ILRS QCB Meeting March 20th, 2023 (version 1)
Virtual Meeting (9 AM – 11:00 AM EST – 13:00 UTC)
Next Meeting:
<mark>**May 15th, 2023**</mark>
<mark>**9:00 am – 11:00 am EDT (14:00 (14:00 UTC)**</mark>

Participants:

Erricos Pavlis, Van Husson, Julie Horvath, Frank Lemoine, Mathis Blossfeld, Matthew Wilkinson, Mike Pearlman, Peter Dunn, Randy Ricklefs, José Carlos Rodríguez Pérez, Thomas Varghese, Tom Oldham, Stefan Riepl, Claudia Carabajal.

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

Agenda:

Van Husson:
- SPAD LAGEOS RMSs vs Range
- Analysis of 2022 ILRS Calibration and LAGEOS Moments

Other items by other members.

Van Husson (see slides):

SPAD LAGEOS RMS versus Range

Past aggregate analysis from Toshi had indicated that for the SPAD systems there is a linear trend between Normal Point (NP) residuals and single shot NP bin RMS. As the NP Bin RMS increases so did the residuals. A decrease in bin RMS implies the returns within a NP bin, on average, are closer to the leading edge of the spacecraft array. This new analysis addresses the question "Are LAGEOS single shot bin RMSs correlated with Range". The answer is no.

Of the eight SPAD systems analyzed, Herstmonceux is the only system which operates at only the single photon level. This may explain why in 2022, they are the only system that shows a clear distinction between LAGEOS-2 and LAGEOS-1 RMSs.

Analysis of 2022 LAGEOS Moments

The CRD NPs and calibration moments (RMS, skew, kurtosis) can be used as a sanity check on the calibration and satellite data screening techniques listed in the site logs.

Analysis of Izana, Tsukuba and Wettzell (SOSW) NP

Matt Wilkerson's OrbitNP program can be used for the following:
   1. to determine the data screening employed by the stations using the station's CRD data (fullrate and NPs)

   2. to determine the impact of different data screening techniques on the satellite Center of Mass (CoM) correction

3. to determine the impact of different NP algorithms

Stations 7701 and 7306 are using an undocumented Leading Edge (LE) filter on LAGEOS (-1,-2) but not LARES-2 nor other satellites. Action: These are both DIGOS systems and their site logs need an update so that new LAGEOS CoM corrections can be calculated.

Station 7827 SOSW NP algorithm is different from the Herstmonceux algorithm in two ways (selecting the epoch and applying a sigma filter to each NP bin versus the entire pass).

If fullrate residuals are not flat prior to NP formation, clipping can induce random and/or systematic errors in the NPs.

Discussion

Matt Wilkinson mentioned that Wettzell SOSW (7827) provides excluded returns in their fullrate data using the CRD FRD Filter Flag, but not all stations do this. Jose Rodriguez recommends that stations add excluded returns (e.g. within 5 sigma) to their CRD fullrate data, which will assist in computing satellite center of mass corrections.

