September 30, 2020

ILRS QCB Meeting
September 24, 2020
Virtual Meeting
Next Meeting October 15, 2020

Participants

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

Agenda

- Brief on ILRS preparations for ITRF2020 submission (Erricos 10 min)
- Continued diagnostic work (Van 40 min)
- Update on NP studies (Randy 15 min)
- Analysis of NPTs not following ILRS guidelines (John R. 15 min)
- Questions and discussion All (30 min)

Chart Posting

The charts from the meeting are available at
https://ilrs.cddis.eosdis.nasa.gov/docs/2020/ILRSQCB_slides_20200924.pdf

See the charts for more detail.

Preparation for the ITRF2020 submission (Erricos)

The bias model has been completed; some adjustment may be necessary to include some last-minute changes. Some station issues are only now being discovered because they did not report system changes on their history logs. This seems to be a common problem. There was some mix up with Tahiti with their TIU and ET data, which Jason is cleaning up. Next will come the LARES tests and then the reprocessing.

Continued diagnostic work on Simosato (Van)

A change of laser and some other system components was made at Simosato in June 2018, was not recorded on History Logs, but introduced range biases and erratic performance with a few shifts in systems delay. The change in the laser was entered into the Site log. Can the system delay shifts be reconciled and the data made useful in the ITRF solution? There are some uncertainties with the barometric pressure which is only calibrated every 5 years (if that).

- Simosato data would be useful in the ITRF. Should the effort be spent to resurrected this data? ACTION: Decision by Erricos and Cinzia
- Some questions for the station:
  a. Can the station identify the cause of the shifts in the system delays?

b. Is the height difference between the ranging system and the barometer accommodated in their pressure value?
c. Tell the station to post the notices of system component changed on its History Log. ACTION: Message to the station from Erricos, info Toshi.

- Does the satellite C/M model need to be changed to accommodate the new station configuration ACTION: Decision by Jose.

This station needs some help. Refer to the NESC

Herstmonceux open-source normal point program discussions (Randy)

Herstmonceux open-source normal point program discussions

- One of the comments during a previous meeting was that the conversion of the ILRS/Andy Sinclair's DISTRIB.F function that calculates data mean, RMS, skew, kurtosis, and peak-mean had some error, because it did not reproduce the RMS, skew, and kurtosis of the stations' data as well as the python library routines. It turns out that there were two issues with the implementation:
    - The number of points in the distrib-based normal points were the same as for the python library-based normal points, but the statistics were different. The reason was that the number of points for the distrib-based NPs was wrong, as the number of points surviving filtering was different. When that was corrected and the number of points agreed, the statistics were identical (except peak-mean, which I was not able to compute with python routines). The python and FORTRAN versions were tested again, with a normal point having a large number of observations (>2000), and the statistics agreed.
    - The points from both techniques should have been the same. The distrib-based code was doing s 2.5 sigma filtering of the data in each normal point bin. It should have been 3 or > 3 sigma, since the data should only be filtered on a pass basis (confirmed by Peter). When that was fixed, the number of points and the statistics for both techniques agreed.
- Unless a way is found soon to produce peak-mean with the python library routines, it's advisable to use the distrib.py code, especially since it is the ILRS standard.
- Based on discussions during the meeting, these changes will be made and tested:
    - Use distrib for the entire pass to populate statistics in the '50' session/pass record.
    - Use the full-pass peak and the normal point mean to create the normal point peak-mean. The full-pass peak will be more stable than the peaks based on small numbers of observations in normal point windows.
    - If certain to-be-defined quality criteria are not met, considered setting the peak-mean to "na".
- Matt provided feedback on the poorly matching station and Herstmonceux software produced normal points from the January 2020 LAGEOS 1 data I sent him. His comments are below.

- More NPs were created due to a low acceptance of number of returns used
- Many normal points did not agree due to different epochs being used:
  - This will happen if different clipping is applied by the station to the normal points than to the full rate data and I was able to apply clipping to account for this.
  - There were also NPs that had the same number of returns but different epochs.
    - For Yarragadee there were examples of NP with 2 returns and the question is which epoch do you choose?
    - Some stations were choosing what I would consider to be the wrong epoch, Zimmerwald was doing this repeatedly.
- I found a pass that did not have flattened residuals due to a large amount of data being on one side of the pass and therefore dominating the least squares fit.
  - I overcame this by adding an option for a first iteration quick pass which selects data more evenly across the pass.
- Finally, I found that I was repeatedly getting a large range bias for Simosato. I realized that I was using the wrong height value, taken from the ILRS website. We agreed that I should use more official coordinates.

Analysis of NPTs not following ILRS guidelines (John R. 15 min)

Concerning the Herstmonceux NPT software, it appears that the software works fine and sometimes produced a more consistent set of normal points than the original software. However, for some of the poorer performing stations, the new software sometimes made quite bad NPTs, but this seemed to be limited to a few Russian and Ukrainian station

The NPT analysis raised some questions about the production by some stations of low-return NPTs, which were based on only 1 or 2 returns. Yarragadee in particular had about 15% of its data based on low-return NPTs. Analysis of the data for January 2020 showed that the inclusion of the low-return NPTs in the LAGEOS fits increased the fit RMS and the NPT precision estimate compared to retaining only NPTs with at least 6 returns. The orbit RMS differed by as much as 8 mm (mostly along-track). The effect on the estimation of the Yarragadee coordinates, however, was limited, with the largest difference in the height of only 0.6 mm.

The concern is that the network is not producing consistent NPTs (some stations adhering to the ILRS guidelines for number of returns and others not). Many, if not most, of the end users may not be aware of this. As the above analysis indicates, these low-return NPTs tend to be less reliable, but there are two competing arguments. Many of the low-return NPTs may be at the lowest elevations and thus important for improving the observation geometry, but they are also less reliable and will increase the noise. This may be less an issue for low altitude satellites, and some tests will be done to investigate the impact on them. For reference frame work with the LAGEOS satellites, eliminating the low-return NPTs in the analysis may best.

Issues:

1. Stations need to operate with stable configurations; frequent configuration changes lend to corruption of the data or deletion of the data;
2. We should put much more stress on long and short stability rather than NP rms

3. Stations must keep up-to-date history logs; otherwise the analysts are faced with unexplained discontinuities and trends that corrupt the data; Items to be noted in history logs include change of components in the signal path (laser, timing components, components in the epoch timing systems, etc), changes or recalibration of barometers, change in procedure that influence the range value

We have tentatively set the next meeting for October 15, but several people will be unable make it. We will look for another possible date.

Next Meeting: October 15, 2020, 09:00 a.m. (EST), 14:00 UTC.