, 7110, 7124, 7501) only have one laser with a wavelength of 532 nm and only have one detector, a Micro-Channel Plate Photo Multiplier Tube (MCP-PMT), but they all have two receiver chains, a primary and secondary
- Both the primary and secondary receiver configuration use the same MCP-PMT, but have separate dual cascading discriminators
- The primary chain is used to track LEOs and MEOs (LAGEOS-1/-2, LARES-2). If the return signals are strong enough it could and has been used to track HEOs including Etalon
- The secondary receiver chain has been named the High Sensitivity Laser Receiver (HSLR) and/or the Amplified Return Signal Unit (ARSU), which uses a low noise amplifier to amplify the return signal prior to the receive discriminator. This configuration is used to track HEOs including Etalon. In the past few years, the original amplifiers have failed and have been replaced with a newer model with better gain
- The System Configuration Indicator (SCI) in the MERIT II (Column 126) and CSTG format (Column 47) were to be used to indicate what MOBLAS receiver chain was in use (1 for primary, 2 for secondary). In the CRD format, the SCI field was discarded except for a 60 Compatibility record which was only used to convert legacy formatted data to CRD. In the CRD V2 format, an amplifier in use field was added to the C2 Detector Configuration record

ARSU Differences

Category/Specs	Old ARSU	New ARSU
Manufacturer	B&H Electronics	Pasternack
Model	DC3000H20	PE15A63016
Signal bypass circuitry	Yes	No
Delay Cable	Yes	No
System delay difference from Primary Receiver	~+9 meters	~+0.47 meters
Average Amplification (Gain)	23 dB	24 dB
Attenuator	Yes	Optional
Single photoelectron returns	No	Yes

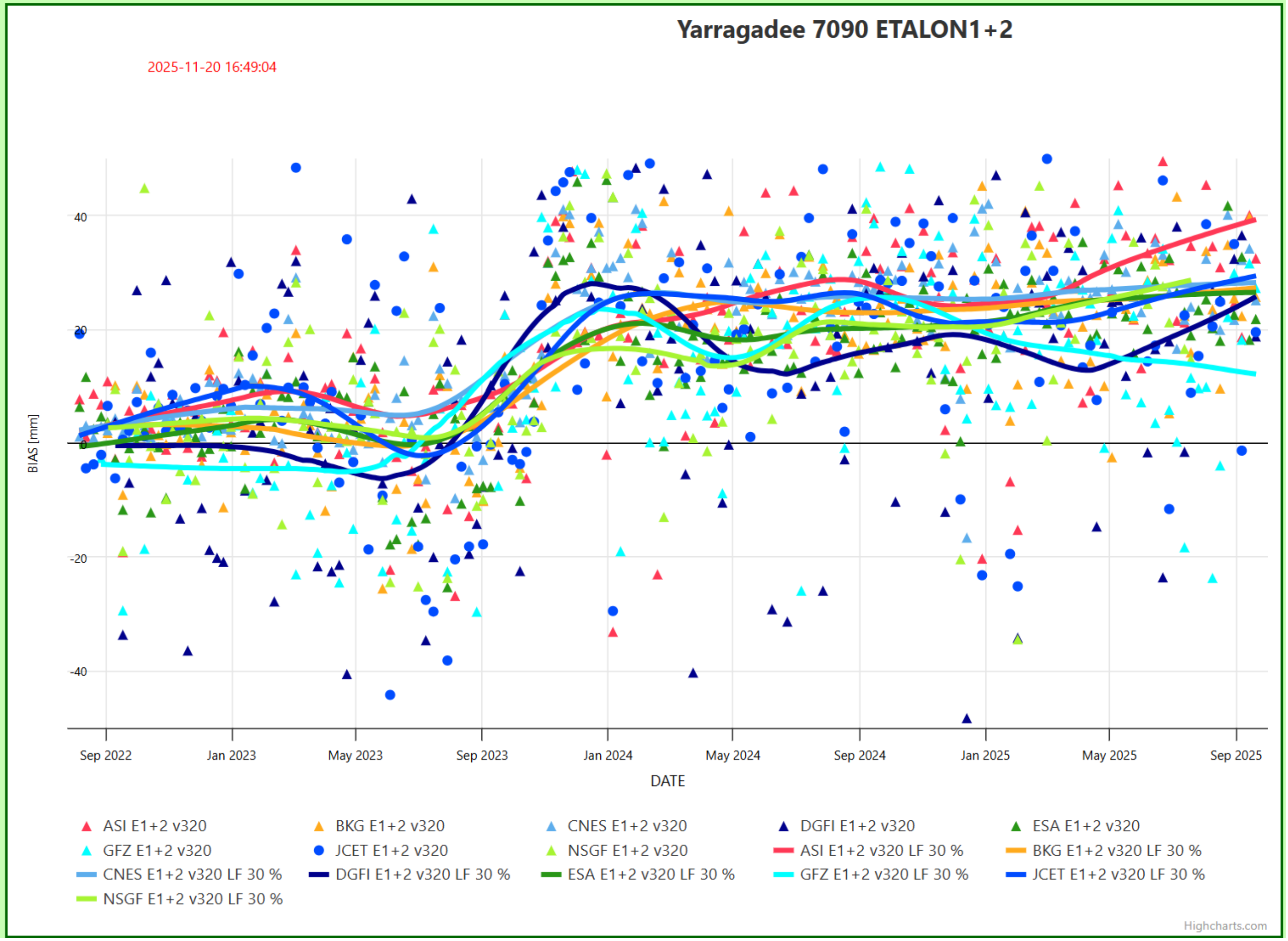
- **Other differences**
  - The new ARSU has a lower receive discriminator threshold
- **To maximize data quantity, the optional attenuator in the new ARSU has been disabled**
- **The stations updated their change history, but not their site logs**

7090 YARL System Performance (Calibration Single Shot RMSs)



- ❑ **MOBLAS single shot RMSs are higher when using the secondary receive chain**
- ❑ **Based on calibration RMSs, 7090 YARL switched exclusively to the ARSU to track Etalon in late 2003**
- ❑ **The upgraded ARSU was installed on 21-Oct-2023**
- ❑ **The new ARSU can trigger on single photoelectrons where the old ARSU could not**

7090 YARL SSEM (V320) Etalon Range Biases by Analysis Center (AC)



- The 7090 Etalon range bias jumped ~+20 mm on 21-Oct-2023 after installation of the new ARSU
- Was the jump caused by a calibration issue or something else?
- Two potential calibration errors
  - Etalon calibrations are taken at 10 Hz while Etalon ranging is at 5 Hz. The transmit power and beam divergence changes between 5 and 10 Hz. The laser is optimized at 5 Hz
  - Etalon calibration data are taken at different signal strengths, which yields a lower RMS, versus Etalon signal strengths

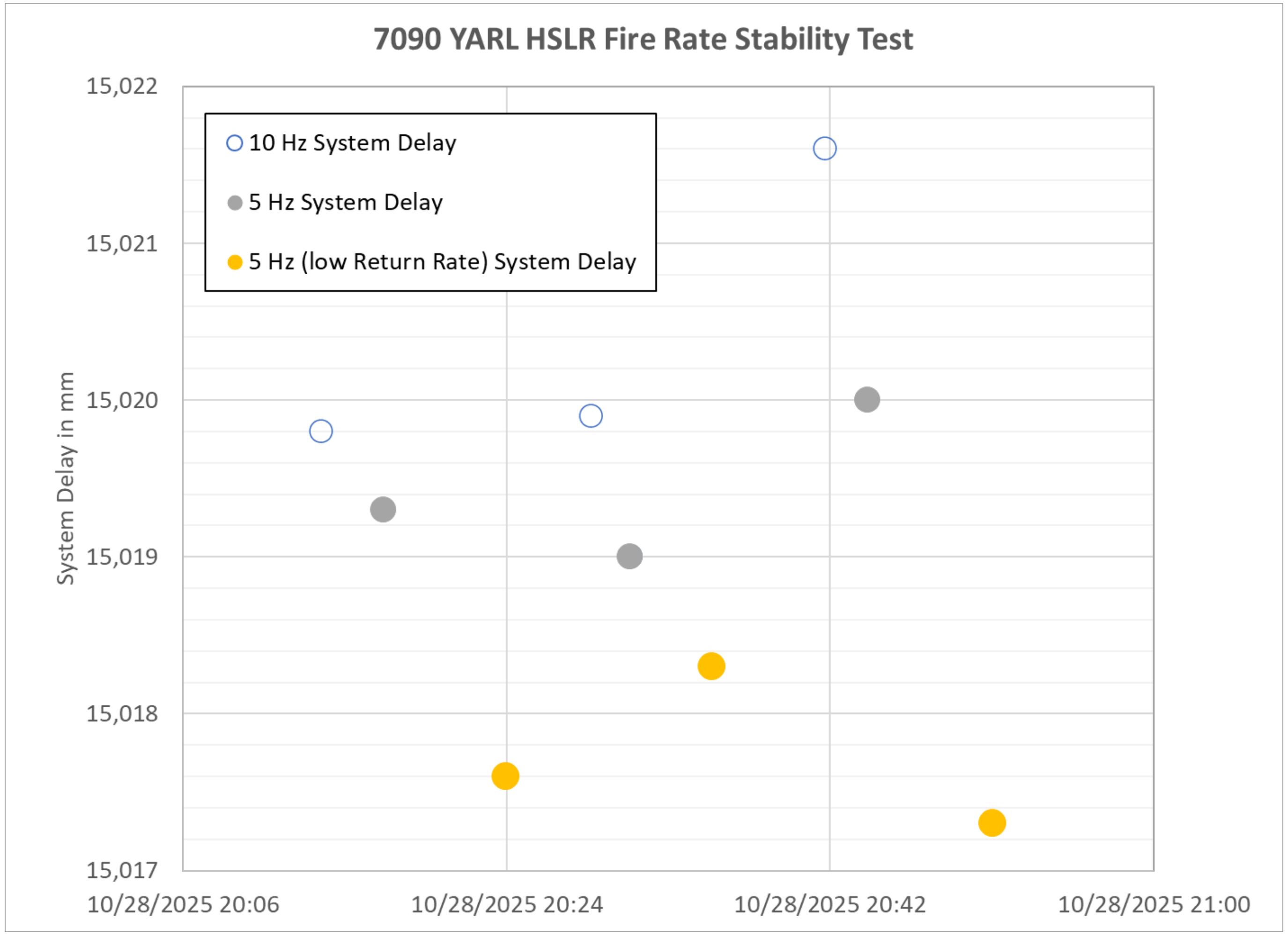
7090 YARL Ground Tests

Date and Time	Fire Rate (Hz)	System Delay in mm	RMS in mm	Mean Receive Energy	Receive Energy RMS	Return Rate (%)	Az Angle Res (mdeg)	El Angle Res (mdeg)	Data Set
10/28/2025 20:13	10	15019.8	10.2	355	80	71.4%	-0.73	2.57	1
10/28/2025 20:17	5	15019.3	10.4	424	99	54.9%	-0.73	-0.54	2
10/28/2025 20:23	5	15017.6	11.1	417	91	31.0%	0.73	-0.43	3
10/28/2025 20:28	10	15019.9	10.1	389	76	74.0%	0.27	-0.43	4
10/28/2025 20:30	5	15019.0	10.3	458	111	58.1%	0.27	-0.43	5
10/28/2025 20:35	5	15018.3	10.9	430	94	39.2%	0.27	-0.43	6
10/28/2025 20:41	10	15021.6	9.5	402	90	85.9%	0.27	-0.43	7
10/28/2025 20:44	5	15020.0	10.2	457	120	61.7%	0.27	-0.43	8
10/28/2025 20:51	5	15017.3	12.4	415	88	23.7%	0.27	-0.43	9

