

# IMPROVEMENT OF THE SOFTWARE BERNESE FOR SLR DATA PROCESSING IN THE MAIN METROLOGICAL CENTRE OF THE STATE TIME AND FREQUENCY SERVICE

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**ABSTRACT.** Preparatory works for resuming operational calculations of the Earth rotation parameters based on the results of satellite laser ranging data processing (LAGEOS 1, LAGEOS 2) are to be completed in the Main Metrology Centre Of The State Time And Frequency Service (VNIIFTRI) in 2014. For this purpose BERNESE 5.2 software (Dach & Walser, 2014) was chosen as a base software which has been used for many years in the Main Metrological Centre of the State Time and Frequency Service to process phase observations of GLONASS and GPS satellites. Although in the BERNESE 5.2 software announced presentation the possibility of the SLR data processing is declared, it has not been fully implemented. In particular there is no such an essential element as corrective action (as input or resulting parameters) in the local time scale (“time bias”), etc. Therefore, additional program blocks have been developed and integrated into the BERNESE 5.2 software environment. The program blocks are written in Perl and Matlab program languages and can be used both for Windows and Linux, 32-bit and 64-bit platforms.

## 1. INTRODUCTION

In 2010 at VNIIFTRI a program development for SLR measurements processing was started under the supervision of leading researcher M. B. Kaufman to calculate Earth rotation parameters. The program was developed on the base of BERNESE software. The authors of the work developed and implemented algorithm and calculation technique for determination of ERP from SLR observations, and also individual software elements enabling to calculate and then to include Range-bias (Rb) and Time-bias (Tb) corrections in measurements files. Also a software module was developed to provide preliminary analysis and screening of rough measurements.

## 2. RESULTS

At this time ILRS Network includes around 40 stations. The measurements of 33 are used for ERP calculation. The list of stations which measurements are used for ERP calculation is shown in Table 1.

Nowadays the program is operating in experimental conditions and the first results have been obtained:

- the influence of Rb and Tb on the observations carried out on station MDVL is shown in Fig. 1;
- Figure 2 shows the residuals between calculated pole coordinate ( $X_p$ ,  $Y_p$ ) and IERS for 2013.

## 3. CONCLUSIONS

The conclusions are:

- the programme for Earth Rotation Parameters (ERP) calculation has been developed;
- the accuracy of the obtained results is close to one of the IERS.

In order to integrate the programme into the service activity the only thing left to do is to overcome a series of technical issues.

Monument	Location Name, Country	Monument	Location Name, Country
1873	Simeiz, Ukraine	7405	Concepcion, Chile
1879	Altay, Russia	7406	San Juan, Argentina
1884	Riga, Latvia	7501	Hartebeesthoek, South Africa
8834	Wettzell, Germany	7810	Zimmerwald, Switzerland
1893	Katzively, Ukraine	7821	Shanghai, China
7080	McDonald Observatory, Texas	7824	San Fernando, Spain
7090	Yarragadee, Australia	7825	Mt Stromlo, Australia
7105	Greenbelt, Maryland	7838	Simosato, Japan
7110	Monument Peak, California	7839	Graz, Austria
7119	Haleakala, Hawaii	7840	Herstmonceux, United Kingdom
7124	Tahiti, French Polynesia	7841	Potsdam, Germany
7237	Changchun, China	7845	Grasse, France
7249	Beijing, China	7941	Matera, Italy
7308	Koganei, Japan(CRL)	1874	Mendeleevo, Russia
7328	Koganei, Japan		

Table 1: List of ILRS station which measurements were used for ERP calculation.

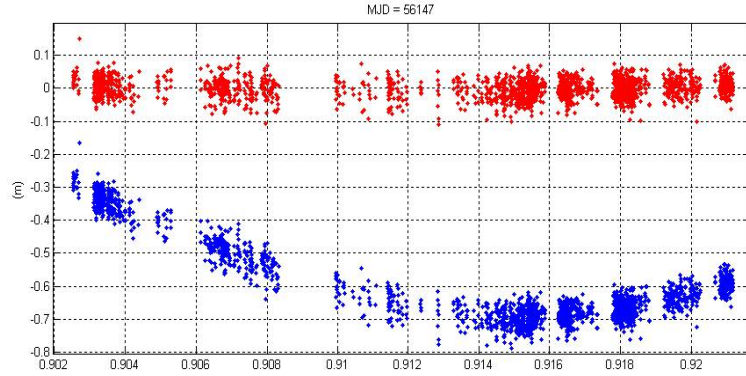


Figure 1: Influence of Rb and Tb on laser satellite measurement (station MDVL).

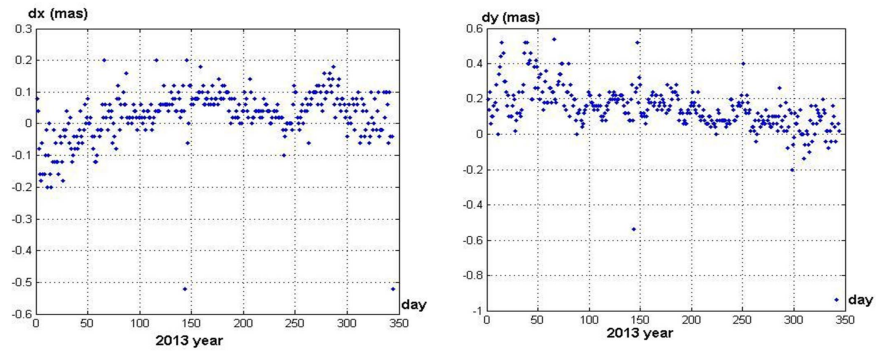


Figure 2: Residuals between calculated pole coordinate values ( $X_p$ ,  $Y_p$ ) and IERS data.

#### 4. REFERENCES

Dach, R., Walser, P., 2014, “Bernese GNSS Software Version 5.2. Tutorial. Processing Example. Introductory Course. Terminal Session”, September 2014.