August 5, 2020

ILRS QCB Meeting
July 16, 2020
Virtual Meeting

Participants

Erricos Pavlis, Matt Wilkinson, Peter Dunn, David Sarrocco, Stefan Riepl, Toshi Otsubo, Van Husson, Jose Rodriguez, Tom Varghese, Graham Appleby, Jason Laing, Carey Noll, Mike Pearlman, Tom Oldham. Frank Lemoine, Randy Ricklefs. Did I miss anybody?

Chart Posting

The charts from the meeting are available at
https://ilrs.cddis.eosdis.nasa.gov/docs/2020/ILRSQCB_slides_20200716.pdf

Processing NP data with the Weiner Filter (Stefan)

- The Herstmonceux 2019 data set for Lageos1 and Lageos2 has been processed to form Wiener filtered normal points. Due to the short laser pulse length the histogram binning can be done with high resolution down to 0.125mm per bin. The normal point histograms show considerably more details than those obtained from systems with longer pulse length. The occurrence of multiple peaks in the measured response function lead to a clearly visible excess in the signal spectrum when compared to the incoherent response function. This excess seems to be characteristic for Lageos reflector array but appears with more contrast in measurements to Lageos2;
- The Wiener filtered data was used to calculate normal points. In contrast to the standard iterative editing technique, which causes correlations between Single Shot RMS and Normal Point Residuals, the Wiener filtered data doesn't show a correlation of that kind and leads to a considerably reduced scatter in Single Shot RMS;
- Due to the limited knowledge on orientation of the Lageos reflector arrays, the long-term average transfer function can be used only in the deconvolution process instead of the transfer function for every normal point instance. This is a performance limiting issue for the Wiener filter algorithm, preventing to exploit its full resolution and accuracy and causing unwanted outliers in the normal point data. The procedure was repeated for various video bandwidths of the Wiener filter algorithm in order to reduce these outliers. The least outliers are obtained operating the filter at a video bandwidth comparable to the bandwidth of an MCP-PMT detector;
- The scatter of the resulting distribution towards shorter Normal Point residuals may be caused by interreference effects between the partial rays of the contributing retro reflectors;
- Further improvements rely on the determination of the array orientation and the ability to model the instantaneous transfer function for every normal point interval.

Comparing alternative normal point formulation Methods (Matt)

- At present, the method to calculate normal points is fixed by the ILRS;
- Stations are responsible for forming their own normal points. However, this has resulted in different flattening methods and different levels of clipping of range residuals;
- Alternative methods to form normal points have been proposed and these would require a center-of-mass correction to be calculated should they be adopted;
- To test such a method, a 2019 dataset of 'unclipped', flattened residuals for Lageos 1 & 2 from Herstmonceux SLR data was provided to Stefan Riepl to form normal points for comparison;
- It is not straight forward to compare one set of generated normal points with another as the preferred central epoch could change, due to data filtering, and therefore the normal point range will be different. So, any comparison must be done at the residual level;
- The normal point range residual dependency on single shot RMS can be minimized with controlled clipping about a well-defined point on the satellite distribution. Alternatively, allowing stations to calculate normal points using other methods could avoid this bias.

7105 Greenbelt Systematic Calibration Errors (Van)

- Comparing range biases from one satellite to another can be a good tool to identify mm level bias changes; when the PMT voltages were held stable, LAGEOS and LARES range biases relative to Starlette were short by ~4 mm, while Ajisai and Etalon biases were long by several mm; Could we still have mm level errors in our geodetic CoM corrections?
- A continued look at PMT voltage changes between calibration and satellite ranges showed possible biases as large as a cm;
- Operations in regions of excessive discriminator time walk introduced range biases of +3 to +5 mm during the period of Sep-2018 to Jun-2019;
- The ILRS Data Handling file needs to have another dimension, because biases can be satellite specific.

Next QCB meeting scheduled for August 18, at 9 am EDT (13:00 UT). Van will present the MOBLAS-4 (Monument Peak) and MOBLAS-5 (Yarragadee) geodetic range bias analysis as he has performed for MOBLAS-7. Also, Van has done some analysis of the current time series of the NASA MOBLAS Etalon Center of Mass Corrections being used.

Let Mike know if anyone has additional material to discuss.

Randy, will you be ready to discuss the work at UTX?