Legend
10 Hz at strong return rates
5 Hz at strong return rates
5 Hz at low return rates

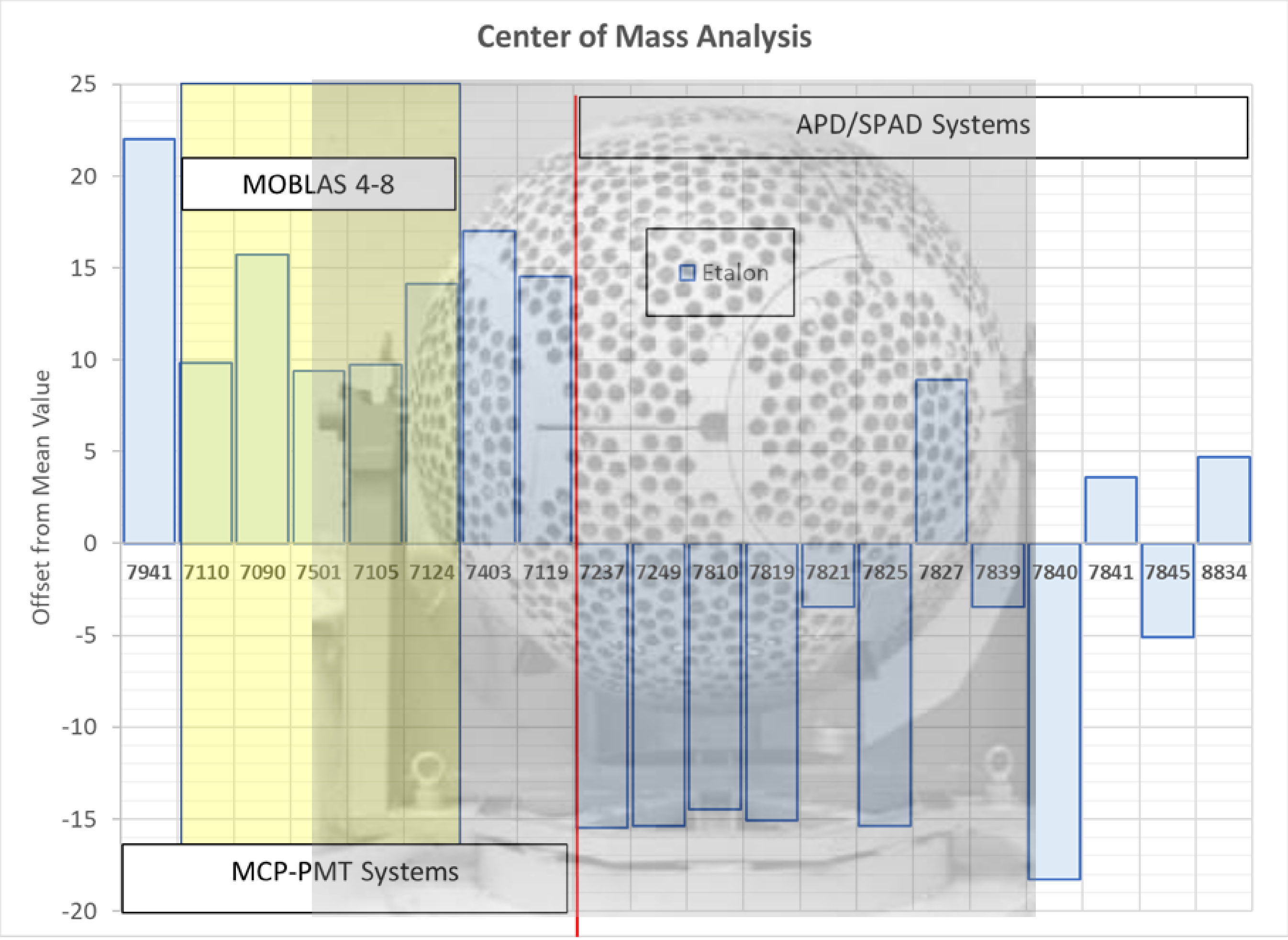
- **The following ground test was devised to characterize any potential errors:**
  1. Take a calibration at 10 Hz at typical calibration single strengths (i.e. in the flat portion of the receive discriminator curve at high return rates)
  2. Take a calibration at 5 Hz at typical calibration signal strengths (i.e. in the flat portion of the receive discriminator curve at high return rates)
  3. Take a calibration at 5 Hz at low returns rate (i.e. 10%) to better mimic the Etalon 5 Hz return rates
  - Repeat the 3 calibrations twice
- **What to look for**
  - The system delay variation between datasets 1 and 3 will indicate the potential Etalon range bias due to a calibration error
- **The test wasn't perfect because**
  - the pointing angles didn't stabilize until the 4th dataset
  - The return rates in the 3rd, 6th, and 9th datasets were not taken at a 10% return rate but were taken at lower return rates from the other two tests

7090 YARL Ground Tests



- ❑ The largest system delay peak-to-peak variation between calibrations taken at 10 Hz at high return rates and calibration taken at 5 Hz at low return rates was 4.3 mm but in the wrong direction to explain the +20mm change in the Etalon Range Bias (RB)
- ❑ What else could explain the RB change?

Etalon Center of Mass (CoM) Corrections



- The Etalon retroreflector array has 2146 cubes and its diameter is 1.294 meters
- Bar chart of current Etalon CoMs by system. The center line is the mean Etalon CoM. The peak-to-peak variation in the Etalon CoM is a whopping 38 mm
- Is the MOBLAS Etalon CoM with the new ARSU closer to APD/SPAD Systems since returns are at the single photoelectron level? If so this would explain the +20mm increase in the 7090 Etalon RB because ARSU returns would on average be deeper into the spacecraft

Conclusions/Actions/Questions

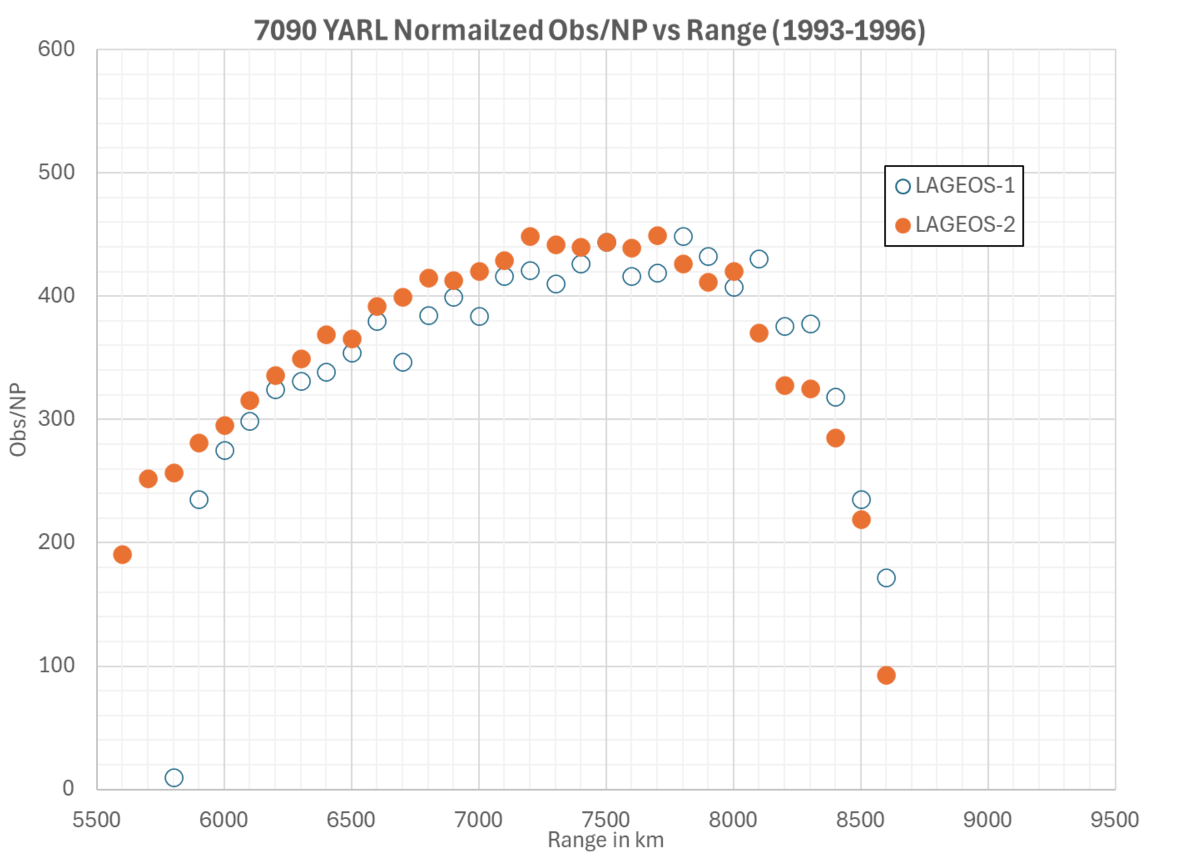
- Should the MOBLAS operators be encouraged to calibrate Etalon at 5 Hz and low return rates to better simulate the operating conditions on the satellite which in theory would mitigate a calibration error/range bias?
- The MOBLAS stations need to update their site logs based on the new ARSU
- Do Etalon CoM corrections consider a secondary receive chain where the signal is amplified?
- A new Etalon Range Bias (RB) needs to be estimated for when the MOBLAS systems have switched to the new ARSU and update the Data Handling File (DHF) if needed
- Lessons learned: CoM correction updates can impact existing RB estimates in the DHF (e.g. 7110 Etalon CoM correction update in Sept 2022)

