June 21,2022

ILRS QCB Meeting
April 13, 2022
Virtual Meeting
Next Meeting June 27, 2022
9:00 am EDT (14:00 UT)

Participants

Erricos Pavlis, Jason Laing, Claudia Carabajal, Stefan Ripple, Van Husson, Peter Dunn, Randy Ricklefs, Mike Pearlman, José Rodríguez, Jeffrey Dorman, Toshi Otsubo, Frank Lemoine.

The charts from the meeting are available at
https://ilrs.cddis.eosdis.nasa.gov/science/qcb/qcbActivities/index.html

Erricos – ITRF update, History Logs, etc.

The ITRF has been issued by Zuheir, the plan for implementation is still pending. The SLRF2020 will be issued shortly with a description of the bias model, and its implementation instructions; it will include new stations that were not included in the ITRF development along with the historical short-occupation sites (WEGENER, MedLAS, etc.).

Not much progress has been made in the History logs; the major delinquents are the Russians and the Chinese. See Table 1 - History Log Voids by Station dated 05/24/2022.

Progress has been made in the validation of the transition to CRD v2. Again, we have large voids in particular in the Russian Network. See Table 2 – Latest Status on CRD V2 dated 06/07/2022.

The new ILRS station in Izaña, Tenerife (7701) has passed qualification and is now in operation.

The process for reviewing site logs is already an established procedure; Christian is the focal point; Van and Randy will help review the new and updated site logs. If we have not already done so, we should alert the stations to be more vigilant on some items submitted in the site logs (e.g. station names) that may have been taken as a station choice without following the prescribed rules (to avoid inconsistent station names).

To address Standardization of site names, Erricos will provide a list of site names used by the analysis group to Claudia as a good start (once SLRF2020 is released). The names should be a single word with 5 characters, the same as those in the Site Logs, the data reports, etc. Any change of names needs to be vetted with the stations. Christian can change the names in the EDC site and the Site Logs if necessary, avoiding action by the stations. Aside from the Site Logs, bias reports from the different analysis centers may contain a site name. We need to get folks to establish proper names.

Erricos has contacted Christian regarding stations that have not operated for a year, but have not been moved to quarantine at the EDC. Christian was going to look into an automated or manual mechanism to move dormant stations into quarantine. Case in point Beijing, 7249, the station returned to normal operations after a long period being down and it was placed in quarantine retroactively, starting with their first data release in February 2022.

Peter Dunn: Range biases at Herstmonceux; Interpretation of biases TLRS-3 Station (pre-1998 Station logs) – Arequipa, Peru.

At Herstmonceux, when a measured calibration offset of 8.5 mm was applied to the Stanford SR620s: between February 2002 and February 2007, Herstmonceux data reads short on LAGEOS-1 by -2.7 +/- 1 mm standard error.

When the Stanford Research counter was replaced by the unbiased Herstmonceux Event timer: between February 2007 and June 2020, Herstmonceux reads short on LAGEOS-1 by -2.1 +/- 1 mm standard error. The most likely reason for a 2 or 3 mm bias is CoM offset. LAGEOS-2 also has a consistent, but slightly smaller offset.

Van Husson: CoM and SSEM Range bias issues at Monument Peak, Etalon Range biases, Graz barometer and range bias issues.

This write-up includes comments provided by Jose's comment below.

Herstmonceux LAGEOS Bin RMS vs. Range Analysis:
Toshi's past yearly aggregate analysis of SPAD stations, including Herstmonceux, has indicated a linear relationship between combined LAGEOS (LAGEOS-1 and -2) NP post-fit residuals and normal point bin RMS. One remaining question with Herstmonceux data is: Are LAGEOS bin RMS's range/elevation dependent? If so, then range/elevation dependent biases would be difficult to separate from a station height error. See "Herstmonceux Bin RMS vs Range analysis.pdf".

Two years (2016 and 2017) of Herstmonceux normal point data were aggregated by bin RMS (2 mm bins) and range (100 km bins) for each LAGEOS satellite. Aggregating by bin, RMS did not show any obvious dependency with LAGEOS-1 or -2 ranges. Aggregating by LAGEOS, range did not show any trends with bin RMS except for a noticeable reduction in bin RMS at the longest ranges (>=7900 km)/ the lowest elevation angles (slide 3).