**Discussion on ITRF2020/DTRF2020 scale time series**
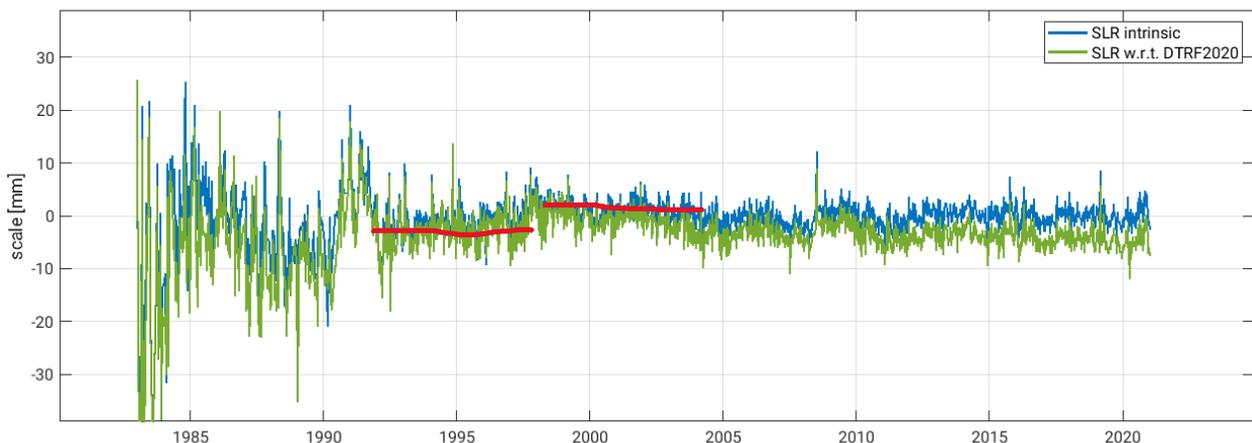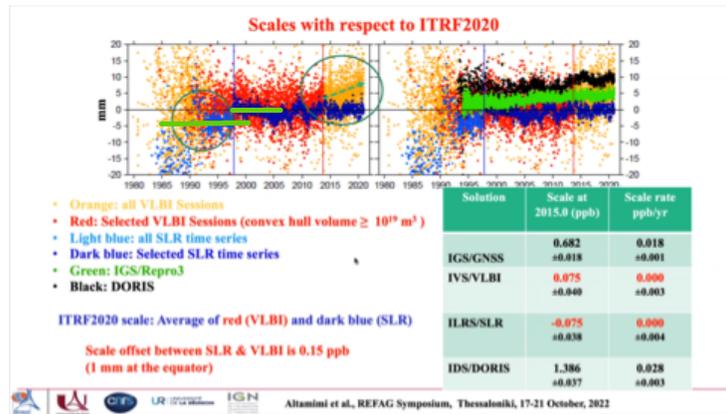
Fig. 1: upper panel: slide on ITRF2020 scale by Z. Altamimi, REFAG Symposia 2022. Lower panel: ILRS intrinsic scale time series (blue) and SLR scale time series w.r.t. DTRF2020 combined solution (green).

Figure 1 serves as basis for the discussion on potential quality issues of SLR observations which affect the ITRF scale realization. At the discussion of the last ILRS QCB, the question was asked if the jump of ~ 5mm in the ITRF2020 scale time series (1997.5) might be caused by changes of the ILRS network. M. Bloßfeld said that the comparison of the ILRS scale with the DTRF2020 does not show such systematics and that these spurious signals might be caused by the combination. As one can see from Fig. 1 (lower panel), neither the SLR intrinsic scale time series (weekly SLR solutions transformed on accumulated SLR-only long-term (secular) TRF) nor the time series of scale parameters estimation between the weekly SLR solutions and the combined secular DTRF2020 solution show these signals. This might indicate that the spurious signals in the SLR scale time series as seen in the ITRF2020 comparison are not caused by quality issues of the SLR observations.
Erricos Pavlis added the following statements:
First of all the offset is not as "terrible" as advertised, the two plots have a 1:2 scale difference and the ~5 mm drop in the ITRF2020 plot nearly the same in the DTRF2020 plot once you consider this scale difference!
The second item to consider is that at the time ~1997, things were not as organized as now and there may be eccentricity or tie issues that cause the SLR solutions to disagree with some of the other techniques defining the ITRF2020, especially since all connections are done through GPS at that time, with minimal co-location of techniques.
In that case, how each CC handles the "ties" becomes crucial and a few mm offsets can be easily introduced!

Peter Dunn:

Requested that Mathis forward the time series, commenting that the issues may be the result of data problems and combination issues, and it does not seem like an issue with the quality of the data.

The next QCB meeting will be held on May 15th, 2023 at 9 am EDT (13:00 UTC).

After the meeting, updates from the Izaña and Tsukuba stations:

3/27/23 (from Van Husson)

"
[ilrs-qcb] FW: [EXTERNAL] Re: Analysis of 7701 Izana and 7306 Tsukuba LAGEOS Data Editing Criteria
Fyi... Response from Jens in regards to a LE filter being applied for stations 7701 and 7306 for LAGEOS-1, LAGEOS-2 and Ajisai. (but NOT LARES-2). Jens will update their site log to reflect this editing criterion.

Based on my analysis using OrbitNP at our last QCB meeting, there is a 7 to 8 mm difference on LAGEOS-1 and LAGEOS-2 between their 2.2 sigma edit and their 2 cm LE filter.