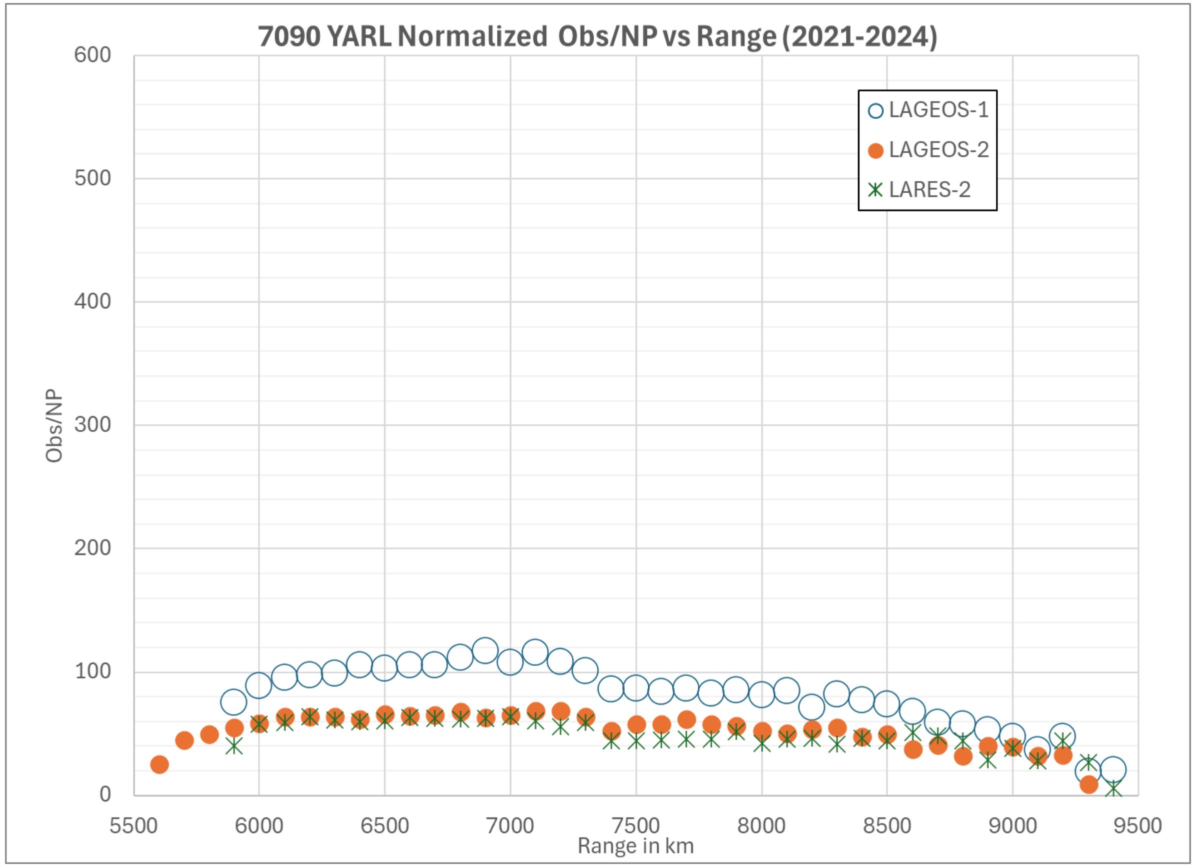
Medium Earth Orbit (LAGEOS-1, LAGEOS-2, LARES-2) Signal Strength Investigation (1993-1996 to 2021-2024)

ILRS QCB

Van Husson

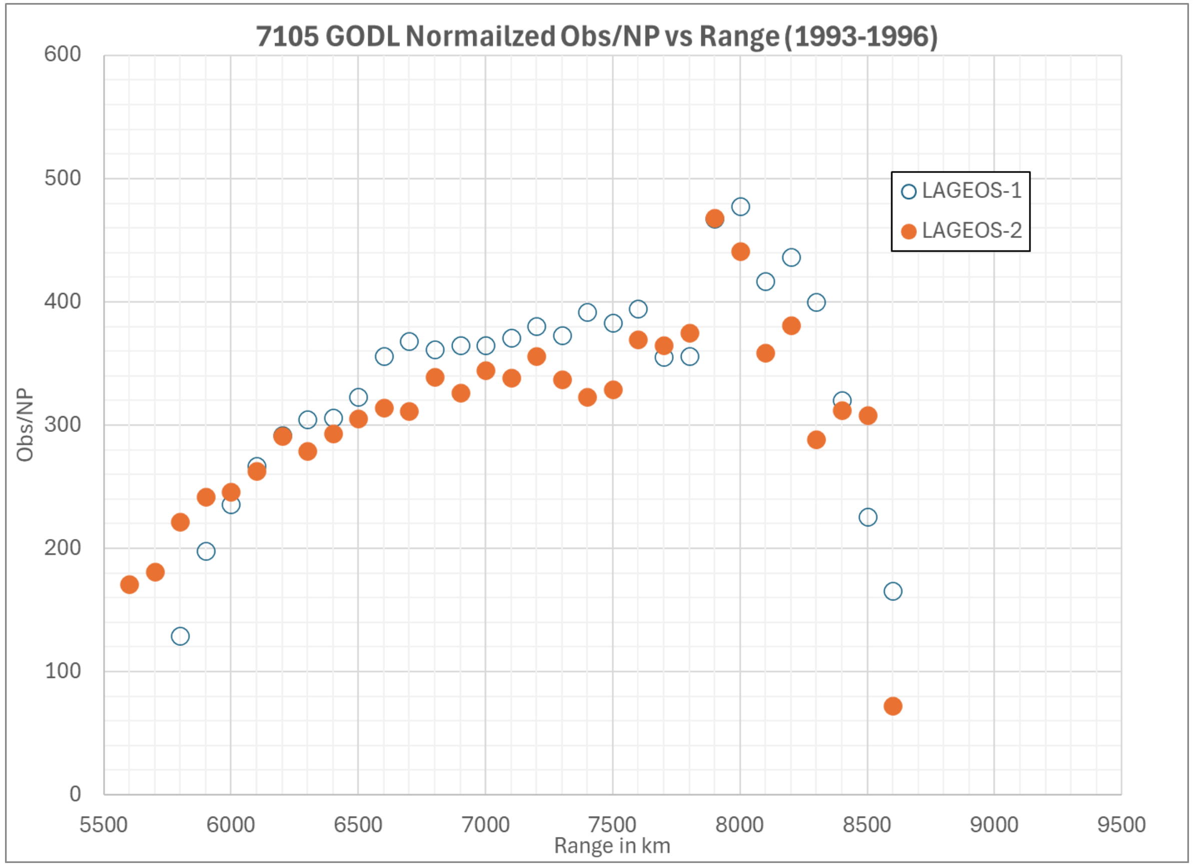
7090 YARL LAGEOS-1, LAGEOS-2, and LARES-2 Data Yield Comparisons

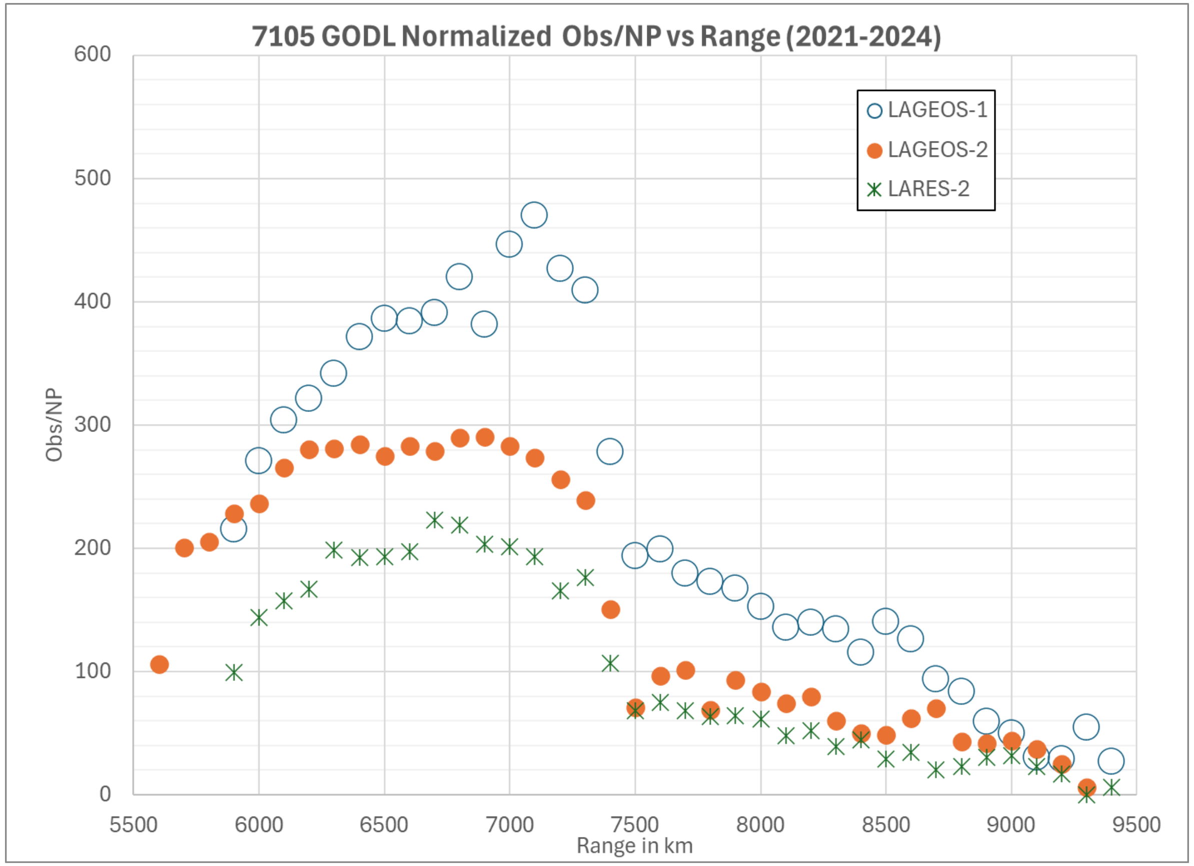




- The MOBLAS laser repetition rate has increased from 5 to 10 Hz post event timer dependent upon the range (5 or 10 Hz at <7500 km, 5 Hz only > 7400 km). There has been a noticeable reduction in the # of obs/NP (pass interleaving; degradation in signal strength; degradation in the ranging machine)