Jose Rodriguez mentioned that Herstmonceux does not track below 30 degrees of elevation during the day for aircraft safety considerations, but during the night ranging is performed below 30 degrees. Therefore, the longest LAGEOS ranges only occur at night.

The following plot (Figure 1) was generated post meeting to show the bin RMS as a function of time of day. Since Herstmonceux is in England (i.e. local time is the same as GMT), there are BIN RMS diurnal peak-to-peak variations of ~3 mm. Based on Toshi's aggregate time of day analysis (see Figure 2), there does not appear to be a diurnal trend of the residuals.

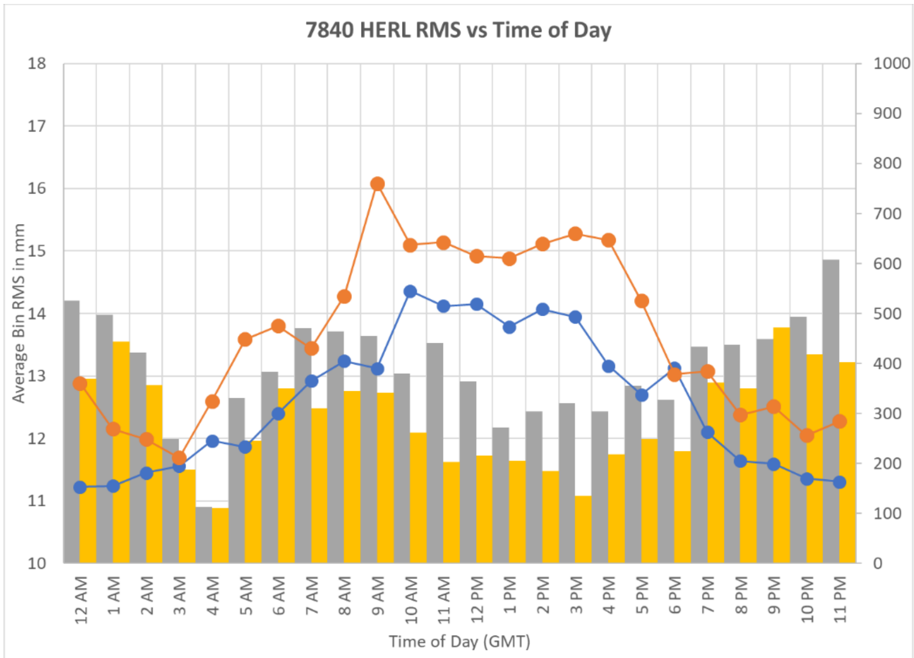

Figure 1: Herstmonceux Bin RMS vs. Time of Day

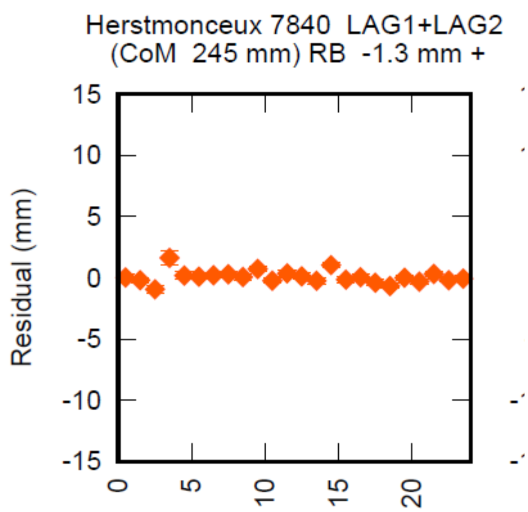

Figure 2: Toshi's Herstmonceux LAGEOS Range Bias vs. Time of Day Analysis (July 2016 to June 2017)

Graz Barometric Pressure Data Analysis:

Background: A linear barometric drift of +0.13 millibars/year in Graz's Paroscientific MET3 barometric sensor between 2015 and 2020 has been well documented and presented at past ILRS standing committee meetings.