Regards, Van

-----Original Message-----
From: Jens Steinborn <jens.steinborn@digos.eu>
Sent: Monday, March 27, 2023 4:35 AM
To: Husson, Van (PERATON) <vhusson@peraton.com>
Cc: Andrea Di Mira <Andrea.Di.Mira@esa.int>; nakamura.shinichi@jaxa.jp; Matthew Wilkinson <matwi@nerc.ac.uk>
Subject: [EXTERNAL] Re: Analysis of 7701 Izana and 7306 Tsukuba LAGEOS Data Editing Criteria

Dear Vanl,

you analysis is correct and the sitelog description is incomplete with respect to the Lageos handling:

1. LAGEOS-1 and LAGEOS-2 are filtered by a 2.2 sigma clipping followed by a 2cm
   Leading Edge filter.
2. Yes, Ajisai is processed with a 30cm LE filter. All other satellites are
   only filtered with 2.2 sigma clipping.
3. No changes in the data editing of any satellites have been made since
   incorporating the LE filter for LAGEOS-1/-2 and Ajisai in August 2022.

We would propose to add the following information to the sitelog:

Additional Information   : Additional leading Edge 20 mm rejection criteria for Lageos1/2;
                           : Additional leading Edge 300 mm rejection criteria for Ajisai;

Would this be acceptable for the correct CoM handling?

Beste
Jens

Am 07.03.23 um 20:59 schrieb Husson, Van (PERATON):
>
> Dear Jens,
>
>
>
> I hope you, your colleagues and their families are doing well. Also
> congratulations to you and your colleagues on the new station at Tsukuba in Japan.
>
>
>
> I noticed something about 7701 Izana LAGEOS (-1 and -2) CRD normal
> point (NP) skew that peaked my curiosity. So I downloaded the January
> 2023 LAGEOS-1 fullrate data (all stations) and then ran Matt
> Wilkinson's OrbitNP to generate NPs on a few 7701 passes to see if I
> could understand why the 7701 LAGEOS-1 and -2 skew was around minus 0.4.
>
>
>
> Based on my analysis, it appears when 7701 and/or 7306 LAGEOS (-1 or
> -2) normal points are generated, some type of Leading Edge filter
> (2cm?) is being applied after the 2.2 sigma edit (Reference: 7701 and
> 7306 Site log Section
> 10.01 On-site NP Generation at
>https://edc.dgfi.tum.de/en/stations/7701/site_log/ascii/
>and
> https://edc.dgfi.tum.de/en/stations/7306/site_log/ascii/; respectively).
>
>
>
> See attached plots of 7701 and 7306 fullrate and normal point (NP)
> residuals from OrbitNP. In the first attached chart, I ran OrbitNP
> thrice on the same
> 7710 LAGEOS-1 fullrate CRD, using three different OrbitNP generation options:
>
> 1) no additional editing
>
> 2) applied 2.2 sigma edit and
>
> 3) applied an ~2cm LE filter

>
> and then overlaid your station generated 7701 CRD NPs on your fullrate residuals.
>
>
>
> The orange dots (OrbitNP generated NP with no additional screening)
> and black dots (OrbitNP generated NP using a 2.2 sigma edit) on the
> chart are essentially the same, which verifies a 2.2 sigma filter was
> applied in the generation of the 7701 fullrate residuals.
>
>
>
> The green dots are your 7701 generated NPs and the yellow dots are the
> ObritNP generated NPs with a LE filter applied. Three of the four
> green and yellow dotted normal points are essentially the same
> implying some type of LE filter was applied when generating the station NPs.
>
>
>
> Also attached is a chart of 7306 LAGEOS-2 OrbitNP fullrate residuals
> and OrbitNP NPs along with the station generated 7306 CRD NPs. It also
> appears a LE filter was applied to the 7306 fullrate residuals prior
> to onsite NP generation.
>
>
>
> The data edit criterion listed in Section 10 of the site log is used
> by Jose Rodriguez to generate the Center on Mass (CoM) Corrections for
> all the geodetic satellites. If that information is not accurate, it
> may impact the CoM corrections. In the case of 7701 and 7306, there
> appears to be a 7 to 8 mm difference in LAGEOS NPs between a 2.2 sigma edit and an LE edit.
>
>
>
> We also did the same analysis on a 7306 LARES-2 and a 7701 Galileo
> pass and it appears no LE filtered was applied only a 2.2 sigma filter.
>
>
>
> Can you answer the following questions:
>
>
>
> 1. What type of filtering is applied to 7701 and 7306 LAGEOS-1 and LAGEOS-2
>   data in the process of generating NPs?
> 2. Is a LE filter applied to any other satellites or just LAGEOS-1 and LAGEOS-2?
> 3. Has there been any change for any satellites in the data editing approach
>   for these two stations?
> 4. If necessary, can you please update the 7701 and 7306 Site logs (Section
>   10 additional information) to reflect any deviation from the 2.2 sigma
>   edit and for each satellite (a good example to follow is the 7839 Site Log
>   Section 10.03
>https://edc.dgfi.tum.de/en/stations/7701/site_log/ascii/
>and
> https://edc.dgfi.tum.de/en/stations/7306/site_log/ascii/; respectively.
>
> Hopefully you understand my analysis and if not I will try and clarify
> based on your response.
>
>
>