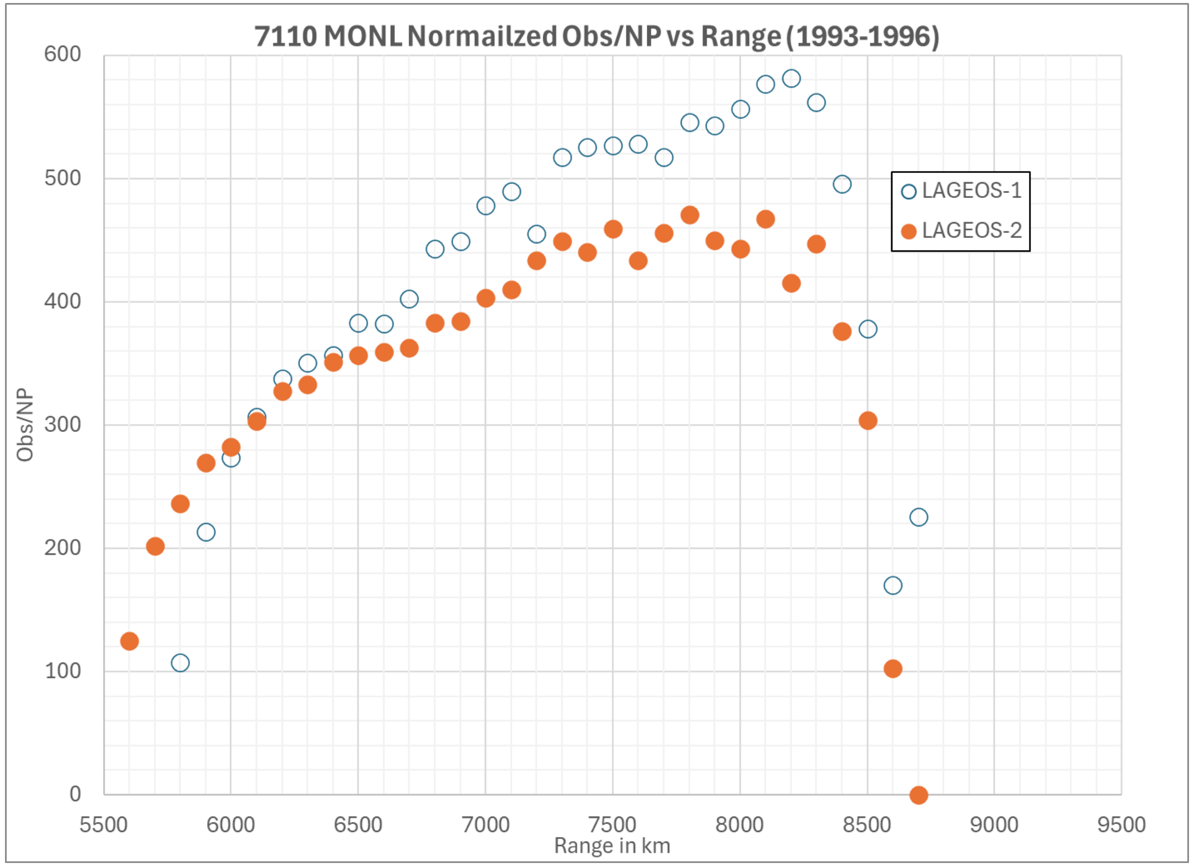
7105 GODL LAGEOS-1, LAGEOS-2, and LARES-2 Data Yield Comparisons

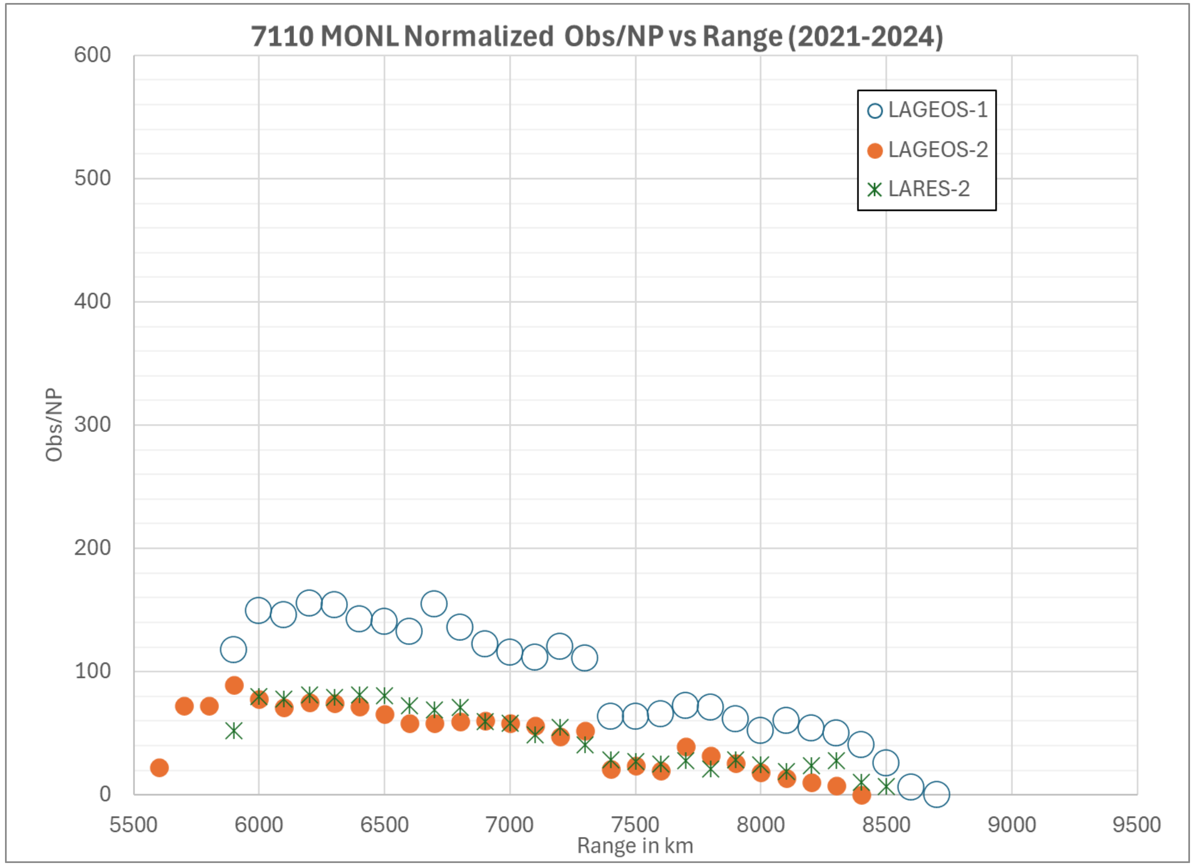




- ❑ On the right chart there is a clear distinction around 7400 km when the laser is switched from 10 to 5 Hz

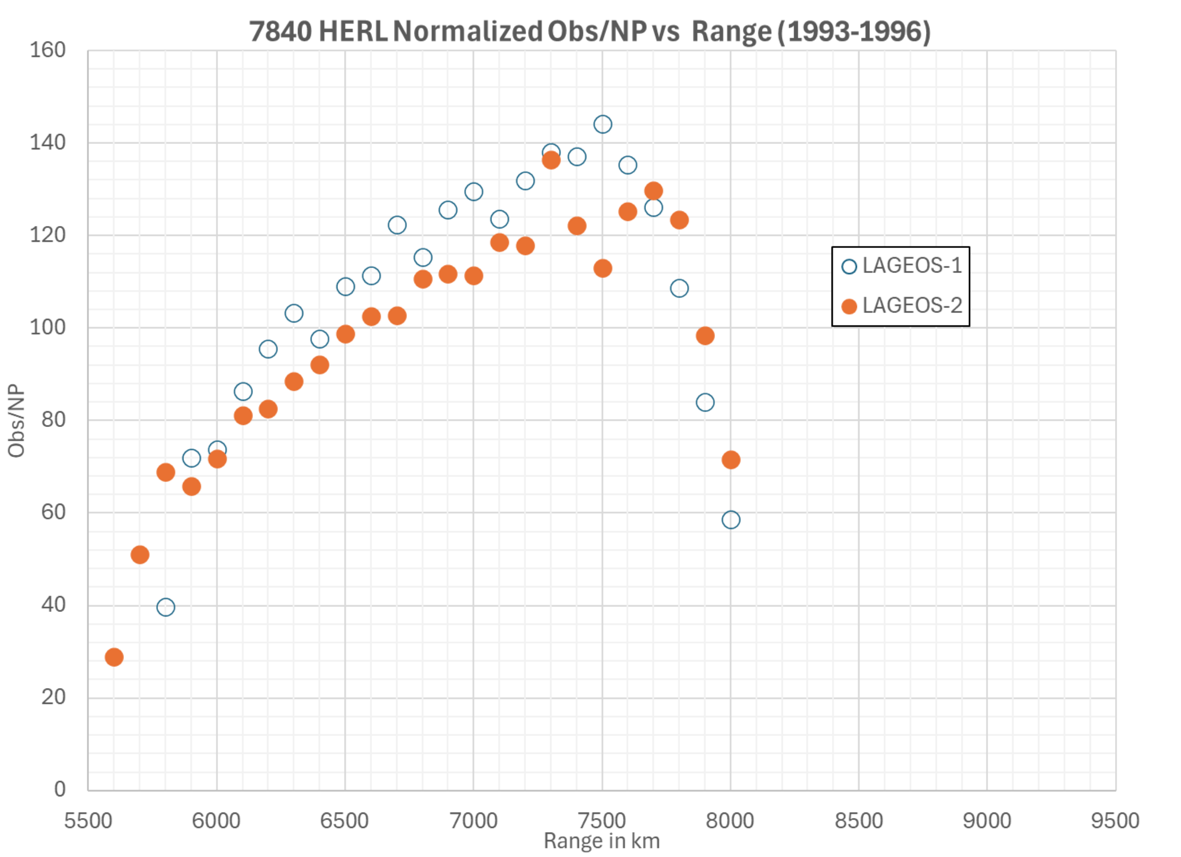
7110 MONL LAGEOS-1, LAGEOS-2, and LARES-2 Data Yield Comparisons

