

Networks and Engineering Standing Committee Meeting

21st International Workshop on Laser Ranging

Tuesday 6th November 2018, 18:30

John Curtin School of Medical Research in Canberra, Australia.

In attendance:

Matthew Wilkinson (Chair), Georg Kirchner (co-Chair), Rivers Lamb, Kate Stevenson, Chris Szvec, Zhang Haifeng, Takehiro Matsumoto, Julie Horvath, Christopher Clarke, John Degnan, Randy Ricklefs, Jake Griffiths, Hiroo Kunitomi, Tom Varghese, Ryoma Ishibashi, Luca Porcelli, Reed Smith, Ulrich Schreiber, Kalvis Salmins, Arttu Raja-Halli, Jose Rodriguez, Paul Ries, Rob Sherwood, Evan Hoffman, Carey Noll, Toshi Otsubo, Stefan Riepl, Alexander Kehm, Mathis Bloßfeld, Franz Koidl, Stephen Merkowitz, Randall Carman, Zhang Zhongping, Peiyuan Wang, Pierre Lauber, Mike Pearlman, Erricos Pavlis, Pablo Raul Yanyachi

Preview of the QC tests for CRD data at the ILRS Data Centres - Katherine Stevenson

Kate presented plans to upgrade and standardise the CRD quality checks performed at the ILRS Data Centres. This will ensure that incorrect field entries are detected and that discrepancies across data files are reduced. The ILRS Central Bureau has requested that the NESC review and approve the draft QC before implementation.

Example questions to the NESC:

- *Should there be prescribed limits on beam divergence? (Configuration Record)*
- *How often should stations be calibrating?*
- *How often should stations be recording meteorological data?*
- *What would be a reasonable range of values for normal point kurtosis?*

Volunteers from the NESC are needed to look at these proposals. If you'd be willing to assist with this task, please contact Matt (matwi@nerc.ac.uk). This review will be carried out in early 2019.

A discussion on how a normal point is formed

The process to form normal points is well defined, but is this the only acceptable way? Should stations be allowed to develop and implement alternative methods? How should this be managed?

Two presentations earlier in the day from the kHz SLR stations Herstmonceux and SOS-W in Wettzell looked at changing their processes of data reduction. The Wettzell method used a de-convolution Wiener filter to consistently define a point on the satellite response.

The NESC discussed other possible ways of reducing SLR residuals, particularly in the light of the high data yields from kHz SLR. Further discussion between data suppliers and users is required before any decision can be made.

A discussion on what makes full rate data?

The full-rate data files contain the individual SLR observations. At the beginning of 2018 it became a requirement for all SLR stations to submit full-rate data alongside their normal points. Exactly what to include in this file is not completely clear. Should the full-rate data file only contain the ranges that went in to forming the normal point? Should the full-rate data contain **all** SLR returns from the satellite?

The answer depends on the particular user in mind. If the data is for use in orbit analysis then only the data that formed the NP is most useful. If the full-rate data will be used for re-processing or analysis of the residual dataset, for example for spin state analysis, then all satellite data-points are desirable.

Randy Ricklefs brought attention to a data flag in the CRD format called the "Filter Flag" which can be set 0=unknown, 1=noise or 2=data. This flag could be used to distinguish between satellite returns data and the clipped data that was used to form the normal point. Matt Wilkinson will work on a proposal to the ILRS CB.

orbitNP.py

The new orbit adjustment and normal point formation software *orbitNP.py* is now available for download on the ILRS Software webpage: <https://ilrs.cddis.eosdis.nasa.gov/technology/software/index.html>

It was developed from FORTRAN code at the SGF, Herstmonceux UK. It runs from the command line and can process full-rate CRD files or raw epoch-range data using a corresponding CPF prediction file. Hopefully this will be useful to the community as an analysis tool and example code for reducing SLR data.

Update on the NESC online forum

The forum is available to the NESC to support the community, answer questions and discuss problems and ideas. It aims to exploit the knowledge and experience in the ILRS. Currently there are 87 members.

Questions to the NESC

There were numerous issues raised during the 1 hour NESC meeting and in the week of the IWLR. For illustration, these included:

- How do SLR stations monitor the stability of the reference invariant point and the impact of thermal changes?
- How good are the meteorological measurements at the SLR stations? Are they globally calibrated?
- How should the ILRS respond to the increasing number of targets requesting laser ranging support?
- How can stations demonstrate their high achieving performance to funding bodies?
- How accurate are the timing references at SLR stations?

It is not at all possible to address these questions, as valid as they may be, in the annual 1 hour NESC meeting. The NESC online forum offers some space to advance these discussions, but the NESC needs to operate in a way that it can address these concerns.

NESC Operations

The NESC exists to support SLR activities in the ILRS network by seeking analysis feedback, sharing knowledge and expertise between stations and by working to move the technique forward. It can respond to requests for advice from the Governing Board, Central Bureau or other SCs. And it can make recommendations to these bodies.

The NESC needs to function in a way that it can fully address the types of questions noted above and be able bring about some sort of resolution and way forward.

Matt Wilkinson suggested that in the future the NESC should change how it operates and how the meetings are run to better serve the needs of the ILRS. The strength of the NESC is its membership and it should involve its members to identify the issues, find solutions and report back to the NESC. The NESC meetings would then include:

- Determining priorities and problems
- Identifying some individuals to work on the issues
- Reviewing reports back the NESC that detail how an issue was considered and resolved.
- Once an issue is resolved any recommendations should be drafted and sent to the appropriate ILRS body.

Consultation on these changes will follow in a more detailed email to the NESC from Matt Wilkinson.

Change of Co-Chair

Finally, our Co-Chair Georg Kirchner intends to retire in the not too distant future. Georg was Chair of the NESC for many years and in that time provided valuable guidance and assistance to many stations and helped to advise and direct the ILRS. The NESC will require a new Co-Chair(s) and Matt Wilkinson will oversee this.

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