January 17th, 2023.

ILRS QCB Meeting September 21, 2022
Virtual Meeting (9 AM – 11:37 AM EST – 14:00 UTC)
Next Meeting:
January 18th, 2023
9:00 am – 11:00 am EDT (14:00 (14:00 UTC)

Participants:

Erricos Pavlis, José Rodriguez, Stefan Rieppl, Van Husson, Peter Dunn, Randy Ricklefs, David Sarrocco, Mike Pearlman, Frank Lemoine, Graham Appleby, Tom Oldham, John Ries, Claudia Carabajal.

The charts from the meeting will be available at:
https://ilrs.gsfc.nasa.gov/science/qcb/qcbActivities/index.html

Agenda:

Analysis Centers - Erricos

- Implementation of the CRDv2 format, History Logs, ITRF updates.

Jose Rodriguez:

- Center of mass correction in preparation for the ASC products. (Slides provided).

Van Husson:

- Recent 7839 Graz range biases (1 or 2 slides) (Slides provided)
- 7501 Hartebeesthoek calibration target change in April 2012 (slides provided)
- Simosato LAGEOS return rates still very low (Slides provided)

Peter Dunn:

- Large height jump at HART in 2012 (picked up in ITRF2014, and ITRF 2020 SSEM analysis)

Stephan Riepl:

- Optimal Wiener filter (see presentation)

Other items by other members.

José Rodriguez (see slides provided):

José presented on the updates to the center of mass corrections in preparation for ITRF2020 products. CoM version adopted for 1993 to 2020 was v200608.
For the ITRF2020 reanalysis ASCs were asked to deliver solutions for the 1983–1993 period, valuable for the computation of the different global TRF solutions (IGN, DGFI, JPL).
A coarse approach was followed to provide the corrections for several missing pre-ILRS stations. v210511 adopted for the reanalysis. ILRS ASC will soon transition to ITRF2020 standards for their daily and weekly products. There have been recent station updates, and some missing stations, which required a minor update to the corrections.
Very small differences (mostly sub-mm) obtained given the modest system changes.
Exception for LAGEOS:
– 7821 SHAO2 tweaked leading edge filter in 2021
– ~3.4 mm difference in both LAGEOS and LAGEOS-2
Probably too early to notice from the regular RB time series
See presentation for details on the updates.
For 7110 (Monument Peak, California):
– Corrected Etalon 20 mm error (and Ajisai 14 mm)

– Found out reason for the strange value other instances → modelling inconsistency
Van commented that the MOBLAS systems (7090, 7105, 7110, 7124, 7501) sometimes use their secondary receiver, the high sensitivity laser receiver (HSLR), for tracking Etalon and other HEOs. The HSLR uses an amplifier to amplify the received signal by 24 dB. In the historical dataset (CRD V1 and CTSG), the only way to tell when the HSLR was used is by the system delay. The CoM correction between the MOBLAS primary and secondary receiver are probably different. The current Etalon CoM corrections are based on the primary receiver configuration. If new CoM corrections for the secondary receiver could be developed, Van could provide the time periods when the HSLR were in use by the MOBLASs.

From now on, the models and documentation will be available from:
https://icts-yebes.oan.es/slr/com_models/

Erricos – ITRF update – History Log updates, CRD V2 Implementation (see tables included, as updated for the ILRS meeting on January 9th, 2023), Bias validation:

- San Fernando (7824) ETU vs TIU Bias Validation:

The bias between the two timing units was estimated from the comparison of range bias estimates calculated on the basis of two separate data groups taken on the same passes of LAGEOS, LAGEOS-2, LARES and Starlette. The TIU measures shorter than the ETU by ~10 mm. The ETU became the operational unit for the station on Aug. 30, 2022 at 10:00 UTC.

- Riga (1884) Bias Validation SLRF2014 vs SLRF2020:

Riga has been tracking again recently and is trying to complete quarantine soon. They asked to be evaluated with the use of the new (ITRF2020) coordinates instead of 2014 because of the known errors in the old ITRF. We did the analysis both ways to show them the effect of the two TRFs and their current data look very good using SLRF2020. From biases at the level of -200 mm with ITRF2014, the new coordinates are now showing only -7 mm on LAGEOS and -14 mm on LARES, with a precision of 4-5 mm.

- SOS-Wettzell (7827) Preliminary QC after returning to operations:

The initial data that we received from 7827 indicate that the updates to the system resulted in less noisy data compared to what we had seen just before it stopped tracking in the fall of 2020. Bias results look promissing and we expect to have the station soon out of quarantine.

Erricos also reported that the LARES-2 mission has released the coordinates of the CCRs on the satellite body to José Rodriguez with the caveat that he does not make them public. The calculated CoG corrections will be public as soon as they become available.