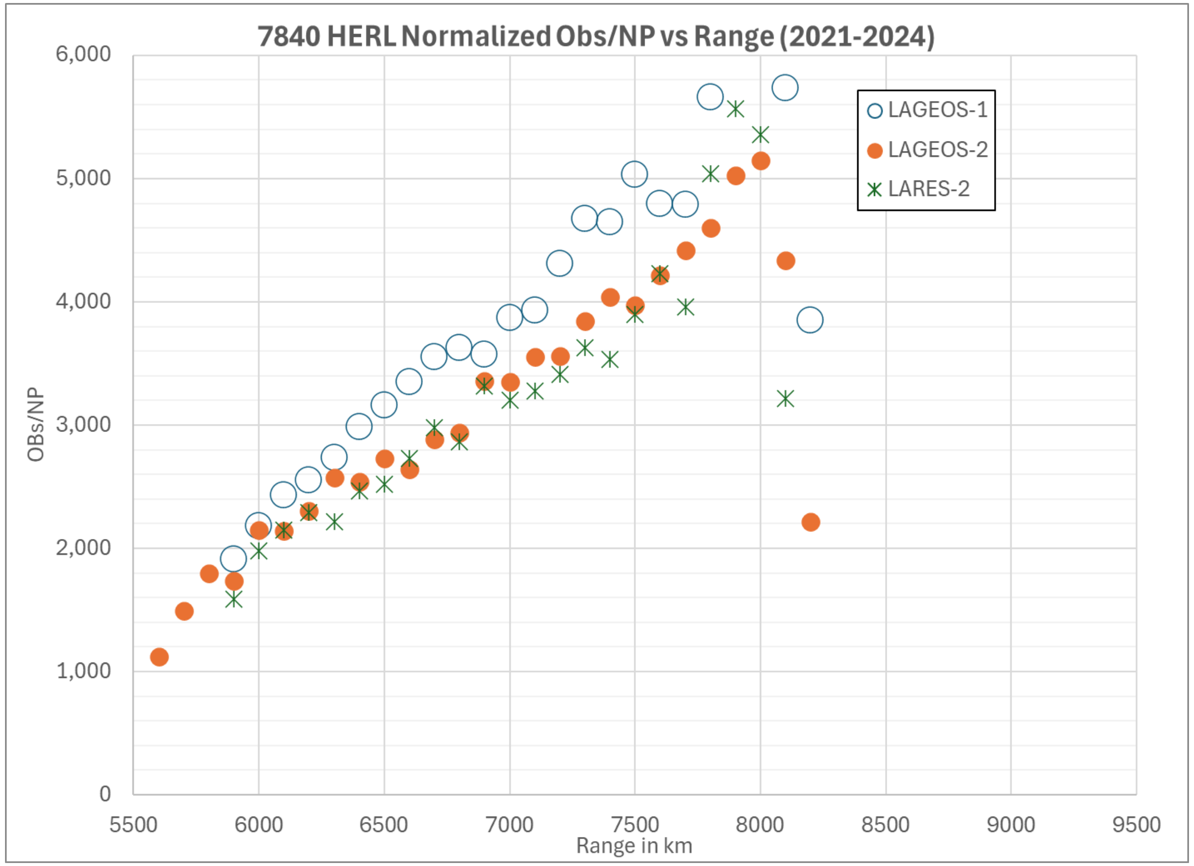




- ❑ On the right chart there is a clear distinction around 7400 km when the laser is switched from 10 to 5 Hz
- ❑ Do the recent trends indicate a degradation in system performance; weaker returns from the satellite and/or change in operating hours?

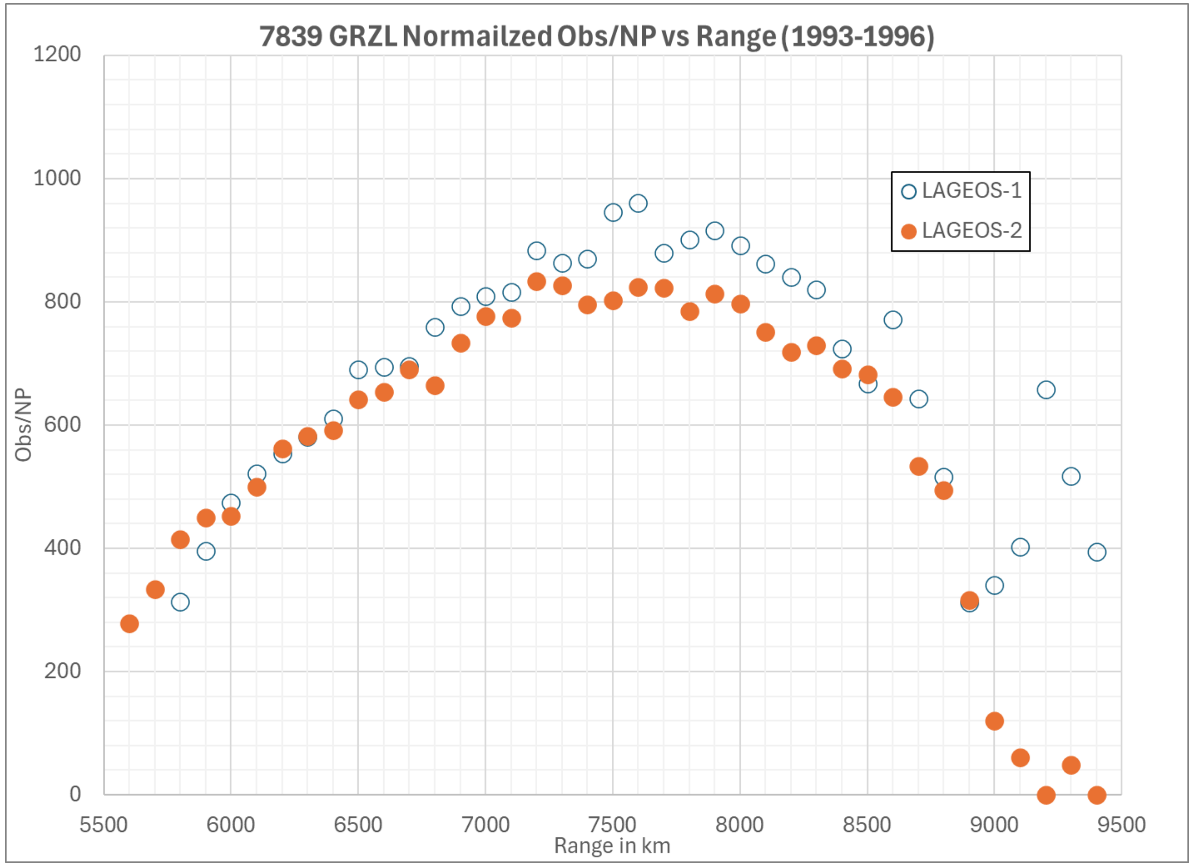
7840 HERL LAGEOS-1, LAGEOS-2, and LARES-2 Data Yield Comparisons

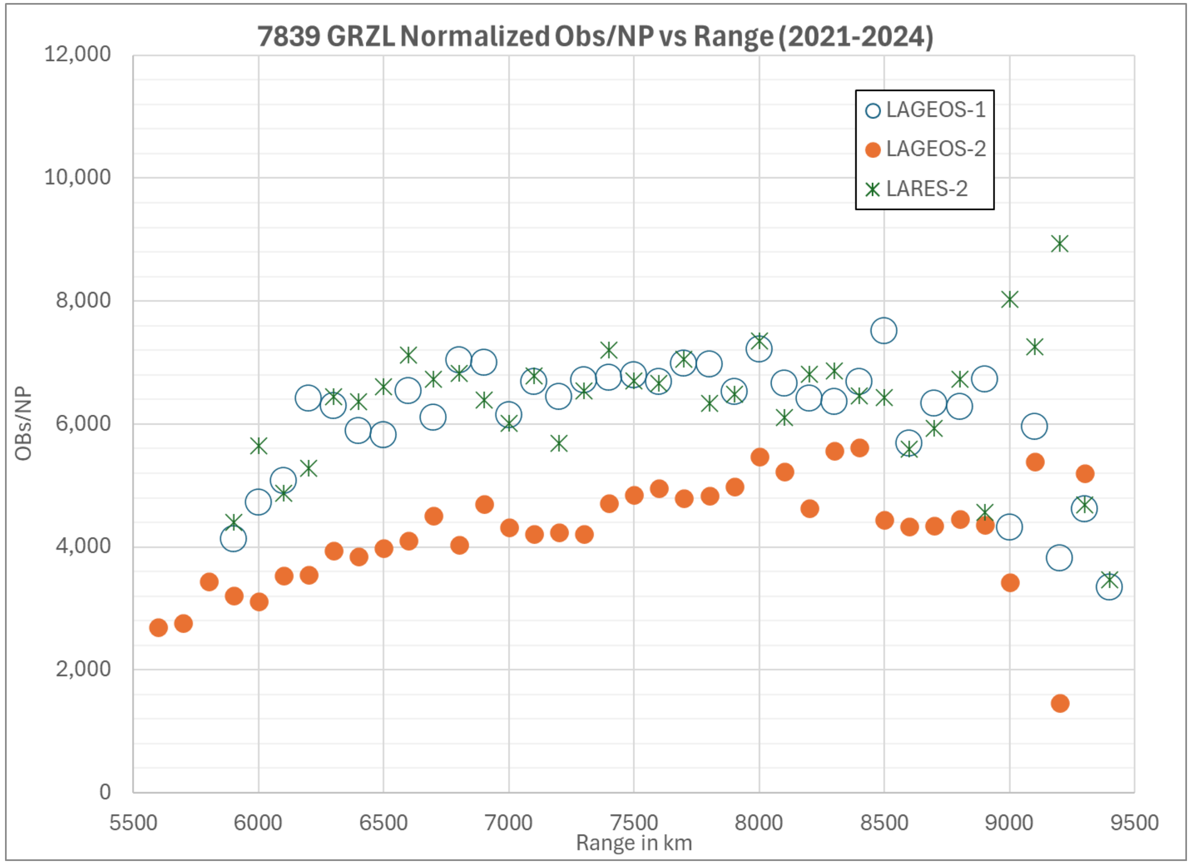




- ❑ **HERL is a single photon system**
- ❑ **In both time periods, LAGEOS-2 signals appear weaker to LAGEOS-1**

7839 GRZL LAGEOS-1, LAGEOS-2, and LARES-2 Data Yield Comparisons





- ❑ **Graz is multi-photon system and implemented a LAGEOS 20 mm LE filter in March 2008**
- ❑ **A 20 mm LE filter is also applied to LARES-2. LARES-2 LE return rates are like LAGEOS-1, but not LAGEOS-2**

Conclusions/Questions

- ❑ The trends in Obs/NP per Range are station dependent. The recent trends in 7090 and 7110 may indicate a decline in system performance
- ❑ Currently, LAGEOS-2 return signals appear weaker relative to LAGEOS-1 for all stations. Does this indicate anything about the quality and long-term performance of the LAGEOS-2 retroreflectors?
- ❑ The LARES-2 LE returns from Graz are just as strong as LAGEOS-1
- ❑ Do these trends indicate a possible long-term change in the Center of Mass (CoM) Corrections for any of these systems?
- ❑ Is the CoM on these MEO targets range dependent based on the ranging machine configuration?