> Thanks for your attention and best regards,
>
> Van
>
> Van S Husson
>
> ILRS Central Bureau
>
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>

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4/4/23 (from Andrea DiMira)
"Dear Claudia, Van,

Thanks a lot for your thorough analysis and timely communication regarding the issue.
Please accept my apologies for the delayed response.
As proposed by Van and Jens we will update the site log to reflect the leading edge filter setting we apply
 in the "additional information" field – section 10 "Preprocessing Information":

Additional Information
  • Additional leading Edge 20 mm rejection criteria for Lageos1/2;
  • Additional leading Edge 300 mm rejection criteria for Ajisai;

Best regards,
Andrea"

4/4/23: (from Takehiro Matsumoto)
"Dear Claudia, Van,

Apologies for my delayed response.
I submitted an updated site-log for review by the ILRS CB. The changes are as follows.
  • The station position is updated to Toshi's initial estimated value in Section 2.
  • The additional information about NP-generation is added in Section 10.1 (same as Izana station).

Best Regards,
Takehiro"

"Dear Claudia,

I have created the new station history log. I will keep it updated.
Is it required to update it when the site-log is updated like this time?

Best Regards,
Takehiro"
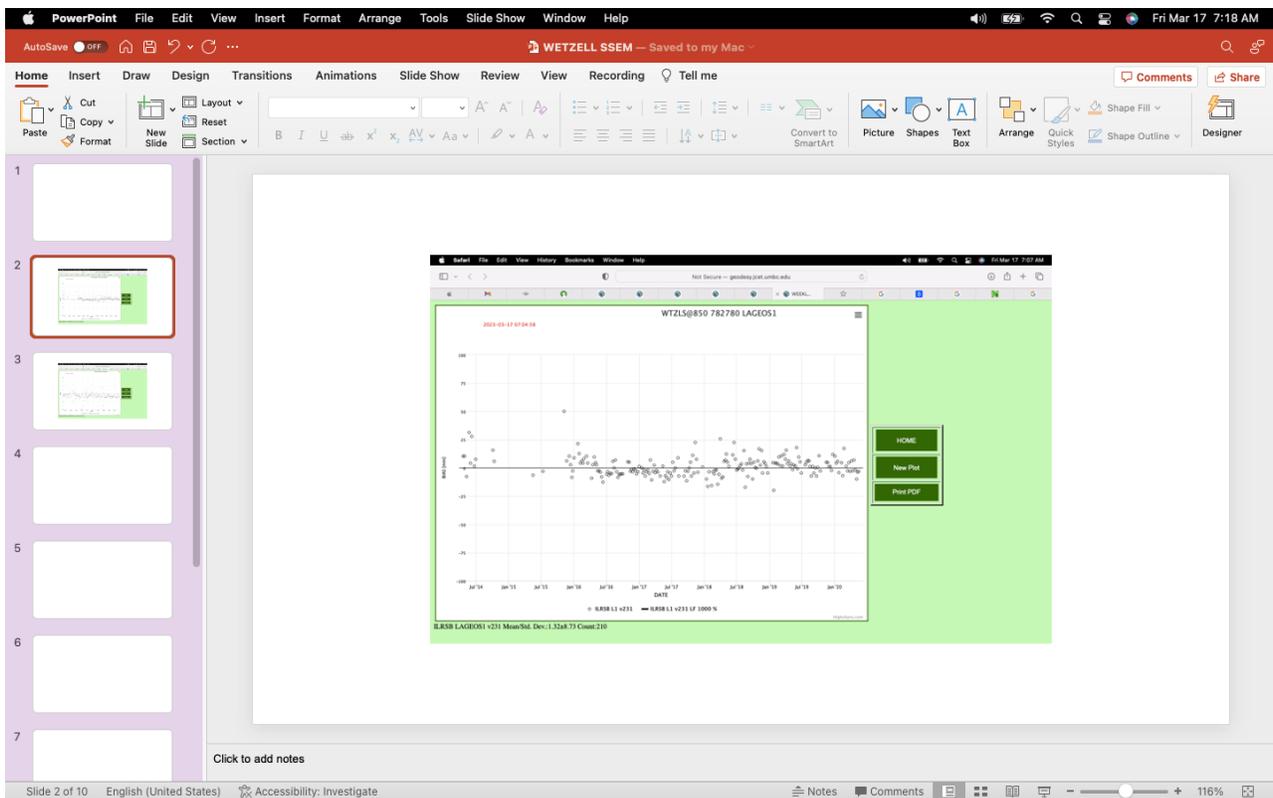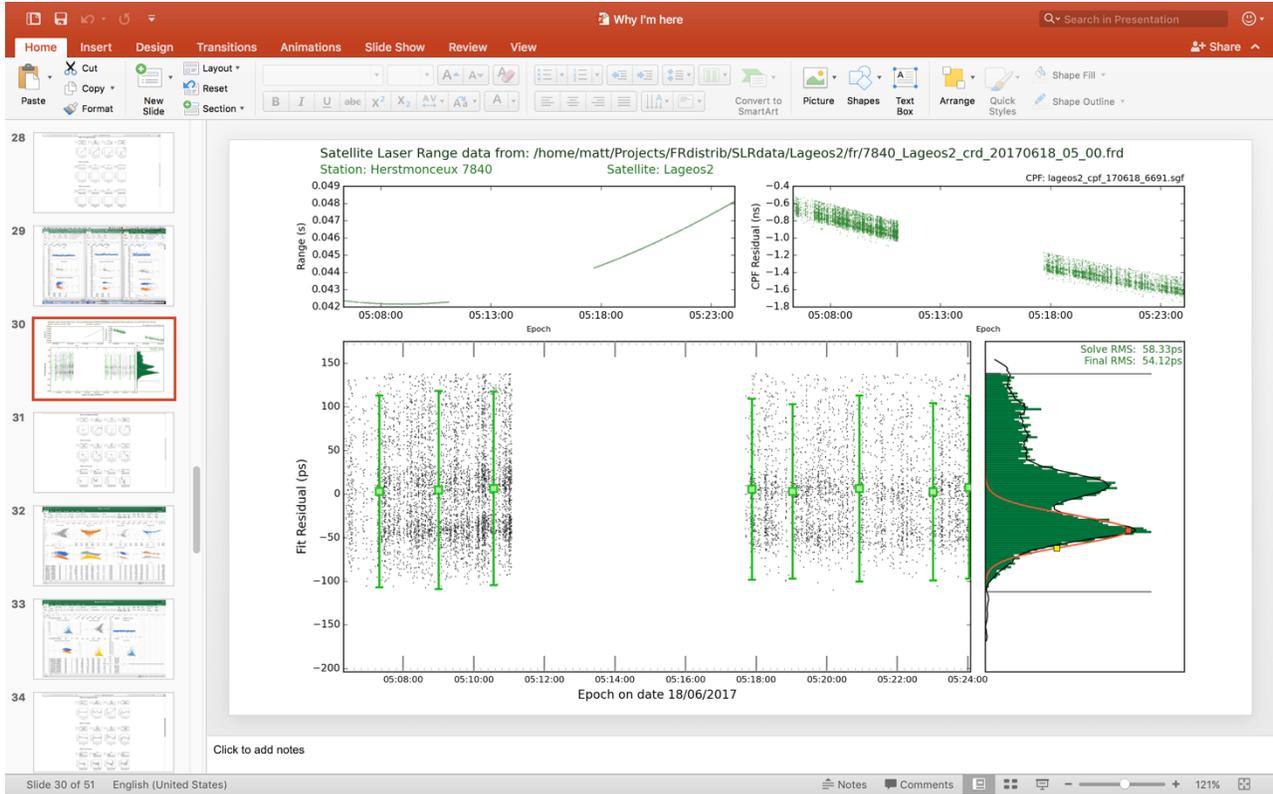
HERL LAGEOS-1 Normal Point Bin RMS
2022-03-01 to 2023-03-01
AVG 11.64 STD 1.51 MIN 7.79 MAX 24.58 for 14326 data points

HERL LAGEOS-2 Normal Point Bin RMS
2022-03-01 to 2023-03-01
AVG 12.48 STD 2.87 MIN 6.45 MAX 24.28 for 10372 data points

12mm

L1 AVG SS RMS 11.6mm, <12mm; lower for R>7800 km

L2 AVG SS RMS 12.5mm, >12mm; lower for R>7800 km; lots of long noise
quite a lot of short noise