Two-fold Quality Assessment of Global SLR Data

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Introduction

Laser ranging stations should ideally yield error-free ranging observations, but measurement errors will occur in various ways. It is often hard for a station to detect it, and therefore quick feedback from analysis centres is required to reduce the amount of anomalous data.

Large-size (> 10 cm) errors can be detected easily and notified quickly. There are also small-size measurement errors that can be detected by accumulating a long-term (~ 1 year) data set.

Six-Hourly Quality Check Reports

Hitotsubashi University has issued daily reports and it was upgraded to 6-hourly report in 2012. The analysis reports are available on the website of Hitotsubashi University shown in Fig. 1. We have implemented an automatic error detection filter so that a human does not have to look into a large report file (~300 kbytes) every six hours [1].

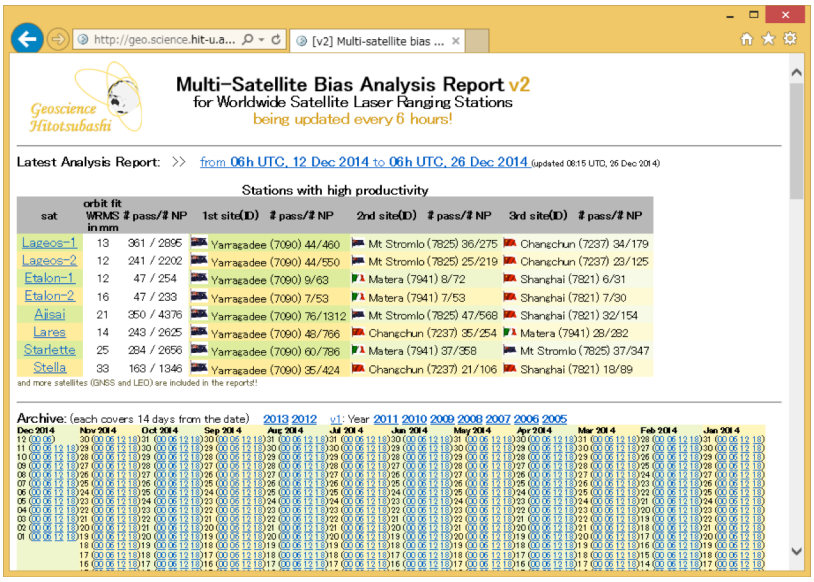

Fig. 1: Hitotsubashi University's webpage for the quality check reports. URL: http://geo.science.hit-u.ac.jp/slr/bias/ .

The automatic anomaly detection scheme is roughly as follows. First, the ordinary behavior of range bias and time bias are scanned for the past 20 weeks and the scatter RMSes are derived. Then, from the past 2 weeks' data, the anomalous (> 3 x RMS) passes are extracted and marked. If there are more than 3 marked passes that behaves similarly and are seen in more than one satellite, these passes are notified to the system administrators (authors). The last stage is left for a human who checks the data and decides whether he should send an email message to the station and the mailing list.

In January-August 2014, the new filter has detected a number of anomalous cases, 8 of which have been instantly reported to the stations and the RapidServiceMail mailing list (archived at http://rapidservicemail.dgfi.badw.de/). It has significantly reduced human's tasks.

Long-term In-Depth Quality Check Analysis

It is not realistic to try to detect a small (< 10 cm) bias just from a 2-week span. Following our study at NICT [2], various types of systematic errors have been detected from a 1-year multiple-satellite data. All of the plots are shown in the poster presentation [3] and also on our website. The details of the analysis is described separately in [3]

Summary and Future Studies

It is both important to notify an incident quickly and to detect a small incident. As it is not possible to do them both in one system, we plan to build a two-fold scheme: the 6-hourly quality check analysis will be kept running and the long-term analysis will be presented once per year or every 2 years.

References

[1] Otsubo T., Kobayashi M. and Takakura S., Subdaily Quality Check of Laser Ranging Data at Hitotsubashi University, 18th International Workshop on Laser Ranging, 13-0203, 2013, <http://cddis.gsfc.nasa.gov/lw18>.

[2] Otsubo T., Obara N., Systematic range bias 2005-2006, 15th International Laser Ranging Workshop, 2006, <http://cddis.gsfc.nasa.gov/lw15>.

[3] Otsubo T., Systematic Range Error 2013-2014, in these proceedings, 2014, <http://cddis.gsfc.nasa.gov/lw19>.