January 25, 2021

ILRS QCB Meeting
January 19, 2021
Virtual Meeting
Next Meeting February 23, 2021
9:00 am EST

Participants

Erricos Pavlis, Matt Wilkinson, Peter Dunn, Van Husson, Jason Laing, Mike Pearlman, Randy Ricklefs, David Sarrocco, Toshi Otsubo, Rivers Lamb, Tom Varghese, John Ries, Tom Oldham

The charts from the meeting are available at
https://ilrs.cddis.eosdis.nasa.gov/docs/2021/ILRSQCB_slides_20210119.pdf
See the charts for more detail.

Status of the ILRS ITRF contribution (Erricos)

The ILRS product for ITRFS 2020 is running about 1 ½ months late. The bias model has been finalized. The model and the guidelines will be going out to the AC's. We await the gravity field data from Grace. The data span will be 1993 – 2020.

Summary of analysis of 'low-return' normal points (John)

While the ILRS has certain criteria for the number of returns that are required for generating a laser range normal point (NPT), at least several stations do not appear to be adhering to those guidelines. Looking at the year 2020, there were about 6% of the LAGEOS-1 NPTs with less than 6 returns, and about 3% were based on only 1 or 2 returns. The precision statistics of the low-return NPTs were as expected; the low-return NPTs were noisier than those with at least 6 returns. A particular concern was noticed for the two low satellites. Whereas the overall range bias (the network weighted average of the range residuals) was near-zero, the range bias for the NPTs with less than 6 returns varied from 6-10 mm for Starlette and 4 to 7 mm for LARES. There was no similar issue for L1 or L2; the low-return NPTs were not significantly more biased than the overall range bias.

Overall, the presence of low-return NPTs does not seem to present a significant issue since the number of low-return normal points is a small percentage of the total data. If the low-return NPTs were simply ignored, some passes would be lost entirely, but these are going to be the least reliable in any case. To keep as much as the data as possible, but reduce the effect of the low-return NPTs, some analysts may consider some sort of down-weighting strategy for them. A simple strategy was tested, but it gave mixed results. The most concerning issue seen was the introduction of a significant range bias in the low-return normal points, even those with 5, 4 or 3 returns, for the low satellites. If the SLR data is being used for orbit accuracy calibration, for example, the analysts may want to see if their results are improved by excluding or down-weighting these lower-return NPTs.

The primary conclusion is that the users of SLR data should be made aware that the ILRS data do in fact contain NPTs that do not adhere to the guidelines, and that they may wish to examine if their processing procedures are affected in some way.

Range Residuals to Normal Points - How flat is too flat? (Matt)

SLR ranges are plotted as residuals to a reference orbit. These O-C residuals must then be flattened in order to form normal points. This is achieved at stations using either orbital adjustment or a high order polynomial fit.

Flattening by orbit adjustment can be achieved using the orbitNP.py software. Using this software, it is possible to pick out and process individual passes from full-rate data for all stations and satellites. Each station decides the method to form residuals and the data clipping criteria.

A number of passes were shown where the orbit adjustment software had failed to produce flattened residuals. These included passes for Ajisai, Lageos, Lares, Cryosat2 and Stella.

It was discussed how each station had clipped the full-rate data to form normal points; that resulted in a dataset that could not be flattened by orbit adjustment.

Update on the Simosato story (Van)

Simosato is still working on updating its station change history log to document system changes prior to July 2017. When obvious Simosato LAGEOS outliers are edited, the JCET weekly range biases agree well with the corresponding HITU pass-by-pass LAGEOS range

In the JCET pass-by-pass range bias analysis, a significant number of Simosato LAGEOS normal points were edited, but not in the HITU pass-by-pass analysis. Every AC has its own style in data editing, documented on file at the CDDIS. In general, a constant (2, 2.5, 3, 3.5 etc.) times the RMS of fit is used in the automatic edit process. In some cases, analysts will have a second look at the solution if they notice large errors and apply manual edits in extreme cases.

When generating Simosato station coordinates, do the analysis centers edit individual normal points and what is the editing criteria? Note: Not shown, but the HITU time biases estimates are sometimes 10’s of microseconds, since they tend to not edit individual normal points.

The Simosato LAGEOS-2 December 2020 return rate with their new 1 kHz laser is quite small relative to Herstmonceux 1 kHz laser, with its return rate purposely maintained below 10% to keep at the single photon level.

Issues:

1. Stress Stations need for stable configurations;
2. More stress on long and short stability rather than NP rms
3. Stress need for up-to-date history logs;
4. Stress need for redundant barometers;
5. Stress need for frequent calibrations (ever 2 hours or at systems changes)
6. Is the C/M correction used for the NASA ranging to GNSS satellites appropriate for the use of the amplifier; is the amplifier still used?

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