Review of QCB Action Items

ILRS QCB
Van Husson
24-Nov-2025

7210 HALL Action Items

❑ 7210 Action Items:

- Update the Data Handling File (DHF) to either delete 7210 between 1-Jan-1983 and 21-Jan-1994 or solve for a frequency error (Action: NASA/JCET AC) and then update the DHF accordingly. (Action: ASC)
- Provide 7210 barometric corrections for the DHF (Action: Van Husson)
  - New 7210 range biases need to be computed (Action: Each AC) and update the DHF accordingly (Action: ASC)

7080 MDOL Action Items

❑ 7080 Action Items:

- Analysis Centers (ACs) to check their software to ensure any elevation (tropospheric); range (frequency); or range-rate (epoch) dependent biases in the DHF are applied a priori (Action: Each AC)
- Update the DHF based on new 7080 barometric corrections provide by Van (Action: ASC)

7105 GODL Action Items

7105 Action Items:

- Update the 7105 start date from day 20:047:00000 to 20:227:00000 for Satellites 51, 52, 53, and 54 in the DHF(Action: ASC). This will hopefully eliminate a discontinuity in the 7105 heights
- Update the DHF based on updated barometric corrections provide by Van (Action: ASC)

7501 HARL Action Items

❑ 7501 Action Items:

- Remove the optional 7501 HARL -66 mm range bias corrections in the DHF and add a new entry to delete all 7501 data between 12:071:00000 and 12:099:00000 due to range bias instability (Action: ASC)
- Compute a 7501 LAGEOS-1 and LAGEOS-2 fixed range bias for the two periods 00:219:0000 to 12:071:00000 and 12:099:0000 to 17:050:00000 (Action: Each AC) and update the DHF (Action: ASC)
- Determine if 7501 LAGEOS (-1,-2) range biases can be computed for the MTLRS occupation in early 1993 and if not, consider deleting this data in the DHF because it may negatively influence 7501's height rate (Action: ASC)
- Note: Hopefully, these actions above will remove two 'unknown' height discontinuities in the 7501 heights and will flatten the 7501 velocity to agree with the 7501 VLBI site velocity

7110 MONL Action Items

❑ 7110 Action Items:

- Reanalyze the 7110 LAGEOS (1,2) and Etalon (1,2) data since19-Aug-2001 using the updated 7110 Center of Mass (CoM) corrections (version 220915) and the 2011 update to the 7110 system eccentricities (Action: Each AC) and then update the 7110 ranges biases in the DHF (Action: ASC)

7119 HA4T Action Items

❑ 7119 Action Items:

- Update the 7119 end date of the LAGEOS-1 and -2 range bias entries of +9.9 and +10.9 mm; respectively, from 00:000:00000 to 25:089:25200 and compute a new RB if needed (Action: ASC)

Etalon Action Items

❑ Etalon Action Items:

- Compute new Etalon range biases for 7090, 7105, and 7110 starting on 21-Oct-2023, 02-Jul-2022 and 28-Mar-2023; respectively (Action: Each AC) and update the DHF accordingly (Action: ASC)
- Note: Based on the 7090 YARL Etalon Range Bias investigation, new Etalon CoM corrections may need to be computed which would impact the actions above

ILRS QCB Meeting

11/24/2025

Mike Pearlman & Claudia Carabajal

Agenda

Jose:

- Yebes QC Ananlysis 2025 – 1064 nm and 532 nm (**Jose**)

Van:

- Analysis of the apparently anomalous estimation of YARL height (**Jose**)
- ITRF2020_u2024 Core Station Heights (Van)
- 7090 YARL Etalon Bias Investigation (Van)
- MEO Signal Strength Investigation (Van)
- VMF news (Van)
- Review of QCB Action Items (Van)

Mike/Claudia:

- ILRS CB updates

Others?

Station Performance Guidelines

- 2015 Performance Guidelines (published on ILRS Website)
  https://ilrs.gsfc.nasa.gov/docs/2015/ILRS_passperfstandard_201511.pdf
- 2023 Revised Performance Guidelines (revised after the launch of LARES-2)
  Included in the 10/06/2025 meeting notes, sent to ILRS CB, and to ASC Chair/Co-Chair.
- Trying to arrange a meeting with ASC to get their point of view before the next ASC meeting, requested discussion was added to agenda.
- Final version (2025/2026) Performance Guidelines, shared with ASC, and discussion at the next ILRS ASC meeting.

To be finalized after consensus is achieved, approved by ILRS GB, and published on the ILRS website, and disseminated to the community.

SP3c Codes:

- Consolidating the information on the Spacecraft ID Correspondence Table for Orbit Exchange Files (SP3c), currently on the CDDIS site, and the ILRS site, and the IGS site. Some discrepancies found with SP3c codes used by CNES, need to confer with Alexandre Couhert. Reading information from SINEX metadata to compare or obtain the SP3c codes, especially for all the GNSS constellations.
- Recently assigned ***L81 to*** **Sentinel-1D.**

Station News

- No new station applications.
- The following stations have **passed quarantine**. Data has been released to the public:
  - **San Fernando** (7824), Spain; **Xian** (NTSC, 7329) Station, China; **Hartebeesthoek** (HARL, 7501), South Africa
- The following stations are **in quarantine**:
  - IZN-1 (**Izaña**, Spain), due to a hardware problem, chiller issue at the station.
- Toshi Otsubo requested that Ishioka and Xian be included in the Weekly Tracking Reports sent by QuickLook_RH8 via ilrs-sta. These reports are generated by the NASA SLR Data Operations Center (DOC).
  - Once released from quarantine, Xian data will be released as operational and will then appear automatically in the weekly tracking reports. Will Xian be added to your HITU bias reports?
  - For ‘Engineering' stations like Ishioka, the CB in coordination with the ILRS Data Centers (EDC and the CDDIS) have an action to develop a separate classification of 'engineering' data so that 'engineering data' is more easily accessible to end users.

Station News: Station Surveys and Plan

- Station Surveys were sent to the following contacts/stations back in April 2025:
  - Herve Mariey (Grasse-7845)
  - Michihiro Suzuki (Simosato-7838)
  - Shinchi Nakamura (Tsukuba-7306)
  - Stefan Riepl (Wettzell-7827)
  - Johann Eckland and Ulrich Schreiber (Wettzell-8834)
  - Beatriz Vaquero Jimenez and Adolfo Garcia Marin (Yebes-7817)
  - Zhang Zhongping (Shanghai-7821) (new)
  - Andrea Di Mira (Izaña-7701) (new)

  Did not respond:
  - Dr. Michael Lachut. (Mt. Stromlo-7825)
  - Jie Zhang (Wuhan-7396)

- Review Team still working on the reviews of the Station Surveys and Plan that we received (now 8).
- We will be organizing a meeting in early December 2025.
- We will be providing feedback to the stations after all inputs are received from the reviewers, and they are discussed by the review team.

Station News: Engineering Stations

- Updating the list of Engineering Stations, and where to put the data: (see table on ILRS webpage)

Monument	Code	Location Name, Country	CDDIS SOD	IERS DOMES Numbers	IGS Site Log	IVS Site Log	IDS Site Log	Date of Latest Site Log	Date of Latest Site History Log
7040	OCTL	Wrightwood, California	70409201	49901S001	-	-	-	20050127	-
7125	GO1L	Greenbelt, Maryland	71259301	40451M114	X	X	X		-
7317	ISHL	Ishioka, Japan	73179501	21791M004	X	X	-	20250411	-
7395	GEOL	Geochang, Republic of Korea	73956501	23910S001	X	-	-	20170925	-
7816	SMIL	Stuttgart, Germany	78165202	10916S001	X	X	-	20221206	-
7826	STRK	Mt Stromlo, Australia	78269101	50119S007	X	-	X	20190813	-
7865	STAL	Stafford, Virginia	78658601	49654M001	-	-	-	20200312	20191015

- Engineering Stations Contacted: OCTL, GEOL, SMIL, STRK, to request updates on status on current or future station activities, and any publications or papers that may describe them that they may want to share. **No responses to date.**
- There have been discussions (ILRS CB/QCB, Justine, Van, Christian) regarding having 'engineering' data in a different class, and putting the engineering station data to its own folder. Any updates on this? wWho can lead this effort?
- 'Engineering' stations may never meet the stringent quarantine data gathering and data quality requirements. Their data may always be in a quarantine folder, which many users never access. Having a unique category for engineering stations may impact NASA SLR Data Operations.

Station News: Engineering Stations
The message: Subject "Updates on Engineering Station Activities"

"Dear Stuttgart (SMIL) Station colleagues,
The ILRS would like to update the Status of the Engineering Stations, so we are contacting our Station colleagues requesting any news on current and future activities at these Engineering Stations.
We would also like to know if there are any publications that describe station activities that you would like to share, that can be published on the ILRS website Station page.

In addition, if any changes to the station's Site Log are needed, including Station Contacts, let us know.

Please let us know of any updates, which will be communicated to the ILRS Central Bureau and the Governing Board.

Regards,
Claudia."

Station News:
Grasse and coordination with Sentinel-3 calibration retro

- CNES and GeoAzur recently started an experiment in **Grasse (Calern)**, France, installing a corner reflector next to the Grasse Laser Station (MeO) **to validate the performance of the Sentinel-3 topography mission**. The corner reflector works very well, they would now like to use the laser to go further.
- The Grasse laser station is part of the ILRS network. Even though Sentinel-3A&B are both registered in the ILRS priority list, these satellites are restricted due to the presence of optical payloads onboard the satellites which could be damaged by a Laser.

CNES and GeoAzur need:

- The maximal authorized intensity in nanoJ/cm² to adjust MeO's intensity to this specific mission (especially since MeO is initially designed for lunar laser ranging experiments).
- An authorization to perform the laser tracking for GeoAzur (Clément Courde).

Clément sent parameters, and could possibly range with the coherent laser, but still power is too high. Mission asked if power is tunable. ILRS will continue to work on getting a signed agreement for Restricted Tracking if possible.