Initially, Erricos observed a linear mm level range bias drift in both LAGEOS-1 and -2 data starting in 2015 and asked Graz personnel to investigate. Graz was able to determine there was

drift in their MET3 sensor by comparing their station barometric readings to barometric pressures from a local Austrian weather station.
(Reference: https://ilrs.cddis.eosdis.nasa.gov/docs/2020/NESC_slides_20201217.pdf)

Later, Mateusz Drożdżewski confirmed these findings by comparing Graz barometric pressures from the 2008 to 2019 timeframe with derived barometric pressures from the Vienna Mapping Function (VMF).
(Reference: **https://ilrs.cddis.eosdis.nasa.gov/docs/2022/NESC_Slides_Jan20_2022.pdf**).

The VMF data contains tropospheric parameters for each day and each SLR station with 6-hour resolution and is based on ray-traced delays from Numerical Weather Models (NWMs.) VMF data from Jan 1990 to August 2019 is openly available via the internet from **https://vmf.geo.tuwien.ac.at/trop_products/SLR/VMF3o/VMF3o_EI/** and **VMF Data Server (tuwien.ac.at)**.

Van's presentation was focused on comparing Graz barometric pressures to the Graz VMF data from the 1992 to 2011 timeframe. Based on this comparison, there were up to +6 millibar offsets between these two measurements prior to 17-September-1995 when Graz installed the Paroscientific MET3A sensor. There is excellent agreement (a mean offset of zero millibars) between the VMF and Graz barometric reading post MET3A installation. There are +/- 0.2 millibar annual variations in these 2 datasets, which are correlated with the temperature. *Note: Based on this comparison the actual implementation of the MET3 into the Graz data processing did not occur until after 21-September-1995 and not on the 17th*. See "Barometric Pressure Analysis (Graz).pdf"

Graz SSEM LAGEOS -1 and -2 range bias estimates, available from the JCET website, prior to the MET3A installation exhibit large fluctuating negative range biases which are in part caused by these high Graz barometric readings (a positive barometric error will induce a negative elevation dependent range bias).

These Graz barometric errors need to be modeled and then Graz SSEM range bias estimates need to be updated to uncover the new resultant range bias well prior to next ITRF solution. At the next QCB meeting, Van will show other examples of other stations with significant barometric errors using the VMF data for comparison. Therefore, the ILRS will need to determine the best approach for modelling past historical barometric errors.

The next QCB meeting will be held on June 27 at 9 am EDT.

Please forward suggested agenda items for the meeting to Claudia.

Table 1. History Log Voids by Station

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					220228
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					220414
Greenbelt	7105					220521
Monument_Peak	7110					210802
Haleakala	7119					220201
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
Tanegashima	7358	NO DATA				CLOSED
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				220311
Hartebeesthoek_HRTL	7503	NO DATA				
Izana	7701					
Zimmerwald_532	7810	030905-060203	080715-100901			220222
Borowiec	7811	030329-071227	080205-131218			211005
Kunming	7819	NO DATA until 220329				220329
Shanghai_2	7821	140222-170315	170720-190811			210922
San_Fernando	7824	900703-930222	971216-010124	090302-110601	180801-210518	220421
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				210326
Herstmonceux	7840					220210
Potsdam_3	7841	040906-081026	081026-110501	170303-200303		211229
Grasse_MEO	7845	010601-200818				220203
Matera_MLRO	7941	140902-171204	171206-210629			220315
Wettzell	8834	980720-001012	001012-090324	090324-131021	170407-190604	210115

* Assuming at least 2 year data gap

Status 2022.05.24

Table 2. Latest status on CRD v2

Insufficient Passes

In testing or Done	Close to submission	No Response	Monument	Code	Location Name, Country	JCET testruns NOV.2021-APR.2022	6/7/22
			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		
			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		
			7237	CHAL	Changchun, China	7237	
			7249	BEIL	Beijing, China	7249	
CLOSED	CLOSED	CLOSED	7358	GMSL	Tanegashima, Japan		
	February 2022 target date		7394	SEJL	Sejong City, Republic of Korea		
			7395	GEOL	Geochang, Republic of Korea		
			7396	JFNL	Wuhan, China	7396	
			7403	AREL	Arequipa, Peru		
			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	
	OUT OF COMMISSION INDEFINITELY		7827	SOSW	Wettzell, Germany		
			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	
31	2	10				32	0

Release 2022.06.07