Van Husson (see slides):

- 7501 HARL Calibration Time Series Analysis

Between 11-Mar-2012 to 4-Apr-2012, 7501 would alternate between calibration targets (D&E) with Target E being prime. On 4-Apr-2012, a MINICO was taken between Targets E & D with an offset of -5.4 mm after accounting for a typo (-66 mm) in the onsite Target E range. Post 4-Apr-2012, Target D was the prime calibration target.

In ITRF2020, there is a 'unknown' height discontinuity that coincides with the calibration target switch.
No height for 2 weeks – someone to ask Zuheir about it.

Peter Dunn rationalized SSEM biases with 2020 position time series. Short term 6 mm error that shows in heights (one height point). What does the analysis group see? 2 cm drop after April 1st, 2012.
Erricos will investigate. John Ries commented that the data was tossed between those dates in his analysis. Graham commented that we need to look at the height at station for that period. Needs further research.

- 7839 Graz Analysis

Graz had a slowly drifting barometer between 1-Jan-2015 and 10-Dec-2020, which was resolved when the barometer was replaced. Based on JCET analysis, the negative barometric drift induced a drifting positive range

bias.
Based on replacing the barometric with a newly calibrated on 10-Dec-2020, it was expected the LAGEOS range bias estimates in 2021 would return to previous 2015 range bias levels. However, based on JCET analysis, that did not occur, therefore it appears a new positive mm level range bias was introduced around the same time of the barometric replacement. On 29-Jun-2022, Graz replaced their laser start diode which appears to have changed the bias again, but more data is needed since Graz range biases have annual signals.

- 7838 Simosato Analysis

Simosato continues to struggle with extremely low return rates since they switched to a 1 kHz laser in December 2018.

Peter Dunn: Will present at the next ILRS QCB meeting, if issues are resolved.

Stephan Riepl: Optimal Wiener filter (see presentation)
Optimal Wiener Filter for multiphoton systems – comparison of Lageos1 and Lageos2 data
Summary:
Lageos1 and Lageos2 full rate data from 2019 has been analyzed for the stations 7090, 7105, 7110 and 7941 in order to derive empirical system specific transfer functions (ESSTF) for each station.
Residual histograms have been obtained by using the orbitNP algorithm, from which an instrument function derived from calibration rms is deconvolved.
The differences obtained for the yearly average are found to be marginal as an overall comparison of the statistical moments of the transfer functions underpins.
The timeseries obtained from the monthly averaged transfer functions statistical moments in general show the same signatures for Lageos1 and Lageos2.
In conclusion the obtained transfer functions show system specific features rather than satellite specific ones. The statistical moments of the transfer functions agree within the error for Lageos1 and Lageos2.
In turn the monthly averaged ESSTFs are used to calculate normal points, which mitigates the dispersion in the normal point rms vs normal point residual statistics and confines the resulting normal points to rms values obtained in calibration measurements.

Next meeting, December 7th, 2022. Meeting was postponed.

The next QCB meeting will be held on January 18th, 2023 at 9 am EDT (14:00 UTC).

Table 1. History Log Voids by Station (2022.12.29)

Station Location	CDP #	Time Gap(s)*				Last entry
Kiev	1824	000120-080302	080402-110515			141410
Komsomolsk	1868	NO DATA				
Simeiz	1873	NO DATA				
Mendeleevo	1874	NO DATA				
Altay	1879	NO DATA				
Riga	1884					220825
Arkhyz	1886	NO DATA				
Baikonur	1887	NO DATA				
Svetloe	1888	NO DATA				
Zelenchukskaya	1889	NO DATA				
Badary	1890	NO DATA				
Irkutsk	1891	NO DATA				
Katzively	1893	NO DATA				
Yarragadee	7090					220920
Greenbelt	7105					221204
Monument_Peak	7110					210802
Haleakala	7119					221110
Tahiti	7124	020825-080414	130321-191022			210415
Changchun	7237	950101-970802	020714-051002	180410-210106		211215
Beijing	7249	881101-940301	940301-981116	981116-211013		211220
Sejong	7394	NO DATA				
Wuhan	7396	NO DATA				
Arequipa	7403	920718-951023	951023-981130	981130-010523		200629
San Juan, Argentina	7406	NO DATA				
Brasilia	7407	NO DATA				
Hartebeesthoek_HARL	7501	020409-081105				221120
Hartebeesthoek_HRTL	7503	NO DATA				
Izana	7701					
Zimmerwald_532	7810	030905-060203	080715-100901			220222
Borowiec	7811	030329-071227	080205-131218			211005
Kunming	7819					221212
Shanghai_2	7821	140222-170315	170720-190811			210922
San_Fernando	7824	900703-930222	971216-010124	090302-110601	180801-210518	220830
Mount_Stromlo_2	7825					210901
Wettzell_SOSW	7827	140501-160511	160511-190528			200424
Simosato	7838	900701-950810	950810-991007	991019-040701	080401-181212	211209
Graz	7839	150504-190311				220629
Herstmonceux	7840					220210
Potsdam_3	7841	040906-081026	081026-110501	170303-200303		211229
Grasse_MEO	7845	010601-200818				220722
Matera_MLRO	7941	140902-171204	171206-210629			220718
Wettzell	8834	980720-001012	001012-090324	090324-131021	170407-190604	210115