Mission News: ICESat-2 tracking by new stations

- Scott Luthcke and his team requested that we check on a few stations and see if we can add a few more. They will need to be evaluated by the mission once the current System Parameters are provided, to see if they can safely track ICESat-2.
  - San Fernando – SFEL (San Fernando, Spain); recently passed quarantine, new improved system.
  - SOSW - 7827 (Wettzell, Germany); hasn’t tracked since late 2020.
  - ZIML - 7810 (Zimmerwald, Switzerland); hasn’t tracked since early 2022.
  - HARL - 7501 (Hartebeesthoek, South Africa); no tracking from 2022-2023, resumed tracking in 2024, but recently hasn't tracked since late 2024.
  - MDOL - 7080 (McDonald Observatory, Texas); on our approved stations list, but hasn’t tracked throughout the mission.

  Checking on the status for each one, to report back to Scott. Already reported on HARL.

Mission Updates/New Missions: QZS-5 & -7, NanoFF-B

QZS-5 and QZS-7:

- QZS-5 and QZS-7 (JAXA, Kakeru Fukumitsu) that the missions were approved for support, The mission communicated that when those are launched and support begins, the following satellites will be the ones to include in the Priority Tracking list for this GNSS constellation (4 satellites): QZS-5 (1587), QZS-7 (1588), QZS-1R (1585), QZS-6 (1586)
- SIC assigned:

QZS-5	**1587**
QZS-7	**1588**

NanoFF B:

- Tracking for the **NanoFF B** satellites campaign started on September 29th, 2025.
- Van asked that the service providing time offsets included the satellite in their roster.
- Sent a message to the stations to announce the start of support for this mission is requested.
- Predictions are being delivered to the CDDIS/EDC, and they have passed the QC.
- Mission page: https://ilrs.cddis.eosdis.nasa.gov/missions/satellite_missions/current_missions/nanoFF_general.html

NanoFF – Campaign details

https://ilrs.gsfc.nasa.gov/missions/satellite_missions/current_missions/nanoFF_general.html

Detailed Tracking Plan for NanoFF-B (NORAD: 58755, ILRS ID 2318517)
(Updates were provided to the network as needed)
Requested start date: on or after **29 September 2025** (tentatively)
End date: **31 December 2025** (tentatively)
Total requested tracking duration: ~50 hours

Low priority:
29 September – 12 October 2025 (5 hours)

1. Stations are requested to attempt tracking NanoFF-B at their convenient times/dates.
2. Purpose: verification of GNSS-based orbit determination (low-frequency GNSS) against SLR measurements.
3. Thruster maneuvers: Δv up to 2 cm/s (~37 m mean semi-major axis change) every 3–4 days. Thruster maneuvers will be announced through the standard notification protocol and reflected in updated CPF prediction files.

High priority:
13 October – 31 December 2025 (45 hours)

1. Mission activities
   - Satellite will be commanded to record GNSS data at higher frequency during these intervals, for later analysis.
   - Raw GNSS data will also be recorded.
   - The mission team understands that stations will track/observe the satellite whenever possible based on predictions. This is subject to weather and other operational constraints.
2. In line with ILRS CB's guidance, the mission will also issue SLRMail notifications (copied to ILRS CB).
3. No thruster maneuvers are planned. Differential drag will be used to control the relative along-track separation of the formation.

NanoFF – Tracking as of November 20th, 2025 (EDC)

NanoFF-B (2318517)

ILRS Tracking Statistics of Normal Points (CRDv2)

Station	First Observation	Last Observation	Pass-Segments	Observations	Duration in [s]
70900513, Yarragadee	2025-10-20 01:57:19	2025-11-14 14:45:36	8	94	785
72496102, Beijing	2025-11-04 14:52:57	2025-11-04 14:56:57	1	5	241
78106801, Zimmerwald	2025-10-28 20:41:40	2025-10-28 20:44:58	1	14	199
78176201, Yebes	2025-10-17 22:14:49	2025-10-17 22:15:52	2	19	120
78403501, Herstmonceux	2025-10-01 21:24:46	2025-10-09 21:52:59	2	10	209
78418701, Potsdam	2025-10-24 19:42:40	2025-10-24 21:19:38	2	13	292

Last update: Nov. 20, 2025, 1:13 p.m.

Distance between the spacecrafts is now between 50 km - 100 km.

Mission Updates/New Missions: HTV-X

- **HTV-X Objectives:**

The HTV-X will transfer essential cargo such as large-sized devices for the ISS and life support goods for astronauts. The costs for the HTV-X will be cut down through compact designing and efficient operations. Moreover, the HTV-X will be designed to become more useful for owners of experiment devices on earth.
After transporting cargoes and leaving the ISS, the HTV-X can be used as a platform for technical demonstration. Users of the HTV-X can be engaged in demonstration experiments for advanced technologies on the orbit for up to 18 months.

HTV-X will also be able to propose solutions to national challenges and take part in innovations by conducting experiments for acquisition of new technologies even outside of space business.

- **Mission Instrumentation:**

The Service Module is the module which integrates all the functions required for the HTV-X to navigate in outer space. It also has functions of transporting exposed cargoes and devices to be used in technical demonstration missions.

The design concept of the integrating Service Module enables new applications such as independent flight of the Service Module and its docking with other modules in outer space.

Evolution from the H-II Transfer Vehicle (HTV) "KOUNOTORI":
https://humans-in-space.jaxa.jp/en/htv-x/specifications/

For more details, please refer to https://humans-in-space.jaxa.jp/en/htv-x/specifications/

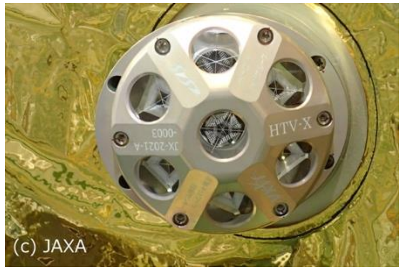
Mission Updates/New Missions: HTV-X

- **HTV-X Parameters:**

HTV-X Parameters	
Sponsor:	JAXA
Expected Life:	Up to 18 months after leaving the ISS
Primary Application:	Transfer essential cargo such as large-sized devices for the ISS/conduct experiments
COSPAR ID:	2025-241A/ILRS ID 2524101
SIC Code:	1559
Satellite Catalog (NORAD) Number:	66174
Launch Date:	October 21, 2025
LRA Diameter:	Approx 12 cm
LRA Shape:	A pyramid with the apex of a hexagonal pyramid cut off
Reflectors:	7 CCRs in LRA
Orbit:	ISS orbit
Inclination:	51.7 deg
Eccentricity:	Approx 0
Perigee:	Approx 400 km ~ 430 km
Period:	Approx 91 minutes
Weight:	16,000 kg (Launch Mass)

HTV-X, the new unmanned spacecraft now being developed by JAXA as the successor to the "Kounotori" (HTV) (Courtesy of JAXA).

Apparence of Mt.FUJI Retroreflector (Courtesy of JAXA).



HTV-X will remain docked to the ISS for a while. Shinichi Nakamura expects that SLR observations of HTV-X will bwgin around **February 2026**. Once the schedule is confirmed, the ILRS will be contacted.

Satellite Name	Satellite (COSPAR) ID	SIC Code	Satellite Catalog (NORAD) Number	NP Indicator	Bin Size (Seconds)	Altitude (km)	Inclination (deg)	Orbital Period (mins)	First Tracked Date
HTV-X	2025-241A/ILRS ID 2524101	1559	66174	1	5	400 -430	51.7	~91	

Based on altitude, it can be placed on the priority list after Cyosat-2, and before PAZ, at 4, for the time we are supporting the mission. Stations will accommodate depending on other tracking priorities.
When I am advised that predictions have been submitted and have passed the QC, I will inform the stations that support can begin, coordinating with the mission colleagues at JAXA.

Mission Updates/New Missions: HTV-X

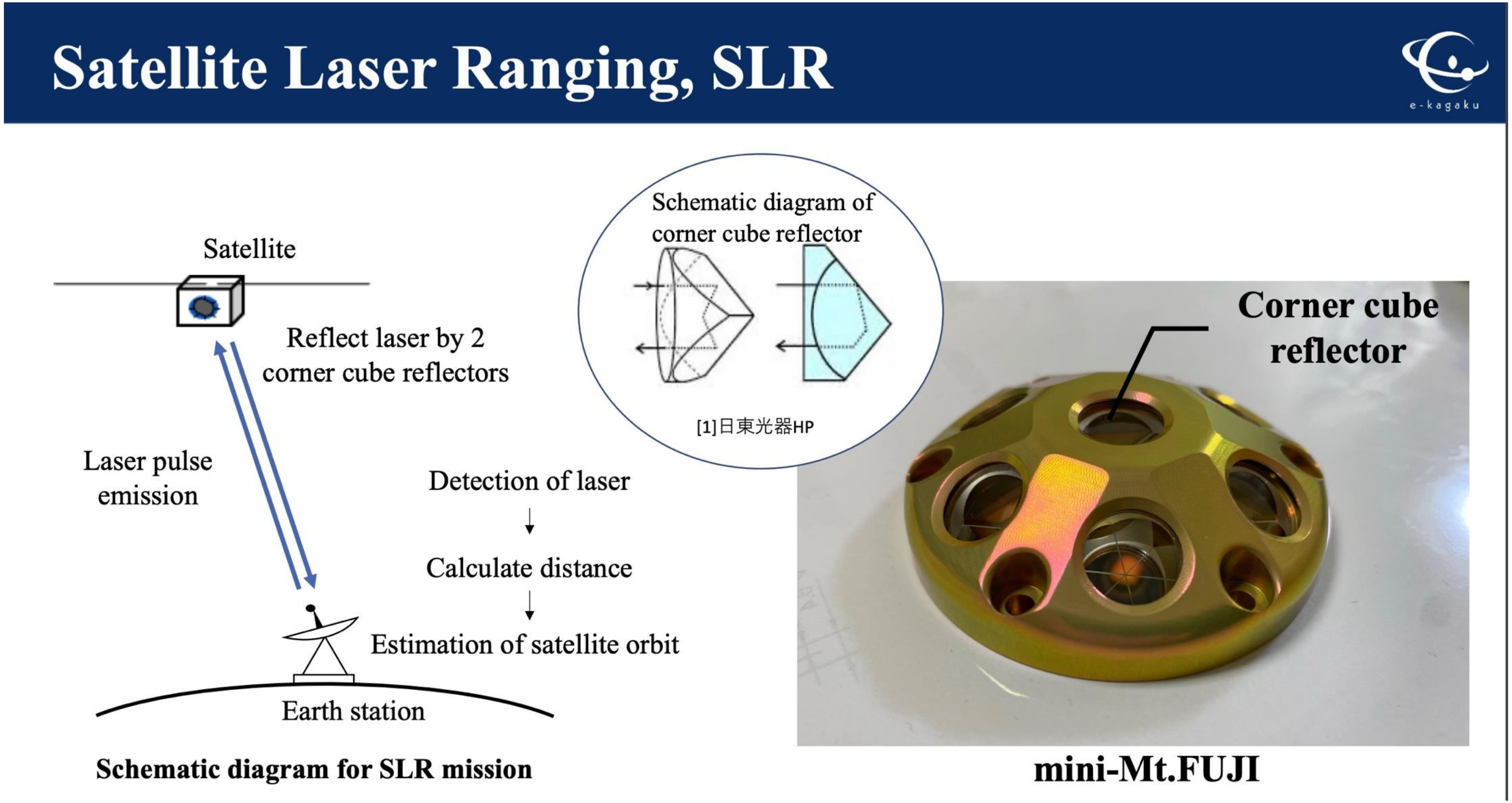
- **HTV-X** launched **October 26, 2025**. Shinichi Nakamura (JAXA) will report as soon as the observation period for SLR using HTV-X is decided on details for the support of the tracking campaign. Sent the request for the update to the ILRS Mission page to link it to the Active missions, and move it from the Future Missions. [No updates to ILRS webpages are happening during Government Shutdown]
  - Mission launch page https://www.youtube.com/live/ljdP_M5k_-g
  - We assigned the **SIC 1559** to HTV-X.
  - **COSPAR 2025-241A/ILRS ID 2524101; NORAD 66174.**

新型宇宙ステーション補給機1号機（HTV-X1）／H3ロケット7号機打上げライブ中継

HTV-X will remain docked to the ISS for a while.

