

MCC ANALYSIS PROCEDURE OF THE SLR DATA QUALITY AND STATIONS PERFORMANCE.

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Abstract

There are different independent estimations for the LAGEOSes passes quality that are calculated in the Analysis Centers. Sometimes there are the considerable differences between these results, especially for the new or not too very stable SLR stations. It is necessary to find the fruitful procedure of the complex analysis of the different Analysis Centers results for the SLR station staff support, especially in the questionable situations. In the paper are given some proposals and recommendations for this problem solving.

Introduction

Below in Figure 1 are showing the Riga station LAGEOS 1&2 range biases that given in comparison between three data Analysis Centers (CSR, MCC and DUT). The graph in the Figure 1 is taken from Kazimirs Lapushka message to ILRS and AC's. The graph is showing the problem very clear. "The differences into range biases from different Analysis Centers don't be shipped to the stations as the measuring errors" wrote K. Lapushka. For example, the pass number 175 (in Figure 1 with arrowed line) showing that, where CSR and DUT are giving huge opposite RB and MCC close to zero. "Is that a Station error?" asked K. Lapushka.

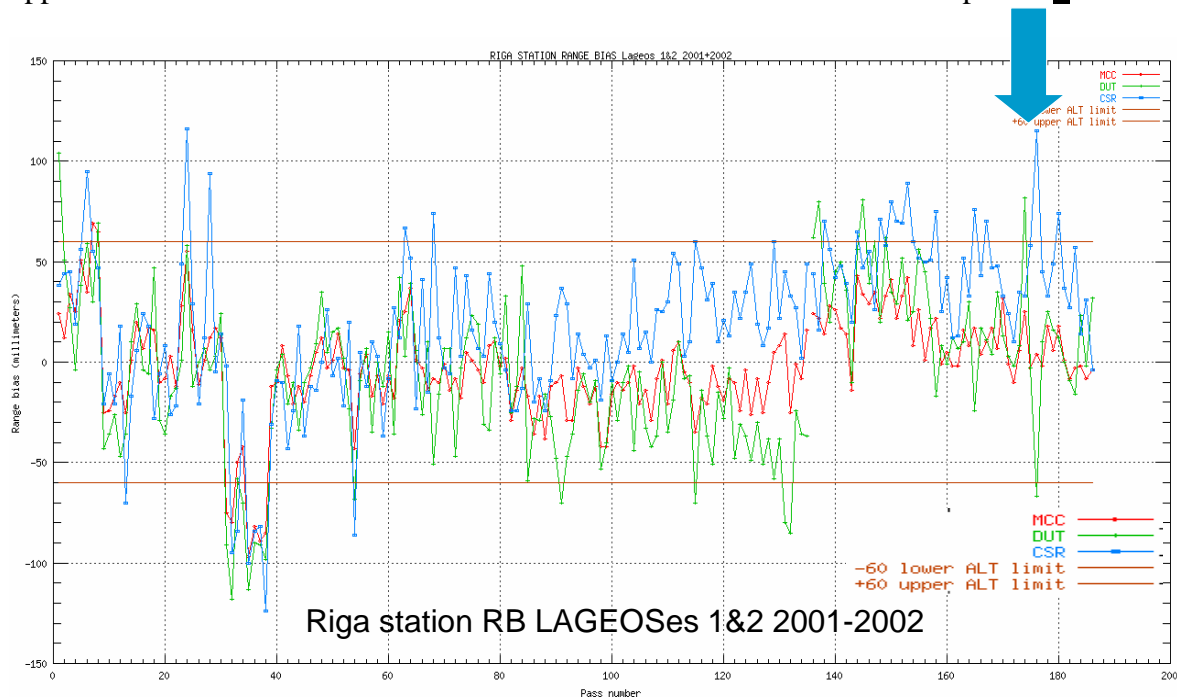


Figure 1. The estimations of the Riga station range biases in comparison between three Analysis Centers.

MCC analysis procedure of the stations performance

MCC analysis procedure of the SLR LAGEOSes data quality and stations performance is based on the following standard steps:

- SLR data analysis and “bad” points rejection using automatic or/and manual procedure
- Precise orbits determination with the its real accuracy (rms) estimation
- The measurements residuals calculation for the separate passes
- The different statistic values calculation (ME, RMS, ORMS etc.)
- The attempt to interpret the measurement residuals as function of the Range Bias and Time Bias (depending on the both ascending and descending branches tracking during estimated pass)
- The forming of “MCC Residual Analysis Report” for ILRS stations

Once more it is necessary to emphasize that really MCC Service (and other Analysis Centers) calculate the SLR data residuals based on the precise satellite orbits and station co-ordinates (see in Figure 2 the values ME – “Mathematical Expectation”, RMS – “Root Mean Square for ME” and ORMS – “Root MEAN Square for the Orbit” from the MCC Weekly Residual Analysis Report). ME, RMS and ORMS are very important objective characteristics for the SLR data quality control.

Only for the next step MCC Service (and other Analysis Centers) tries to interpret the calculated SLR data residuals as Range and Time Biases based on the different mathematical procedures (see in Figure 2 the values TB – “Time Bias”, RB – “Range Bias” and PRMS – “Precise Root MEAN Square for the Polynomial”).