* Assuming at least 2 year data gap

Status 2022.12.29

Table 2. Latest status on CRD v2

In testing or Done	Close to submission	No Response	Monument	Code	Location Name, Country	JCET testruns NOV.2021-JAN.2023	Insufficient Passes 1/4/23
			1824	GLSL	Golosiiv, Ukraine	1824	
			1868	KOML	Komsomolsk-na-Amure, Russia		
			1873	SIML	Simeiz, Ukraine	1873	
			1874	MDVS	Mendeleevo 2, Russia	1874	
			1879	ALTL	Altay, Russia		
			1884	RIGL	Riga, Latvia		1884
			1886	ARKL	Arkhyz, Russia	1886	
			1887	BAIL	Baikonur, Kazakhstan		
			1888	SVEL	Svetloe, Russia	1888	
			1889	ZELL	Zelenchukskya, Russia	1889	
			1890	BADL	Badary, Russia	1890	
			1891	IRKL	Irkutsk, Russia	1891	
			1893	KTZL	Katzively, Ukraine	1893	
	no data for L1/L2/LRS		7045	APOL	Apache Point, NM	7045	
			7090	YARL	Yarragadee, Australia	7090	
			7105	GODL	Greenbelt, Maryland	7105	
			7110	MONL	Monument Peak, California	7110	
			7119	HA4T	Haleakala, Hawaii	7119	
			7124	THTL	Tahiti, French Polynesia	7124	
			7237	CHAL	Changchun, China	7237	
			7249	BEIL	Beijing, China	7249	
			7394	SEJL	Sejong City, Republic of Korea	7394	
			7396	JFNL	Wuhan, China	7396	
			7403	AREL	Arequipa, Peru	7403	
			7406	SJUL	San Juan, Argentina		
			7407	BRAL	Brasilia, Brazil		
			7501	HARL	Hartebeesthoek, South Africa	7501	
			7503	HRTL	Hartebeesthoek, South Africa	7503	
			7701	IZ1L	Tenrife, Spain	7701	
			7810	ZIML	Zimmerwald, Switzerland	7810	
			7811	BORL	Borowiec, Poland	7811	
			7819	KUN2	Kunming, China	7819	
			7821	SHA2	Shanghai, China	7821	
			7824	SFEL	San Fernando, Spain	7824	
			7825	STL3	Mt Stromlo, Australia	7825	
			7827	SOSW	Wettzell, Germany	7827	
			7838	SISL	Simosato, Japan	7838	
			7839	GRZL	Graz, Austria	7839	
			7840	HERL	Herstmonceux, United Kingdom	7840	
			7841	POT3	Potsdam, Germany	7841	
			7845	GRSM	Grasse, France (LLR)	7845	
			7941	MATM	Matera, Italy (MLRO)	7941	
			8834	WETL	Wettzell, Germany (WLRS)	8834	
37		**0**	**5**		43	**36 + 1**	1

Release 2023.01.04

Table 3. Quarantined Stations

	Station	Code	Site	DC	SOD	DOMES	First Data	Last Data	
	1824	GLSL	Golosiiv, Ukraine	EDC	18248101	12356S001	2000-02-15	2023-01-04	today
	1868	KOML	Komsomolsk-na-Amure, Russia	EDC	18685901	12341S001	1992-06-19	2021-04-22	622 day(s)
	1879	ALTL	Altay, Russia	EDC	18799401	12372S001	2008-11-19	2021-04-23	621 day(s)
	1884	**RIGL**	**Riga, Latvia**	**EDC**	**18844401**	**12302S002**	**1987-09-21**	**2022-12-19**	**16 day(s)**
	1886	ARKL	Arkhyz, Russia	EDC	18869601	12373S001	2010-12-03	2022-07-09	179 day(s)
	1887	**BAIL**	**Baikonur, Kazakhstan**	**EDC**	**18879701**	**25603S001**	**2011-10-17**	**2022-12-28**	**7 day(s)**
	7407	BRAL	Brasilia, Brazil	EDC	74072701	48081S001	2014-05-12	2021-08-30	492 day(s)
	7810	ZIML	Zimmerwald, Switzerland	EDC	78106801	14001S007	1997-07-09	2022-02-14	324 day(s
	7306	**TKBL**	**Tsukuba, Japan**	**EDC**	**73069301**	**21797S001**	**0000-00-00**	**0000-00-00**	**None day(s)**