SLR observations of HTV-X will occur around February. Shinichi Nakamura will communicate with the ILRS.

Mission Updates/New Missions: e-Kagaku-1



Note: The ekagaku1 satellite is not a JAXA satellite. It was developed and is operated by students from junior high school through university. JAXA is assisting with the SLR implementation.

Mission Updates/New Missions: e-Kagaku-1

- **e-kagaku-1** was transported to the ISS in September. It was released from the ISS on October 10th. In fact, radio communication has not been established since then. The satellite mission now stands on the brink of success or failure. Mission sincerely requests our cooperation.
- CPF were distributed starting Nov. 4th, 2025, created using orbits derived from JAXA's SSA radar observations. We believe it offers higher accuracy than TLE.

  Satellite Name: ekagaku1
  SIC: 1558
  NORAD ID: 65942
  COSPAR: 1998-067XP
  ILRS ID: 9806736
  Altitude: Approximately 400 km.

Satellite Name	Satellite (COSPAR) ID	SIC Code	Satellite Catalog (NORAD) Number	NP Indicator	Bin Size (Seconds)	Altitude (km)	Inclination (deg)	Orbital Period (mins)	First Tracked Date
ekagaku1	1998-067XP	1586	65942	1	5	500	51.3	92.2 - 94.6	-

- Shinichi Nakamura (JAXA) is coordinating tracking activities:
  - JAXA is uploading the CPF for the ekagaku1 satellite to the EDC. Issues with uploading to CDDIS.
  - Due to maintenance, JAXA will not update the CPF for the ekagaku1 satellite on Saturday (11/7) and Sunday (11/8). No need to conduct SLR observations of the ekagaku1 satellite on Saturday and Sunday of last week, no updates since the following Monday.
  - SLR observations of ekagaku1 will resume on Monday, November 9.
  - We have not yet detected the ekagaku1 satellite by SLR, but the mission will appreciate everyone's cooperation.

Mission Updates: Sentinel-6B/Jason CSB

We are happy to announce the successful launch of the Sentinel-6B/Jason CS-B mission.
The Sentinel-6B satellite was launched on November 16, 2025, at 9:21 p.m. PST from Vandenberg Space Force Base in California, using a SpaceX Falcon 9 rocket.

You can view the launch in the mission page at https://science.nasa.gov/mission/sentinel-6B/

The ILRS GB approved SLR tracking support for this mission.
The Sentinel-6/Jason-CS mission is a joint oceanography mission to monitor global ocean circulation and sea-level.
The Sentinel-6B/Jason-CSB satellite is the follow-on to the TOPEX/POSEIDON, Jason-1, Jason-2, Jason-3 and Sentinel-6A/Jason-CSA satellites.

The Jason-CS Programme – established by Declaration EUM/C/83/15/Dcl.I – constitutes EUMETSAT's direct contribution to the funding, development and implementation of the Sentinel-6/Jason-CS mission, which also involves ESA, the EU, NOAA, NASA, and CNES.

Baris Kostal (Copernicus Ground Segment System Engineer) interacted with CDDIS and EDC to get the flow of predictions tested, and delivered.

The mission will not reach the Science Orbit until **December 16th, 2025**. A message was sent to the stations and the community in preparation for support.

Mission Updates: GPS III and GRITSS

Expecting a MSRF from Stephen Merkowitz for two of the upcoming **Global Positioning System (GPS) III** launches (first as early as the end of January 2026). Several factors including the recent US Government shutdown held up finalizing some of the details needed to complete the form. The presentation at 2019 Canberra ILRS Workshop has more details: https://ilrs.gsfc.nasa.gov/lw21/docs/2018/presentations/Session6_Merkowitz_presentation.pdf

We are also waiting for the MSRF for **GRITSS.**
GRITSS (Geodetic Reference Instrument Transponder for Small Satellites): This is a current technology demonstration mission that uses a CubeSat to improve the accuracy of the International Terrestrial Reference Frame, which is vital for Earth science missions. Launch expected in June 2026 (TBD).

For more information: https://ntrs.nasa.gov/citations/20240000613

Coordination between GEDI and ACES Experiment

Scott Luthcke (NASA GSFC, CO-Investigator for the GEDI mission) is looking to have better coordination between GEDI and the ACES project.

GEDI mission: https://gedi.umd.edu/mission/mission-overview/

•GEDI has been deployed on the International Space Station (ISS) since 2018.
•GEDI produces the first high resolution laser ranging observations of the 3D structure of the Earth.
•GEDI makes precise measurements of forest canopy height, canopy vertical structure, and surface elevation.
•GEDI radically improves our ability to understand important atmospheric and water cycling processes, biodiversity, and habitat.

Scott and his team are in charge of operational orbits and geolocation of the GEDI laser altimetry measurements**. The laser altimeter is a sensitive instrument on the ISS.**

The GEDI instrument/mission may be impacted by the ACES experiment and the laser energy of the stations currently lasing to the ISS. They are currently taking significant steps to try and point away.

Therefore, the GEDI mission would like a direct communication line so they can get the schedule for tracking and discuss their assumptions. The ILRS share the ACES contacts, and requested that they coordinate with Scott Luthcke. No response yet.

UAW Munich (first week of March, 2026)/REFAG2026 Symposium

The next GGOS/IERS Unified Analysis Workshop (UAW2026) is taking place at the same venue of the REFAG2026 Symposium (Munich, Germany) in the following two days (5 and 6 March 2026). For details, please see https://geodesy.science/events/munich2026/. Need to identify within the ILRS any key issues related to data analysis that your Service would like to discuss. It is of the utmost importance to select topics that are common to other techniques, without including issues that can be treated internally by our Service.
Frank Lemoine is coordinating with ASC and others to define topics and recommend possible participants.
No updates on participants, let us know if you are attending.

Laura Sanchez sent a message listing topics that will be discussed.

REFAG2026 deadline for abstracts was extended to November 2nd.
Did anyone submit an abstract?

AGU (Dec 15-19, 20205, New Orleans, Luisiana, USA)

Congratulations to the AGU Awardees – Geodesy Section: AGU celebrates individuals who have made significant contributions to the Earth and space sciences every year.

Geodesy Section recipients of AGU's 2025 honors:

Helen A. Fricker, 2025 William Bowie Lecture

Jérôme Benveniste, 2025 Ivan I Mueller Award for Distinguished Service and Leadership

Wenbin Xu, 2025 John Wahr Early Career Award

Felix W. Landerer, 2025 AGU Fellow

AGU will be presenting the **John Wahr** and **Mueller** awards to the recipients at this year's **Bowie Lecture**, so make sure to join us there.

And please remember to nominate your deserving colleagues for Geodesy section awards and other AGU awards, including AGU Fellowship nominations. Further details on the John Wahr Early career Award (and past recipients) can be found here.

Question to the ILRS CB (Your inputs requested):

From: matthias.simon--- via ilrs-cb <ilrs-cb@lists.nasa.gov>
Date: Friday, November 7, 2025 at 11:49 AM
To: ilrs-cb@lists.nasa.gov <ilrs-cb@lists.nasa.gov>
Cc: thomas.zechel@dlr.de <thomas.zechel@dlr.de>
Subject: [ilrs-cb] Using ILRS for a GNSS demonstration mission based on Cubesats

Dear all,
we are currently developing a demonstration mission utilizing two Cubesats in LEO for monitoring GNSS measurements from different satellites of several GNSS constellations.
As there is a need to verify the position and attitude of these demonstrators, it is intended to use SLR as verification method.
Before taking this method as granted and before starting with a more detailed design of the mission, I wanted to know if this is generally possible that IRLS is able to provide SLR measurements and whether ILRS would be willing to support this mission.

If you have any further questions, please feel free to ask.

Best regards,
Matthias Simon

Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR)

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Recent Papers:

- **Definition and Realization of the International Lunar Reference Frame, by** K. SoÅLsnica, A. Fienga, D. Pavlov, N. Rambaux, and R. Zajdel, Astronomy and Astrophysics, arXiv:2510.15484v1 , https://doi.org/10.48550/arXiv.2510.1548
- **Retroreflectors for space traffic management**, by Moritz Vogel,* Nils Bartels, Wolfgang Riede, Stefan Scharring, and Thomas Dekorsy, German Aerospace Center, Institute of Technical Physics, Pfaffenwaldring 38-40, 70569 Stuttgart, Germany (moritz.vogel@dlr.de), Applied Optics, Vol. 64, No. 31 / 1 November 2025
- Advancing multi-GNSS orbit combination in the variance component estimation framework, by Radosław Zajdel, Gustavo Mansur, Pierre Sakic, Paul Rebischung, Andreas Brack, Benjamin Männel, Jan Douša, Journal of Geodesy (2025) 99:90, https://doi.org/10.1007/s00190-025-02005-w
- Extending the ICESAT-2 ATLAS Lidar Capabilities to Other Planets Within Our Solar System, by John J. Degnan, Independent Research, Odenton, MD 21113, USA; jjdegnan3rd@gmail.com, Photonics 2025, 12, 1038, https://doi.org/10.3390/photonics12101038