The main reasons of the different Range Bias and Time Bias results for the different Analysis Centers are following:

- Differences in the satellite precise orbits that used for the SLR data analysis
- Different co-ordinate sets of the SLR stations that used in the Centers by SLR data analysis (really it’s very difficult to find the correct and precise co-ordinates for the unstable and “often modernized” stations)
- Incorrect attempts to interpret the measurement residuals as function of the Range Bias and Time Bias (Especially it’s very difficult or practically impossible for the short passes)
- Differences in the “bad” points rejection procedures for Analysis Centers

Russian Mission Control Center Residual Analysis Report										
Maidanak (1864 NP)										
	TTL	INC	ME	RMS	ORMS		TB	RB	PRMS	SCI
			mm	mm	mm		us	mm	mm	
1864 ...	06	05	8	16	17	...	17	22	4	0
1864 ...	10	07	8	17	20	...	18	6	5	0
1864 ...	10	07	-28	10	32	...	8	-28	7	0

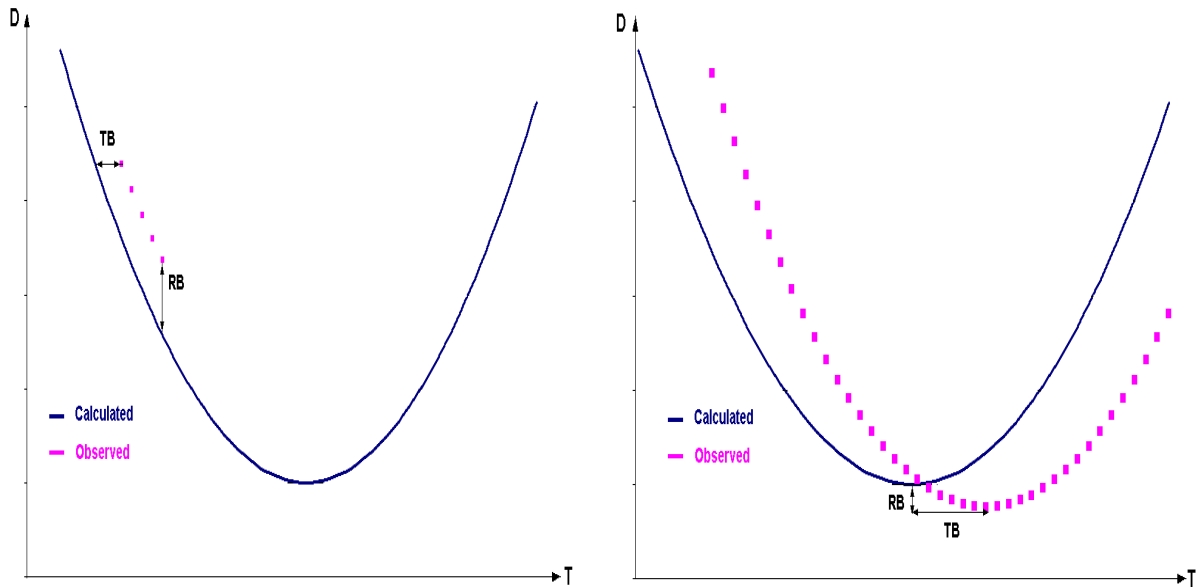
— From orbits
- - From polynomial

Figure 2. The fragment from the MCC Weekly Residual Analysis Report.

Figure 3 shows the problems by the interpretation of the SLR data residuals as function of the Range Bias and Time Bias for the short and long passes. As you can see from the graph in Figure 3 it is impossible to find without ambiguity the RB and TB for the short passes (left graph). The

short pass data residuals can be interpreted as function RB only (TB=0) or as function TB only (RB=0) or as any combination of the RB and TB. There is perfectly other situation with the long passes (the right graph in the Figure 3). There is one version in this case only for the interpretation of the SLR data residuals as function of the RB and TB. The RB and TB errors for the long passes are the consequence of the satellite orbit and station co-ordinates precision only.

RB and TB estimation procedure



Ambiguous results for the short passes

Precise results for the long passes

Figure 3. The estimations of the Riga station range biases in comparison between three Analysis Centers.

It is possible to propose some recommendations for the SLR stations and Analysis Centers on the base of this paper matters.

The tracking recommendations for the stations:

- Both ascending and descending branches tracking (especially for the station calibration);
- Min 10-minutes pass duration for Lageoses and 5-minutes for low orbiters;
- Min 6 QLNP per one pass;
- Min 20 deg elevation (especially for the station calibration);
- As much passes duration as possible (especially for calibration and precise TB and RB estimation).

The recommendations for the Analysis Centers:

- The coordination in the main methodology questions by the SLR data analysis;
- The agreement of the stations coordinates sets;
- The coordination in the RB&TB understanding for the both (long and short) passes;
- The separation of the short and long (calibrating) passes estimation;
- The timely and quickly contacts with other Analysis Centers in the case of necessity based on the concrete ILRS solution and recommendations